

**GENERAL TECHNICAL REQUIREMENTS
FOR PCM-2 AND PCM-4 SUBSCRIBER SYSTEMS**

A. Technical Characteristics of Local Exchanges

Loop Resistance including telephone set	$\geq 1,000 \Omega$
Insulation resistance between wires of pair:	$\geq 10,000 M\Omega/Km$
Power Supply Voltage for Ericsson/Siemens exchanges (AXE-10)/(EWSD)	$60V \pm 6V$ dc
Ringer signal frequency:	$25 \text{ Hz} \pm 8\%$
Ringer signal voltage:	$35V - 90V_{rms}$
Dial pulse frequency:	$10 \text{ pps} \pm 1 \text{ pps}$
Dial tone or Busy tone frequency:	$425 - 450 \text{ Hz}$
Dial tone or Busy tone voltage:	$0.32V - 10V_{rms}$
Pulse String ratio: nominal	$1.6/1$ (61.5% / 38.5%)
Local Exchange Tolerance:	$1.9/1 - 1.3/1$

B. Technical Characteristics of Telephone Sets

DC Resistance:	$< 400 \Omega$
Pulse String ratio: nominal	$1.6/1$ (61.5% / 38.5%)
Deviation allowed:	$1.9/1 - 1.4/1$
Minimum ringing signal voltage:	$25V - 90V_{rms}$

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From: J.P.

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MARCONI SPEECH AND INFORMATION SYSTEMS

Telecommunications Group

FLEXICAL

Specification for Digital Signalling Protocol

Telecom Portugal Version

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1. Introduction

This signalling protocol specification is based on document 717.10.001 dated 22th October 1990 issued by Telecom Portugal. The signalling protocol used is the two bit line code in accordance with table B-VIII of annex II. Modifications have been made to reflect the differences between operating with a PBX and operating with an announcement machine. This signalling protocol is for use with the Lisbon exchange system until further notice.

The signalling protocol is intended to allow communication between FLEXICALL and an exchange providing a premium rate announcement service.

The signalling is carried out in timeslot 16 of the serial data streams in the channel associated mode in accordance with CCITT recommendation G.704. This provides four bits of signalling data per channel, the a, b, c and d bits, in both directions. The signalling from the exchange, the forward direction, utilises the a and b bits, the remaining bits are set to pre-defined values. The signalling from FLEXICALL, the backward direction, utilises the a and b bits, the remaining bits are set to pre-defined values. FLEXICALL is not configured to generate calls, it only receives incoming traffic.

The bit values for each signalling state are defined in the signalling state table. The sequence of signalling states and the critical timings are defined in the operational requirements.

Information Systems

2. Operational requirements

- 2.1 Any change of state shall not be recognized as a change of state until a minimum period of 10 ms has elapsed.
- 2.2 Any change of state shall be recognized as a change of state within a maximum period of 15 ms.
- 2.3 For any change of state that requires both signalling bits to change simultaneously FLEXICALL shall ensure that the time difference between the two bits changing has a maximum period of 2 ms.
- 2.4 During the initialisation stage FLEXICALL shall transmit the Blocking signal (state 10) in all 30 signalling channels.
- 2.5 When initialisation is complete, the link is established and FLEXICALL is ready to receive incoming calls then FLEXICALL shall transmit the De-blocking signal (state 9) in all 30 signalling channels.
- 2.6 A request for a service to be transmitted in a channel timeslot is initiated by the exchange sending the Seize signal (state 2).
- 2.7 After recognition of a valid Seize signal FLEXICALL shall respond with the Seize Acknowledge signal (state 3) within a maximum period of 20 ms.
- 2.8 The exchange shall then send n digits by decadic signalling. The first digit shall be the most significant. Each digit shall consist of n break signals, each separated by a make signal. For digit 1 n shall be 1, for digit 2 n shall be 2 and so on to digit 9 where n shall be 9. For digit 0 n shall be 10.
- 2.9 The break signal (state 4a) shall have a minimum period of 15 ms and a maximum period of 200 ms. 4
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- 2.10 The make signal (state 4b) shall have a minimum period of 15 ms and a maximum period of 200 ms.
- 2.11 After at least one valid break signal has been detected a make signal with a minimum period of 205 ms shall signify the end of the first digit. A=10
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- 2.12 After the start of the nth digit, i.e. at least one valid break signal has been detected, a make signal with a minimum period of 205 ms shall signify the end of the nth digit.
- 2.13 Once all the digits have been received then if the service selected by the received digits is available FLEXICALL shall respond with ring tone (section 5.1) in the corresponding audio channel within a maximum period of 1 second. After the defined number of ring cycles have been completed the ring tone shall stop and the service shall start in the audio

- channel. FLEXICALL shall respond with the Answer signal (state 5) within a maximum period of 50 ms after the service starts.
- 2.14 Whilst the announcement is in progress, speech (state 6), if a Clear Forward signal (state 7) is received then FLEXICALL shall terminate the announcement and respond with the Clear Back signal (state 8). The Clear Forward signal shall be recognized as a break signal of greater than 205 ms.
- 2.15 FLEXICALL shall then prepare the channel to receive a new call. Once FLEXICALL is ready to receive a new call in that channel it shall respond with the Release Guard signal (state 9) after a minimum period of 250 ms.
- 2.16 Should the announcement terminate before a Clear Forward signal (state 7) has been received then FLEXICALL shall send the Clear Back signal (state 8) and prepare the channel to receive a new call.
- 2.17 The exchange shall respond with the Clear Forward signal (state 7). Once FLEXICALL has detected the Clear Forward signal (state 7) and is ready to receive a new call in that channel it shall respond with the Release Guard signal (state 9) after a minimum period of 250 ms.
- 2.18 Once all the digits have been received then if the service selected by the received digits is not available FLEXICALL shall respond with number unobtainable tone (section 5.2) in the corresponding audio channel within a maximum period of 1 second. FLEXICALL shall then wait for Clear Forward (state 7) to be received from the exchange before clearing the channel to receive a new call by sending the Idle signal (state 1).
- 2.19 Should a Clear Forward signal (state 7) be received after the Seize Acknowledge signal (state 3) has been sent but before the Answer signal (state 5) has been sent then FLEXICALL shall respond with the Idle signal (state 1) within 20 ms. The Clear Forward signal shall be recognized as a break signal of greater than 205 ms.
- 2.20 Should FLEXICALL develop a fault that affects the provision of services then the blocking signal (state 10) shall be sent in all 30 signalling channels.
- 2.21 Should FLEXICALL develop a fault that affects the provision of services in an individual channel then the blocking signal (state 10) shall be sent in that signalling channel.
- 2.22 If an error is detected during the signalling phase, out of sequence states, incorrect states, incorrect timings or too many digit pulses then FLEXICALL shall respond by transmitting number unobtainable tone in the audio channel and Idle (state 1) in the signalling channel. FLEXICALL shall then wait for Clear Forward (state 7) to be received from the exchange before clearing the channel to receive a new call.

- 2.23 If insufficient digits are received to determine a service then the call will be assumed to have failed after a maximum period of 20 seconds after the last break pulse was received. FLEXICALL shall respond by sending number unobtainable tone in the audio channel and Idle (state 1) in the signalling channel. FLEXICALL shall then wait for Clear Forward (state 7) to be received from the exchange before clearing the channel for a new call.
- 2.24 During speech (state 6) FLEXICALL shall not respond to any signalling state other than Clear Forward (state 7) or Transmission Fault (state 11) e.g. any charging/metering signalling states received shall be ignored.
- 2.25 Should FLEXICALL receive the Transmission Fault signal (state 11) at any time on any channel it shall immediately respond with the Blocking signal (state 10) in that channel. Any service in progress shall be terminated. When the Idle signal (state 1) is received from the exchange FLEXICALL shall respond with the Release Guard signal (state 9) when it is ready to accept a call in that channel.

1 BIT SYSTEM

2 BIT SYSTEM

✓ TELEVOZ

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5. Call Progress tones

5.1 Ring tone

Frequency: 425 +/- 15 Hz
 Level: -12 dBmO +/- 3 dB
 Harmonics: 3rd less than -18dBm
 others less than -29dBm
 Cadence: 1000 +/- 100 ms tone
 5000 +/- 500 ms pause

5.2 Number Unobtainable tone

Frequency: 425 +/- 15 Hz
 Level: -12 dBmO +/- 3 dB
 Harmonics: 3rd less than -18dBm
 others less than -29dBm
 Cadence: 200 +/- 20 ms tone
 200 +/- 20 ms pause

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3. Signalling state table

E=SUCCESS

	From Exchange				From FLEXICALL			
	a _f	b _f	c _f	d _f	a _b	b _b	c _b	d _b
1. Idle	1	0	0	1	1	0	0	1
2. Seize	0	0	0	1	1	0	0	1
3. Seize Acknowledge	0	0	0	1	1	1	0	1
4. Decadic Pulsing								
a. Break	1	0	0	1	1	1	0	1
b. Make	0	0	0	1	1	1	0	1
5. Answer	0	0	0	1	0	1	0	1
6. Speech	0	0	0	1	0	1	0	1
7. Clear Forward	1	0	0	1	X	1	0	1
8. Clear Back	X	0	0	1	1	1	0	1
9. De-blocking (Idle) Release Guard	1	0	0	1	1	0	0	1
10. Blocking	1	0	0	1	1	1	0	1
11. Transmission Fault	1	1	0	1	X	X	0	1

Sats'g

T-2 INCL

50ms

digit PULSE
set digit

X = bit in either state

Default Translation

14229

Immediate Start
DID

4. Sequence Diagram

