CFM Series

Full Outdoor Unit

Technical Description

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1 Overview

Proprietary notice

The specifications or information contained in this document are subject to change without notice due to continuing introduction of design improvements. If there is any conflict between this document and compliance statements, the latter will supersede this document.

This document briefly describes the CFM series **Full Outdoor Unit** (FODU) covering the built-in management system, configuration functionality, hardware features, etc.

1.1 Full Outdoor Units

There are three types of Full Outdoor Units:

- 2xE1 FODU, operating with 4 Mbps WAN capacity, provides 2xE1 traffic ports;
- 4xE1 FODU, operating with 8 Mbps WAN capacity, provides 4xE1 traffic ports;
- Ethernet + 2E1 FODU, operating with 34 Mbps WAN capacity, provides 10\100Base-T Ethernet port, and 2xE1 traffic ports. Note: The total throughput of the Ethernet bridge is 30 Mbps by default, because both E1 ports are enabled; to switch the bridge to full WAN capacity, the E1 ports should be disabled.

The Full Outdoor Unit is available for 7, 8, 13, 15, 18, 23, 26 and 38 GHz bands.

FODUs provide the following interfaces:

Port (see Figure 1)	**FODU type**		
	2E1	4E1	Ethernet + 2E1
• Two E1 (G.703) traffic interfaces, 120 Ω balanced, with hermetically sealable RJ-45 socket;	N/A	√	N/A
• Two E1 (G.703) traffic interfaces, 120 Ω balanced, implemented in 18-pin socket;	√	√	√
• 100Base-T Ethernet traffic port with hermetically sealable RJ-45 socket	N/A	N/A	√
• RS232 serial console port with Twin-BNC port connector, - provides local management, - control and monitoring of the FODU from a PC via command interface (e.g., using programs like "Hyper Terminal");	√	√	√
• 10Base-T Ethernet management port (Full Duplex), implemented in 18-pin socket; the port provides Telnet, Web and SNMP maangment;	√	√	√
• RSSI port with BNC socket for antenna alignment adjustment: this port is used for antenna positioning during installation;	√	√	√
• Alarm relay: special dry relay alarm contact group signalizes any malfunction; the alarm triggers in case of any of the following occurrences: - Power supply failure; - Loss of WAN frame synchronization (from far-end site); - Received signal level is lower the predefined value (with *RxAlarmLevel* command); - Humidity level too high; - Transmitter PLL failure. Normally relay contacts are closed (circuit is closed).	√	√	√

The RS-232 interface, and 2 E1 traffic interfaces, as well as alarm relay and power supply outlet are all implemented on a single 18-pin port connector (refer to Chapter 5 for pinouts).

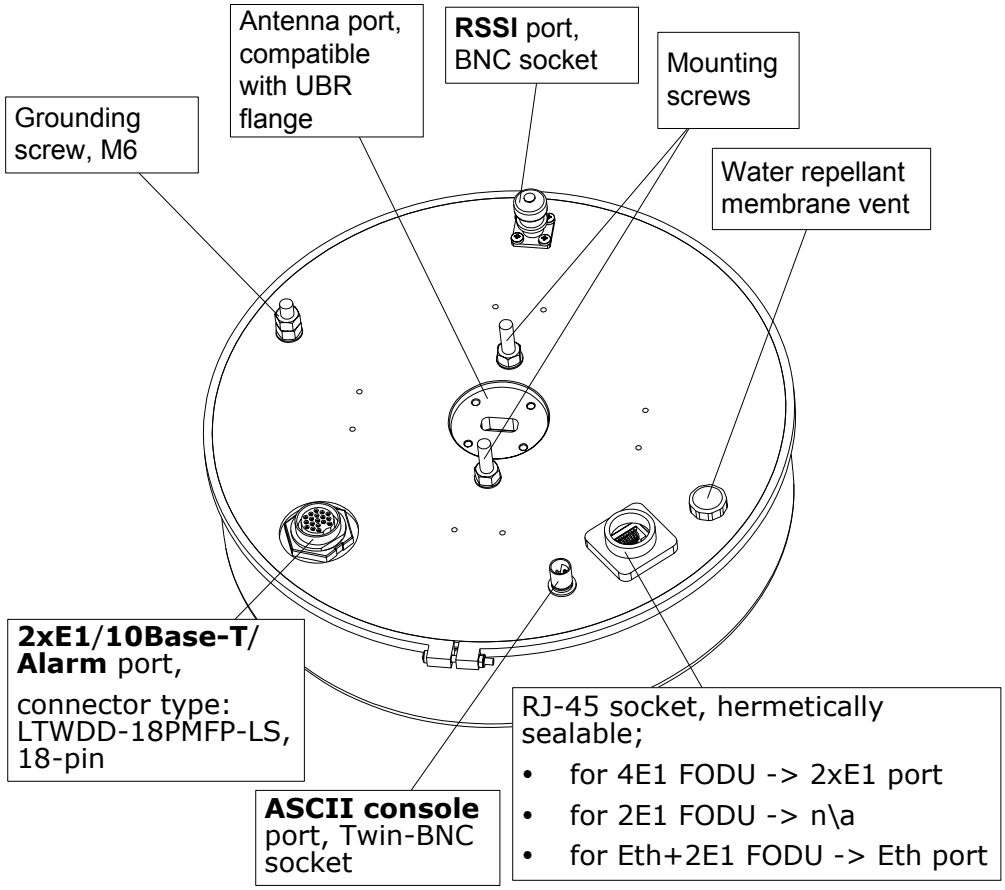

Figure 1. FODU overview

1.2 Interface Termination Unit (CFM-8-TU4E1)

Along with the Full Outdoor Unit, the **CFM-8-TU4E1** unit may be used for FODU interface termination; the CFM-8-TU4E1 unit terminates following ports

- **E1 ports**: the unit converts four balanced E1 signals coming from the FODU to unbalanced, providing
  - four balanced 75 Ω E1 ports with BNC connector, and
  - four unbalanced 120 Ω E1 ports with RJ-45 socket (see Figure 2 for details).
- **10Base-T management port**; to connect PC, the crossover TP cable must be used.

Additionally, the Termination Unit provides Power socket.

Note: the unit does not provide serial management port (RS-232), the serial port can only be used by directly connecting to FODU.

The CFM-8-TU4E1 unit is optional and can be used with any of the CFM Full Outdoor Units, it is frequency and capacity independent.

CFM-8-TU4E1 unit mechanical data:

- Dimensions (HxWxD): 44 x 482,6 x 54 mm
- Weight: 0,6 kg

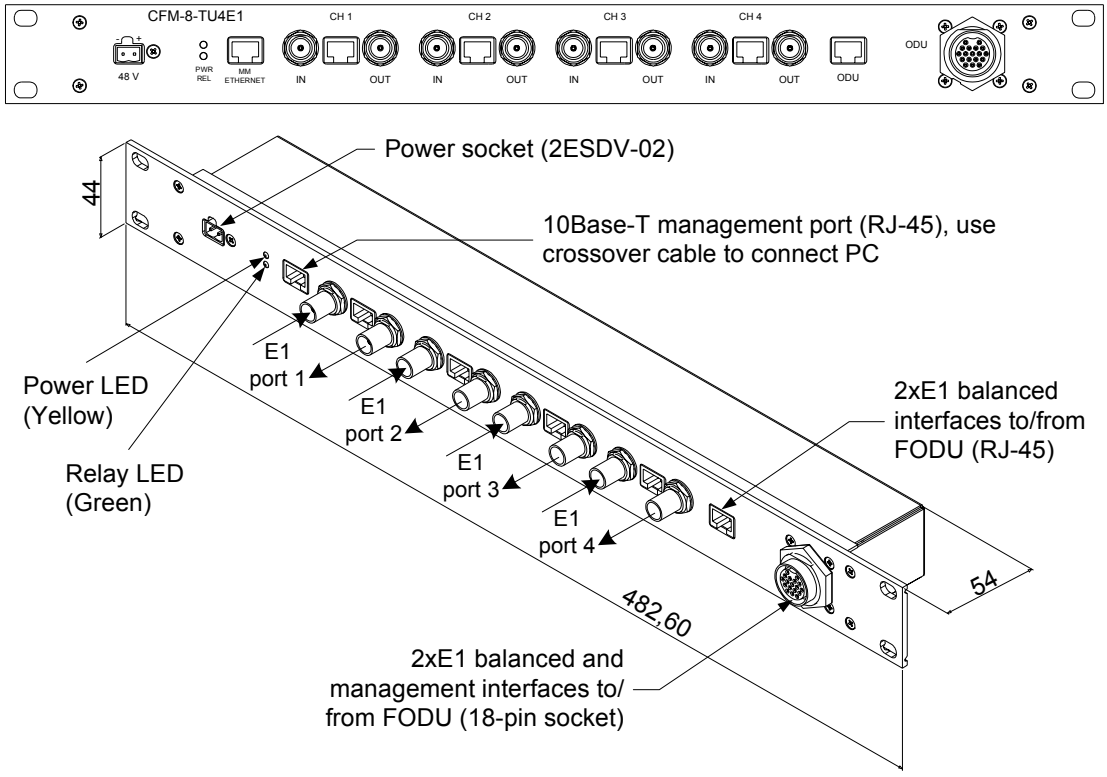

Figure 2. Termination Unit for FODU; the E1 port numbers on the front panel correspond to FODU port numbering.

1.3 Technical data

General specifications

<table>
<tr><td>Weight</td><td>3.0 kg</td></tr>
<tr><td>FODU Dimensions HxWxD</td><td>∅ 280 x 85 mm</td></tr>
<tr><td>Power consumption</td><td>15 W max</td></tr>
<tr><td>Power supply</td><td>From 20 to 60 VDC (directly on input of the FODU)</td></tr>
<tr><td>Operating temperature</td><td>-33 °C to +55 °C</td></tr>
<tr><td>Traffic interface ports</td><td>
<table>
<tr><td rowspan="2">FODU</td><td colspan="2">Traffic interface port</td></tr>
<tr><td>E1</td><td>10\100Base-T</td></tr>
<tr><td>2E1</td><td>2xE1→RJ-45</td><td>n/a</td></tr>
<tr><td>4E1</td><td>2xE1→RJ-45
2xE1→18 pin sock.</td><td>n/a</td></tr>
<tr><td>Ethernet + 2E1</td><td>2xE1→18 pin sock.</td><td>RJ-45</td></tr>
</table>
See Figure 1.
</td></tr>
<tr><td>Traffic capacity</td><td>2E1 FODU -> 2x2 Mbps
4E1 FODU -> 4x2 Mbps
2E1 + 100Base-T FODU -> (2x2 + 30)Mbps; by disabling sepparate E1 port(s), the WAN capacity are added to 100Base-T Ethernet port capacity.</td></tr>
<tr><td>Management ports</td><td>• RS-232 port for VT-100 terminal (ASCII console) with Twin-BNC port connector,
• 10Base-T port for Telnet, Web and SNMP management with 18-pin hermetically sealable connector, operates in Full Duplex mode.</td></tr>
<tr><td>Additional features:</td><td>• RSSI port (BNC socket) for antenna alignment adjustment;
• Alarm port (dry relay output) on 18 pin connector, see chapter 5 for pinouts.</td></tr>
</table>

Radio parameters

<table>
<tr><td>For all FODUs</td><td>Background BER: 10^{-11} , measurement methods:
7/8 GHz – ETSI EN 301 216 (2001-07),
13/15/18 GHz - ETSI EN 301 128 (2001-02),
23GHz - ETSI EN 300 198 (2002-03),
26GHz - ETSI EN 300 431 (2002-07),
38GHz - ETSI EN 300 197 (2002-07).</td></tr>
<tr><td>FODU operating in 7 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):
<table>
<tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr>
<tr><td>BER 10^{-6}</td><td>-84 dBm</td><td>-84.5 dBm</td><td>-77 dBm</td></tr>
<tr><td>BER 10^{-3}</td><td>-87 dBm</td><td>-87.5 dBm</td><td>-81 dBm</td></tr>
</table>
Max transmit power: 27 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 27 dBm
Waveguide flange: UBR 84</td></tr>
<tr><td>FODU operating in 8 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):
<table>
<tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr>
<tr><td>BER 10^{-6}</td><td>-84 dBm</td><td>-84.5 dBm</td><td>-77 dBm</td></tr>
<tr><td>BER 10^{-3}</td><td>-87 dBm</td><td>-87.5 dBm</td><td>-81 dBm</td></tr>
</table>
Max transmit power: 27 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 27 dBm
Waveguide flange: UBR 84</td></tr>
<tr><td>FODU operating in 13 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):
<table>
<tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr>
<tr><td>BER 10^{-6}</td><td>-83 dBm</td><td>-81 dBm</td><td>-75 dBm</td></tr>
<tr><td>BER 10^{-3}</td><td>-86 dBm</td><td>-84 dBm</td><td>-78 dBm</td></tr>
</table>
Max transmit power: 20 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 20 dBm
Waveguide flange: UBR 140</td></tr>
</table>

<table>
<tr><td>FODU operating in 15 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):<table><tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr><tr><td>BER 10^{-6}</td><td>-83 dBm</td><td>-81 dBm</td><td>-75 dBm</td></tr><tr><td>BER 10^{-3}</td><td>-86 dBm</td><td>-84 dBm</td><td>-78 dBm</td></tr></table>Max transmit power: 20 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 20 dBm
Waveguide flange: UBR 140</td></tr>
<tr><td>FODU operating in 18 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):<table><tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr><tr><td>BER 10^{-6}</td><td>-83.5 dBm</td><td>-81 dBm</td><td>-74 dBm</td></tr><tr><td>BER 10^{-3}</td><td>-87 dBm</td><td>-84 dBm</td><td>-77 dBm</td></tr></table>Max transmit power: 19 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 19 dBm
Waveguide flange: UBR 220</td></tr>
<tr><td>FODU operating in 23 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):<table><tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr><tr><td>BER 10^{-6}</td><td>-83.5 dBm</td><td>-80.5 dBm</td><td>-75.5 dBm</td></tr><tr><td>BER 10^{-3}</td><td>-87 dBm</td><td>-84.0 dBm</td><td>-79 dBm</td></tr></table>Max transmit power: 19 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 19 dBm
Waveguide flange: UBR 220</td></tr>
</table>

<table>
<tr><td>FODU operating in 26 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):<table><tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr><tr><td>BER 10^{-6}</td><td>-82 dBm</td><td>-79 dBm</td><td>-73 dBm</td></tr><tr><td>BER 10^{-3}</td><td>-87 dBm</td><td>-84 dBm</td><td>-78 dBm</td></tr></table>Max transmit power: 19 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 19 dBm
Waveguide flange: UBR 260</td></tr>
<tr><td>FODU operating in 38 GHz band</td><td>Receiver thresholds at antenna port (guaranteed):<table><tr><td>BER</td><td>2E1 FODU</td><td>4E1 FODU</td><td>Ethernet +2E1 FODU</td></tr><tr><td>BER 10^{-6}</td><td>-79.5 dBm</td><td>-76.5 dBm</td><td>-70.5 dBm</td></tr><tr><td>BER 10^{-3}</td><td>-83 dBm</td><td>-80.0 dBm</td><td>-74 dBm</td></tr></table>Max transmit power: 14 dBm
Frequency stability: +/- 10 PPM
Tx power attenuation: -10 … 14 dBm
Waveguide flange: UBR 320</td></tr>
</table>

1.4 Cable Requirements

RS-232 Serial Connection

The ASCII console must be connected to the RS-232 serial port with Twin-BNC connector. This requires a twisted pair (TP) cable with common shield (foil and plaited shield), the cable must be suitable for Twin-BNC connector.

Using a proper cable, the operation is guaranteed for up to 10 m of cable.

E1

The user equipment is connected to the FODU via twisted-pair cable (at least 8 pairs, - 16 wires), see Chapter 5 for pinouts. The 18-pin connector is suited for cables with the diameter from 4 to 10.5 mm.

E1 signals will be carried properly over at least 100 m of TP cable. The length of cable is restricted by the maximum allowable attenuation; - the attenuation must not exceed 6 dB.

For RJ-45 port use Cat 3 UTP or better cable.

10Base-T

10Base-T port pins are on the 18-pin connector, see Chapter 5.1 for details. If using Termination unit, the cross-over cable is required between Telnet\SNMP terminal, and Termination unit.

Power Supply to the Radio

The acceptable cable length witch will provide proper operation of the system from DC power feed point of view is determined by wire diameter and supplied DC voltage, typical figures are given in the table below.

Power supply voltage	Stranded wire diameter [mm]/AWG	Max. cable length
48 VDC	0.5 mm/24 AWG	100 m
24 VDC	0.5 mm/24 AWG	20 m

In order to provide proper sealing between the cable and the connector, the cable must have a diameter of the outer jacket from 4 to 10.5 mm with a minimum wire diameter of 0.5 mm (24 AWG).

1.5 Labelling

The label can be found on the front side of the unit.

The label contains the following information (see sample in the picture below):

- Model name ("CFM-15-F4E1"). The FODU model name is
  - CFM-xx-F2E1 for 4 Mbps 2xE1 FODU,
  - CFM-xx-F4E1 for 8 Mbps 4xE1 FODU,
  - CFM-xx-FR34 for 34 Mbps Ethernet+2xE1 FODU,

  xx - frequency band of the FODU.
- Model part # (F154E101);
- Unit serial # (04180047); Combined model part # + Unit S/N produces unique identifier for particular Unit;
- Subband identifier A, B, or C if appropriate for particular frequency band and channel plan;
- Tx High or Low designation (L or H in 2 rightmost boxes).

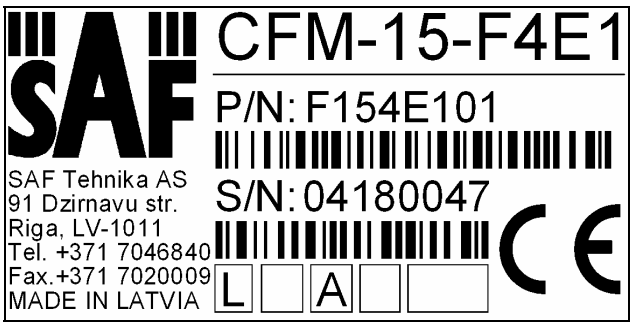

Figure 3. Label of the 4xE1 FODU, operating in 15 GHz band;

2 Management

There are three ways to adjust and read settings and operation parameters of the FODU equipment:

1. using ASCII console (also called VT-100 terminal) connected to the RS-232 port,
2. using Telnet terminal connected to the 10Base-T management port, or
3. using SNMP terminal, connected to the 10Base-T management port.

2.1 10Base-T Port

The 10Base-T management port (Full Duplex mode) is used to connect the FODU to PC or Ethernet network for Web, SNMP and Telnet management.

2.1.1 Web Server

The Web server allows to monitor and configure the FODU from Web page via HTTP; the user can connect to Web server via Ethernet management port. In order to configure the FODU or update software, the user must specify username and password to access configurations Web pages (Figure 7, Figure 8 , Figure 9 and Figure 11), each time the user connects to Web server, he will be prompted to enter username and password once will try to open configurations or software upload page. The username and password for Web server can be specified\changed using ASCII console (via serial port), or using Telnet terminal (via 10Base-T port); in order to change username and password, it is not required to know the current username and password.

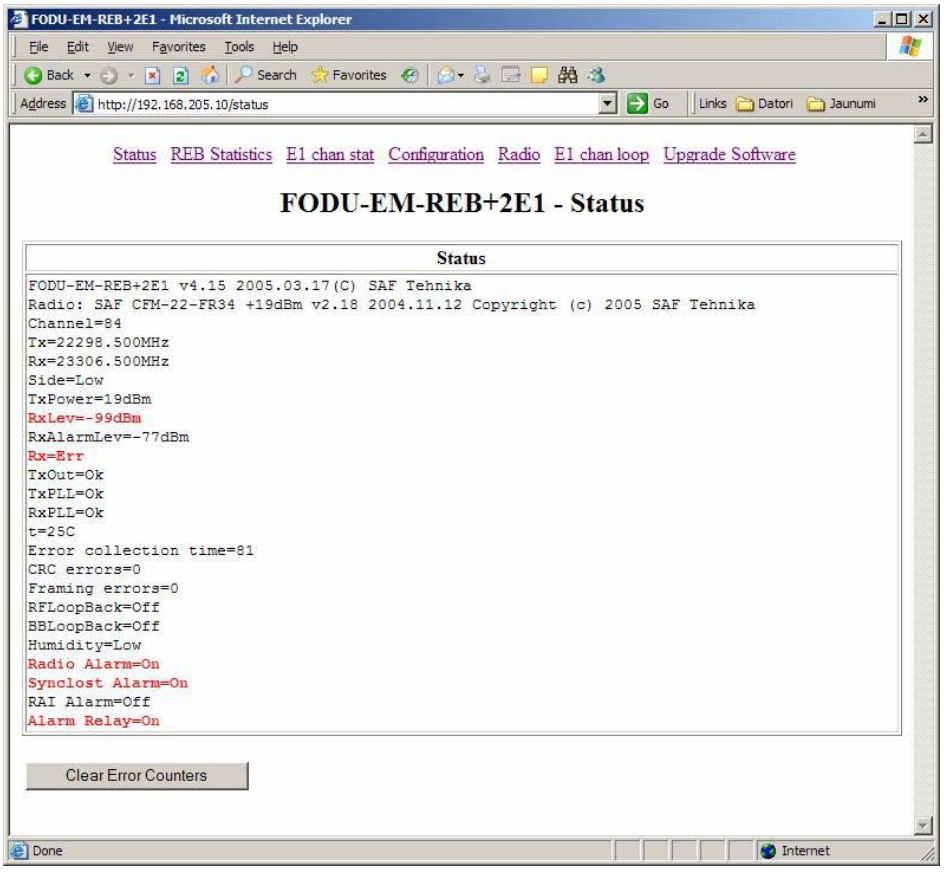

Figure 4

The Web server allows to

- Monitor the FODU radio parameters, inspect current configuration, alarm status, etc. (see Figure 4)
- Inspect Ethernet bridge counters (see Figure 5)

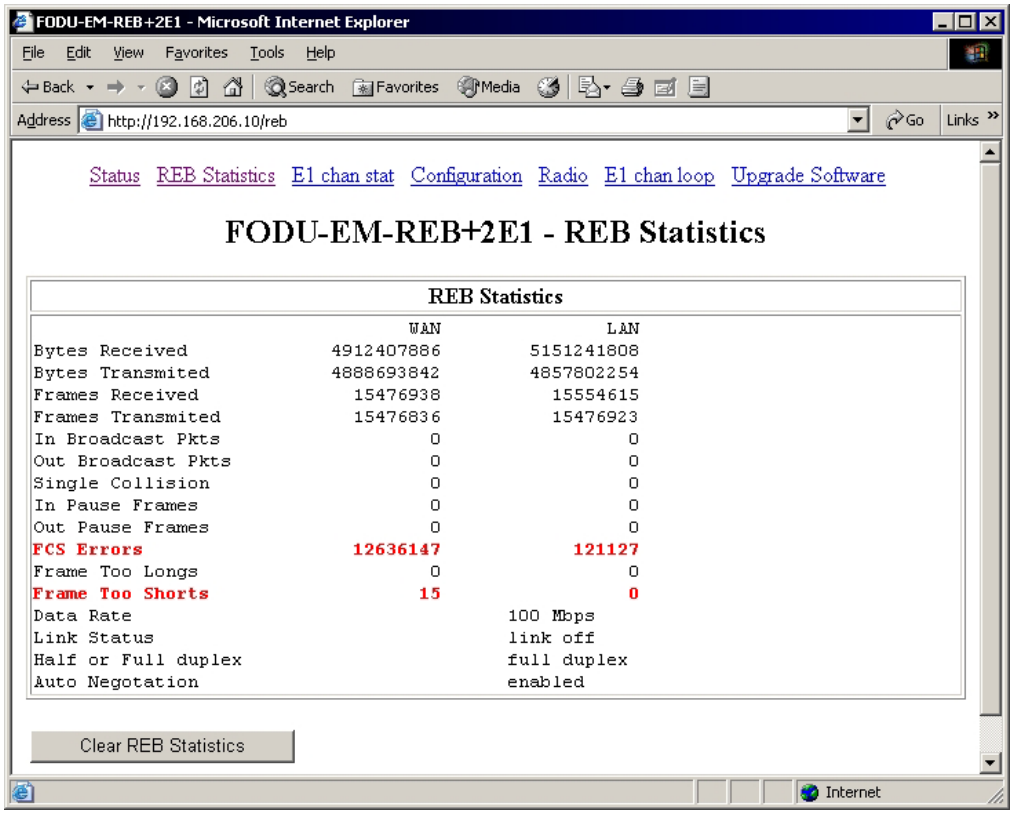

Figure 5

- Monitor E1 port status (see Figure 6)

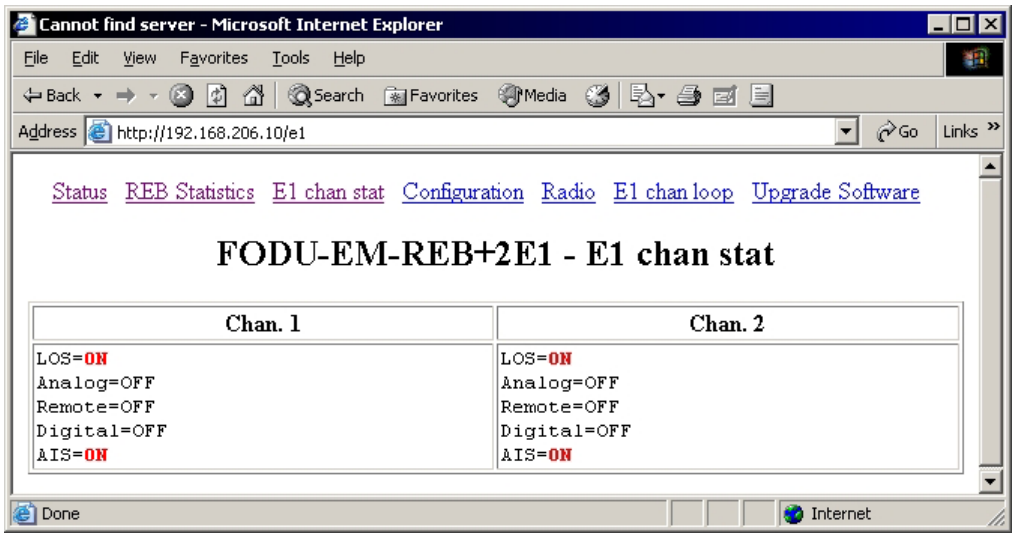

Figure 6

- Save current configuration in EEPROM, and restart the FODU (see Figure 7).

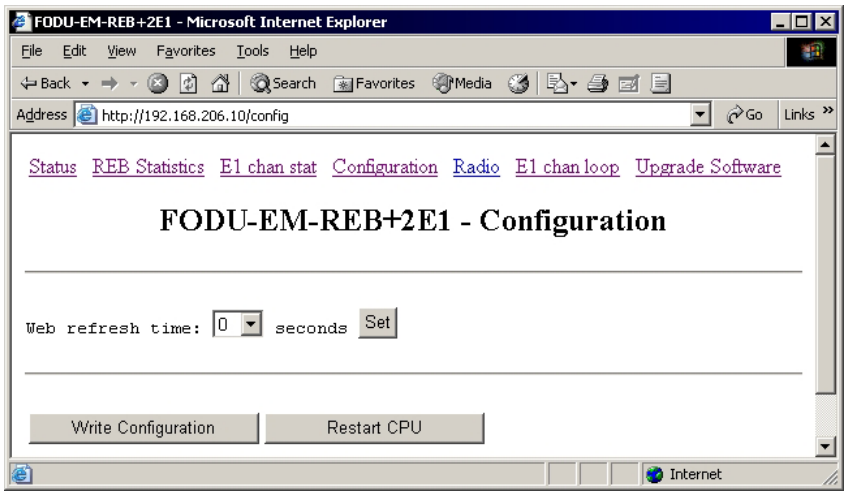

Figure 7

– Configure radio parameters: frequency and transmitter power (see Figure 8)

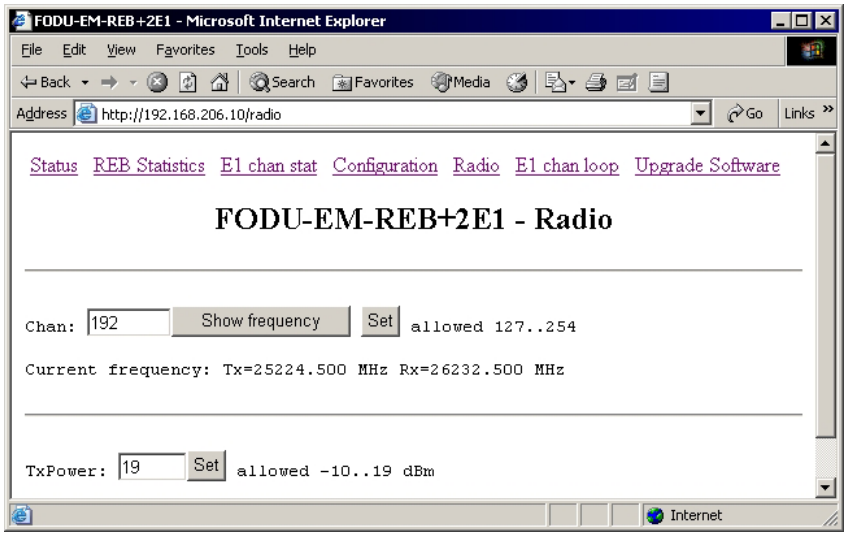

Figure 8

– Switch on\off E1 port loopbacks, analog, digital, remote (see Figure 9)

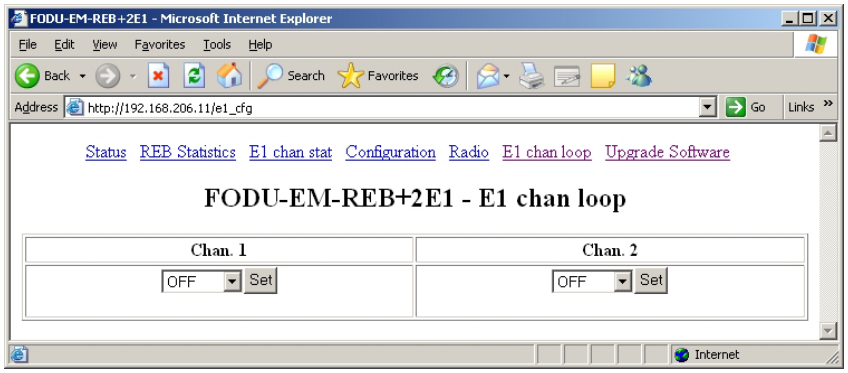

Figure 9

– Update FODU software, see chapter 2.7 for more information.

2.1.2 SNMP Management

SNMP Traps

The FODU management controller sends SNMP traps to the Trap Manager with IP address specified with "snmp trap <trap-IP>" command from Telnet or ASCII console. The SNMP Trap Manager is a PC with installed SNMP trap management software. The default Trap Manager IP address is 255.255.255.255 meaning that no trap packets are sent by the management controller.

The SNMP trap contains information about Radio alarm (RA) status and Synch Lost (SL) alarm status.

Browsing MIB

The FODU has an SNMP agent which can be accessed using PC with installed SNMP MIB browser. SAF Tehnika provides MIB files for each FODU version.

MIB variables

The following table describes all variables defined in the MIB.

Table 1

Variable Name	Variable Type	Value List	Description
termProduct	String		Textual name of terminal type. Read-only.
termDescription	String		Textual description of terminal. Read-only.
termLocation	String		IDU name. Read-write.
termVersion	String		Textual version of management software. Read-only.
termOperation	Integer (32 bit)	none(0) booting(1) ok(2) testing(3) error(4)	Terminal (IDU) operational status: *none* – not initialized; *testing, illegalSpeed, error* – reserved Read-only.
termUpTime	Integer (32 bit)		System up-time in seconds. Read-only.
termSlip	IP address		SLIP address. Read-only.
TermAddr	IP address		Ethernet management port IP address. Read-only.
writeConfig	Integer (32 bit)		Write configuration in EEPROM. Write-only.
restartCPU	Integer (32 bit)		Restart the FODU. Write-only.
statClear	Integer (32 bit)		For Eth+2E1 FODU only. Write-only. Clear FODU framer counters.
bbVersion	String		Textual version of the Base-band controller software. Read-only.
bbOperation	Integer (32 bit)	none(0) booting(1) ok(2) testing(3) loopback(4) illegalSpeed(5) error(6)	Operational status of the Base-band modem: *none* – not initialized *loopback* – Base-band loop is set on *testing, illegalSpeed, error* – reserved Read-only.
bbLinkCapacity	Integer (32 bit)		Base-band link capacity in Kbps. Read-only.
bbLinkCapacityDescription	String		Comment on Base-band link
bbLoopback	Integer (32 bit)	off(0) digital(1) analog(2)	Base-band loopback. Read-write.

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bbSyncLostAlarm	Integer (32 bit)	none(0) on(1)	The Sync Lost Alarm. Read-only. *none* – Off
rfOperation	Integer (32 bit)	none(0) booting(1) ok(2) testing(3) error(4) noDataFromODU(5)	Operational status of the Radio: *none* – not initialized *testing, error* – reserved *noDataFromODU* – no data is being received from ODU Read-only.
rfAlarm	Integer (32 bit)	none(0) on(1)	Radio Alarm, *none* – off. Read-only.
rfVersion	String		Textual version of the Radio. Read-only.
rfSide	Integer (32 bit)	low(0) high(1)	Band side of the Radio: low or high. Read-only.
rfChannel	Integer (32 bit)		Channel number. Read-write.
rfTxFrequency	String		Tx frequency. Read-only.
rfRxFrequency	String		Rx frequency. Read-only.
rfTxPower	Integer (32 bit)		Transmitter power. Read-write.
rfRxState	Integer (32 bit)	low(0) ok(1) error(2) loopback(3)	Reception status: *low* – Rx signal level *ok* - normal *error* - internal fault in the Radio *loopback* – RF loop is set on Read-only.
rfRxLevel	Integer (32 bit)		Received signal level [dBm]. Read-only.
rfTxOut	Integer (32 bit)	error(0) ok(1) off(2)	Operation status of the ODU transmitter: *ok* – proper operation *error* – internal fault (no data from ODU) *off* – Tx power = off Read-only.
rfTxPLL	Integer (32 bit)	error(0) ok(1)	Operation status of ODU Tx syntheser loop (PLL lock): *ok* – normal operation *error* - internal fault in ODU transmitter. Read-only.
rfRxPLL	Integer (32 bit)	error(0) ok(1)	Operation status of ODU Rx syntheser loop (PLL lock): *ok* – normal operation *error* - internal fault in ODU transmitter. Read-only.
rfOduTemperature	Integer (32 bit)		Internal temperature of ODU (^{0}C). Read-only.
rfOduHumidity	Integer (32 bit)	low(0) high(1)	Humidity level inside ODU: *low* - acceptable moisture level Read-only.
rfLoopback	Integer (32 bit)	off(0) on(1)	RF loopback. Read-write.
rfRxAlarmLevel	Integer (32 bit)		Rx level (in dBm) at which the Radio Alarm is switched on. Read-write.

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ch1los	Integer (32 bit)	off(0) on(1)	E1 channel 1 LOS status. Read-only.
ch1ais	Integer (32 bit)	off(0) on(1)	E1 channel 1 AIS status. Read-only.
ch1loopback	Integer (32 bit)	off(0) analog(1) remote(2) digital(3)	E1 channel 1 loopback. Read-write.
ch1disable	Integer (32 bit)	off(0) on(1)	E1 channel 1 enable/disable Off -> enable, On -> disable. Read-write.
ch2los	Integer (32 bit)	off(0) on(1)	E1 channel 2 LOS status. Read-only.
ch2ais	Integer (32 bit)	off(0) on(1)	E1 channel 2 AIS status. Read-only.
ch2loopback	Integer (32 bit)	off(0) analog(1) remote(2) digital(3)	E1 channel 2 loopback. Read-write.
ch2disable	Integer (32 bit)	off(0) on(1)	E1 channel 2 enable/disable: Off -> enable, On -> disable. Read-write.
reb-data-rate	Integer (32 bit)		Current port data rate (100 Mbps or 10 Mbps). Read-only.
reb-link-status	Integer (32 bit)	off(0) on(1)	Ethernet link status. Read-only.
reb-duplex	Integer (32 bit)	half(0) full(1)	Half or Full duplex. Read-only.
reb-auto-negotiation	Integer (32 bit)	disabled(0) enabled(1)	Auto negotiation: enabled or disabled. Read-only.
reb-clear-statistics	Integer (32 bit)		Clear Ethernet bridge statistics. Write-only.
reb-connection	Integer (32 bit)	auto(0) 10fdx(1) 10hdx(2) 100fdx(3) 100hdx(4)	Change port speed. Write-only.
reb-flowcntrl	Integer (32 bit)	enable(0) disable(1)	Enable or disable flow control. Write-only.
reb-wan-bytes-received	Integer (32 bit)		Bytes received from WAN. Read-only.
reb-wan-bytes-transmitted	Integer (32 bit)		Bytes transmitted to WAN. Read-only.
reb-wan-frames-received	Integer (32 bit)		Frames received from WAN. Read-only.
reb-wan-frames-transmited	Integer (32 bit)		Frames transmitted to WAN. Read-only.

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reb-wan-in-broadcast-pkts	Integer (32 bit)		Read-only.
reb-wan-out-broadcast-pkts	Integer (32 bit)		Read-only.
reb-wan-singe-collision	Integer (32 bit)		Read-only.
reb-wan-in-pause-frames	Integer (32 bit)		Read-only.
reb-wan-out-pause-frames	Integer (32 bit)		Read-only.
reb-wan-fcs-errors	Integer (32 bit)		Read-only.
reb-wan-frames-too-long	Integer (32 bit)		Read-only.
reb-wan-frames-too-short	Integer (32 bit)		Read-only.
reb-lan-bytes-received	Integer (32 bit)		Bytes received from LAN. Read-only.
reb-lan-bytes-transmitted	Integer (32 bit)		Bytes transmitted to LAN. Read-only.
reb-lan-frames-received	Integer (32 bit)		Frames received from LAN. Read-only.
reb-lan-frames-transmitted	Integer (32 bit)		Frames transmitted to LAN. Read-only.
reb-lan-in-broadcast-pkts	Integer (32 bit)		Read-only.
reb-lan-out-broadcast-pkts	Integer (32 bit)		Read-only.
reb-lan-singe-collision	Integer (32 bit)		Read-only.
reb-lan-in-pause-frames	Integer (32 bit)		Read-only.
reb-lan-out-pause-frames	Integer (32 bit)		Read-only.
reb-lan-fcs-errors	Integer (32 bit)		Read-only.
reb-lan-frames-too-long	Integer (32 bit)		Read-only.
reb-lan-frames-too-short	Integer (32 bit)		Read-only.

2.1.3 Telnet Management

The FODU management controller has a Telnet server which can be accessed via 10Base-T management port. The FODU supports only one Telnet client at a time.

When connected to Telnet server, the user will be prompted to enter username and password, the default username is "telnet" and password "saf" (case sensitive). The username and password for Telnet access can be changed using ASCII console (via serial port), or using Telnet terminal, see chapter 2.3 for appropriate commands.

To end Telnet session, press CTRL + D. For information about Telnet commands, please refer to chapter 2.3.

2.2 RS-232 Port

RS-232 serial management provides terminal management via connected PC or other VT-100 terminal device. The terminal can be connected remotely via telephone network, using dial-up modems.

The VT-100 terminal connected to the RS-232 serial interface is referred to as the ASCII management console (or ASCII console) and provides the management functionality available via Command Line Interface described in Chapter 2.3.

2.2.1 Connecting to the RS-232 Port

To connect the ASCII console to the Radio via RS-232 interface, please refer to Chapter 5 for pinouts; the serial port of the management console should be configured as 19200 8-N-1, no data flow control.

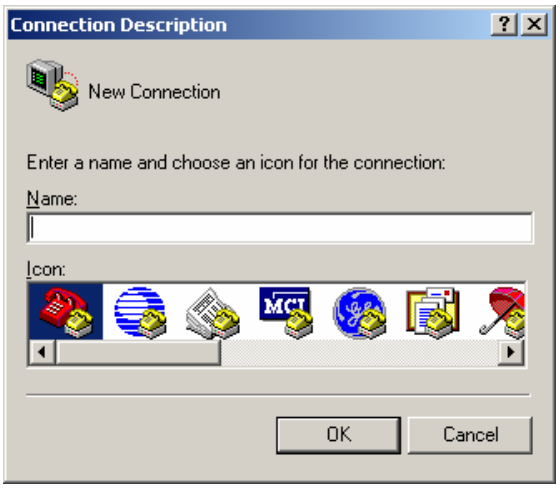
If using modems, the management terminal is connected with the Radio remotely through a telephone line. In this case the modem, *which is connected with the FODU*, should be configured as stated below:

- Auto answer on first ring ON
- Echo offline commands OFF
- Suppress result codes
- DTR override

The modem configuration then should be saved (typically with AT&W string).

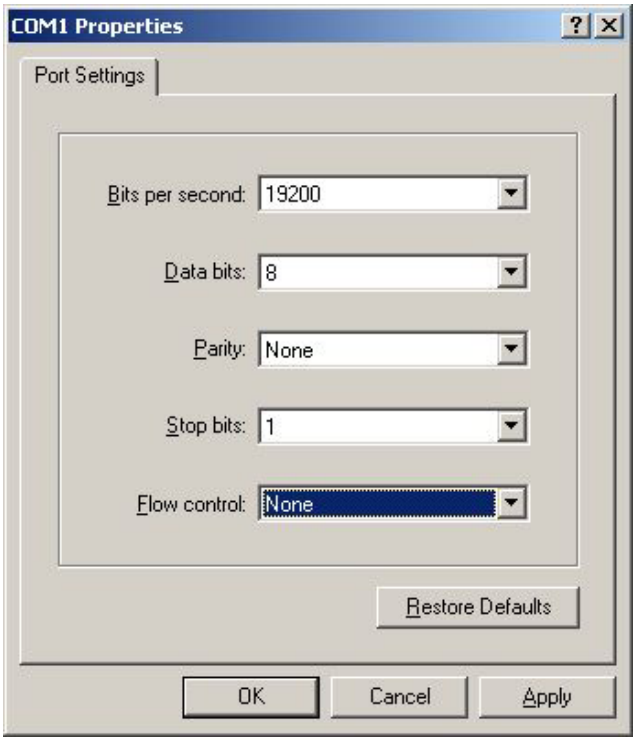
In order to connect the PC to the RS232 management port using *Hyper Terminal* program (this program is included in any Windows™ version), proceed as described below.

1. Connect PC to the RS232 serial port by means of "straight through" or modem serial cable (null-cable).
2. Run "Hyper Terminal" program.
3. Make a *New connection*, enter connection name.



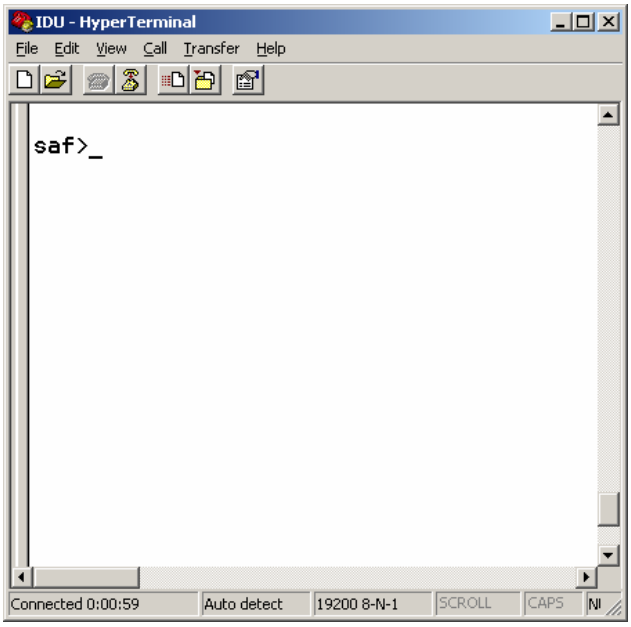
4. Choose port (COM1 or COM2).

5. Set port settings (bits per second: 19200, data bits: 8, parity: none, stop bits: 1, no data flow control).



6. Press OK
7. Press Enter. Password is disabled by default.

If successfully connected, the prompt should appear as in the picture below. You are connected to FODU. See Chapter 2.3 for available commands.



2.3 Command Interface for Telnet and ASCII Consoles

The command line management interface offers the widest configuration and monitoring functionality. The following tables summarize all available commands for ASCII management terminals.

Command	Description
Name <*deviceName*>	Assigns a name to the FODU; the default name is "SAF". Use double quotes for spaces, e.g., *name "Latvia Riga".* Name can be up to 20 symbols long.
restartcpu	Restart the management controller CPU; this does not affect (interrupt) the E1 traffic.
write	Save all settings in the EPROM. This command saves current configuration script from RAM in EPROM, the script stored in EPROM will execute after the restart of management controller. **Important!** In order for any configuration changes to take effect also after the restart of management controller (or FODU), use "write" command to save the configuration in EPROM.
BBloop {on | analog | off} [<*1..10*>]	Set baseband loopback: "on" – set digital loopback (dual), "analog" – set analog loopback (non-dual), "off" – suspend baseband loopback; for more information see chapter 4.2. The optional parameter ([]) is duration, default value is 1 minute. Maximum duration is 10 minutes.
RFloop {on | off} [<*1..10*>]	Set RF loopback, - "on" – set loopback, "off" – suspend loopback; for more information see chapter 4.1. The optional parameter ([]) is duration, default value is 1 minute. Maximum duration is 10 minutes.
RxAlarmLevel <*alarmLevel*>	Set the Rx signal level at which the Radio Alarm is switched on; if entered without argument, displays current Rx alarm level.
Chan <*channel#*>	Set the radio Tx and Rx frequency. Channel numbers and their corresponding Tx/Rx frequency values are found in the document "*Channel plans*". If command entered without argument, current Tx/Rx channel is displayed.
Txpower {-10|-9|…|0|+1|+2|…|+20 |off}	Set the FODU Transmitter power [dBm]. The default setting is "OFF". If *txpower* is entered without argument, the current Tx power is returned.
e1 {1 | 2 | 3 | 4} **loop** {analog | digital | remote | off}	Set on/off E1 interface loopback, the following loopbacks are available: analog, digital, remote. Example: E1 1 loop digital The analog and remote loopback is not dual; the digital loopback is dual; for more information about E1 loop tests see chapter 4.3.
e1 {1 | 2 | 3 | 4} **stat**	Return the E1 interface status, example: e1 2 stat LOS ON Analog loopback OFF Remote loopback OFF Digital loopback OFF AIS ON
e1 {1 | 2 } {enable | disable}	Switch on\off E1 port; the disabled E1 port capacity will be added to capacity of 100Base-T Ethernet port.

reb connection {auto | 10fdx | 10hdx | 100fdx | 100hdx}	Configure Ethernet bridge connection mode (for Eth+2E1 FODU only)
reb flowcntrl {enable | disable}	Switch on\off flow control for the Ethernet bridge (for Eth+2E1 FODU only)
reb stat [clear]	Display statistics of the bridge 10\100Base-T port (for Eth+2E1 FODU only). Example: SAF>reb stat WAN LAN Bytes Received 1 0 Bytes Transmited 0 0 Frames Received 0 0 Frames Transmited 0 0 In Broadcast Pkts 0 0 Entering "REB stat clear" will clear the statistics counters.
Time <*yyyy-mm-dd hh:mm*>	Set the date and time; if entered without argument, displays current date and time.
log { show | <*start_num*> }	The management controller maintains event log, - events include configuration changes, management controller restarts, local site alarm changes, RAI alarm changes. The maximum count of log entries is 1023, the events are written in EPROM cyclically, overwriting older entries. The "log show" or "log" commands display latest 20 log entries, the log entries are numbered, - entry with the largest number is the latest event. The "log show" command can be followed up with an entry number to display latest 20 entries beginning from the entry specified by the number, e.g., "*log show 100*" will display entries 100…120.
Cfg {show | run | clear | delete <*num*> | factory | load | write }	- "Cfg show" - shows the configuration script stored in RAM; - "Cfg run" – executes the configuration script stored in RAM; - "Cfg clear" - clears the configuration script stored in RAM; - Cfg delete <num> - deletes an entry in the configuration script (in RAM), <num>- entry number, e.g., *cfg delete 5*; - Cfg factory – loads factory settings in EPROM (including IP settings) and restarts the management controller; - Cfg load - loads the configuration script from EPROM into RAM, but the script will not execute; - "Cfg write" - same as command "write"
Stat [*clear*]	"stat" displays radio configuration and alarm status, CRC and framing error counter. The CRC error counter counts the frames which have erroneous bits in their content; The framing error counter counts the frames which have errors in frame synchronisation bits. Here is the fragment of *stat* information: … Error collection time=42 CRC errors=8 Framing errors=2 … Both of these counters are stopped when SL alarm is switched on. The counters are cleared if: – FODU management controller is restarted, – "stat clear" command is entered.
Ver	Show software and hardware version of the FODU.

Ping <*IP_addr*>	Ping the host with address <*IP_addr*>. This command is very useful to configure and to verify the service channel via radiolink.
ip {addr <*addr*> | mask <*mask*> | gw <*addr*> | seraddr <*addr*> | remaddr <*addr*>}	– "ip addr <*addr*>" - sets the IP address of Ethernet management port, – "ip mask <*mask*>" - sets the IP netmask of Ethernet management port, – "ip gw <*addr*>" - sets the IP address of the default gateway, – "ip seraddr <*addr*>" - sets the SLIP IP address of the serial port of management module in the local (near-end) FODU, – "ip remaddr <*addr*>" - specifies the SLIP IP address of the serial port of management module for the remote (far-end) FODU. The changes of any of these parameters will not take effect until the management controller is not restarted.
route {print | add <*dstn*> mask <*mask*> <*gw*> | delete <*dstn*>}	– "route print" – display list of routes, example: site-20>route print 192.168.000.011 255.255.255.255 000.000.000.000 192.168.000.010 02 - .O... 192.168.000.010 255.255.255.255 000.000.000.000 192.168.000.010 01 - I.... 192.168.205.010 255.255.255.255 000.000.000.000 192.168.205.010 01 - I.... 192.168.205.000 255.255.255.000 000.000.000.000 192.168.205.010 02 - .O... 192.168.206.000 255.255.255.000 192.168.000.011 192.168.000.010 02 - .O... site-20> – "route add <dstn> mask <mask> <gw>" – add a route for address <dstn>, mask <mask>, to gateway <gw>. Example: route add 192.168.205.0 mask 255.255.255.0 192.168.0.11 – "Route delete <dstn>" – delete a route for address <dstn>. Example: route delete 192.168.205.0
telnet {port <port_nr> | user [username] [password]}	– "telnet port <port_nr>" command changes telnet port; default telnet port is 23. – "telnet user [username] [password]" changes username and password (both 0…8 symbols long) for access to the FODU from Telnet terminal; use double quotes for username or password containing spaces. To disable username and password, enter *telnet user* "" "" command. The telnet username and password is case sensitive, the default username is "telnet", the default password is "saf".
snmp trap <*trap-IP*>	"snmp trap <trap-IP>" – specify IP address of the snmp trap manager terminal.
web user <*username*> <*password*>	Specify username and password for access from Web terminal; both are case sensitive, up to 16 symbols long.
web refresh <*seconds*>	Specify Web page refresh time in seconds.

Syntactic notes and comments:
- Commands are in **bold** font.
- All arguments (variables) are in *italic* font.
- Subcommands and keywords are in regular font.
- Arguments in square brackets ([ ]) are optional but required arguments are in angle brackets (<>).
- Alternative keywords are grouped in braces ({}) and separated by vertical bars (|).
- The usage of each command is displayed if the command followed by the "?" (or any unrecognizable string) is entered, e.g., *txpower ?*

The management system is automatically restarted if it freezes, this is performed by a watchdog timer. The restart of management system does not affect (interrupt) the E1/Ethernet traffic.

2.4 Configuring Management Service Channel

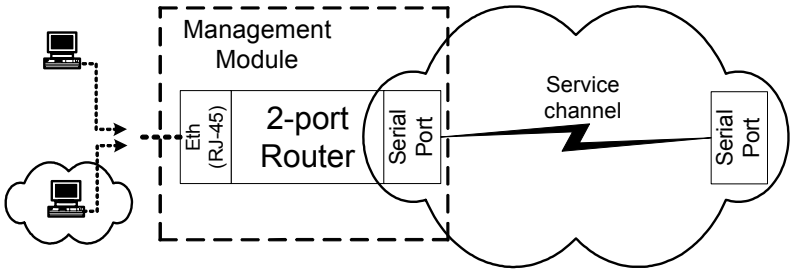
The FODU features SLIP-based service channel which enables access to far-end site(s) via radiolink for remote management.

Before using the Management Service Channel, the mandatory precondition is to properly configure the following parameters:

- IP address and net-mask of the FODU Ethernet port;

  The console is connected via Ethernet management port on the FODU Management Module.
- Local SLIP IP address;

  The FODU management module has a virtual serial port onboard that is used to receive/transmit the management information from/to the other virtual serial port on the far-side via service channel, both of these serial ports operate using SLIP. Virtual serial port SLIP IP addresses can be picked from the "private internet" addresses, e.g., 10.X.X.X or 192.168.X.X. Both of these addresses must be from different subnet than that of the FODU Ethernet port, because the management controller operates as the router with two ports - Ethernet and serial (SLIP).
- Remote SLIP IP address;
- IP address of the gateway or host that is connected to the local FODU Ethernet management port via other network segment(s).



The configuration of local and remote serial port IP addresses (SLIP addresses) should conform the following principle.

	Terminal A	Terminal B
Local SLIP IP address	IP 1	IP 2
Remote SLIP IP address	IP 2	IP 1

In order to configure the service channel between two sites, proceed as follows:

- enter Ethernet and SLIP port IP addresses,
- enter proper route for destination address of the far-end site Ethernet port,
- save the configuration using "write" command,
- restart the management controller ("restartcpu" command).

See examples in Figure 10.

Note: The IP addresses and routes must be properly configured for the FODU using ASCII console before the FODU is installed in its final location, because later it may not be possible to connect to FODU via Telnet terminal.

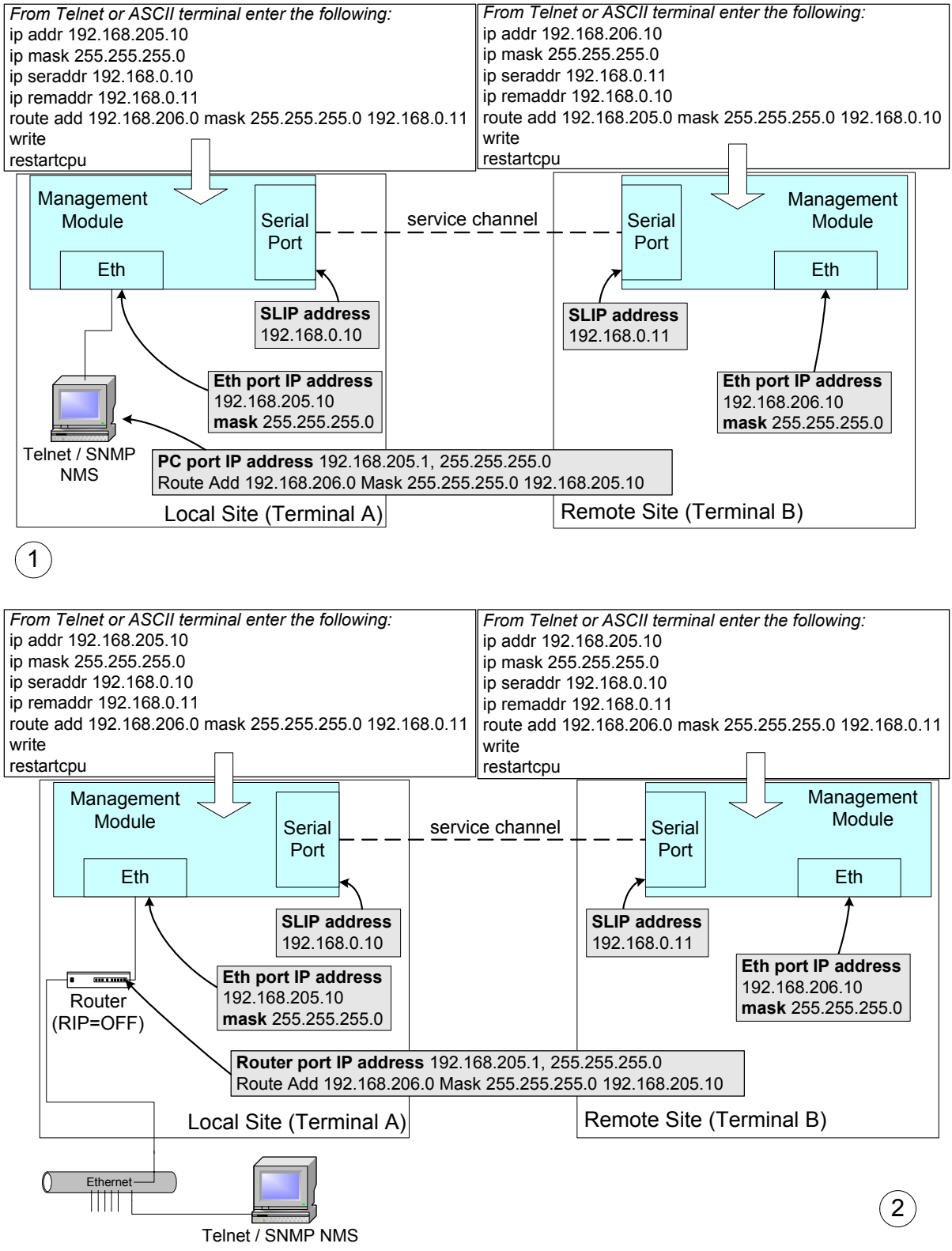


Figure 10. Examples of IP configuration for management channel via one hop: in example 1. the Telnet/SNMP terminal is connected directly to the FODU; in example 2. the Telnet/SNMP terminal is in other network segment than IP address of the FODU 10Baset-T port.

2.5 Alarms

When inspected, the FODU will report the status (ON or OFF) of the following alarms:

- Radio alarm (RA): the Radio alarm is switched on in the following cases:
  - The receive signal level is lower than *RxAlarmLevel* value
  - The humidity within the radio is too high (possibly ODU is opened);
  - Transmitter malfunction (TxOut=Error);
  - Radio loopback is switched on;
  - Transmitter power is switched off.
- Synch Lost alarm (SL): the SL alarm is switched on as soon as frame synchronisation is lost for the incoming WAN traffic, and is switched off when synchronisation is re-established;
- Remote Alarm Indicator (RAI): the RAI signal is received from the far-end FODU; each FODU transmits RAI signal to the far-end FODU while SL alarm is switched on.

The alarms status can be inspected using

- Telnet client,
- ASCII console, or
- SNMP MIB Browser.

2.6 Configuring Radio Parameters

2.6.1 Default Radio Settings

The Full Outdoor Units are shipped with disabled Transmitter (TxPower OFF) and channel is set to one in the middle of respective A or B subband of the Low or High band side for LA, HA, LB and HB FODU types, or in the middle of the Low or High band side, - model types L and H. The type of FODU can be clarified from label, see chapter 1.5 for information about label.

2.6.2 Configuring Tx Frequency

The Tx frequency can be set using "**chan**" command from ASCII or Telnet terminal, example: *chan 22*

The Rx frequency is automatically adjusted according to Tx frequency for a given channel plan in which the FODU operates.

2.6.3 Configuring Tx Power

The Tx Power level of the Radio can be adjusted using **Txpower** command from console terminal, example: *Txpower +10*

Although the guaranteed minimum transmitter power is 0 dBm, the Tx power can be adjusted within limits from -10 dBm to +20 dBm in steps of 1 dB, as well as turned off (*Txpower off*).

To avoid possible interference with other radio equipment, the default setting is "OFF".

2.7 Updating FODU software

The FODU management software can be updated via 10Base-T management port, using Web server. To update FODU software, proceed as follows:

- Connect to FODU Web server,
- Open 'Upgrade Software' page (Figure 11),

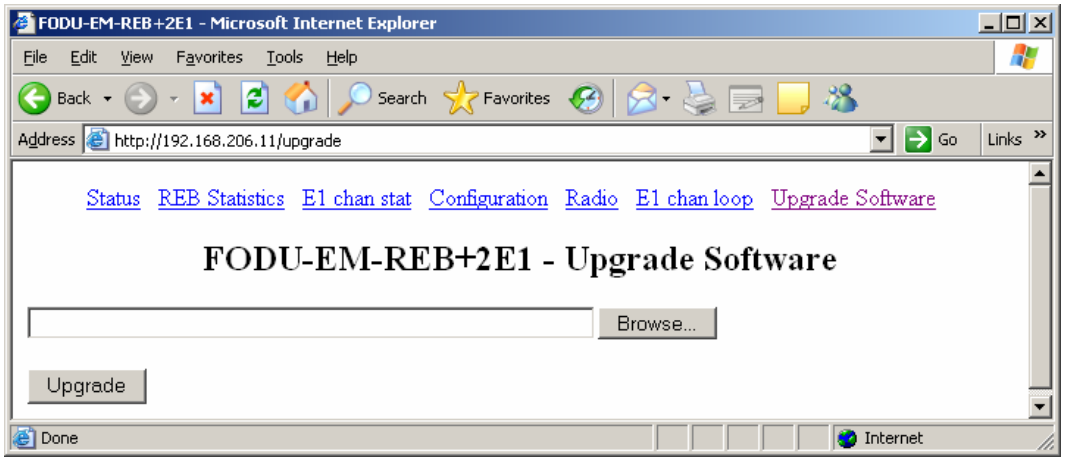


Figure 11

- Choose the software file to upload to FODU ('bin' extension) and press 'Upgrade' button.
- Wait until the following notation appears (Figure 12).

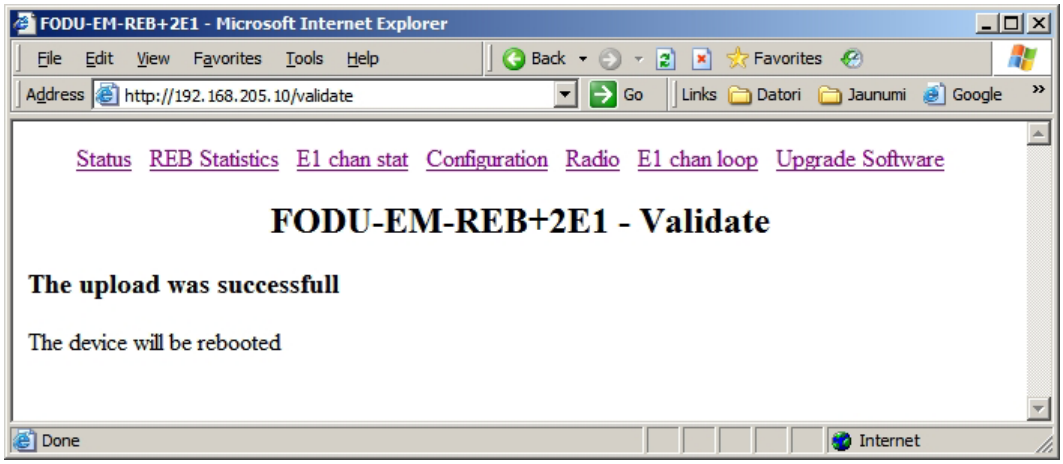


Figure 12

3 RSSI Port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

4 Loopbacks

The FODU supports the following loop tests:

- Radio loop;
- Base-band loops:
  - Digital base-band loop,
  - Analog base-band loop.
- E1 interface loops:
  - Analog E1 interface loop,
  - Digital E1 interface loop,
  - Remote E1 interface loop.

Any of the loopback modes can be set at the far-end FODU via service channel. The radio loop (RF loop) and base-band loops can be set on a limited time 1 to 10 minutes. The loop time limitation is necessary for the far-end radio and far-end base-band loops, because once any of these loops are set via service channel at the far-end FODU, the far-end FODU can no longer be accessed since the management traffic loops back before the management controller receives it.

The E1 interface loops have no time limit.

4.1 Radio loopback

Radio (RF) loopbacks can be set on a fixed time interval only; The duration of the loopback mode can be specified from 1 to 10 minutes.

Radio loopback mode is a special FODU operation mode, where the Rx frequency during the loopback mode is set equal to the Tx frequency. During radio loopback mode, the signal is transmitted and looped back through the duplexer filter to the receiver block. The radio loopback is not dual.

Important notes:

1. Because of the frequency characteristic of the duplexer filter, in order to set the radio loop, the FODUs operating in the Low band side must be switched to the highest available frequency channel, but the FODUs operating in the High band side must be switched to the lowest available frequency channel;
2. During the radio loop, the transmitter power should be switched to maximum level;
3. *For FODUs operating in **18 GHz** band, the radio loopback mode is not available.*

From Telnet or ASCII terminal, the radio loopback can be activated using "RFloop {on|off} [<*1...10*>]" command, the default duration of the loop mode is 1 minute; duration can be set from 1 to 10 minutes, examples:

rfloop on 10 – sets radio loop for 10 minutes,

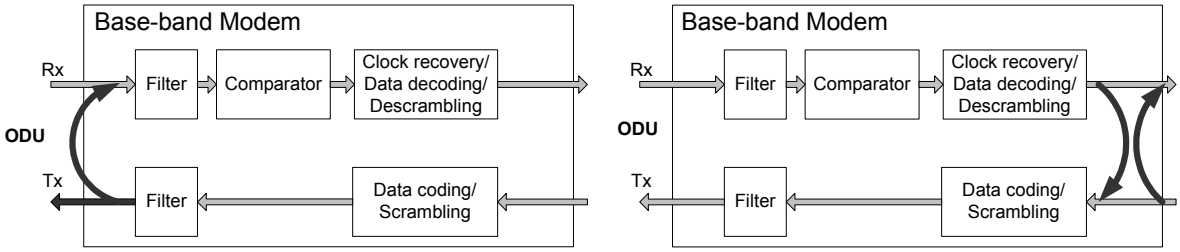
rfloop off – resumes to normal operation.

4.2 Base-band loopbacks

Base-band loopbacks can be set from Telnet or ASCII console, on a fixed time interval only; the duration of the loopback mode can be specified from 1 to 10 minutes.

The baseband loop is set in the baseband modem within the FODU. There are two types of **baseband loopbacks** (both can not be activated simultaneously):

- Digital baseband loopback: the signal from the multiplexer board in the baseband modem is looped back to the receiving device; the digital baseband loopback is dual (see figure below);
- Analog baseband loopback: the modulated signal on the baseband modem output is immediately looped back to the receiving device.



From Telnet or ASCII terminal, the base-band loopback can be activated using "BBloop {on|analog|off} [<*1..10*>]" command; the default duration of the loop mode is 1 minute, duration can be set from 1 to 10 minutes. Examples:

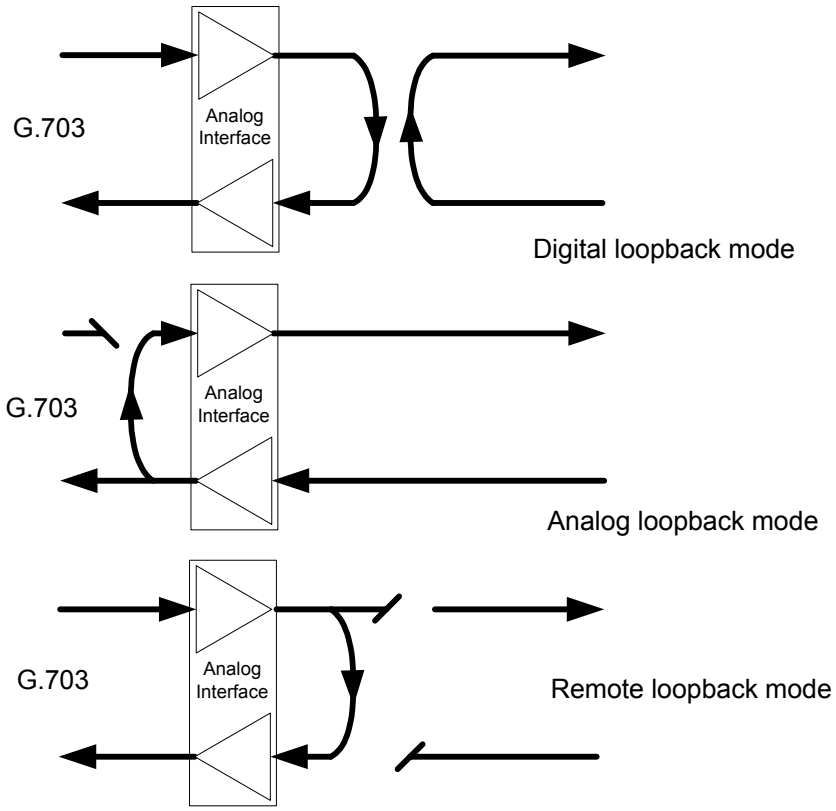
bbloop on 10 – sets the digital base-band loop for 10 minutes,

bbloop analog 10 – sets the analog base-band loop for 10 minutes,

bbloop off – resumes to normal operation.

4.3 E1 Interface Loopbacks

The E1 interface supports analog, digital and remote loopback modes. Only one loopback mode can be set at a time for a single E1 channel (see figure below).
The digital loopback mode is dual since there are two loops closed, remote and local.



The E1 interface remote loopback mode

From Telnet or ASCII terminal, the E1 loopback can be activated using "e1 {1 | 2 | 3 | 4} loop {analog | digital | remote | off}" command; the E1 interface loopback mode will last until "e1 {1 | 2 | 3 | 4} loop off" command is entered. Example:
e1 1 loop digital – sets the digital loop in the 1st e1 interface.

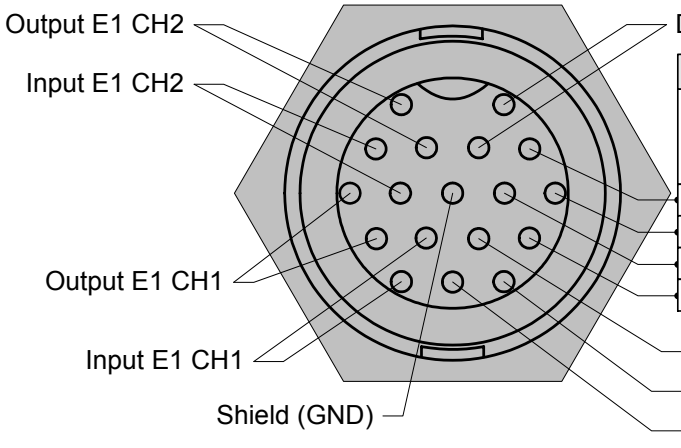
The E1 port number arguments correspond to E1 ports as follows:

18-pin connector	->	ports 1 and 2
RJ-45	->	ports 3 and 4

5 Pinouts

5.1 18-pin connector

The pinouts for the 18-pin port connector (on the FODU) are given in the picture below. The pictured pin layout corresponds to the cable connector solder side.



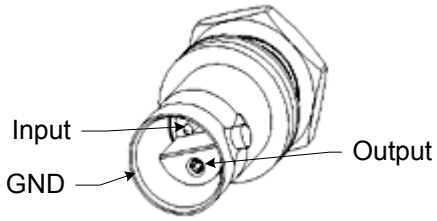
10Base-T management port pins		
Signal	RJ-45 socket pin as for hubs/switches	RJ-45 socket pin as for PC network cards
Tx +	3	1
Tx -	6	2
Rx -	2	6
Rx +	1	3

There are 18 pins: 4 pins are used by Ethernet management port (see Figure 13 for information on RJ-45 socket pin numbering); 8 pins are used as inputs and outputs for both E1 channels; 2 pins are used for relay, 2 pins for DC supply; 2 "Shield" pins can be used to ground the cable shield if shielded cable is used.

The GND pins are not to be used for lightning protection; there is a special grounding screw (M6) on the front of the unit intended for lightning protection; the Full ODU must be grounded using the grounding screw.

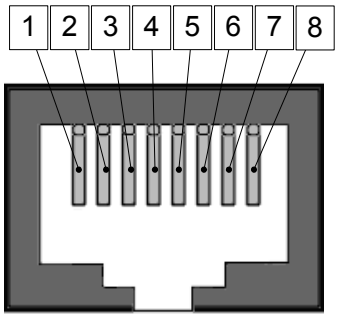
5.2 Twin BNC connector

Twin BNC connector is used for RS-232 serial port. Pinouts are shown in picture below.



5.3 Sealed RJ-45 socket

Two of four E1 channels are implemented on sealed RJ-45 socket on the 4xE1 FODU. The pinouts of that socket are as follows.

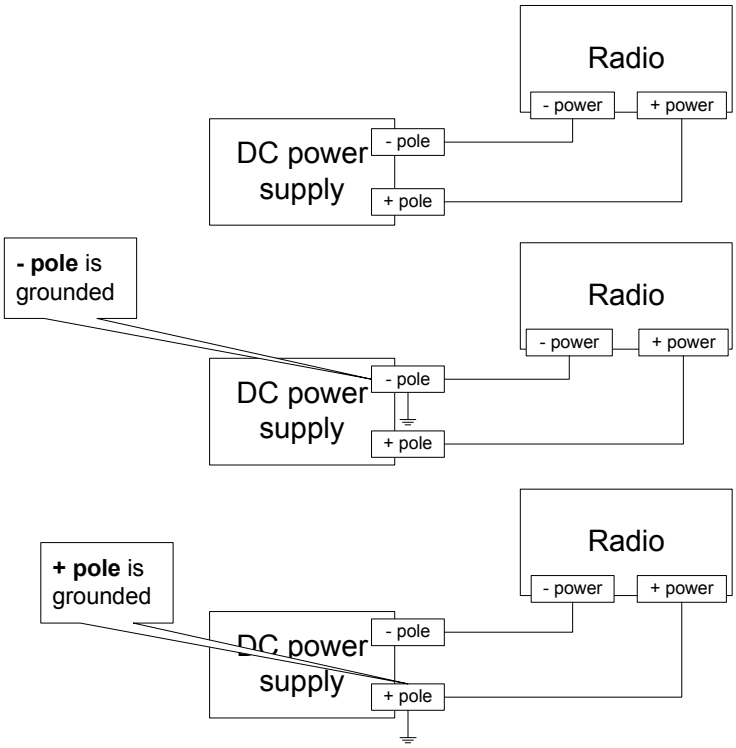


1, 2 – INPUT CH 3
3, 6 – INPUT CH 4
4, 5 – OUTPUT CH 3
7, 8 – OUTPUT CH 4

Figure 13. RJ-45 socket pin numbering

6 Power Supply

The Radio must be supplied with 20…60 VDC, depending on the power supply used the following schemes can be used.



7 SAF Tehnika A/S Contacts

Most up to date contacts of SAF Tehnika A/S could be found at Web site www.saftehnika.com.

SAF Tehnika A/S technical support could be reached at:

- Email: techsupport@saftehnika.com
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- Fax: +371 7020009