INTERNATIONAL TELECOMMUNICATION UNION

ITU-T R.103

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TELEGRAPHY

TELEGRAPH TRANSMISSION

CODE AND SPEED - DEPENDANT TDM 600 BIT/S SYSTEM FOR USE IN POINT - TO - POINT OR BRANCH - LINE MULDEX CONFIGURATIONS

ITU-T Recommendation R.103

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation R.103 was published in Fascicle VII.1 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.

Recommendation R.103

CODE AND SPEED-DEPENDANT TDM 600 BIT/S SYSTEM FOR USE IN POINT-TO-POINT OR BRANCH-LINE MULDEX CONFIGURATIONS

(Melbourne, 1988)

The CCITT,

considering

(a) that telex subscribers are often geographically located in small groups;

(b) that TDM multiplexing systems are economical for the transmission of large numbers of channels;

(c) that certain telex switches handle TDM frames in accordance with Series-R Recommendations directly and that frame fill should be optimized;

(d) that telex switches handle channels at 50 bauds and a 7.5 unit code;

(e) that a facility for regenerating start-stop signals is used in new TELEX networks;

(f) that the branch-line multiplexing system should be capable of accepting and regenerating all the signals of the TELEX signalling system;

(g) that the minimum signal transfer delay through TDM systems is achieved by the transmission of interleaved elements,

recommends

that, where banch-line remote or low multiplex capacity TDM systems are to be used for telegraphy, the equipment shall comply with the following standards:

1 System capacity

The system shall be capable of multiplexing up to 8 channels at 50 bauds (7.5 bits including a stop element of 1.5 units).

2 Start-stop channel inputs

2.1 The modulation rate tolerance that shall be accepted on incoming 50 baud start-stop signals with a stop element of 1.4 units shall be at least ± 1.4%.

2.2 When receiving characters at 50 bauds having nominally 1.5-unit stop elements, the system shall be capable of transmitting without error isolated incoming characters that have a 1-unit stop element, occurring at a maximum rate of one per second.

2.3 The minimum interval between start elements of undistorted successive continuous characters that may be presented at the channel input when the nominal modulation rate is 50 bauds shall be 145 5/6 ms.

2.4 There shall be no restriction on the continuous transmission of all characters (including combination No. 32 of International Telegraph Alphabet No. 2) when they are presented at the maximum permitted rate.

2.5 The effective net margin on all channel inputs when undistorted signals are received from a transmitter having a nominal character length and rate shall be at least 40%.

2.6 At the nominal modulation rate of 50 bauds, an input character start element shall be rejected if it is less than 0.4 units duration and shall be accepted if it is more than 0.6 units duration.

2.7 Elements corresponding to start polarity (at the distant multiplexer output) shall be inserted in the aggregate stream if the channels are unequipped.

2.8 In the case of an open-circuit line condition at the start-stop channel input, it shall be possible to choose to transmit elements corresponding to a steady start or stop polarity in the aggregate bit stream, according to the availability polarity selected.

3 Start-stop channel outputs

3.1 The maximum degree of gross start-stop distortion, produced by the system on a start-stop channel, shall be 3% for all modulation rates.

3.2 The maximum difference possible between the mean modulation rate of the channel output signals and the nominal modulation rate shall be 0.2%.

3.3 The minimum stop element duration released at the ouptut shall be 1.25 units, whatever the distortion, the length of the stop element or the input rate within the range specified in §§ 2.1 to 2.4 of this Recommendation of the character recognized at the other end, whether this character is in accordance with this Recommendation of Recommendations R.101, R.102 or R.112 (for a rate of 50 bands and a 7.5 unit code).

3.4 Within 6 ms of the recognition of one of the failures described in §§ 8.3 and 8.4 or carrier loss signalled by the modem, the steady polarity as selected in accordance with § 2.8 shall be applied to the channel outputs of the *TDM system affected.*

3.5 The affected terminal shall signal its synchronization status to the distant terminal over the signalling channel provided (control channel).

4 Multiplexing details

4.1 Channel interleaving shall be on a *bit-by-bit multiplexing basis.*

4.2 Both start and stop elements of each input character shall be transmitted through the aggregate.

4.3 The transfer delay shall not exceed 60 ms.

5 Frame structure

5.1 A unique frame of 12 bits, of duration 20 ms, equivalent to an aggregate signal rate of 600 bit/s shall be used, as shown in Table 1/R.103.

5.2 The frame may be considered as a 600 bit/s *start/stop* character, time slot “12” being the start element of polarity A, slots 10 and 11 forming the stop element of polarity Z, as shown in Figure 1/R.103.

6 Aggregate signal details

6.1 The aggregate signal rate shall be 600 bit/s. The tolerance on the modulation rate of the receive aggregate signals of the TDM system shall be between +2.3% and –0.5%.

6.2 The effective net margin of the aggregate signal receiver of the TDM system shall be at least 40%.

6.3 The maximum degree of isochronous distortion of the send aggregate signals of the TDM system shall be 5%.

TABLE 1/R.103

Frame details

Remote muldex slot	Use
1	Data channel 1
2	Data channel 2
3	Data channel 3
4	Data channel 4
5	Data channel 5
6	Data channel 6
7	Data channel 7
8	Data channel 8
9	Control channel
10	Z synchronization
11	Z synchronization
12	A synchronisation

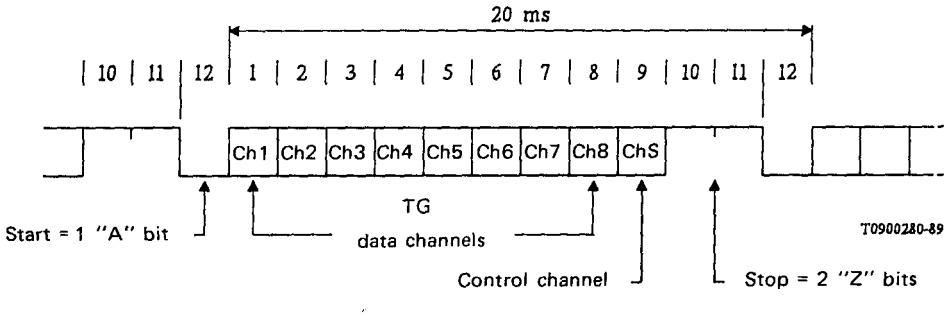

FIGURE 1/R.103

Branch-line muldex frame

6.4 When the TDM system is operated over an international telephone-type circuit, a modem complying with the appropriate aspects of the Series-V Recommendations (in particular Recommendation V.23) should preferably be employed.

7 Control channel encoding

7.1 The 50 bit/s control channel, the position of which in the frame described in 5 is accurately known, enables all risk of imitation to be eliminated.

7.2 The structure of the control channel shall be in accordance with Figure 2/R.103. It corresponds to an anisochronous character with a recurrence of 240 ms, formed from a one unit start element of polarity Z, five information elements and a six unit stop element of polarity A.

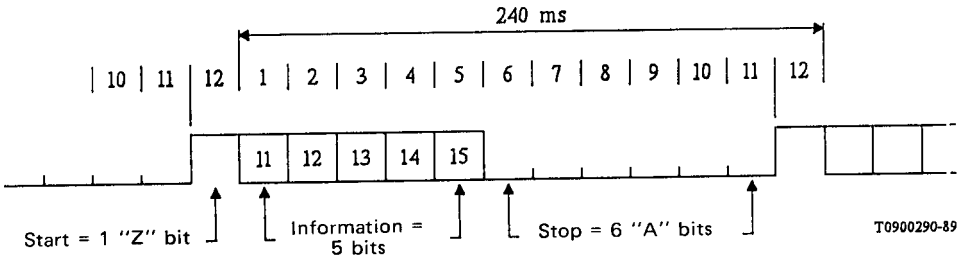

FIGURE 2/R.103

Branch-line muldex control channel

7.3 The control channel information provides for the transmission of information in accordance with Table 2/R.103.

TABLE 2/R.103

Information transmitted by the control channel

5	4	3	2	1	Information elements Function
0	0	0	0	0	Without alarm or other informations (default)
0	0	1	0	0	Loss of synchronism
0	0	0	0	1	Loop "d" request (Remoteloop 2 on 600 bit/s aggregate)
1	X	X	X	X	National use
0	1	0	0	0	Remoteloop "f" on TG channel 1
0	1	0	0	1	2
0	1	0	1	0	3
0	1	0	1	1	4
0	1	1	0	0	5
0	1	1	0	1	6
0	1	1	1	0	7
0	1	1	1	1	8

Note – The least siginificant bits are sent first.

8 Synchronizing

8.1 The maximum average synchronization time in the absence of error and imitation shall be 600 ms.

8.2 Synchronism shall be considered acheived after recognition of the frame positioning pattern (sequence of two elements of polarity Z followed by an element of polarity A) as described in 5 and at least two successive recognitions of the control channel (6 elements of polarity A followed by one element of polarity Z modulo 12) in compliance with 7.

8.3 The maximum time loss of synchronization due to a steady polarity signal shall be 120 ms.

8.4 The maximum time loss of synchronization for repeated error on the synchronization pattern in the control channel shall be 380 ms.

9 Telex signalling

9.1 Specifications for the signals used to establish, to clear and to control telex calls are laid down in Recommendation U.1 (types A and B), U.11 (type C) and U.12 (type D). Recommendation U.25 lists the modes of both-way telex signalling on a single circuit and the signalling combinations on a given aggregate that a TDM terminal shall be capable of handling.

9.2 Recommendation U.25 also lays down the tolerances on the control signals from a TDM terminal to telex and vice versa.

10 Maintenance

The branch looping facilities shall remain in accordance with Recommendation R.115.

11 Numbering of channels

The numbering of channels for the branch line telegraph muldex is given in Tables 1/R.114 and 4/R.114 in accordance with the numbering scheme concerning Recommendations R.101 and R.102.

12 Channel selection

Remote channels shall be grouped so as to provide maximum ease of use of heterogeneous frames, a time slot allocation involving little variation in the sampling rate being retained.

The selection of channel grouping and the method used shall be based on bilateral agreement, particularly when the channels of an existing system have to be branched without there being any possibility of a reconfiguration of the whole.

Tables 3/R.103 and 4/R.103 give an example of remote channel grouping on the basis of muldexes in conformity with Recommendation R.101 or R.102.

TABLE 3/R.103

Example of grouping of remote channels for an R.101 muldex.

	200 baud channels eliminated	50 baud channels extended
Remote channel 1	2001 2004	0501, 0513, 0525, 0536 0504, 0516(2), 0528, 0539
Remote channel 2	2005 2009	0505, 0529, 0517, 0540 0509, 0532, 0521, 0544
Remote channel 3	2002 2006	0502, 0526, 0514, 0537 0506, 0530, 0518, 0541
Remote channel 4	2003 2010	0503, 0527, 0515, 0538 0501, 0533, 0522, 0545
Remote channel 5	2007 2011	0507, 0531, 0519, 0542 0511, 0534, 0523, 0546
		0508, 0512, 0520, 0524, 0535 0543(1)

Note 1 – Although incomplete, a sixth remote channel could be implemented with the remaining 50 baud channels.

Note 2 – Channel 0516 may not be remoted when the corresponding TS is used to transmit the maintenance channel in the R.101 multiplexer.

TABLE 4/R.103

Example of grouping of remote channels for an R.102 muldex

		200 baud channels eliminated
Remote channel	1	2004 and 2016
	2	2012 and 2020
	3	2001 and 2013
	4	2005 and 2017
	5	2009 and 2021
	6	2002 and 2014
	7	2006 and 2018
	8	2010 and 2022
	9	2003 and 2015
	10	2007 and 2019
	11	2011 and 2023