INTERNATIONAL TELECOMMUNICATION UNION

ITU-T Q.121

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

SPECIFICATIONS OF SIGNALLING SYSTEM No. 4

SIGNAL CODE

ITU-T Recommendation Q.121

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation Q.121 was published in Fascicle VI.2 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.

2. SIGNAL CODE

2.1 *General*

The signals of System No. 4 are:

- signal called "line signals" for the so-called supervisory functions;
- signals (binary code signals and their acknowledgement signals) used for the transmission of numerical information.

2.2 *Transit working*

In transit operation, the line equipment at the transit exchange shall record that the condition is transit; this will facilitate, in particular, the parallel reception of the clear-forward signal at the transit and incoming international exchanges. (See Recommendation Q.120, item 1.9).

2.3 *Line signals*

2.3.1 *Line signal code*

The line signal code is given in Table 1.

The use of two frequencies in this code makes it possible to form a characteristic *compound signal,* in which both frequencies are transmitted simultaneously and which can be used as a preparatory signal element (called a *refix*) to the control signal element (called a *suffix)* having a single frequency.

The compound signal prefix element is much less likely to be imitated by speech currents than a single-frequency element of the same duration and serves to prepare a switching circuit for the reception of the suffix element which follows. The prefix signal element also serves to bring about the splitting of the line at the receiving end to prevent the remaining part of the signal from passing out of the section in which it is intended to be operative.

2.3.2 *Sending duration of line signal elements*

The elements of each of the voice-frequency line signals shown in Table 1 have a duration of:

P	150 ± 30 ms
X and Y	100 ± 20 ms
XX and YY	350 ± 70 ms.

TABLE 1

Code for Signalling System No. 4

The symbols used in Table 1 have the following significance:

Prefix signal element	P	prefix signal constituted by two frequencies *x* and *y* compounded
Control signal elements or "suffixes"	X	short signal element of the single frequency *x*
	Y	short signal element of the single frequency *y*
	XX	long signal element of the single frequency *x*
	YY	long signal element of the single frequency *y*

List No.	Name of signal	Code
(See Rec. Q.120)	FORWARD SIGNALS	
1	a) Terminal seizing – *Prise terminale*	**PX**
	b) Transit seizing – *Prise pour transit international*	**PY**
3	Numerical signals – *Signaux de numérotation*	Binary code (see Table 2)
4	End-of-pulsing signal – *Signal de fin de numérotation*	
9	Clear-forward – *Signal de fin*	**PXX**
12	Forward transfer – *Signal d'intervention*	**PYY**
	BACKWARD SIGNALS	
2	Proceed-to-send / *Invitation à transmettre*: a) Terminal – *Terminale*	**X**
	b) International transit – *de transit international*	**Y**
5	Number-received – *Numéro reçu*	**P**
6	Busy-flash – *Occupation*	**PX**
7	Answer – *Réponse*	**PY**
8	Clear-back – *Raccrochage du demandé*	**PX**
10	Release-guard – *Libération de garde*	**PYY**
11	Blocking[a] – *Blocage*	**PX**
–	(Unblocking) *(Déblocage)* = use of signal 10 of the list	**PYY**

a) In addition to the blocking which results from the reception of a blocking signal at the outgoing end of a circuit, the outgoing equipment should be such that a *temporary* condition of "circuit busied" should result at the outgoing end on receiving, on a free circuit, one or other of the frequencies *x* or *y* or both these frequencies. This condition should be maintained for as long as the frequency or frequencies are received. The maintenance instructions given to the maintenance staff stipulate that such an occupation of a circuit should be as short as possible and in any case less than 5 minutes.

(The durations of the signal elements P, X and Y, XX and YY are multiples of 50 ms with a tolerance of ± 10 ms.)

Once the sending of a signal has begun it must be sent completely. If two signals have to be sent one immediately after the other in the same direction, a silent interval must separate the two successive signals. The duration of this interval must not be less than 100 milliseconds but it must not be so long as to cause an unreasonable delay in signalling.

This 100 ms interval must also occur between the sending of a numerical signal including the acknowledgement signal and a subsequent line signal.

Sending of the proceed-to-send or busy-flash signal by an incoming or transit exchange should not take place until 50 ms after the end of the receipt of the corresponding seizing signal. Such a delay will normally result from the operation of equipment (operating times of relays, time of hunting for register).

On sending, there will be no intentional interval of silence between the prefix element and the suffix element of a signal but where such an interval exists its duration at the sending end must not exceed 5 ms.

It can happen, when sending the P prefix element, that the two frequencies will not be sent simultaneously. The interval of time between the instants when each of the two frequencies is sent must not, in this case, exceed 1 ms. In the same way, if the suffix element does not immediately follow the prefix but is separated from it by an interval of silence as explained in the paragraph above, the interval of time between the two instants when the sending of each of the two frequencies ceases shall not exceed 1 ms.

2.3.3 *Recognition time*[1)] *of line-signal elements at the receiving end*

At the output of the signal receiver, the duration of the direct current signal elements produced by the line signals is determined in terms of the sending duration of the voice-frequency signal elements and the distortion due to the line and to the signal receiver.

This overall distortion due to the line and the signal receiver is taken to be 10 ms maximum for a prefix-element and 15 ms for a suffix-signal element. (The distortion of the suffix-signal element may be greater than that of the prefix-signal element, because it depends not only on the distortion of the pulse consisting of a single frequency which is sent as a suffix element, but also on the moment when the other frequency used for the prefix element ceases.)

The incoming switching equipment must recognize a signal only after a certain time, called the recognition time, from the beginning of the receipt of the direct current signal, so that risk of recognizing false signals is reduced and so that signals of different length can be distinguished.

The recognition times of the line signal elements are:

P:	80 + 20 ms
X e Y:	40 + 10 ms
XX e YY:	200 + 40 ms.

The incoming switching equipment shall be able to recognize a signal correctly when the prefix and the suffix of this signal are separated by an interval of silence of 15 ms or less.

2.4 *Numerical signals*

2.4.1 *Binary numerical signal code*

The numerical signal code is given in Table 2. This code is a binary code of four elements each separated from the next by a short interval of silence *s;* each element consists of the sending of one or other of the signalling frequencies.

The symbols used in Table 2 and in Figure 2/Q.121 have the following significance:

x short element of the single frequency *x*

y short element of the single frequency *y*.

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1) See definition of recognition time in § 2.5 hereafter.

TABLE 2

Binary Code of System No. 4

Signal	Combination				
	Number	Elements			
		1	2	3	4
Digit 1	1	**y**	**y**	**y**	**x**
" 2	2	**y**	**y**	**x**	**y**
" 3	3	**y**	**y**	**x**	**x**
" 4	4	**y**	**x**	**y**	**y**
" 5	5	**y**	**x**	**y**	**x**
" 6	6	**y**	**x**	**x**	**y**
" 7	7	**y**	**x**	**x**	**x**
" 8	8	**x**	**y**	**y**	**y**
" 9	9	**x**	**y**	**y**	**x**
" 0	10	**x**	**y**	**x**	**y**
Call operator code 11	11	**x**	**y**	**x**	**x**
Call operator code 12	12	**x**	**x**	**y**	**y**
Space code (except case envisaged under 1.4.2.3 of Q.104)	13	**x**	**x**	**y**	**x**
Incoming half-echo suppressor required [a]	14	**x**	**x**	**x**	**y**
End-of-pulsing	15	**x**	**x**	**x**	**x**
Space code	16	**y**	**y**	**y**	**y**

The relation between the transmitted digits and the different combinations of the binary code is arrived at by giving the value 8, 4, 2 or 1 to the presence of an element x depending on whether this element x constitutes the 1st, 2nd, 3rd or 4th element of the numerical code.

a) Signal code 14 is available for use upon multi-lateral or bilateral agreement for echo suppressor control (see Recommendations Q.107 and Q.115).

2.4.2 *Sending duration of the signal elements x and y*

The sending duration of the signal elements x and *y* to line, as voice-frequency signals, shall be:

35 ± 7 ms.

The sending duration of the interval of silence *s* between signal elements of the same digit shall have the same value of 35 ± 7 ms.

(The maximum duration of the signal elements and intervals of silence is not a critical factor in the design of the system but is specified in order that the speed of signalling is not unduly slow.)

2.4.3 *Recognition time*[2] *of the x, y and s elements at the receiving end*

The recognition time by the incoming switching equipment:

a) of the direct current signal elements *x* and *y*;

b) of intervals of silence *s*;

received from the output of the signal receiver is: 10 ± 5 ms.

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2) See definition of recognition time in § 2.5 d) above.

2.4.4 *Acknowledgement signals*

Incoming international and international transit exchanges shall return an acknowledgement signal to the outgoing international exchange *at the end of the reception* of the 4th element of a numerical signal.

At the outgoing international exchange a numerical signal will be sent only if a signal is received from the incoming and acknowledging the receipt of the preceding numerical signal. However, to avoid this procedure delaying the transmission of numerical signals the sending of numerical signals may begin *as soon as the acknowledgement signal is recognized.*

Two types of acknowledgement signals are provided, one constituted by the signal element *x* defined above and the other constituted by the signal element *y* defined above.

The acknowledgement signal *x* has two meanings:

- after a terminal proceed-to-send signal has been received by the outgoing register: "digit received; send next digit";
- after a transit proceed-to-send signal, but before a terminal proceed-to-send signal has been received: "digit received; stop the sending of digits".

The acknowledgement signal *y* has one meaning only, i.e. after a transit proceed-to-send signal has been received: "digit received; send next digit".

2.5 *Signalling timing diagrams*

Figures 1/Q.121 and 2/Q.121 give diagrams showing for line signal elements (Figure 1) and for numerical signal elements *x* and *y* (Figure 2):

a) the sending duration (transmission at voice-frequency over the line);

b) the received duration (direct current signals at the signal receiver output);

c) the safety margins that allow for equipment not being in adjustment, etc.;

d) the recognition time of the receiving switching equipment; this time assumes an operating margin is defined between a lower limit *t* and an upper limit *T*. The switching equipment must *not* recognize a signal element *before t* but must *certainly* have recognized it *at the end of time T.*

2.6 *General note on the operation of signalling and switching equipment*

The tolerances defined in §§ 2.3 and 2.4 concerning the sending duration of signal and their recognition times at the receiving end must be strictly observed in all circumstances and especially under all conditions of battery voltage variation likely to arise in working conditions.

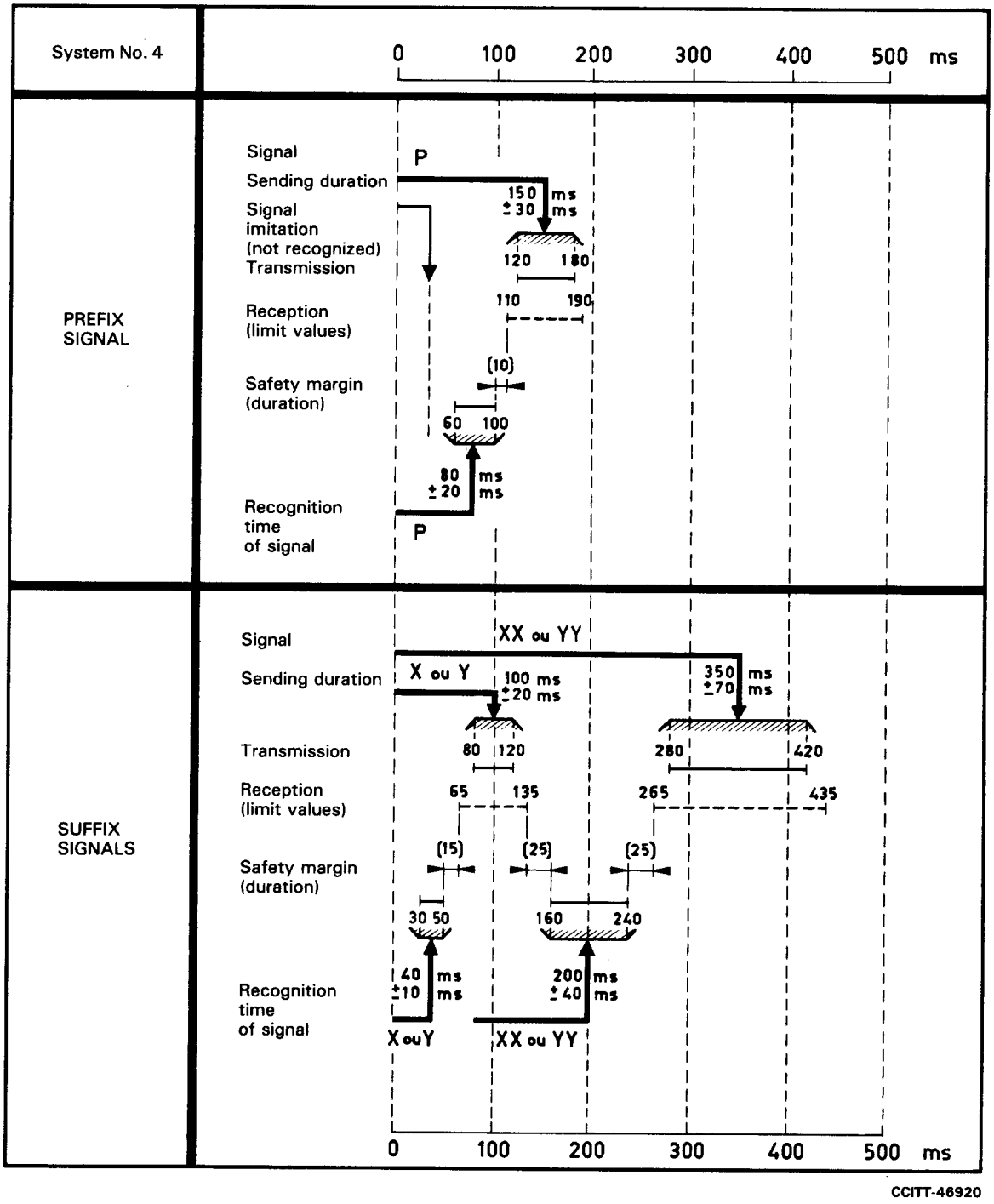

FIGURE 1/Q.121

Duration of Line Signal Elements

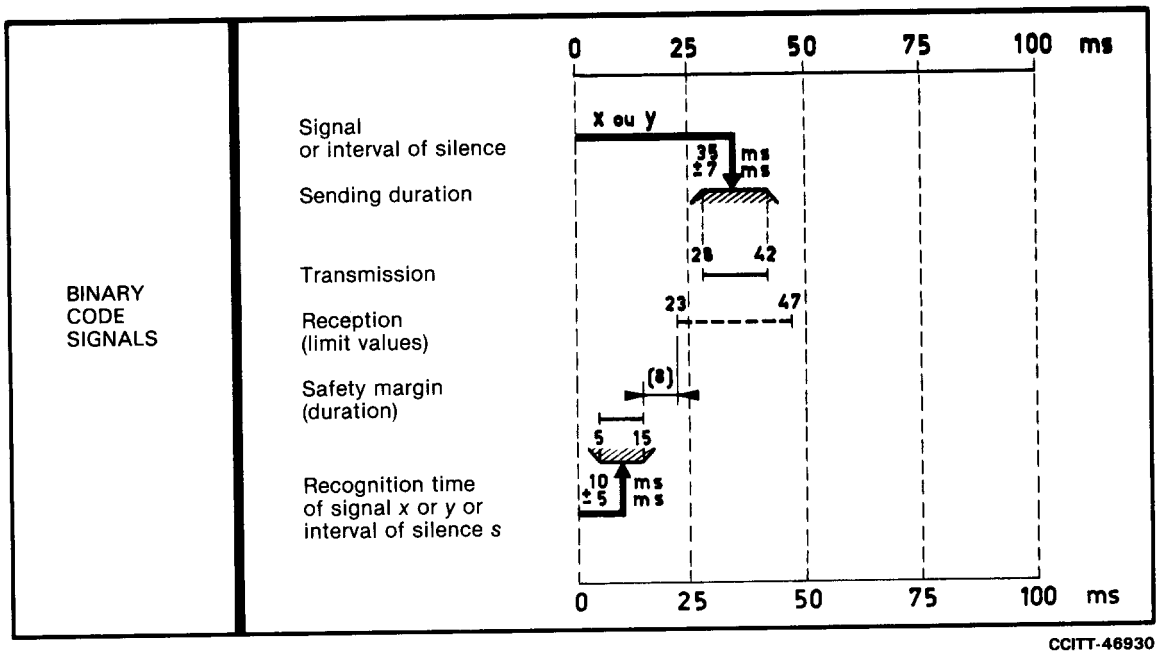

FIGURE 2/Q.121

Numerical Signal Elements

Legend to Figures 1 and 2/Q.121

Signalling timing diagrams

Figures 1 and 2 give diagrams showing for line signal elements (Figure 1) and for numerical signal elements *x* and *y* (Figure 2):

- the sending duration (transmission at voice-frequency over the line);
- the received duration (direct current signals at the signal receiver output);
- the safety margins that allow for equipment not being in adjustment, etc.;
- the recognition time (which assumes an operating margin) of the receiving switching equipment; this margin is defined between a lower limit *t* and an upper limit *T*. The switching equipment must *not* recognize a signal element *before t* but must *certainly* have recognized it *at the end of time T.*