



CFM-MP-MUX

Indoor Unit

Installation and Configuration Manual

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1 Introduction

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 describes the CFM series 1+1 modular multiplexer Indoor Unit, CFM-MP-MUX, covering hardware features, built-in management system, configuration functionality, etc.

The CFM-MP-MUX is part of SAF Tehnika's CFM series digital microwave radio product family providing:

- Means of interconnecting the user equipment with the Radio (ODU); **The CFM-MP-MUX Indoor Unit is intended for use with the CFM-LM radios.**
The modularity of the CFM-MP-MUX IDU allows to install various CFM series traffic interface modules (for more information please refer to chapter 2.1).
- Local and remote management functionality (incl. Web, Telnet, SNMP, ASCII)
- Alarm interface (optional).

The IDU is frequency-independent; the operating frequency is determined by the ODU only.

Revision history

| Revision | Date | Comments |
|-----------------|-------------|--------------------------------------|
| 1.0 | May, 2005 | |
| 1.1 | June, 2005 | For MP-MUX SW ver. 4.09 (2005.05.31) |

1.1 Protected Link Configuration

The CFM-MP-MUX IDU is compatible with the CFM-M-MUX IDU.

The link may have both sites protected where each site consists of one protected IDU (CFM-MP-MUX) and two ODUs.

The link may also have only one of sites protected, - one site with the protected IDU and one or two ODUs and the other site with the non-protected modular multiplexer (CFM-M-MUX IDU) and one ODU.

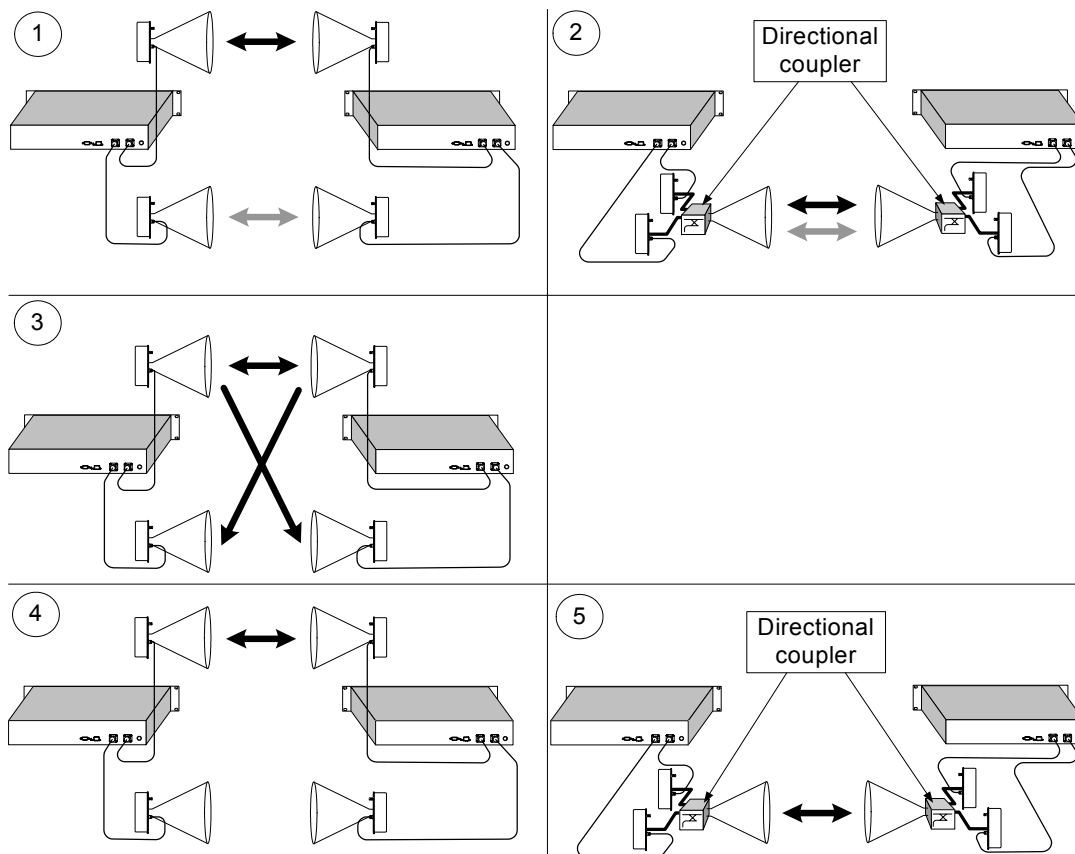


Figure 1. Supported 1+1 configurations:

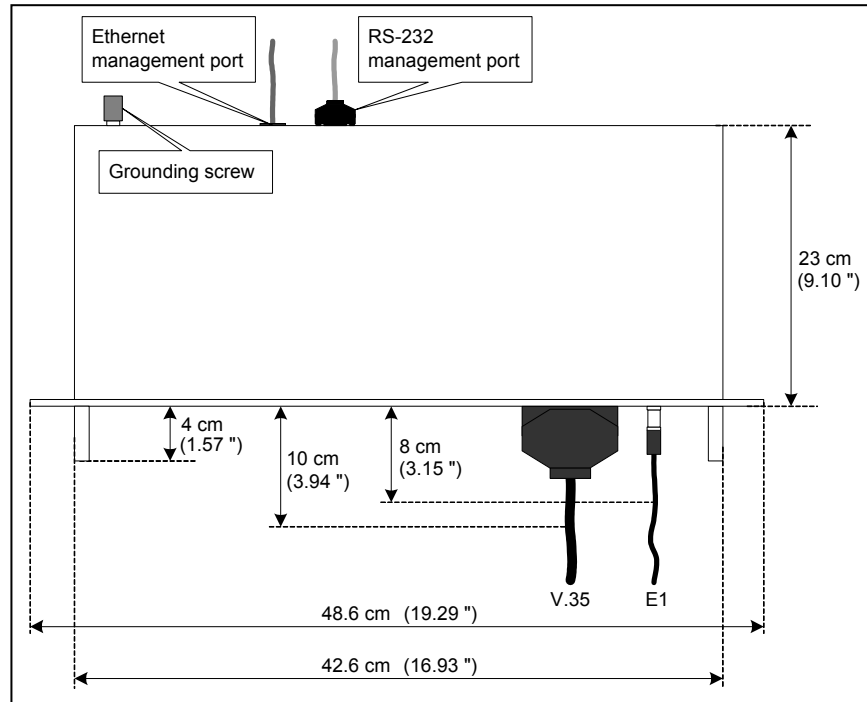
1. frequency diversity with four antennas, two frequency pairs are used and both transmitters operate simultaneously at each site;
2. frequency diversity with two antennas;
3. space diversity with four antennas, one transmitter and two receivers operate for each direction, and only one frequency pair is used;
4. HSB (hot standby) configuration with four antennas, only one frequency pair is used, only one transmitter transmits at each site;
5. HSB configuration with two antennas.

For 1+1 configurations with two antennas, a directional coupler is used, with insertion loss of 1 dB and coupling 6 dB.

2 Hardware Features

2.1 IDU Appearance

The CFM-MP-MUX IDU is implemented as 19" rack mountable aluminium 2U high unit, the depth of the unit is 230 mm without front panel handles and 270 mm with handles.



The **CFM-MP-MUX** IDU provides four sockets for installation of interface modules. For information about data rate distribution among multiplexer slots, please see Table 5.

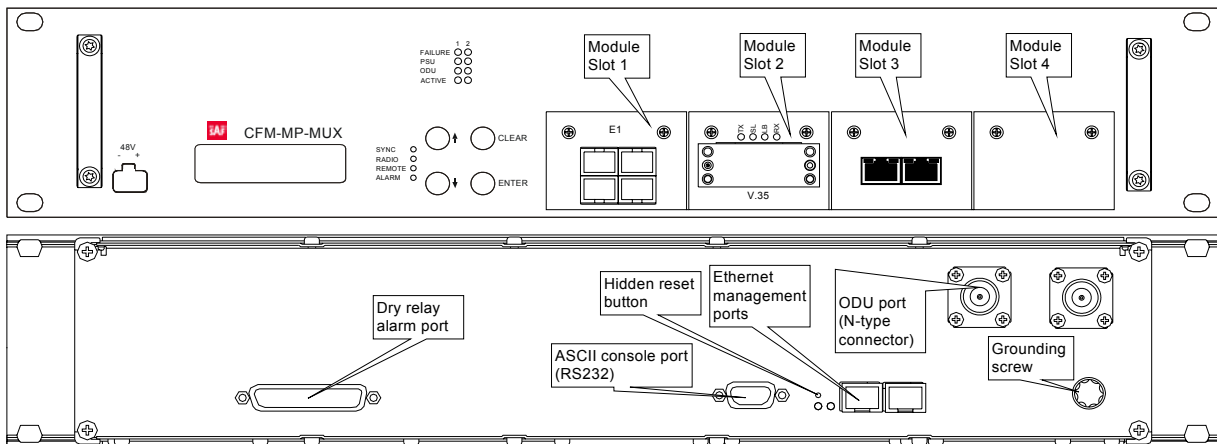


Figure 2. The CFM-MP-MUX IDU (front and rear panel)

The CFM-MP-MUX IDU provides the following interfaces:

- Traffic ports, provided by installed interface modules; the following interface modules are available:
 - **V.35** interface module (port connector M34), supported speeds: 64 kbps, 128 kbps, 256 kbps, 512 kbps, 1024 kbps, 2048 kbps, 4096 kbps, 6144 kbps, 8192 kbps;
 - **2-port 100Base-T Ethernet** module (RJ-45 sockets);
 - **E1** module, provides one E1 port, (2048 kbps speed) with both 120 Ω RJ-45 socket, and 75 Ω BNC interfaces);
 - **4xE1** module, provides four E1 ports, the ports can be separately switched on/off, accordingly the module capacity is 2 Mbps, 4 Mbps, 6 Mbps or 8 Mbps;
- RS-232 serial management port;
- Ethernet management ports for Web, Telnet or SNMP management;
- RS232 console port;
- Alarm port (optional);
- LCD/keypad;
- Port activity LEDs and alarm LEDs.

Table 1. Connectors

| Connector(s) / label | Comments |
|-------------------------------|---|
| Front panel connectors | |
| + - 48V | Power connector (D-sub type), IDU should be powered from 20 – 60 VDC power source. Either “+” or “-” pole of the power source can be grounded, one should make sure if the chosen grounding wire is connected to ground on IDU power connector. |
| Rear panel connectors | |
| DB-9 type connector | RS232 management port for connection of ASCII console (or analog line modem for the remote connection of ASCII console); The RS232 console port is also used to update management software. |
| DB-25 type connector | Alarm port. |
| RJ-45 sockets | 10Base-T Ethernet management port, this port is used to connect Telnet or Web terminal. |

Table 2. LEDs

| Front panel LEDs | |
|---------------------------------------|--|
| Label | Description |
| SYNC | Red Signal Lost LED indicates the loss of Multiplexer synchronization; if not lit – operating properly. |
| RADIO | Radio Alarm LED indicates problems with radio unit and IDU-ODU cable. The following problems cause the Radio Alarm to switch on: <ul style="list-style-type: none"> - Rx signal level is lower the predefined value, - the corresponding parameter is RxAlarmLev on the LCD or RxAlarmLevel using Telnet/ASCII console. The default value for this parameter is -77 dBm; - The humidity within the radio is too high (possibly ODU is opened); - Transmitter malfunction (TxOut=Error) - RF Cable=Short – cable is faulty, RF Cable=Off – cable or Radio is faulty; - Tx and Rx synthesizer loops are not locked (TxPLL=Error, RxPLL=Error) If not lit – operating properly (Rx=OK & TxOut=OK & Humidity=Low & RF Cable – OK & TxPLL=OK & RxPLL=OK). Note: the RA LED will also switch on if the Radio loopback is active and/or if the transmitter power is switched off. |
| REMOTE | Remote Alarm Indicator (RAI alarm), - indicates that the far-end site has the SL alarm switched on. |
| ALARM | YELLOW – indicates that the BER is equal or higher the BER level, specified with <i>BerAlarmLevel</i> command from Telnet or ASCII terminal. Default <i>BerAlarmLevel</i> value is 10^{-6} . |
| FAILURE | Alarm LED: OFF – normal operation (no alarm); RED – Indicates failure of ODU, or failure in connection between IDU and ODU (cable). |
| PSU | Alarm LED: OFF – normal operation (no alarm); RED – Indicates that power supply module is faulty. |
| ODU | YELLOW – ODU is transmitting signal to far end (transmitter switched on); OFF – ODU transmitter is switched off. Note: in 'FD' (Frequency Diversity) operation mode both 'ODU' LEDs are switched on since both ODUs are transmitting. |
| ACTIVE | GREEN – the input signal is received from ODU (1 or 2); OFF – the input signal is received from ODU (1 or 2). Note: only one 'ACTIVE' LED (1 or 2) can be switched on at a time. |
| Rear panel LEDs (see Figure 3) | |
| A | If blinking (with a period of about 1 sec.), indicates operation of the management module CPU; |
| B | If lit, indicates that Ethernet link is established with the management terminal (SNMP, Web or Telnet); |

Table 3

| Other front panel LED signals | |
|-------------------------------|--|
| Alarm | Description |
| Wrong Capacity | <p>In case if</p> <ul style="list-style-type: none"> - the WAN capacity is lower than sum of MUX slot speeds (LAN speed higher than WAN speed), or - one or more MUX slot speed settings does not support the selected WAN capacity (for example, slot 1 configured with <i>RMN</i> capacity while WAN capacity is 16 Mbps). <p>SYNC, RADIO, REMOTE and ALARM LEDs switch on and off alternatively in the following combination: (RADIO, REMOTE) <-> (SYNC, ALARM)</p> |
| IDU HARDWARE FAILURE | <p>If IDU hardware failure occurs, SYNC, RADIO, REMOTE and ALARM LEDs simultaneously will be switching on and off.</p> |

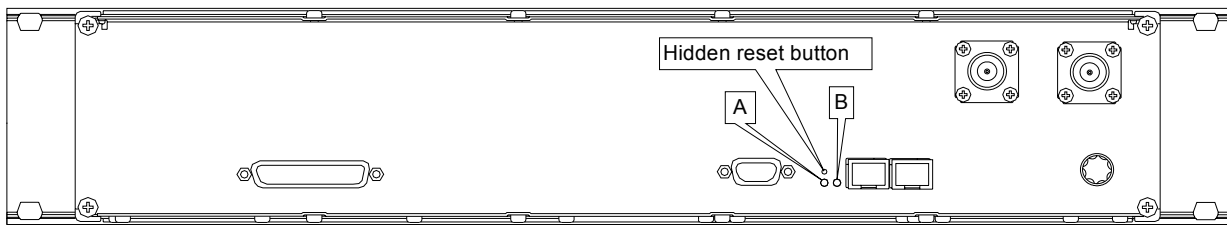


Figure 3. The rear panel LEDs

2.2 Mechanical Data

| Weight (with no modules), [kg] | Dimensions HxWxD, [mm] |
|--------------------------------|------------------------|
| 2.8 | 88x482x284 |

2.3 Functional Description

Figure 4 shows the simplified block diagram of the CFM-MP-MUX IDU.

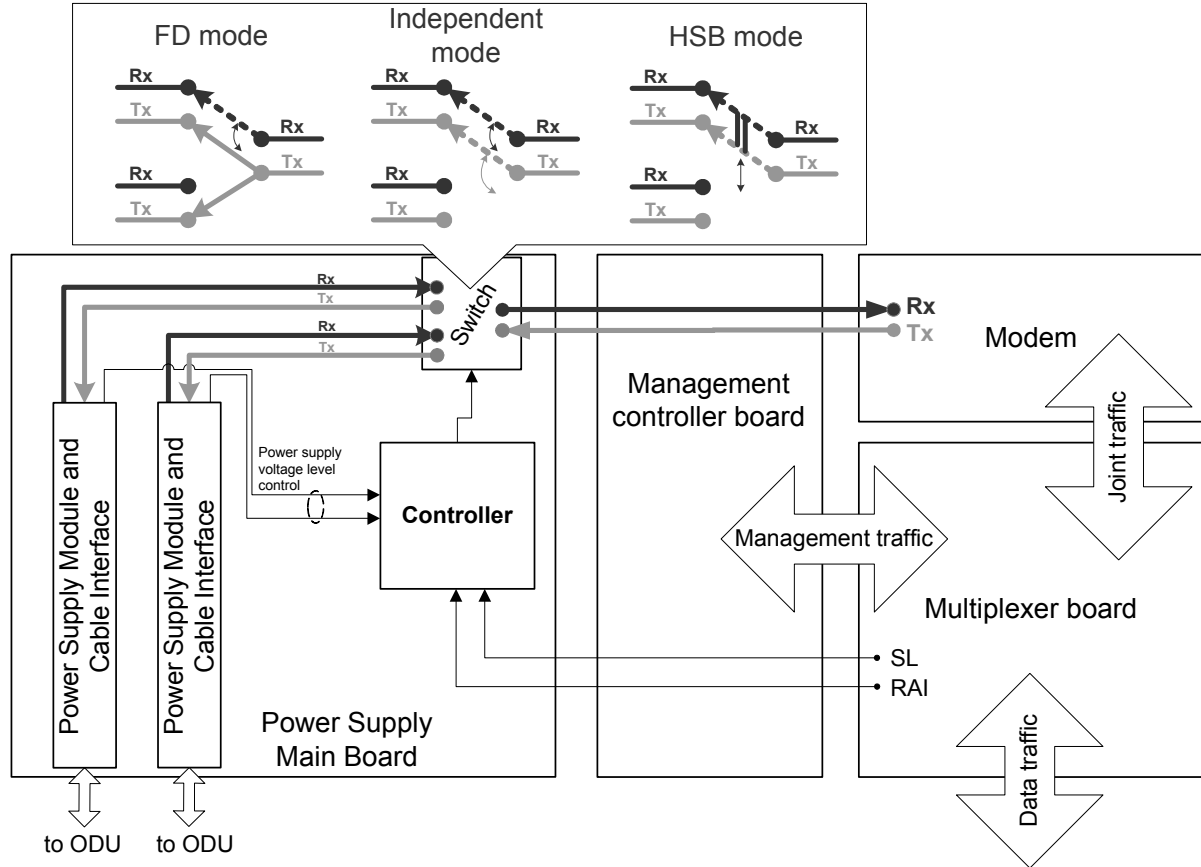


Figure 4. Block diagram of the CFM-MP-MUX IDU

The CFM-MP-MUX IDU consists of the following PCBs:

- Multiplexer board,
- Modem board,
- Management controller board,
- Power supply mainboard,
- 2 x Power supply and Cable Interface modules (PSM/CI modules).

The Power Supply mainboard has two slots onboard, each slot for one PSM/CI module, - the PSM/CI module is duplicated. Each PSM/CI module

- provides the power supply voltages for each PCB in the IDU,
- provides power supply to the ODU (Cable Interface part),
- and transmits/receives IF traffic signals to/from ODU.

The Power supply mainboard has the traffic switch and the controller onboard. The controller monitors the levels of power supply output voltages of both PSM/CI modules. Both PSM/CI modules operate in parallel, but the *incoming* traffic is received solely from one PSM/CI module and passed to the modem (see Figure 4).

The signal from the PSM/CI module is further passed to the radio via 50 Ω coaxial cable.

The switch-over between PSM/CI modules is performed in one of the following events:

- SL alarm at the local site switches on meaning that the E3 frame synchronization has been lost;
- RAI (Remote Alarm Indicator) signal is received from the WAN, this means that the far-end site has the SL alarm switched on;
- Power supply failure;
- Radio cable failure, - if there is a break or short-circuit in the IDU-ODU cable (same as the *RF cable* parameter returning "short" or "off" value in status display mode of the LCD;
- RA (Radio Alarm) switches on, this occurs in one of the following cases:
 - o Boundaries of *RF level max / RF level min / RF level delta* parameters have been reached
 - o Received signal level lower the *RxAlarmLevel* value;
 - o Problems with Radio: Humidity = high, TxPLL failure;

If the fault occurs, the total switch-over time does not exceed 50 milliseconds.

2.3.1 FD Mode

When operating in FD (frequency diversity) mode, the outgoing (Tx) traffic is passed to both ODUs (see Figure 4), the transmitters of both ODUs are switched on; the incoming signal (Rx) is chosen from one of the PSM/CI modules, depending on the received signal level and alarm status.

The FD mode should be used for frequency-diversity protected link configurations.

Note: in FD mode both *ODU* LEDs (1 and 2) will be switched on (yellow), since both ODUs are transmitting.

2.3.2 Independent Mode

When operating in Independent Mode, the incoming (Rx) and outgoing (Tx) traffic is switched between PSM/CI modules independently, - the incoming traffic can be received from one ODU while the outgoing traffic is passed to the other ODU (see Figure 4). One ODU is transmitting and both ODUs are receiving signal at each end.

The Independent mode should be used for space-diversity protected link configurations.

2.3.3 HSB Mode

The HSB (hot standby) Mode is similar to Independent Mode, except that both, incoming and outgoing traffic, are switched between PSM/CI modules *simultaneously* (see Figure 4).

2.4 Labeling

The IDU and ODU label contains the following information:

- Product brand name
- Product number (P/N)
- Serial number (S/N)

The Serial Number uniquely identifies the unit (IDU or ODU); the Serial Number contains 4-digit number, which is derived from the Product Number of the unit, and a 5-digit consecutive number of the product; the 5-digit consecutive numbering for IDU label is separate for each IDU type (e.g. MUX IDU, REB IDU, E1 IDU, etc.), for ODU label – separate for each frequency band.

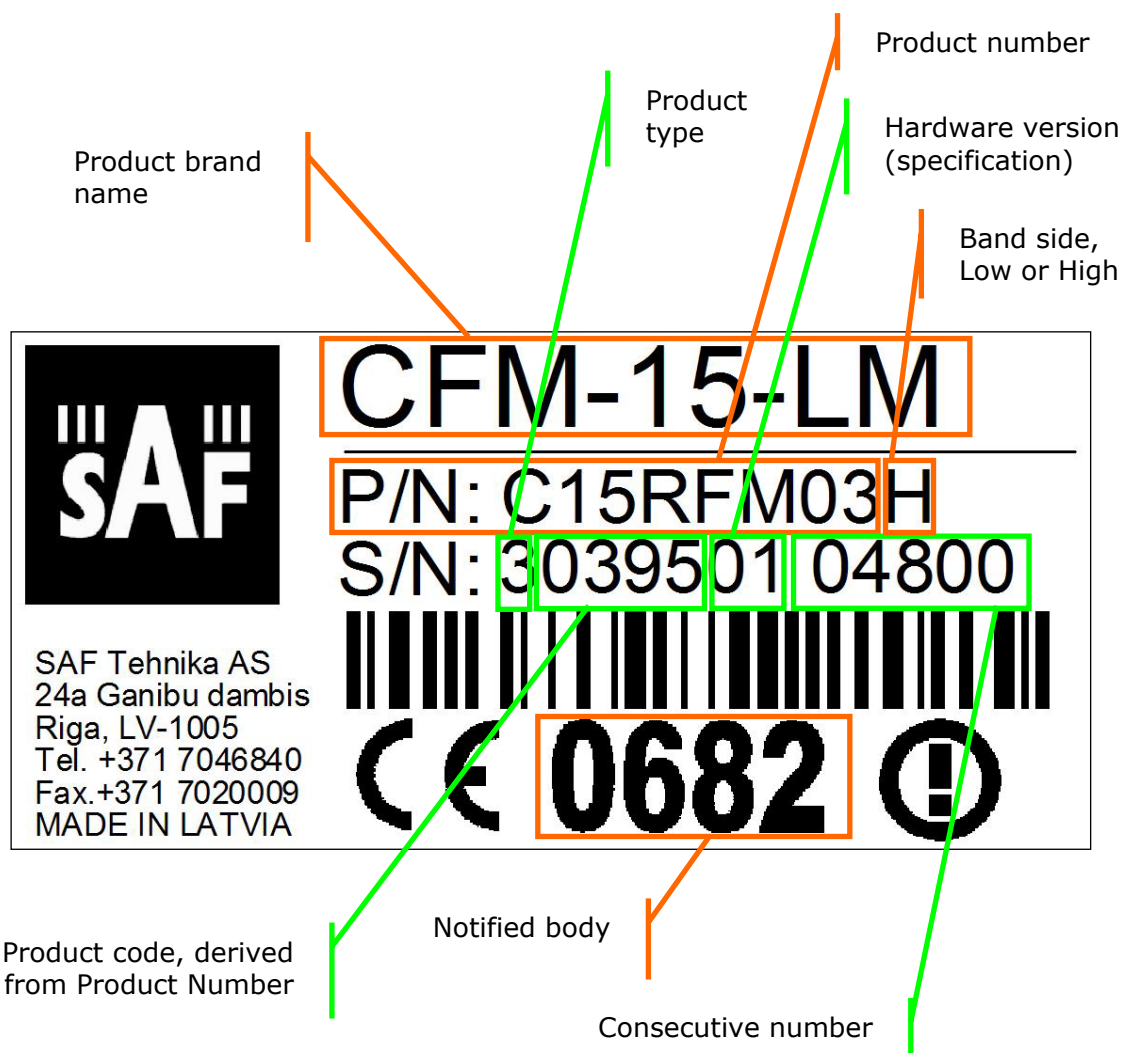


Figure 5. Label of the CFM-15-LM ODU

3 Configuration and Management

3.1 LCD/Keypad

LCD and keypad provides most basic method to locally configure and monitor the local CFM terminal (IDU+ODU).

LCD display is constantly backlight and is able to display 2 lines of 16 symbols in each line.

The LCD operates in two modes - **Status** and **Setup** display mode, please refer to Flow Chart 1, page 44.

Keypad consists of 4 buttons:

ENTER is used to confirm the choice of displayed item or entered data as well as to switch from "*status display*" to "*setup*" mode.

CLEAR is used to cancel the choice or to move to previous menu level

↑ ↓ Up/Down buttons are used:

- To switch between options for menu items displayed

- To choose parameter to set up and to set its value.

3.1.1 "Status Display" Mode of the LCD Management Interface

Once the IDU is powered up, it automatically enters "Manual Display" mode, displaying two parameters at a time statically (use up/down buttons to scroll through parameters). These parameters are listed in the Table 4).

Table 4. Parameters displayed in "Status Display" mode

| Parameter | Values and description |
|--|--|
| Tx=15131.000MHz Tx=15166.000MHz | Indicates current Tx frequency of ODU1 and ODU2. |
| Rx=14711.000MHz Rx=14746.000MHz | Indicates current Rx frequency of ODU1 and ODU2. |
| TxPower=+20dBm TxPower=+20dBm | Indicates current output power of ODU1 and ODU2. |
| Rx= OK Rx= OK | Indicates various conditions of Rx signal from ODU1 and ODU2: "OK" indicates IDU receives acceptable signal from ODU; "Low" indicates that received signal level is too low for IDU to operate properly; "Error" indicates some internal fault in ODU receiver, please contact sales representative or manufacturer; "Loopback" indicates radio loopback mode: Rx = Tx frequency |
| RxLev= -46dBm RxLev= -48dBm | Indicates the level of the received signal (at ODU1 and ODU2). |
| Cable= -5dBm Cable= -10dBm | Parameter indicates signal attenuation in ODU-IDU cable, values of 0 ... -20 dB provide proper operation of IDU. |
| TxOut= Ok TxOut= Ok | Indicates operation status of ODU transmitter: "Ok" indicated proper operation; "Error" indicates internal fault in ODU transmitter, please contact sales representative or manufacturer. |
| TxPLL= Ok TxPLL= Ok | Indicates operation status of ODU Tx Syntheser Loop (PLL lock): "Ok" indicates proper operation; "Error" indicates internal fault in ODU transmitter, please contact sales representative or manufacturer. |
| RxPLL= Ok RxPLL= Ok | Indicates operation status of ODU Rx Syntheser Loop (PLL lock): "Ok" indicated proper operation; "Error" indicates internal fault in ODU receiver, please contact sales representative or manufacturer. |
| ODU t= 23C ODU t= 23C | Indicates internal temperature of ODU1 and ODU2. |
| Humidity=Low Humidity=Low | Indicates humidity level inside ODU1 and ODU2, "Low" indicates acceptable moisture levels; "High" indicates too high level of humidity, condensing. |
| Restart= 00 Restart= 00 | Parameter indicates number of ODU management controller restarts since counter was reset on power up. |
| RF Cable – OK RF Cable – OK | Parameter indicates power consumption of the ODU unit: "OK" indicates acceptable level; "Short" indicates short circuit in cable; "Off" indicates too low power consumption by ODU. This is most likely due to the brake in the cable. If the cable is intact, the ODU is faulty. |
| PW max = 20 | Indicates maximum possible transmitting power. |
| RxAlarmLev =-77 RxAlarmLev =-77 | Indicates the Rx level (in dBm) at which the Radio Alarm is switched on. |
| IDU t= 31C | Indicates temperature inside IDU. |
| BlkErr = 8275703 | <i>Block Error</i> counter; Errored block is WAN frame with one or more bit errors. Errored blocks are not counted while Sync lost (SL) alarm is switched on. |
| BBlkErr = 10196 | <i>Background Block Error</i> counter: the background block errors are counted while BER < 10 ⁻³ , and are not counted while Sync lost (SL) alarm is switched on. |

| | |
|-------------------------|--|
| StatTime = 90931 | Time, during which all error measurements are performed. |
| ErrSec = 1361 | Errored seconds; errored second is a one-second period in which one or more bits are in error or during which SL alarm is switched on. |
| SErrSec = 1259 | Severely errored seconds. Severely errored second is a one-second period which has a bit-error ratio $\geq 1 \cdot 10^{-3}$ or during which SL alarm is switched on. |
| SLTime = 35 | Synch Lost time, - time, during which SL alarm is switched on. |
| AvTime = 89773 | Availability time. Please refer to ITU-T recommendation G.826 (Annex A) for definition of availability of the path or connection. |
| UnAvTime = 1258 | Unavailability time. |
| BER = No Errors | Indicates BER within the last BER time frame. BER time frame length (in seconds) can be changed with 'bertime' command. |
| B.BER = 8.2e-06 | Indicates background BER. |
| BBLoopback=OFF | Indicates if the base-band loopback is switched on or off. |

3.1.2 "Setup" Mode of the LCD Management Interface

The following table describes parameters available for change from the IDU LCD in **Setup** mode. Algorithm of LCD operation is shown on Flow Chart 1, page 44.

Table 5

| Parameter | Values and description |
|----------------------------|--|
| Access Code | Specify the panel access code (a number from 0 – 200) that was set up from Telnet or ASCII console to enable any adjustments from IDU. |
| Restart CPU | Restarts management module CPU for the new IP settings to take effect. Resets all management counters. |
| Reset Counters | Resets <i>BlkErr</i> , <i>BBlkErr</i> , <i>StatTime</i> , <i>ErrSec</i> , <i>SErrSec</i> , <i>SLTime</i> , <i>AvTime</i> and <i>UnAvTime</i> counters. Counters are also cleared when management controller is rebooted. For more information about counters, see Table 4. |
| Write config | Saves all settings in EPROM of management controller. |
| Remote IP | Specifies the IP address of the remote (far-end) CFM-MP-MUX IDU management module Eth port. |
| Change Chan ## | Set the Rx and Tx frequency. "Change Chan" item provides ODU Tx and Rx frequency setup functionality: If this item is chosen LCD display shows, for example: <div style="text-align: center; border: 1px solid black; padding: 2px; width: fit-content; margin: 10px auto;"> Change Chan 163 Tx=23583.000MHz </div> where "163" – number of currently used Tx channel and "Tx" – frequency appropriate to channel. This immediately changes the channel setting for <i>both</i> local ODUs, but only one ODU is transmitting at a time, - the transmitter of the other ODU is switched off. |
| ODU1 Tx Power +5dBm | Adjust the Transmitter power for ODU1 or ODU2. The default setting is "OFF", allowing safe deployment of the equipment avoiding interference risk with other radio equipment. |
| Capacity 34M | Set the maximum capacity (WAN speed): 8 Mbps, 16 Mbps or 34 Mbps. Once the capacity is changed, the IDU will configure the software for various IDU components; this will take a few minutes. Once the configuration is complete, the IDU will automatically restart. After the capacity change, the user must manually reconfigure all MUX slot speeds from LCD or from Telnet or ASCII terminal using 'muxspeeds' command; the new configuration must be saved using 'write' command. |

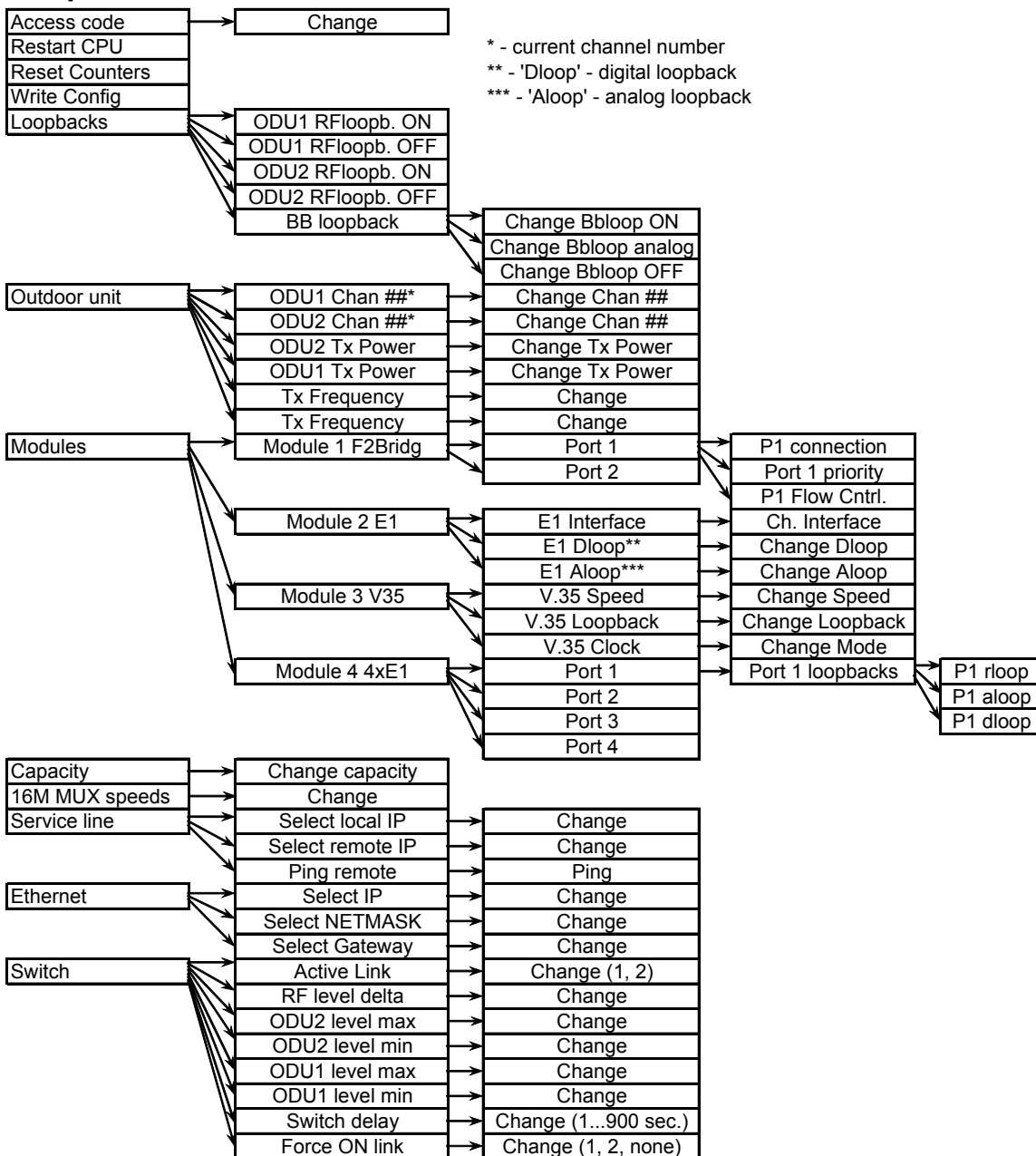
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| 34M MUX speeds | <p>Sets the data rate for each multiplexer slot; use 1E1...4E1 modes for E1 modules, and 2M...16M modes for Ethernet and V.35 modules; supported speeds for each slot are the following:</p> <ul style="list-style-type: none"> • CFM-MP-MUX with the maximum capacity of 8 Mbps: all slots support speeds 0...8 Mbps with 2 Mbps step. • CFM-MP-MUX with the maximum capacity of 16 Mbps: slot 1 and slot 2 supports speeds 0...16 Mbps with 2 Mbps step; slot 3 and slot 4 supports speeds 0...8 Mbps with 2 Mbps step. • CFM-MP-MUX with the maximum capacity of 34 Mbps: slot 2 supports speeds 0...16 Mbps with 2 Mbps step; slot 3 and slot 4 supports speeds 0...8 Mbps with 2 Mbps step; slot 1 supports speeds 0...8 Mbps with 2 Mbps step and RMN (remaining capacity) and FOD modes. In RMN mode the slot operates with any capacity equal to $(34 - C_{2,3,4})$ Mbps, where $C_{2,3,4}$ – the sum of capacities of slots 2, 3 and 4. The slot 1 is the only slot which supports capacity above 16 Mbps, including the maximum capacity of 34 Mbps. The FOD mode should be used for compatibility with the CFM Full Outdoor Unit, operating with WAN capacity of 34 Mbps. In case if the opposite site has the CFM series FODU installed, and link operates with 34 Mbps capacity, the CFM-MP-MUX must have one of the following configurations: <table border="1" data-bbox="597 842 1291 1108"> <tr> <td colspan="4">In case if FODU and CFM-MP-MUX operates with 34 Mbps capacity</td> </tr> <tr> <th>Slot 1</th> <th>Slot 2</th> <th>Slot 3</th> <th>Slot 4</th> </tr> <tr> <td>FOD</td> <td>1E1</td> <td>1E1</td> <td>0M</td> </tr> <tr> <td>FOD</td> <td>0M</td> <td>0M</td> <td>0M</td> </tr> <tr> <td>FOD</td> <td>1E1</td> <td>0M</td> <td>0M</td> </tr> <tr> <td>FOD</td> <td>0M</td> <td>1E1</td> <td>0M</td> </tr> </table> <p>The numbering of slots is shown in Figure 2.</p> | In case if FODU and CFM-MP-MUX operates with 34 Mbps capacity | | | | Slot 1 | Slot 2 | Slot 3 | Slot 4 | FOD | 1E1 | 1E1 | 0M | FOD | 0M | 0M | 0M | FOD | 1E1 | 0M | 0M | FOD | 0M | 1E1 | 0M |
|--|--|---|--------|--|--|--------|--------|--------|--------|-----|-----|-----|----|-----|----|----|----|-----|-----|----|----|-----|----|-----|----|
| In case if FODU and CFM-MP-MUX operates with 34 Mbps capacity | | | | | | | | | | | | | | | | | | | | | | | | | |
| Slot 1 | Slot 2 | Slot 3 | Slot 4 | | | | | | | | | | | | | | | | | | | | | | |
| FOD | 1E1 | 1E1 | 0M | | | | | | | | | | | | | | | | | | | | | | |
| FOD | 0M | 0M | 0M | | | | | | | | | | | | | | | | | | | | | | |
| FOD | 1E1 | 0M | 0M | | | | | | | | | | | | | | | | | | | | | | |
| FOD | 0M | 1E1 | 0M | | | | | | | | | | | | | | | | | | | | | | |
| Select IP Select NETMASK Select Gateway | <p>IP and NETMASK – IP address and netmask of the Ethernet port of the management controller (default IP address - 192.168.205.010 or 192.168.206.010, default netmask 255.255.255.000)</p> <p>Gateway – IP address of the management console (Web or Telnet) directly connected to the Ethernet management port or the IP address of the gateway if the console is connected via network (indirectly), the default value is 255.255.255.255 (no gateway specified).</p> <p>IP, Netmask and Gateway parameters provide the means of addressing the IDU management controller in order to control and manage IDU locally and monitor ODU both locally and remotely. Note: It is necessary to restart the management CPU for any changes in IP settings (including SNMP terminal and service channel IP settings) to take effect.</p> | | | | | | | | | | | | | | | | | | | | | | | | |
| Select local IP | <p>Sets the IP address of the serial port of service channel for the local IDU management module (near-end terminal).</p> | | | | | | | | | | | | | | | | | | | | | | | | |
| Select remote IP | <p>Sets the IP address of the serial port of service channel for the remote IDU management module (far-end terminal).</p> | | | | | | | | | | | | | | | | | | | | | | | | |
| RF loopback OFF | <p>Turns off the RF loopback (local), RF loopback ON turns the RF loopback on.</p> | | | | | | | | | | | | | | | | | | | | | | | | |

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| | |
|------------------------|--|
| BB loopback OFF | Turns off the baseband loopback (any), BB loopback ON sets the digital baseband loopback, BB loop analog sets the analog loop. |
| Modules | This item contains all the commands for configuration of the installed modules. <i>Notes:</i> <ul style="list-style-type: none"> - <i>E1 interface</i> – switch between 120 Ω and 75 Ω port of the E1 module; - <i>V.35 clock</i> – invert the RxC signal. For more information refer to <i>V.35 Interface Module Installation and Configuration Guide</i>, this document can be found in the accompanying documentation CD. |
| Switch | The 'switch' menu offers to configure all parameters related to 1+1 switching, for information about parameters regarding 1+1 switching, see <i>1+1 configuration commands</i> table in chapter 3.4. |

Setup mode menu tree



3.2 Resetting the IDU

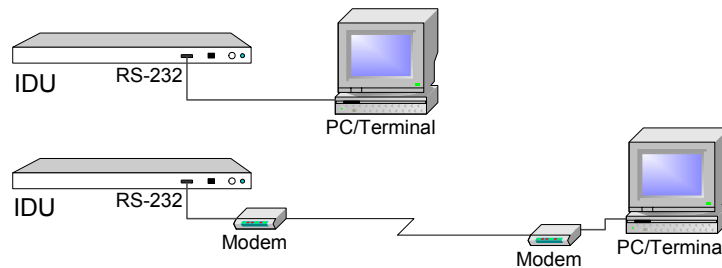
Depending on the method used, the user may reset the whole terminal (IDU+ODU) or the management controller individually, see table below for details.

| | |
|--|---|
| Reset through the LCD menu system using "Restart CPU" option or from the Telnet/ASCII console using "restartcpu" command | Restarts the management module. Resets all management counters. |
| Reset action using hidden button at the rear side of the IDU (see Figure 3) | Restarts both the multiplexer module and the management module. Resets all management counters. Note: This may require a pin, at least 15 mm long, approx. 1.5 mm in diameter. |
| Unplugging of power supply | Restarts the multiplexer module and the management module. Resets all management counters. |

3.3 RS-232 Serial Management Port

The RS-232 serial management port provides terminal management via connected PC or other terminal device or modem.

The terminal connected to the serial management port provides the same management functionality as Telnet interfaces (refer to Command Interface). In order to interconnect the IDU and the management terminal directly through serial ports, a "straight through modem cable is needed.



If using modems, the management terminal is connected with the IDU remotely through a telephone line. In this case the modem, which is connected with the IDU should be set to *Auto Answer* mode.

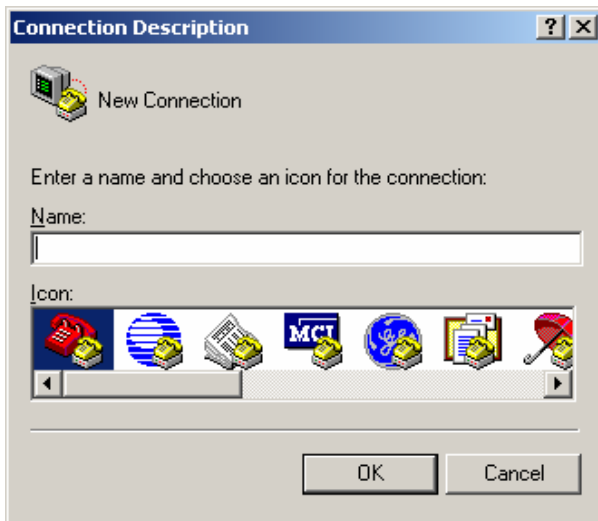
```
c:\ Telnet 192.168.205.12
Telnet server. Press CTRL/D to end session
Login: telnet
Password:
SAF komut>?
Valid commands:
  enable disable disableWDT exit ip link link1 link2
  cfg mac name ping panel resetWDT restartcpu route snmp
  switch time txpower ver write webrefresh wwwuser telnetuser
SAF komut>link1 ?
valid subcommands: community WriteCommunity ip stat remotestat
SAF komut>link1 stat
Link 1 Status : On
Rx Level      : -59 dBm
RF Alarm      : On
Sync Lost Alarm: Off
SAF komut>_
```

Telnet management window

In order to connect the console to the Radio via RS-232 interface, the serial port of the management console should be configured as 19200 8-N-1, no data flow control.

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.

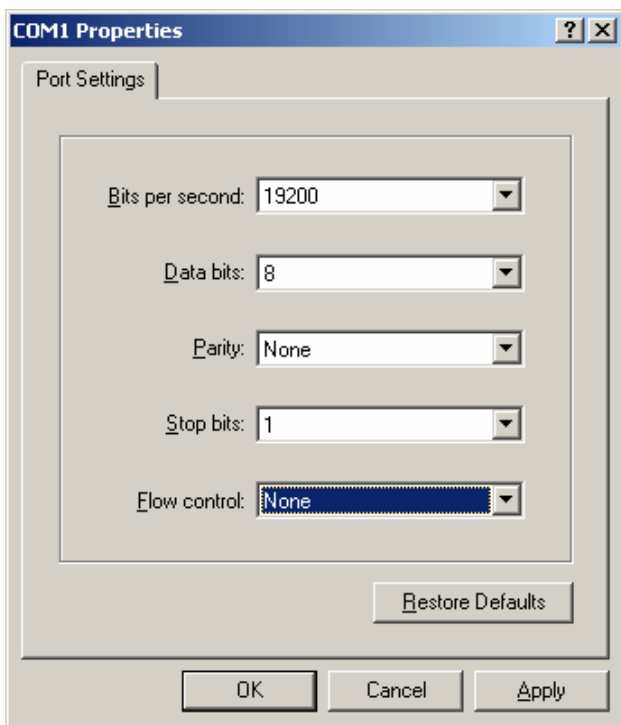
1. Connect PC to the RS232 serial port by means of "straight through" or modem serial cable (null-cable).
2. Run "Hyper Terminal" program.
3. Make a *New connection*, enter connection name.



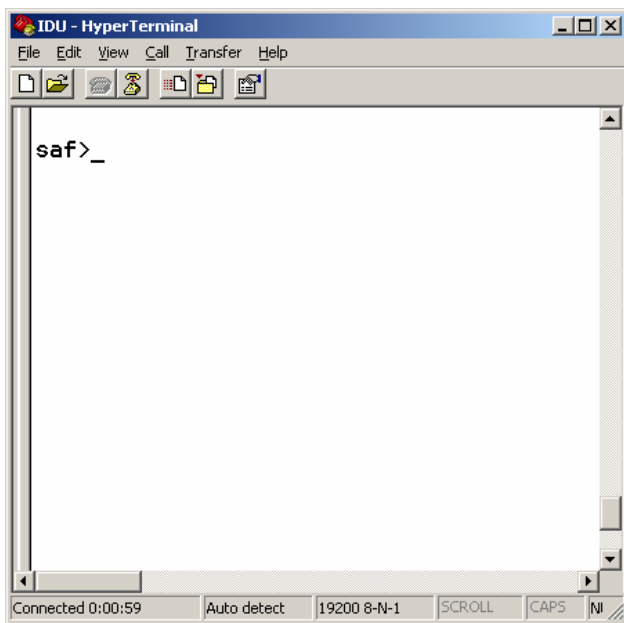
4. Choose port (COM1 or COM2).



- Set port settings (bits per second: 19200, data bits: 8, parity: none, stop bits: 1, data flow control: none).



- Press OK
- Press Enter. Password is disabled by default.
If successfully connected, the prompt should appear as in the picture below. See Chapter 3.4 for available commands.



3.4 Command Interface

The CFM equipment (IDU and ODU) can be monitored and configured using command interface described in this chapter, connecting with

- ASCII console to RS232 port, or
- Telnet terminal via Ethernet management port; the Telnet management supports only one client.

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

Tips:

- To end Telnet or ASCII session press Ctrl+D, then, to open session again, the prompt will appear to enter username and password.
- For default (factory) usernames and passwords please refer to chapter 3.4.5.

| Common commands | |
|--|--|
| Command | Description |
| Time | Show current date and time. |
| Time <YYYY-MM-DD HH:mm:ss> | Set the date and time. The clock is not available on IDU LCD. |
| Name <deviceName> | Assigns a name to the IDU; The default name is "SAF". The IDU name appears in the prompt string of the Telnet/ASCII terminal management windows, it can also be seen on the IDU LCD by pressing clear button while in status display mode as well as on the Web browser window. The name can be a maximum of 16 symbols long. If using space(s), the argument should be in double quotes, Example: <i>name "SAFterm2 14 7"</i> . |
| Lcd <1...255> | Adjust LCD contrast (values 0...255), default value is 165. |
| Muxspeeds {slt1}+{slt2}+{slt3}+{slt4} | Set the data rate for each multiplexer slot. See Table 5 for more information about configuration of MUX slot speeds. Example: <i>muxspeeds rmn+2e1+2e1+2m</i> . |
| capacity {8M 16M 34M} | Set the multiplexer capacity (WAN data rate). After the capacity change, the user must manually reconfigure all MUX slot speeds using 'muxspeeds' command; the new configuration must be saved using 'write' command. |
| Write | Save all settings in the EPROM. This command saves all current settings in EPROM, including those in the script. |
| Ping <IPaddress> | This command is for troubleshooting purposes to verify the service channel connectivity, - sends a special packet to the specified address and then waits for a reply. |
| RxAlarmLevel <RxLevel> | Set the Rx signal level at which the Radio Alarm is switched on. |
| BerAlarmLevel <BERLevel> | Set the BER level at which the Alarm LED is switched on. |
| Webrefresh <refreshperiod> | Refreshes the contents of WEB interface with a specified period (<i>refreshperiod</i>); The period is given in seconds; the minimum period is 2 seconds. |
| BBloop {on analog off} [duration] | Set baseband loopback, "on" – set digital loopback (dual), "analog" – set analog loopback (non-dual), "off" – suspend baseband loopback. Duration can be from 1 to 10 minutes, it is equal to 1 min. by default. Example: <i>BBloop on 3</i> |
| RFloop {ODU1 ODU2} {on off} [duration] | Set RF loopback, - "on" – set loopback, "off" – suspend loopback. Duration can be from 1 to 10 minutes, it is equal to 1 min. by default. Example: <i>Rfloop odu1 on 3</i> |
| resetWDT | The management module has a watchdog timer (WDT), which manages the automatic restart of the management system if it "freezes" for about 2 seconds. <i>Resetwdt</i> command will reset watchdog timer causing the management system to restart, this will also reset all management counters. |
| ResetWDT | Reset watchdog timer, this will restart management controller, and reset all management counters. |
| ClearCounters | Reset all counters, - <i>BlkErr</i> , <i>BBlkErr</i> , <i>StatTime</i> , <i>ErrSec</i> , <i>SErrSec</i> , <i>SLLTime</i> , <i>AvTime</i> and <i>UnAvTime</i> counters. Counters are also cleared when IDU is rebooted. For more information about counters see Table 4. |
| Exit | Close Telnet session (same as to press Ctrl+D) |

| | |
|--|--|
| Disable {telnet www snmp rip} | <p>"telnet" – Disable Telnet interface "www" – Disable Web interface "snmp" – Disable SNMP interface "rip" – Disable RIP</p> <p>Note: after the command is entered, it is necessary to save the configuration in EPROM (use write command) and restart the IDU for changes to take effect.</p> |
| RestartCPU | Restart CPU of the management controller (new IP settings will take effect). Resets all management counters. |
| Mod detect | Detects and displays a list of currently installed modules. This detection procedure is carried out each time when management controller boots up. |
| Mod {1 2 3 4} stat | <p>Show parameters, - lists all parameters and input/output status that refer to the specific module.</p> <p>Example for E1 interface module:</p> <pre>SAF>mod 1 stat Module E1 vers. 2 E1 impedance 120 TxAIS OFF Enable Analog Loopback OFF Enable Local Loopback OFF Enable Remote Loopback OFF RxAIS OFF RxLOS OFF</pre> <p>Example for REB interface module:</p> <pre>SAF>mod 4 stat Module Bridge vers. 1 Link ON FDX ON Filter ON</pre> |
| Mod dump | Show a list of modules and contents of their respective CPU registers (in hexadecimal system). This command is for diagnostic purposes only. |
| Bertime <seconds> | Change time frame for BER measurement (in seconds). |
| Ethernet {port1 port2} connection {auto 10fdx 10hdx 100fdx 100hdx} | Configures Ethernet management ports (1 and 2): change connection mode for port 1 or port 2. |
| Ethernet {port1 port2} flowcntrl {enable disable} | Configures Ethernet management ports (1 and 2): enable or disable <i>flow control</i> for port 1 or port 2. |
| Ethernet stat | Displays the configuration and actual status of Ethernet management port 1 and port 2. |

| 1+1 configuration commands | |
|--|--|
| Command | Description |
| Switch stat | Display information regarding 1+1 protection. |
| Switch mode {FD independent HSB } | Change operation mode of the 1+1 protection, for more information refer to Chapter 0. |
| Switch {enable disable} | <i>enable</i> - enables 1+1 switching to be performed considering <i>rxmin</i> , <i>rxmax</i> , <i>delta</i> and <i>BER</i> parameters. <i>disable</i> - 1+1 switching is performed only in case of SL alarm. The factory setting is <i>'disable'</i> . |
| Switch active {1 2} | Change currently active Rx side, this command is applicable in <i>HSB</i> and <i>independent</i> operation modes only. |
| Switch activetx {1 2} | This command works only in <i>Independent</i> mode; - switch the active ODU for Tx traffic. Note: In <i>Frequency diversity</i> mode both ODUs will transmit, in <i>HSB</i> mode the transmitting ODU is set the same as for Rx traffic (receiving ODU). |
| Switch force {1 2 Off} | Force the side (1 or 2) to be active ignoring any condition(s) that could cause to switch over to other side; "Off" - normal mode. |
| Switch rxmin <minRXlevel> | Sets the minimum RX signal level, - if the RX signal appears below it, the Rx traffic is switched from other ODU. |
| Switch rxmax <maxRXlevel> | Sets the maximum RX signal level which, when exceeded, causes to switch to the other ODU. |
| Switch delta <RxDifference> | Sets the difference between link 1 RX signal level and link 2 RX signal level which, when exceeded, causes to switch to the other link with the higher RX signal level unless the conflict with the "RF level max" parameter subsist. |
| Switch ber <BER_margin> | Sets the maximum BER level which, when exceeded, causes to switch over the Rx traffic from the other ODU. |
| Switch delay <seconds> | Specify minimum delay between consecutive switchover attempts of the MP-MUX IDU. The default value is 2 seconds. The 'switch delay' must be specified different at both sides of the hop, it is recommended to specify 2 seconds for one MP-MUX IDU, and 3 seconds for other side IDU. |
| Switch show {yes no} | - 'yes' - the IDU notifies about 1+1 switchover operations via Telnet and ASCII management, by sending message, for example: <code>[SWITCH ACTIVE ODU[1] - SyncLoss problems when active ODU2]</code> The message shows which ODU is set as active (receiving) and why the switchover operation was performed. - 'no' - disable notifications about switchover operations (default) |

| Configuring ODU parameters | |
|--|---|
| Command | Description |
| Chan {ODU1 ODU2} <channel#> | Set the ODU Tx and Rx frequency. Channel numbers and corresponding Tx/Rx frequency values are found in tables in the document ' <i>Channel plans</i> '. |
| Txfreq {ODU1 ODU2} <frequency-kHz> | Set the ODU Tx\Rx channel by specifying Tx frequency as integer in [kHz] units. Example: <i>txfreq 14711000</i> |
| Txpower {ODU1 ODU2} {-10 -9 ... 0 +1 +2 ... +20 off} | Set the ODU Transmitter power [dBm]. The default setting is "OFF". |

| Verification commands (read-only) | |
|-----------------------------------|---|
| Command | Description |
| Stat | Show parameters, - lists all the parameters that are displayed in the status display mode of the IDU LCD. |
| Mac | Verify the MAC address of the Ethernet management port. |
| Ver | Display hardware and software version of the IDU and ODU, and IDU serial number. |
| ODU | Display software version of both ODUs. |
| sernum | Display IDU serial number. |
| ustat | Display inputs and outputs of the alarm port. |

| Configuring E1 Interface Module parameters | |
|---|---|
| Command | Description |
| Mod {1 2 3 4} setE1 {Aloop Dloop Remote Off} | Set the analog, digital or remote loopback in the module (<i>Aloop</i> – analog loopback; <i>Dloop</i> – digital loopback, <i>Remote</i> – remote loopback, <i>off</i> – disable current E1 module loopback). Example: <i>Mod 3 setE1 Dloop</i> |
| Mod {1 2 3 4} setE1 {120 75} | Set the impedance of E1 interface, 120 Ω or 75 Ω . (for 1xE1 modules) |

| Configuring 4xE1 Interface Module parameters | |
|---|--|
| Command | Description |
| Mod {1 2 3 4} setE1 {port1 port2 port3 port4} {Aloop Dloop Remote Off} | Set the analog, digital or remote loopback in the module (<i>Aloop</i> – analog loopback; <i>Dloop</i> – digital loopback, <i>Remote</i> – remote loopback, <i>off</i> – disable current E1 module loopback). Example: <i>Mod 3 setE1 Dloop</i> |
| Mod {1 2 3 4} setE1 {port1 port2 port3 port4} {on off} | Enable/Disable the transmission of AIS signal (for testing purposes). |

| Configuring 2-port 100Base-T Ethernet Bridge Module | |
|--|---|
| Command | Description |
| Mod {1 2 3 4} setf2bridge {port1 port2} connection {auto 10hdx 10fdx 100hdx 100fdx} | Configure port speed and duplex, 10hdx – 10 Mbps half duplex, 10fdx - 10 Mbps full duplex, etc. Example: Mod 3 setf2bridge port1 connection 100fdx The factory setting for both ports is <i>auto</i> . |
| Mod {1 2 3 4} setf2bridge {port1 port2} priority {low high} | Configure port priority. The factory setting for both ports is <i>low</i> . |
| Mod {1 2 3 4} setf2bridge {port1 port2} flowcntrl {enable disable} | Enable or disable flow control for the specified port. |
| Mod {1 2 3 4} statistics | Displays statistical information: <ul style="list-style-type: none"> - Received packets and bytes, transmitted packets and bytes, errors for port 1, port 2 and WAN port; - Collisions for port 1 and port 2. |

| Configuring V.35 Interface Module parameters | |
|---|---|
| Command | Description |
| Mod {1 2 3 4} setV35 speed {64 128 256 512 1024 2048 4096 6144 8192} | Set the speed of V.35 interface (in kbps). |
| Mod {1 2 3 4} setV35 phase {normal inverse} | Invert the RxC clock signal (it is transmitted from V.35 module to user equipment) |
| Mod {1 2 3 4} setV35 polarity {normal inverse} | Invert the incoming and outgoing data signals (RxD – outgoing, TxD – incoming) between DCE (module) and DTE (user equipment). |
| Mod {1 2 3 4} setV35 loop {on off} | Set the loopback mode of V.35 interface module. |
| Mod {1 2 3 4} setV35 {Master Slave} | Set the sync status of V.35 interface module, ie. master or slave. Example: Mod 2 setV35 slave |

| Security commands | |
|---|--|
| Command | Description |
| Enable password <password> | Specify a password to prevent unauthorized access to the ASCII PC terminal (connected through RS232 serial port). For more information, see chapter 3.4.5. |
| Panel access <accesscode> | Specify a password to prevent unauthorized configuration through the IDU management interface. The password can be a number from 0 - 200. For more information, see chapter 3.4.5. |
| Enable rfweb {yes AnyString} | Enables configuration of ODU parameters (frequency, Tx power) from the Web terminal. In order to enable it, use "yes" with small caps; to disable use any string instead of "yes" argument except the empty string (""). By default, the ODU configuration from Web is disabled. |
| WWWuser <username> <password> | Specify a password (1 - 20 symbols) to prevent unauthorized access to the Web terminal. |
| Telnetuser <username> <password> | Specify a password (1 - 20 symbols) to prevent unauthorized access to the Telnet terminal. |
| FTPuser | Specify username and password (1 - 20 symbols) to prevent unauthorized connection to FTP server. |
| Management network configuration commands | |
| Command | Description |
| Start ftp | Runs the FTP server on the IDU. By default it is switched off. In order to use FTP server, it is required to: 1) Start FTP server using 'start ftp' command; 2) Specify username and password using 'ftpuser' command. |
| start tftp | Runs the TFTP on the IDU, by default it is switched off. |
| IP addr <IPaddress> | Set the IP address of Ethernet management port (requires to restart the management module CPU). |
| IP mask <IPnetmask> | Set the IP netmask of Ethernet management port (this requires to restart the management module CPU for changes to take effect). |
| IP gw <IPaddress> | Set the IP address of the default gateway connected to the Ethernet management port (this requires to restart the management module CPU for changes to take effect). |
| IP seraddr <IPaddress> | Set the IP address of the serial port of service channel for the local (near-end) IDU management module (requires to restart the management module CPU). |
| IP remaddr <IPaddress> | Set the IP address of the serial port of service channel for the remote (far-end) IDU management module (requires to restart the management module CPU). |
| Route add <destinationIPaddr> Mask [netmask] <gateway> [metric] | Add a static route to the routing table for packets destined to the network(s) which are not to be accessed via radiolink. The variable "metric" is set to 1 by default. Example: Route add 192.168.205.0 Mask 255.255.255.0 155.13.79.13 5 |
| Route delete <destinationIPaddr> [netmask] | Delete a static route from the routing table. |
| SNMP community read <communityname> | Specify the SNMP community name of the agent to enable parameters to be read (not configured). The default community name to read parameters is <i>saf-public</i> . |
| SNMP community write <communityname> | Specify the community name of the agent to enable parameters to be written (configured). The default community name for writing parameters is <i>saf-private</i> . |
| SNMP trap <IPaddress> | Set the IP address of the management terminal with the installed Trap Manager software, based on SNMP platform (requires to restart the management module CPU). |

| Commands for script editing | |
|---|--|
| Command | Description |
| Cfg show | Show the configuration script stored in RAM. |
| Cfg load | Load the configuration script from EPROM into RAM. |
| Cfg clear | Clear the script stored in RAM. |
| Cfg delete <stringNumber> | Clear a single string in the configuration script. This command is useful for script editing. |
| Cfg write | Save current script in EPROM. This command saves in EPROM the current script as well as settings that are specified in it. |
| cfg backup <filename> | Save current configuration script in text file on the Flash disk, with the specified filename. |
| cfg restore <filename> | Load the configuration script (specified text file) in RAM, but does not execute the script. Further, <ul style="list-style-type: none"> - to apply the script (execute commands), use '<i>cfg run</i>' command. - to store the script in EEPROM, use '<i>write</i>' command. |
| Cfg factory yes | Reset the configuration by loading in EEPROM the script with default settings. This command performs the following actions (in the following order): <ol style="list-style-type: none"> 1. clears the current script from EEPROM, 2. creates and stores in EEPROM the new script with the following settings: <ul style="list-style-type: none"> - IP addr 192.168.205.010 or 192.168.206.010 - IP mask 255.255.255.000 - IP gw - 255.255.255.255 (default gateway - none) - IP seraddr 192.168.0.10 - (SLIP configuration, - IP address of the local serial port) - IP remaddr 192.168.0.11 - (SLIP configuration, - IP address of the remote serial port) - Enable rfweb yes (enable configuration from Web terminal) - SNMP trap 255.255.255.255 (none) - RxAlarmLevel <#> (# - default value, see description of <i>rxalarmlevel</i> command) - muxspeeds 0M+0M+0M+0M 3. restarts the management controller |
| log { show <start_num> } | The management controller maintains event log, - events include configuration changes, management controller restarts, local site alarm changes (RA, SL, RAI alarms). 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. |
| Commands for operations with files and file system | |
| Please refer to chapter ' <i>Working with files</i> '. | |
| Syntactic notes: <ul style="list-style-type: none"> - Commands are in bold font. - All arguments (variables) are in <i>italic</i> 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 (). | |

3.4.1 Working with configuration script

The management module has RAM and EEPROM chips onboard. When IDU is booted up, bootstrap is loaded from the EPROM into RAM. The bootstrap contains the parameters that were previously stored in EPROM using **write** and/or **cfg write** commands. These parameters are stored in EPROM in the form of script and when booting up, the script parameters are loaded into RAM. These parameters can be freely changed in run-time, - changing the data in RAM. If the IDU is shut down without saving the current configuration (script) in EPROM, the original configuration will be restored from EPROM on the next boot-up.

Here is an example of script:

```
SAF>cfg show
01: ip remaddr 192.168.0.11
02: ip seraddr 192.168.0.10
03: Chan 144
04: muxspeeds rmn+8M+8M+4E1
05: snmp community read safpub
06: snmp trap 255.255.255.255
07: route add 62.85.14.0 MASK 255.255.255.0 192.168.12.22
```

The script can be edited:

- string can be added by simply entering the required command (the script will be supplemented with the new string or the instant string entry will be updated)
- string can be deleted using "**cfg delete** <string#>" command line.

the changes can be saved in EPROM using **cfg write** command line. Note: the parameters, that are not specified in the configuration script will have their default values when the IDU is restarted.

3.4.2 Description of commands

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- string can be deleted using "**cfg delete** <string#>" command line.
- the changes can be saved in EPROM using **cfg write** command line. Note: the parameters, that are not specified in the configuration script will have their default values when the IDU is restarted.

3.4.3 File system

The software used by the IDU management controller is organised in files, which are stored in Flash disk.

Firmware and boot configuration files

The following files are needed for the IDU to start:

- 'Boot.ini' file, - device boot configuration file. This file is text file and contains the name of the firmware file which must be executed at startup. The file name can be freely changed, but its default name is 'boot.ini', hereinafter it is assumed, that this file has default filename. The most important factor about this file is that it must be uploaded with 'B' and 'e' attribute flags (flags are case sensitive!), only then it will be treated as executive script.

Attribute flags for 'boot.ini' file:

B – query run at boot; **e** – executive script

For information how to upload files in the Flash disk, please refer to chapter 3.5.

- Firmware file, - this file is the main firmware executable for the appropriate IDU model. The file name can be freely changed, but its default name will contain the version and IDU model, e.g., 'MMUX400.elf.lzip'. The most important factor about this file is that it must be uploaded with 'E' and 'c' attribute flags, otherwise this file will not be used as the firmware.

Attribute flags for firmware file:

E – executable binary; **c** - compressed

Notes:

- The files are uploaded from PC to Flash disk using TFTP (via Ethernet management port), or using Xmodem protocol (via RS232 serial port), for more information about file upload please refer to chapter 3.5; configuration backup files are created by IDU management system.
- The flash disk may store other files as well, for example previous firmware versions, configuration backup files, - up to 3.5 Mb (3 or 4 firmware files).
- The attribute flags for files are case sensitive.
- The file names can be changed, but it is very important that the file has the necessary attribute flags otherwise the file will not be used neither as firmware, nor as 'boot.ini' type file.
- There are no file extensions in the file system; either file, when edited, is treated as ASCII text file.
- When uploading the file, if the Flash disk stores the file with the same filename as for uploadable file, it will be overwritten with the new file.

Configuration backup files

Using '*cfg backup <filename>*' command, the user can create the backup file of the current CFM site configuration. The configuration backup file is text file and, when created, contains the current configuration script, - the same configuration script that are stored in EEPROM. Please refer to chapter 3.4.1 for more information about configuration script.

The configuration backup files are stored in Flash disk, where they can be edited or downloaded to PC. The backup configuration file can be applied in run-time, by consecutively entering '*cfg restore <filename>*' and '*cfg run*' commands. Note: the configuration restored from file is not stored in EEPROM and therefore will be lost when IDU is restarted, to save it in EEPROM use '*write*' command.

The user can create and store several configuration files to quickly revert to other CFM site configurations.

Working with files

The following commands are intended to operate with files, stored in the Flash disk on the management controller.

| | |
|---------------------------------------|---|
| <code>edit <filename></code> | <p>Edits the specified file. This command is intended for editing configuration backup files and boot configuration file (boot.ini). For example, <i>edit boot.ini,Be</i></p> <p>– file 'boot.ini' will be opened for editing. 'Be' specifies that this file will be saved with attributes 'B' and 'e'. If boot.ini file is intended to be modified, it should always be opened specifying 'B' and 'e' flags as in example above, this will ensure that file will be saved with these attributes (flags).</p> <p>To close the file and save changes press Ctrl+Z, to close the file without saving changes press Ctrl+Q. The configuration backup files do not require specific attributes.</p> |
| <code>tfs ls</code> | <p>Displays a list of files stored in the Flash disk, and how many bytes are used by these files and how many bytes are free.</p> <p>'tfs dir' can also be used.</p> |
| <code>tfs cat <filename></code> | <p>Displays the contents of a text file.</p> <p>'tfs type' can also be used.</p> |
| <code>tfs del <filename></code> | <p>Deletes the specified file from Flash disk.</p> <p>'tfs rm' can also be used.</p> |
| <code>tfs check</code> | <p>Checks the files and file system consistency; this command is for diagnostic purposes. For example:</p> <div data-bbox="581 1073 1305 1339" style="border: 1px solid black; padding: 5px;"><pre>SAF>tfs check TFS device //FLASH/ check: mainappb.elf.ezip... ok mmux400.elf.ezip... ok cfg1.txt... ok boot.ini... ok PASSED TFS checked ...</pre></div> <p>In this example no files are corrupted.</p> |
| <code>tfs clean</code> | <p>Defragments the Flash disk. It is recommended to perform the defragmentation if larger files (like firmware files) are uploaded or deleted.</p> |

3.4.4 Storage of radio parameters

The radio parameter values (transmit frequency and power) are stored internally in Flash memory of the Radio unit, the Radio operates exactly with those values stored in its Flash memory. When the radio parameter is modified while the equipment is in operation, the corresponding radio parameter value in the Radio Flash memory is overwritten with the new one and applied in operation. Since the radio parameters are stored in ODU in Flash memory, it is not necessary for the IDU configuration script (bootstrap) to contain strings that configure radio parameters. In case if the configuration script stored in IDU EEPROM contains strings that configure radio parameter(s), each time the equipment is booted, the radio parameter values written in the IDU bootstrap are uploaded to the Radio and the previously stored radio parameter values in Flash memory are overwritten with those in the IDU bootstrap. Hence the radio parameter configuration in the IDU bootstrap has a higher priority as they will override the values stored in the Radio Flash memory when the equipment is rebooted.

It is useful to write the radio parameter configuration in the IDU configuration script for the purpose to be able to quickly replace the ODU later.

3.4.5 Security commands

General tips

Telnet server supports one user only. The default username and password for Telnet terminal is:

- Username (login): telnet
- Password: saf
- Web server supports two users. By default the Web server is disabled, because the username and password for Web terminal is not specified; the username and password to connect to Web server from Web terminal can be specified, using

``WWWuser <username> <password>`` command.

Take note of upper case and lower case type, it should be taken into account for both username and password!

The passwords may contain spaces, if using space(s) the password should be entered in quote marks.

For ASCII, Telnet and Web terminals the password can be changed by simply re-entering the appropriate security command while logged on, and then saving the configuration in EEPROM using ``write`` command.

To terminate Telnet session, or log off from ASCII terminal, press Ctrl+D.

To disable username and/or password, enter the password configuration command with empty string in argument:

- for ASCII console: `enable password ""`
- for Telnet terminal: `telnetuser "" ""`
- for Web access: `wwwuser "" ""`

In case if user has forgotten username and password for Telnet access and password for access from ASCII console, it is possible to restart the IDU without applying settings stored in EEPROM, and then find out the Username and Password using `'cfg show'` command. Proceed as follows:

- connect to IDU with ASCII console (via serial port);
- Enter `'restartcpu'` command and follow the strings displayed on ASCII console window; as soon as `'Press <Esc> twice to stop initialisation'` string appears (see Figure 6), press Esc key twice.

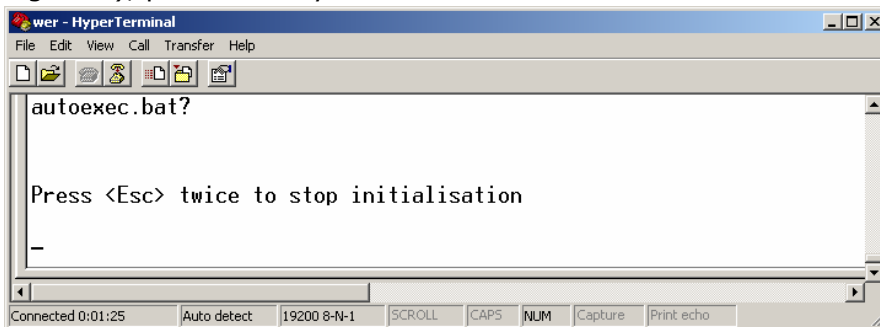


Figure 6

- Enter `'cfg show'` command to display boot configuration script, which will also include security commands with Usernames and Passwords.

By default there are no password specified for access from ASCII console, - when user connects to IDU from ASCII console, no prompt is displayed to enter password.

Important!

The specification of username and password (or access code) should always be followed by saving the configuration script (using "write" or "cfg write" commands) otherwise the password request will be ignored after the restart of IDU.

Panel access code

The panel access code for the access from IDU panel can be specified from the Telnet and ASCII terminals only. When the access code is specified, the adjustment and configuration of any IDU/ODU parameters and loopbacks from IDU LCD is not available, unless the correct access code is specified at IDU using keypad (refer to chapter 3.1.2). The specification of access code should also be followed by saving the configuration script otherwise the access code value will be set to default (none) on the IDU restart. The panel access code can be changed by simply entering the new access code (number from 0 – 200) using *panel access* command. To disable the panel access code feature, enter 0 value, which means that this feature is disabled (default setting).

3.5 Uploading software

The user can upgrade the IDU management software by uploading the appropriate firmware file to IDU Flash disk, and then edit boot configuration file if necessary. The file upload can be performed

- via Ethernet management port using TFTP, or
- via RS232 serial port using Xmodem protocol.

3.5.1 Uploading file via Ethernet management port (TFTP)

Assuming that the IDU IP settings are properly configured, proceed as follows:

- 1) Connect the IDU to network or directly to PC,
- 2) Make sure TFTP is running on IDU (by default, the TFTP is switched off); to run the TFTP on IDU, connect to IDU with Telnet client and enter the following command: `'start tftp'`.
- 3) Run the program that enables to use TFTP service, for example command interpreter (cmd.exe) if using Windows, see Figure 7.
- 4) For example, to upload the firmware file `'mmux400.elf.ezip'` with attribute flags `'E'` and `'c'`, enter command:

tftp -i 192.168.205.11 put C:\files\mmux400.elf.ezip,Ec

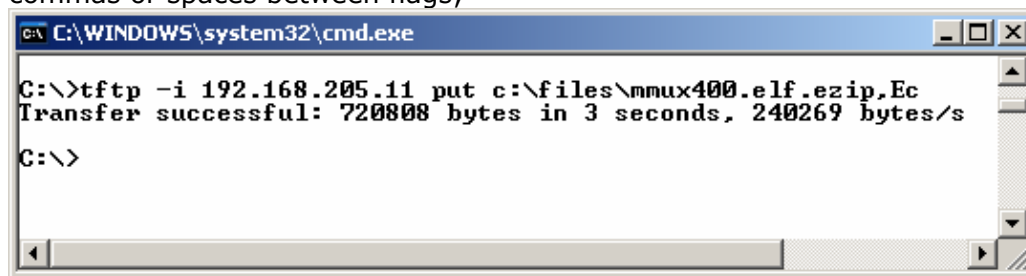
where:

`'-i'` – key which specifies that file must be transferred in binary image transfer mode;

`'192.168.205.11'` – IDU Ethernet management port IP address (host);

`'C:\files\mmux400.elf.ezip'` – firmware file (source);

`'Ec'` – file attribute flags `'E'` and `'c'`; the attribute flags are separated from file name or source with comma (only comma and no space) and there are no commas or spaces between flags;



```
C:\WINDOWS\system32\cmd.exe
C:\>tftp -i 192.168.205.11 put c:\files\mmux400.elf.ezip,Ec
Transfer successful: 720808 bytes in 3 seconds, 240269 bytes/s
C:\>
```

Figure 7

- 5) If uploaded file is large (like firmware file), it is recommended to defragment Flash disk. Use `'tfs clean'` command from Telnet or ASCII terminal to perform defragmentation.
- 6) If the uploaded file is firmware file which should be used by IDU, it is necessary to edit `'boot.ini'` file by deleting the entry with old file name and writing file name of the new firmware file; the `'boot.ini'` file must be saved with `'B'` and `'e'` flags (file attributes), for more information how to edit files, please refer to chapter `

7) *Working with files*, page 33.

Note: to copy file from IDU Flash disk to PC hard disk via TFTP, use the following command:

tftp -i 192.168.205.11 get filename C:\destination

where

'192.168.205.11' – IDU port IP address (host);

'filename' – file to be copied from IDU to PC; 'C:\destination' – destination path where the file will be saved on PC hard disk.

3.5.2 Uploading file via serial port (Xmodem)

File upload via serial port takes much longer time compared to using TFTP and should be used only in case if Ethernet connection with IDU management system is not available, or does not start normally.

- 1) Connect the ASCII console to IDU RS232 port, make connection with the following properties: Bits per second: 19200; Data bits: 8; Parity: none; Stop bits: 1; Flow control: none; if using 'Hyper Terminal' program, please refer to chapter 3.3 for information how to make a connection.
- 2) Type 'restartcpu' and, while IDU is booting, press any key when 'boot.ini?' prompt appears. This will stop executing script in 'boot.ini' file and the IDU will remain in MicroMonitor mode, this is system startup mode which loads the management system firmware;

Note: while in MicroMonitor mode, the 'uMON>' prompt will be displayed, instead of normal prompt with IDU name (default 'SAF>').

- 3) In MicroMonitor mode enter the following command:

xmodem -cd -F <filename-no_flags> -f Ec

where

<filename-no_flags> - file name with no flags specified

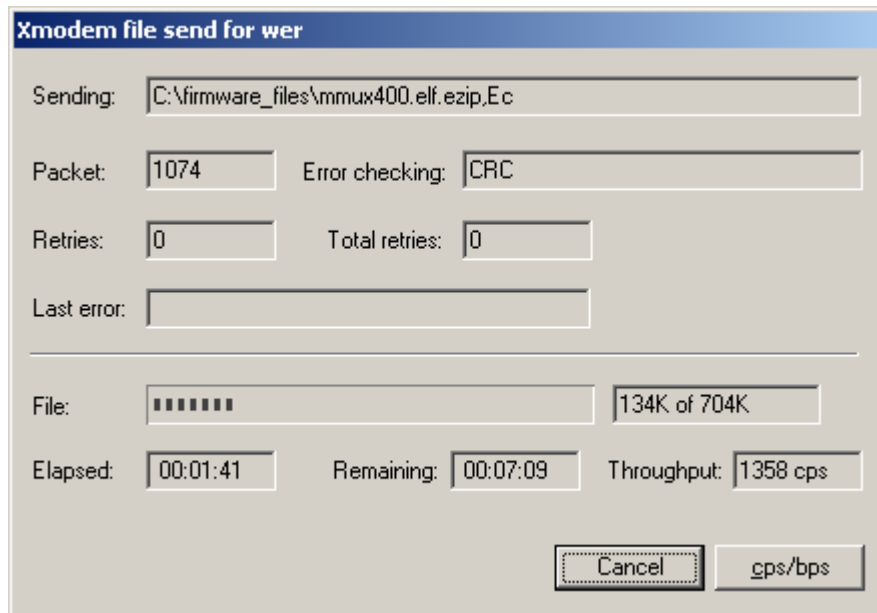
'**Ec**' – file flags, in case the file is firmware file - 'E' and 'c' flags must be used; if the file is boot configuration file (boot.ini), the flags must be '**Be**' ('B' and 'e'); the flags for configuration backup files may not be specified, in that case the command will be

xmodem -cd -F < filename-no_flags >

- 4) Use terminal emulation software with file upload function, such as *Hyper Terminal* (in Windows) to upload the firmware file to IDU as binary image (use binary transfer mode), using Xmodem protocol.

If using *Hyper Terminal*, proceed as follows: from menu select

'Transfer'→'Send File...', then select file and in 'protocol' box select *Xmodem* protocol and press 'Send' button, the following box should appear



When upload is complete, the following information will be displayed (Figure 8):

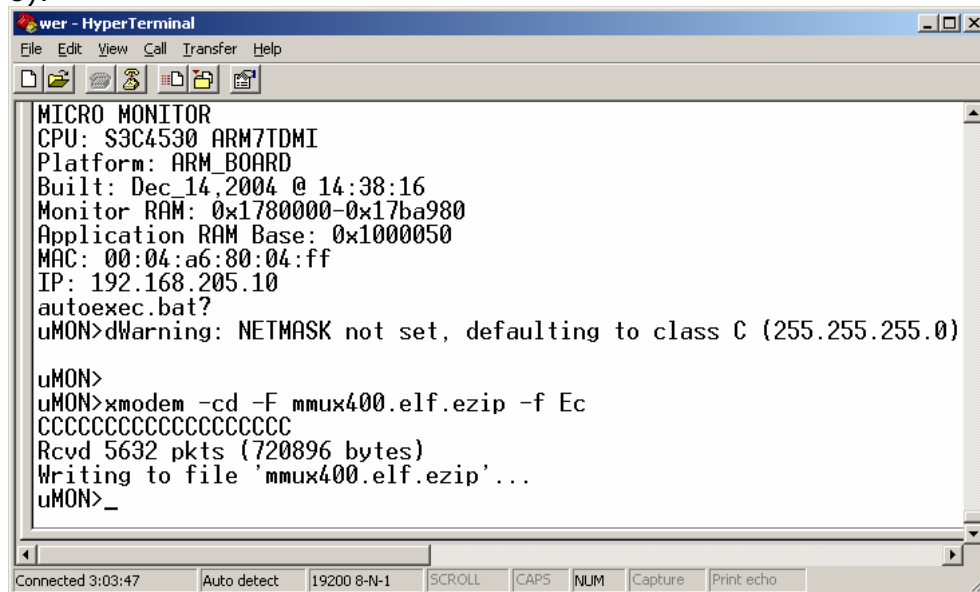


Figure 8

- 5) Enter 'reset' command to exit from MicroMonitor mode and restart the IDU.
- 6) Proceed with steps 4) and 5) in chapter 3.5.1.

3.6 Ethernet Management Port

The Ethernet management port of the IDU terminal is intended as main source of management connectivity and will provide the broadest range of management functionality:

- SNMP management via integrated SNMP agent of management board;
- Web management via integrated Web server of management board;
- Telnet server and CLI interface.

Ethernet interface could be used:

- To connect IDU to PC/Laptop to manage IDU;
- To LAN to constantly monitor IDU;
- To router or any other TCP/IP packet network termination unit to have IDU as part of network for management information.

3.6.1 SNMP Interface

The SNMP management allows to:

- Read and configure parameters of IDU via SNMP;
- Receive SNMP traps from IDU.

In order to use the SNMP management facilities, it is necessary to configure:

- the *IP address* of the management PC with the installed SNMP Trap Manager program; the IP address can be specified from a Telnet or ASCII console using "*SNMP trap <IPaddress>*" command, or from IDU front panel. The default value is **255.255.255.255** (no SNMP Trap Manager specified). The Trap Manager address should be configured for each IDU, from which it is necessary to receive information on parameters, counters and alarms. The information is sent as SNMP Trap packets through the mediation of UDP protocol.

SNMP *read* and *write* community names (passwords); there are no default *read* and *write* community names specified, - while SNMP community names are not specified, accordingly it will not be possible to *read* and *write* parameters via SNMP.

SNMP management functionality is available from any SNMP browser, by means of compiling provided MIB file to the MIB browser application's MIB module.

SAF MIB files are available from:

- SAF Tehnika Web site: www.saftehnika.com,
- From SAF Tehnika tech support, email: techsupport@saftehnika.com,
- Contacting SAF Tehnika or distributors.

```
***** SNMP QUERY STARTED *****
1: activeLink.0 (integer) link2(2)
2: localLink1Status.0 (integer) linkoff(3)
3: localLink2Status.0 (integer) on(4)
4: remoteLink1Status.0 (integer) unreachable(1)
5: remoteLink2Status.0 (integer) unreachable(1)
6: remoteControlStatus.0 (integer) unknown(0)
7: localLink1RxLevel.0 (integer) -65
8: localLink2RxLevel.0 (integer) -70
9: remoteLink1RxLevel.0 (integer) 0
10: remoteLink2RxLevel.0 (integer) 0
11: localLink1RfAlarm.0 (integer) 0
12: localLink2RfAlarm.0 (integer) 1
13: remoteLink1RfAlarm.0 (integer) 1
14: remoteLink2RfAlarm.0 (integer) 1
15: localLink1SyncLostAlarm.0 (integer) 0
16: localLink2SyncLostAlarm.0 (integer) 0
17: remoteLink1SyncLostAlarm.0 (integer) 1
18: remoteLink2SyncLostAlarm.0 (integer) 1
***** SNMP QUERY FINISHED *****
```

Sample of SNMP query of the CFM-MP-MUX IDU

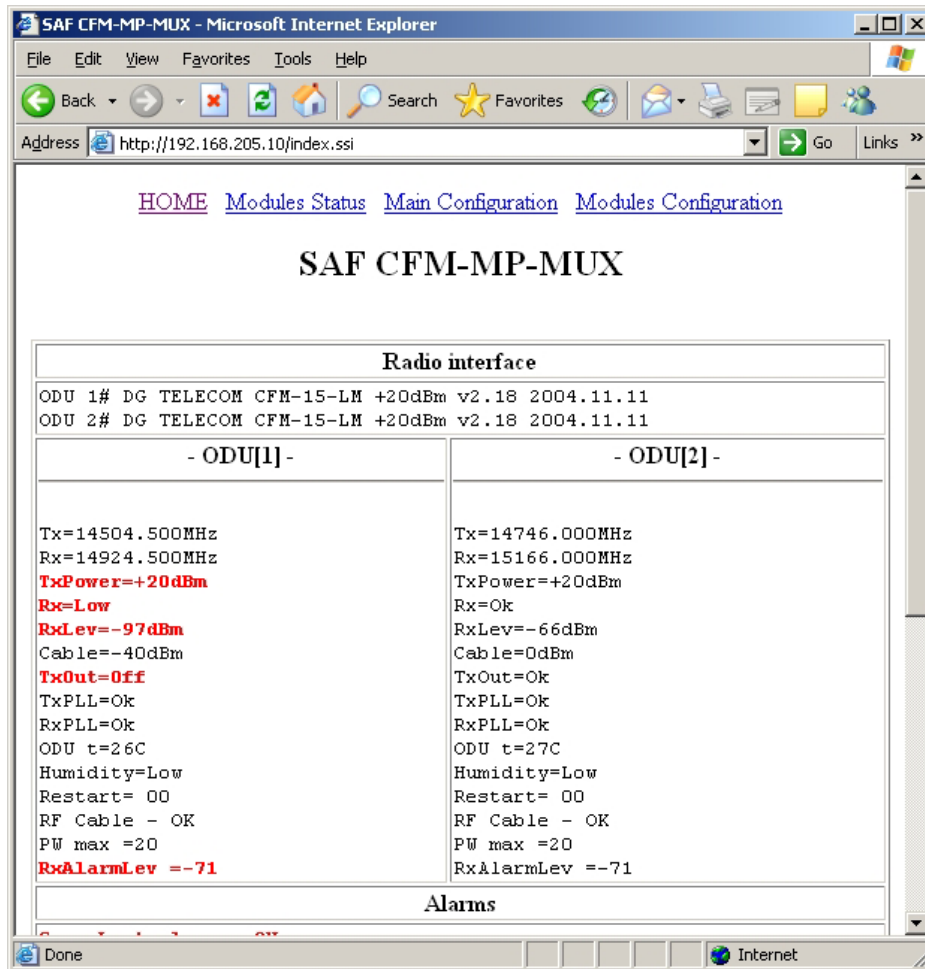
3.6.2 Web Interface

The CFM-M-MUX management system is running a Web server; the user can connect to Web server via Ethernet management port. Using Web interface it is possible to remotely configure and monitor the units (counters, radio parameters, configuration etc.) from Web page via HTTP. The Web server does not provide configuration of parameters related to 1+1 switching (*switch* commands).

The IDU management system supports up to 2 Web clients.

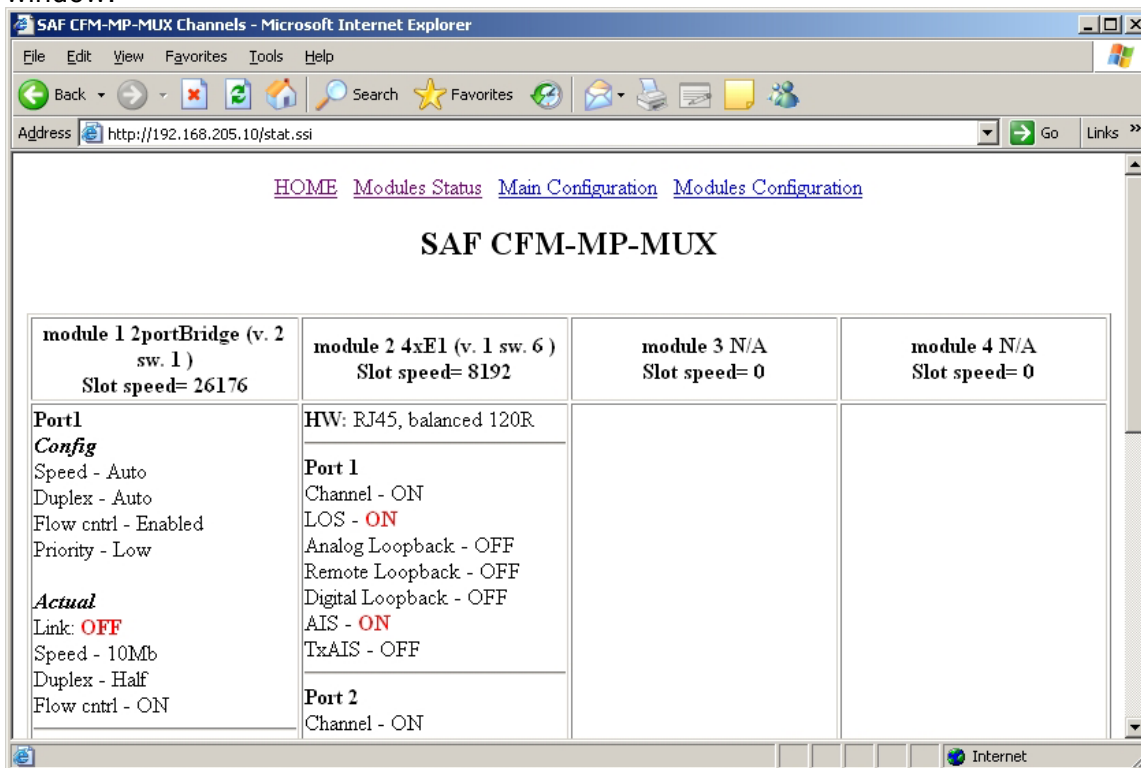
Web interface is accessible by any standards based Web browser.

Before connecting to Web server, it is necessary to specify User Name and Password, using '*wwwuser <username> <password>*' command, from Telnet or ASCII terminal. If User Name and Password is not specified, the user will not be able to open configuration pages (configure settings).



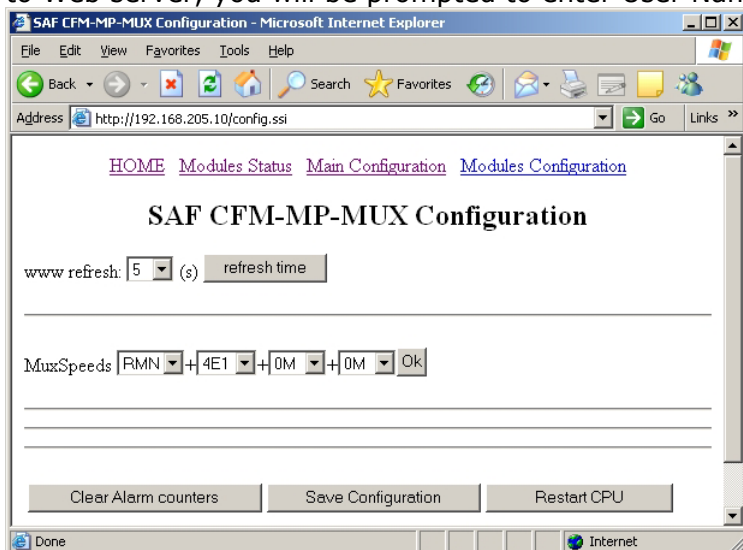
Main Web management window: entries, which are highlighted in red, indicate that specific parameters do not comply with the norms of normal operation, all other parameters are satisfactory

To check the status of each module, click on a *Status* link to open the module status window.



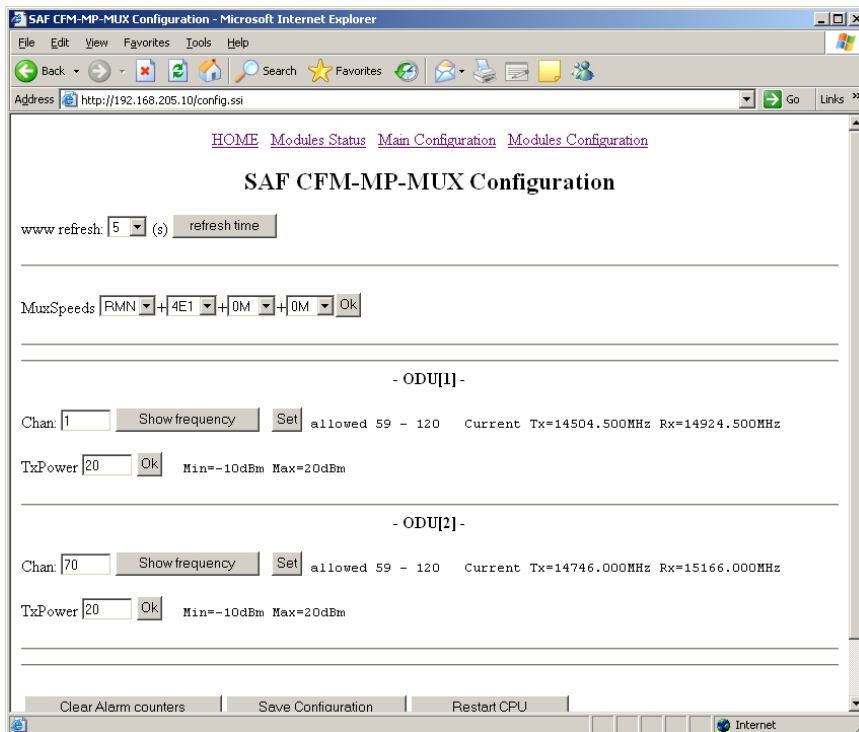
Module Status window

In order to save the configuration, change multiplexer slot speeds, restart the CPU or change the Web page refresh time, go to the *Main Configuration* window (see the Figure below). When clicked on the *Configure* link for the first time since connected to Web server, you will be prompted to enter User Name and Password.



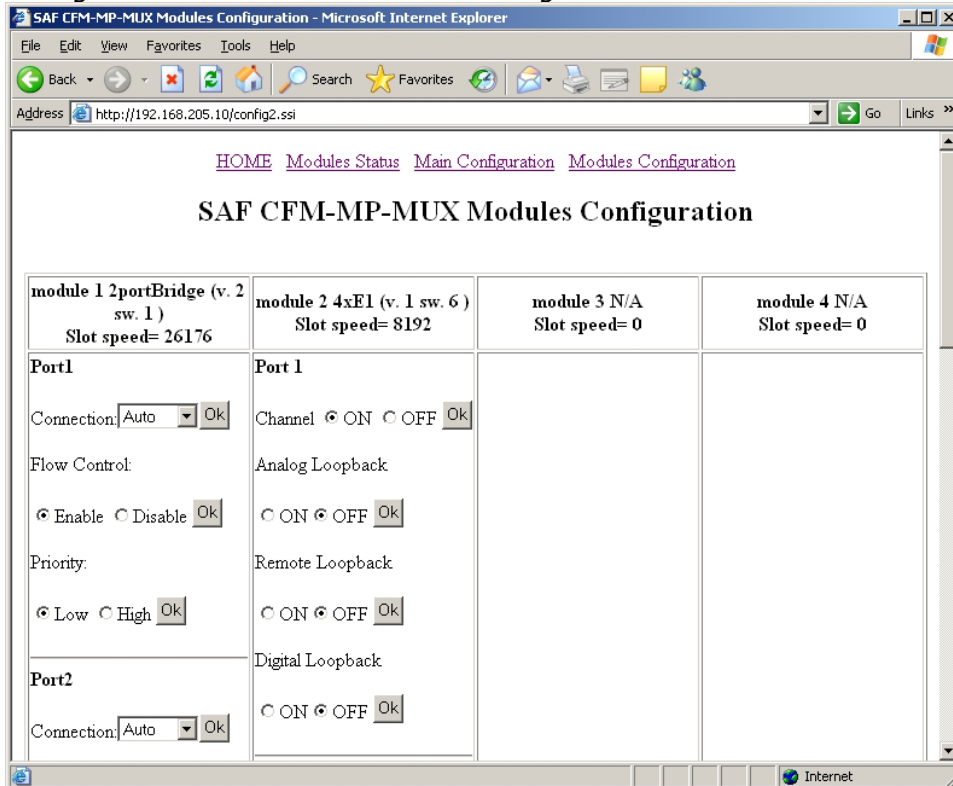
Main Configuration window (Radio parameter configuration is disabled)

By default, the *Main Configuration* window does not allow to configure ODU parameters (frequency channel and output power); the radio parameter configuration from Web page is factory-set as disabled. It can be enabled with 'enable rfweb yes' command from Telnet or ASCII console.



The CFM IDU Main Configuration window extended with the ODU parameter configuration

To configure each interface module (speed, loopbacks, etc.), open the *Modules Configuration* window via *Modules Configuration* link.



Modules Configuration window

3.6.3 Telnet management

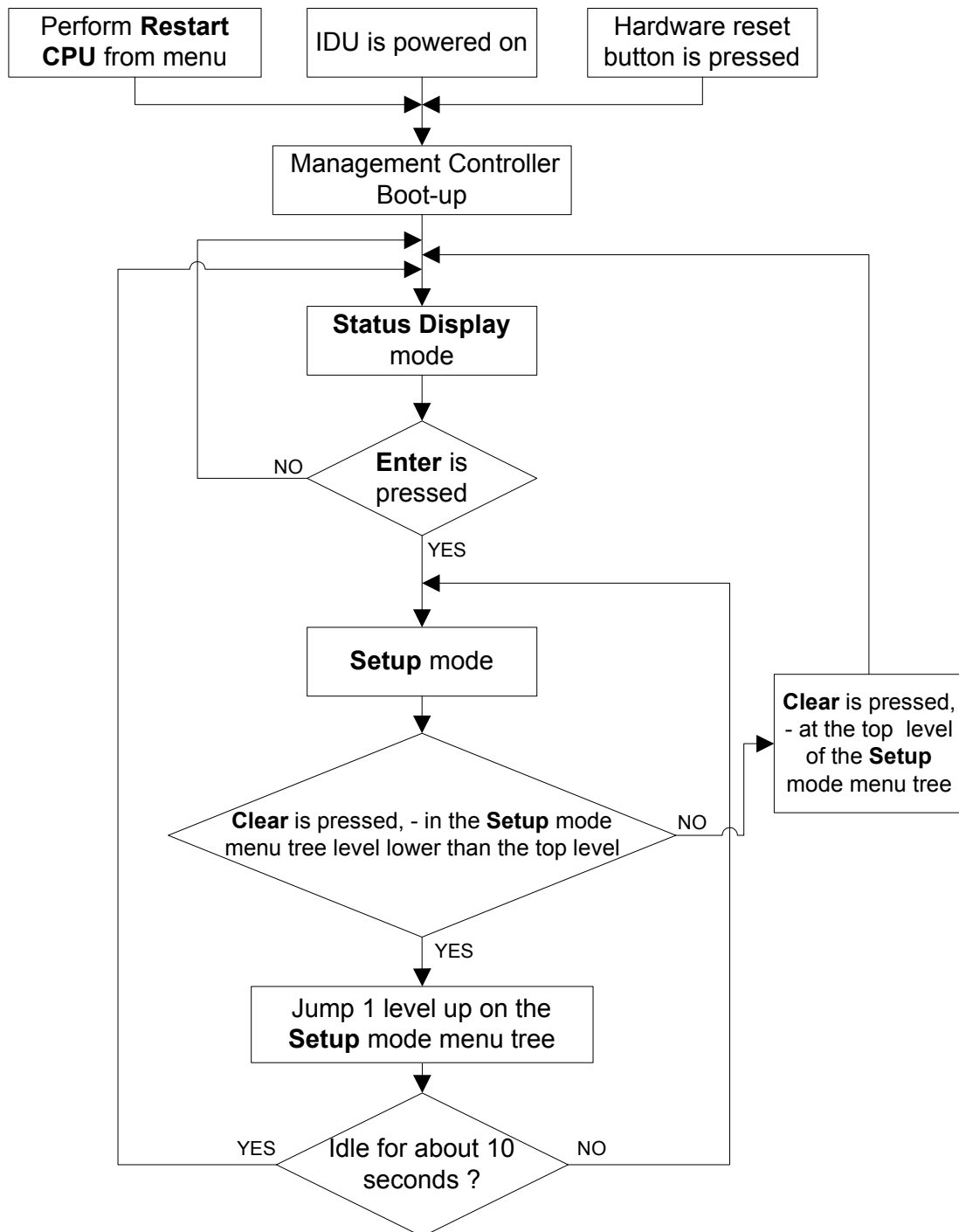
The user can connect to Telnet server via Ethernet management port (1 client is supported).

In order to connect to IDU via Telnet, the user will be prompted for login name and password. The default (factory preset) Telnet login-name\password is not specified; in order to connect to IDU via Telnet, the user must specify Telnet login-name and password using '*Telnetuser <username> <password>*' command; information about command interface is given in chapter 3.4.

3.6.4 Engineering Order Wire

The service channel also enables the Engineering Order Wire (EOW) using IP telephones, connected to the 10Base-T management port. For more information please refer to *EOW application guide*.

3.7 Using IDU LCD



Flow Chart 1. Using LCD

3.8 Alarm Port

The Alarm port is optional feature.

The Alarm port comprises the set of outputs of relay switches intended for the CFM site supervision and the user inputs to connect an external device that requires to be supervised. Each output of the relay switch can be used either as NO type (normally open) or NC type (normally closed).

The following alarms are available through the alarm port as parallel relay *outputs*:

- A: Power alarm. If there are no problems with DC power supply to any component of the site, the relay is closed (active relay state or initial state); if power supply failure – relay is opened (passive relay state).
- B: SL – *Synch Lost* alarm, ON - relay is closed (active state), OFF – relay is opened (passive state).
- C: RA – *Radio Alarm*, ON - relay is closed, OFF – relay is opened (normal operation).
- D: TxPLL – Tx Phase-locked Loop failure, ON - relay is closed, OFF – relay is opened (normal operation).

There are four parallel *inputs* of the alarm port available: input A, input B, input C, input D. These inputs are used for connection of an external device which supplies DC voltage on input, - "0" or "1"; the alarm status triggers if input voltage is changed between "0" and "1"; refer to Chapter 4 for alarm port electrical specifications.

The alarm port outputs can be supervised via SNMP manager and/or Web console. For information on Alarm port pinouts and electrical specifications, please refer to Chapter 4.

3.9 Default Settings

| Parameter/description | Parameter command or name | | Default value/setting |
|--|---------------------------|-------------------|--|
| | Telnet / ASCII | LCD | |
| Rx signal level by which the Radio Alarm is switched on | RxAlarmLevel | RxAlarmLev | -77 dBm |
| MUX capacity (WAN data rate) | Capacity | Capacity | (customer specified) |
| MUX slot speeds | Muxspeeds | MUX speeds | 0M+0M+0M+0M |
| Management controller IP address | IP addr | IP | 192.168.205.10 or 192.168.206.10 |
| Management controller IP address netmask | IP mask | Netmask | 255.255.255.0 |
| IP address of the gateway to the service channel | IP gw | Gateway | 255.255.255.255 |
| Transmitter power | txpower | Tx Power | 0 dBm |
| IDU name | Name | - | SAF |
| SNMP community name of the agent to read (all SNMP parameters are read-only) | SNMP community read | - | Saf-public |
| IP address of the SNMP trap manager | SNMP trap | - | 255.255.255.255 - trap manager not specified |
| Web page refresh time | Webrefresh | - | 5 seconds |
| Username and password for ASCII console | Enable password | - | (disabled) |
| Access number for LCD/Keypad | Panel access | - | 0 (disabled) |
| Username and password for Web terminal | WWWuser | - | Not specified. |
| Username and password for Telnet terminal | Telnetuser | - | Not specified. |
| Switch operation mode | Switch mode | - | HSB |
| Enable/disable 1+1 switching by performance, - Rx signal level and BER level | Switch | - | disabled |
| Rx signal level difference | Switch delta | - | 40 dB |
| Maximum RX signal level for switchover to other ODU | Switch rxmax | - | -40 dBm |
| Minimum RX signal level for switchover to other ODU | Switch rxmin | - | -80 dBm |
| BER margin for switchover to other ODU | Switch ber | - | 10 ⁻³ |
| Minimum delay between consecutive switchover attempts | Switch delay | - | 2 seconds |
| Forced side | Switch force | - | off |

3.10 Performing Loop-back Tests

Loopback tests are accessible using local or remote management methods. All baseband and RF loopbacks (local and remote) for safety purposes can be set on a fixed time interval only. The interface loopbacks (E1, V.35) does not have time limit and must be switched off manually.

3.10.1 Setting Loop Tests from IDU LCD/Keypad

From the IDU LCD all loop tests are set on 1 minute time interval.

- **Baseband loopback:**
From status display mode do the following: Press "ENTER" to enter setup mode → select "Loopbacks" → select "BBloopback ON" to set the digital baseband loops or "BBloop analog" to set the analog baseband loop → select "Yes".
- **RF loopback:**
From status display mode do the following: Press "ENTER" to enter setup mode → select "Loopbacks" → select "RFloopback ON" → select "Yes".
- **V.35 interface loopback:**
From *status display mode* do the following: Press "ENTER" to enter setup mode → select "Modules" → select "Module # V35" → select "V.35 Loopback" → "Change Loopback", switch over to ON and confirm.
- **E1 interface loopback:**
From *status display mode* do the following: Press "ENTER" to enter setup mode → select "Modules" → select "Module # E1" → select "E1 Aloop" for analog loopback (non-dual) or "E1 Dloop" for digital loopback → "Change", switch over to ON and confirm.
- **REB interface loopback:** not available.

3.10.2 Setting Loop Tests from Telnet/ASCII terminal

From the remote management terminal, the loopbacks can be activated using the following commands:

- **V.35 interface module loopback:**
Use command "Mod # setV35 loop {on|off}", # - MUX slot number
Example: mod 3 setv35 loop on (see also syntax notes on page 29).
- **E1 interface module loopback:**
"Mod # setE1 {Aloop|Dloop}", if argument is "Aloop" - analog loopback is activated, "Dloop" activates digital loopback, "Remote" -remote loopback, "off" - switch off any E1 interface loopback (for details refer to Chapter 0), # - MUX slot number.
- **Baseband loopback:**
"BBloop {on|analog|off} [duration]". Duration is set in minutes as values from 1 to 10. If duration is not specified the loopback will be set on 1 minute. There are two baseband loop tests available:
 - Analog: if setting analog loopback, use "bbloop analog" command, analog loopback is not dual.
 - Digital: if setting digital loopback, use "bbloop on" command, digital loopback is dual.
- **RF loopback:**
"RFloop {on|off} [duration]", duration = 1 min by default.

3.10.3 Radio loopback

Radio (RF) loopbacks can be set on a fixed time interval only; if using LCD/Keypad, the RF loop test is set for 1 minute. If setting RF loop from Telnet or ASCII console, the duration of radio loopback mode can be specified from 1 to 10 minutes.

The radio loop is set in the ODU. Radio loopback mode is a special ODU 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 ODUs operating in the Low band side must be switched to the highest available frequency channel, but the ODUs operating in the High band side must be switched to the lowest available frequency channel;
2. Before setting the radio loop, the transmitter power should be switched to maximum level;
3. In CFM-18-LM and CFM-18-L4 ODUs the radio loopback mode is not available.

3.10.4 Base-band loopbacks

The baseband loop is set in the baseband modem in the IDU. Base-band loopbacks can be set on a fixed time interval only; if using LCD/Keypad, the base-band loop test is set for 1 minute. If setting base-band loopback from Telnet or ASCII console, the duration of baseband loopback mode can be specified from 1 to 10 minutes. There are two types of **baseband loopbacks** (both can not be activated simultaneously):

- Digital baseband loopback: the signal from the ODU and from the multiplexer (or Bridge 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 looped back to the receiving device and also passed further to the ODU.

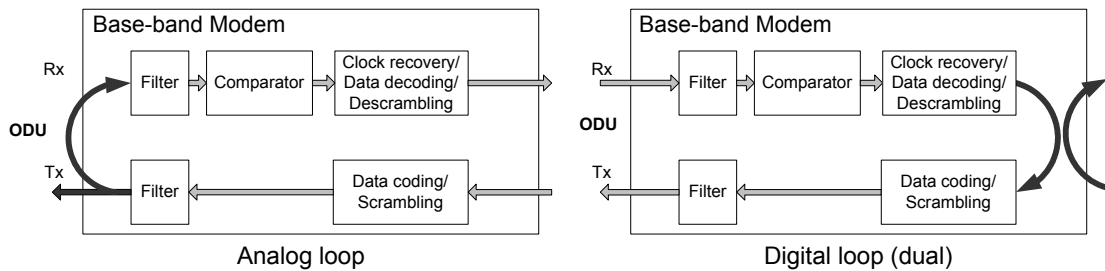


Figure 9. Baseband loopback modes: signal is looped in the modem

3.10.5 V.35 Interface Module Loopback

The loopback mode of V.35 interface module is dual.

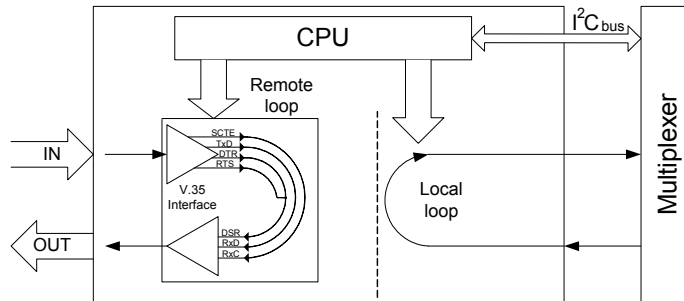


Figure 10. V.35 Interface Module Loopback

3.10.6 E1 Interface Module Loopbacks

The E1 interface module supports analog, digital and remote loopback modes. Only one loopback can be active at a time for a single E1 channel, when other is switched on, the current one is switched off.

The digital loopback mode is dual since there are two loops closed, remote and local (see figure below).

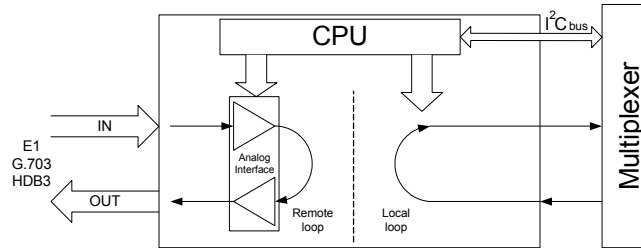


Figure 11. E1 Interface Module Digital loopback mode

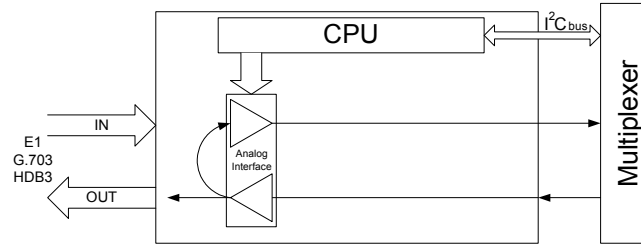


Figure 12. E1 Interface Module Analog loopback mode

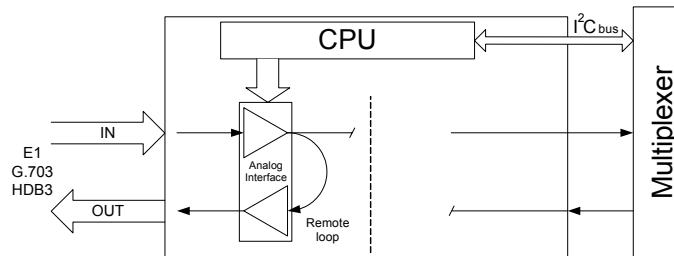
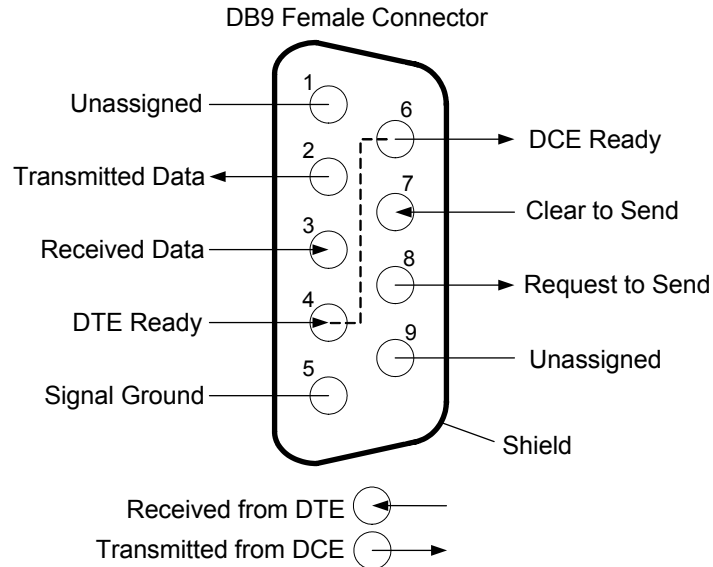


Figure 13. E1 Interface Module Remote loopback mode

4 Pinouts

- Standard Ethernet patch cables should be used for Ethernet management port;
- Any "straight through" or modem serial cable can be used with RS-232 Telnet/ASCII management port.

RS-232 management port pinouts



Ethernet and E1 port pinouts

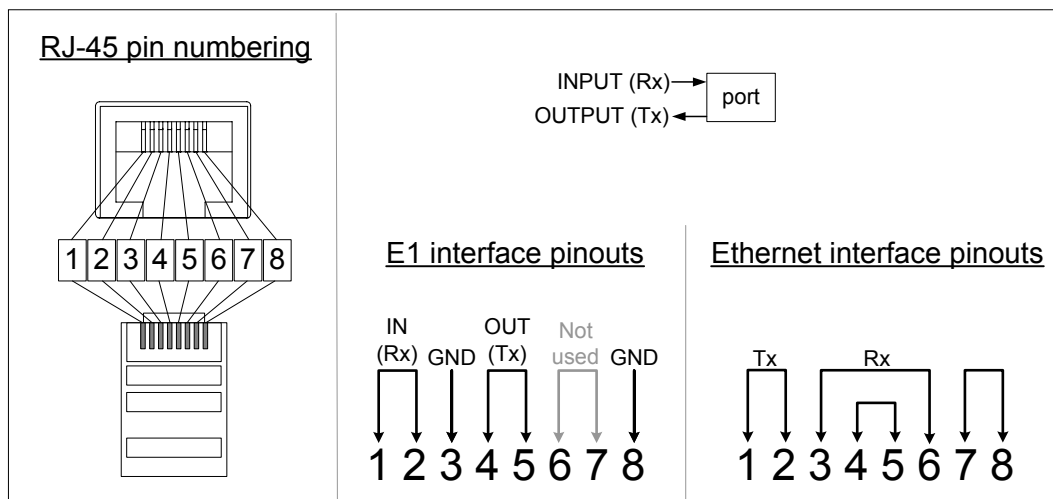


Figure 14. E1 and Ethernet interface pinouts

Alarm interface port specification

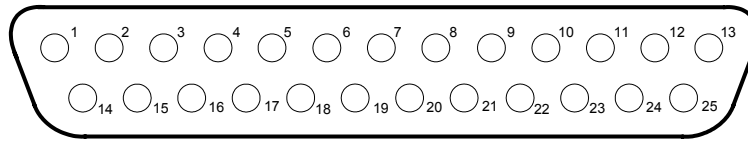


Figure 15. DB25 Male connector pin layout

The pin assignments for relay outputs are the following:

| | Output A | | Output B | | Output C | | Output D | |
|-------------------|----------|------|----------|------|----------|------|----------|------|
| Pair of pins | 1-2 | 2-14 | 3-4 | 4-16 | 5-6 | 6-18 | 7-8 | 8-20 |
| Type: NC* or NO** | NO | NC | NO | NC | NO | NC | NO | NC |

NC* - Normally Closed

NO** - Normally Open

Input pins:

| | Input A | Input B | Input C | Input D |
|--------------------|---------|---------|---------|---------|
| Pin | 10 | 11 | 12 | 13 |
| GND pins (closest) | 22 | 23 | 24 | 25 |

Electrical specifications of the outputs of the alarm interface port:

Rated load: 0.5 A at 125 VAC; 2 A at 30 VDC

Max. switching current: 2 A

Max. switching voltage: 250 VAC, 220 VDC

Max. switching capacity: 62.5 VA, 60 W

Electrical specifications of the inputs of the alarm interface port:

Impedance: 4,7 kΩ,

$U_{r0''}$ = 1...2 V DC,

$U_{r1''}$ = 2,4...48 V DC.

5 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
- Telephone: +371 7046840
- Fax: +371 7020009