



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

U.12

(03/93)

TELEGRAPH SWITCHING SPECIFIC SIGNALLING SCHEMES AND INTERWORKING BETWEEN SIGNALLING SYSTEMS

TERMINAL AND TRANSIT CONTROL SIGNALLING SYSTEM FOR TELEX AND SIMILAR SERVICES ON INTERNATIONAL CIRCUITS (TYPE D SIGNALLING)

ITU-T Recommendation U.12

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation U.12 was revised by the ITU-T Study Group IX (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

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 U.12

**TERMINAL AND TRANSIT CONTROL SIGNALLING SYSTEM
FOR TELEX AND SIMILAR SERVICES ON INTERNATIONAL CIRCUITS
(TYPE D SIGNALLING)**

*(Geneva, 1972; amended at Geneva, 1976, 1980 and Malaga-Torremolinos, 1984
and Helsinki, 1993)*

The CCITT,

considering

- (a) that new networks are being introduced based upon stored programme control techniques;
- (b) that these networks, which may be synchronous or anisochronous, are being provided to carry either telex and similar services or these services in combination with data traffic;
- (c) that the equipment provided for these networks facilitates an enhanced range of facilities compared with those available on existing types of telex network;
- (d) that these factors justify the establishment of a new type of signalling, enabling both telex and other traffic to be handled, as far as practicable, by common processes;
- (e) that, for interworking between these anisochronous networks for telex and similar switched telegraph services, a signalling standard (designated type D) has been adopted, based upon that described in Recommendation X.70 [1] for start-stop data services on anisochronous networks;
- (f) that the decentralized signalling to apply on connections between synchronous public data networks is described in Recommendation X.71 [2],

unanimously declares the view

1 Signal conversion

1.1 Subclause 1.1/U.1 concerning the responsibility for signal conversion, should be the ultimate aim for interworking between networks using type D signalling on the one hand and type A, B or C signalling on the other hand.

1.2 However, in order to avoid unnecessary inconvenience during the introductory stages of the new signalling system, it is recommended that countries employing type D signalling systems should provide for incoming international traffic type A or B signalling and possibly for transit working type C signalling. The question as to when 1.1/U.1 will become fully effective is yet to be resolved.

1.3 Rules for interworking Recommendation U.12 signalling with signalling standards defined in Recommendations U.1 and U.11 are given in Recommendation U.15.

2 General switching and signalling principles

2.1 Decentralized signalling will apply, the same channel being used for control signalling and information transfer.

2.2 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.

2.3 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. Selection signals will be transmitted by the originating country at automatic speed in a single block that includes an end-of-selection signal. It is nevertheless necessary to coordinate the transmission of signals on the forward path to allow sufficient time for retransmission or conversion of backward path signals.

2.4 The schedule of telex destination codes laid down in Recommendation F.69 [3] will apply. The same numerical codes will be used for network identification purposes.

2.5 Alternative routing will be permitted. The principle of a few high usage circuits will be adopted, with overflow on to adequately provided routes between centres. 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.

2.6 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.

2.7 In all cases (including transit switching) the originating network will be responsible for recording accounting information.

2.8 The grade of service for the provision of circuits should not be worse than one lost call in 50 for routes carrying overflow traffic or from which overflow is not permitted. For high-usage direct links, circuits would be provided at a grade of service to be agreed bilaterally, but should not be worse than one lost call in ten.

2.9 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.

3 Specific signalling characteristics

NOTES

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.

Centre X and centre Y will provide any necessary signalling conversion to the type of signalling employed on the preceding and succeeding links if these do not use type D signalling.

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 by the originating subscriber.

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). Compared with Recommendation X.70 [1], some other multiples are selected in order to enable simpler interworking with systems operating in accordance with Recommendations U.1 and U.11.

4 The control signalling code (CSC) used in this signalling system is described in Table 8.

3.1 The signalling system for telex and similar services between two anisochronous networks using type D signalling is described in Table 1.

3.2 The incoming equipment may release the connection if the calling signal exceeds the maximum period of two characters, or of four characters in exceptional cases where extension of call signals has been requested by centre Y. Start polarity will be maintained on the backward signalling path from centre Y to centre X.

3.3 The first forward path signal following the calling signal (class-of-traffic signal) is distinctive from the first backward path signal to provide a guard against head-on collisions in the case of bothway 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 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 they exist and there are no free circuits on the primary route. In the event of a further head-on collision on the recall, or on the call attempt via the

overflow route, no further recall will be made and the call will be cleared down. In the case of a transit centre, the service signal No. 20 (NC) followed immediately by the clearing signal will be returned to the preceding centre after the reception-confirmation signal and the network identification signal (see Recommendation F.69 [3]).

3.4 If there is failure to receive the reception-confirmation or reception-congestion signal within 4 seconds from the start of the calling signal or receipt of a spurious signal, as indicated by a character other than a first class-of-traffic character, the reception-confirmation signal or reception-congestion signal should then 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). If the second attempt is unsuccessful, the service signal No. 20 (NC) followed by the clearing signal will be returned to the preceding centre after the reception-confirmation signal and the network identification signal (see Recommendation F.69 [3]).

3.5 Selection signals can be divided into two parts. The first part, designated as the network selection signals, contains information regarding network and subscriber requirements and may be composed of one or more characters (see Tables 2, 3, 4, 4a, 5 and 5a). The second part comprises the address signals (the called subscriber number, which is preceded by the destination code in the case of a transit call). The network selection signals used in the forward direction (see also Appendix II) are further subdivided and assembled as follows (see 3.5.1 to 3.5.4 below) for signalling purposes:

3.5.1 First class-of-traffic character (see Table 2)

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 may be used. Whether the second class-of-traffic and user-class characters follow or not will be indicated by the bits b_3 and b_4 of the first class-of-traffic character.

3.5.2 User-class character (see Table 3)

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. 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. When seven user classes in Table 3 are not sufficient, a second user-class character may be added by means of an escape character. Whether a second class-of-traffic character follows or not will be indicated by bit b_4 of the first user-class character.

3.5.3 Second and subsequent class-of-traffic characters (see Tables 4 and 4a)

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 will indicate whether another class-of-traffic character follows or not.

3.5.4 Closed user group character (see Tables 5 and 5a)

closed user group is defined as follows: A number of users of a public switched communication service who have the facility that they can communicate with each other but access is barred to and from all other users of the service.

NOTES

1 A special facility, permitting a user in a closed group to call any other user connected to a public switched communication service or to any other network with which interworking is permitted, may be offered. This is termed *Closed user group with outgoing access*. Access to users of this facility is restricted to other members of the closed user group.

The start of closed user group character would precede the closed user group number which would be coded into a number of hexadecimal characters up to a maximum of four (see Table 5).

2 Further study is required concerning administrative aspects of the method to provide the closed user group facility.

3.5.5 The numerical characters used for the second part of the selection signals are shown in Table 6. When the first class-of-traffic character indicates a terminal call, the Recommendation F.69 [3] telex destination code will be omitted.

3.6 The incoming equipment should maintain start polarity on the backward signalling path by releasing the connection if the first received character is spurious, as indicated by a character other than a valid first class-of-traffic signal. This procedure prevents the possibility of regarding a second selection signal as a first class-of-traffic character and provides a further safeguard against false calls.

In the case of receipt of a spurious signal as indicated by a parity error or by a character other than a valid selection signal (with the exception of the first class-of-traffic signal), the incoming equipment should return the service signal No. 20 (NC) to the preceding centre – after the reception-confirmation and the network identification signal (see Recommendation F.69 [3]) – followed by the clearing signal.

The incoming equipment may release the connection if all of the selection signals are not correctly received within a period of 15 seconds from the reception of the first class-of-traffic signal. In this event, the service signal No. 20 (NC) is returned to the preceding centre, followed by the clearing signal.

3.7 For the address signals, i.e. the destination code and the national number, the maximum number of digits to be expected is 12.

3.8 In the case of receipt of the reception-congestion signal at a transit centre, the service signal No. 61 (NC) should be returned to the preceding centre (after the reception-confirmation and the network identification signal) and followed by the clearing signal.

3.9 The network identification signal shall be sent following the reception-confirmation signal.

If several networks are involved in setting up a call, the calling network will receive the network identification signals one after the other. If a transit centre fails to receive the first character of a network identification signal within two seconds of the reception-confirmation signal, it will return the service signal No. 20 (NC) to the preceding centre, followed by the clearing signal. The network identification signals could be useful for retracing the route followed by a call (for traffic statistics, international accounts, analyses of unsuccessful calls and the clearing of faults).

It is possible for a transit centre to receive backward path signals, such as network identification signals, a call-connected signal or service signals, from subsequent centres whilst the backward path signals originated locally are still being sent. It is necessary for the transit centre to ensure that the received signals are retransmitted to the preceding centre without mutilation or loss. This can be ensured if the forward seizure does not occur before complete transmission of the reception confirmation signal.

3.10 The backward path signals indicating effective and ineffective call conditions are scheduled in Tables 7, 7a and 7b.

3.11 If the last backward path signalling character, call-connected, or service signal is not received within 90 seconds from the end of selection, then the service signal No. 20 (NC) will be returned to the preceding centre and followed by the clearing signal.

3.12 If the called station is not able to receive information immediately, the return of the start-of-transit-through-connect or call-connected signals to the calling station should be delayed accordingly (up to a maximum of 3 seconds for telex in accordance with Recommendation S.9 [4]).

3.13 In this type of signalling, originating and terminating national centres contain the identification of the calling or called subscribers respectively. These identifications may be exchanged within the network as an optional subscriber's feature.

In the case of a call terminating in a network with a signalling standard other than type D, and hence called line identification is not available, the last type D centre in the connection should send only the call-connected signal in response to a request for the called line identification. The last type D centre may be either an international transit centre, the last international gateway or a national type D centre.

In the case of a call originating in a network with a signalling standard other than type D, and hence the calling line identification is not available, the first type D centre in the connection should send only the end-of-line-identification signal (CSC character No. 12) in response to a request for the line identification. The corresponding printed service signal to indicate the absence of the line identification to the calling or called subscriber as appropriate is NI.

3.14 The call connected signal confirms that the call is extended to the called subscriber and, if applicable, that the calling line identification has been completely received by the terminating centre and passed to the called subscriber and, when applicable, that the called line identification has been completely transmitted to the originating centre (see Appendix III).

Regardless of the action taken on calling and/or called line identifications, tripping of the called subscribers answerback is required. Normally this is initiated by the originating type D centre. The rules for taking the called subscribers answerback in interworking cases are given in Recommendation U.15.

Return of the answerback is supervised by the originating centre. If it does not arrive within 6 seconds of the commencement of the WRU signal sequence, the originating centre returns the **DER** signal in International Telegraph Alphabet No. 2 (ITA2) to the calling subscriber and clears the connection.

The WRU signal confirms that the call-connected signal has been received by the originating centre and, when applicable, that the called line identification has been completely received by the originating centre and passed to the calling subscriber (see Appendix III).

The call-connected signal is sent on the backward path by the terminating centre, the WRU signal is sent by the originating centre to the called subscriber, but not before the calling subscriber is ready to receive the answerback signal.

The connection must be switched through in the originating centre and in the terminating centre within the timings shown in Appendix III.

In transit centres the connection can be switched through earlier provided that losses and mutilations of characters are avoided.

Connect-through procedures at centres where interworking between type D and other standards takes place are described in Recommendation U.15.

Complete network through-connection is assured when the called subscriber's answerback is received by the calling terminal.

3.15 The guard delays on clearing are measured from the moment when start polarity has been established on both signalling paths by:

- either recognizing or transmitting the clearing signal on one signalling path; and
- either transmitting or recognizing the clear-confirmation signal on the other signalling path.

On all type D signalling paths the guard period for incoming calls should be a period of 3–4 characters. A new call shall not be accepted until this guard period has elapsed. This is on the assumption that the terminating centre will be able to accept the first selection signal after a negligible period of stop polarity and will also be able to return the reception-confirmation signal within a negligible delay after the receipt of the first class-of-traffic character.

On all type D signalling paths the guard period for outgoing calls should be a period of at least eight characters. If centres are able to distinguish between the different clearing conditions, shorter periods may be introduced accordingly.

3.16 The automatic retest signal will be initiated as indicated in 3.4 above.

The circuit should be marked *unavailable* for outgoing traffic and should be tested up to five times at nominal intervals of 1.0 minute or 1.2 minutes and a check made to confirm the receipt of a reception-confirmation signal in response to each test. If a valid reception-confirmation signal has not been received at the end of this first group of tests, the retest will continue with a further group of up to five tests at either 5.0/6.0- or 30/36-minute intervals. If 5.0- or 6.0-minute intervals are used and a valid reception-confirmation signal has not been received at the end of this second group of tests, a further group of up to nominally five retests will be made at 30- or 36-minute intervals. An alarm will be given at an appropriate time. However, this retest procedure may be discontinued at any stage at the discretion of the outgoing Administration.

If, however, during the above sequence of retests, a valid reception-confirmation signal is received, a clearing signal will be transmitted in the place of the retest signal. Following a valid clear-confirmation signal, the incoming and the outgoing sides of the trunk circuit should not be returned to service until after expiry of the appropriate guard delay time. In order to cater for the possibility that a faulty circuit may be seized at both ends, the automatic retest equipment should be arranged to allow an incoming call to be received during the start polarity period of the automatic retest signals. Administrations may, however, ignore such calls that occur during the incoming guard delay period. Where an exchange has knowledge of a transmission system failure, it is desirable that retest signals shall not be applied to the affected circuits.

The intervals between the tests at the two ends of the trunk circuit should be made different to be sure that successive retests do not overlap at both ends. In general, the international/intercontinental transit centre having the higher Recommendation F.69 [3] telex destination code should take the longer interval (i.e. 1.2, 6 and 36 minutes). The tolerance on all above time intervals is $\pm 10\%$. Nevertheless, when this requirement would entail considerable difficulty, alternative arrangements may be adopted by agreement between the two Administrations concerned.

The use of a special first class-of-traffic character for retest permits the incoming centre to be informed about retests on its incoming circuits.

3.17 If at the receiving end parity does not check, provisionally the connection should be cleared down unless otherwise specified. However, the possibility of different actions remains open for further study.