Optical Modem

FOM8-E3

E3 Interface

34 368 kbps

Installation and Operating Manual

Version 1.4 – 17-Mar-2005

Contents

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.

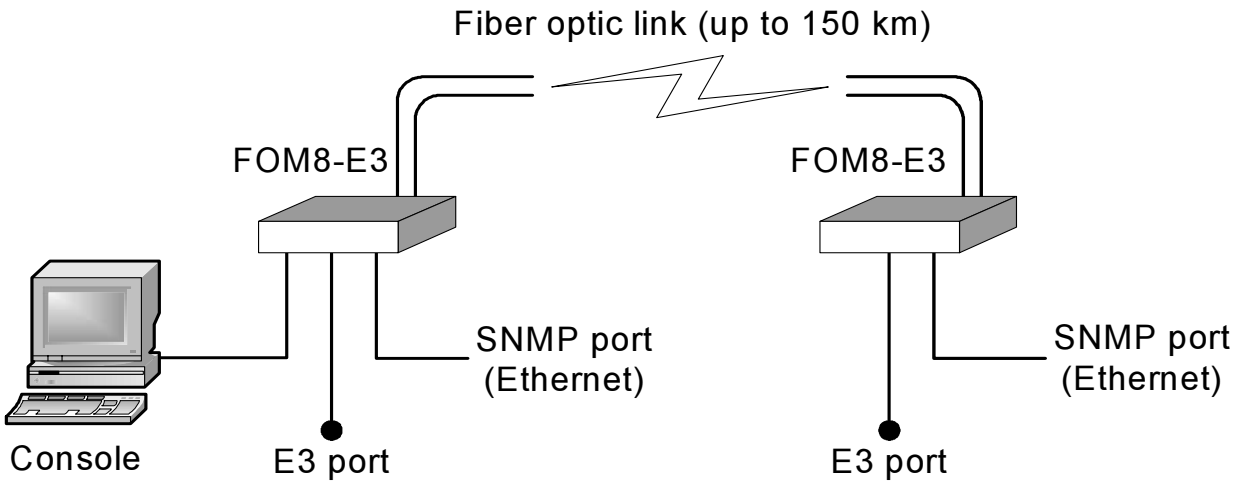
Section 1. Introduction

1.1. General

The FOM8-E3 is a high speed synchronous duplex long-range modem. It transmits E3 data stream over a fiber optic link at ranges up to 150 km, significantly exceeding the capabilities of wire modems. The FOM8-E3 application on short ranges may also be suitable, for the purpose of protecting the transmitted data or in environments with strong electromagnetic interference.

Typical FOM8-E3 Application

The picture shows typical application of the device:



The FOM8-E3 operation may be controlled from the ASCII terminal (*the console*) connected to the FOM8-E3 control RS-232 port or from Ethernet network by the SNMP protocol.

The modem has two modes of operation: Transparent and Framed.

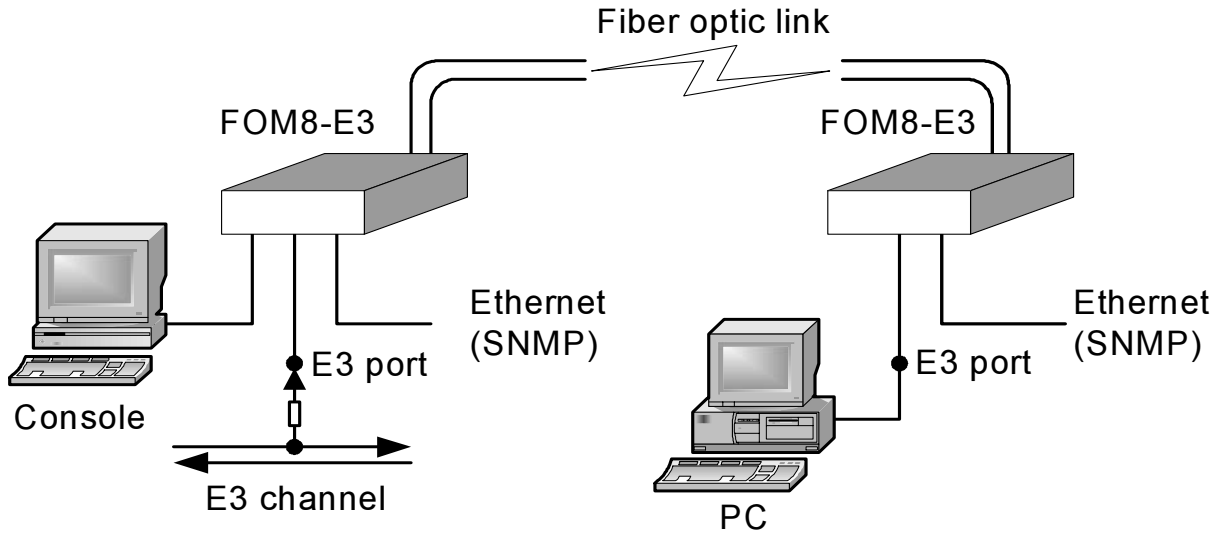
The benefit of the Framed mode is the availability of the special virtual service channel (called as *monitoring channel*), which is created between the devices to provide the ability to control the remote device, and to monitor its status from the console of the local device.

In the Transparent mode E3 data stream (framed or unframed) is transmitted transparently over an optical link. The monitoring channel between the devices is not available.

If E3 data is framed according to the ITU-T G.751 format, then the modems (both local and remote) may be switched to the Framed mode. In this mode E3 data is transmitted transparently excluding the NAT bit, which is «robbed» for the monitoring channel.

E3 Channel Monitoring Mode

The device may be used for the remote monitoring of an operating E3 channel:



In the monitoring mode, the E3 receiver is connected via external resistor to the required line of the E3 channel, and the E3 transmitter is switched off. Signal attenuation in the resistor is compensated by additional gain. The received data may be sent to a PC for processing (the Cronyx Tau-PCI-E3 board may be used).

1.2. Features

- Transmits the E3 stream (G.703, 34 368 kbps) over an fiber optic link at ranges up to 150 km
- Single mode or multimode fibers
- Dual or single fiber (WDM) operation
- Operates either in framed or Transparent mode. Transmmittion in the Transparent mode is transparent to the input E3 framing
- Complies with ITU-T G.703, G.751, G.823, and G.955 Recommendations
- Supports local and remote fiber optic link loopbacks and local E3 port loopback
- Supports E3 monitoring mode
- Integrated Bit Error Rate tester (BER tester)
- RS-232 console port for control and monitoring
- Remote login feature for control and monitoring the remote device from the console of the local device
- Dedicated Ethernet port for SNMP-based management
- «Dry contacts» relay port for alarm indication
- Desktop or 1U rack mount version (for 19-inch rack)
- Operates from 176-264VAC or 36-72VDC
- Front panel LEDs for fault and diagnostics conditions indication

The built-in BER tester allows to measure the error rate in the fiber optic link, and in the E3 port. The measurements are performed using fixed or pseudo-random code according to the ITU-T O.151 Recommendation. Pattern length is $2^{23} - 1 = 8\ 388\ 607$ bits.

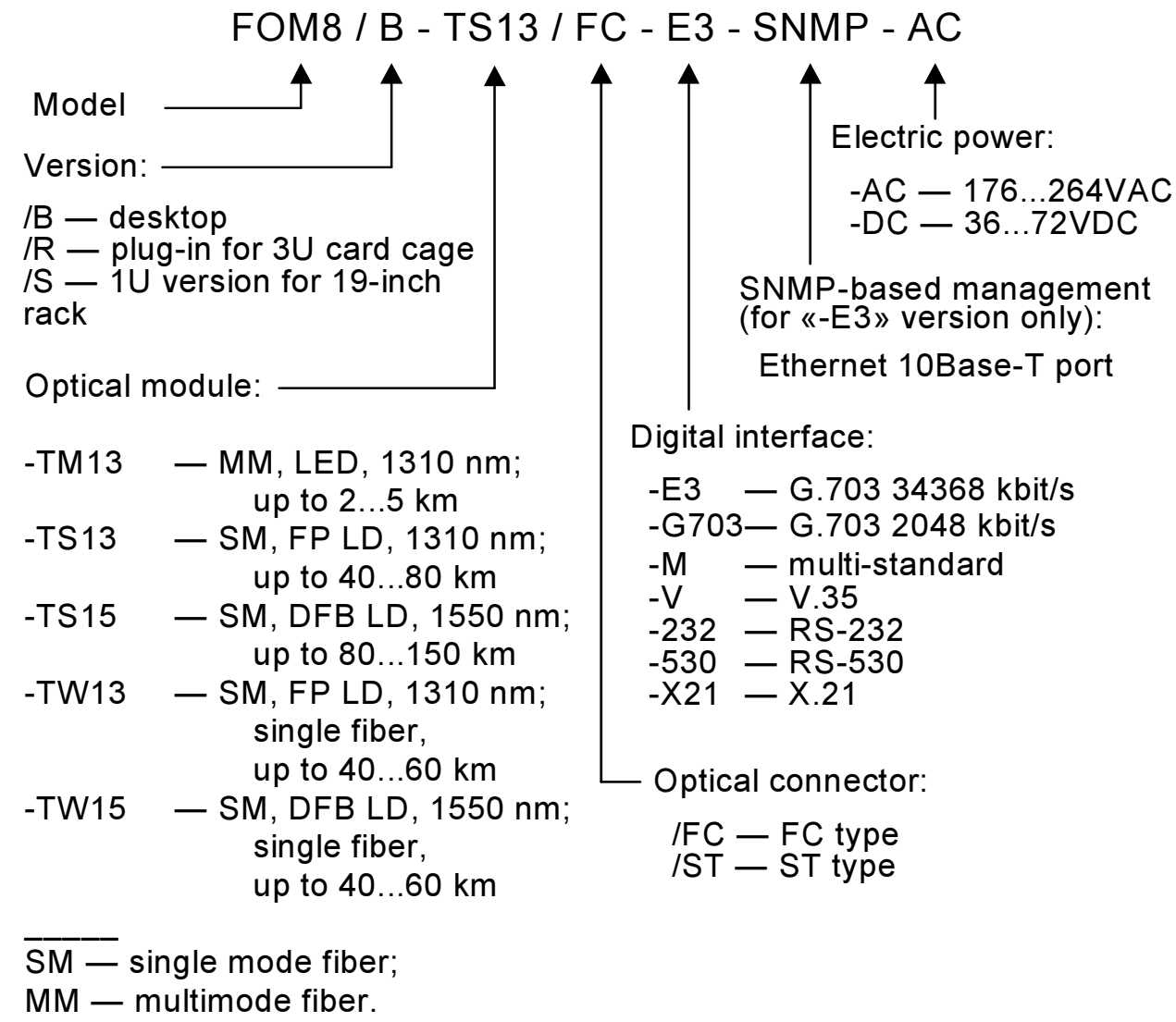
There is a capability of remote login to control the remote device from the console port of the local device. Commands are transmitted to the remote device via special virtual monitoring channel.

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

1.3. Ordering Information

The FOM8-E3 is a member of the FOM8 family, which includes devices of various form-factors, optical module types, digital interface types, SNMP-based management option, and power sources.



Notes:

1) The «-E3» and «/R» versions are mutually exclusive.

2) The «-E3» version is not supplied without SNMP-based management option.

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 TW13 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

E3 Port

Connectors type ..... BNC
Line code HDB3
Error detection ..... Bipolar violation
Line impedance ..... 75 Ohm unbalanced (coaxial)
Receiver signal level ..... 0 to -15 dB
Maximum cable length ..... Up to 400 m
Overvoltage protection ..... Sidactors
Overcurrent protection ..... Fuses

Alarm Port

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 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 type ..... Ethernet 10Base-T
Connector type RJ-45

Diagnostic Modes

Loopbacks ..... Local on E3 port, local and remote on fiber optic link
Error rate measurement ..... Built-in BER tester
Control ..... Via the RS-232 control port, via the SNMP port, or from a remote device

Mechanical Characteristics

Desktop version ..... Dimensions 210 mm x 260 mm x 70 mm; weight 1.3 kg

Rack mount version ..... Dimensions 444 mm x 262 mm x 44 mm; weight 3.4 kg

Power Requirements

AC supply voltage ..... 176–264 VAC, 50 Hz (for the «-AC» version)

DC supply voltage ..... 36–72 VDC (for the «-DC» version)

Max. power consumption ..... 12.5 W

Environmental Characteristics

Temperature ..... 0 to 50 °C

Relative humidity ..... Up to 80%, non-condensing

Section 2. Installation

2.1. Site Requirements

Allow at least 10 cm clearance at the front and at the rear 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

Delivered items include:

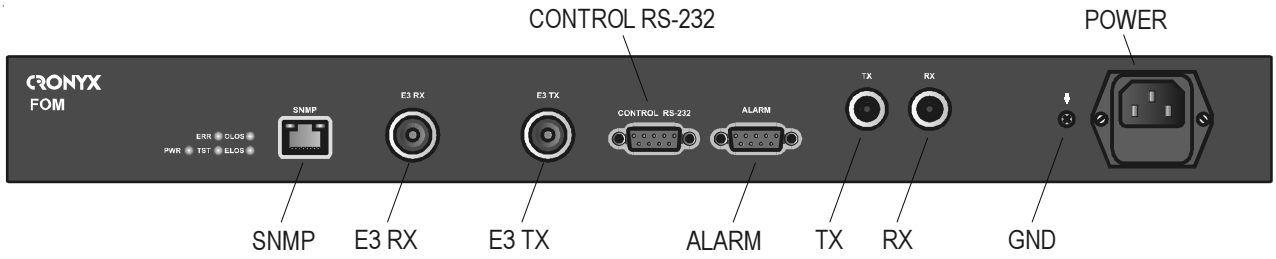
- FOM8-E3 unit of a version as ordered – 1 piece

- Bracket for mounting the FOM8-E3 unit in a 19-inch rack (for the «/S» version) – 2 pieces
- Self-adhesive foot for the FOM8-E3 unit (for the «/S» version) – 4 pieces
- Power cable (for the «-AC» version) – 1 piece
- 3-screw removable terminal block (for the «-DC» version) – 1 piece
- This *Installation and Operating manual* – 1 piece.

2.5. Connections

Rack Mount («/S») Version Connectors Arrangement

All connectors are located on the front panel of the modem:

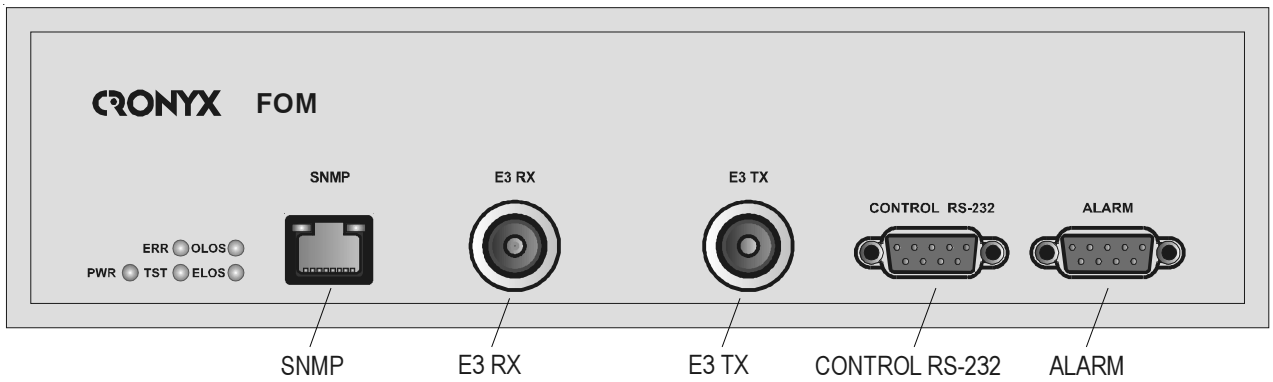


- SNMP – Ethernet 10Base-T SNMP port.
- E3 RX – for connection with the modem's E3 port receiver.
- E3 TX – for connection with the modem's E3 port transmitter.
- CONTROL RS-232 – console port.
- ALARM – alarm port.
- TX – for connection with the modem's optical transmitter.
- RX – for connection with the modem's optical receiver.
- GND – ground terminal (an M4 grounding screw).
- POWER – power inlet (see para. *Power Connection* below).

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

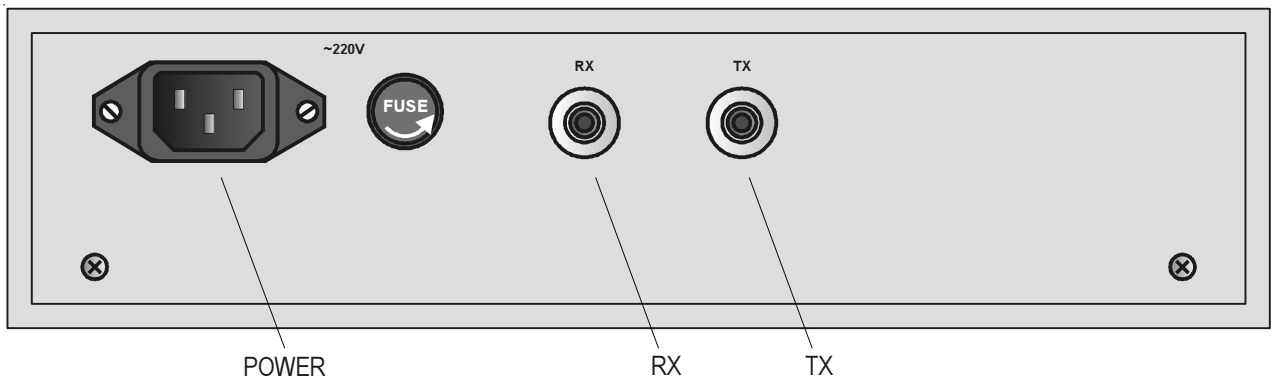
Desktop («/B») Version Connectors Arrangement

Front panel connectors are as follows:



- SNMP – Ethernet 10Base-T SNMP port.
- E3 RX – for connection with the modem's E3 port receiver.
- E3 TX – for connection with the modem's E3 port transmitter.
- CONTROL RS-232 – console port.
- ALARM – alarm port.

Rear panel connectors are as follows:

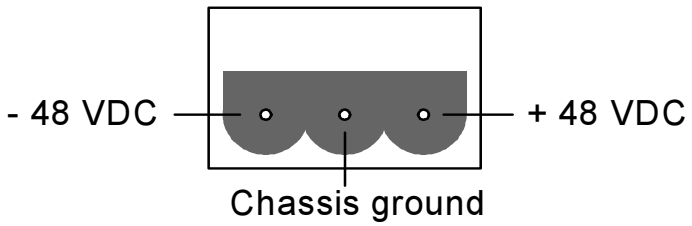


- POWER – power inlet (see para. *Power Connection* below).
- RX – for connection with the modem's optical receiver.
- TX – for connection with the modem's optical transmitter.

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:



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

Optical Connectors (TX and RX)

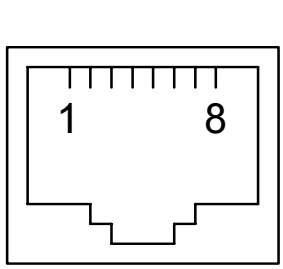
FC or ST connectors are used for connecting fiber optic link, depending on the order code. Pay attention to proper cable connections («RX» – for connection with the modem's receiver, «TX» – for connection with the transmitter). Do not allow cable bending at sharp angles, and cable twisting.

E3 Port Connectors (TX and RX)

Standard BNC connectors are used for connection of the E3 channel. Pay attention to proper cable connections («E3 RX» – for connection to the modem's receiver, «E3 TX» – for connection to the transmitter).

SNMP Port Connector

An RJ-45 socket is provided for connection of the Ethernet (10Base-T, IEEE 802.3 standard) cable for managing the device via the SNMP protocol:



1 - TX +
2 - TX -
3 - RX +
4 - not used
5 - not used
6 - RX -
7 - not used
8 - not used

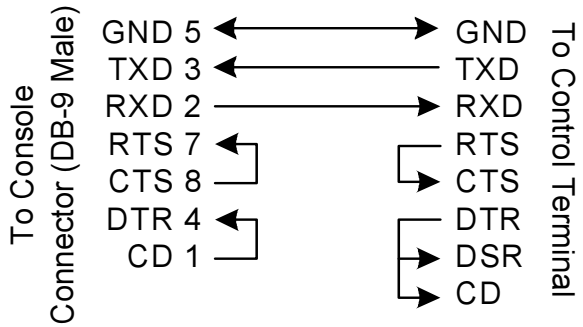
Use straight cable for connection to the Ethernet hub.

Console Port Connector

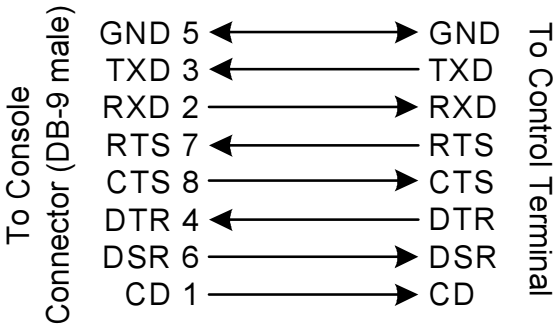
A DB-9 (female) connector is provided for console connection. The console port has a standard RS-232 DCE interface, with the following settings: async mode, 9 600 baud, 8 bits per character, 1 stop bit, no parity. Use a straight cable for connection to a PC COM port.

An RTS signal (for flow control) from the DTE controlling device is required for proper operation.

It is recommended to use the following cable schemes:



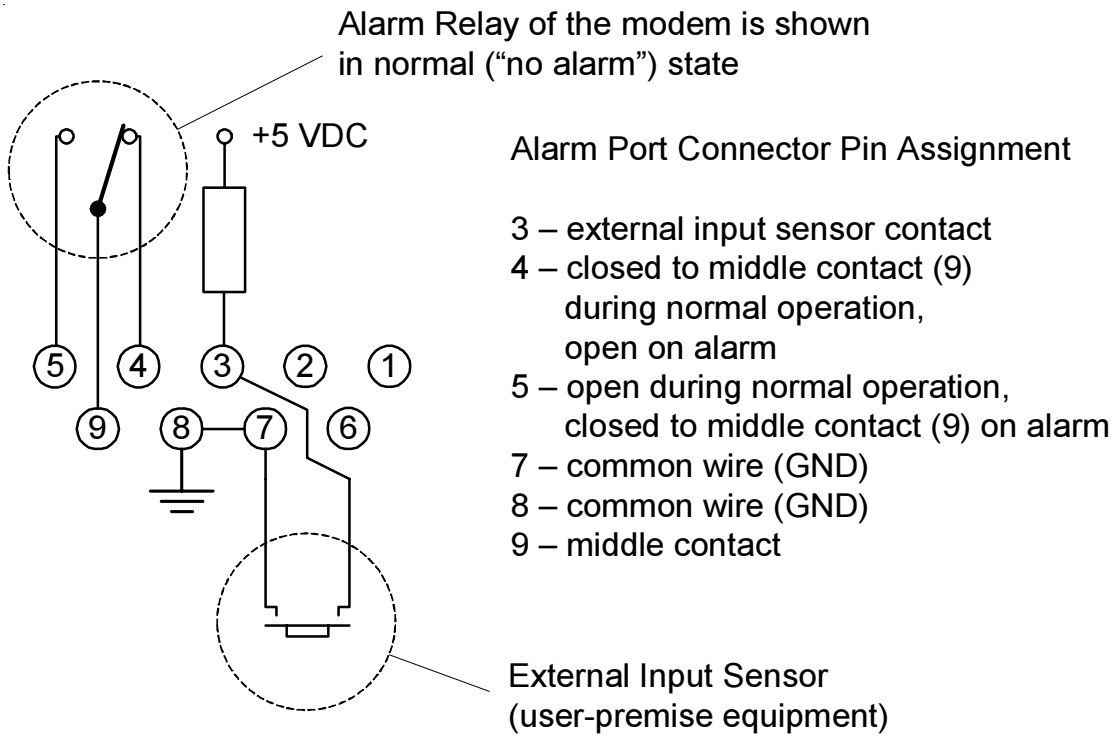
Cable without modem control



Cable with modem control

Alarm Port Connector

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



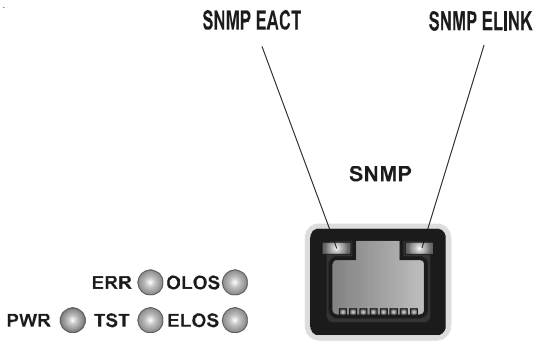
The external input sensor connected to pins 3 and 7 must be isolated from other electrical circuits. Failure to comply with this requirement may lead to modem breakdown.

Pins 1, 2, and 6 are reserved and must be leaved unconnected.

Section 3. Operation

3.1. Indicators

The figure shows the arrangement of the LED indicators at the front panel of the device:



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

Indicator	Color	Normal state
PWR	Green	On
TST	Red	Off
OLOS	Red	Off
ELOS	Red	Off
ERR	Red	Off
SNMP ELINK	Green	On, if the Ethernet 10Base-T cable is connected to the SNMP port
SNMP EACT	Green	Flashes during Ethernet 10Base-T data transmission via the SNMP port

The indicators functions are detailed in the table below:

Indicator	Color	Function
PWR	Green	Is on when the power is switched on.
ERR	Red	Error indicator: • Is on or flashes when there is a synchronization loss of the optical link or the E3 channel. • Flashes when there are errors of the BER tester – in the link test mode (TST lights).
TST	Red	Test mode; loopback indication: • Is on when the BER tester is enabled. • Flashes in a regular pattern when local optical link loopback or local E3 port loopback is enabled. • Flashes in double flashes when remote optical link loopback is enabled.
OLOS	Red	Loss of optical receiver signal; optical link loopbacks indication: • Is on when there is a loss of carrier in the optical receiver. • Flashes in a regular pattern when local optical link loopback is enabled. • Flashes in double flashes when remote optical link loopback is enabled.
ELOS	Red	Loss of E3 port receiver signal; loopback indication on the E3 port: • Is on when there is a loss of carrier on the E3 port receiver • Flashes in a regular pattern when local E3 port loopback is enabled.
SNMP EACT	Green	Ethernet data transmission in progress.
SNMP ELINK	Green	Ethernet 10Base-T cable connected.

3.2. Alarm Interface

The modem 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 modem).

Alarm conditions are as follows:
- Power failure.
- Loss of signal in the optical link or in the E3 Port.

In the Framed mode there are two additional alarm conditions:
- Loss of framing sinchronization in the optical link or in the E3 Port (high error rate at the absence of AIS).
- 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 *«Configure» Menu* chapter below).

If the modem 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* at the *Cable Connections* chapter above.

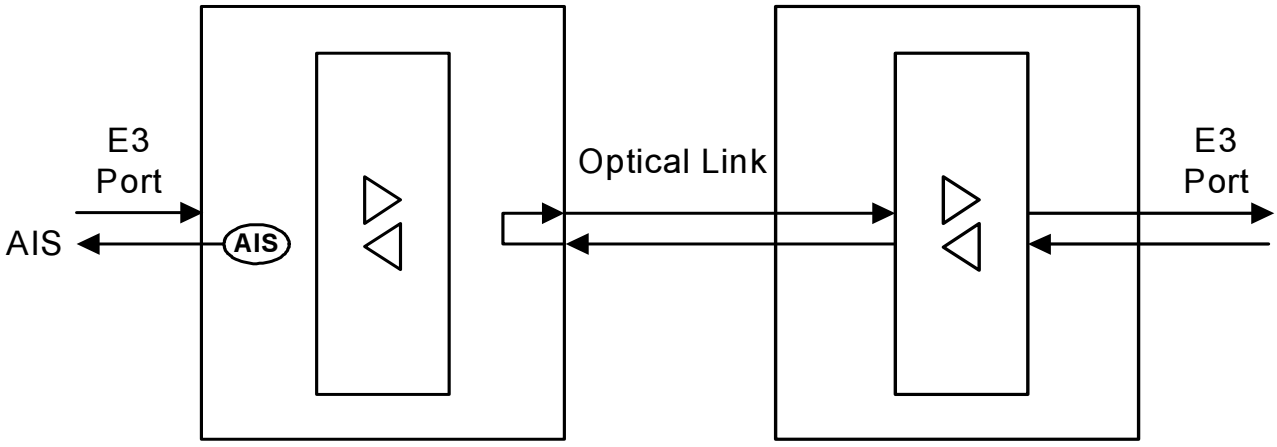
3.3. Device Response to Fault Conditions

Condition	Local Device		Remote Device	
	Indicators and Relay	Code Output to E3 Port	Indicators and Relay	Code Output to E3 Port
Power failure	All indicators are off, relay in the ALARM state		OLOS is on, relay in the ALARM state	AIS
Loss of input signal from optical link	OLOS is on, relay in the ALARM state	AIS		
High optical link input signal error rate, the Framed mode	ERR is on, relay in the ALARM state	AIS		
AIS is received from the optical link		AIS		
Loss of E3 Port input signal, the Framed mode	ELOS is on, relay in the ALARM state	Remote Alarm/AIS*		
Loss of E3 Port input signal, the Unframed mode	ELOS is on, relay in the ALARM state	AIS		
High E3 Port input signal error rate, the Framed mode	ERR is on, relay in the ALARM state	Remote Alarm/AIS*		
AIS is received at the E3 Port				AIS
E3 Port local loopback is enabled	TST and ELOS flash regularly			
Local optical link loopback is enabled	TST and OLOS flash regularly	AIS		
Remote optical link loopback is enabled	TST and OLOS flash in double flashes		TST and OLOS flash regularly	AIS
BER tester enabled	TST is on continuously, ERR flashes on errors			

*) See the *«E3 loss of sync option» Command* section.

3.4. Loopbacks

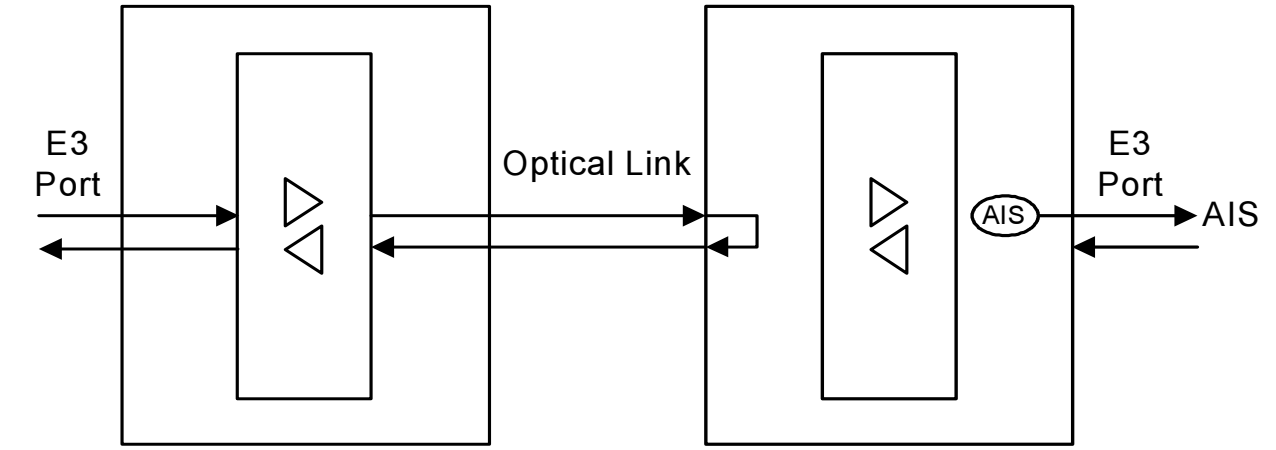
Local Optical Link Loopback



Local modem:
the local optical link loopback is enabled, the TST and OLOS indicators are flashing regularly

Remote modem

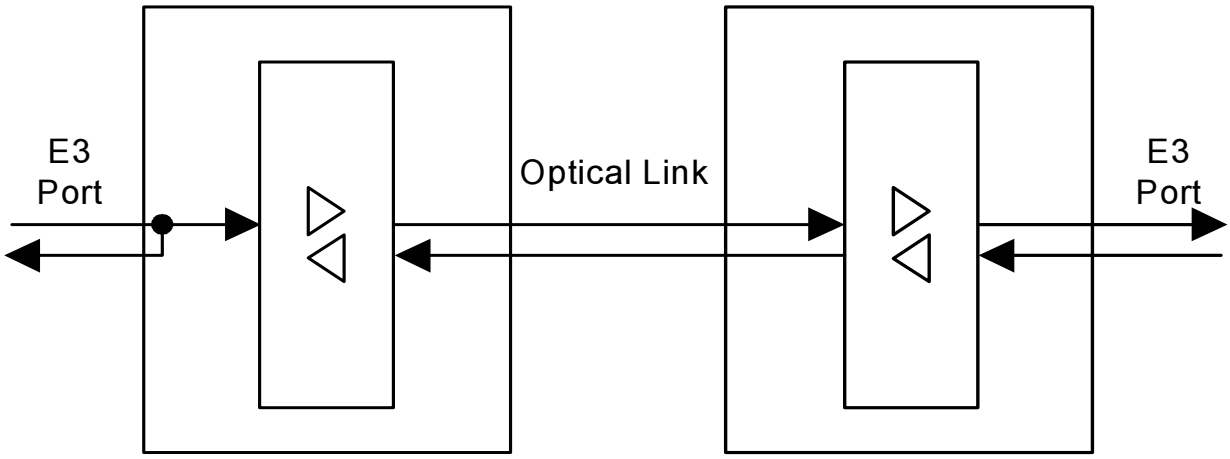
Remote Optical Link Loopback



Local modem:
remote optical link loopback request is enabled, the TST and OLOS indicators are flashing in double flashes

Remote modem:
local optical link loopback is enabled according to the remote request, the TST and OLOS indicators are flashing regularly

E3 Port Loopback



Local modem:
the E3 port loopback is enabled, the TST and ELOS indicators are flashing regularly

Remote modem

3.5. Built-in BER Tester

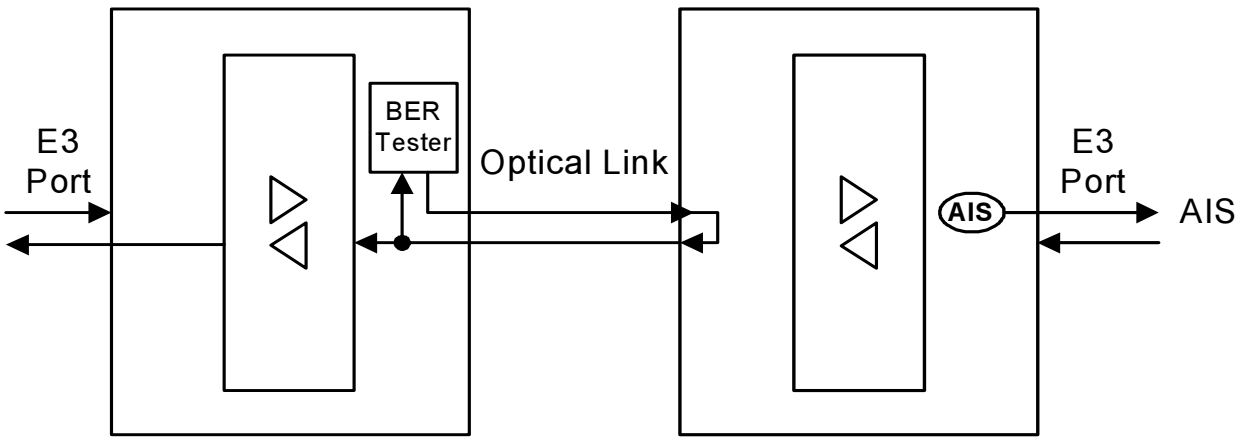
The FOM8-E3 modem is equipped with a built-in BER tester, which allows to measure the error rates in the optical link, or in the E3 Port.

Measurements are performed using fixed or pseudo-random code (according to the O.151 Recommendation; pattern length equals to 2^{23}-1=8388607 bits). The BER tester is controlled from the console (see the *«Test» Menu* section) or via SNMP.

The operation of the BER tester assumes that the data transmitted to the selected channel are identical to the data received from this channel(for example, an internal or external loopback is enabled at the channel, or the same test data arrive to the channel receiver input from a BER tester of another similar device, or external test equipment).

Optical Link Test: Remote Link Loopback Enabled

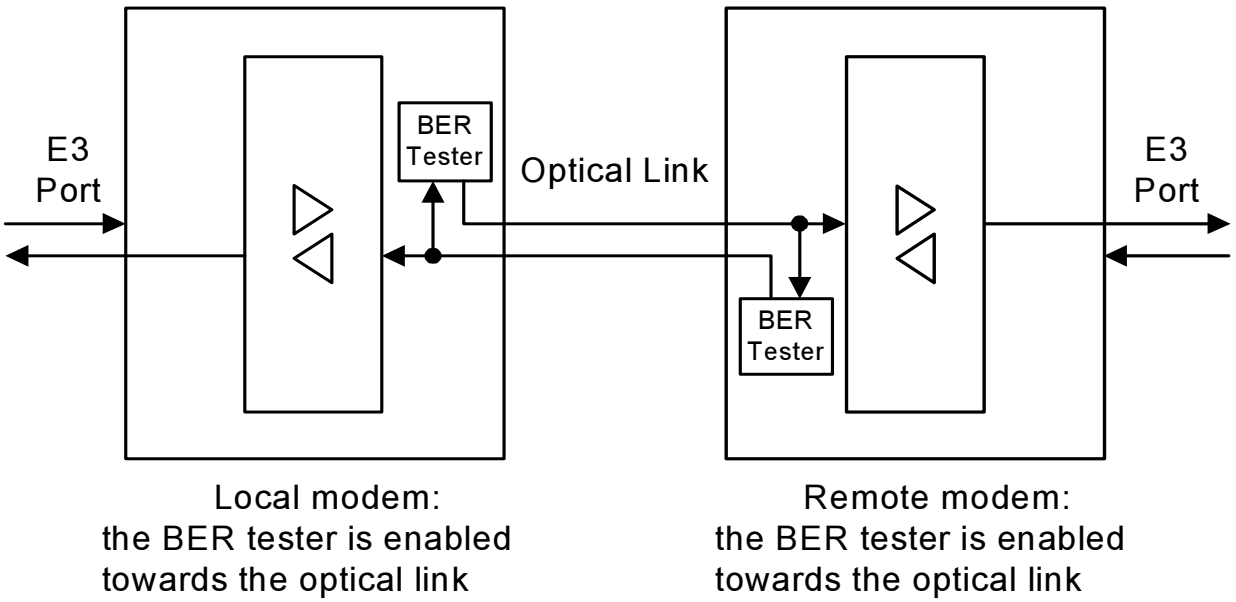
A BER tester is enabled on the local device, and an optical link loopback is enabled on the remote device:



If the devices operate in the Framed mode, the testing does not violate framing, and the capability to control the remote device from the console of the local device is preserved. When operating in the Transparent mode, testing is performed using the full bandwidth of the optical link.

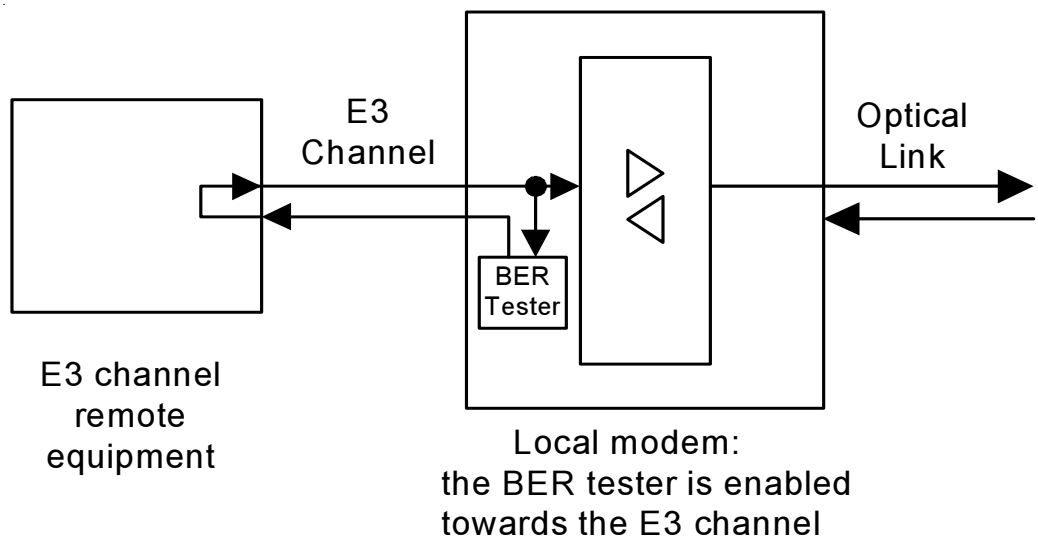
Optical Link Test: Two BER Testers Against Each Other

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



E3 Channel Test

A BER tester is enabled on the local device towards the E3 channel:



Testing is performed using the full bandwidth. On the remote equipment of the E3 channel, a loopback must be enabled towards the E3 channel.

Section 4. Control From the Console

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 picture:

```
Cronyx FOM8-E3-SNMP revision A, 23/01/2004

Mode: Framed, State: No alarm
Link: Ok
E3 port: Ok

  1. Statistics
  2. Event counters
  3. Loopback...
  4. Test...
  5. Configure...
  6. Login to remote unit
  0. Reset

Command: _
```

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

The «Mode» in the line below shows the operating mode of the device:

- Framed – framed mode.
- Transparent – transparent mode.

Further, «State» shows the «alarm» state (see the «Alarm Interface» section for more details).

The «Link» line shows the state of the optical link:

- Ok – normal mode.
- LOS – loss of signal in the link.

- AIS – AIS is being received.
- LOF – loss of framing (in the Framed mode).
- FARLOF – failure situation at the remote device (in the Framed mode).
- Loop – the local optical link loopback is enabled: the received signal is turned back.
- 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:

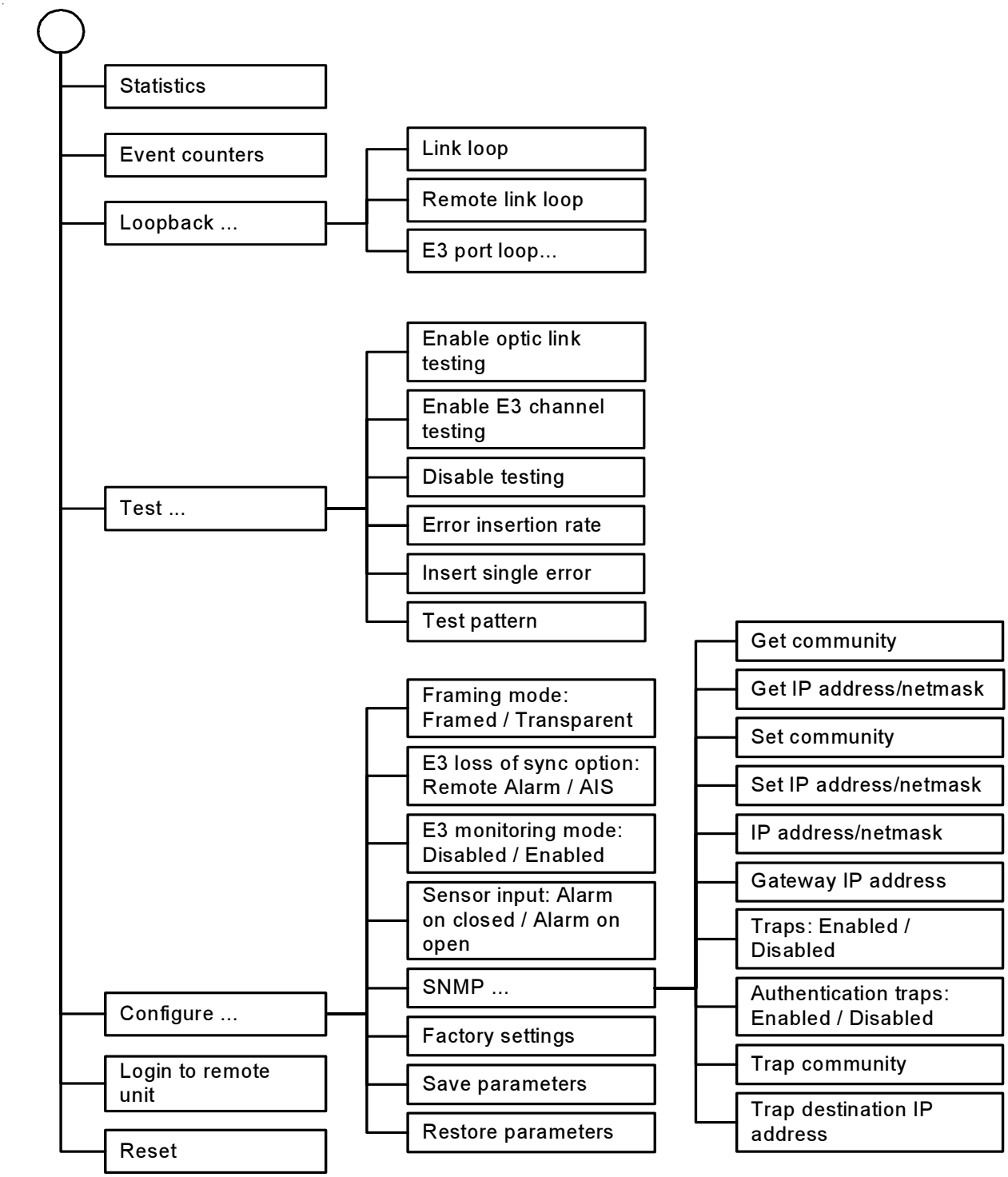
- Test pattern not detected – if the test pattern was not detected in the received data.
- Test error rate – error rate in the received data, from 10^{-1} to 10^{-8}.
- Time total/loss – total test time (days hours:minutes:seconds)/time in the «test pattern not detected» state (seconds).
- Bit errors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

The «E3 port» line shows the E3 port state:

- Ok – normal state.
- LOS – loss of optical link signal.
- AIS – AIS is being received.
- LOF – loss of framing (in the Framed mode).
- FARLOF – the «Remote alarm» signal is received (bit 11 of the E3 frame, the Framed mode).
- TX FAILURE – E3 transmitter failure.
- Loop – the local loopback is enabled on the E3 port: the received signal is turned back.

When the BER tester is enabled towards the E3 channel, test results will be displayed on the next line on the screen.

4.2. Menu Structure



4.3. «Statistics» Command

The «*Statistics*» screen shows local and remote status and statistics counters values of the optical link and E3 ports.

```
Statistics: Session #4, 0 days, 1:37:43

Mode: Framed, State: No alarm

                            Errored seconds
                           -----------------
                 CV        Receive  Transmit Status

Local Link:      -         0        0        Ok
Remote Link:     -         1        0        Ok

Local E3 port:   0         0        0        Ok
Remote E3 port:  0         1        0        Ok

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

The information on the screen is refreshed every two 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 «Statistics» line 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 shows the operating mode and the state of the device (see the «Upper level menu» section for more detail on *Mode* and *State*).

The middle part of the screen shows states of the channels and associated statistics counters.

For optical links:

- Local Link (changed to *Link*, if remote optical link information is not available) – local modem's optical link information.
- Remote Link – remote modem's optical link information.

The *Status* column shows channels state as a set of flags:

- Ok – normal mode.
- LOS – loss of signal in the channel.
- AIS – alarm indication signal (the «all ones» code) is receiving from the channel.
- LOF – loss of framing detected (in the Framed mode).
- FARLOF – failure situation at the remote device (in the Framed mode).

When there is no input signal from the optical link at the remote device, it will try to notify the local device about this. In the Transparent mode, the AIS signal (the «all ones» code) will be output to the optical link. In the Framed mode the FARLOF signal is output (this signal will also be output when the loss of framing in the input signal from the optical link occurs). Thus AIS or FARLOF will be detected by the local device if optical link in the direction from remote to local device is operable.

For the local device, the specified flags may be followed by information about enabled loopbacks (*Loop* if the local loopback is enabled, *Remote loop* if the remote loopback is enabled).

Statistics counters columns shown under the subtitle *Errored seconds* are as follows:

- 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.

The remote optical link state is unavailable in the Transparent mode so the line for the Remote Link will be absent.

The E3 ports state and statistics counters will be shown below on the screen:

- Local E3 port (changed to *E3 port*, if remote modem E3 port information is not available) – for the E3 port of the local modem.
- Remote E3 port – for the E3 port of the remote modem.

The CV column shows numbes of code violations.

Port *Status* column is displayed as a set of flags:

- Ok – normal mode.
- LOS – loss of signal in the channel.
- AIS – alarm indication signal is receiving (the «all ones» code).
- LOF – loss of framing (in the Framed mode).
- FARLOF – the «Remote alarm» signal is received (bit 11 of the E3 frame, the Framed mode).

The specified flags for the local device may be followed by the indication (*Loop*) about the enabled local loopback.

If BER tester is enabled, then the corresponding Link or E3 port line on display will be followed by the line showing test status and results.

The remote E3 port state is unavailable in the Transparent mode so the line for the Remote E3 port will be absent.

4.4. «Event counters» command

Use "*Event counters*" command to get more detailed information about counters.

```
Alive: 0 days, 0:03:13 since last counter clear

Link counters

0  - out of sync on transmit
0  - loss of framing on transmit
158  - out of sync on receive
2  - loss of framing on receive
159  - out of sync on monitoring channel
0  - loss of framing on monitoring channel
0  - payload checksum errors

E3 port counters

0  - seconds with receive errors (LOS, LOF)
0  - seconds with transmit errors
0  - HDB3 code violations

Press any key to continue...

Command: _
```

Optical link counters:

- out of sync on transmit – the counter of synchronization losses of the transmitter.
- loss of framing on transmit – the counter of short-time losses of framing of the transmitter.
- out of sync on receive – the counter of synchronization losses of the receiver.

- loss of framing on receive – the counter of short-time cycle losses of framing of the receiver.
- out of sync on monitoring channel – the counter of synchronization losses on the monitoring channel.
- loss of framing on monitoring channel – the counter of short-time losses of framing on the monitoring channel.
- payload checksum errors – the counter of data checksum errors.

E3 port counters:

- seconds with receive errors (LOS, LOF) – time, in seconds, during which receiver errors were detected (loss of signal, loss of framing).
- seconds with E3 transmit errors – time, in seconds, during which transmitter errors were detected.
- HDB3 code violations – HDB3 code violations counter.

4.5. «Loopback» menu

The «*Loopback*» menu is designed for loopbacks management:

```
Loopback

Mode: Framed, State: No alarm
Link: Ok
E3 port: Ok

  1. Link loop - disabled
  2. Remote link loop - disabled
  3. E3 port loop - disabled

Command: _
```

The following loopbacks are implemented:

- Link loop – local loopback on the optical link. The data received from the optical link are turned back.
- Remote link loop – remote loopback on the optical link. A request to enable or disable the remote link loop is transmitted through the optical link to the remote modem (the command is unavailable in case of remote login).

- E3 port loop – loopback on the E3 port. Data received from the E3 channel are turned back.

The menu shows only the items which may be currently executed. When any loopback is in the «on» state, the only available operation is to disable this loopback.

Loopback modes are not stored in the nonvolatile memory.

4.6. «Test» Menu

The «*Test*» menu is used to control the Bit error rate meter. Enable testing for the desired channel:

```
Bit Error Test

Mode: Framed, State: No alarm

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

  1. Enable optic link testing
  2. Enable E3 channel testing

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

After the channel testing is enabled, in the menu appear the commands to change testing parameters, and the single error insertion command:

```
Link Bit Error Test

Mode: Framed, State: No alarm
Link: Ok,
    Test error rate=0.0, Time total/loss=00:00:08/1, Bit errors=0

  Time total: 00:00:08
   Sync loss: 00:00:01
  Bit errors: 0
  Error rate: 0.0

  1. Disable testing
  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 upper line displayed begins with the specification of the channel under testing (*Link* for optical link, *E3 port* for the E3 channel).

The information on the screen is refreshed every two 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 statistics counters, press «C».

Command 1 turns testing off – stops the generation of test data pattern. Command 2 selects the error insertion rate, 10^{-7} to 10^{-1} errors/bit. Command 3 inserts a single error. Command 4 toggles the test data pattern between a fixed 8-bit code specified by the user (binary test pattern), and a pseudo-random test pattern.

Test results information is displayed in the following lines:

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

If any test parameter was changed, the test results information is reset.

BER tester modes are not saved in the nonvolatile memory.

4.7. «Configure» Menu

The «*Configure*» menu allows to set modem operating modes:

```
Configure

Mode: Transparent, State: No alarm
Link: Ok
E3 port: Ok

  1. Framing mode: Unframed
  2. E3 loss of sync option: Remote Alarm
  3. E3 monitoring mode: Disabled
  4. Sensor input: Alarm on closed
  5. SNMP...
  6. Factory settings
  7. Save parameters
  8. Restore parameters

Command: _
```

Uhe the «*Factory settings*» command to return parameters to their default values (for details see the appropriate section below).

After having set the parameters, use the «*Save parameters*» command to write current parameters values to the modem's nonvolatile memory (NVRAM). Saved parameters will be restored after the next device power-on or reset.

Uhe the «*Restore parameters*» command at any time to restore parameters values from the NVRAM.

«Framing mode» Command

The command allows to select one of the two values: «Transparent» (the default) and «Framed».

The command specifies the data transmission mode.

In the Transparent mode data are transmitted via the full bandwidth of the optical channel. The transmission is transparent to the input E3 framing (if any).

If the E3 stream is framed, and the NAT bit of the E3 frame is not used by external equipment, then this command may be used to switch devices (local and remote) to the Framed mode. In this case there is a possibility to control the remote device and to monitor its state from the console of the local device (see sections *«Statistics»*, *«Login to remote unit»* and para. *«Remote link loop» Command* at the *«Loopback» Menu* section).

The command is unavailable during remote login (because the restoration of the Transparent mode would have interrupted the operation of the monitoring channel, making it impossible to operate via remote login).

«E3 loss of sync option» Command

The command allows to select one of the two values: «Remote Alarm» (default) and «AIS».

The command specifies the mode of device response (while operating in the Framed mode) to failure situations in the E3 channel: loss of input signal, and loss of framing (in the absence of AIS).

In the «Remote Alarm» mode, bit 11 of set I is set in the E3 frame of the stream output to the E3 port.

In the «AIS» mode, the "all ones" code is output to the E3 port.

Select the option required for the correct interaction with the equipment connected to the E3 port of this device.

«E3 monitoring mode» Command

The command allows to select one of the two values: «Disabled» (default) and «Enabled».

During normal operation the monitoring mode is «Disabled».

When the monitoring mode is «Enabled», the E3 port receiver is connected to the operating E3 line to be monitored via resistors, and the E3 transmitter is disabled. Signal attenuation in the resistors is compensated by additional gain.

«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, when contact 3 closes to contact 7, the remote device goes into the alarm status. (See «Alarm Interface» section for more details).

«SNMP» Menu

The «*SNMP*» menu is used for setting network IP addresses and SNMP protocol parameters:

```
SNMP

Mode: Framed, State: No alarm
Link: Ok,
    Test error rate=0.0, Time total/loss=00:13:44/1, Bit errors=0
E3 port: Ok
MAC address: 00-09-94-ff-ff-ff

  1. IP address/netmask: 144.206.181.187 / 24
  2. Gateway IP address: 144.206.181.254
  3. Get community: public
  4. Get IP address/netmask: 144.206.181.0 / 24
  5. Set community: cronyx
  6. Set IP address/netmask: 144.206.181.0 / 24
  7. Traps: Disabled
  8. Authentication traps: Disabled
  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.

«Factory settings» Command

The «*Factory settings*» command restores the device modes to their initial state:

- Framing mode: Transparent.
- E3 loss of sync option: Remote Alarm.
- E3 monitoring mode: Disabled.
- Sensor input: Normal.

The «*Factory settings*» command does not affect the IP address and SNMP protocol parameter settings (see the «SNMP» menu).

The command is unavailable during remote login (because the restoration of the Transparent mode would have interrupted the operation of the monitoring channel, making it impossible to operate via remote login).

4.8. «Login to remote unit» Command

The «*Login to remote unit*» command allows connecting to the remote modem 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 FOM8-E3-SNMP revision A, 26/01/2004

Mode: Framed, State: No alarm
Link: Ok
E3 port: Ok

  1. Statistics
  2. Event counters
  4. Test...
  5. Configure...
  0. Reset

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

In the remote login mode, all operations are enabled, except changing the mode to Transparent (this also applies to the «*Factory settings*» command). Also, it is impossible to control the remote loopback at the optical link.

4.9. «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 modem is equipped with an SNMP port. The port uses standard Ethernet 10Base-T interface. Its RJ-45 socket is located on the front panel. All general device control functions are available via the SNMP protocol: it is possible to view the current device modes, channels and link states, local and remote error statistics, to control loops and the BER tester, to change configuration parameters, and to reset the device.

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 sent 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 optical link – the LINK DOWN trap.
- Switch of the optical link to the normal mode – the LINK UP trap.
- Loss of signal at the E3 port – the PORT DOWN trap.
- Appearance of signal at the E3 port – the PORT UP trap.

5.2. Management Information Blocks (MIBs)

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

- RFC1213 (MIB-II) – 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-FOM8E3-MIB – a device-specific management information block for controlling the device and monitoring its state.

The CRONYX-FOM8E3-MIB management information block specification files are available from the www.cronyx.ru website.