INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

RED BOOK

VOLUME VII – FASCICLE VII.3

TERMINAL EQUIPMENT AND PROTOCOLS FOR TELEMATIC SERVICES

RECOMMENDATIONS OF THE T SERIES

VIII^TH PLENARY ASSEMBLY
MALAGA-TORREMOLINOS, 8-19 OCTOBER 1984

Geneva 1985

INTERNATIONAL TELECOMMUNICATION UNION

CCITT

THE INTERNATIONAL
TELEGRAPH AND TELEPHONE
CONSULTATIVE COMMITTEE

RED BOOK

VOLUME VII – FASCICLE VII.3

TERMINAL EQUIPMENT AND PROTOCOLS FOR TELEMATIC SERVICES

RECOMMENDATIONS OF THE T SERIES

VIIITH PLENARY ASSEMBLY
MALAGA-TORREMOLINOS, 8-19 OCTOBER 1984

Geneva 1985

ISBN 92-61-02291-X

CONTENTS OF THE CCITT BOOK
APPLICABLE AFTER THE EIGHTH PLENARY ASSEMBLY (1984)

RED BOOK

Volume IV	–	*(4 fascicles, sold separately)*
FASCICLE IV.1	–	Maintenance; general principles, international transmission systems, international telephone circuits. Recommendations M.10-M.762 (Study Group IV).
FASCICLE IV.2	–	Maintenance; international voice frequency telegraphy and fascimile, international leased circuits. Recommendations M.800-M.1375 (Study Group IV).
FASCICLE IV.3	–	Maintenance; international sound programme and television transmission circuits. Series N Recommendations (Study Group IV).
FASCICLE IV.4	–	Specifications of measuring equipment. Series 0 Recommendations (Study Group IV).
Volume V	–	Telephone transmission quality. Series P Recommendations (Study Group XII).
Volume VI	–	*(13 fascicles, sold separately)*
FASCICLE VI.1	–	General Recommendations on telephone switching and signalling. Interface with the maritime mobile service and the land mobile services. Recommendations Q.1-Q.118 *bis* (Study Group XI).
FASCICLE VI.2	–	Specifications of Signalling Systems Nos. 4 and 5. Recommendations Q.120-Q.180 (Study Group XI).
FASCICLE VI.3	–	Specifications of Signalling System No. 6. Recommendations Q.251-Q.300 (Study Group XI).
FASCICLE VI.4	–	Specifications of Signalling Systems R1 and R2. Recommendations Q.310-Q.490 (Study Group XI).
FASCICLE VI.5	–	Digital transit exchanges in integrated digital networks and mixed analogue-digital networks. Digital local and combined exchanges. Recommendations Q.501-Q.517 (Study Group XI).
FASCICLE VI.6	–	Interworking of signalling systems. Recommendations Q.601-Q.685 (Study Group XI).
FASCICLE VI.7	–	Specifications of Signalling System No. 7. Recommendations Q.701-Q.714 (Study Group XI).
FASCICLE VI.8	–	Specifications of Signalling System No. 7. Recommendations Q.721-Q.795 (Study Group XI).
FASCICLE VI.9	–	Digital access signalling system. Recommendations Q.920-Q.931 (Study Group XI).
FASCICLE VI.10	–	Functional Specification and Description Language (SDL). Recommendations Z.101-Z.104 (Study Group XI).
FASCICLE VI.11	–	Functional Specification and Description Language (SDL), annexes to Recommendations Z.101-Z.104 (Study Group XI).
FASCICLE VI.12	–	CCITT High Level Language (CHILL). Recommendation Z.200 (Study Group XI).
FASCICLE VI.13	–	Man-Machine Language (MML). Recommendations Z.301-Z.341 (Study Group XI).

Volume VII	–	*(3 fascicles, sold separately)*
FASCICLE VII.1	–	Telegraph transmission. Series R Recommendations (Study Group IX). Telegraph services terminal equipment. Series S Recommendations (Study Group IX).
FASCICLE VII.2	–	Telegraph switching. Series U Recommendations (Study Group IX).
FASCICLE VII.3	–	Terminal equipment and protocols for telematic services. Series T Recommendations (Study Group VIII).
Volume VIII	–	*(7 fascicles, sold separately)*
FASCICLE VIII.1	–	Data communication over the telephone network. Series V Recommendations (Study Group XVII).
FASCICLE VIII.2	–	Data communication networks: services and facilities. Recommendations X.1-X.15 (Study Group VII).
FASCICLE VIII.3	–	Data communication networks: interfaces. Recommendations X.20-X.32 (Study Group VII).
FASCICLE VIII.4	–	Data communication networks: transmission, signalling and switching, network aspects, maintenance and administrative arrangements. Recommendations X.40-X.181 (Study Group VII).
FASCICLE VIII.5	–	Data communication networks: Open Systems Interconnection (OSI), system description techniques. Recommendations X.200-X.250 (Study Group VII).
FASCICLE VIII.6	–	Data communication networks: interworking between networks, mobile data transmission systems. Recommendations X.300-X.353 (Study Group VII).
FASCICLE VIII.7	–	Data communication networks: message handling systems. Recommendations X.400-X.430 (Study Group VII).
Volume IX	–	Protection against interference. Series K Recommendations (Study Group V). Construction, installation and protection of cable, and other elements of outside plant. Series L Recommendations (Study Group VI).
Volume X	–	*(2 fascicles, sold separately)*
FASCICLE X.1	–	Terms and definitions.
FASCICLE X.2	–	Index of the Red Book.

PAGE INTENTIONALLY LEFT BLANK

PAGE LAISSEE EN BLANC INTENTIONNELLEMENT

CONTENTS OF FASCICLE VII.3 OF THE RED BOOK

PRELIMINARY NOTES

1 The Questions entrusted to each Study Group for the Study Period 1985-1988 can be found in Contribution No. 1 to that Study Group.

2 In this fascicle, the expression "Administration" is used for shortness to indicate both a telecommunication Administration and a recognized private operating agency.

3 The status of annexes and appendices attached to the Series T Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information.

COLLABORATION WITH OTHER INTERNATIONAL ORGANIZATIONS ON CCITT-DEFINED TELEMATIC [1] SERVICES

Recommendation A.21 published in Volume I is reproduced below for the convenience of the reader.

Recommendation A.21

COLLABORATION WITH OTHER INTERNATIONAL ORGANIZATIONS ON CCITT-DEFINED TELEMATIC SERVICES [1]

(Geneva, 1980, amended at Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that, according to Article 1 of the agreement between the United Nations and the International Telecommunication Union, the United Nations recognizes the International Telecommunication Union as the specialized agency responsible for taking such action as may be appropriate under its basic instrument for the accomplishment of the purposes set forth therein;

(b) that Article 4 of the *International Telecommunication Convention* (Nairobi, 1982) states that the purposes of the Union are:

"*a)* to maintain and extend international cooperation between all Members of the Union for the improvement and rational use of telecommunications of all kinds, as well as to promote and to offer technical assistance to developing countries in the field of telecommunications;

b) to promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, as far as possible, generally available to the public;

c) to harmonize the actions of nations in the attainment of those ends.";

(c) that Article 40 of the *Convention* states that "in furtherance of complete international coordination on matters affecting telecommunication, the Union shall cooperate with international organizations having related interests and activities";

(d) that this cooperation has to recognize the advisory capacity of organizations participating in the work of CCITT;

(e) that, in the study of terminals for new CCITT-defined telematic services (e.g. for Teletex, Telefax, Datafax, Bureaufax, Videotex services), ISO in particular is invited to give advice to CCITT based on their work on data systems and data communications;

[1] "Telematic services" is used provisionally and includes such services as Videotex, Teletex, facsimile, etc.

(f) that this cooperation has to be organized in a manner that will avoid duplication of work and of decisions that would be contrary to the principles set out above;

recognizes the following principles

(1) It is the responsibility of the CCITT alone to make the decisions regarding the operational, technical (including factors needed to ensure international interworking) and tariff principles of the CCITT-defined services.

(2) While the CCITT will define many of the relevant factors for the CCITT-defined telematic services, other international organizations will be invited to give specialist advice to CCITT on subjects that are of mutual interest, such as:

- character sets and coding;
- end-to-end control procedures including error protection;
- interfaces between terminals and circuit terminating equipment;
- terminal transmitter distortion and receiver margin;
- paper sizes and text formatting.

(3) Standardization, if required, of hardware and software implementation of terminals, such as printing systems, paper feed, character type fonts, paper characteristics, etc., are outside the scope of CCITT.

Recommendation T.0

CLASSIFICATION OF FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION OVER THE PUBLIC NETWORKS

(Geneva, 1976; amended at Geneva, 1980 and Malaga-Torremolinos, 1984)

1 For document facsimile transmission by international communications carried on the public networks there is a need for providing sufficient operating speeds to meet users' requirements.

2 Users' requirements may best be served at the present time by classifying the following four basic categories of document facsimile apparatus.

2.1 *Apparatus for use over the public telephone network*

Group 1 (See Note 1)

Apparatus which uses double sideband modulation without any special measures to compress the bandwidth of the transmitted signal and which is suitable for the transmission of documents of ISO A4 size at nominally 4 lines per mm in about six minutes via a telephone-type circuit.

Apparatus in this group may be designed to operate at a lower definition suitable for the transmission of documents of ISO A4 size in a time between three and six minutes.

Group 2 (See Note 2)

Apparatus which exploits bandwidth compression techniques in order to achieve a transmission time of about three minutes for the transmission of an ISO A4 size document at nominally 4 lines per mm via a telephone-type circuit. Bandwidth compression in this context includes encoding and/or vestigial sideband working but excludes processing of the document signal to reduce redundancy.

Group 3 (See Note 3)

Apparatus which incorporates means for reducing the redundant information in the document signal prior to the modulation process and which can achieve a transmission time of about 1 minute for a typical typescript document of ISO A4 size via a telephone-type circuit. The apparatus may incorporate bandwidth compression of the line signal.

2.2 *Apparatus for use over the public data networks*

Group 4 (See Note 4)

Apparatus which incorporates means for reducing the redundant information in the document signal prior to transmission mainly via public data networks (PDNs). The apparatus will utilize procedures applicable to the PDN and will assure an essentially error-free reception of the document. The apparatus may also be used on the public telephone network where an appropriate modulation process will be utilized.

3 The users will choose among this apparatus, in accordance with their needs and the facilities afforded by the connection and the network.

4 Procedures for groups 1, 2 and 3 document facsimile transmission in the public switched telephone network should be in accordance with Recommendation T.30.

5 Procedures for Group 4 document facsimile transmission should be in accordance with Recommendations T.62, T.70 and T.73.

Note 1 – This apparatus has been standardized in Recommendation T.2.

Note 2 – This apparatus has been standardized in Recommendation T.3.

Note 3 – This apparatus has been standardized in Recommendation T.4.

Note 4 – This apparatus has been standardized in Recommendations T.5 and T.6.

Recommendation T.1

STANDARDIZATION OF PHOTOTELEGRAPH APPARATUS

(former CCIT Recommendation D.1; amended at New Delhi, 1960, Geneva, 1964, Mar del Plata, 1968 and Malaga-Torromolinos, 1984)

The CCITT,

considering

that the transmission of pictures is possible only if certain characteristics of the transmitting and receiving equipments are identical,

unanimously declares the view

that phototelegraph apparatus and the associated modulating and demodulating equipment should be constructed and employed according to the following standards:

1 Scanning track

At the transmitting apparatus the message area should be scanned in a "negative" direction. The orientation of the document in relation to the scanning plane will depend upon its dimensions and is of no consequence.

At the receiving apparatus scanning takes place in a "negative" direction for "positive" reception and in a "positive" direction for "negative" reception.

2 Index of cooperation

The normal index is 352 (corresponds to a factor of cooperation of 1105).

The preferred alternative index, for use when less dense scanning is required, or when the characteristics of circuits (and particularly combined radio and metallic circuits) so demand, is 264 (a factor of cooperation of 829). The admissible tolerances on the above-mentioned values are ± 1%.

3 Dimensions of apparatus

3.1 *Apparatus with drum scanning*

The most currently used drum diameters are 66, 70 and 88 mm.

The drum factor of the sending apparatus shall not be more than 2.4.

The drum factor of the receiving apparatus shall not be less than 2.4.

The width of the picture-retaining device (dead sector) may not exceed 15 mm. An allowance of 3% of the total length of a scanning line is also made for phasing. Thus, since the total circumference of a drum of the diameter of 66 mm is about 207 mm, the usable circumference will be at least 186 mm.

3.2 *Apparatus with flat-bed scanning*

The total lengths of the most current scanning lines are 207, 220 and 276 mm of which 15 mm are not used for effective transmission, because of the possibility that the receiving station may use a drum apparatus.

Before transmitting a picture to a receiving station using a drum apparatus, it is necessary to ensure that the value of ratio:

$$\frac{\text{Length of document to be transmitted}^{1)}}{\text{total length of a scanning line}} \times \pi$$

is less or at most equal to the drum factor of the receiver used.

3.3 Table 1/T.1 gives corresponding values of index of cooperation *M*, factor of cooperation *C*, drum diameter *D*, total length of scanning line *L*, scanning pitch *P* and scanning density *F* for apparatus in most common use.

TABLE 1/T.1

M	*C*	*D* (mm)	*L* (mm)	*P* (mm)	*F* (lines/mm)
264	829	66	207	1/4	4
264	829	70	220	1/3.77	3.77
264	829	88	276	1/3	3
350	1099	70	220	1/5	5
352	1105	66	207	3/16	16/3
352	1105	88	276	1/4	4

Note – The maximum dimensions of the pictures to be transmitted result from the parameters given in the table.

4 Reproduction ratio

In the case where apparatus working with different lengths of scanning line (but with the same index of cooperation) are interconnected, there will be a slight change in size and the reproduction will bear the same proportion as the original, the ratio being that of the total lengths of the scanning lines.

1) Measured in the direction perpendicular to the scanning line.

5 Drum rotation speed – scanning line frequency

5.1 Table 2/T.1 gives the normal and approved alternative combinations of drum rotation speeds or of scanning line frequencies and indices of cooperation.

TABLE 2/T.1

	Drum rotation speed in rpm or scanning line frequency	Index of cooperation	
		Metallic circuits	Combined metallic and radio circuits
Normal conditions	60 90	352	352 264
Alternatives for use when the phototelegraph apparatus and metallic circuits are suitable	90 120 150	264 and 352 264 and 352 264	

Note 1 – In the case of transmitters operating on metallic circuits, the index 264 is not intended to be used with an 88-mm drum. In the case of transmitters operating on combined metallic and radio circuits, the index 264 associated with a drum diameter of 88 mm is intended to be used only exceptionally.

Note 2 – The provisions given in the table are not intended to require the imposition of such standards on users who use their own equipment for the transmission of pictures over leased circuits. However, the characteristics of the apparatus used should be compatible with the characteristics of the circuits used.

5.2 The speed of transmitters must be maintained as nearly as possible to the nominal speed and in any case within $\pm$ 10 parts in 10^6 of the nominal speed. The speed of receivers must be adjustable and the range of adjustment should be at least $\pm$ 30 parts in 10^6 from the nominal speed. After regulation, the speeds of the transmitting and receiving sets should not differ by more than 10 parts in 10^6.

6 Judder

The stability of the speed during one rotation should be such that the maximum shift of the drum surface from the average position should not exceed one quarter of the scanning pitch P at normal index 352, which means that the maximum angle of the oscillations should not exceed 0.08 degree measured from the average position.

7 Synchronization

When phototelegraph stations have available a standard of frequency which is better than $\pm$ 5 parts in 10^6, verification of the synchronism between the two stations may be dispensed with. In view of the saving of time, this method should be adopted wherever possible.

To compare the speeds of a transmitter and a receiver, an alternating current whose frequency bears an unvarying relationship to the transmitter speed and has a nominal value of 1020 Hz is used.

Where there is the possibility that the transmitter and receiver may be connected by a circuit liable to introduce frequency drifts, for example, by a carrier telephone circuit, the use of the simple 1020-Hz synchronizing tone is unsatisfactory. The preferred method of overcoming this difficulty is to transmit the phototelegraph carrier (of about 1900 Hz) modulated by the 1020-Hz synchronizing tone.

At the receiving end, the 1020-Hz synchronizing frequency is restored by detection and can then be used in the normal manner.

8 Phasing

Phasing is performed after the speeds of the transmitter and receiver drums have been equalized.

For phasing purposes, the transmitter sends a series of alternating white and black signals in such a way that the black lasts 95% and the white 5% of the total scanning line period (admissible tolerance: ± 0.5% of the total duration of a scanning line). The apparatus must be so adjusted that the pulses corresponding to the signal for white are transmitted:

– during scanning of the "dead sector", when drum apparatus is used,

– during "lost time", when flat-bed apparatus is used,

and that they are placed at the middle of the dead sector (or of the interval corresponding to the lost time).

(Tolerance admitted in the position of the "white" pulses: $\Delta_E = \pm 1\%$ of a "total scanning line length".)

At the receiving station, phasing signals are used to start the apparatus so that short white pulses occur in the middle of the "lost time" (tolerance admitted: $\Delta_R = \pm 2\%$ of a "total scanning line length").

Note – These tolerances allow for the fact that the restitution of the original may deviate from its nominal position by 3% of a "total scanning line length", when the sending and receiving stations are operating with the maximum authorized drift in the same direction.

9 Contrast

The transmitter must transmit the original document without changing the contrast of the tone scales of the picture to be transmitted.

10 Modulation and demodulation equipment

10.1 *Amplitude modulation*

Phototelegraph equipment shall normally provide for transmission and reception of an amplitude-modulated audio-frequency carrier, which is the normal mode of transmission for international metallic circuits.

The level of the output signal of the transmitter shall be greatest for white and least for black. It is desirable that the ratio of nominal white signal to nominal black signal should be approximately 30 decibels.

To simplify multi-destination operation and AM/FM conversion for radio operation it is desirable that the amplitude of the transmitted signal should vary linearly with the photocell voltage and that no corrections for tone scale should be made at the phototelegraph transmitting station.

For audio-frequency telephone circuits, the frequency of the picture carrier-current is fixed at about 1300 Hz. This frequency gives the least delay distortion on lightly loaded underground cables.

In the case of carrier telephone circuits providing a transmission band from 300 to 3400 Hz, a carrier-current frequency of about 1900 Hz is recommended.

10.2 *Frequency modulation*

Preferably phototelegraph apparatus should also provide for transmission and reception of a frequency-modulated audio-frequency carrier for use when necessary:

a) on combined metallic and radio circuits;

b) on wholly metallic circuits.

In such a case, the characteristics of the frequency-modulated output should be:

mean frequency	1900 Hz
white frequency	1500 Hz
black frequency	2300 Hz

The deviation of frequency should vary linearly with photocell voltage or, in the case of conversion from amplitude modulation to frequency modulation, with the amplitude of the amplitude-modulated carrier.

The stability of the transmission must be such that the frequency corresponding to a given tone does not vary by more than 8 Hz in a period of 1 second and by more than 16 Hz in a period of 15 minutes.

The receiving apparatus must be capable of operating correctly when the drift of black and white frequencies received does not exceed their nominal value by more than ± 32 Hz.

Note – It is recognized that there are difficulties operating with these frequency limits on the public switched telephone network (PSTN) where certain types of signalling equipment are used. By prior agreement between users on the PSTN, alternative frequencies of 1300 Hz for white and 2100 Hz for black may be used.

11 Positive or negative reception

Selection of positive or negative reception should be made by adjustment at the receiver. The adaptation of the transmitted signals to the characteristics of the photographic materials must also be effected at the receiving end according to the type of reproduction, negative or positive.

Recommendation T.2

STANDARDIZATION OF GROUP 1 FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION

(Mar del Plata, 1968; amended at Geneva, 1972 and 1976)

The CCITT,

considering

(a) that there is a requirement for Group 1 facsimile apparatus which enables an ISO A4 document to be transmitted over a telephone-type circuit in approximately six minutes;

(b) that document facsimile transmission may be requested alternately with telephone conversation or when either or both stations are unattended; in both cases the facsimile operation should conform to Recommendation T.30,

unanimously declares the view

that Group 1 facsimile apparatus for use on the general switched telephone network and international leased circuits should be designed and operated according to the following standards:

1 Scanning track

The message area should be scanned in the same direction in the transmitter and receiver. Viewing the message area in a vertical plane, the scanning direction should be from left to right, and subsequent scans should be adjacent and below the previous scan.

2 Index of cooperation

The nominal index of cooperation is 264. In cases where a lower vertical resolution is acceptable, and by agreement between the users, an optional index of cooperation of 176 may be used.

These values should be observed with a nominal tolerance of ± 1% for each equipment.

3 Dimensions of apparatus

3.1 The apparatus should accept documents up to a minimum of ISO A4 size (nominally 210 mm × 297 mm).

3.2 The total scanning line length (active sector plus dead sector) should be nominally 215 mm. Nominally 200 mm should be available for scanning or recording, the remainder being the dead sector.

3.3 For any one document the nominal number of scans should be 1144 for an index of cooperation of 264 (762 scans for an index of 176). The receiver should be capable of recording nominally 1144 scans per document for an index of cooperation of 264 (or 762 scans for an index of 176).

3.4 Apparatus with other dimensions may be used provided that the index of cooperation is respected, that the total scanning line length lies between 210 and 250 mm and the usable recording line length retains the same ratio to the total scanning line length.

4 Scanning density

Scanning density is normally 3.85 lines per mm.

5 Scanning line frequency

In the subscriber-to-subscriber service via the general switched telephone network, the scanning line frequency should be 180 lines per minute (see Note).

For leased circuits operation the best line frequency, which may be higher or lower than 180 lines per minute, may be chosen according to the circuit characteristics.

The scanning line frequency during the transmission should be kept within $\pm$ 10 parts in 10^6 of the nominal value.

Note – With manual control at the two ends of connection set up over the general switched telephone network, another scanning line frequency (e.g. 240 per minute) may be chosen by agreement between the two operators.

6 Phasing

The duration of the phasing signal for transmitters should be 15 $\pm$ 1 seconds.

In a preferred method of phasing (see Note 1), the transmitter sends a series of alternating white and black signals in such a way that the white pulse (phasing pulse) is 4 to 6% of the total scanning line length and the leading edge is 2 to 3% in advance of the middle of the dead sector.

Receiving apparatus should synchronize the middle of its dead sector 0.5 to 4.5% lagging the leading edge of the received phasing pulse (see Note 2).

Note 1 – In a permitted method of phasing for present generation machines, the transmitter sends a series of white and black signals in such a way that the white pulse is 2 to 12% of the total scanning line length and the leading edge is 2 to 3% in advance of the middle of the dead sector.

Note 2 – Maximum reduction of recorded scanning line length due to synchronizing misalignment should not exceed 3% of total scanning line length. Maximum reduction of recorded scanning line length due to the combined effect of deviations of the transmitter and receiver scanning line frequencies should not exceed 4% of total scanning line length. The effect of these reductions of recorded scanning line length may cause it to be less than the nominal 200 mm.

7 Modulation and demodulation equipments

7.1 *Amplitude modulation* (for leased circuits only)

The facsimile signal level is higher for black and lower for white.

The carrier frequency should range between 1300 and 1900 Hz and will depend upon the characteristics of the circuits used.

7.2 *Frequency modulation* (for leased circuits and for switched connections)

The frequency corresponding to black will normally be f_0 + 400 Hz and the frequency corresponding to white will normally be f_0 – 400 Hz (see Note).

For switched connections f_0 = 1700 Hz (provisional). For leased circuits f_0 should range between 1300 and 1900 Hz: the choice of the centre frequency f_0 will depend upon the circuit characteristics. However, if the user, in some cases, wishes to use the apparatus on switched connections, f_0 = 1700 Hz.

The stability of the transmitter must be such that the significant frequencies do not vary by more than 32 Hz from their nominal value in a period of 15 minutes.

Note – Attention is drawn to the fact that there are some equipments currently in operation for which black and white elements are represented in the opposite sense, but the preferred standard for new equipment is as indicated above.

7.3 *Power at the transmitter output*

When amplitude modulation is used, the power of black at the transmitter output must be able to be adjusted between −7 dBm and 0 dBm. The white level must be approximately 15 dB below the black level.

In frequency-modulated systems, the level at the output of the facsimile apparatus must be able to be adjusted between −15 dBm and 0 dBm.

The equipment should be so designed that there is no possibility of this adjustment being tampered with by an operator.

7.4 *Power at the receiver input*

The facsimile receiver must be so designed that it functions correctly when the input power ranges between 0 dBm and −40 dBm, the latter value being considered provisional. In the case of amplitude modulation, this concerns the power of the black signal. No control of receiver sensitivity should be provided for operator use.

Recommendation T.3

STANDARDIZATION OF GROUP 2 FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION

(Geneva, 1976; amended at Geneva, 1980)

The CCITT,

considering

(a) that Recommendation T.2 refers to Group 1 type apparatus for ISO A4 document transmission in approximately six minutes;

(b) that there is a demand for Group 2 apparatus which enables an ISO A4 document to be transmitted over a telephone-type circuit in approximately three minutes;

(c) that the Group 2 apparatus reproduces document quality similar to Group 1 apparatus;

(d) that such a service may be requested either alternatively with telephone conversation, or when either or both stations are not attended; in both cases, the facsimile operation will follow Recommendation T.30;

(e) interconnection between two machines of different designs, both conforming to Recommendation T.3 as published in the Orange Book may give a lower guaranteed reproducible area in certain cases;

unanimously declares the view

that Group 2 facsimile apparatus for use on the general switched telephone network and international leased circuits shall, in future, be designed and operated in accordance with this Recommendation. Apparatus conforming to Recommendation T.3 of the Orange Book may continue in service.

1 Scanning track

The message area should be scanned in the same direction in the transmitter and receiver. Viewing the message area in a vertical plane, the scanning direction should be from left to right and subsequent scans should be adjacent and below the previous scan.

In order to avoid loss of information, users should insert documents so that the scanning direction is from the wider to the narrower margin.

2 Dimensions of apparatus

The following dimensions are recommended but apparatus with other dimensions may be used provided that the factor of cooperation is respected and that the total scanning line length lies between 215 and 222 mm.

Factor of cooperation (FOC)	829 ± 1%
Total scanning line-length (TLL)	215 mm
Usable scanning line-length (ULL) The end of ULL shall lie between 0 and 1 mm within the nominal position of the right hand edge of an ISO A4 size document.	205 mm minimum
Input document size	Up to a minimum of ISO A4 size (nominally 210 × 297 mm)

The foregoing dimensions give rise to the following approximate secondary dimensions.

Index of cooperation (IOC)	264
Scanning density	3.85 line/mm
Number of scanning lines in a document 297 mm long	1145

3 Scanning line frequency

3.1 The scanning line frequency should be 360 lines per minute.

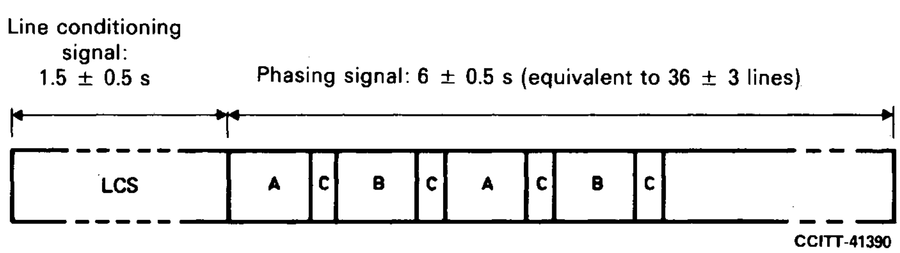
Note – Another scanning line frequency (e.g. 300 lines per minute) may be chosen by agreement between the two stations.

3.2 The scanning line frequency during the transmission should be kept within ± 5 parts in 10^6 of the nominal value.

4 Phasing

For phasing prior to transmission of document information the transmitter sends a signal as shown in Figure 1/T.3. The start of the carrier indicates the end of the lost time. The accuracy of the adjustment at the transmitter of the end of lost time to the start of carrier should be ± 0.5% of TLL. The receiver should phase its reference point with an accuracy of ± 1% of TLL to this start of the carrier. The reference point should be 209 mm before the end of ULL (see Figure 2/T.3).

Note – In the case of the multiple page transmission the phasing procedure may need to be repeated between pages.



LCS Line conditioning signal: 1100 ± 50 Hz. Transmission of this signal is optional
A Carrier in 0° phase for 94-96% of total scanning line length
B As A but may be in 180° phase
C No signal (at least 26 dB below the carrier) for the remaining 4-6% of TLL

FIGURE 1/T.3

Structure of line conditioning and phasing signal

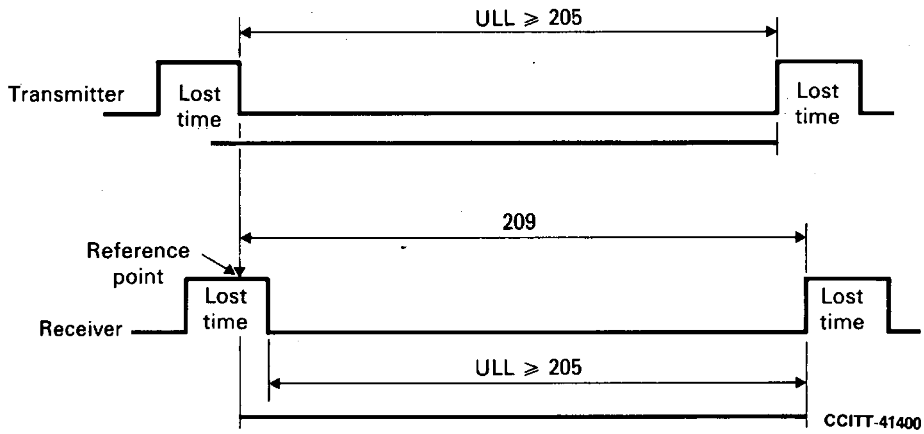


FIGURE 2/T.3

5 Document transmission

5.1 During transmission of document information the transmitter should transmit full amplitude carrier during the lost time for at least 4% of the transmission time for TLL. The phase of the carrier may be reversed at the end of this signal.

Following the lost time the information transmitted to the receiver is the one contained in ULL. The value of ULL is defined in § 2.

The receiver must be able to reproduce at least ULL on the reproduction media after the end of the lost time.

5.2 This signal may be used at the receiver as an amplitude reference independent of the document signal and also to indicate to the receiver that document transmission is still in progress.

6 Paper alignment

All types of apparatus should be designed to ensure that paper is positioned within ± 1.5 mm of nominal in the horizontal direction. In the vertical direction it must be ensured that paper is positioned in such a way that scanning and recording start not more than 4 mm down the document from the top edge.

7 Modulation and demodulation

7.1 Equivalent modulated waveforms with vestigial sideband amplitude modulation – phase modulation characteristics should be used for Group 2 apparatus operated on leased circuits and on the general switched telephone network. The carrier frequency should be 2100 ± 10 Hz (see Note). A white signal should be represented by maximum carrier and a black signal by minimum (at least 26 dB below white) or no carrier. The phase of the carrier representing white may be reversed after each transition through black.

Note – It should be noted that there are equipments in service using, inter alia, a carrier frequency of 2048 Hz.

7.2 The facsimile transmission could contain a limited range of half-tones represented by a carrier amplitude less than that sent during the lost time.

7.3 A vestigial sideband filter symmetrical about the 2100-Hz carrier frequency should be provided at the transmitter. The response of this filter should conform to Figure 3/T.3. The accuracy of this filter is not critical but the relative transmittance at the carrier frequency should be 0.5 with a tolerance of ± 0.05 and the characteristic should be sensibly symmetrical about the carrier frequency.

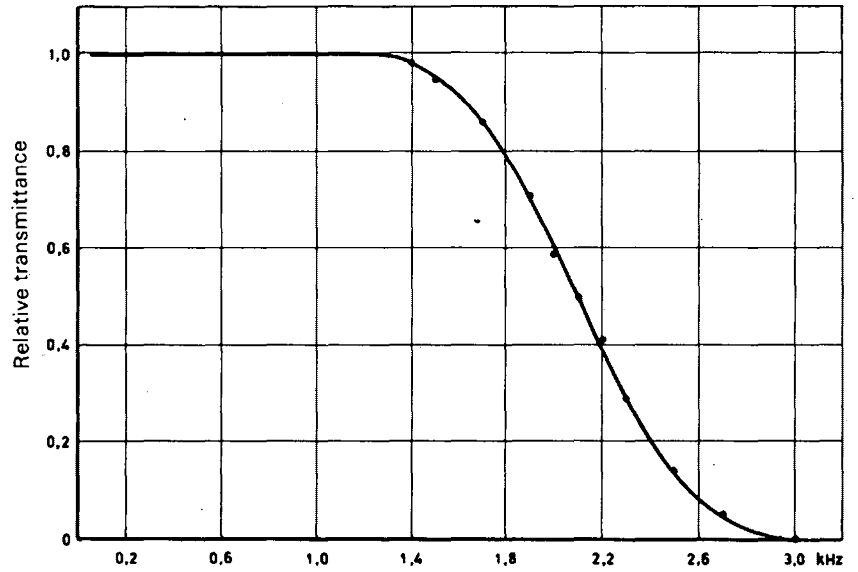


FIGURE 3/T.3
Frequency response of the vestigial sideband filter

7.4 The receiving apparatus must be capable of operating correctly when the drift of carrier frequency does not exceed its nominal value by more than ± 16 Hz.

7.5 A fixed compromise equalizer, an automatic equalizer or an adaptive equalizer may be provided in the receiver but this should be a matter for further study.

8 Power at the transmitter output

The power of the white signal should be adjustable from −15 dBm to 0 dBm but the equipment should be so designed that there is no possibility of this adjustment being tampered with by an operator. The black level should be at least 26 dB below the white level.

9 Power at the receiver input

The receiving apparatus should be capable of functioning correctly when the received signal level for white is within the range 0 dBm to −40 dBm, the latter value being considered provisional. No control of receiver sensitivity should be provided for operator use.

APPENDIX I

(to Recommendation T.3)

Guaranteed reproducible area for Group 2 machines conforming to Recommendation T.3

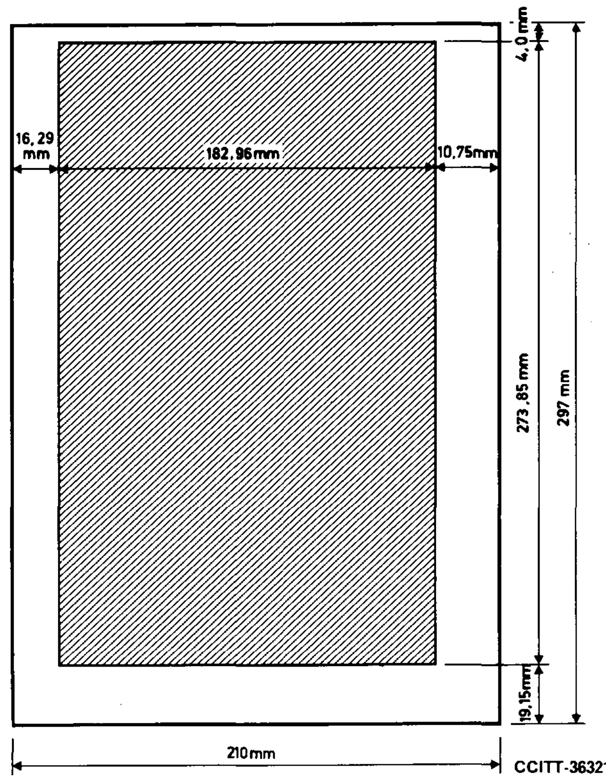
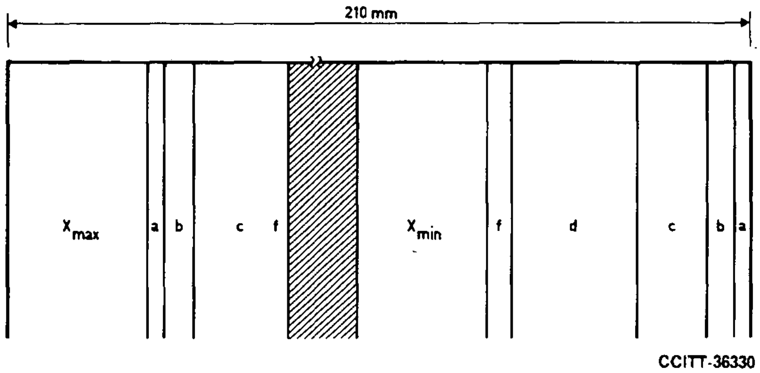


FIGURE I-1/T.3

Guaranteed reproducible area for Group 2 machines for use on facsimile services referring to ISO A4 paper size

I.1 *Horizontal loss*



a Phasing loss at the transmitter (± 0.5%)

b Phasing loss at the receiver (± 1.0%)

c Losses by skew (at the bottom of the page) ($\pm 10^{-5}$)

d Loss caused by the enlarging effect in the case when different values of TLL are used.
This value applies to ULL and the right and bottom margins only, because the beginning of ULL of the transmitter and receiver are aligned with the same position by the phasing procedure

f Loss caused by incorrect paper insertion allowing for ± 1.5 mm tolerance

x Loss caused by the tolerance allowing ULL to be located relative to the A4 size format

FIGURE I-2/T.3

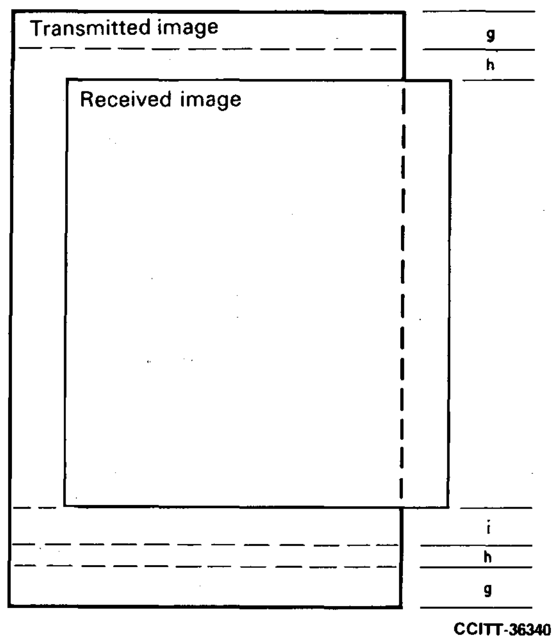
TABLE I-1/T.3

Results

Horizontal losses				Left margin (mm)		Right margin (mm)	
				205	210	205	210
Phasing	Transmitter	a	± 0.5%	1.11	1.11	1.11	1.11
	Receiver	b	± 1.0%	2.22	2.22	2.22	2.22
Skew		c	$\pm 5 \times 10^{-6}$	2.46	2.46	2.46	2.46
Enlarging		d		–	–	6.46	6.62
Paper insertion		f		1.50	1.50	1.50	1.50
Lost time	Min.	x		–	–	1.00	1.00
	Max.	x		5.00	–	–	–
			Total	12.29	7.29	14.75	14.91
			Shifted value	16.29	3.29	10.75	10.91

TLL: 215 to 222 mm
ULL: 205 to 210 mm

I.2 *Vertical loss*



g Gripping loss caused by paper feed mechanism
(at the top of the document: 4.00 mm)

h Loss caused by inserting the paper incorrectly

i Loss caused by the enlarging effect plus FOC tolerance (59 lines lost)

FIGURE I-3/T.3

TABLE I-2/T.3

		Top mm	Bottom mm
Gripping loss	g	4.0	4.0
Paper insertion	h		
Enlarging + FOC	i	–	15.15
	Total	4.0	19.15

STANDARDIZATION OF GROUP 3 FACSIMILE APPARATUS FOR DOCUMENT TRANSMISSION

(Geneva, 1980, amended at Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that Recommendation T.2 refers to Group 1 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately six minutes;

(b) that Recommendation T.3 refers to Group 2 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately three minutes;

(c) that there is a demand for Group 3 apparatus which enables an ISO A4 document to be transmitted over a telephone-type circuit in approximately one minute;

(d) that for a large number of applications black and white reproduction is sufficient;

(e) that such a service may be requested either alternatively with telephone conversation, or when either or both stations are not attended; in both cases, the facsimile operation will follow Recommendation T.30;

unanimously declares the view

that Group 3 facsimile apparatus for use on the general switched telephone network and international leased circuits should be designed and operated according to the following standards:

1 Scanning track

The message area should be scanned in the same direction in the transmitter and receiver. Viewing the message area in a vertical plane, the picture elements should be processed as if the scanning direction were from left to right with subsequent scans adjacent and below the previous scan.

2 Dimensions of apparatus

Note – The tolerances on the factors of cooperation are subject to further study.

2.1 The following dimensions should be used:

a) A standard resolution and an optional higher resolution of 3.85 line/mm ± 1% and 7.7 line/mm ± 1% respectively in vertical direction.
b) 1728 black and white picture elements along the standard scan line length of 215 mm ± 1%.
c) Optionally, 2048 black and white picture elements along a scan line length of 255 mm ± 1%.
d) Optionally, 2432 black and white picture elements along a scan line length of 303 mm ± 1%.

2.2 Input documents up to a minimum of ISO A4 size should be accepted.

Note – The size of the guaranteed reproducible area is shown in Appendix I.

3 Transmission time per total coded scan line

The total coded scan line is defined as the sum of DATA bits plus any required FILL bits plus the EOL bits.

For the optional two-dimensional coding scheme as described in § 4.2, the total coded scan line is defined as the sum of DATA bits plus any required FILL bits plus the EOL bits plus a tag bit.

To handle various printing methods, several optional minimum total coded scan line times are possible in addition to the 20 milliseconds standard.

3.1 The minimum transmission times of the total coded scan line should conform to the following:

1) Alternative 1, where the minimum transmission time of the total coded scan line is the same both for the standard resolution and for the optional higher resolution:

   a) 20 milliseconds recommended standard,

   b) 10 milliseconds recognized option with a mandatory fall-back to the 20 milliseconds standard,

   c) 5 milliseconds recognized option with a mandatory fall-back to the 10 milliseconds option and the 20 milliseconds standard,

   d) 0 millisecond recognized option with a mandatory fall-back to the 5 milliseconds option, the 10 milliseconds option and the 20 milliseconds standard, and an optional fall-back to the 40 milliseconds option,

   e) 40 milliseconds recognized option.

2) Alternative 2, where the minimum transmission time of the total coded scan line for the optional higher resolution is half of that for the standard resolution (see Note). These figures refer to the standard resolution:

   a) 10 milliseconds recognized option with a mandatory fall-back to the 20 milliseconds standard,

   b) 20 milliseconds recommended standard,

   c) 40 milliseconds recognized option.

The identification and choice of this minimum transmission time is to be made in the pre-message (phase B) portion of Recommendation T.30 control procedure.

Note – Alternative 2 applies to equipment with printing mechanisms which achieve the standard vertical resolution by printing two consecutive, identical higher resolution lines. In this case, the minimum transmission time of the total coded scan line for the standard resolution is double the minimum transmission time of the total coded scan line for the higher resolution.

3.2 The maximum transmission time of any total coded scan line should be less than 5 seconds. When this transmission time exceeds 5 seconds, the receiver must proceed to disconnect the line.

4 Coding scheme

4.1 *One-dimensional coding scheme*

The one-dimensional run length coding scheme recommended for Group 3 apparatus is as follows:

4.1.1 *Data*

A line of Data is composed of a series of variable length code words. Each code word represents a run length of either all white or all black. White runs and black runs alternate. A total of 1728 picture elements represent one horizontal scan line of 215 mm length.

In order to ensure that the receiver maintains colour synchronization, all Data lines will begin with a white run length code word. If the actual scan line begins with a black run, a white run length of zero will be sent. Black or white run lengths, up to a maximum length of one scan line (1728 picture elements or pels) are defined by the code words in Tables 1/T.4 and 2/T.4. The code words are of two types: Terminating code words and Make-up code words. Each run length is represented by either one Terminating code word or one Make-up code word followed by a Terminating code word.

Run lengths in the range of 0 to 63 pels are encoded with their appropriate Terminating code word. Note that there is a different list of code words for black and white run lengths.

Run lengths in the range of 64 to 1728 pels are encoded first by the Make-up code word representing the run length which is equal to or shorter than that required. This is then followed by the Terminating code word representing the difference between the required run length and the run length represented by the Make-up code.

TABLE 1/T.4

Terminating codes

White run length	Code word	Black run length	Code word
0	00110101	0	0000110111
1	000111	1	010
2	0111	2	11
3	1000	3	10
4	1011	4	011
5	1100	5	0011
6	1110	6	0010
7	1111	7	00011
8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100
11	01000	11	0000101
12	001000	12	0000111
13	000011	13	00000100
14	110100	14	00000111
15	110101	15	000011000
16	101010	16	0000010111
17	101011	17	0000011000
18	0100111	18	0000001000
19	0001100	19	00001100111
20	0001000	20	00001101000
21	0010111	21	00001101100
22	0000011	22	00000110111
23	0000100	23	00000101000
24	0101000	24	00000010111
25	0101011	25	00000011000
26	0010011	26	000011001010
27	0100100	27	000011001011
28	0011000	28	000011001100
29	00000010	29	000011001101
30	00000011	30	000001101000
31	00011010	31	000001101001
32	00011011	32	000001101010
33	00010010	33	000001101011
34	00010011	34	000011010010
35	00010100	35	000011010011
36	00010101	36	000011010100
37	00010110	37	000011010101
38	00010111	38	000011010110
39	00101000	39	000011010111
40	00101001	40	000001101100
41	00101010	41	000001101101
42	00101011	42	000011011010
43	00101100	43	000011011011
44	00101101	44	000001010100
45	00000100	45	000001010101
46	00000101	46	000001010110
47	00001010	47	000001010111
48	00001011	48	000001100100
49	01010010	49	000001100101
50	01010011	50	000001010010
51	01010100	51	000001010011
52	01010101	52	000000100100
53	00100100	53	000000110111
54	00100101	54	000000111000
55	01011000	55	000000100111
56	01011001	56	000000101000
57	01011010	57	000001011000
58	01011011	58	000001011001
59	01001010	59	000000101011
60	01001011	60	000000101100
61	00110010	61	000001011010
62	00110011	62	000001100110
63	00110100	63	000001100111

TABLE 2/T.4

Make-up codes

White run lengths	Code word	Black run lengths	Code word
64	11011	64	0000001111
128	10010	128	000011001000
192	010111	192	000011001001
256	0110111	256	000001011011
320	00110110	320	000000110011
384	00110111	384	000000110100
448	01100100	448	000000110101
512	01100101	512	0000001101100
576	01101000	576	0000001101101
640	01100111	640	0000001001010
704	011001100	704	0000001001011
768	011001101	768	0000001001100
832	011010010	832	0000001001101
896	011010011	896	0000001110010
960	011010100	960	0000001110011
1024	011010101	1024	0000001110100
1088	011010110	1088	0000001110101
1152	011010111	1152	0000001110110
1216	011011000	1216	0000001110111
1280	011011001	1280	0000001010010
1344	011011010	1344	0000001010011
1408	011011011	1408	0000001010100
1472	010011000	1472	0000001010101
1536	010011001	1536	0000001011010
1600	010011010	1600	0000001011011
1664	011000	1664	0000001100100
1728	010011011	1728	0000001100101
EOL	000000000001	EOL	000000000001

Note — It is recognized that machines exist which accommodate larger paper widths whilst maintaining the standard horizontal resolution. This option has been provided for by the addition of the Make-up code set defined as follows:

Run length (black and white)	Make-up codes
1792	00000001000
1856	00000001100
1920	00000001101
1984	000000010010
2048	000000010011
2112	000000010100
2176	000000010101
2240	000000010110
2304	000000010111
2368	000000011100
2432	000000011101
2496	000000011110
2560	000000011111

4.1.2 *End-of-line (EOL)*

This code word follows each line of Data. It is a unique code word that can never be found within a valid line of Data; therefore, resynchronization after an error burst is possible.

In addition, this signal will occur prior to the first Data line of a page.

Format: 000000000001

4.1.3 *Fill*

A pause may be placed in the message flow by transmitting Fill. Fill may be inserted between a line of Data and an EOL, but never within a line of Data. Fill must be added to ensure that the transmission time of Data, Fill and EOL is not less than the minimum transmission time of the total coded scan line established in the pre-message control procedure.

Format: variable length string of 0s.

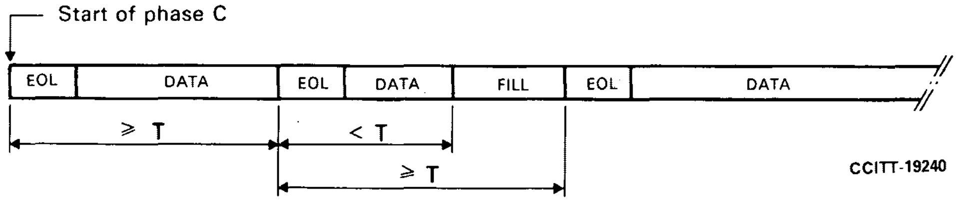
4.1.4 *Return to control (RTC)*

The end of a document transmission is indicated by sending six consecutive EOLs. Following the RTC signal, the transmitter will send the post message commands in the framed format and the data signalling rate of the control signals defined in Recommendation T.30.

Format: 000000000001 000000000001
(total of 6 times)

Figures 1/T.4 and 2/T.4 clarify the relationship of the signals defined herein. Figure 1/T.4 shows several scan lines of data starting at the beginning of a transmitted page. Figure 2/T.4 shows the last coded scan line of a page.

The identification and choice of either the standard code table or the extended code table is to be made in the pre-message (phase B) portion of Recommendation T.30 control procedures.



T Minimum transmission time of a total coded scan line

FIGURE 1/T.4

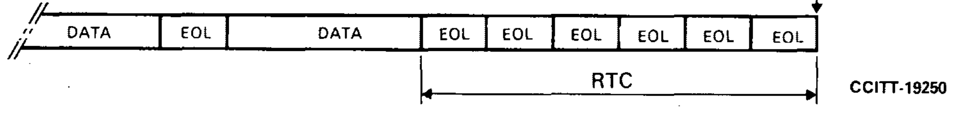


FIGURE 2/T.4

4.2 *Two-dimensional coding scheme*

The two-dimensional coding scheme is an optional extension of the one-dimensional coding scheme specified in § 4.1 and is as follows:

4.2.1 *Data*

4.2.1.1 *Parameter K*

In order to limit the disturbed area in the event of transmission errors, after each line coded one-dimensionally, at most K-1 successive lines shall be coded two-dimensionally. A one-dimensionally coded line may be transmitted more frequently than every K lines. After a one-dimensional line is transmitted, the next series of K-1 two-dimensional lines is initiated. The maximum value of K shall be set as follows:

Standard vertical resolution: $K = 2$

Optional higher vertical resolution: $K = 4$.

Note 1 – Some Administrations pointed out that for the optional higher vertical resolution K may optionally be set to a lower value.

Note 2 – Some Administrations reserve the right to approve only such apparatus for use in the facsimile service in their respective countries which will be able to produce a visible sign on its received facsimile message indicating that two-dimensional coding has been used in the transmission process.

4.2.1.2 *One-dimensional coding*

This conforms with the description of Data in § 4.1.1.

4.2.1.3 *Two-dimensional coding*

This is a line-by-line coding method in which the position of each changing picture element on the current or coding line is coded with respect to the position of a corresponding reference element situated on either the coding line or the reference line which lies immediately above the coding line. After the coding line has been coded it becomes the reference line for the next coding line.

4.2.1.3.1 *Definition of changing picture elements (see Figure 3/T.4)*

A changing element is defined as an element whose "colour" (i.e. black or white) is different from that of the previous element along the same scan line.

a_0 The reference or starting changing element on the coding line. At the start of the coding line a_0 is set on an imaginary white changing element situated just before the first element on the line. During the coding of the coding line, the position of a_0 is defined by the previous coding mode. (See § 4.2.1.3.2.)

a_1 The next changing element to the right of a_0 on the coding line.

a_2 The next changing element to the right of a_1 on the coding line.

b_1 The first changing element on the reference line to the right of a_0 and of opposite colour to a_0.

b_2 The next changing element to the right of b_1 on the reference line.

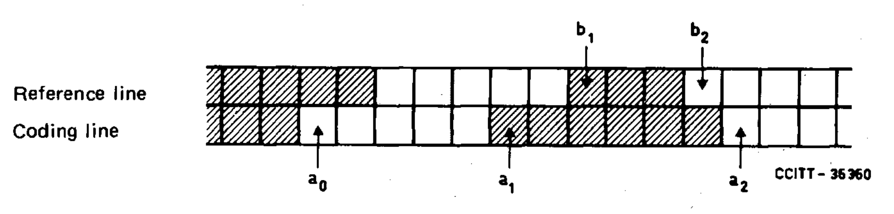


FIGURE 3/T.4

Changing picture elements

4.2.1.3.2 *Coding modes*

One of the three coding modes are chosen according to the coding procedure described in § 4.2.1.3.3 to code the position of each changing element along the coding line. Examples of the three coding modes are given in Figures 4/T.4, 5/T.4 and 6/T.4.

a) *Pass mode*

This mode is identified when the position of b_2 lies to the left of a_1. When this mode has been coded, a_0 is set on the element of the coding line below b_2 in preparation for the next coding (i.e. on a'_0).

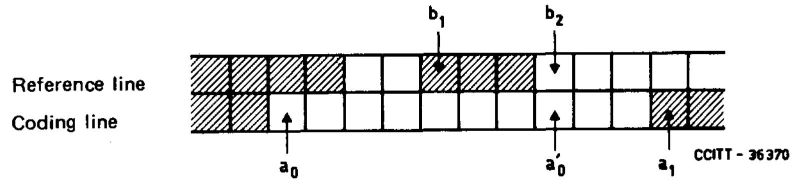


FIGURE 4/T.4

Pass mode

However, the state where b_2 occurs just above a_1, as shown in Figure 5/T.4 is not considered as a pass mode.

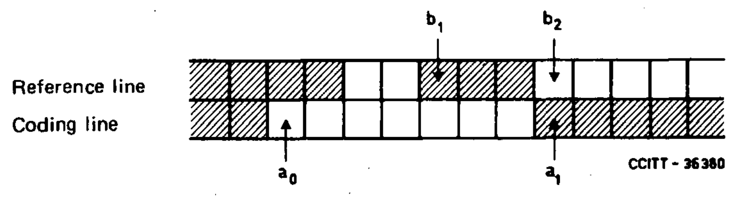


FIGURE 5/T.4

An example not corresponding to a Pass mode

b) *Vertical mode*

When this mode is identified, the position of a_1 is coded relative to the position of b_1. The relative distance a_1b_1 can take on one of seven values V(0), $V_R(1)$, $V_R(2)$, $V_R(3)$, $V_L(1)$, $V_L(2)$ and $V_L(3)$, each of which is represented by a separate code word. The subscripts R and L indicate that a_1 is to the right or left respectively of b_1, and the number in brackets indicates the value of the distance a_1b_1. After vertical mode coding has occurred, the position of a_0 is set on a_1, (see Figure 6/T.4).

c) *Horizontal mode*

When this mode is identified, both the run-lengths a_0a_1 and a_1a_2 are coded using the code words $H + M(a_0a_1) + M(a_1a_2)$. H is the flag code word 001 taken from the two-dimensional code table (Table 3/T.4). $M(a_0a_1)$ and $M(a_1a_2)$ are code words which represent the length and "colour" of the runs a_0a_1 and a_1a_2 respectively and are taken from the appropriate white or black one-dimensional code tables (Tables 1/T.4 and 2/T.4). After a horizontal mode coding, the position of a_0 is set on a_2 (see Figure 6/T.4).

4.2.1.3.3 *Coding procedure*

The coding procedure identifies the coding mode that is to be used to code each changing element along the coding line. When one of the three coding modes has been identified according to Step 1 or Step 2 mentioned below, an appropriate code word is selected from the code table given in Table 3/T.4. The coding procedure is as shown in the flow diagram of Figure 7/T.4.

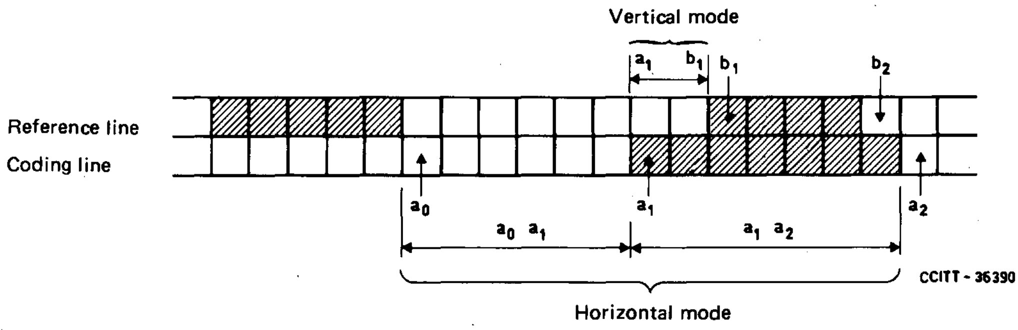


FIGURE 6/T.4

Vertical mode and Horizontal mode

Note – It does not affect compatibility to restrict the use of pass mode in the encoder to a single pass mode. Variations of the algorithm which do not affect compatibility should be the subject of further study.

Step 1

i) If a pass mode is identified, this is coded using the word 0001 (Table 3/T.4). After this processing, picture element a'_0 just under b_2 is regarded as the new starting picture element a_0 for the next coding. (See Figure 4/T.4.)

ii) If a pass mode is not detected then proceed to Step 2.

Step 2

i) Determine the absolute value of the relative distance a_1b_1.

ii) If $|a_1b_1| \leqslant 3$, as shown in Table 3/T.4, a_1b_1 is coded by the vertical mode, after which position a_1 is regarded as the new starting picture element a_0 for the next coding.

iii) If $|a_1b_1| > 3$, as shown in Table 3/T.4, following horizontal mode code 001, a_0a_1 and a_1a_2 are respectively coded by one-dimensional coding. After this processing position a_2 is regarded as the new starting picture element a_0 for the next coding.

4.2.1.3.4 *Processing the first and last picture elements in a line*

a) *Processing the first picture element*

The first starting picture element a_0 on each coding line is imaginarily set at a position just before the first picture element, and is regarded as a white picture element (see § 4.2.1.3.1).

The first run length on a line a_0a_1 is replaced by $a_0a_1 - 1$. Therefore, if the first run is black and is deemed to be coded by horizontal mode coding, then the first code word $M(a_0a_1)$ corresponds to a white run of zero length (see Figure 10/T.4, Example 5).

b) *Processing the last picture element*

The coding of the coding line continues until the position of the imaginary changing element situated just after the last actual element has been coded. This may be coded as a_1 or a_2. Also, if b_1 and/or b_2 are not detected at any time during the coding of the line, they are positioned on the imaginary changing element situated just after the last actual picture element on the reference line.

4.2.2 *Line synchronization code word*

To the end of every coded line is added the end-of-line (EOL) code word 000000000001. The EOL code word is followed by a single tag bit which indicates whether one- or two-dimensional coding is used for the next line.

TABLE 3/T.4

Two-dimensional code table

Mode	Elements to be coded		Notation	Code word
Pass	b_1, b_2		P	0001
Horizontal	a_0a_1, a_1a_2		H	001 + $M(a_0a_1)$ + $M(a_1a_2)$ (see Note)
Vertical	a_1 just under b_1	$a_1b_1 = 0$	V(0)	1
	a_1 to the right of b_1	$a_1b_1 = 1$	$V_R(1)$	011
		$a_1b_1 = 2$	$V_R(2)$	000011
		$a_1b_1 = 3$	$V_R(3)$	0000011
	a_1 to the left of b_1	$a_1b_1 = 1$	$V_L(1)$	010
		$a_1b_1 = 2$	$V_L(2)$	000010
		$a_1b_1 = 3$	$V_L(3)$	0000010
Extension	2-D (extensions) 1-D (extensions)			0000001xxx 000000001xxx (see Note 2)

Note 1 — Code M( ) of the horizontal mode represents the code words in Tables 1/T.4 and 2/T.4.

Note 2 — It is suggested the uncompressed mode is recognized as an optional extension of the two-dimensional coding scheme for Group 3 apparatus. The bit assignment for the xxx bits is 111 for the uncompressed mode of operation whose code table is given in Table 4/T.4.

Note 3 — Further study is needed to define other unspecified xxx bit assignments and their use for any further extensions.

Note 4 — If the suggested uncompressed mode is used on a line designated to be one-dimensionally coded, the coder must not switch into the uncompressed mode following any code word ending in the sequence 000. This is because any code word ending in 000 followed by a switching code 000000001 will be mistaken for an end-of-line code.

TABLE 4/T.4

Uncompressed mode code words

Entrance code to uncompressed mode	On one-dimensionally coded line: 000000001111 On two-dimensionally coded line: 0000001111	
Uncompressed mode code	*Image pattern* 1 01 001 0001 00001 00000	*Code word* 1 01 001 0001 00001 000001
Exist from uncompressed mode code	0 00 000 0000	0000001T 00000001T 000000001T 0000000001T 00000000001T

T denotes a tag bit which tells the colour of the next run (black = 1, white = 0).

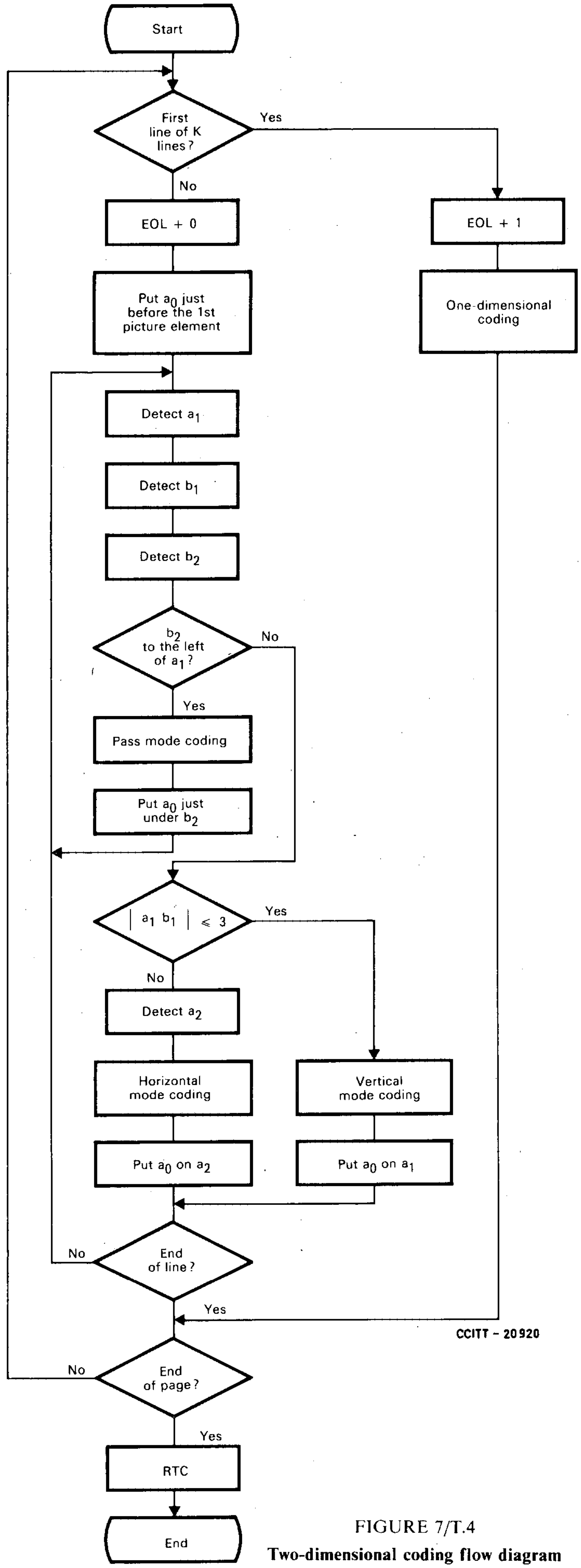


FIGURE 7/T.4

Two-dimensional coding flow diagram

In addition, EOL plus the tag bit 1 signal will occur prior to the first Data line of a page.

Format:

EOL + 1: one-dimensional coding of next line

EOL + 0: two-dimensional coding of next line

4.2.3 *Fill*

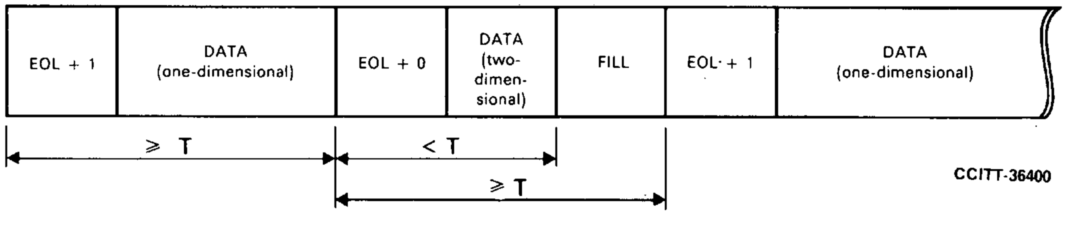
Fill is inserted between a line of Data and the line synchronization signal, EOL + tag bit, but is not inserted in Data. Fill must be added to ensure that the transmission time of Data, Fill and EOL plus tag bit is not less than the minimum transmission time of the total coded scan line.

Format: variable length string of 0 s.

4.2.4 *Return to control (RTC)*

The format used is six consecutive line synchronization code words, i.e., 6 × (EOL + 1).

To further clarify the relationship of the signals defined herein, Figures 8/T.4 and 9/T.4 are offered in the case of K = 2. Figure 8/T.4 shows several scan lines of data starting at the beginning of a transmitted page. Figure 9/T.4 shows the last several lines of a page.



T Minimum transmit time of a total coded scan line

FIGURE 8/T.4

Message transmission (first part of page)

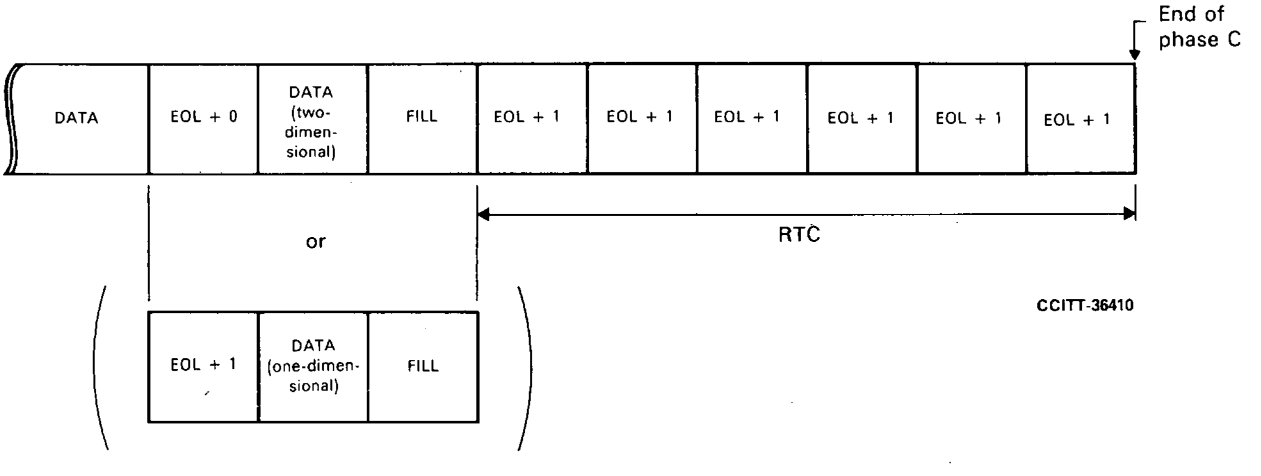


FIGURE 9/T.4

Message transmission (last part of page)

4.2.5 *Coding examples*

Figure 10/T.4 shows coding examples of the first part of scan lines and Figure 11/T.4 coding examples of the last part, while Figure 12/T.4 shows other coding examples. The notations P, H and V in the figures are, as shown in Table 3/T.4, the symbols for pass mode, horizontal mode and vertical mode respectively. The picture elements marked with black spots indicate the changing picture elements to be coded.

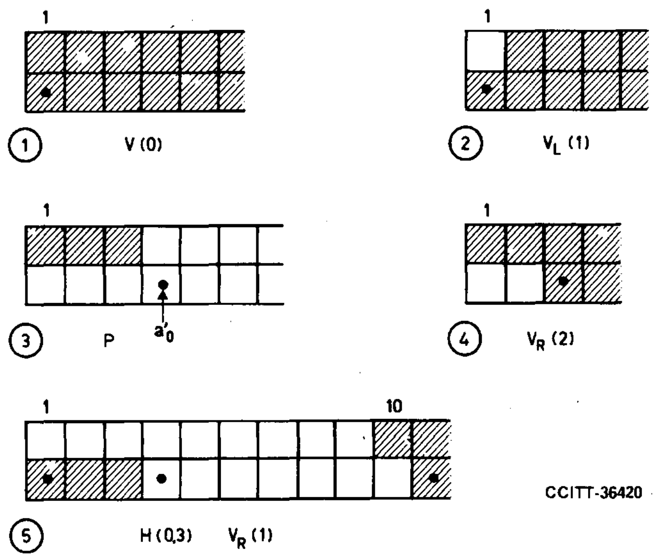


FIGURE 10/T.4

Coding examples: first part of scan line

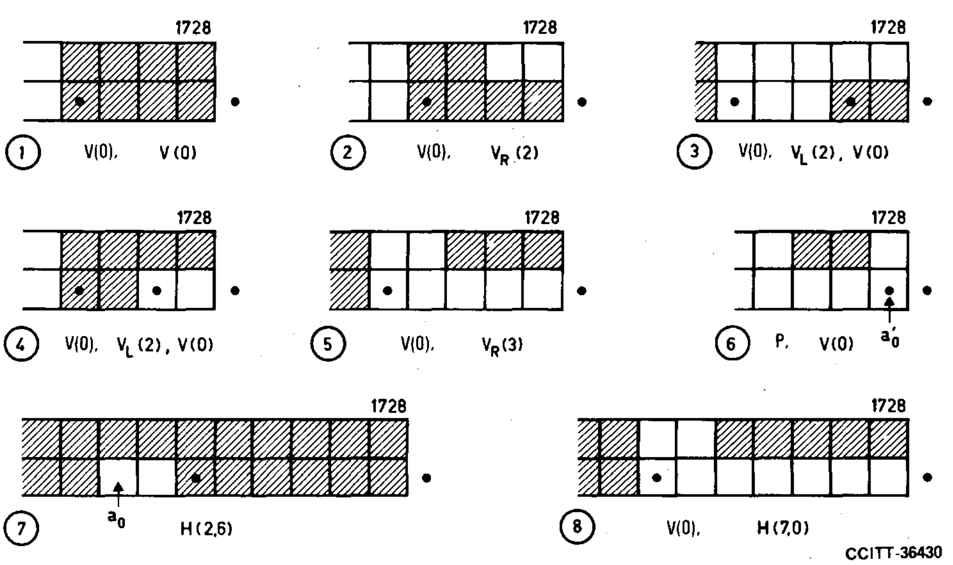


FIGURE 11/T.4

Coding examples: last part of scan line

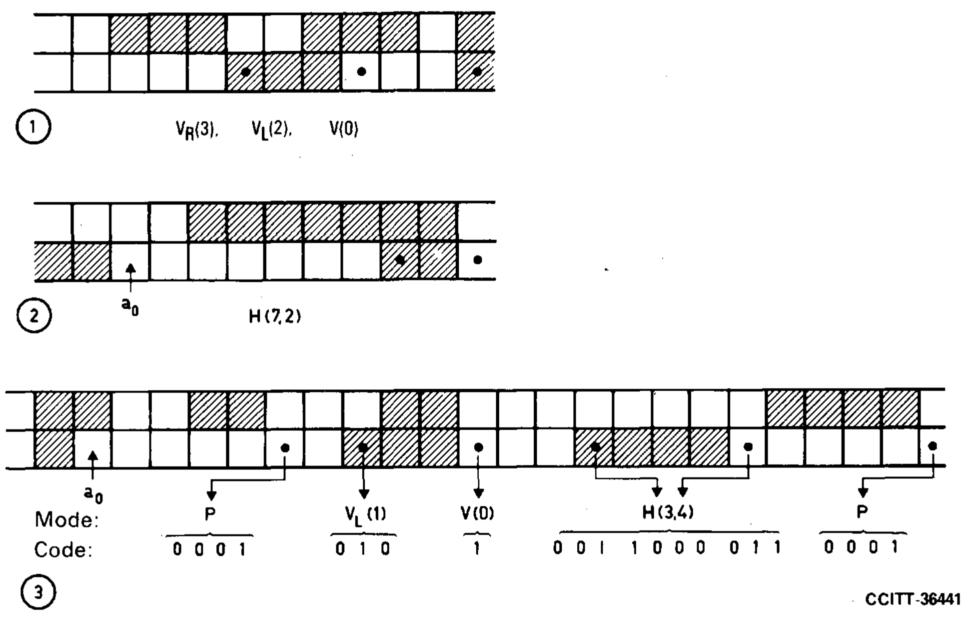


FIGURE 12/T.4
Coding examples

5 Modulation and demodulation

Group 3 apparatus operating on the general switched telephone network shall utilize the modulation, scrambler, equalization and timing signals defined in Recommendation V.27 *ter*, specifically §§ 2, 3, 7, 8, 9, 11 and the Appendix.

5.1 The training signal to be used shall be the long training sequence with protection against talker echo. (See Recommendation V.27 *ter*, §2.5.1, Table 3/V.27 *ter*).

5.2 The data signalling rates to be used are 4800 bit/s and 2400 bit/s as defined in Recommendation V.27 *ter*.

Note 1 – Some Administrations pointed out that it would not be possible to guarantee the service at a data signalling rate higher than 2400 bit/s.

Note 2 – It should be noted that there are equipments in service using, inter alia, other modulation methods.

Note 3 – Where quality of communication service can successfully support higher speed operation, such as may be possible on leased circuits or high-quality switched circuits, Group 3 apparatus may optionally utilize the modulation, scrambler, equalization and timing signals defined in Recommendation V.29, specifically §§ 1, 2, 3, 4, 7, 8, 9, 10 and 11. Under this option the data should be non-multiplexed and limited to the data signalling rates of 9600 bit/s and 7200 bit/s.

6 Power at the transmitter output

The average power should be adjustable from –15 dBm to 0 dBm but the equipment should be so designed that there is no possibility of this adjustment being tampered with by an operator.

Note – The power levels over the international circuits will conform to Recommendation V.2.

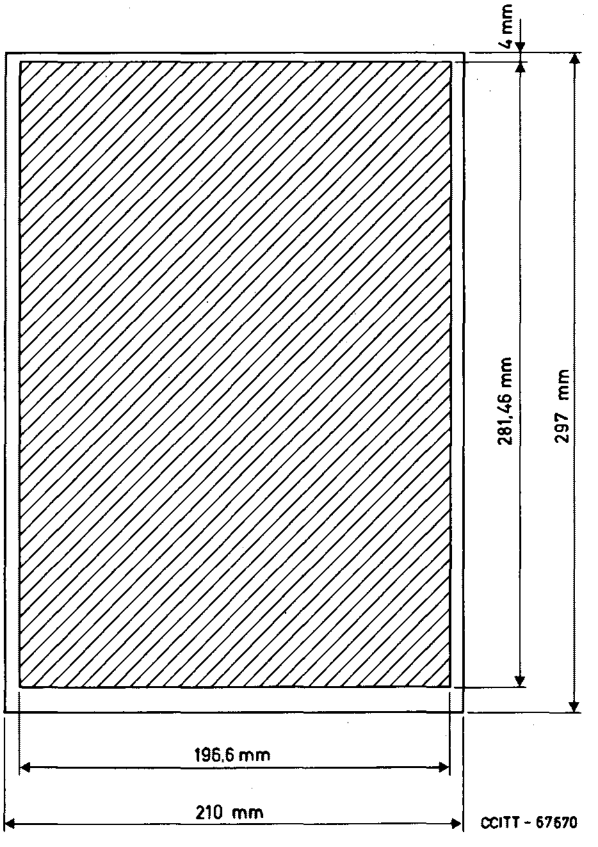
7 Power at the receiver input

The receiving apparatus should be capable of functioning correctly when the received signal level is within the range of 0 dBm to –43 dBm. No control of receiver sensitivity should be provided for operator use.

APPENDIX I

(to Recommendation T.4)

Guaranteed reproducible area for Group 3 apparatus conforming to Recommendation T.4



Note 1 – Paper characteristics (i.e. weight) are important parameters. Lightweight paper may cause additional paper handling errors and may result in a reduced guaranteed reproducible area.

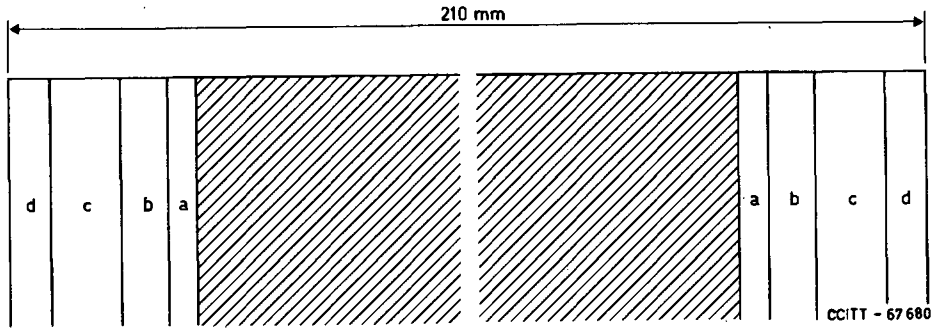
Note 2 – Sheet feed mechanisms may reduce the guaranteed reproducible area.

Note 3 – All calculations were done using worst case values. Using nominal values increases the reproducible area.

Note 4 – The exact horizontal position of this area within the ISO A4 paper size as well as sizes larger than the above are subject to national recommendations and/or definitions.

FIGURE I-1/T.4

Guaranteed reproducible area for Group 3 machines for use on facsimile services referring to ISO A4 paper size



a : Printer/scanner tolerances
b : Loss caused by the enlarging effect due to TLL tolerance
c : Loss caused by skew
d : Record medium positioning errors

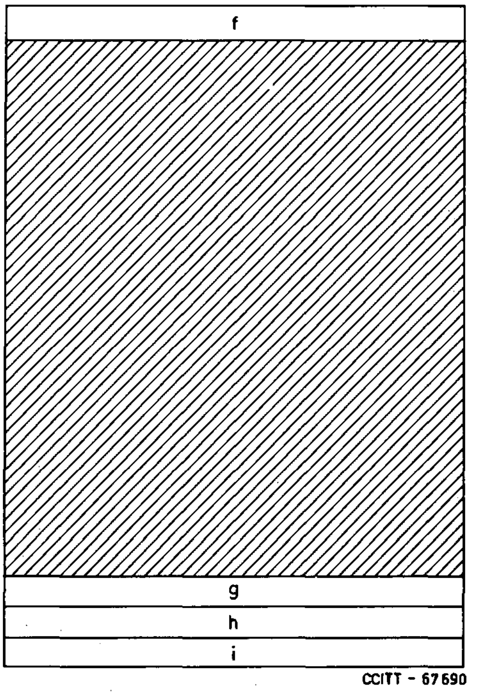
FIGURE I-2/T.4

Horizontal loss

TABLE I-1/T.4

Horizontal losses

Printer/scanner	a	± 0.5 mm
Enlarging	b	± 2.1 mm
Skew	c	± 2.6 mm
Positioning errors	d	± 1.5 mm



f : Paper insertion loss
g : Loss caused by skew
h : Scanning density tolerance
i : Gripping loss

FIGURE I-3/T.4

TABLE I-2/T.4

Vertical losses

Paper insertion	f	4.0 mm
Skew	g	± 1.8 mm
Scan line tolerance	h	± 2.97 mm
Gripping loss	i	2.0 mm

Note – Scanning density tolerance will reduce to 0 mm on roll-fed machines.

GENERAL ASPECTS OF GROUP 4 FACSIMILE APPARATUS

(Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that Recommendation T.2 refers to Group 1 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately six minutes;

(b) that Recommendation T.3 refers to Group 2 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately three minutes;

(c) that Recommendation T.4 refers to Group 3 type apparatus for ISO A4 document transmission over a telephone-type circuit in approximately one minute;

(d) that there is a demand for Group 4 apparatus which incorporates means for reducing the transmission time and assures essentially error-free reception of the documents;

(e) that telematic terminals including Group 4 facsimile apparatus are to be standardized, taking into account the commonality among these terminals;

(f) that there is a demand for mixed mode of operation where both facsimile coded information and character coded information can be treated within a page by the same apparatus;

unanimously declares

that Group 4 facsimile apparatus as defined in Recommendation T.0 should be designed and operated according to the following standard.

1 General

1.1 Group 4 facsimile apparatus is used mainly on public data networks (PDN) including circuit-switched, packet-switched, and the integrated services digital network (ISDN). The apparatus may be also used on the public switched telephone network (PSTN) where an appropriate modulation process will be utilized.

1.2 The procedures used with Group 4 facsimile apparatus enable it to transmit and reproduce image coded information essentially without transmission errors.

1.3 Group 4 facsimile apparatus has the means for reducing the redundant information in facsimile signals prior to transmission.

1.4 The basic image type of the Group 4 facsimile apparatus is black and white.

Other image types, e.g. grey scale image or colour image are for further study.

1.5 There are three classes of Group 4 facsimile terminals:

- *Class I* – Minimum requirement is a terminal able to send and receive documents containing facsimile encoded information (in accordance with Recommendations T.6 and T.73).
- *Class II* – Minimum requirement is a terminal able to transmit documents which are facsimile encoded (in accordance with Recommendations T.6 and T.73). In addition, the terminal must be capable of receiving documents which are facsimile coded (in accordance with Recommendations T.6 and T.73), Teletex coded (in accordance with the basic coded character repertoire as defined in Recommendations T.60 and T.61), and also mixed-mode documents (in accordance with Recommendations T.72 and T.73).
- *Class III* – Minimum requirement is a terminal which is capable of generating, transmitting and receiving facsimile coded documents (in accordance with Recommendations T.6 and T.73), Teletex coded documents (in accordance with the basic coded character repertoire as defined in Recommendations T.60 and T.61), and mixed-mode documents (in accordance with Recommendations T.72 and T.73). See Note.

Note – The above definitions are extracted from Study Group I where "terminal" is used instead of "apparatus".

2 Scope of Recommendations concerning Group 4 facsimile apparatus

2.1 This Recommendation defines the general aspects of Group 4 facsimile apparatus.

2.2 The rules to be followed in the Group 4 facsimile service are defined in Recommendation F.161.

2.3 The Group 4 facsimile coding scheme and facsimile control functions are defined in Recommendation T.6.

2.4 All Group 4 facsimile apparatus communicates with unique procedures that are described as follows:

a) the interface to the physical network is defined in this Recommendation. See Note 1;

b) the transport end-to-end control procedure is defined in Recommendation T.70;

c) Group 4 facsimile control procedures are defined in Recommendation T.62. See Note 2;

d) Group 4 facsimile document interchange protocol is defined in Recommendation T.73. See Note 3.

Note 1 – Recommendation T.71 may be applicable for PSTN operation.

Note 2 – Recommendations T.62 and T.70 are used in Group 4 facsimile, Teletex and terminal supporting mixed mode of operation.

Note 3 – Recommendation T.73 is used in Group 4 facsimile and terminal supporting mixed mode of operation.

2.5 When operating as mixed-mode terminals, Recommendation T.72 applies.

3 General characteristics of the apparatus

3.1 *Basic characteristics*

3.1.1 The Group 4 facsimile apparatus provides the means for direct document transmission from any subscriber to any other subscriber.

3.1.2 All apparatus participating in the international Group 4 facsimile service has to be compatible with each other at the basic level defined in this Recommendation. Additional operational functions may be invoked.

3.1.3 The range of data rates is described in § 6. Detailed arrangements on a national level are left to the Administrations concerned, as it is recognized that national implementation of the Group 4 facsimile service on various types of network may involve national operation at different data throughput rates.

3.1.4 The page is the basis for facsimile message formatting and transmission. Both A4 and North American paper formats are taken into account.

3.1.5 Facsimile coding schemes are applied in order to reduce the redundant information in facsimile signals prior to transmission.

3.1.6 The apparatus must have the ability to reproduce facsimile messages. The content, layout and format of facsimile messages must be identical at the transmitting and receiving apparatus.

3.1.7 The reproducible area is defined within which facsimile messages are assured to be reproduced. (See § 3.2.6).

3.1.8 The Group 4 facsimile apparatus should provide means for automatic reception. In addition Class II/III apparatus should provide means for automatic reception of Teletex and mixed mode documents.

3.1.9 All Classes of Group 4 facsimile apparatus shall incorporate the functions defined as basic for the Group 4 facsimile service in § 3.2 below. In addition, optional functions can be incorporated. In this Recommendation, the optional functions are divided into CCITT standardized options and nationally and/or privately specified options.

3.2 *Basic functions*

3.2.1 Group 4 facsimile apparatus shall be capable of handling:

a) the basic end-to-end control procedures as defined in Recommendation T.62;

b) document interchange protocol as defined in Recommendation T.73;

c) the basic facsimile coding scheme as defined in Recommendation T.6;

d) the control functions associated with the basic facsimile coding scheme as defined in Recommendation T.6.

3.2.2 All classes of Group 4 apparatus shall have the following provisions for facsimile messages:

a) provision for scanning the documents to be transmitted (see § 3.2.5);

b) provision for receiving and presenting hard or soft copies of the documents.

3.2.2.1 In addition Group 4 Class II apparatus shall have provision for receiving and displaying basic Teletex and mixed mode documents.

3.2.2.2 In addition to the requirements for Group 4 Class II apparatus, Class III apparatus shall have provisions for generating and transmitting basic Teletex and mixed mode documents.

3.2.3 Basic page formatting functions are as follows:

a) vertical page orientation;

b) paper size of ISO A4;

c) reproducible area/printable area is defined taking into account ISO A4 and North American paper formats and ISO standard 3535.

3.2.4 *Terminal identification*

Each Group 4 facsimile apparatus should be equipped with a unique identification. Details of the identification are given in Recommendation F.161.

3.2.5 *Scanning*

The message area should be scanned in the same direction in the transmitter and receiver. Viewing the message area in a vertical plane, the picture elements shall be processed as if the scanning direction were from left to right with subsequent scans adjacent to and below the previous scan.

3.2.6 *Page sizes and reproducible area*

3.2.6.1 Sometimes paper length may not be specified, because the paper end is detected by paper scanning.

3.2.6.2 The size of the guaranteed reproducible area for ISO A4 paper size is identical to Group 3 apparatus described in Appendix I to Recommendation T.4.

3.2.7 *Group 4 facsimile transmission pel density (resolution) requirements*

The Group 4 facsimile resolution requirements and their tolerances are given in Table 1/T.5:

TABLE 1/T.5

Resolution (pels/25.4 mm)	Horizontal and vertical tolerance %
200 × 200	± 1
240 × 240	± 1
300 × 300	± 1
400 × 400	± 1

Centre line referencing will be used for paper positioning. Each page will be positioned on the scanner so that the centre line is in registration with the value: (number of pels/line)/2. (For further study.)

Specific values for the number of pels per line, scan line length and nominal number of scan lines per page are given in Tables 2a/T.5 and 2b/T.5 for all the Group 4 resolutions for ISO A4, North American, B4, and A3 paper. Table 3/T.5 and Figure 1/T.5 specify the blanking procedure for ISO A4 and North American paper. An equal number of pels on the left and right side of the page are set to white to fit the paper format. The same procedure is used for the other paper formats.

The raster point in the upper left corner of an ISO page is used as a reference for portrait mode character printing. This raster point, termed the (1 , 1) raster reference point, is used as a starting point for determining character margins and positions. This is also illustrated in Figure 1/T.5.

TABLE 2a/T.5

Number of pels and the scan line length for different paper sizes

		ISO A4	North American	ISO B4	ISO A3
Number of picture elements along a scan line	Resolution (pels/25.4 mm)				
	200	1728	1728	2048	2432
	240	2074	2074	2458	2918
	300	2592	2592	3072	3648
	400	3456	3456	4096	4864
Scan line length (mm) (P)		219.46	219.46	260.10	308.86
Paper width (mm) (Q)		210	215.9	250	297
P − Q		9.46	3.56	10.10	11.86

TABLE 2b/T.5

Nominal number of scan lines for various paper sizes

		ISO A4	North American	ISO B4	ISO A3
Nominal number of scan lines per page for each pel-transmission density	Resolution (pels/25.4 mm)				
	200	2339	2200	2780	3307
	240	2806	2640	3335	3969
	300	3508	3300	4169	4961
	400	4677	4400	5559	6614
Nominal paper length (mm)		297	279.4	353	420

TABLE 3/T.5

Blanking and address reference point for A4 and North American paper

Resolution (pels/25.4 mm)	Pels per line	Pels per North American line	Pels per ISO A4 line	Blanking margin A (pels)	Blanking margin B (pels)	ISO A4 reference point	Total line length (mm)
200 × 200	1728	1700	1654	14	37	(38 , 1)	219.46
240 × 240	2074	2040	1984	17	45	(46 , 1)	219.46
300 × 300	2592	2550	2480	21	56	(57 , 1)	219.46
400 × 400	3456	3400	3308	28	74	(75 , 1)	219.46

Note – The pels as defined in the blanking margin sections A and B (see Fig. 1/T.5) are equivalent to the discarded pels in Recommendation T.73.

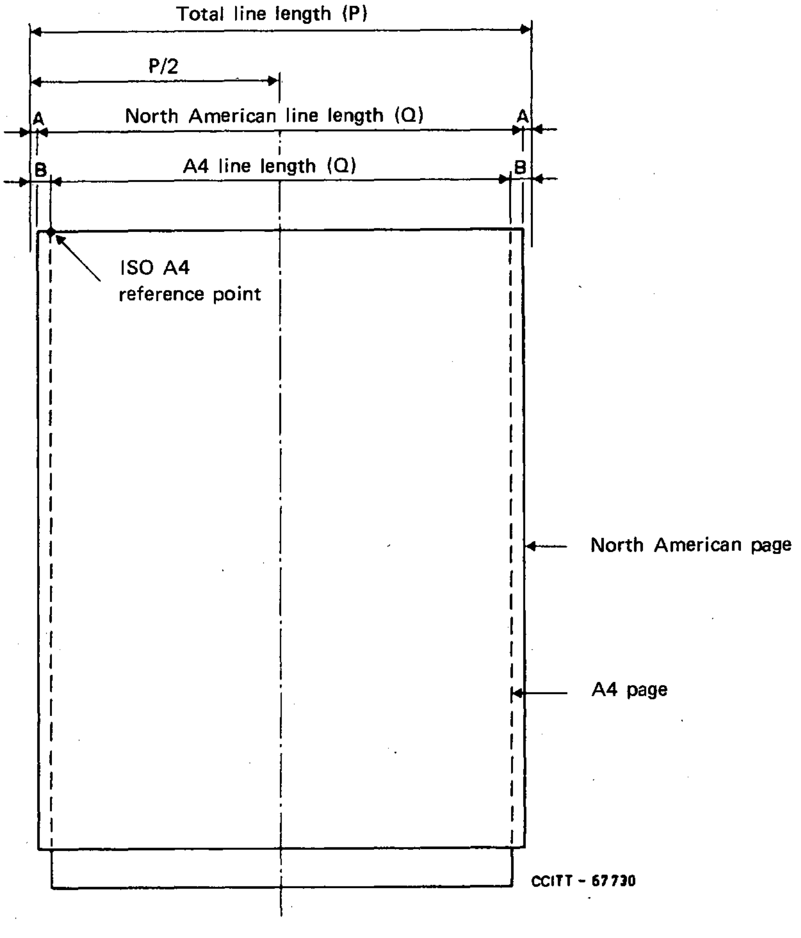


FIGURE 1/T.5

3.2.8 *Group 4 facsimile class structure*

Table 4/T.5 shows the class structure of Group 4 facsimile apparatus.

TABLE 4/T.5

Class structure

Class	I (See Note 1)	II (See Note 1)	III (See Note 1)
Standard pel transmission density (pels/25.4 mm)	200	200 and 300 (See Note 2)	200 and 300 (See Note 2)
Optional pel transmission density (pels/25.4 mm)	240 and/or 300 and/or 400	240 and/or 400 (See Note 3)	240 and/or 400 (See Note 3)
Pel conversion capability in standard	Not required	Yes	Yes
Teletex	Not required	Reception only	Yes
Mixed mode	Not required	Reception only	Yes
Page memory	Not required	Yes	Yes

Note 1 – Administrations may determine which class with options is to be used for their national service. Standardization work has to continue with the goal of achieving a uniform standard.

Note 2 – When operating as a mixed-mode terminal per Recommendation T.72, the pel receiving density of 240 pels per 25.4 mm is required.

Note 3 – To achieve a high service quality, the pel density of the scanner and printer should be greater than or equal to the transmission pel density. This requirement is waived for a terminal which has a scanner or printer with a pel density of 240 × 240 pels per 25.4 mm and can communicate at 300 pels per 25.4 mm. In this case, the 240 × 240 pels per 25.4 mm terminal will exceptionally meet the standard Class II/III requirement.

Note 4 – For a period of four years, Group 4 Class I apparatus may be manufactured utilizing Group 3 scanner/printer components.

Note 5 – When a resolution conversion is necessary, the conversion is performed by the apparatus which minimizes the transmission cost and time. An exception would be a 240 × 240 pels per 25.4 mm terminal transmitting to a 300 × 300 pels per 25.4 mm terminal which is operating at the standard transmission density.

Note 6 – Pel conversion algorithms should aim at low impairment of the quality and are for further study.

3.2.9 *Facsimile coding schemes*

3.2.9.1 In order to reduce the redundant information in facsimile signals, the basic facsimile coding scheme is defined in Recommendation T.6. This coding scheme is used assuming that transmission errors are corrected by control procedures in lower levels.

3.2.9.2 On an optional basis an apparatus can use other CCITT standardized coding schemes defined in Recommendation T.6.

3.3 *CCITT-standardized optional functions*

3.3.1 The possibility of using optional functions can be negotiated during a handshaking procedure in the end-to-end control procedure (see Recommendation T.62).

3.3.2 The optional functions are invoked by a document interchange protocol (see Recommendation T.73).

3.3.3 As the service develops, additions and changes to the CCITT-standardized optional functions listed below may be needed:

a) optional coding schemes defined in Recommendation T.6;
b) control functions associated with optional coding schemes;
c) grey scale images;
d) colour images;
e) resolution conversion algorithms.

3.3.4 Optional page formatting functions are as follows:

a) paper sizes of ISO B4 and ISO A3;
b) other page formats are for further study.

3.4 *Optional functions for national standardization or private use*

The CCITT standardization includes the necessary rules and means for indication of, or escape into, functions specified nationally or for private use (see Recommendations T.62 and T.73).

3.5 *Default conditions*

In the absence of specific indications, the receiving apparatus shall assume the following conditions:

a) communication (as specified in Recommendation T.62):
   - one way (calling apparatus transmitting the facsimile message);
   - normal document;

b) coding scheme:
   - basic facsimile coding scheme;

c) image type:
   - black and white two-level image;

d) presentation:
   - paper size of ISO A4;
   - pel transmission density of 200 pels per 25.4 mm;
   - number of picture elements along scan line of 1728 pels per 219.46 mm;
   - vertical page orientation.

4 Mixed mode capabilities

For mixed mode of operation, requirements for Group 4 Class II and Class III terminals are specified in Recommendation T.72.

5 Communications

5.1 *Storage*

Receiving storage is not required for Group 4 Class I terminals. The minimum storage requirement for Group 4 Class II and Class III is 128 k octets. This value is based on a pel transmission density of 300 pels per 25.4 mm for an ISO A4 document. However, this does not cover the worst case situation for dense documents. Additional memory may be required and can be negotiated.

5.2 *Call identification*

The control procedures include the exchange of reference informationprior to sending any document. Details of the call identification line are covered in Recommendation F.161. Printing the call identification line at the top of each page is an option.

5.3 *Interworking*

For further study.

6 Network-related requirements

6.1 *Networks*

The Group 4 facsimile transport service can be provided using a circuit-switched public data network (CSPDN), a packet-switched public data network (PSPDN), a public switched telephone network (PSTN), or an integrated services digital network (ISDN). In all types of network the Group 4 facsimile apparatus will provide automatic answering, transmission, reception and clearing.

6.2 *Circuit-switched public data network (CSPDN)*

a) Functional and procedural aspect of the interface: Recommendation X.21.

b) With external data circuit terminating equipment (DCE) – mechanical and electrical characteristics of the interface: Recommendation X.21.

c) Bit rates: user classes of services 4 to 7 in Recommendation X.1.

d) Link procedure: LAPB/Recommendation X.75.

6.3 *Packet-switched public data network (PSPDN)*

a) Functional and procedural aspects of the interface: Recommendation X.25, levels 1, 2, 3.

b) Duplex transmission.

c) Bit rates: user classes of service 8 to 11 in Recommendation X.1.

d) Number of logical channels at a time: one or more.

6.4 *Public switched telephone network (PSTN)*

a) Modulation/demodulation schemes are for further study.

b) Functional and procedural aspects of the interface: for further study.

c) Link procedure: Recommendation T.71 may be applicable.

d) Bit rate: for further study.

e) Automatic answering: Recommendation V.25.

6.5 *Integrated services digital network (ISDN)*

The operation of Group 4 facsimile apparatus on the ISDN can be achieved by the implementation of the relevant series I Recommendations.

7 Indicators

7.1 Indicators should inform users about situations in which negative effects on the grade of service can be expected.

7.2 The following indicators are required:

a) apparatus unable to transmit (e.g. paper jam at transmitting end);

b) apparatus unable or soon unable to receive (e.g. paper jam or receiving memory nearly full);

c) operator assistance required;

d) message received in store.

8 Access to facsimile MHF

Users of Group 4 facsimile apparatus may wish to have access to the services offered by message handling facilities. This requires the ability to generate control documents (see Recommendation T.62). The details are left for further study.

FACSIMILE CODING SCHEMES AND CODING CONTROL FUNCTIONS FOR GROUP 4 FACSIMILE APPARATUS

(Malaga-Torremolinos, 1984)

1 General

1.1 *Scope*

1.1.1 Recommendation T.6 defines the facsimile coding schemes and their control functions to be used in the Group 4 facsimile.

1.1.2 This Recommendation should be read in conjunction with the following Recommendations:

T.5 – General aspects of Group 4 facsimile apparatus

T.73 – Document interchange protocol for the Telematic services

T.62 – Control procedures for Teletex and Group 4 facsimile services

T.70 – Network-independent basic transport service for Telematic services

F.161 – International Group 4 facsimile service

In addition, in the case of Group 4 Class II/III (Teletex or mixed mode of operation), the following Recommendations should also be read:

T.60 – Terminal equipment for use in the Teletex service

T.61 – Character repertoire and coded character sets for the international Teletex service

T.72 – Terminal capabilities for mixed mode of operation

1.2 *Fundamental principles*

1.2.1 *Facsimile coding schemes and coding control functions*

Facsimile coding schemes consist of the basic facsimile coding scheme and optional facsimile coding schemes. They are defined in § 2 and §§ 3 and 4, respectively.

Facsimile coding schemes are specified assuming that transmission errors are corrected by control procedures at a lower level.

The basic facsimile coding scheme is the two-dimensional coding scheme which is in principle the same as the two-dimensional coding scheme of Group 3 facsimile specified in Recommendation T.4.

Optional facsimile coding schemes are specified not only for black and white images but also for grey scale images and colour images.

Facsimile coding control functions are used in facsimile user information in order to change facsimile parameters or to invoke the end of facsimile block. They are defined in § 2.4.

2 Facsimile coding schemes and coding control functions for black and white images

2.1 *General*

This section specifies the facsimile coding schemes, and associated control functions for black and white images.

Facsimile coding schemes consist of the basic facsimile coding scheme and optional coding schemes.

The use of the optional facsimile coding schemes is subject to mutual agreement between terminals and shall be initiated by the appropriate procedural steps.

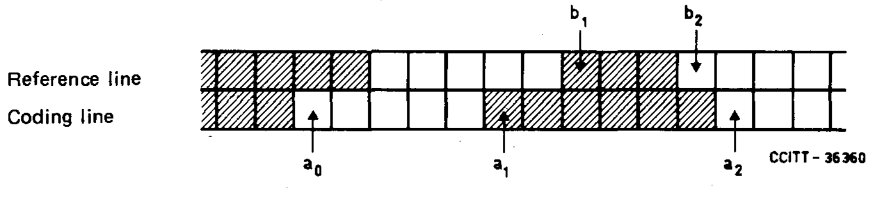
2.2 *Basic facsimile coding scheme*

2.2.1 *Principle of the coding scheme*

The coding scheme uses a two-dimensional line-by-line coding method in which the position of each changing picture element on the current coding line is coded with respect to the position of a corresponding reference element situated on either the coding line or the reference line which is immediately above the coding line. After the coding line has been coded, it becomes the reference line for the next coding line. The reference line for the first coding line in a page is an imaginary white line.

2.2.2 *Definition of changing picture elements* (see Figure 1/T.6)

A changing element is definied as an element whose "colour" (i.e. black or white) is different from that of the previous element along the same scan line.



a_0 : The reference or starting changing element on the coding line. At the start of the line a_0 is set on an imaginary white changing element situated just before the first element on the line. During the coding of the coding line, the position of a_0 is defined by the previous coding mode (see § 2.2.3).

a_1 : The next changing element to the right of a_0 on the coding line.

a_2 : The next changing element to the right of a_1 on the coding line.

b_1 : The first changing element on the reference line to the right of a_0 and of opposite colour to a_0.

b_2 : The next changing element to the right of b_1 on the reference line.

FIGURE 1/T.6

Changing picture elements

2.2.3 *Coding modes*

One of the three coding modes are chosen according to the coding procedure described in § 2.2.4 to code the position of each changing element along the coding line. Examples of the three coding modes are given in Figure 2/T.6, 3/T.6 and 4/T.6.

2.2.3.1 *Pass mode*

This mode is identified when the position of b_2 lies to the left of a_1. (See Figure 2/T.6.)

However, the state where b_2 occurs just above a_1, as shown in Figure 3/T.6 is not considered as a pass mode.

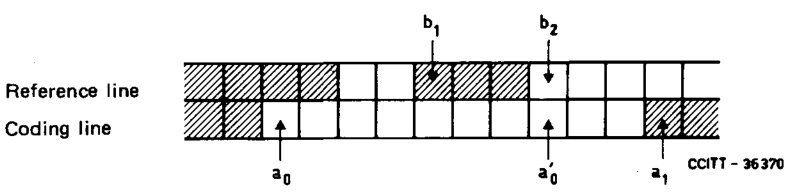


FIGURE 2/T.6

Pass mode

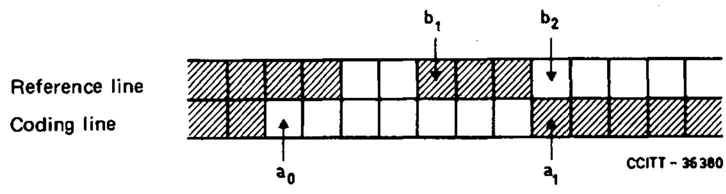


FIGURE 3/T.6

An example not corresponding to a Pass mode

2.2.3.2 *Vertical mode*

When this mode is identified, the position of a_1 is coded relative to the position of b_1. The relative distance a_1b_1 can take on one of seven values V(0), $V_R(1)$, $V_R(2)$, $V_R(3)$, $V_L(1)$, $V_L(2)$ and $V_L(3)$, each of which is represented by a separate code word. The subscripts R and L indicate that a_1 is to the right or left respectively of b_1, and the number in brackets indicates the value of the distance a_1b_1 (see Figure 4/T.6).

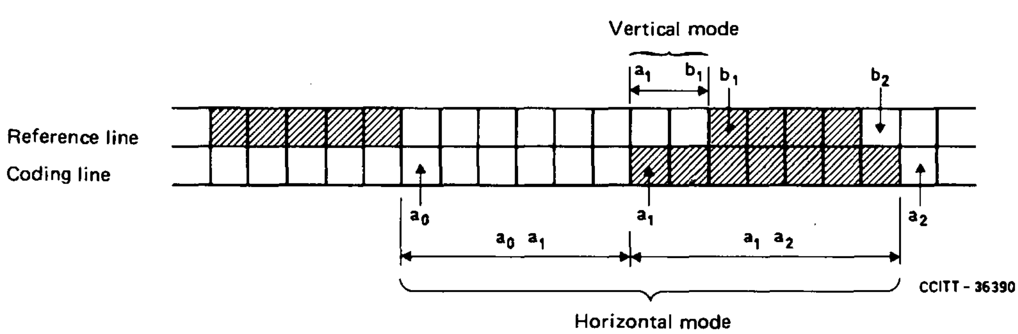


FIGURE 4/T.6

Vertical mode and horizontal mode

2.2.3.3 *Horizontal mode*

When this mode is identified, both the run-lengths a_0a_1 and a_1a_2 are coded using the code words H + $M(a_0a_1)$ + $M(a_1a_2)$. H is the flag code word 001 taken from the two-dimensional code table (Table 1/T.6). $M(a_0a_1)$ and $M(a_1a_2)$ are code words which represent the length and "colour" of the runs a_0a_1 and a_1a_2 respectively and are taken from the appropriate white or black run-length code tables (Tables 2/T.6 and 3/T.6).

TABLE 1/T.6

Code table

Mode	Elements to be coded		Notation	Code word
Pass	b_1, b_2		P	0001
Horizontal	a_0a_1, a_1a_2		H	001 + $M(a_0a_1)$ + $M(a_1a_2)$ (see Note)
Vertical	a_1 just under b_1	$a_1b_1 = 0$	V(0)	1
	a_1 to the right of b_1	$a_1b_1 = 1$	$V_R(1)$	011
		$a_1b_1 = 2$	$V_R(2)$	000011
		$a_1b_1 = 3$	$V_R(3)$	0000011
	a_1 to the left of b_1	$a_1b_1 = 1$	$V_L(1)$	010
		$a_1b_1 = 2$	$V_L(2)$	000010
		$a_1b_1 = 3$	$V_L(3)$	0000010
Extension				0000001xxx

Note – Code M( ) of the horizontal mode represents the code words in Tables 2/T.6 and 3/T.6.

TABLE 2/T.6

Terminating codes

White run length	Code word	Black run length	Code word
0	00110101	0	0000110111
1	000111	1	010
2	0111	2	11
3	1000	3	10
4	1011	4	011
5	1100	5	0011
6	1110	6	0010
7	1111	7	00011
8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100
11	01000	11	0000101
12	001000	12	0000111
13	000011	13	00000100
14	110100	14	00000111
15	110101	15	000011000
16	101010	16	0000010111
17	101011	17	0000011000
18	0100111	18	0000001000
19	0001100	19	00001100111
20	0001000	20	00001101000
21	0010111	21	00001101100
22	0000011	22	00000110111
23	0000100	23	00000101000
24	0101000	24	00000010111
25	0101011	25	00000011000
26	0010011	26	000011001010
27	0100100	27	000011001011
28	0011000	28	000011001100
29	00000010	29	000011001101
30	00000011	30	000001101000
31	00011010	31	000001101001
32	00011011	32	000001101010
33	00010010	33	000001101011
34	00010011	34	000011010010
35	00010100	35	000011010011
36	00010101	36	000011010100
37	00010110	37	000011010101
38	00010111	38	000011010110
39	00101000	39	000011010111
40	00101001	40	000001101100
41	00101010	41	000001101101
42	00101011	42	000011011010
43	00101100	43	000011011011
44	00101101	44	000001010100
45	00000100	45	000001010101
46	00000101	46	000001010110
47	00001010	47	000001010111
48	00001011	48	000001100100
49	01010010	49	000001100101
50	01010011	50	000001010010
51	01010100	51	000001010011
52	01010101	52	000000100100
53	00100100	53	000000110111
54	00100101	54	000000111000
55	01011000	55	000000100111
56	01011001	56	000000101000
57	01011010	57	000001011000
58	01011011	58	000001011001
59	01001010	59	000000101011
60	01001011	60	000000101100
61	00110010	61	000001011010
62	00110011	62	000001100110
63	00110100	63	000001100111

TABLE 3/T.6

Make-up codes between 64 and 1728

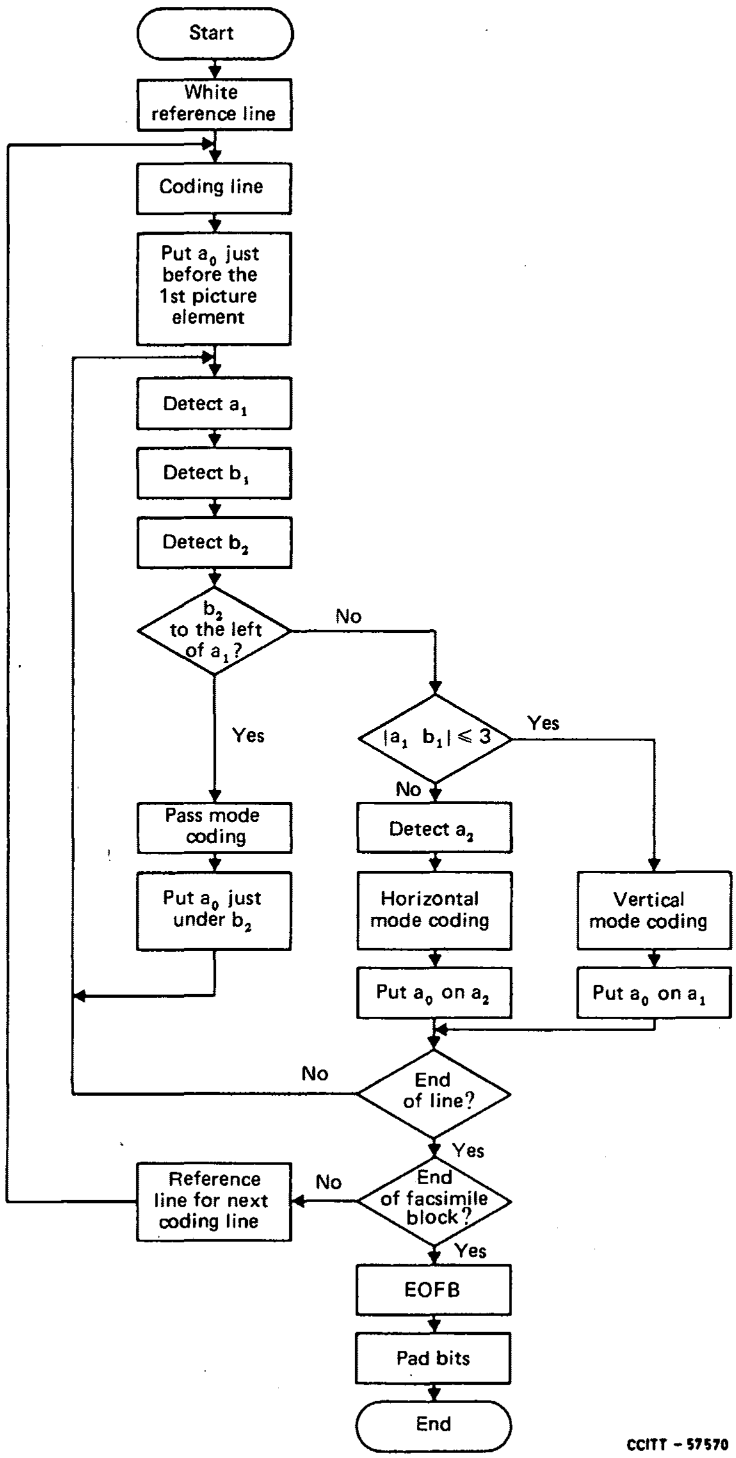
White run lengths	Code word	Black run lengths	Code word
64	11011	64	0000001111
128	10010	128	000011001000
192	010111	192	000011001001
256	0110111	256	000001011011
320	00110110	320	000000110011
384	00110111	384	000000110100
448	01100100	448	000000110101
512	01100101	512	0000001101100
576	01101000	576	0000001101101
640	01100111	640	0000001001010
704	011001100	704	0000001001011
768	011001101	768	0000001001100
832	011010010	832	0000001001101
896	011010011	896	0000001110010
960	011010100	960	0000001110011
1024	011010101	1024	0000001110100
1088	011010110	1088	0000001110101
1152	011010111	1152	0000001110110
1216	011011000	1216	0000001110111
1280	011011001	1280	0000001010010
1344	011011010	1344	0000001010011
1408	011011011	1408	0000001010100
1472	010011000	1472	0000001010101
1536	010011001	1536	0000001011010
1600	010011010	1600	0000001011011
1664	011000	1664	0000001100100
1728	010011011	1728	0000001100101

Make-up codes between 1792 and 2560

Run length (black and white)	Make-up codes
1792	00000001000
1856	00000001100
1920	00000001101
1984	000000010010
2048	000000010011
2112	000000010100
2176	000000010101
2240	000000010110
2304	000000010111
2368	000000011100
2432	000000011101
2496	000000011110
2560	000000011111

2.2.4 *Coding procedure*

The coding procedure identifies the coding mode that is to be used to code each changing element along the coding line. When one of the three coding modes has been identified according to Step 1 or Step 2 mentioned below, an appropriate code word is selected from the code table given in Table 1/T.6. The coding procedure is as shown in the flow diagram of Figure 5/T.6.



CCITT – 57570

FIGURE 5/T.6

Coding flow diagram

Step 1

i) If a pass mode is identified, this is coded using the word 0001 (Table 1/T.6). After this processing, picture element a'_0 just under b_2 is regarded as the new starting picture element a_0 for the next coding (see Figure 2/T.6).

ii) If a pass mode is not detected, then proceed to Step 2.

Note – It does not affect compatibility to restrict the use of pass mode in the encoder to a single pass mode. Variations of the algorithm which do not affect compatibility should be the subject of further study.

Step 2

i) Determine the absolute value of the relative distance a_1b_1.

ii) If $|a_1b_1| \leq 3$, as shown in Table 1/T.6, a_1b_1 is coded by the vertical mode, after which position a_1 is regarded as the new starting picture element a_0 for the next coding.

iii) If $|a_1b_1| > 3$, as shown in Table 1/T.6, following horizontal mode code 001, a_0a_1 and a_1a_2 are respectively coded by one-dimensional run length coding.

Run lengths in the range of 0 to 63 pels are encoded with their appropriate terminating code word of Table 2/T.6. Note that there is a different list of code words for black and white run lengths. Run lengths in the range of 64 to 2623 pels are encoded first by the make-up code word representing the run length which is nearest, not longer, to that required. This is then followed by the terminating code word representing the difference between the required run length and the run length represented by the make-up code. Run lengths in the range of lengths longer than or equal to 2624 pels are coded first by the make-up code of 2560. If the remaining part of the run (after the first make-up code of 2560) is 2560 pels or greater, additional make-up code(s) of 2560 are issued until the remaining part of the run becomes less than 2560 pels. Then the remaining part of the run is encoded by terminating code or by make-up code plus Terminating code according to the range as mentioned above.

After this processing, position a_2 is regarded as the new starting picture element a_0 for the next coding.

Note – Coding examples are given in Recommendation T.4, § 4.2.5.

2.2.5 *Processing the first and last picture element in a line*

2.2.5.1 *Processing the first picture element*

The first starting picture element a_0 on each coding line is imaginarily set at a position just before the first picture element, and is regarded as a white picture element (see § 2.2.2).

The first run length on a line a_0a_1 is replaced by $a_0a_1 - 1$. Therefore, if the first actual run is black and is deemed to be coded by horizontal mode coding, then the first code word $M(a_0a_1)$ corresponds to an imaginary white run of zero length (see Figure 10/T.4).

2.2.5.2 *Processing the last picture element*

The coding of the coding line continues until the position of the imaginary changing element situated just after the last actual element has been coded. This may be coded as a_1 or a_2. Also, if b_1 and/or b_2 are not detected at any time during the coding of the line, they are positioned on the imaginary changing element situated just after the last actual picture element on the reference line.

2.3 *Optional facsimile coding schemes for black and white images*

2.3.1 *Uncompressed mode*

Uncompressed mode is an optional coding scheme associated to the basic facsimile coding scheme and is used to transmit the image information without data compression techniques as shown in Table 4/T.6.

The extension code in § 2.2.4 with the xxx bits set to 111 is used as an entrance code from the basic coding scheme in § 2.2 to the uncompressed mode.

TABLE 4/T.6

Uncompressed mode code words

Entrance code to uncompressed mode	Basic coding scheme : 0000001111	
Uncompressed mode code	*Image pattern* 1 01 001 0001 00001 00000	*Code word* 1 01 001 0001 00001 000001
Exist from uncompressed mode code	 0 00 000 0000	0000001T 00000001T 000000001T 0000000001T 00000000001T

T denotes a tag bit which tells the colour of the next run (black = 1, white = 0).

2.4 *Facsimile coding control functions*

2.4.1 *Control functions for basic facsimile coding scheme*

2.4.1.1 *End-of-facsimile block*

The end-of-facsimile block (EDFB) code is added to the end of every coded facsimile block. The format of EOFB is as follows:

Format: 000000000001000000000001
24 bits

2.4.1.2 *Pad bits*

Pad bits may be used after the end-of-facsimile block code if it is necessary to align on octet boundaries or to a fixed block size. The format used is as follows.

Format: Variable length string of 0s.

2.4.1.3 *Extension*

Extension code is used to indicate the change from the current mode to another mode, e.g., another coding scheme.

Format: 0000001xxx,

where xxx = 111 indicates uncompressed mode which is specified in § 2.3.1.

Further study is needed to define other unspecified xxx bit assignments and their use for any further extensions.

3 **Optional grey scale facsimile coding schemes and their coding control functions**

For further study.

4 **Optional colour facsimile coding schemes and their coding control functions**

For further study.

DOCUMENT FACSIMILE TRANSMISSIONS ON LEASED TELEPHONE-TYPE CIRCUITS

(Geneva, 1964; amended at Mar del Plata, 1968, at Geneva, 1972, 1976 and 1980)

1 Type of circuits to be used

The telephone-type circuits used should have characteristics as recommended in Recommendation H.12.

Note – If the leased circuit is used alternately for telephone conversation and facsimile transmission and if the latter is unidirectional, it is not necessary to provide for disabling echo suppressors located on the long-distance leased circuit. However, when such a circuit is used for the simultaneous operation in both directions appropriate measures should be taken to disable echo suppressors before the actual facsimile transmission takes place.

2 Modulation

Equipment conforming to Recommendation T.2 or Recommendation T.3 may be used. In the case of Recommendation T.2 equipment, either amplitude or frequency modulation may be chosen.

3 Power

The maximum power output of the transmitting apparatus into the line shall not exceed 1 mW whatever the frequency.

For frequency-modulation equipment conforming to Recommendation T.2, the level at the transmitter output shall be so adjusted that the level of the facsimile and control signals on the trunk circuit does not exceed −13 dBm0 regardless of the type of operation (duplex or simplex).

For amplitude-modulation equipment conforming to Recommendation T.2, higher black levels may be used provided the mean power in any hour, in one direction of transmission, does not exceed 32 microwatts (−15 dBm0) at the zero relative level point of the trunk circuit.

For equipment conforming to Recommendation T.3, higher white levels may be used provided the mean power in any hour, in one direction of transmission, does not exceed 32 microwatts (−15 dBm0) at the zero relative level point of the trunk circuit.

4 Multipoint transmission

If facsimile transmissions take place simultaneously from a transmitting station to several receiving stations, arrangements shall be made at the junction points so that, on the circuits following the junction points, the same power levels are maintained as those prescribed for individual transmissions.

5 Phase distortion

Equipment conforming to Recommendation T.2 should not require any special treatment. However, equipment conforming to Recommendation T.3 may require phase distortion correction in some cases.

DOCUMENT FACSIMILE TRANSMISSIONS IN THE GENERAL SWITCHED TELEPHONE NETWORK

(Mar del Plata, 1968; amended at Geneva, 1972, 1976 and 1980)

1 Type of circuits to be used

Since circuits of the general telephone network and the station lines of telephone subscribers should be capable of being used for document facsimile transmissions on the general network, the circuits to be used are those of the general switched network which have 2-wire terminals at both ends of the facsimile station.

Note – For the actual document transmission, which is one-way, there is no need to cater for the disabling of echo suppressors. Compandors do not seem detrimental to document facsimile transmission.

2 Overall loss

The conditions for overall transmission loss are the same as those for circuits of the general switched telephone network.

3 Modulation

Equipment conforming to Recommendation T.2 or Recommendation T.3 may be used. In the case of Recommendation T.2 equipment, frequency modulation shall be used.

4 Power

In order to avoid the risk that facsimile signals be disturbed, e.g. by dial pulses transmitted over adjacent channels or by noise, it is important that the sending level should be as high as possible, provided, however, that it shall not exceed –13 dBm0 on the trunk circuit for frequency-modulation equipment conforming to Recommendation T.2 or that the mean power in any hour, in one direction of transmission, shall not exceed 32 microwatts (–15 dBm0) at the zero relative level point of the trunk circuit for equipment conforming to Recommendation T.3.

The maximum power output of the transmitting apparatus into the line shall not exceed 1 mW whatever the frequency.

5 Amplitude and phase distortion

Equipment conforming to Recommendation T.2 should not require any special treatment. However, equipment conforming to Recommendation T.3 may require both amplitude and phase distortion correction on certain connections.

PHOTOTELEGRAPH TRANSMISSIONS ON TELEPHONE-TYPE CIRCUIT[1]

(former CCIT Recommendation D.3; amended at New Delhi, 1960, Geneva, 1964, 1972 and 1980)

Note – In the case of carrier circuits, this Recommendation applies only to systems established on the basis of 12-channel group links. Systems using 16-channel group links will be the subject of subsequent study.

The CCITT,

considering

(a) that both audio-frequency telephone circuits and carrier circuits can be used for phototelegraphy;

(b) that when normal audio-frequency circuits or carrier circuits are used, amplitude modulation offers some advantages over frequency modulation[2] and is therefore to be preferred for phototelegraph transmissions on circuits set up from end to end on cable or line-of-sight radio-relay links[3].

However, in the case of circuits subject to sudden level variations or to noise, frequency modulation may be preferable to amplitude modulation; Administrations could in this case come to an agreement to use frequency modulation for phototelegraph calls over such circuits; the provisions of Recommendation T.1 relative to the frequency-modulation characteristics should then be applied.

Note – Study Group XV/Joint Working Party LTG mention in Recommendation H.41 that when carrier circuits are used, frequency modulation offers advantages over amplitude modulation in that it does not overload carrier systems and avoids the influence of sudden level variations or noise. It is therefore to be preferred. However, this point should be studied further from the phototelegraph transmission point of view.

unanimously declares the view

that phototelegraph transmissions over telephone circuits require that the following conditions be observed, according to the way in which the circuits are used for phototelegraphy:

1 Circuits permanently used for phototelegraphy

It seems that these circuits are few. In any case, they should even more easily meet the characteristics given in § 2 below.

2 Circuits used normally (and preferentially) for phototelegraphy

2.1 *Types of circuit to be used*

Two-wire circuits have no practical value for phototelegraphy because of feedback phenomena.

For the same reason, 4-wire circuits should be extended to the phototelegraph stations on a 4-wire basis at the appropriate amplifier stations, the terminating units and echo-suppressors always being disconnected.

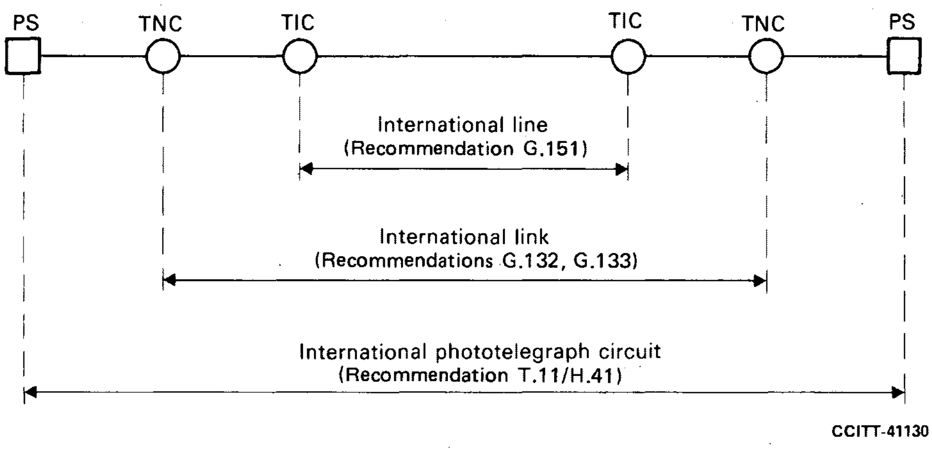
The configuration of a phototelegraph circuit is given in Figure 1/T.11.

---

[1] Recommendation T.11 corresponds to Recommendation H.41.

[2] In particular, with the same index of cooperation and speed, frequency-modulation necessitates a wider frequency range than that of amplitude-modulation to obtain a picture of the same quality.

[3] See Recommendation T.15 for phototelegraph transmissions over combined radio and metallic circuits.



PS Phototelegraph station
TIC Terminal international centre
TNC Terminal national centre

Note — The phototelegraph circuit is set up on lines according to the terminology used by Study Group IV, in Recommendations M.1010 and M.1015.

FIGURE 1/T.11

Constitution of a phototelegraph circuit

2.2 *Overall loss*

The same conditions apply to the overall transmission loss of 4-wire circuits used for phototelegraphy as apply, in general, for telephony.

2.3 *Sent signal power*

The emission voltage for the phototelegraph signal corresponding to maximum amplitude should be so adjusted that the maximum power level of the signal at the zero relative level point is −13 dBm0 for frequency modulation phototelegraph transmissions and that the peak signal power level for amplitude-modulation phototelegraph transmissions in principle should be −3 dBm0. In the case of amplitude-modulation, the level of the signal corresponding to black is usually about 30 dB lower than that of the signal corresponding to white.

Note – The levels of −3 and −13 dBm0 specified above are provisional and need further study from the facsimile transmission point of view.

2.4 *Relative levels*

If phototelegraph transmissions take place simultaneously from a transmitting station to several receiving stations, arrangements shall be made at the junction point so that, on the circuits following the junction point, the same power levels are maintained as those prescribed for individual transmissions.

2.5 *Attenuation distortion*

The limits for attenuation distortion on international circuits used for phototelegraphy are given in Recommendation G.151 concerning telephone circuits. The attenuation distortion between two terminal national centres shall therefore not exceed the limits indicated in Recommendation G.132 and it will not normally be necessary to compensate the distortion of the lines linking the phototelegraph stations to the terminal national centres in order to obtain, for amplitude-modulated phototelegraph transmission, an attenuation distortion between phototelegraph stations of less than 8.7 dB in the wanted band.

2.6 *Variation of circuit overall loss with time* (See Notes 1 and 2)

2.6.1 The objective is that:

2.6.1.1 The difference between the mean value and the nominal value of the transmission loss value should not exceed 0.5 dB.

2.6.1.2 The standard deviation from the mean value should not exceed 1 dB.

However, in the case of circuits set up wholly or partly on older-type equipment, where the international line consists of two or more circuit sections, a standard deviation not exceeding 1.5 dB may be admitted.

2.6.2 The method for achieving the above objective values is left to the discretion of Administrations (better maintenance, fitting of automatic regulators, etc.).

2.6.3 The assumption is made that these limits for the variation of loss with time of a single circuit may be compared to limits for loss measurements made on a set of circuits at a given time. Experience indicates that such a comparison has a practical validity although it has not been fully demonstrated at this time. Administrations are encouraged to use this Recommendation as giving currently practical limits for sets of circuits. This does not preclude the application of these limits to single circuits, should this prove practical at any time.

Note 1 – See Recommendation M.160 and Reference [1].

Note 2 – The provisions specified in § 2.6 are provisional and need further study from the facsimile transmission point of view.

2.7 *Phase distortion* (see also Recommendation T.12)

Phase distortion limits the range of satisfactory phototelegraph transmissions. Differences between the group delays of a telephone circuit, in the interval of the phototelegraph transmission, should not exceed

$$\Delta t \leqslant \frac{1}{2 f_p}$$

f_p = maximum modulation frequency corresponding to the definition and scanning speed.

2.8 *Interference*

Interfering currents, whatever their nature, should not exceed the CCITT recommended limits for telephone circuits.

3 Telephone circuits rarely used for phototelegraphy

3.1 *Transmission characteristics*

It seems that the majority of the characteristics specified by the CCITT for modern telephone circuits are sufficient to permit phototelegraph transmissions on a circuit chosen at random in a group of circuits normally used for telephone working. However, it is not certain that such a circuit would have a sufficiently low phase distortion for such use, particularly channels 1 and 12 of a 12-circuit group, use of which is not advised. The influence of phase distortion is more noticeable in frequency modulation.

With amplitude modulation there is a further risk that phototelegraph transmissions will be subject to faulty modulation because the special precautions applied to circuits regularly used for phototelegraphy (see § 2.6 above) cannot be applied to circuits taken at random.

3.2 *Precautions concerning signalling*

As long as automatic switching for phototelegraph circuits is not envisaged, the signal receiver can be disconnected so that no signalling disturbances can occur even when frequency modulation is used. However, if frequency modulation is used for phototelegraph transmission and if it is impracticable to disconnect the signal receiver, then it would be desirable, in the case of the single-frequency system, that a blocking signal be transmitted along with the picture signal to operate the guard circuit and render the receiver inoperative.

It is also apparent that the frequency of such a blocking signal should lie well outside the range of frequencies involved in the picture transmission.

The frequency and the level of the blocking signal must depend on the characteristics of the VF receiver (or receivers in the case of a tandem international connection), as designed by different Administrations to meet the specification to be prescribed for international signalling.

In the case of the two-frequency international signalling system, the CCITT has indicated its view that no interference will take place.

Reference

[1] *Statistical theory requirements*, Green Book, Vol. IV.2, Supplement No. 1.6, ITU, Geneva, 1973.

Recommendation T.12

RANGE OF PHOTOTELEGRAPH TRANSMISSIONS ON A TELEPHONE-TYPE CIRCUIT

(former CCIT Recommendation D.3; amended at New Delhi, 1960 and Geneva, 1964)

Note – In the case of carrier circuits, this Recommendation applies only to systems established on the basis of 12-channel group links. Systems using 16-channel group links will be the subject of subsequent study.

The CCITT,

considering

(a) that the differences between the delays of the various frequencies and the width of the transmission band actually usable on a circuit for telephony give rise, when phototelegraph signals are started or stopped, to transient phenomena which limit the phototelegraph transmission speed;

(b) that the range of phototelegraph calls of satisfactory quality, for a given transmission speed, depends especially on the constitution of the circuit, i.e. on:

- the loading and length, in the case of audio-frequency circuits;
- the number of 12-channel group links used in tandem in the case of carrier circuits,

and on the choice of the carrier frequency for amplitude-modulated photograph transmission, or on the mean frequency in the case of frequency modulation;

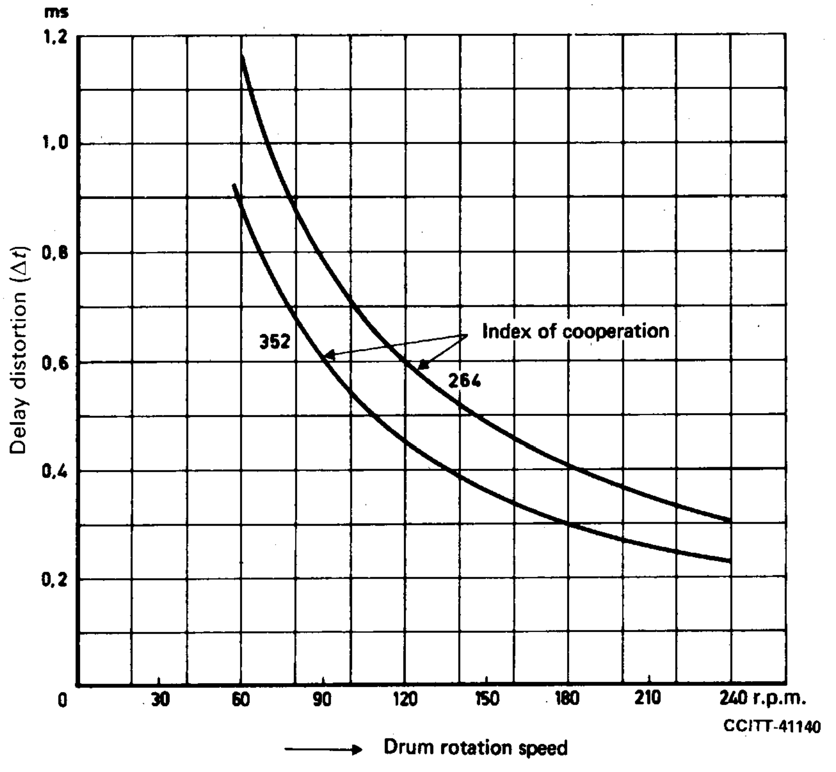
(c) that phototelegraph transmission of satisfactory quality requires that the limits of differences between the group delays in the transmitted frequency band, as shown in Figure 1/T.12, are not to be exceeded;

(d) that the CCITT has recommended the following for international telephone circuits:

the permissible differences for a worldwide chain of twelve circuits, each set up on a single group link between the minimum group delay throughout the frequency band transmitted and the group delay at the upper and lower limits of this band are those given in Table 1/T.12;

unanimously declares the view

that, as regards the effect of phase distortion on phototelegraph transmission quality, the carrier frequency (where amplitude modulation is used) or the mean frequency (when frequency modulation is used) must be chosen in such a way that it is as near as possible to the frequency which has the minimum group delay on the telephone circuit.



Note — The scanning spot is assumed to have the same dimensions in both directions (square or circular).

FIGURE 1/T.12

Permissible delay distortion in the transmitted frequency band as a function of the phototelegraph transmission speed

TABLE 1/T.12

	Lower limit of the frequency band	Upper limit of the frequency band
International chain	30 ms	15 ms
Each of the national 4-wire extensions	15 ms	7.5 ms
On the whole 4-wire chain	60 ms	30 ms

1 Circuits permanently used for phototelegraphy

1.1 It will generally be possible, by agreement between Administrations, to choose a circuit satisfying stricter limits than those specified above from the point of view of phase distortion.

1.2 Moreover, it will be possible to compensate phase distortions by inserting phase equalizers and to effect phototelegraph transmissions occupying the whole nominal band of the circuit.

2 Circuits used normally (or preferentially) for phototelegraphy

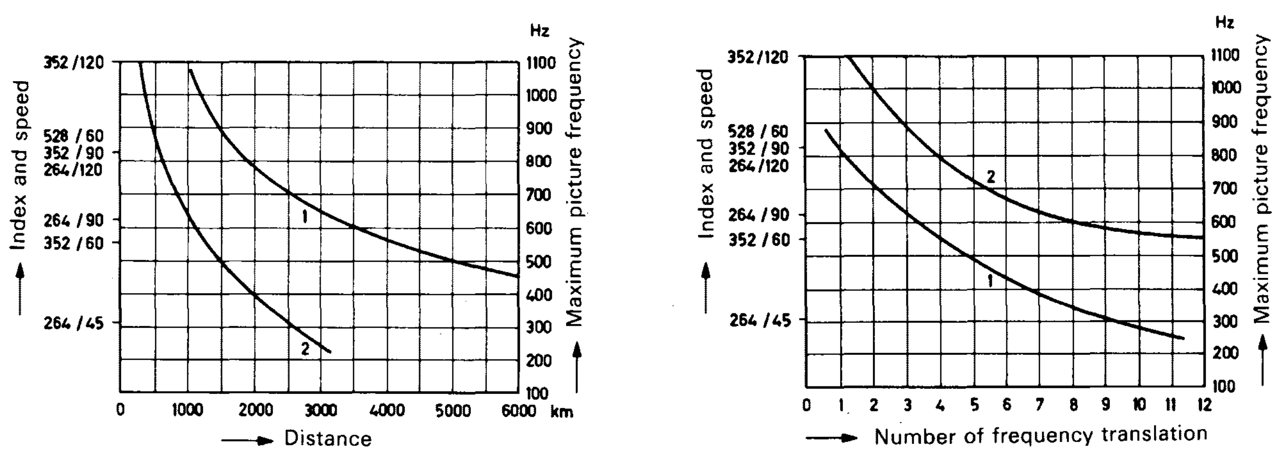
2.1 The greater the differences between the delays in the transmission intervals, the narrower should be the bandwidth chosen (leading to a lower phototelegraph definition or transmission speed).

2.2 Hence, audio-frequency circuits should in any case be lightly loaded circuits.

2.3 Phase distortion is well within the limits indicated above, in the case of carrier circuits, if a single modern-type carrier system is considered (and considering especially the telephone channels in the middle of a 12-channel group of such a system).

2.4 Nevertheless, it would be unjustifiable from the financial point of view to make the aforementioned recommendation concerning phase distortion stricter simply with a view to the occasional use of only a few circuits for high-speed phototelegraph transmissions.

2.5 The curves of Figure 2/T.12 give information on the relative performances of amplitude- and frequency-modulated phototelegraph transmissions on audio-frequency and carrier telephone circuits.



a) Audio-frequency circuits

b) Carrier frequency channels

CCITT-41150

Curve 1 : AM carrier = 1300 Hz
Curve 2 : FM = 1900 ± 400 Hz
AM carrier = 1900 Hz

FIGURE 2/T.12

Range of phototelegraph transmission

3 Telephone circuits rarely used for phototelegraphy

If phototelegraph connections are set up on circuits selected at random from modern-type groups of telephone circuits (for example, by automatic switching), a circuit may be taken which has too high a degree of phase distortion, particularly if it has been set up on channels 1 or 12 of a 12-channel group, use of which is deprecated. It is impossible, in this case, to draw up general information on the range of phototelegraph transmissions; however, it will be possible to meet the conditions for a transmission of adequate quality if the phototelegraph connection comprises only one 12-channel group link and if transmission is effected in normal conditions as outlined in Recommendation T.1.

PHOTOTELEGRAPH TRANSMISSION OVER COMBINED RADIO AND METALLIC CIRCUITS [1]

(former CCIT Recommendation D.4; amended at New Delhi, 1960 at Geneva, 1964, Mar del Plata, 1968 and Geneva, 1976)

The CCITT,

considering

(a) that, to facilitate interworking, it is desirable to standardize the characteristics of systems employed for phototelegraph transmission over long-distance HF (decametric) circuits [2];

(b) that it is desirable to standardize certain characteristics of the systems in such a way as to make them equally suitable for transmission over metallic circuits;

(c) that the transmission system using direct amplitude modulation is generally unsatisfactory over HF (decametric) radio circuits, because of the intolerable fading ratio usually encountered;

(d) that the system of sub-carrier frequency modulation has proved satisfactory, but requires standardization in respect of the centre frequency and shift frequencies, taking into account the values of the picture-modulation frequencies to be transmitted;

(e) that, when a direct frequency-modulation system is employed, the terminal equipment normally used for a sub-carrier modulation system should be usuable without serious modifications;

(f) that, taking into account the quality necessary for reproduction of the picture received, the effect of multipath echoes on long-distance HF (decametric) radio circuits normally limits the maximum admissible picture-modulation frequency to approximately 600 Hz,

1) This Recommendation corresponds to CCIR Recommendation 344-2.

2) The transmission over communication-satellite systems will be the subject of later study.

unanimously declares the view

that phototelegraph transmissions over combined radio and metallic circuits should conform to the following provisions:

1 Characteristics of radio circuits

1.1 When a sub-carrier frequency-modulation system is used, the following characteristics should be observed:

centre frequency	1900 Hz
frequency corresponding to white	1500 Hz
frequency corresponding to black	2300 Hz

(the 1500-Hz frequency is also used for the phasing signal)

1.2 When a direct frequency-modulation system is employed, the following characteristics should be observed:

centre frequency (corresponding to assigned frequency)	f_0
frequency corresponding to white	f_0 − 400 Hz
frequency corresponding to black	f_0 + 400 Hz

(the frequency f_0 − 400 Hz is also used for the phasing signal)

1.3 In both systems the stability of frequencies should be such that the variations are less than:

8 Hz during a period of 1 second,
16 Hz during a period of 15 minutes.

2 Characteristics of equipment and metallic circuits

The standards for phototelegraph apparatus and the specifications for transmission on metallic circuits are given in Recommendations T.1 and T.11.

On the metallic sections connected to both ends of the radio path, frequency modulation can be used whatever type of modulation is used over the radio circuits. However, amplitude modulation should preferably be used (see Recommendation T.11 on this subject).

3 Typical circuit

In principle, a worldwide hypothetical connection consisting of combined radio and wire channels may involve a maximum of two radio circuits with two metallic circuits at either end. Another metallic circuit may be required in the radio channel link if, in a country, the receiving and transmitting radio stations are at a distance from each other or if the two radio circuits terminate in neighbouring countries. The typical circuit for this connection is shown in Figure 1/T.15.

The frequency tolerances on each of the various sections of this connection should be no greater than those proposed by the CCITT (see Recommendations G.225 and T.1) as shown in Figure 1/T.15.

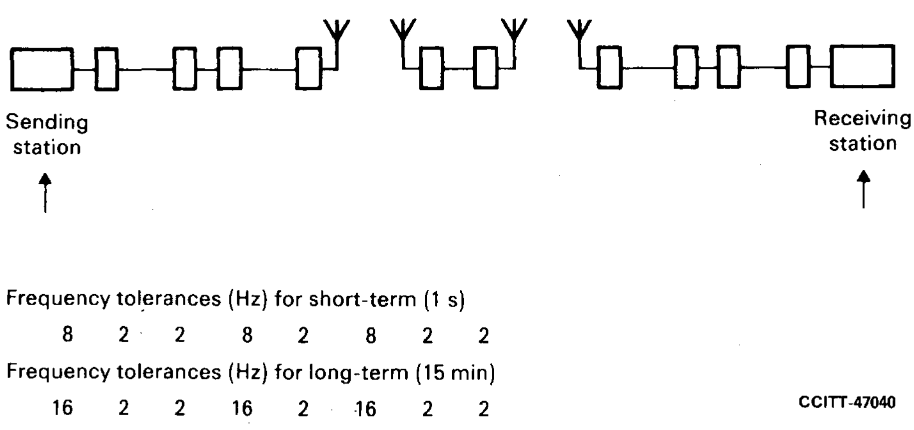


FIGURE 1/T.15

Typical circuit in a worldwide phototelegraph connection

If it is assumed that these deviations are distributed at random and if we take the standard deviation, we shall obtain the values 15 and 28 Hz respectively, which are not harmful for satisfactory reception, since CCITT Recommendation T.1 admits a maximum deviation of 32 Hz.

4 Modulation conversion

When conversion from amplitude modulation to frequency modulation (or vice versa) is required, the conversion should be such that the deviation of the frequency-modulated carrier varies linearly with the amplitude of the amplitude-modulated carrier.

Each Administration will decide, when the question arises, on the location of modulation converters. They may be placed either at the terminal phototelegraph station or at the control station associated with the radio station, to facilitate speech on the circuit used for phototelegraphy, if the radio channel will carry speech.

Recommendation T.20

STANDARDIZED TEST CHART FOR FACSIMILE TRANSMISSIONS [1)]

(New Delhi, 1960; amended at Geneva, 1964, and Mar del Plata, 1968)

The CCITT,

considering

that it will be a great advantage to use a standardized test chart to check the quality of facsimile transmissions and that such a chart would provide the receiving office with a reliable and rapid means of checking the quality of test transmissions according to uniform principles and of making comparisons between different transmission results in a precise way. The chart has been designed for measuring the quality of both picture and black-and-white transmissions and it enables the apparatus used and the communication channels to be judged by means of objective measurements, the results of which may be expressed in code.

unanimously declares the view

(1) that tests of facsimile transmission quality will be carried out in the international service with the aid of the "CCITT standardized test chart".

(2) that this test chart is made by the ITU under the supervision of the CCITT and should be offered for sale by the ITU. There are two editions:

- test charts sold before the IVth Plenary Assembly of the CCITT (October 1968) are of the first edition;
- test charts sold since the IVth Plenary Assembly of the CCITT are of the second edition.

These test charts are described in the annex to this Recommendation; the specimens printed in the annex cannot be used for measurements.

(3) that these two test charts are compatible and a test chart of either the first edition or the second can be used in the international service.

---

1) With the standardization of two test charts for document facsimile transmission (Test charts Nos. 2 and 3) in Recommendation T.21, this chart will be designated as "Test chart No. 1".

ANNEX A

(to Recommendation T.20)

Description of the standardized test chart No. 1

A.1 The test chart No. 1 has the following dimensions:

– length: 250 mm,

– width: 110 mm.

The lateral margin is some 10 mm wide on either side. The margin at top and bottom is 20 mm wide, approximately. The chart is divided into sections marked on the transparent paper delivered with every chart.

A.2 Sections 1 and 2 contain two tone scales, each having 15 density steps, varying from black and white and vice versa. Nos. 1, 4, 8, 11, and 15 bear their numbers on them, the number 1 always betokens white and the number 15 black.

A.3 Section 3 is occupied by a group of black lines on a white background, in the form of hyperbolae. The thickness of the lines and the distances between them diminish regularly from left to right, from 1 mm to 1/6 mm.

If a vertical line be drawn through the hyperbolae, the lines therein will subtend distances on the vertical line equal to the inverse of the figures on the scale graduated from 1 to 6 at the bottom of Section 3.

A.4 Section 4 contains two groups of hyperbolae similar to those of Section 3 but limited to the scanning densities lying between 3 and 6. One group is made up of grey lines on a white ground, the other by grey lines on a black ground.

A.5 Section 5 contains three patterns.

a) *First edition*

The first pattern is made up of five black lines on a white background, the lines being 0.25 mm thick, arranged in one group of two lines and another of three lines. These lines are 0.25 mm apart, and the two groups are separated by 1.5 mm.

The second pattern is the same as the first, but the lines are white on a black background.

The third pattern consists of two similar groups of black lines on a white background, as follows:

– line, thickness	1 mm
– separation	0.25 mm
– line, thickness	0.25 mm
– separation	1 mm
– line, thickness	0.25 mm
– separation	0.25 mm
– line, thickness	1 mm

The two groups are separated by 1 mm.

b) *Second edition*

The first pattern is made up of eight black lines on a white background, separating into three groups:

– one group of two black lines being 0.25 mm thick and 0.25 mm apart;

– one group of three black lines being 0.25 mm thick and 0.25 mm apart;

– one group of three black lines being 0.1 mm thick and 0.25 mm apart.

These groups are separated by 1.5 mm.

The second and third patterns are respectively the same as those of Section 5 of the first edition.

A.6 Section 6 contains a tapering black line on a white background, and a tapering white line on a black background. The maximum width of the tapering lines is 0.7 mm.

At the top of the section is a scale in millimetres, showing the width of the tapering lines.

A.7 Section 7 contains a strip of tone equivalent to that in Section 1, step 11, on a background of Section 1, step 5.

A.8 In the first edition, Section 8 accommodates a photograph of UNESCO House in Paris.

In the second edition, Section 8 accommodates a portrait of an Argentine boy.

A.9 Section 9 contains two concentric circles, the radii of which differ by 1 mm. A square, with its diagonals, is inscribed in the inner circle.

In the second edition the radii of the two circles are bigger than those of the first edition and the exterior circle is osculating with the limits of Section 9.

A.10 There are two Sections numbered 10 which contain adjustment lines.

In the first edition, these lines are numbered from 1 to 6 and these figures are placed in the central part of the left half of Section 10.

In the second edition, only the even adjustment lines are numbered and these figures are placed at the left of the prolongation of the line separating Sections 3 and 12, 7 and 12 respectively.

A.11 Section 11 contains a pattern of lines, with a spacing of 2.5 mm. It is divided into two equal parts by a vertical line. The column on the right contains white rectangles, while that on the left contains alternate white and black rectangles.

In the second edition Section 11 is so cut that the parts adjacent to Sections 10 are kept in white. These parts are used for extension of the adjustment lines of Sections 10.

To indicate the centre of the test charts of the second edition, a line in the right column of Section 11 which is the prolongation of the line separating the density steps 8 and 9 of Section 1 is 0.5 mm thick.

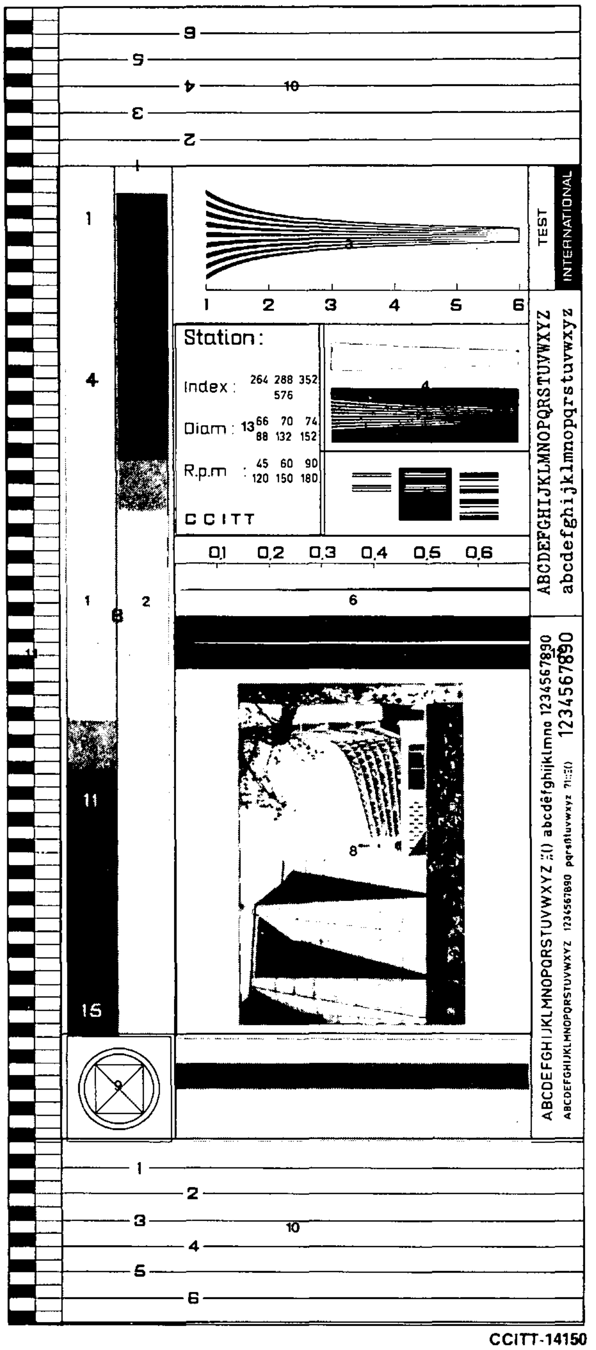
A.12 Section 12 contains letters, digits, and punctuation marks printed in various styles, and arranged so that they can be read sideways.

Section 12 is divided into three parts:

– the bottom part contains typographical signs (letters, figures, and a few punctuation marks), printed in various styles.
– the middle part contains signs in typewritten characters 2.3 mm high.
– the top part contains two words: "TEST" and "INTERNATIONAL" one above the other. "TEST" is black on a white background, while "INTERNATIONAL" is white on a black background.

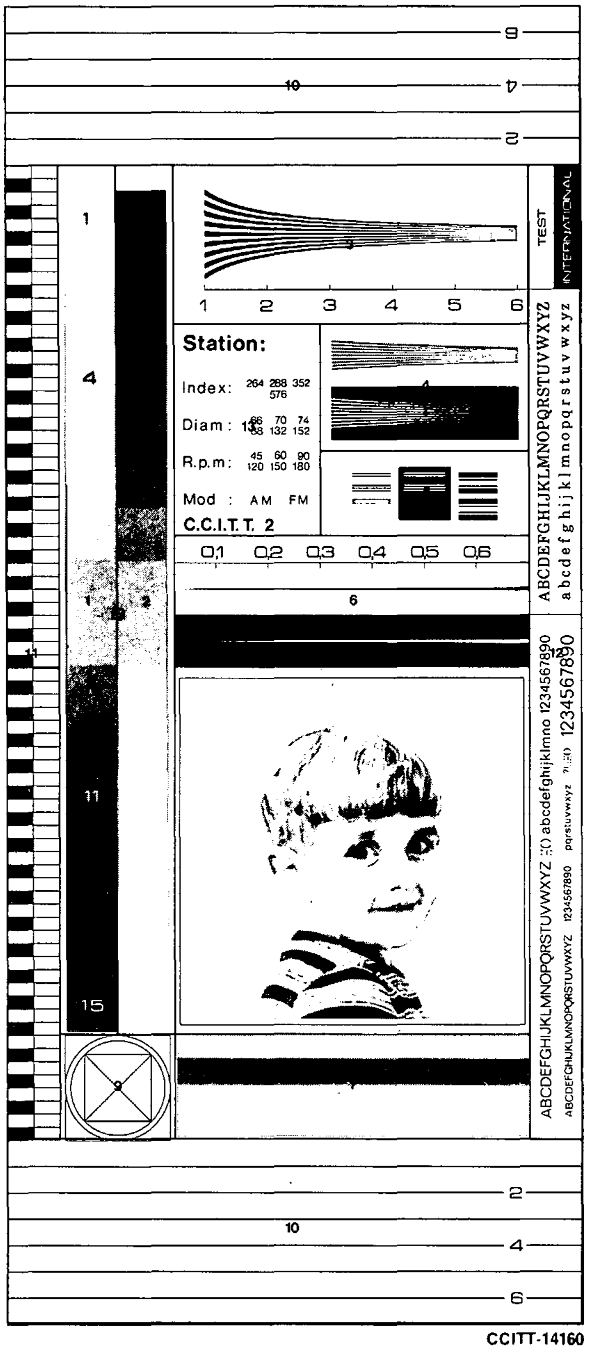
A.13 Section 13 contains

– space for the name of the transmitting station;
– the cooperation indices most often used;
– the diameters in millimetres of the drums most often used;
– the r.m.p. of the drums;
– "Mod.: AM FM" to indicate either amplitude modulation or frequency modulation (the second edition only);
– the indication "CCITT" in the test charts of the first edition is replaced by "CCITT 2" for the test charts of the second edition.



CCITT-14150

Test chart No. 1 (first edition)



CCITT-14160

Test chart No. 1 (second edition)

STANDARDIZED TEST CHARTS FOR DOCUMENT FACSIMILE TRANSMISSIONS

(Geneva, 1980)

The CCITT,

considering

(a) that a standardized test chart to check the quality of document facsimile transmissions will have great advantages. Owing to the development of international document facsimile transmission services, a great variety of characters and symbols, including ideographic symbols, are involved and must be taken into consideration.

(b) that the many different reasons for conducting the test has led to the definition of two test charts:

- one, "transmission test chart" for evaluating the make-up of the page and the legibility of the text in the various languages used by the ITU;
- the other, "characterization test chart" for the evaluation of the technical quality parameters enabling the technicians to detect any faults;

unanimously adopts the view

(1) that tests of document facsimile transmission quality should be carried out in the international service using the CCITT standardized test charts;

(2) that these test charts should be produced by the ITU under the supervision of the CCITT and should be offered for sale by the ITU. There are two types of charts:

- "Test chart No. 2: Transmission test" intended for the general evaluation of legibility,
- "Test chart No. 3: Characterization test" intended to check the quality parameters of apparatus.

The charts are described in Annex A; the specimens printed in Annex A cannot be used for measurements;

(3) that the charts should be used with facsimile apparatus in accordance with Recommendations T.2, T.3 and T.4.

ANNEX A

(to Recommendation T.21)

Description of the standardized document facsimile test charts

1 Dimensions of the test charts

- length: 297 mm
- width: 210 mm

They are divided into sections marked:

- 2.1 - 2.16 on the Test chart No. 2 for transmission test,
- 3.1 - 3.23 on the Test chart No. 3 for characterization test.

These section markings are also used to designate the following paragraphs which describe the given section.

The characterization test chart is prepared by a process using a small frame in order to simplify production.

2 Test chart No. 2: Transmission test

This test chart contains elements permitting quantitative evaluations of distortion and character groups intended for evaluation of the readability of the facsimile document.

2.1 *4 groups of arrows and lines*

These groups permit evaluation of framing distortions of the facsimile document appearing as lost margins.

2.2 *Alternating black-white lines, thickness 0.5 mm*

The black lines on the facsimile document must be separated: this is the test of minimum acceptable definition.

2.3 *2 sets of 1 black band and 1 white band*

Limits of horizontal resolution for isolated black and white lines. The numbers placed between the two bands indicate thicknesses in microns.

2.4 *Diagonal line*

This line permits evaluation of sweep uniformity over the entire test-pattern surface.

2.5-2.6 *Black circles and concentric circles with two perpendicular diameters*

Flattening of circles along either diameter indicates differences between the transmitting and receiving devices, either in the selection of horizontal and vertical definitions or in the index of cooperation.

2.7 *Horizontal band*

Permits evaluation of vertical definition.

2.8 *Random characters*

The characters are in "Univers 8 points" and "English Times 8 points".

Certain characters are arranged in a vertical line. These groups must be reproduced legibly by all facsimile machines.

2.9 to 2.14 *Texts in English – French – Spanish – Chinese – Arabic – Russian*

They permit evaluation of the overall quality of the transmitter-receiver system by examination of the limits of readability for the small characters.

2.15 *Empty box*

Special typed or handwritten texts may be entered in this box, as required by users.

2.16 *4 scales with millimetre graduations*

These scales permit determination of distortions in length on horizontal and vertical lines by direct measurement with a graduated rule.

3 Test chart No. 3: Characterization test

This test chart permits a definition of the quantizeable limits in the performance of facsimile machines (half-tone, framing, definition, etc.).

This is a reference for the drafting of lists of characteristics for CCITT Recommendations or of technical specifications.

As such, this test chart is intended for facsimile-machine adjustment and maintenance operations.

3.1 *Band of alternating black and white lines, thickness 5 mm*

Permits measurement of scanning distortion and adjustment of the black and white levels.

3.2 *2 density level bands in complementary order*

These scales permit measurement of the scanners' analogue response curves and definition of the white/black decision threshold level in digital transmission devices.

The two bands, covering nearly the width of the page, are reversed for verification of the uniformity of the scanner's response over the entire length of the horizontal line.

The densities, varying between 0.2 and 1.5, are indicated in the margin of each of the bands.

3.3 *Black band covering the entire page width*

Permits adjustment of characteristic "black" signals through the entire sequence of the electronic devices.

3.4-3.5 *Isolated black and white lines, variable thickness, 2 complementary bands*

Using this group, it is possible to define the limits of resolution for isolated black and white lines.

Line thicknesses are indicated in microns.

3.6 *Band of alternating lines, 8 lines per mm (black and white line thickness 125 microns)*

Obliqueness: 2°

This band permits verification of the optical definition of integrated 1728-point scanners.

Obliqueness is required in order to obtain, during test pattern advance, a situation in which the points of the image are perfectly centred on the detector's photosensitive cells where the modulation depth is at a maximum.

3.7-3.8 *Strips of alternating lines, 6 lines per mm (black and white line thickness 166.6 microns)*

Zone 3.7 consists of lines with an obliqueness of 3°.

Zone 3.8 consists of vertical lines.

Zone 3.7 has the same purpose as zone 3.6, but less severe.

Zone 3.8 permits examination of limits of definition.

3.9 *Alternating lines, 4 lines per mm (black and white line thickness 250 microns)*

Permits verification of standardized facsimile-machine definition.

The black lines on the received copy must be separated.

3.10 *Alternating lines, 2 lines per mm (black and white line thickness 500 microns)*

This scale represents the minimum permittable definition for a facsimile machine. The black lines on the facsimile document must be clearly separated.

3.11 *Vertical and horizontal bundles (converging patterns)*

This group of 3 bundles of converging lines permits quantization of the limits of horizontal and vertical definitions.

The numbers shown along the bundles indicate the thickness of black and white lines in microns.

3.12 *Diagonal line*

This line is designed for evaluation of sweep uniformity over the entire test chart surface.

3.13 *Black lines, thickness 250 microns, spaced 750 microns*

3.14 *Black lines, thickness 250 microns, spaced 1000 microns*

The two scales of 3.13 and 3.14 simulate character downstrokes. They must be faithfully reproduced by facsimile.

3.15 *Black spindle and white spindle*

Permits quantization of the limits of horizontal resolution for isolated black and white lines. The numbers shown along the band indicate line thicknesses in microns.

3.16 *2 vertical lines, thickness 250 microns, spacing 1000 microns*

The purpose of this group of 2 lines is the evaluation of longitudinal jitter effect. The value of the jitter effect may be quantized by measurement of the minimum dimension reached at the spacing between the two lines.

3.17 *Decreasing-density character set*

This group of characters permits examination of the limits of reproducible density. Results obtained yield information on the effectiveness of adaptive thresholds. They also permit definition of unusable document types, due either to insufficient relative density of characters (e.g., hard pencils), or to inadequate character size, or to a combination of these two parameters.

3.18 *ISO characters* (cf NFZ 43006 - June 1965)

Correct identification of the ISO character is a guarantee of satisfactory imaging of comparable typographic characters. They therefore permit completely objective readability tests.

3.19 *Random characters*

Some of the characters are in "Univers 6 point" font.

The characters are arranged in two groups:

- a first group along horizontal lines, positioned in the lower part of the test pattern;
- a second group along vertical lines, positioned in the centre of the test pattern.

These characters permit qualitative evaluation of readability.

3.20 *Group of Chinese, Russian and Arabic characters*

This group completes the group of 3.11 and 3.19 for evaluations of readability of Chinese, Russian and Arabic characters.

3.21 *4 scales, graduation in millimetres*

These scales permit determination of distortions in length of horizontal and vertical lines by direct measurement with a graduated rule.

3.22 *4 groups of arrows and lines*

These groups permit quantization of framing defects of the facsimile document.

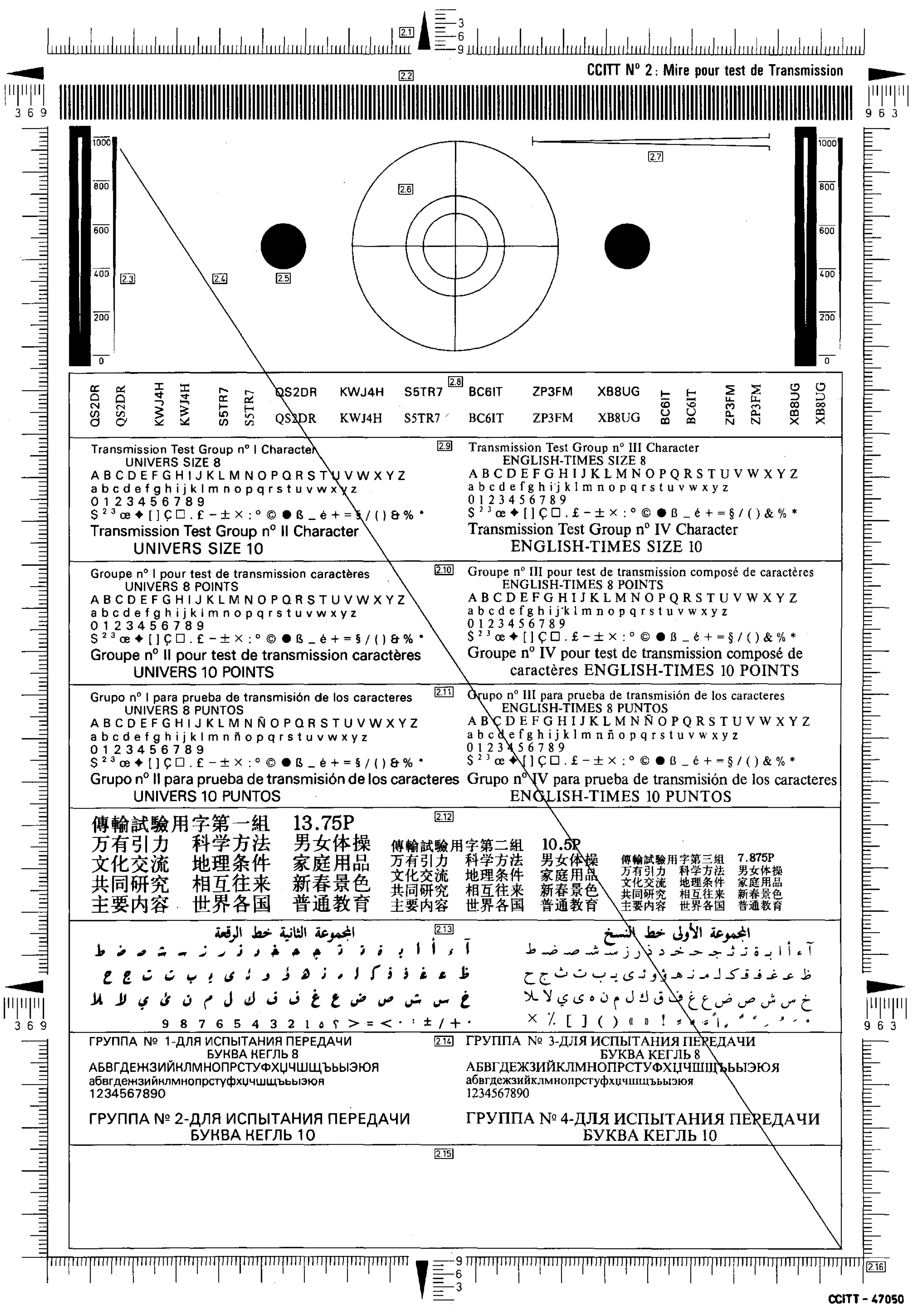
The numbers indicate distances in millimetres measured from the edge of the test pattern.

3.23 *Frame A′ A B B′*

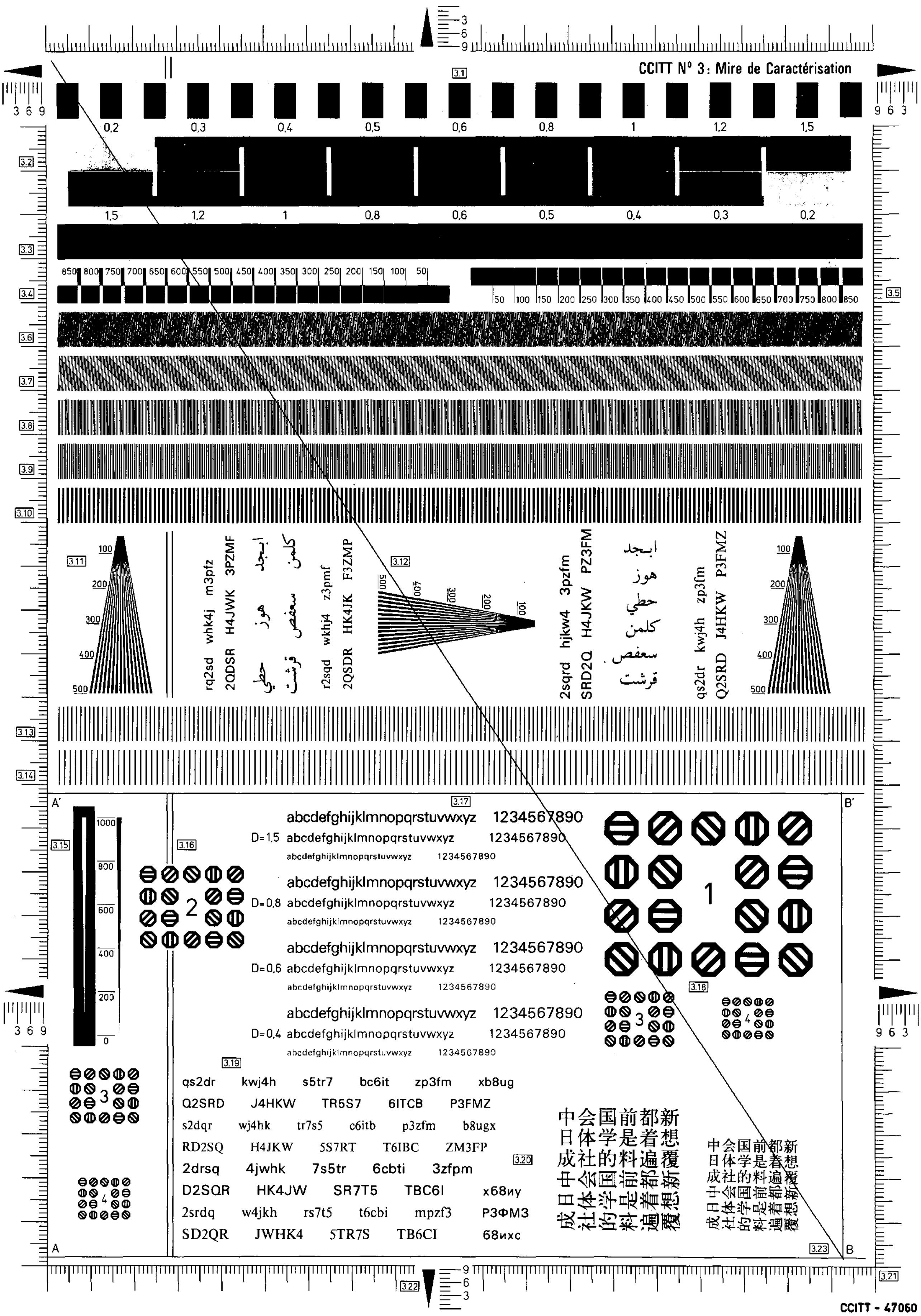
This frame permits measurement of parallelogram deformation of the image caused by time-base frequency differences.

A square placed on A B B′, with one side aligned with AB, intercepts line A′ B′ at a point B″.

Quantization may take the form of a value in millimetres for the distance B′ B″.



Test chart No. 2



Test chart No. 3

PROCEDURES FOR DOCUMENT FACSIMILE TRANSMISSION IN THE GENERAL SWITCHED TELEPHONE NETWORK [1]

(former Recommendation T.4, Mar del Plata, 1968; amended and renumbered at Geneva, 1976 and 1980 and Malaga-Torremolinos, 1984)

Introduction

i) This Recommendation is intended to apply to document facsimile apparatus covered by CCITT Recommendations T.2, T.3 and T.4. It describes the procedures and signals to be used where facsimile equipments are operated over the general switched telephone network. When existing equipments are operating in a non-CCITT manner, they shall not interfere with equipments operating in accordance with the Series T Recommendations.

ii) Arrangements for automatic calling/answering on the general switched telephone network have been aligned as closely as possible with those described in the Series V Recommendations for data terminal equipment.

iii) While there are eight possible operating methods (see Table 1/T.30) each may be described by five separate and consecutive phases:

Phase A Call set up

Phase B Pre-message procedure for identifying and selecting the required facilities

Phase C Message transmission (includes phasing and synchronization where appropriate)

Phase D Post-message procedure including end-of-message and confirmation and multi-document procedures

Phase E Call release

iv) Two separate signalling systems are described: first a simple system using single frequency tones and second a binary coded system which offers a wide range of signals for more complex operational procedures. Thus tonal signalling is restricted to manual operation at both stations or where a manually operated station intends to transmit to a called station equipped as an automatic answering receiver. Facsimile machines conforming to Recommendations T.2 and T.3 will normally use the tonal signalling system although the binary coded system may be provided in addition where complex procedures are required, e.g. comprehensive automatic functions.

v) For digital document facsimile apparatus conforming to Recommendation T.4 it is intended that the binary coded system shall be the standard signalling arrangement, but additionally a tonal signalling capability may be provided when the digital facsimile apparatus has a fallback capability to apparatus conforming to Recommendations T.2 and T.3. The binary coded signalling has priority and should be tried first; if this fails to elicit a response, tonal signalling should be attempted.

vi) The binary coded signalling system is based on a high level data link control (HDLC) format developed for data transmission procedures. The basic HDLC structure consists of a number of frames each of which is subdivided into a number of fields. It provides for frame labelling, error checking and confirmation of correctly received information and the frames can be easily extended if this should be required in the future.

vii) The transmission of the facsimile message itself (phase C) will be according to the modulation system described in the appropriate Recommendation for the facsimile apparatus.

[1] Facsimile apparatus referred to as Groups 1, 2 or 3 in this Recommendation are those conforming to Recommendations T.2, T.3 or T.4 respectively.

CONTENTS

The CCITT,

considering

(a) that facilities exist for facsimile transmission over the general switched telephone network;

(b) that such facsimile transmission may be requested either alternatively with telephone conversation or when either or both stations are not attended;

(c) that for this reason the operations involved in establishing and/or releasing a facsimile call should be capable of automatic operation;

unanimously declares the view

that the facsimile apparatus should be designed and operated according to the following standards:

1 Scope

1.1 *General*

1.1.1 This Recommendation is concerned with the procedures which are necessary for document transmission between two facsimile stations in the general switched telephone network.

These procedures essentially comprise the following:

- call establishment and call release,
- compatibility checking, status and control command,
- checking and supervision of line conditions,
- control functions and facsimile operator recall.

1.1.2 Only the procedures with their corresponding signals are specified in this Recommendation.

1.2 *Classification of operating methods*

1.2.1 This Recommendation regulates the operational sequence of manually operated facsimile stations as well as of automatic stations.

The automatic facsimile station is understood to be a station which is capable of performing all procedures (listed in § 1.1 above) automatically. In this case, an operator is not necessary.

If, however, an operator is required for any of these procedures, the station must be regarded as a manually operated station.

1.2.2 Based upon all combinations which may result from the fact that there are manually operated stations and automatic facsimile stations, the operating methods shown in Table 1/T.30 are possible.

TABLE 1/T.30

Method No.	Description of operating method	Direction of facsimile transmission	Overall designation
1	*Manual* operation at calling station and *Manual* operation at called station	Calling station *transmits to* called station	1-T
		Calling station *receives from* called station	1-R
2	*Manual* operation at calling station and *Automatic* operation at called station	Calling station *transmits to* called station	2-T
		Calling station *receives from* called station	2-R
3	*Automatic* operation at calling station and *Manual* operation at called station	Calling station *transmits to* called station	3-T
		Calling station *receives from* called station	3-R
4	*Automatic* operation at calling station and *Automatic* operation at called station	Calling station *transmits to* called station	4-T
		Calling station *receives from* called station	4-R

Note – There may also be operating methods which will allow messages to be received by more than one station (multipoint connection).

1.3 *Station identification*

1.3.1 For the purpose of classifying an automatic facsimile station as a non-speech terminal, a tone must be transmitted to line. As both automatic calling and called facsimile stations transmit tones to line during call establishment, a normal telephone user who becomes inadvertently connected to one will receive tone signals for a period of sufficient duration to indicate clearly to him that he is incorrectly connected.

1.3.2 Additionally an automatic verbal announcement may be used which can provide station identification.

1.4 *General provisions*

1.4.1 The control signals specified in this Recommendation have been chosen in such a way that the telephone service is not affected.

1.4.2 If any malfunction of the facsimile procedures described in this Recommendation is detected, the call should be released.

1.4.3 Where the called station has automatic facsimile apparatus which is not ready or not able to operate, the call should not be answered automatically.

1.4.4 This Recommendation includes procedures for switching from facsimile to speech. However, speech facilities may be omitted if this is permitted by the regulations of the Administrations.

1.5 *Optional provisions*

1.5.1 The operator at each station may have the possibility of calling the other station at any time during the progress of the facsimile procedure (see § 2.2 below).

1.5.2 The procedures in this Recommendation allow a facsimile station to transmit and/or receive several documents successively without the aid of an operator.

1.5.3 This Recommendation includes procedures for incorporating a unique station identification command if required to prevent unauthorized stations from demanding a message.

If enhanced security is required, this may be provided by the use of the non-standard facilities frame.

2 Explanation of terms used

2.1 *Facsimile station main functions*

One or more equipments at the end of the line providing three main functions.

2.1.1 *Call establishment and call release*

The establishment and release of a connection according to the normal rules of using the general switched telephone network.

2.1.2 *Procedure*

To identify, to supervise and to control the facsimile transmission according to a protocol.

2.1.3 *Message transmission*

To transmit and/or receive the facsimile message.

2.2 *Time sequence of a facsimile call* (see Figure 1/T.30)

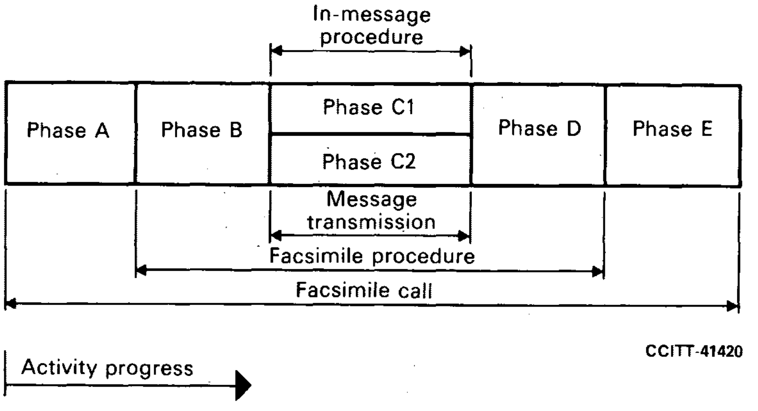


FIGURE 1/T.30

2.3 *Description of phases*

2.3.1 *Phase A – Call establishment*

Call establishment can be realized manually and/or automatically.

2.3.2 *Phase B – Pre-message procedure*

The pre-message procedure consists of the identification of capabilities and the commanding of the chosen conditions as well as the confirmation of acceptable conditions.

When connection is established between apparatus operating in accordance with this Recommendation and apparatus operating in a non-CCITT manner, the equipments should disconnect before the in-message procedure unless both equipments include optional, compatible, procedures.

2.3.2.1 *Identification section*

- group identification,
- confirmation for reception,
- subscriber identification (option),
- non-standard facilities identification (option).

2.3.2.2 *Command section*

- group command,
- phasing/training,
- synchronization,
- as well as the following optional commands:
  - non-standard facilities command,
  - subscriber identification command,
  - polling (send) command,
  - line conditioning,
  - echo suppressor disabling.

2.3.3 *Phase C1 – In-message procedure*

The in-message procedure takes place at the same time as message transmission and controls the complete signalling for in-message procedure, e.g., in-message synchronization, error detection and correction and line supervision.

2.3.4 *Phase C2 – Message transmission*

Message transmission procedure is covered by the appropriate Recommendation for the equipment.

2.3.5 *Phase D – Post-message procedure*

The post-message procedure includes information regarding:

- end-of-message signalling,
- confirmation signalling,
- multipage signalling,
- end-of-facsimile procedure signalling.

2.3.6 *Phase E – Call release*

Call release shall be realized manually and/or automatically.

3 Description of a facsimile call

3.1 *Phase A – Call establishment*[2)]

The establishment of a facsimile call may be realized either manually, if an operator is in attendance, or automatically. To accomplish this, four operating methods have been defined.

---

2) See Appendix II for abbreviations used in this Recommendation.

3.1.1 *Operating method 1*

Manual operation at both the calling and called station. Figure 2/T.30 indicates the operators' actions required to establish a call.

Call event No.	Calling station	Called station
1	Operator hears dial tone and dials desired number	
2	Operator hears ringing tone	Call rings and operator answers the call
3	Verbal identification	Verbal identification
4	Facsimile machine is switched to line	Facsimile machine is switched to line
5	Begin facsimile procedure (see §§ 4 and/or 5 of this Recommendation)	Begin facsimile procedure (see §§ 4 and/or 5 of this Recommendation)

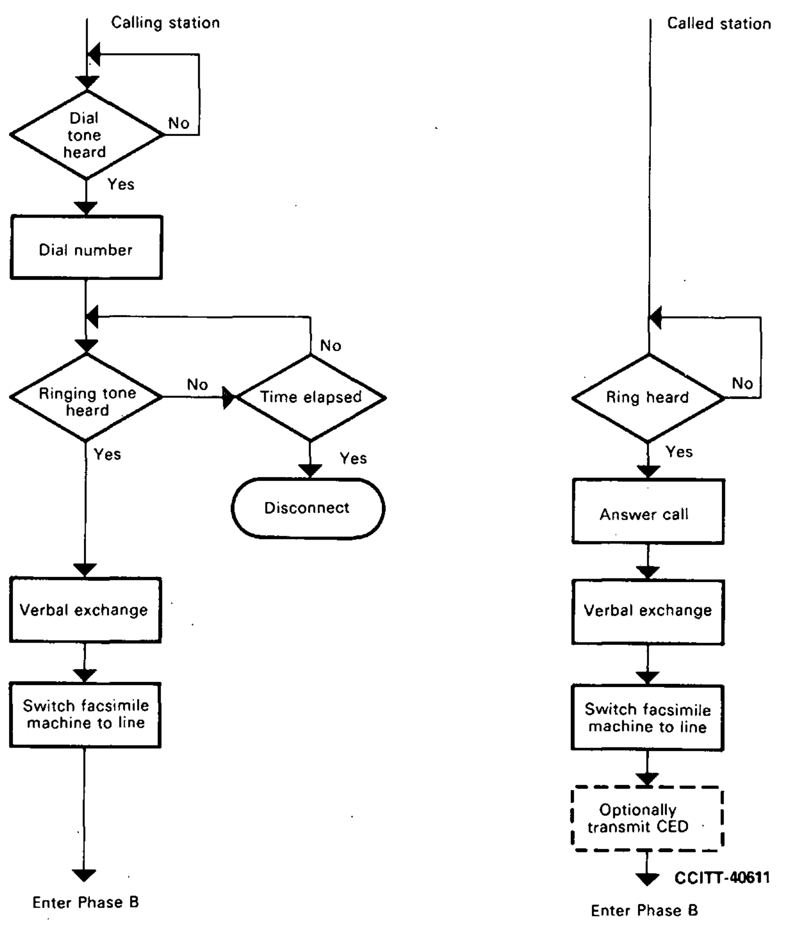


FIGURE 2/T.30
Call establishment, operating method 1

3.1.2 *Operating method 2*

Manual operation at the calling station and automatic operation at the called station. Figure 3/T.30 indicates the operator's and apparatus actions required to establish a call.

Call event No.	Calling station	Called station
1	Operator hears dial tone and dials desired number	
2	Operator hears ringing tone	Equipment detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4	Operator hears CED and facsimile machine is switched to line	Transmit CED
5	Begin facsimile procedure (see §§ 4 and/or 5 of this Recommendation)	Begin facsimile procedure (see §§ 4 and/or 5 of this Recommendation)

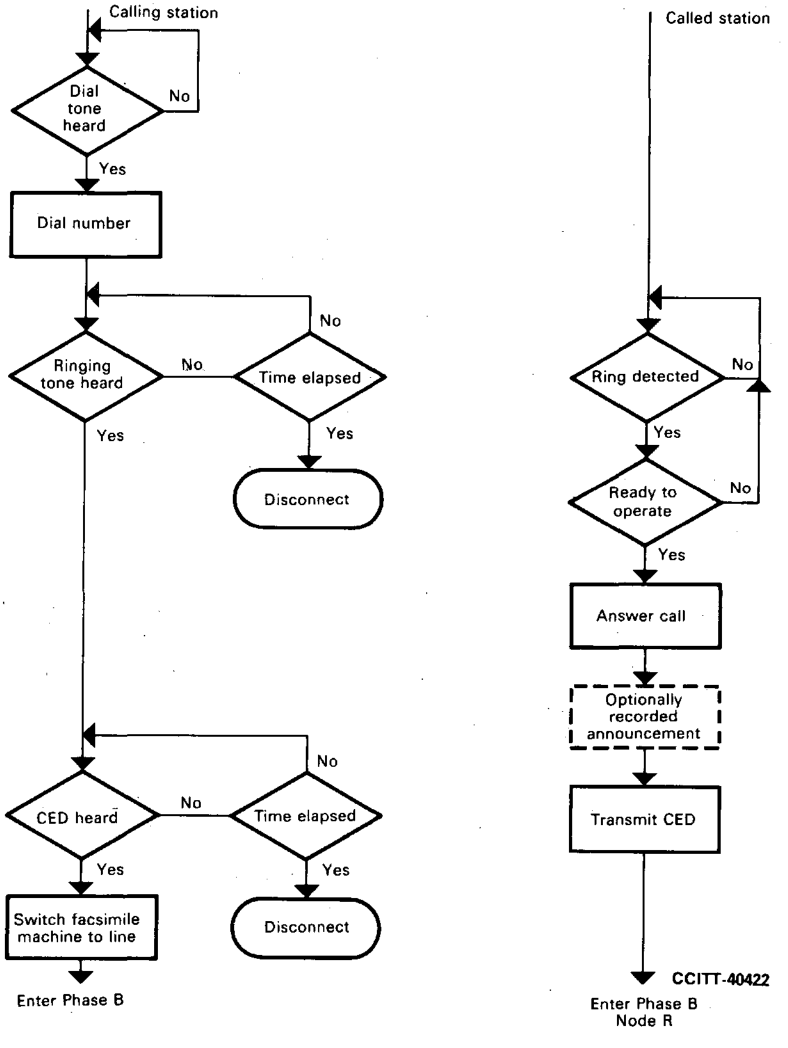


FIGURE 3/T.30
Call establishment, operating method 2

3.1.3 *Operating method 3*

Automatic operation at the calling station and manual operation at the called station. Figure 4/T.30 indicates the operator's and apparatus actions required to establish a call.

Call event No.	Calling station	Called station
1	Equipment detects dial tone and dials desired number (see Note). To clearly indicate to a called operator that he is connected to a facsimile machine or to a normal telephone user that he is inadvertently connected, CNG will be transmitted to line during the time that signals are attempted to be detected *Note* — An alternative procedure may be specified by Administrations	
2		Call rings and operator answers the call
3		Operator detects CNG and switches facsimile machine to line (optionally CED may be generated)
4	Begin facsimile procedure (see § 5 of this Recommendation)	Begin facsimile procedure (see § 5 of this Recommendation)

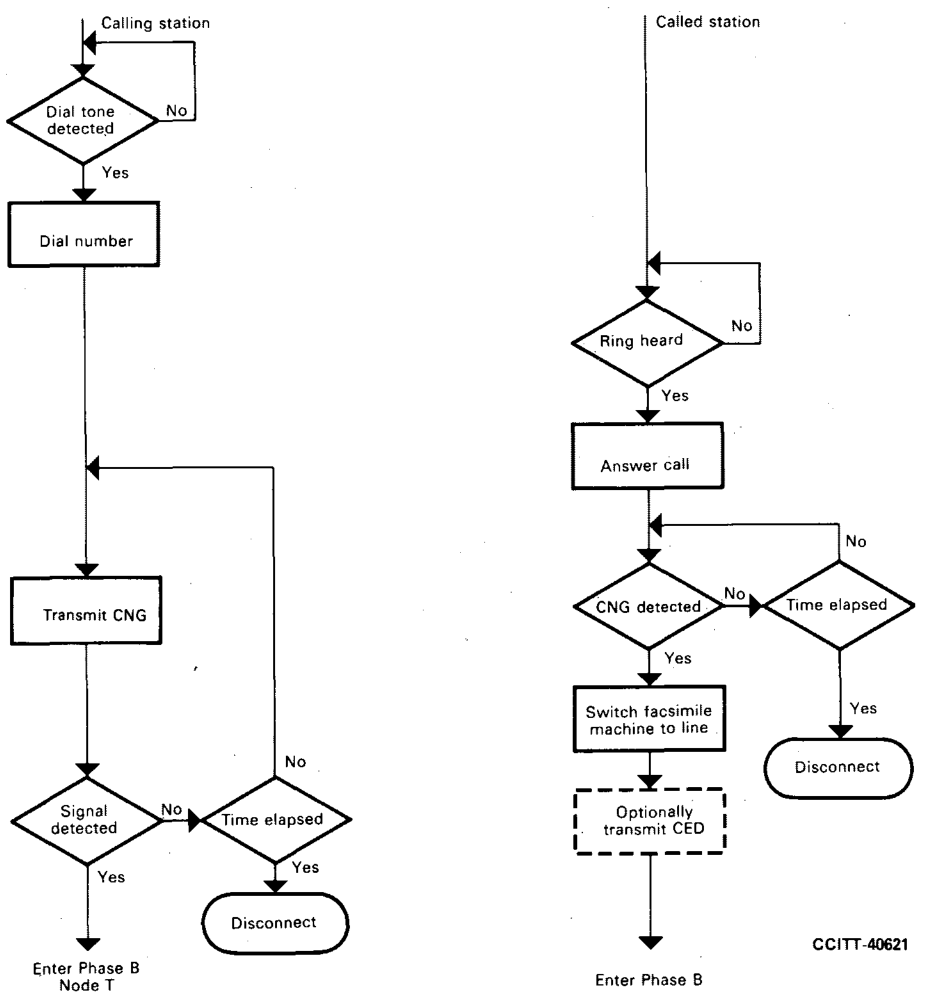


FIGURE 4/T.30

Call establishment, operating method 3

3.1.4 *Operating method 4*

Automatic operation at both the calling and called stations. Figure 5/T.30 indicates the actions required by the apparatus to establish a call.

Call event No.	Calling station	Called station
1	Equipment detects dial tone and dials desired number (see Note). To clearly indicate to a normal telephone user that he is inadvertently connected, CNG will be transmitted to line during the time that signals are attempted to be detected. *Note* – An alternative procedure may be specified by Administrations	
2		Equipment detects ring and answers the call
3		Optionally, a recorded verbal announcement may be transmitted
4		Transmit CED
5	Begin facsimile procedure (see § 5 of this Recommendation)	Begin facsimile procedure (see § 5 of this Recommendation)

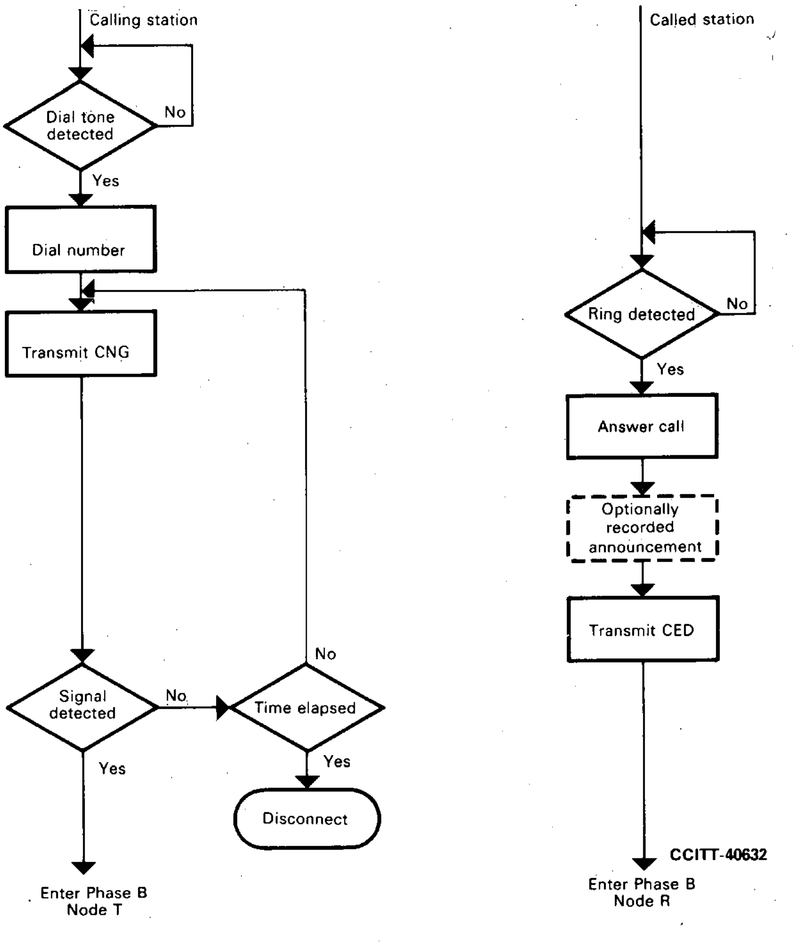


FIGURE 5/T.30
Call establishment, operating method 4

3.2 *Phases B, C and D – Facsimile procedure*

When entering phase B, the following rules should be adhered to:

All manual receivers and all auto-answering units must enter phase B by identifying their capabilities (i.e. Node R of the flow diagram in § 4.2 or 5.2). All manual transmitters and all auto-calling units must enter phase B prepared to detect the capabilities and issue the appropriate mode setting command (i.e. Node T of the flow diagram in § 5.2). To allow for operating method 2-R, the delay between the transmission of the digital identification signals shall be 4.5 seconds ± 15% when sent from a manual facsimile receiver.

The detailed information pertaining to the tonal and binary coded facsimile procedures is contained in §§ 4 and 5 below. The relationship between these two procedures and an overview regarding the total system operation is given in the following:

3.2.1 *The interaction between tonal and binary coded procedures*

Facsimile procedures, as described in this Recommendation, may be realized in two different ways:

– tonally, with a limited number of tones for simple procedures (see § 4 below) and

– binary coded, for more comprehensive procedures (see § 5 below).

Binary coded signalling is especially desirable for machines which use:

– comprehensive automatic functions;

– digital concepts internally (e.g. redundancy reduction techniques);

– fast transmission rates (in order to keep pre- and post-message time short compared to total transmission time);

– special security features.

Recommendations concerning the interaction between tonal and binary coded signalling recognize the principle of the priority of coded procedures such that, when available, binary coded signalling shall be tried first. The interaction steps are as follows:

– The unattended called station shall answer a call with the CED signal.

– The unattended calling station shall indicate a call with the CNG signal.

– Whenever it is capable of binary coded signalling, the called station will start with binary coded signalling.

– Facsimile stations being capable of tonal signalling only will start tonally.

– Facsimile stations being capable of both binary coded and tonal signalling will send a sequence of signals, the first being a binary coded signal and the second and all following signals being a composite of tonal and binary coded information.

– If the calling station reacts binary coded then the binary coded signalling goes on through all control procedures.

– If the calling station reacts tonally, then the tonal signalling goes on through all procedures.

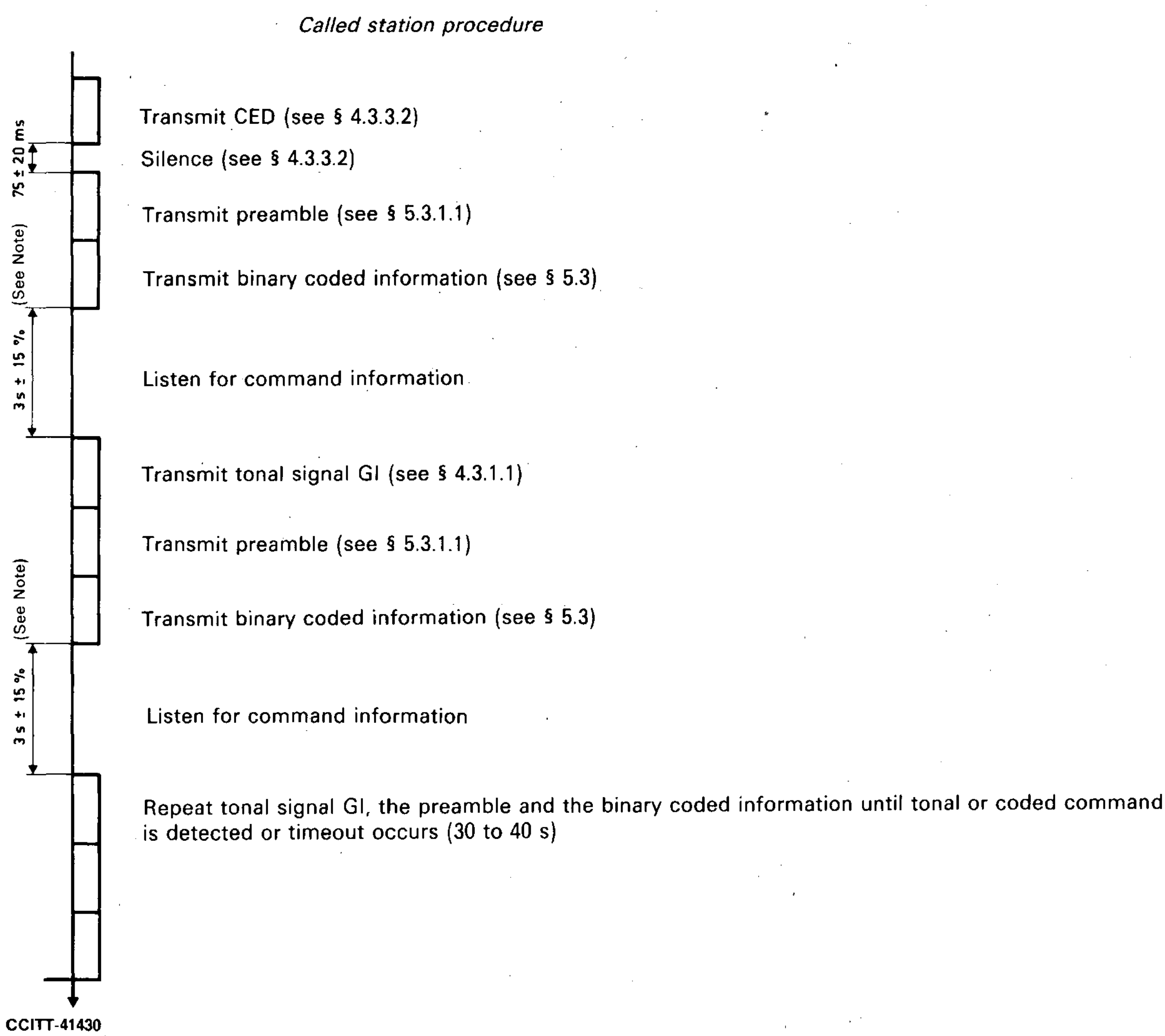
An example of a station having both binary-coded and tonal capabilities is shown in Figure 6/T.30 for further clarification.

3.2.2 *Signal sequences*

The recommended system utilizes the interchange of signals between the two equipments to verify compatibility and assure operation. To do this, the called station identifies its capabilities tonally (in the simplest configuration) and/or binary coded. The calling station responds to this accordingly with a command tonally or binary coded. Now the transmitter continues phase B.

Following the transmission of the message, the transmitter sends an end-of-message signal and the receiver confirms reception. Multiple documents can then be transmitted by the repetition of this procedure.

The flow of signals is shown in Figure 7/T.30 for the configuration where the calling station is transmitting. These signals may be tonal or binary coded, subject to the conditions of § 3.2.1 above.



Note – For manual receivers using the binary coded procedure, this delay should be 4.5 s ± 15%.

FIGURE 6/T.30

Binary-tonal identification signal

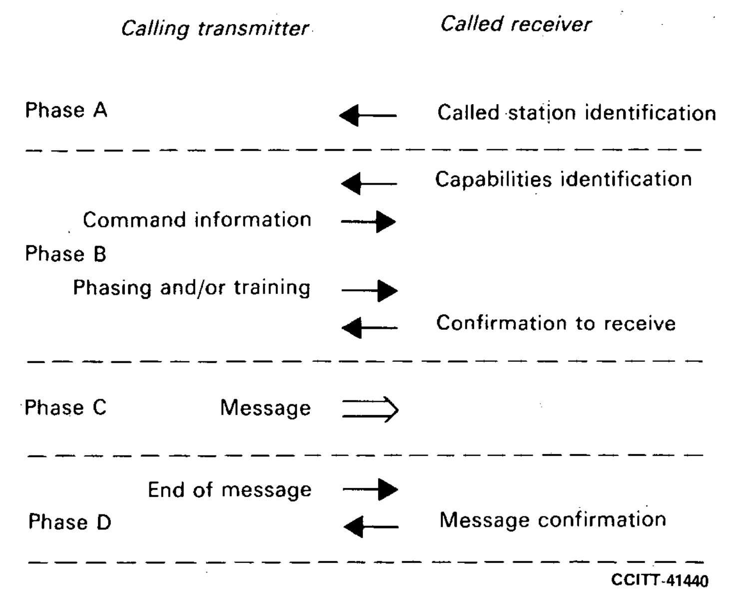


FIGURE 7/T.30
Calling station is transmitting

The condition where the calling station is to receive documents is shown in Figure 8/T.30. The simple tonal systems do not provide this capability.

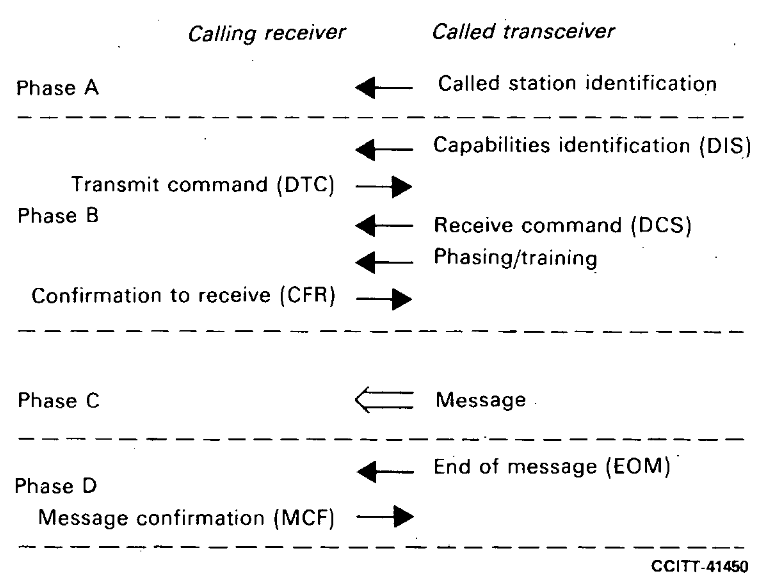


FIGURE 8/T.30
Calling station is receiving

3.3 *Phase E – Call release*

Call release occurs after the last post-message signal of the procedure or under certain conditions, e.g.:

3.3.1 *Time out*

When a signal as specified by the facsimile procedure is not received within the specified time-out period, the apparatus may signal to the operator (if one is in attendance) or disconnect the telephone connection. The appropriate time-out periods are specified in §§ 4 and 5 below.

3.3.2 *Procedural interrupt*

The facsimile procedure may be interrupted by sending a procedural interrupt signal, by notifying the attending operator or by disconnecting the connection. The signal is defined in §§ 4 and 5 below.

3.3.3 *Command*

In the case where binary coded procedures are utilized, the call may be immediately terminated by the binary coded system commands, as specified in § 5 below.

4 Tonal signalling for facsimile procedure

This signalling system covers operating methods 1-T and 2-T and has to be implemented for apparatus operating according to Recommendations T.2 and T.3.

4.1 *Description*

Phases B and C

Transmitter	Receiver
	1. Transmit GI
2. GI detected	
3. Select appropriate group	
4. Transmit GC	
5. Transmit phasing	
	6. Detect GC and phasing Select group and phase
	7. Transmit CFR
8. Detect CFR	
9. Transmit message	

Phase D

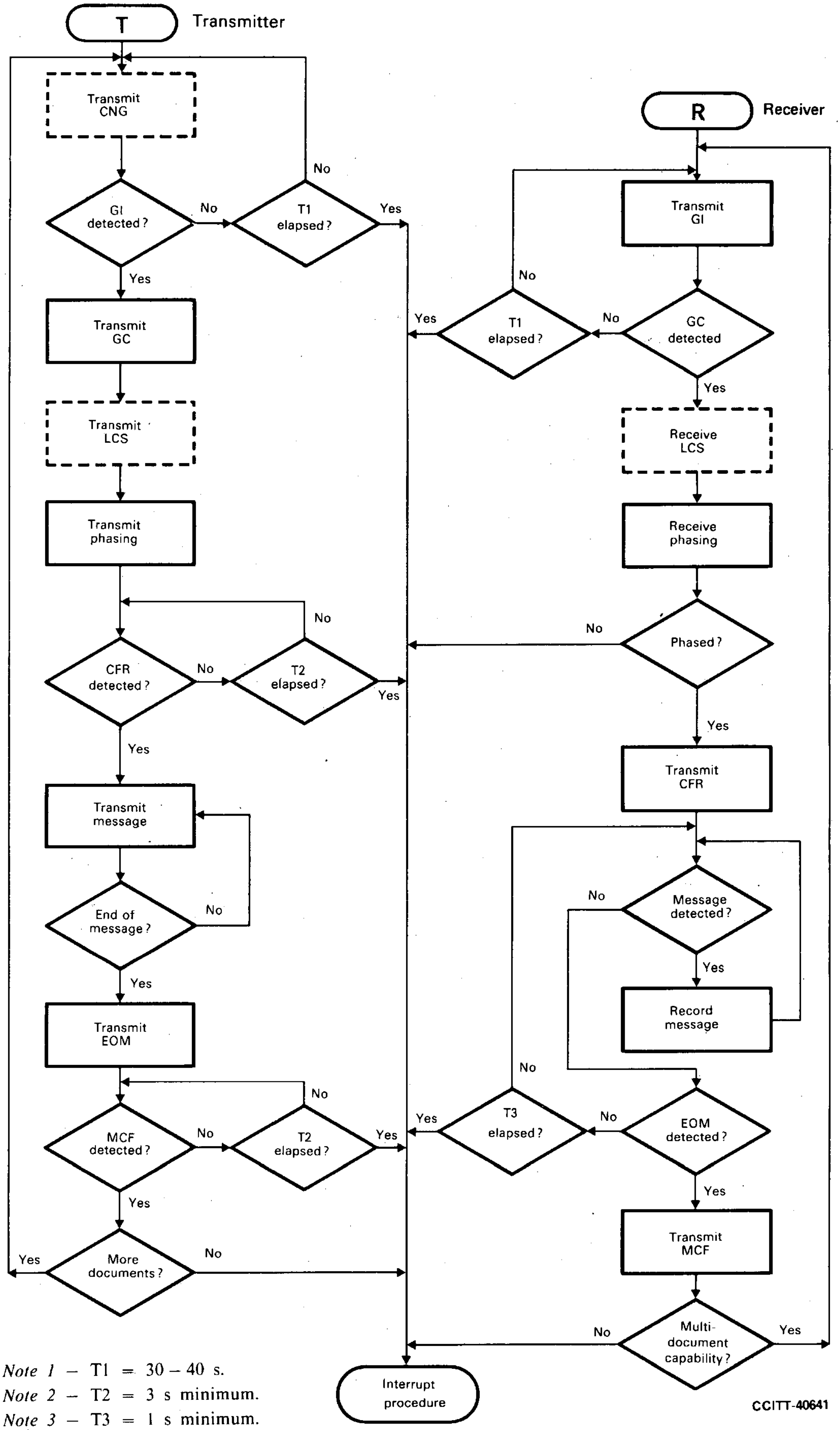
Single-document transmitter	Multi-document receiver
1. Transmit EOM	
	2. Detect EOM
	3. Transmit MCF
	4. Prepare for next document
5. Detect MCF Switch back to telephone Operator loads document	
	6. When ready to receive transmit GI
7. Operator hears GI and switches machine to line	
8. Detect GI	
9. Transmit GC	
Continue phases B and C	

Multi-document transmitter	Single-document receiver
1. Transmit EOM	
	2. Detect EOM
	3. Transmit MCF
	4. Switch back to telephone Operator loads paper
5. Detect MCF and prepare for next document	
6. When ready to transmit, transmit CNG (optional)	
	7. Operator hears CNG and switches machine to line
	8. Transmit GI
9. Detect GI	
10. Transmit GC	
Continue phases B and C	

Multi-document transmitter to multi-document receiver and single document facsimile apparatus operate accordingly.

Note – It is acknowledged that there are existing equipments in the field that may not conform in all aspects to this Recommendation. Therefore, the decision may be made to go to a mode of operation other than specified herein. The diagram of Appendix I describes, as an example, one of these conditions. Other methods may be possible as long as they do not interfere with the recommended operation.

4.2 *Flow diagram* (Figure 9/T.30)



Note 1 – T1 = 30 – 40 s.

Note 2 – T2 = 3 s minimum.

Note 3 – T3 = 1 s minimum.

Note 4 – Broken boxes indicate signals not used in all methods.

FIGURE 9/T.30

4.3 *Tonal signal functions and formats*

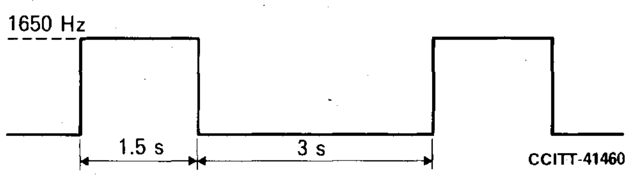
The signals used are single frequencies to line. The equipment used to detect the signal should be capable of functioning correctly with the frequency tolerances quoted plus an additional tolerance of ± 6 Hz due to the line.

4.3.1 *Facsimile receiver signals (signals transmitted by the receiver)*

4.3.1.1 *Group identification (GI) signals*

4.3.1.1.1 *GI 1 (Group 1)*

Format (Figure 10/T.30)



Note – Tolerances: timing ± 15%; frequency ± 6 Hz.

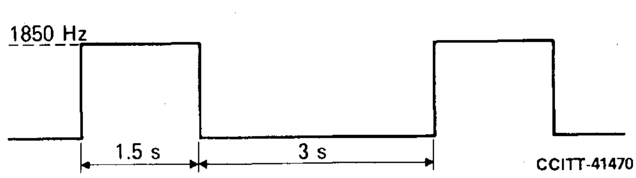
FIGURE 10/T.30

Function

1) To indicate the apparatus is in the receive mode and capable of receiving at least one page in the Group 1 mode.
2) The signal is repeated until detection of GC or time T1 elapses.

4.3.1.1.2 *GI 2 (Group 2)*

Format (Figure 11/T.30)



Note – Tolerances: timing ± 15%; frequency ± 6 Hz.

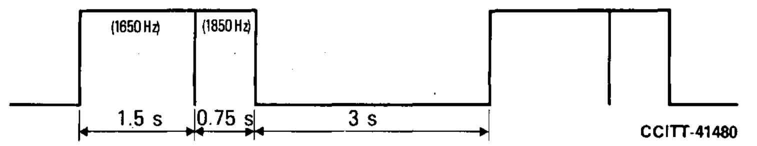
FIGURE 11/T.30

Function

1) To indicate the apparatus is in the receive mode and is capable of receiving at least one page in the Group 2 mode.
2) The signal is repeated until detection of GC or time T1 elapses.

4.3.1.1.3 *GI 1/2 (Group 1/2)*

Format (Figure 12/T.30)



Note – Tolerances: timing ± 15%; frequency ± 6 Hz.

FIGURE 12/T.30

Function

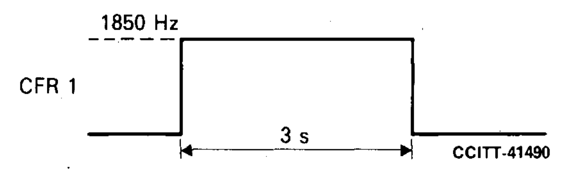
1) To indicate the apparatus is in the receive mode and is capable of receiving at least one page in the Group 1 or Group 2 mode. The apparatus is capable of adjusting automatically to the speed of the transmitting.
2) The signal is repeated until detection of GC or time T1 elapses.

Note – To prevent confusing the repeating GI signal with the busy tone, it may be required by certain Administrations that a delay be incorporated prior to answering the call.

4.3.1.2 *Confirmation to receive (CFR) signals*

4.3.1.2.1 *CFR 1 (Group 1)*

Format (Figure 13/T.30)



Note – Tolerances: timing ± 15%; frequency ± 6 Hz.

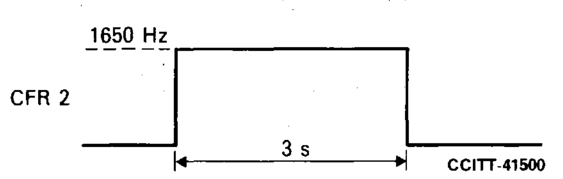
FIGURE 13/T.30

Function

To indicate that the receiver has phased and is ready to receive at least one page in the Group 1 mode. The signal must start after the completion of the phasing signal at the receiver with a maximum delay of one second.

4.3.1.2.2 *CFR 2 (Group 2)*

Format (Figure 14/T.30)



Note – Tolerances: timing ± 15%; frequency ± 6 Hz.

FIGURE 14/T.30

Function

To indicate that the receiver has phased and is ready to receive at least one page in the Group 2 mode. The signal must start after the completion of the phasing signal at the receiver with a maximum delay of one second.

4.3.1.3 *Message confirmation (MCF) signal*

4.3.1.3.1 *MCF 1 (Group 1)*

Format

The same frequency and duration as for CFR 1.

Tolerances: timing ± 15%; frequency ± 6 Hz.

Function

To indicate that the receiver has received one page in Group 1 mode.

4.3.1.3.2 *MCF 2 (Group 2)*

Format

The same frequency and duration as for CFR 2.

Tolerances: timing ± 15%; frequency ± 6 Hz.

Function

To indicate that the receiver has received one page in the Group 2 mode.

Note – The MCF signal must start a maximum of 0.5 second after the completion of the EOM signal (see § 4.3.2.4) at the receiver.

4.3.2 *Facsimile transmitter signals (signals transmitted by the transmitter)*

4.3.2.1 *Group command (GC) signal*

Format

GC1 = 1300 Hz ± 32 Hz for a duration of more than 1.5 seconds and less than 10 seconds.

GC2 = 2100 Hz ± 10 Hz for a duration of more than 1.5 seconds and less than 10 seconds.

Function

To indicate to the receiver the Group that the transmitter has chosen. The GC signal starts at the end of the capabilities identification signal with a maximum delay of 1 second as measured on the line at the transmitter.

Note – It should be noted that the capabilities identification of a combined Group 1 or 2 and Group 3 machine may consist of the tonal GI signal concatenated with the binary coded identification signal. Some equipment exists which sends the GC signal at the end of the GI signal and not at the end of the capabilities identification signal. This should be avoided in new designs. However, manufacturers of combined group equipments should take account of this anomaly.

4.3.2.2 *Line conditioning signals (LCS)*

Format

As in Recommendation T.3.

Function

1) To enable a receiver to equalize the line.
2) This is an optional signal and non-transmission should not affect compatibility.

4.3.2.3 *Phasing*

Format and function

As defined by Recommendations T.2 and T.3.

4.3.2.4 *End-of-message (EOM) signal*

Format

1100 Hz ± 38 Hz. Timing: 3 seconds ± 15% immediately following the message.

Function

To indicate phase C has been completed.

4.3.3 *Common signals*

4.3.3.1 *Procedure interrupt signal (PIS) (applicable in both directions)*

Format

462 Hz ± 1.5 Hz for 3 seconds minimum.

Function

1) To stop a distant machine.
2) May be used as operator recall.

Note 1 – This is an optional signal.

Note 2 – Some Administrations have in use national telephone signalling systems which may interpret this signal as a clearing signal. This may cause clear down of the connection.

Note 3 – Some machines use this signal as a disconnect signal only when the receiver detects this signal immediately after transmitting MCF or transmitting MCF/GI and, in either case, before a subsequent GI.

Note 4 – The satisfactory operation of the PIS signal cannot be guaranteed in the presence of, for example, echo suppressors.

4.3.3.2 *Called station identification (CED)*

At 1.8 to 2.5 seconds after the called station is connected to the line, it sends a continuous 2100 Hz ± 15 Hz tone for a duration of not less than 2.6 seconds and not more than 4.0 seconds.

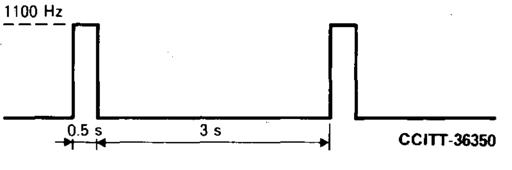
The called station delays for a period of 75 ± 20 milliseconds after terminating the CED tone before transmitting further signals.

Function

To indicate a called non-speech terminal.

4.3.3.3 *Calling tone (CNG)*

Format (Figure 15/T.30)



1100 Hz, ON for 0.5 second, OFF for 3 seconds.

Note – Tolerances: timing ± 15%; frequency 1100 Hz ± 38 Hz.

FIGURE 15/T.30

Function

1) To indicate a calling non-speech terminal. This signal is mandatory for automatic calling units and optional for manual units.
2) To indicate that the apparatus is in the transmit mode and is ready to transmit on receipt of the appropriate GI.
3) Where an apparatus is capable of sending more than one document without the necessity of operator assistance, this signal may be transmitted between documents whilst the transmitter is waiting for the appropriate GI. It would indicate to an operator that the transmitter was still connected to line.

Note – It should generally be assumed that for Group 1 and Group 2 transmissions, echo suppressors may be in the circuit.

5 Binary coded signalling for facsimile procedure

For Group 1 and Group 2 machines that require additional facilities to those provided by the procedures described in § 4 above, the binary coded control procedures should be transmitted in a synchronous mode at 300 bits per second.

For Group 3 machines, 300 bits per second is the standard data signalling rate for the transmission of binary coded procedural data. Additionally, signalling of the binary coded procedural data at 2400 bits per second is allowed as a recognized option.

Except as otherwise noted, the binary coded control procedures should be transmitted in a synchronous mode on the general switched telephone network at 300 bits per second ± 0.01% utilizing the characteristics of the Recommendation V.21 channel No. 2 modulation system. (For the tolerances, see § 3 of Recommendation V.21.) Signal generators should have a distortion not exceeding 1% and the control signal receivers should accept signals with a distortion not exceeding 40%.

Note 1 – For Group 3 machines, the transmission of training, TCF, and all in-message signals, shall be at the data rate of the high-speed message channel.

Note 2 – It is acknowledged that existing equipments may not conform in all aspects to this Recommendation. Other methods may be possible as long as they do not interfere with the recommended operation.

Note 3 – Transmission of signals utilizing the modulation system of Recommendation V.21 channel No. 2 should be followed by a delay of 75 ± 20 milliseconds before the signalling, utilizing a different modulation system commences, (e.g. the delay between DCS and the Recommendation V.27 *ter* or V.29 training sequence).

Note 4 – The transmission of signalling utilizing the modulation systems of Recommendation V.27 *ter* or Recommendation V.29 should be followed by a delay of 75 ± 20 milliseconds before the signalling, utilizing a different modulation system, commences (e.g. the delay between RTC and MPS).

5.1 *Description*

Phases B, C and D

Case 1: Calling station wishes to transmit (see Figure 7/T.30).

Calling station	Called station
	1. Transmit DIS
2. DIS detected	
3. Transmit DCS	
	4. DCS detected
	5. Select mode
6. Transmit phasing/training	
	7. Phasing/training
	8. Transmit CFR
9. Detect CFR	
10. Transmit message	
	11. Receive message
12. At end of message send either: a) EOM or b) EOP or c) MPS or d) PRI-Q	
	13. Detect EOM, EOP, MPS or PRI-Q
	14. Transmit one of the confirmation signals of post-message responses (see § 5.3.6.1.7)

Note – Binary coded signals must be preceded by a preamble (see § 5.3.1 below).

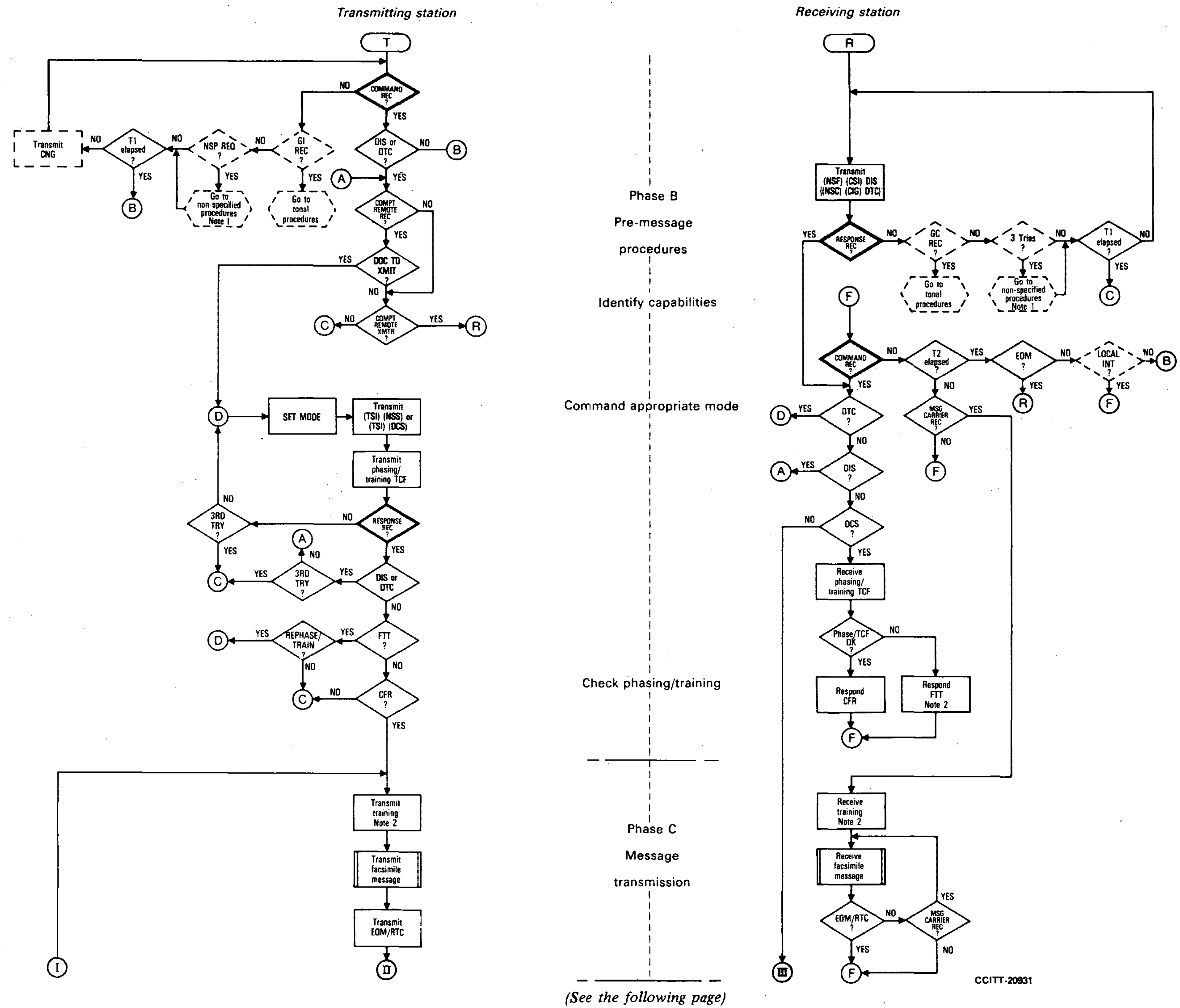
Case 2: Calling station wishes to receive (see Figure 8/T.30).

Calling station	Called station
	1. Transmit DIS
2. DIS detected	
3. Transmit DTC	
	4. DTC detected
	5. Transmit DCS
6. DCS detected	
7. Select mode	
	8. Transmit Training/Phasing
9. Training/Phasing	
10. Transmit CFR	
	11. Detect CFR
	12. Transmit message
13. Receive message	
	14. At end of message send either: a) EOM or b) EOP or c) MPS or d) PRI-Q
15. Detect EOM, EOP, MPS or PRI-Q	
16. Transmit one of the confirmation signals of post-message responses (see § 5.3.6.1.7)	

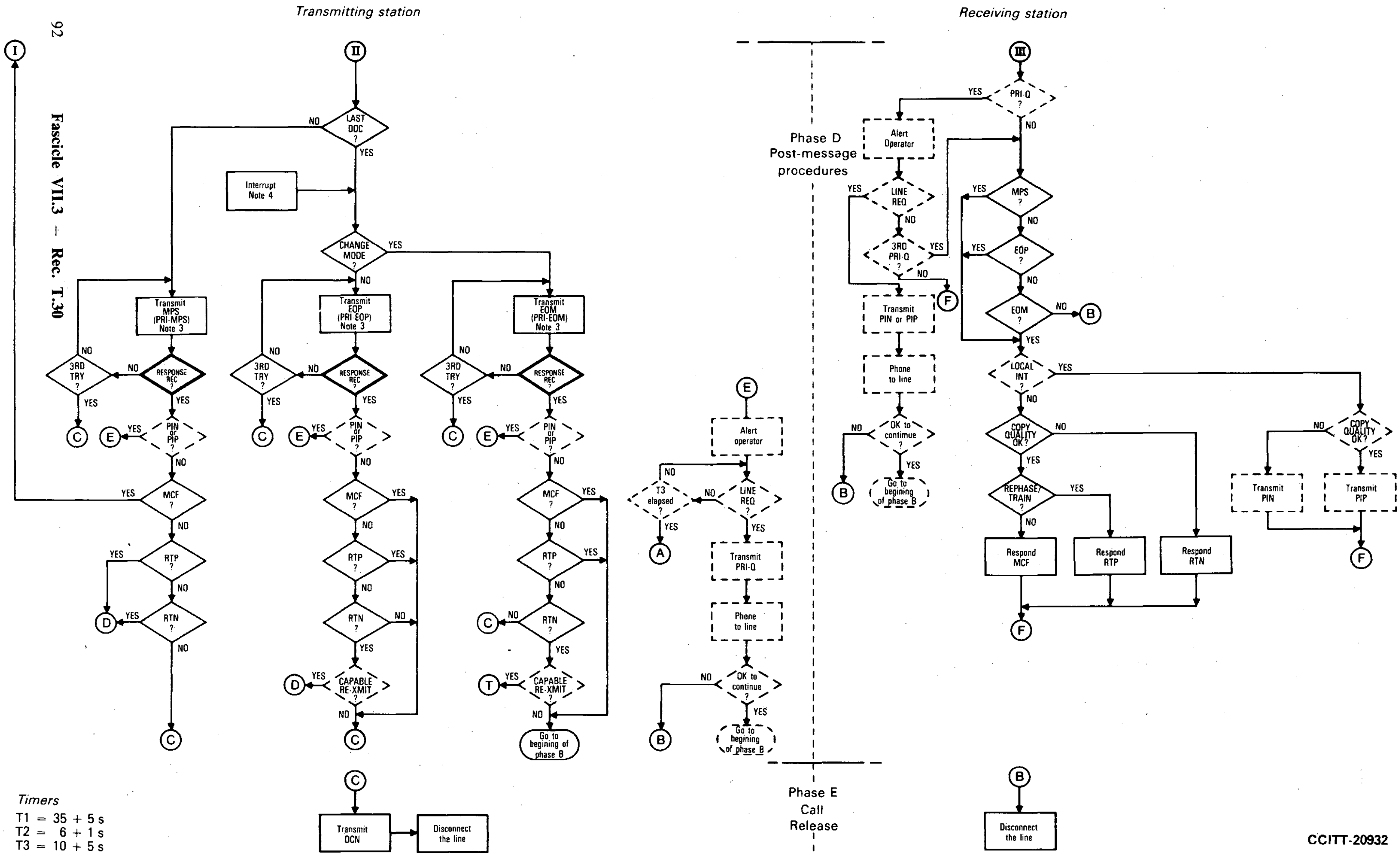
Note – Binary coded signals must be preceded by a preamble (see § 5.3.1 below).

5.2 *Flow diagrams* (see also Appendix IV)

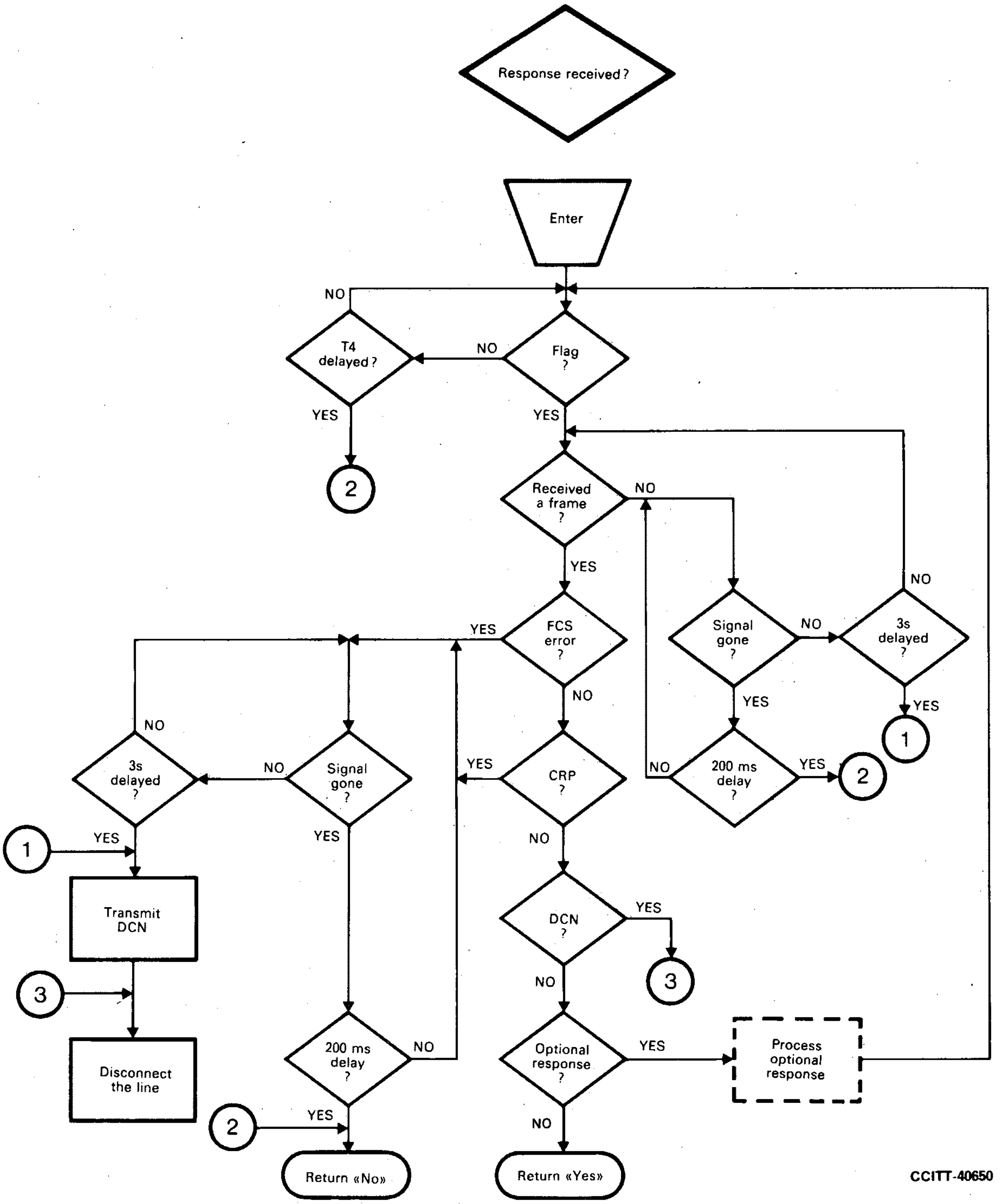
For the Notes and an explanation of terms to the flow diagrams, see § 5.2.1.



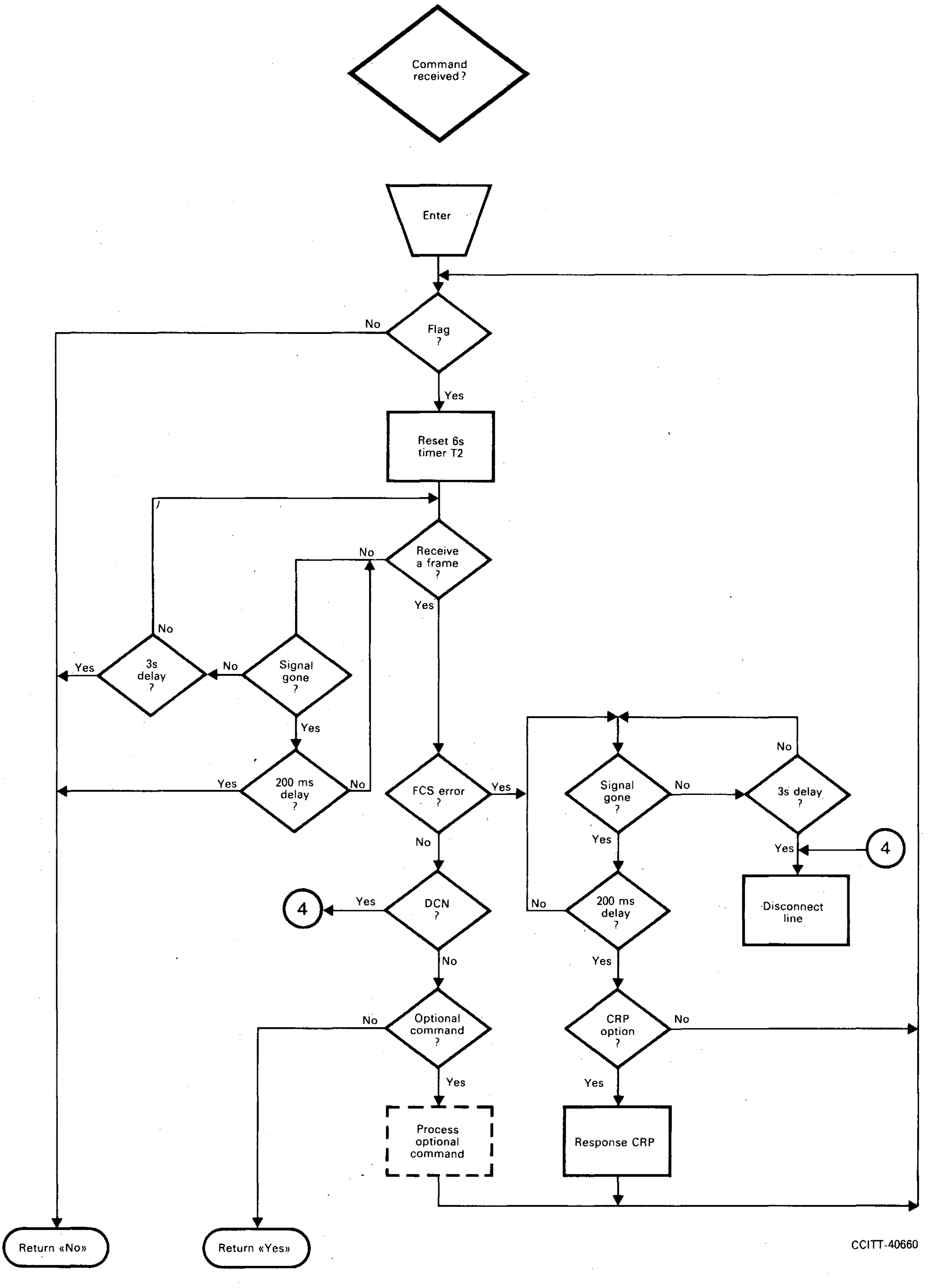
(See the following page)



(See the preceding page)



T4 = 4.5s ± 15%, for manual units
T4 = 3.0s ± 15%, for automatic units

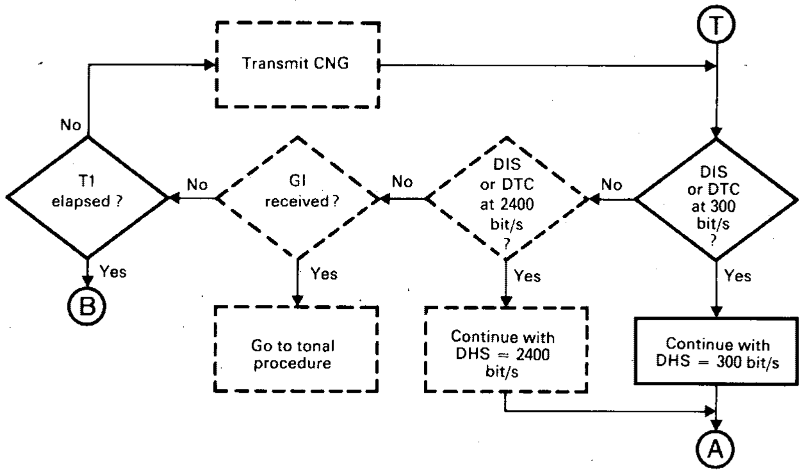


Command received ?
Enter
Flag ?
No
Yes
Reset 6s timer T2
Receive a frame ?
No
Yes
Signal gone ?
3s delay ?
200 ms delay ?
FCS error ?
DCN ?
4
Optional command ?
Process optional command
Return «No»
Return «Yes»
Signal gone ?
3s delay ?
200 ms delay ?
Disconnect line
CRP option ?
Response CRP

CCITT-40660

Interworking between the standard mode (300 bit/s) and the recognized optional mode (2400 bit/s) for the binary coded handshaking procedure is provided by an alternating method.

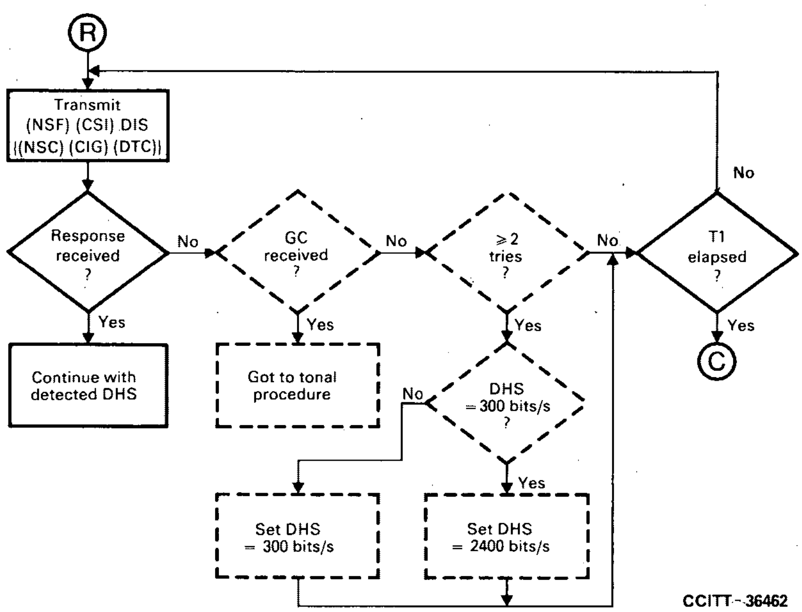
Left-hand side of beginning of phase B of the flow diagram



CCITT-36451

Note – DHS = Digital handshaking speed   Dotted lines = optional

Right-hand side of beginning of phase B of the flow diagram



CCITT-36462

Note – The station listens to a response at 300 bits/s (2400 bit/s) after transmitting a command at 300 bit/s (2400 bit/s) and continues with the detected DHS.

5.2.1 *Flow diagram key*

COMMAND REC — The "command received" subroutine searches for an error-free standard command. The decision diamonds in the flow diagram refer to the most recent standard command received (e.g., EOM, MPS, etc.).

COMPT REMOTE REC	The FIF associated with the DIS has indicated a "compatible remote receiver".
DOC TO XMIT	The station has "at least one document to be transmitted".
COMPT REMOTE XMTR	The FIF associated with the DIS has indicated a "compatible remote transmitter" which has documents to send.
RESPONSE REC	The "response received" subroutine which searches for an error-free standard response.
LAST DOC	The "last document", for the given operating mode, has been transmitted.
SET MODE	The system controller will "set the appropriate mode" of operation.
3RD TRY	The command has been repeated three times without an appropriate response.
CAPABLE RE-XMIT	The transmitting station is "capable of retransmitting" a document which was not received with acceptable quality.
MSG CARRIER REC	The "message channel carrier has been received". This carrier is 1800 Hz for the Group 3 modulation scheme, and 1700 Hz for the Group 3 optional modulation scheme, 2100 Hz for the Group 2 modulations, and 1300-2100 Hz for the Group 1 modulation scheme.
PHASE/TRAIN OK	The phasing/training-TCF signal has been analyzed and the results of "phasing/training were OK".
CHANGE MODE	The transmitting unit desires to exit from the transmitting mode of operation and reestablish the capabilities.
NSP REQ	A "non-specified procedure" has been "recognized" by a unit compatible with the station initiating that procedure.
COPY QUALITY OK	By some algorithm, the "copy quality was deemed OK".
REPHASE/ TRAIN	By some algorithm, it is deemed desirable to transmit a new phasing/training signal.
FLAG	There has been the detection of a "flag".
RECEIVE A FRAME	The unit has "received one complete HDLC frame".
FCS ERROR	The HDLC frame received contained an "FCS error".
OPTIONAL RESPNS	The HDLC frame received contained one of the listed "optional responses".
OPTIONAL COMMAND	The HDLC frame received contained one of the listed "optional commands".
CRP OPTION	The facsimile unit has the "CRP option" and can, therefore, request an immediate retransmission of the most recent command.
LOCAL INT	Either the "local" machine or the "local" operator wishes to generate an interrupt of the standard facsimile procedures. An operator would use this as a means to request the establishment of voice contact.
LINE REQ	This means that the local operator has "requested" that the telephone line be connected to the handset for voice contact with the remote end.
PRI-Q	A general term referring to either PRI-EOM, a PRI-MPS, or a PRI-EOP post-message command, i.e., the fifth bit of the standard post-message command is set to 1.

Note 1 – The non-specified procedure, NSP, refers to a procedure which takes 6 seconds or less to complete. It may not necessarily be a definable signal sequence.

Note 2 – This signal pertains to Group 3 apparatus only.

Note 3 – The PRI-EOM, PRI-EOP, PRI-MPS post-message commands are sent when a local interrupt request is pending.

Note 4 – At any time during the operation an interrupt may be generated which would result in a procedural interrupt. It is understood that if this interrupt happens during the transmission of the document, the EOM/RTC signal will be transmitted prior to invoking the procedural interrupt.

Note 5 – Where the symbol / is used, the term to the left of the symbol refers to Groups 1 and 2 equipment, and the term to the right of the symbol refers to Group 3 equipment.

Note 6 – Where the symbols { } are used, the signals within these symbols are a response to DIS from the calling unit wishing to receive.

Note 7 – Where the symbols ( ) are used, the signals within these symbols are optional.

5.3 *Binary coded signal functions and formats*

An HDLC frame structure is utilized for all binary coded facsimile control procedures. The basic HDLC structure consists of a number of frames, each of which is subdivided into a number of fields. It provides for frame labelling, error checking and confirmation of correctly received information.

More specifically, the example in Figure 16/T.30 of a format is used for binary coded signalling. This example shows an initial identification sequence (see § 5.3.6.1.1 below).

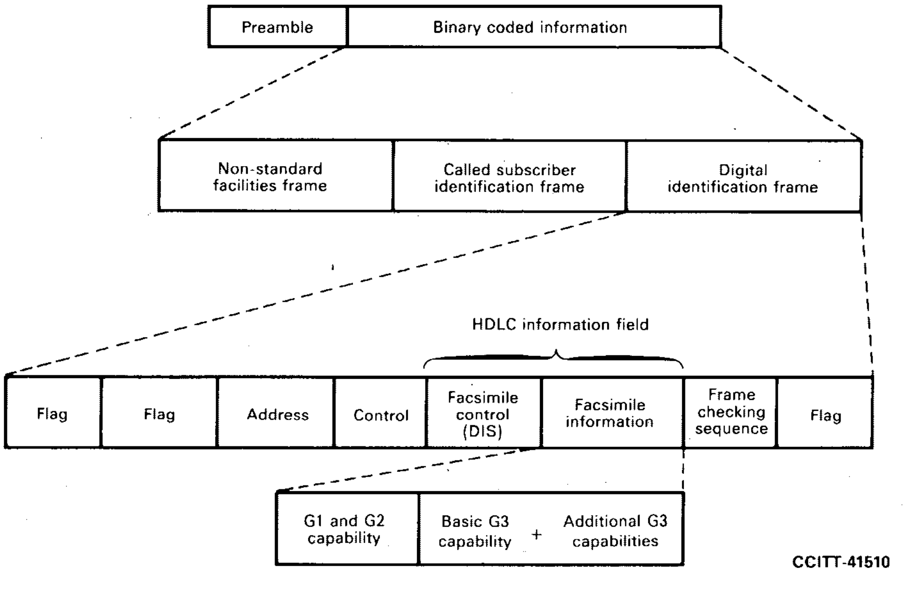


FIGURE 16/T.30

In the following descriptions of the fields, the order in which the bits are transmitted is from the most to the least significant bit, i.e. from left to right as printed. The exception to this is the CSI format – see § 5.3.6.2.4.

The equivalent between binary notation symbols and the significant conditions of the signalling code should be in accordance with Recommendation V.1.

Note 1 – Any initial (capabilities identification) non-standard frame which is transmitted shall be accompanied by a mandatory frame. The mandatory frame shall always be the last one transmitted (see Figure 16/T.30).

Note 2 – A machine which receives optional frame(s) which it does not recognize shall discard the frame(s) and use the mandatory frames in continuing the procedure.

5.3.1 *Preamble*

The preamble shall precede all binary coded signalling whenever a new transmission of information begins in any direction (i.e. for each line turnaround). This preamble assures that all elements of the communication channel (e.g. echo suppressors) are properly conditioned so that the subsequent data may be passed unimpaired. This preamble may take the following forms:

5.3.1.1 The preamble for binary coded signalling at 300 bit/s shall be a series of flag sequences for 1s ± 15%.

5.3.1.2 For the optional binary coded procedure at 2400 bit/s, the preamble shall be the long training modem sequence defined in Recommendation T.4.

5.3.2 *Message/signalling delineation*

5.3.2.1 Where Group 1 or Group 2 modulation techniques are employed, the delineation is obtained by the transmission of the tonal EOM signal as defined in § 4.3.2.4. This signals the T.2 or T.3 modulation system to drop off the line and be replaced by the T.30 binary coded modulation system.

5.3.2.2 When Group 3 modulation technique is employed, the delineation is obtained by the transmission of the RTC signal as defined in § 4.1.4 of Recommendation T.4. This signals the T.4 modulation system to drop off the line and be replaced by the T.30 binary coded modulation system.

5.3.2.3 The transmission of the delineation signal, either the tonal EOM signal or the RTC signal, shall be followed by a delay or 75 ± 20 ms before the T.30 binary coded modulation system commences to transmit.

5.3.3 *Flag sequence*

The eight bit HDLC flag sequence is used to denote the beginning and end of the frame. For facsimile procedure, the flag sequence is used to establish bit and frame synchronization. To facilitate this, the preamble defined in § 5.3.1 should be used prior to the first frame. Subsequent frames need only one flag sequence.

Continued transmission of the flag sequence may be used to signal to the distant station that the machine remains on line but is not presently prepared to proceed with the facsimile procedure.

Format: 0111 1110

5.3.4 *Address field*

The eight bit HDLC address field is intended to provide identification of specific station(s) in a multi-point arrangement. In the case of transmission on the general switched telephone network, this field is limited to a single format.

Format: 1111 1111

5.3.5 *Control field*

The eight bit HDLC control field provides the capability of encoding the commands and responses unique to the facsimile control procedures.

Format: 1100 X000

X = 0 for non-final frames within the procedure, X = 1 for final frames within the procedure. A final frame is defined as the last frame transmitted prior to an expected response from the distant station.

5.3.6 *Information field*

The HDLC information field is of variable length and contains the specific information for the control and message interchange between two facsimile stations. In this Recommendation it is divided into two parts, the facsimile control field (FCF) and the facsimile information field (FIF).

5.3.6.1 *Facsimile control field (FCF)*

The facsimile control field is defined to be the first eights bits of the HDLC information field. This field contains the complete information regarding the type of information being exchanged and the position in the overall sequence. The bit assignments within the FCF are as follows:

Where X appears as the first bit of FCF, X will be defined as follows:

X is set to 1 by the station which receives a valid DIS signal;

X is set to 0 by the station which receives a valid and appropriate response to a DIS signal;

X will remain unchanged until the station again enters the beginning of phase B.

5.3.6.1.1 *Initial identification*

From the called to the calling station.

Format: 0000 XXXX

1) *Digital identification signal (DIS)* – Characterizes the standard CCITT capabilities of the called apparatus.

Format: 0000 0001

2) *Called subscriber identification (CSI)* – This optional signal may be used to provide the specific identity of the called subscriber by its international telephone number (see § 5.3.6.2.4, CSI coding format).

Format: 0000 0010

3) *Non-standard facilities (NSF)* – This optional signal may be used to identify specific user requirements which are not covered by the Series T Recommendations.

Format: 0000 0100

5.3.6.1.2 *Command to send*

From a calling station wishing to be a receiver to a called station which is capable of transmitting.

Format: 1000 XXXX

1) *Digital transmit command (DTC)* – The digital command response to the standard capabilities identified by the DIS signal.

Format: 1000 0001

2) *Calling subscriber identification (CIG)* – This optional signal indicates that the following FIF information is an identification of that calling station. It may be used to provide additional security to the facsimile procedure (see § 5.3.6.2.5, CIG coding format).

Format: 1000 0010

3) *Non-standard facilities command (NSC)* – This optional signal is the digital command response to the information contained in the NSF signal.

Format: 1000 0100

5.3.6.1.3 *Command to receive*

From the transmitter to the receiver.

Format: X100 XXXX

1) *Digital command signal (DCS)* – The digital set-up command responding to the standard capabilities identified by the DIS signal.

Format: X100 0001

2) *Transmitting subscriber identification (TSI)* – This optional signal indicates that the following FIF information is the identification of the transmitting station. It may be used to provide additional security to the facsimile procedures. (See § 5.3.6.2.6, TSI coding format).

Format: X100 0010

3) *Non-standard facilities set-up (NSS)* – This optional signal is the digital command response to the information contained in the NSC or NSF signal.

Format: X100 0100

4) *Training check (TCF)* – This digital command is sent through the T.4 modulation system to verify training and to give a first indication of the acceptability of the channel for this data rate.

Format: A series of 0s for 1.5 s ± 10%.

Note – No HDLC frame is required for this command.

5.3.6.1.4 *Pre-message response signals*

From the receiver to the transmitter.

Format: X010 XXXX

1) *Confirmation to receive (CFR)* – A digital response confirming that the entire pre-message procedure has been completed and the message transmissions may commence.

Format: X010 0001

2) *Failure to train (FTT)* – A digital response rejecting the Group 3 training signal and requesting a retraining.

Format: X010 0010

5.3.6.1.5 *In-message procedure*

From the transmitter to the receiver. In case of Group 3 machines the in-message procedure formats and specific signals shall be consistent with Recommendation T.4. In-message procedures for Group 1 and Group 2 are defined in Recommendations T.2 and T.3 respectively.

5.3.6.1.6 *Post message commands*

From the transmitter to the receiver.

Format: X111 XXXX

1) *End-of-message (EOM)* – To indicate the end of a page of facsimile information and to return to the beginning of phase B.

Format: X111 0001

2) *Multipage signal (MPS)* – To indicate the end of a page of facsimile information and to return to the beginning of phase C upon receipt of a confirmation.

Format: X111 0010

3) *End-of-procedures (EOP)* – To indicate the end of a page of facsimile information and to further indicate that no further documents are forthcoming and to proceed to phase E, upon receipt of a confirmation.

Format: X111 0100

4) *Procedure interrupt – End-of-message (PRI-EOM)* – To indicate the same as an EOM command with the additional optional capability of requesting operator intervention. If operator intervention is accomplished, further facsimile procedures shall commence at the beginning of phase B.

Format: X111 1001

5) *Procedure interrupt – Multipage signal (PRI-MPS)* – To indicate the same as an MPS command with the additional optional capability of requesting operator intervention. If operator intervention is accomplished, further facsimile procedures shall commence at the beginning of phase B.

Format: X111 1010

6) *Procedure interrupt – End-of-procedure (PRI-EOP)* – To indicate the same as an EOP command with the additional optional capability of requesting operator intervention. If operator intervention is accomplished, further facsimile procedures shall commence at the beginning of phase B.

Format: X111 1100

5.3.6.1.7 *Post-message responses*

From the receiver to the transmitter.

Format: X011 XXXX

1) *Message confirmation (MCF)* – To indicate that a complete message has been received and that additional messages may follow. (This is a positive response to MPS or EOM.)

Format: X011 0001

2) *Retrain positive (RTP)* – To indicate that a complete message has been received and that additional messages may follow after retransmission of training and/or phasing and CFR.

Format: X011 0011

3) *Retrain negative (RTN)* – To indicate that the previous message has not been satisfactorily received. However, further receptions may be possible, provided training and/or phasing are retransmitted.

Format: X011 0010

4) *Procedural interrupt positive (PIP)* – To indicate that a message has been received but that further transmissions are not possible without operator intervention. Failing operator intervention and if further documents are to follow, the facsimile procedure shall begin at the beginning of phase B.

Format: X011 0101

5) *Procedure interrupt negative (PIN)* – To indicate that the previous (or in-process) message has not been satisfactorily received and that further transmissions are not possible without operator intervention. Failing operator intervention and if further documents are to follow, the facsimile procedure shall begin at the beginning of phase B.

Format: X011 0100

Note – All machines shall be able to recognize the PIN and PIP signals. The ability to transmit these signals is optional.

5.3.6.1.8 *Other line control signals*

For the purpose of handling errors and controlling the state of the line.

Format: X101 XXXX

1) *Disconnect (DCN)* – This command indicates the initiation of phase E (call release). This command requires no response.

Format: X101 1111

2) *Command repeat (CRP)* – This optional response indicates that the previous command was received in error and should be repeated in its entirety (i.e., optional frames included).

Format: X101 1000

5.3.6.2 *Facsimile information field (FIF)*

In many cases the FCF will be followed by the transmission of additional 8-bit octets to further clarify the facsimile procedure. This information for the basic binary coded system would consist of the definition of the information in the DIS, DCS, DTC, CSI, CIG, TSI, NSC, NSF and NSS signals.

5.3.6.2.1 *DIS standard capabilities*

Additional information fields will be transmitted immediately following the DIS facsimile control field. The first 8 bits of this information relate to Group 1 and Group 2 apparatus and subsequent bits relate to Group 3 apparatus. The bit assignment for this information is given in Table 2/T.30 where a 1 indicates the condition is valid, except where specifically noted otherwise (e.g. bits 11, 12 and 21, 22, 23).

5.3.6.2.2 *DCS standard commands*

When issuing the command, bits 1, 4 and 9 shall be set to 0. The DCS standard commands are formatted as shown in Table 2/T.30.

5.3.6.2.3 *DTC standard command*

The DTC standard capabilities are formatted as shown in Table 2/T.30.

5.3.6.2.4 *CSI coding format*

The facsimile information field of the CSI signal shall be the international telephone number including the telephone country code, area code, and subscriber number. This field shall consist of 20 numeric digits coded as shown in Table 3/T.30. The least significant bit of the least significant digit shall be the first bit transmitted.

TABLE 2/T.30

Bit No.	DIS/DTC	DCS
1	Transmitter - T.2 operation	
2	Receiver - T.2 operation	Receiver - T.2 operation
3	T.2 IOC = 176	T.2 IOC = 176
4	Transmitter - T.3 operation	
5	Receiver - T.3 operation	Receiver - T.3 operation
6	Reserved for future T.3 operation features	
7	Reserved for future T.3 operation features	
8	Reserved for future T.3 operation features	
9	Transmitter - T.4 operation	
10	Receiver - T.4 operation	Receiver - T.4 operation
11,12	Data signalling rate	Data signalling rate
(0,0)	V.27 *ter* fallback mode	2400 bit/s V.27 *ter*
(0,1)	V.27 *ter*	4800 bit/s V.27 *ter*
(1,0)	V.29	9600 bit/s V.29
(1,1)	V.27 *ter* and V.29	7200 bit/s V.29
13	Reserved for new modulation system	
14	Reserved for new modulation system	
15	Vertical resolution = 7.7 line/mm	Vertical resolution = 7.7 line/mm
16	Two-dimensional coding capability	Two-dimensional coding
17,18	Recording width capabilities	Recording width
(0,0)	1728 picture elements along scan line length of 215 mm ± 1%	1728 picture elements along scan line length of 215 mm ± 1%
(0,1)	1728 picture elements along scan line length of 215 mm ± 1% and 2048 picture elements along scan line length of 255 mm ± 1% and 2432 picture elements along scan line length of 303 mm ± 1%	2432 picture elements along scan line length of 303 mm ± 1%
(1,0)	1728 picture elements along scan line length of 215 mm ± 1% and 2048 picture elements along scan line length of 255 mm ± 1%	2048 picture elements along scan line length of 255 mm ± 1%
(1,1)	Invalid (see Note 7)	Invalid
19,20	Maximum recording length capability	Maximum recording length
(0,0)	A4 (297 mm)	A4 (297 mm)
(0,1)	Unlimited	Unlimited
(1,0)	A4 (297 mm) and B4 (364 mm)	B4 (364 mm)
(1,1)	Invalid	Invalid

Bit No.	DIS/DTC	DCS
21,22,23	Minimum scan line time capability at the receiver	Minimum scan line time
(0,0,0)	20 ms at 3.85 l/mm; $T_{7.7} = T_{3.85}$	20 ms
(0,0,1)	40 ms at 3.85 l/mm; $T_{7.7} = T_{3.85}$	40 ms
(0,1,0)	10 ms at 3.85 l/mm; $T_{7.7} = T_{3.85}$	10 ms
(1,0,0)	5 ms at 3.85 l/mm; $T_{7.7} = T_{3.85}$	5 ms
(0,1,1)	10 ms at 3.85 l/mm; $T_{7.7} = ½\ T_{3.85}$	
(1,1,0)	20 ms at 3.85 l/mm; $T_{7.7} = ½\ T_{3.85}$	
(1,0,1)	40 ms at 3.85 l/mm; $T_{7.7} = ½\ T_{3.85}$	
(1,1,1)	0 ms at 3.85 l/mm; $T_{7.7} = T_{3.85}$	0 ms
24	Extend field	Extend field
25	2400 bit/s handshaking	2400 bit/s handshaking
26	Uncompressed mode	Uncompressed mode
27	Unassigned	
28	Unassigned	
29	Unassigned	
30	Unassigned	
31	Unassigned	
32	Extend field	Extend field

Note 1 – Standard facsimile units conforming to T.2 must have the following capability: Index of cooperation (IOC) = 264.

Note 2 – Standard facsimile units conforming to T.3 must have the following capability: Index of cooperation (IOC) = 264.

Note 3 – Standard facsimile units conforming to T.4 must have the following capability: Paper length = 297 mm.

Note 4 – Where the DIS or DTC frame defines V.27 *ter* capabilities, the equipment may be assumed to be operable at either 4800 or 2400 bit/s.

Where the DIS or DTC frame defines V.29 capabilities, the equipment may be assumed to be operable at either 9600 or 7200 bit/s per V.29.

Note 5 – $T_{7.7}$ and $T_{3.85}$ refer to the scan line times to be utilized when the vertical resolution is 7.7 lines/mm or 3.85 lines/mm, respectively (see bit 15 above). $T_{7.7} = ½\ T_{3.85}$, indicates that in the high resolution mode, the scan line time can be decreased by half.

Note 6 – The standard FIF field for the DIS, DTC and DCS signals is 24 bits long. If the "extended field" bit(s) is a 1, the FIF field shall be extended by an additional eight bits.

Note 7 – Existing equipment may send the invalid (1,1) condition for bits 17 and 18 of their DIS signal. If such a signal is received, it should be interpreted as (0,1).

TABLE 3/T.30

Digit	MSB (FB)	Bits	LSB
0	0	011000	0
1	0	011000	1
2	0	011001	0
3	0	011001	1
4	0	011010	0
5	0	011010	1
6	0	011011	0
7	0	011011	1
8	0	011100	0
9	0	011100	1
Space	0	010000	0

MSB Most significant bit
LSB Least significant bit
FB Fill bit

5.3.6.2.5 *CIG coding format*

The facsimile information field of the CIG signal shall be the international telephone number including the telephone country code, area code and subscriber number. This field shall consist of 20 numeric digits coded as shown in Table 3/T.30. The least significant bit of the least significant digit shall be the first bit transmitted.

5.3.6.2.6 *TSI coding format*

The facsimile information field of the TSI signal shall be the international telephone number including the telephone country code, area code and subscriber number. This field shall consist of 20 numeric digits coded as shown in Table 3/T.30. The least significant bit of the least significant digit shall be the first bit transmitted.

5.3.6.2.7 *Non-standard capabilities (NSF, NSC, NSS)*

When a non-standard capabilities FCF is utilized, it must be immediately followed by a FIF. This information field will consist of at least two octets. The first octet will contain a CCITT country code (see Note below). Additional information could then be transmitted within the FIF field. This information is not specified and can be used to describe non-standard features, etc.

Note – The procedure for obtaining a registered CCITT code is given in Recommendation T.35.

5.3.7 *Frame checking sequences (FCS)*

The FCS shall be a 16 bit sequence. It shall be the 1s complement of the sum (modulo 2) of:

1) the remainder of $x^k (x^{15} + x^{14} + x^{13} + \dots + x^2 + x + 1)$ divided (modulo 2) by the generator polynominal $x^{16} + x^{12} + x^5 + 1$, where k is the number of bits in the frame existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding bits inserted for transparency, and

2) the remainder after multiplication by x^{16} and then division (modulo 2) by the generator polynominal $x^{16} + x^{12} + x^5 + 1$ of the content of the frame, existing between, but not including, the final bit of the opening flag and the first bit of the FCS, excluding bits inserted for transparency.

As a typical implementation, at the transmitter, the initial remainder of the division is preset to all 1s and is then modified by division by the generator polynominal (as described above) on the address, control and information fields; the 1s complement of the resulting remainder is transmitted as the 16-bit FCS sequence.

At the receiver, the initial remainder is preset to all 1s and the serial incoming protected bits and the FCS when divided by the generator polynominal will result in a remainder of 0001110100001111 (x^{15} through x^{0}, respectively) in the absence of transmission errors.

The FCS shall be transmitted to the line commencing with the coefficient of the highest term.

5.4 *Binary coded signalling implementation requirements*

5.4.1 *Commands and responses*

Whereas § 5.2 defines a flow diagram to give an accurate example of the typical use of the binary coded procedures, these procedures are defined specifically in terms of the actions that occur on receipt of commands by the receiving station (see § 5.3).

A response must be sent, and only sent, upon detecting a valid command. Upon receiving a valid response, a new command must be issued within 3 seconds.

5.4.1.1 *Optional command and response frames*

If optional frames (e.g., NSF or NSF, CSI) are sent they must directly precede any mandatory command/response frame which is sent. In this case, bit 5 of the control field is 0 for the optional frames and is 1 only for the final frame (refer to § 5.3.5).

5.4.1.2 *Options within standard frames*

Certain optional portions of standard signals (e.g. the fifth bit of the PRI-Q signal) need not be utilized at either the transmitting unit or the receiving unit. However, the use of these optional portions of standard signals shall not cause erroneous operation.

5.4.2 *Line control procedures and error recovery*

Once the transmitting and receiving stations have been identified, all commands are initiated by the transmitting station and solicit an appropriate response from the receiving station (see Appendix III). Furthermore, the transmission of a response is permitted only when solicited by a valid command. If the transmitting station does not receive an appropriate valid response within 3 s ± 15%, it will repeat the command. After three unsuccessful attempts, the transmitting station will send the disconnect (DCN) command and terminate the call. A command or a response is not valid and should be discarded if:

i) any of the frames, optional or mandatory, have an FCS error;

ii) any single frame exceeds 3 s ± 15% (see Note below);

iii) the final frame does not have the control bit 5 set to a binary 1;

iv) the final frame is not a recognized standard command/response frame (see Appendix III).

The delay of 3 s before retransmission of the command can be shortened by the use of the optional command repeat (CRP) response. If the transmitting station receives a CRP response, it may immediately retransmit the most recent command.

During the initial pre-message procedure, neither station has a defined role (i.e., transmitter or receiver). Therefore, the station transmitting the DIS command will continue to retransmit it until, according to the procedures, each station has identified itself and the normal line control procedures may be followed.

Note 1 – The implications of a maximum frame length of 3 s ± 15% are:

a) no transmitted frame should exceed 2.55 s (i.e., 3 s – 15%);

b) any frame which is received and is detected as greater than 3.45 s shall be discarded (i.e., 3 s + 15%);

c) a frame received which is between 2.55 and 3.45 s duration may be discarded.

Note 2 – A terminal may discard a received DIS signal with the identical bit allocation as that terminal has issued.

5.4.3 *Timing considerations*

5.4.3.1 *Time Outs*

Time-out T1 defines the amount of time two stations will continue to attempt to identify each other. T1 is 35 ± 5 seconds, begins upon entering phase B, and is reset upon detecting a valid signal or when T1 times out.

Time-out T2 makes use of the tight control between commands and responses to detect the loss of command/response synchronization. T2 is 6 ± 1 seconds and begins when initiating a command search, (e.g. the 1st entrance into the "command received" subroutine, reference flow diagram in § 5.2). T2 is reset when an HDLC flag is received or when T2 times out.

Time-out T3 defines the amount of time a station will attempt to alert the local operator in response to a procedural interrupt. Failing to achieve operator intervention, the station will discontinue this attempt and shall issue other commands or responses. T3 is 10 ± 5 seconds, begins on the first detection of a procedural interrupt command/response signal (i.e., PIN/PIP or PRI-Q), and is reset when T3 times out or when the operator initiates a line request.

APPENDIX I

(to Recommendation T.30)

Example of non-standard manual-to-manual basic facsimile operation

It is acknowledged that there are existing equipments in the field that may not conform in all aspects to this Recommendation. Therefore, the decision may be made to go to a mode of operation other than specified herein. Figure I-1/T.30 describes, as an example, one of these conditions. Other methods may be possible as long as they do not interfere with the recommended operation.

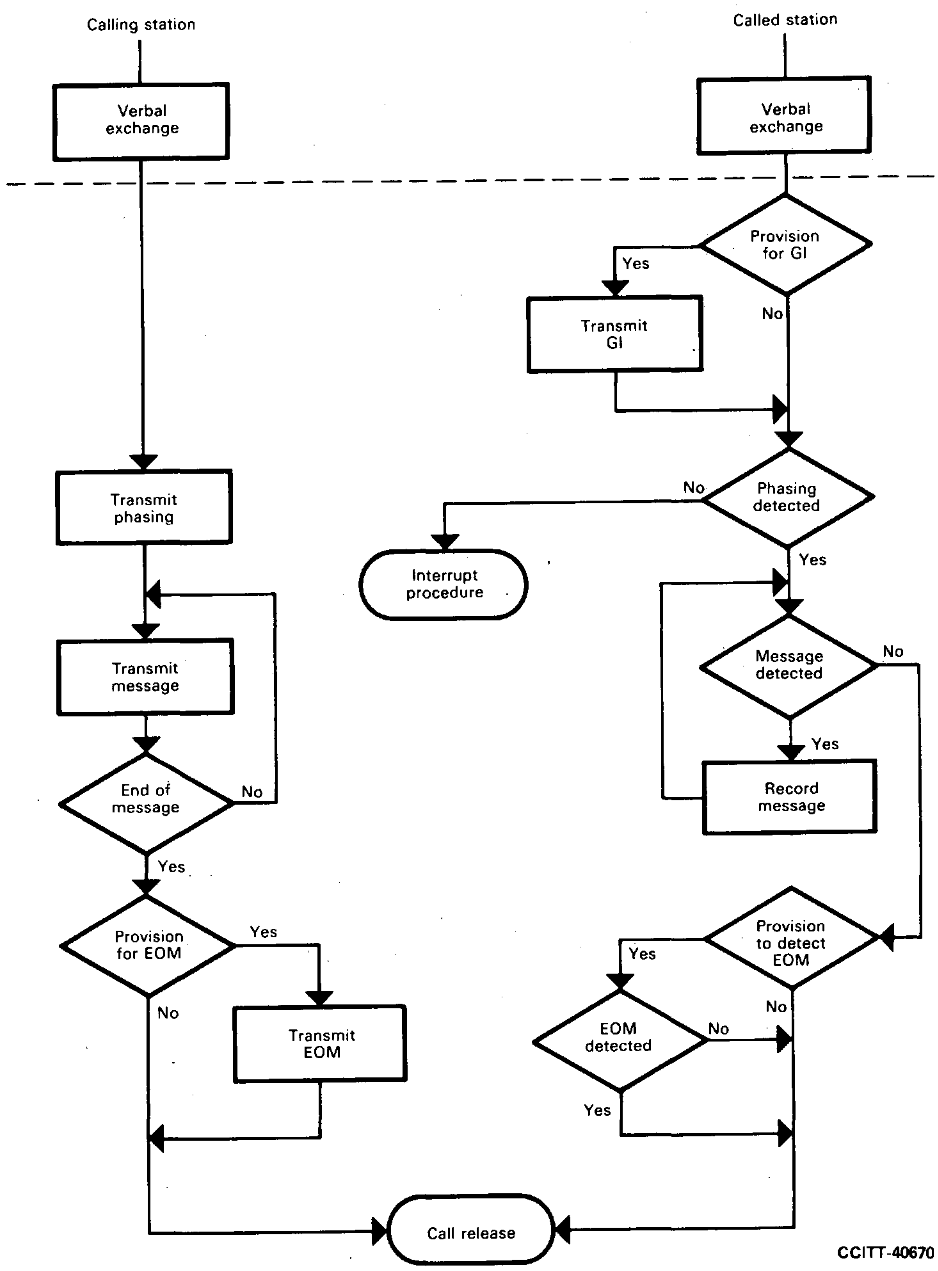


FIGURE I-1/T.30

APPENDIX II

(to Recommendation T.30)

Index of abbreviations used in Recommendation T.30

Abbre-viation	Function	Signal format	Reference
CED	Called station identification	2100 Hz	4.3.3.2
CFR	Confirmation to receive	X010 0001 1850 or 1650 Hz for 3 s	5.3.6.1.4, 1) 4.3.1.2
CRP	Command repeat	X101 1000	5.3.6.1.8, 2)
CIG	Calling subscriber identification	1000 0010	5.3.6.1.2, 2)
CNG	Calling tone	1100 Hz for 500 ms	4.3.3.3
CSI	Called subscriber identification	0000 0010	5.3.6.1.1, 2)
DCN	Disconnect	X101 1111	5.3.6.1.8, 1)
DCS	Digital command signal	X100 0001	5.3.6.1.3, 1)
DIS	Digital identification signal	0000 0001	5.3.6.1.1, 1)
DTC	Digital transmit command	1000 0001	5.3.6.1.2, 1)
EOM	End of message	X111 0001 1100 Hz	5.3.6.1.6, 1) 4.3.2.4
EOP	End of procedure	X111 0100	5.3.6.1.6, 3)
FCF	Facsimile control field	–	5.3.6.1
FIF	Facsimile information field	–	5.3.6.2
FTT	Failure to train	X010 0010	5.3.6.1.4, 2)
GC	Group command	1300 Hz for 1.5 — 10.0 s 2100 Hz for 1.5 — 10.0 s	4.3.2.1
GI	Group identification	1650 or 1850 Hz	4.3.1.1
HDLC	High-level data link control	–	5.3
LCS	Line conditioning signals	1100 Hz	4.3.2.2
MCF	Message confirmation	X011 0001 1650 or 1850 Hz	5.3.6.1.7, 1) 4.3.1.3
MPS	Multi-page signal	X111 0010	5.3.6.1.6, 2)
NSC	Non-standard facilities command	1000 0100	5.3.6.1.2, 3)
NSF	Non-standard facilities	0000 0100	5.3.6.1.1, 3)
NSS	Non-standard set-up	X100 0100	5.3.6.1.3, 3)
PIN	Procedural interrupt negative	X011 0100	5.3.6.1.7, 5)
PIP	Procedural interrupt positive	X011 0101	5.3.6.1.7, 4)
PIS	Procedure interrupt signal	462 Hz for 3 s	4.3.3.1
PRI-EOM	Procedure interrupt - EOM	X111 1001	5.3.6.1.6, 4)
PRI-EOP	Procedure interrupt - EOP	X111 1100	5.3.6.1.6, 6)
PRI-MPS	Procedure interrupt - MPS	X111 1010	5.3.6.1.6, 5)
RTN	Retrain negative	X011 0010	5.3.6.1.7, 3)
RTP	Retrain positive	X011 0011	5.3.6.1.7, 2)
TCF	Training check	Zeros for 1.5 s	5.3.6.1.3, 4)
TSI	Transmitting subscriber identification	X100 0010	5.3.6.1.3, 2)

APPENDIX III

(to Recommendation T.30)

List of commands and appropriate responses

Commands	Comments	Appropriate responses
(NSF) (CSI) DIS	Identifying capabilities: from a manual receiver or an auto answer unit	(NSC) (CIG) DTC (TSI) DCS (NSF) (CSI) DIS (CRP) (TSI) (NSS)
(NSC) (CIG) DTC	Mode setting command: from the calling unit. This is a poll operation	(TSI) DCS (NSF) (CSI) DIS (CRP) (TSI) (NSS)
(TSI) DCS (TSI) (NSS)	Mode setting command: from manual transmitter or automatic transceiver. This command is always followed by phasing/training	CFR FTT (NSC) (CIG) DTC (NSF) (CSI) DIS (CRP)
MPS or EOP or EOM or (PRI-MPS) or (PRI-EOP) or (PRI-EOM)	Post-message commands	MCF RTP RTN PIP PIN (CRP)
DCN	Phase E command	None

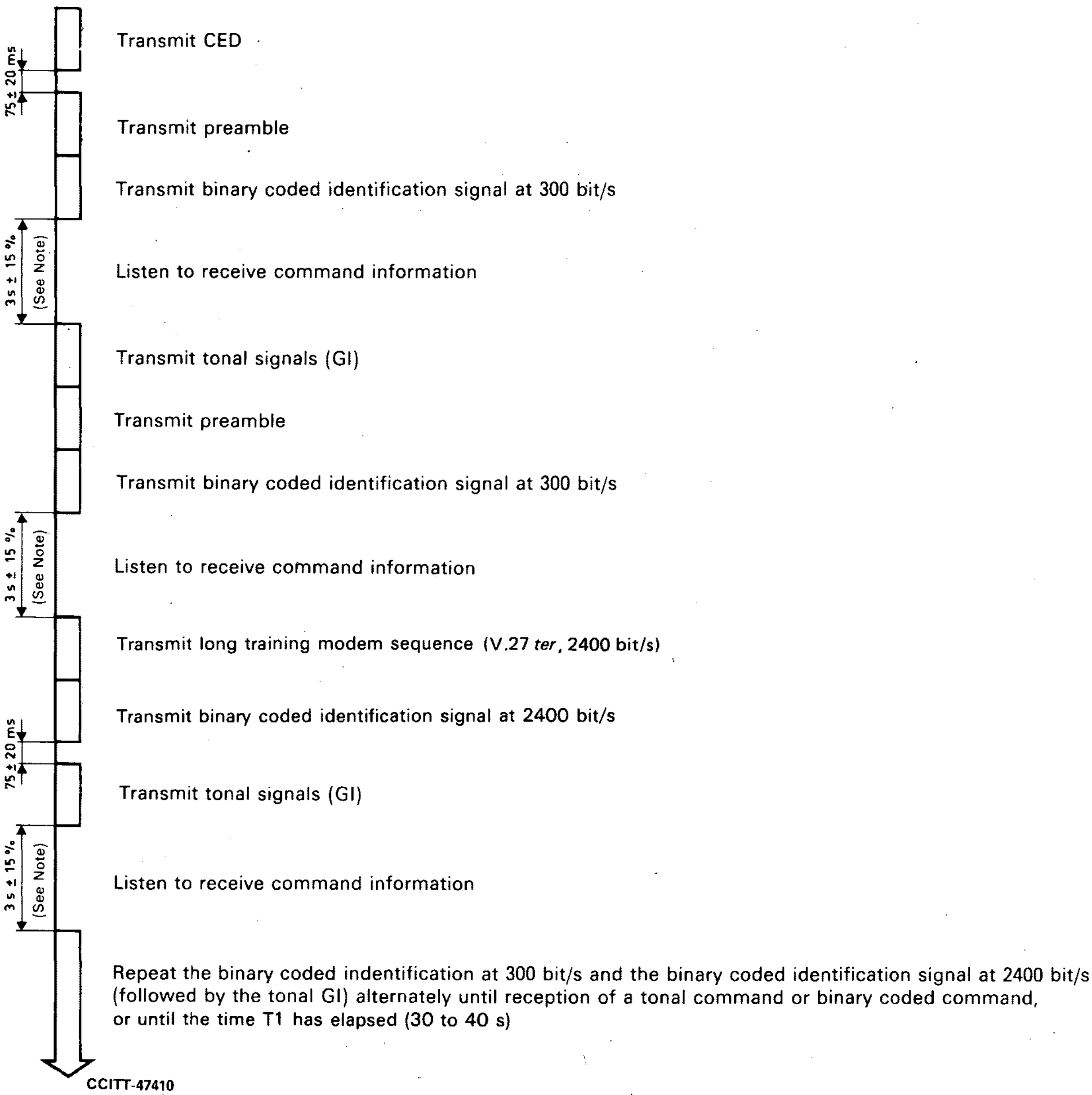
Note – Where the symbols ( ) are used, the signals within these symbols are optional.

APPENDIX IV

(to Recommendation T.30)

Interworking between the standard mode and the recognized optional mode for the binary coded handshaking procedure

An example of a station having the standard binary coded, recognized optional binary coded and tonal capabilities is given in Figure IV-1/T.30.



Note – For manual receivers using the binary coded procedure, this delay should be 4.5 s ± 15%.

FIGURE IV-1/T.30

Called station procedures (Alternating method)

APPENDIX V

(to Recommendation T.30)

Signal sequence examples

The examples below are based on the flow diagrams and are for illustrative and instructional purpose only. They should not be interpreted as establishing or limiting the protocol. The exchange of the various commands and responses is limited only by the rules specified in this Recommendation. (See §§ 5.3 and 5.4).

The notations used in these diagrams are as follows:

- an arrowhead signifies the receiver of the signal;
- a solid line indicates transmission of the signal at the data rate of 300 bit/s;
- the dashed lines indicate transmission at the message data rate (Recommendations V.27 *ter*, V.29);
- a lightning bolt (ϟ) indicates an invalid frame;
- a bold solid line indicates the transmission of tonal signals.

In the following figures, the examples given assume that DIS will be repeated for T1 seconds unless responded by a valid signal.

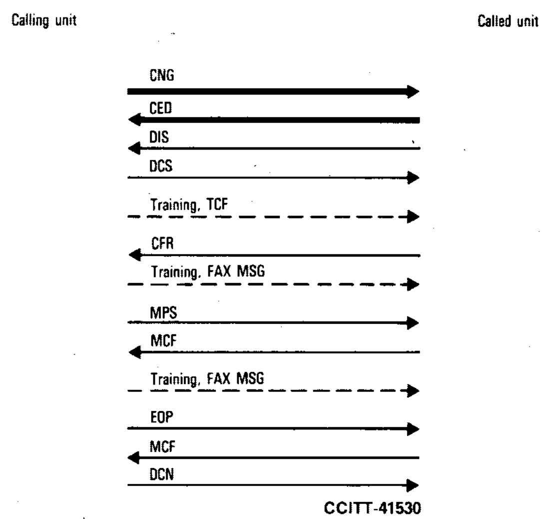


FIGURE V-1/T.30

Example 1 – An auto calling unit wishing to transmit to an auto answer unit: example of post-message commands.

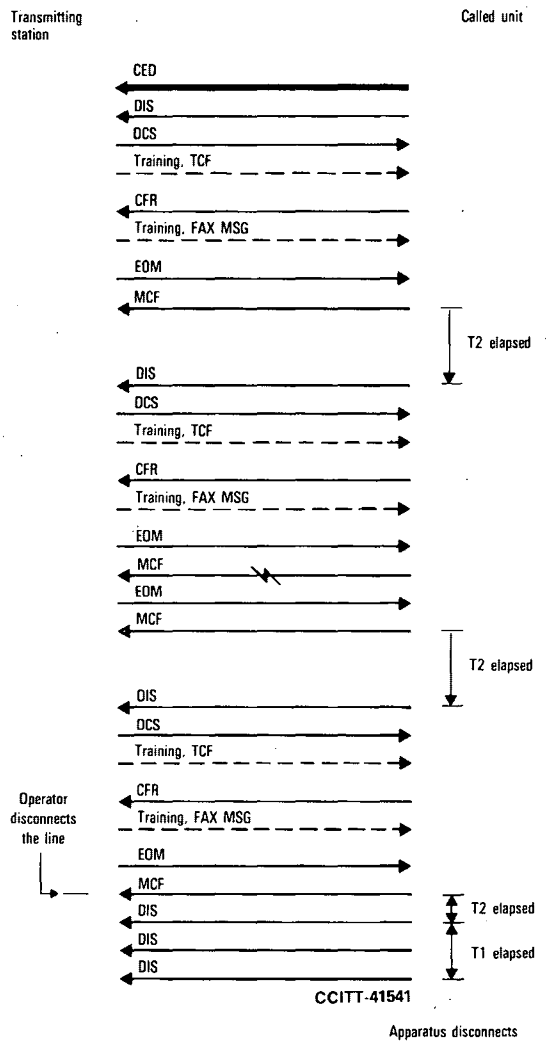


FIGURE V-2/T.30

Example 2 – A single page transmitter wishing to transmit to an auto answer unit : example of EOM.

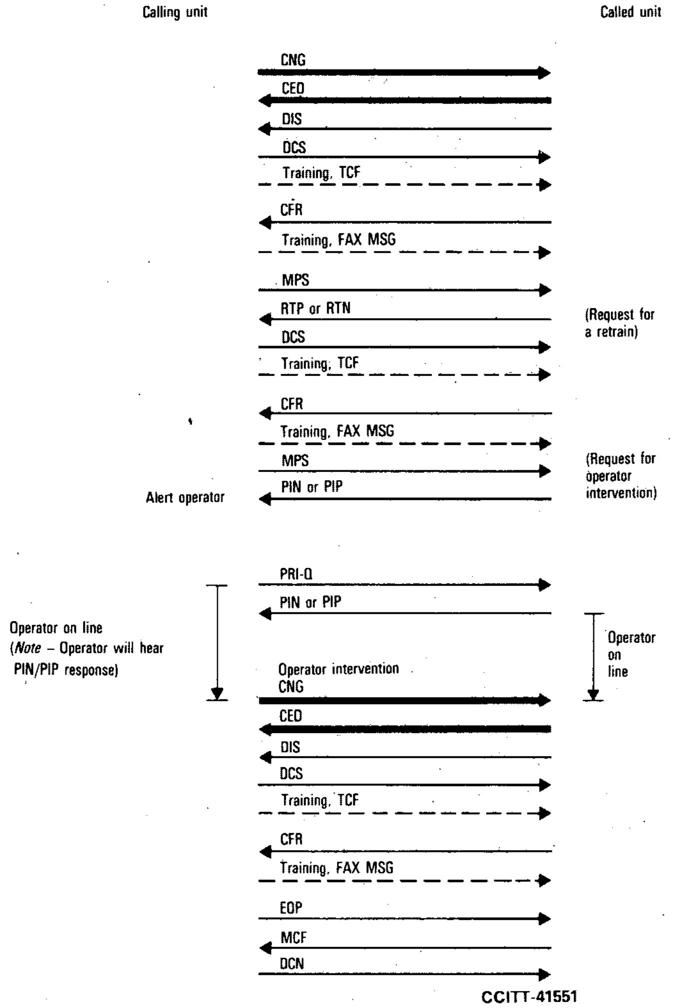


FIGURE V-3/T.30

Example 3 – An auto calling unit wishing to transmit to an auto answer unit : example of post-message responses.

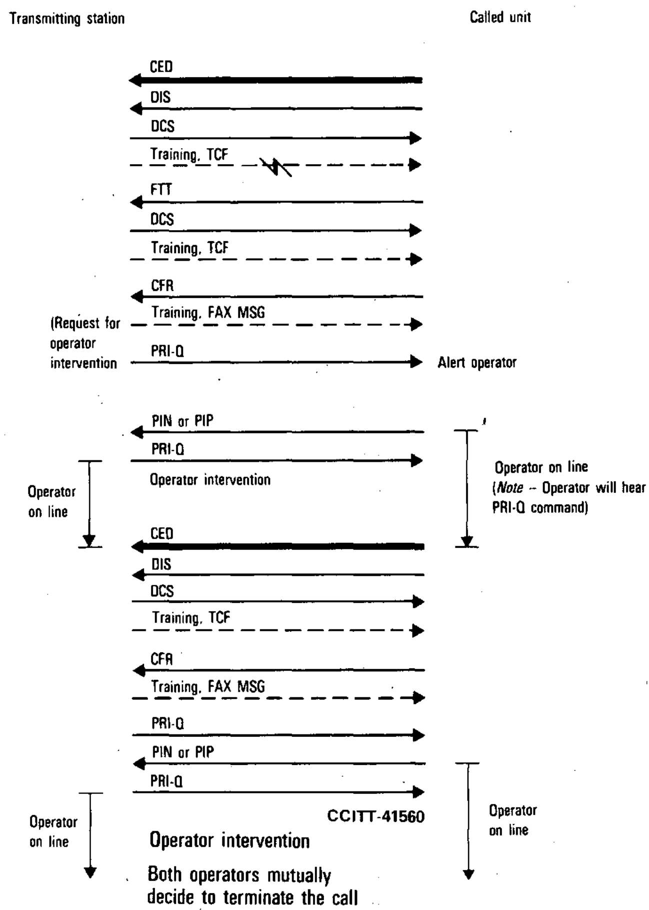


FIGURE V-4/T.30

Example 4 – Manual transmitter wishing to transmit to an auto answer unit: example of initial training failure and procedural interrupts.

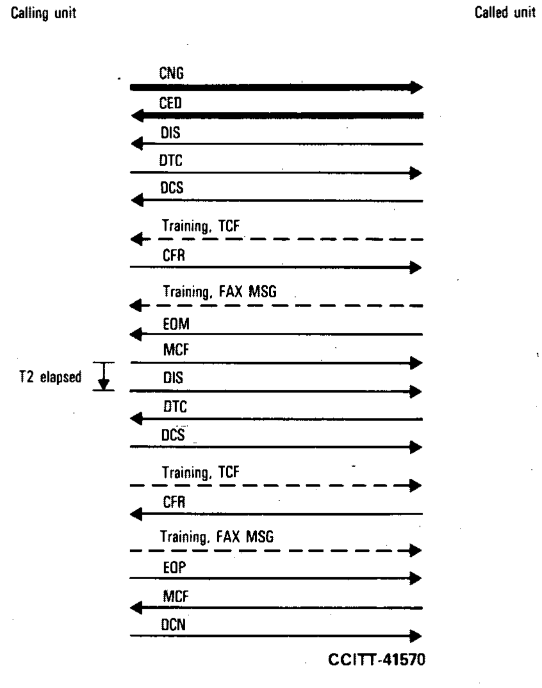


FIGURE V-5/T.30

Example 5 – Auto calling unit wishing to first receive from, then transmit to, an auto answer unit.

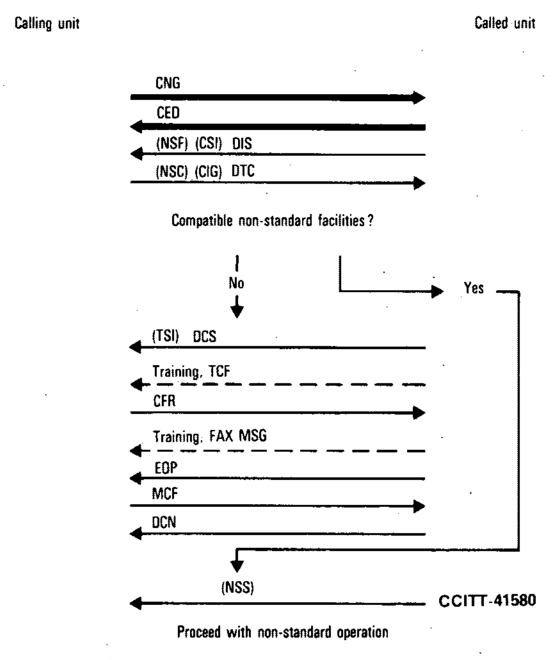


FIGURE V-6/T.30

Example 6 – Auto calling unit wishing to receive from an auto answer unit: example of polling and of optional as well as non-standard signals.

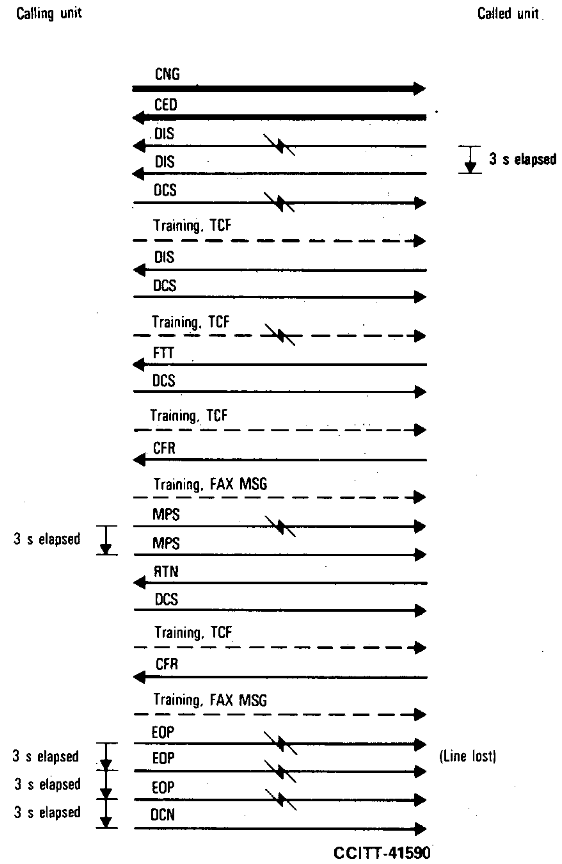


FIGURE V-7/T.30

Example 7 – An auto calling unit wishing to transmit to an auto answer unit: example of standard error recovery techniques.

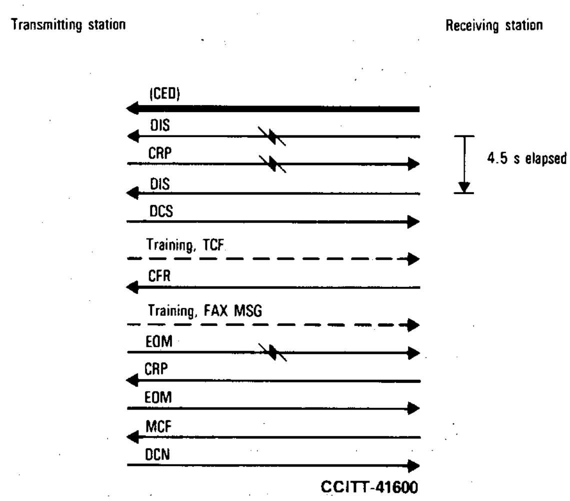


FIGURE V-8/T.30

Example 8 – Manual transmitter wishing to transmit to a manual receiver: example of error recovery technique using the optional CRP response.

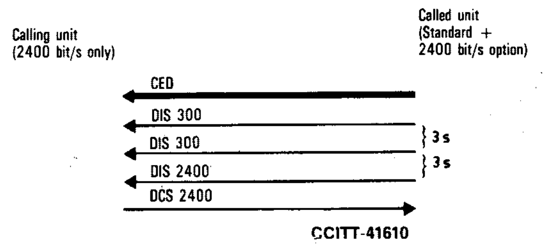


FIGURE V-9/T.30

Example 9 – A 2400 bit/s only machine wishing to transmit to a standard machine including the recognized option for binary coded handshaking procedure.

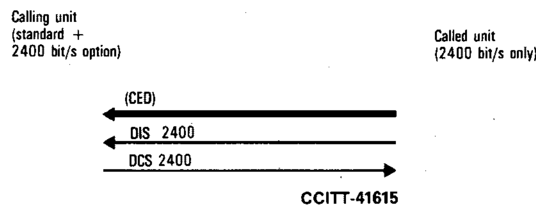


FIGURE V-10/T.30

Example 10 – A standard machine including the recognized option for binary coded handshaking procedure wishing to transmit to a 2400 bit/s only machine.

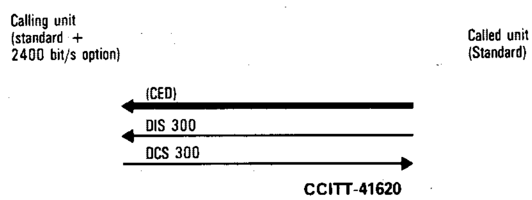


FIGURE V-11/T.30

Example 11 – A standard machine including the recognized option for binary coded handshaking procedure wishing to transmit to a standard machine (not including the optional mode).

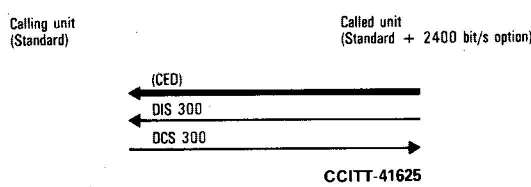


FIGURE V-12/T.30

Example 12 – A standard machine (not including the optional mode) wishing to transmit to a standard machine including the recognized option for binary coded handshaking procedure.

PROCEDURE FOR THE ALLOCATION OF CCITT MEMBERS' CODES [1)]

(Malaga-Torremolinos, 1984)

1 CCITT has defined Recommendation T.30 which details the control procedures for facsimile apparatus. The binary coded control procedures provide for the inclusion of non-standard facilities in addition to the standard facilities given in the appropriate Series T Recommendations and require a unique code to be allocated to each registered CCITT member [1)] who includes such non-standard facilities.

For the assignment of these codes, registered CCITT members [1)] may apply to the appropriate Administration, who will forward their request to the Director of the CCITT.

If authorized by an Administration, the Director of the CCITT will accept such requests direct from registered CCITT members [1)] of the appropriate country.

2 For Group 3 facsimile apparatus, the country codes should be as given in Annex A to this Recommendation.

The code 1111 1111 in Annex A should be reserved for further study.

The allocation of codes to subsequent octets should be carried out nationally.

3 For Group 4 facsimile, teletex and mixed-mode, the allocation of country codes should also be as given in Annex A with the code 1111 1111 again being reserved for further study.

4 The Member countries of the International Telecommunication Union not mentioned in this list who wish to obtain a country code should ask the Director of the CCITT for the assignment of an available country code. In their request, they may indicate the available code preferred.

Assignments by the Director of the CCITT of country codes as well as assignments by countries of the members' codes [1)] will be published in the Operational Bulletin of the International Telecommunication Union.

Note – Non-standard facilities are not defined in CCITT Recommendations but are laid down by Administrations and/or individual manufacturers. On request a CCITT member [1)] may be required to disclose the functional description related to the bit assignments contained within the Facsimile Information Field of the non-standard facilities frame.

---

1) In the context of this Recommendation the term "CCITT member" should be understood to mean a scientific or an industrial organization having been admitted in accordance with the provisions of Article 68 of the International Telecommunication Convention, Nairobi, 1982, to participate in an advisory capacity in meetings of the CCITT. It is understood that Administrations or RPOAs can apply directly to the Director of the CCITT for a registered CCITT code for their own purposes.

ANNEX A

(to Recommendation T.35)

List of country or area codes for non-standard facilities in telematic services

Code b8	b7	b6	b5	Bit b4	b3	b2	b1	Countries or areas
0	0	0	0	0	0	0	0	Japan
0	0	0	0	0	0	0	1	Albania
0	0	0	0	0	0	1	0	Algeria
0	0	0	0	0	0	1	1	American Samoa
0	0	0	0	0	1	0	0	Germany (Federal Republic of)
0	0	0	0	0	1	0	1	Anguilla
0	0	0	0	0	1	1	0	Antigua and Barbuda
0	0	0	0	0	1	1	1	Argentina
0	0	0	0	1	0	0	0	Ascension (see S. Helena)
0	0	0	0	1	0	0	1	Australia
0	0	0	0	1	0	1	0	Austria
0	0	0	0	1	0	1	1	Bahamas
0	0	0	0	1	1	0	0	Bahrain
0	0	0	0	1	1	0	1	Bangladesh
0	0	0	0	1	1	1	0	Barbados
0	0	0	0	1	1	1	1	Belgium
0	0	0	1	0	0	0	0	Belize
0	0	0	1	0	0	0	1	Benin
0	0	0	1	0	0	1	0	Bermudas
0	0	0	1	0	0	1	1	Bhutan
0	0	0	1	0	1	0	0	Bolivia
0	0	0	1	0	1	0	1	Botswana
0	0	0	1	0	1	1	0	Brazil
0	0	0	1	0	1	1	1	British Antarctic Territory
0	0	0	1	1	0	0	0	British Indian Ocean Territory
0	0	0	1	1	0	0	1	British Virgin Islands
0	0	0	1	1	0	1	0	Brunei
0	0	0	1	1	0	1	1	Bulgaria
0	0	0	1	1	1	0	0	Burma
0	0	0	1	1	1	0	1	Burundi
0	0	0	1	1	1	1	0	Byelorussia
0	0	0	1	1	1	1	1	Cameroon
0	0	1	0	0	0	0	0	Canada
0	0	1	0	0	0	0	1	Cape Verde
0	0	1	0	0	0	1	0	Cayman Islandas
0	0	1	0	0	0	1	1	Central African Republic
0	0	1	0	0	1	0	0	Chad
0	0	1	0	0	1	0	1	Chile
0	0	1	0	0	1	1	0	China
0	0	1	0	0	1	1	1	Colombia
0	0	1	0	1	0	0	0	Comoros
0	0	1	0	1	0	0	1	Congo
0	0	1	0	1	0	1	0	Cook Islands
0	0	1	0	1	0	1	1	Costa Rica
0	0	1	0	1	1	0	0	Cuba
0	0	1	0	1	1	0	1	Cyprus
0	0	1	0	1	1	1	0	Czechoslovakia
0	0	1	0	1	1	1	1	Democratic Kampuchea

Code								Countries or areas
Bit								
b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1	
0	0	1	1	0	0	0	0	Democratic People's Republic of Korea
0	0	1	1	0	0	0	1	Denmark
0	0	1	1	0	0	1	0	Djibouti
0	0	1	1	0	0	1	1	Dominican Republic
0	0	1	1	0	1	0	0	Dominica
0	0	1	1	0	1	0	1	Ecuador
0	0	1	1	0	1	1	0	Egypt
0	0	1	1	0	1	1	1	El Salvador
0	0	1	1	1	0	0	0	Equatorial Guinea
0	0	1	1	1	0	0	1	Ethiopia
0	0	1	1	1	0	1	0	Falkland Islands
0	0	1	1	1	0	1	1	Fiji
0	0	1	1	1	1	0	0	Finland
0	0	1	1	1	1	0	1	France
0	0	1	1	1	1	1	0	French Polynesia
0	0	1	1	1	1	1	1	French Southern and Antarctic Lands
0	1	0	0	0	0	0	0	Gabon
0	1	0	0	0	0	0	1	Gambia
0	1	0	0	0	0	1	0	German Democratic Republic
0	1	0	0	0	0	1	1	Angola
0	1	0	0	0	1	0	0	Ghana
0	1	0	0	0	1	0	1	Gibraltar
0	1	0	0	0	1	1	0	Greece
0	1	0	0	0	1	1	1	Grenada
0	1	0	0	1	0	0	0	Guam
0	1	0	0	1	0	0	1	Guatemala
0	1	0	0	1	0	1	0	Guernsey
0	1	0	0	1	0	1	1	Guinea
0	1	0	0	1	1	0	0	Guinea-Bissau
0	1	0	0	1	1	0	1	Guyana
0	1	0	0	1	1	1	0	Haiti
0	1	0	0	1	1	1	1	Honduras
0	1	0	1	0	0	0	0	Hongkong
0	1	0	1	0	0	0	1	Hungary
0	1	0	1	0	0	1	0	Iceland
0	1	0	1	0	0	1	1	India
0	1	0	1	0	1	0	0	Indonesia
0	1	0	1	0	1	0	1	Iran (Islamic Republic of)
0	1	0	1	0	1	1	0	Iraq
0	1	0	1	0	1	1	1	Ireland
0	1	0	1	1	0	0	0	Israel
0	1	0	1	1	0	0	1	Italy
0	1	0	1	1	0	1	0	Ivory Coast
0	1	0	1	1	0	1	1	Jamaica
0	1	0	1	1	1	0	0	Afghanistan
0	1	0	1	1	1	0	1	Jersey
0	1	0	1	1	1	1	0	Jordan
0	1	0	1	1	1	1	1	Kenya
0	1	1	0	0	0	0	0	Kiribati
0	1	1	0	0	0	0	1	Korea (Republic of)
0	1	1	0	0	0	1	0	Kuwait
0	1	1	0	0	0	1	1	Lao (People's Democratic Republic)
0	1	1	0	0	1	0	0	Lebanon

Code								Countries or areas
Bit								
b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1	
0	1	1	0	0	1	0	1	Lesotho
0	1	1	0	0	1	1	0	Liberia
0	1	1	0	0	1	1	1	Libya
0	1	1	0	1	0	0	0	Liechtenstein
0	1	1	0	1	0	0	1	Luxembourg
0	1	1	0	1	0	1	0	Macao
0	1	1	0	1	0	1	1	Madagascar
0	1	1	0	1	1	0	0	Malyasia
0	1	1	0	1	1	0	1	Malawi
0	1	1	0	1	1	1	0	Maldives
0	1	1	0	1	1	1	1	Mali
0	1	1	1	0	0	0	0	Malta
0	1	1	1	0	0	0	1	Mauritania
0	1	1	1	0	0	1	0	Mauritius
0	1	1	1	0	0	1	1	Mexico
0	1	1	1	0	1	0	0	Monaco
0	1	1	1	0	1	0	1	Mongolia
0	1	1	1	0	1	1	0	Montserrat
0	1	1	1	0	1	1	1	Morocco
0	1	1	1	1	0	0	0	Mozambique
0	1	1	1	1	0	0	1	Nauru
0	1	1	1	1	0	1	0	Nepal
0	1	1	1	1	0	1	1	Netherlands
0	1	1	1	1	1	0	0	Netherlands Antilles
0	1	1	1	1	1	0	1	New Caledonia
0	1	1	1	1	1	1	0	New Zealand
0	1	1	1	1	1	1	1	Nicaragua
1	0	0	0	0	0	0	0	Niger
1	0	0	0	0	0	0	1	Nigeria
1	0	0	0	0	0	1	0	Norway
1	0	0	0	0	0	1	1	Oman
1	0	0	0	0	1	0	0	Pakistan
1	0	0	0	0	1	0	1	Panama
1	0	0	0	0	1	1	0	Papua New Guinea
1	0	0	0	0	1	1	1	Paraguay
1	0	0	0	1	0	0	0	Peru
1	0	0	0	1	0	0	1	Philippines
1	0	0	0	1	0	1	0	Poland
1	0	0	0	1	0	1	1	Portugal
1	0	0	0	1	1	0	0	Puerto Rico
1	0	0	0	1	1	0	1	Qatar
1	0	0	0	1	1	1	0	Romania
1	0	0	0	1	1	1	1	Rwanda
1	0	0	1	0	0	0	0	S. Christopher and Nevis
1	0	0	1	0	0	0	1	S. Croix
1	0	0	1	0	0	1	0	S. Helena and Ascension
1	0	0	1	0	0	1	1	S. Lucia
1	0	0	1	0	1	0	0	S. Marino
1	0	0	1	0	1	0	1	S. Thomas
1	0	0	1	0	1	1	0	Sao Tomé and Principe
1	0	0	1	0	1	1	1	S. Vincent and the Grenadines
1	0	0	1	1	0	0	0	Saudi Arabia
1	0	0	1	1	0	0	1	Senegal
1	0	0	1	1	0	1	0	Seychelles

Code								Countries or areas
Bit								
b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1	
1	0	0	1	1	0	1	1	Sierra Leone
1	0	0	1	1	1	0	0	Singapore
1	0	0	1	1	1	0	1	Solomon Islands
1	0	0	1	1	1	1	0	Somalia
1	0	0	1	1	1	1	1	South Africa
1	0	1	0	0	0	0	0	Spain
1	0	1	0	0	0	0	1	Sri Lanka
1	0	1	0	0	0	1	0	Sudan
1	0	1	0	0	0	1	1	Suriname
1	0	1	0	0	1	0	0	Swaziland
1	0	1	0	0	1	0	1	Sweden
1	0	1	0	0	1	1	0	Switzerland
1	0	1	0	0	1	1	1	Syria
1	0	1	0	1	0	0	0	Tanzania
1	0	1	0	1	0	0	1	Thailand
1	0	1	0	1	0	1	0	Togo
1	0	1	0	1	0	1	1	Tonga
1	0	1	0	1	1	0	0	Trinidad and Tobago
1	0	1	0	1	1	0	1	Tunisia
1	0	1	0	1	1	1	0	Turkey
1	0	1	0	1	1	1	1	Turks and Caicos Islands
1	0	1	1	0	0	0	0	Tuvalu
1	0	1	1	0	0	0	1	Uganda
1	0	1	1	0	0	1	0	Ukrainia
1	0	1	1	0	0	1	1	United Arab Emirates
1	0	1	1	0	1	0	0	United Kingdom
1	0	1	1	0	1	0	1	United States
1	0	1	1	0	1	1	0	Burkina Faso
1	0	1	1	0	1	1	1	Uruguay
1	0	1	1	1	0	0	0	U.S.S.R.
1	0	1	1	1	0	0	1	Vanuatu
1	0	1	1	1	0	1	0	Vatican City State
1	0	1	1	1	0	1	1	Venezuela
1	0	1	1	1	1	0	0	Viet Nam
1	0	1	1	1	1	0	1	Wallis and Futuna
1	0	1	1	1	1	1	0	Western Samoa
1	0	1	1	1	1	1	1	Yemen Arab Republic
1	1	0	0	0	0	0	0	Yemen (People's Democratic Republic of)
1	1	0	0	0	0	0	1	Yugoslavia
1	1	0	0	0	0	1	0	Zaire
1	1	0	0	0	0	1	1	Zambia
1	1	0	0	0	1	0	0	Zimbabwe
1	1	0	0	0	1	0	1	
1	1	0	0	0	1	1	0	
1	1	0	0	0	1	1	1	
1	1	0	0	1	0	0	0	
1	1	0	0	1	0	0	1	
1	1	0	0	1	0	1	0	
1	1	0	0	1	0	1	1	
1	1	0	0	1	1	0	0	
1	1	0	0	1	1	0	1	
1	1	0	0	1	1	1	0	
1	1	0	0	1	1	1	1	
1	1	1	1	1	1	1	1	Reserved for further study

Recommendation T.50 [1)]

INTERNATIONAL ALPHABET No. 5

(former Recommendation V.3, Mar del Plata, 1968; amended at Geneva, 1972 and Malaga-Torremolinos, 1984)

Introduction

A seven-unit alphabet capable of meeting the requirements of private users on leased circuits and of users of data transmission by means of connections set up by switching on the general telephone network or on telegraph networks has been established jointly by the CCITT and the International Organization for Standardization (ISO).

This alphabet – International Alphabet No. 5 (IA5) – is not intended to replace International Telegraph Alphabet No. 2 (ITA2). It is a supplementary alphabet for the use of those who might not be satisfied with the more limited possibilities of International Telegraph Alphabet No. 2. In such cases it is considered as the alphabet to be used as common basic language for data transmission and for elaborated message systems.

International Alphabet No. 5 does not exclude the use of any other alphabet that might be better adapted to special needs.

1 Scope and field of application

1.1 This Recommendation specifies a set of 128 characters (control characters and graphic characters such as letters, digits and symbols) with their coded representation. Most of these characters are mandatory and unchangeable, but provision is made for some flexibility to accommodate national and other requirements.

1.2 This Recommendation specifies a 7-bit coded character set with a number of options. It also provides guidance on how to exercise the options to define specific national versions and application-orientated versions. Furthermore it specifies the International Reference Version (IRV) in which such options have been exercised.

1.3 This character set is primarily intended for the interchange of information among data processing systems and associated equipment, and within data communication systems. The need for graphic characters and control functions in data processing has also been taken into account in determining this character set.

1.4 This character set is applicable to all alphabets of Latin letters.

1.5 This character set includes control characters for code extension where its 128 characters are insufficient for particular applications. Procedures for the use of these control characters are specified in ISO Standard 2022.

1.6 The definitions of some control characters in this Recommendation assume that data associated with them are to be processed serially in a forward direction. When they are included in strings of data which are processed other than serially in a forward direction or when they are included in data formatted for fixed-record processing they may have undesirable effects or may require additional special treatment to ensure that they result in their desired function.

2 Conformance and implementation

2.1 *Conformance*

A coded character set is in conformance with this Recommendation if it is a version in accordance with § 6. Equipment claimed to implement this Recommendation shall be able to interchange information by means of a version of the 7-bit coded character set, this version shall be identified in any such claim.

---

1) This Recommendation corresponds to International Standard ISO 646 (1983).

2.2 *Implementation*

The use of this character set requires definitions of its implementation in various media. For example, these could include punched tapes, punched cards, magnetic media and transmission channels, thus permitting interchange of data to take place either indirectly by means of an intermediate recording in a physical medium, or by local connection of various units (such as input and output devices and computers) or by means of data transmission equipment.

The implementation of this coded character set in physical media and for transmission, taking into account the need for error checking, is the subject of ISO publications.

3 Definitions

For the purpose of this Recommendation the following definitions apply.

3.1 bit combination

An ordered set of bits used for the representation of characters.

3.2 character

A member of a set of elements used for the organization, control or representation of data.

3.3 coded character set; code

A set of unambiguous rules that establishes a character set and the one-to-one relationship between the characters of the set and their bit combinations.

3.4 code extension

The techniques for the encoding of characters that are not included in the character set of a given code.

3.5 code table

A table showing the character allocated to each bit combination in a code.

3.6 control character

A control function the coded representation of which consists of a single bit combination.

3.7 control function

An action that affects the recording, processing, transmission or interpretation of data and that has a coded representation consisting of one or more bit combinations.

3.8 graphic character

A character, other than a control function, that has a visual representation normally handwritten, printed or displayed.

3.9 position

That part of a code table identified by its column and row co-ordinates.

4 Specification of the coded character set

The bits of the bit combinations of the 7-bit code are identified by b_7, b_6, b_5, b_4, b_3, b_2 and b_1, where b_7 is the highest-order, or most-significant, bit and b_1 is the lowest-order, or least-significant, bit.

The bit combinations may be interpreted to represent integers in the range 0 to 127 in binary notation by attributing the following weights to the individual bits:

Bit:	b_7	b_6	b_5	b_4	b_3	b_2	b_1
Weight:	64	32	16	8	4	2	1

In this Recommendation, the bit combinations are identified by notation of the form x/y, where x is a number in the range 0 to 7 and y is a number in the range 0 to 15. The correspondence between the notations of the form x/y and the bit combinations consisting of the bits b_7 to b_1 is as follows:

- x is the number represented by b_7, b_6 and b_5 where these bits are given the weights 4, 2 and 1 respectively;
- y is the number represented by b_4, b_3, b_2 and b_1 where these bits are given the weights 8, 4, 2 and 1 respectively.

The notations of the form x/y are the same as those used to identify code table positions, where x is the column number and y the row number (see § 7).

The 128 bit combinations of the 7-bit code represent control characters and graphic characters. The allocation of characters to bit combinations is based on the following principles:

- the bit combinations 0/0 to 1/15 represent 32 control characters;
- the bit combination 2/0 represents the character SPACE, which is interpreted both as a control character and as a graphic character;
- the bit combinations 2/1 to 7/14 represent up to 94 graphic characters as one or more of these bit combinations may be declared to be unused (see § 4.3);
- the bit combination 7/15 represents the control character DELETE.

The allocation of individual characters to the bit combinations of the 7-bit code is specified in §§ 4.1, 4.2 and 4.3 below.

This Recommendation assigns at least one name to each character. In addition, it specifies an acronym for each control character and for the character SPACE, and a graphic symbol for each graphic character. By convention, only capital letters and hyphens are used for writing the names of the characters, except for small letters. For acronyms only capital letters and digits are used. It is intended that the acronyms and this convention be retained in all translations of the text.

The names chosen to denote graphic characters are intended to reflect their customary meaning. However, this Recommendation does not define and does not restrict the meanings of graphic characters. Neither does it specify a particular style or font design for the graphic characters when imaged.

4.1 *Control characters*

The control characters of the 7-bit coded character set are classified in the following categories:

a) *Transmission control characters*

Transmission control characters are intended to control or facilitate transmission of information over telecommunication networks. Procedures for the use of the transmission control characters on telecommunication networks are the subject of other ISO publications.

b) *Format effectors*

Format effectors are mainly intended for the control of the layout and positioning of information on character-imaging devices such as printing and display devices.

c) *Code extension control characters*

Code extension control characters are used to extend the character set of the code. They may alter the meaning of one or more bit combinations that follow them in the data stream. Procedures for the use of the code extension control characters are specified in ISO Standard 2022.

d) *Device control characters*

Device control characters are intended for the control of local or remote devices or ancillary devices connected to a data processing or data communication system. These control characters are not intended to control data communication systems; this should be achieved by the use of transmission control characters.

e) *Information separators*

Information separators are used to separate and qualify data logically. There are four such characters. They may be used either in hierarchical order or non-hierarchically; in the latter case, their specific meanings depend on the application.

f) *Other control characters*

These are the control characters that fall outside the preceding categories.

The composition of each category, and the allocation of the individual control characters in each category to bit combinations of the 7-bit code are specified in §§ 4.1.1 to 4.1.6. Each of these sub-clauses contains a table consisting of three columns. The first column specifies the acronym of each control character, the second column specifies the standard name of the control character and the third column, labelled "Coded representation", specifies the bit combination representing the control character concerned.

Detailed functional descriptions of all control characters are given in § 8.

4.1.1 *Transmission control characters*

The transmission control characters and their coded representations are specified in Table 1/T.50.

TABLE 1/T.50

Transmission control characters – coded representation

Acronym	Name	Coded representation
SOH	Start of heading	0/1
STX	Start of text	0/2
ETX	End of text	0/3
EOT	End of transmission	0/4
ENQ	Enquiry	0/5
ACK	Acknowledge	0/6
DLE	Data link escape	1/0
NAK	Negative acknowledge	1/5
SYN	Synchronous idle	1/6
ETB	End of transmission block	1/7

4.1.2 *Format effectors*

The format effectors and their coded representations are specified in Table 2/T.50.

TABLE 2/T.50

Format effectors – coded representation

Acronym	Name	Coded representation
BS	Backspace	0/8
HT	Horizontal tabulation	0/9
LF	Line feed	0/10
VT	Vertical tabulation	0/11
FF	Form feed	0/12
CR	Carriage return	0/13

4.1.2.1 *Concepts*

The definitions of the format effectors use the following concepts:

a) A page is composed of a number of lines, each being composed of a number of character positions.

b) Each character position is capable of imaging SPACE or a graphic symbol.

c) The graphic symbol imaged at a character position represents a graphic character, a control function, or a combination of one or more graphic characters and/or control functions.

d) The active position is the character position at which the action required by the next character in the data stream is to be effected. If the next character is a graphic character, it is imaged at that position; if it is a control character, the corresponding function is performed relative to that position.

e) Movements of the active position are effected as follows:

   1) The active position is advanced one character position immediately after imaging a SPACE or a graphic character, and upon the execution of the function corresponding to a control character for which a graphic symbol is required to be imaged.

   2) The active position is moved to a specified character position upon the execution of the function corresponding to a control character that is defined to cause a movement of the active position (i.e. a format effector).

f) The active position is not moved upon execution of the function corresponding to a control character that is neither required to be imaged by a graphic symbol nor defined to cause a movement of the active position.

g) The effect of an attempt to move the active position beyond the boundaries of a line or a page is not defined by this Recommendation.

4.1.2.2 *Combined horizontal and vertical movements of the active position*

The format effectors are defined for applications in which horizontal and vertical movements of the active position are effected separately. If a single control character is required to effect the action of CARRIAGE RETURN in combination with a vertical movement, the format effector for that vertical movement shall be used. For example, if the function "new line" (equivalent to the combination of CARRIAGE RETURN and LINE FEED) is required as a single control character, bit combination 0/10 shall be used to represent it. This substitution requires agreement between the sender and the recipient of the data, and the format effectors (LINE FEED, VERTICAL TABULATION and/or FORM FEED) that are affected shall be identified (see § 6).

In order to avoid the need for such prior agreement, to facilitate interchange and to avoid conflicts with specifications in other ISO publications, the use of format effectors for vertical movements to effect combined horizontal and vertical movements is deprecated. It is strongly recommended to use two control characters, for example CARRIAGE RETURN (CR) and LINE FEED (LF) to obtain the effect of "new line".

4.1.3 *Code extension control characters*

The code extension control characters and their coded representations are specified in Table 3/T.50.

TABLE 3/T.50

Code extension control characters – coded representation

Acronym	Name	Coded representation
SO	Shift-out	0/14
SI	Shift-in	0/15
ESC	Escape	1/11

4.1.4 *Device control characters*

The device control characters and their coded representations are specified in Table 4/T.50.

TABLE 4/T.50

Device control characters – coded representation

Acronym	Name	Coded representation
DC1	Device control one	1/1
DC2	Device control two	1/2
DC3	Device control three	1/3
DC4	Device control four	1/4

4.1.5 *Information separators*

The information separators and their coded representations are specified in Table 5/T.50.

TABLE 5/T.50

Information separators – coded representation

Acronym	Name	Coded representation
IS4 (FS)	Information separator four (file separator)	1/12
IS3 (GS)	Information separator three (group separator)	1/13
IS2 (RS)	Information separator two (record separator)	1/14
IS1 (US)	Information separator one (unit separator)	1/15

Each information separator is given two names. The names INFORMATION SEPARATOR FOUR, INFORMATION SEPARATOR THREE, INFORMATION SEPARATOR TWO and INFORMATION SEPARATOR ONE are the general names. The names FILE SEPARATOR, GROUP SEPARATOR, RECORD SEPARATOR and UNIT SEPARATOR are the specific names and are intended mainly for applications where the information separators are used hierarchically. The ascending order is then US, RS, GS, FS. In this case, data normally delimited by a particular separator cannot be split by a higher-order separator but will be considered as delimited by any higher-order separator.

4.1.6 *Other control characters*

The control characters outside the categories in §§ 4.1.1 to 4.1.5 and their coded representation, are specified in Table 6/T.50.

TABLE 6/T.50

Other control characters – coded representation

Acronym	Name	Coded representation
NUL	Null	0/0
BEL	Bell	0/7
CAN	Cancel	1/8
EM	End of medium	1/9
SUB	Substitute character	1/10
DEL	Delete	7/15

4.2 *Character SPACE*

The acronym of the character SPACE is SP and its coded representation is 2/0. This character is interpreted both as a graphic character and as a control character. As a graphic character, it has a visual representation consisting of the absence of a graphic symbol. As a control character, it acts as a format effector that causes the active position to be advanced one character position.

4.3 *Graphic characters*

The 94 bit combinations 2/1 to 7/14 are used for the representation of graphic characters as specified in §§ 4.3.1, 4.3.2 and 4.3.3 below. Each of the §§ 4.3.1 and 4.3.2 contains a table consisting of three columns. The first column is labelled "Graphic" and specifies the graphic symbol of each graphic character, the second column specifies the standard name of the graphic character and the third column, labelled "Coded representation", specifies the bit combination representing the graphic character concerned.

All graphic characters of any version of the 7-bit coded character set are spacing characters, i.e. they cause the active position to advance.

4.3.1 *Unique graphic character allocations*

A unique graphic character is allocated to each of the 82 bit combinations 2/1, 2/2, 2/5 to 3/15, 4/1 to 5/10, 5/15 and 6/1 to 7/10. These characters are specified in Table 7/T.50.

4.3.2 *Alternative graphic character allocations*

Two alternative graphic characters are allocated to each of the bit combinations 2/3 and 2/4. These characters are specified in Table 8/T.50.

Either the character POUND SIGN or the character NUMBER SIGN shall be allocated to bit combination 2/3 and either the character DOLLAR SIGN or the character CURRENCY SIGN shall be allocated to bit combination 2/4 (see § 6).

Unless otherwise agreed between sender and recipient, the graphic symbols £, $ and ¤ do not designate the currency of a specific country.

4.3.3 *National or application-oriented graphic character allocations*

No specific graphic character is allocated to the ten bit combinations 4/0, 5/11 to 5/14, 6/0, and 7/11 to 7/14. These bit combinations are available for national or application-orientated use. A unique graphic character shall be allocated to each of these bit combinations, or the bit combination shall be declared unused (see § 6).

TABLE 7/T.50

Unique graphic character allocations

Graphic	Name	Coded representation
!	Exclamation mark	2/1
"	Quotation mark	2/2
%	Percent sign	2/5
&	Ampersand	2/6
'	Apostrophe	2/7
(	Left parenthesis	2/8
)	Right parenthesis	2/9
*	Asterisk	2/10
+	Plus sign	2/11
,	Comma	2/12
–	Hyphen, minus sign	2/13
.	Full stop	2/14
/	Solidus	2/15
0	Digit zero	3/0
1	Digit one	3/1
2	Digit two	3/2
3	Digit three	3/3
4	Digit four	3/4
5	Digit five	3/5
6	Digit six	3/6
7	Digit seven	3/7
8	Digit eight	3/8
9	Digit nine	3/9
:	Colon	3/10
;	Semicolon	3/11
<	Less-than sign	3/12
=	Equals sign	3/13
>	Greater-than sign	3/14
?	Question mark	3/15
A	Capital letter A	4/1
B	Capital letter B	4/2
C	Capital letter C	4/3
D	Capital letter D	4/4
E	Capital letter E	4/5
F	Capital letter F	4/6
G	Capital letter G	4/7
H	Capital letter H	4/8
I	Capital letter I	4/9
J	Capital letter J	4/10
K	Capital letter K	4/11
L	Capital letter L	4/12

Graphic	Name	Coded representation
M	Capital letter M	4/13
N	Capital letter N	4/14
O	Capital letter O	4/15
P	Capital letter P	5/0
Q	Capital letter Q	5/1
R	Capital letter R	5/2
S	Capital letter S	5/3
T	Capital letter T	5/4
U	Capital letter U	5/5
V	Capital letter V	5/6
W	Capital letter W	5/7
X	Capital letter X	5/8
Y	Capital letter Y	5/9
Z	Capital letter Z	5/10
_	Low line, underline	5/15
a	Small letter a	6/1
b	Small letter b	6/2
c	Small letter c	6/3
d	Small letter d	6/4
e	Small letter e	6/5
f	Small letter f	6/6
g	Small letter g	6/7
h	Small letter h	6/8
i	Small letter i	6/9
j	Small letter j	6/10
k	Small letter k	6/11
l	Small letter l	6/12
m	Small letter m	6/13
n	Small letter n	6/14
o	Small letter o	6/15
p	Small letter p	7/0
q	Small letter q	7/1
r	Small letter r	7/2
s	Small letter s	7/3
t	Small letter t	7/4
u	Small letter u	7/5
v	Small letter v	7/6
w	Small letter w	7/7
x	Small letter x	7/8
y	Small letter y	7/9
z	Small letter z	7/10

TABLE 8/T.50

Alternative graphic character allocations

Graphic	Name	Coded representation
£	Pound sign	2/3
#	Number sign	2/3
$	Dollar sign	2/4
¤	Currency sign	2/4

5 Composite graphic characters

In any version of the 7-bit coded character set specified according to this Recommendation, all graphic characters are spacing characters which cause the active position to move forward. However, by using BACKSPACE or CARRIAGE RETURN, it is possible to image two or more graphic characters at the same character position.

For example, SOLIDUS and EQUALS SIGN can be combined to image "not equals". The character LOW LINE, that may be used as a free-standing character, can also be associated with other character(s) to represent the graphic rendition "underlined".

Diacritical marks may be allocated to the bit combinations specified in § 4.3.3 and be available for composing accented letters. For such composition, it is recommended to use a sequence of three characters, the first or last of which is the letter to be accented and the second of which is BACKSPACE. Furthermore, QUOTATION MARK, APOSTROPHE or COMMA can be associated with a letter by means of BACKSPACE for the composition of an accented letter with a diaeresis, an acute accent or a cedilla, respectively.

6 Versions of the coded character set

6.1 *General*

In order to use the 7-bit coded character set for information interchange, it is necessary to exercise the options left open in § 4:

- to each of the bit combinations 2/3 and 2/4 one of the alternative graphic characters specified in § 4.3.2 shall be allocated;
- each of the bit combinations 4/0, 5/11 to 5/14, 6/0, and 7/11 to 7/14 shall have a unique graphic character allocated to it, or be declared unused;
- the format effectors, if any, to which the facility of § 4.1.2.2 applies, shall be identified.

A graphic character allocated to a bit combination specified in §§ 4.3.1 and 4.3.2 shall not be allocated to any other bit combination. For example the POUND SIGN, if not allocated to bit combination 2/3, shall not be allocated to any other bit combination.

A character set completed in this way is called a "version of ISO Standard 646/CCITT T.50" (see Appendix I).

6.2 *National versions*

6.2.1 The responsibility for defining national versions lies with the national standardization bodies. These bodies shall exercise the options available and make the required selection (see Appendix I).

6.2.2 If so required, more than one national version can be defined within a country. The different versions shall be separately identified. In particular when for a given bit combination, for example 5/12, alternative graphic characters are required, two different versions shall be identified, even if they differ only by this single character.

6.2.3 If there is in a country no special demand for specific graphic characters, it is strongly recommended that the characters of the International Reference Version (IRV) (see § 6.4) be selected and allocated to the same bit combinations as in the IRV.

However, when graphic characters that are different from the characters of the IRV are required, they shall have distinct forms and be given distinctive names which are not in conflict with any of the forms or the names of any of the graphic characters in the IRV.

6.3 *Application-orientated versions*

Within national or international industries, organizations or professional groups, application-orientated versions can be used. They require precise agreement among the interested parties, who will have to exercise the options available and to make the required selection.

6.4 *International Reference Version (IRV)*

This version is available for use when there is no requirement to use a national or an application-orientated version. In information interchange, the IRV is assumed unless a particular agreement exists between sender and recipient of the data. The graphic characters allocated to the IRV are specified in Table 9/T.50.

TABLE 9/T.50

IRV graphic character allocations

<table>
<tr><th>Graphic</th><th>Name</th><th>Coded representation</th></tr>
<tr><td>#</td><td>Number sign</td><td>2/3</td></tr>
<tr><td>¤</td><td>Currency sign</td><td>2/4</td></tr>
<tr><td>@</td><td>Commercial at</td><td>4/0</td></tr>
<tr><td>[</td><td>Left square bracket</td><td>5/11</td></tr>
<tr><td>\</td><td>Reverse solidus</td><td>5/12</td></tr>
<tr><td>]</td><td>Right square bracket</td><td>5/13</td></tr>
<tr><td>^</td><td>Circumflex accent</td><td>5/14</td></tr>
<tr><td>`</td><td>Grave accent</td><td>6/0</td></tr>
<tr><td>{</td><td>Left curly bracket</td><td>7/11</td></tr>
<tr><td>|</td><td>Vertical line</td><td>7/12</td></tr>
<tr><td>}</td><td>Right curly bracket</td><td>7/13</td></tr>
<tr><td>‾</td><td>Tilde, overline</td><td>7/14</td></tr>
</table>

It should be noted that no substitution is allowed when using the IRV and that the facility of § 4.1.2.2 does not apply to any format effector.

According to § 5 it is permitted to use composite graphic characters and there is no limit to their number. Because of this freedom, their processing and imaging may cause difficulties at the receiving end. Therefore agreement between sender and recipient of the data is recommended if composite characters are used.

7 Code tables

A 7-bit code table consists of 128 positions arranged in 8 columns and 16 rows. The columns are numbered 0 to 7, and the rows are numbered 0 to 15.

The code table positions are identified by notations of the form *x/y*, where *x* is the column number and *y* is the row number.

The 128 positions of the code table are in one-to-one correspondence with the bit combinations of the 7-bit code. The notation of a code table position, of the form *x/y*, is the same as that of the corresponding bit combination (see § 4).

Each code table position contains a symbol and/or a reference to a clause of this Recommendation. When a code table position corresponds to a bit combination that represents a control character or the character SPACE, the symbol is the acronym of the character allocated; otherwise it is the graphic symbol representing the character allocated, if any. A reference to §§ 4.1.2.2, 4.3.2 or 4.3.3 is denoted by ①, ② or ③ respectively.

Table 10/T.50 is the basic 7-bit code table. It shows the 7-bit coded character set specified in § 4 and indicates the options related to format effectors (§ 4.1.2.2), alternative graphic characters (§ 4.3.2) and national or application-orientated use (§ 4.3.3).

Table 11/T.50 is the code table for the IRV of the 7-bit coded character set. It shows the result of exercising the three identified options in the manner specified in § 6.4.

TABLE 10/T.50

Basic 7-bit code table

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	③	P	③	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	# / £ ②	3	C	S	c	s
0	1	0	0	4	EOT	DC4	¤ / $ ②	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF ①	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT ①	ESC	+	;	K	③	k	③
1	1	0	0	12	FF ①	IS4	,	<	L	③	l	③
1	1	0	1	13	CR ①	IS3	-	=	M	③	m	③
1	1	1	0	14	SO	IS2	.	>	N	③	n	③
1	1	1	1	15	SI	IS1	/	?	O	_	o	DEL

CCITT-12431

① See § 4.1.2.2.

② See § 4.3.2.

③ See § § 4.3.3 and 6.2.3.

TABLE 11/T.50

International Reference Version (IRV)

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	¤	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	IS4	,	<	L	\	l	|
1	1	0	1	13	CR	IS3	-	=	M	]	m	}
1	1	1	0	14	SO	IS2	.	>	N	^	n	‾
1	1	1	1	15	SI	IS1	/	?	O	_	o	DEL

CCITT-12432

8 Description of the control characters

The control characters are listed below in the alphabetical order of their acronyms.

8.1 *ACK Acknowledge*

A transmission control character transmitted by a receiver as an affirmative response to the sender.

8.2 *BEL Bell*

A control character that is used when there is a need to call for attention; it may control alarm or attention devices.

8.3 *BS Backspace*

A format effector which causes the active position to move one character position backwards.

8.4 *CAN Cancel*

A character, or the first character of a sequence, indicating that the data preceding it is in error. As a result, this data shall be ignored. The specific meaning of this character shall be defined for each application and/or between sender and recipient.

8.5 *CR Carriage Return*

A format effector which causes the active position to move to the first character position on the same line.

8.6 *DC1 Device Control One*

A device control character which is primarily intended for turning on or starting an ancillary device. If it is not required for this purpose, it may be used to restore a device to the basic mode of operation (see also DC2 and DC3), or for any other device control function not provided by other DCs.

8.7 *DC2 Device Control Two*

A device control character which is primarily intended for turning on or starting an ancillary device. If it is not required for this purpose, it may be used to set a device to a special mode of operation (in which case DC1 is used to restore the device to the basic mode), or for any other device control function not provided by other DCs.

8.8 *DC3 Device Control Three*

A device control character which is primarily intended for turning off or stopping an ancillary device. This function may be a secondary level stop, for example wait, pause, stand-by or halt (in which case DC1 is used to restore normal operation). If it is not required for this purpose, it may be used for any other ancillary device control function not provided by other DCs.

8.9 *DC4 Device Control Four*

A device control character which is primarily intended for turning off, stopping or interrupting an ancillary device. If it is not required for this purpose, it may be used for any other device control function not provided by other DCs.

8.10 *DEL Delete*

A character used primarily to erase or obliterate an erroneous or unwanted character in punched tape. DEL characters may also serve to accomplish media-fill or time-fill. They may be inserted into, or removed from, a stream of data without affecting the information content of that stream, but such action may affect the information layout and/or the control of equipment.

8.11 *DLE Data Link Escape*

A transmission control character which will change the meaning of a limited number of contiguously following bit combinations. It is used exclusively to provide supplementary transmission control functions. Only graphic characters and transmission control characters can be used in DLE sequences.

8.12 *EM End of Medium*

A control character that may be used to identify the physical end of a medium, or the end of the used portion of a medium, or the end of the wanted portion of data recorded on a medium. The position of this character does not necessarily correspond to the physical end of the medium.

8.13 *ENQ Enquiry*

A transmission control character used as a request for a response from a remote station – the response may include station identification and/or station status. When a "Who are you" function is required on the general switched transmission network, the first use of ENQ after the connection is established shall have the meaning "Who are you" (station identification). Subsequent use of ENQ may, or may not, include the function "Who are you", as determined by agreement.

8.14 *EOT End Of Transmission*

A transmission control character used to indicate the conclusion of the transmission of one or more texts.

8.15 *ESC Escape*

A control character which is used to provide additional characters. It alters the meaning of a limited number of contiguously following bit combinations. The use of this character is specified in ISO Standard 2022.

8.16 *ETB End of Transmission Block*

A transmission control character used to indicate the end of a transmission block of data where data is divided into such blocks for transmission purposes.

8.17 *ETX End of Text*

A transmission control character which terminates a text.

8.18 *FF Form Feed*

A format effector which causes the active position to advance to the corresponding character position on a pre-determined line of the next form or page.

8.19 *HT Horizontal Tabulation*

A format effector which causes the active position to advance to the next pre-determined character position.

8.20 *IS1 (US) Information Separator One (Unit Separator)*

A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a unit.

8.21 *IS2 (RS) Information Separator Two (Record Separator)*

A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a record.

8.22 *IS3 (GS) Information Separator Three (Group Separator)*

A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a group.

8.23 *IS4 (FS) Information Separator Four (File Separator)*

A control character used to separate and qualify data logically; its specific meaning has to be defined for each application. If this character is used in hierarchical order as specified in the general definition of IS, it delimits a data item called a file.

8.24 *LF Line Feed*

A format effector which causes the active position to advance to the corresponding character position of the next line.

8.25 *NAK Negative Acknowledge*

A transmission control character transmitted by a receiver as a negative response to the sender.

8.26 *NUL Null*

A control character used to accomplish media-fill or time-fill. NUL characters may be inserted into, or removed from, a stream of data without affecting the information content of that stream, but such action may affect the information layout and/or the control of equipment.

8.27 *SI Shift-In*

A control character which is used in conjunction with SO and ESC to extend the graphic character set of the code. It may reinstate the standard meanings of the bit combinations which follow it. The effect of this character when using code extension techniques is described in ISO Standard 2022.

8.28 *SO Shift-Out*

A control character which is used in conjunction with SI and ESC to extend the graphic character set of the code. It may alter the meaning of the bit combinations 2/1 to 7/14 which follow it until a SI character is reached. The effect of this character when using code extension techniques is described in ISO 2022.

8.29 *SOH Start Of Heading*

A transmission control character used as the first character of a heading of an information message.

8.30 *STX Start of Text*

A transmission control character which precedes a text and which is used to terminate a heading.

8.31 *SUB Substitute character*

A control character used in the place of a character that has been found to be invalid or in error. SUB is intended to be introduced by automatic means.

8.32 *SYN Synchronous idle*

A transmission control character used by a synchronous transmission system in the absence of any other character (idle condition) to provide a signal from which synchronism may be achieved or retained between data terminal equipment.

8.33 *VT Vertical Tabulation*

A format effector which causes the active position to advance to the corresponding character position on the next pre-determined line.

APPENDIX I

(to Recommendation T.50)

Guidelines for standards derived from
Recommendation T.50 (ISO Standard 646)

I.1 *General*

When national or application-orientated standards based on Recommendation T.50/ISO 646 are drafted, it is recommended to take account of the following considerations.

I.2 *Structure of a standard*

It is recommended to adopt the same structure and editorial style as implemented for Recommendation T.50/ISO 646. All facilities, restrictions and specifications of the standard should be stated clearly in sentences using plain language, rather than be summarized by tables with notes.

I.2.1 *Control functions*

The standard should contain explicit descriptions of the control functions. Even where those descriptions are identical to the descriptions in § 8, they should be explicit descriptions, not just referenced to Recommendation T.50/ISO 646. For application-orientated standards specific meanings of the Information Separators and of the Device Controls should be defined.

I.2.2 *Graphic characters* (see § 6.2.3)

Where there is no need for particular characters, the graphic characters of the International Reference Version (IRV) should be allocated to the same positions and with the same name as in Recommendation T.50/ISO 646.

I.2.3 *Composite graphic characters and repertoire* (see § 5)

Recommendation T.50/ISO 646 permits the construction of composite graphic characters by using the control characters BACKSPACE and CARRIAGE RETURN so as to image two or more graphic characters at the same character position.

The total number of graphic characters which can be obtained from any version of the character set, with or without using this facility, is called the repertoire. Recommendation T.50/ISO 646 does not define a particular repertoire. However, as the interpretation and/or the imaging of composite characters may cause difficulties, agreement between sender and recipient of the data may be required. In order to avoid the necessity of such agreement and to facilitate interchange, national or application-orientated standards may specify a standard repertoire of graphic characters and thus recognize only a limited number of composite graphic characters. Such limitations are considered fully compatible with Recommendation T.50/ISO 646.

I.2.4 *Versions*

In a standard one or more versions can be specified. It should be noted that a version is not a standard but only part of a standard. The standard itself consists of the well defined version or versions and a set of clauses as mentioned above. The definition of a version requires that the options mentioned in § 6.1 be accurately exercised.

CODED CHARACTER SETS FOR TELEMATIC SERVICES

(Malaga-Torremolinos, 1984)

1 Scope

1.1 The CCITT

considering

(a) the increasing interdependence of the various CCITT character sets and coding schemes in various telematic services;

(b) the introduction of new facilities such as code conversion and interworking between various telematic services;

(c) the convenience of having all relevant CCITT Recommendations on character sets and coding schemes compiled in one series of Recommendations;

(d) that Recommendations T.61 and T.100 define the character coding systems for Teletex and Videotex;

(e) that Recommendation T.50 specifies the International Reference Version (IRV) of the 7-bit coded character set,

provides the following Recommendation as a reference document

from which coded character subsets and elements of code extension mechanisms can be derived for individual telematic services.

1.2 This Recommendation specifies a primary set and a supplementary set of graphic characters which are to be the respective supersets of primary and supplementary character sets used in various telematic services. When various telematic services restrict their primary and supplementary sets to be respective subsets of those given in this Recommendation, it will be ensured that no code position in any of the specified code tables is assigned more than one meaning within different telematic services.

1.3 This Recommendation gives the escape sequences for designating the primary and supplementary sets of graphic characters, to be used according to the code extension techniques specified.

1.4 Additional sets of graphic characters will be subject to further inclusion in this Recommendation once they become applicable to more than one CCITT telematic service.

1.5 This Recommendation describes those code extension mechanisms that are relevant to existing telematic services. Additional mechanisms will be included in this Recommendation as the need for such is identified for one or more telematic services. The purpose of this Recommendation is to include an up-to-date reference superset of all code extension mechanisms used by character coding systems in various telematic services.

1.6 In this Recommendation 7-bit code tables are described which can be used either in a 7-bit or in an 8-bit environment, with applicable code extension mechanisms that are given in other Recommendations specific to given telematic services.

1.7 There is no conformance clause in this Recommendation specifying the mandatory and optional subsets of code extension mechanisms and coded character sets. Conformance requirements will be the subject of other CCITT Recommendations specific to particular telematic services.

2 Graphic character sets

2.1 *Primary set*

2.1.1 The primary set of graphic characters specified in Figure 1/T.51 is identical with the set of graphic characters of the International Reference Version (IRV) of the 7-bit coded character set of Recommendation T.50.

A number of notes are associated with this primary set which are specific to Teletex or Videotex.

2.1.2 The names and code representations of the primary set characters are given in Table 1/T.51.

2.1.3 The primary set is designated as G0 by the sequence ESC 2/8 4/0. It can also be alternatively designated as G1, G2 or G3 by the sequences ESC 2/9 4/0, ESC 2/10 4/0 or ESC 2/11 4/0 respectively. See § 3 of this Recommendation for details on code extension techniques.

2.2 *Supplementary set*

2.2.1 The supplementary set of graphic characters specified in Figure 2/T.51 is a superset of the supplementary set given in Recommendations T.61 and that given in Recommendation T.100.

A number of notes are associated with this supplementary set which are specific to Teletex or Videotex.

2.2.2 Unallocated code positions are subject to future standardization and will be allocated when a need for such is identified in one or more telematic services.

2.2.3 The names and code representations of the supplementary set characters are given in Table 2/T.51.

2.2.4 The supplementary set is designated as G2 by the sequence ESC 2/10 6/2. It can be alternatively designated as G0, G1 or G3 by the sequences ESC 2/8 6/2, ESC 2/9 6/2 or ESC 2/11 6/2 respectively. See § 3 of this Recommendation for details on code extension techniques.

2.2.5 *Notes on the primary and supplementary sets of graphic characters for Figures 1/T.51 and 2/T.51, and Tables 1/T.51 and 2/T.51*

In the figures the number of the Note being referred to is encircled.

Note 1 – All the characters in column 4 of the supplementary set are non-spacing characters. They are all diacritical marks with the exception of 4/12.

Note 2 – Cross-shaded code positions are reserved for future standardization by the CCITT.

Note 3 – Terminals used for CCITT defined telematic services should send only the codes 2/6 and 2/8 of the supplementary set for the number sign and currency sign, respectively. When receiving codes 2/3 and 2/4 from the primary set of graphic characters, terminals should interpret them as # and ¤ respectively.

Note 4 – Terminals used for CCITT defined telematic services should send only the codes 4/1 of the supplementary set followed by SPACE for a stand-alone grave accent, 4/3 of the supplementary set followed by SPACE for a stand-alone circumflex accent, and 4/4 of the supplementary set followed by SPACE for a stand-alone tilde. Whenever a telematic terminal is capable of receiving and interpreting codes 6/0, 5/14 and 7/14 from the primary set of graphic characters, terminals shall interpret them as □̀, □̂ and □̃, respectively.

Note 5 – This code position is reserved.

Note 6 – In certain interactive Videotex systems the code 5/15 of the primary set is used as a terminator for data input field transmitted from terminal to host. Its graphic representation may be different from "low line".

3 Code extension technique

3.1 *General*

3.1.1 Code extension techniques are required for the designation of various graphic or control character sets and their invocation in the 7-bit set or 8-bit set in use. Such techniques are derived from ISO Standard 2022 and ISO/DIS 2022 (November 1983).

3.1.2 This Recommendation describes only those code extension techniques currently specified for existing telematic services. Additional techniques will be further incorporated as they are identified for use in one or more telematic services.

b4	b3	b2	b1	b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
					0	1	2	3	4	5	6	7
0	0	0	0	0				0	@	P	` ④	p
0	0	0	1	1			!	1	A	Q	a	q
0	0	1	0	2			"	2	B	R	b	r
0	0	1	1	3			# ③	3	C	S	c	s
0	1	0	0	4			¤ ③	4	D	T	d	t
0	1	0	1	5			%	5	E	U	e	u
0	1	1	0	6			&	6	F	V	f	v
0	1	1	1	7			'	7	G	W	g	w
1	0	0	0	8			(	8	H	X	h	x
1	0	0	1	9			)	9	I	Y	i	y
1	0	1	0	10			*	:	J	Z	j	z
1	0	1	1	11			+	;	K	[	k	{
1	1	0	0	12			,	<	L	\	l	|
1	1	0	1	13			-	=	M	]	m	}
1	1	1	0	14			.	>	N	^ ④	n	‾ ④
1	1	1	1	15			/	?	O	_ ⑥	o	

CCITT-44101

Note — Notes to this figure are contained in § 2.2.5.

FIGURE 1/T.51

The primary set of graphic characters for telematic services

(coded representation when invoked in columns 2-7 of the code table)

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0				°	②	―	Ω	ĸ
0	0	0	1	1			¡	±	`	¹	Æ	æ
0	0	1	0	2			¢	²	´	®	Đ	đ
0	0	1	1	3			£	³	^	©	ª	ð
0	1	0	0	4			$	×	~	™	Ħ	ħ
0	1	0	1	5			¥	µ	¯	♪	②	ı
0	1	1	0	6			#	¶	˘	②	Ĳ	ĳ
0	1	1	1	7			§	·	˙	②	Ŀ	ŀ
1	0	0	0	8			¤	÷	¨	②	Ł	ł
1	0	0	1	9			‘	’	⑤	②	Ø	ø
1	0	1	0	10			“	”	˚	②	Œ	œ
1	0	1	1	11			«	»	¸	②	º	ß
1	1	0	0	12			←	¼	_	⅛	Þ	þ
1	1	0	1	13			↑	½	˝	⅜	Ŧ	ŧ
1	1	1	0	14			→	¾	˛	⅝	Ŋ	ŋ
1	1	1	1	15			↓	¿	ˇ	⅞	ŉ	
									①			

CCITT-44112

Note — Notes to this figure are contained in § 2.2.5.

FIGURE 2/T.51

The supplementary set of graphic characters for telematic services

(coded representation when invoked in columns 2-7 of the code table)

TABLE 1/T.51

Primary set of graphic characters

Position	Graphic	Name or Description	Position	Graphic	Name or Description	Position	Graphic	Name or Description
2/1	!	Exclamation mark	4/0	@	Commercial at	6/0	`	Grave accent (See Note 4)
2/2	"	Quotation mark	4/1	A	Capital A	6/1	a	Small a
2/3	#	(See Note 3)	4/2	B	Capital B	6/2	b	Small b
2/4	¤	(See Note 3)	4/3	C	Capital C	6/3	c	Small c
2/5	%	Percent sign	4/4	D	Capital D	6/4	d	Small d
2/6	&	Ampersand	4/5	E	Capital E	6/5	e	Small e
2/7	'	Apostrophe	4/6	F	Capital F	6/6	f	Small f
2/8	(	Left parenthesis	4/7	G	Capital G	6/7	g	Small g
2/9	)	Right parenthesis	4/8	H	Capital H	6/8	h	Small h
2/10	*	Asterisk	4/9	I	Capital I	6/9	i	Small i
2/11	+	Plus sign	4/10	J	Capital J	6/10	j	Small j
2/12	,	Comma	4/11	K	Capital K	6/11	k	Small k
2/13	–	Hyphen or minus sign	4/12	L	Capital L	6/12	l	Small l
2/14	.	Full stop, period	4/13	M	Capital M	6/13	m	Small m
2/15	/	Solidus	4/14	N	Capital N	6/14	n	Small n
3/0	0	Digit 0	4/15	O	Capital O	6/15	o	Small o
3/1	1	Digit 1	5/0	P	Capital P	7/0	p	Small p
3/2	2	Digit 2	5/1	Q	Capital Q	7/1	q	Small q
3/3	3	Digit 3	5/2	R	Capital R	7/2	r	Small r
3/4	4	Digit 4	5/3	S	Capital S	7/3	s	Small s
3/5	5	Digit 5	5/4	T	Capital T	7/4	t	Small t
3/6	6	Digit 6	5/5	U	Capital U	7/5	u	Small u
3/7	7	Digit 7	5/6	V	Capital V	7/6	v	Small v
3/8	8	Digit 8	5/7	W	Capital W	7/7	w	Small w
3/9	9	Digit 9	5/8	X	Capital X	7/8	x	Small x
3/10	:	Colon	5/9	Y	Capital Y	7/9	y	Small y
3/11	;	Semicolon	5/10	Z	Capital Z	7/10	z	Small z
3/12	<	Less-than sign	5/11	[	Left square bracket	7/11	{	Left curly bracket
3/13	=	Equal sign	5/12	\	Reverse solidus	7/12	|	Vertical line
3/14	>	Greater-than sign	5/13	]	Right square bracket	7/13	}	Rigth curly bracket
3/15	?	Question mark	5/14	^	Circumflex accent (See Note 4)	7/14	‾	Tilde, overline (See Note 4)
			5/15	_	Low line			

Note – The notes referred to in this table are contained in § 2.2.5.

TABLE 2/T.51

Supplementary set of graphic characters

Position	Graphic [a]	Name or Description	Position	Graphic [a]	Name or Description	Position	Graphic [a]	Name or Description
2/1	¡	Inverted exclamation mark	4/0		(See Note 2)	6/0	Ω	Ohm sign
2/2	¢	Cent sign	4/1	□̀	Grave accent	6/1	Æ	Capital Æ diphthong
2/3	£	Pound sign	4/2	□́	Acute accent	6/2	Đ	Capital D with stroke
2/4	$	Dollar sign	4/3	□̂	Circumflex accent	6/3	ª	Ordinal indicator, feminine
2/5	¥	Yen sign	4/4	□̃	Tilde	6/4	Ħ	Capital H with stroke
2/6	#	Number sign	4/5	□̄	Macron	6/5		(See Note 2)
2/7	§	Section sign	4/6	□̆	Breve	6/6	Ĳ	Capital IJ ligature
2/8	¤	Currency symbol	4/7	□̇	Dot	6/7	Ŀ	Capital L with middle dot
2/9	‘	Single quotation mark left	4/8	□̈	Diaeresis or umlaut mark	6/8	Ł	Capital L with stroke
2/10	“	Double quotation mark left	4/9		(See Note 5)	6/9	Ø	Capital O with slash
2/11	«	Angle quotation mark left	4/10	□̊	Ring	6/10	Œ	Capital Œ ligature
2/12	←	Leftward arrow	4/11	□̧	Cedilla	6/11	º	Ordinal indicator, masculine
2/13	↑	Upward arrow	4/12	□̲	Non-spacing underline	6/12	Þ	Capital thorn, Icelandic
2/14	→	Rightward arrow	4/13	□̋	Double accute accent	6/13	Ŧ	Capital T with stroke
2/15	↓	Downward arrow	4/14	□̨	Ogonek	6/14	Ŋ	Capital eng, Lapp
3/0	°	Degree sign	4/15	□̌	Caron	6/15	ŉ	Small n with apostrophe
3/1	±	Plus/minus sign	5/0	―	Horizontal bar	7/0	ĸ	Small k, Greenlandic
3/2	²	Superscript 2	5/1	¹	Superscript one	7/1	æ	Small æ diphthong
3/3	³	Superscript 3	5/2	®	Registered sign	7/2	đ	Small d with stroke
3/4	×	Multiply sign	5/3	©	Copyright sign	7/3	ð	Small eth, Icelandic
3/5	µ	Micro sign	5/4	TM	Trade mark sign	7/4	ħ	Small h with stroke
3/6	¶	Paragraph sign, pilcrow	5/5	♪	Music note	7/5	ı	Small i without dot
3/7	·	Middle dot	5/6		(See Note 2)	7/6	ĳ	Small ij ligature
3/8	÷	Divide sign	5/7		(See Note 2)	7/7	ŀ	Small l with middle dot
3/9	’	Single quotation mark right	5/8		(See Note 2)	7/8	ł	Small l with stroke
3/10	”	Double quotation mark right	5/9		(See Note 2)	7/9	ø	Small o with slash
3/11	»	Angle quotation mark right	5/10		(See Note 2)	7/10	œ	Small oe ligature
3/12	¼	Fraction one quarter	5/11		(See Note 2)	7/11	ß	Small sharp s, German
3/13	½	Fraction one half	5/12	⅛	Fraction one eighth	7/12	þ	Small thorn, Icelandic
3/14	¾	Fraction three quarters	5/13	⅜	Fraction three eighths	7/13	ŧ	Small t with stroke
3/15	¿	Inverted question mark left	5/14	⅝	Fraction five eighths	7/14	ŋ	Small eng, Lapp
			5/15	⅞	Fraction seven eighths			

[a] Diacritical marks are illustrated together with a rectangle representing the relative position of the graphic character with which they are normally associated.

Note – The Notes referred to in this table can be found in § 2.2.5.

3.2 *Definitions*

For the purpose of code extension techniques given in this Recommendation, the following definitions apply.

3.2.1 **bit combination**

An ordered set of bits used for the representation of characters.

3.2.2 **byte**

A bit string that is operated upon as a unit and the size of which is independent of redundancy or framing techniques.

3.2.3 **character**

A member of a set of elements used for the organization, control or representation of data.

3.2.4 **coded character set; code**

A set of unambiguous rules that establishes a character set and the one-to-one relationship between the characters of the set and their bit combinations.

3.2.5 **code extension**

The techniques for the encoding of characters that are not included in the character set of a given code.

3.2.6 **code table**

A table showing the character allocated to each bit combination in a code.

3.2.7 **control character**

A control function the coded representation of which consists of a single bit combination.

3.2.8 **control function**

An action that affects the recording, processing, transmission or interpretation of data and that has a coded representation consisting of one or more bit combinations.

3.2.9 **to designate**

To identify a set of characters that are to be represented, in some cases immediately and in others on the occurrence of a further control function, in a prescribed manner.

3.2.10 **environment**

The characteristic that identifies the number of bits used to represent a character in a data processing or data communication system or in part of such a system.

3.2.11 **escape sequence**

A bit string that is used for control purposes in code extension procedures and that consists of two or more bit combinations. The first of these bit combinations represents the character ESCAPE (1/11).

3.2.12 **final character**

The character the bit combination of which terminates an escape sequence.

3.2.13 **graphic character**

A character, other than a control function, that has a visual representation normally handwritten, printed or displayed.

3.2.14 **intermediate character**

A character the bit combination of which occurs between that of the ESCAPE character and that of the Final character in an escape sequence consisting of more than two bit combinations.

3.2.15 **to invoke**

To cause a designated set of characters to be represented by the prescribed bit combinations whenever those bit combinations occur, until an appropriate code extension function occurs.

3.2.16 **position**

That part of a code table identified by its column and row coordinates.

3.2.17 **to represent**

a) to use a prescribed bit combination with the meaning of a character in a set of characters that has been designated and invoked; or

b) to use an escape sequence with the meaning of an additional control function.

3.3 *Code extension facilities*

These are depicted in Figure 3/T.51 for the 7-bit environment and Figure 4/T.51 for the 8-bit environment. They include the following functions.

a) designation and invocation of control sets C0 and C1 by means of the relevant escape sequences given in § 3.4;

b) designation of a graphic character set G0 by means of the relevant escape sequence given in § 3.4;

c) designation of up to three additional G-sets called G1, G2 and G3 by means of the relevant escape sequences given in § 3.4;

d) invocation of the designated graphic sets, by means of locking and/or non-locking shift functions, given in § 3.5;

e) designation and invocation of a complete code by means of the relevant escape sequence given in § 3.4.

3.4 *Types of character sets*

There are a number of different types of control and graphic character sets that can be designated and invoked for use in the 7-bit or 8-bit environment. These are listed in Table 3/T.51 and defined below. A given control or graphic character set can be designated by an escape sequence terminated by a Final character F from bit combination 4/0 to 7/14, specific to the character set to be designated. Final characters are allocated by ISO and registered in the ISO "International register of coded character sets to be used with escape sequences."

3.4.1 C0 set of 32 control characters (bit combinations 0/0 to 1/15). A C0 set is designated and invoked by the sequence ESC 2/1 F, where F identifies a registered C0 set.

3.4.2 C1 set of 32 control characters (bit combinations 8/0 to 9/15 in an 8-bit environment, or ESC 4/0 to ESC 5/15 in a 7-bit environment). A C1 set is designated and invoked by the sequence ESC 2/2 F, where F identifies a registered C1 set.

3.4.3 G0 set of 94 graphic characters (bit combinations 2/1 to 7/14).

3.4.4 G1, G2 and G3 sets of 94 graphic characters (bit combinations 2/1 to 7/14 or 10/1 to 15/14). A registered set of 94 graphic characters can be designated by the escape sequence ESC 2/8 F, ESC 2/9 F, ESC 2/10 F or ESC 2/11 F in order to be used as a G0, G1, G2 or G3 set respectively, where F identifies the designated set.

3.4.5 G1, G2 and G3 sets of 96 graphic characters (bit combinations 2/0 to 7/15 or 10/0 to 15/15). A registered set of 96 graphic characters can be designated by the escape sequence ESC 2/13 F, ESC 2/14 F or ESC 2/15 F in order to be used as a G1, G2 or G3 set respectively, where F identifies the designated set.

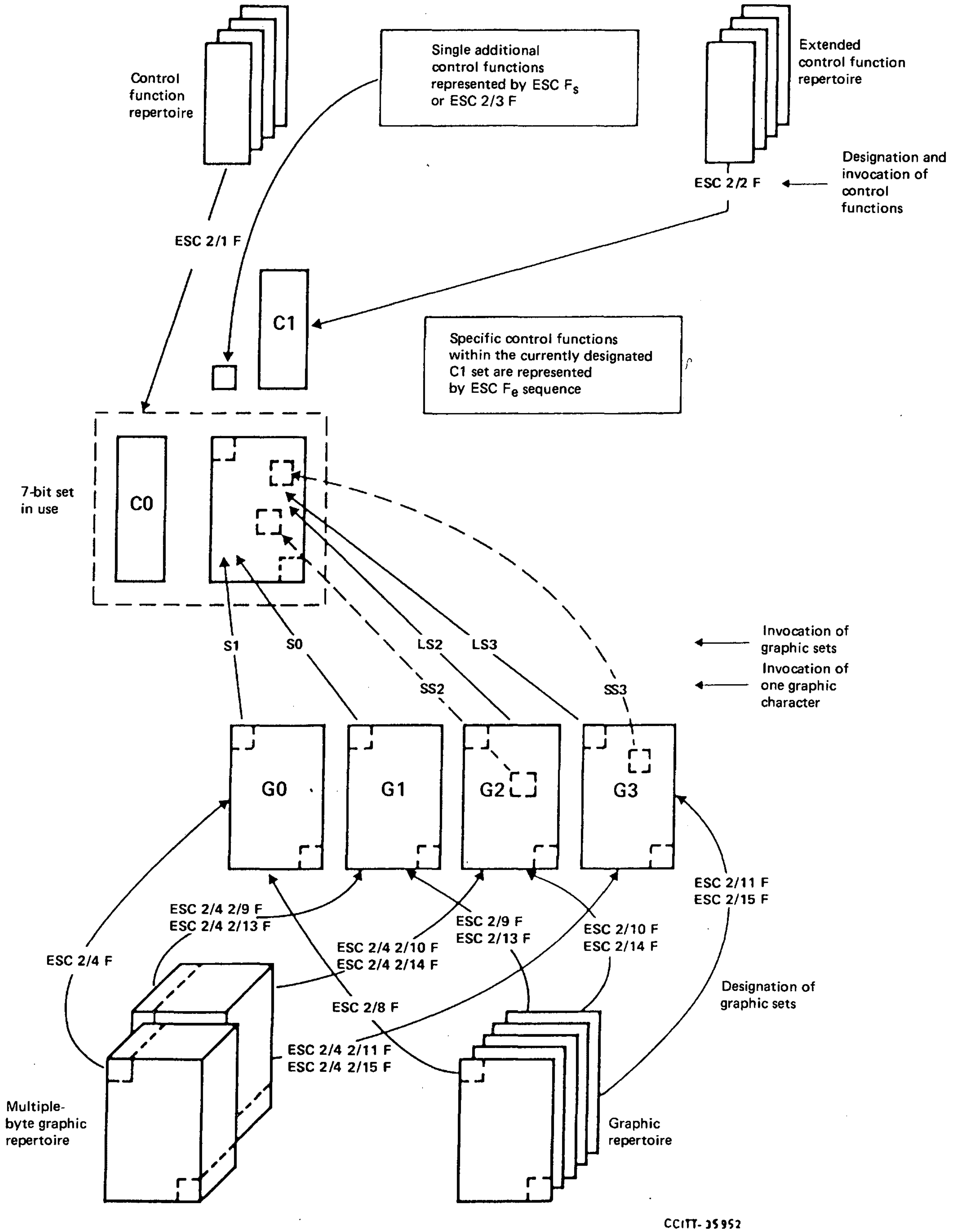


FIGURE 3/T.51

Code extension in 7-bit environment

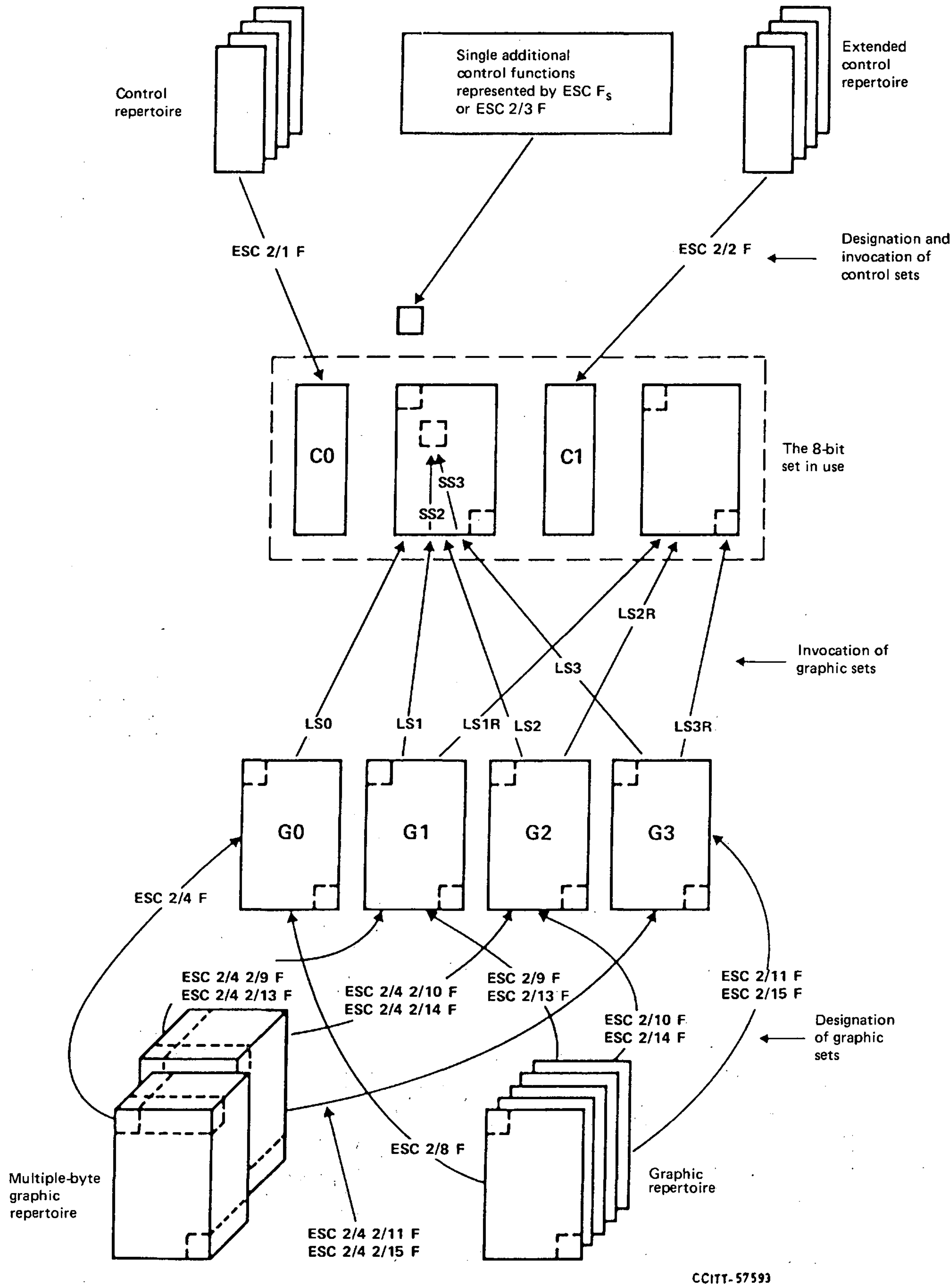


FIGURE 4/T.51

Code extension in 8-bit environment

3.4.6 Multiple-byte G0 set of more than 94 graphic characters each represented by more than one bit combinations from 2/1 to 7/14.

3.4.7 Multiple-byte G1, G2 and G3 sets of more than 94 graphic characters each represented by more than one bit combination from 2/1 to 7/14 or from 10/1 to 15/14. A registered multiple-byte set of more than 94 graphic characters can be designated by the escape sequence ESC 2/4 F, ESC 2/4 2/9 F, ESC 2/4 2/10 F or ESC 2/4 2/11 F in order to be used as a G0, G1, G2 or G3 set respectively, where F identifies the designated set.

3.4.8 Multiple-byte G1, G2 and G3 sets of more than 96 graphic characters each represented by more than one bit combination from 2/0 to 7/15 or from 10/0 to 15/15. A registered multiple-byte set of this type identified by a Final character F can be designated by the escape sequence ESC 2/4 2/13 F, ESC 2/4 2/14 F or ESC 2/4 2/15 F in order to be used as G1, G2 or G3 set respectively.

3.4.9 Complete code containing all bit combinations 0/0 to 7/15 in 7-bit environment, or 0/0 to 15/15 in 8-bit environment. A complete code identified by a Final character F, can be designated and invoked by the escape sequence ESC 2/5 F.

TABLE 3/T.51

Types of character sets

Description	Character set	Designation sequence	Bit combinations	
			7-bit environment	8-bit environment
Sets of 32 control characters	C0 C1	ESC 2/1 F ESC 2/2 F	0/0 to 1/15 ESC 4/1 to ESC 5/15	0/0 to 1/15 8/0 to 9/15
Sets of 94 graphic characters	G0	ESC 2/8 F	2/1 to 7/14	2/1 to 7/14
	G1 G2 G3	ESC 2/9 F ESC 2/10 F ESC 2/11 F	2/1 to 7/14	2/1 to 7/14 or 10/1 to 15/14
Sets of 96 graphic characters	G1 G2 G3	ESC 2/13 F ESC 2/14 F ESC 2/15 F	2/0 to 7/15	2/0 to 7/15 or 10/1 to 15/15
Sets of more than 94 graphic characters each represented by more than one byte	G0	ESC 2/4 F	2/1 to 7/14	2/1 to 7/14
	G1 G2 G3	ESC 2/4 2/9 F ESC 2/4 2/10 F ESC 2/4 2/11 F	2/1 to 7/14	2/1 to 7/14 or 10/1 to 15/14
Sets of more than 96 graphic characters each represented by more than one byte	G1 G2 G3	ESC 2/4 2/13 F ESC 2/4 2/14 F ESC 2/4 2/15 F	2/0 to 7/15	2/0 to 7/15 or 10/0 to 15/15
Complete code		ESC 2/5 F	0/0 to 7/15	0/0 to 15/15

Note – Control sets C0 and C1, and complete codes are simultaneously designated and invoked by the relevant escape sequences indicated.

3.5 *Invocation functions*

Following the designation of a G0, G1, G2 or G3 set as specified in § 3.4, any one of these sets will require invocation into the 7-bit or 8-bit in-use code table. This is performed by the use of either locking shift functions or non-locking shift functions listed in Table 4/T.51. Coding for these functions is given in Table 5/T.51.

3.5.1 *Use of locking shift functions*

There are seven locking shift functions as given in Tables 4/T.51 and 5/T.51. A locking shift function invokes the relevant G0, G1, G2 or G3 set into columns 2 to 7 or into columns 10 to 15 (8-bit code only) in order to replace the previously invoked G-set. The occurrence of a locking shift function shall not affect those bit combinations that are included in any escape sequence or those that follow single shift function SS2 or SS3. If a particular set has already been invoked, use of the corresponding locking shift function has no effect.

3.5.2 *Use of single shift functions*

The single shift function SS2 shall invoke one character from the last designated G2 set. Similarly SS3 shall invoke one character from the last designated G3 set. In the case of using single-byte graphic sets, these invocations alter the meaning of the immediately following bit combination only and ascribe to it the meaning of the corresponding bit combination of the G2 or G3 set. The bit combination permitted to follow SS2 or SS3 is limited to one from columns 2 to 7. If a single-shift function is used to invoke a character from a multiple-byte set, the shift function will affect two or more bit-combinations to represent that character. The use of a single-shift function does not affect the current shift status established by a locking-shift function.

TABLE 4/T.51

Allocation of shift functions to the graphic character sets to be invoked

	Locking shift functions		Non-locking shift functions
A set	Columns 2 to 7 of 7-bit or 8-bit code	Columns 10 to 15 of 8-bit code	Columns 2 to 7 of 7-bit or 8-bit code
G0	SI(7-bit), LS0(8-bit)	–	–
G1	SO(7-bit), LS1(8-bit)	LS1R	–
G2	LS2	LS2R	SS2
G3	LS3	LS3R	SS3

TABLE 5/T.51

Coding for shift functions

Shift function		Coding
Single-shift two	SS2	1/9
Single-shift three	SS3	1/13
Shift in SI(7-bit), locking-shift zero	LS0(8-bit)	0/15
Shift out SO(7-bit), locking-shift one	LS1(8-bit)	0/14
Locking-shift one right	LS1R	ESC 7/14
Loching-shift two	LS2	ESC 6/14
Locking-shift two right	LS2R	ESC 7/13
Locking-shift three	LS3	ESC 6/15
Locking-shift three right	LS3R	ESC 7/12

Recommendation T.60

TERMINAL EQUIPMENT FOR USE IN THE TELETEX SERVICE

(Geneva, 1980; amended at Malaga-Torremolinos, 1984)

1 Scope of Recommendations concerning the Teletex service

1.1 This Recommendation defines the requirements for terminal equipment used in the international Teletex service.

1.2 The rules to be followed in the Teletex service are defined in Recommendation F.200.

1.3 The character repertoire and the coded character sets for the Teletex service are defined in Recommendation T.61.

1.4 All Teletex terminals have to communicate with unique procedures that are described as follows:

a) the interface to the transport network is defined in this Recommendation, see § 6;

b) the transport end-to-end control procedure is defined in Recommendation T.70;

c) the Teletex control procedures are defined in Recommendation T.62.

1.5 Requirements for terminals providing mixed-mode capability are specified in Recommendation T.72.

2 Introduction

2.1 With the aid of a Teletex terminal it is possible to produce character-coded texts and to transmit their true contents and form to a receiving terminal.

2.2 A Teletex terminal, operating in the local mode, can also be used like a typewriter to prepare ordinary office documents. By means of the Teletex communication facilities, the text thus prepared can be transmitted to other Teletex terminals or received from them.

2.3 In this Recommendation *text* refers to character-coded text only.

2.4 Terminals can have various degrees of complexity. Within this Recommendation the emphasis is on requirements for correct interworking of different terminals.

2.5 Details are given on dimensions and positioning of text. Various dimensions refer to the presentation of text on paper. In this respect, paper formats of both 210 × 297 mm (ISO A4) and 216 × 280 mm are taken into account. Other paper sizes are included as options.

2.6 Terminals fulfilling the requirements denoted as *basic requirements* can participate in the Teletex service on a defined level of compatibility.

3 General characteristics of the terminal equipment

3.1 *Basic characteristics*

3.1.1 The Teletex terminal allows text to be communicated from any subscriber to any other subscriber.

3.1.2 All terminals participating in the international Teletex service have to be compatible with one another at the basic level defined in this Recommendation. Additional optional functions may be invoked.

3.1.3 In order to support a high grade of service, a user data rate of 2.4 kbit/s on the subscriber line is recommended wherever possible. Detailed arrangements on a national level are left to the Administrations concerned, as it is recognized that national implementation of the Teletex service on various types of network may involve national operation at different data throughput rates.

3.1.4 When operated in the local mode, e.g. when the Teletex terminal is used in the same way as an office typewriter, the operation in the local mode should not be interrupted by incoming traffic. However, under *receive store full* conditions, the production of a permanent copy of the incoming messages must have priority over the local mode.

3.1.5 In the sending mode, the Teletex terminal must be capable of sending a selection of characters that belong to the basic repertoire of graphic characters.

3.1.6 In the receiving mode, the Teletex terminal must be capable of receiving into store all characters from the basic repertoire of graphic characters.

3.1.7 The presentation device of the terminal must have the ability to represent as legibly as possible all graphic characters of the basic international Teletex character repertoire.

3.1.8 The terminal must have the ability to respond to the control functions of the basic international Teletex repertoire.

3.1.9 The use of graphic character repertoires other than the Teletex basic repertoire of graphic characters is subject to ascertaining the mutual capability of the terminals and has to be initiated by the appropriate procedural steps.

3.1.10 The page is the basis for text formatting and text transmission.

3.1.11 The terminal must be able to handle paper formats in both the vertical and horizontal orientation (see § 4.2 below).

3.1.12 A printable area of the page is defined within which free positioning of the text is possible during local text preparation (see § 4.2 below).

3.1.13 After transmission, the content, layout and format of a Teletex message must be identical at the transmitting and the receiving terminals, when using the defined basic mode of Teletex operation.

3.1.14 The Teletex terminal must be provided with storage for transmitting and receiving functions. See § 5.2 for further details.

3.1.15 The Teletex terminal must provide means for *fully automatic operation* (see definitions in Recommendation F.200).

3.1.16 For the purpose of automatic operation, an internationally agreed unique terminal identification must be provided (see § 5.1 for further details).

3.1.17 The basic Teletex terminal should provide the capability of interworking with telex. Necessary constraints on the Teletex terminal are defined in § 8.

3.1.18 Teletex terminals shall incorporate all functions defined as basic for the Teletex service in § 3.2 below. In addition, optional functions can be incorporated. In this Recommendation, the optional functions are divided into CCITT-standardized options (§ 3.3) and nationally and/or privately specified options (§ 3.4).

3.1.19 This Recommendation does not specify requirements for receive-only terminals. However, it is not intended to exclude such terminals.

3.2 *Basic functions*

3.2.1 A terminal shall be capable of handling:

a) the end-to-end control procedures as defined in Recommendations T.62 and T.70;
b) the appropriate network-dependent procedure, see § 6;
c) the Teletex basic graphic character repertoire;
d) the Teletex basic control function repertoire;
e) text in the basic vertical and horizontal page formats;
f) subscripts and superscripts.

3.2.2 Basic text formatting functions for printers (or other presentation devices as applicable) are as follows:

a) vertical and horizontal page orientation;
b) printable area common to ISO A4 and 216 × 280 mm paper formats;
c) character spacing of 2.54 mm (10 characters per 25.4 mm);
d) line feed parameter values of 0.5, 1, 1.5 and 2 spacings of 4.233 mm (six spacings of 4.233 mm equals 25.4 mm);
e) free positioning of text within the printable area using the Teletex basic repertoire of graphic characters and control functions;
f) partial line up and partial line down functions (for presenting superscript and subscript).

3.2.3 The following Teletex service requirements must be met:

a) terminal identification;

b) storage for receiving and transmitting functions;

c) provisions for a permanent copy (not necessarily on paper) of all text received;

d) provisions for interworking with the telex service.

Note – The use of the terminal identification (transmission, reception) is a matter for the communication procedure (see Recommendation T.62).

3.3 *CCITT-standardized optional functions*

3.3.1 The possibility of using optional functions can be negotiated between terminals during a handshaking procedure in the end-to-end control procedure (see Recommendation T.62).

3.3.2 As the service develops, additions and changes to the CCITT-standardized optional functions listed below may be needed.

3.3.3 For the optional functions of the communication control procedures, see Recommendations T.62 and T.70.

3.3.4 Optional text formatting functions for printers (or other presentation devices as applicable) are to be found in:

a) Annex B to this Recommendation;

b) Annex E to Recommendation T.61.

3.3.5 Alternative character repertoires may be invoked by designation of CCITT-registered national and/or application-oriented character repertoires.

Note – The definition and designation of CCITT-registered national and/or application-oriented character repertoires is a matter for study in the future.

3.3.6 Facsimile mode of operation requires further study. Possible applications are:

a) communication of facsimile coded text on a per page basis;

b) communication of mixed character-coded and facsimile-coded information within the same page.

3.4 *Optional functions for national standardization or private use*

3.4.1 The CCITT standardization includes the necessary rules and means for indication of or escape into functions specified nationally or for private use (see standardized options in Recommendation F.200).

3.5 *Default conditions*

3.5.1 In the absence of specific indication, the receiving terminal shall assume the following conditions:

a) communication (as specified in Recommendation T.62):

- one way (calling terminal is transmitting text),
- normal document;

b) character repertoire – basic international Teletex character repertoire;

c) text presentation:

- vertical basic page format,
- character spacing of 2.54 mm,
- line-feed spacing of 4.23 mm (single spacing),
- default rendition.

4 Text handling

4.1 *Character repertoire*

4.1.1 The terminal, participating in the international Teletex service, can exchange text with all other Teletex terminals. To enable this communication, the international Teletex basic graphic character and control function repertoires, as defined in Recommendation T.61, shall be used.

4.1.2 On an optional basis a terminal can use other national and/or application-oriented character repertoires registered by CCITT. The rules for the code extension technique are described in Recommendation T.61.

4.2 *Paper sizes and printable areas*

4.2.1 If the Teletex terminal is capable of printing text on paper, it has to act like a normal office typewriter. Therefore the following applies.

4.2.2 There are countries that use ISO A4 paper size (210 × 297 mm) or North-American paper size (216 × 280 mm) of which the common area is 210 × 280 mm.

4.2.3 Printable areas are defined for both the vertical and horizontal orientation of the paper, and are expressed by the number of line positions and character positions shown in Table 1/T.60.

4.2.4 The printable areas include an allowance for printing with an offset of 2.12 mm above the first base line and 2.12 mm below the last base line for superscripts and subscripts respectively.

4.2.5 For the definitions of the printable areas in Table 1/T.60 certain assumptions about technical and operational problems have been taken. Further details about these assumptions are given in Annex A.

TABLE 1/T.60

Basic printable areas and basic page formats

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 6.35 8.47	 55 + 1 36 + 1 27 + 1	 38 + 1 25 + 1 19 + 1
Maximum number of characters per line [b]	Character spacing (mm) 2.54	77 (5 + 72)	105 (5 + 100)

[a] The maximum number of lines per page are given in the form (A + B) where A is the number of lines which can be communicated (i.e. the page format) and B the number of lines of the defined printable area for local presentation of the call identification line.

[b] The maximum number of characters per line are given in the form C (D + E) where C is the total number of characters per line defined for the printable area, D the number of characters to the left side of the home position as defined for the page format and E the number of characters to the right side including the home position character.

The home position is defined in Figure B-1/T.60.

4.2.6 It is not the intention of this Recommendation to define precisely the location and the size of the printable areas on paper sheets. However, the design of printing equipment shall always provide for the maximum number of lines and the maximum number of characters per line as shown in Table 1/T.60.

Note – The optional use of preprinted forms needs further study.

4.2.7 Optional printable areas are found in Annex B.

4.3 *Page format*

4.3.1 The size of the communicated text area, vertically or horizontally oriented, is one line spacing less than the defined maximum printable area, to allow for presentation of the call identification line.

4.3.2 The call identification line, if presented, will appear preferably at the superscripted level of the first printable line or the subscripted level of the last printable line, to ensure that it cannot partially overlap superscript text in the first communicable text line, or subscript text in the last communicable text line.

Note – Some existing equipment may be unable to comply with the requirement. If overlapped printing occurs on such terminals, it will be the recipient's responsibility to obtain clarification of text from the sender.

4.3.3 For each text area a home position is defined. See Recommendations T.61 and F.200.

Note – The home positions for different character spacings are shown in Figure B-1/T.60.

5 Communications

5.1 *Terminal identification*

5.1.1 Each Teletex terminal shall be equipped with a unique terminal identifier stored in the terminal.

5.1.2 The terminal identifier consists of 24 characters (octets) to which it shall be possible to assign any permissible bit combination of the primary set of Recommendation T.61.

The content and restrictions of the terminal identifier are defined in Recommendation F.200.

5.1.3 The content of the terminal identifier must be protected against loss or modification due to technical faults or non-authorized intervention.

5.1.4 The Teletex communication procedures include the exchange of the terminal identifiers prior to sending any document. The sender should use the receivers identifier to check the correct establishment of the call. If an automatic check is performed, this is preferably done on the mnemonic part of the terminal identifier, i.e. the part following the equal sign (=), see Recommendation F.200.

5.2 *Storage*

5.2.1 The terminals have to be equipped with a memory for reception, transmission and undisturbed local operation.

5.2.2 The storage ability of a terminal to receive incoming traffic may be established by control procedures prior to message transmission.

5.2.3 If the transmission has to be terminated as a result of insufficient storage at the receiving end, indication of this condition will be given to both the transmitting and receiving parties.

5.2.4 The storage capacity shall be sufficient to meet the quality of service criteria laid down in Recommendation F.200.

5.2.5 Terminal design and/or operating procedures shall be such as to minimize the possibility of loss of messages due to power failure or memory failure (for example by the use of nonvolatile memory or by forced print-out as appropriate).

5.3 *Call identification*

5.3.1 The Teletex procedures include the exchange of reference information prior to sending any document. Details of the call identification line are covered in Recommendation F.200.

6 Network-dependent requirements

6.1 Teletex transport can be provided by a circuit-switched data network (CSDN), a packet-switched data network (PSDN) or a public switched telephone network (PSTN). In all three types of network the Teletex terminal will provide automatic answering, transmission, reception and clearing.

6.2 *Circuit-switched data network*

a) functional and procedural rules for the call control phase: Recommendation X.21;

b) bit rate: 2400 bit/s;

c) link and network layer procedures during the data transfer phase: duplex as defined in Recommendation T.70.

6.3 *Packet-switched data network*

a) functional and procedural rules for the call control phase: Recommendation X.25;

b) bit rates: 2400, 4800, 9600 and 48 000 bit/s.

6.4 *Public switched telephone network*

a) functional and procedural rules for the call control phase in the case of automatic calling and answering: Recommendation V.25 line requirements for automatic calling and answering;

b) bit rates: half-duplex 2400 bit/s; duplex 1200 or 2400 bit/s; Recommendation V.22, V.22 *bis* or V.26 *ter* modem line requirements;

Note – V.22 *bis* line requirements are preferable to V.22.

c) link and network layer procedures during data transfer phase: Recommendation T.70 and in the case of half-duplex operation also Recommendation T.71.

7 Indicators

7.1 Indicators should inform about situations in which operator attention is required in order to maintain the grade of service.

7.2 An indication of the following situations shall be provided:

a) message received in store;

b) terminal unable or soon unable to receive, e.g. when receiving memory is nearly full;

c) operator assistance required, e.g. when printing element or paper orientation requires changing.

The terminal operator's attention shall be drawn to the above situations immediately regardless of the actual condition of the terminal, e.g. when terminal is in stand-by mode.

8 Interworking between Teletex terminals and telex terminals

8.1 In text which is to be sent to a telex terminal, the graphic character set should be restricted to that of International Telegraph Alphabet No. 2 (ITA2). This restriction only applies to that part of the text which is for onward transmission to telex. This restriction should be performed in the Teletex terminal.

8.2 The text for onward transmission to telex shall only contain those characters of ITA2 that form a subset of the basic Teletex character repertoire, as specified in Table C-1/T.60. Coding of these characters shall be in accordance with Recommendation T.61.

8.3 For the new line function, it is strongly recommended to use CR and LF in the order CR followed by LF. The order LF followed by CR is deprecated because this may cause improper printing in certain telex terminals.

8.4 The line length is restricted to 69 characters.

8.5 The Teletex terminal, when interworking with telex, operates at the Teletex terminal's normal data signalling rate.

8.6 The control procedures to be used between a Teletex terminal and a conversion facility (see Recommendation F.200) are defined in Recommendation T.90.

Note – A conversion facility provides for necessary conversion between Teletex and telex of communication procedures, signalling rates, character coding, etc.

ANNEX A

(to Recommendation T.60)

Explanations of the printable areas

A.1 The content of this annex does not form part of the requirements laid down by this Recommendation; instead it gives explanations of how the printable areas in Table 1/T.60 were defined.

A.2 The maximum printable area is defined to be the paper area available to the printing mechanism onto which graphic information can be technically impressed.

A.3 The following parameters were considered:

a) the use of a common paper area of 210 × 280 mm;

b) the worst case conditions for tolerances of paper size and of paper insertion as in Figure A-1/T.60;

c) the need to have the paper sheet held secure in the paper feed mechanism during the whole printout;

d) the use of line spacings of 4.23, 6.35 and 8.47 mm and a character spacing of 2.54 mm. The values for line spacings are rounded off to two decimal places (six spacings of 4.23 mm equal 25.4 mm);

e) the location of characters and base lines on a paper sheet as shown in Figure A-2/T.60;

f) the allowance to print exponents and indices with an offset of not more than 2.12 mm above and below the first and last base lines respectively.

A.4 The parameters in § A.3 lead to the values for the position of the first and last printable characters as in Table A-1/T.60 and Figure A-2/T.60, and are given as examples only.

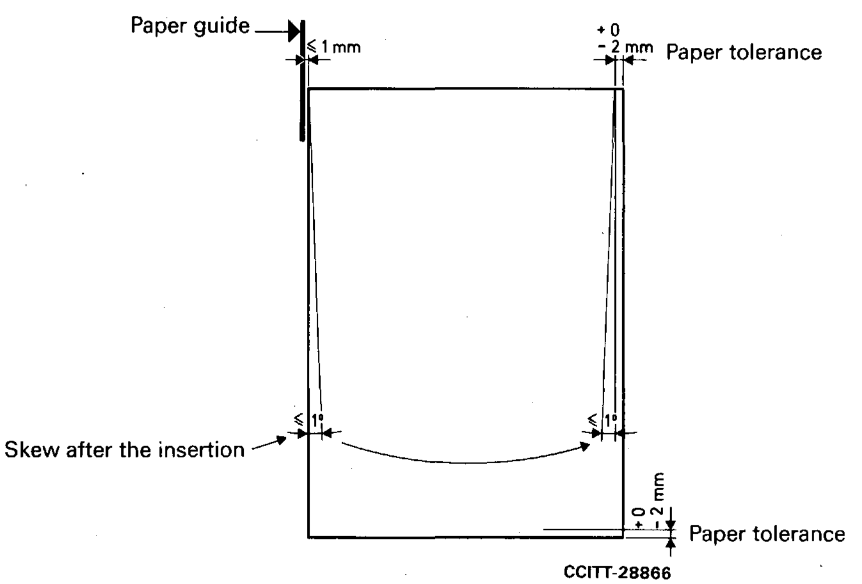
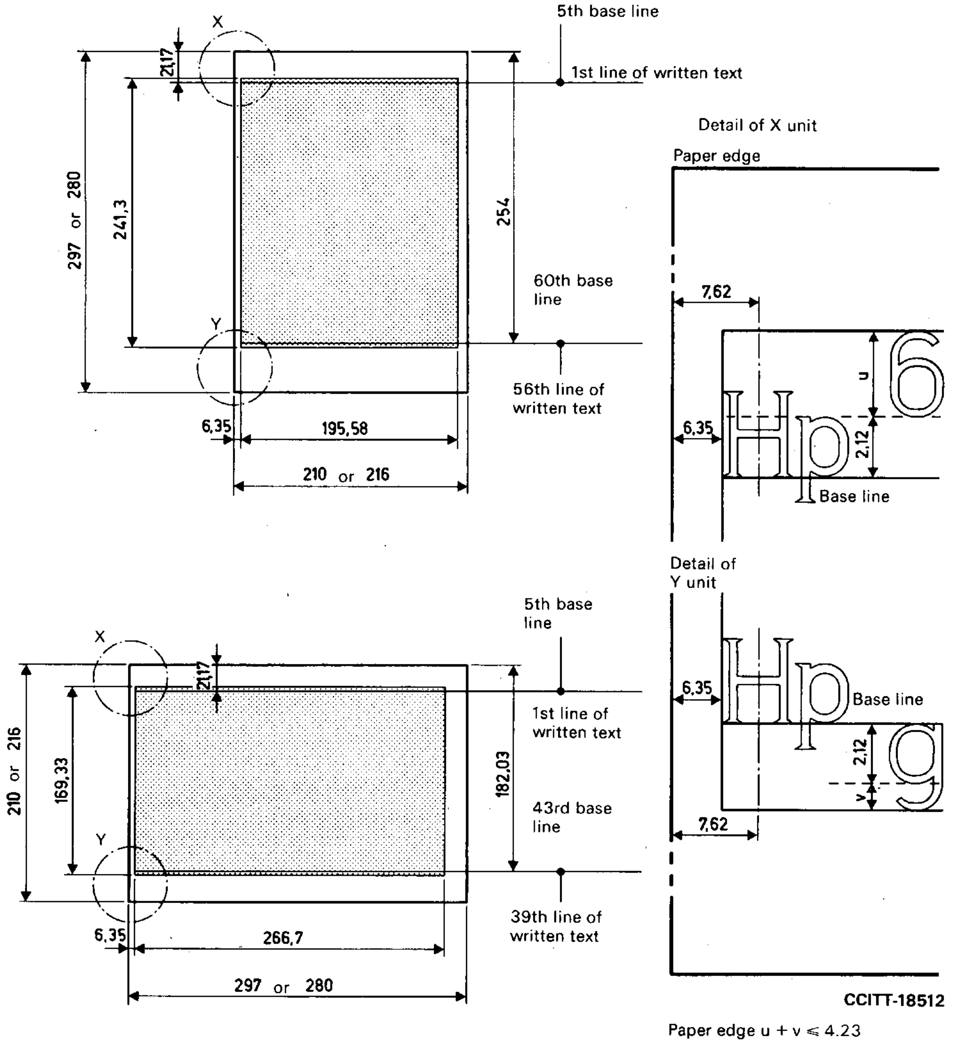


FIGURE A-1/T.60

TABLE A-1/T.60

	Base line position		Character position
	Orientation		for 2.54 mm character spacing
	Vertical	Horizontal	
First printable positions	5	5	3
Last printable positions	60	-	79
	-	43	107



Note 1 – Dotted area indicates the maximum printable area.
Note 2 – All values are nominal, given in mm and rounded to two decimal places.
Note 3 – The line spacing is defined as 6 lines per 25.4 mm and the character spacing as 10 characters per 25.4 mm.

FIGURE A-2/T.60

ANNEX B

(to Recommendation T.60)

Standardized options for printable areas

This annex contains standardized optional values for different sizes of maximum printable areas.

B.1 *Options for presentation within the basic maximum printable areas*

B.1.1 Table B-1/T.60 contains the values for the usage of different optional character and line spacings.

B.1.2 In Figure B-1/T.60, the location of the home position for different character spacings is defined.

B.2 *Options for presentation within ISO A4 paper size*

B.2.1 With the same assumptions as used for the basic printable areas and described in this Recommendation (§ 4 and Annex A), the appropriate maximum printable areas for the ISO A4 paper sheet (210 × 297 mm) and the values for different optional presentation attributes are found in Table B-2/T.60.

B.2.2 The optional printable areas for ISO A4 paper sheets defined by the ISO International Standard 3535 and the United Nations layout key – and the associated page formats – are those shown in Table B-3/T.60.

The part of the printable area intended for presentation of the communicated text are assumed to be located on the ISO A4 paper sheet as follows (compare Figure A-2/T.60):

- For vertical paper orientation:

  First line of communicated text: 3rd base line
  Last possible line for communicated text: 68th base line.

- For horizontal paper orientation:

  First line of communicated text: 5th base line
  Last possible line for communicated text: 48th base line.

The 2nd (resp. 4th) base line is assumed for the locally defined presentation of the call identification line.

Presentation of superscript and subscript on the first and last base line respectively is not assumed for these printable areas.

B.3 *Options for presentation within ISO paper sizes used with Japanese Kanji terminals*

B.3.1 Optional printable areas for ISO A4 paper size for use with Japanese Kanji terminals are shown in Table B-4/T.60.

B.3.2 Optional printable areas for ISO B5 paper size for use with Japanese Kanji terminals are shown in Table B-5/T.60.

B.3.3 Optional printable areas for ISO B4 paper size for use with Japanese Kanji terminals are shown in Table B-6/T.60.

B.4 *Options for presentation with North American legal paper size*

B.4.1 The optional printable areas for North American legal paper size (216 × 356 mm) are shown in Table B-7/T.60.

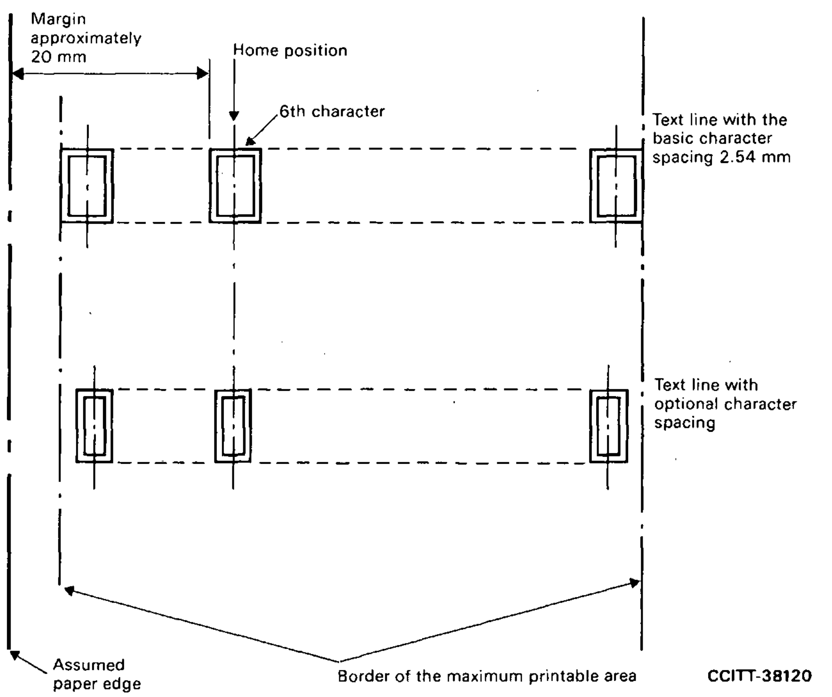
TABLE B-1/T.60

Options for presentation within the basic maximum printable areas
(see § 4)

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 3.175 5	 73 + 1 46 + 1	 50 + 1 32 + 1
Maximum number of characters per line [b]	Character spacing (mm) 2.12 1.69	 92 (6 + 86) 115 (7 + 108)	 125 (6 + 119) 156 (7 + 149)

[a] The maximum number of lines per page are given in the form $(A + B)$ where A is the number of lines which can be communicated (i.e. the page format) and B the number of lines of the defined printable area for local presentation of the call identification line.

[b] The maximum number of characters per line are given in the form $C(D + E)$ where C is the total number of characters per line defined for the printable area, D the number of characters to the left side of the home position as defined for the page format (see Figure B-1/T.60) and E the number of characters to the right side including the home position character.



Note 1 – The home position is defined as the 6th character position within the maximum printable area using the character spacing 2.54 mm.

The Figure shows the home position aligned with the centre of the character field. It is permissible to use the left side of the character or character field as the home position.

Note 2 — This home position shall be used for all other optional character spacings, except in the case of Japanese Kanji terminals (see Note 3).

Note 3 — In the case of Japanese Kanji terminals the home position is such that a margin of approximately 25 mm results.

FIGURE B-1/T.60

Definition of the home position

TABLE B-2/T.60

Optional printable areas/page formats and associated values for ISO A4 paper size

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 3.175 5 6.35 8.47	 59 + 1 78 + 1 49 + 1 39 + 1 29 + 1	 38 + 1 50 + 1 32 + 1 25 + 1 19 + 1
Maximum number of characters per line [b]	Character spacing (mm) 2.54 2.12 1.69	 77 (5 + 72) 92 (6 + 86) 115 (7 + 108)	 110 (5 + 105) 132 (6 + 126) 165 (7 + 158)

[a] See footnote [a] to Table B-1/T.60.

[b] See footnote [b] to Table B-1/T.60.

TABLE B-3/T.60

Optional printable areas/page formats and associated values corresponding to ISO 3535/A4

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 3.175 5 6.35 8.47	 66 + 1 87 + 1 55 + 1 44 + 1 33 + 1	 44 + 1 58 + 1 36 + 1 29 + 1 22 + 1
Maximum number of characters per line [b]	Character spacing (mm) 2.54 2.12 1.69	 77 (5 + 72) 92 (6 + 86) 115 (7 + 108)	 110 (5 + 105) 132 (6 + 126) 165 (7 + 158)

[a] See footnote [a] to Table B-1/T.60.

[b] See footnote [b] to Table B-1/T.60.

TABLE B-4/T.60

Optional printable areas/page formats and associated values for ISO A4 paper size (Standardized option for Japanese Kanji terminals)

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 6.35 8.47	 59 + 1 39 + 1 29 + 1	 38 + 1 25 + 1 19 + 1
Maximum number of characters per line [b]	Character spacing (mm) 4.23	45 (4 + 41)	66 (4 + 62)

[a] See footnote [a] to Table B-1/T.60.

[b] See footnote [b] to Table B-1/T.60.

TABLE B-5/T.60

Optional printable areas/page formats and associated values for ISO B5 paper size (Standardized option for Japanese Kanji terminals)

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 6.35 8.47	 49 + 1 33 + 1 24 + 1	 32 + 1 21 + 1 16 + 1
Maximum number of characters per line [b]	Character spacing (mm) 4.23	38 (4 + 34)	56 (4 + 52)

[a] See footnote [a] to Table B-1/T.60.

[b] See footnote [b] to Table B-2/T.60.

TABLE B-6/T.60

Optional printable areas/page formats and associated values for ISO B4 paper size (Standardized option for Japanese Kanji terminals)

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 6.35 8.47	 75 + 1 50 + 1 37 + 1	 49 + 1 33 + 1 24 + 1
Maximum number of characters per line [b]	Character spacing (mm) 4.23	 56 (4 + 52)	 79 (4 + 75)

[a] See footnote [a] to Table B-1/T.60.

[b] See footnote [b] to Table B-1/T.60.

TABLE B-7/T.60

Optional printable areas/page formats and associated values for North American Legal paper size (216 × 356 mm)

		Paper orientation	
		Vertical	Horizontal
Maximum number of lines per page [a]	Line spacing (mm) 4.23 3.175 6.35 8.47	 73 + 1 97 + 1 48 + 1 36 + 1	 39 + 1 52 + 1 26 + 1 19 + 1
Maximum number of characters per line [b]	Character spacing (mm) 2.54 2.12 1.69	 80 (5 + 75) 96 (6 + 90) 120 (7 + 113)	 135 (5 + 130) 161 (6 + 155) 201 (7 + 194)

[a] See footnote [a] to Table B-1/T.60.

[b] See footnote [b] to Table B-1/T.60.

ANNEX C

(to Recommendation T.60)

Conversion table between the Teletex repertoire and the telex repertoire for Teletex/telex interworking

TABLE C-1/T.60

ITA No. 2 Combination No.	Telex repertoire	Teletex repertoire	Identifier (Recommendation T.61)
Letter case			
1	**A**	a or **A**	LA01 or LA02
2	**B**	**b** or **B**	LB01 or LB02
3	**C**	c or **C**	LC01 or LC02
.	.	.	.
.	.	.	.
.	.	.	.
24	**X**	x or **X**	LX01 or LX02
25	**Y**	y or **Y**	LY01 or LY02
26	**Z**	z or **Z**	LZ01 or LZ02
Figure case			
1	–	–	SP10
2	?	?	SP15
3	:	:	SP13
4	WRU	Note 1	
5	**3**	**3**	ND03
6	Nat. use	Note 2	
7	Nat. use	Note 2	
8	Nat. use	Note 2	
9	**8**	**8**	ND08
10	BELL	Note 1	
11	(	(	SP06
12	)	)	SP07
13	.	.	SP11
14	,	,	SP08
15	**9**	**9**	ND09
16	**0**	**0**	ND10
17	**1**	**1**	ND01
18	**4**	**4**	ND04
19	'	'	SP05
20	**5**	**5**	ND05
21	**7**	**7**	ND07
22	=	=	SA04
23	**2**	**2**	ND02
24	/	/	SP12
25	**6**	**6**	ND06
26	+	+	SA01
Either case			
27	CR	CR	CF15
28	LF	LF	CF12
29	letter-shift	Note 3	
30	figure-shift	Note 3	
31	SP	SP	SP01
32	NU	Note 1	

Note 1 – Not defined in the Teletex repertoire. It will not be transmitted from the conversion facility to the Teletex terminal.

Note 2 – The use of these characters is not defined in international Teletex/telex interworking.

Note 3 – This character is only used for communication between conversion and telex terminal and is not transmitted to the Teletex terminal.

ANNEX D

(to Recommendation T.60)

Definitions

D.1 **printable area**

A printable area is defined to be the paper area available to the printing mechanism onto which graphic information can be technically impressed.

D.2 **page**

A page is the basic element of office correspondence in the Teletex service. This term defines the information that can be presented on one sheet of paper. This information may be stored, displayed or printed.

Note – Relevant paper sizes are indicated in this Recommendation.

D.3 **text**

Text is information for human comprehension that is intended for presentation in a two-dimensional form, e.g. printed on paper or displayed on a screen. Text consists of symbols, phrases or sentences in natural or artificial languages, pictures, diagrams and tables.

D.4 **communicated text area**

Area with a size of one line spacing less than the defined maximum printable area.

Recommendation T.61

CHARACTER REPERTOIRE AND CODED CHARACTER SETS FOR THE INTERNATIONAL TELETEX SERVICE

(Geneva, 1980, amended at Malaga-Torremolinos, 1984)

CONTENTS

1 Introduction

1.1 This Recommendation contains detailed definitions of the repertoires of graphic characters and control functions to be used in the basic international Teletex service, and their coded representations for communication. Additionally, the means are described whereby supplementary character repertoires and their coded representations may optionally be used.

1.2 In the Teletex service, control functions may be communicated as coded characters within the text or by means of the control procedures. This Recommendation defines the repertoire and coding of the former category.

1.3 The character repertoires and coded character sets for Teletex are not intended to replace International Alphabet No. 5 (IA5) or International Telegraph Alphabet No. 2 (ITA2). This Recommendation, based on Recommendation T.50, provides an extended alphabet for use in the international text communication service, Teletex. Where graphic characters of IA5 are not required for Teletex, their code table positions have been left unused, thereby assuring compatibility with IA5. The resulting subset of IA5 has been extended by the definition of additional graphic character sets.

1.4 The development of the coded character set defined in this Recommendation is based on the use of an 8-bit structure for the basic Teletex service.

1.5 This Recommendation should be read in conjunction with the following Recommendations:

T.60 – Terminal equipment for use in the Teletex service;

T.62 – Control procedures for Teletex and Groupe 4 Facsimile services;

F.200 – Teletex service.

1.6 The following Recommendations and ISO standards are related to this Recommendation, however, for the Teletex service this Recommendation only is relevant:

T.50 International Alphabet No. 5;

T.51 Coded character sets for the telematic services.

ISO 646 Information processing – ISO 7-bit coded character set for information interchange;

ISO 2022 Information processing – ISO 7-bit and 8-bit coded character sets – Code extension techniques;

ISO 6429 Information processing – ISO 7-bit and 8-bit coded character sets – Additional control functions for character imaging devices;

ISO 6937 Information processing – Coded character sets for text communication.

1.7 This Recommendation contains ordered lists of graphic characters and control functions forming the Teletex basic repertoire, together with the coded character sets necessary for their communication. For this purpose, the elements of the coded character sets are used either individually or in defined combinations.

1.8 The optional use of additional character repertoires is provided for, but the composition of such repertoires is not defined. Similarly, the code extension techniques for the representation of the additional repertoires are described in general, but no specific allocations of code tables are made.

2 Definitions

2.1 format effectors

F: caractères de mise en page

S: determinantes de formato

Control functions that influence the positioning of text, within the text area, on a presentation device. The following concepts are used in defining format effectors.

2.1.1 **active position**

F: position active

S: posición activa

The character position where the next character would appear if it were presented.

2.1.2 **text area**

F: zone de texte

S: zona de texto

The part of a printed page that is actually used for the presentation of text. The active position moves within the text area only. For Teletex, the text area is the *maximum printable area* (see Recommendation T.60).

2.1.3 **home position**

F: position initiale

S: posición inicial

The reference position on any line to which the active position moves after a terminal receives a *Carriage return*. The starting position for printing is then established from this reference position by the sending terminal, using *Space* or *Backspace* characters as required.

2.2 **presentation control functions**

F: fonctions de commande pour la présentation

S: funciones de control de la presentación

Control functions that influence in a uniform way the presentation attributes of the text (e.g. line spacing or page format) on a presentation device.

2.3 **graphic code extension**

F: extension de code graphique

S: extensión del código gráfico

The method of encoding graphic characters in excess of those that may be represented by the 8-bit code combinations of the basic code table. Alternative sets of 94 graphic characters may be *designated* by means of escape sequences and *invoked* by means of shift functions. Depending on the designating escape sequence, the alternative sets of characters are represented by bit combinations of the left-hand half (positions 2/1 to 7/14 inclusive) or the right-hand half (positions 10/1 to 15/14 inclusive) of the 8-bit code table.

In the basic Teletex service, escape sequences and shift functions are not used. The primary set of graphic characters defined in § 4.1.3.3 is implicitly designated and invoked into positions 2/1 to 7/14 of the 8-bit code table. The supplementary set of graphic characters defined in § 4.1.3.4 is implicitly designated and invoked into positions 10/1 to 15/14 of the 8-bit code table.

Note – As an enhancement to the basic Teletex service, national or application-oriented sets of graphic characters may be designated by means of appropriate escape sequences, thereby overlaying the primary and supplementary sets. Return to the primary and supplementary sets is accomplished by similar escape sequences.

2.4 **Teletex character repertoire**

F: répertoire des caractères télétex

S: repertorio teletex de caracteres

The total range of graphic characters and control functions that may be communicated between Teletex terminals.

2.5 **Teletex graphic character repertoire**

F: répertoire des caractères graphiques télétex

S: repertorio teletex de caracteres gráficos

The total range of graphic characters that may be communicated between and presented by Teletex terminals.

2.6 **Teletex basic graphic character repertoire**

F: répertoire des caractères graphiques télétex de base

S: repertorio teletex básico de caracteres gráficos

A comprehensive list of graphic characters whose communication is guaranteed by the Teletex service, and which are capable of being presented on all Teletex terminals.

2.7 **Teletex control function repertoire**

F: répertoire des fonctions de commande télétex

S: repertorio teletex de funciones de control

The total range of control functions communicated between Teletex terminals to enable the action of the receiving terminal to be controlled.

2.8 **Teletex basic control function repertoire**

F: répertoire des fonctions de commande télétex de base

S: repertorio teletex básico de funciones de control

A comprehensive list of control functions communicated between Teletex terminals whose effect on the receiving terminal is defined and guaranteed by the service.

2.9 **other Teletex character repertoires**

F: autres répertoires de caractères télétex

S: otros repertorios teletex de caracteres

National or application-oriented lists of graphic characters and control functions, in addition to the Teletex basic repertoires of graphic characters and control functions, that may be communicated between Teletex terminals by mutual agreement.

Note – Specific additional character repertoires may be the subject of CCITT Recommendations.

2.10 **character**

F: caractère

S: carácter

A member of a set of elements that is used for the organization control or representation of data. A character repertoire contains two types of elements: graphic characters and control functions.

2.11 **control function**

F: fonction de commande

S: función de control

An action that affects the recording, processing, transmission or interpretation of data. The coded representation of a control function consists of one or more bit combinations. A control function is not a graphic character, but may have a graphic representation in some circumstances (e.g. for record purposes). It must not, however, be transmitted with the specific intent of producing a graphic representation.

2.12 **control character**

F: caractère de commande

S: carácter de control

A control function, the coded representation of which consists of a single bit combination.

2.13 **graphic character**

F: caractère graphique

S: carácter gráfico

A character, other than a control function, that has a visual representation normally hand-written, printed or displayed. The term *graphic character* is used with a dual meaning:

a) Graphic characters that are elements of a set that can be designated. These are called *elementary graphic characters* in order to distinguish them from the *composite graphic characters.* Some of the elementary graphic characters are used in combinations to represent composite graphic characters.

b) Graphic characters that are members of a repertoire. Some of these are *composite graphic characters* represented by combinations of *elementary graphic characters.*

2.14 **presentation**

F: présentation

S: presentación

The printing or display of a stored character or characters to allow for human comprehension of the stored information.

2.15 **bit combination**

F: combinaison binaire

S: combinación de bits

An ordered set of bits that represents a character.

2.16 **code, coded character set**

F: code, jeu de caractères codés

S: código, juego de caracteres codificados

A set of unambiguous rules that establish a character set and the one-to-one relationship between the characters of the set and their bit combinations.

2.17 **code table**

F: tableau de code

S: tabla de código

A table showing the character corresponding to each bit combination in a code. A code table is normally represented as a rectangular matrix of columns and rows.

2.18 **position**

F: position

S: posición

An item in a code table identified by its column and row coordinates.

2.19 **code extension**

F: extension de code

S: extensión de código

Techniques for encoding characters that are not included in the character set of a given code.

2.20 **escape sequence**

F: séquence d'échappement

S: secuencia de escape

A bit string that is used for control purposes in code extension procedures and that consists of two or more bit combinations. The first of these combinations corresponds to the character *escape.*

2.21 **to designate**

F: désigner

S: designar

To identify a set of characters that are to be represented, in some cases immediately and in others on the occurrence of a further control function, in a prescribed manner.

2.22 **to invoke**

F: appeler

S: invocar

To cause a designated set of characters to be represented by the prescribed bit combinations.

3 Teletex character repertoire

3.1 *General*

3.1.1 The Teletex character repertoire is composed as defined below and as illustrated in Figure 1/T.61.

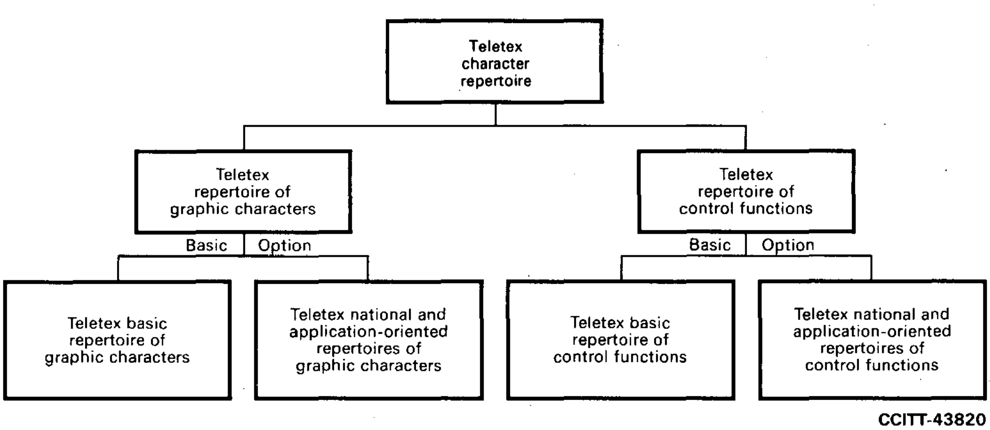


FIGURE 1/T.61
Teletex character repertoire

3.1.2 The Teletex character repertoire consists of the *Teletex repertoire of graphic characters* and the *Teletex repertoire of control functions.*

3.1.3 The Teletex repertoire of graphic characters consists of the *Teletex basic repertoire of graphic characters* and the *Teletex national and application-oriented repertoires of graphic characters.* The basic repertoire of graphic characters is defined in § 3.2.

3.1.4 The Teletex repertoire of control functions consists of the *Teletex basic repertoire of control functions* and the *Teletex national and application-oriented repertoires of control functions.* The basic repertoire of control functions is defined in § 3.3.

3.1.5 The Teletex basic repertoire of graphic characters, together with the Teletex basic repertoire of control functions, constitute the Teletex basic character repertoire.

3.1.6 Bit combinations or sequences of bit combinations that do not represent graphic characters or control functions of the Teletex basic character repertoire, are not defined in this Recommendation.

Note – With the Teletex sets of coded graphic characters and control functions it is, in principle, possible to produce combinations of diacritical marks and graphic characters other than those defined in the Teletex basic graphic character repertoire. However, the presentation of such composite symbols at the receiving terminal cannot be predicted and is therefore not defined in this Recommendation.

3.1.7 Sequences of graphic characters and control functions that would result in the presentation of two or more graphic characters in a single character position are not defined in this Recommendation.

Note – It is possible, in text preparation, to overlay graphic symbols by the use of the control functions BS, SP, CR and RLF. However, no character of the Teletex basic graphic character repertoire shall be transmitted over the communication medium by this means. As it is normal office practice to create graphic symbols by overlaying graphic characters, the user cannot be prevented from using the keyboard to image locally composite symbols and the Teletex service shall not exclude the possibility of the transmission of these overlaid graphic symbols. The presentation of such overlaid graphic symbols at the receiving terminal cannot be predicted and is, therefore, not defined in this Recommendation.

Similarly, an underline implemented by SGR or by *Non spacing underline* and followed by PLD may be a cause of overlap of graphic symbols. Although the definition of PLD in § 3.3.2 states that it is the sender's responsibility to avoid overlap, it may be difficult to prevent an accidental occurrence. In such cases the receiver may suppress printing of the underline to preserve legibility of the other graphic symbol.

3.1.8 The control functions of the Teletex basic repertoire enable a receiving terminal to produce a document that is identical in contents, layout and format, to that produced by the sending terminal.

3.1.9 The use of character repertoires other than the basic repertoire of graphic characters is subject to mutual agreement between terminals and shall be initiated by the appropriate procedural steps.

3.2 *Teletex basic repertoire of graphic characters*

3.2.1 *General*

3.2.1.1 The repertoire of graphic characters defined in this Recommendation consists of:

a) Latin alphabetic characters, listed in § 3.2.2, which comprise:
   - i) the 52 small and capital letters of the basic Latin alphabet;
   - ii) accented letters and umlauts, the graphical representations of which consist of combinations of basic Latin letters and diacritical marks;
   - iii) alphabetic characters that are neither basic Latin letters nor combinations of basic Latin letters and diacritical marks;

b) non-alphabetic characters, listed in § 3.2.3, which comprise decimal digits, currency signs, punctuation marks (including *Space*), diacritical marks, arithmetic signs, subscripts and superscripts, fractions, miscellaneous symbols that have individual special meanings and non-spacing characters.

3.2.1.2 The lists in §§ 3.2.2 and 3.2.3 are composed as described below:

a) the first column contains the identifier of each character, assigned in accordance with the identification system explained in Annex C;

b) the second column presents the graphical representation of the character;

c) the third column specifies the name or the description of the character.

Note – The repertoire of graphic characters defined in this Recommendation contains a limited set of accented letters and umlauts. This set is summarized in Annex B.

Identifier	Graphic	Name or description
LA01	a	small a
LA02	A	capital A
LA11	á	small a with acute accent
LA12	Á	capital A with acute accent
LA13	à	small a with grave accent
LA14	À	capital A with grave accent
LA15	â	small a with circumflex accent
LA16	Â	capital A with circumflex accent
LA17	ä	small a with diaeresis or umlaut mark
LA18	Ä	capital A with diaeresis or umlaut mark
LA19	ã	small a with tilde
LA20	Ã	capital A with tilde
LA23	ă	small a with breve
LA24	Ă	capital A with breve
LA27	å	small a with ring
LA28	Å	capital A with ring
LA31	ā	small a with macron
LA32	Ā	capital A with macron
LA43	ą	small a with ogonek
LA44	Ą	capital A with ogonek
LA51	æ	small æ diphthong
LA52	Æ	capital Æ diphthong
LB01	b	small b
LB02	B	capital B
LC01	c	small c
LC02	C	capital C
LC11	ć	small c with acute accent
LC12	Ć	capital C with acute accent
LC15	ĉ	small c with circumflex accent
LC16	Ĉ	capital C with circumflex accent
LC21	č	small c with caron
LC22	Č	capital C with caron
LC29	ċ	small c with dot
LC30	Ċ	capital C with dot
LC41	ç	small c with cedilla
LC42	Ç	capital C with cedilla
LD01	d	small d
LD02	D	capital D
LD21	ď or d'	small d with caron
LD22	Ď	capital D with caron
LD61	đ	small d with stroke
LD62	Đ	capital D with stroke, Icelandic eth
LD63	ð	small eth, Icelandic
LE01	e	small e
LE02	E	capital E
LE11	é	small e with acute accent
LE12	É	capital E with acute accent
LE13	è	small e with grave accent
LE14	È	capital E with grave accent
LE15	ê	small e with circumflex accent
LE16	Ê	capital E with circumflex accent
LE17	ë	small e with diaeresis or umlaut mark
LE18	Ë	capital E with diaeresis or umlaut mark
LE21	ě	small e with caron
LE22	Ě	capital E with caron
LE29	ė	small e with dot
LE30	Ė	capital E with dot
LE31	ē	small e with macron
LE32	Ē	capital E with macron
LE43	ę	small e with ogonek
LE44	Ę	capital E with ogonek
LF01	f	small f

Identifier	Graphic	Name or description
LF02	F	capital F
LG01	g	small g
LG02	G	capital G
LG11	ǵ	small g with acute accent
LG15	ĝ	small g with circumflex accent
LG16	Ĝ	capital G with circumflex accent
LG23	ğ	small g with breve
LG24	Ğ	capital G with breve
LG29	ġ	small g with dot
LG30	Ġ	capital G with dot
LG42	Ģ	capital G with cedilla
LH01	h	small h
LH02	H	capital H
LH15	ĥ	small h with circumflex accent
LH16	Ĥ	capital H with circumflex accent
LH61	ħ	small h with stroke
LH62	Ħ	capital H with stroke
LI01	i	small i
LI02	I	capital I
LI11	í	small i with acute accent
LI12	Í	capital I with acute accent
LI13	ì	small i with grave accent
LI14	Ì	capital I with grave accent
LI15	î	small i with circumflex accent
LI16	Î	capital I with circumflex accent
LI17	ï	small i with diaeresis or umlaut mark
LI18	Ï	capital I with diaeresis or umlaut mark
LI19	ĩ	small i with tilde
LI20	Ĩ	capital I with tilde
LI30	İ	capital I with dot
LI31	ī	small i with macron
LI32	Ī	capital I with macron
LI43	į	small i with ogonek
LI44	Į	capital I with ogonek
LI51	ĳ	small ij ligature
LI52	Ĳ	capital IJ ligature
LI61	ı	small i without dot
LJ01	j	small j
LJ02	J	capital J
LJ15	ĵ	small j with circumflex accent
LJ16	Ĵ	capital J with circumflex accent
LK01	k	small k
LK02	K	capital K
LK41	ķ	small k with cedilla
LK42	Ķ	capital K with cedilla
LK61	ĸ	small k, Greenlandic
LL01	l	small l
LL02	L	capital L
LL11	ĺ	small l with acute accent
LL12	Ĺ	capital L with acute accent
LL21	ľ or l'	small l with caron
LL22	Ľ or L'	capital L with caron
LL41	ļ	small l with cedilla
LL42	Ļ	capital L with cedilla
LL61	ł	small l with stroke
LL62	Ł	capital L with stroke
LL63	ŀ	small l with middle dot
LL64	Ŀ	capital L with middle dot
LM01	m	small m
LM02	M	capital M
LN01	n	small n
LN02	N	capital N
LN11	ń	small n with acute accent

Identifier	Graphic	Name or description
LN12	Ń	capital N with acute accent
LN19	ñ	small n with tilde
LN20	Ñ	capital N with tilde
LN21	ň	small n with caron
LN22	Ň	capital N with caron
LN41	ņ	small n with cedilla
LN42	Ņ	capital N with cedilla
LN61	ŋ	small eng, Lapp
LN62	Ŋ	capital eng, Lapp
LN63	'n	small n with apostrophe
LO01	o	small o
LO02	O	capital O
LO11	ó	small o with acute accent
LO12	Ó	capital O with acute accent
LO13	ò	small o with grave accent
LO14	Ò	capital O with grave accent
LO15	ô	small o with circumflex accent
LO16	Ô	capital O with circumflex accent
LO17	ö	small o with diaeresis or umlaut mark
LO18	Ö	capital O with diaeresis or umlaut mark
LO19	õ	small o with tilde
LO20	Õ	capital O with tilde
LO25	ő	small o with double acute accent
LO26	Ő	capital O with double acute accent
LO31	ō	small o with macron
LO32	Ō	capital O with macron
LO51	œ	small œ ligature
LO52	Œ	capital Œ ligature
LO61	ø	small o with slash
LO62	Ø	capital O with slash
LP01	p	small p
LP02	P	capital P
LQ01	q	small q
LQ02	Q	capital Q
LR01	r	small r
LR02	R	capital R
LR11	ŕ	small r with acute accent
LR12	Ŕ	capital R with acute accent
LR21	ř	small r with caron
LR22	Ř	capital R with caron
LR41	ŗ	small r with cedilla
LR42	Ŗ	capital R with cedilla
LS01	s	small s
LS02	S	capital S
LS11	ś	small s with acute accent
LS12	Ś	capital S with acute accent
LS15	ŝ	small s with circumflex accent
LS16	Ŝ	capital S with circumflex accent
LS21	š	small s with caron
LS22	Š	capital S with caron
LS41	ş	small s with cedilla
LS42	Ş	capital S with cedilla
LS61	ß	small sharp s, German
LT01	t	small t
LT02	T	capital T
LT21	ť or t'	small t with caron
LT22	Ť	capital T with caron
LT41	ţ	small t with cedilla
LT42	Ţ	capital T with cedilla
LT61	ŧ	small t with stroke
LT62	Ŧ	capital T with stroke
LT63	þ	small thorn, Icelandic

Identifier	Graphic	Name or description
LT64	Þ	capital thorn, Icelandic
LU01	u	small u
LU02	U	capital U
LU11	ú	small u with acute accent
LU12	Ú	capital U with acute accent
LU13	ù	small u with grave accent
LU14	Ù	capital U with grave accent
LU15	û	small u with circumflex accent
LU16	Û	capital U with circumflex accent
LU17	ü	small u with diaeresis or umlaut mark
LU18	Ü	capital U with diaeresis or umlaut mark
LU19	ũ	small u with tilde
LU20	Ũ	capital U with tilde
LU23	ŭ	small u with breve
LU24	Ŭ	capital U with breve
LU25	ű	small u with double acute accent
LU26	Ű	capital U with double acute accent
LU27	ů	small u with ring
LU28	Ů	capital U with ring
LU31	ū	small u with macron
LU32	Ū	capital U with macron
LU43	ų	small u with ogonek
LU44	Ų	capital U with ogonek
LV01	v	small v
LV02	V	capital V
LW01	w	small w
LW02	W	capital W
LW15	ŵ	small w with circumflex accent
LW16	Ŵ	capital W with circumflex accent
LX01	x	small x
LX02	X	capital X
LY01	y	small y
LY02	Y	capital Y
LY11	ý	small y with acute accent
LY12	Ý	capital Y with acute accent
LY15	ŷ	small y with circumflex accent
LY16	Ŷ	capital Y with circumflex accent
LY17	ÿ	small y with diaeresis or umlaut mark
LY18	Ÿ	capital Y with diaeresis or umlaut mark
LZ01	z	small z
LZ02	Z	capital Z
LZ11	ź	small z with acute accent
LZ12	Ź	capital Z with acute accent
LZ21	ž	small z with caron
LZ22	Ž	capital Z with caron
LZ29	ż	small z with dot
LZ30	Ż	capital Z with dot

3.2.3 *Non-alphabetic characters*

3.2.3.1 *Decimal digits*

Identifier	Graphic	Name or description
ND01	1	digit 1
ND02	2	digit 2
ND03	3	digit 3
ND04	4	digit 4
ND05	5	digit 5
ND06	6	digit 6
ND07	7	digit 7
ND08	8	digit 8
ND09	9	digit 9
ND10	0	digit 0

3.2.3.2 *Currency signs*

Identifier	Graphic	Name or description
SC01	¤	general currency sign
SC02	£	pound sign
SC03	$	dollar sign
SC04	¢	cent sign
SC05	¥	yen sign

3.2.3.3 *Punctuation marks*

Identifier	Graphic	Name or description
SP01		space (see also § 3.3.2)
SP02	!	exclamation mark
SP03	¡	inverted exclamation mark
SP04	"	quotation mark
SP05	'	apostrophe
SP06	(	left parenthesis
SP07	)	right parenthesis
SP08	,	comma
SP09	_	low line
SP10	-	hyphen or minus sign
SP11	.	full stop, period
SP12	/	solidus
SP13	:	colon
SP14	;	semicolon
SP15	?	question mark
SP16	¿	inverted question mark
SP17	«	angle quotation mark left
SP18	»	angle quotation mark right

Note – In Teletex (and Videotex), *Quotation mark, Apostrophe* and *Comma* are independent characters that cannot have the meaning of diacritical marks.

3.2.3.4 *Arithmetic signs*

Identifier	Graphic	Name or description
SA01	+	plus sign
SA02	±	plus/minus sign
SA03	<	less-than sign
SA04	=	equals sign
SA05	>	greater-than sign
SA06	÷	divide sign
SA07	×	multiply sign

Note – For *minus sign* see SP10.

3.2.3.5 *Subscripts and superscripts*

Identifier	Graphic	Name or description
NS02	^{2}	superscript 2
NS03	^{3}	superscript 3

3.2.3.6 *Fractions*

Identifier	Graphic	Name or description
NF01	½	fraction one half
NF04	¼	fraction one quarter
NF05	¾	fraction three quarters

3.2.3.7 *Miscellaneous symbols*

Identifier	Graphic	Name or description
SM01	#	number sign
SM02	%	percent sign
SM03	&	ampersand
SM04	*	asterisk
SM05	@	commercial at
SM06	[	left square bracket
SM08	]	right square bracket
SM13	|	vertical line
SM17	µ	micro sign
SM18	Ω	ohm sign
SM19	°	degree sign
SM20	º	ordinal indicator, masculine
SM21	ª	ordinal indicator, feminine
SM24	§	section sign
SM25	¶	paragraph sign, pilcrow
SM26	·	middle dot

3.2.3.8 *Diacritical marks as separate graphic characters*

Identifier	Graphic	Name or description
SD11	□́	acute accent with space
SD13	□̀	grave accent with space
SD15	□̂	circumflex accent with space
SD17	□̈	diaeresis or umlaut mark with space
SD19	□̃	tilde with space
SD21	□̌	caron with space
SD23	□̆	breve with space
SD25	□̋	double acute accent with space
SD27	□̊	ring with space
SD29	□̇	dot with space
SD31	□̄	macron with space
SD41	□̧	cedilla with space
SD43	□̨	ogonek with space

Note – The diacritical marks are illustrated together with a rectangle representing the relative position of the graphic character with which they are normally associated.

3.2.3.9 *Non-spacing characters*

Identifier	Graphic	Name or description
SM27	□̲	non spacing underline

Note – The *Non-spacing underline* character is never used individually but always in combination with some other graphic character to represent the graphic rendition "underlined" for the associated character. The *Non-spacing underline* character can be used in combination with any graphic character of the repertoire, including an accented letter or an umlaut, or *Space.*

3.3 *Teletex basic repertoire of control functions*

3.3.1 *General*

3.3.1.1 The repertoire of control functions defined in this Recommendation consists of:

a) format effectors;

b) presentation control functions;

c) code extension control functions;

d) miscellaneous control functions.

3.3.1.2 In addition to the categories mentioned above, other control functions may be used in the Teletex service, in particular transmission control functions required by lower-level control procedures. These control functions, however, are not specified in this Recommendation since they are not used during the transmission of text in the basic Teletex service.

3.3.1.3 Format effectors, presentation control functions, code extension control functions and miscellaneous control functions are listed in §§ 3.3.2, 3.3.3, 3.3.4 and 3.3.5 respectively. These lists are composed as described below:

a) the first column contains the identifier of each control function, assigned in accordance with the identification system explained in Annex C;

b) the second column presents the abbreviated name of the control function;

c) the third column specifies the name and the definition of the control function.

3.3.1.4 The default state for all control functions defined in § 3.3 § E.3.2 are assumed at the beginning of each page. The same applies to the implicit designation and invocation of character sets defined in §§ A.1 and A.2.

The start of a new page is indicated by either a *Command document start* (CDS), a *Command document continued* (CDC), or a *Command document page boundary* (CDPB) all accompanied by a *Command document user information* (CDUI). See Recommendation T.62.

Because of their immediate effect on the presentation of the new page, parameter values other than default values of those control functions according to §§ 3.3 and E.3.2, e.g., *Page format selection* or *Select horizontal spacing*, must be transmitted before the *Form feed, Carriage return* or *Carriage return, Form feed* sequence. By this sequence the control functions will become effective.

3.3.2 *Format effectors*

Identifier	Abbreviation	Name and definition
SP01	SP	*Space* A format effector that advances the active position one character position on the same line. This character is also regarded as a nonprinting graphic.
CF10	BS	*Backspace* A format effector that moves the active position one character position backwards on the same line.
CF12	LF	*Line feed* A format effector that advances the active position to the corresponding character position of the next line. LF never causes a horizontal movement of the active position. To obtain the equivalent of *New line, Line feed* shall be used in combination with *Carriage return* (CR). In this character sequence CR must immediately be followed by LF or vice versa. See also § 2.1.2 (text area).
CF14	FF	*Form feed* A format effector that advances the active position to the corresponding character position on the first line of the communicated text area of a new page. *Form feed* never causes a horizontal movement of the active position. *Form feed* shall only be used in combination with *Carriage return* (CR). In this character sequence CR must immediately be followed by FF or vice versa. This sequence affects the presentation of the new page (see also § 3.3.1.4). The text shall be introduced by this sequence in every page (including the first page of a document). Any control functions that need to be defined at the start of the page shall precede this sequence. This sequence must not be used more than once within a page according to Recommendation T.62.
CF15	CR	*Carriage return* A format effector that moves the active position to the home position on the same line. *Note* – In some circumstances, CR may involve a forward movement of the active position, viz. when the active position has been moved in front of the home position.

Identifier	Abbreviation	Name and definition
CF16	PLD	*Partial line down* (Start of subscript/End of superscript) A format effector that moves the active position to the corresponding character position on an imaginary line with a partial vertical offset. This offset should be sufficient either to image following characters as subscripts until the first following occurrence of *Partial line up* (PLU) in the data stream or, if the immediately preceding character is imaged as a superscript to restore subsequent imaging of characters to the active line. Any interactions between PLD and vertical format effectors other than PLU are not defined by this Recommendation. Therefore, any occurrence of PLD to start subscript presentation shall be followed by PLU in the same line without another PLD's intervening. Any other use may produce a different printing format at the receiver than was intended by the sender. PLD does not affect the vertical position of any underlining of subsequent character(s) if the underlining is invoked (by SGR or *Non-spacing underline*) prior to the PLD. *Note* – It is intended that the imaging may be achieved by either: – special fonts with or without movement of the active position, or – movement of the active position not exceeding a half line space. The sender is responsible for avoiding overlapped printing. The interpretation and rendition is the responsibility of the receiving terminal.
CF17	PLU	*Partial line up* (Start of superscript/End of subscript) A format effector that moves the active position to the corresponding character position on an imaginary line with a partial vertical offset. This offset should be sufficient either to image following characters as superscripts until the first following occurrence of *Partial line down* (PLD) in the data stream or, if the immediately preceding character is imaged as a subscript, to restore subsequent imaging of characters to the active line. Any interactions between PLU and vertical format effectors other than PLD are not defined by this Recommendation. Therefore, any occurrence of PLU to start superscript presentation shall be followed by PLD in the same line without another PLU's intervening. Any other use may produce a different printing format at the receiver than was intended by the sender. PLU does not affect the vertical position of any underlining of subsequent character(s) if the underlining is invoked (by SGR or *Non-spacing underline*) prior to the PLU. *Note* – It is intended that the imaging may be achieved by either: – special fonts with or without movement of the active position, or – movement of the active position not exceeding a half line space. The sender is responsible for avoiding overlapped printing. The interpretation and rendition is the responsibility of the receiving terminal.

3.3.3 *Presentation control functions*

3.3.3.1 The presentation control functions defined in this Recommendation influence the following presentation attributes:

- page format (vertical or horizontal orientation);
- vertical spacing (line spacing);
- graphic rendition (underlining).

3.3.3.2 Presentation control functions are functions with parameters. Parameter values not defined in this Recommendation are reserved for future standardization by CCITT and/or ISO. In the basic Teletex service the horizontal spacing (character pitch) is fixed; however, in order to facilitate extensions to the basic service, a presentation control function involving this attribute has been included.

3.3.3.3 Vertical spacing, horizontal spacing and graphic rendition may be changed within a page.

3.3.3.4 *Presentation control function descriptions*

Identifier	Abbreviation	Name and definition
CP01	PFS	*Page format selection* A presentation control function with a selective parameter that specifies the format of the page to be introduced by a subsequent *Form feed* (FF) control function. The meaning of the parameter value is: 0: vertical basic page format; 1: horizontal basic page format. The default value of the parameter is 0. The text areas corresponding to these page formats are defined in Recommendation T.60.
CP03	SGR	*Select graphic rendition* A presentation control function with a selective parameter which specifies the graphic rendition aspects of the graphic characters and occurrences of *Space* in the subsequent text. The specific rendition aspects remain in effect until the next occurrence of *Select graphic rendition* within the page. When SGR is used to start underlining within the scope of subscript or superscript presentation (see PLD and PLU § 3.3.2) any horizontal lines used to implement such underlining are lowered or raised together with the subscript or superscript characters to which they apply. Any PLU or PLD functions occurring when underlining is already in effect, do not affect the vertical position of such horizontal lines. (See also Note to § 3.1.7). The representation of multiple underlining is one character position caused by combinations of SGR and *Non-spacing underline* or by other means (eg. $\underline{x}^{\underline{y}}$), is not guaranteed at the receiving end in the basic Teletex service. The meaning of the parameter value is: 0: default rendition; 4: underlined. The default value of the parameter is 0.

Identifier	Abbreviation	Name and definition
CP04	SHS	*Select horizontal spacing*

A presentation control function with a selective parameter, which specifies the character spacing for subsequent text. The parameter value of this control function may be changed within a page, provided that no graphic characters occur between the SHS and the next occurrence of both *Carriage return* (CR) and *Line feed* or both CR and *Form feed.* The new parameter value will take effect immediately.

The meaning of the parameter value is:

0: 10 characters per 25.4 mm.

The default value of the parameter is 0.

Note – In the basic Teletex service, terminals should avoid sending SHS because only one parameter value is valid, and this value is implied by default (see § 3.3.1.4), however, all terminals must be able to receive text containing SHS with parameter value "O" and SHS without a parameter value.

CP05	SVS	*Select vertical spacing*

A presentation control function with a selective parameter that specifies the line spacing for subsequent text. The value of this attribute may be changed at any point within a page to become effective upon the next occurrence of *Line feed* or *Reverse line feed* (see Annex E).

The meaning of the parameter value is:

0: 6 lines per 25.4 mm;
1: 4 lines per 25.4 mm;
2: 3 lines per 25.4 mm;
3: 12 lines per 25.4 mm.

The default value of the parameter is 0.

Parameter value 3 is used to specify half line down spacing (or half line up spacing if used in conjunction with *Reverse line feed*).

3.3.4 *Code extension control function*

Identifier	Abbreviation	Name and definition
CE06	CSI	*Control sequence introducer*

A code extension control function, which is used to provide coded representations for additional control functions, in particular for control functions with parameters, such as presentation control functions.

Note – Control functions for graphic code extension are defined in §§ E.3.2.3 and E.4.2.3.

3.3.5 *Miscellaneous control functions*

Identifier	Abbreviation	Name and description
CM02	SUB	*Substitute character*

A control function used as defined in Recommendation T.50 to indicate an erroneous character. It is intended to permit printing an error indication or otherwise identify the location of a character received in error.

CM04	IGS	*Identify graphic subrepertoire*

A control function with one selective parameter, which is used to indicate to the receiving terminal that a particular subrepertoire of the total repertoire of graphic characters is to be used in the subsequent text. The identification of the graphic subrepertoire may be changed at any point in the text. The selective parameter may be of any value from 0-9999.

The parameter value identifies the subrepertoire according to the register of subrepertoires.

The subrepertoire that is assumed to be identified when this control function is omitted is the entire Teletex basic repertoire of graphic characters.

If any subrepertoire has been explicitly identified, it shall be restated prior to the first character of text on each subsequent page (i.e. prior to *Form feed*).

All subrepertoires shall contain the following graphic characters:

a) the 26 unaccented small letters (LA01, ... LZ01) and the 26 unaccented capital letters (LA02, ... LZ02);

b) the 10 decimal digits (ND01 ... ND10);

c) the nonalphabetic graphic characters:

Identifier	Graphic	Name or description
SP01		space
SP05	'	apostrophe
SP06	(	left parenthesis
SP07	)	right parenthesis
SP08	,	comma
SP10	-	hyphen or minus sign
SP11	.	full stop, period
SP12	/	solidus
SP13	:	colon
SP15	?	question mark
SA01	+	plus sign
SA04	=	equals sign

In addition, a subrepertoire may contain any other graphic characters selected from those listed in this Recommendation.

Note 1 – Each character in a subrepertoire retains its standard coded representation defined in this Recommendation.

Note 2 – The number of graphic characters in a subrepertoire is limited only by the size of the comprehensive repertoire. However, the composition of a subrepertoire may be related to the number of symbols in a changeable printing element. Note that several different symbols may be used in combination to present a single composite graphic character on an output device.

4 Coded representations

4.1 *Graphic character sets*

4.1.1 *Introduction*

4.1.1.1 The coded representations of the graphic characters defined in this Recommendation consist of the bit combination 2/0 for *Space*, and bit combinations of a *primary set* and a *supplementary set* of graphic characters.

4.1.1.2 The primary set and the supplementary set are defined in § 4.1.2. The use of the elements of the primary and supplementary sets to represent the graphic characters of the repertoire defined in § 3.2 is specified in § 4.1.3.

4.1.2 *Code table*

4.1.2.1 The primary set, specified in Figure 2/T.61 is a subset of the set of graphic characters of the International Reference Version of the 7-bit coded character set of Recommendation T.50.

b4	b3	b2	b1		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				b8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				b7	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0	0	0	0	0			SP	0	@	P		p				°			Ω	ĸ
0	0	0	1	1			!	1	A	Q	a	q			¡	±	`		Æ	æ
0	0	1	0	2			"	2	B	R	b	r			¢	²	´		Đ	đ
0	0	1	1	3			④	3	C	S	c	s			£	³	^		ª	ð
0	1	0	0	4			④	4	D	T	d	t			$	×	~		Ħ	ħ
0	1	0	1	5			%	5	E	U	e	u			¥	µ	¯			ı
0	1	1	0	6			&	6	F	V	f	v			#	¶	˘		Ĳ	ĳ
0	1	1	1	7			'	7	G	W	g	w			§	·	˙		Ŀ	ŀ
1	0	0	0	8			(	8	H	X	h	x			¤	÷	¨		Ł	ł
1	0	0	1	9			)	9	I	Y	i	y					②		Ø	ø
1	0	1	0	10			*	:	J	Z	j	z					˚		Œ	œ
1	0	1	1	11			+	;	K	[	k				«	»	¸		º	ß
1	1	0	0	12			,	<	L		l	|				¼	③ _		Þ	þ
1	1	0	1	13			-	=	M	]	m					½	˝		Ŧ	ŧ
1	1	1	0	14			.	>	N		n					¾	˛		Ŋ	ŋ
1	1	1	1	15			/	?	O	① _	o					¿	ˇ		ŉ	

CCITT - 40401

Note 1 — When interworking with Videotex, this code shall have the meaning *delimiter.*

Note 2 — In the 1980 version of this Recommendation code 12/9 was allocated to represent the umlaut mark. The use of this facility is discouraged. Its removal is foreseen in the future.

Note 3 — Non spacing underline is not a diacritical mark and may be combined with any graphic character of the Teletex repertoire.

Note 4 — Teletex terminals should send only the codes 10/6 and 10/8 for graphic characters # and ¤ respectively. When receiving codes 2/3 and 2/4 terminals should interpret them as # and ¤.

FIGURE 2/T.61

Code table for graphic characters showing *Space* in position 2/0, the primary set of graphic characters in positions 2/1 to 7/14, and the supplementary set of graphic characters in positions 10/1 to 15/14

4.1.2.2 The supplementary set, also specified in Figure 2/T.61 contains three types of elements:

a) Diacritical marks, which are used in combination with the letters of the basic Latin alphabet in the primary set to constitute the coded representations of accented letters and umlauts. Each of these characters acts as a modifier indicating that the immediately following letter is to be transformed into an accented letter or an umlaut.

b) Alphabetic characters, which are used in addition to the basic Latin alphabet in the primary set and which are not composed of diacritical marks and basic letters.

c) Nonalphabetic characters, which are used in addition to those in the primary set.

4.1.2.3 Bit combinations equivalent to the empty positions in Figure 2/T.61 code table shall not be transmitted in the basic Teletex service. Shaded positions denote bit combinations which are not part of the sets specified by the table.

Note – In Recommendations T.50 and T.100, and in ISO Standard 6937, bit combinations equivalent to empty positions in Figure 2/T.61 are used to represent graphic characters that are not, however, relevant to the basic Teletex service.

4.1.3 *Formats of coded representations*

4.1.3.1 The formats of the coded representations of the graphic characters of the repertoire defined in this Recommendation are as follows:

a) Alphabetic and nonalphabetic characters of the primary set: Each of these characters is represented by a single bit combination in the range 2/1 to 7/14. The primary set contains the letters of the basic Latin alphabet.

b) Accented letters and umlauts: Each of these characters is represented by a sequence of two bit combinations. The first part of this sequence consists of a bit combination in the range 12/0 to 12/15 (excluding 12/12) representing a diacritical mark. The second part consists of a bit combination in the range 4/1 to 5/10 or 6/1 to 7/10 representing a basic Latin letter.

c) Alphabetic and nonalphabetic characters of the supplementary set: Each of these characters is represented by a single bit combination in the range 10/1 to 11/15 or 13/0 to 15/14.

d) Diacritical marks as separate graphic characters are represented by sequences of bit combinations, in the same way as accented letters and umlauts, with bit combination 2/0 (*Space*) instead of a basic Latin letter.

e) The coded representation of the *Non-spacing underline* character shall precede that of the character to which it applies. In particular, when used to underline an accented letter or umlaut, the *Non-spacing underline* shall precede the bit combination representing the diacritical mark. Between the *Non-spacing underline* character and the character to which it applies, one or more control functions may occur, e.g. *Partial line down* (PLD), *Partial line up* (PLU) or a code extension control function.

   As there are two possibilities of underlining (the *Non-spacing underline* and the control function *Select graphic rendition*) some examples to show the use of them, and their interaction with the control functions PLU and PLD, are included in Annex F.

4.1.3.2 *Space* is coded as 2/0.

4.1.3.3 The coded representation of the Teletex primary set of graphic characters is given in Table 1/T.61.

4.1.3.4 The coded representation of the Teletex supplementary set of graphic characters is given in Table 2/T.61.

4.2 *Control function sets*

4.2.1 *Introduction*

4.2.1.1 The coded representations of the control functions defined in this Recommendation consist of bit combinations of a *primary set* and a *supplementary set* of control functions.

4.2.1.2 The primary set and the supplementary set are defined in § 4.2.2. The use of the elements of the primary and supplementary sets to represent the control functions of the repertoire defined in § 3.3 is specified in § 4.2.3.

TABLE 1/T.61

The Teletex primary set of graphic characters

Position	Graphic	Name or description	Position	Graphic	Name or description	Position	Graphic	Name or description
2/1	!	exclamation mark	4/0	@	commercial at	6/0		(not used)
2/2	"	quotation mark	4/1	A	capital A	6/1	a	small a
2/3		(not used)	4/2	B	capital B	6/2	b	small b
2/4		(not used)	4/3	C	capital C	6/3	c	small c
2/5	%	percent sign	4/4	D	capital D	6/4	d	small d
			4/5	E	capital E	6/5	e	small e
2/6	&	ampersand	4/6	F	capital F	6/6	f	small f
2/7	’	apostrophe	4/7	G	capital G	6/7	g	small g
2/8	(	left parenthesis	4/8	H	capital H	6/8	h	small h
2/9	)	right parenthesis	4/9	I	capital I	6/9	i	small i
2/10	*	asterisk	4/10	J	capital J	6/10	j	small j
2/11	+	plus sign	4/11	K	capital K	6/11	k	small k
2/12	,	comma	4/12	L	capital L	6/12	l	small l
2/13	−	hyphen or minus sign	4/13	M	capital M	6/13	m	small m
2/14	.	full stop, period	4/14	N	capital N	6/14	n	small n
2/15	/	solidus	4/15	O	capital O	6/15	o	small o
3/0	0	digit 0	5/0	P	capital P	7/0	p	small p
3/1	1	digit 1	5/1	Q	capital Q	7/1	q	small q
3/2	2	digit 2	5/2	R	capital R	7/2	r	small r
3/3	3	digit 3	5/3	S	capital S	7/3	s	small s
3/4	4	digit 4	5/4	T	capital T	7/4	t	small t
3/5	5	digit 5	5/5	U	capital U	7/5	u	small u
3/6	6	digit 6	5/6	V	capital V	7/6	v	small v
3/7	7	digit 7	5/7	W	capital W	7/7	w	small w
3/8	8	digit 8	5/8	X	capital X	7/8	x	small x
3/9	9	digit 9	5/9	Y	capital Y	7/9	y	small y
3/10	:	colon	5/10	Z	capital Z	7/10	z	small z
3/11	;	semicolon	5/11	[	left square bracket	7/11		(not used)
3/12	<	less-than sign				7/12	|	vertical line
3/13	=	equals sign	5/12		(not used)	7/13		(not used)
3/14	>	greater-than sign	5/13	]	right square bracket	7/14		(not used)
3/15	?	question mark	5/14		(not used)			
			5/15[a]	_	low line			

[a] When interworking with Videotex, this code shall have the meaning *delimiter*.

TABLE 2/T.61

The Teletex supplementary set of graphic characters

Position	Graphic	Name or description	Position	Graphic[a]	Name or description	Position	Graphic	Name or description
			12/0		(not used)	14/0	Ω	ohm sign
10/1	¡	inverted exclamation mark	12/1	□̀	grave accent	14/1	Æ	capital Æ diphthong
10/2	¢	cent sign	12/2	□́	acute accent	14/2	Đ	capital D with stroke
10/3	£	pound sign	12/3	□̂	circumflex accent	14/3	ª	ordinal indicator, feminine
10/4	$	dollar sign	12/4	□̃	tilde	14/4	Ħ	capital H with stroke
10/5	¥	yen sign	12/5	□̄	macron	14/5		(not used)
10/6	#	number sign	12/6	□̆	breve	14/6	Ĳ	capital IJ ligature
10/7	§	section sign	12/7	□̇	dot	14/7	Ŀ	capital L with middle dot
10/8	¤	currency symbol	12/8	□̈	diaeresis or umlaut mark	14/8	Ł	capital L with stroke
10/9		(not used)	12/9 [b]			14/9	Ø	capital O with slash
10/10		(not used)	12/10	□̊	ring	14/10	Œ	capital Œ ligature
10/11	«	angle quotation mark left	12/11	□̧	cedilla	14/11	º	ordinal indicator, masculine
10/12		(not used)	12/12	□̲	non-spacing underline	14/12	Þ	capital thorn, Icelandic
10/13		(not used)	12/13	□̋	double acute accent	14/13	Ŧ	capital T with stroke
10/14		(not used)	12/14	□̨	ogonek	14/14	Ŋ	capital eng, Lapp
10/15		(not used)	12/15	□̌	caron	14/15	ŉ	small n with apostrophe
11/0	°	degree sign	13/0		(not used)	15/0	ĸ	small k, Greenlandic
11/1	±	plus/minus sign	13/1		(not used)	15/1	æ	small æ diphthong
11/2	²	superscript 2	13/2		(not used)	15/2	đ	small d with stroke
11/3	³	superscript 3	13/3		(not used)	15/3	ð	small eth, Icelandic
11/4	×	multiply sign	13/4		(not used)	15/4	ħ	small h with stroke
11/5	µ	micro sign	13/5		(not used)	15/5	ı	small i without dot
11/6	¶	paragraph sign, pilcrow	13/6		(not used)	15/6	ĳ	small ij ligature
11/7	·	middle dot	13/7		(not used)	15/7	ŀ	small l with middle dot
11/8	÷	divide sign	13/8		(not used)	15/8	ł	small l with stroke
11/9		(not used)	13/9		(not used)	15/9	ø	small o with slash
11/10		(not used)	13/10		(not used)	15/10	œ	small œ ligature
11/11	»	angle quotation mark right	13/11		(not used)	15/11	ß	small sharp s, German
11/12	¼	fraction one quarter	13/12		(not used)	15/12	þ	small thorn, Icelandic
11/13	½	fraction one half	13/13		(not used)	15/13	ŧ	small t with stroke
11/14	¾	fraction three quarters	13/14		(not used)	15/14	ŋ	small eng, Lapp
11/15	¿	inverted question mark left	13/15		(not used)			

[a] Diacritical marks are illustrated together with a rectangle representing the relative position of the graphic character with which they are normally associated.

[b] In the 1980 version of this Recommendation code 12/9 was allocated to represent the umlaut mark. The use of this facility is discouraged. Its removal is foreseen in the future.

4.2.2 *Code table*

4.2.2.1 The primary set, specified in Figure 3/T.61, has been derived from the set of control functions of the 7-bit coded character set of Recommendation T.50.

4.2.2.2 The supplementary set is also specified in Figure 3/T.61.

				b_8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				b_7	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	0	0	0																
0	0	0	1	1																
0	0	1	0	2																
0	0	1	1	3																
0	1	0	0	4																
0	1	0	1	5																
0	1	1	0	6																
0	1	1	1	7																
1	0	0	0	8	BS															
1	0	0	1	9		SS2 (1)														
1	0	1	0	10	LF	SUB														
1	0	1	1	11		ESC (1)							PLD	CSI						
1	1	0	0	12	FF								PLU							
1	1	0	1	13	CR	SS3 (1)														
1	1	1	0	14	LS1 (1)															
1	1	1	1	15	LS0 (1)															

CCITT - 40411

Note — The characters ESC, LS1, LS0, SS2 and SS3 must not be used in the basic Teletex service. The definitions of these control characters are contained in § E.3.2.3.

FIGURE 3/T.61

Code table for control functions showing the primary set of control functions in positions 0/0 to 1/15, and the supplementary set of control functions in positions 8/0 to 9/15

4.2.2.3 Empty positions in the code table denote bit combinations that are reserved for future standardization. Shaded positions denote bit combinations that are not part of the sets specified by the table.

Note – In Recommendation T.50 and in ISO Standard 6429, bit combinations equivalent to empty positions in Figure 3/T.61 are used to represent control functions, which are not, however, relevant to the transmission of text in the basic Teletex service.

4.2.3 *Formats of coded representations*

4.2.3.1 The formats of the coded representations of the control functions of the repertoire defined in this Recommendation are as follows:

a) Control functions that are elements of the primary set: Each of these control functions is represented by a single bit combination in the range 0/0 to 1/15.

b) Control functions that are elements of the supplementary set: Each of these control functions is represented by a single bit combination in the range 8/0 to 9/15.

c) Control functions with parameters: Each of these control functions is represented by a control sequence of the form

$$\text{CSI } P_1 \ldots P_n \, I_1 \ldots I_m \, F$$

as explained in Annex D. The first part of this sequence consists of the coded representation of the code extension control function *Control sequence introducer* (CSI) of the supplementary set; the second part (which may be omitted) consists of one or more bit combinations in the range 3/0 to 3/15 representing one or more parameters of the control function; the last part of the control sequence is composed of one or more bit combinations that identify the intended control function; this part consists of either a single *final* (F) bit combination in the range 4/0 to 7/14, or one or more *intermediate* (I) bit combinations in the range 2/0 to 2/15 followed by a *final* bit combination in the range 4/0 to 7/14.

4.2.3.2 The coded representations of the control functions of the repertoire defined in this Recommendation are specified by the lists in §§ 4.2.4.1 (format effectors), 4.2.4.2 (presentation control functions), 4.2.4.3 (code extension control functions) and 4.2.4.4 (miscellaneous control functions). These lists are composed as described below:

a) the first column contains the identifier of each control function;

b) the second column presents the abbreviated name of the control function;

c) the third column specifies the coded representation of the control function.

4.2.4 *Coded representations*

4.2.4.1 *Format effectors*

Identifier	Abbreviation	Coded representation
CF10	BS	0/8
CF12	LF	0/10
CF14	FF	0/12
CF15	CR	0/13
CF16	PLD	8/11
CF17	PLU	8/12

4.2.4.2 *Presentation control functions*

Identifier	Abbreviation	Coded representation
CP01	PFS	CSI $P_1 \ldots P_n$ 2/0 4/10
CP03	SGR	CSI $P_1 \ldots P_n$ 6/13
CP04	SHS	CSI $P_1 \ldots P_n$ 2/0 4/11
CP05	SVS	CSI $P_1 \ldots P_n$ 2/0 4/12

4.2.4.3 *Code extension control functions*

Identifier	Abbreviation	Coded representation
CE06	CSI	9/11

4.2.4.4 *Miscellaneous control functions*

Identifier	Abbreviation	Coded representation
CM02	SUB	1/10
CM04	IGS	CSI P_1 . . . P_n 2/0 4/13

ANNEX A

(to Recommendation T.61)

Code extension procedures

A.1 The basic Teletex service makes use of an 8-bit coded character set, which is implicitly designated and invoked as a default condition according to § 3.3.1.4.

A.2 This 8-bit code contains the primary set of graphic characters as G0 set in positions 2/1 to 7/14, the supplementary set of graphic characters as G2 set in positions 10/1 to 15/14, the primary set of control characters in positions 0/0 to 1/15 and the supplementary set of control characters in positions 8/0 to 9/15. The characters constituting these basic sets are described in this Recommendation.

A.3 For enhancement of the basic Teletex service the following code extension facilities will be provided:

a) designation and invocation of control sets C0 and C1 by means of the relevant escape sequences. See Figure A-1/T.61.

b) designation of up to four graphic character sets called G0, G1, G2 and G3;

c) invocation of the designated graphic sets, by means of locking and/or non-locking shift functions.

The shift functions used are:

LS0, LS1, LS1R, LS2, LS2R, LS3, LS3R, SS2, SS3.

According to ISO Standard 2022 the bit combination following SS2 or SS3 represents a character from columns 2 to 7, except positions 2/0 and 7/15, of a code table. All characters in columns 8 to 15 are excluded from assignment to the bit combinations following SS2 or SS3. The use of a single shift function does not affect the current status established by one or more of the locking-shift functions.

There are seven locking-shift functions used exclusively for graphic set extension. Each invokes an additional set of 94 graphic characters into columns 2 to 7 or into columns 10 to 15.

The single shift functions, the locking-shift functions and the related G-sets are shown in Table A-1/T.61.

A.4 The shift functions are defined in § E.3.2.3 and coded as specified in § E.4.2.3.

The use of shift functions is implicitly negotiated by specifying the character sets during the negotiation procedure of terminal capabilities in the control procedures of Recommendation T.62. All terminals supporting graphic character code extension techniques must support shift functions LSO, LS2R and SS2 in order to invoke the Teletex primary and supplementary graphic character sets within a page.

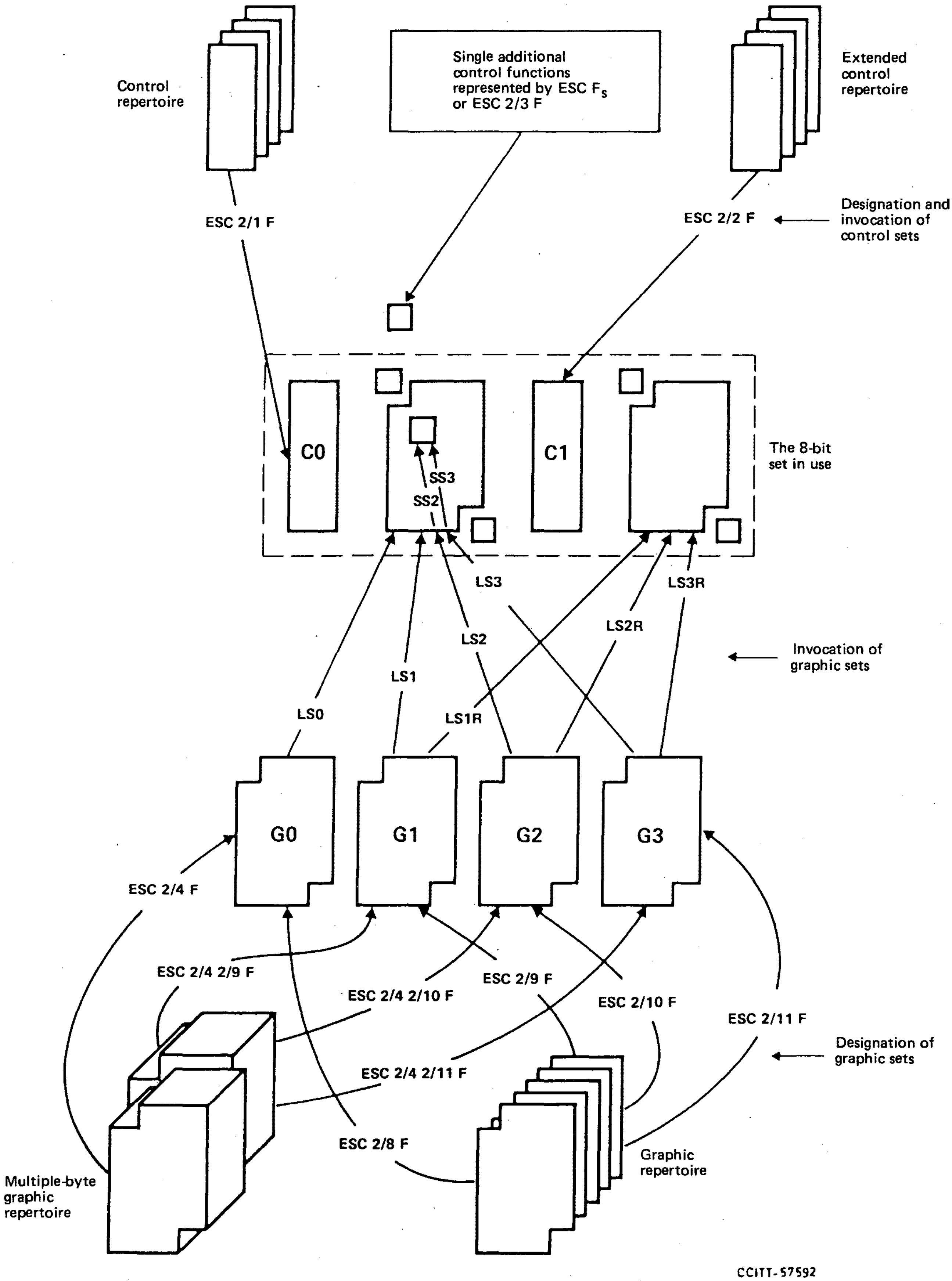


FIGURE A-1/T.61

Code extension in an 8-bit environment (showing all shift facilities)

TABLE A.1/T.61

Allocation of shift functions to the graphic character sets

Graphic character set	Locking shift functions for invocation of G-set to positions		Non-locking shift functions for invocation of G-set to positions
	2/1 to 7/14	10/1 to 15/14	2/1 to 7/14
G0	LS0	–	–
G1	LS1	LS1R	–
G2	LS2	LS2R	SS2
G3	LS3	LS3R	SS3

A.5 For the designation and invocation of control sets the following escape sequences are used:

C0 set ESC 2/1 F

C1 set ESC 2/2 F

The symbol F denotes the final bit combination of an escape sequence.

The final characters F have to be provided by CCITT and ISO.

A.6 For the designation of CCITT/ISO registered graphic character sets the escape sequence formats shown in Table A-2/T.61 are used:

TABLE A.2/T.61

Escape sequence formats for designation of CCITT/ISO registered graphic character sets

Graphic character set	Escape sequence formats for designation of	
	Single-byte set	Multiple-byte set
G0	ESC 2/8 F	ESC 2/4 F
G1	ESC 2/9 F	ESC 2/4 2/9 F
G2	ESC 2/10 F	ESC 2/4 2/10 F
G3	ESC 2/11 F	ESC 2/4 2/11 F

Note 1 – The symbol F denotes the final bit combination of an escape sequence.

Note 2 – The final characters F have to be provided by CCITT and ISO.

A.7 For the designation of *Dynamically redefinable character sets* (DRCS) the escape sequence formats shown in Table A-3/T.61 are used.

TABLE A.3/T.61

Escape sequence formats for designation of dynamically redefinable character sets

Graphic character set	Escape sequence formats for designation of	
	Single-byte DRCS	Multiple-byte DRCS
G0	ESC 2/8 2/0 F	ESC 2/4 2/8 2/0 F
G1	ESC 2/9 2/0 F	ESC 2/4 2/9 2/0 F
G2	ESC 2/10 2/0 F	ESC 2/4 2/10 2/0 F
G3	ESC 2/11 2/0 F	ESC 2/4 2/11 2/0 F

Note 1 – The final character F denotes the final bit combination of an escape sequence.

Note 2 – The final character F should be in the range 4/0 to 7/14 and should be assigned by the user. It is recommended that these final characters be allocated sequentially starting with 4/0.

A.8 Escape sequences for the designation of graphic character sets, and the associated shift functions for invoking these graphic sets, as well as the escape sequence for the designation and invocation of the control sets, may appear at any position within the text.

A.9 The final character F for the basic Teletex character sets are:

– Primary control set F
– Supplementary control set F
– Primary graphic set F
– Supplementary graphic set F

Note – "F" will be replaced by the bit combination assigned by the ISO Registration Authority.

ANNEX B

(to Recommendation T.61)

Use of diacritical marks

B.1 The supplementary set contains 13 diacritical marks that are used in combination with the letters of the basic Latin alphabet in the primary set to constitute the coded representations of accented letters and umlauts. These diacritical marks, and their coded representations, are:

Acute accent	12/2
Grave accent	12/1
Circumflex accent	12/3
Diaeresis or umlaut mark	12/8
Tilde	12/4
Caron	12/15
Breve	12/6
Double acute accent	12/13
Ring	12/10
Dot	12/7
Macron	12/5
Cedilla	12/11
Ogonek	12/14

Note – In the 1980 version of this Recommendation code 12/9 was allocated to represent the umlaut mark. The use of this facility is discouraged. Its removal is foreseen in the future.

B.2 Figure B-1/T.61 specifies the combinations of diacritical marks and basic letters that are defined in this Recommendation.

Basic letter	Acute accent	Grave accent	Circumflex accent	Diaeresis or umlaut mark	Tilde	Caron	Breve	Double acute accent	Ring	Dot	Macron	Cedilla	Ogonek
a A	á Á	à À	â Â	ä Ä	ã Ã		ă Ă		å Å		ā Ā		ą Ą
b B													
c C	ć Ć		ĉ Ĉ			č Č				ċ Ċ		ç Ç	
d D						ď Ď							
e E	é É	è È	ê Ê	ë Ë		ě Ě				ė Ė	ē Ē		ę Ę
f F													
g G	ǵ		ĝ Ĝ				ğ Ğ			ġ Ġ		Ģ	
h H			ĥ Ĥ										
i I	í Í	ì Ì	î Î	ï Ï	ĩ Ĩ					İ	ī Ī		į Į
j J			ĵ Ĵ										
k K												ķ Ķ	
l L	ĺ Ĺ					ľ Ľ						ļ Ļ	
m M													
n N	ń Ń				ñ Ñ	ň Ň						ņ Ņ	
o O	ó Ó	ò Ò	ô Ô	ö Ö	õ Õ			ő Ő			ō Ō		
p P													
q Q													
r R	ŕ Ŕ					ř Ř						ŗ Ŗ	
s S	ś Ś		ŝ Ŝ			š Š						ş Ş	
t T						ť Ť						ţ Ţ	
u U	ú Ú	ù Ù	û Û	ü Ü	ũ Ũ		ŭ Ŭ	ű Ű	ů Ů		ū Ū		ų Ų
v V													
w W			ŵ Ŵ										
x X													
y Y	ý Ý		ŷ Ŷ	ÿ Ÿ									
z Z	ź Ź					ž Ž				ż Ż			

FIGURE B-1/T.61

Use of diacritical marks

ANNEX C

(to Recommendation T.61)

Identification system

C.1 For the purpose of this Recommendation, a system was developed that allows for the identification and description of each graphic character or control function. The system is shown in Figure C-1/T.61

C.2 Each identifier consists of two letters and two digits.

C.3 The first letter indicates the alphabet, the language, etc.

C.4 The second letter indicates the letter of an alphabet or, in the case of a nonalphabetic graphic character or a control function, the group of characters or control functions.

C.5 The first digit indicates whether the letter in the second position is an accented one, whether the diacritical mark is above or below the letter, etc. It has no special meaning in the case of the first letter being a C, N or S.

C.6 The second digit indicates whether the letter is a capital or a small one (even or odd). If the first letter is a C, N or S, this digit being even or odd has no significance.

C.7 The numbering is used in a consistent manner so that each diacritical mark is always given the same number.

C.8 The numbering principle is shown in Table C-1/T.61.

TABLE C-1/T.61

Numbering principle for alphabetic characters

Item	Small	Capital
No diacritical mark	01	02
Acute accent	11	12
Grave accent	13	14
Circumflex accent	15	16
Diaeresis or umlaut mark	17	18
Tilde	19	20
Caron	21	22
Breve	23	24
Double acute accent	25	26
Ring	27	28
Dot	29	30
Macron	31	32
Cedilla	41	42
Ogonek	43	44
Diphthong or ligature	51	52
Special form	61, 63, etc.	62, 64, etc.

L A 0 1

- L A 0 **1**:
  - For alphabetic characters:
    odd digit = small letter;
    even digit = capital letter.
  - If C, N or S in first position:
    no special meaning.
- L A **0** 1:
  - For alphabetic characters:
    zero = letter without diacritical mark;
    one, two or three = letter with diacritical mark above it;
    four = letter with diacritical mark below it;
    five = diphthong or ligature;
    six = special form.
  - If C, N or S in first position:
    no special meaning.
- L **A** 0 1:
  - For alphabetic characters:
    A to Z = the respective letter of the Latin alphabet, or the Latin equivalent in the case of a non-Latin letter;
  - If C in first position:
    E = code extension control function;
    F = format effector;
    P = presentation control function;
    M = other control function.
  - If N in first position:
    D = decimal digit;
    F = fraction;
    S = subscript or superscript.
  - If S in first position:
    A = arithmetic sign;
    C = currency sign;
    D = diacritical mark;
    P = punctuation mark;
    M = other symbol.
- **L** A 0 1:
  - L = Latin alphabetic character;
  - C = control function;
  - N = nonalphabetic graphic character;
  - S = special graphic character.

FIGURE C-1/T.61

Identification system

ANNEX D

(to Recommendation T.61)

Format of control sequences

This Annex is for information only and does not form part of the requirements laid down by this Recommendation; instead, it provides explanations of the format of control sequences. It consists of non-contiguous extracts from the ISO Standard 6429. For ease of cross-reference to that standard the original numbering scheme has been retained in preference to allocating a new set of consistent paragraph numbers. To ensure accurate interpretation of detailed meanings, reference should be made to ISO 6429.

The double codings of parameters, intermediates and finals of a control sequence, and the operand of a single-shift character (as mentioned in Section 10 of the ISO extract) are not allowed in the Teletex service. In addition 7-bit coding is not relevant in the Teletex service.

Extract from ISO Standard 6429.

"5.1.2 *Control functions represented by control sequences*

A control sequence consists of CONTROL SEQUENCE INTRODUCER (CSI) followed by one or more characters which identify the control function and, if applicable, represent the parameters of the control function. The control function CSI itself is an element of the C1 set.

The format of a control sequence shall be:

$$\text{CSI } P_1 \ldots P_n \, I_1 \ldots I_m \, F$$

where:

a) CSI is represented by ESC 5/11 in a 7-bit code and by bit combination 9/11 in an 8-bit code (see § 5.2).

b) $P_1 \ldots P_n$ correspond to parameter values and are represented by bit combinations of column 3; these bit combinations are omitted if the control function has no parameter, and may be omitted if the default parameter value is to apply.

c) $I_1 \ldots I_m$ are Intermediate characters represented by bit combinations of column 2 which, together with the bit combination representing the Final character F, identify the control function; these bit combinations are omitted if the control function is identified only by the bit combination representing the Final character F.

   Note – The number of Intermediate characters is not limited by this International Standard (ISO 6429); in practice, at the most, one Intermediate character will be sufficient since over one thousand control functions may be identified using not more than one Intermediate character.

d) F is the Final character; it is represented by a bit combination of column 4, 5, 6 or 7 (except 7/15); it terminates the control sequence and, together with the Intermediate characters, if present, identifies the control function (however, see § 10).

The occurrence of any bit combinations which do not conform to the above format is an error condition for which recovery is not specified by this International Standard (ISO 6429).

The Final characters (either used alone or together with Intermediate characters) are classified in two categories:

i) the control functions identified by a Final character represented by a bit combination of columns 4, 5 and 6 are either standardized or reserved for future standardization;

ii) the control functions identified by a Final character represented by a bit combination of column 7 (except 7/15) are not standardized and are available for private (or experimental) use.

There are two types of parameters: numeric and selective (see § 5.4).

The bit combinations of columns 4, 5 and 6 representing the Final characters and the bit combinations representing the Intermediate characters are specified in Table 2 and Table 3."

"5.4 *Parameter representations*

A control sequence may contain a string $P_1 \dots P_n$ representing one or more parameters to complete the specification of the control function.

The string of bit combinations representing $P_1 \dots P_n$ contained in a control sequence is called the parameter string. It consists of bit combinations of column 3 and is interpreted as follows:

- If the first bit combination of the parameter string is in the range 3/0 to 3/11, the parameter string is interpreted according to the format described below.
- If the first bit combination of the parameter string is in the range 3/12 to 3/15, the parameter string is available for private (or experimental) use. Its format and meaning are not defined by this International Standard (ISO 6429).

5.4.1 *Parameter string format*

A parameter string shall have the following format:

a) a parameter string consists of one or more parameter sub-strings;

b) each parameter sub-string consists of one or more bit combinations from 3/0 to 3/9, representing the digits zero to nine;

c) parameter sub-strings are separated by one bit combination 3/11;

d) bit combination 3/10 is reserved for future standardization as an additional parameter separator;

e) bit combinations 3/12 to 3/15 shall not be used;

f) in each parameter sub-string, leading bit combinations 3/0 are not significant and may be omitted;

g) if the parameter string starts with the bit combination 3/11, an empty parameter sub-string is assumed preceding the separator; if the parameter string terminates with the bit combination 3/11, an empty parameter sub-string is assumed following the separator; if the parameter string contains successive bit combinations 3/11, empty parameter sub-strings are assumed between the separators;

h) if the control function has more than one parameter, and some parameter sub-strings are empty, the separators (bit combination 3/11) must still be present. However, if the last parameter sub-string(s) is empty, the separator preceding it may be omitted (see Annex B – Coding examples);

j) an empty parameter sub-string or a parameter sub-string which consists of bit combinations 3/0 only represents a default value which depends on the control function.

5.4.2 *Types of parameters*

In a control sequence representing a control function with parameters, each parameter sub-string corresponds to one parameter, and represents the value of that parameter. The number of parameters is either fixed of variable, depending on the control function. If the number of parameters is variable, neither the maximum number of values nor the order in which the corresponding actions are performed are defined by this International Standard (ISO 6429).

5.4.2.1 *Numeric parameters*

In a control sequence representing a control function with numeric parameters, each parameter sub-string which has a value other than a zero represents a quantity in decimal notation.

5.4.2.2 *Selective parameters*

In a control sequence representing a control function with selective parameters, each parameter sub-string whilst expressed by digits, is not quantitative i.e. does not represent a quantity in decimal notation. Each value corresponds to one of the actions the control function can perform.

A particular parameter value may have the same meaning as a combination of two or more separate values."

"10 *Transformation between 7-bit and 8-bit coded representations*

The control functions defined in this International Standard (ISO 6429) can be coded in a 7-bit code as well as in an 8-bit code: both forms of coded representation are equivalent and in accordance with ISO 2022.

However, when data containing these control functions are transformed from a 7-bit to an 8-bit representation or vice versa, the transformation algorithm specified in ISO 2022 may produce results which are formally in disagreement with this International Standard (ISO 6429).

In order to make allowance for such unintended but unavoidable deviations, the format rules are extended in the manner described below.

In an 8-bit code, the bit combination of columns 10 to 15 (except 10/0 and 15/15) are permitted to represent:

a) parameters, intermediates and finals of a control sequence;

b) the contents of a control string;

c) the operand of a single-shift character.

In these situations, the bit combinations in the range 10/1 to 15/14 have the same meanings as the corresponding bit combination in the range 2/1 to 7/14."

ANNEX E

(to Recommendation T.61)

Standardized options

E.1 *General*

E.1.1 This annex contains detailed definitions that shall be used to implement Teletex standardized options included in the Teletex repertoire of graphic characters and control functions.

E.2 *Definitions*

E.2.1 The definitions contained in § 2 shall apply unless explicitly amended.

E.2.2 Additional definitions are for further study.

E.3 *Teletex character repertoire*

E.3.1 *Teletex optional repertoire of graphic characters*

E.3.1.1 *Registered character sets*

- Japanese Kanji terminal optional graphic character repertoire.
- Japanese Graphic Character Set for Information Interchange (JIS C 6226 – 1983 [1)]) used as a GO set.

The use of additional sets is for further study.

E.3.1.2 *Dynamically redefinable character sets (DRCS)*

DRCS will be used by Japanese Kanji terminals to extend their character repertoire. Japanese Kanji character patterns will be loaded into a terminal by procedures described in Recommendations T.62, and shall be designated and invoked as described in Annex A of this Recommendation.

[1)] Japanese Industrial Standard.

A definition for **DRCS** is as follows:

A DRCS is a set of graphic characters whose exact shape is specified and transmitted at the time of use. Such characters may be alphabetic, special symbols or picture element symbols. Once loaded, a DRCS is regarded as a member of a library that can be designated by appropriate ESC sequences as a G0, G1, G2 or G3 set.

ESC I 2/0 F designates such a set, where I will take a value from 2/8 ... 2/11 to indicate whether the set is to be used as a G0, G1, G2 or G3 set respectively.

63 sets may be identified by means of such four character sequences. This should be enough for most requirements but a third or more intermediate character can be inserted between the 2/0 character and the final character if more sets are needed. See ISO Standard 2022.

Sequences with 2/0 as the second intermediate character and with 2/0 to 2/7 as the first Intermediate character are reserved for future standardization.

Multiple-byte graphic sets may also be dynamically redefinable. ECS 2/4 I 2/0 F designate such a set when it is to be a G1, G2 or G3 set, where I takes the same value and has the same meaning as in the preceding paragraphs. However, when such a set is to be a G0 set, it shall be designated by ESC 2/4 2/0 F.

Note 1 – This class of escape sequence is exceptional because the allocation of final (and possible intermediate) character is not done by the ISO Registration Authority but by the user. It is recommended that final characters be allocated sequentially, starting with 4/0.

Note 2 – There is a need for this particular escape sequence as distinct from the normal three character sequence used to represent registered sets. This escape sequence implies an exact description of the shape or font of the characters.

E.3.2 *Teletex optional repertoire of control functions*

Note - For the definition of optional control functions and the associated optional parameter values, the appropriate ISO standard should be considered.

E.3.2.1 *Format effectors*

Identifier	Abbreviation	Name and definition
CF20	RLF	*Reverse line feed*
		A format effector that moves the active position to the corresponding character position on the preceding line, defined by the current value of the vertical spacing (see SVS).
		Note – In order to use RLF, it is first necessary to negociate the use of an optional supplementary control character set containing RLF (in addition to those characters shown in Figure 3/T.61 using the control procedures of Recommendation T.62. Designation and invocation of this control character set may appear at any position in the text. For further details see Annex A.
		The escape sequence for this control set is ESC 2/2 F.
		This control set was not assigned an escape sequence *Final* bit combination during the 1981-84 Study period since no identifiable use for RLF could be found. The need for RLF is for further study.

E.3.2.2 *Presentation control functions*

Identifier	Abbreviation	Name and definition
CP01	PFS	*Page format selection* (Definition: see § 3.3.3) The meaning of the parameter value is: 0: vertical basic page format [1]; 1: horizontal basic page format [1]; 2: vertical A4 page format; 3: horizontal A4 page format; 4: reserved for future option; 5: reserved for future option; 6: vertical ISO 3535/A4 page format; 7: horizontal ISO 3535/A4 page format; 8: vertical North American legal size page format; 9: horizontal North American legal size page format: 10: vertical ISO A4 page format (for use by Japanese Kanji terminals); 11: horizontal ISO A4 page format (for use by Japanese Kanji terminals); 12: vertical ISO B5 page format (for use by Japanese Kanji terminals); 13: horizontal ISO B5 page format (for use by Japanese Kanji terminals); 14: vertical ISO B4 page format (for use by Japanese Kanji terminals); 15: horizontal ISO B4 page format (for use by Japanese Kanji terminals).
CP03	SGR	*Select graphic rendition* (Definition: see § 3.3.3) The meaning of the parameter value is: 0: default rendition [1]; 4: underlined [1]; 26: proportional spacing character pitch may be used. See Note 1 below. When proportional spacing character pitch is invoked, the parameter value of the SHS function shall specify the nominal character pitch. *Note 1* – Parameter value 26 specifies that the text that follows may be presented with proportional spacing at the recipient's option. For interworking with devices not capable of proportional spacing, no line or part of a line of text should contain more characters than are permitted by the current pitch value specified by the most recent occurrence of SHS. *Note 2* – An SGR control sequence may contain more than one parameter. The parameter for a particular rendition will need to be restated on each occurrence of the SGR function if the rendition is to remain operative. Parameters shall be separated by bit combination 3/11. See Annex D § 5.4.1. *Note 3* – A terminal's capability to support proportional spacing shall be indicated by including an SGR sequence, with parameter value 26 only, in the Recommendation T.62 procedure for exchanging non-basic terminal capabilities.

[1] As defined for the basic Teletex service.

Identifier	Abbreviation	Name and definition
CP04	SHS	*Select horizontal spacing* (Definition: see § 3.3.3) The meaning of the parameter value is: 0: 10 characters per 25.4 mm [3]; 1: 12 characters per 25.4 mm; 2: 15 characters per 25.4 mm; 3: 6 characters per 25.4 mm. *Note* – Parameter value 3 may only be used with page formats specified by PFS parameter values 10 to 15.
CP05	SVS	*Select vertical spacing* (Definition: see § 3.3.3) The meaning of the parameter value is: 0: 6 lines per 25.4 mm [3]; 1: 4 lines per 25.4 mm [3]; 2: 3 lines per 25.4 mm [3]; 3: 12 lines per 25.4 mm [3]; 4: 8 lines per 25.4 mm; 5: 6 lines per 30.0 mm; 6: 4 lines per 30.0 mm; 7: 3 lines per 30.0 mm; 8: 12 lines per 30.0 mm.
CP06	SPD	*Select presentation direction* A presentation control function with one selective parameter which specifies the character path and line progression, until these directions are respecified by another occurrence of SPD. The meaning of the parameter value is as follows: 0: character path from left to right, line progression from top to bottom; 1: character path from top to bottom, line progression from right to left when page is orientated for viewing. See Table E.1/T.61. The default value of the parameter is 0. *Note 1* – An occurrence of SPD is only effective at the beginning of a page, i.e. SPD has no effect in the middle of a page. *Note 2* – Some Japanese characters use different patterns for vertical writing to those used for horizontal writing. Table E.2/T.61 shows the difference between horizontal and vertical writing character patterns. *Note 3* – The perceived effects of SPD on the other control functions are shown in Table E-3/T.61. *Note 4* – Figure E-1/T.61 shows an example of a page format using PFS parameter values 10, 12 and 14, with SPD parameter values 0 and 1. *Note 5* – SPD may only be used with page formats specified by PFS parameter values 10 to 15.

[3] As defined for the basic Teletex service.

Identifier	Abbreviation	Name and definition
CP07	GSM	*Graphic Size Modification*

GSM is a presentation control function with two numeric parameters. Its use causes the height and/or width of the character font to be modified until a subsequent occurrence of GSM in the data stream, or a page boundary is reached.

The meaning of the parameter values are:

n : specifies the character dimension in the direction of the line progression as a percentage of the default font size.

m : specifies the character dimension in the direction of the character path as a percentage of the default font size.

The order of the parameters is GSM (*n*, *m*) and the default value of *n* and *m* is 100. Permitted values of parameters n and m, and the effect that these values have on the character spacing (as specified by SHS) and size, are as follows.

For horizontal writing (SPD 0):

GSM 100, 50 causes character spacing and width to be halved.
GSM 100, 100 has no effect.
GSM 100, 200 causes character spacing and width to be doubled.

For vertical writing (SPD 1):

GSM 100, 100 has no effect.
GSM 100, 200 causes character spacing and height to be doubled.

Note 1 – GSM affects only those characters which follow it in the data stream, not those previously received.

Note 2 – GSM may only be used with page formats specified by PFS parameter values 10 to 15.

TABLE E-1/T.61

Intended viewing orientation of a page

Page format select parameter value	Intended viewing orientation of page with SPD parameter values	
	0	1
10, 12, 14	portrait	landscape
11, 13, 15	landscape	portrait

TABLE E-2/T.61

Difference between character patterns used for horizontal and vertical writing

Meaning	Horizontal writing characters	Vertical writing characters	Differences
Long vowel sign	ー	︱	Figure
Hyphen	-	︲	
Equal sign	=	‖	
Numerical rangs sign	～	≀	
Dash	—	︱	
Dotted line	……	︙︙	
Vertical line	|	—	
Parallel sign	‖	=	
Parenthesis and bracket marks	( ) 〔 〕 [ ] { } 〈 〉 《 》 「 」 『 』 【 】	︵ ︶ ︹ ︺ ﹇ ﹈ ︷ ︸ ︿ ﹀ ︽ ︾ ﹁ ﹂ ﹃ ﹄ ︻ ︼	
Japanese comma	、	、	Position
Japanese period	。	。	
Small HIRA-KANA characters	ぁ ぃ ぅ ぇ ぉ ゃ ゅ ょ っ ゎ	ぁ ぃ ぅ ぇ ぉ ゃ ゅ ょ っ ゎ	
Small KATA-KANA characters	ァ ィ ゥ ェ ォ ャ ュ ョ ッ ヮ ヵ ヶ	ァ ィ ゥ ェ ォ ャ ュ ョ ッ ヮ ヵ ヶ	
Half-width characters (European language, KATA-KANA and numeric characters)	半角 (half-width)	半角 a) (half-width)	Enlarging direction
Double-width characters (Japanese language, European language and numeric characters)	倍角 A B	倍角 A B	
Highlight (under line)	強調	強調	Position

CCITT - 83910

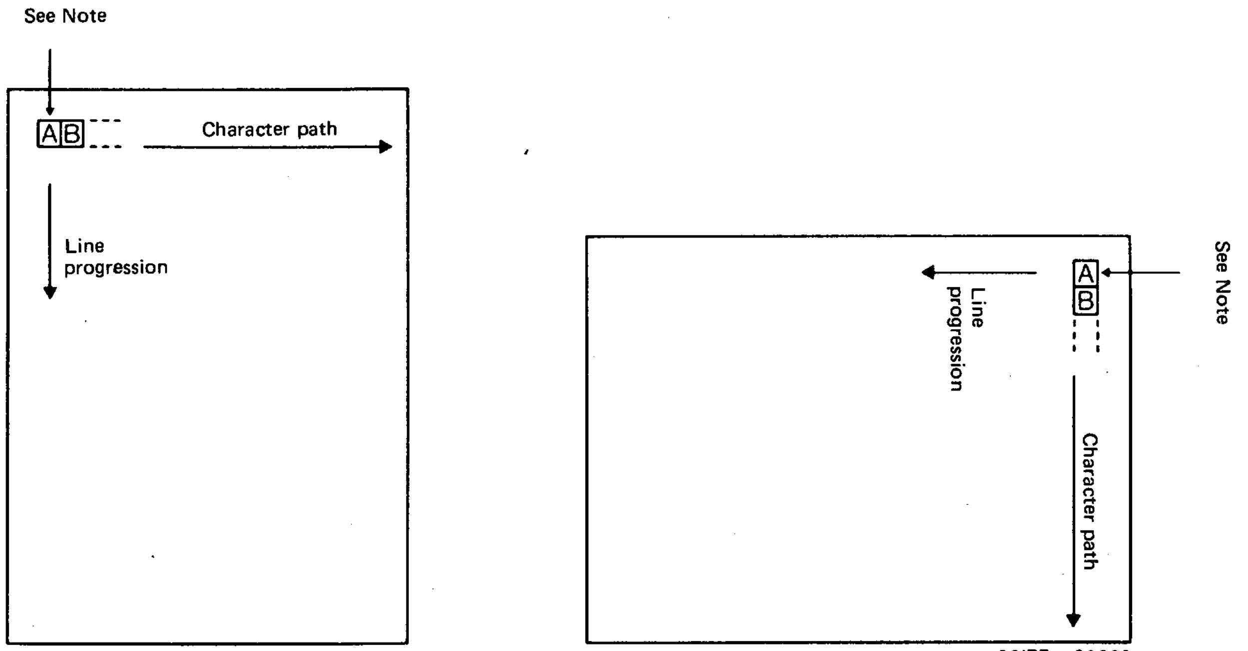
a) No change in pattern.

TABLE E-3/T.61

Perceived effect of SPD on other control functions when page is viewed with intended orientation

Control functions		SPD # 0 (horizontal lines)	SPD # 1 (vertical lines)
Format effectors	BS, CR	Backward (leftward)	Backward (upward)
	RLF	Upward	Rightward
	LF	Downward	Leftward
	PLU	Upward	Rightward
	PLD	Downward (ex.) 化学式H_2O	Leftward (ex.) 化学式H_2O
Presentation control functions	GSM	Character "height"	Character "width"
		Character "width"	Character "height"
	SVS	Vertical direction	Horizontal direction
	SHS	Horizontal direction	Vertical direction
	SGR	Under line	Right side line

CCITT - 83920



a) PFS parameter values: 10, 12, 14
SPD parameter value: 0

b) PFS parameter values: 10, 12, 14
SPD parameter value: 1

Note – Active position when page is introduced by FF, CR as defined in Recommendation T.60.

FIGURE E-1/T.61

Explanation of page format with SPD parameters 0 and 1

E.3.2.3 *Code extension control functions*

Identifier	Abbreviation	Name and definition
CE03	ESC	*Escape* A code extension control function which is used to provide coded representations for additional control functions.
CE04	SS2	*Single Shift 2* A code extension control function which is used in conjunction with ESCAPE to extend the graphic character set of an 8-bit code. SS2 is a non-locking shift function which invokes one character of the currently designated G2 set.
CE05	SS3	*Single Shift 3* A code extension control function which is used in conjunction with ESCAPE to extend the graphic character set of an 8-bit code. SS3 is a non-locking shift function which invokes one character of the currently designated G3 set.
CE07	LS0	*Locking Shift 0* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LSO is a locking shift function which invokes the currently designated GO set into positions 2/1 to 7/14.

Identifier	Abbreviation	Name and definition
CE08	LS1	*Locking Shift 1* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LSI is a locking shift function which invokes the currently designated G1 set into positions 2/1 to 7/14.
CE09	LS1R	*Locking Shift 1 Right* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LS1R is a locking shift function which invokes the currently designated G1 set into position 10/1 to 15/14.
CE10	LS2	*Locking Shift 2* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LS2 is a locking shift function which invokes the currently designated G2 set into positions 2/1 to 7/14.
CE11	LS2R	*Locking Shift 2 Right* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LS2R is a locking shift function which invokes the currently designated G2 set into positions 10/1 to 15/14.
CE12	LS3	*Locking Shift 3* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LS3 is a locking shift function which invokes the currently designated G3 set into positions 2/1 to 7/14.
CE13	LS3R	*Locking Shift 3 Right* A code extension control function which is used in conjunction with other locking shift functions and with ESCAPE to extend the graphic character set of an 8-bit code. LS3R is a locking shift function which invokes the currently designated G3 set into positions 10/1 to 15/14.

E.4 *Coded representations*

E.4.1 *Optional graphic character sets*

E.4.1.1 *Registered character sets*

- Japanese Graphic Character Set for Information Interchange (Set No. 87 in ISO Register) used as a G0 set.

Designation sequence : ESC 2/4 4/2.

E.4.1.2 *Dynamically redefinable character sets (DRCS)*

Designation sequence: see Annex A.

E.4.2 *Optional control functions*

E.4.2.1 *Format effectors*

Identifier	Abbreviation	Coded representation
CF20	RLF	8/13

E.4.2.2 *Presentation control functions*

Identifier	Abbreviation	Coded representation
CP06	SPD	CSI $P_1 \ldots P_n$ 2/0 5/3
CP07	GSM	CSI $P_1 \ldots P_n$ 2/0 4/2

Additional control functions are for further study.

E.4.2.3 *Optional code extension control functions*

Identifier	Abbreviation	Coded representation
CE03	ESC	1/11
CE04	SS2	1/9
CE05	SS3	1/13
CE07	LS0	0/15
CE08	LS1	0/14
CE10	LS2	1/11 6/14
CE12	LS3	1/11 6/15
CE09	LS1R	1/11 7/14
CE11	LS2R	1/11 7/13
CE13	LS3R	1/11 7/12

ANNEX F

(to Recommendation T.61)

Example of underlining

The following examples demonstrate the presentation of permissible combinations of underline and other characters of the basic Teletex repertoire. They also demonstrate the interaction between underline (coded as either a *Non-spacing underline* character or as the control function *Select graphic rendition*) and the control functions PLU and PLD.

Example 1:

a b SGR(4) c d PLU e f PLD PLD g h PLU i j SGR k l

yields: ab$\underline{\text{cd}}^{\underline{\text{ef}}}_{\underline{\text{gh}}}\underline{\text{ij}}$kl See Notes 1 and 2 below.

Example 2:

a b SGR(4) c d SGR(0) PLU SGR(4) e f SGR(0) PLD k l

yields: ab$\underline{\text{cd}}^{\underline{\text{ef}}}$kl

Example 3:

a b SGR(4) c d PLU SGR(4) e f SGR(0) PLD k l

yields: ab$\underline{\text{cd}}^{\underline{\text{ef}}}$kl

Example 4:

a b _ c _ d _ PLU e PLD _ PLD g PLU _ i _ j k l

yields: ab$\underline{\text{cd}}^{\underline{\text{e}}}_{\underline{\text{g}}}\underline{\text{ij}}$kl See Note 1 below

Example 5:

a b _ c _ d PLU _ e _ f PLD k l

yields: ab$\underline{\text{cd}}^{\underline{\text{ef}}}$kl

Note 1 – See § 3.1.7 for guidance on the presentation of underline in situations where a possibility of overlap exists.

Note 2 – This example also demonstrates the use of an SGR without a parameter value.

CONTROL PROCEDURES FOR TELETEX AND GROUP 4 FACSIMILE SERVICES

(Malaga-Torremolinos, 1984)

CONTENTS

1 General

1.1 *Scope*

1.1.1 Recommendation F.200 lays down the provisions for the operation of the automatic international Teletex service. On the technical side, Recommendation T.60 specifies the requirements for international compatibility between Teletex terminals and Recommendation T.61 defines the character repertoire and coded character sets for the international Teletex service.

1.1.2 Recommendation F.161 defines the rules to be followed in the Group 4 facsimile service. On the technical side, Recommendation T.5 specifies the requirements for Group 4 facsimile apparatus and Recommendation T.6 defines the Group 4 facsimile coding scheme and facsimile control functions.

1.1.3 Recommendation T.73 defines the document interchange protocol which may be used when services other than basic Teletex are utilized; e.g. Group 4 facsimile, mixed-mode operation, etc.

1.1.4 Network-dependent communication procedures for call establishment and termination are defined in Recommendations T.60 and T.5 for the Teletex and Group 4 facsimile services, respectively.

1.1.5 This Recommendation defines the end-to-end procedures to be used within the Teletex and Group 4 facsimile services.

1.1.6 Specifically, this Recommendation concerns the end-to-end control procedures that are network-independent. The network-dependent procedures forming a network-independent transport service are specified in Recommendations T.70 and, as applicable, T.71.

1.1.7 The procedure described in this Recommendation should also be used between a Teletex terminal and a Teletex/telex conversion facility (see Recommendations F.200, T.60 and T.90).

1.1.8 Interworking between Teletex and services other than telex, and between Group 4 facsimile and other services is for further study.

1.1.9 This Recommendation assumes that the terminal initiating a call is the terminal regarded as responsible for call charges and that it retains full control of the call.

1.1.10 The provisions in this Recommendation are to be regarded as a first stage in the establishment of Teletex and Group 4 facsimile services in accordance with Recommendations F.200, T.60, T.61 and T.70 as defined in 1980 and Recommendations F.161, T.5, T.6 and T.73 as defined in 1984, respectively. Enhancements and additions to these Recommendations must ensure compatibility with established services.

1.2 *Fundamental principles*

1.2.1 The relationship between the control procedures in this Recommendation and the transport service shall respect the principle that the higher level procedures require the transport service to preserve the structure of blocks, which may be of arbitrary size, given to it by the session level for transmission. Only one session command or response is allowed in such a block. Only one document command or response is allowed in a CSUI or RSUI field (command or response session user information).

1.2.2 The sending terminal is responsible for verifying the correct delivery of the information in its document to the recipient's physical media, i.e. store, hard copy device. This may include linking and other relevant information.

1.3 *Definitions*

1.3.1 Terms and their definitions are listed in Annex A. Where appropriate, each definition mentions the control procedures to which it refers.

1.3.2 Some of the terms used in this Recommendation have been defined in ways that may differ from the meanings of similar terms in other Recommendations.

2 Functions of the procedures

2.1 *General*

2.1.1 The broad functional categories provided to implement the control procedures are listed in Tables 1/T.62 and 2/T.62.

TABLE 1/T.62

Session commands and responses

Command	Response	Abbreviation	Reference
Session establishment and clearing			
Command session start		CSS	§ 3.2.1
	Response session start positive	RSSP	§ 3.2.2
	Response session start negative	RSSN	§ 3.2.3
Command session end		CSE	§ 3.2.4
	Response session end positive	RSEP	§ 3.2.5
Command session abort		CSA	§ 3.2.6
	Response session abort positive	RSAP	§ 3.2.7
Information transfer			
Command session user information		CSUI	§ 3.2.8
	Response session user information	RSUI	§ 3.2.9
Session management			
Command session change control		CSCC	§ 3.2.10
	Response session change control positive	RSCCP	§ 3.2.11

Note – For CSTW (command session two-way simultaneous), RSTWP (response session TWS positive) and RSTWN (response session TWS negative), all of which concern a possible two-way simultaneous mode (under study) see Annex C. For CSTD (command session typed data), which concerns typed data exchange, see Annex G.

TABLE 2/T.62

Document commands and responses

Command	Response	Abbreviation	Reference
Document control			
Command document start		CDS [a]	§ 3.4.1
Command document continue		CDC [a]	§ 3.4.3
Command document capability list		CDCL	§ 3.4.4
	Response document capability list positive	RDCLP	§ 3.4.5
Command document end		CDE [b]	§ 3.4.6
	Response document end positive	RDEP	§ 3.4.7
Command document discard		CDD	§ 3.4.8
	Response document discard positive	RDDP	§ 3.4.9
Command document resynchronize		CDR	§ 3.4.10
	Response document resynchronize positive	RDRP	§ 3.4.11
Information transfer			
Command document user information		CDUI	§ 3.4.12
Error recovery			
	Response document general reject	RDGR	§ 3.4.2
Command document page boundary		CDPB	§ 3.4.13
	Response document page boundary positive	RDPBP	§ 3.4.14
	Response document page boundary negative	RDPBN	§ 3.4.15

[a] RDGR is used as a negative response to this command. A specific negative response is not required.

[b] The negative response to this command is RDPBN.

2.1.2 The procedural elements have also been listed in the appropriate categories since the definitions of the elements together with their associated rules completely specify the functions of the procedures.

2.2 *Background information*

Note – § 2 is given as an aid for the understanding of the procedures. The exact definitions of the control procedures are given in subsequent sections of the Recommendation.

2.2.1 *Exchange of service identification*

2.2.1.1 Two terminals, when connected by a transport service, will, at session establishment, exchange information identifying whether they are participating in the Telematic services and thus they will invoke the relevant service facilities and the associated protocol.

2.2.2 *Negotiation of optional capabilities*

2.2.2.1 Two methods are provided. The first is used at session initiation to exchange a limited list of capabilities. The second method may be used when required, after session initiation, to indicate the sender's requirements for extended capabilities.

2.2.3 *Negotiation of storage requirements*

2.2.3.1 Storage availability can be indicated in the following ways:

a) When a Teletex session is established, it is implicitly assumed that there is adequate receive memory for the call. Exceptionally a receiver memory overflow will occur. The continued sending of the document from the source will be stopped by the sink. The sink shall indicate the reason for stopping the transmission.

b) When a Group 4 facsimile session is established, it can only be assumed that the called terminal has adequate recording paper to print at least one page of information (for basic Class 1 apparatus). Negotiation of storage requirements is mandatory for Group 4 Classes 2 and 3 facsimile apparatus. Having negotiated this requirement, exceptionally, a receive memory overflow may occur. The continued sending of the document from the source will be stopped by the sink. The sink shall indicate the reason for stopping the transmission.

c) The provision is also made in the procedure for a mandatory indication that the ability of the receiving terminal to continue to accept traffic is jeopardized.

d) The control procedure also provides the possibility to investigate the storage availability at the receiving terminal prior to the transmission of a document.

3 Elements of procedure

3.1 *General*

3.1.1 The paragraphs below contain elements of procedure and rules of use which, when combined, define the control procedures.

3.1.2 Definitions applying to the elements of procedure may be found in Annexes A and B.

3.1.3 Annexes C and D describe the two-way simultaneous (TWS) mode of session operation and session suspension function, which are not applicable to the basic services.

3.2 *Session commands, responses and parameters*

(For a summary of session commands and responses, see Table 1/T.62.)

3.2.1 *Command session start (CSS)*

3.2.1.1 The CSS initiates entry into a session.

3.2.1.2 Command parameters are:

a) *Service identifier:* this mandatory parameter identifies whether the sender of this command intends to use the Telematic service.

b) *Terminal identifier:* this mandatory parameter identifies the calling terminal in accordance with the terminal identification specified in Recommendation F.200.

c) *Date and time:* this mandatory parameter gives date and time information as specified in Recommendation F.200.

d) *Additional session reference number:* this number may be used in addition to the basic session reference (terminal identifier of the called terminal, terminal identifier of the calling terminal, date and time) to identify uniquely the session. If the additional session reference number is not used, the parameter shall not be included.

e) *Non-basic terminal capabilities:* these parameters indicate which of the non-basic terminal capabilities listed in Table 3/T.62 for the Teletex service are available as receiving capabilities of the sender of this command. These parameters are mandatory if the terminal is capable of any of the specific functions listed in these table. Absence of the parameter indicates that the specific function is not available.

f) *Non-basic session capabilities:* if used, this non-mandatory parameter indicates which non-basic session capabilities are available as receiving capabilities of the sender of this command.

Note – Examples of the use of this parameter are session suspension (see Annex D), a two-way simultaneous operation (see Annex C), interactive session protocol (see Annex G) and negotiation of the window size for checkpoint (see §§ 3.3.2.7 and 4.3).

g) *Inactivity timer:* this non-mandatory parameter is used to negotiate the value of the inactivity timer (see §§ 4.1.2 and 5.7.2.11).

h) *Session service functions:* this non-mandatory parameter is used to specify the session service capabilities available. This parameter is used for the interactive session protocol (ISP) and typed data transfer (TDX) as described in Annex G.

i) *Session user data:* this non-mandatory parameter is used to convey data of the presentation and/or application protocol(s).

All of the parameters necessary to negotiate the T.73 presentation protocol are contained in this parameter group identifier (PGI) as defined in Recommendation T.73.

j) *Non-standardized capability:* this non-mandatory parameter is used to ascertain compatibility regarding the use of non-standardized terminal capabilities.

The first octet following the parameter identifier and the length indicator identifies a particular country. The meaning and code assignments of subsequent octets are defined by the indicated country.

k) *Private use parameters:* these parameters are not mandatory. Their definition and use are not standardized.

TABLE 3/T.62

Non-basic terminal capabilities included in CSS

Parameter	Function
Control character sets	Reverse line feed
Page formats	ISO A4 vertical and horizontal orientation
Miscellaneous terminal capabilities	Character spacing of 2.12 mm (12 characters per 25.4 mm) Character spacing of 1.69 mm (15 characters per 25.4 mm) Line feed parameter value of one spacing of 3.175 mm Line feed parameter value of one spacing of 0.5, 1.0, 1.5 and two spacings of 5 mm

Note – The definitions of these presentation capabilities may be found in Recommendation T.60. Future extensions and private-use capabilities are to be accommodated with CDCL.

3.2.2 *Response session start positive (RSSP)*

3.2.2.1 The RSSP shall be used to acknowledge entry into a session. It indicates that the CSS command has been understood and is in a correct format.

3.2.2.2 Response parameters are:

a) *Service identifier:* this mandatory parameter identifies whether the sender of this response intends to use the Telematic service.

Note 1 – For the basic Teletex services, the service identifiers in RSSP and CSS must be identical.

Note 2 – In case of interconnections between the terminals of different services, the service identifiers in RSSP and CSS may not be identical.

b) *Terminal identifier:* this mandatory parameter provides the terminal identification of the sender of the RSSP in accordance with the terminal identification specified in Recommendation F.200.

c) *Date and time:* this mandatory parameter must be identical to the corresponding parameter in the CSS. It is used in conjunction with the terminal identifications of both terminals in a session as a reference to that session.

d) *Additional session reference number:* if used in the CSS and if used by the receiver of CSS, this parameter shall have the same value as in the CSS. If it is not used by the receiver of CSS, it shall not appear in the RSSP.

e) *Non-basic terminal capabilities* (i.e. those available as receiving capabilities of the sender of the RSSP): the same conditions apply as for § 3.2.1.2 e) above.

f) *Non-basic session capabilities:* as for § 3.2.1.2 f) above.

g) *Session control functions:* this parameter is used to indicate "request control" and "request session suspension" as defined in this Recommendation.

h) *Inactivity timer:* as for § 3.2.1.2 g) above.

i) *Session service functions:* as for § 3.2.1.2 h) above.

j) *Session user data:* as for § 3.2.1.2 i) above.

k) *Non-standardized capability:* as for § 3.2.1.2 j) above.

l) *Private use parameters:* as for § 3.2.1.2 k) above.

3.2.3 *Response session start negative (RSSN)*

3.2.3.1 The negative response indicates that the session was not entered by the receiver of the CSS. It is not mandatory to indicate the reasons for rejection. A non-mandatory private-use parameter may be used with this response.

Note – It should be noted that existing equipment may send an RSSN without any parameter fields. This shall not be regarded as an error.

3.2.3.2 Response parameters are:

a) *Service identifier:* this mandatory parameter identifies whether the sender of this response intends to use the telematic service.

Note 1 – For the basic services, the service identifiers in RSSN and CSS must be identical.

Note 2 – In case of interconnections between the terminals of different services, the service identifiers in RSSN and CSS may not be identical.

b) *Terminal identifier:* this mandatory parameter provides the terminal identification of the sender of the RSSN in accordance with the terminal identification specified in Recommendation F.200.

c) *Date and time:* this mandatory parameter must be identical to the corresponding parameter in the CSS. It is used in conjunction with the terminal identifications of both terminals in a session as a reference to that session.

d) *Additional session reference number:* if used in the CSS and if used by the receiver of CSS, this parameter shall have the same value as in the CSS. If it is not used by the receiver of CSS, it shall not appear in the RSSN.

e) *Non-basic terminal capabilities* (i.e. those available as receiving capabilities of the sender of the RSSN): the same conditions apply as for § 3.2.1.2 e) above.

f) *Non-basic session capabilities:* as for § 3.2.1.2 f) above.

g) *Reason for sending the negative response:* this parameter is used to indicate the reason for sending the RSSN. The parameter value may be presented to an operator when received. One of the following reasons may be used as a value of the parameter:

- no reason given;
- temporarily unable to enter the session. Shall be used e.g. in the case of memory full;
- text message of maximum 69 characters. It may be possible for the operator to enter this message from the keyboard.

h) *Session service functions:* as for § 3.2.1.2 h) above.

i) *Session user data:* as for § 3.2.1.2 i) above.

j) *Private use parameters:* as for § 3.2.1.2 k) above.

3.2.4 *Command session end (CSE)*

3.2.4.1 The CSE is used for normal (or error-free) termination of a session.

Note – A parameter is reserved to indicate whether the transport connection is to be cleared. Absence of this parameter will cause the transport connection to be cleared.

3.2.5 *Response session end positive (RSEP)*

3.2.5.1 The RSEP indicates to the calling terminal that the called terminal has entered the idle state in an orderly manner.

3.2.6 *Command session abort (CSA)*

3.2.6.1 The CSA may be used at any time by either terminal to terminate a session, whenever a condition is detected indicating that the session cannot be continued successfully. CSA shall only be used when there is no other suitable way of ending the session.

3.2.6.2 One of the following reasons for the abnormal termination of the session must be given as a CSA parameter:

a) local terminal error;

b) unrecoverable procedural error;

c) reason not defined.

Note – One value is reserved to indicate whether the transport connection is to be cleared.

3.2.7 *Response session abort positive (RSAP)*

3.2.7.1 The RSAP response indicates to the sender of a CSA command (either the source or the sink terminal) that the receiver of CSA has entered the idle state in an orderly manner.

3.2.8 *Command session user information (CSUI)*

3.2.8.1 The CSUI is used to indicate to the receiver that the associated information field of this command conveys command, parameters and information for the document procedures.

3.2.8.2 CSUI does not call for a response. There is no relationship between this command and the response RSUI.

3.2.9 *Response session user information (RSUI)*

3.2.9.1 The RSUI is used to indicate to the receiver of this response (source) that the associated information field conveys response and parameters for the document procedures. A non-mandatory parameter, session control function, may be used with this response.

3.2.9.2 This RSUI response is not related to any CSUI command.

3.2.9.3 The parameter, session control functions, is sent with RSUI in conjunction with document response. Use of this parameter with RSUI but without an associated document response is permitted only in the following cases:

a) in the interactive option as defined in Annex G;

b) the session may intentionally be inactive for a period of time. In this case, when no document responses are being generated, use of the session control functions parameter is permitted without an associated document response. For the Teletex service, this requires a preceding negotiation of the inactivity timer to a value different from the default value.

3.2.10 *Command session change control (CSCC)*

3.2.10.1 In the two-way alternate (TWA) mode CSCC changes the source/sink relationship between the two terminals.

Note – A signal for request control is available in some responses (see coding scheme). It may be used to indicate that a terminal sending this signal has information to transmit. The terminal receiving this signal is not required to take any action if this signal is detected.

3.2.11 *Response session change control positive (RSCCP)*

3.2.11.1 The RSCCP indicates to the sender of the CSCC that the sink terminal intends to enter the session sending state.

3.3 *Session procedures*

3.3.1 *Session modes of operation*

3.3.1.1 The following provisions concern the TWA mode of session operation:

a) the basic protocol provides the capability of the TWA mode;

b) at session initiation, the sender of the CSS is defined as being the current source of any text information and is therefore the source terminal;

c) the CSCC exchanges the source/sink relationship between the two terminals. The CSCC command should only be invoked outside document boundaries.

   Note – An alternative mechanism for giving control is defined by the interactive session protocol (ISP) in Annex G;

d) only the terminal that is currently the source terminal may send the CSCC;

e) there is no requirement for sending text information prior to sending a CSCC;

f) when the called terminal has finished transmitting text, it shall hand back the right of sending text to the calling terminal. Only the calling terminal is allowed to send CSE.

3.3.1.2 The following provisions concern the one-way communication (OWC) mode of session operation:

a) the OWC mode is achieved by the CSS sender not issuing a CSCC;

   Note – The interactive option defined in Annex G provides an alternative means for giving control to the receiver of CSS.

b) there is no requirement to send text information.

c) this mode is a subset of TWA.

3.3.2 *Rules for session elements of procedure*

3.3.2.1 Only the terminal that has established the transport connection (the calling terminal) shall send CSS.

3.3.2.2 It is the responsibility of the sender of CSS to examine the parameters of RSSP and to determine whether the session should continue. If it is not to be continued, the session shall be ended normally (by CSE).

3.3.2.3 In continuing the session, neither terminal is permitted to use any procedure or to send any information that does not comply with the receiving capabilities indicated by the session partner in the service identifier and non-basic session and terminal capabilities parameters of the CSS/RSSP exchange at session initiation and/or by the parameters of CDCL/RDCLP exchange.

3.3.2.4 In the TWA or OWC mode, only the sender of CSS may send CSE when he is the current source.

3.3.2.5 In the TWA mode, the recipient of both CSS and CSCC must terminate his period as source by sending CSCC.

Note – An alternative mechanism for giving control is defined by the interactive session protocol (ISP) in Annex G.

3.3.2.6 In any mode of operation, CSA may be sent at any time by either terminal whenever a condition is detected indicating that the session cannot be successfully continued (e.g. due to failure or charging problems). The following rules are applied to the session abort procedure:

a) the session abort procedure is in general completed when the sender of a CSA command receives an RSAP response;

b) the terminal sending the CSA waits for a response RSAP. In state 14, all other commands or responses received will be discarded. If RSAP is not received before a time-out (e.g. T = 4 seconds), the terminal that send the CSA clears the transport connection.

   Note – In all cases, the connection must be cleared when the inactivity timer has expired.

3.3.2.7 The following rules should apply to the use of window size:

a) the indication of the window size parameter is not mandatory for the Teletex service, but is mandatory for the Group 4 facsimile service. It may have a value in the range of 1 to 255. The absence of this parameter in CSS or its corresponding response must be interpreted as the default value of three for the Teletex service;

b) all the Teletex terminals should support a window size of 3. Group 4 facsimile terminals of Classes 2 and 3 should be able to support a window size of 3 when interworking with Teletex. Enhanced Teletex terminals (e.g. with mixed-mode capability) and all Group 4 facsimile terminals may require other window sizes;

c) the rule for the use of window size is that the source terminal is free to use any window size that does not exceed the window size indicated by the sink terminal (in CSS or its corresponding response);

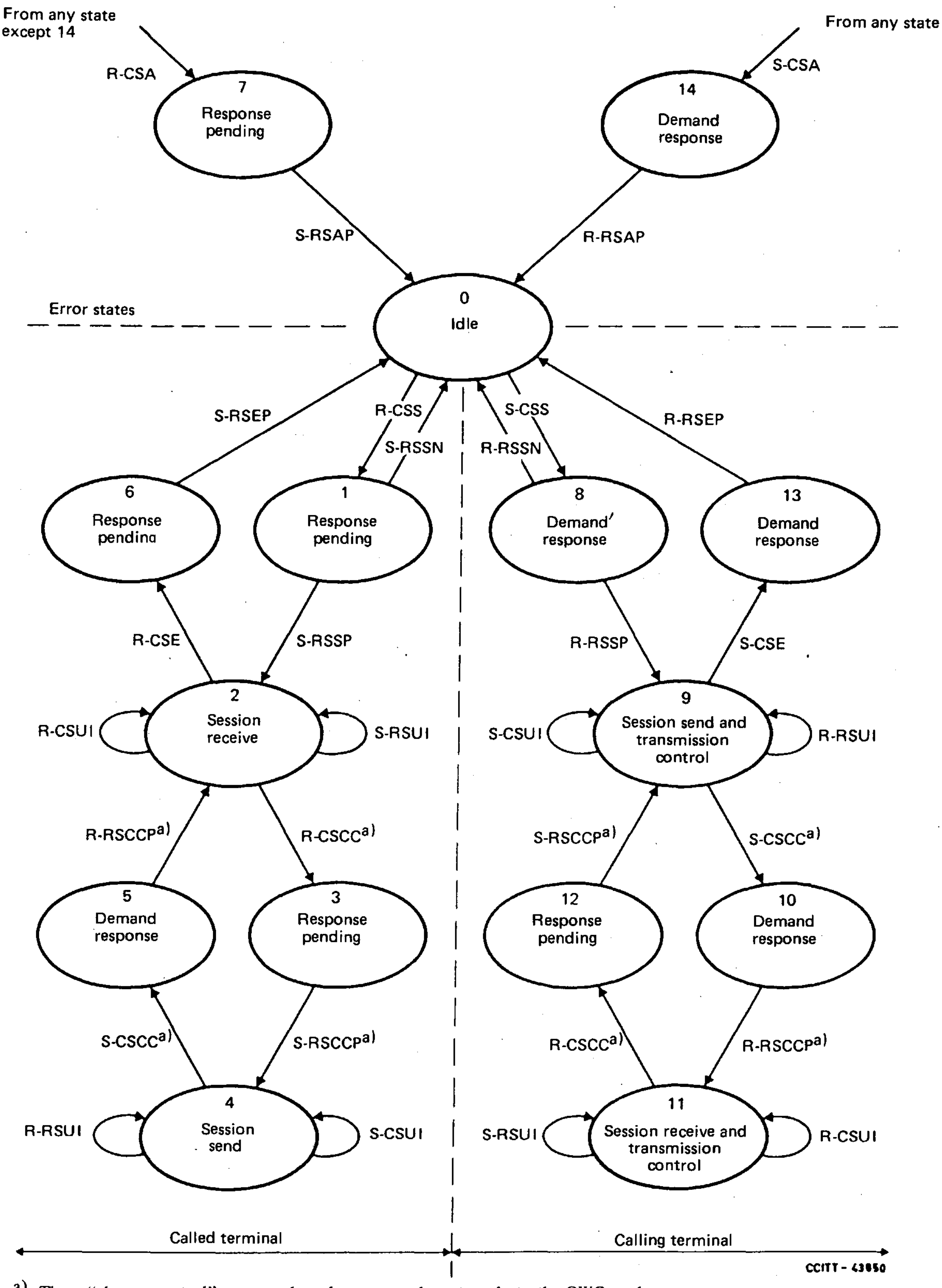
d) if the sender of CSS or its corresponding response is a basic Teletex terminal which does not indicate any parameter for the window size, the receiver should be aware that the sender may ignore any window size indicated and use the window size of 3.

3.3.2.8 Figure 1/T.62 is a state transition diagram for TWA and OWC session modes. The change control commands and responses [marked with an "a)" in the diagram] do not apply to the OWC mode. The general description and rules of operation for state diagrams may be found at Annex E.

3.3.2.9 In a session where the use of the RSUI with request control is permitted (as specified in § 3.2.9.3), the following will apply:

a) an RSUI requesting control may be received after giving control and before receiving any valid session protocol element. This shall not be regarded as a procedural error and shall be discarded;

b) an RSUI requesting control may be received after sending a CSE and before receiving an RSEP. This shall not be regarded as a procedural error and shall be discarded.



a) These "change control" commands and responses do not apply to the OWC mode.

FIGURE 1/T.62

State transition diagram for TWA and OWC session modes

3.4 *Document commands, responses and parameters*

(For summary of document commands and responses, see Table 2/T.62.)

3.4.1 *Command document start (CDS)*

3.4.1.1 The CDS indicates the start of a document (delivery unit) to the receiver of this command. It also indicates the start of the first page (commitment unit). (For the definition of delivery and commitment units, see Annex B.)

3.4.1.2 Command parameters are:

a) *Service interworking identifier:* not a mandatory field (see § 3.5.2).

Note – When communicating with a conversion facility, an identifier may be required for:

i) Teletex/telex interworking – the identifier will indicate that the document(s) has been prepared in accordance with the rules given in Recommendations F.200, T.90 and T.91;

ii) Teletex/Videotex interworking – for further study;

iii) Teletex/facsimile interworking – for further study.

b) *Document type identifier:* not a mandatory field. If a normal document is used, this parameter shall not be indicated. If other types of document are used, the inclusion of this field is obligatory (for a description of types of document, see Annex F).

c) *Document reference number:* (see § 4.2.9).

d) *Indication of required terminal capability* (standardized or private use): not a mandatory field, however, this parameter must be used if standardized optional terminal capabilities are required for the document.

e) *Session user data:* this non-mandatory parameter is used to convey data of the presentation and/or application protocol(s). All of the parameters necessary to invoke the T.73 presentation protocol are contained in this parameter group identifier (PGI) as defined in Recommendation T.73.

f) *Private use parameters* (not mandatory): definition of such parameters is not standardized.

3.4.1.3 There is no response to CDS except in the case of an error, for which RDGR is used.

3.4.2 *Response document general reject (RDGR)*

3.4.2.1 The RDGR may be used by the sink to indicate to the source that a procedural error has occurred and that resynchronization is requested. The bit pattern of command or response up to and including the error shall be returned to the source. Only the first detected error within a command or response must be processed by this method.

3.4.2.2 The response parameter is the bit pattern required by § 3.4.2.1.

3.4.2.3 It is the responsibility of the terminal receiving an RDGR response to take appropriate action.

Note – Use of RDGR for other kinds of error is for further study.

3.4.3 *Command document continue (CDC)*

3.4.3.1 The CDC indicates to the receiver of this command the continuation of transmission of a document (delivery unit) that has previously been partially transmitted.

3.4.3.2 Command parameters are:

a) Document linking information, in order to identify the previous transmission of the partial document, including:

– the checkpoint reference number (see § 4.2.7) from which the transmission is being continued;

– the document reference number, which shall be the same as the document reference number in the CDS;

– the session reference information identifying the session in which the first part of the document was sent.

Note 1 – If several continuations are required to complete transmission of a document, all are linked to the partial transmission in which the CDS was used. The sequence of checkpoint reference numbers is then used to identify the correct sequencing for linking and all such continuations shall be transmitted in this sequence.

Note 2 – It is the responsibility of the receiving terminal to discard any text information that has been duplicated in the process of continuation of an interrupted transmission.

Note 3 – The checkpoint reference number appearing in CDC is the last checkpoint reference number for which a positive acknowledgement has been received.

b) Service interworking identifier: not a mandatory field (see the note under § 3.4.1.2 a) for CDS).

c) Document type identifier: not a mandatory field. If a normal Teletex document is used, this parameter shall not be indicated. If other types of document are used, the inclusion of this field is obligatory (for a description of types of document, see Annex F).

d) Document reference number (of the current session): see § 4.2.9.

e) Optionally, any other parameter field(s) that appeared in the CDS command at the start of the document may be repeated as parameter(s) in CDC. Indication of required terminal capability is mandatory if standardized optional terminal capabilities are required for the document. A terminal receiving a CDC that does not contain all of the terminal capabilities should not reject the continuation of the document.

f) Session user data: this non-mandatory parameter is used to convey data of the presentation and/or application protocol(s). All of the parameters necessary to invoke the T.73 presentation protocol are contained in this PGI as defined in Recommendation T.73.

3.4.3.3 There is no response to CDC except in the case of an error, for which RDGR is used.

3.4.4 *Command document capability list (CDCL)*

3.4.4.1 The CDCL initiates an exchange of information to enable a check of the terminal capabilities (both standardized and private use). The command shall include a list of receiving capabilities that may be needed at the receiver by the sender of this command.

3.4.4.2 The command may also be used to investigate the storage capability of the remote terminal. The required amount of storage (given in kilo-octets) is indicated in a parameter of the command in this case.

3.4.4.3 Command parameters are the list of receiving capabilities and the required amount of storage.

3.4.4.4 The CDCL command should only be invoked outside document boundaries.

3.4.4.5 The CDCL command may be used to negotiate the value of the inactivity timer. The value of the inactivity timer that the sender of this command wishes to use is indicated in a parameter field of this command.

3.4.4.6 The CDCL commmand may be used to convey the session user data of the presentation and/or application protocol(s). All of the parameters necessary to negotiate the T.73 presentation protocol are contained in this PGI as defined in Recommendation T.73.

3.4.4.7 The CDCL command may be used to ascertain compatibility regarding the use of non-standardized capabilities.

3.4.5 *Response document capability list positive (RDCLP)*

3.4.5.1 The RDCLP acknowledges the CDCL and contains one of the following:

a) confirmation that all the requested capabilities are available at the receiver;

b) a list of the requested capabilities that are available at the receiver;

c) a complete list of non-basic receiving capabilities;

d) indication that no extended capabilities are available in the terminal, or that none of the capabilities indicated in the CDCL are available (through the absence of a terminal capability parameter in response to a CDCL asking for one).

3.4.5.2 If the CDCL is used for memory negotiation, one of the following shall be included:

a) confirmation that the amount of memory requested is available and has been reserved;

b) indication of the available (and reserved) amount of memory (in kilo-octets);

c) indication that the requested memory capacity cannot now be reserved;

d) indication that the available memory cannot be estimated (through either explicit indication or the absence of a memory negotiation parameter in a response to a response to a CDCL with a memory request).

Note 1 – Storage that has been reserved by the CDCL command can be released after session termination or when a new CDCL with storage requirement indication is received.

Note 2 – The use of the memory negotiation parameter in RDCLP (i.e. indicating that the memory cannot be estimated) when not present in CDCL is not prohibited. Therefore, reception of such RDCLP in response to CDCL is not to be regarded as an error.

3.4.5.3 The RDCLP response may be used to negotiate the value of the inactivity timer. The value of the inactivity timer that the sender of this response wishes to use is indicated in a parameter field of this response.

3.4.5.4 The RDCLP response may be used to convey the session user data of the presentation and/or application protocol(s). All of the parameters necessary to negotiate the T.73 presentation protocol are contained in this PGI as defined in Recommendation T.73.

3.4.5.5 The RDCLP response may be used to ascertain compatibility regarding the use of non-standardized capabilities.

3.4.6 *Command document end (CDE)*

3.4.6.1 The CDE shall be used to indicate to the receiver of this command the end of a document (delivery unit). It also represents the final checkpoint to which a response shall be made.

3.4.6.2 The command parameter is the checkpoint reference number.

3.4.6.3 The RDPBN shall be used as the negative response to the checkpoint in CDE.

3.4.7 *Response document end positive (RDEP)*

3.4.7.1 The RDEP gives a positive acknowledgement to the last checkpoint (commitment unit). In the basic services, this is the last page reference number.

3.4.7.2 The RDEP shall also indicate that the receiver:

a) has not detected any error;

b) accepts responsibility for the received document (delivery unit);

c) is ready to receive a new CDS or CDC.

3.4.7.3 The RDEP shall include as a parameter the checkpoint reference number of the CDE.

3.4.7.4 Only if the sink terminal has sent an RDEP and received either a valid CDS, CDC, CDCL, CSE or CSCC, is it certain that the source terminal will not use error recovery procedures regarding the preceding document. In all other cases it can happen that after sending RDEP a repetition of pages takes place and the duplications may be deleted by the sink terminal.

3.4.8 *Command document discard (CDD)*

3.4.8.1 The CDD shall be used to indicate to the receiver of this command the abnormal ending of a document and that the receiver of the command is not held responsible for the part of the document received so far. Therefore, as a local function outside these control procedures, the receiver can delete the part of the text received.

Note 1 – CDD is an invitation to discard the whole of the document and not merely the part of the document transmitted since the last CDC.

Note 2 – The receiving terminal may discard the document from its memory and/or indicate to the operator that this part of the document has no value.

Note 3 – The implementation of this function for Group 4 facsimile is for further study.

3.4.8.2 The reason for sending the CDD command may be given as a CDD parameter. If used, only one of the following reasons shall be indicated:

a) local terminal error;

b) unrecoverable procedural error;

c) no specific reason stated.

3.4.8.3 The CDD may only be used to terminate the current document, instead of using CDE or CDR. It cannot be used after a CDR has been sent (see § 4.3.2).

3.4.8.4 The receiver of a CDD is allowed to delete the received part of the document, but has no obligation to do so. If the text is not deleted, the operator shall be informed.

3.4.8.5 No negative response to CDD is allowed except for error conditions where RDGR applies.

3.4.9 *Response document discard positive (RDDP)*

3.4.9.1 The RDDP acknowledges the CDD and indicates that the receiver of the command is ready to receive a new CDS or CDC.

3.4.10 *Command document resynchronize (CDR)*

3.4.10.1 The CDR shall be used by the source to indicate to the sink the point of resynchronization. If used within a document it shall abnormally end that document.

3.4.10.2 The reason for an abnormal ending of a document may be given as a CDR parameter. If used, only one of the following reasons may be given:

a) local terminal error;

b) unrecoverable procedural error;

c) no specific reason stated.

3.4.10.3 No negative response to CDR is allowed except for error conditions where RDGR applies.

3.4.11 *Response document resynchronize positive (RDRP)*

3.4.11.1 The RDRP is sent by the receiver of a CDR as a positive acknowledgement of the command.

3.4.11.2 If RDRP is used within a document, it confirms to the sender of a CDR that the sender of RDRP has already accepted responsibility for the received document (up to the last checkpoint for which a positive acknowledgement has been sent). It does not indicate that the receiver of the command will be able to perform linking of the following parts of the interrupted document (delivery unit).

3.4.11.3 The control procedures provide a means for resuming transmission of an interrupted document.

3.4.11.4 The linking of the parts of an interrupted document is a local operation at the receiver and is therefore not within the responsibility of the control procedures. Thus these procedures cannot guarantee that this linking of parts of a document will be effected.

3.4.12 *Command document user information (CDUI)*

3.4.12.1 The CDUI indicates to the receiver of this command that the associated information is to be interpreted as the user text information field being conveyed.

3.4.12.2 The basic services do not require any parameter for CDUI. The procedure provides means for adding parameters. Any such need is for further study. For the basic services a CDUI has to contain a user information field. The need for having CDUIs without information field is for further study.

3.4.12.3 Several CDUIs may be used to transfer the contents of one page.

3.4.13 *Command document page boundary (CDPB)*

3.4.13.1 The CDPB indicates to the receiver the boundary between pages. It also indicates a checkpoint for error recovery purposes (see § 4). CDPB invites the sink to accept responsibility for the previously received page (commitment unit – see Annex B).

3.4.13.2 The CDPB command parameter is the checkpoint reference number, which, in the basic services, is the page reference number.

3.4.13.3 The checkpoint reference number appearing in the first CDPB after a CDC is the one appearing in this CDC plus one.

3.4.14 *Response document page boundary positive (RDPBP)*

3.4.14.1 This response shall be used to indicate that the receiver accepts responsibility for that page (acknowledgement of commitment unit).

3.4.14.2 Response parameters are:

a) a mandatory parameter giving the checkpoint reference number (see § 3.4.13.2 above);

b) a mandatory parameter indicating whether or not the ability of the receiving terminal to continue to accept traffic is jeopardized (e.g. whether or not the memory threshold has been reached).

3.4.15 *Response document page boundary negative (RDPBN)*

3.4.15.1 This response shall be used to indicate that the receiver does not accept the responsibility for that page (commitment unit), e.g. due to a detected error or other failure.

3.4.15.2 The value of the mandatory parameter giving the reason for a negative response should be one of the following:

a) unable to continue a session (e.g. due to memory full, out of recording paper);

b) sequence error;

c) local terminal error;

d) unrecoverable procedural error;

e) no specific reason stated (used for reasons other than those listed).

3.5 *General rules for document elements of procedure*

3.5.1 When a document has been either started by CDS or continued by CDC, it must be terminated by either CDE, CDR or CDD prior to sending the next CDS or CDC.

3.5.2 The following rules relate to the CDS and CDC parameters:

a) the service interworking parameter may be used to indicate that the document is suitable for interworking; however, use of this parameter is mandatory in the case of service interworking;

b) absence of the document type identifier indicates that the associated document is a normal document.

3.5.3 No negative response to CDS or CDC may be sent after the sending of a positive response to any checkpoint within that document.

3.5.4 With regard to the responses to CDPB (RDPBP or RDPBN), the receiver may reject reception for a detected error, but the receiver is not obligated to monitor for errors in the document. Once a page (commitment unit) has been positively acknowledged, any error recovery for the subsequent detection of an error is beyond the scope of these control procedures.

3.5.5 If, during the transmission of a document, there is an interruption of the transport connection or session such that another call and/or session establishment is needed, the following rules apply.

a) In the case that a document transmission is initiated by a CDS and no checkpoint is positively acknowledged during that document transmission:
   - the receiving terminal shall treat the failure as if a CDD had been received and an RDDP had been sent;
   - the sending terminal shall treat the failure as if a CDD had been sent and an RDDP had been received.

b) In other cases:
   - the receiving terminal shall treat the failure as if a CDR had been received and an RDRP had been sent;
   - the sending terminal shall treat the failure as if a CDR had been sent and an RDRP had been received.

3.5.6 If, during the transmission of a document, an abnormal condition except those described in § 3.5.5 takes place, the following rules apply:

a) in the case that a document transmission is initiated by CDS command and no checkpoint is positively acknowledged, either a CDD or a CDR command should be used. If a CDR is used, it should be interpreted as a CDD;

b) in other cases, a CDD or CDR should be used.

3.5.7 When a source terminal receives an RDPBP with the receiving ability jeopardized (RAJ) parameter set to 1 during a document transmission, it may continue to transmit one or more pages until the window is closed. In this context the following rules apply:

a) if the source subsequently receives an RDPBP with the RAJ parameter set to 0, it will be able to continue transmission;

b) if the source subsequently receives an RDPBN indicating "memory overflow", the document transmission should be terminated abnormally; e.g. exchange of either CDD/RDDP or CDR/RDRP.

Note – In other contexts (e.g. window size of 1), the session may be terminated abnormally due to expiration of an inactivity timer. However, this requires further study.

3.5.8 When a sink terminal sends an RDPBP with the receiving ability jeopardized parameter set to 1, and subsequent memory overflow results in sending RDPBN, the reason code "unable to continue the session" has to be indicated.

3.6 *Rules for document state diagrams*

3.6.1 *General*

3.6.1.1 The rules common to all state diagrams are given in Annex E.

3.6.1.2 For any error a terminal is permitted to send CSA. If this procedure is not used, the following rules shall apply.

3.6.2 *Rules for the sending protocol* (see Figure 2/T.62)

3.6.2.1 Any command or response received in state 1 shall cause an abnormal end of the session and sending of CSA.

3.6.2.2 Reception of any command or response not shown as allowed in the state diagram in states 2 to 11 shall cause CDR or CDD to be sent in accordance with § 3.5.6.

3.6.2.3 Reception of any command or response except RDCLP in state 14 shall cause CDR to be sent.

3.6.2.4 In state 13 receipt of RDRP or RDDP will cause a transition to state 1. Any other command or response will be discarded.

3.6.2.5 The demand response timer started when state 13 is entered is only reset when a valid response is received.

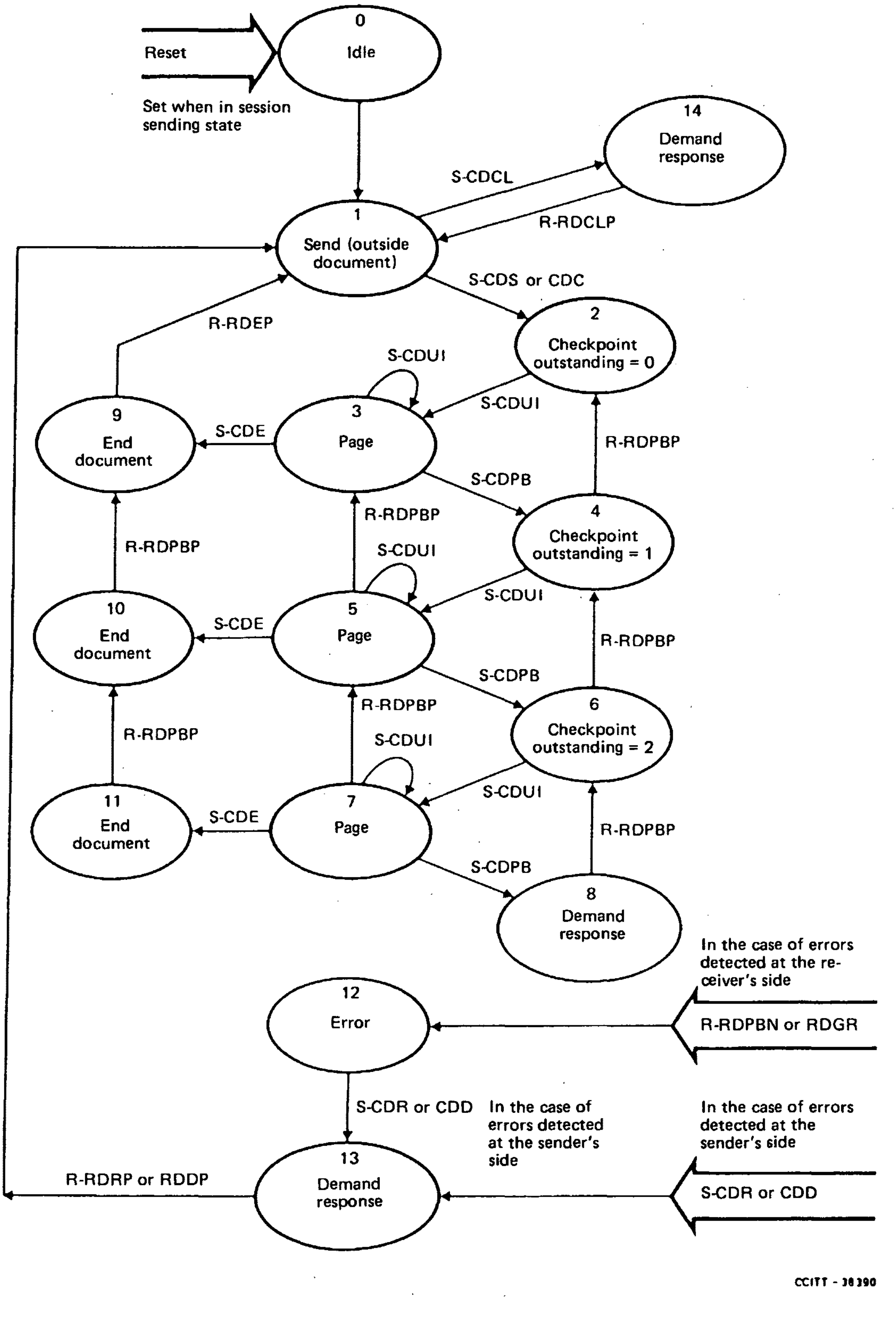


FIGURE 2/T.62

Document state transition diagram for a window size of 3 (sending protocol)

3.6.3 *Rules for the receiving protocol* (see Figure 3/T.62)

3.6.3.1 Reception of any command or response except CDS, CDC, CDCL, CDR or CDD in state 1 shall cause RDGR to be sent.

3.6.3.2 In state 12 receipt of CDR or CDD will cause a transition to state 13. Any other command or response received will be discarded.

3.6.3.3 Reception of any command or response not allowed in the state diagram or any invalid parameters or parameter values in state 2 to 11 may cause RDGR to be sent.

3.6.3.4 The inactivity timer started when state 12 is entered is only reset when a valid command is received.

4 Error recovery

4.1 *General principles*

4.1.1 During a session, each partner is responsible for monitoring for the correct operation of the following:

a) maintenance of the currently agreed source/sink relationship;

b) proper use of the command/response procedural sequences as described in the state diagrams and rules for operation (see § 3.6);

c) detection of any period of inactivity in excess of the inactivity timer value as determined by negotiation (indicating, for example, a failure or other inability to continue productive use of the session);

d) detection of a period of time in excess of the demand response timer value in which the remote terminal has failed to issue a response.

Note – Negotiation of the demand response timer value is for further study.

4.1.2 The following rules apply to the negotiation of the value of the inactivity timer;

a) an inactivity timer value different from 60 seconds will apply only if this parameter is indicated by both terminals, i.e. negotiation, at session establishment (via CSS/RSSP) or document boundaries (via CDCL/RDCLP);

b) if both terminals indicate an inactivity timer value the following rules apply for the duration of the session or until a subsequent negotiation has taken place:

   i) The smaller of the two values applies when both values are greater than or equal to 60 seconds.

   ii) The larger of the two values applies when both values are less than 60 seconds.

   iii) A timer value of 60 seconds applies if one value is above and one is below 60 seconds.

4.1.3 Upon detection of any failure to maintain proper operation as described in § 4.1.1, use of the error recovery procedures defined for each state is mandatory; or, where such error recovery procedures are not specifically defined, session termination (abnormal end) is mandatory.

4.1.4 In the event of an error, this control procedure allows for repeated transmission of information. The number of repetitions should be limited by the sender and may be zero.

4.2 *Rules for checkpointing*

4.2.1 After an abnormal termination of a document, for recovery in the same session the checkpoint reference number and the document reference number are required in order to identify unambiguously the point from which to recover.

4.2.2 A new session (and call) has to be initiated after abnormal termination of a document where recovery is to be effected in a subsequent session or after an abnormal termination and/or interruption of the call. The information required in order to identify unambiguously the point from which to recover is:

a) the reference for the interrupted session;

b) the document reference number; and

c) the checkpoint reference number.

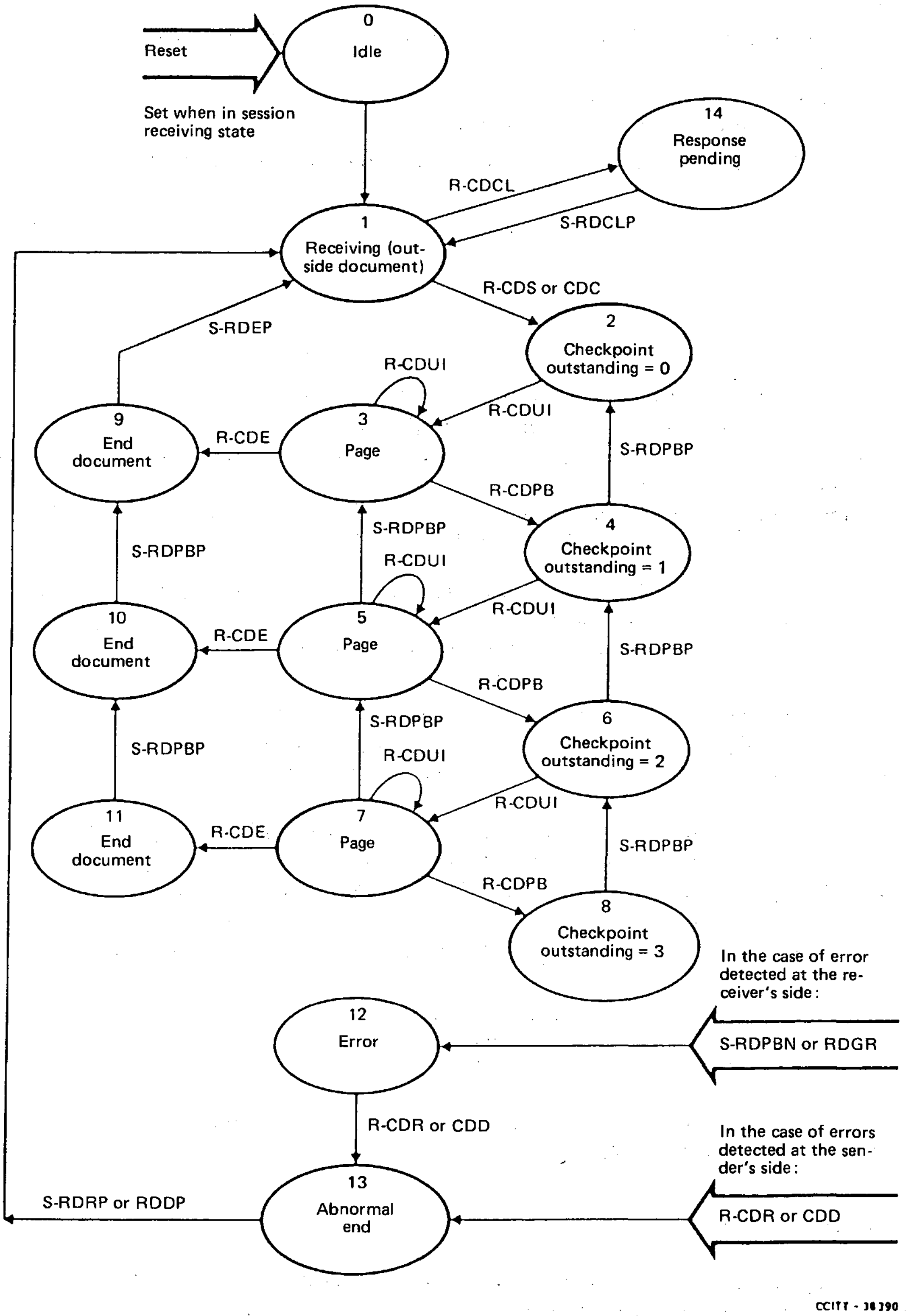


FIGURE 3/T.62

Document state transition diagram for a window size of 3 (receiving protocol)

4.2.3 In the basic services a checkpoint must be inserted at each page boundary using CDPB.

4.2.4 If a negative response is received to a command representing a checkpoint, the transmission must be interrupted by sending a CDR or CDD.

4.2.5 Within a document, a final checkpoint will be represented by the CDE. Transmission of another document is not permitted until the response to this command has been received.

4.2.6 No other checkpointing is permitted in the basic service.

4.2.7 Each command representing a checkpoint shall contain a parameter showing the reference number. Each such command calls for a response, which shall contain a parameter showing the checkpoint reference number to which that response applies. Each checkpoint in the CDPB must be explicitly acknowledged and the acknowledgements must be in the right sequence.

4.2.8 Checkpoint reference numbers shall be assigned as decimal digits starting from 001 and sequentially incremented by one for each checkpoint within a document. The number does not necessarily have to comprise 3 digits and leading zeros do not necessarily have to be transmitted.

4.2.9 Document reference numbers (DRNs) shall be assigned as decimal digits, preferably, but not necessarily, starting from 001. DRNs shall then sequentially be incremented by one for each successive document. DRNs shall be assigned to all documents in a session, irrespective of the document type identifier or whether CDS or CDC is used as the initiating command. The number does not necessarily have to comprise 3 digits and leading zeros do not necessarily have to be transmitted.

Note – In order to uniquely identify the documents exchanged, it is recommended that the same DRNs should not appear within a session. However, it is noted that some existing terminals may cause duplication of DRNs when documents are exchanged in both directions.

4.2.10 The sum of the numbers of digits contained in the checkpoint reference number and the document reference number shall not exceed six, to permit printing in the available space in the call identification line as defined in Recommendation F.200. There is no constraint on the maximum number of digits in either number, as long as this limitation is not exceeded.

4.3 *Acknowledgement window*

4.3.1 In the basic Teletex service the sender is prohibited from exceeding an acknowledgement window size of three. The maximum window size may be negotiated during session establishment using the parameters of the CSS command and the corresponding response (see § 5.7.2.6).

4.3.2 In the Group 4 facsimile service, indication of window size parameters in both CSS command and the corresponding response is required (see §§ 3.3.2.7 and 5.7.2.6).

4.3.3 There are two ways that the sender is permitted to recover from an interrupted transmission:

a) a cancellation is achieved by the subsequent use of CDC and CDD commands and the transmission will be resumed by the CDS command;

b) the sender may resume by use of CDC command, starting at the point in the text of the last checkpoint for which an acknowledging response was received.

On this basis, the receiver must be able to resume reception at a checkpoint ranging from the last acknowledged checkpoint to the last acknowledged checkpoint plus one, minus the window size.

4.3.4 The window mechanism has been introduced in order to allow continuous transmission of pages. The window mechanism may also be used by the receiving terminal to resolve local time problems without affecting the continuous transmission.

Note – For efficiency reasons, the receiving terminal will transmit the response to acknowledge outstanding checkpoint(s) as soon as possible.

4.3.5 The design of a terminal should be such that continuous reception is possible in normal operation of the terminal (e.g. with an average Teletex page content of 1600 octets). The use of the window mechanism should take into account the quality of service requirements in Recommendations F.200 and F.161.

4.3.6 If transmission flow control is needed, it shall be provided by the transport service.

5 Coding

5.1 *Definition of terms used in coding*

5.1.1 **command identifier (CI) or response identifier (RI)**

F: identificateur de commande (IC) ou de réponse (IR)

S: identificador de instrucción (II) o identificador de respuesta (IR)

The heading information that identifies the command or response concerned.

5.1.2 **length indicator (LI)**

F: identificateur de longueur (IL)

S: identificador de longitud (IL)

Represents the length in octets of an associated field or group of fields.

5.1.3 **parameter identifier (PI)**

F: identificateur de paramètre (IP)

S: identificador de parámetro (IP)

Indicates the type of information contained in an associated field or group of fields.

5.1.4 **parameter group identifier (PGI)**

F: identificateur de groupe de paramètres (IGP)

S: identificador de grupo de parámetros (IGP)

A special case of a parameter identifier, which indicates that the associated field consists entirely of a group of parameters, each identified by a parameter identifier.

5.1.5 **parameter value (PV)**

F: valeur de paramètre (VP)

S: valor de parámetro (VP)

The information that represents the value of the parameter identified by either a PI or PGI.

5.1.6 **field**

F: champ; domaine

S: campo

Either a group of one or more bits within a single octet or a group of one or more octets, used to represent a particular set of information.

5.2 *Principles of coding*

5.2.1 The coding of session commands, responses and parameters is independent of the coding of document commands, responses and parameters and vice versa.

5.2.2 Binary field encoding principles have been used to allocate bit patterns for the CI, RI, PGI and PI.

5.2.3 The first section of a session or document field consists of either a CI or an RI. Each CI or RI is always immediately followed by an LI.

5.2.4 Bits of an octet are numbered 8 to 1 where bit 1 is the low order bit and is transmitted first. Octets of a session or document field are consecutively numbered starting from 1 and transmitted in this order.

5.2.5 The value of an LI is a binary number that represents the total length of the immediately following parameter field(s) in octets. The value of the LI does not include either itself or any subsequent user information.

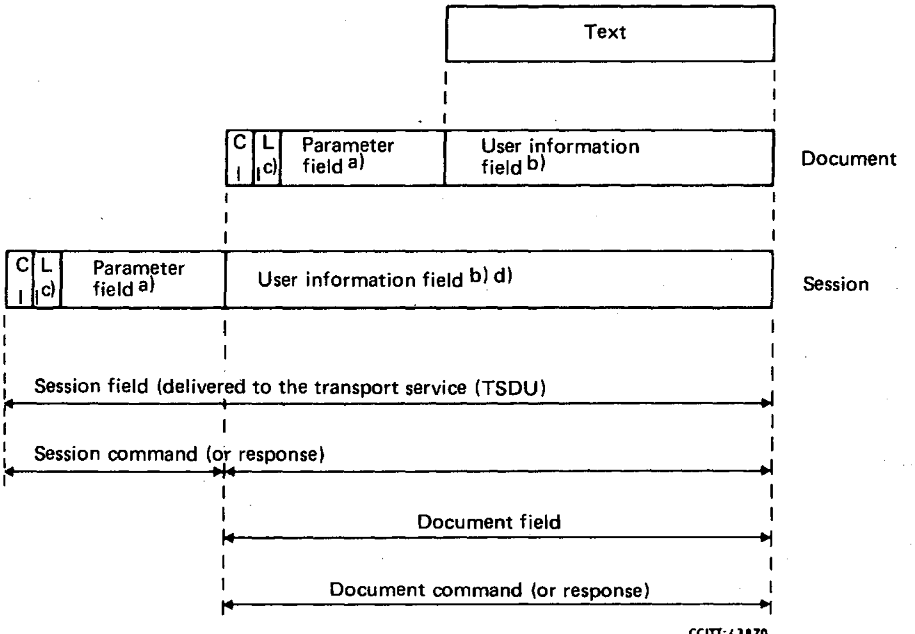
5.2.6 If a parameter field indicated by a PGI appears within a parameter field initiated by a PGI, the PV field of the nested PGI field may not extend beyond the end of the PV of the enclosing PGI field.

5.2.7 To decode CI, RI, PGI and PI, all the bits of the identifier must be considered.

5.2.8 The format of a parameter field initiated by a PGI is the same as the format of such a field initiated by a PI except that the entire PV field consists of a sequence of one or more parameter fields, each of which is initiated by either PI or PGI.

5.2.9 The absence of non-mandatory PI or PGI indicates that no such functions are available. Therefore PIs or PGIs with LI set to zero should be avoided.

5.2.10 Figures 4/T.62, 5/T.62 and 6/T.62 illustrate the coding principles.



TSDU Transport service data unit

a) Present only if LI ≠ 0.

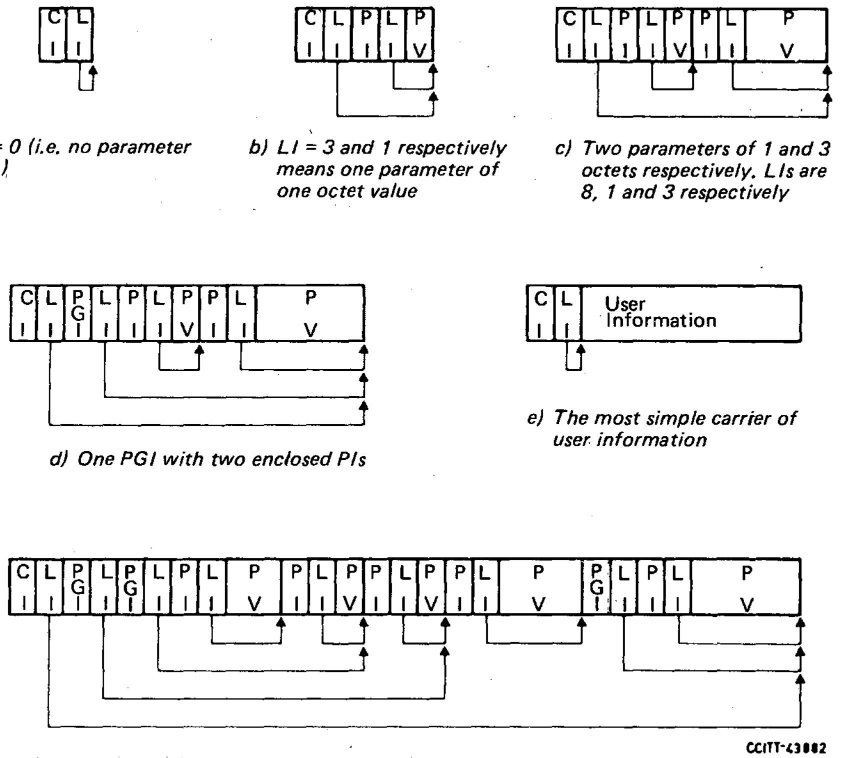
b) Present only after user information commands (or responses).

c) See § 5.2.5.

d) See § 1.2.1.

FIGURE 4/T.62

Illustration of the relationship between session and document commands/responses



a) LI = 0 (i.e. no parameter field)

b) LI = 3 and 1 respectively means one parameter of one octet value

c) Two parameters of 1 and 3 octets respectively. LIs are 8, 1 and 3 respectively

d) One PGI with two enclosed PIs

e) The most simple carrier of user information

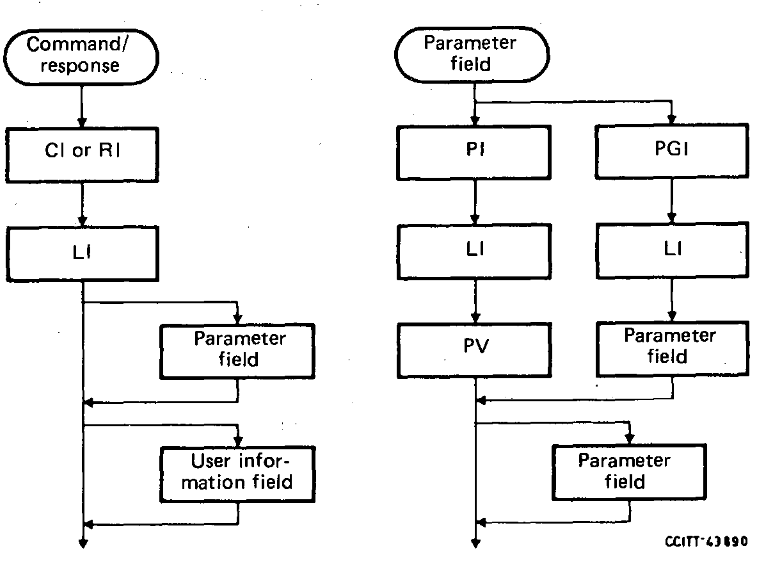
f) Example of complex use of PGIs

Note 1 – In every case the CI can be replaced by an RI.

Note 2 – Any PI or PGI may be omitted when it is not used for conveying information (i.e. parameter values). PIs and PGIs within the same nesting level are put in order of increasing binary value.

FIGURE 5/T.62

Examples of command/response structure



Note – This figure may need further study.

FIGURE 6/T.62

Allowable sequences of units within a command or response

5.3 *Coding of length indicators*

5.3.1 The value of an LI is a binary number that represents the total length in octets of the immediately following CI, RI, PI and/or PGI fields. The value of the LI does not include either itself or any subsequent user information, as noted in § 5.2.5 above.

5.3.2 The basic LI consists of a single octet with a maximum value of 254 in decimal (i.e., a binary value of 11111110).

5.3.3 If the first octet of the LI is 255 decimal (i.e., a binary value of 11111111), this indicates that the value of the LI is contained in the next two following octets allowing a maximum value of 65 535 octets.

5.3.4 Within any octet, the highest order bit is bit 8 with the remaining bits assigned in descending order. Where the length value is represented in two octets, the first contains the higher order bits.

5.4 *Coding of command and response identifiers for session elements*

5.4.1 The coding of CI and RI for session commands and responses is shown in Table 4/T.62.

5.4.2 Apart from private use, the codes of the commands and responses in Table 4/T.62 are assigned in such a way that the bits may be interpreted as follows:

Bit 1	1 = Command	0 = Response
Bit 2	1 = Positive	0 = Negative (for responses)
Bit 3	1 = Initiate	0 = Stop (for most commands)
Bits 4, 5	11 Session 10 Session 01 Interaction 00 Session user	
Bits 6, 7, 8	Set to zero (except for a CSTD and private use) and reserved for extension.	

Note – If possible, this binary field coding structure should be followed in making future code assignments, but this is not mandatory if the number of available code combinations is insufficient. Therefore, it is not intended as a guide for implementation.

5.4.3 One or more of the non-allocated values are to be reserved for future extension. The method of future extension is for further study.

5.5 *Coding of command and response identifiers for document elements*

5.5.1 The coding of command and response identifiers for document commands and responses is shown in Tables 5/T.62 and 6/T.62 respectively.

5.5.2 Apart from private use, the codes of the commands and responses in Tables 5/T.62 and 6/T.62 are assigned in such a way that the bits may be interpreted as follows:

Bit 1	1 = Command	0 = Response
Bit 2	1 = Positive	0 = Negative (for responses)
Bit 3	1 = Initiate	0 = Stop (for most commands)
Bits 4, 5, 6	111, 110, 101 100 011 010 001 000	Document (delivery unit) Reserved Page (commitment unit) Reserved Reserved for recovery unit Text
Bits 7, 8	Set to zero, and reserved for future extension.	

5.5.3 With regard to future extension, see the note in § 5.4.2 and § 5.4.3 above.

TABLE 4/T.62

Command and response identifiers for session elements

Command/response	Bit number							
	8	7	6	5	4	3	2	1
CSS	0	0	0	0	1	1	0	1
CSE	0	0	0	0	1	0	0	1
CSA	0	0	0	1	1	0	0	1
CSCC	0	0	0	1	0	1	0	1
CSUI	0	0	0	0	0	0	0	1
RSSP	0	0	0	0	1	1	1	0
RSSN	0	0	0	0	1	1	0	0
RSEP	0	0	0	0	1	0	1	0
RSAP	0	0	0	1	1	0	1	0
RSCCP	0	0	0	1	0	1	1	0
RSUI	0	0	0	0	0	0	1	0
CSTW	0	0	0	1	1	1	0	1
RSTWP	0	0	0	1	1	1	1	0
RSTWN	0	0	0	1	1	1	0	0
CSTD	0	0	1	0	0	0	0	1
Reserved for private use	1	1	1	1	x	x	x	x

Note – For CSTW, RSTWP and RSTWN, which concern two-way simultaneous operation, see Annex C. For CSTD, which concerns typed data exchange, see Annex G.

TABLE 5/T.62

Coding for document command identifiers

Command	Bit number							
	8	7	6	5	4	3	2	1
CDS	0	0	1	0	1	1	0	1
CDC	0	0	0	1	1	1	0	1
CDE	0	0	1	0	1	0	0	1
CDR	0	0	0	1	1	0	0	1
CDD	0	0	1	1	1	0	0	1
CDPB	0	0	1	1	0	0	0	1
CDCL	0	0	1	1	1	1	0	1
CDUI	0	0	0	0	0	0	0	1
Reserved for private use	1	1	1	1	x	x	x	x

TABLE 6/T.62

Coding for document response identifiers

Response	Bit number							
	8	7	6	5	4	3	2	1
RDEP	0	0	1	0	1	0	1	0
RDRP	0	0	0	1	1	0	1	0
RDDP	0	0	1	1	1	0	1	0
RDPBP	0	0	1	1	0	0	1	0
RDPBN	0	0	1	1	0	0	0	0
RDCLP	0	0	1	1	1	1	1	0
RDGR	0	0	0	0	0	0	0	0
Reserved for private use	1	1	1	1	x	x	x	x

5.6 *Coding of parameter group identifiers and parameter identifiers*

5.6.1 The coding of PGIs and PIs for session commands and responses is shown in Table 7/T.62. The coding of the PGIs and PIs for document commands and responses is shown in Table 8/T.62.

5.6.2 Tables 9/T.62 and 10/T.62 list the PGIs and PIs for each command and response for the session and document elements of procedure together with an indication of whether the PGIs and PIs concerned are mandatory or not.

5.6.3 Where a PI is allocated to a particular PGI this is shown in Table 7/T.62 or 8/T.62. Some PIs are not allocated to a PGI and are used as required. Some PIs may be used without preceding PGIs as defined in Tables 9/T.62 and 10/T.62.

5.6.4 The codes of these PGIs and PIs are assigned in such a way that the binary field consisting of bits 8, 7 and 6 may be interpreted as follows:

Bits 876

000	Session related
001	Document related (These document related PGIs and PIs may possibly be of use to other services.)
010	Document related (for Teletex)
011 100 101	Reserved
110	User data
111	Private use

The binary field consisting of bits 5 and 4 may be interpreted as follows:

Bits 54

00 PGI
01 PI
10 PI
11 PI

The binary field consisting of bits 3, 2 and 1 is used to extend the PGIs when set to 000.

Note – If possible, this binary field coding structure should be followed in making future code assignments, but this is not mandatory if the number of available code combinations is insufficient. Therefore, it is not intended as a guide for implementation.

5.6.5 PGIs and PIs within the same nesting level should be put in the order of increasing binary value. The coding order of PGIs and PIs included in each command or response is defined in Tables 9/T.62 and 10/T.62.

TABLE 7/T.62

Coding of session PGIs and PIs

Parameter group identifier (PGI)									Parameter identifier (PI)								
Name or function	Bit number								Name	Bit number							
	8	7	6	5	4	3	2	1		8	7	6	5	4	3	2	1
Reserved for extension	0	0	0	0	0	0	0	0									
Session reference	0	0	0	0	0	0	0	1	Terminal identifier of the called terminal	0	0	0	0	1	0	0	1
									Terminal identifier of the calling terminal	0	0	0	0	1	0	1	0
									Date and time	0	0	0	0	1	0	1	1
									Additional session reference number	0	0	0	0	1	1	0	0
Non-basic session capabilities	0	0	0	0	0	0	1	0	Miscellaneous session capabilities	0	0	0	0	1	1	0	1
									Window size	0	0	0	0	1	1	1	0
No PGI associated with these PIs									Service identifier	0	0	0	0	1	0	0	0
									Session control functions	0	0	0	1	0	0	0	0
									Session termination parameter	0	0	0	1	0	0	0	1
									Inactivity timer	0	0	0	1	0	0	1	0
									Session service functions	0	0	0	1	0	1	0	0
									Reason	0	0	1	1	0	0	1	0
Non-basic Teletex terminal capabilities	0	1	0	0	0	0	0	1	Control character set	0	1	0	0	1	0	0	1
									Teletex page format	0	1	0	0	1	0	1	0
									Miscellaneous Teletex terminal capabilities	0	1	0	0	1	0	1	1
Session user data	1	1	0	0	0	0	0	1									
Private use	1	1	1	0	0	x	x	x	Private use	1	1	1	0	1	x	x	x
									Private use	1	1	1	1	0	x	x	x
									Private use	1	1	1	1	1	x	x	x
									Non-standardized capabilities	1	1	1	0	1	0	0	0

TABLE 8/T.62

Coding of document PGIs and PIs

Parameter group identifier (PGI)		Parameter identifier (PI)	
Name or function	Bit number 8 7 6 5 4 3 2 1	Name	Bit number 8 7 6 5 4 3 2 1
Reserved for extension	0 0 1 0 0 0 0 0		
Document linking	0 0 1 0 0 0 0 1	Terminal identifier of the called terminal	0 0 0 0 1 0 0 1
		Terminal identifier of the calling terminal	0 0 0 0 1 0 1 0
		Date and time	0 0 0 0 1 0 1 1
		Additional session reference number	0 0 0 0 1 1 0 0
		Document reference number	0 0 1 0 1 0 0 1
		Checkpoint reference number	0 0 1 0 1 0 1 0
No PGI associated with these PIs		Inactivity timer	0 0 0 1 0 0 1 0
		Service interworking identifier	0 0 1 0 1 0 0 0
		Document reference number	0 0 1 0 1 0 0 1
		Checkpoint reference number	0 0 1 0 1 0 1 0
		Acceptance of CDCL parameters	0 0 1 0 1 1 0 0
		Storage capacity negotiation	0 0 1 0 1 1 0 1
		Receiving ability jeopardized	0 0 1 0 1 1 1 0
		Reserved	0 0 1 0 1 1 1 1
		Document type identifier	0 0 1 1 0 0 0 0
		Reflect parameter values	0 0 1 1 0 0 0 1
		Reason	0 0 1 1 0 0 1 0
Reserved for extension	0 1 0 0 0 0 0 0		

TABLE 8/T.62 *(continued)*

Parameter group identifier (PGI)		Parameter identifier (PI)	
Name or function	Bit number 8 7 6 5 4 3 2 1	Name	Bit number 8 7 6 5 4 3 2 1
Non-basic Teletex terminal capabilities	0 1 0 0 0 0 0 1	Graphic character set	0 1 0 0 1 0 0 0
		Control character set	0 1 0 0 1 0 0 1
		Teletex page format	0 1 0 0 1 0 1 0
		Miscellaneous Teletex terminal capabilities	0 1 0 0 1 0 1 1
		Character box height	0 1 0 0 1 1 0 1
		Character box width	0 1 0 0 1 1 1 0
Session user data	1 1 0 0 0 0 0 1		
Private use	1 1 1 0 0 x x x	Private use	1 1 1 0 1 x x x
		Private use	1 1 1 1 0 x x x
		Private use	1 1 1 1 1 x x x
		Non-standardized capabilities	1 1 1 0 1 0 0 0

TABLE 9/T.62

PGIs and PIs for session elements of procedure

Session command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
CSS	Session reference	m	Terminal identifier of the calling terminal	m
			Date and time	m
			Additional session reference number	nm
	Non-basic session capabilities	nm	Miscellaneous session capabilities	nm
			Window size (Note 1)	nm
			Service identifier	m
			Inactivity timer	nm
			Session service functions	nm
	Non-basic Teletex terminal capabilities	nm	Control character sets	nm
			Teletex page formats	nm
			Miscellaneous Teletex terminal capabilities	nm
	Session user data	nm		
	Private use	nm		
			Non-standardized capabilities	nm
CSE			Session termination parameter	nm
CSA			Session termination parameter	m
CSCC				
CSUI		(Note 2)	Session control functions	nm

TABLE 9/T.62 *(continued)*

Session command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
RSSP	Session reference	m	Terminal identifier of the called terminal	m
			Date and time	m
			Additional session reference number	nm
	Non-basic session capabilities	nm	Miscellaneous session capabilities	nm
			Window size	nm
			Service identifier	m
			Session control functions	nm
			Inactivity timer	nm
			Session service functions	nm
	Non-basic Teletex terminal capabilities	nm	Control character sets	nm
			Teletex page formats	nm
			Miscellaneous Teletex terminal capabilities	nm
	Session user data	nm		
	Private use	nm		
			Non-standardized capabilities	nm

TABLE 9/T.62 *(end)*

Session command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
RSSN	Session reference	m	Terminal identifier of the called terminal	m
			Date and time	m
			Additional session reference number	nm
	Non-basic session capabilities	nm	Miscellaneous session capabilities	nm
			Window size	nm
			Service identifier	m
			Session service functions	nm
			Reason	nm
	Non-basic Teletex terminal capabilities	nm	Control character sets	nm
			Teletex page formats	nm
			Miscellaneous Teletex terminal capabilities	nm
	Session user data	nm		
	Private use	nm		
RSEP				
RSAP				
RSCCP				
RSUI			Session control functions	nm

Note 1 – This parameter "window size" in CSS, RSSP and RSSN is mandatory for the Group 4 facsimile service (see § 4.3.2), but not mandatory for the Teletex service.

Note2 – This PI applies only to the interactive option defined in Annex G.

TABLE 10/T.62

PGIs and PIs for document elements of procedure

Document command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
CDS			Service interworking identifier	nm
			Document reference number	m
			Document type identifier	nm
	Non-basic Teletex terminal capabilities	nm	Graphic character sets	nm
			Control character sets	nm
			Teletex page formats	nm
			Miscellaneous Teletex terminal capabilities	nm
			Character box height	nm
			Character box width	nm
	Session User data	nm		
	Private use	nm		

TABLE 10/T.62 *(continued)*

Document command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
CDC	Document linking	m	Terminal identifier of the called terminal	m
		Note	Terminal identifier of the calling terminal	m
			Date and time	m
			Additional session reference number	nm
			Document reference number	m
			Checkpoint reference number	m
			Service interworking identifier	nm
			Document reference number (current session)	m
			Document type identifier	nm
	Non-basic Teletex terminal capabilities	nm	Graphic character sets	nm
			Control character sets	nm
			Teletex page formats	nm
			Miscellaneous Teletex terminal capabilities	nm
			Character box height	nm
			Character box width	nm
	Session user data	nm		
	Private use	nm		

TABLE 10/T.62 *(continued)*

Document command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
CDE			Checkpoint reference number	m
CDR			Reason	nm
CDD			Reason	nm
CDPB			Checkpoint reference number	m
CDUI				
CDCL			Inactivity timer	nm
			Storage capacity negotiation	nm
	Non-basic Teletex terminal capabilities	nm	Graphic character sets	nm
			Control character sets	nm
			Teletex page formats	nm
			Miscellaneous Teletex terminal capabilities	nm
			Character box height	nm
			Character box width	nm
	Session user data	nm		
	Private use	nm		
			Non-standardized capabilities	nm

TABLE 10/T.62 *(end)*

Document command or response identifier	Parameter group identifier (PGI)		Parameter identifier (PI)	
	Description	Mandatory or not mandatory	Description	Mandatory or not mandatory
RDEP			Checkpoint reference number	m
RDRP				
RDDP				
RDPBP			Checkpoint reference number	m
			Receiving ability jeopardized	m
RDPBN			Reason	m
RDCLP			Inactivity timer	nm
			Acceptance of CDCL parameters	nm
			Storage capacity negotiation	nm
	Non-basic Teletex terminal capabilities	nm	Graphic character sets	nm
			Control character sets	nm
			Teletex page formats	nm
			Miscellaneoux Teletex terminal capabilities	nm
			Character box height	nm
			Character box width	nm
	Session user data	nm		
	Private use	nm		
			Non-standardized capabilities	nm
RDGR			Reflect parameter values	m

Note – These PIs are required only if linking is attempted in a new session.

5.6.6 The following rules shall apply to the private use and presently not defined parameters:

a) these parameters, if present in CSS or CDCL (or their corresponding responses), should not lead to procedural errors;

b) the use of these parameters in other commands or responses must be negotiated upon in advance by CSS or CDCL and their corresponding responses (see § 3.3.2.3);

c) presence of these parameters "unexpectedly" in elements other than CSS, RSSP, CDCL or RDCLP may result in procedural errors;

d) the absence of a parameter of this kind in a response to CSS or CDCL must be interpreted as an indication that the terminal is not capable of handling any of these functions.

5.7 *Parameter values*

5.7.1 *General*

5.7.1.1 Unless otherwise specified the following rules apply to the fields containing parameter values (PV):

a) Where a binary number is used to represent a value, the highest order bit of each octet is bit 8 with the remaining bits assigned in descending order. Where a binary value is represented by more than one octet, the first octet contains the highest order bits, with successive octets assigned in descending order;

b) All bits reserved for future standardization shall be set to zero;

c) Where a PV contains graphic characters that may be printed or displayed, they shall be in the intended printing/display sequence and shall be coded as defined in Recommendation T.61;

d) For a PGI designated for extension, the PIs and/or PGIs included in the parameter field do not necessarily conform to the following assignments of PI and PGI values.

5.7.1.2 Assignment of coding to the various parameter values is shown in the following paragraphs.

5.7.2 *Session related parameters*

Note – The following paragaphs include either session related or both session and document related parameters.

5.7.2.1 *Terminal identifier of the called terminal*

A sequence of graphic characters as defined in Recommendation F.200.

5.7.2.2 *Terminal identifier of the calling terminal*

A sequence of graphic characters as defined in Recommendation F.200.

5.7.2.3 *Date and time*

A sequence of graphic characters as defined in Recommendation F.200.

5.7.2.4 *Additional session reference number*

A fixed length sequence of two decimal digits as coded in Recommendation T.61.

5.7.2.5 *Miscellaneous session capabilities*

Bit 1 of the first octet set to 1 indicates the terminal capability for two-way simultaneous information transfer.

Bit 2 of the first octet set to 1 indicates the terminal capability for session suspension.

Bit 3 of the first octet set to 1 indicates the terminal capability for interactive operation

All other bit values are reserved for future standardization.

5.7.2.6 *Window size*

A binary number of fixed length of one octet, with a minimum value of one and a maximum value of 255 in decimal (i.e., a binary value of 11111111). The default value is three in decimal (i.e., a binary value of 00000011).

5.7.2.7 *Service identifier*

The coding for the service identifier is as follows:

Bits 87654321	Service
00000001	Telematic

All other encodings are for further study.

5.7.2.8 *Session control functions*

When used with a response, i.e. either RSSP or RSUI, the following bit assignments are defined in the first octet:

a) bit 1 set to 1 indicates request control (as defined in this Recommendation);

b) bit 2 set to 1 indicates request session suspension (as defined in this Recommendation).

All other bits are reserved for future standardization.

This PI may be used with CSUI, either with or without associated CDUI, only as a part of the interactive option defined in Annex G. When used in this manner, one set of bit assignments is defined: bits 1, 3 and 5 set to 1 indicate "give control" (as defined in Annex G). All other parameter values are reserved for future standardization.

5.7.2.9 *Session termination parameter*

Bit 1 of the first octet set to 1 indicates that the transport connection shall be cleared (default value). When set to 0 it indicates that the connection should not be cleared.

Bit 2 of the first octet set to 1 indicates a local terminal error.

Bit 3 of the first octet set to 1 indicates an unrecoverable procedural error.

Bit 4 of the first octet set to 1 indicates that no reason is given.

All other bits are reserved for future standardization. The CSE command uses only bit 1; all other bits shall be set to 0.

5.7.2.10 *Reason (session or document)*

A field indicating the reason for sending the associated command or response. The value can either be given as a binary coded field or as plain text message. The absence of this parameter indicates that no reason is given.

Bits 87654321	*Reason*
00000000	No specific reason stated (used for session or document reasons other than those listed);
00000001	Temporarily unable to enter into, or to continue, a session (e.g. due to memory full or out of recording paper);
00000010	Explicit text message only for use with RSSN (see Note 1);
00000011	Sequence error (Note 2);
00000101	Local terminal error (Note 2);
00000110	Unrecoverable procedural error (Note 2).

Note 1 – For the basic Teletex service, the text follows immediately after the first byte of the value. Maximum of 69 characters (control characters included). Only characters convertible one-to-one to the telex alphabet (ITA2) shall be allowed. Teletex code shall be used.

Note 2 – These parameter values are valid only in document commands and responses.

Note 3 – The reason parameters for services beyond basic ones are for further study.

5.7.2.11 *Inactivity timer*

a) Bits 8 and 7 indicate the unit of inactivity timer value and bits 6 to 1 indicate the binary value in the range of 1 to 63.

Bits 87	*Unit of timer*
00	Second(s);
01	Minute(s);
10	Hour(s);
11	Reserved for extension.

b) All bits of the first octet set to zero indicates the inactivity timer value is of infinity, i.e. the timer is disabled.

5.7.2.12 *Session service functions*

The parameter value is indicated by a sequence of two octets.

a) In octet 1:

Bits 8-4 (Note 1)	Reserved (set to 0).
Bit 3	Set to 1 to indicate the typed data capability as defined in Annex G, § G.3.
Bit 2 (Note 2)	Set to 1 to indicate the ability to send RDPBN.
Bit 1 (Note 2)	Set to 1 to indicate the ability to send/receive CDCL/RDCLP.

b) In octet 2:

Bits 8, 6, 5 and 3 (Note 1)	Reserved (set to 0).
Bit 7 (Note 2)	Set to 1 to indicate the capability of document transfer.
Bit 4 (Note 2)	Set to 1 to indicate the capability of page synchronization [CDPB/RDPBP(N)].
Bits 2-1 (Note 3)	Set to 0 1 to indicate "half duplex" Set to 1 0 to indicate "duplex"

Note 1 – All bits reserved should be ignored when comparing capabilities indicated in CSS and RSSP.

Note 2 – The indicated bits should be set (to 1 for document transfer and to 0 for no document transfer) as a unit.

Note 3 – Half-duplex and duplex are defined in Annex G.

The absence of this parameter should be interpreted as the following default values:

	Bits 87654321
Octet 1:	00000011
Octet 2:	01001001

5.7.2.13 *Non-standardized capability identifier*

The first octet represents the registered CCITT country code as specified in Recommendation T.35 to be used to identify non-standard capabilities. Additional octets, may be specified by each country's Administration.

5.7.2.14 *Session user data*

All of the parameters associated with this PGI are defined in Recommendation T.73. The maximum length of this user data field following the PGI and its LI is restricted to 512 octets.

5.7.2.15 *Private use*

A set of PGI and PI values is designated as being for private use. Other than the PGIs designated for extensions and the permitted use of private parameters only with certain command and responses, the use of these parameters is not defined.

5.7.3 *Document related parameters*

Note – The following paragraphs include parameters commonly used by basic Teletex and Group 4 facsimile services.

5.7.3.1 *Service interworking identifier*

Bit 1 of the first octet set to 1 shall indicate that the associated document is suitable for forwarding via the telex service.

All other bit values are reserved for future standardization.

5.7.3.2 *Document reference number*

A sequence of decimal digits as defined in this Recommendation and coded in Recommendation T.61.

5.7.3.3 *Checkpoint reference number*

A sequence of decimal digits as defined in this Recommendation and coded in Recommendation T.61.

5.7.3.4 *Acceptance of CDCL parameters*

Bit 1 of the first octet set to 1 indicates acceptance of all non-basic terminal capabilities requested by a CDCL command.

All other bit values are reserved for future standardization.

Note – Parameters b) and c) of RDCLP (§ 3.4.5.1) are coded as non-basic terminal capabilities.

5.7.3.5 *Storage capacity negotiation*

A fixed length sequence of two octets:

a) Bit 1 of the first octet set to 1 indicates that a terminal has reserved the requested amount of storage.

b) Bit 2 of the first octet set to 1 indicates that the binary field in the following octet contains a number indicating storage capacity required/reserved in kilo-octets.

c) Bit 5 of the first octet set to 1 indicates that the binary field in the following octet contains a number, which, when multiplied by 16, indicates storage capacity required/reserved in kilo-octets.

d) Bit 6 of the first octet set to 1 indicates that the binary field in the following octet contains a number, which, when multiplied by 256, indicates storage capacity required/reserved in kilo-octets.

e) Bit 3 of the first octet set to 1 indicates that a terminal cannot estimate its memory capacity.

f) Bit 4 of the first octet set to 1 indicates that a terminal cannot now reserve the requested amount of memory.

g) In the first octet, only one of bit 2, 5 and 6 may be set to one. For negotiation of storage capacity less than or equal to 65 kilo-octets, bit 2 shall be used.

h) Bits 7 and 8 of the first octet are reserved for future standardization.

Octet 2 indicates the memory size available and/or reserved (the meaning is defined in the first octet). It shall be set to 11111111 if bit 3 and/or 4 in the first octet is set to 1.

In cases a), e) and f), the second octet may be ignored by the recipient of RDCLP.

5.7.3.6 *Receiving ability jeopardized*

The first octet shall be enclosed as follows:

Bits 87654321	*Meaning*
00000000	Further traffic can be accepted.
00000001	Ability to receive further traffic is jeopardized.

All other binary values are reserved for future standardization.

5.7.3.7 *Document type identifier*

Absence of this parameter shall indicate a normal document. This parameter, if used, is a binary encoded field of fixed length of one octet identifying the document type as follows:

Bits 87654321	*Type of document*
00000001	Operator document.
00000010	Control document.
00000011	Monitor document.

All other encodings are reserved for future standardization.

5.7.3.8 *Reflect parameter value*

This is an arbitrary length field that contains the bit pattern of the command or response up to and including the detected error.

5.7.4 *Document related parameter for Teletex*

Note – The following parameters may also be used by services other than Teletex.

5.7.4.1 *Control character sets* (refer to Recommendations T.60 and T.61)

A variable length field indicating the receiving capability for non-basic standardized control character sets. Each such control character set shall be indicated by the sequence of characters used to designate that set, as defined in Recommendation T.61. Where more than one such character set are to be indicated, the ESC character fulfills the purpose of a separator between the character set indicators.

5.7.4.2 *Graphic character sets* (refer to Recommendations T.60 and T.61)

5.7.4.2.1 A variable length field indicating the receiving capabilities for non-basic standardized graphic character sets. Each such graphic character sets or DRCS (Dynamically redefinable character set) for Japanese Kanji characters shall be indicated by the sequence of characters used to designate that set, as defined in Recommendation T.61. Where more than one such character set are to be indicated, the ESC character fulfills the purpose of a separator between the character set indicators.

5.7.4.2.2 The following descriptions apply to the use of a DRCS set for Japanese Kanji characters:

a) if the DRCS set is indicated as a parameter value associated with a CDS or CDC command, this should be followed by combinations of a character code (CC) to be registered to the DRCS set and its character dot pattern (DP);

b) the field length of a character code is defined by the DRCS set and that of a character dot pattern is indicated as parameter values of a character box height and a character box width parameters.

Note – The PV field of this parameter in either CDS or CDC will be as follows:

$$\text{DRCS CC}_1\ \text{DP}_1\ \text{CC}_2\ \text{DP}_2 \ldots \text{CC}_i\ \text{DP}_i$$

5.7.4.3 *Teletex page formats* (refer to Recommendations T.60 and T.61)

The value of the first octet of the parameter value will indicate the capability of a page format, as defined in Table 11/T.62. If the terminal is capable of more than one format, these will be indicated in the first and subsequent octets, one octet per value (see Note 1 of the table). No separator between the values will be given. The length indicator of the parameter will indicate if more than one value is given. All parameter values shall be inserted in increasing order of their binary values.

TABLE 11/T.62

Bits 8 7 6 5 4 3 2 1		Format
0 0 0 0 0 0 0 1	(option)	ISO A4, horizontal and vertical
0 0 0 0 0 0 1 0	(option)	North American, horizontal and vertical
1 0 0 0 0 1 0 0	(option)	ISO A4 extended (ISO standard 3535), vertical
0 1 0 0 0 1 0 0	(option)	ISO A4 extended (ISO standard 3535), horizontal
1 0 0 0 1 0 0 0	(option)	North American Legal, vertical
0 1 0 0 1 0 0 0	(option)	North American Legal, horizontal
0 0 0 0 0 0 1 1	(option)	ISO A4, horizontal and vertical (for use by Japanese Kanji terminal)
0 0 0 1 0 0 0 0	(option)	ISO B5, horizontal and vertical (for use by Japanese Kanji terminal)
0 0 1 0 0 0 0 0	(option)	ISO B4, horizontal and vertical (for use by Japanese Kanji terminal)

Note 1 – The whole octet has to be considered when decoded, as the meaning is coded as a value, not as a single bit position within the octet. All other values are reserved, i.e. it is not allowed to "combine" the indication of several formats into the same octet by setting more than one bit to "one".

Note 2 – The following rule is used for the coding of bits 7 and 8:

Bits 8 7	*Meaning*
0 0	Vertical and horizontal
0 1	Horizontal only
1 0	Vertical only.

5.7.4.4 *Miscellaneous terminal capabilities* (refer to Recommendation T.61)

A variable length field indicating the receiving capabilities for non-basic standardized values of character spacing, line spacing and graphic renditions. Each parameter value of such a function shall be indicated by the control sequence (CSI P_i I_i F) as defined in Recommendation T.61. This applies to the functions Select Horizontal Spacing (SHS) for a character pitch, Select Vertical Spacing (SVS) for a line pitch and Select Graphic Rendition (SGR) for a graphic rendition. This also applies to the functions Graphic Size Modification (GSM) and Select Presentation Direction (SPD) for Japanese Kanji capabilities. When more than one such character sequence is to be indicated, a single space shall be inserted between them. Only one parameter value is allowed within a CSI sequence.

5.7.4.5 *Character box height*

A variable length field indicating the receiving capabilities for the number of dots of the character box height. The number of dots shall be indicated by the numeric character as defined in T.61.

Further study is required for indicating more than one value.

5.7.4.6 *Character box width*

A variable length field indicating the receiving capabilities for the number of dots of the character box width. The number of dots shall be indicated by the numeric character as defined in T.61.

Further study is required for indicating more than one value.

ANNEX A

(to Recommendation T.62)

Definitions

Note – Some of the terms used in this Recommendation have been defined in ways that may differ from the meanings of similar terms in other Recommendations.

A.1 *General*

A.1.1 **Teletex terminal**

F: terminal télétex

S: terminal teletex

A device that is capable of transmitting and receiving Teletex documents in accordance with the basic requirements of Recommendation T.60.

A.1.2 **call**

F: communication

S: comunicación

The temporary connection (or apparent connection as perceived by the caller) of one terminal to another for the purpose of exchanging information.

A.1.3 **calling terminal**

F: équipement terminal demandeur

S: terminal llamante (que llama)

The terminal that initiates the procedures to establish a call.

A.1.4 **called terminal**

F: équipement terminal demandé

S: terminal llamado

The terminal to which a call is made.

A.1.5 **service interworking**

F: interfonctionnement de service

S: interfuncionamiento de servicios

The facility of sending and receiving information between a Teletex terminal and a terminal of another service, e.g. telex.

A.1.6 **command**

F: commande

S: instrucción; orden

A command is control information sent to another terminal to initiate execution of a specific function. Some commands require a response.

A.1.7 **response**

F: réponse

S: respuesta

A response is control information sent by the recipient of the command to advise the sender of the command of the action taken. Exceptionally, the reaction to a response may be another response.

A.1.8 **source/sink relationship**

F: relation source/collecteur

S: relación fuente/aceptor (o fuente/sumidero)

User information is transferred from a source to a sink.

A.1.9 **group 4 facsimile apparatus**

F: télécopieur du groupe 4

S: aparato facsímil del grupo 4

A device that is capable of transmitting and receiving facsimile documents in accordance with the basic requirements of Recommendation T.5.

A.2 *Terms specific to session procedures*

A.2.1 **session**

F: session

S: sesión

A session is the interval during which a logical, mutually agreed correspondence between two application/presentation processes exists for the transfer of application and presentation related information.

A.2.2 *Modes of session*

There are three different modes:

A.2.2.1 **one way communication (OWC)**

User information is transferred in one direction only during the session, i.e. only one of the terminals will have the right to be the source.

A.2.2.2 **two way alternate (TWA)**

User information is transferred in both directions, but only in one direction at a time, i.e. the source/sink relation will be changed one or more times during the session.

A.2.2.3 **two way simultaneous (TWS)**

User information is transferred in both directions simultaneously, i.e. both terminals are simultaneously a source as well as a sink.

Note – TWS mode is for further study.

A.2.3 **basic session reference**

F: référence de base de la session

S: referencia básica de la sesión

The basic session reference is used to identify a session. It consists of:

a) terminal identifier of the called terminal;

b) terminal identifier of the calling terminal;

c) date and time.

A.2.4 **expanded session reference**

F: référence élargie de la session

S: referencia extendida de la sesión

The expanded session reference is used to identify a session uniquely. It consists of the mandatory basic session reference plus an optional additional session reference number.

A.3 *Terms specific to document procedures*

A.3.1 **document**

F: document

S: documento

A document is a sequence of one or more pages intended by the originator to be delivered to the address(es) as a single entity in the original page sequence.

A.3.2 **page**

F: page

S: página

The basic element of office correspondence in the Telematic services. One A4 (or A4L, North American Standard or North American Legal) page or the information that may be presented on it.

A.3.3 **checkpoint**

F: point de repère

S: punto de comprobación; punto de validación

A checkpoint is a numbered mark inserted by the sender in the text stream to provide a reference point for error recovery.

A.3.4 **acknowledgement window**

F: fenêtre d'accusé de réception

S: ventana de acuse de recibo

The maximum number or checkpoints that a sender can transmit without receiving an acknowledgement from the receiver.

ANNEX B

(to Recommendation T.62)

Elementary functions of the procedure

B.1 *Introduction*

B.1.1 The purpose of this annex is to provide a more formal description of the document elements of procedure. The definition of independent and elementary functions forming a basic set of elements leads to the following:

a) the description of each element of procedure in this basic set is unambiguous (open to a single interpretation);

b) the functions that are common in two different elements of procedure appear clearly in the description of these elements (see Table B-1/T.62);

c) the separation of the elements of procedure into dialogue elements and elements concerning the structure of the user information;

d) for future elements of procedure, this basic set helps to reuse the elements in the basic set, which are already implemented, in new combinations.

TABLE B-1/T.62

Analysis of document layer commands and responses in terms of elementary functions

Command/ response	User structure	Dialogue
CDS	Start of D, P	Start of DU (CU, RU)
CDE	End of D, P	End of DU (CU, RU)
CDR	Suspend D	End of DU (CU, RU)
	Discard current P	
CDPB	End of P	End of CU (RU)
	Start of P	Start of CU (RU)
CDUI	Start of DUIB	
CDC	Continue D	Start of DU (CU, RU)
	Start of P	
CDD	Discard D	End of DU (CU, RU)
RDEP	–	Ack DU (CU, RU)
RDPBP	–	Ack CU (RU)
RDPBN	–	Nack CU (RU)
RDRP	–	Ack DU (CU, RU)
RDGR	–	End of DU (CU, RU)

D Document
P Page
DU Delivery unit

CU Commitment unit
RU Recovery unit

B.1.2 §§ B.2 and B.3 below describe the basic set of elementary functions. These functions have been selected such that:

a) they are elementary (they cannot be subdivided);

b) they are independent;

c) any element of procedure shall be capable of being described using the basic set.

B.1.3 Only the document elements of procedure have been taken into account.

B.1.4 The other purpose of this annex is to describe the relationship between the OSI (open systems interconnection) session services and the modes of operation. §§ B.5 and B.6 below describe definition of the modes and the relationship, respectively.

B.2 *Dialogue elements*

B.2.1 *Recovery unit (RU)*

A unit delimited by a recovery mark inserted by the sender in the text stream to provide a reference point for resuming transmission after a transmission interruption.

Note – The RU may be used to provide for different recovery mechanisms. The recovery mark may or may not require an acknowledging response depending upon the recovery mechanism.

B.2.2 *Commitment unit (CU)*

Element inviting the sink to take over responsibility for the transmitted information.

B.2.3 *Delivery unit (DU)*

One or more commitment units that are to be considered as a single entity for the purpose of synchronization.

B.2.4 *Interaction unit (IU)*

Element indicating the change of source and sink of data.

B.3 *User structure elements*

B.3.1 *Document user information block (DUIB)*

Smallest quantity of information preserved as one unit by the procedure.

B.3.2 *Page (P)*

The unit of information that may be presented on one physical page.

B.3.3 *Document (D)*

A sequence of one or more pages intended to be delivered as a single unit in the original page sequence.

B.4 *Rules*

B.4.1 The dialogue elements are related in accordance with the following hierarchy:

RU – lowest level in the hierarchy

CU ↓

DU

IU – highest level in the hierarchy.

B.4.2 Initiation/termination of any unit in this hierarchy also initiates/terminates all units at lower levels of the hierarchy.

B.5 *Telematic modes of operation*

There are three modes of operation defined for the Telematic services.

B.5.1 **Document transfer mode**

This mode allows only for transfer of documents without interactive capability. Procedures applying to this mode are defined in the main body of this Recommendation.

B.5.2 **Interactive mode**

This mode allows only for interactive dialogue. No document transfer can take place. Procedures applying to this mode are defined in Annex G.

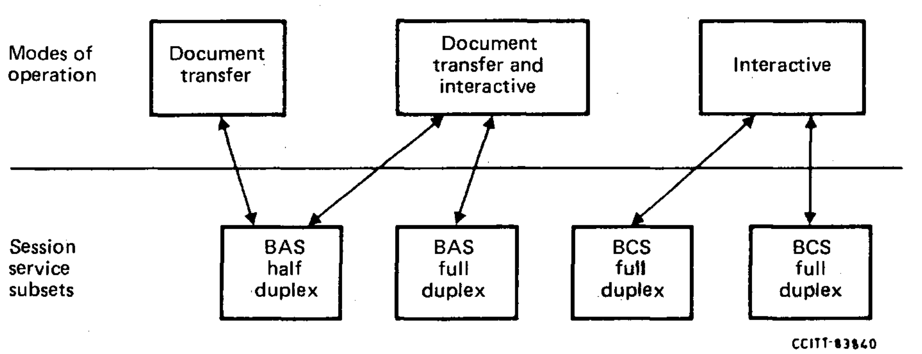
B.5.3 **Document transfer and interactive mode**

This mode allows for interleaving of document transfer with interactive dialogue. Procedures applying to this mode are defined in Annex G.

B.6 *Relationship between Telematic modes of operation and the OSI session services*

B.6.1 *Required session service subsets*

B.6.1.1 The three modes of operation defined in § B.5 above use different subsets of the OSI session services as illustrated in Figure B-1/T.62.



Note – BAS is the Basic Activity Subset and BCS is the Basic Combined Subset, which are described in Recommendation X.215.

FIGURE B-1/T.62

Modes of operation and supporting session service subsets

B.6.1.2 *For the basic combined subset (BCS)*

a) either duplex or half duplex can be selected;

b) neither expedited data exchange nor negotiated release are used;

c) typed data capability can optionally be selected.

B.6.1.3 *For the basic activity subset (BAS)*

a) typed data capability is an option for the "interactive" and combined "document transfer and interactive" modes;

b) only half duplex can be used for the document transfer mode;

c) either half duplex or duplex can be used for "interactive" and "document transfer and interactive" modes.

B.6.2 *Restrictions on the use of the session services*

B.6.2.1 Every mode of operation specifies how it uses the session services. This encompasses restrictions put on the generality offered by the session services. A number of them are reflected in the state transition diagrams given in Annex H. For this, these state transition diagrams take into account only those sequences of events, which are valid in the respective mode of operation, at the session layer boundary.

B.6.3 *Selection of a specific mode*

B.6.3.1 The selection of a particular mode is achieved through the negotiation of the session services available over the established session.

B.6.3.2 Table B-2/T.62 summarizes different cases that may occur and the results of the negotiation.

Note – The availability of the typed data service has no impact on the selection of a mode. If the availability of this has been agreed to, it can be used in any mode.

TABLE B-2/T.62

Selection of a mode of operation

	a)	b)	c)
A	– – – – –	Mode I	– – – – –
B	Mode III	Mode III	Mode II

Note – Modes I, II and III stand for "document transfer", "interactive" and "document transfer and interactive" modes, respectively.

B.6.3.2.1 The result of the negotiation of the session services can be as follows:

a) the functionalities of the BAS subset have been agreed to; the duplex mode is in use;

b) the functionalities of the BAS subset have been agreed to; the half duplex mode is in use;

c) only the functionalities of the BCS subset have been retained by both systems.

B.6.3.2.2 The combination of the supported capabilities can be as follows:

a) document transfer is the only capability commonly supported by both systems;

b) both systems have indicated that they have the interactive capability.

ANNEX C

(to Recommendation T.62)

Two-way simultaneous session mode of operation

Note – Two-way simultaneous (TWS) session mode of operation is envisaged as being one of a range of standardized options. At present, however, corresponding Series F Recommendations state that the use of TWS mode in the international services is for further study.

C.1 *General*

C.1.1 The TWS mode of operation may be used in addition to the basic session procedure.

C.2 *Elements of procedure*

C.2.1 Command session TWS (CSTW) shall be used to invoke the TWS mode of session operation. When this mode has been invoked it continues until ended by the called terminal.

C.2.2 Response session TWS positive (RSTWP) shall indicate that the receiver of CSTW has entered into the TWS mode of session operation.

C.2.3 Response session TWS negative (RSTWN) shall indicate that the TWS mode of operation has not been entered by the receiver of CSTW. It is not mandatory to indicate the reasons for rejection. An optional parameter field is provided to indicate the reason.

C.3 *Rules for TWS mode*

C.3.1 The TWS mode shall be initiated by CSTW, preferably immediately following reception of RSSP. The use of CSTW at any other time within a session is for further study.

C.3.2 Once invoked, the TWS mode continues until terminated by the called terminal's sending CSCC.

C.3.3 CSTW may only be sent by the calling terminal while it is in the sending state.

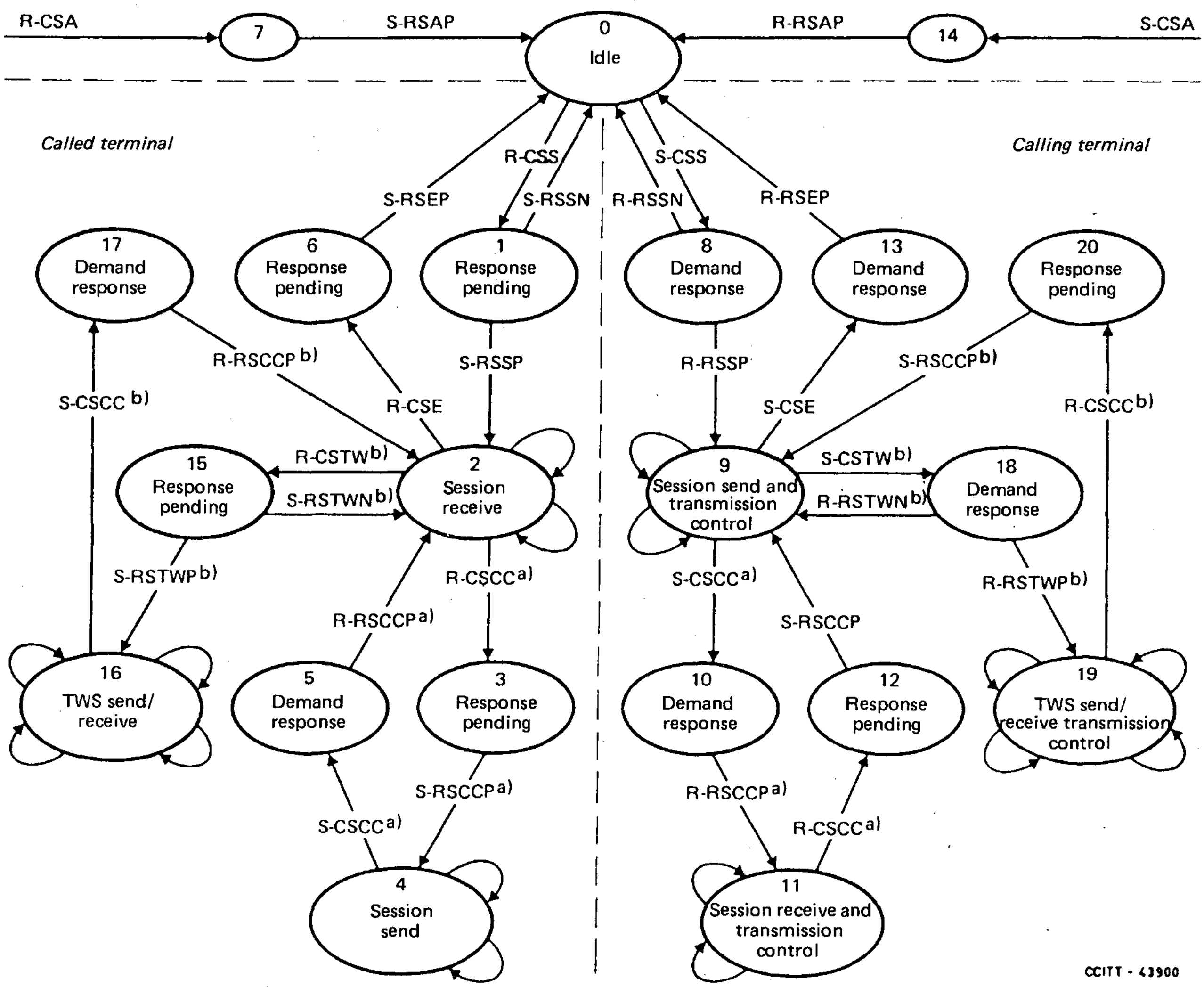
C.3.4 The TWS mode is not a basic capability of the telematic services and therefore the CSTW may be responded to negatively.

C.3.5 To terminate the TWS mode, the called terminal shall send a CSCC when it has finished its transmission of documents. This implies that the session mode returns to the ordinary TWA mode.

After responding to CSCC with an RSCCP, the calling terminal will send CSE when it too is ready for normal session termination.

C.4 *State diagram*

C.4.1 Figure C-1/T.62 is a state diagram for OWC, TWA and TWS showing the error states.



a) Only applicable for TWA mode.

b) Only applicable for TWS mode.

FIGURE C-1/T.62

State diagram for OWC, TWA and TWS modes (error states)

ANNEX D

(to Recommendation T.62)

Session suspension facility

Note – This is a proposal for the suspension facility, and is included for further study and alignment to the generalized session protocol.

D.1 *General*

D.1.1 The suspension facility is an extension of the basic Teletex control procedure. The capability of handling the suspension protocol is negotiated at session establishment.

D.1.2 The suspension facility is primarily intended for interactive applications, when a considerable period of inactivity is expected, or when a terminal for reasons of availability needs to clear the network connection during periods of inactivity. The use of the interactive mode of operation does not necessarily require the use of the suspension facility.

D.1.3 A pair of reference numbers is used to link a request for reactivation to the right session. Each terminal is responsible to maintain a register of its own reference numbers. It is responsible also to ensure that each reference number is only used as a reference in one session at a time. By this mechanism, the protocol offers a basic level of security. It is, however, recommended to implement additional security functions within the application, if a high degree of security is required.

D.1.4 This protocol also offers a "transactional" mode of operation, i.e. a mode of operation which allows a reactivation, data transmission and suspension, in the same protocol element. This mode of operation allows a limited amount of user data to be conveyed, in a way similar to the data transfer using CSUI-CDUI.

D.1.5 The maximum time interval during which the session may be kept suspended is negotiated using the inactivity timer parameter. Both terminals are allowed to propose a suitable value. The smallest value exchanged then applies.

D.1.6 A suspended session cannot be expected to exist after the indicated time has expired.

D.1.7 The suspension is only allowed to be initiated while being outside document boundaries (i.e. before a document has been started by CDS or CDC, or after it has been ended). Any other usage of the suspension mechanism is for further study.

D.1.8 The suspension mechanism is only allowed to be used by terminals capable of the interactive mode of operation. Any other usage is for further study.

D.2 *Elements of procedure*

D.2.1 *Command session suspend, CSE(r)*

D.2.1.1 The CSE(r) is sent by the terminal in control (the sending terminal), when a suspension of the session is required.

D.2.1.2 The command parameters are:

a) A reference number (initiators reference) for the session. This parameter is not mandatory in the basic Teletex service, but is mandatory in the suspension protocol.

b) The sender of the command may optionally indicate the time interval during which the session may be reactivated. The absence of this parameter shall be interpreted as if the current value for the inactivity timer is proposed.

c) The sender of the command may optionally provide a session termination parameter with an identical use as in CSE.

D.2.2 *Response session suspend positive, RSEP(r)*

D.2.2.1 The RSEP(r) indicates that the suspended state has been entered by the receiving terminal.

D.2.2.2 It is mandatory for the sender of the response to include its own reference number (acceptors reference) as a parameter in the response.

D.2.2.3 The sender of the response may optionally acknowledge the reference number received in the CSE(r) (initiators reference) by returning it as a parameter in the response.

D.2.2.4 *Response parameters*

a) Reference number (acceptors reference). This parameter is not mandatory in the basic Teletex service, but is mandatory in the suspension protocol.

b) Reference number (initiators reference). The sender of the response may optionally acknowledge the reference number received in the CSE(r).

c) Inactivity timer value. The sender of the response may optionally propose a shorter value than the value received in the CSE(r). The absence of this parameter in the response indicates that the value in CSE(r) has been accepted and will apply for the suspension.

D.2.3 *Response session suspend negative, RSEN(r)*

D.2.3.1 The RSEN(r) indicates that the session suspension cannot be accepted. The reason for the rejection shall be indicated as a parameter.

D.2.3.2 The RSEN(r) parameter indicates one of the following reasons for rejection:

a) the CSE(r) was illegally used (e.g. by the terminal not currently in control); this shall not be regarded as an error leading to clearing;

b) a suspended session is temporarily not possible;

c) more suspended sessions are not possible.

D.2.4 *Request session suspension*

D.2.4.1 The session suspend request indication can be used by the terminal that currently does not have the control (the receiving terminal), to indicate that a suspension of the session is requested. The sending terminal can then decide how to react.

D.2.4.2 No explicit response is required since a suspension is implicitly the positive response and a negative response has no meaning.

D.2.4.3 The suspend request indication is conveyed in the session control function parameter of the RSUI response.

D.2.5 *Command suspended session reactivate, CSS(r)*

D.2.5.1 The CSS command will be used also to reactivate a suspended session. In this case however, none of the "normal" parameters of CSS will be mandatory. Instead a special parameter carrying the necessary linking information will have to be used.

D.2.5.2 It is also possible in this command to indicate whether the command is a transaction (i.e. reactivate, data transfer and suspend), or a reactivation of the session. No response is allowed if the command is defined as a transaction.

D.2.5.3 Neither of the two terminals will, from the protocol point of view, be allowed to reactivate the session (restrictions on this feature may be imposed by the application).

D.2.5.4 A session is defined as abnormally terminated if not reactivated before the inactivity timer has expired.

D.2.5.5 The command may be followed by a limited amount of user information (maximum 120 octets).

D.2.5.6 *Command parameters*

a) Reference numbers (both initiators and acceptors reference). The reference numbers must be the same as the ones exchanged during the suspension. This parameter is mandatory in the suspension protocol.

b) An indication if the command is a transaction or a reactivation (not mandatory). The absence of this parameter indicates that the command is a transaction.

c) When operating in the transactional mode, the sender of the command may optionally provide a session termination parameter with an identical use as in CSE. This parameter however, has no meaning when the command is a reactivation, and shall therefore not be included in this case.

D.2.6 *Response suspended session reactivate positive, RSSP(r)*

D.2.6.1 The RSSP, with special parameters related to the reactivation, and when used as a response to CSS(r), will indicate a positive response to the reactivation command [CSS(r)].

D.2.6.2 The reactivating system will resume the session, exactly as it was before the suspension took place, upon reception of the positive response. The sender of the response will resume the session directly after sending the response.

D.2.6.3 None of the parameters that are mandatory in the basic service is needed in the RSSP when it is used as a response to CSS(r).

D.2.6.4 *Parameters of the response*

a) Reference numbers (both initiators and acceptors reference). The reference numbers must be the same as the reactivate command. This parameter is mandatory in the suspension protocol.

b) A request control indication (not mandatory). The absence of this parameter indicates that control is not requested.

D.2.7 *Response suspended session reactivate negative, RSSN(r)*

D.2.7.1 The RSSN, with a special parameter indicating the reason for not being capable of resuming the session, will be used to refuse a reactivation when the request can not be effected.

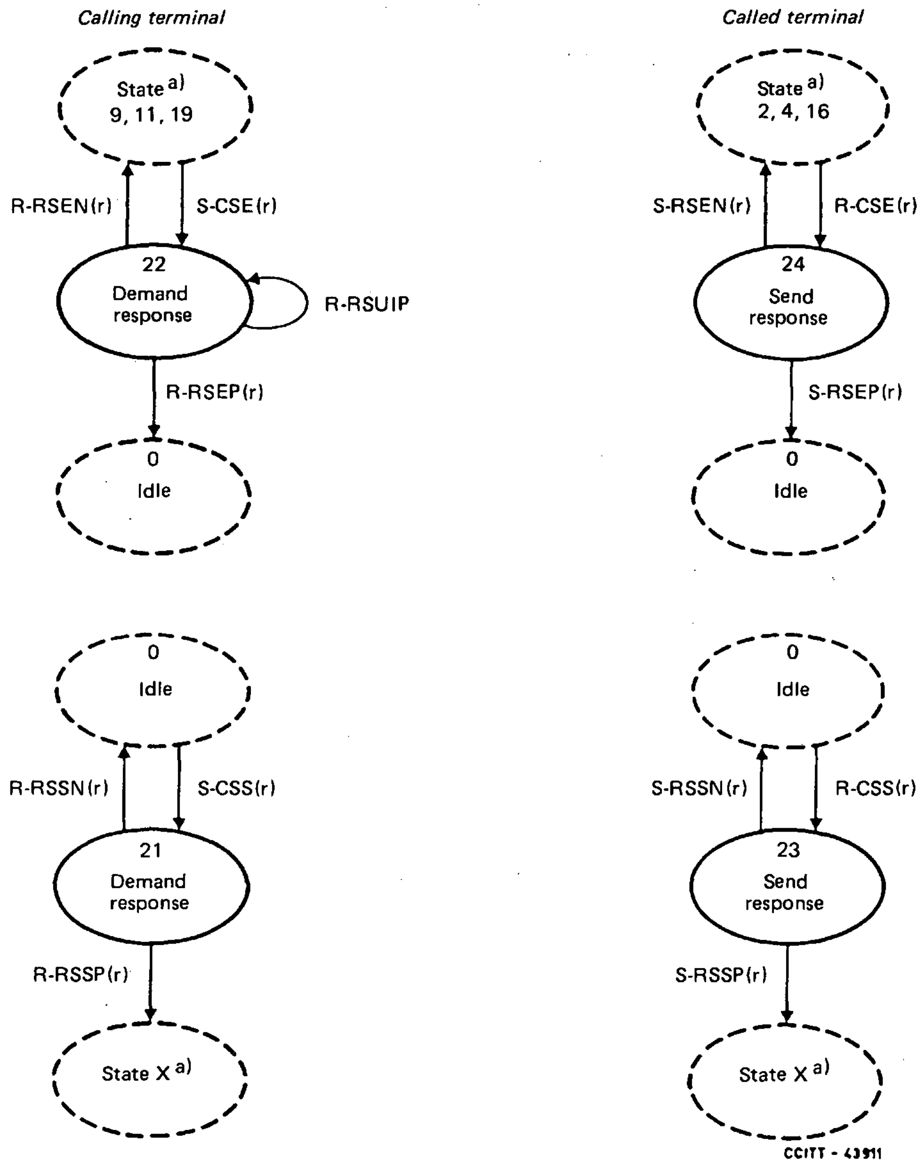
D.2.7.2 It is recommended that all the parameters normally present in RSSN are included also when the response is used as a negative response to a reactivation request, CSS(r). In addition, the reason parameter of the response shall indicate one of the following reasons:

a) illegal use of the command,

b) the linking information was not recognized.

D.3 *State diagram*

D.3.1 Figure D-1/T.62 is a session state transition diagram for the session suspension facility (showing additions to the session state transition diagram required for the facility).



a) This is the state from which the facility was suspended and from which it is to be resumed.

Note – The coding is for further study.

FIGURE D-1/T.62

State diagram for suspension facility

ANNEX E

(to Recommendation T.62)

General description and rules of operation for state diagrams

E.1 Each state diagram is in only one state at any time.

E.2 Each state is represented as an ellipse, which contains a number for reference and a descriptive name.

E.3 Permissible transitions from one state to another are shown as connecting lines with an arrow indicating the permitted direction of the state transition and labelled with the event or events that cause that transition.

E.4 Where a transition may originate from any of several states, it may be indicated by a broad arrow terminating on the description state and labelled with the permissible states of origination and with the event or events that cause that entry into the destination state.

E.5 An event is either the sending (S-) or reception (R-) of a command or a response or an indicated local operation.

E.6 Each state diagram has a state named "idle" and numbered zero. This is the initial or reset state when that state diagram is inactive.

E.7 Upon sending any command that causes entry into a state named "demand response", the sending of any additional commands is not permitted until a response is received. A demand response timer is started, and, if a response is not received prior to expiration of that time-out, session termination, either directly if Command Session Abort (CSA) was sent, or by sending CSA, is mandatory.

E.8 The effect of each event that causes a state transition must be completed prior to consideration of a subsequent event.

E.9 During a session, each session partner has a responsibility for monitoring for proper operation as follows:

a) maintenance of the currently agreed source/sink relationship;

b) proper use of command/response procedural sequences as described in the state diagrams and the rules for their operation;

c) monitoring for a period of inactivity (e.g. indicating a failure or other inability to continue productive use of the session).

Upon detection of a failure to maintain proper operation as described above, use of error recovery procedures defined for each state diagram is mandatory, or where such error recovery procedures are not specifically defined, session termination (abnormal end) is mandatory. This is necessary in order to avoid unproductive use of telematic facilities, incurring unnecessary charges where the service is not being used effectively, and causing degradation of the service.

E.10 The purpose of the state diagrams is to assist in defining proper use of the elements of procedure, and not to define any particular implementation.

ANNEX F

(to Recommendation T.62)

Types of document

F.1 *General*

F.1.1 An indication of the type of document that is transferred shall be given at the start of each document; if not, the normal type of document is used.

F.1.2 A document type indication will indicate to the operating system of the receiving terminal that a special action is required (the action is defined for each type of document).

F.1.3 No additional procedure elements or changes in state transition diagrams are required.

F.2 *Normal document*

F.2.1 This is the normal type of document to be used to transfer text in the Telematic services. Upon reception the document may be immediately printed (in the case of G4 facsimile Class 1) or be immediately stored (all other terminals).

F.2.2 From the procedures point of view, every Teletex terminal must be able to handle this type of document.

Note – Where appropriate the rules for the usage of optional functions have to be followed.

F.3 *Operator document* (optional)

F.3.1 The operator document represents a type of priority message. It can be used in the conversational mode of operation.

It is intended to be presented immediately to the operator (although the decision to present it is left to the receiving operator). It may therefore be immediately indicated to the operator that a new operator document has been received. The operator document shall conform to the same presentation control functions and be treated in the procedure as a normal document. The length of an operator document is arbitrary but, preferably (due to the application), it shall not exceed one page. Note that a terminal that does not have a special dialogue mode can handle an operator document as a normal document.

F.4 *Control document*

F.4.1 The control document can be used in communication with intermediate store-and-forward equipment; e.g. interworking with the telex service, in standardized options and national applications.

F.4.2 The addressing information (and other control information required) can be included as text within such a document. The control document shall, except for the document type indication, follow the same rules (in the procedure) as a normal document. The use of the control document is outside the scope of this Recommendation.

F.4.3 Teletex terminals shall be able to support the control documents defined, in Recommendation T.90, for interworking with the telex service.

F.5 *Monitor document* (optional)

F.5.1 The monitor document will not be made available to the user. It is intended to be available for purposes that can be defined by each Administration, e.g. for maintenance purposes.

F.5.2 The monitor document will be handled by the operating system of the terminal and not displayed to the operator. The monitor document shall, except for the document type indication, conform to the same rules (in the procedure) as a normal document.

ANNEX G

(to Recommendation T.62)

Interactive session protocol and typed data transfer for the Telematic services

G.1 *General*

G.1.1 This annex specifies the optional session layer protocols to be used in the Telematic services for interactive applications. One protocol specified in this annex is called interactive session protocol (ISP). Using this protocol, the Telematic terminals will be able to operate by sending/receiving information outside of document boundaries. The terminals will be able to send this interactive data, as well as documents, within the same session (but not simultaneously).

G.1.2 A second interactive capability specified is called typed data transfer (TDX). Typed data can be exchanged between terminals independent of the normal data flow. TDX can be used in conjunction with ISP or separately.

G.1.3 The use of these capabilities is negotiated at session establishment. Neither of these capabilities requires any features of the transport service in addition to those required for document transfer and provided in Recommendation T.70.

G.2 *Interactive session protocol (ISP)*

G.2.1 *General*

G.2.1.1 This section describes the use of the ISP including protocol elements, state transition diagrams and capability negotiation. The ISP can be used in conjunction with document transfer or as a stand-alone protocol.

G.2.2 *Protocol elements*

G.2.2.1 The protocol elements which are used in the ISP session procedures are listed in Table G-1/T.62. Exact definitions of these elements are found in the main body of this Recommendation with additional material in this annex.

TABLE G-1/T.62

Protocol elements used in the ISP

Abbreviation	Functions
CSS	Command for session start
RSSP	Positive response for session start
RSSN	Negative response for session start
CSE	Command for session end
RSEP	Positive response for session end
CSA	Command for session abort
RSAP	Positive response for session abort
RSUI (with parameter)	Request change control
CSUI (with parameter)	Give change control
CSUI/CDUI (see Note)	Data transfer

Note – If the parameter is included in a CSUI of the CSUI/CDUI, it also gives change control.

G.2.3 *Operation using the ISP*

G.2.3.1 For use of this protocol, three types of operation are defined for the Telematic services. These three types are: document transfer only, document transfer with interactive dialogue outside document boundaries, or interactive dialogue only.

G.2.3.2 The capability allowing the transfer of documents (activities) is defined in the main body of this Recommendation. The capability allowing for interactive dialogue is defined in this annex.

G.2.3.3 In using ISP, there are two modes of interactive data exchange:

a) half duplex mode is the flow of data in one direction until the source gives "control" to the other terminal; i.e. the two terminals exchange "control" of the data flow;

b) duplex mode is the simultaneous exchange of data between two terminals.

G.2.3.4 *CSUI indicating "give control"*

G.2.3.4.1 The parameter "session control functions" is used in conjunction with the CSUI command to indicate that the sender is giving control to the receiver. The use of this PI, and associated "give control" PV, is equivalent to a CSCC/RSCCP exchange. There is no acknowledgement to this mechanism of give control.

G.2.3.4.2 The CSUI with an associated give control indication cannot be sent with any document command other than CDUI. In the case where the sending terminal has no data to send, to give control the CSUI is used with the give control indication and without an associated CDUI.

G.2.3.5 *RSUI indicating "request change control"*

G.2.3.5.1 The parameter "session control functions" is used in conjunction with the RSUI response to indicate a request for change control.

G.2.3.5.2 The RSUI, and associated request control indication, may be sent in conjunction with a document response. The RSUI can be sent, without an associated document response, to autonomously request change control.

G.2.3.6 *Half duplex and duplex modes*

G.2.3.6.1 The default mode of operation using ISP is half duplex with document transfer.

G.2.3.6.2 Duplex operation is available after explicit negotiation. In this case, document transfer is in accordance with the basic requirements of this Recommendation, but outside of document boundaries data can flow in both directions.

G.2.4 *State diagrams*

G.2.4.1 Figure G-1/T.62 is a session state transition diagram for interactive session protocol.

G.2.4.2 Figure G-2/T.62 is a session state transition diagram with no document transfer.

G.2.4.3 Figure G-3/T.62 is a session state transition diagram with duplex document transfer.

G.2.4.4 Figure G-4/T.62 is a document state transition diagram for sending protocol.

G.2.4.5 Figure G-5/T.62 is a document state transition diagram for receiving protocol.

G.2.4.6 Figure G-6/T.62 is a document state transition diagram with no document transfer (sending protocol).

G.2.4.7 Figure G-7/T.62 is a document state transition diagram with no document transfer (receiving protocol).

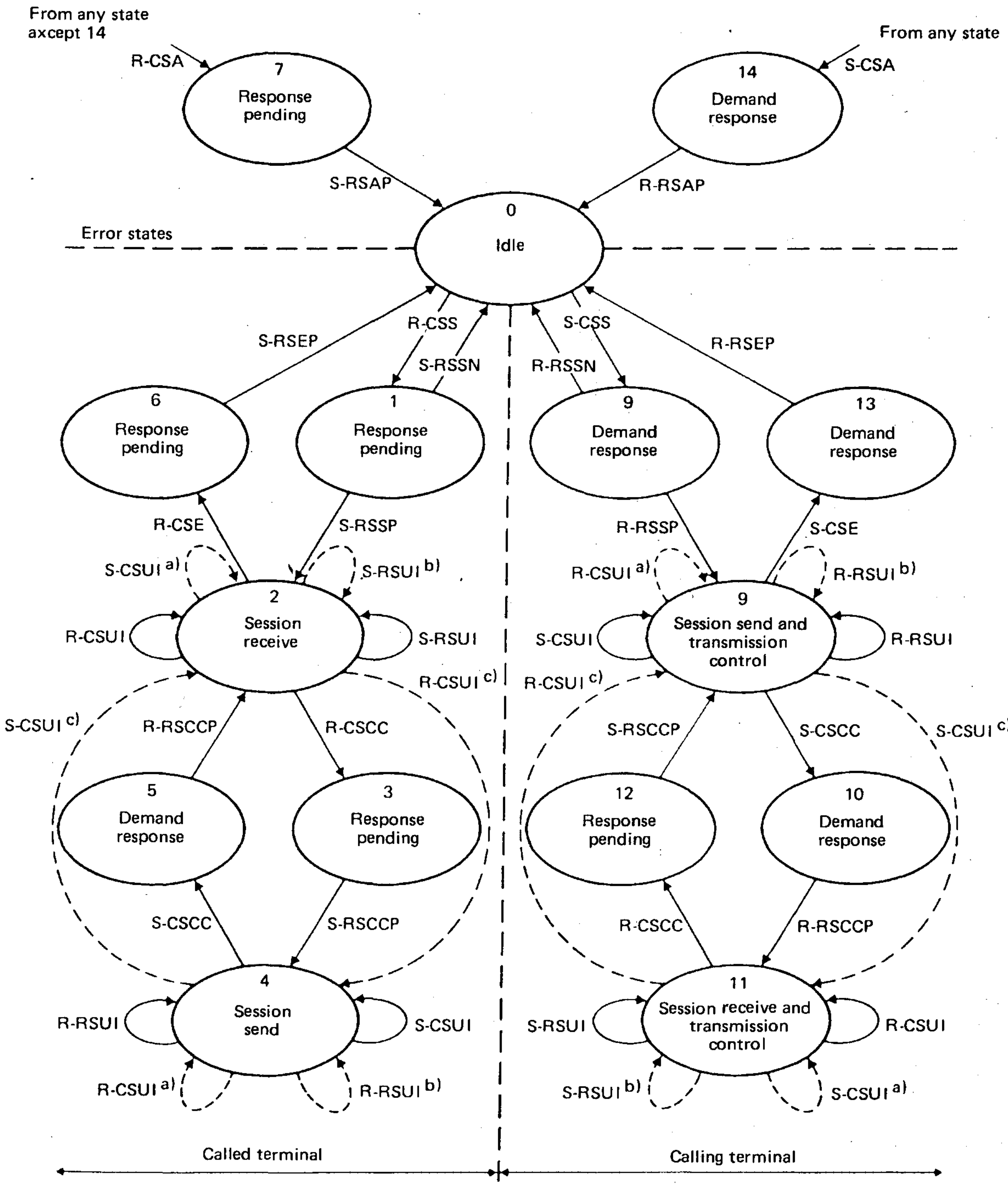
G.2.5 *Rules for ISP protocol*

G.2.5.1 This section describes the specific rules to be observed when the ISP is integrated with the basic control procedures defined in this Recommendation. The rules for the protocol used outside documents will slightly differ depending on whether the session is half duplex or duplex.

G.2.5.2 *Basic rules*

G.2.5.2.1 The capability to operate interactively is negotiated at session establishment.

G.2.5.2.2 The concept of "document" will exactly match that defined in this Recommendation.



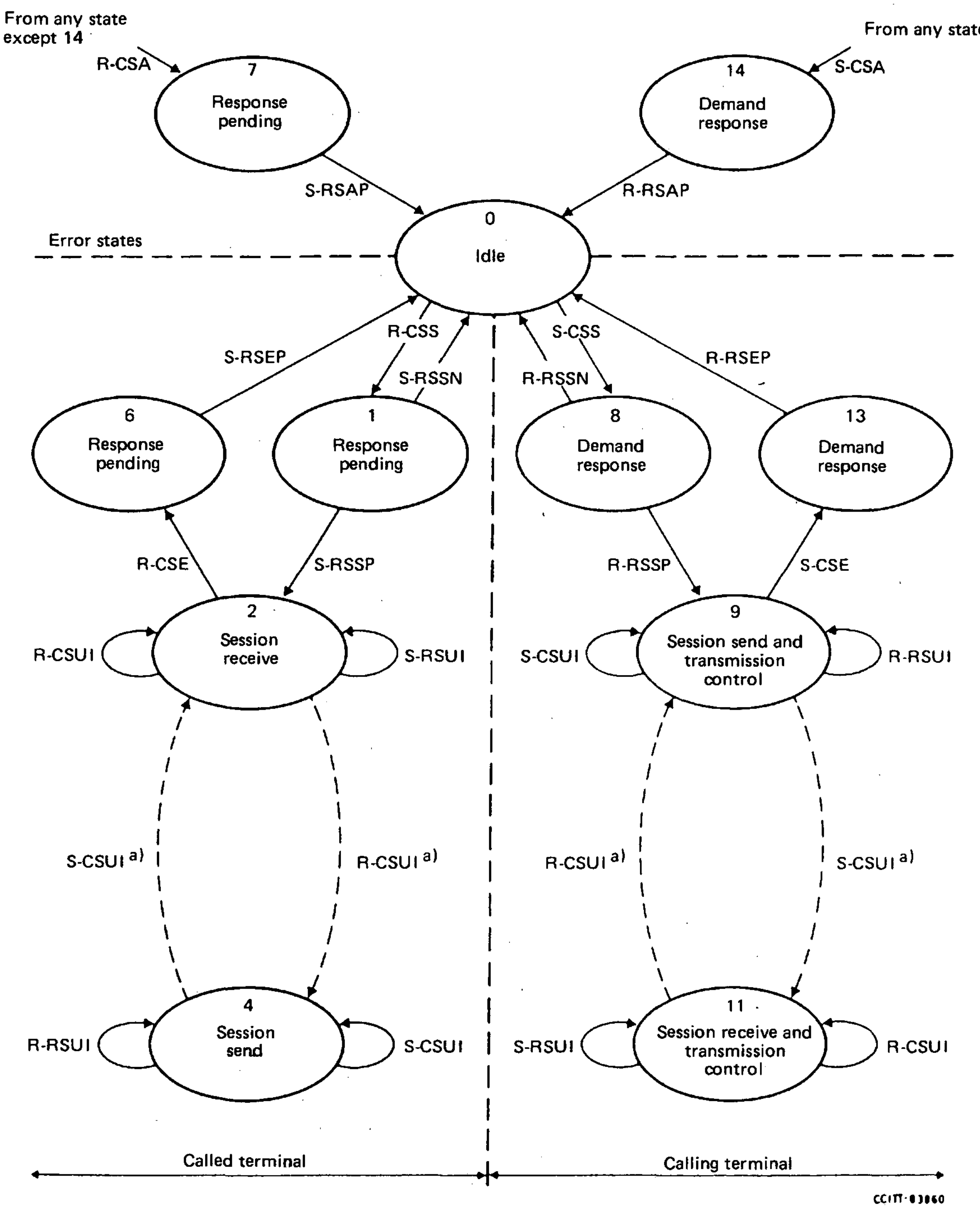
a) Only applicable if duplex selected.

b) Including "request change control".

c) Including "give control".

FIGURE G-1/T.62

Session state transition diagram for interactive session protocol



a) Including "give control".

FIGURE G-2/T.62

Session state transition diagram with no document transfer

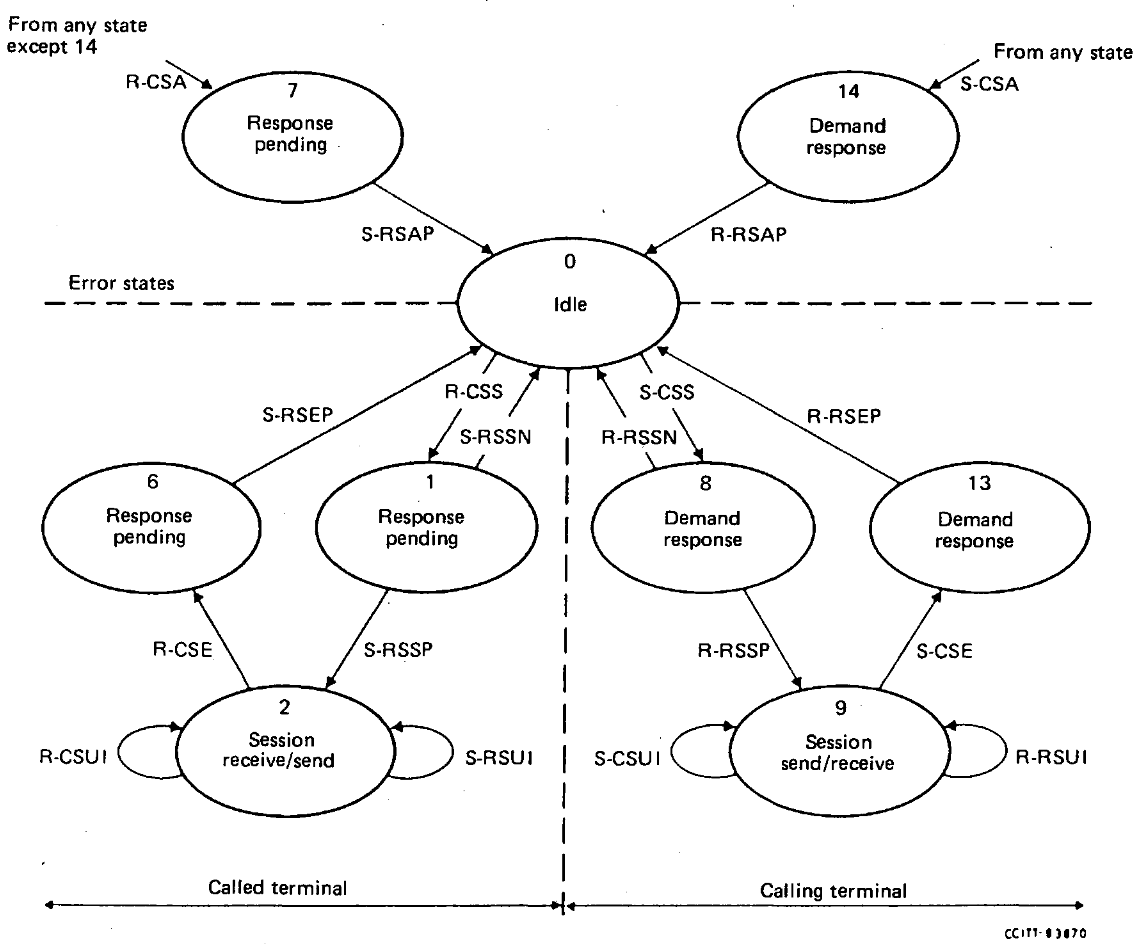
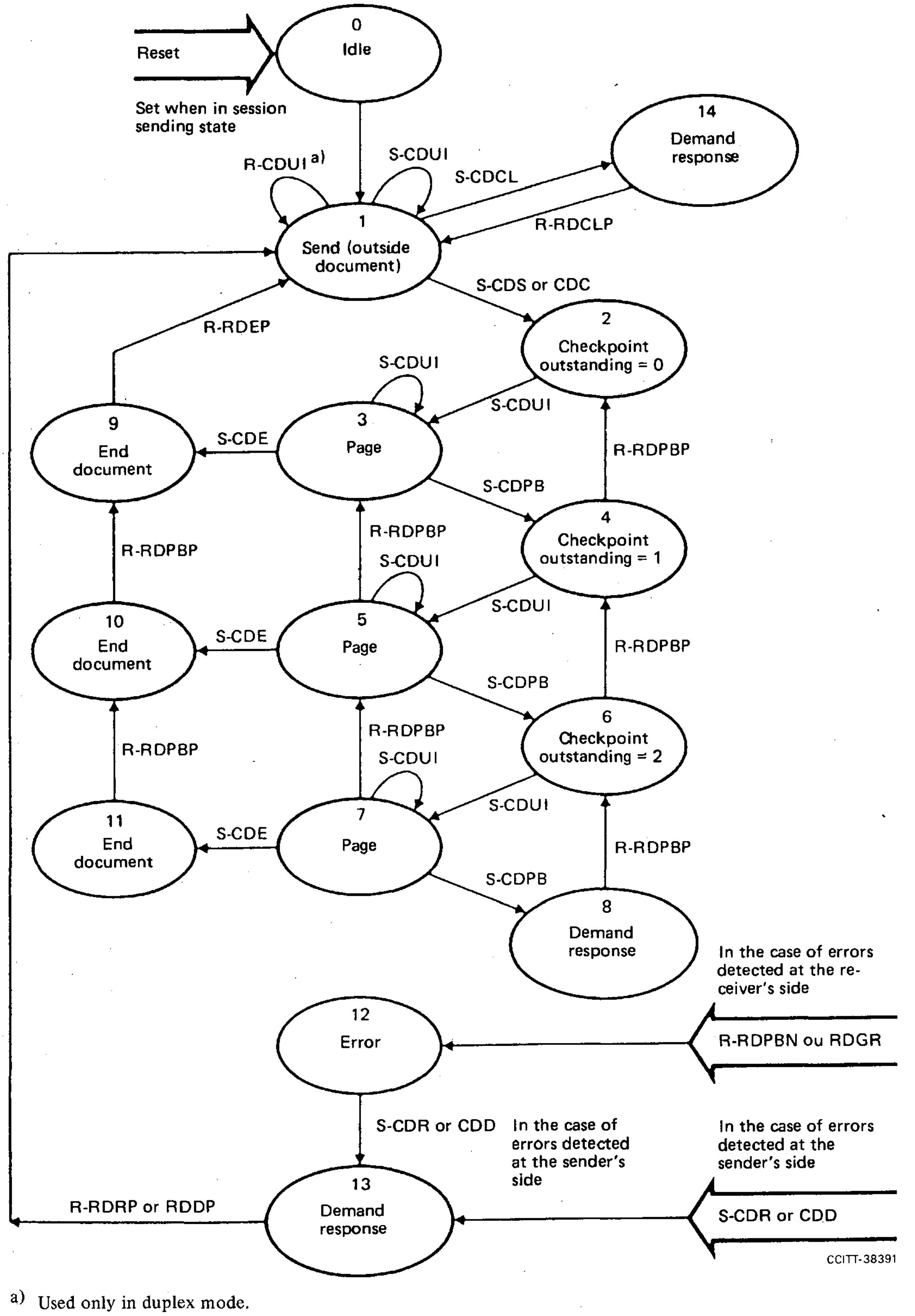


FIGURE G-3/T.62

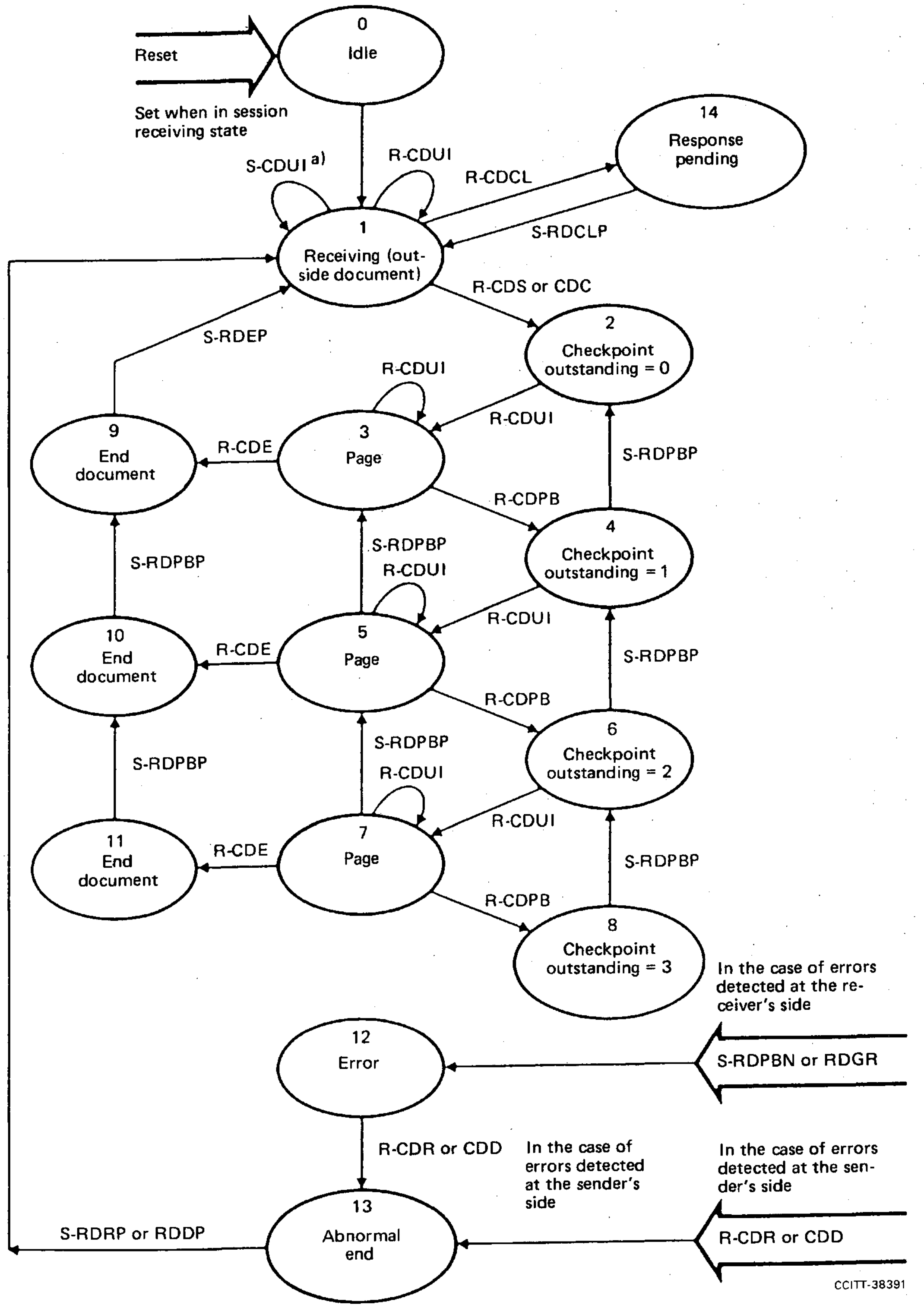
Session state transition diagram with duplex document transfer



a) Used only in duplex mode.

FIGURE G-4/T.62

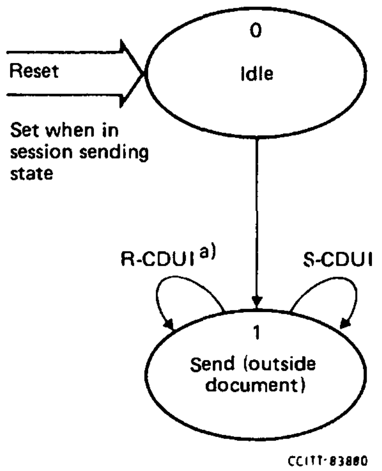
Document state transition diagram (sending protocol)



a) Used only in duplex mode.

FIGURE G-5/T.62

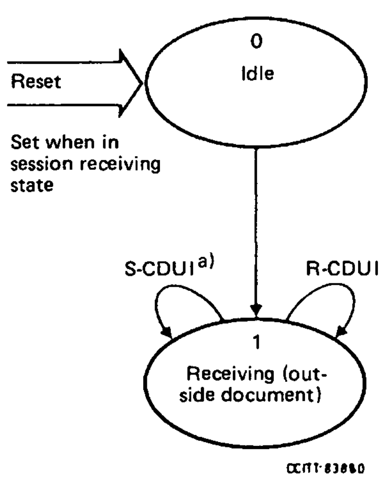
Document state transition diagram (receiving protocol)



a) Used only in duplex mode.

FIGURE G-6/T.62

Document state transition diagram with no document transfer (sending protocol)



a) Used only in duplex mode.

FIGURE G-7/T.62

Document state transition diagram with no document transfer (receiving protocol)

G.2.5.2.3 Interactive data flow will only take place outside document boundaries. This means that synchronization and resynchronization services are not available to the session user during interactive phases.

G.2.5.2.4 A session is always in the "outside document" state after session establishment and prior to the invocation of any document protocol functions.

G.2.5.2.5 A session is also in the "outside document" state after a CDE/RDEP, CDR/RDRP or CDD/RDDP exchange has been concluded.

G.2.5.2.6 The mode outside a document can be half duplex (TWA) or duplex as defined at session establishment.

G.2.5.2.7 Session control functions compatible with basic control procedures are provided, i.e. session control is exchanged by CSCC/RSCCP. In addition, the control may be exchanged using the CSUI with the session control parameter, and requested using the RSUI with the session control parameter. It should be noted that these mechanisms have no effect on the right to transmit interactive user data when the session is in duplex mode.

G.2.5.2.8 In the case where control is exchanged using CSUI, with the associated parameter, control transfer is implicitly acknowledged when data is received.

G.2.5.2.9 The right to start a document resides at the side in control of the session.

G.2.5.2.10 RDGR is not used outside document boundaries to report protocol errors (the CSA is used).

G.2.5.3 *Special rules for half duplex*

G.2.5.3.1 User data is transferred in CSUI/CDUI. The right to send data is controlled by the session control functions. Only the terminal that is in control has the right to send data.

G.2.5.3.2 An RSUI requesting control may be received after giving control and before receiving any valid session protocol element. This shall not be regarded as a procedural error and shall be discarded.

G.2.5.4 *Special rules for duplex mode*

G.2.5.4.1 User data may be sent by either terminal irrespective of which terminal has session control.

G.2.5.4.2 User data may be received by the sending terminal after it has sent a CSCC, CSE, CDS, CDC, CDPB or CDCL. This data shall be passed to the user and is not regarded as a procedural error.

G.2.5.4.3 Reception of data by the sending terminal, after reception of the first response within a document shall be regarded as a procedural error.

G.2.5.5 *Negotiation of interactive session capabilities*

G.2.5.5.1 The use of interactive session capabilities is negotiated at session establishment. The negotiation is based on:

a) the capabilities, indicated by both terminals, in the miscellaneous session capabilities parameter of CSS and RSSP;

b) the set of session services indicated in the session service functions parameter.

G.2.5.5.2 The miscellaneous session capabilities parameter is used to indicate interactive capability. Both terminals must have bit 3 set for an interactive session to continue.

G.2.5.5.3 In addition, the session service functions parameter is used to indicate optional and basic service functions. This parameter is set to the values in accordance with those defined in the main body of this Recommendation (§ 5.7), and is based on the set of capabilities at the receiving and sending terminals. A service is available for use in the session if, and only if, both terminals have set the particular bit in the session service functions parameter.

G.2.5.5.4 Table G-2/T.62 shows the relationship between the capabilities indicated in CSS/RSSP and resulting available capabilities. The table entries of 0 and 1 are interpreted as follows:

a) a "1" indicates that a bit (or bits) is set to 1 in both CSS and RSSP;

b) a "0" is indicated when the corresponding bit is set to 0 in either CSS or RSSP.

TABLE G-2/T.62

Interactive capabilities

Miscellaneous session capabilities	Session service functions		Capabilities available		
	Octet 1, bit 3	Octet 1, bits 1 and 2 Octet 2, bits 4 and 7	ISP	TDX	Document transfer
Absent or bit 3 = 0	0 (Note)	1 (Note)	No	No	Yes
	1	0	No	Yes	No
	1	1	No	Yes	Yes
Bit 3 = 1	0	0	Yes	No	No
	0 (Note)	1 (Note)	Yes	No	Yes
	1	0	Yes	Yes	No
	1	1	Yes	Yes	Yes

Note – These bit assignments are the default values for cases in which the session service functions parameter is not indicated.

G.2.6 *Error handling rules for ISP*

G.2.6.1 The ability to transfer data outside document boundaries does not affect error detection or recovery within a document.

G.2.6.2 The detection of an invalid protocol data unit (PDU) during the interactive phase will result in the generation of CSA.

G.3 *Typed data transfer (TDX)*

G.3.1 *General*

G.3.1.1 This section describes the use of the TDX capability, including the related protocol elements, state transition diagrams and the capability negotiation mechanism.

G.3.1.2 TDX is an independent data exchange mechanism, and as such can be used either in conjunction with the ISP capability or separately. TDX allows the transfer of an amount of user data, restricted in size, which is distinguished from other forms of data transfer over the session.

G.3.2 *Command session typed data (CSTD)*

G.3.2.1 The typed data is conveyed in the CSTD command.

G.3.2.2 CSTD is used to indicate to the receiver of this command that the associated information field conveys typed data.

G.3.2.3 CSTD may only be sent if its use was agreed to at session establishment.

G.3.2.4 When its use has been agreed to, CSTD may be sent by either terminal at any time during the session (see Figure G-8/T.62).

Note – The state machine for the transfer of typed data does not influence the state machine relating to normal data transfer.

G.3.2.5 The CSTD commands are interleaved with normal session commands and responses, if normal data transfer is taking place.

G.3.2.6 The length of the information field shall not exceed 120 octets.

G.3.2.7 There are no parameters associated with the CSTD command, although the addition of parameters to CSTD is not precluded.

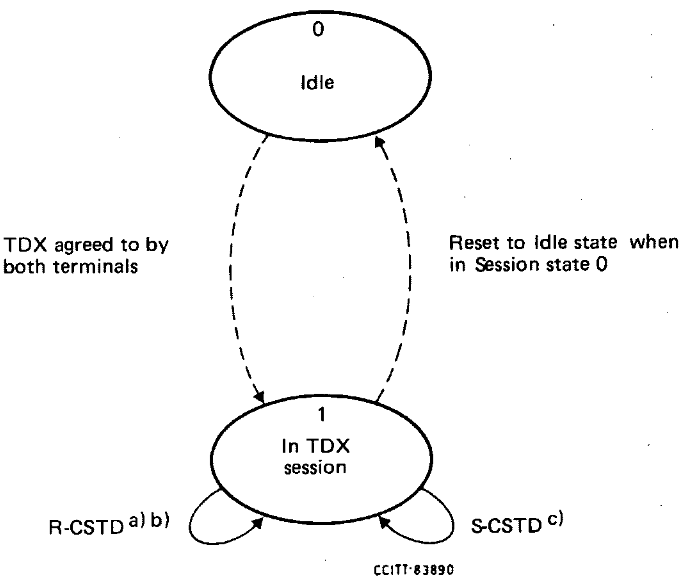
G.3.2.8 There is no response sent in confirmation of a CSTD command.

G.3.3 *Operation using TDX*

G.3.3.1 As specified above, the transfer of information using the TDX capability is not dependent on the usage or existence of any other data exchange capabilities, nor is it dependent on the source/sink relationship between the two terminals as defined for the TWA mode of session operation. Once the session has been established with both terminals in agreement on the usage of the TDX capability, data exchange is conducted in accordance with the state transition diagrams and rules contained in the following paragraphs.

G.3.4 *State transition diagram for TDX*

G.3.4.1 Figure G-8/T.62 is a state transition diagram for typed data transfer (TDX).



a) Reception of the CSTD command when in session states 0, 1 and 8 should be considered as a procedural error.

b) The CSTD command will be discarded if received while in session state 7 or 14.

c) A terminal may not send the CSTD command when in session states 0, 1 ("Response pending" after receiving CSS), 7 ("Response pending" after receiving CSA), 8 ("Demand response" after sending CSS) and 14 ("Demand response" after sending CSA).

FIGURE G-8/T.62

State transition diagram for typed data transfer

G.3.4.2 The TDX state machine is set to state 1 (in TDX session) upon entry into session state 2 ("Session receive" state for half duplex session or "Session receive/send" state for duplex session) or 9 ("Session send" state for half duplex session or "Session send/receive" state for duplex session), provided that the TDX has been agreed upon by both terminals as specified in § G.3.5 concerning capability negotiation. Specifically, the event that causes this state transition is either sending of RSSP (entry into state 2) or receiving of RSSP (entry into state 9) with appropriate parameters.

G.3.4.3 The TDX state machine remains in state 1 until the session state machine enters session state 0 ("Idle").

G.3.5 *Rules for TDX protocol*

G.3.5.1 Typed data has no effect on the session state machine. The CSTD command may be sent by either terminal, irrespective of which terminal has the session control.

G.3.5.2 The capability to use the typed data mechanism shall be negotiated at session establishment in the following manner. TDX is available only if, during the CSS/RSSP exchange of session establishment, both terminals have bit 3 of the first octet of the session service functions parameter set to 1.

ANNEX H

(to Recommendation T.62)

Detailed state transition diagrams for session/document procedures

H.1 *General*

This annex provides detailed state transition diagrams for session/document procedures for the basic services. These diagrams are modelled using the terminology of the open systems interconnection (OSI) model and are aligned with the latest understanding of the CCITT and ISO activities on the OSI session layer. These diagrams are also aligned with the state transition diagrams in this Recommendation but assume a window-independent mechanism.

H.2 *Description on notations*

H.2.1 These diagrams use a presentation method which provides the following levels of description.

a) *Protocol level*

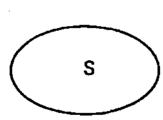
This level addresses only the peer to peer protocol activities between two session entities. It identifies the protocol states, events [receipt of session protocol data units (SPDUs)] and actions (sending of SPDUs).

b) *Detailed level*

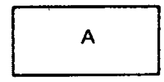
This level addresses the inter-layer and local activities (e.g. management of timers, counters, etc.). It identifies the events, actions and states within each of the protocol level states. The inter-layer activities are described using the session service primitives defined in § H.3.

H.2.2 *Presentation symbols*

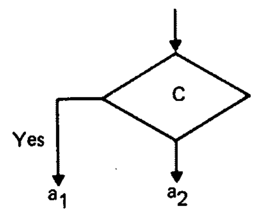
H.2.2.1 *State S*



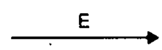
H.2.2.2 *Action A*



H.2.2.3 If condition C is true, then action a_1, otherwise, action a_2.

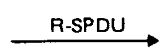


H.2.2.4 *Event E*



H.2.2.5 *Send SPDU action*

H.2.2.6 *Receive SPDU event*



H.2.2.7 *Timers*

a) *Timer T1* – Inactivity timer, value as determined by inactivity timer value negotiation.

b) *Timer T2* – Demand response timer, value 60s [see the Note in § 4.1.1.d)].

c) *Timer T3* – CSA timer of, for example, 4 seconds.

H.2.3 *Notes*

H.2.3.1 With regard to the interactions between session and transport layers, the following is assumed:

a) Each SPDU is transferred by "T-DATA REQ". The transport service data unit (TSDU) will contain the SPDU;

b) Each SPDU is received by "T-DATA IND". The TSDU will contain the SPDU.

H.2.3.2 The management of the various timers requires further study.

H.2.3.3 Response (or confirm) service primitive shall indicate a positive response (or confirm) unless otherwise stated.

H.2.4 *Abbreviations*

H.2.4.1 The abbreviations contained in Table H-1/T.62 apply to the description of service primitives.

TABLE H-1/T.62

Abbreviation of service primitives

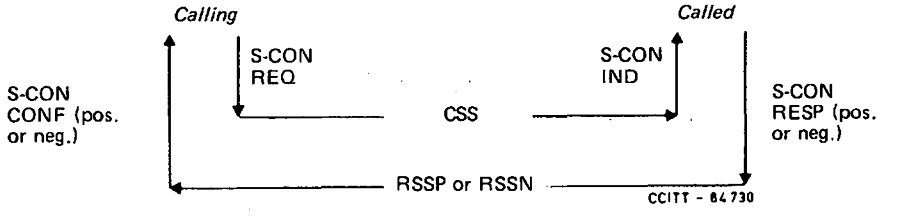
Abbreviation	Meaning	Abbreviation	Meaning
CON	connection	REL	release
CONF	confirmation	REQ	request
IND	indication	RESP	response
POS	positive	NEG	negative
S	session	U	user
P	provider	BEG	begin
CONT	continue	ACT	activity
SYNC	synchronization	MIN	minor
EXPT	exception	CAPAB	capability
ERR	error	FAIL	failure
CTRL	control	PLS	please
INT	interrupt	ABT	abort
DCAD	discard	DISC	disconnection

H.3 *Service primitives*

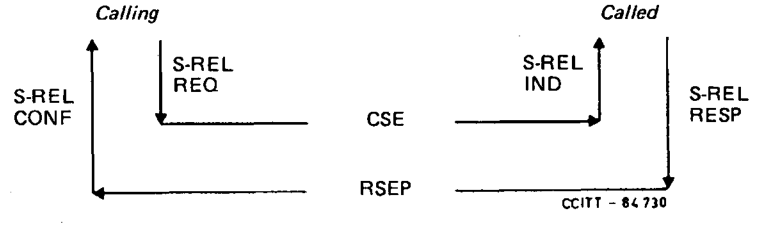
The following illustrates the service primitives and associated SPDUs for the basic session/document control procedures.

H.3.1 *Service primitives for the services provided to the session/document user*

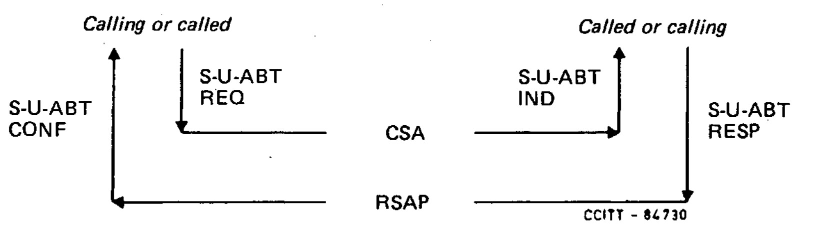
H.3.1.1 *Session connection*



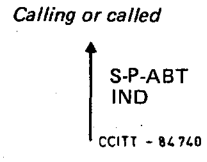
H.3.1.2 *Session release*



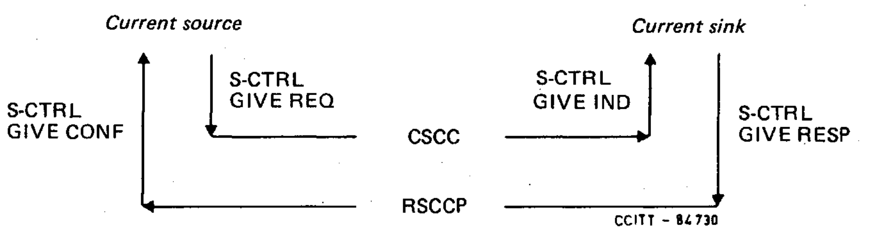
H.3.1.3 *Session user abort*



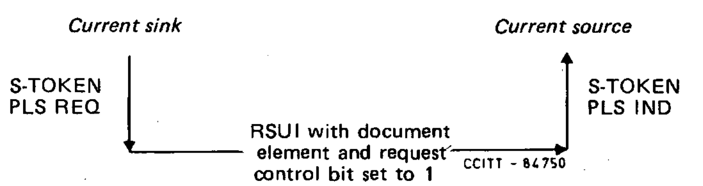
H.3.1.4 *Session provider abort*



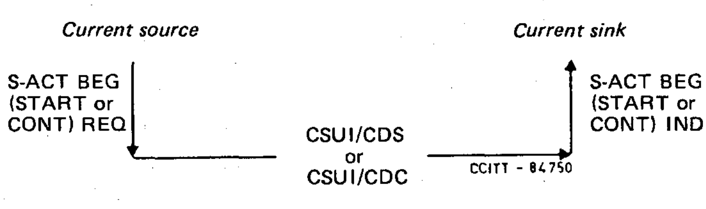
H.3.1.5 *Session control give*



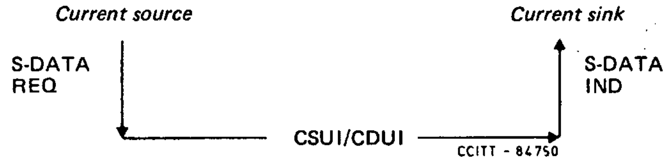
H.3.1.6 *Session token please*



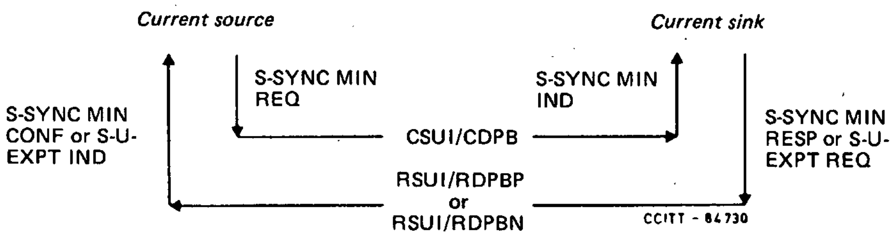
H.3.1.7 *Session activity begin (start or continue)*



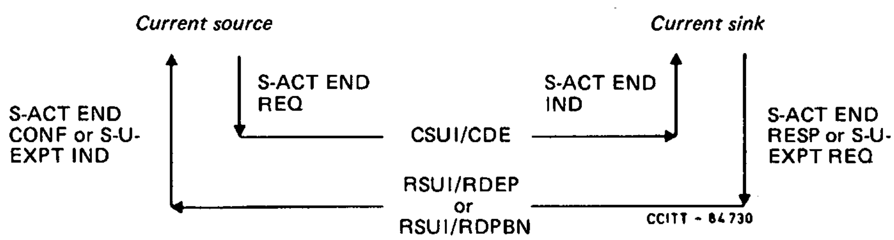
H.3.1.8 *Session data transfer*



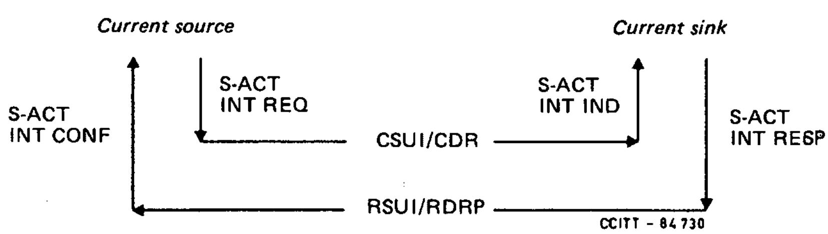
H.3.1.9 *Session synchronization minor*



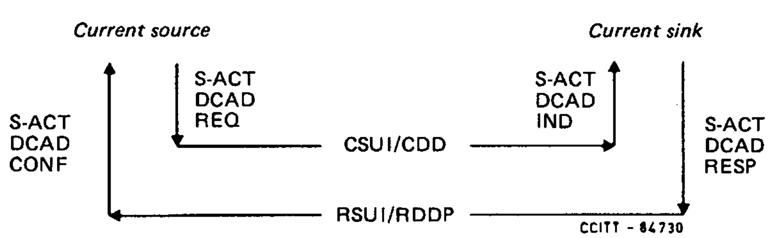
H.3.1.10 *Session activity end*



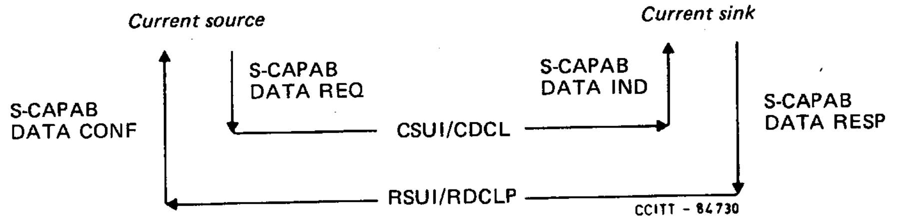
H.3.1.11 *Session activity interrupt*



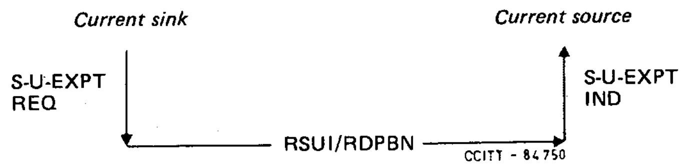
H.3.1.12 *Session activity discard*



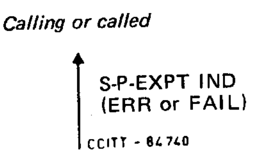
H.3.1.13 *Session capability data*



H.3.1.14 *Session user exception reporting*



H.3.1.15 *Session provider exception reporting*



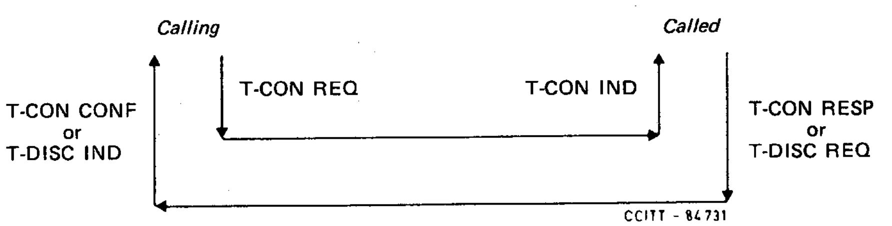
Note – This primitive carries one of the following parameters:

a) ERR – to invite the application to take appropriate action (CDR, CDD, CSA or RDPBN);

b) FAIL – to invite the application to abort (CSA).

H.3.2 *Service primitives for the services expected from the transport layer*

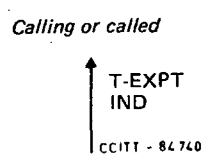
H.3.2.1 *Transport connection*



H.3.2.2 *Transport disconnection (Implicit)*

H.3.2.3 *Transport data transfer*

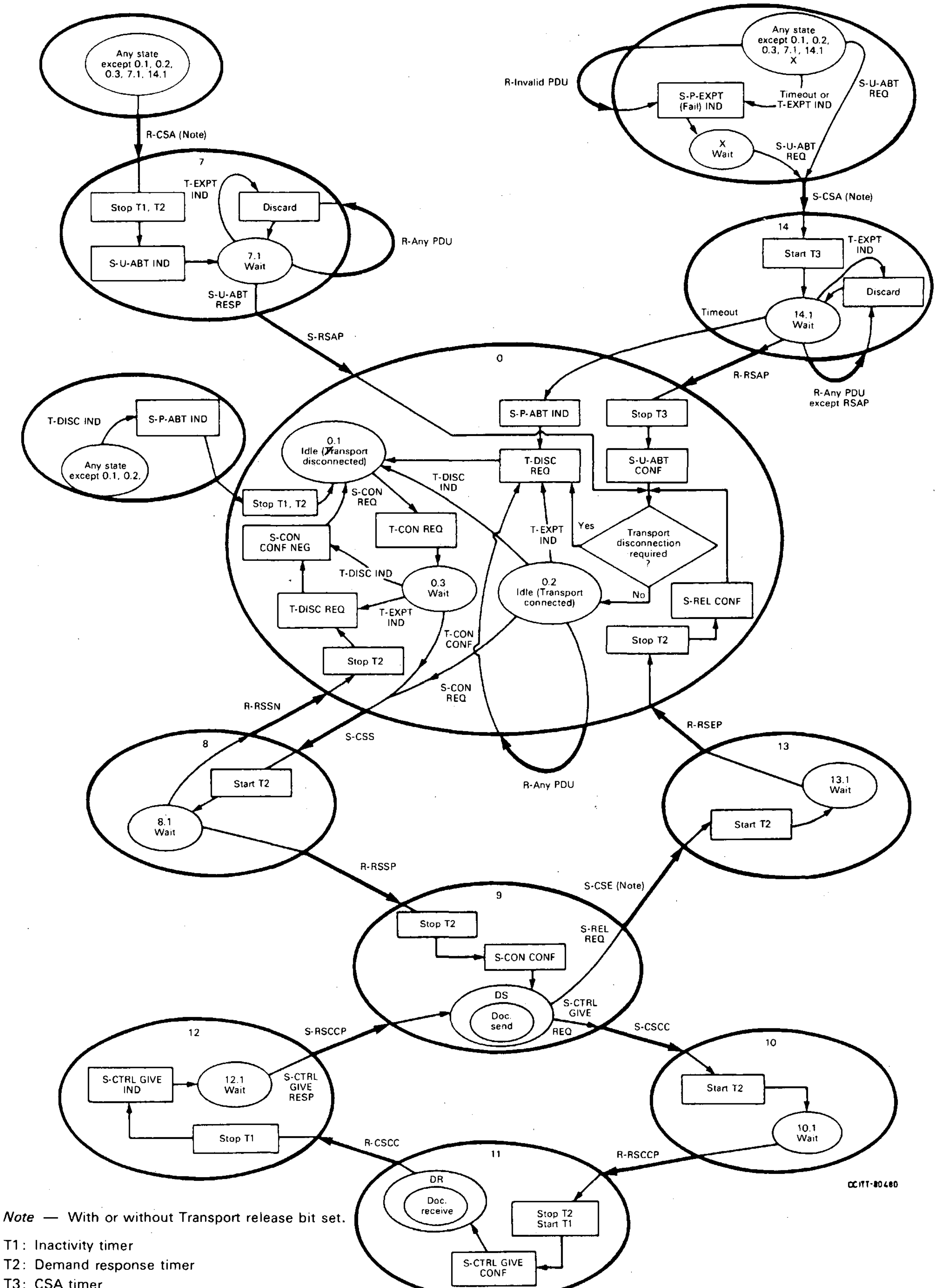
H.3.2.4 *Transport exception reporting (optional and not part of OSI transport class 0)*



H.4 *Detailed state transition diagrams for the basic services*

H.4.1 Figures H-1/T.62 and H-2/T.62 illustrate the detailed state transition diagrams for the calling and the called sides, respectively.

H.4.2 Figures H-3/T.62 and H-4/T.62 illustrate the detailed state transition diagrams for the sending and the receiving protocols, respectively.



Note — With or without Transport release bit set.

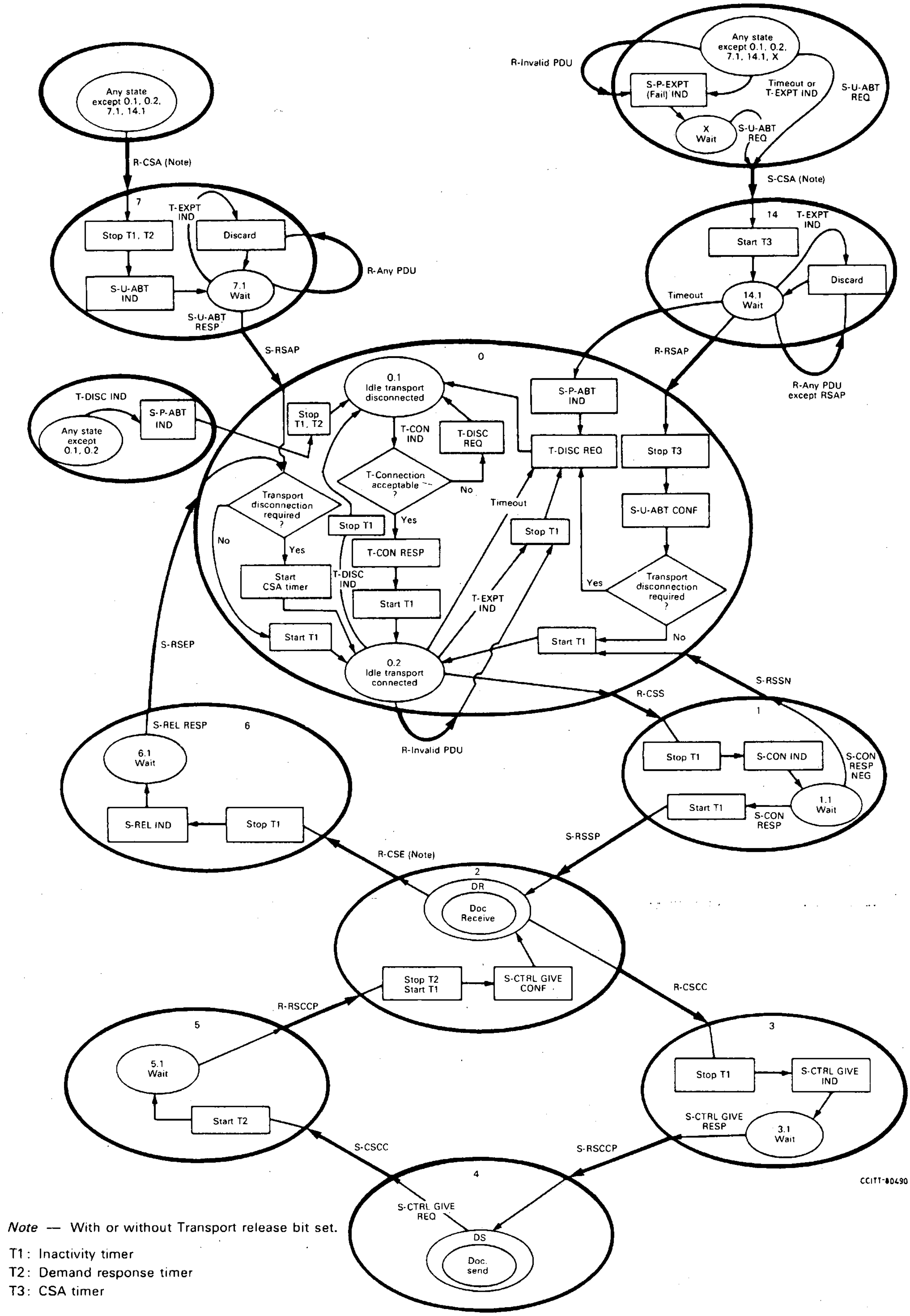
T1: Inactivity timer

T2: Demand response timer

T3: CSA timer

FIGURE H-1/T.62

Teletex session state transition diagram (calling side)



Note — With or without Transport release bit set.

T1: Inactivity timer
T2: Demand response timer
T3: CSA timer

FIGURE H-2/T.62

Teletex session state transition diagram (called side)

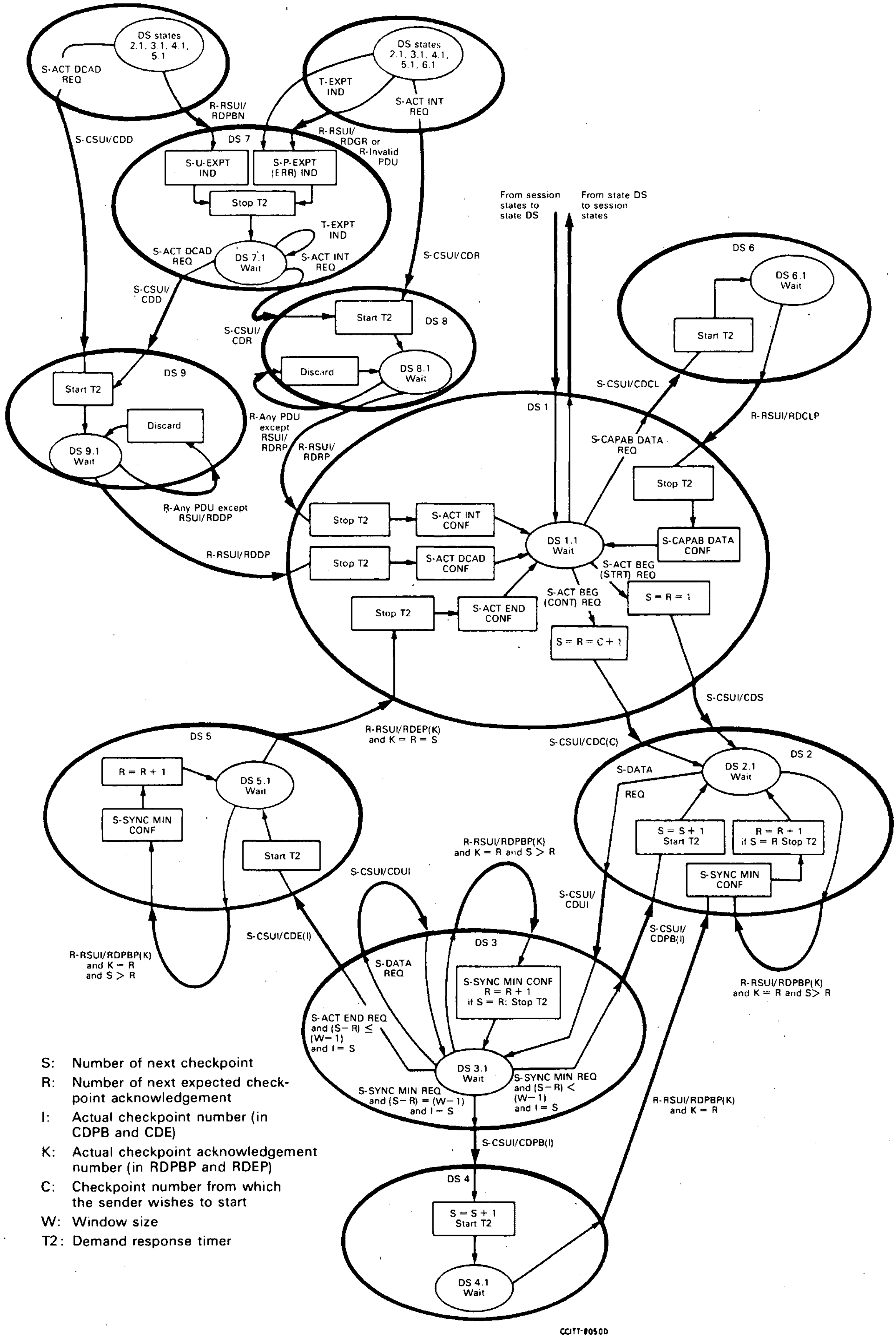
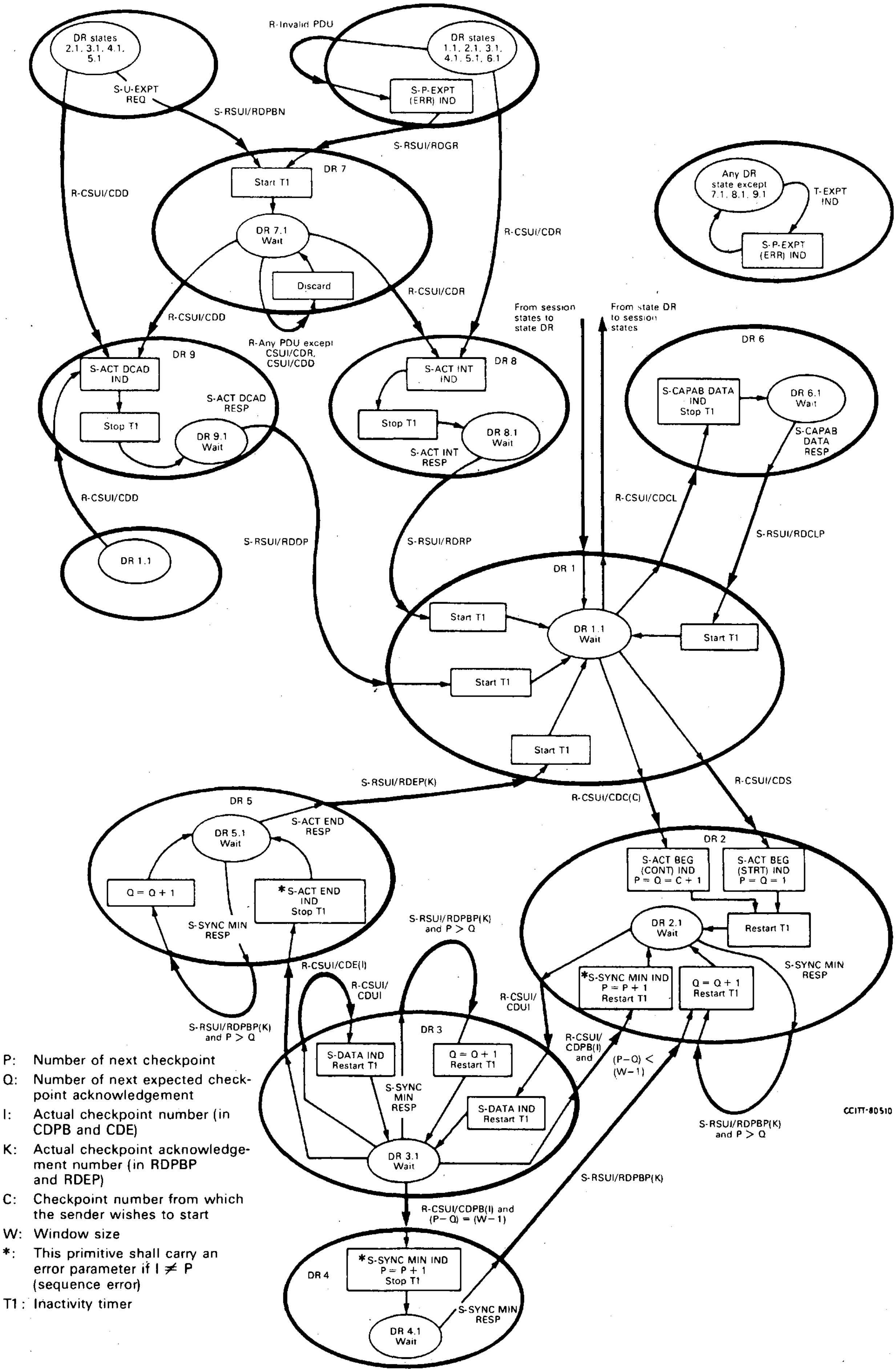


FIGURE H-3/T.62

Teletex document state transition diagram (sending protocol)



P: Number of next checkpoint
Q: Number of next expected checkpoint acknowledgement
I: Actual checkpoint number (in CDPB and CDE)
K: Actual checkpoint acknowledgement number (in RDPBP and RDEP)
C: Checkpoint number from which the sender wishes to start
W: Window size
*: This primitive shall carry an error parameter if I ≠ P (sequence error)
T1: Inactivity timer

FIGURE H-4/T.62

Teletex document state transition diagram (receiving protocol)

ANNEX I

(to Recommendation T.62)

State transition tables for session/document procedures

I.1 *General*

This annex provides state transition tables for session/document procedures for the basic services.

I.2 *Notation details*

I.2.1 *Timers*

I.2.1.1 The following timers are used in the state tables:

a) Timer T1 – Inactivity timer, value as determined by inactivity timer value negotiation

b) Timer T2 – Demand response timer, value 60 seconds.

c) Timer T3 – CSA timer of, for example, 4 seconds.

I.2.2 *Notes*

I.2.2.1 Several actions described in the state tables are marked by a number which relates to the following notes:

1) only if T-DISC is not required;
2) ———— [see § I.2.3.2 h) below];
3) alternative error recovery mechanism;
4) this may also be considered as an error;
5) S-SYNC MIN IND with parameter "procedural error";
6) S-SYNC MIN IND with parameter "sequence error";
7) only if the reuse of the transport connection is intended.

I.2.3 *Symbols*

I.2.3.1 For the description of several different conditions Boolean equations and symbols are used.

I.2.3.2 The symbols have the following meanings:

a) $<$ less than;

b) $>$ greater than;

c) $=$ equal;

d) $\neq$ not equal;

e) $\vee$ or;

f) $\wedge$ and;

g) $\neg$ not;

h) ———— event irrelevant in this specific state since error free operation of the considered terminal is assumed.

I.2.4 *Counters*

I.2.4.1 For the description of the dynamic behaviour of parameters such as checkpoint numbers, several counters and parameter abbreviations are introduced.

I.2.4.2 Counters of the source are as follows:

a) S this indicates the next allowed checkpoint reference number for a CDPB or CDE;

b) R this indicates the next expected checkpoint reference number in an RDPBP or RDEP.

I.2.4.3 Counters of the sink are as follows:

a) P this indicates the next expected checkpoint reference number in a CDPB or CDE to be acknowledged by the sink;

b) Q this indicates the next allowed checkpoint reference number to be acknowledged in an RDPBP or RDEP.

I.2.4.4 Parameter abbreviations are as follows:

a) C a checkpoint reference number from which the source will resume transmission (in case of continuation with CDC);

b) I an actual checkpoint reference number in a CDPB or CDE;

c) K an actual checkpoint reference number to be acknowledged in an RDPBP or RDEP;

d) W acknowledgement window size.

I.2.5 *Abbreviations*

I.2.5.1 The abbreviations contained in Table H-1/T.62 apply to the description of service primitives.

I.3 *State tables*

I.3.1 State tables for a calling terminal is shown in Table I-1/T.62.

I.3.2 State tables for a called terminal is shown in Table I-2/T.62.

TABLE I-1/T.62

State transition tables for calling terminal

Calling terminal

Event \ State			Idle												Wait			
			0.1				0.2				0.3				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ			T-CON REQ	0.3	START T2	S-CSS		8.1	(——			——)	(——			——)
		S-REL REQ	(——			——)	(——			——)	(——			——)	(——			——)
		S-CTRL GIVE REQ	(——			——)	(——			——)	(——			——)	(——			——)
		S-CTRL GIVE RESP	(——			——)	(——			——)	(——			——)	(——			——)
		S-SYNC MIN REQ (I)	(——			——)	(——			——)	(——			——)	(——			——)
		S-SYNC MIN RESP (K)	(——			——)	(——			——)	(——			——)	(——			——)
		S-U-EXPT REQ	(——			——)	(——			——)	(——			——)	(——			——)
		S-ACT END REQ (I)	(——			——)	(——			——)	(——			——)	(——			——)
		S-ACT END RESP (K)	(——			——)	(——			——)	(——			——)	(——			——)
		S-U-ABT REQ	(——			——)	(——			——)	(——			——)	(——			——)
		S-U-ABT RESP	(——			——)	(——			——)	(——			——)		S-RSAP	T-DISCON REQ – 1)	0.1 0.2

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Idle												Wait			
			0.1				0.2				0.3				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(———)				(———)				(———)				(———)			
		S-ACT BEG (CONT) REQ (C)	(———)				(———)				(———)				(———)			
		S-DATA REQ	(———)				(———)				(———)				(———)			
		S-ACT DCAD REQ	(———)				(———)				(———)				(———)			
		S-ACT DCAD RESP	(———)				(———)				(———)				(———)			
		S-ACT INT REQ	(———)				(———)				(———)				(———)			
		S-ACT INT RESP	(———)				(———)				(———)				(———)			
		S-CAPAB DATA REQ	(———)				(———)				(———)				(———)			
		S-CAPAB DATA RESP	(———)				(———)				(———)				(———)			
		T-CON CONF	(———)				(———)				START T2	S-CSS		8.1	(———)			
		T-DISCON IND	(———)							0.1			S-CON CONF NEG	0.1			S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Idle												Wait			
			0.1				0.2				0.3				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND	(------------)						T-DISCON REQ	0.1			T-DISCON REQ S-CON CONF NEG	0.1				7.1
	R-CSS		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-RSSP		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-RSSN		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-CSE		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-RSEP		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-CSA		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-RSAP		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-CSCC		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-RSCCP		(------------)						T-DISCON REQ	0.1	(------------)							7.1
	R-CSUI/CDS		(------------)						T-DISCON REQ	0.1	(------------)							7.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Idle												Wait			
			0.1				0.2				0.3				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/CDC (C)		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-CSUI/CDCL		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-RSUI/RDCLP		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-CSUI/CDE (I)		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-RSUI/RDEP (K)		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-CSUI/CDD		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-RSUI/RDDP		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-CSUI/CDR		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-RSUI/RDRP		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-CSUI/CDUI		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1
	R-RSUI/RDGR		(————			————)			T-DISCON REQ	0.1	(————			————)				7.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Idle												Wait			
			0.1				0.2				0.3				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/CDPB (I)		(————)						T-DISCON REQ	0.1	(————)							7.1
	R-RSUI/RDPBP (K)		(————)						T-DISCON REQ	0.1	(————)							7.1
	R-RSUI/RDPBN		(————)						T-DISCON REQ	0.1	(————)							7.1
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		(————)						T-DISCON REQ	0.1	(————)							7.1
EXPIRY OF T1			(————)				(————)				(————)				(————)			
EXPIRY OF T2			(————)				(————)				(————)				(————)			
EXPIRY OF T3			(————)				(————)				(————)				(————)			

TABLE I-1/T.62 (continued)

Calling terminal

State / Event			Wait				9 Document send												
			8.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			
		S-REL REQ	(----------------------------)				START T2	S-CSE		13.1	(----------------------------)				(----------------------------)			
		S-CTRL GIVE REQ	(----------------------------)				START T2	S-CSCC		10.1	(----------------------------)				(----------------------------)			
		S-CTRL GIVE RESP	(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			
		S-SYNC MIN REQ (I) $\wedge (S-R) < (W-1) \wedge I \neq S$	(----------------------------)				(----------------------------)				(----------------------------)				START T2	S-CSUI/ CDPB (I) S = S+1		DS 2.1
		S-SYNC MIN REQ (I) $\wedge (S-R) = (W-1) \wedge I=S$	(----------------------------)				(----------------------------)				(----------------------------)				START T2	S-CSUI/ CDPB (I) S = S+1		DS 4.1
		S-SYNC MIN RESP (K)	(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			
		S-U-EXPT REQ	(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			
		S-ACT END REQ (I)	(----------------------------)				(----------------------------)				(----------------------------)				START T2	S-CSUI/ CDE (I)		DS 5.1
		S-ACT END RESP (K)	(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			
		S-U-ABT REQ	START T 3	S-CSA		14.1	START T 3	S-CSA		14.1	START T 3	S-CSA		14.1	START T 3	S-CSA		14.1

TABLE I-1/T.62 (continued)

Calling terminal

Event		State	Wait 8.1				9 Document send DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(	—	—	)	(	—	—	)	(	—	—	)	(	—	—	)
		S-ACT BEG (START) REQ	(	—	—	)		S-CSUI/ CDS S=R=1		DS 2.1	(	—	—	)	(	—	—	)
		S-ACT BEG (CONT) REQ (C)	(	—	—	)		S-CSUI/ CDC (C) S=R=C+1		DS 2.1	(	—	—	)	(	—	—	)
		S-DATA REQ	(	—	—	)	(	—	—	)		S-CSUI/ CDUI		DS 3.1		S-CSUI/ CDUI		DS 3.1
		S-ACT DCAD REQ	(	—	—	)	(	—	—	)	START T2	S-CSUI/ CDD		DS 9.1	START T2	S-CSUI/ CDD		DS 9.1
		S-ACT DCAD RESP	(	—	—	)	(	—	—	)	(	—	—	)	(	—	—	)
		S-ACT INT REQ	(	—	—	)	(	—	—	)	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1
		S-ACT INT RESP	(	—	—	)	(	—	—	)	(	—	—	)	(	—	—	)
		S-CAPAB DATA REQ	(	—	—	)	START T2	S-CSUI/ CDCL		DS 6.1	(	—	—	)	(	—	—	)
		S-CAPAB DATA RESP	(	—	—	)	(	—	—	)	(	—	—	)	(	—	—	)
		T-CON CONF	(	—	—	)	(	—	—	)	(	—	—	)	(	—	—	)

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			Wait 8.1				9 Document send DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND	STOP T2		S-P-ABT IND	0.1			S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1
		T-EXPT IND	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSS		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T2		S-CON CONF	DS 1.1			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T2		T-DISCON REQ S-CON CONF NEG	0.1			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T2		S-ABT IND	7.1			S-ABT IND	7.1	STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1
	R-RSAP		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

State / Event			Wait				9 Document send											
			8.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDS		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDC (C)		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDE (I)		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K) ∧ K=R		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDD		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDDP		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDR		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDUI		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

State / Event			Wait				9 Document send												
			8.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDPB (I)		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K) ∧K=R ∧S>R		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	RESTART T2		S-SYNC MIN CONF R=R+1	DS 2.1	RESTART T2		S-SYNC MIN CONF R=R+1	DS 3.1
	R-RSUI/ RDPBP (K) ∧K=R ∧S=R+1		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-SYNC MIN CONF R=R+1	DS 2.1	STOP T2		S-SYNC MIN CONF R=R+1	DS 3.1
	R-RSUI/ RDPBN		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	ANY OTHER DOCUMENT COMMAND OR RESP. OR WRONG FORMAT IN CON-NECTION WITH RSUI		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(———————————————)				(———————————————)				(———————————————)				(———————————————)			
EXPIRY OF T2			STOP T2		S-P-EXPT IND (FAIL)	x	(———————————————)				STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T3			(———————————————)				(———————————————)				(———————————————)				(———————————————)			

TABLE I-1/T.62 (continued)

Calling terminal

Event		State	9 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-REL REQ	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-CTRL GIVE REQ	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-CTRL GIVE RESP	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-SYNC MIN REQ (I)	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-SYNC MIN RESP (K)	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-U-EXPT REQ	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-ACT END REQ (I)	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-ACT END RESP (K)	(------------------------)				(------------------------)				(------------------------)				(------------------------)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1
		S-U-ABT RESP	(------------------------)				(------------------------)				(------------------------)				(------------------------)			

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			9 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(———)				(———)				(———)				(———)			
		S-ACT BEG (CONT) REQ (C)	(———)				(———)				(———)				(———)			
		S-DATA REQ	(———)				(———)				(———)				(———)			
		S-ACT DCAD REQ	START T2	S-CSUI/ CDD		DS 9.1	START T2	S-CSUI/ CDD		DS 9.1	(———)				START T2	S-CSUI/ CDD		DS 9.1
		S-ACT DCAD RESP	(———)				(———)				(———)				(———)			
		S-ACT INT REQ	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1
		S-ACT INT RESP	(———)				(———)				(———)				(———)			
		S-CAPAB DATA REQ	(———)				(———)				(———)				(———)			
		S-CAPAB DATA RESP	(———)				(———)				(———)				(———)			
		T-CON CONF	(———)				(———)				(———)				(———)			
		T-DISCON IND	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1			S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

State / Event			9 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND	STOP T2		S-P-EXPT IND (ERR) 3)	DS 7.1	STOP T2		S-P-EXPT IND (ERR) 3)	DS 7.1	STOP T2		S-P-EXPT IND (ERR) 3)	DS 7.1				DS 7.1
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1			S-ABT IND	7.1
	R-RSAP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/CDS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			9 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDC (C)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-CAPAB DATA CONF	DS 1.1				DS 7.1
	R-CSUI/ CDE (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K) ∧K=R		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-ACT END CONF	DS 1.1	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI/ CDD		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDDP		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI/ CDR		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI/ CDUI		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDGR		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			9 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDPB (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K) $\wedge$ K=R $\wedge$ S>R				S-SYNC MIN CONF R=R+1	DS 2.1			S-SYNC MIN CONF R=R+1	DS 5.1	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-RSUI/ RDPBP (K) $\wedge$ K=R $\wedge$ S=R+1		STOP T2		S-SYNC MIN CONF R=R+1	DS 2.1	STOP T2 STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-RSUI/ RDPBN		STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT IN CONNECTION WITH RSUI		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(——————)				(——————)				(——————)				(——————)			
EXPIRY OF T2			STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	(——————)			
EXPIRY OF T3			(——————)				(——————)				(——————)				(——————)			

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			9 Document send								Wait			
			DS 8.1				DS 9.1				10.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(————)				(————)				(————)			
		S-REL REQ	(————)				(————)				(————)			
		S-CTRL GIVE REQ	(————)				(————)				(————)			
		S-CTRL GIVE RESP	(————)				(————)				(————)			
		S-SYNC MIN REQ (I)	(————)				(————)				(————)			
		S-SYNC MIN RESP (K) ∧ K=Q	(————)				(————)				(————)			
		S-U-EXPT REQ	(————)				(————)				(————)			
		S-ACT END REQ (I)	(————)				(————)				(————)			
		S-ACT END RESP (K)	(————)				(————)				(————)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1
		S-U-ABT RESP	(————)				(————)				(————)			

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			9 Document send								Wait			
			DS 8.1				DS 9.1				10.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(------------------------------)				(------------------------------)				(------------------------------)			
		S-ACT BEG (CONT) REQ (C)	(------------------------------)				(------------------------------)				(------------------------------)			
		S-DATA REQ	(------------------------------)				(------------------------------)				(------------------------------)			
		S-ACT DCAD REQ	(------------------------------)				(------------------------------)				(------------------------------)			
		S-ACT DCAD RESP	(------------------------------)				(------------------------------)				(------------------------------)			
		S-ACT INT REQ	(------------------------------)				(------------------------------)				(------------------------------)			
		S-ACT INT RESP	(------------------------------)				(------------------------------)				(------------------------------)			
		S-CAPAB DATA REQ	(------------------------------)				(------------------------------)				(------------------------------)			
		S-CAPAB DATA RESP	(------------------------------)				(------------------------------)				(------------------------------)			
		T-CON CONF	(------------------------------)				(------------------------------)				(------------------------------)			
		T-DISCON IND	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			9 Document send								Wait			
			DS 8.1				DS 9.1				10.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND				DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
			STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				
	R-CSS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1
	R-RSAP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2 START T1		S-CTRL GIVE CONF	DR 1.1
	R-CSUI/CDS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event		State	9 Document send								Wait			
			DS 8.1				DS 9.1				10.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDC (C)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDE (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K)					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDD		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDDP					DS 8.1	STOP T2		S-ACT DCAD CONF	DS 1.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDR		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP		STOP T2		S-ACT INT CONF	DS 1.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDUI		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDGR					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			9 Document send								Wait			
			DS 8.1				DS 9.1				10.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDPB (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K)					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBN					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CON-NECTION WITH RSUI					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(————————)				(————————)				(————————)			
EXPIRY OF T2			STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T3			(————————)				(————————)				(————————)			

TABLE I-1/T.62 (continued)

Calling terminal

Event		State	11 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-REL REQ	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-CTRL GIVE REQ	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-CTRL GIVE RESP	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-SYNC MIN REQ (I)	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-SYNC MIN RESP (K) ΛK=Q	(-------------------------)				RESTART T1	S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 2.1	RESTART T1	S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 3.1	START T1	S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 2.1
		S-U-EXPT REQ	(-------------------------)				RESTART T1	S-RSUI/ RDPBN		DR 7.1	RESTART T1	S-RSUI/ RDPBN		DR 7.1	START T1	S-RSUI/ RDPBN		DR 7.1
		S-ACT END REQ (I)	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-ACT END RESP (K)	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1
		S-U-ABT RESP	(-------------------------)				(-------------------------)				(-------------------------)				(-------------------------)			

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			11 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(			)	(			)	(			)	(			)
		S-ACT BEG (CONT) REQ (C)	(			)	(			)	(			)	(			)
		S-DATA REQ	(			)	(			)	(			)	(			)
		S-ACT DCAD REQ	(			)	(			)	(			)	(			)
		S-ACT DCAD RESP	(			)	(			)	(			)	(			)
		S-ACT INT REQ	(			)	(			)	(			)	(			)
		S-ACT INT RESP	(			)	(			)	(			)	(			)
		S-CAPAB DATA REQ	(			)	(			)	(			)	(			)
		S-CAPAB DATA RESP	(			)	(			)	(			)	(			)
		T-CON CONF	(			)	(			)	(			)	(			)
		T-DISCON IND	STOP T1		S-P-ABT IND	0.1	STOP T1		S-P-ABT IND	0.1	STOP T1		S-P-ABT IND	0.1			S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			11 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND			S-P-EXPT IND (ERR) 3)	DR 1.1			S-P-EXPT IND (ERR) 3)	DR 2.1			S-P-EXPT IND (ERR) 3)	DR 3.1			S-P-EXPT IND (ERR) 3)	DR 4.1
			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSS		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T1		S-ABT IND	7.1	STOP T1		S-ABT IND	7.1	STOP T1		S-ABT IND	7.1			S-ABT IND	7.1
	R-RSAP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T1		S-CTRL GIVE IND	12.1	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDS		RESTART T1		S-ACT (START) IND P=Q=1	DR 2.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	R-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event: Local event	Event: Protocol event	Event: Service primitive	11 Document receive – DR 1.1: Timer	DR 1.1: Protocol action	DR 1.1: Service primitive	DR 1.1: Final state	DR 2.1: Timer	DR 2.1: Protocol action	DR 2.1: Service primitive	DR 2.1: Final state	DR 3.1: Timer	DR 3.1: Protocol action	DR 3.1: Service primitive	DR 3.1: Final state	DR 4.1: Timer	DR 4.1: Protocol action	DR 4.1: Service primitive	DR 4.1: Final state
	R-CSUI/ CDC (C)		RESTART T1		S-ACT (CONT) IND P=Q=C+1	DR 2.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T1		S-CAPAB DATA IND	DR 6.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDE (I) $\wedge$ (P−Q) $\leq$ (W−1) $\wedge$ I=P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	STOP T1		S-ACT END IND	DR 5.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x							S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K)		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDD		STOP T1		S-ACT DCAD IND	DR 9.1	STOP T1		S-ACT DCAD IND	DR 9.1	STOP T1		S-ACT DCAD IND	DR 9.1			S-ACT DCAD IND	DR 9.1
	R-RSUI/ RDDP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDR		STOP T1		S-ACT INT IND	DR 8.1	STOP T1		S-ACT INT IND	DR 8.1	STOP T1		S-ACT INT IND	DR 8.1			S-ACT INT IND	DR 8.1
	R-RSUI/ RDRP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDUI		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-DATA IND	DR 3.1	RESTART T1		S-DATA IND	DR 3.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
			STOP T1		S-P-EXPT IND (FAIL)	x											S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDGR		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event: Local event	Event: Protocol event	Event: Service primitive	11 Document receive — DR 1.1: Timer	DR 1.1: Protocol action	DR 1.1: Service primitive	DR 1.1: Final state	DR 2.1: Timer	DR 2.1: Protocol action	DR 2.1: Service primitive	DR 2.1: Final state	DR 3.1: Timer	DR 3.1: Protocol action	DR 3.1: Service primitive	DR 3.1: Final state	DR 4.1: Timer	DR 4.1: Protocol action	DR 4.1: Service primitive	DR 4.1: Final state
	R-CSUI/ CDPB (I) ∧(P−Q)< (W−1) ∧I=P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-SYNC MIN IND 5)	DR 2.1 3)	RESTART T1		S-SYNC MIN IND	DR 2.1			S-SYNC MIN IND 5)	DR 4.1 3)
			STOP T1		S-P-EXPT IND (FAIL)	x	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1			COUNTER: P=P+1		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x							S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I) ∧(P−Q)= (W−1) ∧I=P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-SYNC MIN IND 5)	DR 2.1 3)	STOP T1		S-SYNC MIN IND	DR 4.1			S-SYNC MIN IND 5)	DR 4.1 3)
			STOP T1		S-P-EXPT IND (FAIL)	x	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1			COUNTER: P=P+1		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x							S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I) ∧I≠P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-SYNC MIN IND 5)	DR 2.1 3)	RESTART T1		S-SYNC MIN IND 6)	DR 2.1 3)			S-SYNC MIN IND 5)	DR 4.1
			STOP T1		S-P-EXPT IND (FAIL)	x	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K)		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBN		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CON-NECTION WITH CSUI		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			11 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
EXPIRY OF T1			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	(————————)			
EXPIRY OF T2			(————————)				(————————)				(————————)				(————————)			
EXPIRY OF T3			(————————)				(————————)				(————————)				(————————)			

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			11 Document receive																
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(———)				(———)				(———)				(———)			
		S-REL REQ	(———)				(———)				(———)				(———)			
		S-CTRL GIVE REQ	(———)				(———)				(———)				(———)			
		S-CTRL GIVE RESP	(———)				(———)				(———)				(———)			
		S-SYNC MIN REQ (I)	(———)				(———)				(———)				(———)			
		S-SYNC MIN RESP (K) ∧K=Q		S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 5.1	(———)				(———)				(———)			
		S-U-EXPT REQ	START T1	S-RSUI/ RDPBN		DR 7.1	(———)				(———)				(———)			
		S-ACT END REQ (I)	(———)				(———)				(———)				(———)			
		S-ACT END RESP (K)	START T1	S-RSUI/ RDEP		DR 1.1	(———)				(———)				(———)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1
		S-U-ABT RESP	(———)				(———)				(———)				(———)			

TABLE I-1/T.62 (continued)

Calling terminal

Event		State	11 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(-----------)				(-----------)				(-----------)				(-----------)			
		S-ACT BEG (CONT) REQ (C)	(-----------)				(-----------)				(-----------)				(-----------)			
		S-DATA REQ	(-----------)				(-----------)				(-----------)				(-----------)			
		S-ACT DCAD REQ	(-----------)				(-----------)				(-----------)				(-----------)			
		S-ACT DCAD RESP	(-----------)				(-----------)				(-----------)				(-----------)			
		S-ACT INT REQ	(-----------)				(-----------)				(-----------)				(-----------)			
		S-ACT INT RESP	(-----------)				(-----------)				(-----------)				START T1	S-RSUI/ RDRP		DR 1.1
		S-CAPAB DATA REQ	(-----------)				(-----------)				(-----------)				(-----------)			
		S-CAPAB DATA RESP	(-----------)				START T1	S-RSUI/ RDCLP		DR 1.1	(-----------)				(-----------)			
		T-CON CONF	(-----------)				(-----------)				(-----------)				(-----------)			
		T-DISCON IND			S-P-ABT IND	0.1			S-P-ABT IND	0.1	STOP T1		S-P-ABT IND	0.1			S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			11 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND			S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DR 5.1 x			S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DR 6.1 x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSE				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSEP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSA				S-ABT IND	7.1			S-ABT IND	7.1	STOP T1		S-ABT IND	7.1			S-ABT IND	7.1
	R-RSAP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSCC				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSCCP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDS		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DR 7.1 x	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DR 7.1 x				DR 7.1			S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			11 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDC (C)		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P- EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-CSUI/ CDCL		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDCLP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDE (I)		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDEP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDD				S-ACT DCAD IND	DR 9.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	STOP T1		S-ACT DCAD IND	DR 9.1			S-P-EXPT IND (FAIL)	x
									S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDDP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDR				S-ACT INT IND	DR 8.1			S-ACT INT IND	DR 8.1	STOP T1		S-ACT INT IND	DR 8.1			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDUI		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDGR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-1/T.62 (continued)

Calling terminal

Event: Local event	Event: Protocol event	Event: Service primitive	DR 5.1 Timer	DR 5.1 Protocol action	DR 5.1 Service primitive	DR 5.1 Final state	DR 6.1 Timer	DR 6.1 Protocol action	DR 6.1 Service primitive	DR 6.1 Final state	DR 7.1 Timer	DR 7.1 Protocol action	DR 7.1 Service primitive	DR 7.1 Final state	DR 8.1 Timer	DR 8.1 Protocol action	DR 8.1 Service primitive	DR 8.1 Final state
			State: 11 Document receive															
	R-CSUI/ CDPB (I)		(——————————)				START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
			START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1			S-P-EXPT IND (FAIL)	x								
					S-P-EXPT IND (FAIL)	x												
	R-RSUI/ RDPBP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CONNECTION WITH CSUI		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(——————————)				(——————————)				STOP T1		S-P-EXPT IND (FAIL)	x	(——————————)			
EXPIRY OF T2			(——————————)				(——————————)				(——————————)				(——————————)			
EXPIRY OF T3			(——————————)				(——————————)				(——————————)				(——————————)			

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			11 Document receive				Wait				Wait				Wait			
			DR 9.1				12.1				13.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(			)	(			)	(			)	(			)
		S-REL REQ	(			)	(			)	(			)	(			)
		S-CTRL GIVE REQ	(			)	(			)	(			)	(			)
		S-CTRL GIVE RESP	(			)		S-RSCCP		DS 1.1	(			)	(			)
		S-SYNC MIN REQ (I)	(			)	(			)	(			)	(			)
		S-SYNC MIN RESP (K)	(			)	(			)	(			)	(			)
		S-U-EXPT REQ	(			)	(			)	(			)	(			)
		S-ACT END REQ (I)	(			)	(			)	(			)	(			)
		S-ACT END RESP (K)	(			)	(			)	(			)	(			)
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	(			)
		S-U-ABT RESP	(			)	(			)	(			)	(			)

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			11 Document receive				Wait				Wait				Wait			
			DR 9.1				12.1				13.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(-----)				(-----)				(-----)				(-----)			
		S-ACT BEG (CONT) REQ (C)	(-----)				(-----)				(-----)				(-----)			
		S-DATA REQ	(-----)				(-----)				(-----)				(-----)			
		S-ACT DCAD REQ	(-----)				(-----)				(-----)				(-----)			
		S-ACT DCAD RESP	START T1	S-RSUI/ RDDP		DR 1.1	(-----)				(-----)				(-----)			
		S-ACT INT REQ	(-----)				(-----)				(-----)				(-----)			
		S-ACT INT RESP	(-----)				(-----)				(-----)				(-----)			
		S-CAPAB DATA REQ	(-----)				(-----)				(-----)				(-----)			
		S-CAPAB DATA RESP	(-----)				(-----)				(-----)				(-----)			
		T-CON CONF	(-----)				(-----)				(-----)				(-----)			
		T-DISCON IND			S-P-ABT IND	0.1			S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T3		S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event		State	11 Document receive				Wait				Wait				Wait			
			DR 9.1				12.1				13.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSSP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSSN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSE				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSEP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-REL CONF S-REL CONF/ T-DISC REQ	0.2 7) 0.1				14.1
	R-CSA				S-ABT IND	7.1			S-ABT IND	7.1	STOP T2		S-ABT IND	7.1				14.1
	R-RSAP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T3		S-ABT CONF S-ABT CONF/ T-DISC REQ	0.2 7) 0.1
	R-CSCC				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSCCP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1

TABLE I-1/T.62 (continued)

Calling terminal

Event / State			11 Document receive DR 9.1				Wait 12.1				Wait 13.1				Wait 14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDC (C)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDCL				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDCLP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDE (I)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDEP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDD				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDDP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDRP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDUI				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDGR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1

TABLE I-1/T.62 (continued)

Calling terminal

Event: Local event	Event: Protocol event	Event: Service primitive	State: 11 Document receive DR 9.1 — Timer	Protocol action	Service primitive	Final state	Wait 12.1 — Timer	Protocol action	Service primitive	Final state	Wait 13.1 — Timer	Protocol action	Service primitive	Final state	Wait 14.1 — Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDPB (I)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDPBP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDPBN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				14.1
EXPIRY OF T1			(--------	--------	--------	--------)	(--------	--------	--------	--------)	(--------	--------	--------	--------)	(--------	--------	--------	--------)
EXPIRY OF T2			(--------	--------	--------	--------)	(--------	--------	--------	--------)	STOP T2		S-P-EXPT IND (FAIL)	x	(--------	--------	--------	--------)
EXPIRY OF T3			(--------	--------	--------	--------)	(--------	--------	--------	--------)	(--------	--------	--------	--------)	STOP T3		S-P-ABT IND T-DISCON REQ	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
		S-CON REQ	(	------	------	)
		S-REL REQ	(	------	------	)
		S-CTRL GIVE REQ	(	------	------	)
		S-CTRL GIVE RESP	(	------	------	)
		S-SYNC MIN REQ (I)	(	------	------	)
		S-SYNC MIN RESP (K)	(	------	------	)
		S-U-EXPT REQ	(	------	------	)
		S-ACT END REQ (I)	(	------	------	)
		S-ACT END RESP (K)	(	------	------	)
		S-U-ABT REQ	START T3	S-CSA		14.1
		S-U-ABT RESP	(	------	------	)

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Wait x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
		S-ACT BEG (START) REQ	(-------------	-------------	-------------	-------------)
		S-ACT BEG (CONT) REQ (C)	(-------------	-------------	-------------	-------------)
		S-DATA REQ	(-------------	-------------	-------------	-------------)
		S-ACT DCAD REQ	(-------------	-------------	-------------	-------------)
		S-ACT DCAD RESP	(-------------	-------------	-------------	-------------)
		S-ACT INT REQ	(-------------	-------------	-------------	-------------)
		S-ACT INT RESP	(-------------	-------------	-------------	-------------)
		S-CAPAB DATA REQ	(-------------	-------------	-------------	-------------)
		S-CAPAB DATA RESP	(-------------	-------------	-------------	-------------)
		T-CON CONF	(-------------	-------------	-------------	-------------)
		T-DISCON IND			S-P-ABT IND	0.1

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
		T-EXPT IND				x
	R-CSS					x
	R-RSSP					x
	R-RSSN					x
	R-CSE					x
	R-RSEP					x
	R-CSA				S-ABT IND	7.1
	R-RSAP					x
	R-CSCC					x
	R-RSCCP					x
	R-CSUI/CDS					x

TABLE I-1/T.62 (continued)

Calling terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDC (C)					x
	R-CSUI/ CDCL					x
	R-RSUI/ RDCLP					x
	R-CSUI/ CDE (I)					x
	R-RSUI/ RDEP (K)					x
	R-CSUI/ CDD					x
	R-RSUI/ RDDP					x
	R-CSUI/ CDR					x
	R-RSUI/ RDRP					x
	R-CSUI/ CDUI					x
	R-RSUI/ RDGR					x

TABLE I-1/T.62 (end)

Calling terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDPB (I)					x
	R-RSUI/ RDPBP (K)					x
	R-RSUI/ RDPBN					x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT					x
EXPIRY OF T1			(			)
EXPIRY OF T2			(			)
EXPIRY OF T3			(			)

TABLE I-2/T.62

State transition tables for called terminal

Called terminal

State → / Event ↓			Idle								Wait			
			0.1				0.2				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(--------------------------)				(--------------------------)				(--------------------------)			
		S-CON RESP NEG	(--------------------------)				(--------------------------)				(--------------------------)			
		S-REL RESP	(--------------------------)				(--------------------------)				(--------------------------)			
		S-CTRL GIVE REQ	(--------------------------)				(--------------------------)				(--------------------------)			
		S-CTRL GIVE RESP	(--------------------------)				(--------------------------)				(--------------------------)			
		S-SYNC MIN REQ (I)	(--------------------------)				(--------------------------)				(--------------------------)			
		S-SYNC MIN RESP (K)	(--------------------------)				(--------------------------)				(--------------------------)			
		S-U-EXPT REQ	(--------------------------)				(--------------------------)				(--------------------------)			
		S-ACT END REQ (I)	(--------------------------)				(--------------------------)				(--------------------------)			
		S-ACT END RESP (K)	(--------------------------)				(--------------------------)				(--------------------------)			
		S-U-ABT REQ	(--------------------------)				(--------------------------)				(--------------------------)			

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Idle								Wait			
			0.1				0.2				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(			)	(			)	START T3	S-RSAP		0.2
											START T1	S-RSAP	1)	
		S-ACT BEG (START) REQ	(			)	(			)	(			)
		S-ACT BEG (CONT) REQ (C)	(			)	(			)	(			)
		S-DATA REQ	(			)	(			)	(			)
		S-ACT DCAD REQ	(			)	(			)	(			)
		S-ACT DCAD RESP	(			)	(			)	(			)
		S-ACT INT REQ	(			)	(			)	(			)
		S-ACT INT RESP	(			)	(			)	(			)
		S-CAPAB DATA REQ	(			)	(			)	(			)
		S-CAPAB DATA RESP	(			)	(			)	(			)
		T-CON IND ∧ T-CON ACCEPT.	START T1		T-CON RESP POS	0.2	(			)	(			)

TABLE I-2/T.62 (continued)

Called terminal

Event / State			Idle								Wait			
			0.1				0.2				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-CON IND ∧ T-CON ¬ACCEPT.			T-DISC REQ	0.1	(———)				(———)			
		T-DISCON IND	(———)				STOP T1 ∨ T3			0.1			S-P-ABT IND	0.1
		T-EXPT IND	(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-CSS		(———)				STOP T1		S-CON IND	1.1				7.1
	R-RSSP		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-RSSN		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-CSE		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-RSEP		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-CSA		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-RSAP		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1
	R-CSCC		(———)				STOP T1 ∨ T3		T-DISCON REQ	0.1				7.1

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Idle								Wait			
			0.1				0.2				7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSCCP		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDS		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDC (C)		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDCL		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDCLP		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDE (I)		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDEP (K)		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDD		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDDP		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDR		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDRP		(------------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Idle 0.1				Idle 0.2				Wait 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDUI		(------------------------)				STOP T1VT3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDGR		(------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-CSUI/ CDPB (I)		(------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDPBP (K)		(------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	R-RSUI/ RDPBN		(------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		(------------------------)				STOP T1 V T3		T-DISCON REQ	0.1				7.1
EXPIRY OF T1			(------------------------)				STOP T1		T-DISCON REQ	0.1	(------------------------)			
EXPIRY OF T2			(------------------------)				(------------------------)				(------------------------)			
EXPIRY OF T3			(------------------------)				STOP T3		T-DISCON REQ	0.1	(------------------------)			

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Wait				4 Document send											
			1.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	START T1	S-RSSP		DR 1.1	(------)				(------)				(------)			
		S-CON RESP NEG	START T3	S-RSSN		0.2	(------)				(------)				(------)			
		S-REL RESP	(------)				(------)				(------)				(------)			
		S-CTRL GIVE REQ	(------)				START T2	S-CSCC		5.1	(------)				(------)			
		S-CTRL GIVE RESP	(------)				(------)				(------)				(------)			
		S-SYNC MIN REQ (I) $\wedge$ (S−R) < (W−1) $\wedge$ I=S	(------)				(------)				(------)				START T2	S-CSUI/ CDPB (I) S=S+1		DS 2.1
		S-SYNC MIN REQ (I) $\wedge$ (S−R) = (W−1) $\wedge$ I=S	(------)				(------)				(------)				START T2	S-CSUI/ CDPB (I) S=S+1		DS 4.1
		S-SYNC MIN RESP (K)	(------)				(------)				(------)				(------)			
		S-U-EXPT REQ	(------)				(------)				(------)				(------)			
		S-ACT END REQ (I)	(------)				(------)				(------)				START T2	S-CSUI/ CDE (I)		DS 5.1
		S-ACT END RESP (K)	(------)				(------)				(------)				(------)			

TABLE I-2/T.62 (continued)

Called terminal

Event		State	Wait				4 Document send											
			1.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1
		S-U-ABT RESP	(———)				(———)				(———)				(———)			
		S-ACT BEG (START) REQ	(———)					S-CSUI/ CDS S=R=1		DS 2.1	(———)				(———)			
		S-ACT BEG (CONT) REQ (C)	(———)					S-CSUI/ CDC (C) S=R=C+1		DS 2.1	(———)				(———)			
		S-DATA REQ	(———)				(———)					S-CSUI/ CDUI		DS 3.1		S-CSUI/ CDUI		DS 3.1
		S-ACT DCAD REQ	(———)				(———)				START T2	S-CSUI/ CDD		DS 9.1	START T2	S-CSUI/ CDD		DS 9.1
		S-ACT DCAD RESP	(———)				(———)				(———)				(———)			
		S-ACT INT REQ	(———)				(———)				START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1
		S-ACT INT RESP	(———)				(———)				(———)				(———)			
		S-CAPAB DATA REQ	(———)				START T2	S-CSUI/ CDCL		DS 6.1	(———)				(———)			
		S-CAPAB DATA RESP	(———)				(———)				(———)				(———)			

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Wait				4 Document send											
			1.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-CON IND	(------------)				(------------)				(------------)				(------------)			
		T-DISCON IND			S-P-ABT IND	0.1			S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1
		T-EXPT IND			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSE				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSEP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSA				S-ABT IND	7.1			S-ABT IND	7.1	STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1
	R-RSAP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSCC				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event / State			Wait				4 Document send															
			1.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSCCP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDC (C)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDE (I)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K) ∧ K=R				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDD				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDDP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Wait 1.1				4 Document send DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDUI				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDGR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSUI/ CDPB (I)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K) ∧ K=R ∧ S>R				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-SYNC MIN CONF R=R+1	DS 2.1			S-SYNC MIN CONF R=R+1	DS 3.1
	R-RSUI/ RDPBP (K) ∧ K=R ∧ S=R+1				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-SYNC MIN CONF R=R+1	DS 2.1	STOP T2		S-SYNC MIN CONF R=R+1	DS 3.1
	R-RSUI/ RDPBN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CONNECTION WITH RSUI				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Wait				4 Document send											
			1.1				DS 1.1				DS 2.1				DS 3.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
EXPIRY OF T1			(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			
EXPIRY OF T2			(----------------------------)				(----------------------------)				STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T3			(----------------------------)				(----------------------------)				(----------------------------)				(----------------------------)			

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			4 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-CON RESP NEG	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-REL RESP	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-CTRL GIVE REQ	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-CTRL GIVE RESP	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-SYNC MIN REQ (I)	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-SYNC MIN RESP (K)	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-U-EXPT REQ	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-ACT END REQ (I)	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-ACT END RESP (K)	(---------------------------)				(---------------------------)				(---------------------------)				(---------------------------)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1

TABLE I-2/T.62 (continued)

Called terminal

Event / State			4 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(————)				(————)				(————)				(————)			
		S-ACT BEG (START) REQ	(————)				(————)				(————)				(————)			
		S-ACT BEG (CONT) REQ (C)	(————)				(————)				(————)				(————)			
		S-DATA REQ	(————)				(————)				(————)				(————)			
		S-ACT DCAD REQ	START T2	S-CSUI/ CDD		DS 9.1	START T2	S-CSUI/ CDD		DS 9.1	(————)				START T2	S-CSUI/ CDD		DS 9.1
		S-ACT DCAD RESP	(————)				(————)				(————)				(————)			
		S-ACT INT REQ	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1	START T2	S-CSUI/ CDR		DS 8.1
		S-ACT INT RESP	(————)				(————)				(————)				(————)			
		S-CAPAB DATA REQ	(————)				(————)				(————)				(————)			
		S-CAPAB DATA RESP	(————)				(————)				(————)				(————)			
		T-CON IND	(————)				(————)				(————)				(————)			

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			4 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1			S-P-ABT IND	0.1
		T-EXPT IND	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x			 S-P-EXPT IND (FAIL)	DS 7.1 x
	R-CSS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1			S-ABT IND	7.1
	R-RSAP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			4 Document send															
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI CDS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDC (C)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-CAPAB DATA CONF	DS 1.1				DS 7.1
	R-CSUI/ CDE (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K) ∧ K=R		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-ACT END CONF	DS 1.1	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI CDD		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDDP		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI/ CDR		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI/ CDUI		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event / State			4 Document send																
			DS 4.1				DS 5.1				DS 6.1				DS 7.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-CSUI/ CDPB (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K) ∧K=R ∧S>R				S-SYNC MIN CONF R=R+1	DS 2.1			S-SYNC MIN CONF R=R+1	DS 5.1	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-RSUI/ RDPBP (K) ∧K=R ∧S=R+1		STOP T2		S-SYNC MIN CONF R=R+1	DS 2.1	STOP T2 STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	R-RSUI/ RDPBN		STOP T2		S-U-EXPT IND 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-U-EXPT REQ 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT IN CON-NECTION WITH RSUI		STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x	STOP T2		S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DS 7.1 x				DS 7.1
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(————)				(————)				(————)				(————)			
EXPIRY OF T2			STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	(————)			
EXPIRY OF T3			(————)				(————)				(————)				(————)			

TABLE I-2/T.62 (continued)

Called terminal

State / Event			4 Document send								Wait			
			DS 8.1				DS 9.1				5.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(----------)				(----------)				(----------)			
		S-CON RESP NEG	(----------)				(----------)				(----------)			
		S-REL RESP	(----------)				(----------)				(----------)			
		S-CTRL GIVE REQ	(----------)				(----------)				(----------)			
		S-CTRL GIVE RESP	(----------)				(----------)				(----------)			
		S-SYNC MIN REQ (I)	(----------)				(----------)				(----------)			
		S-SYNC MIN RESP (K) ∧ K=Q	(----------)				(----------)				(----------)			
		S-U-EXPT REQ	(----------)				(----------)				(----------)			
		S-ACT END REQ (I)	(----------)				(----------)				(----------)			
		S-ACT END RESP (K)	(----------)				(----------)				(----------)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			4 Document send								Wait			
			DS 8.1				DS 9.1				5.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(			)	(			)	(			)
		S-ACT BEG (START) REQ	(			)	(			)	(			)
		S-ACT BEG (CONT) REQ (C)	(			)	(			)	(			)
		S-DATA REQ	(			)	(			)	(			)
		S-ACT DCAD REQ	(			)	(			)	(			)
		S-ACT DCAD RESP	(			)	(			)	(			)
		S-ACT INT REQ	(			)	(			)	(			)
		S-ACT INT RESP	(			)	(			)	(			)
		S-CAPAB DATA REQ	(			)	(			)	(			)
		S-CAPAB DATA RESP	(			)	(			)	(			)
		T-CON IND	(			)	(			)	(			)

TABLE I-2/T.62 (continued)

Called terminal

State / Event			4 Document send								Wait			
			DS 8.1				DS 9.1				5.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1	STOP T2		S-P-ABT IND	0.1
		T-EXPT IND				DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
			STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x				
	R-CSS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1	STOP T2		S-ABT IND	7.1
	R-RSAP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	RESTART T2		S-CTRL GIVE CONF	DR 1.1

TABLE I-2/T.62 (continued)

Called terminal

Event / State			4 Document send DS 8.1				DS 9.1				Wait 5.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDS		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDC (C)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDE (I)		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K)					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDD		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDDP					DS 8.1	STOP T2		S-ACT DCAD CONF	DS 1.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDR		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP		STOP T2		S-ACT INT CONF	DS 1.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDUI		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

State / Event			4 Document send								Wait			
			DS 8.1				DS 9.1				5.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I)		STOP T2		S-P-EXPT IND (FAIL)	x				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K)					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBN					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CON-NECTION WITH RSUI					DS 8.1				DS 9.1	STOP T2		S-P-EXPT IND (FAIL)	x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(------------------------)				(------------------------)				(------------------------)			
EXPIRY OF T2			STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x	STOP T2		S-P-EXPT IND (FAIL)	x
EXPIRY OF T3			(------------------------)				(------------------------)				(------------------------)			

Called terminal

Event \ State			2 Document receive																
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(————)				(————)				(————)				(————)			
		S-CON RESP NEG	(————)				(————)				(————)				(————)			
		S-REL RESP	(————)				(————)				(————)				(————)			
		S-CTRL GIVE REQ	(————)				(————)				(————)				(————)			
		S-CTRL GIVE RESP	(————)				(————)				(————)				(————)			
		S-SYNC MIN REQ (I)	(————)				(————)				(————)				(————)			
		S-SYNC MIN RESP (K) ∧K=Q	(————)				RESTART T1	S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 2.1	RESTART T1	S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 3.1	START T1	S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 2.1
		S-U-EXPT REQ	(————)				RESTART T1	S-RSUI/ RDPBN		DR 7.1	RESTART T1	S-RSUI/ RDPBN		DR 7.1	START T1	S-RSUI/ RDPBN		DR 7.1
		S-ACT END REQ (I)	(————)				(————)				(————)				(————)			
		S-ACT END RESP (K)	(————)				(————)				(————)				(————)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			2 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(			)	(			)	(			)	(			)
		S-ACT BEG (START) REQ	(			)	(			)	(			)	(			)
		S-ACT BEG (CONT) REQ (C)	(			)	(			)	(			)	(			)
		S-DATA REQ	(			)	(			)	(			)	(			)
		S-ACT DCAD REQ	(			)	(			)	(			)	(			)
		S-ACT DCAD RESP	(			)	(			)	(			)	(			)
		S-ACT INT REQ	(			)	(			)	(			)	(			)
		S-ACT INT RESP	(			)	(			)	(			)	(			)
		S-CAPAB DATA REQ	(			)	(			)	(			)	(			)
		S-CAPAB DATA RESP	(			)	(			)	(			)	(			)
		T-CON IND	(			)	(			)	(			)	(			)

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			2 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND	STOP T1		S-P-ABT IND	0.1	STOP T1		S-P-ABT IND	0.1	STOP T1		S-P-ABT IND	0.1			S-P-ABT IND	0.1
		T-EXPT IND			S-P-EXPT IND (ERR) 3)	DR 1.1			S-P-EXPT IND (ERR) 3)	DR 2.1			S-P-EXPT IND (ERR) 3)	DR 3.1			S-P-EXPT IND (ERR) 3)	DR 4.1
			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSS		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSN		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSE		STOP T1		S-REL IND	6.1	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSEP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSA		STOP T1		S-ABORT IND	7.1	STOP T1		S-ABORT IND	7.1	STOP T1		S-ABORT IND	7.1			S-ABORT IND	7.1
	R-RSAP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSCC		STOP T1		S-CTRL GIVE IND	3.1	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSCCP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event / State			2 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDS		RESTART T1		S-ACT BEG (START) IND P=Q=1	DR 2.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDC (C)		RESTART T1		S-ACT BEG (CON) IND P=Q=C+1	DR 2.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDCL		STOP T1		S-CAPAB DATA IND	DR 6.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDCLP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDE (I) ∧ (P−Q) ≤ (W−1) ∧ I=P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	STOP T1		S-ACT END IND	DR 5.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x							S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDEP (K)		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDD		STOP T1		S-ACT DCAD IND	DR 9.1	STOP T1		S-ACT DCAD IND	DR 9.1	STOP T1		S-ACT DCAD IND	DR 9.1			S-ACT DCAD IND	DR 9.1
	R-RSUI/ RDDP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDR		STOP T1		S-ACT INT IND	DR 8.1	STOP T1		S-ACT INT IND	DR 8.1	STOP T1		S-ACT INT IND	DR 8.1			S-ACT INT IND	DR 8.1
	R-RSUI/ RDRP		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDUI		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-DATA IND	DR 3.1	RESTART T1		S-DATA IND	DR 3.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
			STOP T1		S-P-EXPT IND (FAIL)	x											S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event / State			2 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I) ∧ (P−Q)< (W−1) ∧ I=P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-SYNC MIN IND 5)	DR 2.1 3)	RESTART T1		S-SYNC MIN IND	DR 2.1			S-SYNC MIN IND 5)	DR 4.1 3)
			STOP T1		S-P-EXPT IND (FAIL)	x	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1			COUNTER: P=P+1		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x							S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I) ∧ (P−Q)= (W−1) ∧ I=P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-SYNC MIN IND 5)	DR 2.1 3)	STOP T1		S-SYNC MIN IND	DR 4.1			S-SYNC MIN IND 5)	DR 4.1 3)
			STOP T1		S-P-EXPT IND (FAIL)	x	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1			COUNTER: P=P+1		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x							S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I) ∧ I≠P		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1		S-SYNC MIN IND 5)	DR 2.1 3)	RESTART T1		S-SYNC MIN IND 6)	DR 2.1 3)			S-SYNC MIN IND 5)	DR 4.1
			STOP T1		S-P-EXPT IND (FAIL)	x	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
							STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBP (K)		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBN		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CON- NECTION WITH CSUI		RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	RESTART T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1
			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

State / Event			2 Document receive															
			DR 1.1				DR 2.1				DR 3.1				DR 4.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT		STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x	(———)			
EXPIRY OF T2			(———)				(———)				(———)				(———)			
EXPIRY OF T3			(———)				(———)				(———)				(———)			

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			2 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-CON RESP NEG	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-REL RESP	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-CTRL GIVE REQ	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-CTRL GIVE RESP	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-SYNC MIN REQ (I)	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-SYNC MIN RESP (K) $\wedge K=Q$		S-RSUI/ RDPBP (K)	COUNTER: Q=Q+1	DR 5.1	(-------------------)				(-------------------)				(-------------------)			
		S-U-EXPT REQ	START T1	S-RSUI/ RDPBN		DR 7.1	(-------------------)				(-------------------)				(-------------------)			
		S-ACT END REQ (I)	(-------------------)				(-------------------)				(-------------------)				(-------------------)			
		S-ACT END RESP (K)	START T1	S-RSUI/ RDEP		DR 1.1	(-------------------)				(-------------------)				(-------------------)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1

TABLE I-2/T.62 (continued)

Called terminal

Event / State			2 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-ACT BEG (START) REQ	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-ACT BEG (CONT) REQ (C)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-DATA REQ	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-ACT DCAD REQ	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-ACT DCAD RESP	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-ACT INT REQ	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-ACT INT RESP	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	START T1	S-RSUI/ RDRP		DR 1.1
		S-CAPAB DATA REQ	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)
		S-CAPAB DATA RESP	(----	----	----	----)	START T1	S-RSUI/ RDCLP		DR 1.1	(----	----	----	----)	(----	----	----	----)
		T-CON IND	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)	(----	----	----	----)

TABLE I-2/T.62 (continued)

Called terminal

State / Event			2 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND			S-P-ABT IND	0.1			S-P-ABT IND	0.1	STOP T1		S-P-ABT IND	0.1			S-P-ABT IND	0.1
		T-EXPT IND			S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DR 5.1 x			S-P-EXPT IND (ERR) 3) S-P-EXPT IND (FAIL)	DR 6.1 x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSSN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSE				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSEP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSA				S-ABT IND	7.1			S-ABT IND	7.1	STOP T1		S-ABT IND	7.1			S-ABT IND	7.1
	R-RSAP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSCC				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSCCP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			2 Document receive												
			DR 5.1				DR 6.1				DR 7.1				DR 8.1
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state

Local event	Protocol event	Service primitive	DR 5.1 Timer	DR 5.1 Protocol action	DR 5.1 Service primitive	DR 5.1 Final state	DR 6.1 Timer	DR 6.1 Protocol action	DR 6.1 Service primitive	DR 6.1 Final state	DR 7.1 Timer	DR 7.1 Protocol action	DR 7.1 Service primitive	DR 7.1 Final state	DR 8.1 Timer	DR 8.1 Protocol action	DR 8.1 Service primitive	DR 8.1 Final state
	R-CSUI/ CDS		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-CSUI/ CDC (C)		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-CSUI/ CDCL		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDCLP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDE (I)		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDEP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDD				S-ACT DCAD IND	DR 9.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	STOP T1		S-ACT DCAD IND	DR 9.1			S-P-EXPT IND (FAIL)	x
									S-P-EXPT IND (FAIL)	x								
	R-RSUI/ RDDP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDR				S-ACT INT IND	DR 8.1			S-ACT INT IND	DR 8.1	STOP T1		S-ACT INT IND	DR 8.1			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDRP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDUI		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								

Called terminal

Event / State			2 Document receive															
			DR 5.1				DR 6.1				DR 7.1				DR 8.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-CSUI/ CDPB (I)		(————)				START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
			START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1			S-P-EXPT IND (FAIL)	x								
					S-P-EXPT IND (FAIL)	x												
	R-RSUI/ RDPBP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	R-RSUI/ RDPBN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT IN CON-NECTION WITH CSUI		START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1	START T1	S-RSUI/ RDGR	S-P-EXPT IND (ERR) 3)	DR 7.1				DR 7.1			S-P-EXPT IND (FAIL)	x
					S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x								
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T1		S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x
EXPIRY OF T1			(————)				(————)				STOP T1		S-P-EXPT IND (FAIL)	x	(————)			
EXPIRY OF T2			(————)				(————)				(————)				(————)			
EXPIRY OF T3			(————)				(————)				(————)				(————)			

TABLE I-2/T.62 (continued)

Called terminal

Event / State			2 Document receive				Wait				Wait				Wait			
			DR 9.1				3.1				6.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(————)				(————)				(————)				(————)			
		S-CON RESP NEG	(————)				(————)				(————)				(————)			
		S-REL RESP	(————)				(————)				START T1	S-RSEP		0.2	(————)			
		S-CTRL GIVE REQ	(————)				(————)				(————)				(————)			
		S-CTRL GIVE RESP	(————)					S-RSCCP		DS 1.1	(————)				(————)			
		S-SYNC MIN REQ (I)	(————)				(————)				(————)				(————)			
		S-SYNC MIN RESP (K)	(————)				(————)				(————)				(————)			
		S-U-EXPT REQ	(————)				(————)				(————)				(————)			
		S-ACT END REQ (I)	(————)				(————)				(————)				(————)			
		S-ACT END RESP (K)	(————)				(————)				(————)				(————)			
		S-U-ABT REQ	START T3	S-CSA		14.1	START T3	S-CSA		14.1	START T3	S-CSA		14.1	(————)			

TABLE I-2/T.62 (continued)

Called terminal

Event / State			2 Document receive				Wait				Wait				Wait			
			DR 9.1				3.1				6.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(————)				(————)				(————)				(————)			
		S-ACT BEG (START) REQ	(————)				(————)				(————)				(————)			
		S-ACT BEG (CONT) REQ (C)	(————)				(————)				(————)				(————)			
		S-DATA REQ	(————)				(————)				(————)				(————)			
		S-ACT DCAD REQ	(————)				(————)				(————)				(————)			
		S-ACT DCAD RESP	START T1	S-RSUI/ RDDP		DR 1.1	(————)				(————)				(————)			
		S-ACT INT REQ	(————)				(————)				(————)				(————)			
		S-ACT INT RESP	(————)				(————)				(————)				(————)			
		S-CAPAB DATA REQ	(————)				(————)				(————)				(————)			
		S-CAPAB DATA RESP	(————)				(————)				(————)				(————)			
		T-CON IND	(————)				(————)				(————)				(————)			

TABLE I-2/T.62 (continued)

Called terminal

State / Event			2 Document receive				Wait				Wait				Wait			
			DR 9.1				3.1				6.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND			S-P-ABT IND	0.1			S-P-ABT IND	0.1			S-P-ABT IND	0.1	STOP T3		S-P-ABT IND	0.1
		T-EXPT IND			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSSP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSSN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSE				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSEP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSA				S-ABT IND	7.1			S-ABT IND	7.1			S-ABT IND	7.1				14.1
	R-RSAP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x	STOP T3		S-ABT CONF S-ABT CONF T-DISCON REQ	0.2 7) 0.1
	R-CSCC				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSCCP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1

TABLE I-2/T.62 (continued)

Called terminal

State / Event			2 Document receive				Wait				Wait				Wait			
			DR 9.1				3.1				6.1				14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDS				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDC (C)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDCL				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDCLP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDE (I)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDEP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDD				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDDP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDRP				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDUI				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			2 Document receive DR 9.1				Wait 3.1				Wait 6.1				Wait 14.1			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-CSUI/ CDPB (I)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDPBP (K)				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	R-RSUI/ RDPBN				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
	ANY OTHER DOCUMENT COMMAND OR RESP OR WRONG FORMAT				S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x			S-P-EXPT IND (FAIL)	x				14.1
EXPIRY OF T1			(------------------------)				(------------------------)				(------------------------)				(------------------------)			
EXPIRY OF T2			(------------------------)				(------------------------)				(------------------------)				(------------------------)			
EXPIRY OF T3			(------------------------)				(------------------------)				(------------------------)				STOP T3		S-P-ABT IND T-DISCON REQ	0.1

TABLE I-2/T.62 (continued)

Called terminal

Event: Local event	Event: Protocol event	Event: Service primitive	State: Wait x — Timer	Protocol action	Service primitive	Final state
		S-CON RESP POS	(———	———	———	———)
		S-CON RESP NEG	(———	———	———	———)
		S-REL RESP	(———	———	———	———)
		S-CTRL GIVE REQ	(———	———	———	———)
		S-CTRL GIVE RESP	(———	———	———	———)
		S-SYNC MIN REQ (I)	(———	———	———	———)
		S-SYNC MIN RESP (K)	(———	———	———	———)
		S-U-EXPT REQ	(———	———	———	———)
		S-ACT END REQ (I)	(———	———	———	———)
		S-ACT END RESP (K)	(———	———	———	———)
		S-U-ABT REQ	START T3	S-CSA		14.1

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
		S-U-ABT RESP	(			)
		S-ACT BEG (START) REQ	(			)
		S-ACT BEG (CONT) REQ (C)	(			)
		S-DATA REQ	(			)
		S-ACT DCAD REQ	(			)
		S-ACT DCAD RESP	(			)
		S-ACT INT REQ	(			)
		S-ACT INT RESP	(			)
		S-CAPAB DATA REQ	(			)
		S-CAPAB DATA RESP	(			)
		T-CON IND	(			)

TABLE I-2/T.62 (continued)

Called terminal

State / Event			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
		T-DISCON IND			S-P-ABT IND	0.1
		T-EXPT IND				x
	R-CSS					x
	R-RSSP					x
	R-RSSN					x
	R-CSE					x
	R-RSEP					x
	R-CSA				S-ABT IND	7.1
	R-RSAP					x
	R-CSCC					x
	R-RSCCP					x

TABLE I-2/T.62 (continued)

Called terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
	R-CSUI/ CDS					x
	R-CSUI/ CDC (C)					x
	R-CSUI/ CDCL					x
	R-RSUI/ RDCLP					x
	R-CSUI/ CDE (I)					x
	R-RSUI/ RDEP (K)					x
	R-CSUI/ CDD					x
	R-RSUI/ RDDP					x
	R-CSUI/ CDR					x
	R-RSUI/ RDRP					x
	R-CSUI/ CDUI					x

TABLE I-2/T.62 (end)

Called terminal

Event \ State			Wait			
			x			
Local event	Protocol event	Service primitive	Timer	Protocol action	Service primitive	Final state
	R-RSUI/ RDGR					x
	R-CSUI/ CDPB (I)					x
	R-RSUI/ RDPBP (K)					x
	R-RSUI/ RDPBN					x
	ANY OTHER COMMAND OR RESP OR WRONG FORMAT					x
EXPIRY OF T1			(	------	------	)
EXPIRY OF T2			(	------	------	)
EXPIRY OF T3			(	------	------	)

PROVISIONS FOR VERIFICATION OF TELETEX TERMINAL COMPLIANCE

(Malaga-Torremolinos, 1984)

The CCITT,

considering,

(a) that Administrations planning to offer the Teletex service will require provisions to facilitate the verification of compliance of Teletex terminals;

(b) that Recommendation F.200 fixes the rules to be followed in the automatic international Teletex service;

(c) that Recommendation T.60 defines the requirements for terminal equipment used in the international Teletex service;

(d) that Recommendation T.61 defines the character repertoire and coded character sets for the international Teletex service;

(e) that Recommendations T.62 defines the control procedures for the Teletex service;

(f) that a standardized "test text" could provide a means to facilitate the verification of the presentation capabilities of Teletex terminals,

unanimously declares the following:

1 Introduction

1.1 *Objective*

This Recommendation contains a reference test text and associated encoding of characters to facilitate Administrations' verification of the text presentation capabilities of Teletex terminals.

1.2 *Scope*

1.2.1 The reference test text contained herein is based on Recommendations F.200, T.60, T.61 and T.62, and contains only the basic Teletex repertoire of graphic characters and control functions.

1.2.2 The reference test text is intended to assist verification and does not necessarily guarantee the compliance of Teletex terminals subjected to it.

1.2.3 The reference test text does not supersede Recommendations F.200, T.60, T.61 or T.62 which continue to be the definitive specifications for the Teletex character repertoire, its associated coding representation and control procedures.

1.2.4 Additional provisions to facilitate the verification of Teletex terminals are required and are for further study.

2 General

2.1 *General description of test text*

The test text consists of a document of two pages, the first presented in the horizontal format (see Annex A) and the second in the vertical format (see Annex B).

2.2 *Description of page 1 (Annex A)*

The first page begins with the control functions PFS, IGS, SHS, FF and CR.

Note – The IGS function has been included for completeness of control functions. However, its parameter values have not been defined and require further study. Terminals may ignore the IGS function but must be capable of receiving it.

The control functions are followed by a framing line to test the required capability of printing 100 characters beginning at the home position. The sequence 1234567890 should appear exactly 10 times. One group of ten digits is superscripted to demonstrate the availability of the upper extreme of the printing area.

This is followed by the "diacritical mark" test, in which every required combination of letters and diacritical marks is produced. This section is single-spaced [SVS(0)] and occupies lines 3 to 28 inclusive.

Midway through line 28, an SVS(1) sequence (9/11 3/1 2/0 4/12) is sent; this results in 1.5 line spacing beginning with the next LF function (line 29).

Immediately following the CR LF sequence terminating line 30, five BS characters (0/8) are sent followed by two X's (5/8). This tests for the existence of five character positions to the left of the home position, and the ability to print in them, as well as correct functioning of the BS format effector. A CR (0/13) is then sent to return to the home position – a rightward movement of the active position – and the line number.

The centre of line 31 exercises the ability to combine diacritical marks with letters and nonspacing underline.

At line 32, an SVS(2) activates a line spacing of 2.

Finally, line 34 completes the framing, illustrating that we can print in all extreme character positions (line 34 is actually the 38th single-spaced line on the page and therefore the last required). One group of digits is subscripted and underlined to further demonstrate the availability of the extremes of the printing area.

2.3 *Description of page two (Annex B)*

The start of page 2 is indicated by a protocol element (as defined in Recommendation T.62) which resets all control functions to a default state in accordance with Recommendation T.61, § 3.3. For this page no presentation control functions are sent prior to the Carriage Return (CR) Form Feed (FF) sequence that introduces the text of the page. Therefore, the terminal should revert to the default control function values [PFS(0) and SVS(0)], resulting in a vertical page format and single line spacing.

This is followed by a framing line to demonstrate the capability of printing 72 positions starting at the home position. One group of ten digits is superscripted to demonstrate the availability of the upper extreme of the printing area.

A complete character set test follows, in row and column form. All characters in both the primary and supplementary sets are displayed on lines 12 to 30 inclusive.

Lines 1 to 18 are printed with single sine spacing. Line 19 contains an SVS(1) sequence, resulting in 1.5 line spacing beginning with line 20.

Line 33 contains the control function "SUB" which may have a graphical representation (ʕ in this document). The graphical representation of this control function (SUB) in Annex B and Annex D is only one of several presentation possibilities as defined in Recommendation T.61, § 3.3.5. Terminals receiving a substitute character may either represent it with a spacing character or ignore it.

Line 32 contains an SVS(2), resulting in double spacing from line 32.

Line 34 contains SGR(4), resulting in underlining of the text on that line.

Immediately after the new line sequence at the end of line 34, five BS (0/8) are sent, followed by two X's, a CR (0/13) and the line number (35), which should appear in the home position. This again demonstrates the backspace function, the existence of five print positions to the left of the home position in the vertical format, and CR causing a rightward movement of the active position to the home position.

Line 35 exhibits the combination of the nonspacing character (12/12) with various graphic characters.

Line 36 exercises PLU (8/12) and PLD (8/11), alone and in combination with the nonspacing underline. In the middle group, the nonspacing underline precedes the "start super/subscript" command, and in the last group it follows the super/subscript command.

Line 37 combines PLU and PLD with the SGR(4) presentation function. In the first group, SGR(4) precedes the first character and remains effective for all characters, while in the second group it is sent prior to the first character and also after each "start super/subscript" command. Also on this line, an X followed by an LF (0/10) is sent without the CR. This results in the next line number 38 being printed beneath and one position to the right of the X. This is repeated once more on line 39.

Note that in lines 36 and 37 underlining may be suppressed in those character positions where it causes overprinting (T.61, § 3.1.7).

Finally, line 40 completes the framing, demonstrating the capability of printing in all extreme positions (line 40 corresponds to 55 single spaced lines). A group of ten digits is subscripted and underlined to illustrate complete capability in the extremes.

3 Reference test text

Annexes A and B graphically represent the test text, whereas Annexes C and D represent the applicable coding to realize the test.

```
12345678901234567890123456789012345678901234567890123456789012345678901234567890¹²³⁴⁵⁶⁷⁸⁹⁰1234567890
2                      PRESENTATIOŅ ŤEST TEXŢ          Page 1
3   a A  á Á  à À  â Â  ä Ä  ã Ã       ă Ă     å Å     ā Ā     ą Ą
4   b B
5   c C  ć Ć       ĉ Ĉ            č Č            ċ Ċ     ç Ç
6   d D                           ď Ď
7   e E  é É  è È  ê Ê  ë Ë       ě Ě            ė Ė ē Ē     ę Ę
8   f F
9   g G  ģ         ĝ Ĝ                 ğ Ğ       ġ Ġ     Ģ
10  h H            ĥ Ĥ
11  i I  í Í  ì Ì  î Î  ï Ï  ĩ Ĩ                   İ ī Ī     į Į
12  j J            ĵ Ĵ
13  k K                                                  ķ Ķ
14  l L  ĺ Ĺ                      ľ Ľ                    ļ Ļ
15  m M
16  n N  ń Ń                 ñ Ñ  ň Ň                    ņ Ņ
17  o O  ó Ó  ò Ò  ô Ô  ö Ö  õ Õ            ő Ő      ō Ō
18  p P
19  q Q
20  r R  ŕ Ŕ                      ř Ř                    ŗ Ŗ
21  s S  ś Ś       ŝ Ŝ            š Š                    ş Ş
22  t T                           ť Ť                    ţ Ţ
23  u U  ú Ú  ù Ù  û Û  ü Ü  ũ Ũ       ŭ Ŭ  ű Ű  ů Ů   ū Ū     ų Ų
24  v V
25  w W            ŵ Ŵ
26  x X
27  y Y  ý Ý       ŷ Ŷ  ÿ Ÿ
28  z Z  ź Ź                      ž Ž            ż Ż
29      Here the line spacing is set to '1-1/2' [SVS(1)].

30

XX  31                    ŤŢĈŘB

32

33      Here the line spacing is set to '2' [SVS(2)].

343456789012345678901234567890123456789012345678901234567890123456789012345678901234567890₁₂₃₄₅₆₇₈₉₀1234567890
```

ANNEX A (to Recommendation T.63)

1234567890123456789012345678901234567890123456789012345678901234567890 12

PRESENTATION TEST TEXT Page 2

No parameters were specified for this new page. Therefore, by default, line spacing should be '1' [SVS(0)], and page format should be vertical [PFS(0)].

Character Set Test

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0				0	@	P		p				°			Ω	κ
1			!	1	A	Q	a	q			¡	±	`		Æ	æ
2			"	2	B	R	b	r			¢	²	´		Đ	đ
3			#	3	C	S	c	s			£	³	^		ª	ð
4			¤	4	D	T	d	t			$	×	~		Ħ	ħ
5			%	5	E	U	e	u			¥	µ	¯			ı
6			&	6	F	V	f	v			#	¶	˘		Ĳ	ĳ

19

Here the line spacing is set to '1-1/2' [SVS(1)].

7			'	7	G	W	g	w			§	·	˙		Ŀ	ŀ
8			(	8	H	X	h	x			¤	÷	¨		Ł	ł
9			)	9	I	Y	i	y							Ø	ø
10			*	:	J	Z	j	z					˚		Œ	œ
11			+	;	K	[	k				«	»	¸		º	ß
12			,	<	L		l	|				¼	_		Þ	þ
13			-	=	M	]	m					½	˝		Ŧ	ŧ
14			.	>	N		n					¾	˛		Ŋ	ŋ
15			/	?	O	_	o					¿	ˇ		ŉ	

31

Here the line spacing is set to '2' [SVS(2)].

<u>Format Effector Tests</u> [SGR(4)]

XX <u>nonspacing underline</u>

$E_i=M_ic^2$ $\underline{E_i=M_ic}^2$ $\underline{E_{\underline{i}}=M_{\underline{i}}c}^2$

$\underline{E_i=M_ic}^2$ $\underline{E_{\underline{i}}=M_{\underline{i}}c}^2$ X

38

39

40345678901234567890123456789012345678901234567890123456789012345678901 2

ANNEX C

(to Recommendation T.63)

Teletex presentation test text coding

Page 1

9/11	3/1	2/0	4/10							[PFS(1)]
9/11	3/1	3/2	3/3	3/4	2/0	4/13				[IGS (1234)]
9/11	3/0	2/0	4/11	0/12	0/13					[SHS(0)] [FF] [CR]

Line 1

3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
8/12										[PLU]
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
8/11										[PLD]
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
0/10	0/13									[LF] [CR]

Line 2

3/2	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	5/0	5/2	PR
4/5	5/3	4/5	4/14	5/4	4/1	5/4	4/9	4/15	4/14	ESENTATION
2/0	5/4	4/5	5/3	5/4	2/0	5/4	4/5	5/8	5/4	TEST TEXT
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
2/0	5/0	6/1	6/7	6/5	2/0	3/1				Page 1
0/13	0/10									[CR] [LF]

Line 3

3/3	2/0	2/0	2/0	6/1	2/0	4/1	3 a A
2/0	2/0	12/2	6/1	2/0	12/2	4/1	á Á
2/0	2/0	12/1	6/1	2/0	12/1	4/1	à À
2/0	2/0	12/3	6/1	2/0	12/3	4/1	â Â
2/0	2/0	12/8	6/1	2/0	12/8	4/1	ä Ä
2/0	2/0	12/4	6/1	2/0	12/4	4/1	ã Ã
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/6	6/1	2/0	12/6	4/1	ă Ă
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/10	6/1	2/0	12/10	4/1	å Å
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/5	6/1	2/0	12/5	4/1	ā Ā
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/14	6/1	2/0	12/14	4/1	ą Ą
0/13	0/10						[CR] [LF]

Line 4

3/4	2/0	2/0	2/0	6/2	2/0	4/2	4 b B
0/13	0/10						[CR] [LF]

Line 5

3/5	2/0	2/0	2/0	6/3	2/0	4/3	5 c C
2/0	2/0	12/2	6/3	2/0	12/2	4/3	ć Ć
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/3	6/3	2/0	12/3	4/3	ĉ Ĉ
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/15	6/3	2/0	12/15	4/3	č Č
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/7	6/3	2/0	12/7	4/3	ċ Ċ
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/11	6/3	2/0	12/11	4/3	ç Ç
0/13	0/10						[CR] [LF]

Line 6

3/6	2/0	2/0	2/0	6/4	2/0	4/4	6 d D
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/15	6/4	2/0	12/15	4/4	ď Ď
0/13	0/10						[CR] [LF]

Line 7

3/7	2/0	2/0	2/0	6/5	2/0	4/5	7 e E
2/0	2/0	12/2	6/5	2/0	12/2	4/5	é É
2/0	2/0	12/1	6/5	2/0	12/1	4/5	è È
2/0	2/0	12/3	6/5	2/0	12/3	4/5	ê Ê
2/0	2/0	12/8	6/5	2/0	12/8	4/5	ë Ë
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/15	6/5	2/0	12/15	4/5	ě Ě
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/7	6/5	2/0	12/7	4/5	ė Ė
2/0	2/0	12/5	6/5	2/0	12/5	4/5	ē Ē
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/14	6/5	2/0	12/14	4/5	ę Ę
0/13	0/10						[CR] [LF]

Line 8

3/8	2/0	2/0	2/0	6/6	2/0	4/6	8 f F
0/13	0/10						[CR] [LF]

```
Line 9
 3/9   2/0   2/0   2/0   6/7   2/0   4/7          9  g G
 2/0   2/0  12/2   6/7   2/0   2/0                   ǵ
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0  12/3   6/7   2/0  12/3   4/7             ĝ  Ĝ
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0  12/6   6/7   2/0  12/6   4/7             ğ  Ğ
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0  12/7   6/7   2/0  12/7   4/7             ġ  Ġ
 2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0  12/11  4/7                Ģ
0/13  0/10                                       [CR] [LF]

Line 10
 3/1   3/0   2/0   2/0   6/8   2/0   4/8          10  h H
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0  12/3   6/8   2/0  12/3   4/8             ĥ  Ĥ
0/13  0/10                                       [CR] [LF]

Line 11
 3/1   3/1   2/0   2/0   6/9   2/0   4/9          11  i I
 2/0   2/0  12/2   6/9   2/0  12/2   4/9             í  Í
 2/0   2/0  12/1   6/9   2/0  12/1   4/9             ì  Ì
 2/0   2/0  12/3   6/9   2/0  12/3   4/9             î  Î
 2/0   2/0  12/8   6/9   2/0  12/8   4/9             ï  Ï
 2/0   2/0  12/4   6/9   2/0  12/4   4/9             ĩ  Ĩ
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0  12/7   4/9                İ
 2/0   2/0  12/5   6/9   2/0  12/5   4/9             ī  Ī
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0  12/14  6/9   2/0  12/14  4/9             į  Į
0/13  0/10                                       [CR] [LF]

Line 12
 3/1   3/2   2/0   2/0   6/10  2/0   4/10         12  j J
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0
 2/0   2/0  12/3   6/10  2/0  12/3   4/10            ĵ  Ĵ
0/13  0/10                                       [CR] [LF]
```

```
Line 13
 3/1    3/3    2/0    2/0   6/11    2/0   4/11                     13  k K
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0  12/11   6/11    2/0  12/11   4/11                        ķ Ķ
0/13   0/10                                                        [CR] [LF]

Line 14
 3/1    3/4    2/0    2/0   6/12    2/0   4/12                     14  l L
 2/0    2/0   12/2   6/12    2/0   12/2   4/12                         ĺ Ĺ
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0  12/15   6/12    2/0  12/15   4/12                         ľ Ľ
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0  12/11   6/12    2/0  12/11   4/12                         ļ Ļ
0/13   0/10                                                        [CR] [LF]

Line 15
 3/1    3/5    2/0    2/0   6/13    2/0   4/13                     15  m M
0/13   0/10                                                        [CR] [LF]

Line 16
 3/1    3/6    2/0    2/0   6/14    2/0   4/14                     16  n N
 2/0    2/0   12/2   6/14    2/0   12/2   4/14                         ń Ń
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/4   6/14    2/0   12/4   4/14                         ñ Ñ
 2/0    2/0  12/15   6/14    2/0  12/15   4/14                         ň Ň
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0  12/11   6/14    2/0  12/11   4/14                         ņ Ņ
0/13   0/10                                                        [CR] [LF]
```

Line 17

3/1	3/7	2/0	2/0	6/15	2/0	4/15	17 o O
2/0	2/0	12/2	6/15	2/0	12/2	4/15	´o ´O
2/0	2/0	12/1	6/15	2/0	12/1	4/15	`o `O
2/0	2/0	12/3	6/15	2/0	12/3	4/15	ˆo ˆO
2/0	2/0	12/8	6/15	2/0	12/8	4/15	¨o ¨O
2/0	2/0	12/4	6/15	2/0	12/4	4/15	˜o ˜O
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/13	6/15	2/0	12/13	4/15	˝o ˝O
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/5	6/15	2/0	12/5	4/15	¯o ¯O
0/13	0/10						[CR] [LF]

Line 18

3/1	3/8	2/0	2/0	7/0	2/0	5/0	18 p P
0/13	0/10						[CR] [LF]

Line 19

3/1	3/9	2/0	2/0	7/1	2/0	5/1	19 q Q
0/13	0/10						[CR] [LF]

Line 20

3/2	3/0	2/0	2/0	7/2	2/0	5/2	20 r R
2/0	2/0	12/2	7/2	2/0	12/2	5/2	´r ´R
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/15	7/2	2/0	12/15	5/2	ˇr ˇR
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/11	7/2	2/0	12/11	5/2	¸r ¸R
0/13	0/10						[CR] [LF]

Line 21

3/2	3/1	2/0	2/0	7/3	2/0	5/3	21 s S
2/0	2/0	12/2	7/3	2/0	12/2	5/3	´s ´S
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/3	7/3	2/0	12/3	5/3	ˆs ˆS
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/15	7/3	2/0	12/15	5/3	ˇs ˇS
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	2/0	2/0	2/0			
2/0	2/0	12/11	7/3	2/0	12/11	5/3	¸s ¸S
0/13	0/10						[CR] [LF]

```
Line 22
 3/2    3/2    2/0    2/0    7/4    2/0    5/4          22  t T
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/15   7/4    2/0   12/15   5/4              ť Ť
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/11   7/4    2/0   12/11   5/4              ţ Ţ
0/13   0/10                                             [CR] [LF]

Line 23
 3/2    3/3    2/0    2/0    7/5    2/0    5/5          23  u U
 2/0    2/0   12/2    7/5    2/0   12/2    5/5              ú Ú
 2/0    2/0   12/1    7/5    2/0   12/1    5/5              ù Ù
 2/0    2/0   12/3    7/5    2/0   12/3    5/5              û Û
 2/0    2/0   12/8    7/5    2/0   12/8    5/5              ü Ü
 2/0    2/0   12/4    7/5    2/0   12/4    5/5              ũ Ũ
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/6    7/5    2/0   12/6    5/5              ŭ Ŭ
 2/0    2/0   12/13   7/5    2/0   12/13   5/5              ű Ű
 2/0    2/0   12/10   7/5    2/0   12/10   5/5              ů Ů
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/5    7/5    2/0   12/5    5/5              ū Ū
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/14   7/5    2/0   12/14   5/5              ų Ų
0/13   0/10                                             [CR] [LF]

Line 24
 3/2    3/4    2/0    2/0    7/6    2/0    5/6          24  v V
0/13   0/10                                             [CR] [LF]

Line 25
 3/2    3/5    2/0    2/0    7/7    2/0    5/7          25  w W
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/3    7/7    2/0   12/3    5/7              ŵ Ŵ
0/13   0/10                                             [CR] [LF]

Line 26
 3/2    3/6    2/0    2/0    7/8    2/0    5/8          26  x X
0/13   0/10                                             [CR] [LF]

Line 27
 3/2    3/7    2/0    2/0    7/9    2/0    5/9          27  y Y
 2/0    2/0   12/2    7/9    2/0   12/2    5/9              ý Ý
 2/0    2/0    2/0    2/0    2/0
 2/0    2/0   12/3    7/9    2/0   12/3    5/9              ŷ Ŷ
 2/0    2/0   12/8    7/9    2/0   12/8    5/9              ÿ Ÿ
0/13   0/10                                             [CR] [LF]
```

```
Line 28
 3/2   3/8   2/0   2/0   7/10   2/0   5/10                 28 ´z ´Z
 2/0   2/0  12/2  7/10    2/0  12/2   5/10                    ´z ´Z
 2/0   2/0   2/0   2/0    2/0
 2/0   2/0   2/0   2/0    2/0
9/11   3/1   2/0  4/12                                      [SVS(1)]
 2/0   2/0   2/0   2/0    2/0
 2/0   2/0   2/0   2/0    2/0
 2/0   2/0 12/15  7/10    2/0 12/15   5/10                    ˘z ˘Z
 2/0   2/0   2/0   2/0    2/0
 2/0   2/0   2/0   2/0    2/0
 2/0   2/0   2/0   2/0    2/0
 2/0   2/0  12/7  7/10    2/0  12/7   5/10                    ˙z ˙Z
0/13  0/10                                                  [CR] [LF]

Line 29
 3/2   3/9   2/0   2/0    2/0   2/0   2/0   4/8   6/5      29     He
 7/2   6/5   2/0   7/4    6/8   6/5   2/0  6/12   6/9      re the li
6/14   6/5   2/0   7/3    7/0   6/1   6/3   6/9  6/14      ne spacin
 6/7   2/0   6/9   7/3    2/0   7/3   6/5   7/4   2/0      g is set
 7/4  6/15   2/0   2/7    3/1  2/13   3/1  2/15   3/2      to '1-1/2
 2/7   2/0  5/11   5/3    5/6   5/3   2/8   3/1   2/9      '  [SVS (1)
5/13  2/14  0/13  0/10                                     ]. [CR] [LF]

Line 30
 3/3   3/0  0/13  0/10                                     30 [CR] [LF]

Line 31
 0/8   0/8   0/8   0/8    0/8   5/8   5/8  0/13            [5x[BS]] XX [CR]
 3/3   3/1   2/0   2/0    2/0   2/0   2/0   2/0            31
 2/0   2/0   2/0   2/0    2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0    2/0   2/0   2/0   2/0
 2/0   2/0   2/0
12/12 12/15  5/4 12/12  12/11   5/4 12/12  12/3            _˘T_.T_ˆ
 4/3  12/12 12/15  5/2  12/12   4/2                        C_˜R_B
0/13  0/10                                                 [CR] [LF]

Line 32
 3/3   3/2  9/11   3/2    2/0  4/12  0/13                  32 [SVS(2)] [CR]
0/10                                                       [LF]

Line 33
 3/3   3/3   2/0   2/0    2/0   2/0   2/0   4/8   6/5      33     He
 7/2   6/5   2/0   7/4    6/8   6/5   2/0  6/12   6/9      re the li
6/14   6/5   2/0   7/3    7/0   6/1   6/3   6/9  6/14      ne spacin
 6/7   2/0   6/9   7/3    2/0   7/3   6/5   7/4   2/0      g is set
 7/4  6/15   2/0   2/7    3/2   2/7   2/0  5/11   5/3      to '2' [S
 5/6   5/3   2/8   3/2    2/9  5/13  2/14                  VS(2)]
0/13  0/10                                                 [CR] [LF]
```

Line 34

3/3	3/4	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	3434567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
8/11	9/11	3/4	6/13							[PLD] [SGR(4)]
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
8/12	9/11	3/0	6/13							[PLU] [SGR(0)]
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890

ANNEX D

(to Recommendation T.63)

```
0/13  0/12                                                    [CR] [FF]

Line 1
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
8/12                                                          [PLU]
 3/1   3/2   3/3   3/4   3/5   3/6   3/7   3/8   3/9   3/0    1234567890
8/11                                                          [PLD]
 3/1   3/2   0/13  0/10                                       12 [CR] [LF]

Line 2
 3/2  0/13   0/10                                             2 [CR] [LF]

Line 3
 3/3   2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0    3
 2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0
 2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0   5/0   5/2              PR
 4/5   5/3   4/5   4/14  5/4   4/1   5/4   4/9   4/15  4/14   ESENTATION
 2/0   5/4   4/5   5/3   5/4   2/0   5/4   4/5   5/8   5/4     TEST TEXT
 2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0   2/0
 2/0   5/0   6/1   6/7   6/5   2/0   3/2   0/13  0/10          Page 2 [CR] [LF]

Line 4
 3/4  0/13   0/10                                             4 [CR] [LF]

Line 5
 3/5                                                          5
 2/0   2/0   2/0   2/0   2/0   4/14  6/15  2/0   7/0   6/1        No pa
 7/2   6/1   6/13  6/5   7/4   6/5   7/2   7/3   2/0   7/7    rameters w
 6/5   7/2   6/5   2/0   7/3   7/0   6/5   6/3   6/9   6/6    ere specif
 6/9   6/5   6/4   2/0   6/6   6/15  7/2   2/0   7/4   6/8    ied for th
 6/9   7/3   2/0   6/14  6/5   7/7   2/0   7/0   6/1   6/7    is new pag
 6/5   2/14  2/0   5/4   6/8   6/5   7/2   6/5   6/6   6/15   e. Therefo
 7/2   6/5   2/12  0/13  0/10                                 re, [CR] [LF]

Line 6
 3/6                                                          6
 2/0   2/0   2/0   2/0   2/0   6/2   7/9   2/0   6/4   6/5        by de
 6/6   6/1   7/5   6/12  7/4   2/12  2/0   6/12  6/9   6/14   fault, lin
 6/5   2/0   7/3   7/0   6/1   6/3   6/9   6/14  6/7   2/0    e spacing
 7/3   6/8   6/15  7/5   6/12  6/4   2/0   6/2   6/5   2/0    should be
 2/7   3/1   2/7   2/0   5/11  5/3   5/6   5/3   2/8   3/0    '1' [SVS(0
 2/9   5/13  2/12  2/0   6/1   6/14  6/4   2/0   7/0   6/1    )], and pa
 6/7   6/5   0/13  0/10                                       ge [CR] [LF]

Line 7
 3/7                                                          7
 2/0   2/0   2/0   2/0   2/0   6/6   6/15  7/2   6/13  6/1         forma
 7/4   2/0   7/3   6/8   6/15  7/5   6/12  6/4   2/0   6/2    t should b
 6/5   2/0   7/6   6/5   7/2   7/4   6/9   6/3   6/1   6/12   e vertical
 2/0   5/11  5/0   4/6   5/3   2/8   3/0   2/9   5/13  2/14    [PFS(0)].
0/13  0/10                                                    [CR] [LF]
```

```
Line 8
 3/8   0/13   0/10                                                      8 [CR] [LF]

Line 9
 3/9    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    9
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0    4/3    6/8    6/1    7/2    6/1        Chara
 6/3    7/4    6/5    7/2    2/0    5/3    6/5    7/4    2/0    5/4    cter Set T
 6/5    7/3    7/4   0/13   0/10                                       est [CR] [LF]

Line 10
 3/1    3/0   0/13   0/10                                              10 [CR] [LF]

Line 11
 3/1    3/1    2/0    2/0    2/0    2/0    2/0    2/0    2/0    3/0    11         0
 2/0    2/0    3/1    2/0    2/0    3/2    2/0    2/0    3/3    2/0      1   2   3
 2/0    3/4    2/0    2/0    3/5    2/0    2/0    3/6    2/0    2/0     4   5   6
 3/7    2/0    2/0    3/8    2/0    2/0    3/9    2/0    3/1    3/0    7   8   9 10
 2/0    3/1    3/1    2/0    3/1    3/2    2/0    3/1    3/3    2/0     11  12  13
 3/1    3/4    2/0    3/1    3/5                                       14  15
0/13   0/10                                                            [CR] [LF]

Line 12
 3/1    3/2    2/0    2/0    2/0    2/0    2/0    3/0    2/0           12       0
 2/0    2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    3/0    2/0    2/0    4/0    2/0    2/0               0   @
 5/0    2/0    2/0    2/0    2/0    2/0    7/0    2/0    2/0           P       p
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
11/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0           °
14/0    2/0    2/0   15/0   0/13   0/10                                Ω   κ [CR] [LF]

Line 13
 3/1    3/3    2/0    2/0    2/0    2/0    2/0    3/1    2/0           13       1
 2/0    2/0    2/0    2/0    2/0    2/0
 2/1    2/0    2/0    3/1    2/0    2/0    4/1    2/0    2/0           !   1   A
 5/1    2/0    2/0    6/1    2/0    2/0    7/1    2/0    2/0           Q   a   q
 2/0    2/0    2/0    2/0    2/0    2/0   10/1    2/0    2/0                   ¡
11/1    2/0    2/0   12/1    2/0    2/0    2/0    2/0    2/0    2/0    ±   `
14/1    2/0    2/0   15/1   0/13   0/10                                Æ   æ [CR] [LF]

Line 14
 3/1    3/4    2/0    2/0    2/0    2/0    2/0    3/2    2/0           14       2
 2/0    2/0    2/0    2/0    2/0    2/0
 2/2    2/0    2/0    3/2    2/0    2/0    4/2    2/0    2/0           "   2   B
 5/2    2/0    2/0    6/2    2/0    2/0    7/2    2/0    2/0           R   b   r
 2/0    2/0    2/0    2/0    2/0    2/0   10/2    2/0    2/0                   ¢
11/2    2/0    2/0   12/2    2/0    2/0    2/0    2/0    2/0    2/0    ²   ´
14/2    2/0    2/0   15/2   0/13   0/10                                Đ   đ [CR] [LF]

Line 15
 3/1    3/5    2/0    2/0    2/0    2/0    2/0    3/3    2/0           15       3
 2/0    2/0    2/0    2/0    2/0    2/0
 2/3    2/0    2/0    3/3    2/0    2/0    4/3    2/0    2/0           #   3   C
 5/3    2/0    2/0    6/3    2/0    2/0    7/3    2/0    2/0           S   c   s
 2/0    2/0    2/0    2/0    2/0    2/0   10/3    2/0    2/0                   £
11/3    2/0    2/0   12/3    2/0    2/0    2/0    2/0    2/0    2/0    ³   ^
14/3    2/0    2/0   15/3   0/13   0/10                                ª   ð [CR] [LF]
```

```
Line 16
 3/1    3/6    2/0    2/0    2/0    2/0    2/0    3/4    2/0           16     4
 2/0    2/0    2/0    2/0    2/0    2/0
 2/4    2/0    2/0    3/4    2/0    2/0    4/4    2/0    2/0           ¤  4  D
 5/4    2/0    2/0    6/4    2/0    2/0    7/4    2/0    2/0           T  d  t
 2/0    2/0    2/0    2/0    2/0    2/0   10/4    2/0    2/0                 $
11/4    2/0    2/0   12/4    2/0    2/0    2/0    2/0    2/0    2/0    ×  ~
14/4    2/0    2/0   15/4   0/13   0/10                                Ħ  ħ [CR] [LF]

Line 17
 3/1    3/7    2/0    2/0    2/0    2/0    2/0    3/5    2/0           17     5
 2/0    2/0    2/0    2/0    2/0    2/0
 2/5    2/0    2/0    3/5    2/0    2/0    4/5    2/0    2/0           %  5  E
 5/5    2/0    2/0    6/5    2/0    2/0    7/5    2/0    2/0           U  e  u
 2/0    2/0    2/0    2/0    2/0    2/0   10/5    2/0    2/0                 ¥
11/5    2/0    2/0   12/5    2/0    2/0    2/0    2/0    2/0    2/0    µ  ¯
 2/0    2/0    2/0   15/5   0/13   0/10                                   ı [CR] [LF]

Line 18
 3/1    3/8    2/0    2/0    2/0    2/0    2/0    3/6    2/0           18     6
 2/0    2/0    2/0    2/0    2/0    2/0
 2/6    2/0    2/0    3/6    2/0    2/0    4/6    2/0    2/0           &  6  F
 5/6    2/0    2/0    6/6    2/0    2/0    7/6    2/0    2/0           V  f  v
 2/0    2/0    2/0    2/0    2/0    2/0   10/6    2/0    2/0                 #
11/6    2/0    2/0   12/6    2/0    2/0    2/0    2/0    2/0    2/0    ¶  ˘
14/6    2/0    2/0   15/6   0/13   0/10                                Ĳ  ĳ [CR] [LF]

Line 19
 3/1    3/9    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    19
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
9/11    3/1    2/0   4/12                                            [SVS(1)]
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
 2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0    2/0
 3/1    3/9   0/13   0/10                                            19 [CR] [LF]

Line 20
 3/2    3/0    2/0    2/0    2/0    2/0    4/8    6/5    7/2           20    Her
 6/5    2/0    7/4    6/8    6/5    2/0   6/12    6/9   6/14           e the lin
 6/5    2/0    7/3    7/0    6/1    6/3    6/9   6/14    6/7           e spacing
 2/0    6/9    7/3    2/0    7/3    6/5    7/4    2/0    7/4            is set t
6/15    2/0    2/7    3/1   2/13    3/1   2/15    3/2    2/7           o '1-1/2'
 2/0   5/11    5/3    5/6    5/3    2/8    3/1    2/9   5/13            [SVS(1)]
2/14   0/13   0/10                                                   .[CR] [LF]

Line 21
 3/2    3/1   0/13   0/10                                            21 [CR] [LF]
```

Line 22

3/2	3/2	2/0	2/0	2/0	2/0	2/0	3/7	2/0		22		7	
2/0	2/0	2/0	2/0	2/0	2/0								
2/7	2/0	2/0	3/7	2/0	2/0	4/7	2/0	2/0		'	7	G	
5/7	2/0	2/0	6/7	2/0	2/0	7/7	2/0	2/0		W	g	w	
2/0	2/0	2/0	2/0	2/0	2/0	10/7	2/0	2/0				§	
11/7	2/0	2/0	12/7	2/0	2/0	2/0	2/0	2/0	2/0	:	˙		
14/7	2/0	2/0	15/7	0/13	0/10					Ŀ	ŀ	[CR]	[LF]

Line 23

3/2	3/3	2/0	2/0	2/0	2/0	2/0	3/8	2/0		23		8	
2/0	2/0	2/0	2/0	2/0	2/0								
2/8	2/0	2/0	3/8	2/0	2/0	4/8	2/0	2/0		(	8	H	
5/8	2/0	2/0	6/8	2/0	2/0	7/8	2/0	2/0		X	h	x	
2/0	2/0	2/0	2/0	2/0	2/0	10/8	2/0	2/0				¤	
11/8	2/0	2/0	12/8	2/0	2/0	2/0	2/0	2/0	2/0	÷	¨		
14/8	2/0	2/0	15/8	0/13	0/10					Ł	ł	[CR]	[LF]

Line 24

3/2	3/4	2/0	2/0	2/0	2/0	2/0	3/9	2/0		24		9	
2/0	2/0	2/0	2/0	2/0	2/0								
2/9	2/0	2/0	3/9	2/0	2/0	4/9	2/0	2/0		)	9	I	
5/9	2/0	2/0	6/9	2/0	2/0	7/9	2/0	2/0		Y	i	y	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0					
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0					
14/9	2/0	2/0	15/9	0/13	0/10					Ø	ø	[CR]	[LF]

Line 25

3/2	3/5	2/0	2/0	2/0	2/0	3/1	3/0	2/0		25		10	
2/0	2/0	2/0	2/0	2/0	2/0								
2/10	2/0	2/0	3/10	2/0	2/0	4/10	2/0	2/0		*	:	J	
5/10	2/0	2/0	6/10	2/0	2/0	7/10	2/0	2/0		Z	j	z	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0					
2/0	2/0	2/0											
12/10	2/0	2/0	2/0	2/0	2/0	2/0				˚			
14/10	2/0	2/0	15/10	0/13	0/10					Œ	œ	[CR]	[LF]

Line 26

3/2	3/6	2/0	2/0	2/0	2/0	3/1	3/1	2/0		26		11	
2/0	2/0	2/0	2/0	2/0	2/0								
2/11	2/0	2/0	3/11	2/0	2/0	4/11	2/0	2/0		+	;	K	
5/11	2/0	2/0	6/11	2/0	2/0	2/0	2/0	2/0		[	k		
2/0	2/0	2/0	2/0	2/0	2/0	10/11	2/0	2/0				«	
11/11	2/0	2/0	12/11	2/0	2/0	2/0	2/0	2/0	2/0	»	¸		
14/11	2/0	2/0	15/11	0/13	0/10					º	ß	[CR]	[LF]

Line 27

3/2	3/7	2/0	2/0	2/0	2/0	3/1	3/2	2/0		27		12	
2/0	2/0	2/0	2/0	2/0	2/0								
2/12	2/0	2/0	3/12	2/0	2/0	4/12	2/0	2/0		,	<	L	
2/0	2/0	2/0	6/12	2/0	2/0	7/12	2/0	2/0			l	|	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0					
11/12	2/0	2/0	12/12	2/0	2/0	2/0	2/0	2/0	2/0	¼	¯		
14/12	2/0	2/0	15/12	0/13	0/10					Þ	þ	[CR]	[LF]

Line 28

3/2	3/8	2/0	2/0	2/0	2/0	3/1	3/3	2/0		28 13
2/0	2/0	2/0	2/0	2/0	2/0					
2/13	2/0	2/0	3/13	2/0	2/0	4/13	2/0	2/0		- = M
5/13	2/0	2/0	6/13	2/0	2/0	2/0	2/0	2/0		] m
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0		
11/13	2/0	2/0	12/13	2/0	2/0	2/0	2/0	2/0	2/0	½ ˝
14/13	2/0	2/0	15/13	0/13	0/10					T t [CR] [LF]

Line 29

3/2	3/9	2/0	2/0	2/0	2/0	3/1	3/4	2/0		29 14
2/0	2/0	2/0	2/0	2/0	2/0					
2/14	2/0	2/0	3/14	2/0	2/0	4/14	2/0	2/0		. > N
2/0	2/0	2/0	6/14	2/0	2/0	2/0	2/0	2/0		n
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0		
11/14	2/0	2/0	12/14	2/0	2/0	2/0	2/0	2/0	2/0	¾ ˛
14/14	2/0	2/0	15/14	0/13	0/10					Ŋ ŋ [CR] [LF]

Line 30

3/3	3/0	2/0	2/0	2/0	2/0	3/1	3/5	2/0		30 15
2/0	2/0	2/0	2/0	2/0	2/0					
2/15	2/0	2/0	3/15	2/0	2/0	4/15	2/0	2/0		/ ? O
5/15	2/0	2/0	6/15	2/0	2/0	2/0	2/0	2/0		_ o
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0		
11/15	2/0	2/0	12/15	2/0	2/0	2/0	2/0	2/0	2/0	¿ ˇ
14/15	0/13	0/10								ŉ [CR] [LF]

Line 31

3/3	3/1	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	31
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
9/11	3/2	2/0	4/12							[SVS(2)]
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	
3/3	3/1	0/13	0/10							31 [CR] [LF]

Line 32

3/3	3/2	2/0	2/0	2/0	2/0	4/8	6/5	7/2		32 Her
6/5	2/0	7/4	6/8	6/5	2/0	6/12	6/9	6/14		e the lin
6/5	2/0	7/3	7/0	6/1	6/3	6/9	6/14	6/7		e spacing
2/0	6/9	7/3	2/0	7/3	6/5	7/4	2/0	7/4		is set t
6/15	2/0	2/7	3/2	2/7	2/0	5/11	5/3	5/6		o '2' [SV
5/3	2/8	3/2	2/9	5/13	2/14	0/13	0/10			S(2)]. [CR] [LF]

Line 33

3/3	3/3	2/0	2/0	2/0	2/0	2/0	2/0	2/0	2/0	33
2/0	2/0	1/10	0/13	0/10						⸮ [CR] [LF]

```
Line 34
 3/3     3/4    2/0    2/0    2/0    2/0    2/0    2/0                 34
9/11     3/4   6/13                                                    [SGR(4)]
 4/6    6/15    7/2   6/13    6/1    7/4    2/0    4/5    6/6    6/6   Format Eff
 6/5     6/3    7/4   6/15    7/2    2/0    5/4    6/5    7/3    7/4   ector Test
 7/3    9/11    3/0   6/13    2/0    2/0    2/0    2/0    2/0          s [SGR(0)]
5/11     5/3    4/7    5/2    2/8    3/4    2/9   5/13                 [SGR(4)]
0/13    0/10                                                           [CR] [LF]

Line 35
 0/8     0/8    0/8    0/8    0/8    5/8    5/8   0/13                 [5x[BS]] XX [CR]
 3/3     3/5    2/0    2/0    2/0    2/0    2/0    2/0                 35
12/12   6/14  12/12   6/15  12/12   6/14  12/12    7/3                 _n_o_n_s
12/12    7/0  12/12    6/1  12/12    6/3  12/12    6/9                 _p_a_c_i
12/12   6/14  12/12    6/7  12/12    2/0  12/12    7/5                 _n_g_ _u
12/12   6/14  12/12    6/4  12/12    6/5  12/12    7/2                 _n_d_e_r
12/12   6/12  12/12    6/9  12/12   6/14  12/12    6/5                 _l_i_n_e
 0/13   0/10                                                           [CR] [LF]

Line 36
 3/3     3/6    2/0    2/0    2/0    2/0    2/0    2/0                 36
 4/5    8/11    6/9   8/12   3/13   4/13                               E [PLD] i [PLU]=M
8/11     6/9                                                           [PLD] i
8/12     6/3   8/12    3/2   8/11                                      [PLU] c [PLU] 2 [PLD
 2/0     2/0    2/0    2/0    2/0    2/0    2/0
12/12    4/5  12/12   8/11    6/9   8/12  12/12   3/13                 _E_ [PLD] i [PLU] _=
12/12   4/13  12/12   8/11    6/9   8/12  12/12    6/3                 _M_ [PLD] i [PLU] _c
12/12   8/12    3/2   8/11                                             _ [PLU] 2 [PLD]
 2/0     2/0    2/0    2/0    2/0    2/0
12/12    4/5   8/11  12/12    6/9   8/12  12/12   3/13                 _E [PLD] _i [PLU] _=
12/12   4/13   8/11  12/12    6/9   8/12  12/12    6/3                 _M [PLD] _i [PLU] _c
8/12   12/12    3/2   8/11                                             [PLU] _2 [PLD]
0/13    0/10                                                           [CR] [LF]

Line 37
 3/3     3/7    2/0    2/0    2/0    2/0    2/0    2/0                 37
9/11     3/4   6/13                                                    [SGR(4)]
 4/5    8/11    6/9   8/12   3/13   4/13                               E [PLD] i [PLU] = M
8/11     6/9                                                           [PLD] i
8/12     6/3   8/12    3/2   8/11                                      [PLU] c [PLU] 2 [PLD
9/11     3/0   6/13                                                    [SGR(0)]
 2/0     2/0    2/0    2/0    2/0    2/0    2/0
9/11     3/4   6/13    4/5   9/11    3/0   6/13                        [SGR(4)] E [SGR(0)]
8/11                                                                   [PLD]
9/11     3/4   6/13    6/9   9/11    3/0   6/13                        [SGR(4)] i [SGR(0)]
8/12                                                                   [PLU]
9/11     3/4   6/13   3/13   4/13   9/11    3/0   6/13                 [SGR(4)] = M [SGR(0)
8/11                                                                   [PLD]
9/11     3/4   6/13    6/9   8/12                                      [SGR(4)] i [PLU]
```

Line 37 (cont'd)

9/11	3/0	6/13								[SGR(0)]
9/11	3/4	6/13	6/3	9/11	3/0	6/13				[SGR(4)] c [SGR(0)
8/12										[PLU]
9/11	3/4	6/13	3/2	8/11						[SGR(4)] 2 [PLD]
9/11	3/0	6/13	2/0	2/0	2/0	2/0	2/0	2/0		[SGR(0)]
5/8	0/10									X [LF]

Line 38

3/3	3/8	0/10	38 [LF]

Line 39

3/3	3/9	0/13	0/10	39 [CR] [LF]

Line 40

3/4	3/0	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	4034567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
8/11	9/11	3/4	6/13							[PLD] [SGR(4)]
3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/0	1234567890
8/12	9/11	3/0	6/13							[PLU] [SGR(0)]
3/1	3/2									

NOTE: This is the end of the test text.

NETWORK-INDEPENDENT BASIC TRANSPORT SERVICE FOR THE TELEMATIC SERVICES

(Geneva, 1980, amended at Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that the Teletex service will be introduced in different types of network, i.e. circuit-switched public data networks (CSPDN), packet-switched public data networks (PSPDN) and the public switched telephone network (PSTN);

(b) that there is a need for international interworking between terminals belonging to the same or different types of Telematic services;

unanimously declares the following view

1 Scope

1.1 This Recommendation defines the *network-independent basic transport service* applicable to Teletex and Group 4 facsimile terminals connected to the types of network mentioned in (a) above in terms of:

a) the transport services provided to the higher layer [the transport services are provided by the transport layer (layer 4) in association with the underlying services provided by the supporting layers 1 to 3];

b) the transport layer procedure (see § 5 below).

Note – The transport layer procedure for integrated services digital networks is for further study. The use of this transport procedure for other Telematic services and the use of other transport procedures is left for further study.

1.2 § 2 describes the transport service. § 3 describes the transport service implementation for different types of networks. § 4 outlines the guidelines for interworking between networks. § 5 specifies the transport layer procedure, and Annexes A and B provide associated state transition diagrams and tables respectively.

2 Transport service

2.1 *Transport service objectives*

2.1.1 The purpose of the transport service is to provide two communicating session entities within two terminals with transport services, i.e. the means for transparent and reliable end-to-end transfer of data between them irrespective of the particular type of network used.

2.1.2 The main requirements of the transport service to be provided by a transport entity to the local transport user, i.e. the session entity, are:

a) *Network independence.* The transport service shall be homogeneous, while allowing a suitable wide variety of underlying communications media, protocols and mechanisms.

b) *End-to-end significance.* The transport service shall have end-to-end significance, connecting the end users irrespective of the number of individual communication links used.

c) *Transparency.* The transport service shall be octet transparent, i.e. not restrict the content, format or coding of the information (data or control) received from or delivered to the transport user.

d) *Error free delivery.* The transport service shall assure error-free delivery. Non-recoverable errors are to be visible to the transport service user.

e) *Cost efficiency.* The transport service shall optimize the use of the available communication resources to provide the performance required by each communicating transport user at maximum efficiency.

2.2 *General structure of the transport service*

2.2.1 The general structure of the transport service is shown in Figure 1/T.70.

3 Transport service implementation for different types of networks

Note – The transport layer procedure on all types of networks is defined in § 5. The network dependent control procedures of the underlying layers are described in the following.

3.1 *Terminals connected to a PSPDN*

3.1.1 *Physical layer DTE/DCE interface characteristics*

The physical layer of Recommendation X.25 applies.

3.1.2 *Link layer procedure*

The link layer procedure shall, unless otherwise specified, be the symmetrical procedures as specified in Recommendation X.25, LAPB (Link Access Procedure B).

3.1.3 *Network layer procedure*

Recommendation X.25 Virtual Call procedures apply. However the following points should be noted when using this transport protocol:

a) The qualifier bit in data packets should always be set to 0.

b) The delivery confirmation bits in all packets should be set to 0.

c) The terminal should not send an *interrupt request* packet.

d) Normal X.25 reset procedures will apply.

e) Each control block or data block of the transport layer shall be carried in a complete data packet sequence.

f) The terminal should not send a *DTE REJ packet.*

g) Terminals shall use a specific protocol identifier within call request/incoming call packets for the Teletex service and Group 4 facsimile apparatus. This identifier is represented by the first octet of the call user data field (remaining octets, if any, should be ignored) as shown below:

   bit 87654321

   octet 1 00000010

   In the case of CSPDN/PSPDN interworking the functional mapping of this protocol identifier requires further study.

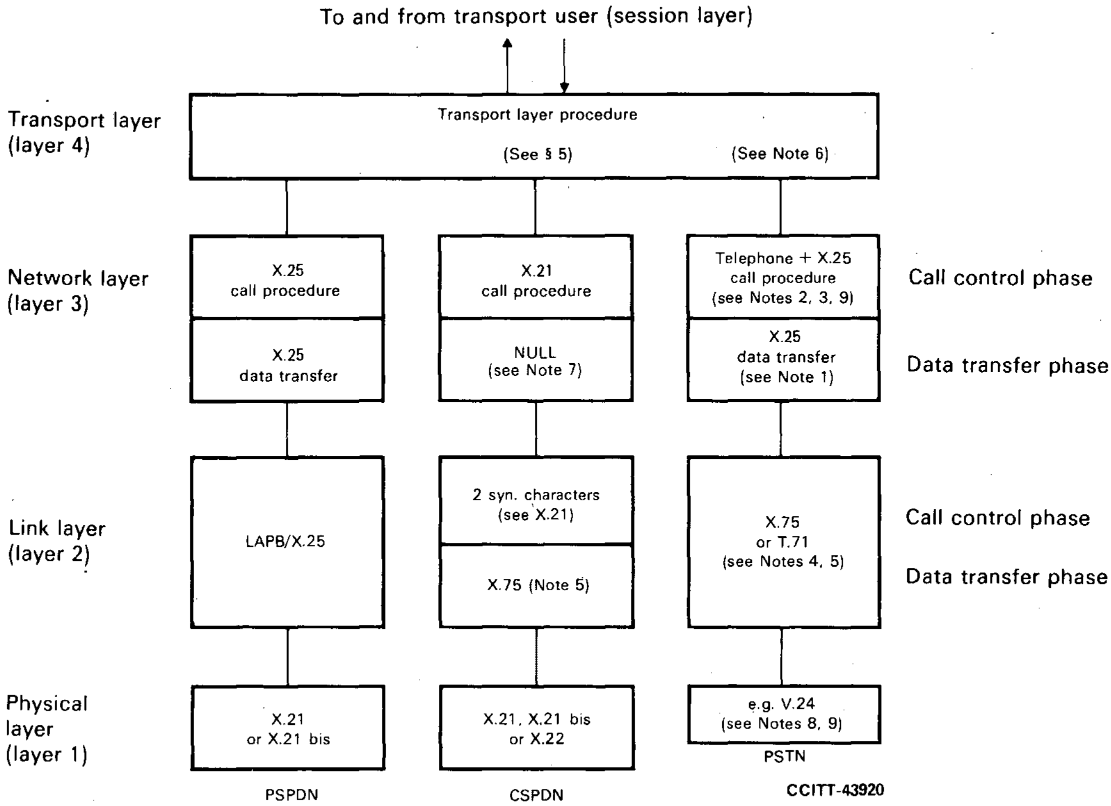
h) Terminals shall not use the fast select facility.

3.2 *Terminals connected to the PSTN*

3.2.1 *Physical layer DTE/DCE interface characteristics*

The DTE/DCE physical layer element shall be in accordance with existing Series V Recommendations. The physical layer may provide for half-duplex or full-duplex transmission depending on the modem standard.

Note – The PSTN modem standards are discussed in Study Group XVII. Furthermore, in the case of a modem integrated in the terminal, the interface may only be functionally equivalent to a Series V Recommendation. This is also for further consideration in Study Group XVII.



Note 1 — The X.25 network layer procedure is introduced to ease interworking with PSPDNs.

Note 2 — The establishing of the network connection is performed by two-stage selection: the first using normal telephone procedures and the second using X.25 call control procedures.

Note 3 — For terminals connected to PSTN accessing PSPDN, the procedures in Note 2 apply. See also Rec. X.32.

Note 4 — T.71 defines a half-duplex link access procedure, based on Recommendation X.75 for single link operation (see § 3.2.2).

Note 5 — The link layer procedures are in accordance with Recommendation X.75 for single link operation (however, see §§ 3.2.2 and 3.3.2) and in this respect Recommendation X.75 (1980 version) is to be regarded as the reference specification of this protocol.

Note 6 — In all cases of interworking including interworking between terminals connected to the same type of network or to different types of networks (i.e. CSPDN, PSPDN, PSTN), this transport layer procedure is executed peer-to-peer between the communicating terminals.

Note 7 — For terminals connected to CSPDNs, no function is needed in the network layer in the data transfer phase as indicated in this figure. However, in order to facilitate interworking with PSPDNs a minimum network layer is introduced (see § 3.3.3).

Note 8 — The modem may also be integrated within the terminal and in such cases Recommendation V.24 need not apply (see § 3.2.1).

Note 9 — For automatic calling and/or answering, Recommendation V.25 may be applicable.

FIGURE 1/T.70

Transport service general structure

3.2.2 *Link layer procedure*

3.2.2.1 Depending on the service provided by the physical layer, the link layer procedures over a single physical circuit between two terminals have to cater for a half-duplex or full-duplex transmission facility to provide a full-duplex service to the network layer. For full-duplex physical layer service, the link layer procedure shall conform to the Link Access Procedure described in Recommendation X.75, for single link operation. For addressing assignments and the system parameters see §§ 3.2.2.2 and 3.2.2.3 respectively. For half-duplex physical layer service the link layer procedure is as defined in Recommendation T.71. This is a half-duplex Link Access Procedure, based on Recommendation X.75 for single link operation.

3.2.2.2 The following describes the application of the link addressing procedure of Recommendation X.75. Link addresses (A and B) shall be assigned dynamically or on a per-call basis according to the following rules:

a) the calling terminal shall take Address A;

b) the called terminal shall take Address B;

c) commands and responses shall be transferred as shown in Figure 2/T.70;

d) A and B addresses are coded as follows:

Address	12345678
A	11000000
B	10000000

Note – The terminal will discard all frames received with an address other than A and B.

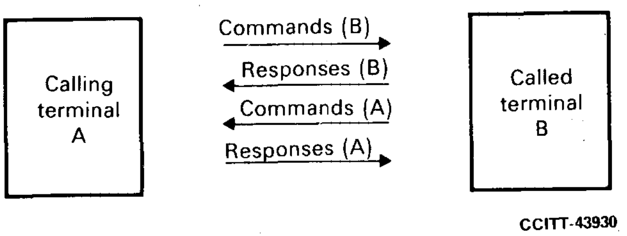


FIGURE 2/T.70

3.2.2.3 System parameters are:

a) timer, T1;

b) maximum number of retransmissions, N2;

c) maximum number of bits in an I frame, N1;

d) maximum number of outstanding I frames, k.

The above system parameters are to be specified by the Administration. However, the possible range of values that may be attributed to each parameter is to be standardized. Such values are for further study.

3.2.3 *Network layer procedure*

3.2.3.1 See § 3.1.3. In addition, for all calls (PSTN only, PSTN-PSPDN, PSTN-PSPDN-PSTN) second stage addressing will apply using X.25 virtual call procedures. The calling terminal should include the called address and the calling address (see Note 2) in call request packets. The format of the called address shall conform to:

a) the telephone network addressing scheme for PSTN only calls;

b) the telephone network addressing scheme with an X.121 DNIC for PSTN-PSPDN calls (see Note 3);

c) the X.121 addressing scheme for PSTN-PSPDN calls (see Note 1).

Note 1 – For other cases of internetworking the above rule shall apply.

Note 2 – In the case of PSTN-PSPDN calls the verification of the calling address by the network requires further study. The format of the calling address is for further study.

Note 3 – The feasibility of such connections is for further study.

3.3 *Terminals connected to a CSPDN*

3.3.1 *Physical layer DTE/DCE interface characteristics*

The DTE/DCE physical interface characteristics shall be in accordance with Recommendation X.21, or as an option, X.22 for multi-call operation.

3.3.2 *Link layer procedure*

3.3.2.1 The link layer procedure shall be used during the data phase of Recommendation X.21 or X.21 *bis* for data interchange over a single physical circuit. The link layer procedure shall conform to the level 2 procedures described in Recommendation X.75 for single link operation.

3.3.2.2 The following describes the application of the link addressing procedures of Recommendation X.75. Link addresses (A and B) shall be assigned dynamically on a per-call basis according to the following rules:

a) the calling terminal shall take address A;

b) the called terminal shall take address B;

c) commands and responses shall be transferred as shown in Figure 2/T.70;

d) A and B addresses are coded as follows:

Address	12345678
A	11000000
B	10000000

Note – The terminal will discard all frames received with an address other than A and B.

3.3.2.3 The system parameters shall have the following values:

a) timer T1 = 6 s (for average I frame length of 518 octets);

b) maximum number of retransmissions N2 = 8;

c) maximum number of outstanding I frames k = 7;

d) maximum number of bits in an I frame N1 = 16 512 bits. The actual maximum number of bits in an I frame is a terminal design parameter, which may depend upon the maximum length of the network layer data block. The lower limit for N1 to be implemented by Teletex terminals is 1152 bits. Whether a new value for Group 4 facsimile apparatus is required or not, it is left for further study.

3.3.3 *Network layer procedure*

The network layer procedure used on a CSPDN is described in the following. Further study on this network layer procedure will also be carried on.

3.3.3.1 *Call control phase*

The call control procedure conforms to Recommendation X.21, or as an option, Recommendation X.22 for multi-call operation.

3.3.3.2 *Data transfer phase*

A minimal network layer is present during the data transfer phase and accommodated through the use of a two-octet network block header. The header comprises a one-octet length indicator followed by a network block type code. The only network block currently defined is a network data block as shown in Figure 3/T.70.

		Bits							
		8	7	6	5	6	3	2	1
Octets	1	0	0	0	0	0	0	0	1[a)]
	2	M[b)]	Q[c)]	0	0	0	0	0	0
		Network user data field							

a) The length indicator expresses in octets the length of the network data block header. This length does not include octet 1.

b) The more data mark (M) is used to preserve the integrity of transport layer control and transport data blocks. When M is set to 1 it indicates that more data are to follow.

c) The qualifier bit (Q) is introduced to provide a functional mapping with the X.25 qualifier bit for CSPDN/PSPDN interworking. The Q bit is not used for telematic services and shall be set to 0.

FIGURE 3/T.70
Network data block

4 Interworking between networks

4.1 It is the responsibility of Administrations to decide in which network(s) the telematic services are to be provided.

4.2 Three possibilities are considered below:

a) Terminals connected to a circuit switched public data network (CSPDN);

b) Terminals connected to a packet switched public data network (PSPDN);

c) Terminals connected to a public switched telephone network (PSTN).

4.3 Interworking between telematic terminals connected to any network must be possible.

4.4 International interworking between telematic terminals shall preferably take place between networks of the same type when these networks are provided by both countries involved.

4.5 In the case of international interworking between telematic terminals connected to dissimilar networks, Recommendation X.300 shall apply.

Note – The interworking between CSPDNs and PSPDNs will require a gateway function between the two networks. Two specific requirements of this gateway function have been identified:

a) For an interim period, a packet layer reset in a PSPDN will be mapped to a link layer disconnection in a CSPDN. Alternative functional mappings are for further study.

b) The execution of necessary supervisory functions. This aspect requires further definition.

5 Transport layer procedure

5.1 *Transport functions*

5.1.1 *General*

5.1.1.1 The transport layer will perform all those functions that are necessary to bridge the gap between the services provided by the network layer and the services needed by the session layer. Therefore, the functions performed are dependent on two criteria: the services provided by the underlying network layer and the services required by the session layer.

5.1.1.2 It is the responsibility of the transport service user to select a given quality of service, which may imply the use of certain transport layer functions such as:

a) establishment of a transport connection
   - transport connection identification
   - transport connection multiplexing;

b) data transfer
   - sequence control
   - error detection
   - error recovery
   - segmenting and reassembling
   - flow control
   - purge;

c) termination of a transport connection.

Note – Not all of the above functions will be available in the basic transport service (see § 5.1.3).

5.1.2 *Transport protocol classes*

5.1.2.1 Transport layer functions are grouped (for ease of negotiation) into a hierarchical system of transport protocol classes whereby classes occupying superior positions in the hierarchy implement functions of the lower classes together with the optional functions identified for their own class.

5.1.2.2 During transport connection establishment the use of a given transport protocol and optional functions should be negotiated according to the following rules:

- the calling terminal indicates the transport protocol class and (if applicable) optional functions required;
- the called terminal indicates the transport protocol class and (if applicable) optional functions that it is willing to support;
- all parameters to be used in the transport connection must be explicity indicated, otherwise default values will apply.

5.1.2.3 The basic transport service described here is fulfilled by a protocol denoted in Recommendation X.224 as transport protocol class 0. That protocol class is compatible with Recommendation T.70. In the event of a discrepancy between transport protocol class 0 as described in Recommendation X.224 and Recommendation T.70, the latter takes precedence.

5.1.3 *The basic transport service (TS)*

5.1.3.1 A limited set of transport layer functions is defined for a basic transport service. The basic transport service is provided by transport layer functions which are performed by *transport layer protocol elements.*

5.1.3.2 Transport protocol data units (TPDUs) carrying transport service (TS) user information or control information are called *blocks.*

5.1.3.3 Transport layer block types are as follows:

a) transport connection request (TCR) block;
b) transport connection accept (TCA) block;
c) transport connection clear (TCC) block;
d) transport data (TDT) block;
e) transport block reject (TBR) block.

5.1.3.4 The TCR and TCA blocks are used to indicate the protocol class, and optional functions, applying to a transport connection. The TCC block is used to indicate the reason for refusing a connection establishment. The TDT block carries information of the transport service user. The TBR block is used to report procedure errors to the remote terminal.

5.1.4 *Transport layer functions*

5.1.4.1 Basic class functions and associated transport layer protocol elements, i.e. blocks, include:

a) transport connection establishment, transport connection identification, optional extended addressing and optional transport data block size negotiation (TCR, TCA and TCC blocks);

b) data delimitation, segmentation/reassembling of arbitrarily long transport service data units (TSDU). These are contained within TDT blocks. The end of a TSDU is indicated by a TSDU end mark in the last data block;

c) detection and indication of procedural errors (TBR block).

5.1.4.2 Other characteristics of the basic transport service are:

a) maintenance of TSDU integrity;

b) overflow: if the user cannot absorb new data and if the appropriate buffers are not available, flow control is performed at network/link layer as appropriate;

c) error: no mechanism is provided within the transport layer to facilitate recovery from detected errors. Where such errors are detected the user of the transport service should be informed so that appropriate recovery action may be taken.

5.2 *Description of connection establishment and termination procedures*

5.2.1 *General*

5.2.1.1 The transport layer connection establishment and termination procedures shall also be used for negotiating transport protocol class and, if applicable, optional transport connection functions.

5.2.1.2 For the basic transport service, means are provided to establish a transport connection using a TCR block and a TCA block. This exchange provides:

a) a way to negotiate options;

b) a transport connection identification. The transport connection is identified by use of cross-references. Each end of the connection is responsible for selecting a suitable transport connection identifier.

5.2.1.3 This mechanism also provides an identification of the transport connection independent of any network connection identification and therefore provides independence from the life of the network connection. The binary value 0 should not be used as an identifier. The use of such references for reconnection requires further definition.

5.2.2 *Transport connection request (TCR) block*

5.2.2.1 The calling terminal shall indicate a transport connection request by transferring a TCR block to the remote terminal. The TCR block includes the transport functions (e.g. source reference, class, and optional functions) for negotiation of the characteristics of the transport connection being established.

5.2.3 *Transport connection accept (TCA) block*

5.2.3.1 The called terminal shall indicate its acceptance of the transport connection by transferring a TCA block to the remote terminal. The TCA block includes the transport parameters applying to the connection and to be used by the calling terminal.

5.2.3.2 If a terminal receives the request for an optional TDT block size it may either:

- indicate its support by reproducing the requested value in the TCA block;
- request in the TCA block the use of a shorter allowable TDT block. The calling side either accepts this size by sending the first TDT block or disconnects the network connection;
- not accept the requested TDT block size parameter value by sending a TCA block without a TDT block size parameter. Therefore, the standardized TDT block size will apply.

A TCR requesting an optional TDT block size not supported by the called side should not be answered with TBR.

5.2.4 *Transport connection clear (TCC) block*

5.2.4.1 If a transport connection cannot be established, the called terminal shall respond to the TCR block with a TCC block. The clearing cause shall indicate why the connection was not accepted.

It is up to the calling side whether the receipt of a TCC will cause complete disconnection or whether a new TCR with a parameter different from the first one will be sent (e.g. another extended layer-4 address). In order to allow for subsequent TCRs, the sender of TCC may provide in the optional parameter field an appropriate parameter and associated value to indicate that another TCR is invited. The new optional parameter and its associated value(s) are for further study.

Note – There is no explicit transport connection termination procedure in this Recommendation. Therefore, the lifetime of the transport connection is directly correlated to the lifetime of the supporting network connection.

5.2.5 *Transport connection collision*

5.2.5.1 If the calling terminal receives a TCR block, it shall transfer a TBR block to notify the called terminal of the procedure error (see Annex B).

5.2.6 *Extended addressing*

5.2.6.1 The extended addressing capability may be used to address terminals in a multiterminal configuration.

The extension addresses for called and calling terminals are optional parameters to TCR and TCA. The use of the calling extension address is for further study.

5.2.6.2 The receiving terminal shall respond with a TCA according to Table 1/T.70.

TABLE 1/T.70

Received TCR	Receiver reaction	
	Multi-terminal with extended addressing [a]	Stand-alone terminal
Without extended addressing	Send TCA with extended addressing	Send TCA without extended addressing
With extended addressing	Send TCA with extended addressing [b]	Send TCA without extended addressing

[a] Multi-terminal configuration, with capability for extended addressing.

[b] If the called terminal is occupied or out of order, the call should be routed to a default terminal or mailbox. The sender will then be informed of the routing by the extension address of the connected terminal. The receiver of TCR may also in this case react by sending TCC.

5.2.6.3 The calling terminal may, when receiving a called terminal address in the TCA, act as specified in Table 2/T.70.

TABLE 2/T.70

Sent TCR	Calling terminal reaction		
	TCA received with:		
	no extended addressing	correct extended addressing	incorrect extended addressing
Without extended addressing	OK	Neglect extension (See Note)	
With extended addressing	[a]	OK	[a]

[a] Reaction left to the discretion of the calling terminal.

Note – Terminal complying with the 1980-1984 version of Recommendation T.70 may react by releasing the network connection.

5.3 *Description of data transfer procedures*

5.3.1 *General*

5.3.1.1 The data transfer procedure described in the following subsections applies only when the transport layer is in the data transfer phase, i.e. after completion of transport connection establishment and prior to clearing.

Note – When a connection is cleared, transport data blocks may be discarded. Hence it is left to the transport service user to define protocols able to cope with the various possible situations that may occur.

5.3.2 *Transport data block (TDT) length*

5.3.2.1 The standard maximum TDT block length to be supported by all terminals is 128 octets including the data block header octets. However, the TDT block length may be restricted to a lower value when the TDT block is concatenated with other TDT blocks (see § 5.5.3).

5.3.2.2 Other maximum data field lengths may be supported in conjunction with an optional TDT block size negotiation connection function (see §§ 5.5.4.3 and 5.5.5.3). Optional maximum data field lengths shall be chosen from the following: 256, 512, 1024 and 2048 octets. If the requested optional TDT block size cannot be supported, a shorter allowable TDT block size must be selected (see § 5.2.3.2).

The agreed maximum TDT block size should be aimed at for TDT blocks having the TSDU end mark set to 0 and a number of octets less than the agreed maximum shall not cause the receiving transport entity to reject this TDT block.

5.3.3 *Transport service data unit (TSDU) end*

5.3.3.1 The *TSDU end mark* is used to preserve the integrity of the TSDU. The TSDU end mark is set to binary 1 in the last TDT data block carrying information related to a certain TSDU. Exceptionally, this TDT block may be sent without carrying user information in order to allow for an immediate termination of a TSDU in certain error conditions.

In case of a TSDU that comprises a single TDT block the TSDU end mark is also set to 1. In all other cases the TSDU end mark is set to zero.

5.4 *Treatment of procedure errors*

5.4.1 A terminal shall send a TBR block to the remote terminal to report the receipt of an invalid or not implemented block (if not explicitly specified otherwise in this Recommendation). During the establishment of a transport connection, terminals shall not send a TBR block upon the receipt of a TCR block whose parameters or parameter values are invalid or not implemented. In this case, terminals shall act as if no errors have occurred and send the appropriate response (if any).

A terminal receiving a TBR block shall take appropriate recovery action.

Note 1 – A TBR whether invalid or valid shall not be answered by sending a TBR block.

Note 2 – Terminals complying with the Recommendation T.70 version of the 1981-1984 study period may react to all of the above indicated conditions by sending TBR.

Note 3 – The definition of invalid block/parameter, etc. is provided by the state transition tables (see Annex B).

5.5 *Formats*

5.5.1 *General*

5.5.1.1 Transport protocol data units (TPDUs) carrying transport service (TS) user information or control information are called *blocks* (see § 5.1.3). All blocks contain an integral number of octets.

5.5.1.2 Bits of an octet are numbered 8 to 1 where bit 1 is the low order bit and is transmitted first. Octets of a block are consecutively numbered starting from 1 and are transmitted in this order.

5.5.1.3 *TDT block(s)* are used to transfer a transport service data unit (TSDU) transparently whilst maintaining the structure of the latter by means of the TSDU end mark.

5.5.1.4 *Control blocks* (TCR, TCA, TCC, TBR) are used to control the transport protocol functions, including optional functions.

5.5.1.5 A parameter field is present in all control blocks within the basic transport service to indicate optional functions. The parameter field contains one or more parameter elements. The first octet of each parameter element contains a parameter code to indicate the function(s) requested.

The general coding structure is shown in Figure 4/T.70.

Octets	Bits 8 … 1
1	Parameter code
2	Parameter length indicator
3 … n	Parameter value

FIGURE 4/T.70
Parameter element coding structure

5.5.1.6 The parameter code field is binary coded and, without extension, provides for a maximum of 255 parameters. Parameter code 11111111 is reserved for extension of the parameter code. The extension mechanism is for further study.

Octet 2 indicates the length, in octets, of the parameter value field. The parameter field length is binary coded and bit 1 is the low order bit of this indicator.

Octet 3 and subsequent octets contain the value of the parameter identified in the parameter code field. The coding of the parameter value field is dependent on the function being requested.

5.5.2 *Structure of transport control and transport data blocks*

5.5.2.1 Figure 5/T.70 illustrates the general structure of transport layer blocks. A summary of transport layer blocks is given in Figure 6/T.70.

	Octet 1	Octet 2	Octet 3 ... Octet N	Octet N+1 ... Octet M
Bits 8	1			
	Length indicator	Block type	Functional code field (fixed format)	Parameter or data field (variable format)

CCITT-43961

FIGURE 5/T.70

General block structure

5.5.2.2 *Length indicator (LI) field*

5.5.2.2.1 Octet 1 contains the length indicator (LI). The value of this indicator is a binary number that represents the length in octets of the control block (including parameters) and the header length in octets of data blocks (excluding any subsequent user information). In both cases this length does not include octet 1.

5.5.2.2.2 The basic LI value shall be restricted to 127 (i.e., a binary value of 01111111). The use of higher LI values and the use of the binary value 11111111 for extension purposes is for further study.

	Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	
TCR	Length	11100000	00000000	00000000	Source	reference	00000000	Parameters
TCA	Length	11010000	Destination	reference	Source	reference	00000000	Parameters
TCC	Length	10000000	Destination	reference	Source	reference	Clearing cause	Parameters
TBR	Length	01110000	Destination	reference	Reject cause	Parameters		
TDT	Length	11110000	(TSDU end mark) 0000000	Data				

TSDU end mark

CCITT-43971

Note — The terms "source" and "destination" refer to the initiator and the recipient of the transport protocol data unit (TPDU), respectively. The value of the "source reference" is a local system parameter. The source reference of a received transport block is to be used as destination reference in the response to that transport block.

FIGURE 6/T.70

Transport layer block types

5.5.2.3 *Block type field*

5.5.2.3.1 Octet 2 contains the block type code. Bits 1 to 4 of octet 2 are set to 0 for all transport layer blocks currently defined. It is for further study to determine whether or not bits 1 to 4 are required for future extension to the range of transport layer blocks currently defined or are used for other functions.

5.5.2.4 *Functional code field*

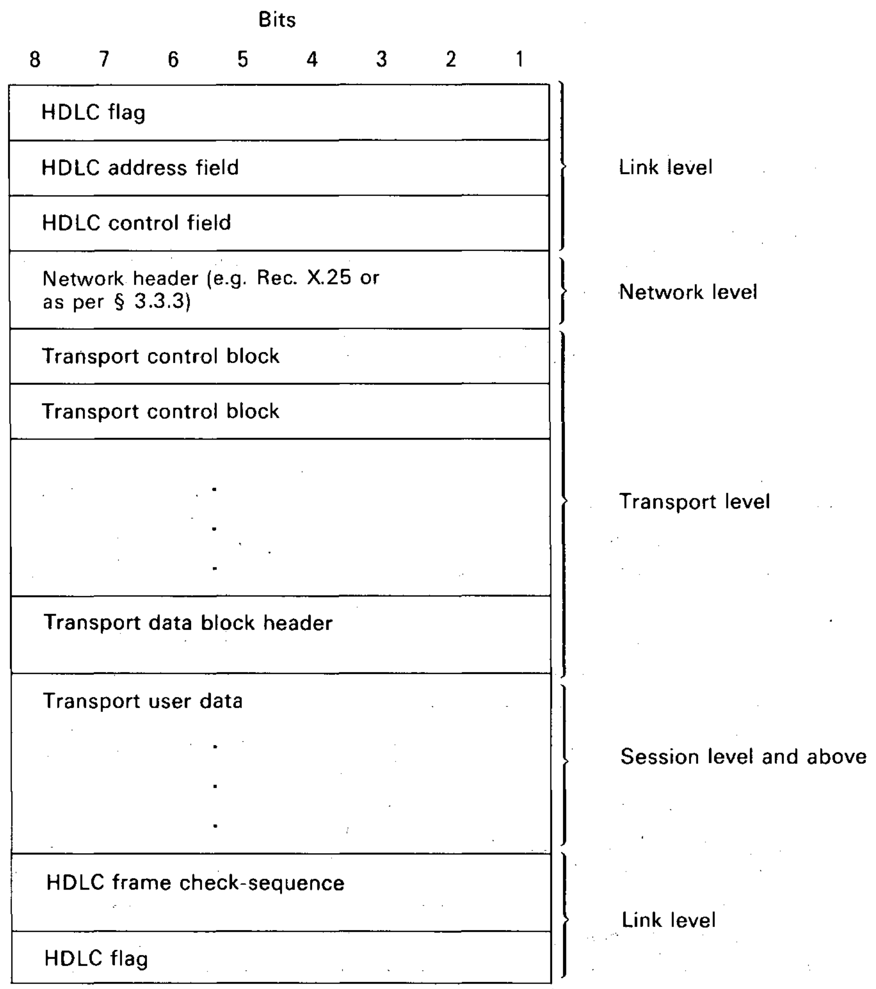
5.5.2.4.1 Octet 3 and subsequent octets contain functional codes in a fixed format as per the block type (see Figure 6/T.70).

5.5.2.5 *Parameter or TSDU field*

5.5.2.5.1 A parameter field or a data field containing transport service (TS) user data may optionally follow the functional code field.

5.5.3 *Concatenation*

5.5.3.1 Concatenation of transport control and/or transport data blocks is currently not applicable to this Recommendation. However, where concatenation is used in the future, the arrangement shown in Figure 7/T.70 would apply.



Note — This figure does not imply that a transport data or control block will fit within a single network data block.

FIGURE 7/T.70
Information field structure of HDLC I-frame (example)

5.5.4 *Transport connection request (TCR) block format*

5.5.4.1 Figure 8/T.70 illustrates the format of the TCR block.

Octets	Bits 8	7	6	5	4	3	2	1
1	Length (octets)							
2	1	1	1	0	0	0	0	0 [a]
3	Not used (set to 0)							
4	Not used (set to 0)							
5	Source							
6	reference							
7	0	0	0	0	0	0	0	0 [b]
8 … n	Parameters [c] (optional)							

[a] Block type: TCR.

[b] Transport service extension field: Octet 7 is reserved for any future extension such as providing for a range of transport service classes. In the basic transport service this octet shall be set to zero.

[c] The parameter field is present only when the terminal is requesting an optional transport connection function.

FIGURE 8/T.70

Transport connection request block

5.5.4.2 *Parameters for extended addressing*

Separate parameters are provided for the indication of called and calling extension addresses. The coding of these parameters is shown in Figure 9/T.70. The setting of bit 8 for extended addressing should be ignored by the transport layer.

The use of more than one called extension address is for further study.

Octets	Bits 8 7 6 5 4 3 2 1	
1	Extension address parameter type	11000001 for calling address type or 11000010 for called address type
2	Parameter length indicator	
3	IA5 digit 1	
	IA5 digit 2	
	⋮	
	IA5 digit n	

FIGURE 9/T.70

Extended addressing

5.5.4.3 *Parameter for transport data block size negotiation*

This parameter defines the proposed maximum transport data block size (in octets including the transport data block header) to be used over the requested transport connection. The coding of this parameter is shown in Figure 10/T.70.

Octets	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	
1	1	1	0	0	0	0	0	0	Parameter type code
2	0	0	0	0	0	0	0	1	Parameter length indicator
3	0	0	0	0	X	X	X	X	Transport data block size

XXXX:
- 1 0 1 1 = 2048 octets
- 1 0 1 0 = 1024 octets
- 1 0 0 1 = 512 octets
- 1 0 0 0 = 256 octets
- 0 1 1 1 = 128 octets

FIGURE 10/T.70

Transport data block size parameter

5.5.5 *Transport connection accept (TCA) block format*

5.5.5.1 Figure 11/T.70 illustrates the format of the TCA block.

Octets	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
1	Length (octets)							
2	1	1	0	1	0	0	0	0[a)]
3	Destination							
4	reference							
5	Source							
6	reference							
7	0	0	0	0	0	0	0	0[b)]
8 … n	Parameters (optional)[c)]							

a) Block type: TCA.

b) Transport service extension field; Octet 7 is reserved for any future extension such as providing for a range of transport service classes. In the basic transport service this octet shall be set to zero irrespective of the setting in the TCR block.

c) The parameter field is present only when the terminal is requesting or confirming an optional transport connection function.

FIGURE 11/T.70

Transport connection accept block

5.5.5.2 *Parameters for extended addressing*

See § 5.5.4.2.

5.5.5.3 *Parameter for transport data block size negotiation*

See § 5.5.4.3. The parameter value shall be equal to or less than the value specified in the TCR block.

5.5.6 *Transport connection clear (TCC) block format*

5.5.6.1 Figure 12/T.70 illustrates the format of the TCC block.

Octets	Bits 8	7	6	5	4	3	2	1
1	Length (octets)							
2	1	0	0	0	0	0	0	0[a]
3	Destination							
4	reference							
5	Source							
6	reference							
7	Clearing cause[b]							
8 … n	Parameters (optional)							

[a] Block type: TCC

[b] Clearing cause:

		Bits 8 7 6 5 4 3 2 1
0 – Reason not specified	=	0 0 0 0 0 0 0 0
1 – Terminal occupied	=	0 0 0 0 0 0 0 1
2 – Terminal out of order	=	0 0 0 0 0 0 1 0
3 – Address unknown	=	0 0 0 0 0 0 1 1

FIGURE 12/T.70

Transport connection clear block

5.5.6.2 *Parameter for additional clearing information*

This parameter is provided to allow additional information relating to the clearing of the connection. The coding of this parameter is given in Figure 13/T.70 below.

Octets	Bits 8	7	6	5	4	3	2	1	
1	1	1	1	0	0	0	0	0	Parameter code
2	Parameter length indicator								
3 … n	Additional information								

FIGURE 13/T.70
Additional clearing information parameter

5.5.7 *Transport block reject (TBR) block format*

5.5.7.1 Figure 14/T.70 illustrates the format of the TBR block.

Octets	Bits 8	7	6	5	4	3	2	1
1	Length (octets)							
2	0	1	1	1	0	0	0	0[a]
3	Destination							
4	reference							
5	Reject cause[b]							
6 … n	Parameter field							

[a] Block type: TBR

[b] Reject cause:

			Bits 8 7 6 5 4 3 2 1
0 –	Reason not specified	=	0 0 0 0 0 0 0 0
1 –	Function not implemented	=	0 0 0 0 0 0 0 1
2 –	Invalid block	=	0 0 0 0 0 0 1 0
3 –	Invalid parameter	=	0 0 0 0 0 0 1 1

FIGURE 14/T.70
Transport block reject block

5.5.7.2 *Rejected block parameter* (mandatory)

This parameter is used to indicate the bit pattern of the rejected block up to and including the octet that caused the rejection. Only the first detected procedural error or parameter, which cannot be acted upon, shall be indicated by this method. The coding of this parameter is given in Figure 15/T.70 below:

Octets	Bits 8	7	6	5	4	3	2	1
1	1	1	0	0	0	0	0	1
2	Parameter length indicator							
3 … n	Rejected information							

FIGURE 15/T.70

5.5.8 *Transport data block (TDT) format*

5.5.8.1 Figure 16/T.70 illustrates the format of the TDT block.

Octets	Bits 8	7	6	5	4	3	2	1
1	Length (octets)							
2	1	1	1	1	0	0	0	0 a)
3	TSDU end b)	0	0	0	0	0	0	0
4 … n	Data							

a) Block type: TDT

b) TSDU end: indicates the end of TSDU when set to 1

FIGURE 16/T.70
Transport data block

ANNEX A

(to Recommendation T.70)

A.1 *Transport and network service*

The transport service (TS) is provided by the transport protocol (TP) making use of the services available from the network layer. This annex also defines the TS characteristics which the TS users may exploit.

Interactions between TS users and the TS provider take place at the two TS access points (TSAP) (see Figures A-1/T.70 to A-6/T.70). Information is passed between a TS user and a TS provider by means of primitives, which may convey parameters.

Primitives are abstract representations of interactions. They are solely descriptive and do not represent a specification or implementation.

The occurrence of a primitive is a logically instantaneous and indivisible event. The event occurs at a logically separate instant, which cannot be interrupted by another event. Only primitives of global significance are mentioned (having an impact on the remote user).

The following types of primitives are defined:

a) request primitive

b) indication primitive

c) response primitive

d) confirm primitive.

The primitives a) and c) are directed from the service user to the service provider, b) and d) are going in the opposite direction.

"Transport" is designated by T, "Network" is designated by N. The terms CONNECT, DATA, DISCONNECT as part of a primitive name indicate that the primitive is used for establishment, data transfer, release of a transport connection (TC) or network connection (NC).

Examples:

T-CONNECT request	request to establish a TC
T-DATA request	request to transmit TS user data
N-DISCONNECT indication	indication that the NC has been released.

The relationship between valid sequences of TS primitives and the appropriate protocol elements is shown in Figures A-1/T.70 to A-6/T.70. The sequences of valid network service (NS) primitives are illustrated in Figures A-7/T.70 to A-12/T.70.

A.1.1 *Transport service*

The interactions shown in Figures A-1/T.70 to A-6/T.70 are not exhaustive.

A.1.1.1 *Transport connection establishment*

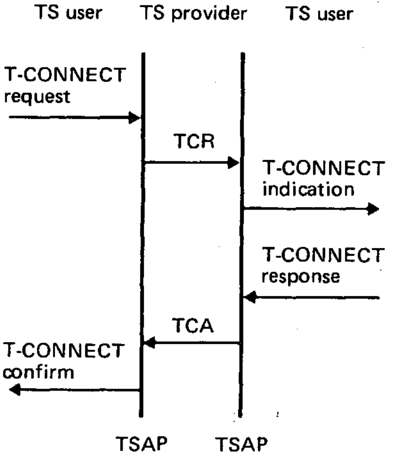


FIGURE A-1/T.70

Successful TC establishment

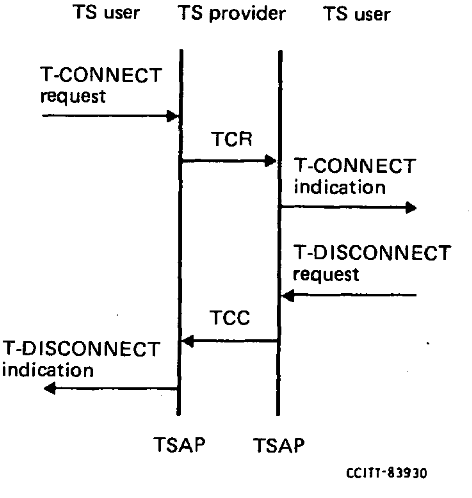
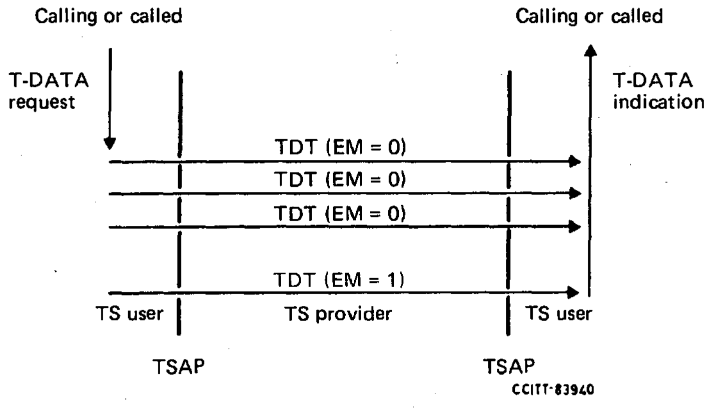


FIGURE A-2/T.70

Rejection of TC establishment by TS user

A.1.1.2 *Transfer phase*

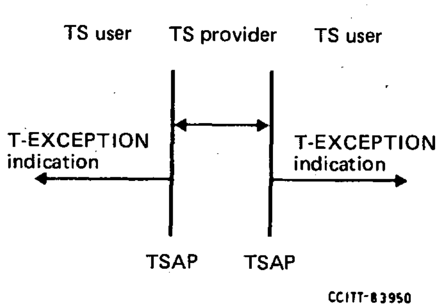


Note – This is one method of realizing segmenting/reassembling.

FIGURE A-3/T.70

T-DATA transfer

A.1.1.3 *Transport service error reporting*



Note – The use of this primitive is optional.

FIGURE A-4/T.70

Transport service error reporting

A.1.1.4 *TC release*

At present only the implicit release of TC is defined (see § 5.2.4.1 of this Recommendation).

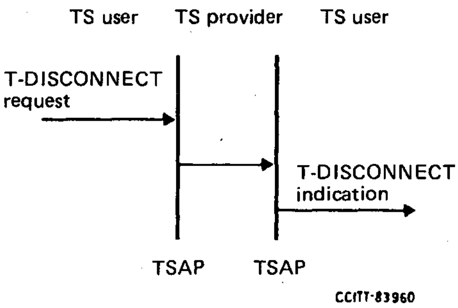


FIGURE A-5/T.70

TC release initiated by TS user

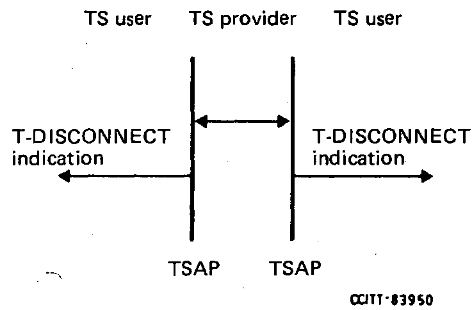


FIGURE A-6/T.70

TC release initiated by the TS provider

A.1.2 *Network service*

Figures A-7/T.70 to A-12/T.70 show the relationships of network service (NS) primitives at both sides of an NC.

A.1.2.1 *Network connection establishment*

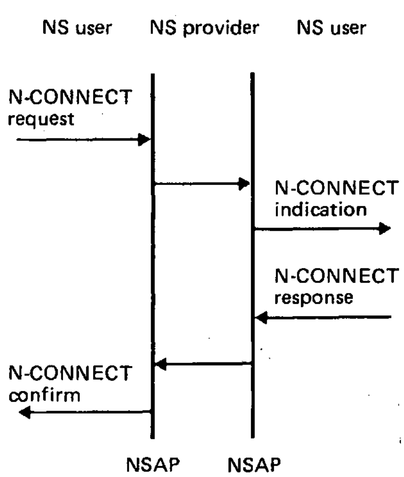


FIGURE A-7/T.70

Successful NC establishment

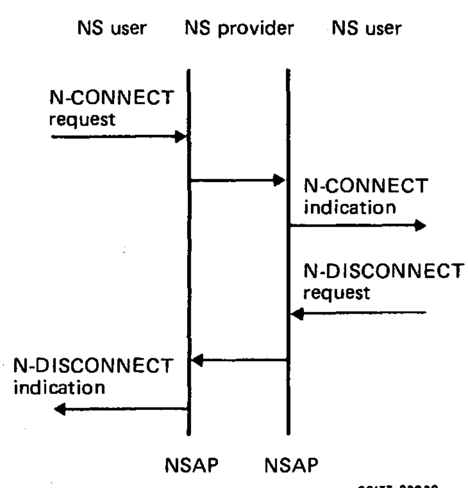


FIGURE A-8/T.70

Rejection of NC establishment by NS user

A.1.2.2 *Network data transfer*

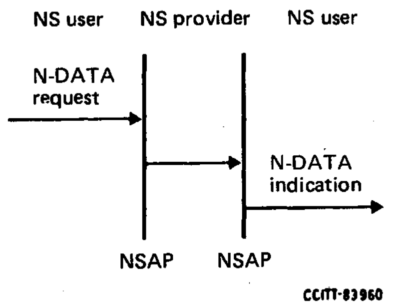


FIGURE A-9/T.70

N-DATA transfer

A.1.2.3 *Network service error reporting*

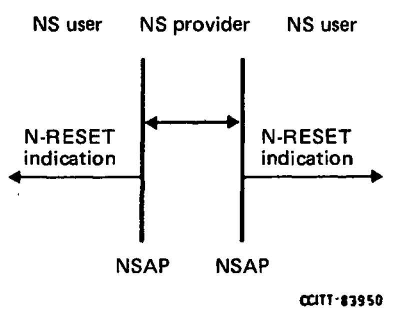


FIGURE A-10/T.70

Network service error reporting

A.1.2.4 *Network connection release*

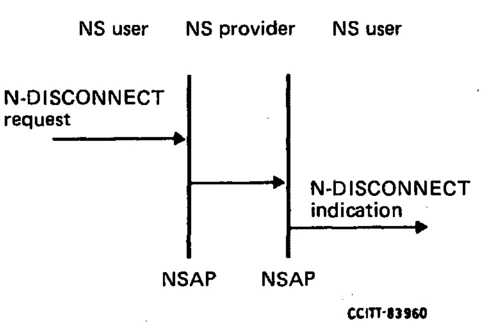


FIGURE A-11/T.70

NS release initiated by NS user

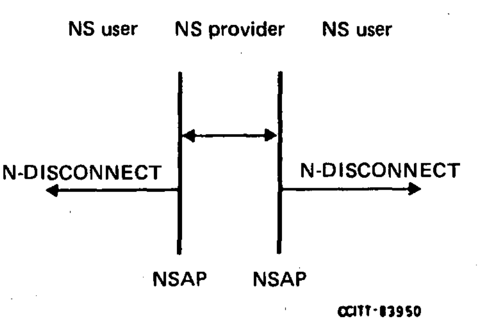


FIGURE A-12/T.70

NC release initiated by the NS provider

A.2 *State transition diagrams for the basic transport layer procedures*

This part represents detailed state transition diagrams for the basic transport procedures.

Two description levels are used:

a) *Protocol level*

This level addresses only the peer to peer protocol activities between two transport entities. It identifies the protocol state, events [receipt of transport protocol data units (TPDUs)] and actions (sending of TPDUs).

b) *Detailed level*

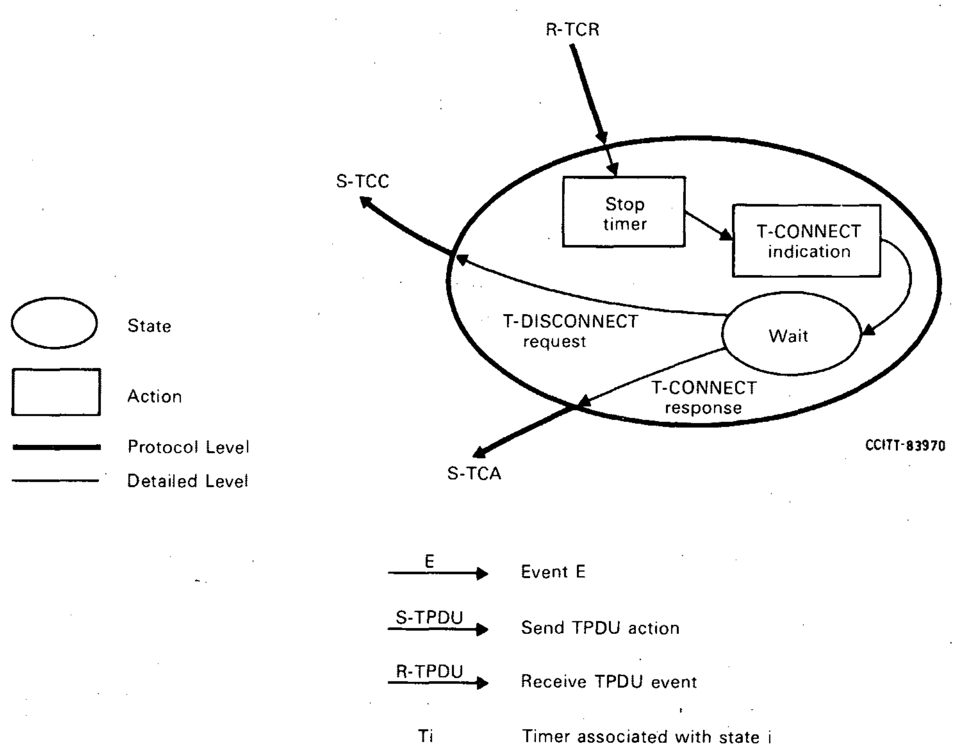
This level addresses the inter-layer and local activities. It identifies the events, actions, conditions and states within each of the protocol level states. The inter-layer activities are described using the transport service primitives defined in the 1st part of this Annex.

Example (see Figure A-13/T.70):

For pure illustrative reasons, the example shows a simplified description of state 1 (response pending, called side) of the state transition diagram of this Recommendation. The event R-TCR may be answered either by sending the action S-TCA or S-TCC.

The events and actions are not interruptable. They will complete their transfer irrespective of the occurrence of other events.

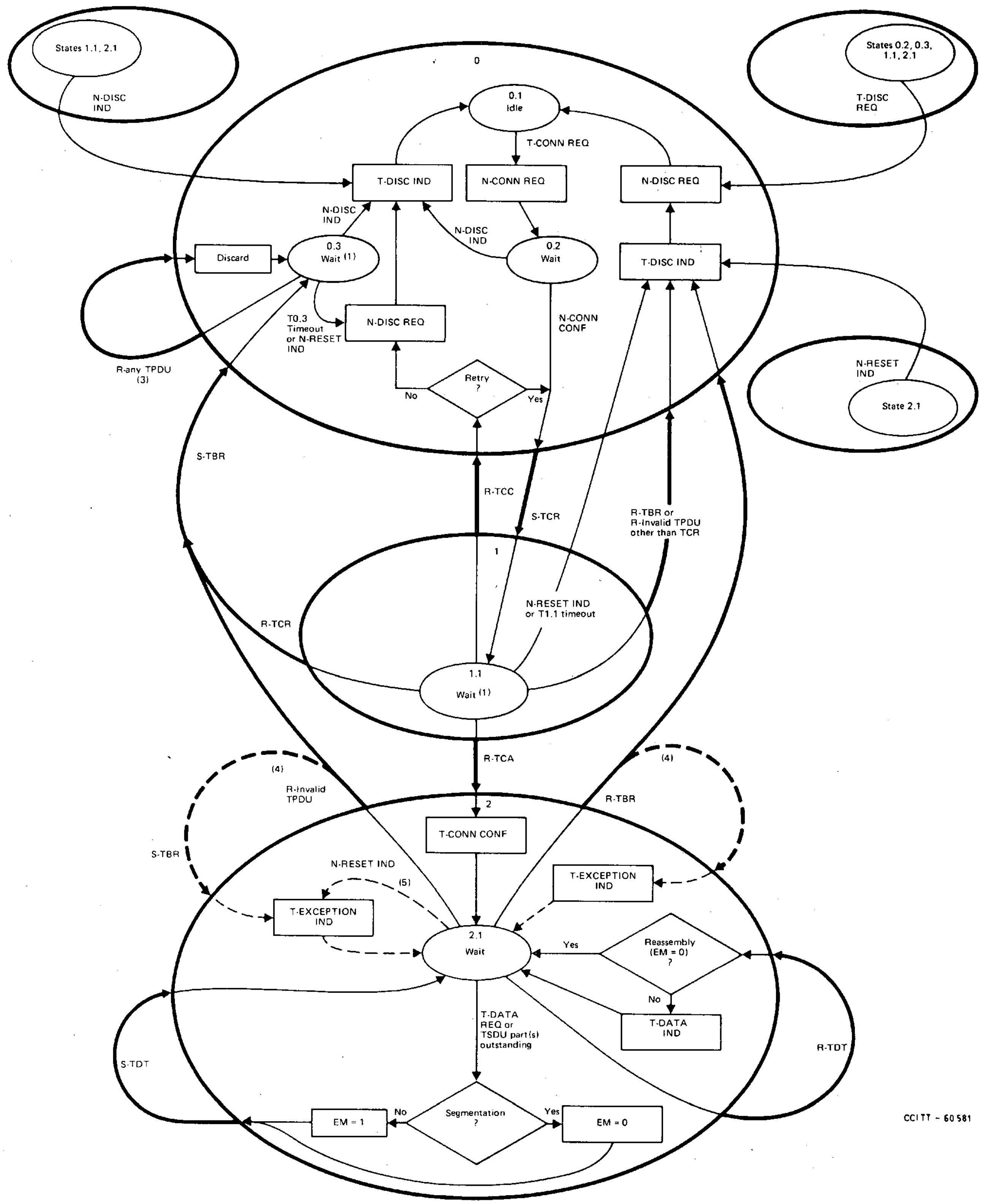
The detailed state transition diagrams are given in Figures A-14/ and A-15/T.70.



Note 1 — Each TPDU is transferred by N-DATA request. The NSDU will contain the TPDU.

Note 2 — Each TPDU is received by N-DATA indication. The NSDU will contain the TPDU.

FIGURE A-13/T.70



(1) States 0.3 and 1.1 have timers, T0.3 and T1.1 respectively. When entering any of these states the associated timer is started. The timer is stopped upon exit from the state [see (3)].

(2) There are other valid methods for describing segmentation.

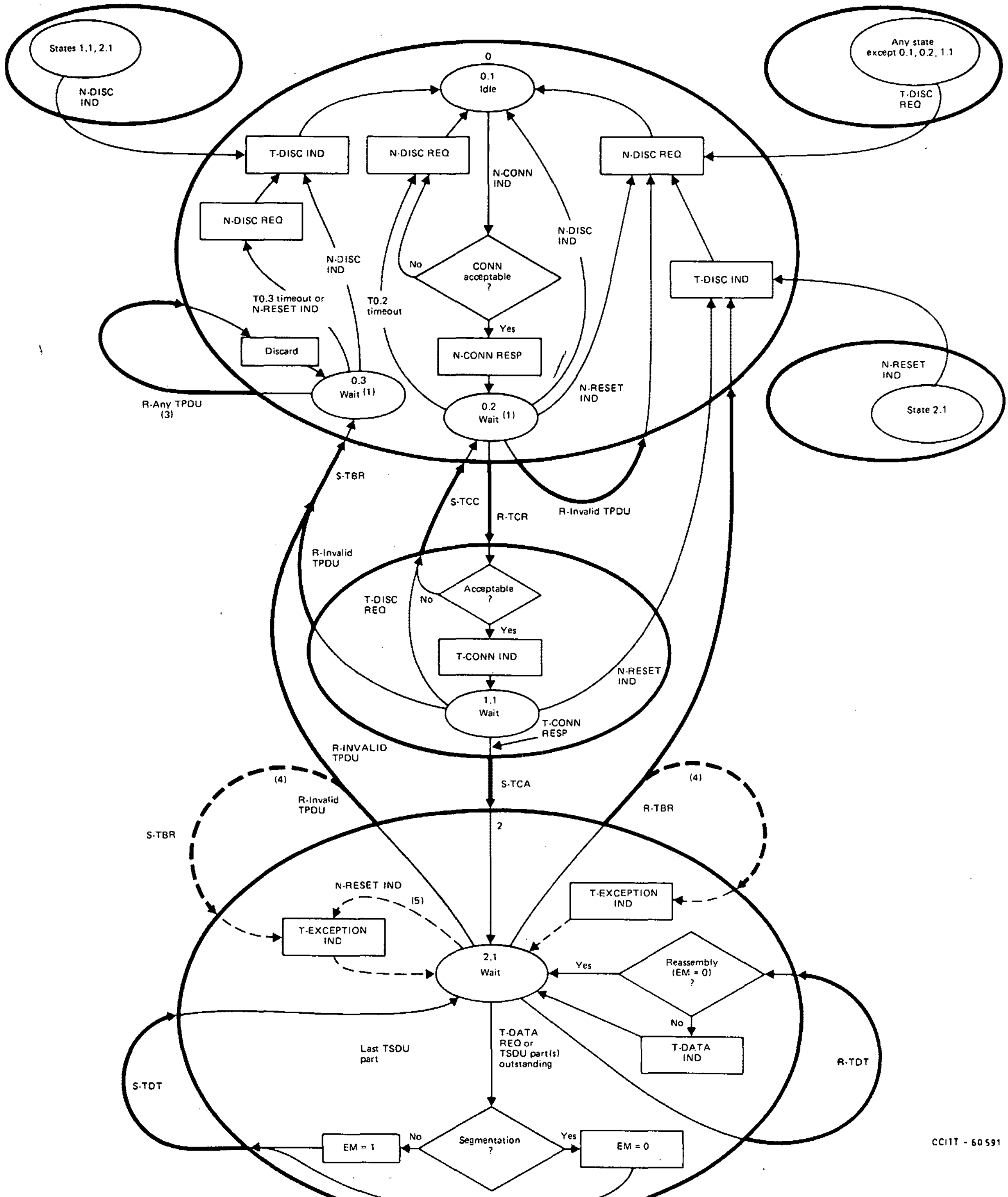
(3) This state transition does not start/stop T0.3 timer.

(4) Optional transition (shown in broken lines) if "T-EXCEPTION IND" is provided.

(5) Optional transition (shown in broken lines) if "T-EXCEPTION IND" is provided. The use of this option is independent of the use of option (4) above.

FIGURE A-14/T.70

Teletex transport state transition diagram (calling side)



(1) States 0.2 and 0.3 have timers, T0.2 and T0.3 respectively. When entering any of these states the associated timer is started. The timer is stopped upon exit from the state [see (3)].

(2) There are other valid methods for describing segmentation.

(3) This state transition does not start/stop T0.3 timer.

(4) Optional transition (shown in broken lines) if "T-EXCEPTION IND" is provided.

(5) Optional transition (shown in broken lines) if "T-EXCEPTION IND" is provided. The use of this option is independent of the use of option (4) above.

FIGURE A-15/T.70

Teletex transport state transition diagram (called side)

ANNEX B

(to Recommendation T.70)

B.1 *State tables*

The state tables:

B-1/T.70: Transport connection establishment, calling side

B-2/T.70: Transport connection establishment, called side

B-3/T.70: Data phase (symmetrical protocol)

present the transitions of the transport protocol in a table form in contrast to the diagram form to be seen in Annex A. While the diagrams are useful to overview the protocol mechanism the appropriate tables give clear information of which event is possible in which state and which actions are to be performed. Moreover each of the events and conditions is combined with a shortening in brackets (e.g.: E 5) which is a pointer to the 2nd part of this annex, so that the reader of these tables can easily come to know which meaning a certain event, action or condition has.

An impossible event related to a certain state can be recognized by an empty field in the crossing-point of the state and the event.

B.2 *Lists of events, actions and conditions*

The lists of events (Table B-4/T.70), actions (Table B-5/T.70) and conditions (Table B-6/T.70) intend to care for detailed explanations and clarification related to the protocol components (events, actions and conditions) found in the diagrams and tables.

All the components in the tables are accompanied by a list number (e.g. E 1, A 10, C 3, etc.) which can be interpreted as a pointer to the corresponding additional information in the lists. The letters E, A, C of the list numbers stand for Event, Action, Condition.

The following abbreviations are used:

EM	End Mark
LI	Length Indicator of the transport block (octet 1)
loc.	local
NC	Network Connection
NS	Network Service
NSDU	Network Service Data Unit
PLI	Parameter Length Indicator
TC	Transport Connection
TP	Transport Protocol
TPDU	Transport Protocol Data Unit
TS	Transport Service
TSDU	Transport Service Data Unit

AND, OR and NOT (used mainly in E 5) shall be considered as the known Boolean operators.

TABLE B-1/T.70

State table for calling side

No	Event: Local	Event: Protocol event	Event: Service primitive	Idle 0.1: Local	Idle 0.1: Protocol action	Idle 0.1: Service primitive	Idle 0.1: Final state	Idle 0.2: Local	Idle 0.2: Protocol action	Idle 0.2: Service primitive	Idle 0.2: Final state	Idle 0.3: Local	Idle 0.3: Protocol action	Idle 0.3: Service primitive	Idle 0.3: Final state	Waiting 1.1: Local	Waiting 1.1: Protocol action	Waiting 1.1: Service primitive	Waiting 1.1: Final state
1.1		R-TCR (E 1)											Discard any R-TPDU (A 14)		0.3	STOP T1.1 (A 1) START T0.3 (A 2)	S-TBR (A 3)		0.3
1.2		R-TCC (E 2) Retry (C 1)													0.3	RESTART T1.1 (A 6)	S-TCR (A 7)		1.1
1.3		R-TCC (E 2) No retry (C 2)													0.3	STOP T1.1 (A 1)		N-DISC req. (A 4) T-DISC ind. (A 5)	0.1
1.4		R-TCA (E 3)													0.3	STOP T1.1 (A 1)		T-CONN. conf. (A 8)	2.1
1.5		R-TBR (E 4)													0.3	STOP T1.1 (A 1)		T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1
1.6		R-invalid TPDU (E 5)													0.3	STOP T1.1 (A 1)		T.DISC. ind. (A 5) N-DISC. req. (A 4)	0.1
1.7			T-CONN. req. (E 6)			N-CONN. req. (A 10)	0.2												
1.8			N-CONN. conf. (E 7)					START T1.1 (A 12)	S-TCR (A 7)		1.1								
1.9			N-DISC. ind. (E 8)							T-DISC. ind. (A 5)	0.1	STOP T0.3 (A 13)		T-DISC. ind. (A 5)	0.1	STOP T1.1 (A 1)		T-DISC. ind. (A 5)	0.1
1.10			N-RESET ind. (E 9)									STOP T0.3 (A 13)		N-DISC. req. (A 4) T-DISC. ind. (A 5)	0.1	STOP T1.1 (A 1)		T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1
1.11			T-DISC. req. (E 10)							N-DISC. req. (A 4)	0.1	STOP T0.3 (A 13)		N-DISC. req. (A 4)	0.1	STOP T1.1 (A 1)		N-DISC. req. (A 4)	0.1
1.12	TIME-OUT (E 11)											STOP T0.3 (A 13)		N-DISC. req. (A 4) T-DISC. ind. (A 5)	0.1	STOP T1.1 (A 1)		T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1

TABLE B-2/T.70

State table for called side

State / Event				Idle												Waiting			
				0.1				0.2				0.3				1.1			
	Local	Protocol event	Service primitive	Local	Protocol action	Service primitive	Final state	Local	Protocol action	Service primitive	Final state	Local	Protocol action	Service primitive	Final state	Local	Protocol action	Service primitive	Final state
2.1		R-TCR (E 1) Acceptable (C 3)						STOP T0.2 (A 11)		T-CONN. ind. (A 15)	1.1		Discard any R-TPDU (A 14)		0.3				
2.2		R-TCR (E 1) Not acceptable (C 4)						RESTART T0.2 (A 16)	S-TCC (A 17)		0.2				0.3				
2.3		R-invalid TPDU (E 5)						STOP T0.2 (A 11)	N-DISC. req. (A 4)		0.1				0.3	START T0.3 (A 2)	S-TBR (A 3)		0.3
2.4			N-CONN. ind. (E 12) Acceptable (C 5)	START T0.2 (A 9)		N-CONN. resp. (A 22)	0.2												
2.5			N-CONN. ind. (E 12) Not acceptable (C 6)			N-DISC. req. (A 4)	0.1												
2.6			T-CONN. resp. (E 13)														S-TCA (A 24)		2.1
2.7			N-DISC. ind. (E 8)					STOP T0.2 (A 11)			0.1	STOP T0.3 (A 13)		T-DISC. ind. (A 5)	0.1			T-DISC. ind. (A 5)	0.1
2.8			N-RESET ind. (E 9)					STOP T0.2 (A 11)		N-DISC. req. (A 4)	0.1	STOP T0.3 (A 13)		T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1			T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1
2.9			T-DISC. req. (E 10)									STOP T0.3 (A 13)		N-DISC. req. (A 4)	0.1	START T0.2 (A 9)	S-TCC (A 17)		0.2
2.10	TIME-OUT (E 11)							STOP T0.2 (A 11)		N-DISC. req. (A 4)	0.1	STOP T0.3 (A 13)		T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1				

TABLE B-3/T.70

Data phase (symmetrical protocol)

	Event: Local	Event: Protocol event	Event: Service primitive	Data phase 2.1: Local	Data phase 2.1: Protocol action	Data phase 2.1: Service primitive	Final state
3.1		R-TDT (E 14), EM = 0 (C 7)					2.1
3.2		R-TDT (E 14), EM = 1 (C 8)				T-DATA ind. (A 18)	2.1
3.3		R-TBR (E 4), Recovery (C 9)				T-EXCEPT. ind. (A 19)	2.1
3.4		R-TBR (E 4), No recovery (C 10)				T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1
3.5		R-inv. TPDU (E 5), Recovery (C 9)			S-TBR (A 3)	T-EXCEPT. ind. (A 19)	2.1
3.6		R-inv. TPDU (E 5), No recovery (C 10)		START T0.3 (A 2)	S-TBR (A 3)		0.3
3.7			T-DATA req. (E 15), Segm. (C 11)		S-TDT (EM = 0) (A 20)		2.1
3.8			T-DATA req. (E 15), No segm. (C 12)		S-TDT (EM = 1) (A 21)		2.1
3.9	TSDU part(s) outstand. (E 16)	Segm. (C 11)			S-TDT (EM = 0) (A 20)		2.1
3.10	TSDU part(s) outstand. (E 16)	No segm. (C 12)			S-TDT (EM = 1) (A 21)		2.1
3.11			N-RESET ind. (E 9), Recovery (C 9)			T-EXCEPT. ind. (A 19)	2.1
3.12			N-RESET ind. (E 9), No recovery (C 10)			T-DISC. ind. (A 5) N-DISC. req. (A 4)	0.1
3.13			N-DISC. ind. (E 8)			T-DISC. ind. (A 5)	0.1
3.14			T-DISC. req. (E 10)			N-DISC. req. (A 4)	0.1

TABLE B-4/T.70

List of events

No.	Name	Type	Description
E 1	R-TCR	TP	Layer 4 receives via the NS N-DATA indication a TPDU including the transport block TCR.
E 2	R-TCC	TP	Layer 4 receives via the NS N-DATA indication a TPDU including the transport block TCC.
E 3	R-TCA	TP	Layer 4 receives via the NS N-DATA indication a TPDU including the transport block TCA.
E 4	R-TBR	TP	Layer 4 receives via the NS N-DATA indication a TPDU including the transport block TBR.
E 5	R-invalid TPDU *(continued)*	TP	Layer 4 receives via the NS N-DATA indication a TPDU whose validity check fails due to following reasons: – syntactical errors – procedure errors 1. *Invalid TPDUs due to syntactical errors* 1.1 TCR: 1.1.1 The value of octet 1 (LI): 1.1.1.1 $\neq$ the number of the TCR block octets minus 1 OR 1.1.1.2 is greater than 127 OR 1.1.1.3 is smaller than 6 OR 1.1.2 see 1.6 1.2 TCA: 1.2.1 The value of octet 1 (LI): 1.2.1.1 $\neq$ the number of the TCA block octets minus 1 OR 1.2.1.2 is greater than 127 OR 1.2.1.3 is smaller than 6 OR 1.2.2 see 1.6 OR 1.2.3 The value of octet 3 (4 resp.) $\neq$ octet 5 (6 resp.) of the appropriate TCR block OR 1.2.4 The value of octet 7 $\neq$ 0 OR 1.2.5 The parameter "Transport Data Block Size" is present: 1.2.5.1 AND its value $\neq$ 07 (hexadecimal), in response to a TCR block without the transport data block size parameter OR 1.2.5.2 AND its value does not respond to the rules according to § 5.2.3.2 of Recommendation T.70 OR 1.2.5.3 AND is value is different from the values (hexadecimal): 07, 08, 09, 0A, 0B OR 1.2.5.4 AND the PLI $\neq$ 1 OR 1.2.6 $LI \neq 6 + 2N + \sum_{i=1}^{N} PLI$ where N is the number of parameters 1.3 TCC: 1.3.1 The value of the LI (octet 1): 1.3.1.1 $\neq$ the number of the TCC block octets minus 1 OR 1.3.1.2 is greater than 127 OR 1.3.1.3 is smaller than 6 OR 1.3.2 see 1.6 OR 1.3.3 The value of octet 3 (4 resp.) $\neq$ octet 5 (6 resp.) of the appropriate TCR block OR 1.3.4 $LI \neq 6 + 2N + \sum_{i=1}^{N} PLI$ where N is the number of parametres 1.4 TBR: (also see § 5.4.1 Note 1) 1.4.1 The value of the LI: 1.4.1.1 $\neq$ the number of the TBR block octets minus 1 OR 1.4.1.2 is greater than 127 OR 1.4.1.3 is smaller than 7 OR 1.4.2 see 1.6 OR

TABLE B-4/T.70 *(cont.)*

No.	Name	Type	Description
E 5	R-invalid TPDU *(cont.)*	TP	1.4.3 The value of octet 3 (4 resp.) ≠ octet 5 (6 resp.) of the appropriate TC establishment block (TCR resp. TCA) received from the peer entity OR 1.4.4 The value of the LI minus 6 ≠ value of the PLI OR 1.4.5 The Rejected block parameter is not present 1.5 TDT: 1.5.1 The value of the LI ≠ 2 OR 1.5.2 The TSDU end mark is 0 AND the information field is empty OR 1.5.3 The TDT block size is larger than negotiated in the establishment phase 1.6 No identified block: The value of the TPDU octet 2 is not equal to one of the following values (hexadecimal): E0, D0, 80, 70, F0. 2. *Invalid TPDUs due to procedure errors* Failure cases: 2.1 After S-TCR: 2.1.1 NOT R-TCA OR 2.1.2 NOT R-TCC OR 2.1.3 NOT R-TBR OR 2.2. After S-TCA 2.2.1 NOT R-TDT OR 2.2.2 NOT R-TBR OR 2.3 After S-TDT: 2.3.1 NOT R-TDT OR 2.3.2 NOT R-TBR OR 2.4 After S-TCC: NOT R-TCR OR 2.5 After S-TBR: NOT R-TDT (in state 2.1) OR 2.6 After R-TDT (EM=1): R-empty TDT (EM=1) OR 2.7 After R-empty TDT (EM=1): R-empty TDT (EM=1) OR 2.8 After N-CONNECT response: NOT R-TCR
E 6	T-CONNECT request	TS	Layer 5 requests a TC from layer 4.
E 7	N-CONNECT confirm	NS	Affirmative answer to N-CONNECT request (A 10); a NC is existing now.
E 8	N-DISCONNECT indication	NS	Report from layer 3 to layer 4 that the NC is not existing (any more).
E 9	N-RESET Indication	NS	Indication to layer 4 that an error has occurred in layer 1, 2 or 3, possibly with data loss. The NC is kept existing.
E 10	T-DISCONNECT request	TS	Layer 5 requests a TC clearing from layer 4.
E 11	TIMEOUT	loc.	The timer presently surveying a state reached its limit. Following value ranges are defined:

States	Values: Calling side	Values: Called side
0.2	not applicable	45 s ± 30 s
0.3	6 s ± 4 s	6 s ± 4 s
1.1	45 s ± 30 s	not applicable

TABLE B-4/T.70 *(end)*

No.	Name	Type	Description
E 12	N-CONNECT indication	NS	Indication to layer 4 by the layer 3 that an NC is being established; the answer to this is N-CONNECT response (A 22) or N-DISCONNECT request (A 4).
E 13	T-CONNECT response	TS	Affirmative answer by the layer 5 to T-CONNECT indication (A 15).
E 14	R-TDT	TP	Layer 4 receives via the NS N-DATA indication an NSDU including the transport block TDT.
E 15	T-DATA request	TS	Layer 5 requests the transmission of data. Whether this is a complete TSDU or not is a local matter and not subject of this definition.
E 16	TSDU part(s) outstanding	loc.	Layer 4 is ready to send the next TDT block.

TABLE B-5/T.70

List of Actions

No.	Name	Type	Description
A 1	STOP Timer T1.1	loc.	Timer T1.1 surveying the state 1.1 is stopped.
A 2	START Timer T0.3	loc.	Timer T0.3 surveying the state 0.3 is started after having been reset.
A 3	S-TBR	TP	Via the NS N-DATA request a NSDU including the transport block TBR is sent to the peer entity.
A 4	N-DISCONNECT request	NS	Layer 4 requests the layer 3 to release the offered or existing NC.
A 5	T-DISCONNECT indication	TS	Layer 5 is informed by the layer 4 that the TC being established or existing is cleared.
A 6	RESTART T1.1	loc.	Timer T1.1 surveying the state 1.1 is reset and started again. Moreover it is necessary either to limit the number of T1.1-restarts or to limit the sum of all the times of T1.1; othewise an infinite loop S-TCR – R-TCC – S-TCR – etc. would be allowed.
A 7	S-TCR	TP	Via the NS N-DATA request a NSDU including the transport block TCR is sent to the peer entity.
A 8	T-CONNECT confirm	TS	Affirmative answer to the event T-CONNECT request (E 6) indicating that the data phase of the TC has been entered.
A 9	START T0.2	loc.	Timer T0.2 surveying the state 0.2 is started after having been reset.
A 10	N-CONNECT request	NS	Layer 4 requests the layer 3 for an NC to be established.
A 11	STOP T0.2	loc.	Timer T0.2 surveying the state 0.2 is stopped.
A 12	START T1.1	loc.	Timer T1.1 surveying the state 1.1 is started after having been reset.
A 13	STOP T0.3	loc.	Timer T0.3 surveying the state 0.3 is stopped.
A 14	DISCARD any R-TPDU	TS	Any data received by N-DATA indication are discarded. The transmission of further data is stopped.
A 15	T-CONNECT indication	TS	Layer 4 indicates a request for a TC-establishment to the layer 5.
A 16	RESTART T0.2	loc.	Timer T0.2 surveying the state 0.2 is reset and started again.
A 17	S-TCC	TP	Via the NS N-DATA request an NSDU including the transport block TCC is sent to the peer entity.
A 18	T-DATA indication	TS	Layer 4 indicates the receipt of a complete TSDU to the layer 5. How and when the contents is transferred is a local matter and therefore not shown here.
A 19	T-EXCEPTION indication	TS	Layer 5 is informed of an error which occurred between the layer 1 and layer 4, possibly with data loss; the TC is kept existing. Due to this error it is possible that the following TSDU transferred to the layer 5 contains errors or deficiencies.
A 20	S-TDT (EM=0)	TP	A TPDU with TSDU end mark set to 0 is sent to the peer entity and further parts of the TSDU will follow (i.e. segmenting occurs).
A 21	S-TDT (EM=1)	TP	see A 20, but the TSDU end mark is set to 1 (i.e. this TPDU contains a complete TSDU or the last part of a TSDU).
A 22	N-CONNECT response	NS	Affirmative answer to N-CONNECT indication (E 12).
A 23	S-TBR	TP	The called side sends a TBR block to the calling side in order to point to a received failured TPDU. In this case the destination reference can be set to 0.
A 24	S-TCA	TP	Via the NS N-DATA request an NSDU including the transport block TCA is sent to the peer entity.

TABLE B-6/T.70

List of conditions

No.	Name	Description
C 1	Retry	The TC establishment is tried once more.
C 2	No Retry	NOT C 1
C 3	TC acceptable	The TC offered by the peer entity is accepted by the layer 4 due to local circumstances.
C 4	TC not acceptable	NOT C 3
C 5	NC acceptable	The NC offered by the layer 3 is accepted by the layer 4 due to local circumstances.
C 6	NC not acceptable	NOT C 5
C 7	EM = 0	TSDU end mark of the TDT block is 0
C 8	EM = 1	TSDU end mark of the TDT block is 1
C 9	Recovery	The terminal provides the TS T-EXCEPTION indication
C 10	No Recovery	NOT C 9
C 11	Segmentation	The TSDU received from layer 5 is longer than the negotiated TDT block size and has therefore to be segmented and consequently to be reassembled on the receiver side.
C 12	No Segmentation	NOT C 11

Recommendation T.71

LAPB EXTENDED FOR HALF-DUPLEX PHYSICAL LEVEL FACILITY

(Malaga-Torremolinos, 1984)

The CCITT,

considering

(a) that the Teletex service will be introduced in different types of networks, i.e. Circuit Switched Public Data Networks (CSPDN), Packet Switched Public Data Networks (PSPDN) and Public Switched Telephone Networks (PSTN);

(b) that depending on the service provided by the physical level, the link level procedures may have to cater for a half-duplex transmission facility;

(c) that some Administrations are considering the provision of a Teletex service with a half-duplex transmission facility on the PSTN;

(d) that modems according to Recommendation V.26 *bis* are suitable for half-duplex transmission at 2400 bit/s on PSNTs,

unanimously declares

that this Recommendation defines the link level procedure using LAPB extended for half-duplex physical level service.

1 Introduction

1.1 *General*

1.1.1 Figure 1/T.71 shows the Half-Duplex Transmission Module (HDTM) for extending the use of LAPB for operation of Teletex terminals connected to the PSTN where use of half-duplex 2400 bit/s modems is planned. This is referred to in Recommendation T.70 as LAPX.

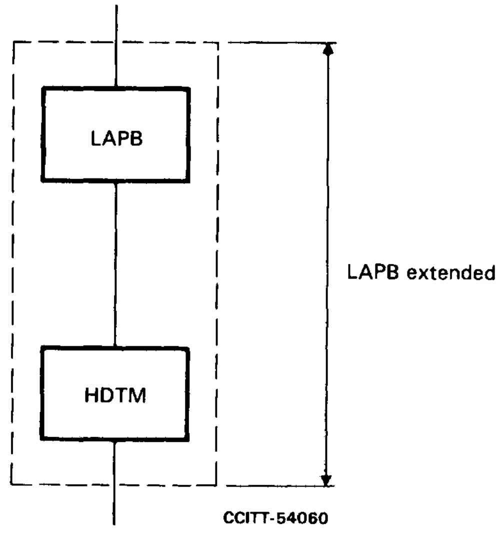


FIGURE 1/T.71

Teletex data link layer for PSTN based on LAPB plus the half-duplex transmission module (HDTM)

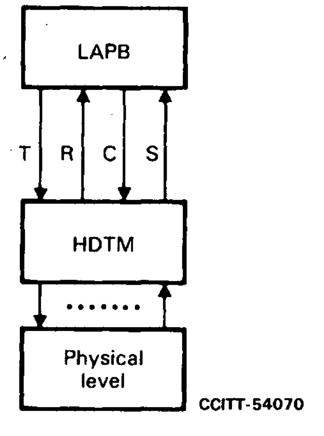
1.1.2 Before the HDTM begins operation the physical circuit must be established by the appropriate PSTN call control procedures. The operation of the HDTM is such that the calling DTE will initially have the right to transmit. For the link addressing conventions refer to Recommendation T.70.

1.2 *Architecture*

1.2.1 *Level relationships*

It is an objective to avoid modification of the definition of LAPB in order to adapt it for half-duplex operation. However there is a functional requirement that the HDTM inhibit LAPB from sending frames during certain phases of the half-duplex procedure. The means of accomplishing this functional requirement is not defined.

The logical relationships between LAPB, the HDTM and the physical level are as shown in Figure 2/T.71.



T Transmit data functions
R Receive data functions
C Control functions
S Status functions

FIGURE 2/T.71

Level relationships

1.2.2 *Control (C) and status (S) functions*

The following logical functions are defined to describe the interactions between LAPB and the HDTM:

Control <TERM>

– Revert to the HDTM idle state since LAPB has entered the disconnected phase (equivalent to ADM of HDLC).

Status <OP-T>

– LAPB is enabled to send frames.

Status <INOP-T>

– LAPB is inhibited from sending frames.

2 State diagram and descriptions

2.1 *State diagram*

The state diagram shown in Figure 3/T.71 describes the procedure for controlling the right to transmit. The number in each ellipse is the state reference number.

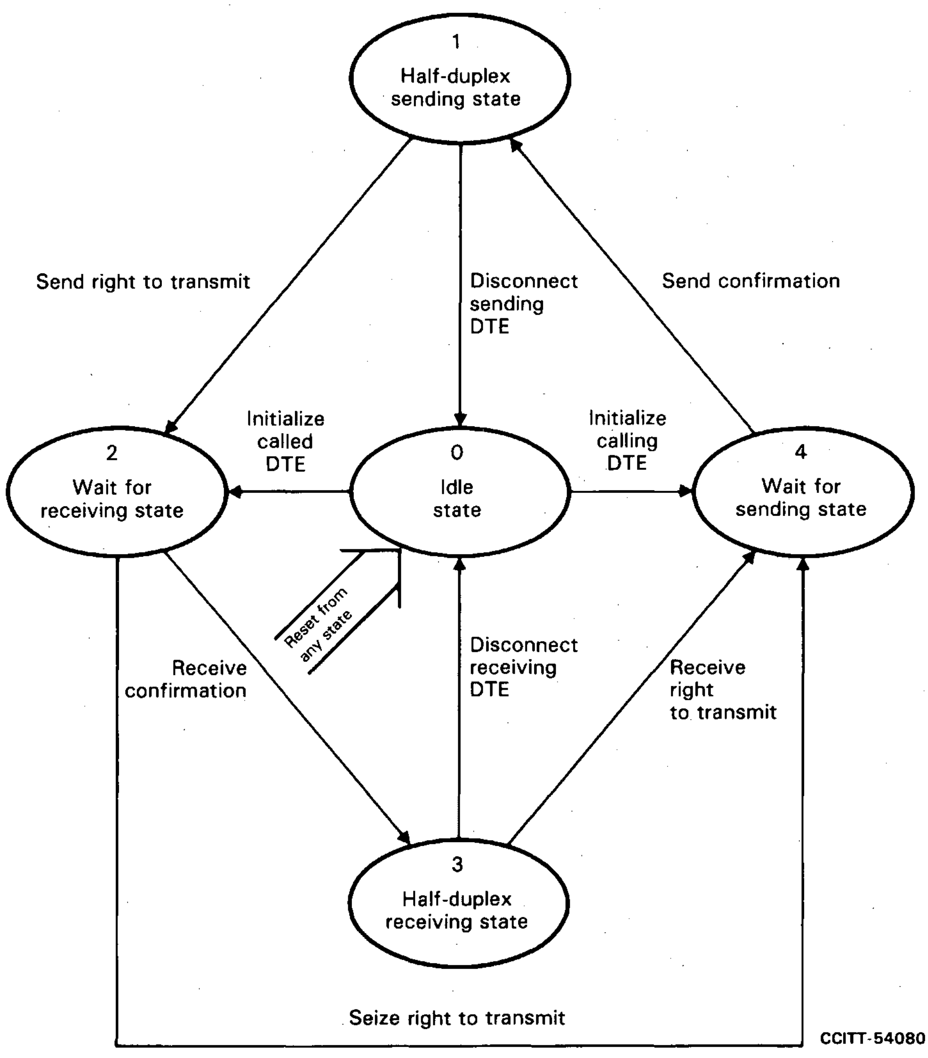


FIGURE 3/T.71

State diagram

2.2 *State definitions*

2.2.1 *Idle state (state 0)*

The DTE is in an inactive state. This is the initial state prior to call establishment and the final state after call termination.

2.2.2 *Half-duplex sending state (state 1)*

The DTE is in a half-duplex sending state, so that all signals generated by LAPB are passed to the physical level.

2.2.3 *Wait for receiving state (state 2)*

The DTE is awaiting indication that the remote DTE has entered the half-duplex sending state. No signals generated by LAPB are passed to the physical level.

2.2.4 *Half-duplex receiving state (state 3)*

The DTE is in a half-duplex receiving state, so that no signals generated by LAPB are passed to the physical level. The remote DTE is considered to be in the half-duplex sending state.

2.2.5 *Wait for sending state (state 4)*

The DTE is awaiting indication of the availability of the physical level for transmission of frames to the remote DTE. All signals generated by LAPB are passed to the physical level, but LAPB is inhibited from sending frames.

2.3 *Table of transitions between states*

Table 1/T.71 shows the events that cause transitions from one state to another, along with any resulting actions. This shows a generalized description of the operation of the HDTM.

2.4 *State definitions expressed in terms applicable to a modem interface*

The following definitions apply to the use of the HDTM with the V.26 *bis* modem interface, as an example.

2.4.1 *Idle state (state 0)*

Circuit 107 is OFF.

2.4.2 *Half-duplex sending state (state 1)*

Circuit 105, circuit 106 and circuit 107 are ON. LAPB is connected to circuit 103 and enabled to send frames.

2.4.3 *Wait for receiving state (state 2)*

Circuit 107 is ON, circuit 105 is OFF. LAPB is inhibited from sending frames and disconnected from circuit 103, which is held in the binary 1 condition. Timer T is running.

2.4.4 *Half-duplex receiving state (state 3)*

Circuit 107 is ON, circuit 105 is OFF. LAPB is inhibited from sending frames and disconnected from circuit 103, which is held in the binary 1 condition.

2.4.5 *Wait for sending state (state 4)*

Circuit 105 and circuit 107 are ON, and circuit 106 is OFF. LAPB is connected to circuit 103 but is inhibited from sending frames.

2.5 *Table of transitions between states expressed in terms applicable to a modem interface*

Table 2/T.71 shows, in terms of the V.26 *bis* modem interface, the events that cause a state transition and the resulting action(s).

TABLE 1/T.71

Description of state transitions

Present state	Event	Action	New state
0	Calling DTE: Data circuit established (e.g. data set ready, ready for data)	→	4
0	Called DTE: Data circuit established (e.g. data set ready, ready for data)	Start timer T	2
4	Indication of availability of the physical level for transmission	Send indication to the remote DTE that the half-duplex sending state has been entered Status <OP-T> (see Note 1)	1
1	Conclusion of transmission	Send request that remote DTE enter the half-duplex sending state (see Note 4) Start timer T Status <INOP-T> (see Note 2)	2
2	Reception of indication that the remote DTE has entered the half-duplex sending state	Stop timer T	3
2	Expiry of timer T	→	4
3	Reception of notification that the remote DTE is requesting a change in the direction of transmission	→	4
1	LAPB has entered a disconnected phase (i.e. Control <TERM>, see Note 3)	→	0
3	LAPB has entered a disconnected phase (i.e. Control <TERM>, see Note 3)	→	0
Any	Physical level has no circuit to a remote DTE	→	0

Note 1 – Status <OP-T> indicates to LAPB that the sending of frames is enabled.

Note 2 – Status <INOP-T> indicates to LAPB that the sending of frames is inhibited.

Note 3 – Control <TERM> indicates that LAPB has entered the disconnected phase (equivalent to ADM of HDLC).

Note 4 – HDTM uses the idle data link channel state indication (at least 15 contiguous 1's) for requesting that the remote DTE enter the half-duplex sending state.

TABLE 2/T.71

Description of state transitions in terms of the V.26 *bis* modem interface

Present state	Event	Action	New state
0	Calling DTE: Circuit 107 ON	Turn circuit 105 ON Connect LAPB to circuit 103	4
0	Called DTE: Circuit 107 ON	Start timer T	2
4	Circuit 106 ON	Enable sending of LAPB frames (see Note 1)	1
1	Transmission concluded (see Note 2)	Inhibit sending of LAPB frames Disconnect LAPB from circuit 103 Hold circuit 103 in the binary 1 condition Turn circuit 105 OFF (see Note 3) Start timer T	2
2	Reception of a flag	Stop timer T	3
2	Expiry of timer T	Turn circuit 105 ON Release circuit 103 from binary 1 condition Connect LAPB to circuit 103	4
3	Reception of 15 contiguous 1 bits (see Notes 4 and 5)	Turn circuit 105 ON Release circuit 103 from binary 1 condition Connect LAPB to circuit 103	4
1	LAPB has entered a disconnected phase	Turn circuit 105 OFF	0
3	LAPB has entered a disconnected phase	——————→	0
Any	Circuit 107 OFF	Turn circuit 105 OFF	0

Note 1 — It is necessary to ensure that at least one full flag is transmitted after circuit 106 comes ON. This flag may be the opening flag of the first frame.

Note 2 — The HDTM may determine that a transmission by the LAPB module has been concluded by either of the following:

- counting a sequence of contiguous flags on circuit 103 while in state 1,
- a time-out, T,
- a signal from another source, e.g., from a higher level.

However, if no frame is transmitted while in state 1, not less than five contiguous flags shall be sent in state 1 before entry into state 2.

Note 3 — It is recommended that circuit 105 not be turned OFF until 15 bit times after the binary 1 condition is established on circuit 103. This will assure transmission of an idle sequence to the remote DTE.

Note 4 — It is recognized that whether or not an idle sequence is sent by the remote DTE, the DTE will detect an idle sequence after circuit 109 goes OFF, since according to Recommendation V.26*bis*, this will hold circuit 104 in the binary 1 condition.

Note 5 — It is understood that circuit 109 will go OFF. Entry into state 4 may be made dependent on this OFF condition, as an implementation option.

2.6 *Timer T*

This timer is used to recover from an apparent failure of the remote DTE to take the right to transmit. To avoid a contention condition during this recovery process, different values of timer T are to be used by the called and calling DTE. A calling DTE uses the value T_a, and a called DTE uses the value T_b.

The values of T_a and T_b are system parameters and must be studied further in relationship to interworking requirements and other system parameters in Recommendation T.70.

ANNEX A

(to Recommendation T.71)

Additional rules making for greater efficiency in half-duplex transmission

A.1 *General considerations*

- Greater efficiency is obtained in recovery situations.
- The application of these rules is optional.
- The application of these rules does not imply any incompatibility or entail any amendment of DTEs (or DCEs) which observe the procedures described in Recommendation T.71.

A.2 *Rules of operation*

1) Before the DTE (or DCE) gives the turn back, it ensures that it has acknowledged all the frames received and accepted before it received the turn.

2) If the DTE (or DCE) receives or takes the turn, it will always first retransmit all the I-frames which have not been acknowledged.

3) The DTE (or DCE) must replace the last RR frame in each turn, if any, by an REJ frame carrying the appropriate N(R).

Recommendation T.72

TERMINAL CAPABILITIES FOR MIXED MODE OF OPERATION

(Malaga-Torremolinos, 1984)

CONTENTS

The CCITT,

considering

(a) that Telematic services have been defined or are going to be defined for a number of applications;

(b) that these applications, in some cases, can be conveniently combined into one single terminal to give improved performance to the users of these terminals;

(c) that standardization work has been aiming at common protocols and compatible parameters for various equipments and procedures;

(d) that Teletex and Group 4 facsimile seem particularly suited to form a common service where required;

(e) that other services already defined or under study could be incorporated,

unanimously declares

that mixed-mode capabilities should be designed and operated in accordance with the following standards:

1 Scope

1.1 The international Teletex service requirements to the mixed mode of operation are defined in Annex C of Recommendation F.200.

1.2 The service requirements for Group 4 facsimile service related to the mixed mode of operation are defined in Recommendation F.161.

1.3 This Recommendation defines technical requirements unique to the mixed mode of operation.

2 Introduction

2.1 Terminals providing the teletex and facsimile mixed mode of operation shall fulfill the minimum set of facilities defined in this Recommendation.

2.2 The following CCITT Recommendations may also apply to terminals for mixed mode of operation:

- T.5: General aspects of Group 4 facsimile apparatus;
- T.6: Facsimile coding schemes and coding control functions for Group 4 facsimile apparatus;
- T.60: Terminal equipment for use in Teletex service;
- T.61: Character repertoire and coded character sets for the international Teletex service;
- T.62: Control procedures for the Teletex and Group 4 facsimile services;
- T.70: Network-independent basic transport service for telematic services;
- T.73: Document interchange protocol for telematic services;
- Series I Recommendations as applicable.

2.3 *Definitions*

2.3.1 Terms and their definitions are listed in Annex A.

3 General characteristics of the terminal equipment

3.1 *General*

3.1.1 Terminals supporting mixed mode of operation shall provide a minimum set of facilities. The ability to provide this minimum set of facilities is indicated at the session layer and by the document interchange protocol as defined in Recommendation T.73.

3.1.2 These terminals may in addition to the minimum set provide other facilities. These facilities are negotiated separately from the set of facilities defined below.

3.2 *Minimum set of facilities required for terminals supporting mixed mode*

The minimum set of facilities required for terminals supporting mixed mode of operation are:

3.2.1 the ability to create, transmit and receive documents in Text Image Format 1 (TIF.1) (see § 4.1);

3.2.2 the ability to position and dimension layout objects using a standardized coordinate system (see § 4.2);

3.2.3 the ability to designate the type of coding used to represent text contained in a block as specified in § 3.2.5;

3.2.4 the ability to handle the maximum interchanged image area and to provide, at least, the image area for assured reproduction which are defined for ISO A4 paper size in §§ 4.4.3 and 4.4.4 (see also § 3.3.4);

3.2.5 the ability to receive and present documents, structured in accordance with TIF.1, composed of:

a) one (or more) page(s) containing only text belonging to the Teletex basic repertoire of Recommendation T.61;

b) one (or more) page(s) containing only text encoded by the facsimile coding scheme defined in Recommendation T.6;

c) one (or more) page(s) containing text encoded as per a) and b);

d) any combination of pages defined in a), b) and c);

3.2.6 the ability to process up to 31 received blocks for presentation as a single page, without using negotiation;

3.2.7 the ability to handle the call identification line information (see § 4.7);

3.2.8 the ability to superimpose transparently information contained in blocks;

3.3 *Negotiable facilities for mixed mode*

One or more additional facilities listed in this section may be provided by a terminal supporting mixed mode:

3.3.1 the ability to receive and present documents using one or more of the standardized options defined in Recommendations T.60, T.5, T.61 and T.6;

3.3.2 the ability to receive and present documents using additional capabilities described in T.73;

3.3.3 the ability to send and/or receive documents using the non-standardized capabilities as allowed in Recommendation T.62;

3.3.4 the ability to handle the maximum interchanged image area and to provide, at least, the image area for assured reproduction which are defined for North-American paper size and ISO B4 paper size (see §§ 4.4.3 and 4.4.4);

3.3.5 the ability to provide image areas for other paper sizes (for further study);

3.3.6 the ability to create, transmit and receive documents in Text Image Formats other than TIF.1;

3.3.7 the ability to process more than 31 received blocks for presentation as a single page;

3.3.8 the ability to receive and present documents, the presentation of which requires grey scales or colour (see Note);

3.3.9 the ability to superimpose opaquely information contained in blocks (see Note);

3.3.10 the ability to create, transmit and receive documents in Text Processable Format (TPF) (see Note).

Note – The procedure for using this facility is for further study.

4 Text handling

4.1 *Document structure*

The document structure handled by terminals providing mixed mode of operation will be transmitted using the functionalities defined for TIF.1 in Recommendation T.73, § 6.

Terminals providing mixed mode of operation will have the ability to handle a generic and specific layout document structure composed of:

- document profile;
- document;
- page;
- block.

The minimum set of facilities is defined by the tables in § 4.5.

4.2 *Positioning of layout objects*

4.2.1 This section gives the rules for positioning of layout objects when using the text image format defined in Recommendation T.73.

4.2.2 The positioning of all layout objects shall be specified, directly or indirectly, in relation to the origin of the Cartesian coordinate system in which all objects are positioned in the fourth quadrant as viewed in the vertical orientation. All positions shall be given non-negative values along the X-axis and the Y-axis, respectively.

4.2.3 For mixed mode, the top left corner of the defined interchanged image area shall be the origin of the coordinate system.

4.2.4 The reference point for positioning of layout objects is the top left corner of the object in the coordinate system.

4.2.5 Dimension and position of frames and blocks shall be specified in basic measurement units (BMU). The size of a BMU depends on output medium and on the magnification/reduction (M/R) ratio.

4.3 *Positioning of text within blocks*

Within this § 4.3, all references to blocks are to be interpreted as applying to basic layout objects, i.e either to blocks or to pages that are not subdivided into blocks.

In positioning text within a block, the area of the block is treated as a sub-page that is independent of adjoining areas. The text image is not permitted to extend beyond the area of the block.

4.3.1 *Character coded text*

For positioning of characters, it is assumed that each character is contained in a character box.

The reference point for positioning of a character box is the intersection of the character base line and the left edge of the character box, as shown in Figure 1/T.72.

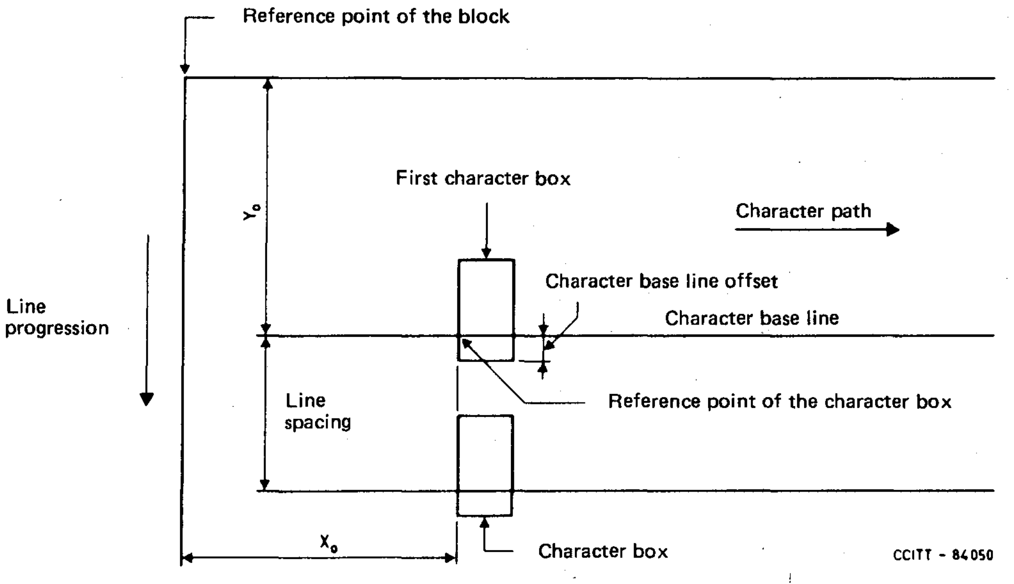
The reference point of the block to which the first character box is referred, is the reference point for positioning of layout objects.

The initial offset is the distance measured from the reference point of the block to the location of the reference point of the first character box.

The first character boxes of each line are aligned.

With the defined value of initial offset, the reference point of the first character box in the block shall be located by both coordinate directions relative to the reference point of the block, as shown in Figure 1/T.72.

Without initial offset, the reference point of the first character box in the block shall be located on the edge of the block with a distance equal to the defined value of the line spacing measured from the nearest block corner opposite the line progression, as shown in Figure 2/T.72.



X_0 : Horizontal initial offset
Y_0 : Vertical initial offset

FIGURE 1/T.72

Position of character boxes in a block
(character path: 0°, line progression: 270°)

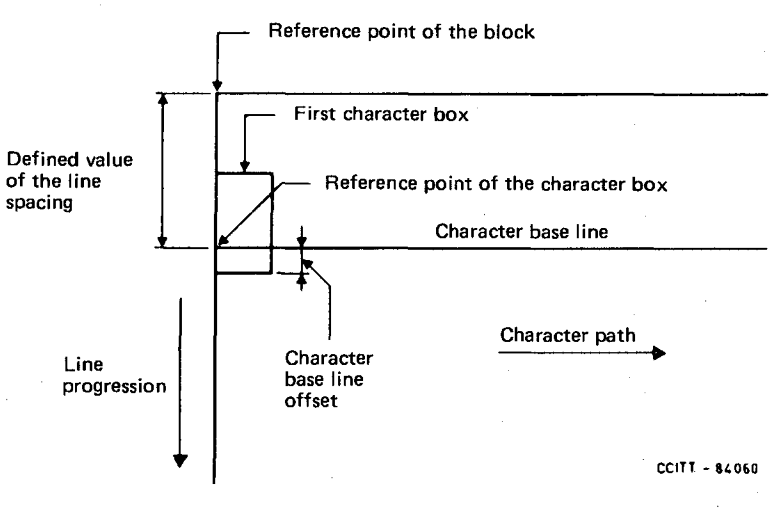


FIGURE 2/T.72

Position of the first character box in a block
when using the standard default value for initial offset
(character path: 0°, line progression: 270°)

In character-coded text information using format effectors as in Recommendation T.61, the format effectors operate within the area of the block as if this were the area of the page. A carriage return would move the active position to the initial character position of the line defined in the block by the initial offset.

The following control functions in Recommendation T.61 must not be used in the mixed mode of operation:

- form feed;
- page format selection.

If an initial offset is specified, it is possible, within the limits of the page or block, to backspace along an extended projection on the line to character positions preceding the initial character position on that line.

For the transmission of character-coded information within a block intended for vertical viewing, a character path of 0° shall be specified. For the transmission of character-coded information within a block intended for horizontal viewing, a character path of 90° shall be specified. This means that a receiving page (vertical) intended for horizontal viewing has to be turned by 90° to the right. See Figures 3/T.72 and 4/T.72.

Line Progression is always perpendicular to the character path and is measured relative to the character path.

4.3.2 *Photographic coded text*

The position of the first line is established from an initial point, specified by the coordinate distances from the reference point of the block to the initial pel as shown in Figure 5/T.72.

The reference point of the block to which the initial pel of the line is referred, is the reference point for positioning of layout objects.

The position of the initial pel within the block is called the initial offset.

Without initial offset, the initial pel of the first line in the block will coincide with the reference point of the block.

For the transmission of photographic coded text within a block, a pel path of 0° shall be specified. Thus, the pel path shall be from left to right and the line progression of successive lines proceeds from top to bottom.

4.4 *Dimensions for text presentation*

4.4.1 *Basic measurement unit (BMU)*

The size of the basic measurement unit (BMU) is $1/1200 \times 25.4$ mm if the output medium is paper and the magnification/reduction ratio is one. To avoid introducing positioning errors between the mandatory image resolutions, it is preferred that the positioning of text layout objects be specified in increments of 20 BMU.

4.4.2 *Paper sizes*

Different physical paper sizes can be used for presentation of mixed-mode information. Such paper sizes are ISO A4 (210×297 mm), North American paper size (215.9×279.4 mm) and ISO B4 paper size (250×353 mm).

4.4.3 *Interchanged image area*

In the context of this Recommendation, a page is a rectangular area that corresponds to the interchanged image area. The page is a layout object that is used as the reference area for positioning and imaging the text information content. In this Recommendation, the interchanged image area may be equal to or smaller than the idealized or nominal size of the corresponding physical paper size.

In addition, for photographic coded text, if the attribute "number of discarded pels" is specified, the interchanged image area may exceed the nominal paper size in the horizontal dimension.

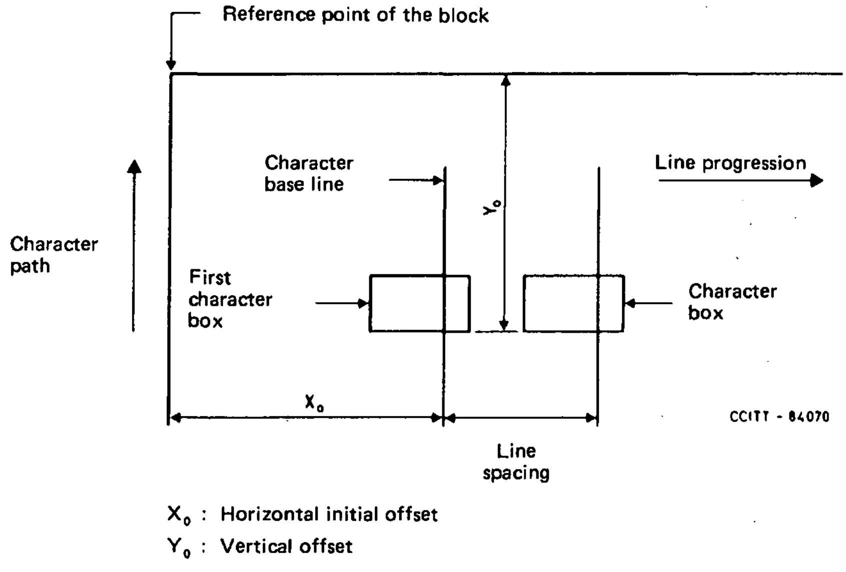


FIGURE 3/T.72

Position of character boxes in a block (character path: 90°, line progression: 270°)

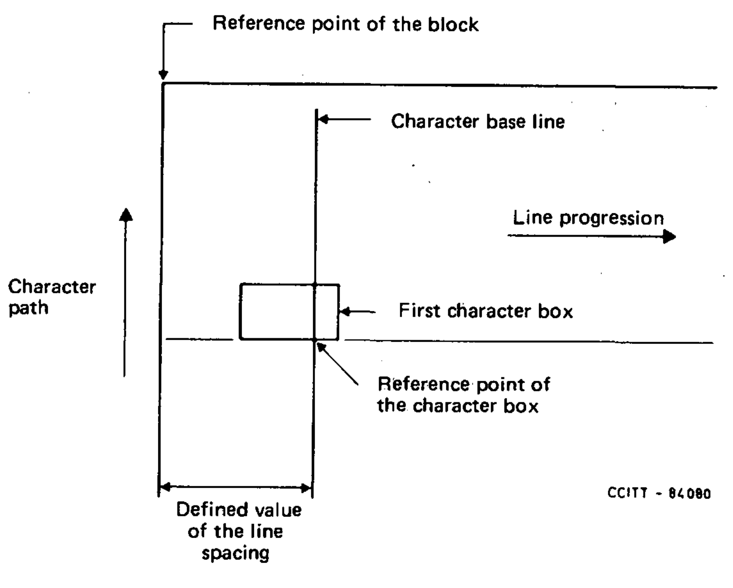
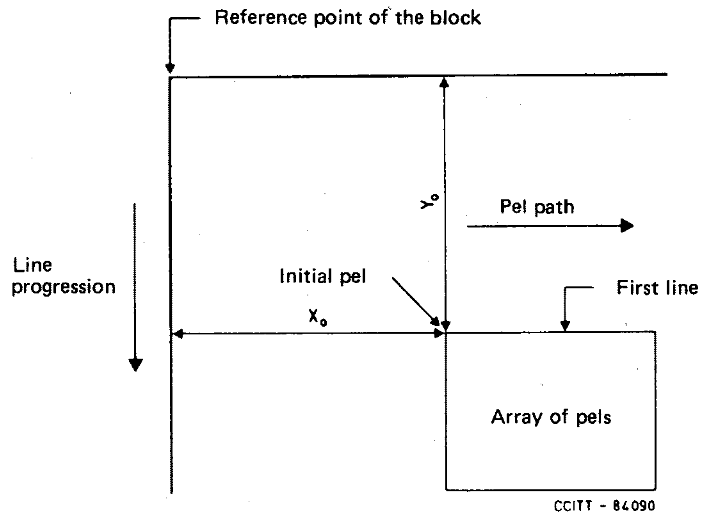


FIGURE 4/T.72

Position of the first character box in a block when using a standard default value for initial offset (character path: 90°, line progression: 270°)



X_0 : Horizontal initial offset
Y_0 : Vertical initial offset

FIGURE 5/T.72

Position of pels in the block

The following page sizes are defined, showing the maximum allowed dimensions of layout objects at the page level:

a) interchanged image area for the ISO A4 paper size:
   - maximum width 9 920 BMU (210 mm)
   - maximum height 14 030 BMU (297 mm)

b) optional interchanged image area for the North American letter paper size:
   - maximum width 10 200 BMU (215.9 mm)
   - maximum height 13 200 BMU (279.4 mm)

c) optional interchanged image area for the ISO B4 paper size:
   - maximum width 11 811 BMU (250 mm)
   - maximum height 16 677 BMU (353 mm)

The interchanged image areas defined above describe the presentation of text information on the specified paper sizes in both the vertical and horizontal image orientations.

The use of larger page sizes (e.g. corresponding to other physical paper sizes) must be negotiated.

4.4.4 *Image area for assured reproduction*

When the interchanged image area uses the maximum page sizes specified in § 4.4.3, the possibility of edge losses must be considered when the text information is to be printed on paper. These edge losses may be caused, for example, by the optional printing of a call identification line at the receiver, by tolerances on the physical paper size, and by equipment tolerances (see, for example, Annex A of Recommendation T.60).

For the option of printing a call identification line, an area at the top of the page is reserved. This same area is used for both vertical and horizontal image orientations. If used, the call identification line is to be printed on the second character baseline which is 400 BMU (8.466 mm) from the X-axis. The reserved area consists of 72 character boxes, each 120 BMU in width and 200 BMU in height, starting at 945 BMU (20 mm) from the Y-axis and extending for 8640 BMU. The maximum permitted character baseline offset of these character boxes is

72 BMU, so that the area of assured reproduction starts at 472 BMU (10 mm) from the X-axis. Any interchanged text in the area of these character boxes may be suppressed, to avoid obscuring the image of the call identification line.

The image areas for assured reproduction are defined as follows:

a) ISO A4 paper size:

– width	9 240 BMU	(195.6 mm)
– height	13 200 BMU	(279.4 mm)

b) North American letter paper size:

– width	9 240 BMU	(195.6 mm)
– height	12 400 BMU	(262.5 mm)

c) ISO B4 paper size:

– width	11 200 BMU	(237.1 mm)
– height	15 200 BMU	(321.7 mm)

These image areas for assured reproduction are illustrated in Figure 6/T.72 and Figure 7/T.72, respectively, showing the maximum edge losses on each paper edge. The indicated edge losses are based on the idealized or nominal paper sizes as defined in § 4.4.2 and do not take account of paper size tolerances.

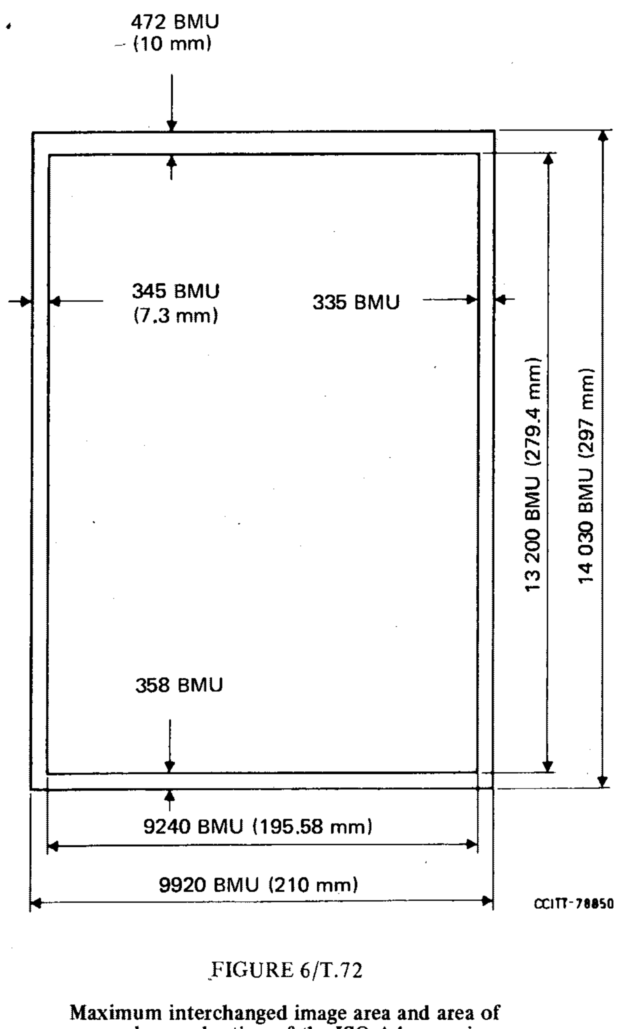


FIGURE 6/T.72

Maximum interchanged image area and area of assured reproduction of the ISO A4 page size

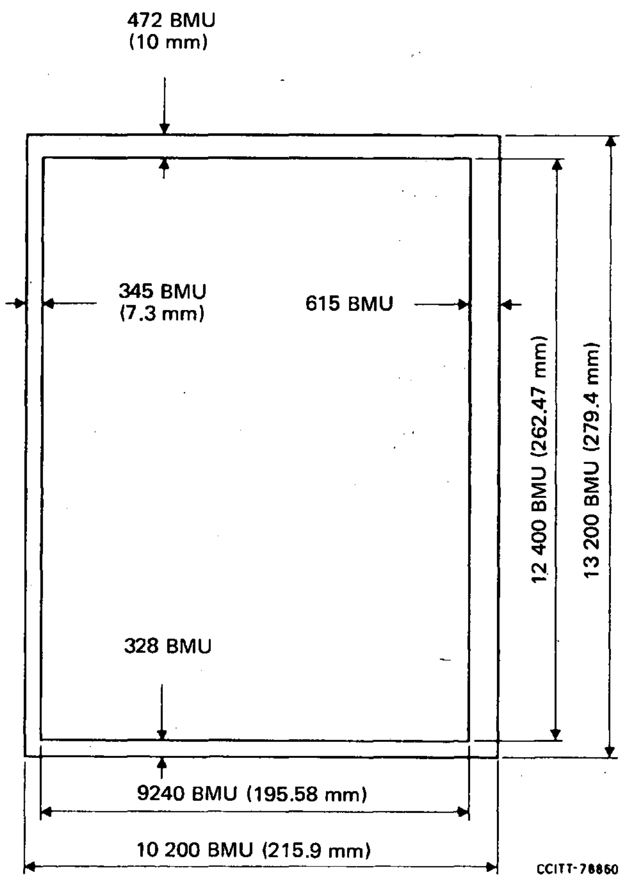


FIGURE 7/T.72

Maximum interchanged image area and area of assured reproduction of the North American letter page size

Note – The indicated size and location of the area of assured reproduction accommodates ISO 3535 forms, UN/ECE Trade Documents, and the printed line lengths of the basic Teletex service (i.e. 77 characters at 10 characters per 25.4 mm) for the ISO A4 page size. For the North American letter page size, it also accommodates ISO 3535 forms and UN/ECE Trade Documents, as used for that paper size.

4.4.5 *Positioning of the interchanged image area when printing on paper*

When the sender uses the maximum dimensions permitted for the interchanged image area, then the sender has fully specified the intended positioning. The receiver shall position the text image using coordinates based on the nominal paper size, as illustrated in Figures 6/T.72 or 7/T.72 for the maximum interchanged image area.

When the dimensions of the interchanged image area are equal to or less than the dimensions of the area of assured reproduction, the receiver shall position the text image within the area of assured reproduction so as to minimize the possibility of loss of text information. Any positioning that complies with this requirement is permitted, at the choice of the receiver.

Facsimile image parameters, for the image dimensions in Figures 6/T.72 and 7/T.72, are shown for reference in Table 1/T.72.

TABLE 1/T.72

Parameters for facsimile images extending over the image dimensions shown in Figures 6/T.72 and 7/T.72 (for reference only)

Image dimension		Number of pels per line at various image resolutions				
BMU	mm	180 pels/25.4 mm	200 pels/25.4 mm	240 pels/25.4 mm	300 pels/25.4 mm	400 pels/25.4 mm
9 920	210.0	1488	1654	1984	2480	3308
9 240	195.6	1386	1540	1848	2310	3080
10 200	215.9	1530	1700	2040	2550	3400
		Number of facsimile image lines at various image resolutions				
14 030	297.0	2104	2339	2806	3508	4677
13 200	279.4	1980	2200	2640	3300	4400
12 400	262.5	1860	2067	2480	3100	4133

4.5 *Values for minimum set of facilities*

The Tables 2/T.72 to 6/T.72 constitute the minimum set of facilities required to handle mixed-mode documents structured according to the TIF.1 interchange format (see Recommendation T.73).

In these tables are listed document descriptors and their attributes as well as text presentation attributes. The attributes are diversely qualified:

m: *mandatory*, indicates the attribute must be explicitly stated at each occurrence;

d: *defaultable*, indicates the attribute is always necessary, but may be described elsewhere according to the default mechanisms, as defined in Recommendation T.73, § 2;

nm: *non-mandatory*, indicates the attribute is not always used by the sender, depending upon the specific needs.

TABLE 2/T.72

Attributes of the document profile descriptor

List of attributes		Defined values	Standard default values
Reference to generic structure	nm		
Reference to specific structure	nm		
Presentation capabilities			
Basic terminal characteristics	m	Mixed mode	
Interchange format	m	TIF.1	
Non-basic terminal capabilities	nm		
Non-basic structural capabilities	nm		
Maximum number of objects per page	d	31	31

TABLE 3/T.72

Attributes of generic and specific layout descriptors

List of attributes		Defined values	Standard default values
Document descriptor			
Object type	m	Document	
Object identifier	Note 1		
Reference to subordinate objects	nm	Page identifier	
Reference to corresponding generic object	Note 2	Generic document identifier	
Default value lists	nm	Page, block	
User readable comment	nm	T.61 coded string	
Page descriptor			
Object type	m	Page	
Object identifier	Note 1		
Reference to subordinate objects	nm	Block identifier	
Reference to corresponding generic object	Note 2	Generic page identifier	
Presentation attributes	Note 3	See Tables 5/T.72 and 6/T.72	
Dimensions	d	Width ⩽ 9920 BMU Height ⩽ 14 030 BMU	Width = 9240 BMU Height = 13 200 BMU
Reference to content portions	nm	Content portion identifier	
Default value lists	nm	Block	
User readable comment	nm	T.61 coded string	
Block descriptor			
Object type	m	Block	
Object identifier	Note 1		
Reference to corresponding generic object	Note 2	Generic block identifier	
Presentation attributes	Note 4	See Tables 5/T.72 and 6/T.72	
Position	d	X,Y BMU	0,0 BMU
Dimensions	d	X,Y BMU	Page dimensions
Transparent	d	Transparent	Transparent
Reference to content portions	nm	Content portion identifier	
User readable comment	nm	T.61 coded string	

Note 1 – Mandatory only in generic objects.

Note 2 – Mandatory only in specific objects and only if there is a corresponding generic object.

Note 3 – Mandatory unless specified by a corresponding generic object or in a default value list at document level.

Note 4 – Mandatory unless specified by a corresponding generic object or in a default value list at page level or document level.

TABLE 4/T.72

Attributes of the text unit

List of attributes		Defined values	Standard default values
Content portion identifier	nm		
Type of coding	m	Character box: T.61 Photographic: T.6	
Coding attributes for T.6 photographic information			
Number of pels per line	m	N	
Compression	d	Compressed as in T.6	Compressed as in T.6
Number of discarded pels	d	M	0
Alternative graphic representation	nm	T.61 coded string	

TABLE 5/T.72

Presentation attributes for character box element

List of attributes		Defined values	Standard default values
Content type	m	Character box	
Character path	d	0°, 90°	0°
Line progression	d	270°	270°
Character box orientation	d	0°	0°
Character spacing	d	120 BMU	120 BMU
Line spacing	d	100, 200, 300 and 400 BMU	200 BMU
Alignment	d	Left aligned	Left aligned
Initial offset	d	X,Y BMU	See Note 1
Graphic rendition	d	Default rendition underlined	Default rendition

Note 1 – The default initial offset will be such that the first character box will be located on one of the two left corners of the layout object depending on the given values for character path and line progression. The two possibilities are listed below:

Character path	Line progression	Position of the first character box
0°	270°	Upper left corner
90°	270°	Lower left corner

TABLE 6/T.72

Presentation attributes for photographic elements

List of attributes		Defined values	Standard default values
Content type	m	Photographic	
Pel path	d	0°	0°
Line progression	d	270°	270°
Pel transmission density (receiving capabilities)	m	240, 300 pels per 25.4 mm	
Initial offset	d	X,Y BMU	0,0 BMU

4.6 *Values for negotiable facilities*

This section contains options that are not necessarily implemented and therefore shall be the subject of a negotiation during the session establishment phase.

4.6.1 *Document profile descriptor*

Attributes of the document profile descriptor are given in Table 7/T.72.

TABLE 7/T.72

Attributes of the document profile descriptor

List of attributes		Values for negotiable facilities
Non-basic structural capabilities	nm	
Maximum number of objects per page	d	> 31

4.6.2 *Layout descriptor*

Attributes of generic and specific layout descriptors are given in Table 8/T.72.

TABLE 8/T.72

Attributes of generic and specific layout descriptors

List of attributes		Values for negotiable facilities
Page descriptor		a) Interchanged image area for North American letter paper size
Dimensions	d	Width ⩽ 10 200 BMU Height ⩽ 13 200 BMU b) Interchanged image area for ISO B4 paper size Width ⩽ 11 811 BMU Height ⩽ 16 677 BMU

4.6.3 *Text unit*

Attributes of the text unit are given in Table 9/T.72.

TABLE 9/T.72

Attributes of the text unit

List of attributes		Values for negotiable facilities
Coding attributes for T.6 photographic information Compression	d	Uncompressed as specified in T.6

4.6.4 *Presentation attributes for character box elements*

These attributes are given in Table 10/T.72.

TABLE 10/T.72

Presentation attributes for character box elements

List of attributes		Values for negotiable facilities
Character path	d	270°
Character spacing	d	80, 100 and 200 BMU
Line spacing	d	150 BMU
Graphic rendition	d	Proportional spacing

4.6.5 *Presentation attributes for photographic elements*

These attributes are given in Table 11/T.72.

TABLE 11/T.72

Presentation attributes for photographic elements

List of attributes		Values for negotiable facilities
Pel transmission density	m	180, 200, 400, 600 and 1200 pels per 25.4 mm

4.7 *Call identification line (CIL)*

4.7.1 The basic CIL presentation rules as defined in Recommendation F.200 should apply.

4.7.2 For printing CIL, an area, as defined in § 4.4.4 is provided.

5 Communication

5.1 *Coding schemes available*

5.1.1 Recommendation T.61 defines the coding scheme to be used for character coded text.

5.1.2 Recommendation T.6 defines facsimile coding techniques to be used for photographic coded text.

The use of the end of facsimile block (EOFB) control function defined in Recommendation T.6 is mandatory at the end of each Text Unit. The line length used for coding and decoding is the one defined by the number of pels per line specified by the attribute of the Text Unit.

5.1.3 The use of other coding techniques is for further study.

5.2 *Pel transmission density for photographic coded text*

5.2.1 Terminals must provide the capability to receive photographic coded text using pel transmission densities of 240 and 300 pels per 25.4 mm in both horizontal and vertical directions.

Note – Future standardization work should aim at one single standard pel transmission density, taking into account both implementation and service quality aspects.

5.2.2 Optional pel transmission densities may be negotiated (see Table 11/T.72).

5.3 *Orientation of mixed-mode pages for transmission*

The intended viewing orientation of mixed-mode pages may be either vertical or horizontal. For the transmission of the page the orientation shall be vertical.

5.4 *Receiving capabilities*

5.4.1 The negotiation of the storage capacity at the session layer of the communication as described in §§ 3.4.4.2 and 5.7.3.5 of Recommendation T.62 is mandatory for terminals providing mixed mode of operation.

5.4.2 As such terminal can receive full pages encoded with an image coding technique, the receiving storage capacity should be sufficient in order to store at least one full page encoded with an image coding technique.

5.4.2.1 When the image coding technique used is as defined in Recommendation T.6, the storage capacity should be at least equal to 128 k octets. This value does not cover the worst case situation and may have to be changed depending on experience.

ANNEX A

(to Recommendation T.72)

Terms and definitions

Note 1 – Some of the terms used in this Recommendation have been defined in ways that may differ from the meanings of similar terms in other Recommendations.

Note 2 – Bold faced typed terms in the definitions are defined elsewhere in this annex.

The following table includes the list of terms in alphabetical order with the corresponding paragraph number.

A.1 **attribute**

A property of a **document** or a **constituent** of a document expressing a characteristic of the document or constituent concerned, or a relationship with one or more other documents or constituents.

Note – In Recommendations T.61 and T.62 related properties and characteristics of devices as well as presentation attributes are called parameters.

A.2 **basic object**

An object that is not subdivided.

Note – A basic object may be structured internally according to a presentation architecture.

A.3 **basic measurement unit (BMU)**

A unit of measurement used for positioning and dimensioning of **layout objects**.

A.4 **block (text block)**

A basic **layout object** corresponding to a rectangular area within a **page** or within a frame with its sides parallel to the sides of the enclosing page or frame, in which only one category or **graphic element** is to be imaged.

A.5 **character**

A member of a set of elements (upon which agreement has been reached and that is) used for the organization, control or representation of information (data).

A.6 **character base line**

A positioning reference for the placement of symbols within a **character box**.

A.7 **character box**

1) A rectangular area on the **presentation medium** that can be used for the **rendition** of one **graphic character**.

2) A rectangular area within which a **graphic character** is contained. The nominal spacing between symbols, if any, is included within the character box.

A.8 **character box element**

Either language character or **pictorial character** that is presented within a **character box**.

Note – This term is also used as an alternative term for **graphic character**.

A.9 **character coded text**

The coded representation for text interchange of graphic characters and associated control functions. This coded representation is specified in Recommendation T.61.

A.10 **character path**

The direction of progression of succesive **character boxes** along a line.

A.11 **constituent**

A **layout** or **logical object** below the level of **document** or a content portion.

A.12 **content portion**

A part of the content of the **document** associated with at most one basic **layout object** and one basic **logical object**.

Note – Other terms in use are "portion of text" and "portion of document content".

A.13 **control function**

An action that affects the recording, processing, transmission, or interpretation of data and that has a coded representation consisting of one or more octets of bits.

A.14 **descriptor**

A data element representing a **layout object** or a **logical object.**

A.15 **document**

An amount of **text** that can be interchanged as a unit defined by the originator between applications.

A.16 **document class**

A category of **documents** defined by a set of common properties, e.g. letter, memorandum, report, invoice.

A.17 **document descriptor**

A set of **attributes** describing the **layout** or **logical** structure of a **document**.

A.18 **document profile**

A set of **attributes** associated with a **document**, for the purpose of handling the document as a whole.

A.19 **document structure**

The result of dividing and subdividing the content of a **document** into increasingly smaller parts, the parts being called **layout objects**, **logical objects**, and **text units**.

A.20 **generic**

Term qualifying a **layout** or **logical structure**, a **layout** or **logical object** or an **attribute** pertaining to a **document class**.

A.21 **graphic character**

A character, other than a **control function**, that has a visual representation normally handwritten, printed or displayed. Graphic characters include simple alphanumeric characters, composite characters (e.g. accented letters) and **pictorial characters** (e.g. mosaics).

A.22 **graphic element (of text)**

The smallest individually specified element used to construct an **image**. There are three categories of graphic elements of **text**, namely **character box elements**, geometric elements and **photographic elements**.

A.23 **Image**

Visual **presentation** of a **text**.

A.24 **image area**

That part of a **page** that is available for assured reproduction of **text**.

A.25 **information field**

Part of a **text unit**, that contains the **content portions** (i.e. the textual information).

A.26 **interchange**

The process of providing a duplicate of a **document** to a receiving person or device.

A.27 **interchange format**

A representation of a **document** by a collection of data elements for the purpose of **interchange**.

A.28 **layout object**

One of the parts pertaining to the **layout structure**, e.g. **page**, **block**.

A.29 **layout structure**

The result of dividing and subdividing the content of a **document** into increasingly smaller parts, on the basis of the **presentation**, e.g. into **pages** and **blocks**.

A.30 **logical object**

One of the parts pertaining to the **logical structure**, e.g. chapter, section, paragraph.

A.31 **logical structure**

The result of dividing and subdividing the content of a **document** into increasingly smaller parts, on the basis of the meaning of the content, e.g. into chapters, sections, paragraphs.

A.32 **mixed mode**

A mixed-mode capability provides the means of transferring the information content of a document between sender and recipient, where the information content has been encoded using different techniques (e.g. in all forms of facsimile or character coding) and the document structure fully identified enabling the recipient to apply sophisticated editing methods.

A.33 **page**

A **layout object** that is a rectangular area with dimensions equal to the associated interchanged image area.

A.34 **pel path**

The direction of progression of successive **photographic elements** along a line.

A.35 **photographic element**

An individual picture element (pel, pixel) used in arrays to construct images. Each pel has a specific shape, size, colour, intensity and position.

A.36 **photographic coded text**

The coded representation for text interchange of photographic elements. This coded representation is specified in Recommendation T.6.

A.37 **pictorial character**

Predetermined pattern which is intended to be presented in adjacent **character boxes** to construct rulings, boxes, figures, logos, diagrams, or other pictures occupying multiple character boxes.

A.38 **presentation**

The printing or display of stored **graphic elements** to allow for human comprehension of the stored information.

A.39 **presentation medium**

The carrier of information in a form perceptible to a human, e.g. a sheet of paper or a display screen.

A.40 **rendition**

The operation consisting of presenting the document content on a **presentation medium**.

A.41 **specific**

Term qualifying a **layout** or **logical structure**, a **layout** or **logical object**, or an **attribute**, pertaining to a particular document.

A.42 **text**

Text is information for human comprehension that is intended for **presentation** in a two-dimensional form, e.g. printed on paper or displayed on a screen. Text consists of symbols, phrases, or sentences in natural or artificial languages, pictures, diagrams, and tables.

A.43 **text image format (TIF)**

An **interchange format** that provides for the representation of the **document profile**, **layout objects** and **content portions** of a **document**.

A.44 **text processable format (TPF)**

An **interchange format** that provides for the representation of the **document profile**, **logical objects**, **content portions** and, optionally, **layout objects** of a **document**.

A.45 **text unit**

A data structure representing a **content portion**.

DOCUMENT INTERCHANGE PROTOCOL FOR THE TELEMATIC SERVICES

(Malaga-Torremolinos, 1984)

CONTENTS

1 General

1.1 *Scope*

1.1.1 This Recommendation defines the document interchange protocol to be used above session services within the Telematic service when a document structure is required for mixed mode and Group 4 facsimile.

The application of the Recommendation to the International Videotex service is for further study.

The extension of the Recommendation to other applications, especially interactive is for further study.

1.1.2 *Concerning the service aspects*

- Recommendation F.200 lays down the operational provision for the automatic international Teletex service. The service requirements unique to the mixed mode of operation are described in Annex C of Recommendation F.200.
- Recommendation F.161 describes the service requirement for Group 4 (G4) facsimile service.

1.1.3 *On the technical side*

1.1.3.1 The terminal equipment is defined by:

- Recommendation T.60 for Teletex,
- Recommendation T.5 for Group 4 facsimile,
- Recommendation T.72 for terminals providing mixed mode of operation.

1.1.3.2 Concerning the information coding:

- Recommendation T.61 defines the character repertoire and coded character set for the international Teletex service;
- Recommendation T.6 defines the coding scheme used in Group 4 facsimile equipments;
- further consideration to geometric coding scheme is for further study.

1.1.3.3 Recommendation X.200 defines the architectural reference model for CCITT applications, identifying the role of the peer protocol of the presentation layer control procedures.

1.1.3.4 Recommendation T.62 specifies the control procedures for Teletex and Group 4 facsimile services (including the mixed mode capability).

This Recommendation with current application rules for mixed mode and Group 4 facsimile indicates the way the document interchange protocol uses the control procedures described in Recommendation T.62.

It is recognized that Recommendations X.215 and X.225 specify the OSI session service and session protocol in a way which intends to be compatible with Recommendation T.62.

However, the question whether and how these Recommendations, in combination with this Recommendation, can be used in a manner fully compatible with the combination of Recommendation T.62 and this Recommendation is left for further study.

1.1.3.5 Recommendation T.70 specifies the network independent basic transport for Teletex and Group 4 facsimile services.

Recommendations X.214 and X.224 define the services and protocol of the transport layer in a way which intends to be fully compatible with Recommendation T.70.

1.1.4 This Recommendation defines the document interchange protocol to be used above session services, within the Telematic services, when a document structure is required for mixed mode and for Group 4 facsimile.

Recommendation T.73 is embedded in a framework of Recommendations for Telematic services as shown in Figure 1/T.73.

The current understanding of the relationship between this Recommendation and other OSI protocols is illustrated in Figure 2/T.73.

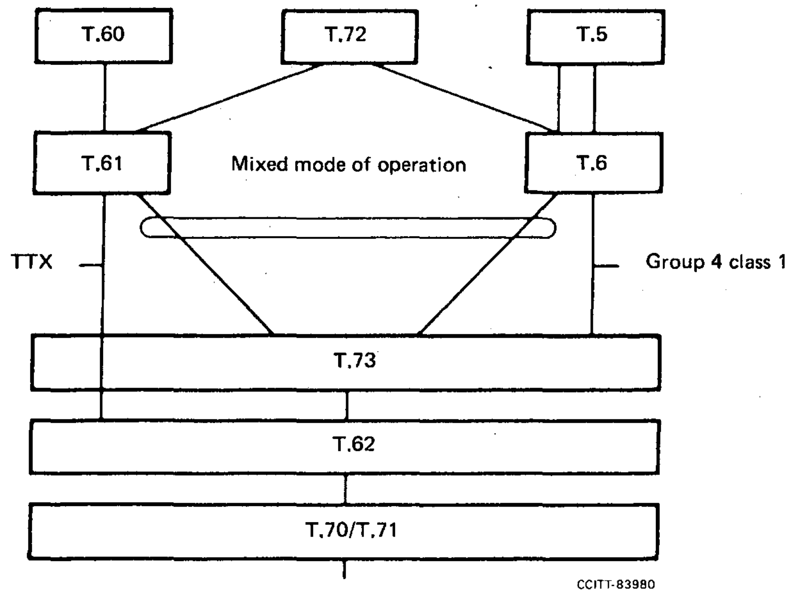


FIGURE 1/T.73

Framework of Recommendations for telematic terminals

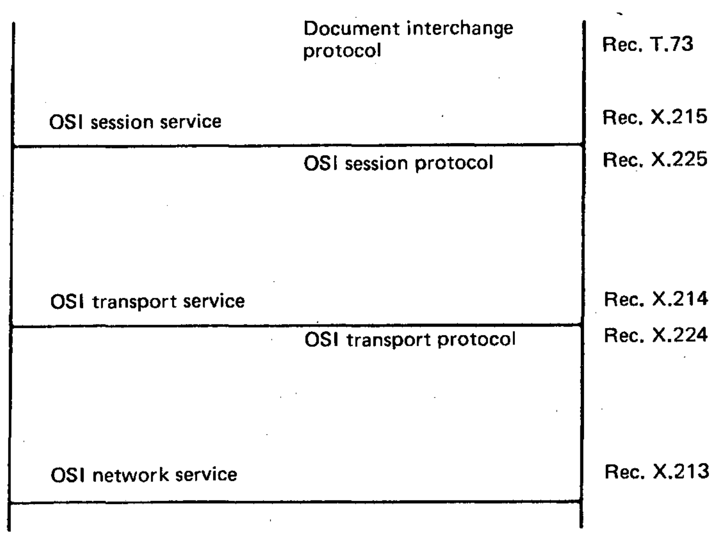


FIGURE 2/T.73

Relation between Recommendation T.73 and OSI protocols

(This figure is intended to be a guideline for the further work and requires further study)

1.2 *Fundamental principles*

1.2.1 *Document architecture concept*

1.2.1.1 For the purpose of this Recommendation, a document is defined as an amount of text that is interchanged between telematic terminals.

1.2.1.2 A document can be interchanged for two major purposes:

- it may be interchanged as an original in a final form allowing for printing, displaying and storing by the recipient;
- it may be interchanged in a revisable form allowing for processing by the recipient;

Processing includes editing, reformating, filing and other manipulations.

1.2.1.3 Text is information for human comprehension that can be presented in a two-dimensional form, e.g. printed on paper or displayed on a screen.

1.2.1.4 Text consists of graphic elements such as character box elements, geometric elements and photographic elements, which constitute the content of a document.

1.2.1.5 The contents of a document need be separated into various portions in order to:

- delimit presentation objects such as pages,
- delimit logical objects such as paragraphs,
- use different types of coding,
- allow processing after communication.

The description of these portions of text and their relationship constitute the document architecture.

The architecture supports incorporation of a set of sub-architectures within the content, which are in accordance with other Recommendations (e.g. T.61 and T.6).

1.2.1.6 The document architecture recognizes two structures:

- the layout structure,
- the logical structure.

The layout structure relates the content portions to layout objects for their positioning and rendition on the presentation media.

The logical structure relates the content portions to logical text objects serving specific purposes: sections, headings, paragraphs, footnotes and figures.

The architecture that is particular to a given document is called specific document architecture.

1.2.1.7 A given document may contain predefined layout objects with common content portions representing logos, forms, etc. which may appear several times in the document. These predefined content portions and their relationship are described by the generic layout structure.

In a similar manner there may be predefined objects and structuring rules which constitute the generic logical structure.

The interchanged generic document structures help:

- to improve the transmission efficiency,
- to maintain the consistency of the document with the document class during revision at the recipient, and
- to facilitate the creation of new documents of a certain class.

A comprehensive description of a document comprising specific and generic structures is shown in Figure 3/T.73.

If the logical structure is used, there are associated layout directives allowing for the control of formatting or reformatting.

1.2.1.8 A document contains a document profile as a set of attributes at document level. The document profile contains information for handling the document as a whole, and may repeat information in the document content.

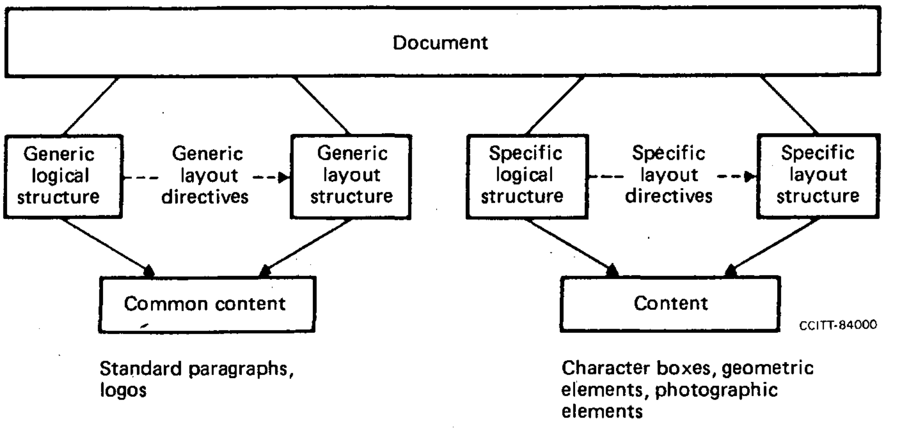


FIGURE 3/T.73

Document architecture

1.2.1.9 By the use of different components of the document architecture, different interchange formats can be derived. Two major types or formats are distinguished:

- text image format,
- text processable format.

1.3 *Definitions*

1.3.1 Terms and their definitions are listed in Annex A.

1.3.2 Some of the terms used in this Recommendation have been defined in ways that may differ from the meanings of similar terms in other Recommendations.

2 Functions for the structuring and interchange of text

2.1 *Document profile*

The document profile is a set of attributes at the highest level in the document structure. It provides supplementary information to facilitate handling the document as a whole.

The document profile contains references to the generic layout structure and specific layout structure, and specifies the presentation capabilities (see § 4).

In addition, it may describe the document and its history, including information for processing, indexing, filing and retrieval. It may duplicate some information for delivery control (e.g., the "envelope") and in the document body (e.g., document name, author, date, etc.).

2.2 *Document layout structure*

The document layout structure consists of the specific layout structure and the generic layout structure.

2.2.1 *Specific layout structure*

The specific layout structure is a tree structure with a variable number of hierarchical levels. The actual number of levels depends on the given document.

The nodes of the tree are specific layout objects. The branches of the tree represent the division of specific layout objects into subordinate specific layout objects.

At the highest level of the tree is the specific document. At successively lower levels of the hierarchy are specific page set, specific page, specific frame and specific block.

There may be zero, one, or more levels of page set between the levels of specific document and page. A page set consists of one or more pages and/or one or more subordinate page sets.

In the context of this Recommendation, a page is a rectangular area that corresponds to the interchanged image area. The page is the reference area used for positioning and imaging the content of the document. The size of the interchanged image area may be smaller than, equal to, or greater than the size of the corresponding physical page.

All layout objects subordinate to a page are positioned, directly or indirectly, relative to the page and are dimensioned such that they do not extend beyond the page.

The lowest level of the layout hierarchy may be either a page or a block. Below the level of page are zero, one, or more levels of frame.

A frame is a rectangular area within a page or within a frame of a hierarchically higher level, with its sides parallel to the sides of the page.

A block is a rectangular area with its sides parallel to the sides of the page. It is a basic container for a portion of the document content.

All blocks and frames are positioned relatively to the next higher level of the layout hierarchy.

Any number of blocks may be overlaid, partially or fully, independent of the category of graphic element to be imaged in the block. Thus, an image may consist of a photographic block transparently overlaid by a character box block.

A block may overlay another block transparently or opaquely. This is specified by attributes of the block concerned.

Any number of frames at the same level within a given subtree may overlay partially or fully. A frame may overlay other frames with the attribute of claiming, in which case the overlaid area is subtracted from the area of the non-claiming frame.

2.2.2 *Generic layout structure*

The generic layout structure allows for predefined relationship between specific page sets, pages, frames, and blocks, and predefined attribute specifications applying to those objects.

The generic layout structure consists of a set of predefined generic layout objects to which specific layout objects may refer. There are five types of generic layout objects: generic document, generic page set, generic page, generic frame, and generic block.

A generic page set provides predefined sequences of generic pages and generic page sets.

A generic page may contain one or more generic frames and/or one or more generic blocks.

A generic frame provides a predefined area of the page layout. Generic frames may be nested within higher level frames and may overlay.

A generic block provides for predefined attributes (e.g., position, dimensions) and content. Examples of predefined content portions are standard logos and copyright notices. This predefined content is of a single category of graphic element.

Wherever such a common content portion occurs in the specific document, there is a specific block in the specific layout structure that refers to the corresponding generic block in the generic layout structure. This reference specifies that the common content portion associated with the generic block is to be imaged in the specific block referring to the generic block.

Generic blocks may overlay and may be specified with the attribute of either transparent or opaque.

2.3 *Document interchange*

2.3.1 *General*

The interchange representation of a document in image form consists of a sequence of protocol elements, each representing the document profile, a layout object or a content portion. Three types of such elements are defined: a document profile descriptor, which represents the document profile, layout descriptors, which represent layout objects, and text units, which represent content portions. The order in which these descriptors and text units appear in the sequence of protocol elements is specified for each application in the corresponding application rules (see § 6).

2.3.2 *Presentation capabilities descriptor*

The presentation capabilities descriptor is a data element of the document interchange protocol which consists of a sequence of subordinate data elements and elementary data items. This protocol element is used to provide the negotiation mechanism defined in § 4.

It consists of four main parts:

a) a data element which represents the basic terminal characteristics;

b) a data element which represents the interchange format;

c) a sequence of data elements which represents the non-basic terminal capabilities;

d) a sequence of data elements which represents the non-basic structural capabilities.

2.3.3 *Document profile descriptor*

The document profile descriptor is a data element of the document interchange protocol, which consists of a sequence of subordinate data elements, and elementary data items.

It consists of four main parts:

a) a data element which represents the reference to the generic layout structure of the document.

b) a data element which represents the reference to the specific layout structure of the document.

c) a sequence of data elements which represents the presentation capabilities a terminal must provide to be able to handle the document.

d) an information field, filled by the application level which represents other document profile attributes concerning the document (data, author, etc.). The exact contents of this field is left for further study.

The elementary data items used to represent the document profile descriptor are data types such as numeric strings, octet strings, character strings, and bit strings.

2.3.4 *Layout descriptor*

A layout descriptor is an element of the document interchange protocol that represents a specific or generic layout object and its attributes. Each layout object is represented by one layout descriptor, which explicitly indicates whether it is specific or generic.

A layout descriptor is a data element consisting of a sequence of subordinate data elements and elementary data items, each representing one attribute of the layout object. Each subordinate data element again consists of a sequence of subordinate data element and/or elementary data items. The elementary data items are of a small number of basic data types such as numbers, character strings and bit strings.

2.3.5 *Text units*

A text unit is an element of the document interchange protocol that represents a portion of document content and the associated attributes.

A text unit is a data element that consists of two main parts:

a) a sequence of data elements representing the attributes of the portion of document content.

b) an information field consisting of one or more data elements that represent the portion of document content concerned.

The data elements used to represent the content are basic data types such as numeric strings, octet strings, character strings, and bit strings.

2.3.6 *Relationships between descriptors and between descriptors and text units*

The relationships between descriptors, and between descriptors and text units, are normally represented by structured identifiers and references. A structured identifier is a data element within a descriptor or text unit that uniquely identifies that descriptor or text unit. A reference is a data element within a descriptor that identifies a related descriptor or a related text unit and refers to that descriptor or text unit.

There are three types of relationships between descriptors, and between descriptors and text units, which express the corresponding relationships between objects and between objects and content portions.

a) *Hierarchical relationships between objects*

These are normally represented by structured identifiers, which indicate the hierarchical relationship of the object represented by the descriptor to all superior objects.

Additionally, a sequence of references in the descriptor of a layout object, referring to the descriptors of the subordinate objects at the next lower hierarchical level, may be used.

The hierarchical relationship between objects may also be represented implicitly (i.e. without making use of identifiers or references) when it is possible to do so unambiguously and when so defined in the relevant application rules (§ 6).

b) *Correspondence between a specific object and a generic object*

If such a correspondence exists, it is always represented by a reference in the descriptor of the specific object concerned, referring to the descriptor of the corresponding generic object.

c) *Correspondence between objects and contents*

Portions of document content represented by text units correspond either to pages or to blocks. The correspondence is normally represented by a structured identifier within the text unit. Additionally, a sequence of references in the descriptor of the page or block concerned, referring to the corresponding text unit, may be used.

This correspondence may also be represented implicitly (i.e. without making use of identifiers or references), if the text units immediately follow in the interchange sequence the descriptor of the page or block concerned.

2.4 *Text positioning*

2.4.1 *Page coordinate system*

The positioning of all text is specified, directly or indirectly, in relation to an orthogonal coordinate system. The origin of the coordinate system is at the top left-hand corner of the page, and the horizontal axis coincides with the top edge of the page. As a consequence, the vertical axis coincides with the left edge of the page. Horizontal positions (X coordinates), are measured from the vertical axis to the right, and vertical positions (Y coordinates) are measured from the horizontal axis downward. The page is therefore considered to be in the fourth quadrant of the Cartesian coordinate system.

2.4.2 *Positioning of layout objects on a page*

The reference point for positioning is the top left of each layout object. A layout object at any level of the hierarchy is positioned relative to the reference point of the layout object at the next higher level and is contained entirely within the area of that layout object. Thus, the layout object immediately below the level of page are positioned in absolute page coordinates, while all objects subordinate to that level use relative positioning.

2.4.3 *Positioning of text in a block*

In positioning text within a block, the area of the block is treated as a sub-page that is independent of adjoining areas. The text image is not permitted to extend beyond the area of the block. The effect of this may be illustrated by the following examples:

Example 1

The line lengths and number of lines used for any form of text must be contained entirely within the text block.

Example 2

In character-coded text presentation using format effectors as in Recommendation T.61, the format effectors operate within the area of the block as if this were the area of the page. A carriage return, for example, would move the active position to the initial character position of the line defined in the block.

Example 3

Any final form of text that would overflow the defined area of the block would be "cropped" at the edges of the block, while a processable text form can be formatted to conform to the specified line and block layouts in the area of the block.

2.4.3.1 *Character box and character base line*

Each alphanumeric or pictorial character is imaged within a rectangular area named character box. The character base line is a reference line across the width of a character box. This base line is a positioning reference for the placement of symbols within a character box. For example, in Latin alphabets, capital letters and small letters without descenders are positioned on the character base line. The character base line may be offset from the base of the character box.

The offset is necessary if the font design uses descenders or if underlining is to be used.

A pictorial character may extend over the entire character box. In this case, the purpose of any offset of the character box from the character base line is to allow alignment of pictorial characters with language characters.

The height and width of a character box and the offset position of the character base line depend on the font design of the character set concerned. Adjacent character boxes are normally positioned contiguously on a line, so that the nominal spacing between symbols is to be included within the character box. (The term "font design" should be interpreted in a general sense so that it applies to pictorial characters as well as alphanumeric characters).

The height of the character box and the position of the character base line are the same for all characters in a given font design. The height of the character box is equal to the nominal unit line spacing for the font. Depending on the font design, the width of the character base is either the same for all characters or variable from one character to another, to allow for proportional spacing.

The reference point of a character box, for positioning purposes, is the intersection of the character base line and the left edge of the character box, as shown in Figure 4/T.73.

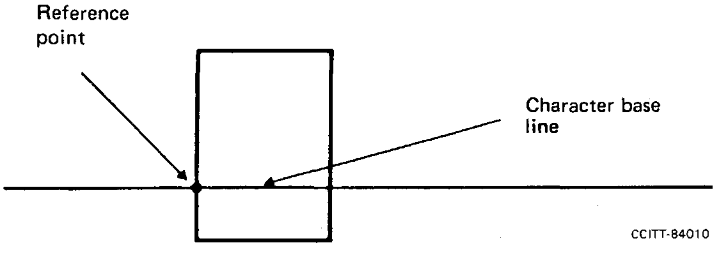


FIGURE 4/T.73

Illustration of character box and character base line with offset

The positioning of character boxes may be rotated, with the axis of rotation at the reference point of each character box. The character base line maintains its relative position within the character box. The default rotation is 0°, as depicted in Figure 4/T.73, with 90°, 180° and 270° as selectable alternatives.

When the character path is parallel to the character base line, the character boxes making up a line are aligned on their character base lines. The character spacing is the distance between the reference points of successive character boxes. This is nominally defined as the width of the character box.

When the character box orientation is such that the character base lines are orthogonal to the direction of the character path, the character box reference points are aligned on the line. The distance along the line between the reference points of successive character boxes is nominally equal to the height of the character boxes.

2.4.3.2 *Positioning of photographic elements*

The first pel to be imaged on each line is positioned at the initial position, as established by the initial offset, if any, from the reference point of the layout object. Imaging of pels does not extend beyond the end of the line which, in this Recommendation, is at the edge of the containing layout object.

Provision is made, with the attribute "number of discarded pels", to accommodate the "overscan" practice of Group 4 facsimile equipment. This attribute may be used either explicitly or, in the case of Text Image Format 0 (TIF.0), implicitly, using a default value. If this attribute is used, the first pel to be imaged is the first one following the number of pels specified to be discarded on each line (see § 2.5.5.3). Additional pels that would extend beyond the end of the line would also be discarded.

2.4.4 *Positioning of lines within a block or page*

The position of the first line is established from an initial point, specified by the coordinate distances from the reference point of the layout object to the reference point of the initial graphic element on that line. The position of this initial point within the block or page is called the initial offset. This initial point, in conjunction with the direction of the graphic element path and the line length, specifies the positioning of the first line.

Each subsequent line is positioned relative to the preceding line. Line progression is the path direction relative to the graphic element path from the initial point of the first line to the initial point of subsequent lines. It is orthogonal to the graphic element path direction; the default is 270°, with 90° as the alternative.

Line spacing is the orthogonal distance between adjacent lines. Line spacing may be equal to, greater than or less than the nominal dimension of character boxes, on the side that is parallel to the direction of line progression.

The length of all lines in a block or page is the same. The end point of a line is specified by the distance along the graphic element path from the initial point to the last point on the line at which any part of the last graphic element on that line may be positioned.

2.5 *Attributes*

2.5.1 *Attribute classification*

Attributes are parameters of the specific and generic layout objects, and of the content portions, that specify characteristics of and relationships between the objects and the content portions.

Categories of attributes of layout objects are:

- identification attributes, specifying the type of object (specific or generic page, block, etc.) and identifying the individual object;
- structure attributes, specifying the hierarchical relationship between objects, the correspondence between specific and generic objects, and the correspondence between layout objects and content portions;
- positioning attributes, specifying the dimensions and positions of the objects, and overlay characteristics;
- presentation attributes, specifying how the content of the objects is to be imaged, e.g. character spacing, line spacing, resolution.

Attributes of content portions are the content portion identifier, the type of coding, coding attributes, and alternative graphic rendition.

The attributes of specific and generic layout objects are defined in § 2.5.3 for identification, structure and positioning attributes, and in § 2.5.4 for presentation attributes. The attributes of content portions are defined in § 2.5.5.

2.5.2 *Default attributes*

Certain attributes, for example the positioning and presentation attributes of layout objects, can be specified either explicitly for the object to which they apply directly, or at higher levels of the hierarchy. In the latter case, the attributes are interpreted as default values for the lower levels. They can be overridden by generic and specific attributes at the lower levels.

For example, it is possible to specify the default page size at document level, or the default resolution for photographic blocks at page level.

In addition, standard default values (to be used when no particular values are specified) are defined in this Recommendation and in Recommendations defining telematic terminals.

To determine the attributes of a specific layout object, the priority order is:

1) attributes specified explicitly in the specific layout object concerned;
2) attributes specified explicitly in the corresponding generic object, if the specific object concerned refers to that generic object (i.e. layout object at the same level in the generic structure);
3) the default attributes specified in the specific object at the next higher level, unless the specific object concerned is the document itself. These attributes may, in turn, be determined by reference to a generic object at that level, or be "inherited" from still higher levels in the specific structure;
4) the default values defined in this Recommendation and in Recommendations defining telematic terminals.

2.5.3 *Attributes of layout objects*

The attributes applicable to specific and generic layout objects are defined in this section. Some attributes apply only to certain types of objects. Where this is the case, it is mentioned in the definition. Otherwise, the attribute applies to all object types.

2.5.3.1 *Object type*

This attribute specifies whether the object concerned is a document, a page set, a page, a frame or a block.

This attribute is represented as a data element in the descriptor to which it applies.

2.5.3.2 *Object identifier*

This attribute identifies an object uniquely within the context of the document and is used to refer to that object.

An object identifier consists of a sequence of numbers. Each of these numbers corresponds to a level of the layout structure and identifies a particular object at that level.

The first number is always zero for an object in the generic layout structure, or one for an object in the specific layout structure. Subsequent numbers in the sequence are assigned by the document origination process to identify objects at successively lower levels of the particular subtree hierarchy, up to and including a final number assigned to the object being identified.

This attribute is represented as a data element in the descriptor of the object to which it applies. The contents of this data element is a string of decimal-coded numbers with a single space character as a delimiter between each pair of adjacent numbers.

2.5.3.3 *Reference to corresponding generic object*

This attribute applies only to objects in the specific layout structure. It is used only when it is intended to establish a defined relationship between a specific object and the corresponding object in the generic structure.

This attribute is represented as a data element in the descriptor of the specific object. The content of this data element is the object identifier of the corresponding generic object (see § 2.5.3.2).

2.5.3.4 *References to subordinate objects*

This attribute applies to all objects except those at the lowest level of the hierarchy. It consists of a sequence of numbers, each of which indicates a subordinate object at the next lower level of the hierarchy. Each of these numbers is equal to the last number in the object identifier (see § 2.5.3.2) of the corresponding subordinate object. The order of the numbers in the sequence represents any orders that may be applicable to the subordinate objects.

This attribute is represented as a data element in the descriptor of the object to which it applies. The contents of this data element is a sequence of decimal-coded integers specifying the subordinate objects at the next lower level of the hierarchy.

2.5.3.5 *References to content portions*

This attribute applies only to objects at the lowest level of the hierarchy. It consists of a sequence of numbers, each of which indicates a content portion that is to be imaged in that object. Each of these numbers is equal to the last number in the content portion identifier (see § 2.5.5.1) of the corresponding content portion. The order of the numbers in the sequence represents the order in which the content portions are to be imaged.

This attribute is represented as a data element in the descriptor of the object to which it applies. The contents of this data element is a sequence of decimal-coded integers specifying the subordinate objects at the next lower level of the hierarchy.

2.5.3.6 *User-readable comments*

This attribute contains a character sequence that is to be interpreted as comments relevant to that object or to the associated content portions. This character sequence is not part of the body of the document.

This attribute is represented as a data element in the descriptor of the object to which it applies. The contents of this data element consists of a sequence of characters coded according to Recommendation T.61.

2.5.3.7 *Default value lists*

This attribute specifies a set of attribute value lists that are applicable as defaults to subordinate objects of designated objects types. Use of such a list is not permitted if it is specified as being applicable to the same or a higher level than the object in which it appears.

Each such list is represented as a data element in the contents of a descriptor. Each such list must identify the object type to which it is to be applied: i.e., either page set, page, frame or block. The contents of each such list consist of a set of attribute data elements that specify the default values to be applied.

A default value list may specify the following attributes:

- all positioning attributes,
- all presentation attributes,
- reference to corresponding generic objects.

2.5.3.8 *Position*

This attribute applies only to frames and blocks. It consists of a pair of coordinates that specify the position of the object relative to the object at the next higher level in the hierarchy (i.e., either the containing page or frame).

This attribute is represented as a data element that is applicable to the level of frame or block. The content of this data element consists of two integers that specify the *X* and *Y* coordinate distances in basic measurement units (BMUs), from the positioning reference point of the containing object to the reference point of the object to which this attribute applies.

Each of the *X* and *Y* coordinates may be indicated as being either fixed or variable. The use of variable position co-ordinates is application-dependent.

2.5.3.9 *Dimensions*

This attribute applies only to pages, frames and blocks. It consists of a pair of dimensions that specify the size of the object.

This attribute is represented as a data element that is applicable to the level of page, frame, or block. The content of this data element consists of two integers that specify the X and Y dimensions of the object in basic measurement units (BMUs).

Each of the X and Y dimensions may be indicated as being either fixed or variable.

The use of variable dimensions is application-dependent (e.g. The "unlimited page length" defined in Recommendation T.5).

2.5.3.10 *Overlay attributes*

There are two attributes used to describe overlay characteristics:

a) *Claiming*

This attribute is applicable to the level of frames. It may take the value of either claiming or non-claiming to designate the overlay characteristics of frames. (For further study).

b) *Transparent*

This attribute is applicable to the level of blocks. It may take the value of either transparent or opaque to designate the overlay characteristics of blocks.

Each of these attributes is represented by a data element, one applicable to frames and the other applicable to blocks.

2.5.4 *Presentation attributes*

This is a category of attributes of objects at the lowest level of the layout hierarchy. Certain of these attributes may be modified from their initially specified values by control functions embedded in the text information field of a content portion. The attributes that can be changed by this means are a property of the content type and type of coding. For example, content portions coded according to Recommendation T.61 include control functions that may change the line spacing, character spacing, graphic rendition, etc.

Except where indicated, these presentation attributes appear as data elements applicable to objects at the lowest level of the layout hierarchy (i.e., either page or block, as appropriate).

2.5.4.1 *Content type*

This attribute identifies the type(s) of graphic elements forming the content of the object. In doing so, it also designates the use of the set of presentation attributes that may be applied to that content type.

In the initial applications defined in this Recommendation, the value of the content type attribute indicates the use of either character box or photographic graphic elements. Other content types are for further study.

This attribute is represented as a data element for which the default value is application-dependent (see § 6).

2.5.4.2 *Attributes of character box content type*

2.5.4.2.1 *Image orientation attributes*

a) *Character path*

This attribute specifies the direction of progression of successive character box elements along a line.

b) *Line progression*

This attribute specifies the direction of progression of successive lines, relative to the direction of the character path, as defined in § 2.4.4.

c) *Character box orientation*

This attribute applies only to character box elements. It specifies the orientation relative to the direction of the character path, as defined in § 2.4.3.

These three attributes are represented in separate data elements.

2.5.4.2.2 *Image dimensions attributes*

The following attributes are each represented by a data element that specifies each relevant dimension as an integer, in basic measurement units (BMUs). The default values are those associated with the analogous default values in Recommendation T.61.

a) Character box size, i.e. width, height. This attribute is represented as a data element consisting of a pair of dimensioning integers.

Note – For proportional spacing fonts, it is possible to specify the width as a variable dimension.

b) Character base line offset.

c) Character spacing.

d) Line spacing.

The attributes are as described in § 2.4.

2.5.4.2.3 *Image positioning attributes*

The following attributes specify parameters of positioning and imaging character box elements:

a) *Alignment*

This attribute specifies the method of positioning characters along a line. Possible values are "*left aligned*", "*right aligned*", "*centered*", "*justified*".

b) *Line layout*

This attribute specifies horizontal tabulation positions, temporary indentation and other line layout parameters. The content of this attribute are to be specified in conjunction with the type of coding attributes that use this parameter.

c) *Initial offset*

This attribute specifies the position of the first character box within the layout object. This establishes the initial character position on each line, as defined in § 2.4.4.

This attribute is represented as a data element consisting of two integers that specify the X and Y coordinates of the initial offset, in basic measurement units (BMUs).

2.5.4.2.4 *Rendition attributes*

a) *Graphic rendition*

This attribute specifies rendition parameters for font, style, colour, etc.

2.5.4.3 *Attributes of photographic element content type*

2.5.4.3.1 *Image orientation attributes*

a) *Pel path*

This attribute specifies the direction of progression of successive photographic elements along a line.

b) *Line progression*

This attribute specifies the direction of progression of successive lines, relative to the direction of the graphic element (pel) path, as defined in § 2.4.4.

2.5.4.3.2 *Image dimensions attributes*

a) *Pel transmission density*

This attribute specifies the number of photographic elements (pels) per unit of length in both the vertical and horizontal directions.

This attribute is represented as a data element that designates a value of either 180, 200, 240, 300, 400, 600 or 1200 pels per 25.4 mm. The default value is application-dependent (see § 6).

2.5.4.3.3 *Image positioning attributes*

a) *Initial offset*

This attribute specifies the position of the first pel within the layout object. This establishes the initial pel position on each line, as defined in § 2.4.4.

This attribute is represented as a data element consisting of two integers that specify the *X* and *Y* coordinates of the initial offset, in basic measurement units (BMUs).

2.5.5 *Attributes of content portions*

2.5.5.1 *Content portion identifier*

This attribute identifies a content portion uniquely within the context of the document.

A content portion identifier consists of a sequence of numbers. Each of these numbers, except the last one, corresponds to a level of the layout structure and identifies a particular object at that level. The last number identifies the content portion concerned within the set of content portions associated with the same layout object at the lowest level.

The first number is always zero for a content portion associated with the generic layout structure, or one for a content portion associated with the specific layout structure. Subsequent numbers in the sequence are assigned by the document origination process to identify objects at successively lower levels of the particular subtree hierarchy, up to a final number assigned to the content portion being identified.

This attribute is represented as a data element in the text unit of the content portion to which it applies. The contents of this data element is a string of decimal-coded numbers with a single space character as a delimiter between each pair of adjacent numbers.

2.5.5.2 *Type of coding*

This attribute specifies the coding used to represent the content. In the initial applications of this Recommendation, character box elements are coded according to Recommendation T.61 and photographic elements are coded according to Recommendation T.6. Other types of coding are for further study.

This attribute is represented as a data element in a text unit.

The default value is application dependent.

2.5.5.3 *Coding attributes*

These attributes are associated with the type of coding of the content portion. They provide additional parametric information used in encoding/decoding the content portion.

These attributes are represented as data elements in a text unit.

Note – In the case of character box elements, this attribute might be used to indicate an extended character repertoire, use of dynamically redefinable character sets (DRCS), etc. In the initial applications of this Recommendation, no such parameters are defined for character box elements, so the content of this data element is not defined.

In the case of photographic elements that are coded according to Recommendation T.6, the following attributes are defined:

a) *Number of pels per line*

This is specified as an integer in a data element.

The default value is application-dependent.

b) *Number of discarded pels*

This attribute specifies the number of pels, within the number of pels per line, that are to be discarded at the beginning of each interchanged image line of pels. Imaging is started, from the next pel, at the initial pel position (specified by the combination of layout object boundary plus initial offset, if any).

This attribute is specified as an integer in a data element.

The default value is application-dependent.

c) *Number of lines*

This is specified as an integer in a data element.

The default value is application-dependent.

d) *Compression*

The basic coding technique specified in Recommendation T.6 uses a compression algorithm. In an alternative mode, the image information may contain uncompressed parts.

This attribute is specified in a data element.

The default value is application-dependent.

2.5.5.4 *Alternative graphic representation*

This attribute specifies a sequence of characters that may be imaged in lieu of the actual text information content, when an imaging device is not capable of decoding and/or imaging the content portion.

This attribute is represented as a data element in the text unit. The contents of this data element consists of a sequence of characters coded according to Recommendation T.61.

3 Functions for the interchange of text in processable form

For further study.

4 Communication concepts

4.1 *General*

This section describes the use of Recommendation T.62 by the document interchange protocol. In addition, this section describes the exchange (and invocation) of presentation capabilities.

Note – The use of Recommendations X.215 and X.225 is for further study.

4.2 *Use of the session service defined in Recommendation T.62, Annex I*

4.2.1 *Assignment of a presentation capabilities negotiation to the session connection and session capabilities exchange*

a) *Session service primitives*

The procedure uses the following session service primitives:

– Session Connection

S – CONNECT request, S – CONNECT indication
S – CONNECT response, S – CONNECT confirm

– Session Capabilities Exchange

S – CAPAB DATA request, S – CAPAB DATA indication
S – CAPAB DATA response, S – CAPAB DATA confirm.

b) *Protocol elements used*

The following protocol element is sent on the session connection and session capabilities exchange:

– Presentation capabilities descriptor protocol element (see § 2.3.2).

c) *Transfer of protocol element*

The presentation capabilities descriptor protocol element is transferred using the session connection and/or session capabilities exchange services listed in a) above.

4.2.2 *Assignment of a presentation capabilities indication/invocation to the session activity begin*

a) *Session service primitives*

The procedure uses the following session service primitives:

S – ACT BEG request, S – ACT BEG indication.

b) *Protocol element used*

The following protocol element is sent on the session activity begin:

– Presentation capabilities descriptor protocol element (see § 2.3.2).

c) *Transfer of protocol element*

The presentation capabilities descriptor protocol element is transferred using the session activity begin service listed in a) above.

4.2.3 *Use of session normal data*

a) *Session service primitives*

The procedure uses the following session service primitives:

S – DATA request, S – DATA indication.

b) *Protocol elements used*

The following protocol elements are sent on the session normal flow:

– Document profile descriptor protocol element (see § 2.3.3).
– Generic layout descriptor protocol element (see § 2.3.4).
– Specific layout descriptor protocol element (see § 2.3.4).
– Text unit protocol elements (see § 2.3.5).

c) *Transfer of protocol element*

The protocol elements listed in b) above are transferred using the session normal data transfer service listed in a) above.

4.3 *Use of Recommendation T.62 commands*

4.3.1 *General*

A number of possible document types are referred to in this Recommendation. These are indicated in Table 1/T.73. A terminal may negotiate the capability to use several types of documents within a session. This negotiation is accomplished with the CSS/RSSP and CDCL/RDCLP exchanges during the session establishment phase. However, only one type of document may be invoked at any given time during the document transfer phase. The negotiation and invocation are described below.

Presentation capabilities consist of terminal presentation capabilities and document interchange capabilities.

4.3.2 *Negotiation*

The presentation capabilities are negotiated as follows:

– For CSS, RSSP the presentation capabilities indicated within the session user data (SUD) parameter shall only indicate which interchange format(s) and basic terminal capabilities are available as receiving capabilities of the sender of the command/response.

– For CDCL, the presentation capabilities indicated within the SUD, should include a list of optional receiving capabilities as defined in §§ 6.3.2 and 6.4.2, that may be needed at the receiver by the sender of the command.

For RDCLP, the optional presentation capabilities available should be indicated.

The presentation capabilities attributes are conveyed in the SUD, using the presentation capabilities descriptor (PCD) protocol element. The coding of this protocol element is specified in § 5.

Options of the basic Teletex document transfer are negotiated using the non-basic Teletex capabilities PGI and not the SUD PGI.

SUD and the non-basic Teletex terminal capabilities outside SUD PGIs shall not be used together in a single exchange of CDCL/RDCLP.

4.3.3 *Invocation*

For CDS/CDC, the presentation capabilities indicated within the SUD should include the presentation capabilities which are required for the document.

The presentation capabilities attributes are conveyed in the SUD, using the presentation capabilities descriptor protocol element.

When sending a document in a format specified by this Recommendation, the SUD parameter is always contained in the CDS/CDC of the document.

When sending a basic Teletex document, the session user data is absent from the CDS/CDC of the document.

The document sender only sends document which the sink has indicated it is capable of handling.

4.4 *Attributes used in negotiation/invocation*

The following attributes are used for negotiating/invoking the presentation capabilities:

Basic terminal characteristics – This attribute indicates the type of basic terminal characteristics (coding, apparatus, etc.) which is available according to the relevant Recommendations.

Any combination of the following capabilities may be indicated:

- the capability of operating as a Teletex terminal according to Recommendations T.60/T.61;
- the capability of operating as a Group 4 facsimile terminal, according to Recommendations T.5/T.6;
- the capability of operating as a terminal supporting basic mixed mode of operation according to Recommendation T.72.

Interchange format – This attribute is used to negotiate and invoke the type of document interchange format which can be handled.

Any combination of the following interchange formats can be indicated.

- TIF.0 defined in § 6.3;
- TIF.1 defined in § 6.4.

Non-basic terminal capabilities – These capabilities are:

- graphic character sets: values coded as specified in T.62;
- control character sets: values coded as specified in T.62;
- page dimensions: this attribute which refers to image areas used will be defined by a pair of measures (see § 2.5.3.9);
- coding attributes: will specify attributes referring to the coding scheme used (compression for facsimile coding scheme, etc.);
- presentation attributes: will specify additional attributes used for the presentation of the information (see § 2.5.4).

Non-basic structural capabilities – These capabilities are:

- number of objects per page.

Table 1/T.73 indicates the selection of presentation capabilities for negotiation and invocation, depending on the type(s) of document to be transferred.

The capability of sending multiple documents within the same session may be indicated. For example, to negotiate both facsimile class 1 and structured facsimile capabilities, the basic terminal characteristics will indicate "facsimile", while the interchange format will indicate "TIF.0" and "TIF.1".

TABLE 1/T.73

Capabilities for negotiation and invocation

Document type	Basic terminal characteristics	Interchange format
Basic Teletex	Teletex (Note 1)	– –
Structured Teletex (Note 2)	Teletex	TIF.1
Facsimile Group 4, Class 1	Facsimile	TIF.0
Structured facsimile (Note 2)	Facsimile	TIF.1
Mixed mode	Mixed mode	TIF.1

Note 1 – For negotiation, this terminal characteristic is indicated only if document types other than basic Teletex are available. For invocation, when sending a basic Teletex document, this parameter is absent.

Note 2 – These document types are subsets of the mixed-mode document type.

4.5 *Capabilities resulting from the received presentation capabilities*

The presentation capabilities are negotiated by exchanging the combination of the attributes of basic terminal characteristics and text image format.

These attributes of presentation capabilities are specified in § 2.3.2. Table 2/T.73 specifies the result of presentation capabilities negotiation.

If a basic Teletex terminal calls a group 4 facsimile class 1 terminal, the facsimile terminal will respond with an RSSN and appropriate parameters.

In all other cases, the called terminal shall, independently from the CSS parameters, respond with RSSP. The only reasons for sending RSSN are exceptional local terminal states.

TABLE 2/T.73

Type of document that can be transferred depending on the received presentation capabilities

Basic terminal characteristics / Interchange format	Teletex	Facsimile	Mixed mode
TIF.0	Basic Teletex (Note 2)	Group 4 Class 1	None
TIF.1	Basic Teletex Structured Teletex	Structured facsimile	Mixed mode

Note 1 – Multiple values for the interchange format and basic terminal capabilities may be indicated.

Note 2 – In the absence of presentation capabilities negotiation only basic Teletex documents can be transferred. When presentation capabilities negotiation is used, it is necessary to indicate basic Teletex capabilities explicitly.

4.6 *Data transfers* (see also Figure 5/T.73)

The document profile descriptor, the generic layout descriptors, the specific layout descriptors and the text units will be carried inside the session service data units (CSUI – CDUI T.62 commands). Other protocol elements may be defined in the future, and their conveyance is for further study.

When a document is transmitted as described in § 6.2, a synchronization point is set at each page boundary of the specific structure. The generic structure is transmitted without setting synchronization points and therefore linked with the first specific page. If the document is transmitted by using, for any reasons, more than one session, the generic structure will be associated during each session with the first transmitted specific page.

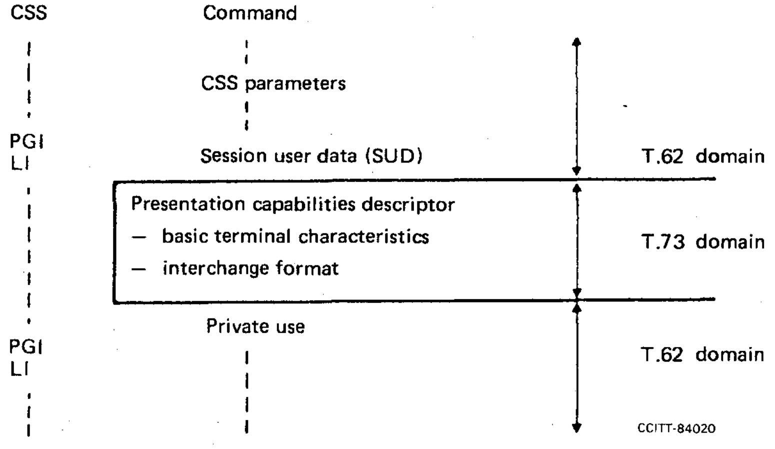


FIGURE 5/T.73

Example of make-up of SUD parameter fields

5 Specification of protocol elements

This section provides the detailed specifications of the protocol elements introduced elsewhere in this Recommendation.

The protocol elements are represented using the presentation transfer syntax of Recommendation X.409, and are specified in this section using the corresponding notation. An overview of Recommendation X.409 is contained in Annex B.

The formal definitions of all protocol elements and their subordinate data elements are presented in Figures 6 to 12/T.73. The following restrictions apply to these definitions and their use in the document interchange protocol:

- Whenever a "named number list" is specified in connection with the data type "integer", all values not explicitly listed are reserved for future assignment.
- All application-wide and context-specific data element identifiers that are not assigned in Figures 6/T.73 to 12/T.73 are reserved for future assignment.
- Length fields longer than three octets shall not be used in applications of this Recommendation. A length field of three octets allows for the representation of a length of up to 65535; a data element with a length exceeding 65535 shall have a length field of the indefinite form.

5.1 *Protocol elements*

The following protocol elements are used in this Recommendation: document profile descriptor, presentation capabilities descriptor, layout descriptor and text unit. Each layout descriptor is either generic or specific. These possibilities are specified in Figure 6/T.73.

5.2 *Document profile descriptor*

The document profile descriptor represents the document profile and includes a pointer to the generic document layout descriptor, a pointer to the specific document layout descriptor and a data element for presentation capabilities. The resulting specification is contained in Figure 7/T.73.

5.3 *Presentation capabilities descriptor*

The presentation capabilities descriptor is used in the negotiation and invocation of the presentation capabilities (Figure 8/T.73). It includes the basic terminal characteristics, the interchange format and the non-basic capabilities. The latter contain sequences of non-basic attribute values used in the document. For example, if the non-basic character spacing values 100 (12 pitch) and 80 (15 pitch) are used in addition to the basic character spacing value 120 (10 pitch), the sequence "presentation attributes" should contain two instances of the presentation attribute "character spacing", representing the values 100 and 80 respectively.

5.4 *Layout descriptor*

As specified in Figure 9/T.73, a layout descriptor is a sequence of two components. The first of these indicates which type of layout object the descriptor represents, namely document, page set, page, frame or block. The second component contains any other attributes of the object. It takes the form of a set drawn from the following: object identifier, references to subordinate objects or to text units, reference to generic object, position, dimensions, the overlay characteristic transparent, presentation attributes, default value lists for subordinate objects and user-readable comments.

Object identifiers are coded as strings of characters in the range 0 to 9 and space, where the latter is used as a separator between numbers.

The following data types are introduced to facilitate the definitions of the positioning, dimensioning and presentation attributes:

Measure – used to represent coordinate distances or dimensions, in units of BMU, that may be specified as either fixed or variable.

Measure pair – used to represent pairs of coordinate distances or dimensions, in units of BMU.

5.4.1 *Default value list*

One set of layout attributes is defined for each object type, namely page set, page, frame and block. This choice is specified in Figure 10/T.73. Common definitions are provided for attributes that apply to more than one object type. Five attributes or groups of attributes are specified: reference to generic object, position, dimensions, transparent and presentation attributes.

5.4.2 *Presentation attributes*

As specified in Figure 11/T.73, the presentation attributes include content type, character box attributes and photographic attributes.

The following data types are introduced to facilitate the definitions of the character box and photographic attributes:

One of four angles – used to represent angles of 0, 90, 180 or 270 degrees.

One of two angles – used to represent angles of 90 or 270 degrees.

5.5 *Text units*

As specified in Figure 12/T.73, a text unit is a sequence of two components. The second component is the text information itself, whereas the first one includes any attributes of the content portion that the text unit represents. Content portion attributes are: content portion identifier, type of coding, coding attributes and alternative graphic representation.

Content portion identifiers are coded as strings of characters in the range 0 to 9 and space, where the latter is used as a separator between numbers.

```
ProtocolElement                        ::=  CHOICE {
    documentProfileDescriptor               [0] IMPLICIT DocumentProfileDescriptor,
    genericLayoutDescriptor                 [1] IMPLICIT LayoutDescriptor,
    specificLayoutDescriptor                [2] IMPLICIT LayoutDescriptor,
    textUnit                                [3] IMPLICIT TextUnit,
    presentationCapabilitiesDescriptor      [4] IMPLICIT PresentationCapabilities}
```

FIGURE 6/T.73

Formal definition of protocol element

```
DocumentProfileDescriptor              ::=  SET {
    referenceToGenericLayoutStructure       [0] IMPLICIT ObjectReferenceName OPTIONAL,
    referenceToSpecificLayoutStructure      [1] IMPLICIT ObjectReferenceName OPTIONAL,
    presentationCapabilities                [2] IMPLICIT PresentationCapabilities OPTIONAL,
    otherDocumentProfileAttributes          [3] IMPLICIT OtherDocumentProfileAttributes OPTIONAL}

OtherDocumentProfileAttributes         ::=  SET {-- none at present --}
```

FIGURE 7/T.73

Formal definition of document profile descriptor

```
PresentationCapabilities              ::=  SET {
    basicTerminalCharacteristics           [0] IMPLICIT BasicTerminalCharacteristics,
    interchangeFormat                      [1] IMPLICIT InterchangeFormat,
    nonBasicTerminalCapabilities           [2] IMPLICIT NonBasicTerminalCapabilities OPTIONAL,
    nonBasicStructuralCapabilities         [3] IMPLICIT NonBasicStructuralCapabilities OPTIONAL}

BasicTerminalCharacteristics          ::=  OCTET STRING
                                           — each octet has value 1, 2 or 3
                                           — 1 indicates Teletex according to T.60 and T.61
                                           —
                                           — 2 indicates Facsimile according to T.5 and T.6
                                           —
                                           — 3 indicates Mixed Mode according to T.72

InterchangeFormat                     ::=  OCTET STRING
                                           — each octet has value 0 or 1
                                           — 0 indicates TIF.0, 1 indicates TIF.1

NonBasicTerminalCapabilities          ::=  SET {
    graphicCharacterSets                   [0] IMPLICIT OCTET STRING OPTIONAL,
                                           — coded as defined in T.62, § 5.7.4.2
    controlCharacterSets                   [1] IMPLICIT OCTET STRING OPTIONAL,
                                           — coded as defined in T.62, § 5.7.4.1
    pageDimensions                         [2] IMPLICIT SEQUENCE OF MeasurePair OPTIONAL,
    codingAttributes                       [3] IMPLICIT SEQUENCE OF CodingAttribute OPTIONAL,
    presentationAttributes                 [4] IMPLICIT SEQUENCE OF PresentationAttribute OPTIONAL}

CodingAttribute                       ::=  CHOICE {
    compression                            [0] IMPLICIT Compression,
                                           — others for further study —}

PresentationAttribute                 ::=  CHOICE {
    characterPath                          [0] IMPLICIT OneOfFourAngles OPTIONAL,
    characterBoxLineProgression            [1] IMPLICIT OneOfTwoAngles OPTIONAL,
    characterBoxOrientation                [2] IMPLICIT OneOfFourAngles OPTIONAL,
    characterBoxSize                       [3] IMPLICIT MeasurePair OPTIONAL,
    characterBaseLineOffset                [4] IMPLICIT INTEGER OPTIONAL,
    characterSpacing                       [5] IMPLICIT INTEGER OPTIONAL,
    lineSpacing                            [6] IMPLICIT INTEGER OPTIONAL,
    alignment                              [7] IMPLICIT Alignment OPTIONAL,
    graphicRendition                       [8] IMPLICIT GraphicRendition OPTIONAL,
    pelPath                                [9] IMPLICIT OneOfFourAngles OPTIONAL,
    photographicLineProgression            [10] IMPLICIT OneOfTwoAngles OPTIONAL,
    pelTransmissionDensity                 [11] IMPLICIT PelTransmissionDensity OPTIONAL}

NonBasicStructuralCapabilities        ::=  SET {
    numberOfObjectsPerPage                 [0] IMPLICIT INTEGER OPTIONAL}
```

FIGURE 8/T.73

Formal definition of presentation capabilities

```
LayoutDescriptor                    ::=  SEQUENCE {
     layoutObjectType                    LayoutObjectType,
     layoutDescriptorBody                LayoutDescriptorBody OPTIONAL}

LayoutObjectType                    ::=  INTEGER {document (0), pageSet (1), page (2),
                                                            frame (3), block (4)}

LayoutDescriptorBody                ::=  SET {
     objectIdentifier                    ObjectReferenceName OPTIONAL,
     referencesTo                        CHOICE {
          subordinateObjects             [0] IMPLICIT SEQUENCE OF NumericString,
          contentPortions                [1] IMPLICIT SEQUENCE OF NumericString} OPTIONAL,
     referenceToGenericObject            [2] IMPLICIT ObjectReferenceName OPTIONAL,
     position                            [3] IMPLICIT MeasurePair OPTIONAL,
     dimensions                          [4] IMPLICIT MeasurePair OPTIONAL,
     transparent                         [5] IMPLICIT Transparent OPTIONAL,
     presentationAttributes              [6] IMPLICIT PresentationAttributes OPTIONAL,
     defaultValueLists                   [7] IMPLICIT SEQUENCE OF DefaultValueList OPTIONAL,
     userReadableComments                [8] IMPLICIT CommentString OPTIONAL}

ObjectReferenceName                 ::=  [APPLICATION 1] IMPLICIT PrintableString
                                         — digits 0 to 9 with space as a delimiter

MeasurePair                         ::=  SEQUENCE {Measure, Measure}

Measure                             ::=  CHOICE {
     fixedMeasure                        [0] IMPLICIT INTEGER,
     variableMeasure                     [1] IMPLICIT INTEGER}

Transparent                         ::=  INTEGER {transparent (0)}
                                         — other values for further study

CommentString                       ::=  T61String
                                         — same character set as PrintableString
                                         — plus carriage return and line feed
```

FIGURE 9/T.73

Formal definition of layout descriptor

```
DefaultValueList                    ::=  CHOICE {
     pageSetAttributes                   [1] IMPLICIT PageSetAttributes,
     pageAttributes                      [2] IMPLICIT PageAttributes,
     frameAttributes                     [3] IMPLICIT FrameAttributes,
     blockAttributes                     [4] IMPLICIT BlockAttributes}

PageSetAttributes                   ::=  SET {
     referenceToGenericObject            < Attribute OPTIONAL}

PageAttributes                      ::=  SET {
     referenceToGenericObject            < Attribute OPTIONAL,
     dimensions                          < Attribute OPTIONAL,
     presentationAttributes              < Attribute OPTIONAL}

FrameAttributes                     ::=  SET {
     referenceToGenericObject            < Attribute OPTIONAL,
     position                            < Attribute OPTIONAL,
     dimensions                          < Attribute OPTIONAL}

BlockAttributes                     ::=  SET {
     referenceToGenericObject            < Attribute OPTIONAL,
     position                            < Attribute OPTIONAL,
     dimensions                          < Attribute OPTIONAL,
     transparent                         < Attribute OPTIONAL,
     presentationAttributes              < Attribute OPTIONAL}

Attribute                           ::=  CHOICE {
     referenceToGenericObjet             ObjectReferenceName,
     position                            [0] IMPLICIT MeasurePair,
     dimensions                          [1] IMPLICIT MeasurePair,
     transparent                         [2] IMPLICIT Transparent,
     presentationAttributes              [3] IMPLICIT PresentationAttributes}
```

FIGURE 10/T.73

Formal definition of default value list

```
PresentationAttributes          ::=  SET{
     contentType                     ContentType OPTIONAL,
     characterBoxAttributes          [0] IMPLICIT CharacterBoxAttributes OPTIONAL,
     photographicAttributes          [1] IMPLICIT PhotographicAttributes OPTIONAL}

ContentType                     ::=  [APPLICATION 2] IMPLICIT INTEGER {characterBox (0),
                                                                       photographic (1)}

CharacterBoxAttributes          ::=  SET{
     characterPath                   [0] IMPLICIT OneOfFourAngles OPTIONAL,
     lineProgression                 [1] IMPLICIT OneOfTwoAngles OPTIONAL,
     characterBoxOrientation         [2] IMPLICIT OneOfFourAngles OPTIONAL,
     initialOffset                   [3] IMPLICIT MeasurePair OPTIONAL,
     characterBoxSize                [4] IMPLICIT MeasurePair OPTIONAL,
     characterBaseLineOffset         [5] IMPLICIT INTEGER OPTIONAL,
     characterSpacing                [6] IMPLICIT INTEGER OPTIONAL,
     lineSpacing                     [7] IMPLICIT INTEGER OPTIONAL,
     alignment                       [8] IMPLICIT Alignment OPTIONAL,
     lineLayout                      [9] IMPLICIT LineLayout OPTIONAL,
     graphicRendition                [10] IMPLICIT GraphicRendition OPTIONAL}

PhotographicAttributes          ::=  SET{
     pelPath                         [0] IMPLICIT OneOfFourAngles OPTIONAL,
     lineProgression                 [1] IMPLICIT OneOfTwoAngles OPTIONAL,
     pelTransmissionDensity          [2] IMPLICIT PelTransmissionDensity OPTIONAL,
     initialOffset                   [3] IMPLICIT MeasurePair OPTIONAL}

OneOfFourAngles                 ::=  INTEGER {d0 (0), d90 (1), d180 (2), d270 (3)}

OneOfTwoAngles                  ::=  INTEGER {d90 (1), d270 (3)}

Alignment                       ::=  INTEGER {leftAligned (0), rightAligned (1),
                                               centered (2), justified (3)}

LineLayout                      ::=  -- application-dependent, for further study

GraphicRendition                ::=  SEQUENCE OF GraphicRenditionAspect

GraphicRenditionAspect          ::=  INTEGER {-- SGR parameter value, see ISO 6429 --}

PelTransmissionDensity          ::=  INTEGER {p180 (0), p200 (1), p240 (2), p300 (3),
                                               p400 (4), p600 (5), p1200 (6)}
```

FIGURE 11/T.73

Formal definition of presentation attributes

```
TextUnit                                  ::=  SEQUENCE {
    contentPortionAttributes                   ContentPortionAttributes OPTIONAL,
    textInformation                            TextInformation}

ContentPortionAttributes                  ::=  SET {
    contentPortionIdentifier                   PortionReferenceName OPTIONAL,
    typeOfCoding                               [0] IMPLICIT TypeOfCoding OPTIONAL,
    codingAttributes                           CHOICE {
        t61Attributes                          [1] IMPLICIT T61Attributes,
        t6Attributes                           [2] IMPLICIT T6Attributes} OPTIONAL,
    alternativeGraphicRepresentation           [3] IMPLICIT CommentString OPTIONAL}

PortionReferenceName                      ::=  [APPLICATION 0] IMPLICIT PrintableString
                                               — digits 0 to 9 with space as a delimiter

TypeOfCoding                              ::=  INTEGER {t61 (0), t6 (1)}

T61Attributes                             ::=  SET {— none at present —}

T6Attributes                              ::=  SET {
    numberOfPelsPerLine                        [0] IMPLICIT INTEGER OPTIONAL,
    numberOfLines                              [1] IMPLICIT INTEGER OPTIONAL,
    compression                                [2] IMPLICIT Compression OPTIONAL,
    numberOfDiscardedPels                      [3] IMPLICIT INTEGER OPTIONAL}

Compression                               ::=  INTEGER {uncompressed (0), compressed (1)}
                                               — other values for further study

TextInformation                           ::=  CHOICE {
    t61String                                  T61String,
    t6String                                   OCTET STRING}
```

FIGURE 12/T.73

Formal definition of text unit

6 Application rules

6.1 *Interchange formats*

This chapter describes the minimal requirements for the interchange of text in image form. The interchange format to be used for documents consisting of one or more full pages of photographic elements (facsimile) is the text image format 0 (TIF.0).

The interchange format to be used for documents consisting of one or more pages, some or all comprising blocks of photographic and character box elements (mixed mode) is the text image format 1 (TIF.1).

Such documents may consist of blocks of a single category of graphic elements. Then, they are called structured teletex documents or structured facsimile documents.

The use of this Recommendation is not required for the interchange of documents consisting of full pages of character box elements, i.e. for the basic Teletex service.

The specification of other interchange formats is for further study.

6.2 *Order of transmission*

The transmission of the description of a layout structure follows the natural order, i.e. the description of the tree structure (other forms of description are for further study). The protocol elements representing the generic structure elements (if any) follow the document profile descriptor and are followed by the protocol elements representing the specific objects.

Every text unit follows immediately the descriptor of the associated lowest-level object.

The order of transmission of the descriptors and text units is illustrated in Figure 13/T.73.

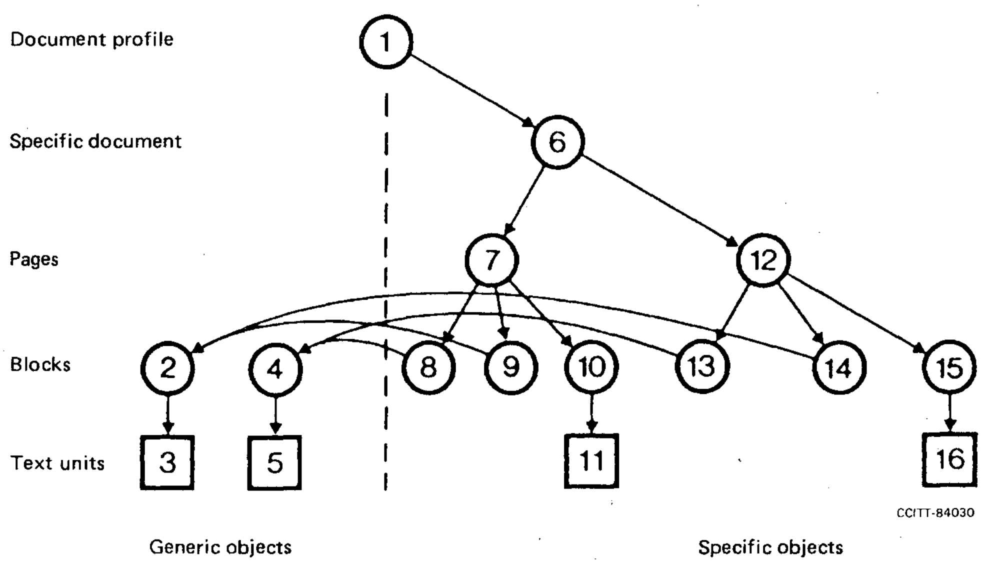


FIGURE 13/T.73

Transmission sequence of protocol elements

6.3 *Interchange format TIF.0*

This format is defined with a specific layout structure consisting of:

i) document descriptor,

ii) page descriptor(s),

iii) text unit(s).

6.3.1 Every descriptor or text unit comprises a number of attributes, listed in Tables 3/T.73 to 20/T.73, that are all necessary.

In these tables, descriptors and their attributes as well as presentation attributes are listed. The attributes are diversely qualified:

m: Mandatory, indicates the attribute must be explicitly stated at each occurrence;

d: Defaultable, indicates the attribute is always necessary, but may be described elsewhere according to the default mechanisms, as defined in § 2;

nm: Non-mandatory, indicates the attribute is not always used by the sender, depending upon the specific needs.

TABLE 3/T.73

TIF.0 – Attributes of the presentation capabilities descriptor

List of attributes		Defined values	Standard default values
Presentation capabilities			
Basic terminal characteristics	m	Facsimile	
Interchange format	m	TIF.0	
Non-basic terminal capabilities	nm		

TABLE 4/T.73

TIF.0 – Attributes of layout descriptors

List of attributes		Defined values	Standard default values
Document descriptor			
Object type	m	Document	
Object identifier	nm		
Reference to subordinate objects	nm	Page identifier	
Default value lists	nm	Page	
Page descriptor			
Object type	m	Page	
Object identifier	nm		
Presentation attributes	d	See Table 6/T.73	
Dimensions	d	Width $\leq$ 9920 BMU Height $\leq$ 14 030 BMU	Width = 9920 BMU Height = 14 030 BMU
Reference to content portions	nm	Content portion identifier	

TABLE 5/T.73

TIF.0 – Attributes of the text unit

List of attributes		Defined values	Standard default values
Content portion identifier	nm		
Type of coding	d	Photographic: T.6	Photographic: T.6
Coding attributes for T.6 photographic information			
Number of pels per line	d	Any number of Pels	See note 1
Compression	d	Compressed as in T.6	Compressed as in T.6
Number of discarded Pels	d	Any number of Pels	See note 2

Note 1 – The default number of pels per line is determined according to Table D-1/T.73.

Note 2 – If the number of pels per line exceeds the image line length in pels (see Annex D) the default number of discarded pels is half the excess number of pels. If the number of pels per line does not exceed the image line length in pels, the default number of discarded pels is zero.

TABLE 6/T.73

TIF.0 – Presentation attributes for photographic elements

List of attributes		Defined values	Standard default values
Content type	d	Photographic	Photographic
Pel path	d	0°	0°
Line progression	d	270°	270°
Pel transmission density (receiving capabilities)	d	200 pels per 25.4 mm	200 pels per 25.4 mm

6.3.2 *Values for negotiable facilities for TIF.0*

This section refers to options that are not necessarily implemented and therefore shall be the subject of a negotiation during the session establishment phase.

TABLE 7/T.73

TIF.0 – Attributes of the presentation capabilities descriptor

List of attributes		Values for negotiate facilities
Non-basic terminal capabilities	nm	See Tables 8/T.73 to 10/T.73

TABLE 8/T.73

TIF.0 – Attributes of layout descriptors

List of attributes		Values for negotiable facilities
Page descriptor Dimensions	d	10 200 × 13 200 (North. Am.) 11 811 × 16 677 (ISO B4) 14 030 × 19 840 (ISO A3)

Note – An undefinite page length is represented by a variable measure in the vertical dimension. The value of this data is then arbitrary and should be the nominal page length.

TABLE 9/T.73

TIF.0 – Attributes of the text unit

List of attributes		Values for negotiable facilities
Coding attributes for T.6 photographic information Compression	d	Uncompressed as specified in T.6

TABLE 10/T.73

TIF.0 – Presentation attributes for photographic elements

List of attributes		Values for negotiable facilities
Pel transmission density	m	240, 300, 400 pels per 25.4 mm

6.4 *Interchange format TIF.1*

The basic conformance level for the mixed-mode application is defined as follows:

- Document profile descriptor.
- Both generic and specific layout structures can be used. They consist of:
  - i) Document descriptor,
  - ii) Page descriptor(s),
  - iii) Block descriptor(s),
  - iv) Text unit(s).

In the generic structure (if any) these objects are all optional.

In the specific structure all objects are normally used, but blocks may be omitted for the description of pages fully filled with the same category of graphic elements (Teletex or Facsimile).

Blocks are allowed to overlay (partially or totally) each other transparently.

6.4.1 The list of attributes usable to define the descriptors and text units is given in Tables 11/T.73 to 13/T.73.

The references to subordinate objects, pages, blocks, as well as the references to content portions may be omitted in this application since the interchange format follows the natural order of description of the tree structure (see § 6.2).

In order to limit the amount of data interchanged, the following features can be used:

1) Repeated contents can be defined once only by means of generic objects.
2) Default attribute values can be specified at any level in the hierarchy for subordinate objects.
3) Attributes using a standard default value can be completely omitted.

TABLE 11/T.73

TIF.0 – Attributes of the presentation capabilities descriptor and the document profile descriptor

List of attributes		Defined values	Standard default values
Reference to generic structure	nm		
Reference to specific structure	nm		
Presentation capabilities			
Basic terminal characteristics	m	mixed mode	
Interchange format	m	TIF.1	
Non-basic terminal capabilities	nm		
Non-basic structural capabilities	nm		
Maximum number of objects per page	d	31	31

TABLE 12/T.73

TIF.0 – Attributes of generic and specific layout descriptors

List of attributes		Defined values	Standard default values
Document descriptor			
Object type	m	Document	
Object identifier	Note 1		
Reference to subordinate objects	nm	Page identifier	
Reference to corresponding generic object	Note 2	Generic document identifier	
Default value lists	nm	Page, block	
User readable comment	nm	T.61 coded string	
Page descriptor			
Object type	m	Page	
Object identifier	Note 1		
Reference to subordinate objects	nm	Block identifier	
Reference to corresponding generic object	Note 2	Generic page identifier	
Presentation attributes	Note 3	See Tables 14/T.73 and 15/T.73	
Dimensions	d	Width ⩽ 9920 BMU	Width = 9240 BMU
		Height ⩽ 14 030 BMU	Height = 13 200 BMU
Reference to content portions	nm	Content portion identifier	
Default value lists	nm	Block	
User readable comment	nm	T.61 coded string	
Block descriptor			
Object type	m	Block	
Object identifier	Note 1		
Reference to corresponding generic object	Note 2	Generic block identifier	
Presentation attributes	Note 4	See tables 14/T.73 and 15/T.73	
Position	d	X, Y BMU	0,0 BMU
Dimensions	d	X, Y BMU	Page dimensions
Transparent	d	Transparent	Transparent
Reference to content portions	nm	Content portion identifier	
User readable comment	nm	T.61 coded string	

Note 1 – Mandatory only in generic objects.

Note 2 – Mandatory only in specific objects and only if there is a corresponding generic object.

Note 3 – Mandatory unless specified by a corresponding generic object or in a default value list at document level.

Note 4 – Mandatory unless specified by a corresponding generic object or in a default value list at page level or document level.

TABLE 13/T.73

TIF.1 – Attributes of the text unit

List of attributes		Defined values	Standard default values
Content portion identifier	nm		
Type of coding	m	Character box: T.61 Photographic: T.6	
Coding attributes for T.6 photographic information			
Number of pels per line	m	Any number of pels	
Number of discarded pels	d	Any number of pels	0
Compression	d	Compressed as in T.6	Compressed as in T.6
Alternative graphic representation	nm	T.61 coded string	

TABLE 14/T.73

TIF.1 – Presentation attributes for character box elements

List of attributes		Defined values	Standard default values
Content type	m	Character box	
Character path	d	0°, 90°	0°
Line progression	d	270°	270°
Character box orientation	d	0°	0°
Character spacing	d	120 BMU	120 BMU
Line spacing	d	100, 200, 300 and 400 BMU	200 BMU
Alignment	d	Left aligned	Left aligned
Initial offset	d	X, Y BMU	Note 1
Graphic rendition	d	Default rendition; underlined	Default rendition

Note 1 – The default initial offset will be such that the first character box will be located on one of the two left corners of the layout object depending on the given values for character path and line progression. The two possibilities are listed below:

Character path	Line progression	Position of the first character box
0°	270°	Upper left corner
90°	270°	Lower left corner

TABLE 15/T.73

TIF.1 – Presentation attributes for photographic elements

List of attributes		Defined values	Standard default values
Content type	m	Photographic	
Pel path	d	0°	0°
Line progression	d	270°	270°
Pel transmission density (receiving capabilities)	m	240, 300 pels per 25.4 mm	
Initial offset	d	X, Y BMU	0,0 BMU

6.4.2 *Values for negotiable facilities for TIF.1*

This section refers to options that are not necessarily implemented and therefore shall be the subject of a negotiation during the session establishment phase (see Table 16/T.73).

TABLE 16/T.73

Attributes of the presentation capabilities descriptor and the document profile descriptor

List of attributes		Values for negotiable facilities
Non-basic terminal capabilities	nm	See Tables 17/T.73 to 20/T.73
Non-basic structural capabilities	nm	
Maximum number of objects per page	d	> 31

TABLE 17/T.73

Attributes of generic and specific layout descriptors

List of attributes		Values for negotiable facilities
Page descriptor		
Dimensions	d	a) Interchanged image area for North American letter paper size. Width ⩽ 10 200 BMU Height ⩽ 13 200 BMU b) Interchanged image area for ISO B4 paper size. Width ⩽ 11 811 BMU Height ⩽ 16 677 BMU

TABLE 18/T.73

Attributes of the text unit

List of attributes		Values for negotiable facilities
Coding attributes for T.6 photographic information		
Compression	d	Uncompressed as specified in T.6

TABLE 19/T.73

Presentation attributes for character box elements

List of attributes		Values for negotiable facilities
Character path	d	270°
Character spacing	d	80, 100 and 200 BMU
Line spacing	d	150 BMU
Graphic rendition	d	Proportional spacing

TABLE 20/T.73

Presentation attributes for photographic elements

List of attributes		Values for negotiable facilities
Pel transmission density	m	180, 200, 400, 600, 1200 pels per 25.4 mm

ANNEX A

(to Recommendation T.73)

Terms and definitions

Note – Some of the terms used in this Recommendation have been defined in ways that may differ from the meanings of similar terms in other Recommendations.

A.1 **attribute**

A property of a document or a constituent of a document expressing a characteristic of the document or constituent concerned, or a relationship with one or more other documents or constituents.

Note – In Recommendations T.61 and T.62, related properties and characteristics of devices as well as presentation attributes are called parameters.

A.2 **basic object**

An object that is not subdivided.

Note – A basic object may be structured internally according to a presentation architecture.

A.3 **basic measurement unit (BMU)**

A unit of measurement used for positioning and dimensioning of layout objects.

A.4 **block (text block)**

A basic layout object corresponding to a rectangular area within a page or within a frame with its sides parallel to the sides of the enclosing page or frame, in which only one category of graphic element is to be imaged.

A.5 **character**

A member of a set of elements (upon which agreement has been reached and that is) used for the organization, control or representation of information (data).

A.6 **character base line**

A positioning reference for the placement of symbols within a character box.

A.7 **character box**

1) A rectangular area on the presentation medium that can be used for the rendition of one graphic character.

2) A rectangular area within which a graphic character is contained. The nominal spacing between symbols, if any, is included within the character box.

A.8 **character box element**

Either language characters or pictorial characters that are presented within character boxes.

Note – This term is also as an alternative term for graphic character.

A.9 **character path**

The direction of progression of successive character boxes along a line.

A.10 **composite object**

An object that is subdivided into other composite objects and/or basic objects.

Note – Composite layout objects are termed document, page set, page, or frame.

A.11 **constituent**

A layout or logical object below the level of document or a content portion.

A.12 **constructor**

A data element whose content is itself a data element, or a series of data elements.

A.13 **content**

The actual information conveyed by the document, independent of layout structure and logical structure.

A.14 **content portion**

A part of the content of the document associated with at most one basic layout object and one basic logical object.

Note – Other terms in use are "portion of text" and "portion of document content".

A.15 **contents**

Substance of a data element containing the primary information the data element is intended to convey.

Note – Sometimes the contents is termed "value".

A.16 **control function**

An action that affects the recording, processing, transmission, or interpretation of data and that has a coded representation consisting of one or more octets of bits.

A.17 **data element**

A sequence of data elements serves for the coded representation of a document or its constituents. A data element consists of three components that always appear in the following order: identifier, length, indicator, contents.

Note – See also *data structure.*

A.18 **data structure**

A set of data items representing an object, a content portion, a part of an object or content portion, or the document description. The data items constituting a data structure represent attributes of the constituents or the document description concerned.

Note – The term *data structure* might be replaced by *data element* or *constructor* (element)./

A.19 **descriptor**

A data element representing a layout object or a logical object.

A.20 **document**

An amount of text that can be interchanged as a unit defined by the originator between applications.

A.21 **document body**

The content of a document and the attributes of the layout and logical objects, excluding the document profile.

A.22 **document class**

A category of document defined by a set of common properties, e.g. letter, memorandum, report invoice.

A.23 **document descriptor**

A set of attributes describing the layout or logical structure of a document.

A.24 **document profile**

A set of attributes associated with a document, for the purpose of handling the document as a whole.

A.25 **document structure**

The result of dividing and subdividing the content of a document into increasingly smaller parts, the parts being called layout objects, logical objects, and text units.

A.26 **editing**

The carrying out of operations associated with altering the content of a document, e.g. replace, insert, delete.

A.27 **enveloping data**

Information added to a document to ensure its interchange.

A.28 **frame**

A composite layout object within a page or within another frame with its sides parallel to the sides of the enclosing page or frame, intermediate at one or more levels between the page and the block in a layout structure.

A.29 **generic**

Term qualifying a layout or logical structure, a layout or logical object, or an attribute pertaining to a document class.

A.30 **geometric element**

A collection of drawing primitives including points, arcs, lines, rectangles, and polygons used to construct drawing in a predescribed area.

A.31 **graphic element**

A character, other than a control function, that has a visual representation normally handwritten, printed, or displayed. Graphic characters include simple alphanumeric characters, composite characters (e.g. accented letters) and pictorial characters (e.g. mosaics).

A.32 **graphic element (of text)**

The smallest individually specified element used to construct an image. There are three categories of graphic elements of text, namely character box elements, geometric elements and photographic elements.

A.33 **image**

Visual presentation of a text.

A.34 **image area**

That part of a page that is available for assured reproduction of text.

A.35 **information field**

Part of a text unit that contains the content portions (i.e. the textual information).

A.36 **interchange**

The process of providing a duplicate of a document to a receiving person or device.

A.37 **interchange format**

A representation of a document by a collection of data elements for the purpose of interchange.

A.38 **layout directive**

An attribute of a logical object that specifies the manner of presentation (e.g. rendition, positioning), optionally in relation to a layout object.

A.39 **layout object**

One of the parts pertaining to the layout structure, e.g. page, block.

A.40 **layout structure**

The result of dividing and subdividing the content of a document into increasingly smaller parts, on the basis of the presentation, e.g. into pages and blocks.

A.41 **length, length indicator**

Component of a data element specifying the length of the contents in octets.

A.42 **length field**

The field in a data element that contains the length indicator.

A.43 **logical object**

One of the parts pertaining to the logical structure, e.g., chapter, section, paragraph.

A.44 **logical structure**

The result of dividing and subdividing the content of a document into increasingly smaller parts, on the basis of the meaning of the content, e.g. into chapters, sections, paragraphs.

A.45 **mixed mode**

A mixed mode capability provides the means of transferring the information content of a document between sender and recipient, where the information content has been encoded using different techniques (e.g. in all forms of facsimile or character coding) and the document structure fully identified enabling the recipient to apply sophisticated editing methods.

A.46 **office document architecture (ODA)**

Rules for applying structure to office documents.

A.47 **overlay**

Positioning of layout objects in such a manner that they overlap each other partially or fully on the presentation medium.

A.48 **page**

A layout object that is a rectangular area with dimensions equal to the associated interchanged image area.

A.49 **page set**

A composite layout object corresponding to a sequence of other page sets and/or pages.

A.50 **parameter**

A term sometimes used instead of attribute.

A.51 **pel path**

The direction of progression of successive photographic elements along a line.

A.52 **photographic element**

An individual picture element (pel, pixel) used in arrays to construct images. Each pel has a specific shape, size, colour, intensity and position.

A.53 **pictorial character**

Predetermined pattern which is intended to be presented in adjacent character boxes to construct rulings, boxes, figures, logos, diagrams, or other pictures occupying multiple character boxes.

A.54 **portion of text**

See *content portion.*

A.55 **presentation**

The printing or display of stored graphic element to allow for human comprehension of the stored information.

A.56 **presentation medium**

The carrier of information in a form perceptible to a human, e.g. a sheet of paper or a display screen.

A.57 **processing**

The carrying out of operations on a document. This includes editing, formatting, rendition, filing, retrieval.

A.58 **rendition**

The operation consisting of presenting the document content on a presentation medium.

A.59 **retrieval**

The recovery of previously filed information.

A.60 **specific**

Term qualifying a layout or logical structure, a layout or logical object, or an attribute, pertaining to a particular document.

A.61 **symbol**

See *graphic character.*

A.62 **text**

Text is information for human comprehension that is intended for presentation in two-dimensional form, e.g. printed on paper or displayed on a screen. Text consists of symbols, phrases, or sentences in natural or artificial languages, pictures, diagrams and tables.

A.63 **text image format (TIF)**

An interchange format that provides for the representation of the document profile, layout objects and content portions of a document.

A.64 **text processable format (TPF)**

An interchange format that provides for the representation of the document profile, logical objects, content portions and, optionally, layout objects of a document.

A.65 **text unit**

A data structure representing a content portion.

ANNEX B

(to Recommendation T.73)

Summary of presentation transfer syntax

The protocol specified by this Recommendation is based upon the transfer syntax defined in Recommendation X.409. This annex briefly describes that syntax and some of the associated concepts, and illustrates its use by examples.

B.1 *Data types, data values and standard notation*

Recommendation X.409 defines a transfer syntax for various kinds of information. Each piece of information is considered to have a type as well as a value. A *data type* is a class of information (for example, numeric or textual). A *data value* is an instance of such a class (for example, a particular number or a fragment of text). Recommendation X.409 defines a number of generally useful data types from which application-specific data types are constructed in this Recommendation and in others that make use of the Recommendation X.409 transfer syntax. Among the generally useful data types defined by Recommendation X.409 are Integer, Octet, String, Sequence and Set.

The *standard notation* defined in Recommendation X.409 is a formal description method that allows data types relevant for an application to be specified in terms of other data types, including the generally useful data types of Recommendation X.409. This notation is used in § 5 of the present Recommendation, where the protocol element data types are specified in terms of Sets and Sequences of more elementary data types which in turn are specified in terms of others, and finally in terms of basic data types such as Integer and Octet String.

B.2 *Standard representation*

The *standard representation* for a data type is the set of rules for encoding values of that type for transmission as a sequence of octets. The representation of a value also encodes its type and length, and is completely implied by the standard notation of the data type.

The standard representation of a data value is a *data element* having three components, which always appear in the following order. The *Identifier* designates the data type and governs the interpretation of the Contents. The *Length* specifies the length of the Contents. The *Contents* is the substance of the object, containing the primary information the object is intended to convey. The Identifier and the Length each consist of one or more octets; the Contents consists of zero or more octets.

B.2.1 *Identifier*

Four *classes* of data types are distinguished by means of the Identifier: universal, application-wide, context-specific and private-use. *Universal* types are generally useful, application-independent types; they are defined in Recommendation X.409. *Application-wide* types are more specialized, being peculiar to a particular application; they are defined in this Recommendation, and in others using Recommendation X.409, by means of the standard notation. *Context-specific* types, like application-wide types, are peculiar to an application and defined using the standard notation. However, they are used only within an even more limited context – for example, that of a Set – and their identifiers are assigned so as to be distinct only within that limited context. *Private-use* types are reserved for private use; the assignment of specific private-use Identifiers can be accomplished by means of the standard notation but is outside the scope of Recommendation X.409 or this Recommendation.

Two *forms* of data elements are distinguished by means of the Identifier: primitive and constructor. A *primitive* element is one whose Contents is atomic. A *constructor* element is one whose Contents is itself a data element, or a series of data elements. Constructor elements are thus recursively defined.

B.2.2 *Length*

The Length specifies the length in octets L of the Contents and is itself variable in length. It may take any of three forms; short, long and indefinite.

The *short* form may (but need not) be used when L is less than 128.

The *long* form may (but need not) be used for any value of L.

The *indefinite* form may (but need not) be used when the element is a constructor. When this form is employed, a special *end-of-contents* (EOC) element terminates the Contents.

Note – All constructor data elements, whether or not of indefinite length, are ultimately composed of primitive data elements (perhaps with several intervening "levels" of constructor data elements). Primitive data elements *always* have a definite length.

B.2.3 *Contents*

The Contents are variable in length and are interpreted in a type-dependent way. If the data element is a constructor, the Contents themselves comprise zero or more elements; data elements are thus recursively defined.

B.3 *Built-in types and defined types*

The generally useful data types defined by Recommendation X.409 consist of built-in types and defined types.

Built-in types are used to construct all other data types. They include Integer, Octet String, Sequence, Set and Tagged. Integer is a primitive data type. Octet String can be either primitive or constructor. Sequence and Set are constructor data types. Identifiers for these data types are of the universal class and are specified in Recommendation X.409. A Tagged data type is a data type for which the Identifier can be specified using the standard notation, as is done in § 5 of this Recommendation.

Defined types are specified in Recommendation X.409 using the standard notation. They include Numeric String, Printable String, and Recommendation T.61 String, all of which are defined in terms of the built-in type Octet String. They can be either primitive or constructor; their identifiers are of the universal class and are specified in Recommendation X.409.

B.4 *Example 1*

This is an example of the application of the protocol elements to the Group 4 class 1 facsimile service. Figure B-1/T.73 describes the elements using the standard notation defined in Recommendation X.409. The octet-level representation of the elements is shown in Figure B-2/T.73 using hexadecimal notation, two hexadecimal digits per octet. The structure of the presentation capabilities used in the SUD of CSS and RSSP during the negotiation phase is contained in Figures B-1a)/T.73 and B-2a)/T.73. Figures B-1b)/T.73 and B-2b/T.73 show the specific coding of the presentation capabilities used to invoke a Group 4 class 1 document type in the CDS command. The data transmitted within one or more CDUI commands during the information transfer phase is shown in Figures B-1c)/T.73 and B-2c)/T.73.

```
presentationCapabilitiesDescriptor {
     basicTerminalCharacteristics 'ZZ .... ZZ'H,
     interchangeFormat 'YY .... YY'H}
```

a) Presentation capabilities used in SUD of CSS and RSSP

Note – The octet string 'ZZ .... ZZ'H must contain an octet with value '02'H, indicating Facsimile, and the octet string 'YY .... YY'H must contain an octet with value '00'H, indicating TIF.0.

```
presentationCapabilitiesDescriptor {
     basicTerminalCharacteristics '02'H,
     interchangeFormat '00'H}
```

b) Presentation capabilities used in SUD of CDS

```
specificLayoutDescriptor {
     layoutObjectType document}

specificLayoutDescriptor {
     layoutObjectType page}

textUnit {
     textInformation
          t6String 'XXXX ........ XXXX'H}
           -- where the X's represent the facsimile code
```

c) Layout descriptors and text unit transferred in CDUI commands

FIGURE B-1/T.73

```
A4  Identifier: presentationCapabilitiesDescriptor
LL  Length
    80  Identifier: basicTerminalCharacteristics
    LL  Length
        ZZ .... ZZ  Contents
    81  Identifier: interchangeFormat
    LL  Length
        YY .... YY  Contents
```

a) Presentation capabilities used in SUD of CSS and RSSP

```
A4  Identifier: presentationCapabilitiesDescriptor
06  Length: 6 octets
    80  Identifier: basicTerminalCharacteristics
    01  Length: 1 octet
        02  Contents: '02'H (Facsimile)
    81  Identifier: interchangeFormat
    01  Length: 1 octet
        00  Contents: '00'H (TIF.0)
```

b) Presentation capabilities used in SUD of CDS

```
A2  Identifier: specificLayoutDescriptor
03  Length: 3 octets
    02  Identifier: layoutObjectType
    01  Length: 1 octet
        00  Contents: 0 (document)
A2  Identifier: specificLayoutDescriptor
03  Length: 3 octets
    02  Identifier: layoutObjectType
    01  Length: 1 octet
        02  Contents: 2 (page)
A3  Identifier: textUnit
80  Length: indefinite
    24  Identifier: textInformation t6String (OCTET STRING, constructor)
    80  Length: indefinite
        04  Identifier (OCTET STRING, primitive)
        LL  Length
            XXXX ........ XXXX Contents: first segment of facsimile code
        04  Identifier (OCTET STRING, primitive)
        LL  Length
            XXXX ........ XXXX Contents: second segment of facsimile code
        .
        .
        .
        04  Identifier (OCTET STRING, primitive)
        LL  Length
            XXXX ........ XXXX Contents: last segment of facsimile code
        00  Identifier (EOC)
        00  Length: zero
    00  Identifier (EOC)
    00  Length: zero
```

c) Layout descriptors and text unit transferred in CDUI commands

Note 1 – The octet string 'ZZ .... ZZ'H in *a)* must contain an octet with value '02'H, indicating facsimile, and the octet string 'YY .... YY'H must contain an octet with value '00'H, indicating TIF.0.

Note 2 – The symbol LL used in *a)* and *c)* represents the length (short form or long form) of the associated data element.

FIGURE B-2/T.73

B.5 *Example 2*

This is an example of the use of the protocol elements specified in § 5, and the implied coding method, for the representation of a part of a mixed-mode document. The document part concerned consists of a page which contains two blocks. One block contains character-coded information, whereas the content of the other block is a photographically encoded picture which is supposed to be represented by a content portion associated with a generic block.

The specific structure of this document part consists, therefore, of a page with two subordinate blocks, one which refers to a content portion and the other one of which refers to a generic block which, in turn, refers to a content portion.

The representation of this document part consists of three specific layout descriptors, one generic layout descriptor, and two text units (one associated with the specific structure and one associated with the generic structure).

These protocol elements are formally described below using the standard notation for data values defined in Recommendation X.409.

```
-- Layout descriptor for the page:

specificLayoutDescriptor {
     layoutObjectType page,
     layoutDescriptorBody {
          objectIdentifier "1 3",
          referencesTo
               subordinateObjects {"1", "2"},
          dimensions {fixedMeasure 9920, fixedMeasure 14030}}}


-- Layout descriptor for the first specific block:

specificLayoutDescriptor {
     layoutObjectType block,
     layoutDescriptorBody {
          objectIdentifier "1 3 1",
          referencesTo
               contentPortions {"1"},
          position {fixedMeasure 2145, fixedMeasure 2872},
          dimensions {fixedMeasure 6000, fixedMeasure 1200}
          presentationAttributes {
               contentType characterBox,
               characterBoxAttributes {
                    lineSpacing 400,
                    graphicRendition {3}}}}}


-- Text unit for the first specific block:

textUnit {
     contentPortionAttributes {
          contentPortionIdentifier "1 3 1 1",
          typeOfCoding t61{,
     textInformation
          t61String "This is an example of a page containing two blocks."}


-- Layout descriptor for the second specific block:

specificLayoutDescriptor {
     layoutObjectType block,
     layoutDescriptorBody {
          objectIdentifier "1 3 2",
          referenceToGenericObject "0 28",
          position {fixedMeasure 2145, fixedMeasure 6472}}}
```

– – Layout descriptor for the generic block:

```
genericLayoutDescriptor {
    layoutObjectType block,
    layoutDescriptorBody {
        objectIdentifier "0 28",
        referencesTo
            contentPortions {"1"};
        dimensions {fixedMeasure 6000, fixedMeasure 6000}
        presentationAttributes {
            contentType photographic,
            photographicAttributes {pelTransmissionDensity p240}}}}
```

– – Text unit for the generic block:

```
textUnit {
    contentPortionAttributes {
        contentPortionIdentifier "0 28 1",
        typeOfCoding t6,
        codingAttributes
            t6Attributes {numberOfPelsPerLine 1200},
        alternativeGraphicRepresentation "Censored"},
    textInformation
        t6String 'XXXX ........ XXXX'H}
         -- where the X's represent the facsimile code
```

The octet-level representation of these protocol elements is shown below in hexadecimal notation, two hexadecimal digits per octet.

– – Layout descriptor for the page (30 octets):

```
A2  Identifier: specificLayoutDescriptor
1C  Length: 28 octets
    02  Identifier: layoutObjectType (INTEGER)
    01  Length: 1 octet
        02  Contents: 2 (page)
    31  Identifier: layoutDescriptorBody (SET)
    17  Length: 23 octets
        41  Identifier: objectIdentifier (ObjectReferenceName)
        03  Length: 3 octets
            312033  Contents: "1 3"
        A0  Identifier: referencesTo subordinateObjects
        06  Length: 6 octets
            12  Identifier (NumericString)
            01  Length: 1 octet
                31  Contents: "1"
            12  Identifier (NumericString)
            01  Length: 1 octet
                32  Contents: "2"
        A4  Identifier: dimensions
        08  Length: 8 octets
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                22D8  Contents: 9920
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                36CE  Contents: 14030
```

-- Layout descriptor for the first specific block (55 octets):

```
A2  Identifier: specificLayoutDescriptor
35  Length: 53 octets
    02  Identifier: layoutObjectType (INTEGER)
    01  Length: 1 octet
        04  Contents: 4 (block)
    31  Identifier: layoutDescriptorBody (SET)
    30  Length: 48 octets
        41  Identifier: objectIdentifier (ObjectReferenceName)
        05  Length: 5 octets
            3120332031  Contents: "1 3 1"
        A1  Identifier: referencesTo contentPortions
        03  Length: 3 octets
            12  Identifier (NumericString)
            01  Length: 1 octet
                31  Contents: "1"
        A3  Identifier: position
        08  Length: 8 octets
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                085D  Contents: 2145
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                0B38  Contents: 2872
        A4  Identifier: dimensions
        08  Length: 8 octets
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                1770  Contents: 6000
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                04B0  Contents: 1200
        A6  Identifier: presentationAttributes
        0E  Length: 14 octets
            42  Identifier: contentType (ContentType)
            01  Length: 1 octet
                00  Contents: 0 (characterBox)
            A0  Identifier: characterBoxAttributes
            09  Length: 9 octets
                87  Identifier: lineSpacing
                02  Length: 2 octets
                    0190  Contents: 400
                AA  Identifier: graphicRendition
                03  Length: 3 octets
                    02  Identifier (INTEGER)
                    01  Length: 1 octet
                        03  Contents: 3 (bold)
```

-- Text unit for the first specific block (70 octets):

```
A3  Identifier: textUnit
44  Length: 68 octets
    31  Identifier: contentPortionAttributes (SET)
    09  Length: 9 octets
        40  Identifier: contentPortionIdentifier (PortionReferenceName)
        07  Length: 7 octets
            31203320312031  Contents: "1 3 1 1"
        80  Identifier: typeOfCoding
        01  Length: 1 octet
            00  Contents: 0 (t61)
    14  Identifier: textInformation t61String (T61String, primitive)
    34  Length: 52 octets
        54686973206973 ........ 74776F20626C6F636B732E
                Contents: "This is .... two blocks."
```

– – Layout descriptor for the second specific block (30 octets):

```
A2  Identifier: specificLayoutDescriptor
IC  Length: 28 octets
    02  Identifier: layoutObjectType (INTEGER)
    01  Length: 1 octet
        04  Contents: 4 (block)
    31  Identifier: layoutDescriptorBody (SET)
    17  Length: 23 octets
        41  Identifier: objectIdentifier (ObjectReferenceName)
        05  Length: 5 octets
            3120332032  Contents: "1 3 2"
        82  Identifier: referenceToGenericObject
        04  Length: 4 octets
            30203238  Contents: "0 28"
        A3  Identifier: position
        08  Length: 8 octets
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                085D  Contents: 2145
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                1948  Contents: 6472
```

– – Layout descriptor for the generic block (38 octets):

```
A1  Identifier: genericLayoutDescriptor
24  Length: 36 octets
    02  Identifier: layoutObjectType (INTEGER)
    01  Length: 1 octet
        04  Contents: 4 (block)
    31  Identifier: layoutDescriptorBody (SET)
    1F  Length: 31 octets
        41  Identifier: objectIdentifier (ObjectReferenceName)
        04  Length: 4 octets
            30203238  Contents: "0 28"
        A1  Identifier: referencesTo contentPortions
        03  Length: 3 octets
            12  Identifier (NumericString)
            01  Length: 1 octet
                31  Contents: "1"
        A4  Identifier: dimensions
        08  Length: 8 octets
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                1770  Contents: 6000
            80  Identifier: fixedMeasure
            02  Length: 2 octets
                1770  Contents: 6000
        A6  Identifier: presentationAttributes
        08  Length: 8 octets
            42  Identifier: contentType (ContentType)
            01  Length: 1 octet
                01  Contents: 1 (photographic)
            A1  Identifier: photographicAttributes
            03  Length: 3 octets
                82  Identifier: pelTransmissionDensity
                01  Length: 1 octet
                    02  Contents: 2 (p240)
```

– – Text unit for the generic block:

```
A3  Identifier: textUnit
80  Length: indefinite
    31  Identifier: contentPortionAttributes (SET)
    1B  Length: 27 octets
        40  Identifier: contentPortionIdentifier (PortionReferenceName)
        06  Length: 6 octets
            302032382031  Contents: "0 28 1"
        80  Identifier: typeOfCoding
        01  Length: 1 octet
            01  Contents: 1 (t6)
        A2  Identifier: codingAttributes t6Attributes
        04  Length: 4 octets
            82  Identifier: numberOfPelsPerLine
            02  Length: 2 octets
                04B0  Contents: 1200
        83  Identifier: alternativeGraphicRepresentation
        08  Length: 8 octets
            43656E736F26564  Contents: "Censored"
    24  Identifier: textInformation t6String (OCTET STRING, constructor)
    80  Length:indefinite
        04  Identifier (OCTET STRING, primitive)
        820800  Length: 2048 octets
            XXXX ........ XXXX  Contents: first segment of facsimile code
        04  Identifier (OCTET STRING, primitive)
        820800  Length: 2048 octets
            XXXX ........ XXXX  Contents: second segment of facsimile code
        .
        .
        .
        04  Identifier (OCTET STRING, primitive)
        8204E3  Length: 1251 octets
            XXXX ........ XXXX  Contents: last segment of facsimile code
        00  Identifier (EOC)
        00  Length: zero
    00  Identifier (EOC)
    00  Length: zero
```

ANNEX C

(to Recommendation T.73)

Summary of data element identifier assignment

This annex contains a collection of tables that summarizes the assignment of the data element identifiers specified in § 5.

Each table corresponds to a SEQUENCE or SET defined in § 5. The table specifies the identifiers of all data elements that may occur within the SEQUENCE or SET concerned. Each row of the table specifies:

1) the value of the identifier in hexadecimal notation (including the bits representing the class and the form of the identifier);
2) the implied built-in data type (only SEQUENCE, SET, INTEGER and OCTET STRING are implied by the definitions in § 5);
3) the name of the data element (with proper word separation and capitalization).

Context: T.73 (the protocol)		
Identifier	Implied data type	Data element name
A0	SET	Document profile descriptor
A1	SEQUENCE	Generic layout descriptor
A2	SEQUENCE	Specific layout descriptor
A3	SEQUENCE	Text unit
A4	SET	Presentation capabilities descriptor

Context: Document profile descriptor (SET)		
Identifier	Implied data type	Data element name
80	OCTET STRING	Reference to generic layout structure
81	OCTET STRING	Reference to specific layout structure
A2	SET	Presentation capabilities
A3	SET	Other document profile attributes

Context: Presentation capabilities (SET)		
Identifier	Implied data type	Data element name
80	OCTET STRING	Basic terminal characteristics
81	OCTET STRING	Interchange format
A2	SET	Non-basic terminal capabilities
A3	SET	Non-basic structural capabilities

Context: Non-basic terminal capabilities (SET)		
Identifier	Implied data type	Data element name
80	OCTET STRING	Graphic character sets
81	OCTET STRING	Control character sets
A2	SEQUENCE	Page dimensions
A3	SEQUENCE	Coding attributes
A4	SEQUENCE	Presentation attributes

Context: Non-basic structural capabilities (SET)		
Identifier	Implied data type	Data element name
80	INTEGER	Number of objects per page

Context: Coding attributes (SEQUENCE) in presentation capabilities		
Identifier	Implied data type	Data element name
80	INTEGER	Compression

Context: Presentation attributes (SEQUENCE) in presentation capabilities		
Identifier	Implied data type	Data element name
80	INTEGER	Character path
81	INTEGER	Character box line progression
82	INTEGER	Character box orientation
A3	SEQUENCE	Character box size
84	INTEGER	Character base line offset
85	INTEGER	Character spacing
86	INTEGER	Line spacing
87	INTEGER	Alignment
A8	SEQUENCE	Graphic rendition
89	INTEGER	Pel path
8A	INTEGER	Photographic line progression
8B	INTEGER	Pel transmission density

Context: Layout descriptor (SEQUENCE)		
Identifier	Implied data type	Data element name
02	INTEGER	Layout object type
31	SET	Layout descriptor body

Context: Layout descriptor body (SET)		
Identifier	**Implied data type**	**Data element name**
41	OCTET STRING	Object identifier
A0	SEQUENCE	References to subordinate objects
A1	SEQUENCE	References to content portions
82	OCTET STRING	Reference to generic object
A3	SEQUENCE	Position
A4	SEQUENCE	Dimensions
85	INTEGER	Transparent
A6	SET	Presentation attributes
A7	SEQUENCE	Default value lists
88	OCTET STRING	User-readable comments

Context: Measure pair (SEQUENCE)		
Identifier	**Implied data type**	**Data element name**
80	INTEGER	Fixed measure
81	INTEGER	Variable measure

Context: Default value lists (SEQUENCE)		
Identifier	**Implied data type**	**Data element name**
A1	SET	Page set attributes
A2	SET	Page attributes
A3	SET	Frame attributes
A4	SET	Block attributes

Context: Page set attributes (SET)		
Identifier	**Implied data type**	**Data element name**
41	OCTET STRING	Reference to generic object

Context: Page attributes (SET)		
Identifier	Implied data type	Data element name
41	OCTET STRING	Reference to generic object
A1	SEQUENCE	Dimensions
A3	SET	Presentation attributes

Context: Frame attributes (SET)		
Identifier	Implied data type	Data element name
41	OCTET STRING	Reference to generic object
A0	SEQUENCE	Position
A1	SEQUENCE	Dimensions

Context: Block attributes (SET)		
Identifier	Implied data type	Data element name
41	OCTET STRING	Reference to generic object
A0	SEQUENCE	Position
A1	SEQUENCE	Dimensions
82	INTEGER	Transparent
A3	SET	Presentation attributes

Context: Presentation attributes (SET) in layout descriptor		
Identifier	Implied data type	Data element name
42	INTEGER	Content type
A0	SET	Character box attributes
A1	SET	Photographic attributes

Context: Character box attributes (SET)		
Identifier	Implied data type	Data element name
80	INTEGER	Character path
81	INTEGER	Line progression
82	INTEGER	Character box orientation
A3	SEQUENCE	Initial offset
A4	SEQUENCE	Character box size
85	INTEGER	Character base line offset
86	INTEGER	Character spacing
87	INTEGER	Line spacing
88	INTEGER	Alignment
89 or A9	– – ? – –	Line layout
AA	SEQUENCE	Graphic rendition

Context: Photographic attributes (SET)		
Identifier	Implied data type	Data element name
80	INTEGER	Pel path
81	INTEGER	Line progression
82	INTEGER	Pel transmission density
A3	SEQUENCE	Initial offset

Context: Text unit (SEQUENCE)		
Identifier	Implied data type	Data element name
31	SET	Content portion attributes
14	OCTET STRING (primitive)	Text information (T.61 string)
34	OCTET STRING (constructor)	Text information (T.61 string)
04	OCTET STRING (primitive)	Text information (T.6 string)
24	OCTET STRING (constructor)	Text information (T.6 string)

Context: Content portion attributes (SET)		
Identifier	Implied data type	Data element name
40	OCTET STRING	Content portion identifier
80	INTEGER	Type of coding
A1	SET	Coding attributes (T.61 attributes)
A2	SET	Coding attributes (T.6 attributes)
83	OCTET STRING	Alternative graphic representation

Context: T.6 attributes (SET)		
Identifier	Implied data type	Data element name
80	INTEGER	Number of pels per line
81	INTEGER	Number of lines
82	INTEGER	Compression
83	INTEGER	Number of discarded pels

ANNEX D

(to Recommendation T.73)

Default values for coding attributes for TIF.0

Table D-1/T.73 has been derived from Recommendation T.5 and is shown for reference.

TABLE D-1/T.73

Pel transmission density	Number of pels per line	Image line length (in pels)	
		ISO A4	North American
200	1728	1654	1700
240	2074	1984	2040
300	2592	2480	2550
400	3456	3308	3400

TELETEX REQUIREMENTS FOR INTERWORKING WITH THE TELEX SERVICE

(Malaga-Torremolinos, 1984)

1 General

1.1 *Scope*

1.1.1 Recommendation F.200 lays down the provisions for the operation of the automatic international Teletex service. In particular, Recommendation F.200 defines the basic service requirements and principles for interworking between Teletex and telex services via a conversion facility (CF).

1.1.2 Recommendation T.60 defines the requirements for terminal equipment used in the international Teletex service, including the interworking with telex terminals, and the conversion table to the telex repertoire in case of interworking.

1.1.3 Recommendation T.61 defines the character repertoire and the coded character sets for the Teletex service.

1.1.4 Recommendation T.62 defines the end-to-end control procedures to be used within the Teletex service as well as between a Teletex terminal and a Teletex/telex conversion facility (CF).

1.1.5 Recommendation T.70 defines the network-independent basic transport service applicable to Teletex terminals, as well as between a Teletex terminal and a CF.

1.1.6 This Recommendation defines the requirements additional to Recommendation T.62 for use between a Teletex terminal and a CF to provide interworking between Teletex and telex services, using store-and-forward principles, in the following cases:

a) when the CF and Teletex terminal are in the same country, with message transfer in either direction;

b) when the CF and Teletex terminal are in different countries, with message transfer in the CF to Teletex terminal direction. This is subject to bilateral agreement.

Note 1 – Due to practical operational difficulties such as charging, message transfer in the direction from a Teletex terminal to a CF in another country is not considered in this Recommendation.

Note 2 – The requirements of interconnection of CFs for the international interworking between Teletex and telex services are for further study.

Note 3 – The real-time conversion operation is not considered in this Recommendation.

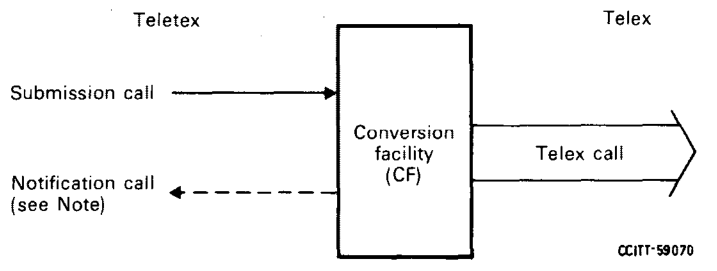
1.1.7 The provisions in this Recommendation are independent of the means and procedures for communication between the CF and the telex network. These are covered in Recommendation F.200.

1.2 *Basic Teletex/telex interworking model*

1.2.1 As illustrated in Figure 1/T.90 and in the single-message case, the communications between a CF and a Teletex terminal for the transfer of a message from Teletex to telex may consist of two calls, namely:

a) a submission call initiated by a Teletex terminal to transfer to the CF a message prepared in the telex mode as per Recommendations F.200 and T.60, and related control information;

b) a notification call initiated by the CF in which delivery or non-delivery information may be provided. This call is mandatory if the telex call is unsuccessful but optional if the telex call succeeds.



Note — A notification call is mandatory if the telex call is unsuccessful but optional if the telex call succeeds (see § 4.3.1).

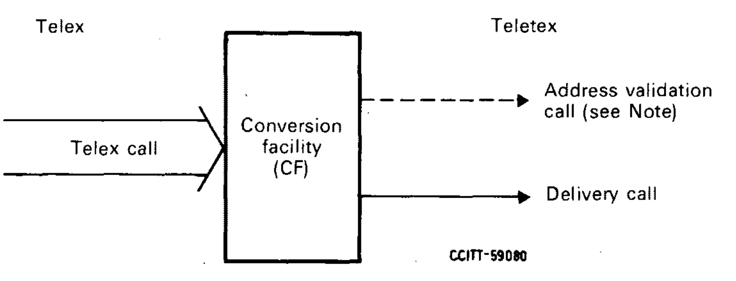
FIGURE 1/T.90

Interworking model with message transfer from Teletex to telex

1.2.2 As illustrated in Figure 2/T.90, the communications between a CF and a Teletex terminal for the transfer of a message from telex to Teletex may consist of two calls, namely:

a) an address validation call initiated by the CF to validate the called Teletex number. The requirement for this call is a national matter;

b) a delivery call initiated by the CF to transfer to the Teletex terminal a message received from the telex terminal.



Note — The requirement for this call is a national matter (see Figure 2/F.201).

FIGURE 2/T.90

Interworking model with message transfer from telex to Teletex

1.2.3 For transferring additional control information between the Teletex terminal and the CF, *control documents* are used. A control document may be associated with one or more normal documents. This set will be called a *message*. All these normal documents should be in telex mode and shall be delivered by the CF as a single *telex message*. The control document need not be prepared in telex mode. An acknowledgement control document will refer to a message and not to individual documents.

2 Session elements of procedure

2.1 The session elements of procedure shall be in accordance with Recommendation T.62. However, the following qualifications shall apply:

2.1.1 The values of mandatory parameters used during session establishment shall be as given in Table 1/T.90.

2.1.2 The value of the "terminal identifier of the calling terminal" parameter in the CSS of the delivery call depends on whether the CF and Teletex terminal are in the same or different countries.

TABLE 1/T.90

Mandatory parameter values during session establishment

T.62 parameters	Call type			
	Submission	Notification	Address validation	Delivery
Terminal identifier of the calling terminal (in CSS)	TTX's TID	CF's TID	CF's TID	See § 2.1.2
Terminal identifier of the called terminal (in RSSP)	CF's TID	TTX's TID	TTX's TID	TTX's TID
Date and time	Submission call originating date and time by TTX	Notification call originating date and time by CF	Address validation call originating date and time by CF	Delivery call originating date and time by CF
Service identifier	Teletex	Teletex	Teletex	Teletex

TID Terminal Identification
TTX Teletex Terminal

2.1.2.1 When the CF and Teletex terminal are in the same country, it may be either the terminal identification of the CF or, alternatively, the terminal identifier derived from the calling telex answerback (A/B) in one of the following forms in which optional fields are enclosed in parentheses:

8 – = <A/B>

8 <TDC> – = <A/B>

8 <TDC> – <A/B number>(– <A/B machine identity>)=(<A/B subscriber name>)

Note 1 – <A/B> is the value of the answerback received from the telex terminal after the deletion of the CR LF characters, if present.

Note 2 – <TDC> is the value of the Recommendation F.69 "telex destination code" of the originating network.

Note 3 – <A/B number> is the subscriber number part of the received <A/B>, as described in Note 1, which conforms to Recommendation F.60.

Note 4 – <A/B machine identity> is the optional machine identity part of the received <A/B>, as described in Note 1, which conforms to Recommendation F.60.

Note 5 – <A/B subscriber name> is the optional subscriber name part of the received <A/B>, as described in Note 1, which conforms to Recommendation F.60. This may also include the telex network identification code.

2.1.2.2 When the CF and Teletex terminal are in different countries, it shall be the terminal identification of the CF in accordance to the format specified in Recommendation F.201. The calling telex answerback shall be contained in the text of the normal document in the format and at the point at which it was obtained by the CF.

3 Document elements of procedures

3.1 *General*

3.1.1 The document elements of procedure shall be in accordance with Recommendation T.62. In addition, the Teletex terminal and the CF shall be able to handle control documents defined in this Recommendation as shown in Table 2/T.90.

4 Control documents

4.1 For transferring additional control information between the Teletex terminal and the CF, control documents are used. The additional control information is contained in the user information part of the control document and is called "control text". A summary of the control documents is in Table 2/T.90.

TABLE 2/T.90

Control documents for Teletex/telex interworking service

Type of call (see Figures 1/T.90 and 2/T.90)	Control document	Status of control document	
		CF	Teletex terminal
Teletex to telex message transfer			
Submission	Telex submission	Mandatory	Mandatory
Notification	Telex delivery notification (Note 2)	Mandatory	Selectable
	Telex non-delivery notification (Note 2)	Mandatory	Mandatory
Telex to teletex message transfer			
Address validation	Telex validation (Note 1)	Optional	Optional
Delivery	Telex message delivery	Optional	Optional

Mandatory: Shall always be implemented.

Optional: Shall be implemented according to national requirements.

Selectable: To be implemented as appropriate.

Note 1 – An address validation call need not contain a telex validation control document.

Note 2 – At present, this only relates to a single telex address.

4.2 *Telex submission control document*

4.2.1 The Telex submission control document shall be used by the Teletex terminal to indicate to the CF that the associated subsequent normal document(s) is to be transferred to a telex terminal.

4.2.2 Elements of the control text are:

a) control document identifier – mandatory;

b) submission control information – optional.

This element consists of the following parameters:

i) telex address – optional.

This is the address of the recipient. It need not be present if provided in lower layer procedures;

ii) answerback – optional.

This is the expected telex answerback. It is to be provided if automatic check by the CF is required;

iii) acknowledgement request – optional.

This is the request for telex delivery notification. This parameter is only present if the user requires advice of a successful telex call. It need not be present in cases where the CF always provides delivery notification.

4.2.3 This control document may be utilized in multi-addressing by providing several sets of the submission control information element in § 4.2.2 above. The provision of this capability in a CF is a national matter.

Note – The inclusion of Teletex addresses within the multi-addressing list is for further study.

4.2.4 Multiple telex submission control documents (each with associated normal documents) may be used within the same session. The provision of this capability in a CF is a national matter.

4.3 *Telex delivery notification control document*

4.3.1 If the Teletex user requires notification after the successful message transfer to the telex terminal [see § 4.2.2 b)], then the telex delivery notification control document shall be sent by the CF to the originator of the telex message. As a national matter, some CFs may always provide this delivery notification.

4.3.2 Elements of the control text are:

a) control document identifier – mandatory;

b) correlation information – mandatory.

This provides a unique reference to the corresponding telex submission control document. The element parameters which are provided by the CF are a national matter. These parameters are:

– CF TID

This is the terminal identification of the CF to which the corresponding telex submission control document was sent.

– TTX TID

This is the terminal identification of the Teletex terminal which sent the telex submission control document.

– Date and time

This is the date and time of the submission call.

– CD No.

This is the document reference number of the telex submission control document.

– Add'l session Ref No.

This is the additional session reference number if used in both the CSS and RSSP in the submission call;

c) submitted control information – mandatory.

This reflects the relevant parameters of the telex submission control document pertaining to a single address. These parameters are:

– telex address

Note – This parameter can be derived from lower layer procedures if not present in the telex submission control document.

– answerback

– acknowledgement request;

d) delivery information – mandatory.

This provides information concerning call establishment from CF to the called telex terminal. The element parameters which are provided by the CF are a national matter. These parameters are:

– telex address

This is the address derived from the telex submission control document and used by the CF to establish the call.

Note – This parameter can be derived from lower layer procedures if not present in the telex submission control document.

– received answerback

This is the complete telex answerback as received by the CF;

e) time of delivery – optional.

This is the time at which the CF delivered the telex message to the telex terminal;

f) telex transmission duration – optional;

g) note – optional.

This is used to convey additional information;

h) received recorded message – optional.

This is used to convey to the Teletex terminal any recorded message from the telex destination.

4.4 *Telex non-delivery notification control document*

4.4.1 The telex non-delivery notification control document shall be used in the following cases:

a) if a telex message cannot be delivered;

b) if a telex message was only partially delivered;

c) if a message is incompletely received in the CF and this partial message successfully delivered (see § 6.1.2).

4.4.2 Elements of the control text are:

a) control document identifier – mandatory;

b) correlation information – mandatory [see 4.3.2 b)];

c) submitted control information – mandatory [see 4.3.2 c)];

d) delivery information – mandatory.

This provides information concerning call attempt or call establishment. For details of the parameters, [see § 4.3.2 d)];

e) time of delivery – optional.

This is the time at which the CF delivered the partial telex message to the telex terminal if a partial delivery was achieved;

f) telex transmission duration – optional.

This may be provided if a partial delivery was achieved;

g) last page delivered – optional.

This shall identify the last page number, and its document reference number, successfully transmitted to telex;

h) failure cause – mandatory.

The cause may be one of the following examples:

– service signal from telex network;
– clearing before call connect;
– wrong answerback;
– clear or break during message transmission;
– submitted normal document not in the telex mode;

i) note – optional [see 4.3.2 g)];

j) received recorded message – optional [see 4.3.2 h)].

4.5 *Telex validation control document*

4.5.1 The telex validation control document is used by the CF to indicate to the called Teletex terminal that a message from telex will subsequently be sent from the CF. The use of this control document is a national matter (e.g. for unique message identification) and shall not be allowed over international connections.

4.5.2 Elements of the control text are:

a) control document identifier – mandatory;

b) reference – mandatory. This reference is assigned by the CF.

4.6 *Telex message delivery control document*

4.6.1 The telex message delivery control document is used by the CF to indicate to the Teletex terminal that the associated subsequent normal document was received from a telex terminal. The use of this control document is a national matter.

Note – The use of this control document over international connections requires further study.

4.6.2 Elements of the control text are:

a) control document identifier – mandatory;

b) reference – optional.

This reference is assigned by the CF. If the telex validation control document is used, then this reference must be quoted;

c) received time – mandatory.

This contains the time at which the telex was received by the CF;

d) received telex answerback – optional.

This is the complete telex answerback as received by the CF;

e) Note – optional [see § 4.3.2 g)].

5 General rules for control documents

5.1 *Control document utilization*

Teletex terminals shall be capable of constructing messages, each consisting of a control document linked with a sequence of normal documents. The message ends at either the start of the next control document or at the normal end of the session.

5.1.1 The Teletex terminal will allow the following types of communication to a CF within a single session:

– one or more normal documents covered by the same control document ("normal" documents shall be in the "telex" mode);

– one or more addresses covered by the same control document. The provision of this capability in a CF is a national matter;

– more than one control document and related normal documents in the same session. The provision of this capability in a CF is a national matter.

5.1.2 When interworking with telex, the following rules shall apply (see Figure 3/T.90):

– a control document relates to the normal documents which follow it, up to the next control document (if any) within the session, or up to the normal end of the session;

– the presence of more than one address in a control document indicates multi-addressing of all related normal documents;

– within a session, document reference numbers will be assigned, as specified in Recommendation T.62, without distinction between control documents and normal documents.

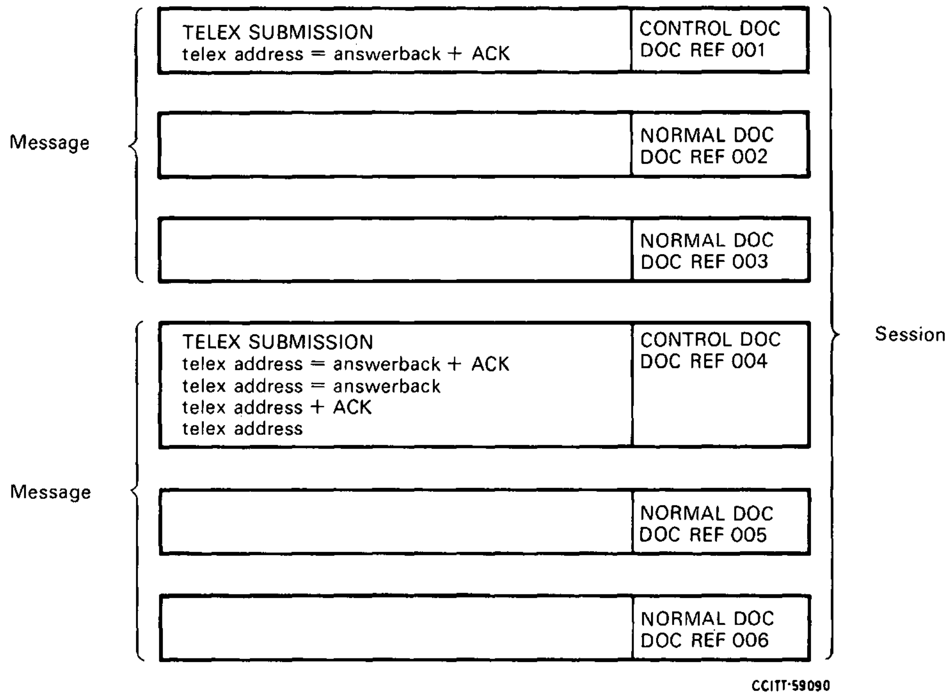


FIGURE 3/T.90

Examples of types of communication (not exhaustive)

6 Error recovery in Teletex/telex interworking

6.1 *Message transfer from Teletex to telex*

6.1.1 During a session, the CF shall perform automatic linking using the procedures specified in T.62.

6.1.2 In the case where a session interruption or CF memory overflow occurs, the following shall apply:

a) All complete messages received and positively acknowledged in that session shall be handled by the CF as in error-free operation.

b) The CF shall handle the interrupted message in one of the following ways:

- The CF shall forward to the telex terminal all positively acknowledged documents and pages of the interrupted document, with an appropriate explanatory text.

  At the end of the text part which is transferred to telex an explanatory text is added, for example:

  "This is an incomplete telex message which may be continued later with the following reference information:

  <rearranged TTX terminal ID> <date and time>"

  At the end of the telex call, the CF may optionally transfer a telex non-delivery notification control document indicating the last page number, and its document reference number, which was successfully transferred to the telex network.

- The CF shall not forward the interrupted message, but shall return a telex non-delivery notification control document to the Teletex terminal to indicate that the complete message has to be retransmitted to the CF.

c) Additionally, in the case of the interrupted message:

- the reaction of the CF is independent of the acknowledgement request of the telex submission control document;
- if a CF in case of interrupted message always sends a telex non-delivery notification, a Teletex terminal or operator should not retransmit any part of that message before receiving that notification.

6.1.3 When the CF is not able to forward the telex message (e.g. because of line interruption) to the telex network, it shall transfer to the Teletex terminal a telex non-delivery notification control document.

6.1.4 If the Teletex terminal retransmits an interrupted message in a new session, it shall send as the first document the control document relating to the interrupted message. When the Teletex operator wants to indicate to the telex terminal that this transmission is a continuation of an interrupted one, the Teletex terminal shall always start the interrupted normal document with CDC. When delivering this message to the telex network, the CF shall precede the continuation of the transmitted message with an appropriate explanatory text, for example "This is a continuation of an incomplete message with the following reference information:

<rearranged TTX terminal ID> <date and time>"

Note – Both parameters of the reference information are taken from the linking information of the CDC command and are identical to the parameters described in § 6.1.2 b).

6.2 *Message transfer from telex to Teletex*

6.2.1 For error conditions arising during the Teletex call, normal error recovery procedures in Recommendation T.62 shall apply.

6.2.2 If an error was detected during telex input, the CF shall add to the end of the interrupted telex message an appropriate explanatory text. An example is "This may be an incomplete message".

This explanatory text may also be used if the telex call was cleared before the CF received the end of input signal (EOI).

7 Coding and formatting of control documents

7.1 *Control document structure*

7.1.1 Figure 4/T.90 illustrates the structure of control documents. The user information part of the control document user information (CDUI) in control documents is called *control text.*

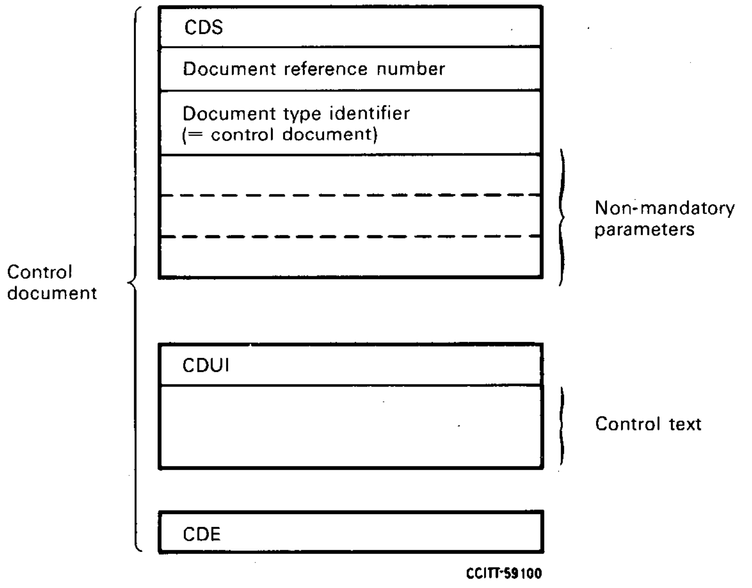


FIGURE 4/T.90

Structure of control documents

7.2 *Control document coding principles*

7.2.1 For the basic Teletex/telex interworking service, the control text shall be coded using explicit, human-readable graphic characters of Recommendation T.61 coding scheme.

7.3 *General formatting of control text*

7.3.1 The control text is subdivided in *elements* each consisting of a number of *fields*.

7.3.2 An element is uniquely identifiable by an *element number* field, which is language-independent, and an *element name* field, which is language dependent. These two fields are always closed by the character "colon" (:). In control documents sent by the CF to the Teletex terminal, at least one of the above fields must be present. For international communications, the element number field shall be mandatory.

7.3.2.1 The element number assigned to the control document identifier shall consist of two parts separated by a period. Each part is a sequentially assigned number. The first part identifies the application which uses the control document. The second part identifies the control document.

7.3.2.2 Each distinct element name, other than control document identifiers, shall be sequentially assigned a different number.

7.3.2.3 There shall be no restriction on the number of digits for element numbers. Any leading zeros in an element number are ignored.

7.3.2.4 Where national requirements dictate the use of non-standardized element numbers, Administrations may choose any value in the range 1000-1999 for the first part of non-standardized control document identifiers and for non-standardized elements.

7.3.3 Parameters to the elements shall be coded in separate *element value* fields.

The parameters will be illustrated in this Recommendation by enclosing them between angular brackets (< >).

7.3.4 In the text each element is contained in one or more lines. When more than one line is used, only the element number field and the element name field shall be present in the first line. See Figure 5/T.90.

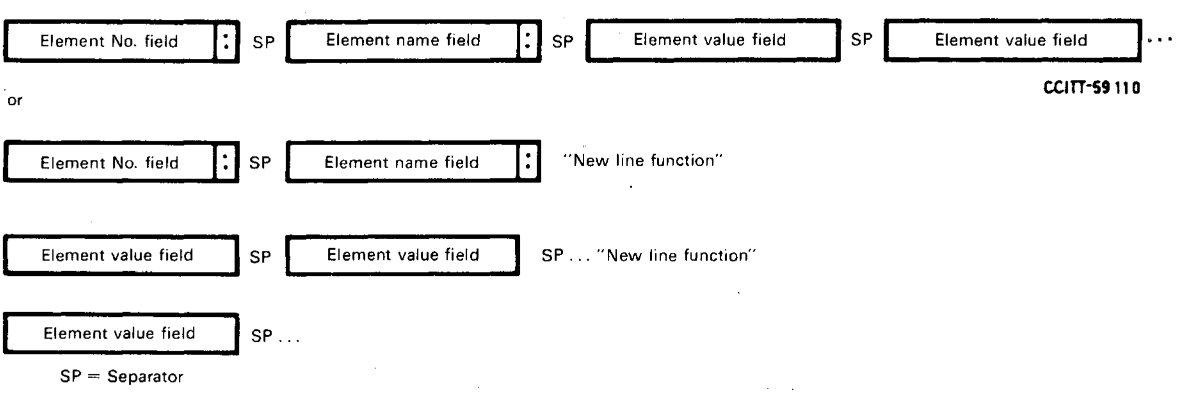


FIGURE 5/T.90

Formats of the elements

7.3.5 The first element present in the control text shall be the control document identifier. This element is mandatory and used to identify the function of the control document, e.g. submission of a telex message, acknowledgement of a previous message.

7.3.6 The element denoted by the name "Note" will be allowed for extending the format to accommodate national requirements.

7.3.7 An element name shall be represented by a *text string*, that is, a sequence of graphic characters. Some parameters may also consist of such text strings. All text strings are language-dependent.

7.3.8 When encoding the control text the following rules shall apply:

a) The control text shall always begin with the character sequence FF CR or CR FF preceded by applicable presentation control functions (see Recommendation T.61 § 3.3.1.4).

b) Each element following the control document identifier may be preceded by one or more empty lines.

c) Each field in an element shall be separated by the character "space" if no other special separator is defined for the element.

Note – It is allowed to have leading spaces or backspaces in a line.

7.3.9 When decoding the control text the following rules shall apply:

a) The first element in the text shall be recognized as the control document identifier. Leading New Line functions (CR LF or LF CR), LF and leading spaces shall be ignored.

b) Contiguous New Line functions (CR LF or LF CR) or LF shall be considered as *one* New Line function.

c) Contiguous embedded spaces are considered as one space. Leading spaces in a line shall be ignored.

Note – Leading backspaces in a line shall be ignored.

7.4 *Format of Teletex/telex interworking control documents*

In this section the formats of the different control documents are shown. Their control texts are illustrated by the use of four different syntax elements:

- The element number field is represented by a sequence of numeric graphic characters.
- The element name field is represented by a text string giving the CCITT language reference name of the field. The actual value shall be a language-dependent representation of that reference name.
- Separators [i.e.: (SP13), / (SP12), = (SA04)] are shown as they shall be represented in the actual control text.
- Element value fields are shown in angular brackets (< >). The actual parameter values are described in the § 7.5.

The formats are illustrated in terms of layout and contents, but do not explicitly show the presentation control functions. These shall be inserted as appropriate (see § 7.3.8).

7.4.1 *Telex submission control document format*

7.4.1.1 Figure 6/T.90 illustrates the format of the control text in the telex submission control document.

```
1.1: TELEX SUBMISSION:

     <TELEX ADDRESS> <= ANSWERBACK> <+ ACKNOWLEDGEMENT REQUEST>
```

FIGURE 6/T.90

Telex submission control document

7.4.1.2 The submission control information element does not have an explicit identification.

7.4.2 *Telex delivery notification control document format*

7.4.2.1 Figure 7/T.90 illustrates the format of the control text in the telex delivery notification control document.

1.2: TELEX DELIVERY NOTIFICATION:

1: CORRELATION INFORMATION:

<CF TID> <TTX TID> <DATE AND TIME> <CD No.> <ADD'L SESSION REF No.>

2: SUBMITTED CONTROL INFORMATION:

<TELEX ADDRESS> <= ANSWERBACK> <+ ACKNOWLEDGEMENT REQUEST>

3: DELIVERY INFORMATION:

<TELEX ADDRESS> = <RECEIVED ANSWERBACK>

4: TIME OF DELIVERY: <DATE AND TIME>

5: TELEX TRANSMISSION DURATION: <DURATION>

6: NOTE: <TEXT>

7: RECEIVED RECORDED MESSAGE:

<TEXT>

Note – If < CD No. > is 5 digits long, and < ADD'L SESSION REF No.> is used, the correlation information line will be 73 characters long. A backspace into the left margin is then necessary in order not to exceed the printable area of a basic Teletex terminal.

FIGURE 7/T.90

Telex delivery notification control document

7.4.3 *Telex non-delivery notification control document format*

7.4.3.1 Figure 8/T.90 illustrates the format of the control text in the telex non-delivery notification control document.

1.3: TELEX NON-DELIVERY NOTIFICATION:

1: CORRELATION INFORMATION:

<CF TID> / <TTX TID> / <DATE AND TIME> / < CD No.> / <ADD'L SESSION REF No.>

2: SUBMITTED CONTROL INFORMATION:

<TELEX ADDRESS> <= ANSWERBACK> <+ ACKNOWLEDGEMENT REQUEST>

3: DELIVERY INFORMATION:

<TELEX ADDRESS> = <RECEIVED ANSWERBACK>

4: TIME OF DELIVERY: <DATE AND TIME>

5: TELEX TRANSMISSION DURATION: <DURATION>

8: LAST PAGE DELIVERED: DOCUMENT = <DOC No.> PAGE = <PAGE No.>

9: FAILURE CAUSE: <CAUSE>

6: NOTE: <TEXT>

7: RECEIVED RECORDED MESSAGE:

<TEXT>

Note – See Note of Figure 7/T.90.

FIGURE 8/T.90

Telex non-delivery notification control document

7.4.4 *Telex validation control document format*

7.4.4.1 Figure 9/T.90 illustrates the format of the control text in the telex validation control document.

```
1.4:  TELEX VALIDATION:
10:   REFERENCE: <REFERENCE>
```

FIGURE 9/T.90

Telex validation control document

7.4.5 *Telex message delivery control document format*

7.4.5.1 Figure 10/T.90 illustrates the format of the control text in the telex message delivery control document.

```
1.5:  TELEX MESSAGE DELIVERY:
10:   REFERENCE: <REFERENCE>
11:   RECEIVED TIME: <DATE AND TIME>
12:   RECEIVED TELEX ANSWERBACK: <RECEIVED ANSWERBACK>
6:    NOTE: <TEXT>
```

FIGURE 10/T.90

Telex message delivery control document

7.5 *Description of parameter values in Teletex/telex interworking control documents*

7.5.1 <TELEX ADDRESS>

A sequence of numeric graphic characters. As a national option, a limited set of graphic characters may be allowed to be embedded in this field as punctuation marks.

7.5.2 <= ANSWERBACK>

An equals sign graphic character followed by a sequence of alphanumeric graphic characters which comprise part or all of the expected answerback code. The carriage return and line feed characters shall not occur in this parameter.

7.5.3 <+ ACKNOWLEDGEMENT REQUEST>

A plus sign graphic character followed by the text string "ACK".

7.5.4 <CF TID>

A sequence of graphic characters as defined in Figure 2/F.200.

7.5.5 <TTX TID>

A sequence of graphic characters as defined in Figure 2/F.200.

7.5.6 <DATE AND TIME>

A sequence of graphic characters as defined in Figure 1/F.200.

7.5.7 <CD No.>

A document reference number as specified in Recommendation T.62.

7.5.8 <ADD'L SESSION REF No.>

An additional session reference number as specified in Recommendation T.62.

7.5.9 <RECEIVED ANSWERBACK>

A sequence of graphic characters representing a telex answerback code from which CR LF characters have been deleted, if present.

7.5.10 <DURATION>

A sequence of graphic characters in the form "HH : MM : SS" representing the numeric values in hours, minutes and seconds.

7.5.11 <TEXT>

Any text string coded as in Recommendation T.61.

7.5.12 <DOC No.>

A document reference number as specified in Recommendation T.62 with a length not exceeding five digits.

7.5.13 <PAGE No.>

A page reference number as specified in Recommendation T.62 with a length not exceeding five digits.

7.5.14 <CAUSE>

This is a text string with the following possible values – the list is not exhaustive:

- network service signal as received from the telex network (see Recommendation U.12) or/and a corresponding text string in the appropriate language
- error in submitted control document
- invalid telex address
- not delivered – interruption in the transmission
- submitted text not prepared for telex
- not permitted telex answerback
- procedural error during the submission call

7.5.15 <REFERENCE>

An alphanumeric text string.

Recommendation T.91

TELETEX REQUIREMENTS FOR REAL-TIME INTERWORKING WITH THE TELEX SERVICE IN A PACKET-SWITCHING NETWORK ENVIRONMENT

(Malaga-Torremolinos, 1984)

1 General

1.1 *Scope*

1.1.1 Recommendations F.200 and F.201 lay down the provisions for the operation of the automatic international Teletex service. In particular, Recommendation F.200 defines the basic service requirements and principles for interworking between Teletex and telex services via a conversion facility (CF).

1.1.2 Recommendation T.60 defines the requirements for terminal equipment used in the international Teletex service, including the interworking with telex terminals.

1.1.3 Recommendation T.61 defines the character repertoire and the coded character sets for the Teletex service.

1.1.4 Recommendation T.62 defines the end – to – end control procedures to be used within the Teletex service as well as between a Teletex terminal and a Teletex/telex Conversion Facility (CF).

1.1.5 Recommendation T.70 defines the network – independent basic transport service applicable to Teletex terminals, as well as between a Teletex terminal and a CF.

1.1.6 This Recommendation defines the requirements additional to Recommendation T.62 for use between a Teletex terminal and a CF to provide interworking between Teletex and telex services, using real-time principles, in the following cases:

a) when the CF and Teletex terminal are in the same country, with message transfer in either direction;

b) when the CF and Teletex terminal are in different countries, with message transfer in the CF to Teletex terminal direction. This is subject to bilateral agreement.

Using this principle, the rate of transfer is determined by the telex terminal. Such a real-time conversion requires the Teletex terminal to be connected to a packet switched data network which provides the rate adaptation.

Note 1 – Due to practical operational difficulties such as charging, message transfer in the direction from a Teletex terminal to a CF in another country is not considered in this Recommendation.

Note 2 – The requirements of interconnection of CFs for the international interworking between Teletex and telex services are for further study.

Note 3 – In order to meet the availability requirements of Recommendation F.200, one of the following provisions may be necessary for Teletex terminals:

– multi – logical channel X.25 interface or,

– some network storage capability.

Note 4 – For calls from Teletex to CF, the value of the inactivity timer might in some cases have to be adapted, depending on the mechanism of the flow-control in the national packet switching network.

Note 5 – For store and forward interworking, see Recommendation T.90.

1.1.7 The provisions in this Recommendation are independent of the means and procedures for communications between the CF and the telex network. These are covered in Recommendation F.201.

1.2 *Basic Teletex/telex interworking model*

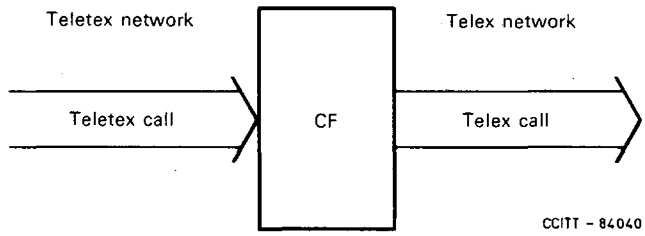
1.2.1 As illustrated in Figure 1/T.91 and in the single message case, the communication between the conversion facility and a Teletex terminal for the transfer of one or several normal documents from the Teletex terminal to a telex terminal consists of only one call, during which the message is transferred from the Teletex terminal to the telex terminal.

The normal documents are prepared in the telex mode as per Recommmendations F.201 and T.60.

1.2.2 As illustrated in Figure 2/T.91 and in the single message case, the communication between the conversion facility and a Teletex terminal for the transfer of a message from the telex terminal to the Teletex terminal consists of only one call.

1.2.3 Control documents are not necessary. A *message* consists of the normal document(s) sent to/by the Teletex terminal within a session.

All these normal documents shall be in telex mode and shall be delivered by the CF to the telex terminal as a single *telex message.*



Note — The called telex address shall be included in the called DTE address field of the call request packet.

FIGURE 1/T.91

Interworking model with message transfer from Teletex to telex

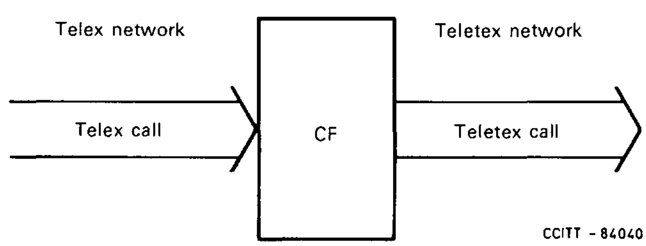


FIGURE 2/T.91

Interworking model with message transfer from telex to Teletex

2 Session elements of procedure

2.1 The session elements of procedure shall be in accordance with Recommendation T.62. However, the following qualifications shall apply:

2.1.1 The values of mandatory parameters used during session establishment shall be as given in Table 1/T.91.

TABLE 1/T.91

Mandatory parameter values during session establishment

T.62 parameters	Call direction	
	Teletex to CF	CF to Teletex
Terminal identifier of the calling terminal (in CSS)	TTX's TID	See § 2.1.2
Terminal identifier of the called terminal (in RSSP)	See § 2.1.3	TTX's TID
Date and time	Originating date and time by TTX	Originating date and time by CF
Service identifier	Teletex	Teletex

TID Terminal Identification
TTX Teletex Terminal
CF Conversion Facility

2.1.2 The value of the "terminal identifier of the calling terminal" parameter in the CSS shall be the terminal identification of the CF in accordance with the format specified in Recommendation F.200.

2.1.3 The value of the "terminal identifier of the called terminal" parameter in the RSSP shall be the terminal identifier derived from the called telex answerback (A/B) in one of the following forms in which optional fields are enclosed in parentheses:

8 – = <A/B>

8 <TDC> – = <A/B>

8 <TDC> – <A/B number> (<A/B machine identity>) = (<A/B subscriber name>)

Note 1 – <A/B> is the value of answerback received from the telex terminal after the deletion of the CR LF characters, if present.

Note 2 – <TDC> is the value of the Recommendation F.69 telex destination code of the originating network.

Note 3 – <A/B number> is the subscriber number part of the received <A/B>, as described in Note 1, which conforms to Recommendation F.60.

Note 4 – <A/B machine identity> is the optional machine identity part of the received <A/B>, as described in Note 1, which conforms to Recommendation F.60.

Note 5 – <A/B subscriber name> is the optional subscriber name part of the received <A/B>, as described in Note 1, which conforms to Recommendation F.60. This may also include the telex network identification code.

2.1.4 The calling telex answerback shall be contained in the text of the normal document in the format and at the point at which it was obtained by the CF.

3 Document elements of procedures

The document elements of procedure shall be in accordance with Recommendation T.62.

4 Error recovery in telex/Teletex interworking

4.1 *Message transfer from Teletex to telex*

4.1.1 During a session, the CF shall perform error recovery using the procedure specified in Recommendation T.62.

In addition the following shall apply:

a) When a CDD is received, the CF shall send an appropriate explanatory text to the telex terminal, for example:

"This is an incomplete telex message which is to be discarded:

<rearranged Teletex terminal ID> <date and time>".

b) The CF shall handle the interrupted message by sending to the telex terminal, at the end of the interrupted message, an appropriate explanatory text, for example:

"This is an incomplete telex message which may be continued later with following information:

<rearranged Teletex terminal ID> <date and time>".

4.1.2 If a Teletex terminal retransmits the missing part of an interrupted message, in a new session, or in the same session (if the call has not been cleared), the Teletex terminal shall start the retransmission with a CDC. When delivering this message to the telex terminal, the CF shall precede the continuation of the transmitted message with an appropriate explanatory text, for example:

"This is a continuation of an incomplete message with the following reference information:

<rearranged Teletex terminal ID> <date and time>".

Note – Both parameters of the reference information are taken from the linking information of the CDC command and are identical to the parameters described in 4.1.1 b).

4.1.3 To check the continuity of the telex connection, upon reception of a CDPB, the CF shall send a WRU to the telex terminal. A RDPBP shall be sent to the Teletex terminal when the correct answerback is received.

If the CF, after having sent a WRU, does not receive the correct answerback, after one retry, then it will reply with a RDPBN to the Teletex terminal, with a parameter indicating: "unrecoverable procedure error". Subsequently, it will also send a CSA in order to abort the session and clear the connection.

Note – If the CF is able to detect a telex line interruption by any other means, it need not use WRU.

4.2 *Message transfer from telex to Teletex*

4.2.1 For error conditions arising during the Teletex call, normal error recovery procedures in Recommendation T.62 shall apply.

On reception of RDPBN or in case of interrupted message, the CF shall always send a CDD command which will be followed by a CSE command and a clear of the connection.

The CF may inform the telex terminal and shall clear the telex connection.

4.2.2 If an error was detected during telex input, the CF shall add at the end of the interrupted telex message an appropriate explanatory text.

An example is: "This may be an incomplete message". This explanatory text may also be used if the telex call was cleared before the CF received the end of input signal (EOI).

Recommendation T.100

INTERNATIONAL INFORMATION EXCHANGE FOR INTERACTIVE VIDEOTEX

(Geneva, 1980, amended at Malaga-Torremolinos, 1984)

Note – The provisions of this Recommendation are retained only during the Study Period 1985-1988 in view of further definition and completion of Recommendation T.101.

CONTENTS

Preamble

The CCITT,

considering

(a) that there is increasing interest in public network-based new interactive information retrieval services using domestic television receivers suitably supplemented, or other apparatus, as terminal equipment;

(b) that the CCIR is studying standards for broadcast *Teletext* services for general reception and has expressed a view that it is desirable that terminal equipment compatibility should exist between broadcast Teletext systems for general reception and public network-based data bank systems;

(c) that such services should be provided over public networks in accordance with CCITT Recommendations and may be required to operate as an international service;

(d) that such services may interwork with terminals provided for text communication services (Teletex for example);

(e) that some Administrations intend to have an early introduction of, or have already introduced, public interactive Videotex services;

unanimously recommends

that the following technical provisions be applied for international information exchange for interactive Videotex service.

1 Purpose and scope of the Recommendation

1.1 *Purpose*

1.1.1 The purpose of this Recommendation is:

a) to facilitate an orderly introduction of early Videotex services (including the continuation of existing services, with a clear identification of potential enhancements) that need to be considered in future developments;

b) to identify parameters needed to design Videotex terminals; and

c) to provide technical recommendations desirable for potential interworking of other services with Videotex services.

1.2 *Scope*

1.2.1 This Recommendation describes the characteristics of coded information that is exchanged between countries participating in the international interactive Videotex service (as described in Recommendation F.300) and defines the display features corresponding to its various elements.

1.2.2 Videotex systems are text communication systems having in addition the capability of a given level of pictorial representation and a repertoire of display attributes. The text and the pictures obtained are intended to be displayed using the current television (TV) raster standards of the different countries.

1.2.3 Different options are offered as a choice for the Administrations to implement their national services. Substantial degrees of compatibility exist between these options, but some transcoding may be necessary to facilitate interworking.

1.2.4 For the international service, four different options for representing pictorial information have been recognized:

a) mosaic character sets;

b) geometric system;

c) dynamically redefinable character sets;

d) photographic representation.

These options are not mutually exclusive and it is possible that systems may develop using two or more options.

1.2.5 For international interworking, two categories of TV systems have to be considered:

a) systems having a vertical resolution of 525 lines per TV frame at 30 TV frames per second;

b) systems having a vertical resolution of 625 lines per TV frame at 25 TV frames per second.

1.2.6 Interworking problems at the pictorial level between countries having different recognized pictorial systems and/or television standards require further study.

1.2.7 This Recommendation is structured as follows:

§§ 1, 2 and 3	deal with the features common to all the options;
§ 4	deals with the coding of characters of the Videotex alphanumeric repertoire defined in Annex B;
§ 5	deals with the alphamosaic option;
§ 6	deals with the alphageometric option;
§ 7	deals with the Dynamically Redefinable Character Sets (DRCS) option;
§ 8	deals with the alphaphotographic option;
§ 9	deals with future enhancements and identifies features requiring further study such as: audio, downloaded software, motion, etc.;
§ 10	deals with line and end-to-end protocols;
§ 11	deals with interworking with other services.

Some of these parts have not been completed, and therefore contain guidelines towards future extensions rather than a complete technical specification.

2 General Videotex coding structure

2.1 *General*

2.1.1 The basis of the coding structure for the Videotex service is Recommendation T.50 and the international standards ISO 2022, ISO 6937 for the 7-bit environment. Specifically, the shift-in code SI (0/15) invokes the G0 set for alphanumeric text mode of operation, and the shift-out code SO (0/14) invokes the G1 set, for all the models (see Annex A). The use of the 8-bit coding scheme is for further study.

2.1.2 In addition to the provisions made by ISO 2022, the transmission of alphabetic characters having diacritical signs is effected by transmitting the code representing the diacritical mark together with the code of the basic alphabetic character.

2.1.3 The different options are designated (and invoked) by specific escape sequences.

2.2 *Designation and invocation in the context of the alphamosaic option*

2.2.1 Two different modes for the alphamosaic option have been identified. They differ in their display control sets. These control sets are designated as the C1 set by the following control sequences: ESC 2/2 4/0 for the serial mode and ESC 2/2 4/1 for the parallel mode, as assigned by ISO. Individual controls are represented by: ESC F_e sequences.

2.2.2 The mosaic graphics set is designated (in the parallel mode) as the G1 set by an escape sequence ESC 2/9 6/3 as allocated by ISO.

2.3 *Designation and invocation in the context of the alphageometric option*

2.3.1 The alphageometric coding scheme is to be designated and invoked by the escape sequence ESC 2/5 (5/x) in accordance with § 5.3.8 of ISO 2022 standard. This designates and invokes a complete code with interpretation as follows.

2.3.2 All the meanings and interpretation of Recommendation T.50 and ISO 2022 remain the same, including C0, G0 and G2 with the exception of SI and SO. The codes of the G1 set and their meanings and interpretations are as described in § 6.

2.3.3 The designation and invocation of the complete code by the sequence ESC 2/5 (5/x) is to be terminated only by ESC 2/9 (F) or ESC 2/13 (F), designating a normal G1 set.

2.4 *Designation and invocation in the context of DRCS*

2.4.1 A DRCS is a set of characters whose shapes are sent from the service and down-loaded via the line. It may be used to represent alphabetic characters, special symbols, or picture element symbols for constructing fine graphics. Once loaded, the DRCS are regarded as members of a library that can be designated by appropriate ESC sequences as G0, G1, G2, G3 sets. One scheme is described in § 7 in the context of a general architecture.

2.5 *Designation and invocation in the context of the alphaphotographic option*

(For further study.)

3 Common features

3.1 *General*

3.1.1 The features pertaining to individual systems will be described in the corresponding paragraphs. The common features comprise common display features and common control functions.

3.2 *Common display features*

3.2.1 The *defined display area* is that rectangular position of the display in which all text and pictorial images may be presented (see Figure 1/T.100).

3.2.2 The *border area* is that part of the visible display of a terminal that is outside the defined display area (see Figure 1/T.100).

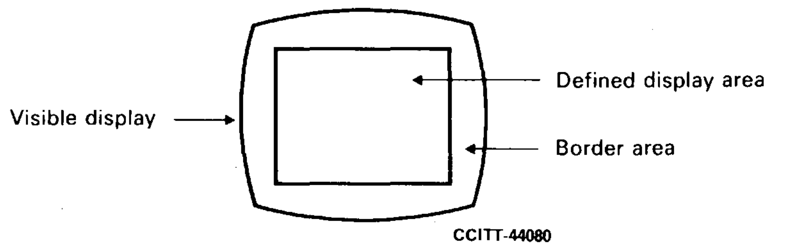


FIGURE 1/T.100

Common display features

3.3 *Common format effector and code extension control functions*

3.3.1 *General*

3.3.1.1 The format effector control functions described for the Videotex system permit the active drawing position to be moved on the visible display area. These are taken from the C0 set (see Figure 2/T.100) together with the *Space* character 2/0. In order to permit interworking between Videotex and other text communications services, these control functions have functional compatibility to the extent possible with the basic C0 control set utilized by these other services.

3.3.2 *Format effector controls*

3.3.2.1 Some of the format effector control functions may be used from terminal to computer with different meanings.

3.3.2.2 *Active position backward (APB)*

This control function causes the active position to be moved one character position backwards on the same row. APB on the first character position on the row moves the active position to the last character position of the preceding row. APB on the first character position on the first row moves the active position to the last character position of the last row.

3.3.2.3 *Active position forward (APF)*

This function causes the active position to be moved to the next character position forward on the same row. At the last position on the row, this control moves the active position to the first character position on the following row. APF on the last character position of the last row moves the active position to the first character position of the first row.

3.3.2.4 *Active position down (APD)*

This function causes the active position to be moved to the equivalent character position on the following row. APD on the last row moves the active position of the equivalent character position of the first row of the display frame or causes a roll-up to be made.

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	2						
0	0	0	1	1	2	3						
0	0	1	0	2	2	3						
0	0	1	1	3	2	3						
0	1	0	0	4	2	3						
0	1	0	1	5	ENQ	2						
0	1	1	0	6	2	2						
0	1	1	1	7	1	2						
1	0	0	0	8	APB	CAN						
1	0	0	1	9	APF	SS2						
1	0	1	0	10	APD	1						
1	0	1	1	11	APU	ESC						
1	1	0	0	12	CS	1						
1	1	0	1	13	APR	SS3						
1	1	1	0	14	SO	3						
1	1	1	1	15	SI	3						

CCITT-44090

Note 1 — Reserved for future study.

Note 2 — Reserved for transmission control characters. Their use in Videotex is for further study.

Note 3 — The definitions of these control functions are given in the relevant options.

Note 4 — As in all the code tables in this Recommendation, the shaded positions do not belong to the character set described.

FIGURE 2/T.100

The primary set of control functions for International Interactive Videotex

3.3.2.5 *Active position up (APU)*

This function causes the active position to be moved to the equivalent character position on the preceding row. APU on the first row moves the active position to the equivalent character position on the last row of the same display frame.

3.3.2.6 *Clear screen (CS)*

This function causes the screen to be cleared and causes the active position to be moved to the first character position on the first row.

3.3.2.7 *Active position return (APR)*

This function causes the active position to be moved to the first character position of the same row.

3.3.2.8 *Space (SP)*

A control function that causes the active position to be moved one character width forward on the same row. It is also regarded as a graphic character with no foreground. In those systems that define an explicit background, the space copies the background colour into the active position and moves the active position one character width forward. If used in conjunction with the inversion attribute it copies the foreground colour into the active position and moves the active position one character width forward.

3.3.2.9 *Cancel (CAN)*

A control function that fills all the character positions of the row, after the active position, with spaces and returns the active position to its original value.

3.3.3 *Code extension control functions*

3.3.3.1 Code extension control functions are used to expand the capability of the 7-bit code beyond 128 different characters or functions. Code extension functions alter the meaning of a number of characters following them.

3.3.3.2 *Escape (ESC)*

A control character that is used to provide additional control functions other than transmission control functions and that alters the meaning of a limited number of contiguously following bit combinations in the manner specified in Recommendation T.51.

3.3.3.3 *Control sequence introducer (CSI)*

A code extension control function that is used to provide coded representations for additional control functions, in particular for control functions with parameters such as presentation control functions.

3.3.3.4 *Shift-out (SO)*

A control character that is used in conjunction with the *Shift-in* character to extend the graphic character set of the code and that alters the meaning of the bit combinations of columns 2-7 of the code table, until the occurrence of the *shift-in* character, except that the meaning of the bit combinations corresponding to the *space* character and the *delete* character (positions 2/0 and 7/15) are unaffected.

3.3.3.5 *Shift-in (SI)*

A control character, used in conjunction with the *shift-out* character, that reinstates the former meanings of the bit combinations of columns 2-7 of the code table.

3.3.3.6 *Single shift (SS2)*

This character alters the meaning of the single-bit combination following it. That bit combination must be one of those from columns 2-7 except 2/0 and 7/15. The meaning of the bit combination concerned is derived from an appropriately designated G2 graphic set.

3.3.3.7 *Single shift (SS3)*

This character alters the meaning of the single-bit combination following it. That bit combination must be one of those from columns 2-7 except 2/0 and 7/15. The meaning of the bit combination concerned is derived from an appropriately designated G3 graphic set.

3.4 *Miscellaneous*

3.4.1 *Null (NUL)*

This function may occur in non-transparent modes in the received bit stream at the terminal. It shall be regarded as a time filler and discarded.

3.4.2 *Enquiry (ENQ)*

A control character used as a request for a response from a remote station, which response may include station identification and/or station status.

3.5 *Coding of control functions*

3.5.1 A proposed coding of the control functions described is shown in Figure 2/T.100 as a C0 set, except for CSI which is coded in the C1 set.

4 Representation of alphanumeric characters in a Videotex system

4.1 *General*

4.1.1 The repertoire for the Latin alphabet is shown in Annex B. The repertoire is derived from ISO 6937. Terminals capable of displaying a subset of the Videotex repertoire shall be permitted.

4.1.2 Character repertoires for non-latin based languages can be accommodated in a similar manner to the latin alphabet (for further study).

4.2 *Coding*

4.2.1 § 4.2 describes the coding of characters the shape of which are stored in the terminal. Some languages require that consecutive letters or diacritical marks will be joined and that no space appear between the characters. When an intersymbol space is required it will be part of the character description.

4.2.2 The code tables are shown in Figures 3/T.100 and 4/T.100. The code combinations representing characters not included in the Videotex repertoire shall not be transmitted.

4.2.3 All the permitted combinations may be expected in the international exchange of information between two national services. It is the responsibility of Administrations and/or RPOAs to decide whether this exchange is a direct terminal to data-base operation or has to be performed through a gateway. See Recommendation F.300.

4.2.4 The graphic characters from columns 2, 3, 5, 6 and 7 of the supplementary set are invoked one at a time by SS2.

4.2.5 A character with a diacritical mark is transmitted by the sequence SS2, a character from column 4 from the supplementary set, and the appropriate character from the primary set. The diacritical marks are non-spacing.

4.2.6 The ISO registration of graphics character sets will indicate any special features such as their use in conjunction with other graphic character sets or non-spacing characters, etc.

4.2.7 For languages based on other than the Latin alphabet further study is required.

5 Alphamosaic option

5.1 *General*

5.1.1 In the alphamosaic option, the display frame is composed of defined character positions, which may be occupied by any of the characters of the repertoire. The repertoire is composed of the alphanumeric repertoire and a mosaic repertoire. The mosaic repertoire is formed by dividing the character space into a matrix of 2 × 3 elements. There are 63 different combinations of these elements.

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0				0	@	P		p
0	0	0	1	1			!	1	A	Q	a	q
0	0	1	0	2			"	2	B	R	b	r
0	0	1	1	3				3	C	S	c	s
0	1	0	0	4				4	D	T	d	t
0	1	0	1	5			%	5	E	U	e	u
0	1	1	0	6			&	6	F	V	f	v
0	1	1	1	7			'	7	G	W	g	w
1	0	0	0	8			(	8	H	X	h	x
1	0	0	1	9			)	9	I	Y	i	y
1	0	1	0	10			*	:	J	Z	j	z
1	0	1	1	11			+	;	K		k	
1	1	0	0	12			,	<	L		l	|
1	1	0	1	13			-	=	M		m	
1	1	1	0	14			.	>	N		n	
1	1	1	1	15			/	?	O	①	o	

CCITT-44100

① Position 5/15 can be displayed as "low line", —, or as "number sign" #, to represent the terminator function required for some existing Videotex services.

FIGURE 3/T.100

The primary set of graphic characters for international interactive Videotex

b4	b3	b2	b1	b7 / b6 / b5	0 / 0 / 0	0 / 0 / 1	0 / 1 / 0	0 / 1 / 1	1 / 0 / 0	1 / 0 / 1	1 / 1 / 0	1 / 1 / 1
					0	1	2	3	4	5	6	7
0	0	0	0	0				°		―	Ω	ĸ
0	0	0	1	1			¡	±	`		Æ	æ
0	0	1	0	2			¢	²	´		Đ	đ
0	0	1	1	3			£	³	^		ª	ð
0	1	0	0	4			$	×	~		Ħ	ħ
0	1	0	1	5			¥	µ	¯			ı
0	1	1	0	6			#	¶	˘		Ĳ	ĳ
0	1	1	1	7			§	·	˙		Ŀ	ŀ
1	0	0	0	8			¤	÷	¨		Ł	ł
1	0	0	1	9			‘	’			Ø	ø
1	0	1	0	10			“	”	˚		Œ	œ
1	0	1	1	11			«	»	¸		º	ß
1	1	0	0	12			←	¼			Þ	þ
1	1	0	1	13			↑	½	˝		Ŧ	ŧ
1	1	1	0	14			→	¾	˛		Ŋ	ŋ
1	1	1	1	15			↓	¿	ˇ		ŉ	

CCITT-44111

FIGURE 4/T.100

The supplementary set of graphic characters for international interactive Videotex

5.1.2 Two modes have been identified, which are known as *serial* and *parallel* modes respectively. The two modes are distinguished by their display control sets which are coded in C1 sets, designated and represented by ESC F_e sequences as described in § 2.2.1.

5.1.3 The two modes have common features and specific features described in §§ 5.2 to 5.4 below.

5.2 *Common control functions*

5.2.1 *General functions*

The *active position home (APH)*

This function causes the active position to be moved to the first position of the first row. Its coded representation is 1/14 in Figure 2/T.100.

5.2.2 *Device control functions*

The following device control functions have been defined.

5.2.2.1 *Definitions*

cursor on (CON)

F: curseur en marche (CON)

S: cursor activo (CON)

The cursor on (CON) causes the active position to be visualized as a marker.

cursor off (COF)

F: curseur arrêté (COF)

S: cursor inactivo (COF)

The cursor off (COF) causes the active position to be displayed in the same way as other character positions.

device stop (DSP)

F: arrêt dispositif (DSP)

S: detención de dispositivo (DSP)

The device stop (DSP) causes a designated terminal device to stop.

device start (DST)

F: mise en marche dispositif (DST)

S: arranque de dispositivo (DST)

The device start (DST) causes a designated terminal device to start.

device wait (DW)

F: dispositif en attente (DW)

S: espera de dispositivo (DW)

The device wait (DW) causes a designated terminal device to pause.

5.2.2.2 *Coding*

CON is coded 1/1, COF is coded 1/4 in the C0 set. DSP, DST and DW functions are coded as 3-character sequences of the Form ESC 3/x, (P) where x = 7, 6 and 5 respectively and P is a parameter that designates a particular device.

5.3 *Serial mode*

5.3.1 *General*

5.3.1.1 The serial mode is based on the assumption that changes in character attributes normally occur in interword spacings. This results in control characters being serially stored in the page memory and normally results in their display on the screen as a rectangle in the prevailing background colour.

5.3.1.2 The C1 set for the serial mode is given in Figure 5/T.100. Display controls of the serial set causes the active position to be moved one character position forward. In that case, the position thus vacated is to be generally displayed as a space. The display control *hold mosaics* ESC 5/14 may modify this situation.

5.3.2 *Display control functions*

5.3.2.1 The (F_e) codes are listed as follows:

5.3.2.2 Alpha red Alpha green Alpha yellow Alpha blue Alpha magenta Alpha cyan Alpha white	Controls functions that cause the currently designated and invoked alphanumeric set to be displayed in the indicated colour until the occurrence of an explicit colour control or the end of a row.

5.3.2.3 *Flashing*

A control function that causes the characters following it in the same row to be displayed alternately as they would normally be displayed, and as spaces, in the prevailing background colour, under the control of a timing device in the receiver.

5.3.2.4 *Steady*

A control function that causes the action of *Flashing* to be stopped.

5.3.2.5 *Start box*

Reserved for starting the action of defining a picture area in a page of text (for further study).

5.3.2.6 *End box*

Reserved for terminating the action of boxing (for further study).

5.3.2.7 *Normal height*

A control function that causes the graphic characters following it to occupy one character position each.

5.3.2.8 *Double height*

A control function that causes the characters following it to occupy each its active positive and the corresponding position on the following row.

5.3.2.9 Mosaics red Mosaics green Mosaics yellow Mosaics blue Mosaics magenta Mosaics cyan Mosaics white	Control functions that cause the mosaic graphic set to be displayed in the indicated colour until the occurrence of an explicit colour control or the end of the row. Unallocated code table positions (4/0-5/15) cause the characters of the currently designated and invoked alphanumeric set to be displayed. This is defined as *blast-through* operation.

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		0	1	2	3	4	5	6	7
0	0	0	0	0					①	①		
0	0	0	1	1					Alpha red	Mosaics red		
0	0	1	0	2					Alpha green	Mosaics green		
0	0	1	1	3					Alpha yellow	Mosaics yellow		
0	1	0	0	4					Alpha blue	Mosaics blue		
0	1	0	1	5					Alpha magenta	Mosaics magenta		
0	1	1	0	6					Alpha cyan	Mosaics cyan		
0	1	1	1	7					Alpha white	Mosaics white		
1	0	0	0	8					Flashing	Conceal display		
1	0	0	1	9					Steady	Conti- guous mosaics		
1	0	1	0	10					End box ①	Sepa- rated mosaics		
1	0	1	1	11					Start Box ①	①		
1	1	0	0	12					Normal height	Black back- ground		
1	1	0	1	13					Double height	New back- ground		
1	1	1	0	14					①	Hold mosaics		
1	1	1	1	15					①	Release mosaics		

CCITT-44120

① Reserved for further study.

Note — This coding represents the final bit combination of ESC F_c sequences in a 7-bit code.

FIGURE 5/T.100

The supplementary set of control functions-serial mode

5.3.2.10 *Conceal display*

A control function that causes all characters following it, although stored in the receiver, to be displayed as spaces until the user chooses to reveal them.

5.3.2.11 *Contiguous mosaics*

A control function that causes the mosaic set to be displayed as represented in Figure 6/T.100 with all cells being contiguous.

5.3.2.12 *Separated mosaics*

A control function that causes the mosaics set to be displayed as represented in Figure 6/T.100 with all cells being separated by the prevailing background colour.

5.3.2.13 *Black background*

A control function that causes the background colour to be black.

5.3.2.14 *New background*

A control function that causes the current colour as defined by previous colour control functions to become the new background colour. The foreground colour is unchanged.

5.3.2.15 *Hold mosaics*

A control function that causes the character positions occupied by display controls to be displayed by repetition of the last displayable mosaic character.

5.3.2.16 *Release mosaics*

A control function that causes the action of *Hold mosaics* to be stopped.

5.3.3 *Mosaic graphics*

5.3.3.1 The *serial mosaic* graphic set is given in Figure 6/T.100 and the default conditions of the mode are shown in Table 1/T.100.

5.4 *Parallel mode*

5.4.1 *General*

5.4.1.1 The *parallel* mode is based on an explicit description of the display frame. This means that the active position is moved only by action of the format effectors or at the reception of spacing display characters. All other functions, including display functions, are non-spacing, not depending on whether the terminal needs a space or not on the screen to process them. It is the responsibility of the information provider to limit the display of the pages to pages to fit the capability assumed to receive, without any modification, pages designed for lower grade terminals.

5.4.1.2 In addition to functions described in § 3.3, the following functions are defined.

active position addressing (APA, coded 1/15)

F: adressage de position active (APA)

S: direccionamiento de posición activa (APA)

This code is followed by two characters. If these both range from 3/0 to 3/9, they represent in decimal form respectively the tens and units of the row address of the first character to be displayed. This first character will be displayed on the first character position of the addressed row. If they both range from 4/0 to 7/14, they represent respectively the row address and the column address, in binary form with 6 useful bits, of the first characters to be displayed.

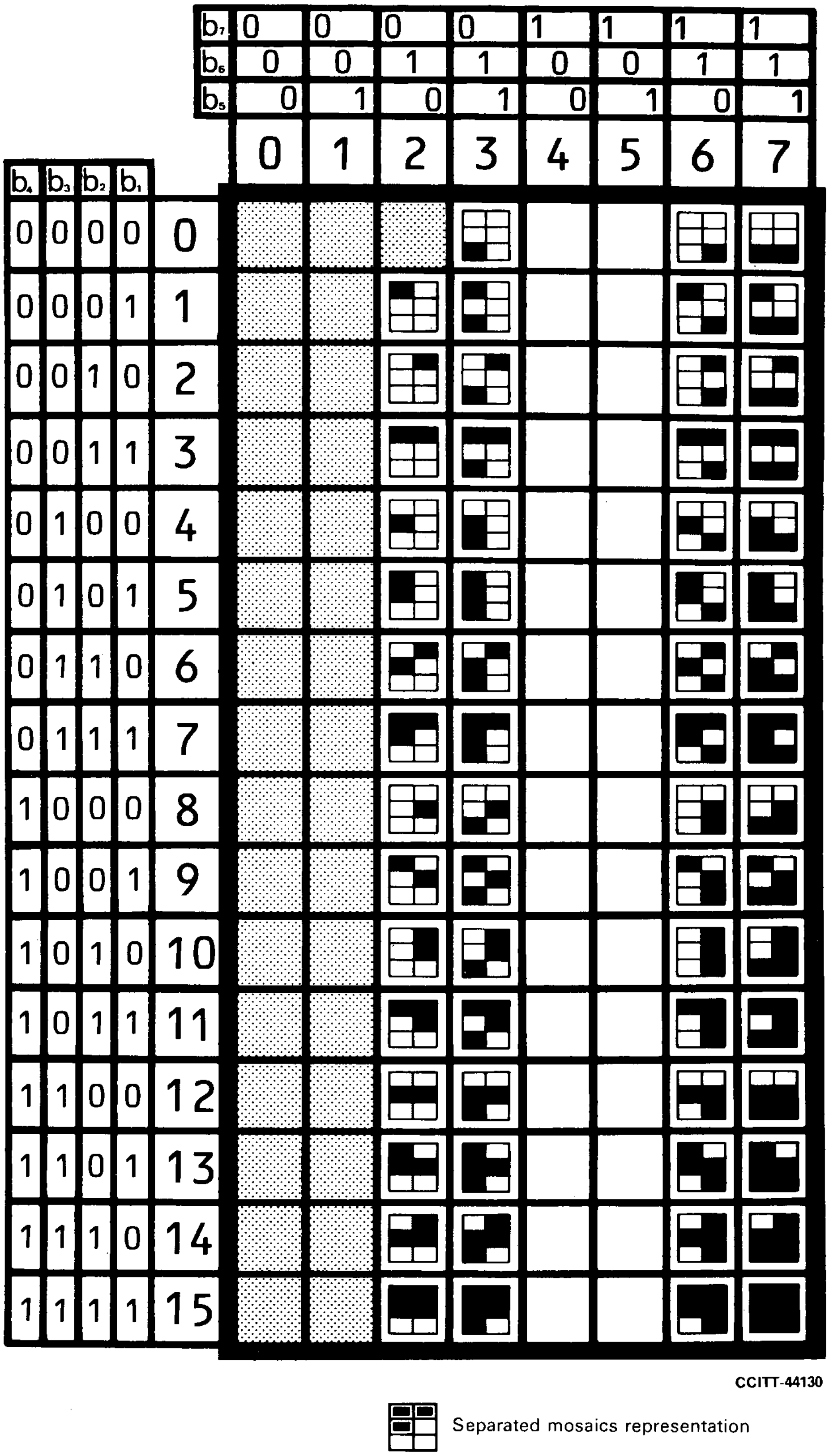


FIGURE 6/T.100

The mosaic set for the serial mode with blast-through characters in columns 4 and 5

TABLE 1/T.100

Display modes and control characters-serial mode

Display mode	Set at	Set after (see Note)	Complementary display mode	Set at	Set after (see Note)
Alphanumerics	Row start	4/1 4/2 4/3 4/4 4/5 4/6 4/7	Block mosaics	—	5/1 5/2 5/3 5/4 5/5 5/6 5/7
Contiguous	Row start 5/9	5/9	Separated	5/10	5/10
Foreground display colour: includes red	Row start	4/1 4/3 4/5 4/7 5/1 5/3 5/5 5/7	Foreground display colour: excludes red	—	4/2 4/4 4/6 5/2 5/4 5/6
Foreground display colour: includes green	Row start	4/2 4/3 4/6 4/7 5/2 5/3 5/6 5/7	Foreground display colour: excludes green	—	4/1 4/4 4/5 5/1 5/4 5/5
Foreground display colour: includes blue	Row start	4/4 4/5 4/6 4/7 5/4 5/5 5/6 5/7	Foreground display colour: excludes blue	—	4/1 4/2 4/3 5/1 5/2 5/3
Black background	Row start 5/12	—	New background colour	5/13	—
Stop conceal	Row start	4/1 4/2 4/3 4/4 4/5 4/6 4/7 5/1 5/2 5/3 5/4 5/5 5/6 5/7	Conceal	5/8	—
Steady	Row start 4/9	—	Flash	—	4/8
Unboxed	Row start 4/10	4/10	Boxed	4/11	4/11
Normal height	Row start 4/12	—	Double height	—	4/13
Release	Row start	5/15	Hold	5/14	—

Note — All attribute control characters are preceded by Escape ESC.

repeat (RPT, coded 1/2)

F: répétition (RPT)

S: repetición (RPT)

This code indicates that the preceding graphics character is to be repeated. The number of repetitions is indicated in binary form by the six least significant bits of the subsequent character chosen from columns 4 to 7. The character itself is not included in the count. This function does not apply to control characters.

5.4.1.3 A supplementary set of 32 controls, of which 31 have been allocated, are coded as a C1 set (see Figure 7/T.100). The attributes defined by such controls become a property of the active position and move with it under the action of format effectors or spacing display characters.

5.4.1.4 The mosaic repertoire is coded as a G1 set, of which several representations may be defined (see Figure 8/T.100).

5.4.2 *Display control functions*

5.4.2.1 The display control functions are of two kinds depending on the range of their action:

- *Defined display area attributes* apply to individual character locations. Their action is limited to zones separated by APA functions.
- *Full screen attributes* apply to the full screen area and are taken as default values for defined display area attributes.

The defined display area attributes are coded as functions from the supplementary set of control functions (Figure 7/T.100) with two character escape sequences.

The full screen attribute is coded as a function from the supplementary set of control functions with four character escape sequences (see § 5.4.2.3).

5.4.2.2 Attributes for use in the defined display area are as follows.

5.4.2.2.1 Black foreground Red foreground Green foreground Yellow foreground Blue foreground Magenta foreground Cyan foreground White foreground	Causes the following characters to be written in the colour indicated.

5.4.2.2.2 *Flashing*

This control function causes the characters following it to be displayed alternatively as they would otherwise be displayed, and as spaces, under the control of a timing device in the receiver.

5.4.2.2.3 *Steady*

This control function causes the action of *flashing* to be stopped.

5.4.2.2.4 *Start box*

This control function causes the characters following it to be inset or added to a television picture, when the receiver is in the user's control (for further study).

5.4.2.2.5 *End box*

This control function causes the action of *start box* to be stopped (for further study).

5.4.2.2.6 *Normal size*

This control function causes the characters following it to occupy one character position each.

				b_7	0	0	0	0	1	1	1	1
				b_6	0	0	1	1	0	0	1	1
				b_5	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1		0	1	2	3	4	5	6	7
0	0	0	0	0					Black foreground	Black background		
0	0	0	1	1					Red F....	Red B....		
0	0	1	0	2					Green F....	Green B....		
0	0	1	1	3					Yellow F....	Yellow B....		
0	1	0	0	4					Blue F....	Blue B....		
0	1	0	1	5					Magenta F....	Magenta B....		
0	1	1	0	6					Cyan F....	Cyan B....		
0	1	1	1	7					White F....	White B....		
1	0	0	0	8					Flash	Conceal display		
1	0	0	1	9					Steady	Stop lining		
1	0	1	0	10					End box ①	Start lining		
1	0	1	1	11					Start box ①	②		
1	1	0	0	12					Normal size	Normal polarity		
1	1	0	1	13					Double height	Inverted polarity		
1	1	1	0	14					Double width	Transparent background		
1	1	1	1	15					Double size	Stop conceal		

① For further study ② Reserved for CSI CCITT-44140

Note — This coding represents the final bit combination of ESC F_e sequences in a 7-bit code.

FIGURE 7/T.100

Supplementary set of control functions — parallel mode

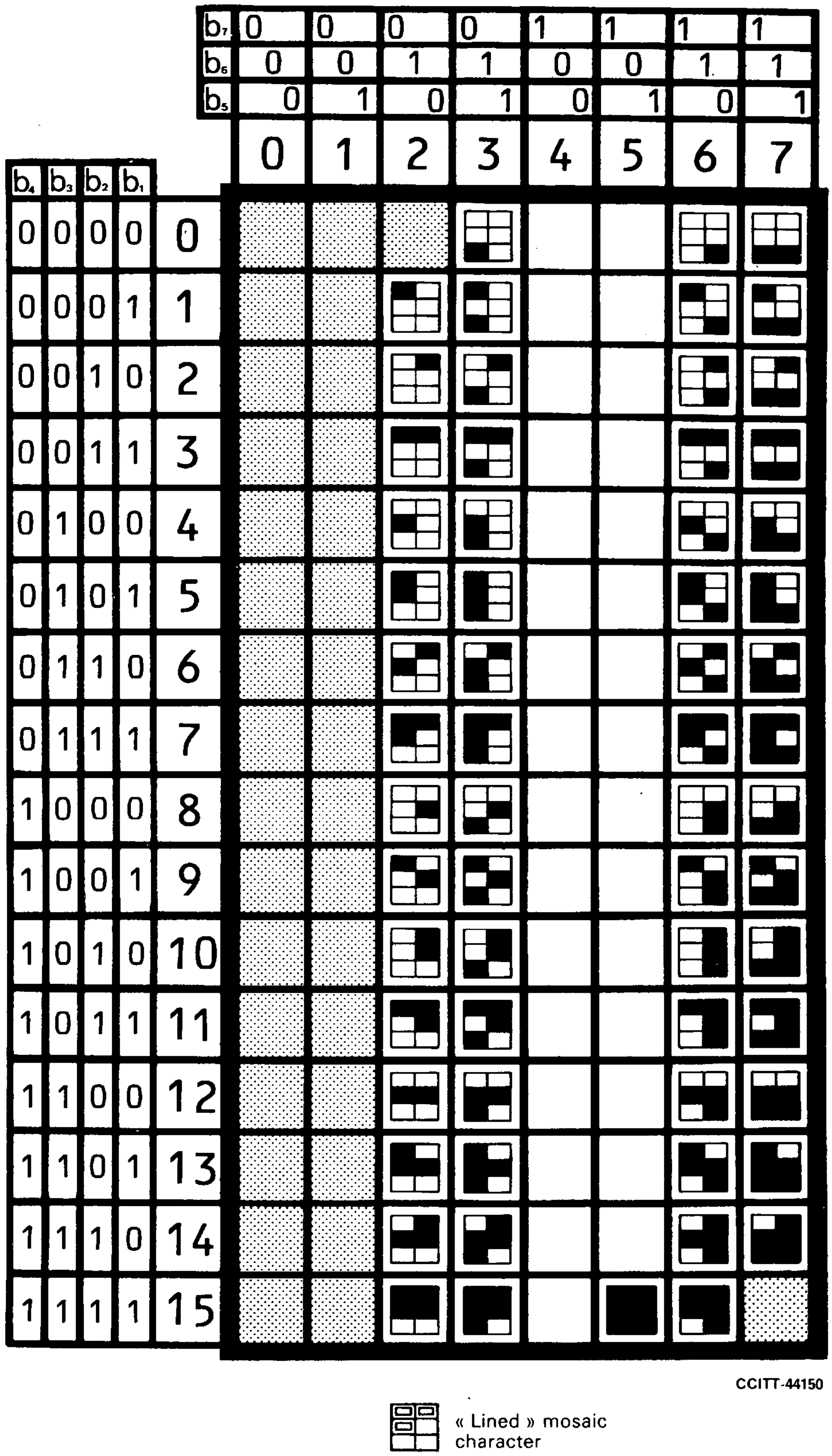


FIGURE 8/T.100

The mosaic character set — parallel mode

5.4.2.2.7 *Double height*

This control function causes the characters following it to occupy each its active position and the corresponding position on the previous row. (The origin of a character is the bottom left corner of the character position.)

5.4.2.2.8 *Double width*

This control function causes the characters following it to occupy two consecutive character positions on the same row, and the active position to be moved two positions forward with every character.

5.4.2.2.9 *Double size*

This control function causes the characters following it to occupy the active position, the next on the row and the two corresponding character positions on the previous row. The active position is moved two character positions forward with every character.

5.4.2.2.10 Black background Red background Green background Yellow background Blue background Magenta background Cyan background White background	Causes the following characters to be displayed in their foreground colour on a background of the colour indicated.

5.4.2.2.11 *Transparent background*

This control function causes the characters following it to be displayed with a transparent background. This means the area not occupied by the foreground colour takes the underlying background colour. This may be one of the eight colours or the video picture as defined by the off screen attributes.

5.4.2.2.12 *Conceal display*

This control function causes the characters following it, in the same unit although stored in the receiver, to be displayed as spaces until the user chooses to reveal them.

5.4.2.2.13 *Stop conceal*

This control function causes the action of *conceal display* to be stopped.

5.4.2.2.14 *Start lining*

This control function causes the characters following in the same unit to be lined. The shape of lining may be different depending on the character set used. In the case of the mosaic set, the lining causes the six cells to be separated with a background boundary.

5.4.2.2.15 *Stop lining*

This control function causes the action of *start lining* to be stopped.

5.4.2.2.16 *Normal polarity*

This control function causes the action of *inverted polarity* to be stopped.

5.4.2.2.17 *Inverted polarity*

This control function causes the characters following it, in the same unit, to be displayed as if the background and the foreground colour have been exchanged. In the flashing attribute, the polarity of the flashing clock is also inverted.

5.4.2.3 *Full-screen attributes*

5.4.2.3.1 Full-screen attributes apply for the total display period and include the border area. In addition, provisions are made for full-row attributes, applying for the entire row including the border area related to that row.

Full-screen attributes display controls are represented by four character *Escape* sequences of the form ESC 2/3 2/0 F_e where F_e is taken from Figure 7/T.100.

Full-row attributes display controls are represented by four-character *Escape* sequences of the form ESC 2/3 2/1 F_e.

5.4.2.3.2 The following full-screen attributes need precise definition:

- *Transparent background:* The full-screen area is occupied by a picture, which may not be part of the Videotex service (e.g. a television picture). Non-concealed characters appear on this picture. If they are also displayed with defined display area transparent background, only the foreground appears over the picture. Concealed characters are displayed as transparent spaces.
- *Conceal:* The defined display area is in the full-screen background colour until the user chooses to reveal it or until this attribute is stopped by full-screen stop conceal.
- *Full-screen stop conceal:* This has the same action as the action of the user on the reveal key.

5.4.2.3.3 For row-defined full-screen attributes, the following may also apply:

- lined;
- double width;
- double height.

5.4.3 *Coding of the mosaic repertoire*

5.4.3.1 The mosaic repertoire is designated as a G1 set invoked by the SO function. Two alternative fonts (contiguous and separated) are proposed. The separated font is obtained by applying the lining attribute applied to the mosaic set. The mosaic set code table is given in Figure 8/T.100 together with examples of the fonts.

5.4.4 *Default conditions*

5.4.4.1 *Default full-screen attributes*

At the beginning of a display frame (initiated by function CS) the default conditions for full-screen attributes are set at white foreground, black background, single size, unboxed, revealed, steady, non-lined.

5.4.4.2 *Default defined display area attributes*

After functions directly addressing a character location on the screen (APH or APA function) the defined display area attributes are reset to the value of the current full-screen attributes.

5.4.4.3 *Default full-row attributes*

The default condition of full-row attributes is the current value of full-screen attributes.

6 Alphageometric option

6.1 *General*

6.1.1 *Description*

6.1.1.1 In the alphageometric option, the display is composed of alphanumeric texts and pictorial drawings that are defined in terms of geometric primitives transmitted to the terminal as drawing commands.

6.1.1.2 One coding scheme for the alphageometric option for Videotex is described in § 6.

6.1.2 *Designation and invocation of geometric codes*

6.1.2.1 The designation and invocation of the alphageometric code is specified in § 2.3.

The occurrence of the control function SO invokes the geometric primitives in code table positions 2/0 to 7/15 inclusive. The occurrence of the code function SI re-establishes the G0 set and the *Space* (2/0) and *Delete* (7/15) functions.

6.1.3 *Geometric primitives*

6.1.3.1 The coding scheme for the G1 set together with the code positions 2/0 and 7/15 for the geometric model is based on geometric primitives. Each drawing primitive is specified in terms of Cartesian coordinates to describe the positions, end-points, or vertices of each drawing operation.

6.1.3.2 Geometric drawings are defined in terms of the drawing primitives: *point*, *line*, *arc*, *rectangle*, and *polygon.*

6.1.4 *Drawing position*

6.1.4.1 Drawings are positionally independent; therefore drawing primitives may overlay each other redefining the drawing at the position.

6.1.5 *Drawing space*

6.1.5.1 Space for geometric drawing operations consists of a rectangular area entirely visible on the display screen. Any area of the display screen outside of the valid drawing area is termed a *border area* and it is not possible to specify a coordinate position in a border area.

6.1.6 *Picture element*

6.1.6.1 The Cartesian coordinate grid is made up of square picture elements (pixels).

6.1.7 *Picture resolution*

6.1.7.1 Any number of picture elements may be implemented. Hence, picture resolution is at the discretion of terminal manufacturers.

6.1.8 *Coordinate system*

6.1.8.1 The coordinate specifications are defined based on a Cartesian 0 to 1 numbering scheme.

6.1.8.2 The numbering system is referenced to the visible valid drawing area and consists of coordinates ranging from 0 to 1 on both the X and Y axes, with coordinate values being specified as fractions of this range.

6.1.8.3 The coordinates are encoded in 2's complement notation and specified as signed numbers to a minimum accuracy of 9 bits, including the sign bit. Increased accuracy is obtained by additional increments of 3 bits. Unused least significant bits are truncated when the coordinates are defined to a greater accuracy than can be handled by the terminal.

6.1.8.4 Display screens with non-square visible areas map into the square drawing area number system so that the origin (0,0) remains in the lower left-hand corner. On a television-like display with a 4 : 3 aspect ratio, this corresponds to a range of 0 to 0.999 ... in the X axis and 0 to approximately 0.75 in the Y axis. Drawing commands addressing the entire square 0 to 1 grid are permissible but only the circumscribed 4 : 3 area is visible.

6.2 *Drawing command*

6.2.1 *General*

6.2.1.1 Drawing commands consist of *operational codes* (opcodes) and their associated data parameters.

6.2.1.2 Opcodes describe the types of drawing operation.

6.2.1.3 Following the opcode byte are one or more blocks of additional bytes of data to describe one or more (X, Y) coordinate positions. Each block of data for the (X, Y) coordinates may contain 3 bytes (9 bits accuracy), 4 bytes (12 bits accuracy), etc., depending on the degree of resolution desired.

6.2.1.4 Figure 9/T.100 is the code table for the opcodes and data bytes or status sub-commands.

6.2.2 *Opcode byte*

6.2.2.1 The structure of the opcode byte is as shown in Figure 10/T.100.

6.2.3 *Opcode definitions*

6.2.3.1 *Point*

Sets the drawing beam to any position in the display space and optionally draws a point.

6.2.3.2 *Line*

Draws a line based on the two given end points.

6.2.3.3 *Arc*

Draws a circular arc based on three points, which are the start point, a point on the arc and the end point of the arc. A circle results when the start and end points are coincidental and the point on the arc defines the opposite end of the diameter. The arc may be either in outline or the area enclosed by the arc and the chord may be filled.

6.2.3.4 *Rectangle*

Draws a rectangle based on specified width and height. The rectangle may be in outline or a filled-in area.

6.2.3.5 *Polygon*

Draws a closed polygon of arbitrary shape specified by the vertices. The polygon may be in outline or a filled-in area. The maximum number of vertices is limited to 256.

6.2.3.6 *Spare*

An opcode available for future definition.

6.2.3.7 *Reserved*

An opcode reserved for a specific future application.

6.2.3.8 *Control*

Provides control over the modes or attributes of the drawing commands.

6.2.4 *Opcode facilities*

6.2.4.1 Each opcode has four variants; these are defined by the facility bits (b2 and b1) as shown in Figure 11/T.100. Facility field interpretations are as given below.

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0			Spare	Rect 4	Numeric data (for opcodes) or status commands			
0	0	0	1	1								
0	0	1	0	2								
0	0	1	1	3								
0	1	0	0	4			Point 1	Poly 5				
0	1	0	1	5								
0	1	1	0	6								
0	1	1	1	7								
1	0	0	0	8			Line 2	Reserved 6				
1	0	0	1	9								
1	0	1	0	10								
1	0	1	1	11								
1	1	0	0	12			Arc 3	Control 7				
1	1	0	1	13								
1	1	1	0	14								
1	1	1	1	15								

CCITT-44160

FIGURE 9/T.100

Operation code and data field assignments

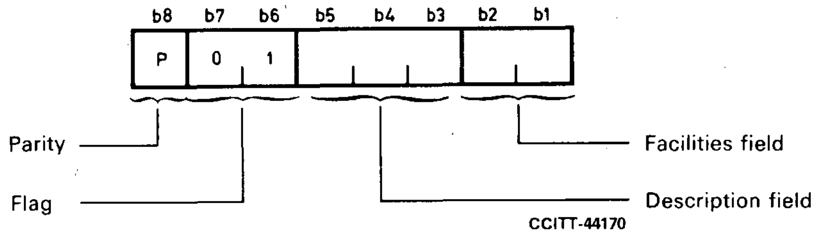


FIGURE 10/T.100

8-bit opcode byte

Opcode	Parity	Flag	Descriptor field	Facility field			
				b2		b1	
	b8	b7 b6	b5 b4 b3	0	1	0	1
Spare	P	0 1	0 0 0	–	–	–	–
Point	P	0 1	0 0 1	INVIS	VIS	ABS	REL
Line	P	0 1	0 1 0	JOIN	SET	ABS	REL
Arc	P	0 1	0 1 1	JOIN	SET	OUTLINE	FILL
Rectangle	P	0 1	1 0 0	JOIN	SET	OUTLINE	FILL
Polygon	P	0 1	1 0 1	JOIN	SET	OUTLINE	FILL
Reserved	P	0 1	1 1 0	–	–	–	–
Control	P	0 1	1 1 1				

INVIS Invisible   ABS Absolute
VIS Visible   REL Relative

FIGURE 11/T.100

Opcode facilities

6.2.4.2 *b2 is binary 1*

a) *Point* – A visible point is drawn on the display screen.

b) *Line, arc, rectangle, polygon* – The initial drawing position is specified within the data bytes as absolute (X, Y) coordinates, i.e., the initial point is *set.*

6.2.4.3 *b2 is binary 0*

a) *Point* – An invisible point is located on the display screen.

b) *Line, arc, rectangle, polygon* – The initial drawing position is the same point as the final drawing position of the previous opcode, i.e., the current drawing is joined to the previous drawing.

6.2.4.4 *b1 is binary 1*

a) *Point* – The (X, Y) coordinates are relative displacements to the preceding coordinate specifications.

b) *Line* – The (X, Y) coordinates for the final drawing position of a line segment are relative displacements from initial drawing position of that line segment.

c) *Arc, rectangle, polygon* – The areas established are filled or crosshatched.

6.2.4.5 *b1 is binary 0*

a) *Point* – The (X, Y) coordinates of the point are absolute values.

b) *Line* – The (X, Y) coordinates of the final drawing position of the line segment are absolute values.

c) *Arc, rectangle, polygon* – The drawings are outlined.

6.3 *Opcode numeric data*

6.3.1 The numerical data bytes associated with an opcode immediately follow the opcode byte and are recognized when the flag bit (b7) is binary 1. Any number of blocks of data bytes defining pairs of coordinates or drawing displacements may follow the drawing opcode until one of the following conditions occurs:

a) when another opcode is encountered;

b) when the *shift-in* code (SI) is encountered;

c) when the *shift-out* code (SO) is encountered;

d) when the *single-shift* codes (SS2 or SS3) are encountered;

e) when an *escape* (ESC) code is encountered.

6.3.2 The minimum number of data bytes that forms a block that defines a pair of X, Y coordinates is three. The structure of the data block is shown in Figure 12/T.100.

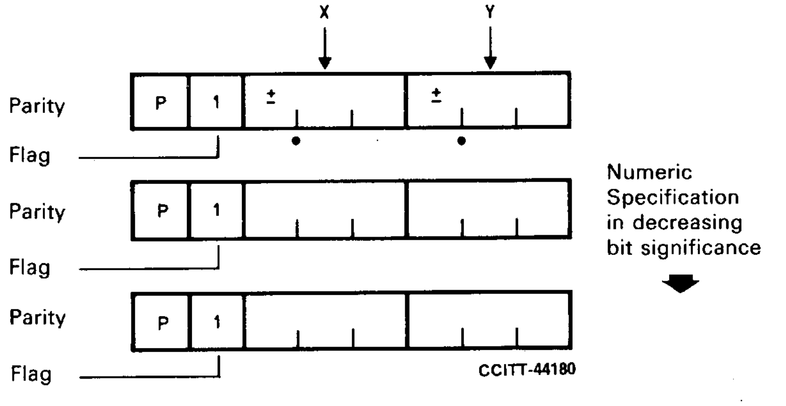


FIGURE 12/T.100

Structure of a block of 3 data bytes

6.4 *Repeated opcode operation*

6.4.1 For each of the *point, line* and *rectangle* opcodes, repeated drawing operations will automatically be effected if the numerical data field following the opcode byte contains more than one complete set of coordinate specifications. A complete set of coordinate specifications is defined as all the coordinates needed to define a *point, line* or *rectangle* drawing as a single drawing. That is, the repeated drawing feature allows concatenated drawings to be effected without having to repeat the opcode itself.

6.5 *Geometric control opcode*

6.5.1 *General*

6.5.1.1 The *control* opcodes control the drawing states of the terminal and the interpretation of the drawing opcode attributes. The sequence of *control* opcodes and their *status* sub-commands always precedes the opcodes for the geometric drawing primitives of *point, line, arc, rectangle, polygon.* The controls also apply to text in *shift-in* (SI) mode. The four *control* opcodes, distinguished by the opcode facilities bits, (b2 and b1), are given in Figure 13/T.100.

Control (value)	P	0	1	1	1	1	0	0
Control (status)	P	0	1	1	1	1	0	1
Control (reserved)	P	0	1	1	1	1	1	0
Control (private)	P	0	1	1	1	1	1	1

CCITT-44190

FIGURE 13/T.100

Control codes

6.5.1.2 *Control (value)*

This control opcode defines the colour or grey scale accessed by subsequent drawing opcodes.

6.5.1.3 *Control (status)*

This control opcode provides extension to a field of sub-commands.

6.5.1.4 *Control (reserved)*

This control opcode is reserved for future control commands.

6.5.1.5 *Control (private)*

This control opcode is reserved for use by terminal manufacturers to implement proprietary non-standard functions.

6.5.2 *Attributes*

6.5.2.1 A number of drawing attributes may be applied to the drawing commands. Attributes are defined by appropriate coded sequences as described below. Once an attribute is defined, it remains valid until the attribute is redefined.

6.5.2.2 In the implementation of attributes, the level of sophistication and complexity are left to the discretion of the implementer.

6.5.2.3 For the different drawing attributes and their feature levels see Recommendation F.300.

6.5.3 *Control (value)*

6.5.3.1 This opcode specifies the colour attribute or grey scale value of the drawings (or text) that follow. Whether the *control (value)* opcode and its associated data bytes contain colour or grey scale information, is predetermined by the *tonal* status sub-command (see § 6.5.4). The number of data bytes is variable and the sequence is terminated on the appearance of another opcode. Less significant bits for colour or grey scale information are truncated where they are not used. The bit assignments of the data bytes are shown in Figure 14/T.100 (only the 6-bit data portion of the 8-bit byte is shown).

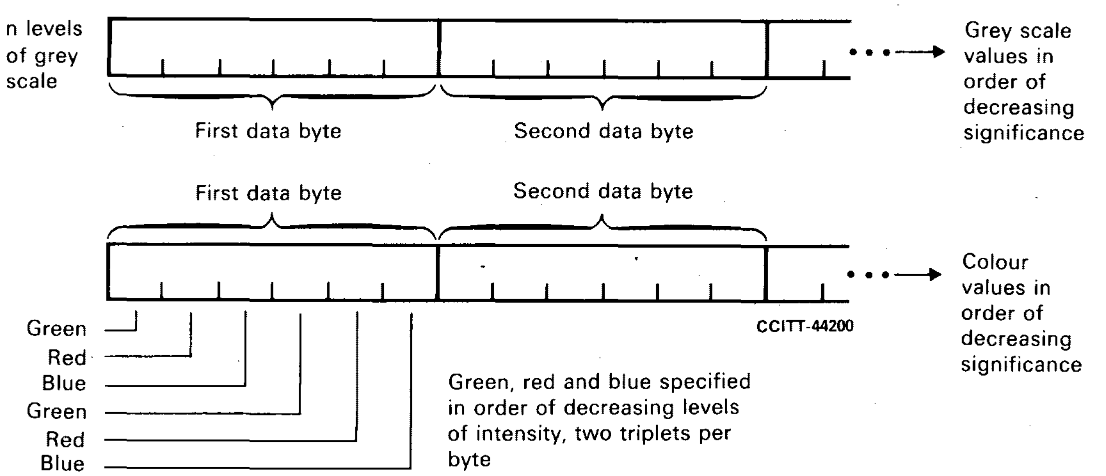


FIGURE 14/T.100

Bit assignments for grey scale or colour attributes

6.5.4 *Control (status) and status sub-commands*

6.5.4.1 The *control (status)* opcode accesses a field of *status sub-commands* (columns 4, 5, 6 and 7) which define in detail all the modes of drawing operation or attributes. The sequence is always *control (status)* followed by a *status sub-command*, which in turn may or may not be further followed by parameter data bytes. Figure 15/T.100 gives the codings of the *status sub-commands*. Detailed definitions of the *status sub-commands* are given below.

6.5.4.2 (4/0) *Clear-to-black*

This sub-command clears the entire display to black.

6.5.4.3 (4/1) *Clear-to-transparent*

This sub-command clears the entire display of the screen to transparent. By transparent is meant that conventional television pictures can be mixed with Videotex images or text.

6.5.4.4 (4/2) *Clear-to-black and initialize*

This sub-command clears the entire display to black and resets the terminal to the default mode.

6.5.4.5 (4/3) *Clear-to-current colour*

This sub-command clears the entire display to the colour currently specified by the *control (value)* opcode sequence.

6.5.4.6 (4/4) *Domain (3 bytes)*

The block of numerical data that follows an opcode contains 3 bytes. This is also the default condition.

6.5.4.7 (4/5) *Domain (4 bytes)*

The block of numerical data that follows an opcode contains 4 bytes.

6.5.4.8 (4/6) *Domain (5 bytes)*

The block of numerical data that follows an opcode contains 5 bytes.

6.5.4.9 (4/7) *Domain (6 bytes)*

The block of numerical data that follows an opcode contains 6 bytes.

6.5.4.10 (4/8) *Drawing (blink-off)*

Terminates the drawing (blink-on) status sub-command.

6.5.4.11 (4/9) *Reserved*

6.5.4.12 (4/10) *Drawing (Blink-on) (or flashing)*

This sub-command causes the drawing (or text) that follows to flash in a repetitive manner for the purpose of drawing attention. In general, an object of any colour or grey scale may be blinked, but in some implementations, blinking may be restricted.

6.5.4.13 (4/11) *Reserved*

6.5.4.14 (4/12) *Tonal (colour)*

This sub-command designates that the *Control (value)* sequence carries colour information (see § 6.5.3).

6.5.4.15 (4/13) *Tonal (grey scale)*

This sub-command designates that the *Control (value)* sequence carries grey scale information (see § 6.5.3).

6.5.4.16 (4/14) *Reserved*

6.5.4.17 (4/15) *Reserved*

6.5.4.18 (5/0) *Line (solid)* (See Note)

This sub-command indicates that the drawing lines will be solid. This is also the default condition.

6.5.4.19 (5/1) *Line (dotted)* (See Note)

This sub-command indicates that the drawing lines will be dotted in texture.

b4	b3	b2	b1	b7 / b6 / b5 →	0 / 0 / 0	0 / 0 / 1	0 / 1 / 0	0 / 1 / 1	1 / 0 / 0	1 / 0 / 1	1 / 1 / 0	1 / 1 / 1
					0	1	2	3	4	5	6	7
0	0	0	0	0					Clear (to black)	Line (solid)	Text format	
0	0	0	1	1					Clear (to trans-parent)	Line (dotted)		
0	0	1	0	2					Clear (to black and initialize)	Line (dashed)		
0	0	1	1	3					Clear (to current colour)	Line (dot-dashed)		
0	1	0	0	4					Domain (3 bytes)	Fill		
0	1	0	1	5					Domain (4 bytes)			
0	1	1	0	6					Domain (5 bytes)	Fill (black highlight)		
0	1	1	1	7					Domain (6 bytes)			
1	0	0	0	8					Drawing (blink-off)			
1	0	0	1	9								
1	0	1	0	10					Drawing (blink-on)			
1	0	1	1	11								
1	1	0	0	12					Tonal control (colour)	Wait (timed)		
1	1	0	1	13				Control status	Tonal control (grey)	Wait (indef-inite)		
1	1	1	0	14								
1	1	1	1	15								

CCITT-44210

FIGURE 15/T.100

Control (status) and Status sub-commands assignment

6.5.4.20 (5/2) *Line (dashed)* (See Note)

This sub-command indicates that the drawing lines will be dashed in texture.

6.5.4.21 (5/3) *Line (dot-dashed)* (See Note)

This sub-command indicates that the drawing lines will be dot-dashed in texture.

Note – The line texture pattern is referenced to the absolute coordinate grid of the display screen so that the texture pattern aligns between drawing commands.

6.5.4.22 (5/4) *Fill*

This sub-command fills the enclosed area drawn in the colour specified by the current *Control (value)* sequence.

6.5.4.23 (5/5) *Reserved*

6.5.4.24 (5/6) *Fill (border highlight black)*

This sub-command fills enclosed area drawn as § 6.5.4.22 above and the circumscribing border is highlighted in black.

6.5.4.25 (5/7) *Reserved*

6.5.4.26 (5/8) *Reserved*

6.5.4.27 (5/9) *Reserved*

6.5.4.28 (5/10) *Reserved*

6.5.4.29 (5/11) *Reserved*

6.5.4.30 (5/12) *Wait (timed)*

This sub-command causes a delay of a specific time in processing and display. The length of wait is specified in tenths of a second, either by one associated parameter byte (6 bits for up to 6.3 seconds) or two parameter bytes (12 bits for up to 6.8 minutes).

6.5.4.31 (5/13) *Wait (indefinite)*

This sub-command causes an indefinite wait. This may be achieved by the terminal responding with a *Pause flow* control character (DC3 in C0 set) towards the computer. The wait is then terminated when the terminal sends a *Resume data flow* character (DC1 in C0 set).

6.5.4.32 (5/14) *Reserved*

6.5.4.33 (5/15) *Reserved*

6.5.4.34 (6/0) *Text format*

This sub-command has an associated data byte, which defines the text formats as follows:

Bit b6 = 0: Free format, i.e., character strings are wrapped around on the right margin.

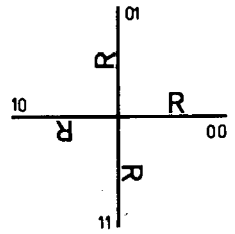
Bit b6 = 1: Annotation format, i.e., character strings are in fixed positions on the screen.

Bit b5 = 0: In free format, character strings are broken on a character boundary.

Bit b5 = 1: In free format, character strings are broken on a word boundary.

b4, b3: Defines character rotation as shown in Figure 16/T.100. Rotated strings of characters proceed in the direction of rotation. However, all other format controls on characters such as APB, APF, APD, APU and APR have their (unrotated) orientation meanings.

b2, b1 = 0.0: Vertical spacing = 1.0
b2, b1 = 0.1: Vertical spacing = 1.5
b2, b1 = 1.0: Vertical spacing = 2.0
b2, b1 = 1.1: Vertical spacing = 2.5



CCITT-44220

FIGURE 16/T.100
Character rotation

6.6 *Default conditions*

6.6.1 The default conditions of the attributes for the alphageometric coding scheme are summarized below:

				Reference
1)	Control (value):	White		§ 6.5.3
2)	Tonal control:	Tonal (colour)		§ 6.5.4.14
3)	Domain:	3 bytes (9 bits)		§ 6.5.4.6
4)	Drawing:	Blink-off		§ 6.5.4.10
5)	Line control:	Solid line		§ 6.5.4.18
6)	Fill:	Solid fill (no highlight)		§ 6.5.4.22
7)	Text format:	a) Free format b) Break on character boundary c) No rotation d) Vertical spacing = 1.0	with bits 1 to 6 set to "0"	§ 6.5.4.34

7 Alpha-dynamically redefinable character sets (DRCS) option

7.1 *General*

7.1.1 A DRCS is a set of characters whose shapes are sent from the data-base and down-loaded via the line. It may be used to represent alphabetic characters, special symbols, or picture element symbols for constructing fine graphics. Once loaded, the DRCS are regarded as members of a library that can be designated by appropriate ESC sequences as G0, G1, G2, G3 sets. Several schemes for the DRCS option are possible. One scheme is described in § 7 in the context of a general architecture. When used in its alphanumeric mode DRCS may be employed as a part of the alphabetic representations of any other Videotex option and in that case the attributes associated with that option are to be used.

7.2 *General architecture for down-loading DRCS*

7.2.1 *Initiation*

The down-loading process is initiated by a designation and invocation sequence. This sequence is followed by one or more of the following functions.

7.2.2 *Identification of character set (ICS)*

This function must immediately follow the initiating sequence. It identifies the *escape* sequence used for the designation of the character set.

7.2.3 *Select coding method (SCM)*

This function defines the type of coding used to describe the DRCS character.

7.2.4 *Select dot composition (SDC)*

This function defines the number of bits horizontally and vertically in a character matrix, the number of bits per pixel, the number of grey scale levels and the number of colours accessible within a character position.

7.2.5 *Pattern transfer (PT)*

This is the active part of the down-loading process. It defines the code location of the first character and provides instructions and data to draw characters. It may also incorporate an error checking procedure.

7.2.6 *Down-loading termination procedure (DLT)*

The down-loading process is terminated by a specific procedure, which may include acknowledgement.

7.3 *A possible coding scheme for the DRCS option*

7.3.1 *Initiating sequence*

The initiating sequence is ESC F_s followed by x bytes indicating the length of the loading data block, where x is for further study.

7.3.2 *Termination procedure*

The down-loading process is terminated by means of counting the length of the loading data block. See § 7.3.1.

7.3.3 *Designation and invocation of loaded DRCS*

7.3.3.1 Once loaded into the terminal, the DRCS is placed into a library. This library is used in the context of ISO 2022 in the 7-bit environment as implemented in earlier sections. Before invoking the designated DRCS, it is required to designate a C1 set to be associated with it. For the scheme described herein any of the C1 sets (to be registered) that are defined in §§ 2.2 and 2.3 may be used.

7.3.3.2 The designation sequence will be of the form ESC I_1, 2/0, ($I_3 \ldots I_n$) F. I_1 will be 2/8, 2/9, ... or 2/15. $I_3 \ldots I_n$ are optional and if present together with F will identify the set. Means for associating the designating sequence with the process of defining the character shapes will be for further study.

8 Alphaphotographic option

8.1 The alphaphotographic option is used to render an image by the transmission and display of individual picture elements.

8.2 This option may include both continuous-tone images such as pictures of faces, etc., as well as pattern-oriented techniques for the display of pictures, including graphics, Latin and non-Latin characters for text, etc. The system features and attributes include colour and monochrome.

8.3 The detailed system proposals are for further study.

9 Service enhancements

9.1 *Introduction*

9.1.1 Many Administrations are offering or considering the introduction of a Videotex service, and it is recognized that this Recommendation may influence some of their decisions. While the other sections of this Recommendation contain details of those aspects of an international Videotex service that could be agreed upon, this § 9 identifies certain potential enhancements (features or attributes) that some Administrations believe need to be considered in future developments.

9.1.2 It is recognized that some of these potential enhancements may only exist on national Videotex services, while others may have international application. However, an enhancement that begins on a national service only could become international in the future. Therefore, it is considered desirable to have international coordination of future enhancements.

9.2 *General*

9.2.1 The growth of international Videotex services during the years following the publication of this Recommendation will be greatly affected by the specific specifications contained in the other parts of this Recommendation. However, some Administrations believe that experiments with and/or implementation of certain enhancements will allow the development of an international service that provides a range of capabilities that will maximize the desirability and utilization of Videotex service.

9.2.2 Some of the potential enhancements to Videotex service, national or international, are presented in the following. This is for the purpose of identifying to interested Administrations those enhancements that warrant serious consideration in the view of the CCITT, but which presently lack enough details to obtain the full agreement of all Administrations.

9.2.3 The enhancements have been grouped into three categories in order to assist the reader in understanding the application of each individual enhancement (which may be referred to by some Administrations as attributes or features or some other descriptive phrase) and to prompt an orderly investigation of them:

a) display-related enhancements;

b) transmission-oriented enhancements;

c) system level enhancements.

9.3 *Display related enhancements*

9.3.1 Most of the currently planned and/or offered services utilize images created with only eight colours, which are formed by the various combinations (on or off) of three primary colours – red, green and blue. Limiting Videotex to eight colours is an unnecessary restriction, since the electronic emission devices controlling the red, green and blue colours can be caused to have more than just the two states of on or off. For example, with just eight different states or levels, a potential of 512 colours exist. Additionally, for those services that use a matrix-oriented screen (e.g. a mosaic graphic mode) different colours could be identified for foreground symbols to those for background areas.

9.3.2 The ability to simulate motion (i.e. animation) is a potential enhancement that can be achieved by several means. These include:

a) alternating between slightly different display frames stored in the terminal;

b) dynamically altering the colour of portions of the display image, making them appear or disappear by redefining the colour table (an image disappears when its colour is set to the same colour as the surrounding area);

c) execution of a resident program to redefine the image at a controlled rate.

9.3.3 The flashing of symbols or areas of the display has typically been limited to changing the foreground symbol (in the case of a matrix-oriented screen) to the background colour, momentarily, or some other single-state change. An enhanced flashing capability could allow for different rates of change and for various conditions associated with each change (e.g. colour X to colour Y, rather than foreground colour to background colour or foreground colour to black).

9.3.4 Different pictorial (text and graphic) symbols may be developed that extend the repertoire of a Videotex service. This may be a fixed extension defined in the terminal memory, or can be a modification to the existing memory by downloading from the data base. The range of extended symbols includes different fonts of existing symbols, smoothed mosaic graphics, or other unique symbols.

9.4 *Transmission oriented enhancements*

9.4.1 The exchange of information directly between terminals, without communicating with a Videotex service may be permitted by some Administrations as an enhanced capability, and could be of value to the users of Videotex terminals. Such a capability would require the existence of control functions that might not otherwise be available in some terminals that utilize certain existing or planned national Videotex services, but this should not cause any incompatibilities with such services.

9.4.2 The optimization of the coded character stream for maximum data rate is a valuable enhancement. This might be accomplished by utilizing an 8-bit per word coding format rather than the 7-bit per word format currently planned by most Administrations, coupled with a related decision on the line or link level protocol selected. The selection of an 8-bit per word format could permit a more efficient transmission of data.

In addition, such techniques as run-length-encoding might be specified in the Recommendation to reduce the transmission of unnecessary or redundant data. The choice of higher speed modems/circuits is also considered by some Administrations as a way to optimize the transfer of data within or between Videotex services.

9.4.3 For some applications of a Videotex service, sophisticated error detection and correction schemes may be required and should be considered with other transmission-oriented enhancements on future Videotex services.

9.5 *System level enhancements*

9.5.1 An enhancement seriously considered by some Administrations is the provision of a Videotex service that provides visual information, augmented by audio information. This capability could permit access by a terminal to visual-only information in a data base, and to visual/audio information in the same or other data base. The audio information might be associated with the visual information, or treated separately, or even alternately depending upon the implementation. The audio information might be analogue or digitally encoded or handled as a composite signal.

9.5.2 The provisioning of peripheral input/output devices associated with the Videotex terminal is an important enhancement for future services. These could include magnetic storage devices for recording visual/audio information as received by the terminal, or recorded locally by the terminal for subsequent transmission to a data base or other terminal. Various hard copy printing devices could also be provided, with their design based upon the specific visual capabilities of the terminal, e.g. degree of resolution and colour of the image on the display screen.

10 Line and end-to-end protocols

10.1 The purpose of § 10 is to describe the protocols needed for international Videotex transactions. § 10 contains an introduction only. Detailed consideration is left for further study.

10.2 The transfer of information from a data base of one service to a user of another service may be split up into two parts:

a) the information transfer from one service to another;

b) the information transfer from the service to the user.

10.3 *Line protocols*

10.3.1 *Line protocols between services*

10.3.1.1 The international line between national data base computers must be able to transmit transparent coding schemes identified in this Recommendation and accept the protocols of § 10.4.

10.3.2 *Line protocols between service and user*

10.3.2.1 The following protocol functions should be studied:

PF1: Start of coded data starts a sequence of data to be understood as textual information (could be coded as STX).

PF2: Start of prefix causes the following bytes to be understood as a prefix containing framing information including codes for error check and/or correction (could be coded as SOH).

PF3: End of coded data ends a sequence of data to be understood as textual information (could be coded as ETX).

PF4: End of frame. Ends a frame of data and requests for reverse transmission and give an answer (could be coded as ETB).

PF5: Answer given in case of error free reception or when error correction is possible (could be coded as ACK).

PF6: Answer given in case of errors when no error correction is possible (could be coded as NAK).

10.3.2.2 It is noted that TC1 to TC10 (SOH to ETB of Recommendation T.50) are intended to control the transmission of information over transmission networks. The use of these functions may therefore not be used as part of the information stream from one service to another.

10.3.2.3 The use of protocol functions is for further study.

10.4 *Protocols for communication between services on the application level*

10.4.1 *General*

10.4.1.1 International exchange of information between national Videotex services may be sent in blocks, here called messages. For efficient use of networks and communication equipment it is important to design the messages to minimize the capacity needed for applications that are frequently used in Videotex services.

10.4.2 *Types of message elements*

10.4.2.1 A complete message is composed of message elements. Each element contains an element identifier, a data field and an indication of element length (explicit or implicit).

10.4.2.2 *Transmit a standardized function*

Codes for functions may be different from the character sequences, sent by the user.

10.4.2.3 *Transmit a service message*

A service message is a frame that is transmitted to the subscriber, without erasing the screen, moving the active position of the cursor, or changing the contents of the previous display.

10.4.2.4 *Transmit a service message code*

The proper service message is generated by the receiving system and transmitted to the subscriber.

10.4.2.5 *Transmit a frame*

Billing and other additional information is to be transmitted together with the frame.

10.4.2.6 *Transmit data block*

By data is meant all types of data that are not listed under separate items, e.g. software. It is necessary to transmit block length when transmitting transparent data.

10.4.2.7 *Transmit field description*

A field description is a list of positions on the screen, where an application program expects additional information to be filled in, either by the user or by the application program itself. It includes also format and type of information, which allows simple syntax control in the host computer.

Three formats are recognized; strings, which means any combination of graphical characters including space, integers (0-9), and free format.

A field may be of input and/or output type. An input field is a field where the information is user originated. An output field is a field in which the information is filled in by the application program.

10.4.2.8 *Transmit a user message to an application*

A user message is the data that is filled in by the user according to a field description. It is sent to the external computer. The transmission is initiated either by a send-function if it is available, or when all input fields are filled. The use of a delimiter causes the rest of the field to be filled with spaces. If a delimiter is used in the first position of a combined input and output field, the contents remain unchanged.

10.4.2.9 *Transmit an application message*

An application message is a block of data to be filled into the output fields, defined by a field description. It may be sent either in the same message as the field description or after.

10.4.2.10 *Request information on terminal capability*

(For further study.)

10.4.2.11 *Transmit information on terminal capability*

(For further study.)

10.4.2.12 *Error condition element*

The detection of contradicting information in a system will result in an error condition message to the other system, e.g. data with a format different to the corresponding field description. The entire message causing the error will be ignored, and it is the responsibility of its transmitting system to handle the error properly.

10.5 *User to data base protocol*

10.5.1 In order to use Videotex service, a user must be able to generate a set of functions, which enables him to access and use different applications. A set of user functions is listed in Recommendation F.300.

10.5.2 The minimum set of characters to code these functions contains the digits 0-9 and two other symbols. For some applications however the generation of alphanumeric as well as pictorial and attribute information and other control characters may be needed.

10.5.3 Although it is desirable that all Videotex services employ the same keying sequences and visual identifiers for these functions, there are historical reasons why there will be different manners of coding the same user functions.

10.5.4 Accessing the national service of another country using an international connection between services is possible if the user obeys the function coding rules of the service of the other country. It is, however, possible that the local data bank may be able to translate the local keying sequence into the appropriate command in a national service level (§ 10.4.2.4). This subject is left for further study.

11 Interworking with other services

11.1 *Telex-Videotex*

11.1.1 Telex is a message transfer service and therefore interworking between telex and Videotex should be limited to the exchange of alphanumeric text between terminal equipments.

11.1.2 Only the graphic characters of the Videotex graphic character repertoire corresponding to International Telegraph Alphabet No. 2 should be used to compose messages.

11.1.3 The message format will be limited by the Videotex page format.

11.1.4 Telex can only display alphanumeric information without the capability of displaying the other attributes of Videotex.

11.2 *Teletex-Videotex*

11.2.1 *Graphic character repertoire*

11.2.1.1 The Teletex and Videotex graphic repertoires are largely identical. The following fallback representations of Videotex characters (Table 2/T.100) may be transcoded at a Videotex-Teletex interworking facility.

TABLE 2/T.100

Identifier	Videotex character	Fallback representation	
SM30	←	<	SA03
SM31	→	>	SA05
SM32	↑	¡	SP03
SM33	↓	!	SP02
SP19	‘	'	SP05
SP20	’	'	SP05
SP21	“	"	SP04
SP22	”	"	SP04
SM12	—	–	SP10
MG01 to MG63	Block graphics	/	SP12

11.2.1.2 For Teletex terminals having the ability to present the Videotex character repertoire in its entirety the need for this transcoding disappears. Therefore on initial call establishment a determination of the terminal display/printing capabilities must be made by handshaking.

11.2.2 *Control functions*

11.2.2.1 Transcoding of the Videotex attribute control functions is for further study.

11.2.3 *Format*

11.2.3.1 Interworking between Videotex and Teletex will be limited to the Videotex display frame format.

11.3 *Videotex-facsimile*

(For further study.)

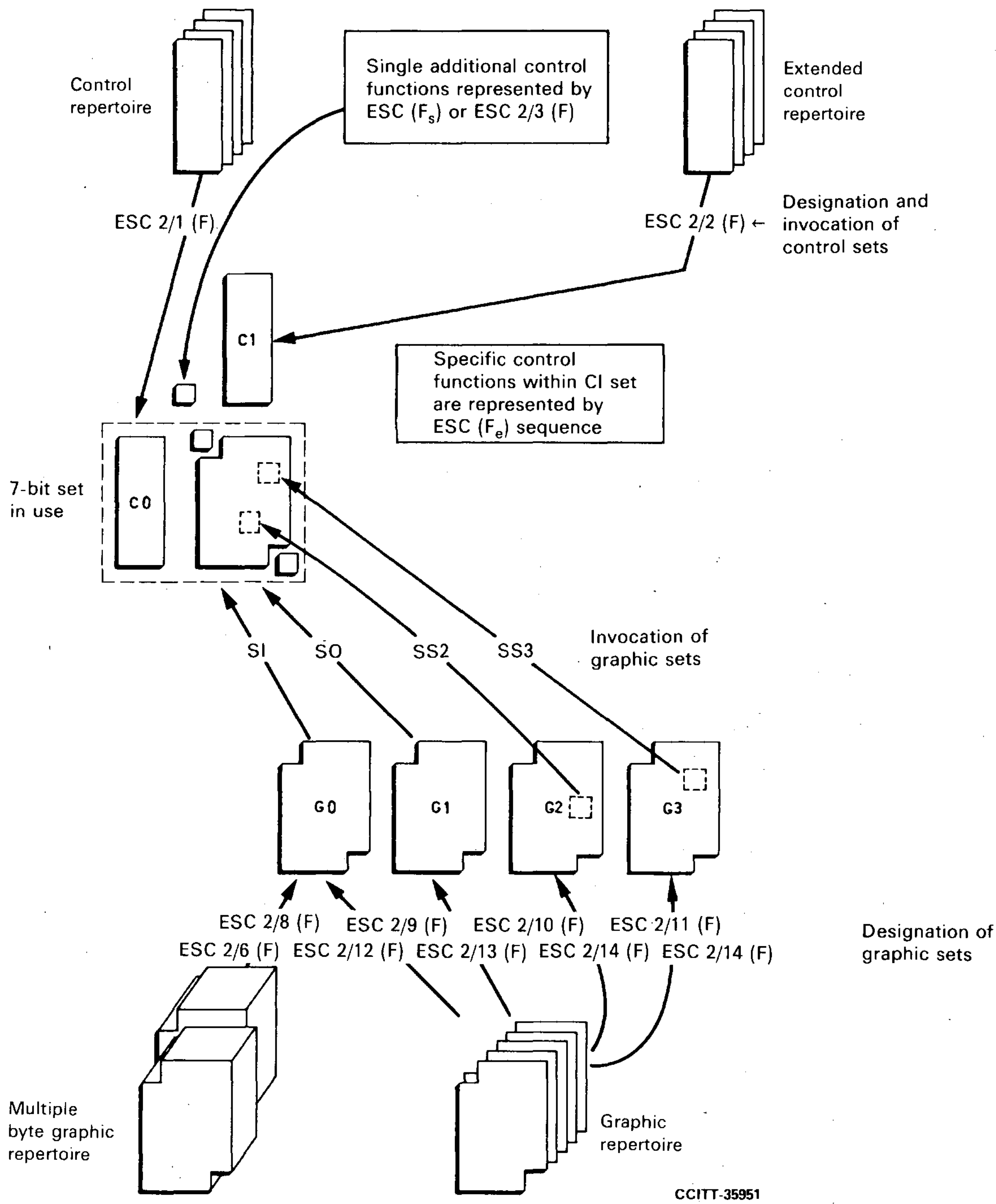
11.4 *Videotex-Teletex*

(For further study.)

ANNEX A

(to Recommendation T.100)

Part of the code extension scheme of ISO 2022



ANNEX B

(to Recommendation T.100)

Repertoire of graphic characters

B.1 *General*

B.1.1 This annex defines the basic graphic repertoire of the International Videotex Service. This repertoire consists of the total range of non-pictorial symbols, which may be communicated between Videotex services and terminals by means of coded character sets for Latin-alphabet based languages.

B.1.2 The repertoire of graphic characters defined in this part of the Recommendation consists of:

a) Latin alphabetic characters, listed in § B.2, which comprise:
   - the 52 small and capital letters of the basic Latin alphabet,
   - combinations of basic Latin letters and diacritical marks,
   - special alphabetic characters, which are neither basic Latin letters nor combinations of basic Latin letters and diacritical marks,

b) non-alphabetic characters, listed in § B.3, which comprise decimal digits, currency signs, punctuation marks, arithmetic signs and miscellaneous symbols that have individual special meanings.

B.1.3 A diacritical mark has no meaning as an individual character but is used only in combination with a basic Latin letter to form an accented letter or an umlaut.

B.1.4 The repertoire of graphic characters defined in this part of the Recommendation contains a limited set of accented letters and umlauts.

B.2 *Latin alphabetic characters*

B.2.1 The repertoire of Latin alphabetic characters is identical to that specified in § 3.2.2 of Recommendation T.61 (for the Teletex basic repertoire of graphic characters).

B.3 *Non-alphabetic characters*

B.3.1 Decimal digits (0 to 9), currency signs, arithmetic signs, subscripts and superscripts and fractions are as specified in §§ 3.2.3.1, 3.2.3.2, 3.2.3.4, 3.2.3.5 and 3.2.3.6 of Recommendation T.61.

B.3.2 Punctuation marks are as specified in § 3.2.3.3 of Recommendation T.61, with the exclusion of SP09 (low line) and the addition of SP19 to SP22, which are as shown in Table B-1/T.100.

B.3.3 Miscellaneous symbols are as shown in Table B-2/T.100.

B.3.4 The lists in Tables B-1/T.100 and B-2/T.100 are composed as described in the following.

The first column contains the identifier of each character, assigned in accordance with the identification system explained in Annex C of Recommendation T.61.

The second column presents the graphical representation of the character.

The third column specifies the name or the description of the character.

TABLE B-1/T.100

Punctuation marks

Identifier	Graphic	Name or description
SP19	‘	Single quotation mark left
SP20	’	Single quotation mark right
SP21	“	Double quotation mark left
SP22	”	Double quotation mark right

Note – In Videotex (and Teletex), *quotation mark, apostrophe* and *comma* are independent characters that cannot have the meaning of diacritical marks.

TABLE B-2/T.100

Miscellaneous symbols

Identifier	Graphic	Name or description
SM01	#	Number sign
SM02	%	Percent sign
SM03	&	Ampersand
SM04	*	Asterisk
SM05	@	Commercial at
SM12	—	Horizontal bar
SM13	|	Vertical line
SM17	µ	Micro sign
SM18	Ω	Ohm sign
SM19	°	Degree sign
SM20	º	Ordinal indicator, masculine
SM21	ª	Ordinal indicator, feminine
SM24	§	Section sign
SM25	¶	Paragraph sign, pilcrow
SM26	·	Middle dot
SM30	←	Leftward arrow
SM31	→	Rightward arrow
SM32	↑	Upward arrow
SM33	↓	Downward arrow

INTERNATIONAL INTERWORKING FOR VIDEOTEX SERVICES

(Malaga-Torremolinos, 1984)

CONTENTS

Note – Annexes B, C and D will not be published in Fascicle VII.3 (T-Series Recommendations) but will be issued as a separate publication.

Preamble

Note – This Recommendation (1984) will be further defined and developed for international interworking, and eventually the new version of this Recommendation will become the single CCITT Recommendation for Videotex interworking.

The CCITT,

considering

(a) that Videotex services have been implemented in different countries/regions using different data syntaxes referred to as Data Syntax I, Data Syntax II, and Data Syntax III, which have an equal status;

(b) that the CCIR is studying standards for broadcast Teletext[1] services for general reception and has expressed a view that it is desirable that terminal equipment compatibility should exist between broadcast Teletext[1] systems for general reception and public network-based data base systems;

(c) that different countries/regions are entitled to use their existing systems;

(d) that interworking between Videotex services in different countries may require transcoding and/or conversion;

(e) that the interworking between Videotex services may be provided by using different types of networks such as the public switched telephone network (PSTN), packet switched public data network (PSPDN), circuit switched public data network (CSPDN), integrated services digital network (ISDN), etc.;

[1] The term "Teletext" has not yet been definitively adopted by CCIR.

(f) that Videotex interworking protocols should offer a large degree of compatibility with protocols used in other telematic services;

(g) that Recommendation T.100 is being retained for the Study Period 1985-1988,

recommends

that the following technical provisions be applied for international interworking for Videotex services.

1 Purpose and scope of the Recommendation

1.1 *Purpose*

The purpose of this Recommendation is:

a) to facilitate the interworking of different Videotex services;

b) to identify parameters needed to communicate with Videotex terminals; and

c) to provide technical recommendations desirable for potential interworking of other telematic services with Videotex services.

1.2 *Scope*

1.2.1 This Recommendation describes the characteristics of coded information that is exchanged between countries participating in the international interactive Videotex service.

1.2.2 Videotex systems are text communication systems having in addition the capability of a given level of pictorial representation and a repertoire of display attributes. The text and pictures obtained are intended to be displayed using the current television (TV) raster standards of the different countries.

1.2.3 Different data syntaxes are offered as a choice for the Administrations to implement their national services. Substantial degrees of compatibility exist between these options, but some transcoding and/or conversion may be necessary to facilitate interworking.

1.2.4 For the purpose of the international service, different data syntaxes have been identified.

a) Interworking Data Syntax

b) Data Syntax I

c) Data Syntax II

d) Data Syntax III

e) Other syntaxes (e.g. mixed mode Teletex) are for further study.

2 Interworking between Videotex services: general

2.1 It is the responsibility of Administrations to decide in which network(s) the Videotex service(s) are to be provided.

2.2 Several possibilities are considered below:

2.2.1 Videotex service operated on the PSTN; the communication between a Videotex terminal and a Videotex host computer is established over the PSTN.

2.2.2 Videotex service operated on the PSTN and a public data network (PDN) (generally a PSPDN); the communication between a Videotex terminal connected to the PSTN and a Videotex host computer connected to a PDN is established via a Videotex access point interfacing between both networks.

2.2.3 Other possibilities (CSPDN, ISDN, etc.) could also be considered.

2.3 International interworking between Videotex services via gateways and connected to any network (PSTN, PSPDN, CSPDN, ISDN, etc.) must be possible. Such interworking allows a Videotex terminal pertaining to a Videotex service to access a Videotex host computer pertaining to another Videotex service. All international data exchange should comply with the specifications contained in this Recommendation. (See Recommendation F.300 for the service description.)

2.4 International interworking between Videotex service should take into account the structure and the reference model for CCITT applications as described in Recommendation X.200, including the maintenance of independence of the layers so that changes of functions or protocols can be made within a layer without affecting other layers.

3 International interworking at network level

3.1 International interworking between Videotex services should preferably take place between networks of the same type (including PSPDN) when these networks are provided by both Administrations involved.

3.2 The network service definition of Open Systems Interconnection for CCITT application is defined in Recommendation X.213.

3.3 When the interworking takes place between Videotex services operated on different types of network, Recommendation X.75 should normally apply. However, the interworking between PSTN and CSPDN is still under study.

4 Transport layer

The Transport layer service of Open Systems Interconnection for CCITT applications is defined in Recommendation X.214.

The Transport protocol of Open Systems Interconnection for CCITT applications is specified in Recommendation X.224. Urgent study is required to determine its application to Videotex interworking.

Provisionally, the classes 0 (corresponding to Recommendation T.70) and 2 may be used as the default transport protocol. Other classes may be negotiated upon prior bilateral agreement.

Other Transport protocols may be used subject to bilateral agreement.

5 Session layer

The Session layer service of Open Systems Interconnection for CCITT applications is defined in Recommendation X.215. The Session protocol of Open Systems Interconnection for CCITT applications is specified in Recommendation X.225. The Session layer for telematic services is defined in Recommendation T.62. Urgent study is required to determine their application to Videotex interworking.

6 Presentation layer

This section is intended to describe the Presentation layer as seen by the host computer of a Videotex service. The provisions may apply to communication between host and terminal and host to host. The extent of these provisions and their applicability for terminal to terminal communication is for further study.

6.1 *Presentation architecture*

6.1.1 *General*

The Presentation architecture provides the facilities to the Application layer to structure the Presentation data in line with the application. From the Presentation layer view, all elements of the Presentation architecture may be manipulated in the same way. The Application layer may assign different interpretations to the contents of these elements.

Functions of the Presentation service are:

- allowing application entities to describe in a commonly understandable way all the data they need to exchange or to refer to. Although Presentation entities use a common syntax when communicating, they do not need to use the same Presentation syntax of data locally;
- permitting the description and modification of the data which is the object of their dialogue. This can be user or management data;
- passing on to Application entities a dialogue structure using Session layer functions.

The two applications which are communicating through the Presentation service both use the concept of the Presentation architecture (PA) which is in fact a STRUCTURE with a set of possible actions which can be performed on it. The PA represents the common view of the Presentation data structure as seen by the two cooperating partners and contains all the information necessary to describe the current state of the communication.

6.1.2 *Organization*

The data structure is composed of "elements" which can be manipulated independently as long as the protocol and other dependency rules are observed. An element may be divided into sub-elements which themselves can be treated as elements by the protocol.

An appropriate basic organization of the elements within the PA is a hierarchy which is logically easy to specify and is general enough for most purposes. However, the full extent of the Presentation architecture is for further study.

There may be any number of levels of sub-elements which may be used within a structure. For example, for the display data element, such a structure may be used to organize information into display objects (sub-pictures) so as to ease transcoding and conversion between information that is coded using different data syntaxes, and to ease the task of information providers.

Parameters can be identified for a sub-element. These parameters would indicate the linkage of a sub-element to other sub-elements. Other optional parameters may be defined to describe the positional relationship and dimensions of a sub-element.

6.1.3 *Operations*

Any of the structure elements can be:

- created
- deleted (implying the deletion of all subordinate elements)
- modified.

For all elements (which exist in multiple at a given level), there is a need to enter default values for efficiency reasons. When an element of a given type is created, the default values can be entered into it. The entering of the default values can either be automatic, by means of a primitive copy function or implicit.

The default elements themselves are structured hierarchically so that default value for default values (and so on) can be used. Moreover, the default values themselves can be modified leading to a very flexible usage of this feature.

6.1.4 *Elements of the Presentation architecture*

The following is a provisional set of elements of the Presentation architecture (PA). This set can be extended if necessary. Its aim is to represent particular elements of the PA recognizable in any state of the communication:

- display-data element
- data-entry element
- administrative element
- application control memory element.

Some elements or sub-elements, which describe the transferred data, are dedicated to be sent to, or received from, the terminal. Other elements or sub-elements are control associated and not normally sent to, or received from, the terminal but used for host to host communication.

6.1.4.1 *Display-data elements*

The display-data element is, from the user's point of view, the most important element of the PA. It mainly represents the data finally transferred to the user's terminal device. The display-data element may be subdivided into sub-elements or transferred as a single element. These sub-elements may be used to describe the contents, control and physical structure which may be organized in a hierarchy. The description may contain screen image sub-areas dynamically redefinable character sets (DRCSs), definitions, etc.

Common terminology will illustrate the utility of this structure. The highest level of the structure for the physical sub-element may be termed a DOCUMENT. This is a grouping of Presentation information which is functionally separable from all other Presentation information; for example, it falls between two general reset Presentation functions. Other sub-elements may be termed BLOCK or PAGE depending upon how they are intended to be used. The bottom level of the structure may be termed a TEXT sub-element (where text is broadly defined to imply all Presentation functionality). This sub-element would contain the Presentation information which would be communicated. The exact definition of these terms and other levels of sub-elements within the structure are for further study.

Interworking is facilitated when the contents of the sub-elements communicated contain a mutually compatible extent of functionality so that no conversions of functionalities are required, although transcoding may be required between the representations in the various data syntaxes. Whether a sub-element may contain only one set or type of functionality is for further study. Sets and types of mutually compatible functionality are for further study. This study should be based on the common repertoire of presentation functionality defined in Recommendation F.300 and the Data Syntaxes I, II and III.

One example of a possible data structure organization which is under study with a view towards interworking between some data syntaxes is briefly described below.

For this organization, the physical sub-element defaults to a sub-tree (hierarchy) of the display data element. The highest level is termed a DOCUMENT. Elements at successively lower levels of the hierarchy may be either a PAGE sub-element and a TEXT sub-element or be a PAGE, BLOCK and TEXT sub-element. In this example organization, a PAGE sub-element is defined as a rectangular area that corresponds to the Defined Display Area (DDA). (See Recommendation F.300). A BLOCK sub-element is defined as a rectangular area with its sides parallel to the edges of the screen and which has parameters defined which permit its position to be described relative to the PAGE sub-element (the DDA). A TEXT sub-element represents the information to be displayed in the area defined by either the PAGE or the BLOCK sub-element.

The relationships between the TEXT, BLOCK, PAGE and DOCUMENT sub-elements would be such that they would default to each other. For this organization, parameters have been defined for the PAGE sub-element, position and type of information contained in the structure below it. This information may be of defined or mixed type.

Parameters have been defined for the BLOCK sub-element, position relative to the PAGE sub-element, dimension and type of information from a constrained set of types of information. Parameters for the TEXT sub-element are for further study.

The above set of parameters is illustrative and is not meant to be exhaustive. This and other organizations are for further study.

6.1.4.2 *Data-entry element*

The data-entry element is used to facilitate the entrance of user supplied data. It represents a set of rules and criteria for the host computer that will be applied to the entrance of user supplied data and also contains the entered data. The user supplied data is grouped in fields. Multiple fields may exist at the same time, together being considered as a form. Possible rules and criteria which the host may use for a field are: permitted characters or value ranges; interrelationship between fields, etc.

6.1.4.3 *Administrative element*

The administrative element is used for data not normally sent to the user and is required by the host for the dialogue. It represents data needed for facilitating the use of the service. Possible examples are: charging criteria, passwords, user identity, user access rights (closed user groups), mailbox identifications, etc.

6.1.4.4 *Application control memory*

The application control memory element is used by the application entity to store operations on other elements and on the elements themselves (display-data, administrative, etc.). The application entity can invoke the stored operations repeatedly. This allows for a fast and efficient transfer of frequently used sequences. For example, a sub-element containing a DRCS definition may be placed in application control memory. This would permit the repeated transferring of display data between hosts without the need of transferring the associated unchanged DRCS definitions.

6.2 *Presentation protocol*

The presentation protocol is directly derived from the presentation architecture. A set of protocol elements (PE) describes the different elements of the PA and the operations which can be performed on it. The elements which are concerned are described in § 6.1.4 above and the operations which can be executed are described in § 6.1.3 above.

Moreover, some control protocol elements are used to exchange information necessary for the dialogue:

- suspend, resume, release, abort
- negotiation elements
  - i) capabilities announcement
  - ii) syntax negotiation
  - iii) 7 and 8 bit status
- control associated data
  - i) error indication
  - ii) recovery messages
  - iii) reset

6.2.1 *Coding*

Any element of the structure or of the protocol is conveyed into the corresponding PA of the peer entity via a PPDU (Presentation Protocol Data Unit). A PPDU consists of PPCI (Presentation Protocol Control Information) and PSDU (Presentation Service Data Unit). The use of PPDU, PPCI and PSDU is provisional and this terminology is for further study. The coding elements and operations are directly derived from the structure of the presentation architecture.

6.2.1.1 *Coding of the protocol elements*

The coding of the protocol is for further study and should be developed taking into account the provisions of other CCITT Recommendations and in particular the evaluation of Recommendations such as T.73.

The syntax of the parameters of the sub-elements in the protocol presentation for the architecture and the relationship of these parameters to data syntax are left for further study.

This coding, referred to as the Videotex International Presentation Protocol should be used, when approved and developed, for international interworking between Videotex services.

This coding must be developed in such a manner that the facilities provided by the Session service are explicitly defined to allow equivalent protocols to be developed for host to terminal communications when no CCITT defined Session layer protocol is available.

6.2.1.2 *Coding of the contents of the display-data element*

The content of the display-data element conforms to one of the several different data syntaxes. A data syntax, referred to as Interworking Data Syntax requires further study and for this, Recommendation T.51 could be a starting point. There are three existing data syntaxes, based on Recommendation T.50, and referred to as Data Syntax I, Data Syntax II and Data Syntax III. They are described in Annex B, Annex C and Annex D respectively, and form an integral part of this Recommendation.

Different Administrations implementing a Videotex service may use one of the above data syntaxes. International interworking between Videotex services should preferably take place using the Interworking Data Syntax (when developed and approved).

If two countries implement the same data syntax, then Videotex interworking between the two countries can use that same data syntax.

If one country implements one data syntax and another country implements a different data syntax, then Videotex interworking between the two countries can either:

i) use the Interworking Data Syntax (when developed and approved) as the intermediary syntax. The initial level of such Interworking Data Syntax (the default) would consist of alphanumeric text only, based upon the International Reference Version (IRV) of Recommendation T.50 and also on Recommendation T.51 (see Annex A). Transcoding/conversion into and from the Interworking Data Syntax by the two countries may be required; or

ii) use one of the two data syntaxes with transcoding/conversion performed either at the originating or destination country. One example is to use transcoding of the entire image within the defined display area coded in one data syntax into the physical pixel pattern definition ("photographic") coded in the other data syntax. The subject of transcoding/conversion is for further study.

6.2.2 *Negotiation phase*

This phase is the initial event at the Presentation layer that follows the architectural rules described above. The syntax and profile are agreed upon between the peer presentation layer processes. In addition, the required management commands are established along with various possible parameters. One such parameter for each command may be identified as a default condition. Such default conditions do not require negotiation, thereby reducing the extent of negotiations.

The negotiation is initiated by the calling process identifying its capabilities (and optionally requesting the desired capabilities of the called process). The called process will in response indicate its capabilities and thereby its implicit willingness to communicate as indicated. This process is expected to be minimized and the final selected capabilities will in principle be the intersection of the capabilities. A typical process including a possible renegotiation phase is illustrated in Table 1/T.101.

TABLE 1/T.101

	Step	Calling	Called
Initial session	1 2 3	I WANT TO DO THESE (C1, C2, ... Cn) – – – SEND DATA AND COMMANDS (C1, C2) – – –	– – – I CAN DO THESE (C1, C2 ... Cm)
Renegotiate during the same session	4 5 6	I WANT TO DO THESE (C4, C5) – – – SEND DATA AND COMMAND (C4) – – –	– – – I CAN DO THESE (C4)

6.2.2.1 *Negotiation on Presentation architecture elements*

Some elements of the Presentation architecture may be negotiated.

– display-data element
  - i) physical structure
  - ii) type of content
  - iii) peripheral devices

– data-entry element
  - i) type of form
  - ii) field description
  - iii) content provisions

- application control-memory element
  - i) size
- Administrative element
  - i) charging rule

The above list is not an exhaustive list.

6.2.2.2 *Negotiation on data syntax*

The syntax used to code the contents of the display-data elements (§ 6.2.1.2) may be negotiated. The following list has been provisionally assigned:

- Interworking Data Syntax
- Data Syntax I
- Data Syntax II
- Data Syntax III
- other (e.g. mixed mode teletex . . .) for further study.

The above is not an exhaustive list.

7 Application layer

For further study.

ANNEX A

(to Recommendation T.101)

Initial level of the Interworking Data Syntax for Videotex

A.1 *General*

The initial level of the Videotex Interworking Data Syntax consists of alphanumeric text based upon the International Reference Version (IRV) of Recommendation T.50 and upon Recommendation T.51. This annex defines control functions and alphanumeric characters based on Recommendations T.50 and T.51, to be used in the Videotex Interworking Data Syntax. Other levels of the Videotex Interworking Data Syntax are for further study.

A.2 *Format effector control functions*

The format effector control functions for Videotex permit the active drawing position to be moved on the visible display area. These are based upon the CO set of the IRV of Recommendation T.50 together with space character 2/0. In order to permit interworking between Videotex services, these control functions have functional compatibility to the extent possible with the basic CO control set utilized in Videotex Data Syntaxes I, II and III.

A.2.1 *Active position backward (APB)*

This control function is coded as 0/8 (backspace in the IRV). It is used to move the active position one character position backwards on the same row. APB on the first character position on the row moves the active position to the last character position of the preceding row.

A.2.2 *Active position forward (APF)*

This control function is coded as 0/9 (horizontal tab in the IRV). It is used to move the active position to the next character position forward on the same row. At the last position on the row, this control moves the active position to the first character position on the following row.

A.2.3 *Active position down (APD)*

This control function is coded as 0/10 (line feed in the IRV). It is used to move the active position to the equivalent character position on the following row.

A.2.4 *Active position up (APU)*

This control function is coded as 0/11 (vertical tab in the IRV). It is used to move the active position to the equivalent character position on the preceding row.

A.2.5 *Clear screen (CS)*

This control function is coded as 0/12 (form feed in the IRV). It is used to clear the screen at least of all the alphanumeric text information and move the active position to the first character position on the first row.

A.2.6 *Active position return (APR)*

This control function is coded as 0/13 (carriage return in IRV). It is used to move the active position to the first character position of the same row.

A.2.7 *Active position home (APH)*

This control function is coded as 1/14. It is used to move the active position to the first character position on the first row.

A.2.8 *Space (SP)*

This control function is coded as 2/0 (space in the IRV). It is used to move the active position one character width forward on the same row. It is also regarded as a graphic character with a transparent background. In those systems that define an explicit background, the space copies the background colour into the active position and moves the active position one character width forward.

A.3 *Code extension control functions*

Code extension control functions are used to expand the capability of the 7-bit code or 8-bit code beyond 128 or 256 different characters and functions. Code extension functions alter the meaning of a number of characters following them.

Code extension facilities defined in Recommendation T.51 are used in the Videotex Interworking Data Syntax (see Tables 4/T.51 and 5/T.51).

A.4 *Alphanumeric characters*

A.4.1 Alphanumeric characters are coded according to the primary and supplementary sets of graphic characters given in Recommendation T.51.

A.4.2 An accented character or a spacing accent can also be coded by a combination of a spacing character together with a non-spacing diacritical mark. Recommendation T.61 gives a list of such accented characters used for Latin-based alphabets.

A.4.3 Fall-back representations of some characters or combinations of characters are allowed.

Printed in Switzerland — ISBN 92-61-02291-X