Multiplexer FMUX/SAT

4 x E1 ports V.35/RS-530/RS-449 link interface in codirectional mode

> Installation and Operations 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.

This is to certify that the multiplexer equipment «FMUX» manufactured by «Cronyx» in compliance with Technical Specifications 150.RUS TY is compliant with the following requirements:

- «Technical Requirements to secondary time trunking equipment for 2/8 Mbit/s digital transmission systems» approved by the Ministry of Information Technologies and Communications of the Russian Federation, January 17, 1997;
- «Technical Requirements to tertiary time trunking equipment for 2/34 Mbit/s digital transmission systems» approved by the Ministry of Information Technologies and Communications of the Russian Federation, January 17, 1997.

Multiplexer equipment «FMUX» has the following application conditions: in public network as secondary and tertiary time trunking equipment of plesiochronous digital hierarchy.

This manual applies to the device with the following firmware version:

Order code prefix	Firmware version
FMUX/S - 4E1 - SAT	Revision A, 28/04/2006

The unit is manufactured in the "/S" design, as a device in 1U high metal enclosure, for mounting in a 19" rack.

Device specifications and design may be changed without prior notice to consumers.

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Section 1. Introduction

1.1. Purpose

FMUX/SAT is a multiplexer with variable frame structure, which allows transmitting up to four E1 channels over synchronous link equipment with codirectional interface, such as satellite modem with V.35 DCE interface (see Section "1.3. Connection Diagram"). *Note*

Hereinafter term "E1" is used to denote data transmission channel with interface complying with ITU-T G.703 standard for transmitting data with bit rate of 2,048 kbit/s in both framed mode in accordance with ITU-T G.704 standard, and unframed (transparent) mode.

1.2. Features

• Data transmission from one to four E1 ports over synchronous link equipment with codirectional interface. Link bit rate depends on the number of E1 ports used:

Number	Link
of E1 Ports	Bit Rate,
	Mbit/s
4	8.448
3	6.336
2	4.224
1	2.112

- Support of ITU-T G.703 standard for 2,048 kbit/s, in both framed mode in accordance with ITU-T G.704 standard, and unframed (transparent) mode
- Compliance with ITU-T G.703, G.823 standards
- Local and remote loops
- Built-in Bit Error Rate tester (BER tester)
- RS-232 console port for monitoring and control
- Auxiliary Ethernet 10Base-T port for management via SNMP
- Remote management
- Emergency alarms ("dry contacts")
- 1U high unit design for a 19" rack

• Built-in power supply unit for mains or battery

E1 port data are transmitted independently, the clock frequency of each port does not depend on that of the other ports.

The device may be managed over the RS-232 interface using ASCII terminal (console), or over SNMP protocol over auxiliary Ethernet 10BaseT port.

Loop and built-in BER tester management is performed from the console. BER tester allows measuring error rate in the link path. The measurements are performed using fixed or pseudo-random code in accordance with ITU-T O.151 standard (the pattern length is $2^{15} - 1 = 32,767$ bits).

A remote login ability is provided for testing remote device ports from local console, when there is no personnel at the other end of the link. Commands to remote device are sent over monitoring channel, organized in the link path.

The FMUX/SAT is equipped with LED indicators, which show state of ports and link equipment, loops enabled states, and testing modes.

The device is equipped with an emergency alarm relay, the "dry" contacts of which may switch on external device to call the operations personnel (in accordance with ITU-T G.742 Standard, s. 10).

The multiplexer has capability of firmware upgrades.

1.3. Order Code

The FMUX/SAT multiplexer is manufactured as a device in 1U high metal enclosure, for mounting in a 19" rack. The multiplexer is equipped with auxiliary Ethernet 10Base-T port for management over SNMP protocol.

The power supply device for 176 - 264 VAC mains has the following order code:

FMUX/S - 4E1 - SAT - SNMP - AC

The device may be ordered with 36 - 72 VDC power supply. In this case "- AC" suffix in the order code must be replaced with "- DC".

1.4. Connection Diagram

General diagram for connecting FMUX/SAT multiplexers to data transmission equipment may be presented as follows:



Fig. 1. Diagram for connecting FMUX/SAT multiplexer to data transmission equipment

Multiplexed data from E1 ports are transmitted over group link via data transmission equipment, and are demultiplexed at the opposite side. Positive digital justification is used for frequency recovery in each separate E1 link.

An example of data transmission equipment may be satellite link and pair of satellite modems operating in codirectional mode ("codirectional" principle suggests that data and corresponding clock signal are transmitted at the same direction). In this case RXD signal and RXC clock signal are transmitted from one multiplexer, and received as TXD and ETC by another multiplexer.

The RXC signal is generated on basis of transmitting multiplexer internal clock, and is used for synchronization during group link data reception by receiving multiplexer. It is important that data transmission equipment should transmit this signal to ETC input of receiving multiplexer transparently.

The FMUX/SAT multiplexer is DCE, and supports operation with CD, DSR, CTS, DTR, and RTS modem signals.

The multiplexer uses the RTS signal loss for indicating the non-operating state of data transmission equipment (in this case "LOS" indicator on the multiplexer lights).

The DTR does not affect operations of the device, but its state is shown on console.

1.5. Specifications

E1 Ports

Nominal bit rate	2,048 kbit/s
Encoding	HDB3
Frame structure	Transparent G.703 stream transmission in both framed (G.704), and unframed mode
Error control	Code violations
Link impedance	120 Ohm balanced (twisted pair)
Receiver signal level	0 to -12 dB
Jitter attenuation	In the transmit path
Overvoltage protection	TVS
Overcurrent protection	Fuse
Connector	RJ-48 (female, 8 pin)

Link Port

Interface type	Multistandard (V.35, RS-530,
	RS-449); in the codirectional
	mode
Clock frequency	8.448, 6.336, 4.224 or
	$2.112 \text{ MHz} \pm 30 \text{ ppm}$
Modem signals	TXD, ETC, RXD, RXC, CD,
	DSR, CTS, RTS
Connector	HDB44 (female)

Console Port

Interface type	RS-232 DCE
Data transmission protocol	Asynchronous, 9600 bit/s, 8
	bits/character, 1 stop bit, no
	parity
Modem signals	DTR, DSR, CTS, RTS, CD
Connector	DB-9 (female)

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SNMP Management Port

Interface type	Ethernet 10Base-T
Connector	RJ-45

Emergency Alarm Port

Connector	DB-9 (male)
Relay contacts current	Up to 600 mA
Relay contacts voltage	
	125 VAC

Diagnostic Modes

Loops	Local, remote
BER tester	Built-in
Management	Over RS-232 control port
	(console), over SNMP, or
	from remote device

Dimensions and Weight

Dimensions	$\dots \dots 444 \text{ mm} \times 262 \text{ mm} \times 44 \text{ mm}$
Weight	

Power Supply

From AC mains ("-AC" option)	176 – 264 VAC, 50 Hz
From DC source ("-DC" option)	36 – 72 VDC
Power consumption	No more than 20 W

Operating Conditions

Temperature	0 to +50 °C
Relative humidity	

Section 2. Installation

2.1. Installation Space Requirements

When installing the multiplexer, allow for at least 10 cm of free space at the front of device for interface cable connections.

The ambient temperature must be 0 to +50 °C, with humidity of up to 80 %, non-condensing.

2.2. Delivered Items

The FMUX unit of the corresponding design	1 pc.
Bracket for mounting FMUX unit in 19" rack	2 pcs.
Self-adhesive foot for FMUX unit	4 pcs.
Power supply cable (for "-AC" model)	1 pc.
Removable part of power supply connector terminal unit (for "-DC" model).	1 pc.
Installation and Operations Manual	1 pc.

2.3. Cable Connections

All connectors are located on the front panel of multiplexer:



Fig. 2. Connector locations

Power Supply Connector

Standard mains connector (IEC 320 C14) is used to connect AC power supply cable (for "-AC" model). The power supply cable is supplied with the device.

To connect DC power supply cable (for "-DC" model), the power supply connector's terminal unit is used. The connector's pin assignment shown below (view from device's front panel side):



Fig. 3. DC power supply connector

The corresponding removable part of terminal unit of the power supply connector, is supplied with the device.

Grounding

M4 screw is located on the front panel for device grounding.



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

E1 Port Connectors

RJ-48 connector is used for E1 port connections:



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

Fig. 4. E1 port connector

Link Port Connector (V.35, RS-530, RS-449)

HDB44 (female) connector is used for connecting link port:

15 (6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0) 1
30\	、 o o o o o o o o o o o o o o /	16
44	\	31

Fig. 5. Link port connector

Din	1/25	DC 520 DC 440	
PIII	V.30	KS-330, KS-449	
10	TXD-a	I XD-a	
25	TXD-b	TXD-b	
8	RXD-a	RXD-a	
9	RXD-b	RXD-b	
6	ETC-a	ETC-a	
7	ETC-b	ETC-b	
5	RXC-a	RXC-a	
4	RXC-b	RXC-b	
14	RTS	RTS-a	
29	—	RTS-b	
11	DTR	DTR-a	
26	—	DTR-b	
13	DSR	DSR-a	
28	—	DSR-b	
15	CTS	CTS-a	
30	—	CTS-b	
12	CD	CD-a	
27	—	CD-b	
1,16	GND	GND	
31	SEL-0*	SEL-0*	
33	SEL-1	SEL-1*	
35	SEL-2	SEL-2	
37	SEL-3	SEL-3*	
39	SEL-4*	SEL-4	
41	SEL-5*	SEL-5	
43	SEL-6*	SEL-6	
* - Connect contact to GND			

Cable Diagrams for Connections to Link Port

Below are cable diagrams for connecting to DTE and DCE devices using external transmit clock. Multiplexer V.35 port input signals are denoted by left arrow (" \leftarrow "), and output signals are denoted by right arrow (" \rightarrow ").

V.35 Cable for Connection to DCE

V.35 Cable for Connection to DTE

Signal	HDB44 (male)		M34 (male)	Signal
TXD-a	10		R	RXD-a
TXD-b	25	<i>←</i>	Т	RXD-b
RXD-a	8	\rightarrow	Р	TXD-a
RXD-b	9	\rightarrow	S	TXD-b
ETC-a	6	←	V	RXC-a
ETC-b	7	←	Х	RXC-b
RXC-a	5	\rightarrow	U	ETC-a
RXC-b	4	\rightarrow	W	ETC-b
RTS	14	\leftarrow	F	CD
DTR	11	\leftarrow	E	DSR
DSR	13	\rightarrow	Н	DTR
CD	12	\rightarrow	С	RTS
CTS	15	Not co	nnected	
GND	1	\leftrightarrow	А	GND
GND	16	\leftrightarrow	В	GND
SEL-x	Con 31, 3 41, 4 GNE	nect 32, 39, 43 to 0 1		

Signal	HDB44 (male)		M34 (female)	Signal
TXD-a	10	\leftarrow	Р	TXD-a
TXD-b	25	\leftarrow	S	TXD-b
RXD-a	8	\rightarrow	R	RXD-a
RXD-b	9	\rightarrow	Т	RXD-b
ETC-a	6	\leftarrow	U	ETC-a
ETC-b	7	\leftarrow	W	ETC-b
RXC-a	5	\rightarrow	V	RXC-a
RXC-b	4	\rightarrow	Х	RXC-b
RTS	14	\leftarrow	С	RTS
DTR	11	\leftarrow	Н	DTR
DSR	13	\rightarrow	E	DSR
CTS	15	\rightarrow	D	CTS
CD	12	\rightarrow	F	CD
GND	1	\leftrightarrow	А	GND
GND	16	\leftrightarrow	В	GND
SEL-x	Connect 31, 39, 41, 43 to GND 1			

RS-530 Cable for Connection to DCE

Signal	HDB44		DB25	Signal
	(n	nale)	(male)	
TXD-a	10	\leftarrow	3	RXD-a
TXD-b	25	\leftarrow	16	RXD-b
RXD-a	8	\rightarrow	2	TXD-a
RXD-b	9	\rightarrow	14	TXD-b
ETC-a	6	\leftarrow	17	RXC-a
ETC-b	7	\leftarrow	9	RXC-b
RXC-a	5	\rightarrow	24	ETC-a
RXC-b	4	\rightarrow	11	ETC-b
RTS-a	14	\leftarrow	8	CD-a
RTS-b	29	\leftarrow	10	CD-b
DTR-a	11	\leftarrow	6	DSR-a
DTR-b	26	\leftarrow	22	DSR-b
DSR-a	13	\rightarrow	20	DTR-a
DSR-b	28	\rightarrow	23	DTR-b
CTS-a	15	Not co	nnected	
CTS-b	30	Not co	nnected	
CD-a	12	\rightarrow	4	RTS-a
CD-b	27	\rightarrow	19	RTS-b
GND	1	\leftrightarrow	1	
GND	16	\leftrightarrow	7	
SEL-x	Connect 31, 32, 33, 37 to GND 1			

RS-530 Cable for Connection to DTE

Signal	HDB44		DB25	Signal
	(ma	ale)	(temale)	
TXD-a	10	\leftarrow	2	TXD-a
TXD-b	25	\leftarrow	14	TXD-b
RXD-a	8	\rightarrow	3	RXD-a
RXD-b	9	\rightarrow	16	RXD-b
ETC-a	6	<u> </u>	24	ETC-a
ETC-b	7	<u> </u>	11	ETC-b
RXC-a	5	\rightarrow	17	RXC-a
RXC-b	4	\rightarrow	9	RXC-b
RTS-a	14	\leftarrow	4	RTS-a
RTS-b	29	\leftarrow	19	RTS-b
DTR-a	11	\leftarrow	20	DTR-a
DTR-b	26	\leftarrow	23	DTR-b
DSR-a	13	\rightarrow	6	DSR-a
DSR-b	28	\rightarrow	22	DSR-b
CTS-a	15	\rightarrow	5	CTS-a
CTS-b	30	\rightarrow	13	CTS-b
CD-a	12	\rightarrow	8	CD-a
CD-b	27	\rightarrow	10	CD-b
GND	1	\leftrightarrow	1	GND
GND	16	\leftrightarrow	7	GND
SEL-x	Connect 31, 33, 37 to GND 1			

RS-449 Cable for Connection to DCE

Signal	HD)B44	DB37	Signal
_	(m	nale)	(female)	_
TXD-a	10	←	6	RXD-a
TXD-b	25	<i>←</i>	24	RXD-b
RXD-a	8	\rightarrow	4	TXD-a
RXD-b	9	\rightarrow	22	TXD-b
ETC-a	6	\leftarrow	8	RXC-a
ETC-b	7	\leftarrow	26	RXC-b
RXC-a	5	\rightarrow	17	ETC-a
RXC-b	4	\rightarrow	35	ETC-b
RTS-a	14	\leftarrow	13	CD-a
RTS-b	29	\leftarrow	31	CD-b
DTR-a	11	\leftarrow	11	DSR-a
DTR-b	26	\leftarrow	29	DSR-b
DSR-a	13	\rightarrow	12	DTR-a
DSR-b	28	\rightarrow	30	DTR-b
CTS-a	15	Not co	onnected	
CTS-b	30	Not co	onnected	
CD-a	12	\rightarrow	7	RTS-a
CD-b	27	\rightarrow	25	RTS-b
GND	1	\leftrightarrow	1	GND
GND	16	\leftrightarrow	19	GND
SEL-x	Connect			
	31,	32,		
	33,	31 TO		
	GNI	רכ		

RS-449 Cable for Connection to DTE

Signal	HDB44		DB37	Signal
	(male)		(female)	_
TXD-a	10	\leftarrow	4	TXD-a
TXD-b	25	\leftarrow	22	TXD-b
RXD-a	8	\rightarrow	6	RXD-a
RXD-b	9	\rightarrow	24	RXD-b
ETC-a	6	←	17	ETC-a
ETC-b	7	←	35	ETC-b
RXC-a	5	\rightarrow	8	RXC-a
RXC-b	4	\rightarrow	26	RXC-b
RTS-a	14	\leftarrow	7	RTS-a
RTS-b	29	\leftarrow	25	RTS-b
DTR-a	11	\leftarrow	12	DTR-a
DTR-b	26	\leftarrow	30	DTR-b
DSR-a	13	\rightarrow	11	DSR-a
DSR-b	28	\rightarrow	29	DSR-b
CTS-a	15	\rightarrow	9	CTS-a
CTS-b	30	\rightarrow	27	CTS-b
CD-a	12	\rightarrow	13	CD-a
CD-b	27	\rightarrow	31	CD-b
GND	1	\leftrightarrow	1	GND
GND	16	\leftrightarrow	19	GND
SEL-x	Connect 31, 33, 37 to GND 1			

SNMP Port Connector

RJ-45 female socket is used for connection of Ethernet cable (10Base-T, IEEE 802.3 standard) for management via SNMP protocol:



Fig. 6. SNMP port connector

Use direct cable for connection to hub.

Console Port Connector

The device may be managed using ASCII terminal (console). DB-9 (female) connector is used for console connection. The console port has standard RS-232 DCE interface, and utilizes the following settings: asynchronous mode, 9600 Baud speed, 8 bits/symbol, 1 stop bit, no parity.



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

It is recommended to use following cable diagrams:



Fig. 7. Console cable diagrams

Use direct cable for connection to PC COM port.

Emergency Alarm Connector

DB-9 (male) connector is used for emergency alarm connection:



Fig. 8. Emergency alarm connector



External input sensor connected to the device must be isolated from other electrical circuits. Failure to comply with this requirement may lead to device malfunction.

Section 3. Operation

3.1. Indicators

The front panel contains indicators, showing device status. List of the indicators and their functions are presented in the table.



Fig. 9. Indicator locations

Indicator	Color	Description
LERR	Red	Link port errors:
		 lights or flashes during high error rate in the link port input signal;
		 lights when receiving test pattern from the link port with loop enabled on the link;
		 lights or flashes when there are BER tester errors in the link test mode (TST indicator lights).
LOS	Red	Lights during loss of the RTS signal.
PORT LOS	Red	E1 port errors:
		 flashes during HDB3 coding errors in the correspond- ing E1 port;
		 lights during loss of carrier in corresponding E1 port;
		 lights when receiving AIS signal at the input of cor- responding E1 port.

Indicator	Color	Description
PORT STATE	Green	E1 port operating mode:
		 lights – normal operation;
		 does not light – port is not used;
		 flashes – loop enabled on the port;
		• double flashes – tributary loop enabled on the port.
PWR	Green	Power is supplied to the device.
RERR	Red	Errors of remote device (when RTS signal is present on the link port input of local device):
		 loss of RTS signal at the link port input of remote device;
		loss of link port synchronization of remote device.
TST	Red	Test mode:
		flashes when BER tester is enabled towards the link port;
		 flashes when loop is enabled on the link port;
		 double flashes when remote loop is enabled.
SNMP EACT	Green	Ethernet data transmission in progress
SNMP ELINK	Green	Ethernet 10Base-T cable connected

In the normal mode indicators must be in the following states:

Indicator	Color	Normal state
PWR	Green	Lights
LERR	Red	Does not light
LOS	Red	Does not light
RERR	Red	Does not light
TST	Red	Does not light
PORT LOS	Red	Does not light
PORT STATE	Green	Lights if port is used
SNMP EACT	Green	Flashes during Ethernet data transmission
SNMP ELINK	Green	Lights if Ethernet 10Base-T cable is connected

3.2. Alarms

The multiplexer is equipped with emergency alarm interface.

The emergency alarm interface is designed for switching on external executive device (such as a bell, buzzer, indicator on control panel, etc.) during emergency.

Alarm relay is used in the "dry contacts" mode (that is, its contacts are isolated from all electrical circuits in the multiplexer).

The following situations are considered emergencies:

- power failure;
- loss of signal or frame synchronization in the link port;
- loss of signal in at least one of the E1 ports used (in "In use" state");
- alarm signal received from external input sensor of remote device.

Alarm from external input sensor for transmission to remote device is generated either when the sensor contacts close (this mode is enabled by default), or when they open (alarm generation mode is described in the "*Sensor input*" subsection of section 4.8 " *"Configure" menu*").

If the multiplexer is installed in unserviceable room, then external input sensor contacts may be used, for example, for transmitting climate sensor signal, door opening signals, etc.

The alarm connector pinout is presented in "*Alarm connector*" subsection of section 2.5 "*Cable connections*".

3.3. Device Response to Emergencies

Loca	Remote Device			
State	Indicators	AIS	Indicators	AIS
	and Relays	Output	and Relays	Output
		to E1		t0 E1 Ports
Loss of power supply	All indicators do	1 0113	LOS lights	To all
	not light.		Relay - ALARM	ports
	Relay - ALARM			1
Loss of link port input	LOS lights.	To all	RERR lights	
signal	Relay - ALARM	ports	_	
High error rate in the link	LERR lights.	To all	RERR lights	
port input signal	Relay - ALARM	ports		
E1 port #N is declared	PORT N STATE			
"Unused"	does not light			
Loss of input signal at E1	PORT N LOS			To port N
port (port is in "in use"				
LOSS OF INPUT SIGNAL AT ET	PORT N STATE			TO PORT IN
state)				
AIS signal received at E1	PORT N LOS			To port N
port #N	lights.			
Local loop enabled on	TST flashes	To all		
the link port		ports		
Remote loop enabled on	ISI double		ISI flashes	Io all
	PURI N SIAIE			IO PORT N
Tributary loop anabled on	DODT N CTATE	To port N		
E1 port #N	double flashes			
		1		

3.4. Loops

Port Loop



Tributary Loop



Local Link Loop



Remote Link Loop



Remote loopback request enabled, TST indicator double flashes Remote Mux: Local loopback enabled by remote request, TST indicator flashes

3.5. Built-in BER Tester

FMUX multiplexer is equipped with built-in BER tester (BERT), which allows measuring error rate in the link path. The measurements are performed using fixed or pseudorandom code according to O.151 Recommendation (pattern length is: 2²³-1=8,388,607 bits). BER tester is managed from the console (see "Test" menu" section).

BER tester calculates error rate by comparing data received from the link with those transmitted to the link.

Warning

When BER tester is enabled on local device, test data are transmitted to the link. If during this, no test data are received from the link, then "Test pattern not detected" message will be displayed on the console. When no multiplexed data from the transmitted ports are received from the link, AIS signal is output to all E1 ports of the multiplexer.

This situation is shown on the diagram below:



When working with BER tester the following two options should be considered.

Link Testing Via Remote Loop

BER tester is enabled on the local device, and a loop towards the link path is enabled on remote device:



Enabling BER testers in Opposite Directions

BER testers are enabled on local and remote device (such configuration allows separate measurements of link error rates in both transmission directions):



Section 4. Management over Console Port

The device is managed using ASCII terminal (console). The console may be used to view current device modes, port states, local and remote error statistics, to select device modes and save them in non-volatile memory.

4.1. Upper Level Menu

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

```
Cronyx FMUX / 4E1-SAT-SNMP revision A, 28/04/2006

Mode: Normal; Sensor=Open

Link: 8448 kbps, Ok, Cable cross V.35

DTR, RTS, ETC, DSR, CTS, CD, RXC

1. Link statistics

2. E1 port statistics

3. Event counters

4. Loop...

5. Test...

6. Configure...

7. Login to remote device

0. Reset

Command: _
```

The upper line represents device model name, revision code and firmware date.

"Mode" line shows the "Alarm" state and external input sensor state:

- "Normal" normal state or "Alarm" "alarm" state;
- "Sensor= ..." state of external input sensor contacts: "Open" or "Closed"; if "Sensor input: Alarm on open" option is selected in configuration menu, then "Alarm on open" definition is shown.

For more information see "Alarms" section.

"Link" line shows bit rate used (8448, 6336, 4224, or 2112 kbit/s) and link port state:

- "OK" normal state, frame synchronization present;
- "LOS" loss of signal in the link;

- "LOF" loss of frame synchronization;
- "AIS" AIS signal is being received;
- "Loop" local loop enabled on the link: the received signal is turned back;
- "Remote loop" request for remote loop enabling.

When BER tester is enabled, the "Link" line also shows information about test results:

- "Test pattern not detected" if the test pattern was not detected in received data;
- "Test error rate=..." error rate in received data, 10⁻¹ to 10⁻⁸ (shown in place of "Test pattern not detected" message);
- "Time total/loss=.../..." total test time (days hours:minutes:seconds)/time in "Test pattern not detected" state (seconds);
- "Bit errors=..." data error counter;
- "Code=..." test pattern code.

4.2. Menu Structure



4.3. "Link statistics" Menu

"*Link statistics*" mode is designed for viewing link ports status and statistics counters:

```
Link statistics: Session #5, 0 days, 0:45:44

Mode: Normal; Sensor=Open

Link: 8448 kbps, 0k, Cable cross V.35

DTR, RTS, ETC, DSR, CTS, CD, RXC

-Errored seconds-

Receive Transmit Status

Link: 0 - 0k

remote: 0 - 0k

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

Information on the screen is updated once per two seconds. To return to upper level menu, you must press <Enter> (or <Return>). Press "R" to toggle screen refresh mode between overlapping and redraw. In overlapping mode the screen will not be cleared when information is updated. To reset the statistics counters to zero, press "C".

"Link statistics" line contains current session number and time passed from switching on or restarting the multiplexer (by "Reset" command). The session number increments every time the device is restarted.

Description of lines in the upper part of the screen, including "**Mode**" and "**Link**", is presented in "Upper level menu" section.

Below are link port states and statistics counters:

- "Link" local multiplexer link port;
- "**Remote**" remote multiplexer link port;

The link ports' "Status" is shown as a set of flags:

- "OK" normal state, frame synchronization present;
- "LOS" loss of signal in the link;
- "AIS" link failure signal reception (the "all ones" code);
- "LOF" loss of frame synchronization;
- "FARLOF" loss of frame synchronization on remote multiplexer.

Statistics counters. Above "-**Errored seconds**-" caption, there are the following column headings:

• "Receive" – number of seconds during which frame synchronization was lost in the link.

("Transmit" column is not used for this model, and contains dash for each link port.)

4.4. "E1 port ptatistics" Menu

"E1 port statistics" menu is designed for viewing E1 ports status and statistics counters:

```
E1 port statistics: Session #5, 0 days, 1:02:06
Mode: Normal; Sensor=Open
Link: 8448 kbps, Ok, Cable cross V.35
        DTR, RTS, ETC, DSR, CTS, CD, RXC
                           -Errored seconds-
                CV
                           Receive Transmit Status
E1 port 0:
                0
                           0
                                             ok
                                    _
E1 port 1:
               0
                           0
                                             0k
                                    _
                0
E1 port 2:
                           0
                                    _
                                             0k
E1 port 3:
                0
                           0
                                             0k
C - clear counters, R - refresh mode, any key to break..._
```

The screen information is updated once per three seconds. To return to the upper level menu, you must press <Enter> (or <Return>). Press "R" to toggle screen refresh mode between overlapping and redraw. In overlapping mode the screen will not be cleared when information is updated. To reset statistics counters to zero, press "C".

"E1 port statistics" line contains current session number and time passed from switching on or restarting the multiplexer. Session number increments every time the device is restarted.

Description of lines in the upper part of the screen, including "**Mode**" and "**Link**", is presented in "Upper level menu" section.

Further, E1 port states and statistics counters are displayed:

- "CV" column the number of code violations;
- "Receive" column (under "-Errored seconds-" caption) contains the number of seconds during which frame synchronization was lost in the link.

("Transmit" column is not used for this model, and contains dash for each E1 port.)

The ports' "Status" is shown as a set of flags:

- "OK" normal state, frame synchronization present;
- "LOS" loss of signal in the link;
- "AIS" link failure signal is being received (the "all ones" code);
- "Loop" loop enabled;
- "Tloop" tributary loop enabled.

States are not shown for unused ports.

4.5. "Event counters" Command

For more information about counters use "Event counters" command:

```
Alive: 0 days, 0:24:39 since last counter clear
Link counters
0 - data encoding errors
0 - payload checksum errors
Mux counters
0 - El port 0 data FIFO errors
0 - El port 1 data FIFO errors
0 - El port 2 data FIFO errors
0 - El port 3 data FIFO errors
Press any key to continue..._
```

"Link counters" – link port counters:

- "data encoding errors" received data encoding errors counter;
- "payload checksum errors" counter of data checksum errors.

"Mux counters" – multiplexer counters:

• "E1 port N data FIFO errors" – error counter for data passing through the FIFO buffer of E1 port #N.

4.6. "Loop" Menu

"Loop" menu is designed for managing loops:

```
Loop

Mode: Normal; Sensor=Open

Link: 8448 kbps, Ok, Cable cross V.35

DTR, RTS, ETC, DSR, CTS, CD, RXC

1. Link loop: Disabled

2. Remote link loop: Disabled

3. Port loop...

4. Tributary loop...

Command: _
```

The following loops are implemented:

- "Link loop" local loop on the link. When loop is "Enabled", data received from the link port are turned back;
- "Remote link loop" remote loop on the link. When it is switched in "Enabled" state, request is sent towards the link, to enable loop in the link port of the remote multiplexer;
- "Port loop..." switches to E1 port loop management menu;
- "Tributary loop..." switches to E1 port tributary loop management menu.

Loop modes are not stored in nonvolatile memory.

"Port loop" Menu

"Port loop" menu is designed for managing loops on E1 ports:

```
Port loop
Mode: Normal; Sensor=Open
Link: 8448 kbps, Ok, Cable cross V.35
DTR, RTS, ETC, DSR, CTS, CD, RXC
1. E1 port 0 loop: Disabled
2. E1 port 1 loop: Disabled
3. E1 port 2 loop: Disabled
4. E1 port 3 loop: Disabled
Command: _
```

"E1 port N loop" – loop management on E1 ports. When the loop is "Enabled", data received from port #N are turned back.

"Tributary loop" Menu

The "Tributary loop" menu is designed for managing tributary loops on E1 ports:

```
Tributary loop
Mode: Normal; Sensor=Open
Link: 8448 kbps, Ok, Cable cross V.35
DTR, RTS, ETC, DSR, CTS, CD, RXC
1. E1 port 0 tributary loop: Disabled
2. E1 port 1 tributary loop: Disabled
3. E1 port 2 tributary loop: Disabled
4. E1 port 3 tributary loop: Disabled
Command: _
```

"E1 port N tributary loop" – tributary loop management. When loop is "Enabled", data received for port #N from the link are turned back. The AIS signal is output into the corresponding E1 port.

4.7. "Test" Menu

"Test" menu is designed for managing BER tester:

```
Bit Error Test
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_
```

Screen information is updated once per two seconds. To return to upper level menu, you must press <Enter> (or <Return>). Press "R" to toggle screen refresh mode between overlapping and redraw. In overlapping mode the screen will not be cleared when information is updated. To reset statistics counters to zero, press "C".

"**Testing: ...**" command enables or disables data test pattern generation (switches from "Disabled" state to "Enabled" and back).

"Error insertion rate: ..." command selects error insertion rate, from 10⁻⁷ to 10⁻¹ errors/bit, or disables error insertion mode, in this case "No errors inserted" message is displayed in place of numeric value.

"Insert single error" command inserts single error.

"**Test pattern: ...**" command allows using either pseudo-random code as a test pattern, or selecting fixed 8 bit code.

Test results information is displayed in the following lines:

- "Time total: ..." total test time;
- "Sync loss: ..." time during which test pattern synchronization was lost;
- "Bit errors: ..." bit error counter;
- "Error rate: ..." error rate in the received data, from 10⁻¹ to 10⁻⁸. If testing is not enabled, "Testing disabled" message is displayed in this field, if no test pattern is detected in the received data, the "Test pattern not detected" message is shown.

Error rate measurement device modes are not saved in nonvolatile memory.

4.8. "Configure" Menu

"Configure" menu allows setting multiplexer operating modes:

```
Configure

Mode: Normal; Sensor=Open

Link: 8448 kbps, Ok, Cable cross V.35

DTR, RTS, ETC, DSR, CTS, CD, RXC

1. Port configuration...

2. Link...

3. SNMP...

4. Sensor input: Alarm on closed

5. Factory settings

6. Save parameters

7. Restore parameters

Command: _
```

"Port configuration" Menu

"Port configuration" menu is designed for selecting a set of E1 ports for use:

```
Port configuration
Mode: Normal; Sensor=Open
Link: 8448 kbps, Ok, Cable cross V.35
      DTR, RTS, ETC, DSR, CTS, CD, RXC
    Е1
          E1
                  E1
                          E1
    port 0 port 1 port 2 port 3
 _____
* 1. E1 E1 E1 E1
2. E1 E1 E1 -
3. E1 E1 - -
 4. E1
          _
(* - current configuration)
Command: _
```

If port is "Unused", its LOS and STATE indicators do not light, and port state does not affect "alarm".

"Link" Menu

"*Link*" menu is designed for setting link port parameters:

```
Link

Mode: Normal; Sensor=Open

Link: 8448 kbps, Ok, Cable cross V.35

DTR, RTS, ETC, DSR, CTS, CD, RXC

1. Transmit data strobe: Normal (data valid on falling edge)

2. Receive data strobe: Normal (data valid on falling edge)

Command: _
```

The menu allows configuring the following parameter values:

- "Transmit data strobe: ..." for transmitted data strobing:
 - "Normal (data valid on falling edge)";
 - "Inverted (data valid on rising edge)";
- "Receive data strobe: ..." for received data strobing:
 - "Normal (data valid on falling edge)";
 - "Inverted (data valid on rising edge)".

"SNMP" Menu

"*SNMP*" menu is designed for setting network IP addresses and SNMP protocol parameters:

```
SNMP
Mode: Normal; Sensor=Open
Link: 8448 kbps, Ok, Cable cross V.35
        DTR, RTS, ETC, DSR, CTS, CD, RXC
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: secret
  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 Ethernet port operation:

- "IP address/netmask: ..." multiplexer SNMP port IP address and netmask length;
- "Gateway IP address: ..." router gateway IP address.

The following parameters must be set for management over SNMP protocol:

- "Get community: ..." password for information request access;
- "Get IP address/netmask: ..." IP address and netmask length for information request access restriction;
- "Set community: ..." password for parameter configuration access;
- "Set IP address/netmask: ..." IP address and netmask length for parameter configuration access restriction;
- "Traps: ..." emergency trap sending ("Enabled" or "Disabled");
- "Authentication traps: ..." unauthorized access trap sending ("Enabled" or "Disabled");
- "Trap community: ..." password for sending emergency traps;
- "Trap destination IP address: ..." IP address for sending emergency traps.

"Sensor input" Command

"*Sensor input*" command switches the remote device alarm generation mode from external sensor. The external sensor has two operating modes: "Alarm on closed" (default) and "Alarm on open". In "Alarm on closed" mode, when the external input sensor contacts are closed, remote device goes into alarm state. (For more details see section 3.2 "*Alarms*").

"Factory settings" Command

"*Factory settings*" command restores device modes to their initial state:

- E1 port use mode all ports "In use";
- transmitted and received data strobe mode "Normal (data valid on falling edge)";
- alarm input sensor contact mode "Sensor input: Alarm on closed".

"Save parameters" Command

After configuring parameters (or executing "*Factory settings*" command) you should store the parameters in non-volatile memory (NVRAM) of the multiplexer using "*Save parameters*" command. In this case the saved parameters will be restored when the device is restarted.

"Restore parameters" Command

If parameters were changed, but not saved to NVRAM using *"Save parameters"* command, then configuration stored in NVRAM may be restored using *"Restore parameters"* command.

4.9. "Login to remote device" Command

"Login to remote device" command gives ability to connect to the menu of the remote multiplexer. An example of remote menu is given below. To disconnect from remote menu, enter X (Ctrl-X).

```
Remote login...
(Press ^X to exit)
Cronyx FMUX / 4E1-SAT-SNMP revision A, 28/04/2006
Mode: Normal; Sensor=Open
Link: 8448 kbps, Ok, Cable cross V.35
DTR, RTS, ETC, DSR, CTS, CD, RXC
1. Link statistics
2. E1 port statistics
3. Event counters
4. Loop...
5. Configure...
0. Reset
Remote (^X to exit): _
```

In the remote login mode, it is possible to view device modes, port state, and local and remote error statistics. It is also allowed to set device modes and loops on E1 ports.

4.10. "Reset" Command

"*Reset*" command causes multiplexer to reload. After this, the modes stored in non-volatile memory (NVRAM) are set.

Section 5. Management over SNMP

The multiplexer is equipped with SNMP management port. Using SNMP protocol, it is possible to view current device modes, port states, and error statistics.

5.1. Configuring SNMP Parameters

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

- IP address/netmask Ethernet port IP address and netmask length;
- Gateway IP address router gateway IP address.
- Get community information request access password.
- Get IP address/netmask information request access restriction IP address and netmask length.

Information request access is permitted only for hosts, whose IP addresses equal to the one specified by "Get IP address" parameter. Higher-order bits are used for IP address comparison, the number of which is specified by "Netmask".

Additional parameters must be configured for access to parameter settings:

- Set community parameter configuration access password.
- Set IP address/netmask parameter configuration access restriction IP address and netmask length.



Parameter configuration access right must be granted to authorized hosts only.

In case of emergencies, device is able to sent SNMP traps. The following parameters must be configured to enable this:

- Traps allow sending emergency traps.
- Authentication traps allow sending unauthorized access traps.
- Trap community password for sending emergency traps.
- Trap destination IP address IP address for sending emergency traps.

SNMP traps are sent when following events occur:

- Multiplexer power-up or reload COLD START trap.
- Unauthorized access attempt over SNMP protocol AUTHENTICATION FAILURE trap.
- Loss of signal or frame synchronization in the link LINK DOWN trap.

- Link switching to the normal mode LINK UP trap.
- Loss of signal at the E1 port PORT DOWN trap.
- Appearance of signal at the E1 port PORT UP trap.

5.2. Management Information Blocks (MIBs)

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

• SNMPv2-MIB – standard management information block, including common system parameters (system), network interfaces (if), IP protocol (IP, ICMP), UDP protocol (UDP), and SNMP protocol statistics (SNMP).

• CRONYX-FMUX-MIB – special management information block, containing E1 ports and link ports states.

CRONYX-FMUX-MIB specification files are available on the following address: www.cronyx.ru.

Web: www.cronyx.ru

E-mail: info@cronyx.ru