Teldat Router

E1/PRI ISDN Interface

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Chapter 1
Introduction

1. Introduction to E1/PRI ISDN interface

This manual describes the function of the E1/PRI ISDN interface implemented in the Teldat Routers. For this you need to have a Centrix-F router with the G.703 interface card at 2048 Kbps (this supports the E1 and the Primary ISDN interfaces).

The E1 interface is a digital interface operating at a speed of 2048 Kbps with a frame length of 256 bits divided into 32 time-slots of 8 bits each with interlaced octets, each one being associated to one of the 32 structured channels (the 2048 kbps are divided among the 32 channels each being 64 Kbps) and thus carrying out multiplexion in the time. The 256 bits frame repetition frequency is 8000 Hz in order to obtain channel capacity of 64 Kbps. I.e. the subsequent frame repeats each 125 µs:

Bit	1	2	3	4	5	6	7	8																							256
Chann	Channel 0								Channel 1					…			…				Channel 30				Channel 31						

The Primary ISDN interface (PRI ISDN) is the same as a 2048 Kbps digital interface with the same characteristics as the E1 interface but with the peculiarity of certain specifications appearing at the moment when the time slots are distributed. This question is dealt with below:

Channel 0 is used as the synchronization channel in both interfaces, carrying out both maintenance functions and operating quality monitoring.

However, in the case of the PRI ISDN interface, channel 16 is reserved for signaling when establishing calls (channel D) while in the E1 interface, channel 16 is simply another channel available to transmit any type of traffic. The standard specifies that should signaling be needed, this should go through channel 16 although if this is not required the channel can be used normally.

	Channel 0	Channel 1	…	Channel 16	Channel 17	…	Channel 29	Channel 30	Channel 31
E1	SINC.	■	■	■	■	■	■	■	■
PRI ISDN	SINC.	■	■	Channel D	■	■	■	■	■

Channels marked as "■" can be freely assigned for data transport at 64 Kbps each.

As you can see, the PRI ISDN interface is a personalized E1 interface where the channels are structured and characterized in a determined way.

The interface is implemented so it complies with the G.703, G.704 recommendations and I.431 for the physical layer, Q.921 for the link layer and Q.931 for the UIT-T access layer.

Chapter 2
Configuration

1. E1/PRI ISDN Interface Configuration

This chapter describes the parameters which can be configured in the E1/PRI ISDN interface. Depending on the behavior you require from the router, you will need to correctly configure the distinct options.

1.1. TYPE OF INTERFACE

The first thing to consider is the type of interface you are going to configure as it depends on this whether certain parameters are applicable or not.

a) Interface configured as E1

In the case of an E1 interface, all the channels (except 0) are available to the user as 64 Kbps B channels and can be used as required.

Regarding the type of connection that can be established for the E1 interface channels, only permanent connections are possible as all the circuits are configured as *PVCs*.

Given that all the circuits are permanent, it doesn't make any sense to assign a number to the interface to receive calls (there are no calls) consequently, you cannot configure a 'local address'.

b) Interface configured as Primary ISDN

If, on the other hand, you wish to use the interface as Primary ISDN, channel 16 is not available as this is used for signaling (channel D). The rest of the available channels can be used as required (except 0).

In this case, you can configure the channels as permanent (*PVC*) or switched (*SVC*).

It is also possible to configure a number or a local address to which ISDN calls can be carried out.

The PVC channels are always assigned so other users cannot use them. The SVCs however are assigned at the moment the call is produced in order to establish the data link and therefore are shared among all the possible users (the channel through which the communication is going to be established is unknown at priori).

1.2. CRC-4

When it is necessary to provide additional protection for frame alignment simulation and/or when you wish to count on a better error monitoring capacity, you can use the *CRC-4, cyclic redundancy check-4 method*. This procedure is extensively described in the G.704 recommendation. Generally this process uses the channel 0 bits series (frame bits numbered from 1 to 8) in order to determine if this functionality is active and to carry out an encoding/decoding to check that the frame arrives aligned etc.

The router can be configured to operate whether the CRC-4 procedure is applied or not.

> *NOTE: When configuring the router, you must bear in mind the possibility of interoperation with other devices which do not permit CRC-4. This means you must enable or disable according to the devices operating together.*

1.3. MAXIMUM FRAME SIZE

This permits you to establish a maximum frame size through the interface. The maximum size can be configured afterwards so that each channel cannot exceed the 'general' maximum size.

1.4. MODE

The mode option refers to the clock signals. In the terminal devices, the network supplier provides the clock signal received by the router. However on some occasions it may be necessary that one of the devices provides the clock signals. Under these circumstances you must advice the indicated router to provide these signals.

2. E1/PRI ISDN Configuration Commands

The E1/PRI ISDN configuration commands are described in this section. Through these commands you can configure the router behavior over this interface in order to achieve the functional specifications required.

The commands available here can be seen in the below table:

Command	Function
? (HELP)	Permits you to view the available commands or their options.
DISABLE	Disables the CRC-4.
ENABLE	Enables the CRC-4.
LIST	Displays the interface configuration information.
SET	Permits you to configure the value for various interface parameters according to the required option.
EXIT	Returns to the configuration *Config>* prompt.

The letters written in **bold**, are the minimum number of characters required to activate the command.

Accessing the E1/PRI ISDN Configuration environment

The configuration commands must be entered at the E1/PRI ISDN interface configuration prompt (E1/PRI config>). In order to access this prompt:

1. At the configuration prompt (Config>), the list of interfaces and associated interface number is displayed through the **LIST DEVICES** command.
2. Enter the command **NETWORK** followed by the interface number associated to the **E1/PRI ISDN** interface.

Example:

```
Config>LIST DEVICES

Con     Ifc Type of interface               CSR      CSR2   int
---       2 PPP Generic Dial                    0             0
---       3 PPP Generic Dial                    0             0
---       4 Router->Node                        0             0
---       5 Node->Router                        0             0
ISDN 1    1 G.703 port (E1)               F001600  F000C00   9E
LAN       0 Ethernet                      A000000            1D
WAN1      6 X25                           F001620  F000D00   9D
Config>NETWORK 1

-- E1 / Primary ISDN Configuration --
E1/PRI config>
```

2.1. ? (HELP)

Use the **?** command (HELP) in order to list the valid commands at the layer where the router is programmed. You can also use this command after a specific command in order to list the available options.

Syntax:

```
E1/PRI config>?
```

Example:

```
E1/PRI config>?
DISABLE
ENABLE
SET
LIST
EXIT
E1/PRI config>
```

2.2. DISABLE

The **DISABLE** command disables the use of the CRC-4, cyclic redundancy check-4 method in the interface.

Syntax:

```
E1/PRI config>DISABLE CRC-4
```

Example:

```
E1/PRI config>DISABLE CRC-4
E1/PRI config>
```

2.3. ENABLE

The **ENABLE** command enables the use of the CRC-4, cyclic redundancy check-4 method in the interface.

Syntax:

```
E1/PRI config>ENABLE CRC-4
```

Example:

```
E1/PRI config>ENABLE CRC-4
E1/PRI config>
```

> *NOTE: In cases where you wish to enable this parameter, you must make sure that the devices, which are going to interact, are capable of supporting CRC-4.*

2.4. LIST

The **LIST** command permits you to display the interface configuration, including the general parameters and those for each independent channel.

Syntax:

```
E1/PRI config>LIST
```

Example:

```
E1/PRI config>LIST

CRC-4                   : Enabled
Local address           :
Maximum frame length    : 2048
Interface type          : PRI ISDN
Mode                    : EQUIPMENT


           B-01 B-02 B-03 B-04 B-05 B-06 B-07 B-08 B-09 B-10
---------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
MTU        2048 2048 2048 2048 2048 2048 2048 2048 2048 2048
Type        svc  svc  svc  svc  svc  svc  svc  svc  svc  svc

           B-11 B-12 B-13 B-14 B-15 B-17 B-18 B-19 B-20 B-21
---------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
MTU        2048 2048 2048 2048 2048 2048 2048 2048 2048 2048
Type        svc  svc  svc  svc  svc  svc  svc  svc  svc  svc

           B-22 B-23 B-24 B-25 B-26 B-27 B-28 B-29 B-30 B-31
---------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----
MTU        2048 2048 2048 2048 2048 2048 2048 2048 2048 2048
Type        svc  svc  svc  svc  svc  svc  svc  svc  svc  svc

E1/PRI config>
```

2.5. SET

The **SET** command permits you to configure various parameters both global (the whole interface) and parts of a determined circuit.

Syntax:

```
E1/PRI config>SET <option, parameter, value>
```

> *NOTE: If you do not enter all the necessary parameters in the command line, the device will request these.*

```
E1/PRI config>SET ?
CIRCUIT
GLOBAL
```

a) SET CIRCUIT

Permits you to establish each circuit's own parameters.

Syntax:

```
E1/PRI config>SET CIRCUIT ?
MAX-FRAME-LENGTH
TYPE
```

• *SET CIRCUIT MAX-FRAME-LENGTH*

Through this parameter, you can configure the maximum frame length through the specified channel. The permitted values are 1024, 2048 and 4096 bytes. The default value is 2048 bytes.

Syntax:

```
E1/PRI config>SET CIRCUIT MAX-FRAME-LENGTH <circuit_number, maximum_frame_size
```

Example:

```
E1/PRI config>SET CIRCUIT MAX-FRAME-LENGTH
Enter circuit (1-31)[1]?2
Maximum frame length (1024,2048,4096)[2048]?4096
E1/PRI config>
```

> NOTE: The maximum frame length associated to a circuit cannot exceed that configured for the interface.

• *SET CIRCUIT TYPE*

This configures the type of connection to be established over the circuits (channels).

Syntax:

```
E1/PRI config>SET CIRCUIT TYPE <circuit_type, circuit_number>
```

This can be **P**ERMANENT or **S**WITCHED.

```
E1/PRI config>SET CIRCUIT TYPE ?
PERMANENT
SWITCHED
```

Example:

```
E1/PRI config>SET CIRCUIT TYPE SWITCHED
Enter circuit (1-31)[1]?
E1/PRI config>
```

or

```
E1/PRI config>SET CIRCUIT TYPE PERMANENT
Enter circuit (1-31)[1]?
E1/PRI config>
```

> NOTE: When you configure the interface as E1, you cannot configure the type of circuit as these are permanent.

b) SET GLOBAL

Configures the interface global parameters.

Syntax:

```
E1/PRI config>SET GLOBAL ?
MAX-FRAME-LENGTH
LOCAL-ADDRESS
INTERFACE-TYPE
MODE
```

• SET GLOBAL INTERFACE-TYPE

Establishes the interface behavior: as E1 (**E**1) or as Primary ISDN (**PRI**).

Syntax:

```
E1/PRI config>SET GLOBAL INTERFACE-TYPE <interface_type>
```

```
E1/PRI config>SET GLOBAL INTERFACE-TYPE ?
E1
PRI
```

Example:

```
E1/PRI config>SET GLOBAL INTERFACE-TYPE E1
E1/PRI config>
```

or

```
E1/PRI config>SET GLOBAL INTERFACE-TYPE PRI
E1/PRI config>
```

• SET GLOBAL LOCAL-ADDRESS

Establishes the local ISDN number associated to the interface in order to receive calls (this parameter is only significant when the interface is a PRI ISDN).

Syntax:

```
E1/PRI config>SET GLOBAL LOCAL-ADDRESS <ISDN_number>
```

Example:

```
E1/PRI config>SET GLOBAL LOCAL-ADDRESS
Local address []?913141592
E1/PRI config>
```

- *SET GLOBAL MAX-FRAME-LENGTH*

The maximum frame length through the interface is configured through this parameter. The permitted values are 1024, 2048 and 4096 bytes. The default value is 2048 bytes.

Syntax:

```
E1/PRI config>SET GLOBAL MAX-FRAME-LENGTH <maximum_frame_size>
```

Example:

```
E1/PRI config>SET GLOBAL MAX-FRAME-LENGTH
Maximum frame length (1024,2048,4096)[2048]?
E1/PRI config>
```

- *SET GLOBAL MODE*

This configures the device functionality as **E**QUIPMENT (the router will receive external clock signals and act as a 'terminal') or **L**INE (the router supplies the line clocks and acts as the 'network').

Syntax:

```
E1/PRI config>SET GLOBAL MODE <mode>
```

```
E1/PRI config>SET GLOBAL MODE ?
EQUIPMENT
LINE
```

Example:

```
E1/PRI config>SET GLOBAL MODE EQUIPMENT
E1/PRI config>
```

or

```
E1/PRI config>SET GLOBAL MODE LINE
E1/PRI config>
```

2.6. EXIT

Through this command, you exit the E1/PRI ISDN interface configuration menu and return to the configuration *Config>* prompt.

Syntax:

```
E1/PRI config>EXIT
```

Example:

```
E1/PRI config>EXIT
Config>
```

1. E1/PRI ISDN interface monitoring

This section summarizes and explains all the E1/PRI ISDN interface monitoring commands. These commands permit you to monitor the interface behavior.

The available monitoring commands are seen in the below table:

Command	Function
? (HELP)	Permits you to list the available commands and their options.
CALLS	Displays the calls produced.
CAUSE	Returns the meanings of the call release codes.
CLEAR	Permits you to initialize the channel statistics and clear the released calls buffer.
STATE	Displays the state and statistics of a B channel physical level.
STATISTICS	Displays the statistics of an active B channel.
EXIT	Returns to the global monitoring prompt (+).

The letters written in **bold**, are the minimum number of characters required to activate the command.

Accessing the E1/PRI ISDN Monitoring environment

The E1/PRI ISDN interface monitoring commands must be entered at the *E1/PRI>* monitoring prompt. In order to access this prompt you need to carry out the following steps:

1. At the monitoring prompt (+), the list of interfaces and associated interface number is displayed through the **DEVICES** command.
2. Enter the command **NETWORK** followed by the interface number associated to the E1/PRI ISDN interface.

Example:

```
+DEVICE

                             Auto-test   Auto-test    Maintenance
Ifc   Interface    CSR    Vect   valids    failures      failures
0     Eth/0     A000000    1d        1          0             0
1     PRI/0     F001600    9e        1          1             0
2     PPP/0           0     0        1          2             0
3     PPP/1           0     0        1          2             0
4     R->N/0          0     0        1          0             0
+NETWORK 1

-- E1 / Primary ISDN Console --

E1/PRI>
```

1.1. ? (HELP)

Use the **?** command (HELP) in order to list the valid commands at the layer where the interface is being monitored. You can also use this command after a specific command in order to list the available options.

Syntax:

```
E1/PRI>?
```

Example:

```
E1/PRI>?
CLEAR
CAUSE
STATISTICS
STATE
CALLS
EXIT
E1/PRI>
```

1.2. CALLS

Information on the calls is displayed through the **CALLS** command:

       ACTIVE: displays data on the active calls

       CLEARED: displays information on the released calls.

Syntax:

```
E1/PRI>CALLS <call_type>
```

```
E1/PRI>CALLS ?
ACTIVE
CLEARED
```

a) CALLS ACTIVE

Example:

```
E1/PRI>CALLS ACTIVE

TYPE   CALLED NUMBER     CALLING NUMBER REF   CHAN    T/START    D/START     CHARGE
OUT          384200                     001   1-B1    17:11:47  01/20/00    000000

E1/PRI>
```

The meaning of the various fields is as follows:

TYPE   Incoming (IN) or outgoing (OUT).

CALLED NUMBER   Telephone number called.

CALLING NUMBER   Number of telephone calling.

REF   Value of call reference in use.

CHAN	This is the line and channel through which the call has been established.
T/START	Indicates the time the call was established.
D/START	Indicates the day the call was established.
CHARGE	Cost of the call (if the network provides this).

b) CALLS CLEARED

Example:

```
E1/PRI>CALLS CLEARED


L T    CALLED N.  CALLING N. CC  DC  T/START    T/END  D/START    D/END CHARGE
1 O     384200              016 000 16:48:05 17:10:57 01/20/00 01/20/00 000000

E1/PRI>
```

The meaning of the various fields is as follows:

L T	Line identifier and channel type.
CALLED N.	Telephone number called.
CALLING N.	Number of telephone calling.
CC	Call release code (cause).
DC	Diagnostic code.
T/START	Time the call was established.
T/END	Time the call was released.
D/START	Day the call was established.
D/END	Day the call was released.
CHARGE	Cost of the call (if the network provides this).

> *NOTE: In cases of **Permanent** links, calls are not generated as the links are permanently established.*

1.3. CAUSE

The **CAUSE** command returns the meaning of a specific release code. This command is for informative purposes in order to make it easier to understand the presented data.

Syntax:

```
E1/PRI>CAUSE <cause_code>
```

Example:

```
E1/PRI>CAUSE 3
Cause (3):  No route to the destination

E1/PRI>
```

1.4. CLEAR

CLEAR enables you to delete the statistics of a specific channel or all of them such as the released calls buffer.

Syntax:

```
E1/PRI>CLEAR <option>
```

```
E1/PRI>CLEAR ?
STATISTICS
CALLS
```

a) CLEAR CALLS

Clears the released calls buffer.

Example:

```
E1/PRI>CLEAR CALLS
E1/PRI>
```

b) CLEAR STATISTICS

Deletes the B channel statistics. If you specify a channel number it will only delete the statistics relevant to that channel while if you do not indicate a number all the statistics for all the channels are deleted.

Syntax:

```
E1/PRI>CLEAR STATISTICS <[channel]>
```

Example:

```
E1/PRI>CLEAR STATISTICS 5
E1/PRI>
```

1.5. STATE

The **STATE** command displays a B channel's physical layer statistics and state.

Syntax:

```
E1/PRI>STATE <channel>
```

Example:

```
E1/PRI>STATE 15


        Statistics circuit B-15

 Lost Rx Frames            0   Non aligned Rx frames        0
 Too large frames          0   Aborted Rx sequences         0
 CRC error Rx frames       0   Incomplete Rx frames         0
 Rx fifo failure           0   Tx fifo failure              0


E1/PRI>
```

The meanings of the fields that appear above are the following:

Lost Rx Frames	Frames lost at reception.
Too large frames	Frames received that exceed the MTU maximum length.
CRC error Rx frames	Frames received with an error in the CRC code.
Rx fifo failure	Errors due to the reception buffer being unable to store all the frames on reception.
Non-aligned Rx frames	Received frames non-aligned to octet.
Aborted Rx sequences	Illegal sequence of '1's found in the frame.
Incomplete Rx frames	Incomplete frames.
Tx fifo failure	Errors in the frame transmission as the interface is incapable of taking the frames from the transmission buffer sufficiently fast enough in order to transmit them.

1.6. STATISTICS

The **STATISTICS** command displays the B channels statistics. If you do not indicate a specific channel the device displays a statistics list for all the B channels.

Syntax:

```
E1/PRI>STATISTICS <[channel]>
```

Example:

```
E1/PRI>STATISTICS 1
Circuit   Pkts Rx     Bytes Rx      Pkts Tx     Bytes Tx
B-1         2849       167498         2849       167503
E1/PRI>
```

1.7. EXIT

Through this command you return to the global monitoring prompt (+).

Syntax:

```
E1/PRI>EXIT
```

Example:

```
E1/PRI>EXIT
+
```

2. E1/PRI ISDN interface statistics

In order to view the interface statistics, enter the **DEVICE** command indicating the number of the interface whose statistics you wish to view at the monitoring prompt (+).

Example:

```
+DEVICE

                              Auto-test   Auto-test     Maintenance
Ifc  Interface    CSR   Vect     valids    failures        failures
0    Eth/0     A000000    1d          1           0               0
1    PRI/0     F001600    9e          0           0               0
2    PPP/0           0     0          1           2               0
3    PPP/1           0     0          1           2               0
4    R->N/0          0     0          1           0               0
+DEVICE 1

                              Auto-test   Auto-test     Maintenance
Ifc  Interface    CSR   Vect     valids    failures        failures
1    PRI/0     F001600    9e          0           0               0


   -- DS2153Q --
Rx Status: OK
RIR:89   SSR:00   SR1:50   SR2:FB  VCR:   0  FAS:   0

Layer 1 status: F1


+
```

The meaning of the fields is as follows:

Ifc	Interface number.
Interface	Type of interface and index.
CSR	control/status/data register address.
Vect	Interruption vector associated to the interface.
Auto-test valids	Number of successful Auto-tests.
Auto-test failures	Number of failed Auto-tests.
Maintenance failures	Number of maintenance failures.
Rx Status	Reception Status.
RIR, SSR, SR1, SR2, VCR, FAS	Information on the status of the chip.
Layer 1 status	Physical layer status.