

**Recommendation T/CS 49-02 (Ostend 1979, revised in Vienna 1982 and Montpellier 1984)**

**SYSTEM L1 DECADIC PULSING INTERREGISTER SIGNALLING**

Recommendation proposed by Working Group T/WG 11 "Switching and Signalling" (CS)

*Revised text of the Recommendation adopted by the "Telecommunications" Commission:*

"The European Conference of Postal and Telecommunications Administrations,

*considering*

- that rotary dial telephones are still widely used on private automatic branch exchange extension lines;
- that equipment located at subscriber's premises and used for private networks may be based on decadic pulsing techniques,

*recommends*

that the members, in conditions requiring decadic pulsing over links between analogue transmission interfaces of private automatic branch exchanges located in different countries, use System L1 signalling as specified below."

**1. GENERAL**

**1.1. Line signalling**

System L1 decadic pulsing signalling is used in conjunction with System L1 line signalling according to Recommendation T/CS 49-01 [1]. The individual line signals to be provided and their uses are specified in Recommendation T/CS 49-03 on the System L1 decadic pulsing call control signalling procedures [2].

**1.2. Principles and field of application**

- 1.2.1. The decadic pulsing interregister signalling system is to provide automatic and semi-automatic working between private automatic branch exchanges (PABXs) via terrestrial circuits.
- 1.2.2. The system is a single voice frequency (1 VF) in-band signalling system, using the same signalling frequency of 2,280 Hz as System L1 line signalling, according to Recommendation T/CS 49-01 [1]. The use of voice frequency signals renders the system suitable for all voice transmission media.
- 1.2.3. The system is for use on four-wire circuits, and the PABX termination arrangements set-out in Recommendation T/CS 49-01 [1] apply.
- 1.2.4. The decadic pulsing call control signalling operates on a link-by-link basis and may be used to set-up multi-link tandem connections. In accordance with CCITT Recommendation Q.25 [3], the signals are contained within the appropriate link and are not allowed to spill-over into subsequent links.
- 1.2.5. The maximum number of tandem connections over which a call may be set-up is determined by the type of interconnecting circuits and is subject to mutual agreement by the parties concerned. All circuits used in System L1 links should be to the standard of CCITT Recommendations G.171 [4] and M.1010 to M.1060 [5].
- 1.2.6. Forward signals may be passed while speech or audible indications are being received in the backward direction.

**1.3. Signals for decadic pulsing**

For System L1 decadic pulsing signalling, the following signals in accordance with Recommendation T/CS 41-01 [6] are specified.

**1.3.1. Forward signals**

- Address signal;
- Proceed-to-send-on-recall signal.

1.3.2. *Backward signals*

- Proceed-to-send signal;
- Address-complete signal;
- Address-complete, extension-free signal;
- Address-complete, extension-busy signal;
- Busy-extension-changed-to-free signal;
- Clear-request signal;
- Proceed-to-send-on-recall signal.

1.3.3. *Clear-request when common-control equipment or switching equipment is released*

A clear-request signal shall be applied, prior to the answer signal when, after recognition of a seizing signal, no address or incomplete address information is received and the incoming PABX times-out, dismissing any common-control equipment.

A clear request signal may be applied prior to the answer signal when an incoming PABX encounters congestion or an engaged extension and releases the switching equipment.

2. **DECADIC PULSING SENDING AND DETECTING REQUIREMENTS**

2.1. **Signal codes**

Address signals (routing digits and extension number) are sent as pulses of signalling tone character-by-character in a non-compelled mode of operation in the sequence required by the numbering arrangements. The interregister signals shall be coded as shown in Table 1 (T/CS 49-02).

Forward signals			
Signal		Code	
Address	Digit 1	one	tone-on pulse
	2	two	tone-on pulses
	3	three	tone-on pulses
	4	four	tone-on pulses
	5	five	tone-on pulses
	6	six	tone-on pulses
	7	seven	tone-on pulses
	8	eight	tone-on pulses
	9	nine	tone-on pulses
	0	ten	tone-on pulses
Proceed-to-send-on-recall (optional)		single	tone-on pulse
Reconnect (optional)		double	tone-on-pulse

Backward signals	
Proceed-to-send (optional)	continuous tone-off
Address-complete (optional)	single tone-on pulse
Address-complete-extension-free (optional)	single tone-on pulse
Address-complete-extension-busy (optional)	double tone-on pulse
Busy-extension-changed-to-free (optional)	single tone-on pulse
Clear-request	continuous tone-on
Proceed-to-send-on-recall (optional)	single tone-on pulse
Reconnect (optional)	double tone-on-pulse

Table 1 (T/CS 49-02). Decadic pulsing interregister signal codes.

Adjacent address signals are separated by an *inter-digit pause (IDP)*. This pause is a function of the type of PABX concerned and the source of the digits, e.g. whether generated within the outgoing PABX or repeated by the PABX under the control of a dial. The inter-digit pause, which will differ depending upon the Administration concerned and the type of PABX, is not specified in this Recommendation and must be mutually agreed upon by the parties involved. During the inter-digit pause the through-connection of the backward speech path is re-established.

Signals having the same coding shall be distinguished by their position in the sequence of the signalling procedure.

The provision and use of particular interregister signals, some of which are optional, will depend upon the requirements of the call control signalling procedures (see Recommendation T/CS 49-03 [2]).

2.2. **Sending of address signals**

The break periods of dial pulses shall be applied to the send signalling path as pulses of tone-on condition within the limits of Table 2 (T/CS 49-02).

Speed (pulses per second)	7		9		11		12	
Break pulse	Min	Max	Min	Max	Min	Max	Min	Max
Duration (ms)	45	112	45	81	45	61	45	52

Table 2 (T/CS 49-02).

Where address signals are generated within the PABX, the speed and break pulse duration applied to the signalling send path shall be either:

- (a)  $10 \pm 0,5$  pulses per second, with break pulse limits of 60-68%, or
- (b)  $10 \pm 1$  pulses per second, with break pulse limits of 58-66%.

2.3. **Detecting of address signals**

Electrical conditions, conforming to the line signal transmission requirements referred to in Section 4. and applied to the PABX termination, shall be regarded as a potential signal.

To discriminate between address signals and signals having similar characteristics, or between address signals and spurious electrical conditions, it is necessary to state the minimum persistence time for a potential signal.

A potential signal is not recognised until the electrical condition proper to the signal (i.e. tone-on or tone-off) has persisted for a stated period. Until that period expires, only an electrical condition exists.

The paragraphs below detail the minimum persistence of a defined electrical condition before it may be recognised as a signal, i.e. an electrical condition persisting for less than the stated period shall not be recognised as a signal. The period after which a potential signal must be recognised as a signal is a function of the PABX logic and is not given in these specifications. However, recognition should occur as soon as possible following expiration of the stated persistence check period and the splitting and spill-over requirements (see Section 4.) must be met.

Pulses of tone-on condition applied to the receive signalling path PABX termination and consistent with the speed and duration limits of Table 3 (T/CS 49-04), are break periods of dial pulses (address signal). Each break pulse is separated from the next by a make pulse, i.e. tone-off condition.

Within an address signal, adjacent pulses may differ in speed and duration and any combination of break pulses within the limits of Table 3 (T/CS 49-04) shall be accepted as dial pulses (address signal).

Speed (pulses per second)	7		9		11		12	
Break pulse	Min	Max	Min	Max	Min	Max	Min	Max
Duration (ms)	35	122	35	91	35	71	35	62

Table 3 (T/CS 49-02).

Break pulses persisting for less than 25 ms applied to the PABX termination shall not be accepted as dial pulses.

Adjacent address signals are separated by an inter-digit pause, see Section 2.1. above.

2.4. **Tone-on pulses**

The sending and detecting requirements of Recommendation T/CS 49-01 [1] apply.

### 3. REGISTER-RECALL SIGNALLING

Register-recall provides the means for control information transfer after termination of the call set-up. Register-recall can, as forward or backward recall, be initiated in either direction, regardless of the direction of the original call set-up.

When the register at the destination PABX is required to be recalled, the forward or backward service-request-recall signal shall be sent. The service-request-recall signal shall not recall the registers of transit switches.

When the transit register is required to be recalled, the forward- or backward-link-recall signal shall be sent to the adjacent transit switch.

Upon recognition of a register-recall signal, the proceed-to-send-on-recall signal is sent to indicate that the responding PABX is ready for System L1 decadic pulsing interregister signalling.

Upon recognition of a register recall signal, the reconnect signal is sent to indicate that the responding PABX

- does not allow a register-recall to be extended, or
- wishes the initiating PABX to switch-through the connection.

### 4. SIGNAL TRANSMISSION REQUIREMENTS ON THE LINE

#### 4.1. Signal sender and receiver

The signal transmission requirements on the line which are specified in Recommendation T/CS 49-01 [1] apply for all signals.

#### 4.2. Splitting and spill-over

CCITT Recommendation Q.25 [3] and Recommendation T/CS 49-01 apply.

Through-transmission shall not be restored during the tone-off periods of address signals.

### REFERENCES

- [1] Recommendation T/CS 49-01. *System L1 line signalling over international interprivate automatic branch exchange lines.*
- [2] Recommendation T/CS 49-03. *System L1 decadic pulsing call control signalling procedures.*
- [3] CCITT Recommendation Q.25. *Splitting arrangements and signal recognition times in "in band" signalling systems.*
- [4] CCITT Recommendation G.171. *Transmission characteristics of leased circuits forming part of a private telephone network.*
- [5] CCITT Recommendations M.1010 to M.1060. *International leased circuits.*
- [6] Recommendation T/CS 41-01. *Signal and signalling message names and meanings.*