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PUBLIC DATA NETWORKS

TRANSMISSION, SIGNALLING AND SWITCHING

**TERMINAL AND TRANSIT CONTROL
SIGNALLING SYSTEM FOR START - STOP
SERVICES ON INTERNATIONAL CIRCUITS
BETWEEN ANISOCHRONOUS DATA
NETWORKS**

ITU-T Recommendation X.70

(Extract from the *Blue Book*)

NOTES

- 1 ITU-T Recommendation X.70 was published in Fascicle VIII.3 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).
- 2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation X.70

TERMINAL AND TRANSIT CONTROL SIGNALLING SYSTEM FOR START - STOP SERVICES ON INTERNATIONAL CIRCUITS BETWEEN ANISOCHRONOUS DATA NETWORKS

(Geneva, 1972, amended at Geneva, 1976 and 1980;
Malaga-Torremolinos, 1984)

With the appearance of public data networks in various countries it becomes necessary to establish the appropriate international control signalling schemes for interworking in order to facilitate the introduction of such networks as much as possible. The main objective of public data networks is to offer to the user a great range of data signalling rates with a minimum of restrictions, very short call set-up and clear-down times and a variety of new service facilities. These requirements can be fulfilled only by a specially conceived signalling system which caters for all foreseeable needs and which is flexible enough to provide also for new, not yet defined services.

For these reasons, the CCITT,

unanimously recommends

for interworking between anisochronous data networks the control signalling scheme given below should be used on international circuits.

Note 1 - The start-stop user classes of service are specified in Recommendation X.1.

Note 2 - The signalling for synchronous user classes of service provided on anisochronous networks is the subject of further study.

Note 3 - The signalling on links between synchronous and anisochronous networks is the subject of further study.

Scope

This Recommendation defines a decentralized terminal and transit control signalling system for start-stop services on international circuits between anisochronous data networks.

1 General switching and signalling principles

1.1 The two classes, namely user class 1 and user class 2, which are considered applicable to anisochronous types of data network require a control signalling rate of 300 bit/s and 200 bit/s respectively.

Telex service based upon 50-baud trunks does not form part of this Recommendation¹⁾.

1.2 Decentralized signalling will apply, the same channel being used for control signalling and data transmission.

1.3 Both terminal and transit operation will be required. Due to the inclusion of transit operation, link-by-link signalling control of calls will be adopted.

Onward selection from transit and incoming terminal centres should be arranged to overlap the receipt of *selection* signals, this in order to minimize call set-up times.

¹⁾ See Recommendation U.12 for telex and similar telegraph services.

Selection signals will be transmitted by the originating country at automatic speed in a single block.

1.4 The numbering scheme that will be applied to networks accessed by this signalling system is defined in Recommendation X.121.

The data network identification code (DNIC) (see Recommendation X.121), and network or service identification signals will be transmitted on both transit and terminal calls. However, the data country code (DCC) portion of the DNIC may be suppressed in the *selection* signals and only the network or service digit forwarded on terminal calls if requested by the incoming network.

1.5 Alternative routing will be permitted. The principle of high-usage circuits will be adopted, with overflow on to adequately provided routes between centres. Overflow on to higher speed circuits will not be permitted.

In order to prevent repeated alternative routing causing traffic to circulate back to the originating point, alternative routing will be restricted to once per call.

1.6 Both-way operation will be assumed and inverse order testing of circuits on both-way routes, or a close approximation to it by testing the route in small groups in fixed order always starting the search from the same position will be specified in order to minimize head-on collisions.

1.7 It is assumed that the gathering of information required for charging and accounting should normally be the responsibility of the originating Administration (see Recommendation D.10). Other arrangements for gathering information are for further study.

1.8 The grade of service to apply for the provision of circuits for links between public data networks of anisochronous type which carry traffic overflowed from other routes or from which overflow was not permitted would not be worse than one lost call in 50.

For high-usage direct links, circuits would be provided at a grade of service of not worse than one lost call in 10.

1.9 Sufficient switching equipment will be provided to ensure that congestion will not be signalled on more than 0.4% of calls in the busy hour, and only then when congestion has been positively identified.

1.10 The target setting-up time for the user classes of service applicable to these types of data networks will be one second.

2 Specific signalling characteristics

Notes applicable to § 2.

Note 1 - X denotes the international centre that originates the call under consideration on the international link concerned. Y denotes the international centre that receives the call under consideration on the international link.

Note 2 - Timings shown are within the centre concerned with no allowance being made for propagation and other delays, such as slow sending of selection signals from the originating terminal.

Note 3 - The times for permanent start polarity (A) and stop polarity (Z) are generally indicated in the following signal descriptions as integral multiples of a character (see Note 4).

Note 4 - For user class 1 the control signalling code (CSC) will employ 7-unit signalling characters with one parity bit, one start and two stop elements (see Table 8/X.70). The parity of the characters will be even and hence will be consistent with Recommendation X.4. The individual bits should be transmitted at the nominal modulation rate (300 bit/s) with the low order bit (i.e. b_1) first and completed by the parity bit (b_8).

The *end-of-selection* signal will be the International Alphabet (IA5) character 2/11(+). The reception confirmation will use IA5 character 2/10 (*). All other signals will be characters chosen from column 3 of IA5 (see Table 1/X.70). This choice helps ensure that the end of selection and reception confirmation signals are uniquely separable from the other signalling characters.

For user class 2 the CSC will employ 4-unit signalling characters with one parity bit, one start and two stop elements (see Table 8/X.70). The parity of the characters will be even with regard to elements of Z polarity. The individual bit should be transmitted at the nominal modulation rate (200 bit/s) with the low order bit (i.e. b_1) first and completed by the parity bit (b_5).

2.1 The signalling system between two data networks of anisochronous type is described in Table 1/X.70.

2.2 The incoming equipment may release the connection if the *calling* signal exceeds the specified maximum period (see Remarks column of Table 1/X.70). Start polarity will be maintained on the backward signalling path from centre Y to centre X.

2.3 The first forward path signal following the *calling* signal (class-of-traffic character) is distinctive from the first backward path signal to provide a guard against head-on collisions in the case of both-way operation.

A head-on collision is detected by the fact that centre X receives a first class-of-traffic character instead of the *reception-confirmation* signal or *reception-congestion* signal.

When a head-on collision is detected, the switching equipment at each end of the circuit should make another attempt to select a free circuit, either on the same group of circuits or on a group of overflow circuits, if facilities for alternative routing exist and there are no free circuits on the primary route. In the event of a further head-on collision on the second attempt, no further attempt will be made and the call will be cleared down. In the case of a transit centre, the *call progress* signal No. 20 followed immediately by the *clearing* signal will be returned to the preceding centre after the *reception-confirmation* signal and the *network* or *service identification* signals.

2.4 Failure to receive the *reception-confirmation* or *reception-congestion* signal within 4 seconds from the start of the *calling* signal or the reception of a spurious signal, as indicated by a character other than a first class-of-traffic characters the *reception-confirmation* signal or *reception-congestion* signal, should initiate the automatic *retest* signal on the circuit concerned.

In the case of failure to receive the correct *reception-confirmation* or *reception-congestion* signal, another attempt to select a circuit should be made (once only). In the case of transit calls, if the second attempt is unsuccessful, the *call progress* signal No. 20 followed immediately by the *clearing* signal, will be returned to the preceding centre after the *reception-confirmation* signal and the *network* or *service identification* signals.

2.5 *Selection* signals can be divided into two parts. The first part, designated as the *network selection* signals, contains information regarding network and user requirements and may be composed of one to nine (or possibly more) characters (see Tables 2/X.70, 3/X.70, 4/X.70, 4a/X.70, 5/X.70 and 5a/X.70). The second part comprises the *address* signals (the called network terminal number which is preceded by the DNIC always in the case of a transit call and also for terminal calls unless the destination country requests omission of the data country code portion, see Tables 6/X.70 and 6a/X.70).

The *network selection* signals used in the forward direction (see also Appendix II) are further subdivided and assembled as follows (see §§ 2.5.1 to 2.5.4 below) for signalling purposes.

Note that the term "user class of service" is abbreviated in the following to "user class".

2.5.1 *First class-of-traffic character* (see Table 2/X.70)

The *calling* signal is always followed by at least one class-of-traffic character. The bit functions of this character were so chosen that no further characters are needed for most connections.

If there is a need for indication of further requirements, a second class-of-traffic character (see § 2.5.3) may be used. Whether a second class-of-traffic or user class characters follow or not, will be indicated by the bits b_3 and b_4 of the first class-of-traffic character.

TABLE 1/X.70

Decentralized signalling between anisochronous data networks

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Free line	Start polarity (polarity A)	Start polarity (polarity A)	
Calling signal	Stop polarity (polarity Z) for a minimum period of one character and a maximum period of two characters followed immediately by <i>selection</i> signals		The equipment at centre Y should be ready to receive <i>selection</i> signals within one character period. The minimum and consequently the maximum periods will be lengthened at the request of the incoming country. (Note - The duration of the <i>calling</i> signal may require review in the light of false calling signals.)
Reception confirmation signal		Stop polarity followed by CSC character No. 14 (user class 2) or by IA5 character No. 2/10 (user class 1)	Stop polarity returned within three character periods after the end of receipt of the first class-of-traffic character. The return of CSC character No 14 or IA5 character No 2/10 shall be commenced within one to two character periods after the inversion to stop polarity. The <i>reception-confirmation</i> signal will have to be absorbed by the switching equipment of X and should not be able to go through that equipment to arrive at the preceding centre.
Selection signals	At least one (first class-of-traffic character only) or possibly several network selection signals depending on the network requirement (see Appendix I), the digits of the DNIC of the called network, the digits of the called terminal number, and an <i>end-of-selection</i> signal		These signal are transmitted immediately after the <i>calling</i> signal without awaiting the reception at X of the <i>reception-confirmation</i> signal. The selection signals are transmitted according to the control signalling code at the appropriate data signalling rate for the user class-of-service concerned and at automatic speed in a single block which included an <i>end-of-selection</i> signal. For the user class 1 the <i>end-of-selection</i> signal will be IA5 character No 2/11 . For user class 2 the <i>end-of-selection</i> signal will be CSC character No. 11. The data country code (DCC) may be omitted on terminal calls at the request of the incoming country.

TABLE 1/X.70 (continued)

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Network or service identification signals		CSC No. 12 followed by the data network identification code (DNIC) of the network	The character CSC No. 12 and DNIC follow the <i>reception-confirmation</i> signal at automatic speed within one to two character periods. These signals must go through centre X and arrive at the originating network. In all cases, the country or network identity shall consist of four decimal digits. The value of the fourth digit should, in the case when it is not explicitly defined by the numbering plan, be at the discretion of the country in question within the limits allowed by the numbering plan.
Reception-congestion signal		Stop polarity for a period of one or two characters followed by the <i>clearing</i> signal	This signal is returned within 0-5 character periods after the start of receipt of the <i>calling</i> signal when the selection signal cannot be received. This signal should be absorbed by centre X and not allowed to be received by a preceding exchange.
Call progress signals without clearing		CSC No. 11 followed by 2 digits (see Table 7d/X.70)	Examples would be <i>redirected call</i> or <i>terminal-called call progress</i> signal (for further details see Appendix III.)
Call connected signal		One CSC character (see Table 7/X.70)	See § 2.14 of the text and for further details see Appendix III.
Strat of transit through-connect signal (STTC)		CSC No. 15 (see Table 7/X.70)	The signal always precedes the <i>transit through-connect</i> signal.
Transit through-connect signal (TTC)		One CSC character (see Table 7b/X.70)	This signal will always be prefaced by the <i>start of transit through-connect</i> signal and will be returned preceding a <i>call progress</i> signal without clearing when this has to be sent. It will also be transmitted when the <i>calling</i> and/or <i>called line identification</i> is required (for further details see Appendix III).
Transit centres through-connected signal (TTD)	CSC No. 11 (see Table 6/X.70)		The signal will be transmitted within 40 to 120 ms after the receipt of the <i>transit through-connect</i> signal (TTC) when no calling line identification is required (for further details see Appendix III).
Called line identification (if applicable)		Combinations of the <i>called line identification</i> signals transmitted at automatic speed within 120 ms of the receipt of the TTD signal or the first character of the <i>calling line identification</i> signals	The <i>called line identification</i> signal consists of the data network or service identification code (DNIC) followed by the digits of the network terminal number and CSC No. 12. Where no identification is available, only No. 12 is sent (for further details see Appendix III).

TABLE 1/X.70 (continued)

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Calling line identification (if applicable)	Combinations of the <i>calling line identification</i> signals transmitted at automatic speed within 40 to 120 ms of receipt of the <i>transit through-connect</i> signal (TTC).		The <i>calling line identification</i> signal consists of the data network or service identification code (DNIC) followed by the digits of the network terminal number and CSC No. 12 Where no identification is available only the DNIC and CSC No. 12 is sent (for further details, see Appendix III).
Originating through-connection signal	ACK character (combination 0/6 of IA5)		For definition see § 2.14 of the text and for further details see Appendix III).
Call progress signals with clearing		CSC No. 11 followed by 2 digits (see Table 7d/X.70) followed by the <i>clearing</i> signal	
Waiting signal	Stop polarity	Stop polarity	
Clearing signal	Inversion to start polarity in the direction of clearing. The minimum recognition time is 210 ms and the maximum time is 420 ms		The minimum period of start polarity on one signalling path which in itself ensures the complete release of the connection is 420 ms.
Clear confirmation signal	Inversion to continuous start polarity in the opposite direction after a minimum duration of 210 ms of clearing signal and a maximum duration of 490 ms		The minimum and maximum periods for the release of the international circuit by an exchange are 210 ms and 490 ms respectively.
Incoming guard delay	Period of 390-420 ms measured from the moment when start polarity has been established on both signalling paths by : - either recognizing or transmitting the <i>clearing</i> signal on one signalling path, and - either transmitting or recognizing the <i>clear confirmation</i> signal on the other signalling path		A new incoming call shall not be accepted until this guard period has elapsed.
Outgoing guard delay	Period of 840 ms measured from the moment when start polarity has been established on both signalling paths by: - either recognizing or transmitting the <i>clearing</i> signal on one signalling path, and - either transmitting or recognizing the <i>clear confirmation</i> signal on the other signalling path		A new outgoing call shall not be originated until this guard period has elapsed.

TABLE 1/X.70 (concluded)

Signal or function	Forward path (X towards Y)	Backward path (Y towards X)	Remarks
Automatic retest signal	Stop polarity for 1-2 character periods followed by CSC No. 13 stop polarity for 4 seconds and then start polarity for a period of 56 seconds and the signal sequence is then repeated		See § 2.17 of the text.
Backward busy signal		Continuous stop polarity for a maximum period of 5 minutes	

Note - For the control signalling code (CSC) numbers mentioned, refer to Table 8/X.70.

TABLE 2/X.70

First CSC ^{a)} character on the forward and backward paths

Combination				Condition signalled
b ₄	b ₃	b ₂	b ₁	
A	A			No further network selection signal follows ^{b)}
A	Z			Second class-of-traffic character follows (see Table 4/X.70) ^{b)}
Z	A			User class character follows (see Table 3/X.70) ^{b)}
		A		Alternative routing not allowed ^{b)}
		Z		Alternative routing allowed ^{b)}
			A	Transit traffic ^{b)}
			Z	Terminal traffic ^{b)}
Z	Z	A	A	Retest signal ^{b)}
Z	Z	A	Z	Reception confirmation for user class 2 only ^{c)}
Z	Z	Z	A	Not allocated
Z	Z	Z	Z	Not allocated

^{a)} CSC = Control signalling code (see Table 8/X.70).

For user class 1 all characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eight bit (b_8) is chosen to give even parity over the character.

^{b)} First class-of-traffic character.

^{c)} For user class 2 only. The reception confirmation signal for user class 1 will be IA5 character No. 2/10.

2.5.2 User class character (indication of speed and code (see Table 3/X.70))

This character, if used, will follow the first class-of-traffic character and will be required when, for example, this information cannot be derived from the incoming line.

As eight user classes in Table 3/X.70 are not sufficient, a second user class character may be added by means of an escape character. Whether a second user class character follows or not, will be indicated by the bits b_1 , b_2 and b_3 of the first user class character. Whether a second class-of-traffic character follows or not will be indicated by bit b_4 of the first user class character.

TABLE 3/X.70

First user class character ^{a)}

Combination				Condition signalled from X to Y ^{b)}
b ₄	b ₃	b ₂	b ₁	
A				No second class-of-traffic character follows
Z				A second class-of-traffic character follows (See Table 4/X.70)
	A	A	A	Reserve
	A	A	Z	300 bit/s (user class 1)
	A	Z	A	50 bit/s (user class 2)
	A	Z	Z	100 bit/s (user class 2)
	Z	A	A	110 bit/s (user class 2)
	Z	A	Z	134.5 bit/s (user class 2)
	Z	Z	A	200 bit/s (user class 2)
	Z	Z	Z	A second user class character follows ^{c)}

a) For user class 1 all characters are in column 3 ($b_5 = 1$, $b_6 = 1$, $b_7 = 0$) of International Alphabet No. 5. The eighth bit (b_8) is chosen to give even parity over the character.

b) The user class character may be omitted if, for example, the information can be derived from the incoming line.

c) For future extension.

2.5.3 *Second and subsequent class-of-traffic characters* (see Tables 4/X.70 and 4a/X.70)

These characters follow any user class characters required. The number of these class-of-traffic characters depends on the number of user facilities available.

The bit b_4 of the second or subsequent class-of-traffic characters indicate whether another class-of-traffic character follows or not.