



Multiplexer
FMUX / 16E1
16 E1 Channels
Installation and Operation Manual

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Safety Precautions



An exclamation point enclosed in a triangle warns the user about important operations and maintenance instructions for the device.

It is mandatory to observe the existing safety rules during installation, operation, and maintenance of the device. Installation, maintenance, and repair operations must be performed only by qualified and certified personnel. Installation, maintenance, and repair operations may not be performed by the operator or the user.

Certificate of Conformance # OS / 1-SP-831



FMUX multiplexer equipment has been tested in the communication hardware and systems testing center of CNIIS of the Ministry of Communication of Russian Federation and has been acknowledged to comply the following technical specifications:

- RD 45.100-2000 «Technical requirements for the equipment of fiber optic transmission path of plesiochronous digital hierarchy»
- «Technical requirements for the 2/8 Mbps second order digital multiplex equipments of digital transmission systems», approved by the Ministry of Communications of the Russian Federation, January 17, 1997
- «Technical requirements for the 2/34 Mbps third order digital multiplex equipments of digital transmission systems», approved by the Ministry of Communications of the Russian Federation, January 17, 1997
- GOST R ISO 9001-96.

FMUX multiplexer hardware is admitted to be used in the interconnected communication network of the Russian Federation as second and third order digital multiplex equipment with optical transmission path.

Cronyx Engineering reserves the right to make changes to technical characteristics and design of the device without the prior notification of customers.

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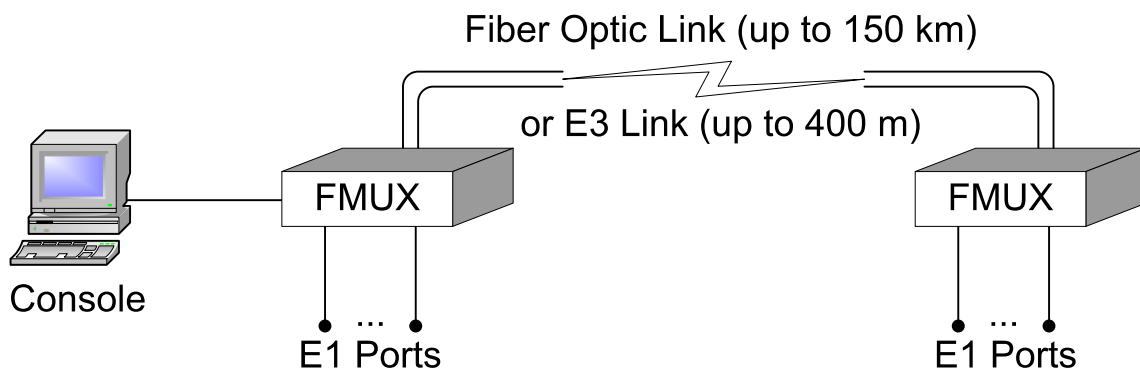
Chapter 1. Introduction

1.1. Application

FMUX/16E1 is a multiplexer that allows the transmission of sixteen E1 channels via fiber optic or E3 link.

Note. Hereinafter the term «E1» is used for a designation of the data link having the interface at nominal bit rate of 2048 kbps in conformity with the ITU-T Recommendation G.703, and operated in both framed mode in conformity with the ITU-T Recommendation G.704 (or with the IKM-30) and unframed (transparent) mode.

The figure below shows the product application diagram:



Each E1 channel is transmitted independently so that the clock frequency of each channel should not depend on other channels clock frequencies.

1.2. Basic Features of the FMUX Family of Multiplexers

- Transmission of four, eight or sixteen E1 channels via fiber optic link (16-channel version may be ordered with E3 link option)
- Single mode or multimode fiber
- Distance up to 150 km
- Single fiber transmission option
- Models with additional Ethernet 10/100Base-T or V.35/RS-530/RS-449/RS-232 ports
- Model with Ethernet 10/100Base-T port operates in remote bridge mode and supports VLAN protocol
- Compliance with ITU-T G.703, G.704, G.742, G.751, G.823, G.955, O.151 and IEEE 802.3 standards
- Local and remote loopbacks
- Integrated BER tester
- Console RS-232 port
- SNMP-based management option (via dedicated Ethernet 10Base-T port)
- Alarm interface («dry contacts» relay)
- Stand-alone or 1U 19-inch rack-mount version
- AC or DC power.

The device operation may be controlled from the console (ASCII terminal connected to the RS-232 control port). The device may be equipped with the dedicated Ethernet 10Base-T port to support SNMP-based management.

The multiplexer's front panel indicators display the channels availability, loopbacks enable and testing modes.

The built-in BER tester allows the error level measurement in the E1 link. The measurements are performed on the fixed or pseudorandom code subject to the ITU-T Recommendation O.151 guidelines (supported length of sequence is $2^{23}-1=8388607$ bits).

There is a capability of remote login to control the remote device operation from the console port of the local device (this mode may be useful if there is no service personnel on the remote end of the link). Commands are transmitted to the remote device via additional monitoring channel.

The device is equipped with an emergency alarm relay. The state of the relay on the local device depends on fault conditions detected and may be controlled from the remote device. The relay operates in «dry contacts» mode and may be used for prompt maintenance (according to the ITU-T Recommendations G.742 and G.751).

The firmware of the device may be updated by user. The instructions for updating the firmware may be found at the www.cronyx.ru web site.

1.3 Ordering Information

FMUX / 16E1 — TS13 / FC — SNMP — AC

Ports: ———— ↑
/16E1 — 16 E1 ports

Electric power: ↑
-AC — ~176...264VAC
-DC — =36...72VDC

- Line module:** ———— ↑
- TM13 — MM, LED, 1310 nm;
up to 2 - 5 km
 - TS13 — SM, FP LD, 1310 nm;
up to 40 - 80 km
 - TS15 — SM, DFB LD, 1550 nm;
up to 80 - 150 km
 - TW13 — SM, FP LD, 1310 nm;
single fiber; up to 40 -
60 km
 - TW15 — SM, DFB LD, 1550 nm;
single fiber; up to 40 -
60 km
 - E3 — E3 interface

SNMP-based management option: dedicated Ethernet 10Base-T port

Connector:
/FC — FC type, optical
/ST — ST type, optical
/BNC — BNC type, coaxial
(for E3 module)

SM — single mode fiber
MM — multimode fiber

1.4. Technical Specifications

Optical Transceiver

	Optical Module				
	TM13	TS13	TS15	TW13	TW15
Fiber Type	Multimode, 50/125	Single Mode, 9/125	Single Mode, 9/125	Single Mode, 9/125	Single Mode, 9/125
No. of Fibers	Two	Two	Two	One	One
Minimum Fiber Optic Cable Power Budget	13 dB	29 dB	29 dB	26 dB	26 dB
Fiber Optic Cable Minimum Length Limitation	No	No	No	No	No
Maximum Fiber Optic Cable Length	2 - 5 km	40 - 80 km	80 - 150 km	40 - 60 km	40 - 60 km
Note				Uses WDM, requires the TW15 optical module at the opposite end of fiber	Uses WDM, requires the TW15 optical module at the opposite end of fiber
Transmitter					
Transmitter Type	LED	FP LD	DFB LD	FP LD	DFB LD
Wavelength	1310 nm	1310 nm	1550 nm	1310 nm	1550 nm
Optical Output Power	-19 dBm	-5 dBm	-5 dBm	-8 dBm	-8 dBm
Spectral Width	200 nm	3 nm	1 nm	3 nm	1 nm
Receiver					
Maximum Input Optical Power	-14 dBm	-3 dBm	-3 dBm	-3 dBm	-3 dBm
Receiver Sensitivity	-32 dBm	-34 dBm	-34 dBm	-34 dBm	-34 dBm

E1 Port Interface

Nominal bit rate	2048 kbps
Line code.....	HDB3
Framing	Transparent stream transmission either with framing (Framed G.704) or without framing (Unframed G.703)
Error detection	Code violation
Line impedance	120 Ohm symmetric (twisted pair)
Receiver signal level	From 0 up to -12 dB
Jitter attenuation.....	In transmit path
Overvoltage protection.....	TVS
Overcurrent protection	Fuse
Connector type	RJ-48 (8-wire socket)

E3 Link Interface

(for the «-E3/BNC» version)

Nominal bit rate	34.768 Mbps
Line code.....	HDB3
Error detection	Code violation
Line impedance	75 Ohm (coax cable)
Receive signal attenuation range	From 0 to -15 dB (up to 440 m)
Overvoltage protection.....	TVS
Overcurrent protection	Fuse
Connector type	BNC

Alarm Port Interface

Connector type	DB-9 (female)
Relay contact current	Up to 600 mA
Relay contact voltage.....	Up to 110 VDC or up to 125 VAC

Console Port Interface

Interface type, connector type	RS-232 DCE, DB-9 (female)
--------------------------------------	---------------------------

Data transfer mode.....	Asynchronous, 9 600 baud, 8 bits per character, 1 stop bit, no parity
Modem signals.....	DTR, DSR, CTS, RTS, CD

SNMP Port Interface

(for the «-SNMP» version)

Interface type.....	Ethernet 10Base-T
Connector type.....	RJ-45 (8-wire socket)

Diagnostic Modes

Loopbacks.....	Local, remote
Error rate measurement.....	Built-in BER tester
Control.....	Via the console port, from a remote device, via the SNMP port <i>(for the «-SNMP» version)</i>

Mechanical Characteristics

Construction.....	1U rack mount for 19-inch cabinet
Dimensions.....	444 mm x 262 mm x 44 mm
Weight.....	3.4 kg

Power Requirements

AC supply voltage.....	176–264 VAC, 50 Hz <i>(for the «-AC» version)</i>
DC supply voltage.....	36–72 VDC <i>(for the «-DC» version)</i>
Max. power consumption.....	20 VA

Environmental Characteristics

Temperature.....	0 to 50 °C
Relative humidity.....	Up to 80%, non-condensing

Section 2. Installation

2.1. Site Requirements

The device should be grounded properly before powering on. Grounding screw located on the front panel of the device.

Allow at least 10 cm clearance at the front of the device for cable connections.

The ambient operating temperature should be 0 to 50 °C, at a relative humidity of up to 80%, non-condensing.

2.2. Optical Link Power Budget Precautions

All components of fiber optic link are subjected to ageing (cable's attenuation tends to raise and parameters of optical transceiver tend to degrade with time).

For the reliable operation it is recommended to ensure that optical power budget of the link be initially extended by 10 to 25 % to compensate the ageing effects.

2.3. Features of WDM Single Fiber Optical Transceivers

Single fiber optical transceivers TW13 and TW15 apply the WDM technology to transmit signals in the opposite directions using different wavelengths of laser light. Thus the use of the TW13 transceiver at one end of the fiber assumes the TW15 be used at the opposite end of the fiber.

Requirements to optical cables and splices for single fiber WDM transceivers are the same as for two fiber ones.

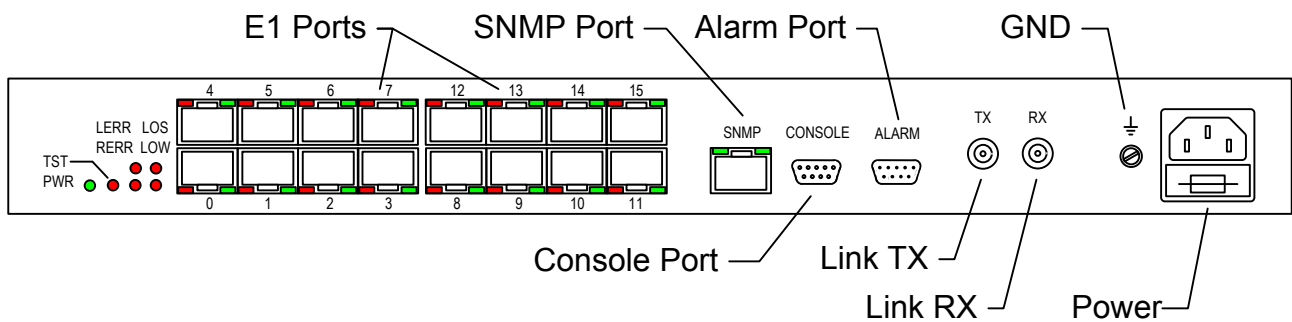
2.4. Delivered Items

FMUX unit of a version as ordered	1 piece
Bracket for mounting the FMUX unit in a 19-inch cabinet.....	2 pieces
Self-adhesive foot for the FMUX unit.....	4 pieces
Power cable (for the «-AC» version).....	1 piece

- FMUX unit grounding screw 1 piece
- 3-screw removable terminal block (for the «-DC» version) 1 piece
- This Installation and Operating manual 1 piece.

2.5. Connections

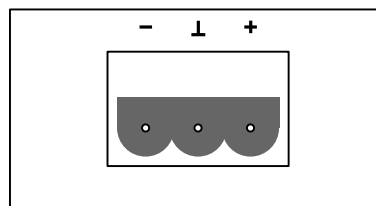
All connectors are located on the front panel of the device.



Power Connection

AC power (for the «-AC» version) is supplied to the device through a standard AC power connector (IEC 320 C14). The power cable is supplied with the device.

The DC power connector (for the «-DC» version) is shown below (view from the front of the device):



The 3-screw removable terminal block is supplied with the device.

Ground Terminal

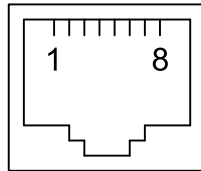
An M4 grounding screw is located on front panel of the device.



Before powering the device on and before connecting other cables, device must be properly grounded.

E1 Ports Connectors

An RJ-48 socket is provided for the E1 ports cables connection:



- 1 - output A
- 2 - output B
- 3 - unused
- 4 - input A
- 5 - input B
- 6 - unused
- 7 - unused
- 8 - unused

TX and RX Optical Link Connectors

Standard FC or ST type connectors are used to connect the fiber optic link depending on the ordering code. Use optical cables to interconnect the TX connector of local device to the RX connector of the remote one, and vice versa. (In single fiber versions of the device the only optical connector is mounted at the TX position.)



Additional care should be taken by handling optical cables and connectors:

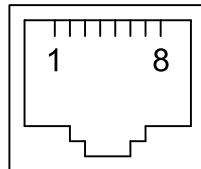
- Do not allow sharp-edged bending and twisting of optical cables.
- Do not apply excessive force by connecting optical cable to avoid damage of the optical connector.
- It is recommended to clean out optical connectors by blowing with pressurized filtered air before connecting optical cables.

TX and RX E3 Link Connectors

Standard BNC connectors are used to connect cables by interconnecting devices ordered with the «-E3/BNC» line module/connector option. Use coax cables to interconnect the TX connector of local device to the RX connector of the remote one, and vice versa.

SNMP Port Connectors

An RJ-45 sockets are provided for connection cables to Ethernet 10Base-T port for SNMP-based management:



- 1 - transmit +
- 2 - transmit -
- 3 - receive +
- 4 - unused
- 5 - unused
- 6 - receive -
- 7 - unused
- 8 - unused

Use straight cable to connect the device to Ethernet hub.

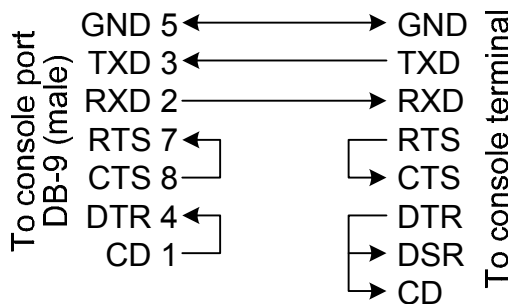
Console Port Connector

Device operation may be controlled from the ASCII terminal (the console). DB-9 (female) connector is used to connect the console. Console port has a standard RS-232 DCE interface and should be used in asynchronous operating mode, 9600 bps rate, 8 bit per character, 1 stop bit, no parity. Use straight cable to connect to the computer COM port.



An RTS signal (for flow control) from the console terminal is required for proper operation.

The following cable wiring schemes are recommended:



Cable without modem control

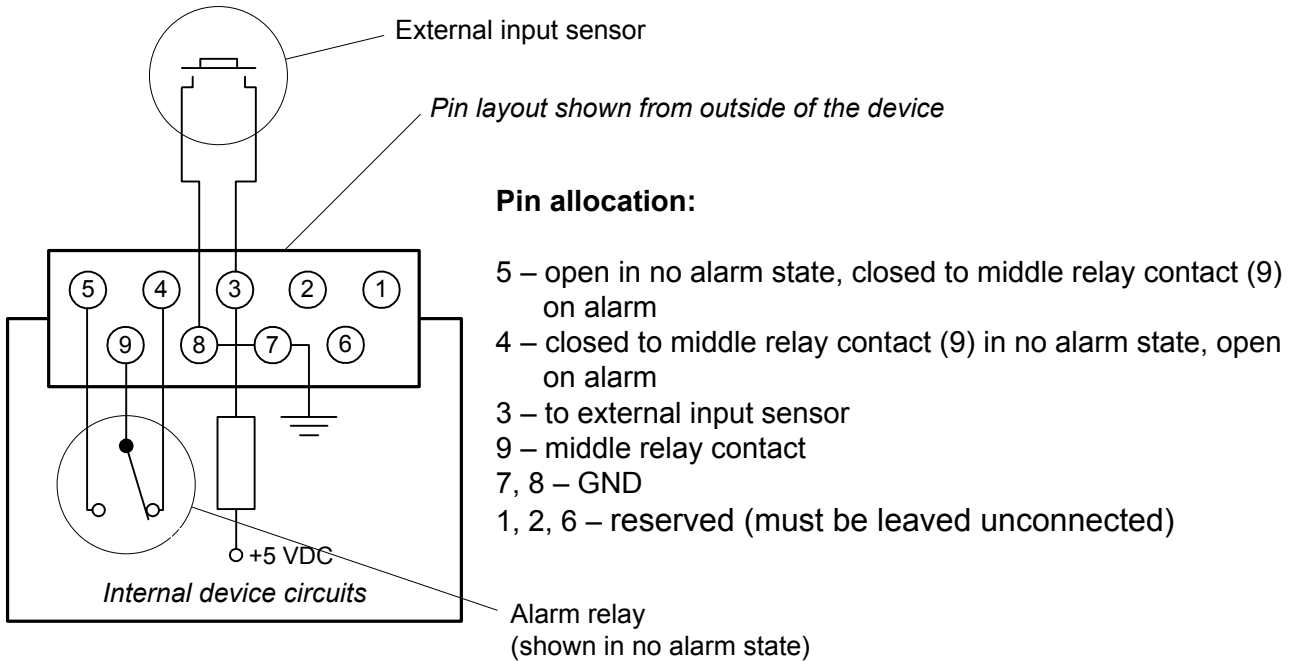


Cable with modem control

Use straight cable to connect to the COM port of the computer.

Alarm Port Connector

A DB-9 (female) connector is used for alarm port connection:

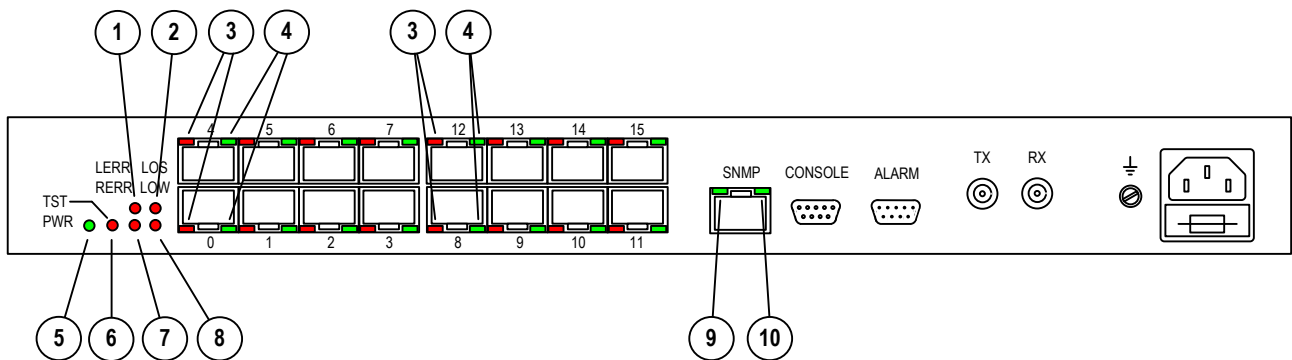


The external input sensor connected to the modem must be isolated from other electrical circuits. Failure to comply with this requirement may lead to modem breakdown.

Chapter 3. Operation

3.1. Front Panel Indicators

The indicators displaying the device status are located on the front panel. The list of indicators and their purpose are shown in the table.



The reference numbers on the figure correspond to the numbers in the table.

No.	Indicator	Color	Function
1	LERR	Red	Link errors indication On or blinking: High link input signal error rate On: Test pattern is being received, local link loopback enabled On or blinking: BER tester errors, test mode enabled (TST indicator is on)
2	LOS	Red	On: link input carrier is lost
3	PORT LOS	Red	E1 port errors indication Blinking: E1 port HDB3 coding errors On: E1 port input carrier is lost On: AIS is being received at E1 port input
4	PORT STATE	Green	E1 port state indication On: Normal operation Off: Port unused Blinking: Port loopback enabled
5	PWR	Green	On: Unit powered Off: Unit not powered

No.	Indicator	Color	Function
6	TST	Red	Test mode indication On: BER tester enabled towards the link Blinking: Local link loopback enabled Blinking in double flashes: Remote link loopback enabled
7	RERR	Red	Remote device errors indication (link input carrier is present) On or blinking: Input carrier or frame synchronization is lost at the remote end of link
8	LOW	Red	Reserved
9	SNMP EACT	Green	SNMP port Ethernet activity indication Blinking: Ethernet data transfer in progress
10	SNMP ELINK	Green	On: Ethernet 10Base-T cable is connected to the SNMP port

During the normal operation, the indicators must be in the following states:

Indicator	Color	Light State at Normal Operating Condition
PWR	Green	On
TST	Red	Off
LOS	Red	Off
LOW	Red	Off
LERR	Red	Off
RERR	Red	Off
PORT LOS	Red	Off
PORT STATE	Green	On: Port is in use
SNMP EACT	Green	Blinking: Ethernet 10Base-T data transmission via the SNMP port is in progress
SNMP ELINK	Green	On: Ethernet 10Base-T cable is connected to the SNMP port

3.2. Alarm Conditions

The device is equipped with an alarm interface.

The alarm relay is used for turning on an external alarm unit (e.g. bell, buzzer, control panel indicator, etc.) during an emergency situation.

The alarm relay is used in «dry contacts» mode (that is, its contacts are isolated from any electrical circuits of the device).

Alarm conditions are as follows:

- Power failure
- Loss of signal or there is no frame synchronization in the link.
- Loss of signal at least at one of E1 ports configured as «In use»
- Alarm signal generated by the external input sensor at the remote device is being received.

The external input sensor has two modes of generation of the alarm signal to be transmitted to the remote device: closing-sensitive (set by default) and opening-sensitive. The mode may be changed from the console (see para. «*Sensor input*» *Command* at the chapter 4.7 «*Configure*» *Menu* below).

If the device is installed in a non-serviced room, the input sensor contacts may be driven, for example, by remote climate sensors, door opening sensors, etc.

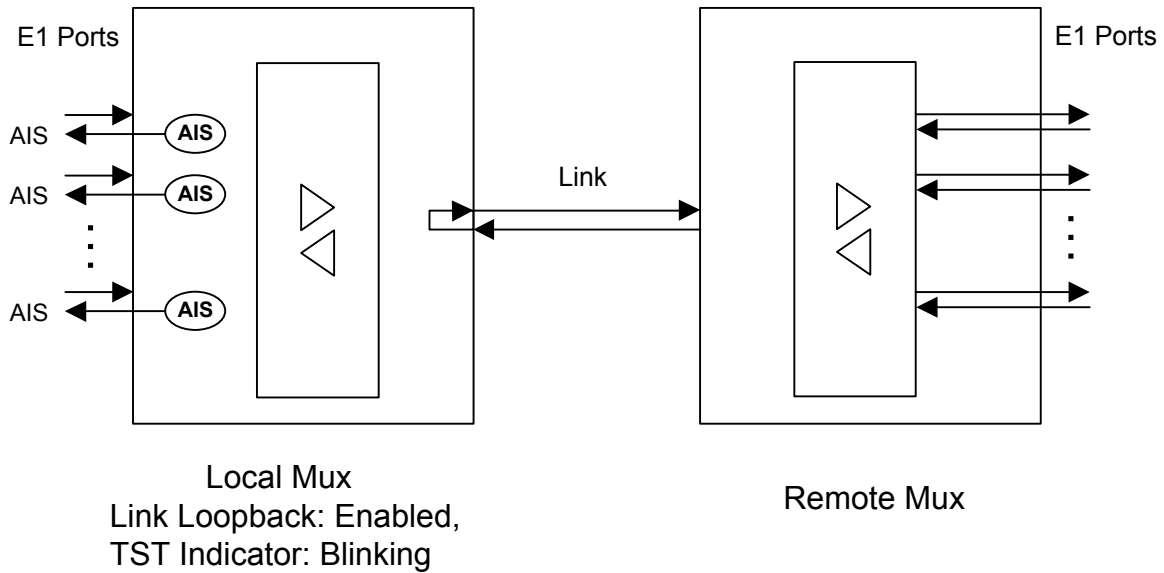
For more details please see the schematics at para. *Alarm Port Connector* of the chapter 2.5. *Connections* above.

3.3. Device Response to Special Conditions

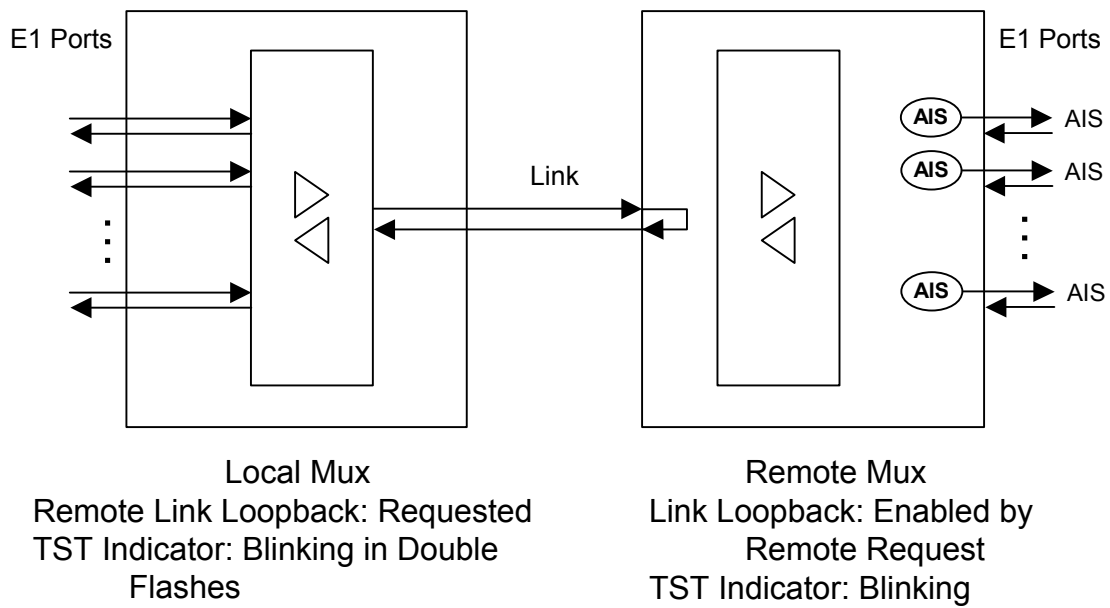
Condition	Local Device		Remote Device	
	Indicators and Relay	AIS Output to E1 Ports	Indicators and Relay	AIS Output to E1 Ports
Power failure	All indicators: Off Relay: Alarm		LOS: On Relay: Alarm	To all ports
Loss of input signal from link	LOS: On Relay: Alarm	To all ports	RERR: On	
High link input signal error rate	LERR: On Relay: Alarm	To all ports	RERR: On	
E1 port N configured as «Unused»	PORT N STATE: Off			
Loss of E1 port N input signal (port is «In use»)	PORT N LOS: On Relay: Alarm			To port N
Loss of E1 port N input signal (port is «Unused»)	PORT N STATE: Off			To port N
AIS is being received at the E1 port N	PORT N LOS: On			To port N
Local link loopback is enabled	TST: Blinking	To all ports		
Remote link loopback is enabled	TST: Blinking in double flashes		TST: Blinking	To all ports
E1 port N loopback is enabled	PORT N STATE: Blinking			To port N

3.4. Loopbacks

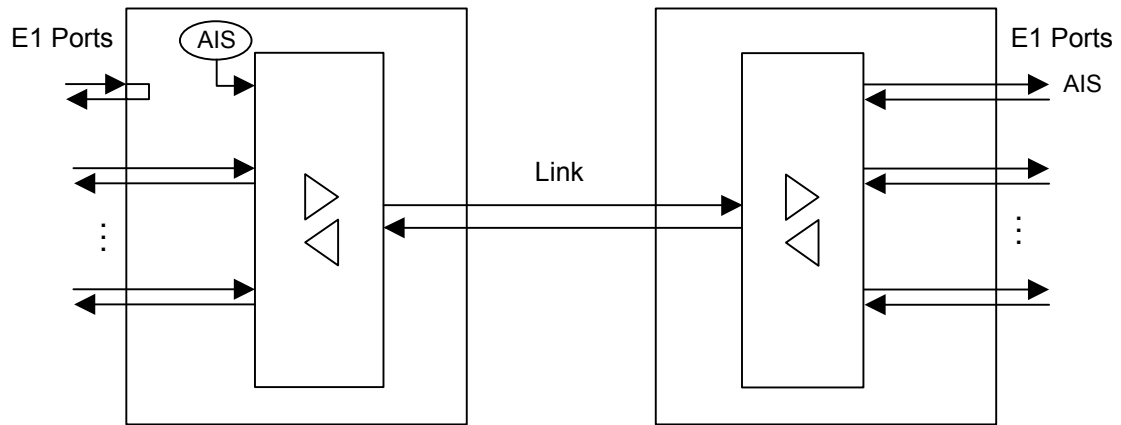
Local Link Loopback



Remote Link Loopback



Port Loopback



Local Mux
Port 0 Loopback: Enabled
PORT 0 STATE Indicator:
Blinking

Remote Mux

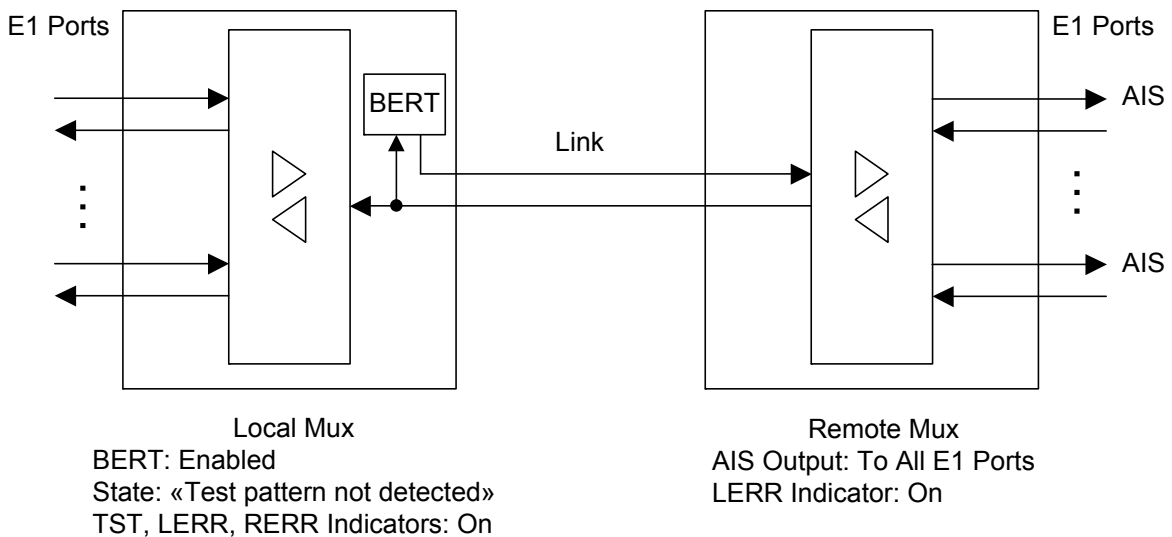
3.5. Built-in BER Tester

The device is equipped with a built-in BER tester, which allows to measure the error rates in the link. Measurements are performed using pseudo-random code according to the ITU-T Recommendation O.151 (pattern length equals to $2^{15}-1=32767$ bits), or fixed 8 bit code sequence selected by user. The BER tester is controlled from the console (see the «Test» Menu section).

The operation of the BER tester assumes that the data transmitted to the link is identical to the data received from the link.

Warning

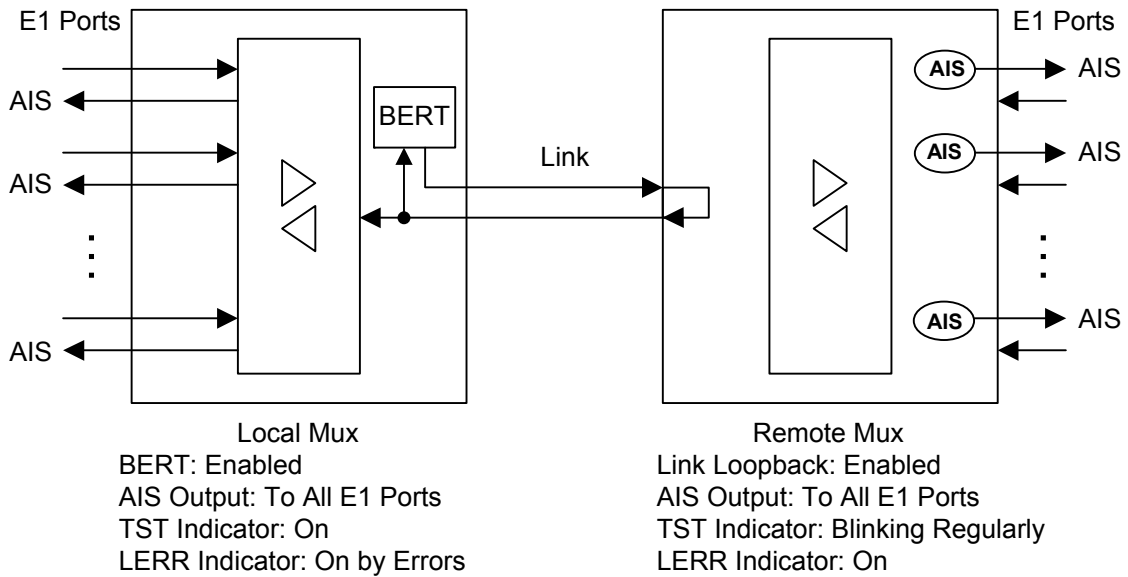
The «Test pattern not detected» diagnostic message is displayed on the console if BER tester is enabled on local device (and transmits test sequence to the E1 link) and there is no same data receiving from the link. This situation is shown on a figure below:



Shown below are two useful examples of the BER tester application.

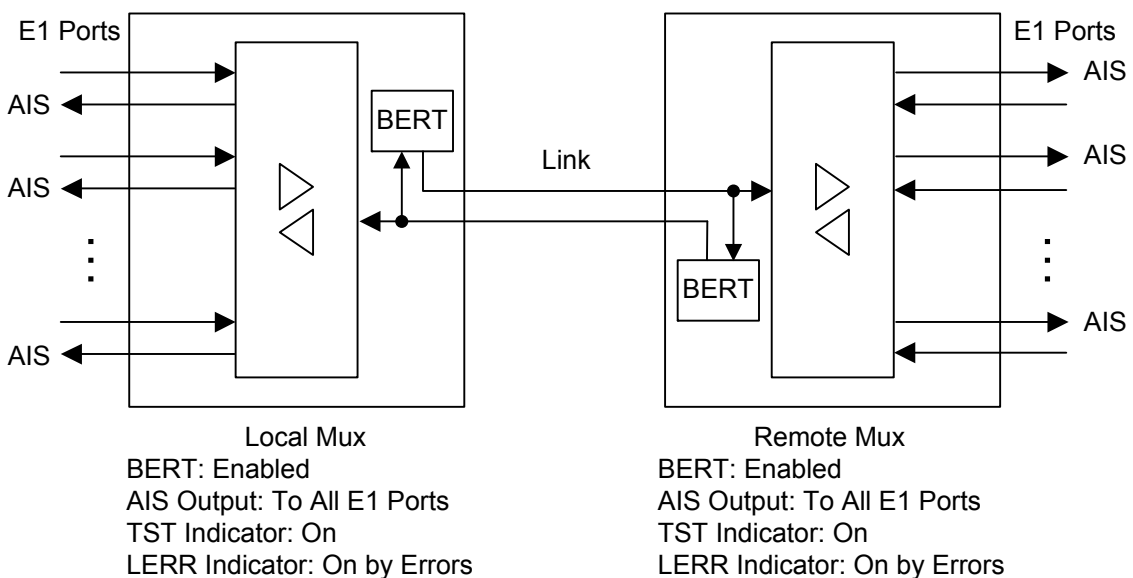
Link Testing: Remote Link Loopback Enabled

A BER tester is enabled on the local device, and an link loopback is enabled on the remote device:



Link Testing: Two BER Testers Enabled Against Each Other

When there is a need to test the link separately in opposite directions, BERTs at both ends of the link may be enabled simultaneously:



Section 4. Control From the Console

Device operation may be controlled from the ASCII terminal (the console). Console access provides capabilities to browse current device operating modes, monitor channels states and statistics counters, set configurable parameters and save them in NVRAM of the device.

4.1. Upper Level Menu

The console interface is designed as a simple hierarchical menu. To select a command, you must enter its number. To return to the upper level menu, you must press <Enter> (or <Return>). An example of the main menu is given in the figure below:

```
Cronyx FMUX / 16E1-SNMP rev. C 18/03/2005
```

```
Mode: Normal; Sensor=Open
```

```
Link: Ok
```

1. Link statistics
2. Port statistics
3. Event counters
4. Loopback...
5. Test...
6. Configure...
7. Login to remote FMUX
0. Reset

```
Command: _
```

The upper line of the screen shows the device model identification, revision code and firmware date.

The «Mode» line below on the screen shows the alarm state of the device and the state of the external input sensor:

- «Normal» or «Alarm» – normal (no alarm) state or alarm state;
- «Sensor= ...» – state of contacts of the external input sensor: «Open» or «Closed»; if «Sensor input: Alarm on open» is configured then the state of contacts will be followed by the message «Alarm on open».

For more information please see the «Alarm Conditions» chapter.

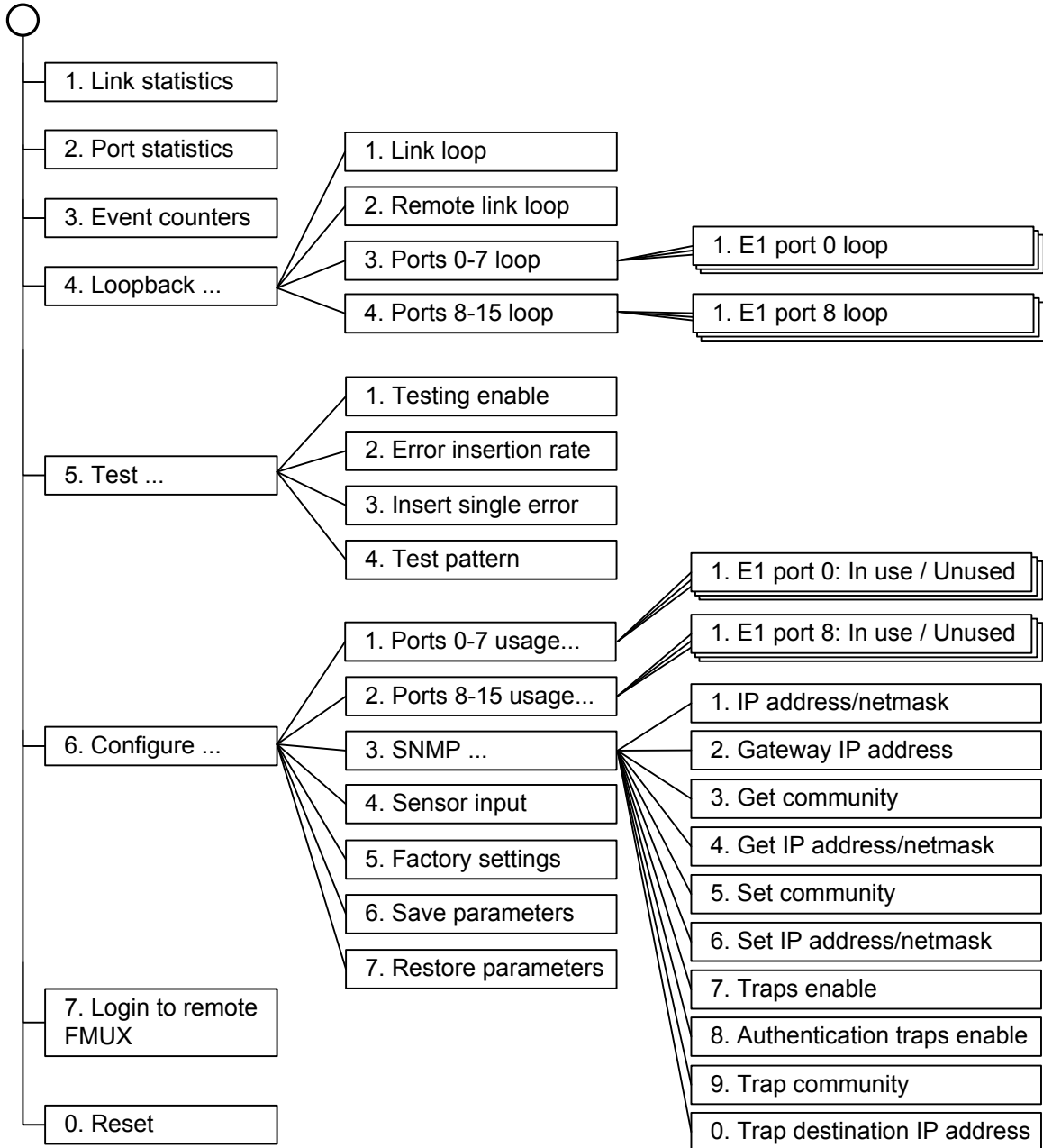
The «Link» line below on screen shows the mode of link:

-
- Ok – normal mode
 - LOS – loss of signal in the link
 - AIS – AIS is being received
 - LOF – loss of framing
 - Loop – the local link loopback is enabled
 - Remote loop – a request for a remote loop is sent.

When the BER tester is enabled towards the optical link, the next line displayed shows test result information:

- Test pattern not detected – if the test pattern was not detected in the received data
- Test error rate – error rate in the received data, from 10^{-1} to 10^{-8}
- Time total/loss – total test time (days hours:minutes:seconds)/time in the «test pattern not detected» state (seconds)
- Bit errors – data error counter
- Code – test pattern code (if constant test pattern was selected).

4.2. Menu Structure



4.3. «Link statistics» Menu

The «*Link statistics*» screen shows local and remote link status and statistics counters values.

```

Link statistics: Session #4, 0 days, 2:15:51

Mode: Normal; Sensor=Open
Link: Ok

                CV          -Errored seconds-
                0          Receive  Transmit  Status
Link:           0           0         0         ok
remote:        0           0         0         ok

C - clear counters, R - refresh mode, any key to break...

```

The information on the screen is refreshed every three seconds. To toggle refresh style between overlapping and redraw, press «R» (in the overlapping mode, the screen will not be cleared before displaying new information). To clear the local device statistics counters, press «C». Press any other key to return to the upper level menu.

The «**Link statistics**» line on screen contains the current session number and time (days, hours:minutes:seconds). The session number is incremented after each restart of the device. Session time is the time from last modem restart (by powering on or using the «Reset» command).

The «**Mode**» and «**Link**» lines in the top part of the screen show the operating mode and the state of the device and state of the link (for more details see the «Upper level menu» section).

This common information on screen is followed by lines entitled as «**Link**» and «**remote**» showing link states and associated statistics counters at local device and at remote device.

The «**Status**» column shows link state as a set of flags:

- «Ok» – normal state, frame synchronization is Ok
- «LOS» – loss of signal
- «AIS» – alarm indication signal (the «all ones» code) is being received
- «LOF» – loss of frame synchronization
- «FARLOF» – loss of frame synchronization at the remote device.

The «**CV**» column shows numbers of code violations (for «-E3/BNC» device version only).

Statistics counters columns located under the subtitle «-Errored seconds-» show times

in seconds during which various error conditions have been encountered:

- «**Receive**» – receive errored seconds: the number of seconds during which receiver errors have been detected
- «**Transmit**» – transmit errored seconds: the number of seconds during which transmitter errors have been detected.

4.4. «Port statistics» Menu

The «Port statistics» screen shows E1 ports status and statistics counters values.

```

Port statistics: Session #4, 0 days, 2:30:29

Mode: Normal; Sensor=Open

      CV      -Errored seconds-
E1 port 0:    0      Receive  Transmit  Status
E1 port 1:    0      0         -         ok
E1 port 2:    0      0         -         ok
E1 port 3:    0      0         -         ok
E1 port 4:    0      0         -         ok
E1 port 5:    0      0         -         ok
E1 port 6:    0      0         -         ok
E1 port 7:    0      0         -         ok
E1 port 8:    0      0         -         ok
E1 port 9:    0      0         -         ok
E1 port 10:   0      0         -         ok
E1 port 11:   0      0         -         ok
E1 port 12:   0      0         -         ok
E1 port 13:   0      0         -         ok
E1 port 14:   0      0         -         ok
E1 port 15:   0      0         -         ok
    
```

C - clear counters, R - refresh mode, any key to break...

The information on the screen is refreshed every three seconds. To toggle refresh style between overlapping and redraw, press «R» (in the overlapping mode, the screen will not be cleared before displaying new information). To clear the local device statistics counters, press «C». Press any other key to return to the upper level menu.

The «**Port statistics**» line on screen contains the current session number and time (days, hours:minutes:seconds). The session number is incremented after each restart of the device. Session time is the time from last modem restart (by powering on or using the «Reset» command).

The «**Mode**» line in the top part of the screen show the operating mode and the state of the device (for more details see the «Upper level menu» section).

E1 ports statistics counters and statuses are shown in columns in the middle of the screen:

- «CV» column – number of code violations
- «Receive» (located under the subtitle «-Errored seconds-») – receive errored seconds: the number of seconds during which receiver errors have been detected.

(The «Transmit» column is not used for this version of the device and contains a dash for each E1 port.)

The «Status» column shows ports state as a set of flags:

- «Ok» – normal state, frame synchronization is Ok
- «LOS» – loss of signal
- «AIS» – alarm indication signal (the «all ones» code) is being received
- «Loop» – port loopback is enabled.

State of ports configured as «Unused» is not shown.

4.5. «Event counters» Command

The «Event counters» command presents more detailed information about counters:

```
Alive: 0 days, 0:25:23 since last counter clear
```

```
Link counters
```

```
0 - loss of framing on receive
0 - receive data errors
0 - receive FIFO errors
0 - transmit FIFO errors
0 - payload checksum errors
```

```
Press any key to continue...
```

«Link counters» – link statistics counters:

- «loss of framing on receive» – counter of short-time loss of frame synchronization states on receive
- «receive data errors» – counter of receive data errors
- «receive FIFO errors» – counter of receive FIFO errors
- «transmit FIFO errors» – counter of transmit FIFO errors
- «payload checksum errors» – counter of data checksum errors.

4.6. «Loopback» Menu

The «*Loopback*» menu is used for loopbacks control:

Loopback

Mode: Normal; Sensor=Open

Link: Ok

1. Link loop: Disabled
2. Remote link loop: Disabled
3. Ports 0-7 loop...
4. Ports 8-15 loop...

Command: _

The following loopbacks are implemented:

- «**Link loop**» – local link loopback. Data received from the link are fed back.
- «**Remote link loop**» – remote link loopback. The request to enable the loopback on the remote device is transmitted towards the link.
- «**Ports 0-7 loop...**» and «**Ports 8-15 loop...**» – E1 ports loopbacks.

The loopback modes are not saved in the non-volatile memory.

«Ports 0-7 loop» and «Ports 8-15 loop» Menus

«Ports 0-7 loop» and «Ports 8-15 loop» menus are used for E1 ports loopbacks control:

Port loopback

Mode: Normal, Sensor=Open
Link: Ok

1. E1 port 0 loop: Disabled
2. E1 port 1 loop: Disabled
3. E1 port 2 loop: Disabled
4. E1 port 3 loop: Disabled
5. E1 port 4 loop: Disabled
6. E1 port 5 loop: Disabled
7. E1 port 6 loop: Disabled
8. E1 port 7 loop: Disabled

Command: _

Port loopback

Mode: Normal, Sensor=Open
Link: Ok

1. E1 port 8 loop: Disabled
2. E1 port 9 loop: Disabled
3. E1 port 10 loop: Disabled
4. E1 port 11 loop: Disabled
5. E1 port 12 loop: Disabled
6. E1 port 13 loop: Disabled
7. E1 port 14 loop: Disabled
8. E1 port 15 loop: Disabled

Command: _

Switching the «E1 port N loop» state to «Enabled» causes data received from the port N to be transmitted back.

4.7. «Test» Menu

The «Test» menu is used to control operation of BER tester:

```

Bit Error Test

Mode: Normal, Sensor=Open
Link: Ok

Time total: 00:00:00
Sync loss: 00:00:00
Bit errors: 0
Error rate: Testing disabled

1. Testing: Disabled
2. Error insertion rate: No errors inserted
3. Insert single error
4. Test pattern: Pseudo-random

<C> - clear errors counter, <R> - refresh mode, <Enter> - exit

```

The information on the screen is refreshed every three seconds. To clear the statistics counters, press «C». To toggle refresh style between overlapping and redraw, press «R» (the information on the screen is refreshed every two seconds; in the overlapping mode, the screen will not be cleared before displaying new information). To return to the upper level menu, press <Enter> (or <Return>).

The «**Testing**» command enables or disables the test data sequence generation.

The «**Error insertion rate**» command selects the error insertion rate, from 10^{-7} up to 10^{-1} errors per bit, or disables error insertion (when disabled the «No errors inserted» message will be printed in place of the error insertion rate value).

The «**Insert single error**» command inserts a single error.

The «**Test pattern**» command allows to select the test pattern: pseudo-random test pattern or «binary» – constant 8 bit code (in this case the additional field «**Binary test code: ...**» for binary code entering will be displayed).

Test results information is displayed in the following lines:

- «Time total» – total time of testing.
- «Sync loss» – the time during which the test pattern synchronization loss has been detected.
- «Bit errors» – data error counter.
- «Error rate» – error rate in the received data, 10^{-8} up to 10^{-1} , or «Test pattern not detected» if the test pattern is not detected in the received data.

BER tester modes are not saved in the nonvolatile memory.

4.8. «Configure» Menu

The «*Configure*» menu is used to set device operating modes:

Configure

Mode: Normal; Sensor=Open

Link: Ok

1. Ports 0-7 usage...
2. Ports 8-15 usage...
3. SNMP...
4. Sensor input: Alarm on closed
5. Factory settings
6. Save parameters
7. Restore parameters

Command: _

«Ports 0-7 usage» and «Ports 8-15 usage» Menus

These menus are used to select E1 ports for operation:

Ports usage

Mode: Normal; Sensor=Open

Link: Ok

1. E1 port 0: In use
2. E1 port 1: In use
3. E1 port 2: In use
4. E1 port 3: In use
5. E1 port 4: Unused
6. E1 port 5: Unused
7. E1 port 6: Unused
8. E1 port 7: Unused

Command: _

Ports usage

Mode: Normal, Sensor=Open

Link: Ok

1. E1 port 8: Unused
2. E1 port 9: Unused
3. E1 port 10: In use
4. E1 port 11: In use
5. E1 port 12: In use
6. E1 port 13: In use
7. E1 port 14: In use
8. E1 port 15: In use

Command: _

In «Unused» mode the LOS and STATE port indicators are not lighted and the port state does not affect the “Alarm” signal generation. Port loopback indication (blinking of the STATE indicator of the port) is independent of port usage mode.

«SNMP» Menu

The «SNMP» menu is used for setting network IP addresses and SNMP protocol parameters (suitable for «-SNMP» version of the device only):

SNMP

Mode: Normal; Sensor=Open

Link: Ok

MAC address: 00-09-94-00-01-54

1. IP address/netmask: 144.206.181.188 / 24
2. Gateway IP address: 144.206.181.254
3. Get community: public
4. Get IP address/netmask: 144.206.181.121 / 0
5. Set community: cronyx
6. Set IP address/netmask: 144.206.181.121 / 0
7. Traps: Enabled
8. Authentication traps: Enabled
9. Trap community: alert
0. Trap destination IP address: 144.206.181.121

Command: _

The following parameters should be set for the operation of the SNMP port:

- IP address/netmask – the IP address of the Ethernet port, and the length of the netmask.
- Gateway IP address – the IP address of the routing gateway.

The following parameters must be set for managing the device over the SNMP protocol:

- Get community – information query access password.
- Get IP address/netmask – the IP address and the netmask length for the restriction of information query access.
- Set community – access password for parameter setting.
- Set IP address/netmask – the IP address and the netmask length for the restriction of access to parameter setting.
- Traps – enable/disable sending SNMP traps (events reports).
- Authentication traps – enable/disable sending traps about unauthorized access attempts.
- Trap community – password for sending traps.
- Trap destination IP address – the destination IP address where to send traps to.

«Sensor input» Command

The «Sensor input» command toggles the input alarm contacts mode. The external sensor has two operating modes: «Alarm on closed» – closing-sensitive (default), and «Alarm on open» – opening-sensitive. In the «Alarm on closed» mode the remote device goes into the alarm status when the contacts are closed. (See the 3.2. «Alarm Conditions» section for more details).

«Factory settings» Command

The «Factory settings» command sets some device parameters to their initial state:

- E1 ports usage mode: All ports are «In use»
- Sensor input: Alarm on closed.

«Save parameters» Command

When some parameters are modified (or after execution of the «Factory settings» command) it's necessary to save their values in the non-volatile memory (NVRAM) of the device by the «Save parameters» command. In this case the parameters saved will be restored at the device restart time.

«Restore parameters» Command

If some parameters was modified and the «Save parameters» command was not executed then their previous values may be restored from the NVRAM by the «Restore parameters» command.

4.9. «Login to remote FMUX» Command

The «*Login to remote FMUX*» command allows connecting to the remote device menu. An example of the remote menu is given below. To disable the remote menu, press ^X (Ctrl-X).

```
Remote login...
(Press ^X to exit)

Cronyx FMUX / 16E1-SNMP rev. C 18/03/2005

Mode: Normal; Sensor=Open
Link: Ok

  1. Link statistics
  2. Port statistics
  3. Event counters
  4. Loopback...
  5. Configure...
  0. Reset

Remote (^X to exit): _
```

In the remote login mode it is possible to monitor the device operating modes, channels state and view values of error statistics counters. It is permitted to configure device operation parameters and control of E1 ports loopbacks.

4.10. «Reset» Command

The «Reset» command causes the modem to reset. The device modes stored in the non-volatile memory (NVRAM) will be in effect after reset.

Section 5. SNMP-based Management

The device may be equipped with an SNMP port (the «-SNMP» ordering option required). It is possible to view the current device modes, port and link states, local and remote error statistics accessing the device by SNMP.

5.1. SNMP Parameters Setting

The following parameters must be set from the console to provide access to the device over the SNMP protocol:

- IP address/netmask – the IP address of the Ethernet port, and the length of the netmask.
- Gateway IP address – the IP address of the routing gateway.
- Get community – information query access password.
- Get IP address/netmask – the IP address and the netmask length for the restriction of information *query* access.

Information query access is permitted only for the hosts, whose IP addresses equal to the one specified by the «Get IP address» parameter. The higher-order N bits are used for IP address comparison. The value of N is specified by the “Netmask” parameter.

Additional parameters must be specified for access to parameter settings:

- Set community – access password for parameter setting.
- Set IP address/netmask – the IP address and the netmask length for the restriction of access to parameter *setting*.



The access rights to set the parameters must be granted to trusted hosts only.

In case of emergencies, the device is able to send SNMP events reports (traps). The following parameters must be specified to enable this:

- Traps – enable/disable to send SNMP traps.
- Authentication traps – enable/disable to send SNMP traps about unauthorized access attempts.
- Trap community – password for sending SNMP traps.
- Trap destination IP address – the IP address of the recipient of traps sent.

SNMP traps are sent when the following events occur:

- Modem power-on or reset causes the device to send the COLD START trap
- Unauthorized access attempt over the SNMP protocol – the AUTHENTICATION

FAILURE trap

- Loss of signal or framing on the link – the LINK DOWN trap
- Switch of the link to the normal mode – the LINK UP trap
- Loss of signal on E1 port – PORT DOWN trap
- Appearance of signal on E1 port – PORT UP trap.

5.2. Management Information Blocks (MIBs)

The following management information blocks (MIBs) are implemented in the device:

- SNMPv2-MIB – a standard management information block, including common system parameters (system), network interfaces (if), the IP protocol (ip, icmp), the UDP protocol (udp), and SNMP protocol statistics (snmp).
- CRONYX-FMUX-MIB – a device-specific management information block for monitoring state of link and data ports.

The CRONYX-FMUX-MIB management information block specification files are available from the www.cronyx.ru web site.

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