



INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**G.753**

**GENERAL ASPECTS OF DIGITAL TRANSMISSION  
SYSTEMS**

**TERMINAL EQUIPMENTS**

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**THIRD ORDER DIGITAL MULTIPLEX  
EQUIPMENT OPERATING AT 34 368 kbit/s  
AND USING POSITIVE/ZERO/NEGATIVE  
JUSTIFICATION**

**ITU-T Recommendation G.753**

(Extract from the *Blue Book*)

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## NOTES

1 ITU-T Recommendation G.753 was published in Fascicle III.4 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 G.753**

### **THIRD ORDER DIGITAL MULTIPLEX EQUIPMENT OPERATING AT 34 368 kbit/s AND USING POSITIVE/ZERO/NEGATIVE JUSTIFICATION**

*(Geneva, 1980, further amended)*

#### **1 General**

The third order digital multiplex system with positive/zero/negative pulse justification as given below is intended for digital connection between countries having the same type of justification using any second order digital systems at 8448 kbit/s.

#### **2 Bit rate**

The nominal bit rate should be 34 368 kbit/s. The tolerance on that rate should not be more than  $\pm 20$  parts per million (ppm).

#### **3 Frame structure**

Table 1/G.753 gives:

- the tributary bit rate and the number of tributaries;
- the number of bits per frame;
- the bit numbering scheme;
- the bit assignment;
- the bunched frame alignment signal.

TABLE 1/G.753

**34 368-kbit/s multiplexing frame structure using positive/zero/negative justification**

Tributary bit rate (kbit/s)	8448
Number of tributaries	4
Frame structure	Bit number
Frame alignment signal (111110100000) Bits from the secondary tributaries	<i>Set I</i> 1 to 12 13 to 716
Justification control bits ( $C_{j1}$ ) Bits for service functions Justification control bits ( $C_{j2}$ ) Bits from the secondary tributaries	<i>Set II</i> 1 to 4 5 to 8 9 to 12 13 to 716
Justification control ( $C_{j3}$ ) Bits reserved for national use Bits from tributaries available for negative justification Bits from tributaries available for positive justification Bits from the tributaries	<i>Set III</i> 1 to 4 5 to 8 9 to 12 13 to 16 17 to 716
Frame length Frame duration Bits per tributary Maximum justification rate per tributary	2148 bits 62.5 $\mu$ s 528 16 kbit/s

Note -  $C_{jn}$  indicates the  $n$ th justification control pulse of the  $j$ th tributary.

#### 4 Loss and recovery of frame alignment and consequent actions

The frame alignment system should be adaptive to the error ratio in the line link. Until frame alignment is restored the frame alignment system should retain its position. A new search for the frame alignment signal should be undertaken when three or more consecutive frame alignment signals have been incorrectly received in their positions.

Frame alignment is considered to have been recovered when more than two consecutive frame alignment signals have been correctly received in their predicted positions.

#### 5 Multiplexing method

Cyclic bit interleaving in the tributary numbering order and positive-negative justification with two-command control are recommended. The justification control signal should be distributed and use  $C_{jn}$ -bits ( $n = 1, 2, 3$  see Table 1/G.753). Correction of one error in a command is possible.

Positive justification should be indicated by the signal 111, transmitted in each of two consecutive frames; negative justification should be indicated by the signal 000, transmitted in each of two consecutive frames, and no justification by the signal 111 in one frame followed by 000 in the next frame.

Digit time slots 9, 10, 11, 12 (Set III) are used for information carrying bits (for negative justification), and digit time slots 13, 14, 15, 16 in Set III when it is necessary are used for no information carrying bits (for positive justification) for the tributaries 1, 2, 3, 4.

Besides, when information from tributaries 1, 2, 3 and 4 is not transmitted, bits 9, 10, 11 and 12 in Set III are available for transmitting information concerning the type of justification (positive or negative) in frames containing commands of positive justification control and intermediate amount of jitter in frames containing commands of negative justification.

Table 1/G.753 gives maximum justification rate per tributary.

## **6 Jitter**

The amount of jitter that should be tolerated at the input of the multiplexer and the demultiplexer should be according to 3.1.1/G.823. The amount of jitter at the output of the multiplexer and the demultiplexer should be studied and specified.

## **7 Digital interface**

The interface at the nominal bit rate 34 368 kbit/s is under study.

## **8 Timing signal**

The clock should be able to be controlled by an external source.

## **9 Service digits**

Some spare bits per frame are available for service functions (bits 5, 6 and 8 in Set II) for national and international use. Bits 5 and 6 in Set II are available for a digital service channel (using 32 kbit/s Adaptive Delta Modulation) and bit 8 in Set II is available for ringing up a digital service channel.

## **10 Fault conditions and consequent actions**

10.1 The digital multiplex equipment should detect the following fault conditions:

10.1.1 Failure of power supply.

10.1.2 Loss of the incoming signal at 8448 kbit/s at the input of the multiplexer.

*Note* - When using separate circuits for the digital signal and the timing signal, loss of either or both of them should constitute loss of the incoming signal.

10.1.3 Loss of the incoming signal at 34 368 kbit/s at the input of the demultiplexer.

*Note* - The detection of this fault condition is required only when it does not result in an indication of loss of frame alignment.

10.1.4 Loss of frame alignment.

10.1.5 Alarm indication received from the remote multiplex equipment at the 34 368 kbit/s input of the demultiplexer (see § 10.2.2 below).

10.2 *Consequent actions*

After detecting a fault condition, appropriate actions should be taken as specified in Table 2/G.753. The consequent actions are as follows:

10.2.1 Prompt maintenance alarm indication generated to signify that the performance is below acceptable standards and maintenance attention is required locally. When detecting the Alarm Indication Signal (AIS) at the 34 368 kbit/s input of the demultiplexer the prompt maintenance alarm indication associated with loss of frame alignment should be inhibited (see Note 1 below).

*Note* - The location and provision of any visual and/or audible alarm activated by this prompt maintenance alarm indication is left to the discretion of each Administration.

10.2.2 Alarm indication to the remote multiplex equipment generated by changing from the state 0 to the state 1 bit 7 of Set II at the 34 368 kbit/s output of the multiplexer.

10.2.3 AIS (see Note 2 below) applied to all four outputs of the 8448 kbit/s tributary outputs from the demultiplexer.

10.2.4 AIS (see Note 2 below) applied to the 34 368 kbit/s output of the multiplexer.

10.2.5 AIS (see Note 2 below) applied to the time slots of the 34 368 kbit/s signal at the multiplexer output corresponding to the relevant 8448 kbit/s tributary.

*Note 1* - The bit rate of the AIS at the output of the corresponding demultiplexer should be as specified for the tributaries. The method of achieving this is under study.

*Note 2* - The equivalent binary content of the AIS at 8448 kbit/s and 34 368 kbit/s is a continuous stream of binary 1s.

TABLE 2/G.753

**Fault conditions and consequent action**

Equipment part	Fault conditions (see § 10.1)	Consequent actions (see §10.2)				
		Prompt maintenance alarm indication generated	Alarm indication to the remote multiplexer generated	AIS applied		
				To all tributaries	To the composite signal	To the relevant time slots of the composite signal
Multiplexer and demultiplexer	Failure of power supply	Yes	Yes, if practicable	Yes, if practicable	Yes, if practicable	
Multiplexer only	Loss of incoming signal on a tributary	Yes				Yes
Demultiplexer only	Loss of incoming signal at 34 368 kbit/s	Yes	Yes	Yes		
	Loss of frame alignment	Yes	Yes	Yes		
	AIS received from the remote multiplexer					

*Note* - A *Yes* in the table signifies that a certain action should be taken as a consequence of the relevant fault condition. An *open space* in the table signifies that the relevant action should *not* be taken as a consequence of the relevant fault condition, if this condition is the only one present. If more than one fault condition is simultaneously present the relevant action should be taken if, for at least one of the conditions, a *Yes* is defined in relation to this action.