



CFM-LM/CFM-L4

Installation Manual

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1 Introduction

This manual describes how to install SAF CFM series microwave radio link consisting of Indoor Units (IDUs) and Outdoor Units (ODUs or Radios). This manual does not cover the installation of Full Outdoor Units - 2E1, and 4E1 FODU.

Revision history

Revision	Date	Comments
1.0	July, 2004	

Safety Precautions

- Installation and service must be done by personnel having appropriate technical training and experience necessary to be aware of hazards during installation and/or service. The installation and/or service must be done under measures to minimize any danger to the involved person or any other person.
- Use the necessary safety devices when working on or around the mast. Be aware of the risk of falling objects. Consider the safety catch when hoisting the antenna and radio.
- Do not use any components (screws, nuts, etc.) other than those delivered together with the SAF Tehnika microwave radio equipment or recommended by SAF Tehnika.

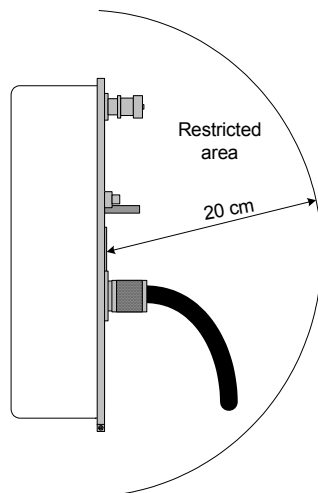
Electrical Safety

- The equipment meets the requirements for class I EN 60950 (protection against electric shock).
- All external circuits are TNV-1 (as defined in EN 60950).
- All equipment must be grounded before the power cable is connected.
- For electrical safety the DC power supply shall have reinforced insulation to the mains supply.

Microwave Radiation

- The transmitter should be switched off before disassembling the equipment to avoid microwave radiation.

No dangerous levels of microwave radiation exist outside the antenna while in operation when the antenna is connected to the radio, yet any part of the body shall not be exposed to the radiation in front of the open radio waveguide output closer than 20 cm while radio transmitter is turned on.



2 Getting Started

Unpacking and Inventory

There are two types of packages, - the box for transportation and the commercial package. IDUs, ODUs and 25 cm Lens-Horn antennas are packed in commercial packages whereas commercial boxes are packed in transportation boxes.

There are two types of transportation packages included:

- Transportation package for two 25 cm LH antennas – contains two trading packages for lens-horn antenna;
- Transportation package for two IDUs and two ODUs – contains two trading packages for IDU and two trading packages for ODU;

Contents of Transportation Package

- Outdoor Unit, 2 pcs.
- Indoor Unit, 2 pcs.
- N-type coax cable connectors, 4pcs.
- Documentation CD, 2 pcs.
- Antennas, 2pcs (if ordered).

Package Weight and Dimensions

The following table lists all the included packages and their weight and dimensions.

Package type	Weight of empty package [g]	Dimensions [mm]
Commercial package for IDU	755	352x270x113
Commercial package for ODU	486	532x365x75
Commercial package for 25 cm LH antenna	1070	375x300x286
Transporting package for 25 cm LH antennas	787	618x395x300
Transporting package for IDUs and ODUs	700	562x385x283

Required Installation Tools

IDU Installation Tools

- Pozidrive screwdriver PZ2 or PH2,
- Necessary tools for assembling the cables and connectors.

ODU Installation Tools

- 10 mm nut wrench for ODU installation,
- Necessary tools for assembling the cables and connectors.

Antenna Installation Tools

- 8 mm and 10 mm nut wrench for 0.25 m lens-horn antenna installation,
- 17 mm nut wrench for 0.3 and 0.6 m parabolic antenna installation,
- 18 and 24 mm nut wrench for 1.2 and larger parabolic antenna installation.

Labels

IDU Label

The IDU label can be found on the rear side of the chassis. This label displays the unit serial number and the product number (or part number). The IDU is identified by the combination of product number and serial number. Last two digits of the product number are revision number (or hardware version).



Figure 1. IDU label

ODU Label

The ODU label can be found on the front side (flange-side) of the chassis.

The ODU is identified by the combination of product number (P/N) and serial number (S/N).

The label contains five squares which display in which band side and subband the unit operates:

- The first two squares specify what band side the specific radio operates (L -Low or H - High).
- The third and the fourth square specify subband A or B (the fourth square – letter A, the fifth square – letter B).
- The fifth square is blank.

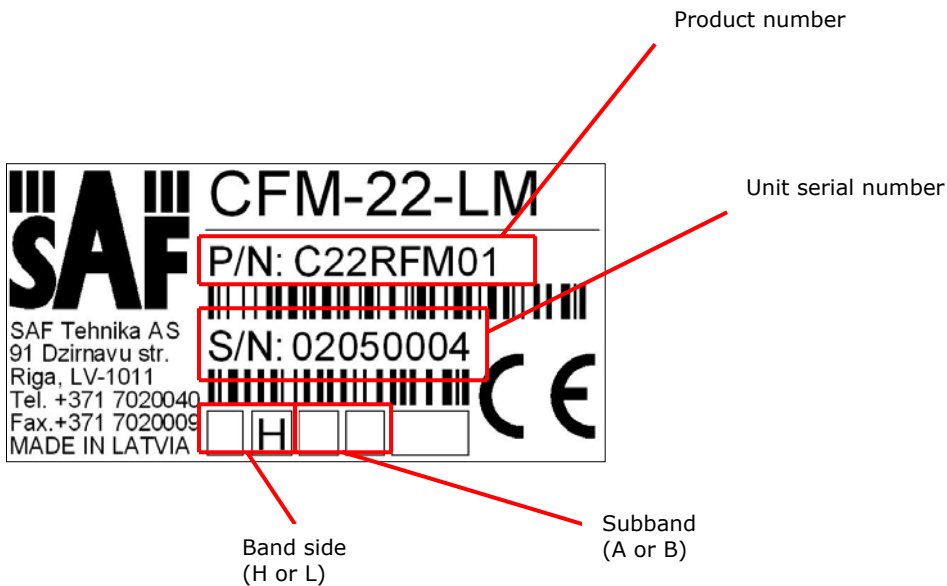


Figure 2. ODU label

3 Performing Initial Configuration

At first it is recommended to configure each unit of the radiolink by setting up the radiolink in domestic circumstances rather than installing it in the actual locations, - this may ease the configuration of the hop, especially management service channel configuration since all the units are conveniently nearby. In order to properly configure the equipment, the hop should be set up in domestic circumstances by interconnecting ODUs using waveguide-coaxial adapters, and coaxial cable. The use of attenuators is preferable, but in case they are not available, the proper measures should be taken into consideration to avoid damage to the receiver of the ODU, see next chapter for more information.

Preparing Radiolink Hop

Required Equipment

In order to simulate one radiolink hop, the following equipment is required:

- IDUs (2 pcs.)
- ODUs (2 pcs.)
- Waveguide-coaxial adapter (2 pcs.)
- Attenuator(s), total recommendable attenuation is 80 dB.
 - Important note: In case if not using attenuators, the transmitter power must be set to -10 dBm to avoid damage to the receiver, - the maximum permissible receiver input level is +15 dBm.**
- Coaxial cable to connect both ODUs of the hop. The following cables are recommended:
 - RG-213,
 - LMR-400
- Power supply unit 20-60 VDC of any polarity with:
 - 24 W or higher output power for each site of 1+0 hop.

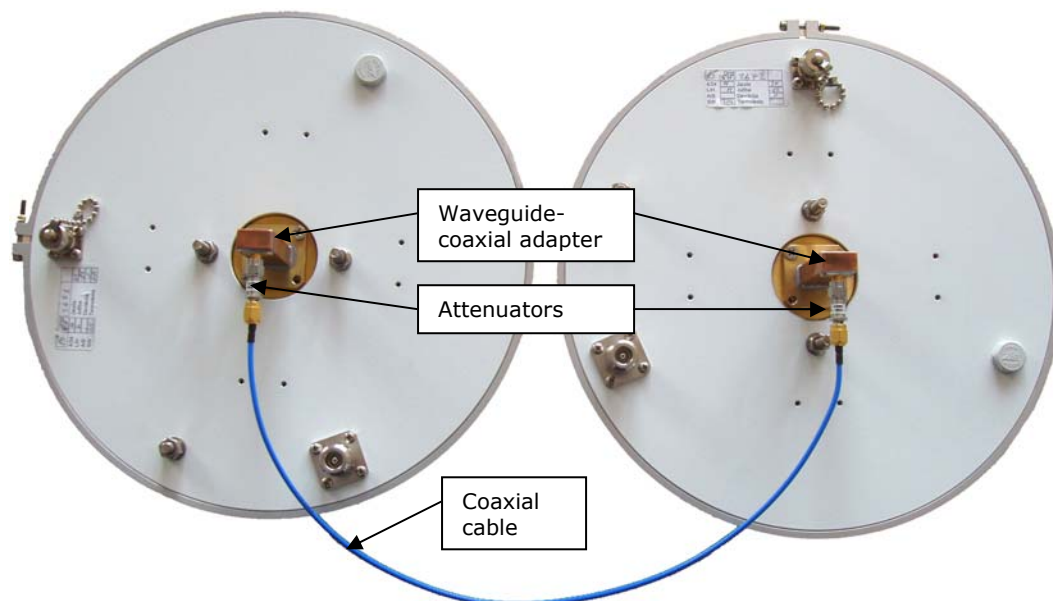
Connecting IDU to ODU

Interconnect IDU with ODU at each site performing the following steps:

- Connect the cable type-N connector to the type-N connector on the IDU and rotate the collar of the coaxial connector clockwise to tighten.
- Similarly connect the cable type-N connector to the type-N connector on the ODU.
- Check to make sure the connectors are still secured.

Interconnecting ODUs

Connect both ODUs as shown in the picture below.



Configuring ODU Parameters

The primary parameters for the link to operate properly are frequency channel and transmitter power.

Setting Transmitter Power

The transmitter power of the new equipment is switched off.

For both sites of a hop, proceed as follows:

- From IDU LCD, using arrow buttons, select **Outdoor unit** -> **Power** -> press ENTER
- Select required transmitter power using up/down arrow buttons and press ENTER
- Select "Yes" and press ENTER to confirm.

Normally the IDU LCD displays basic configuration, radio data and alarm status, remaining in the *status display mode*. To make changes in configuration from IDU LCD, the LCD must be switched from *status display mode* to *setup mode*. This can be done by pressing ENTER key. To return to *status display mode*, press CLEAR key; the LCD will automatically resume to *status display mode* after a few seconds.

Setting ODU Frequency Channel

For both sites of a hop, proceed as follows:

- From IDU LCD, select **Outdoor unit** -> **Chan ##** -> press ENTER
- Select required frequency channel using up/down arrow buttons and press ENTER
- Select "Yes" and press ENTER to confirm.

Connecting PC to RS-232 Management Port

Connecting Directly to RS-232 Port

In order to interconnect the IDU and the PC directly through serial ports, a straight through modem cable is needed.

The serial port of the PC should be configured as follows:

Bits per second - 19200
Data bits - 8
Parity - None
Stop bits - 1
Data flow control - None.

In order to connect the PC to the RS232 management port using *Hyper Terminal* program, which is included in any Windows version, the following steps must be performed. Similar steps can be performed using other terminal emulators.

1. Connect PC to the RS232 serial port with "straight-through" (modem) serial cable.
2. Run "Hyper Terminal" program.
3. Make a *New connection*, enter connection name.
4. Select an open COM port from the "Connect using" drop-down list (COM1 or COM2). The COM Properties window is displayed.
5. Select port settings (bits per second: 19200, data bits: 8, parity: none, stop bits: 1, no data flow control). Press OK.
6. The connection to the radio terminal should now be established. Press Enter and the login prompt is displayed if user name and password is set up. The factory default username and password for ASCII console is "" (disabled), and the login prompt will not appear.
For complete list of console commands please refer to the appropriate IDU management system technical description and configuration guide.

Connecting to RS-232 Port via Dial-up Modems

If using modems, the management terminal is connected with the IDU remotely through a telephone line as shown in the picture below.

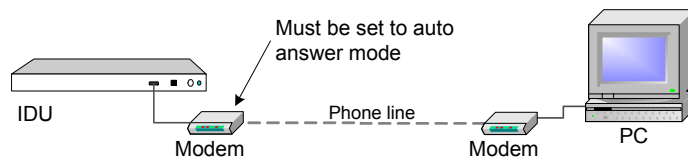


Figure 3.

1. Interconnect the equipment as shown in the Figure 3.
2. Configure the modem, *which is connected to the IDU* as stated below:
 - Auto answer on first ring ON
 - Echo offline commands OFF
 - Suppress result codes
 - DTR override
 - 19200 baud rate
3. Save the modem configuration (typically with AT&W string).

Please refer to the documentation accompanied with the dial-up modem for information about configuration of modem.

Configuring IP Settings

The following IP settings must be properly configured at each site in order to connect Web, Telnet or SNMP terminals as well as to be able to access far-end IDU(s) via radio channel.

1. IP address of 10Base-T port, it can be configured from an ASCII console, or from IDU front panel using keypad;
Using IDU keypad:
 - using arrow buttons, select **Ethernet** -> **Select IP** -> press ENTER
 - select required IP address using up/down arrow buttons and press ENTER
 - select "Yes" and press ENTER to confirm.Using ASCII console, enter command: *IP addr <IPaddress>*
Example: IP addr 192.168.200.1
2. Set the IP netmask for 10Base-T port;
Using IDU keypad:
 - select **Ethernet** -> **Select NETMASK** -> press ENTER
 - select netmask using up/down arrow buttons and press ENTER
 - select "Yes" and press ENTER to confirm.Using ASCII console, enter command: *IP mask <IPnetmask>*
Example: IP mask 255.255.255.0
3. Default gateway;
Using IDU keypad:
 - select **Ethernet** -> **Select Gateway** -> press ENTER
 - select required IP address using up/down arrow buttons and press ENTER
 - select "Yes" and press ENTER to confirm.Using ASCII console, enter command: *IP gw <IPaddress>*
Example: IP gw 192.168.210.1
4. Set the SLIP address for the serial port of the local IDU:
Using IDU keypad:
 - select **Service line** -> **Select local IP** -> press ENTER
 - select required IP address using up/down arrow buttons and press ENTER
 - select "Yes" and press ENTER to confirm.Using ASCII console, enter command: *IP seraddr <IPaddress>*
Example: IP seraddr 192.168.100.1
5. Specify the far-end SLIP port IP address:
Using IDU keypad:
 - select **Service line** -> **Select remote IP** -> press ENTER
 - select required IP address using up/down arrow buttons and press ENTER
 - select "Yes" and press ENTER to confirm.Using ASCII console, enter command: *IP remaddr <IPaddress>*
Example: IP remaddr 192.168.100.2

The management traffic in CFM radiolinks is IP-based. The management controller of the IDU operates as a router (2-port), which implies that standard IP routing principles must be taken into consideration.

Connecting PC to 10Base-T Management Port

Connecting Telnet Client

- Connect a PC to the 10Base-T port of the IDU; if connecting PC directly to the IDU, use crossover patch cable.
- Open telnet client program.
- Open Telnet session to the address of IDU 10Base-T port;
- Enter login and password if prompted; default (factory) Telnet username is "telnet", password "saf" (login name and password is case sensitive).

Note: it may be necessary to configure IP address of the PC.

Connecting Web Terminal

- Connect a PC to the IDU 10Base-T management port, using Cat 5 UTP or better patch cable,
Note: if connecting a PC directly to the IDU, then crossover patch cable must be used.
- Open Web browser.
- In address bar enter the IP address of 10Base-T management port.
This should open the login/password dialog box, default (factory) login name is "SAF" and password "test" (login name and password is case sensitive)
If server can not be found then:
 - if PC is connected directly to the IDU (not via Ethernet network) then make sure the PC and IDU are in one subnet;
 - if PC is connected to the IDU via Ethernet network then make sure the routing of packets addressed to IDU, are properly configured through the network.

Note: it may be necessary to configure IP address of the PC.

Configuring Management Service Channel

The configuration of the management service channel should be done preferably before the IDU is installed at the actual location, in future to avoid necessities to attend each site locally. To configure the service channel, please proceed in the order of the following chapters.

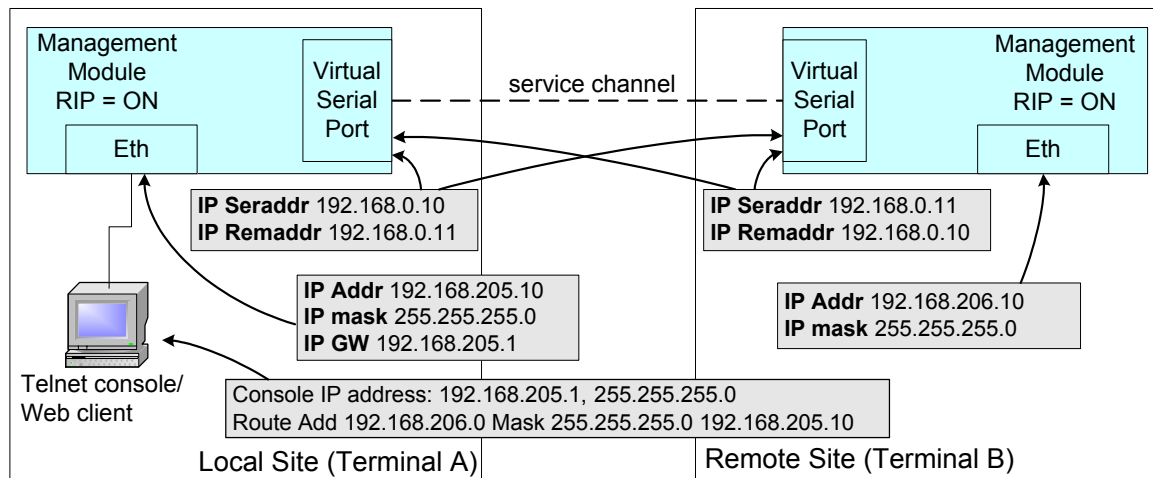
Adding routes

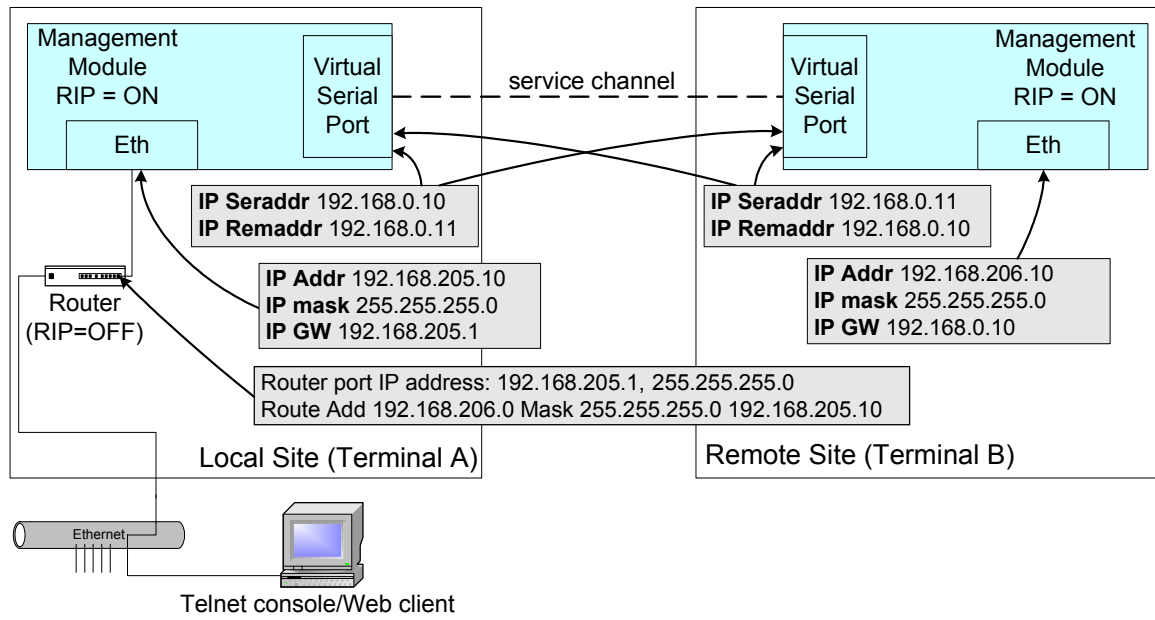
- Connect a PC to the 10Base-T port of the IDU and open Telnet session as described in chapter *Connecting Telnet Client*, or connect a PC to the RS232 port and make a connection.
- Configure routing using the following command:
Route add <destinationIPaddr> Mask <netmask> <gateway> [metric]
where
<destinationIPaddr> - destination IP address
<netmask> - net mask (if the route is related to a single host, the mask can be skipped)
<gateway> - gateway
[metric] - optional
Examples:
Route add 192.168.205.010 Mask 255.255.255.0 155.13.79.13
Route add 192.168.205.010 155.13.79.14
- Save the configuration using *write* command and restart the management controller using *restartcpu* command. After the *restartcpu* command is entered, the Telnet session will terminate. Please refer to chapter *IP Configuration Examples* for detailed examples.

Pinging Far-end IDU

In order to test if the management service channel is properly configured over the radiolink, use ping command to ping via all hops. Ping in step by step each port along the IP channel between management station (PC) and far-end IDU, starting from 10Base-T port of the local IDU down to the 10-Base-T port of the far-end IDU, correct routes as necessary.

IP Configuration Examples





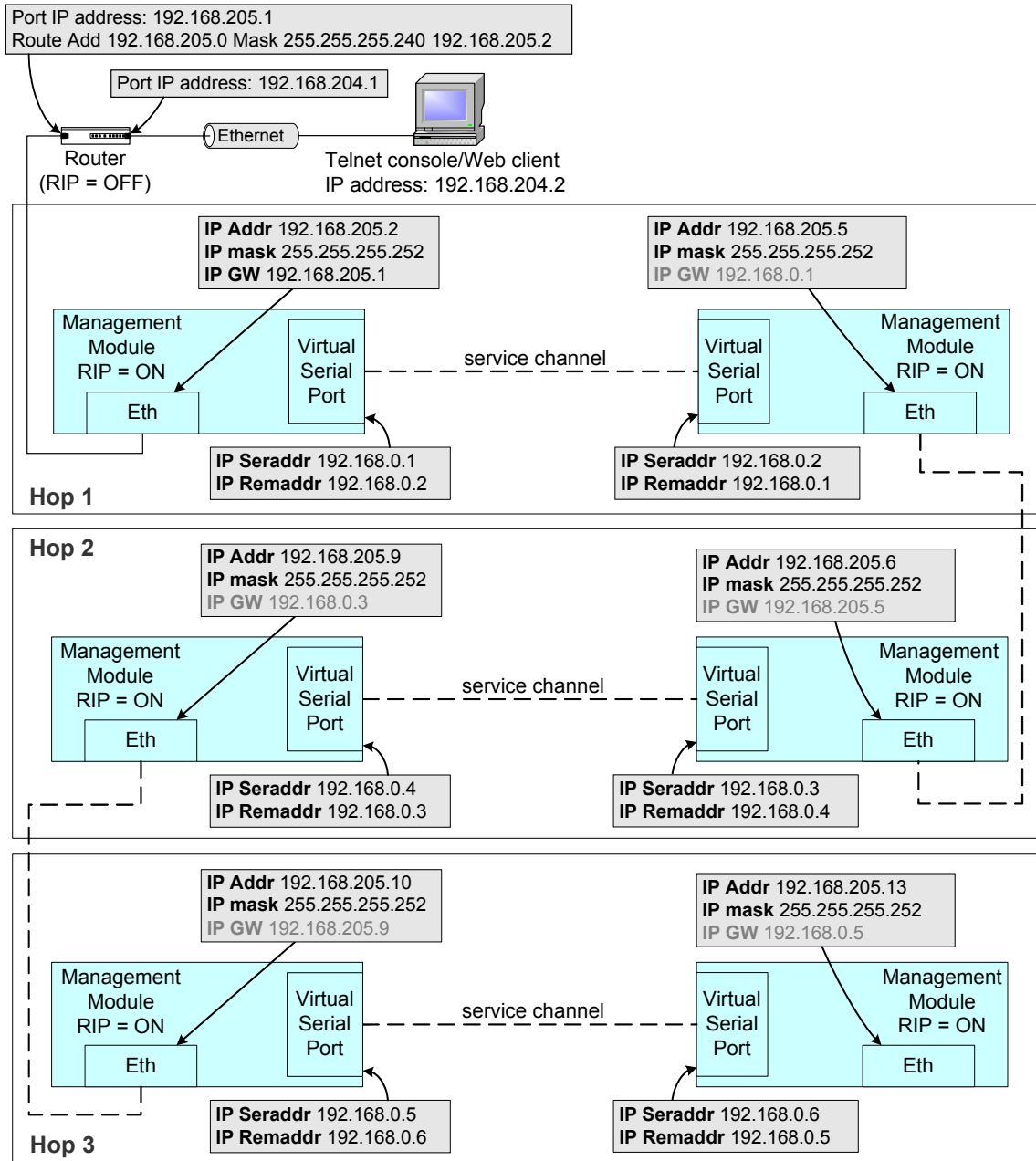


Figure 4

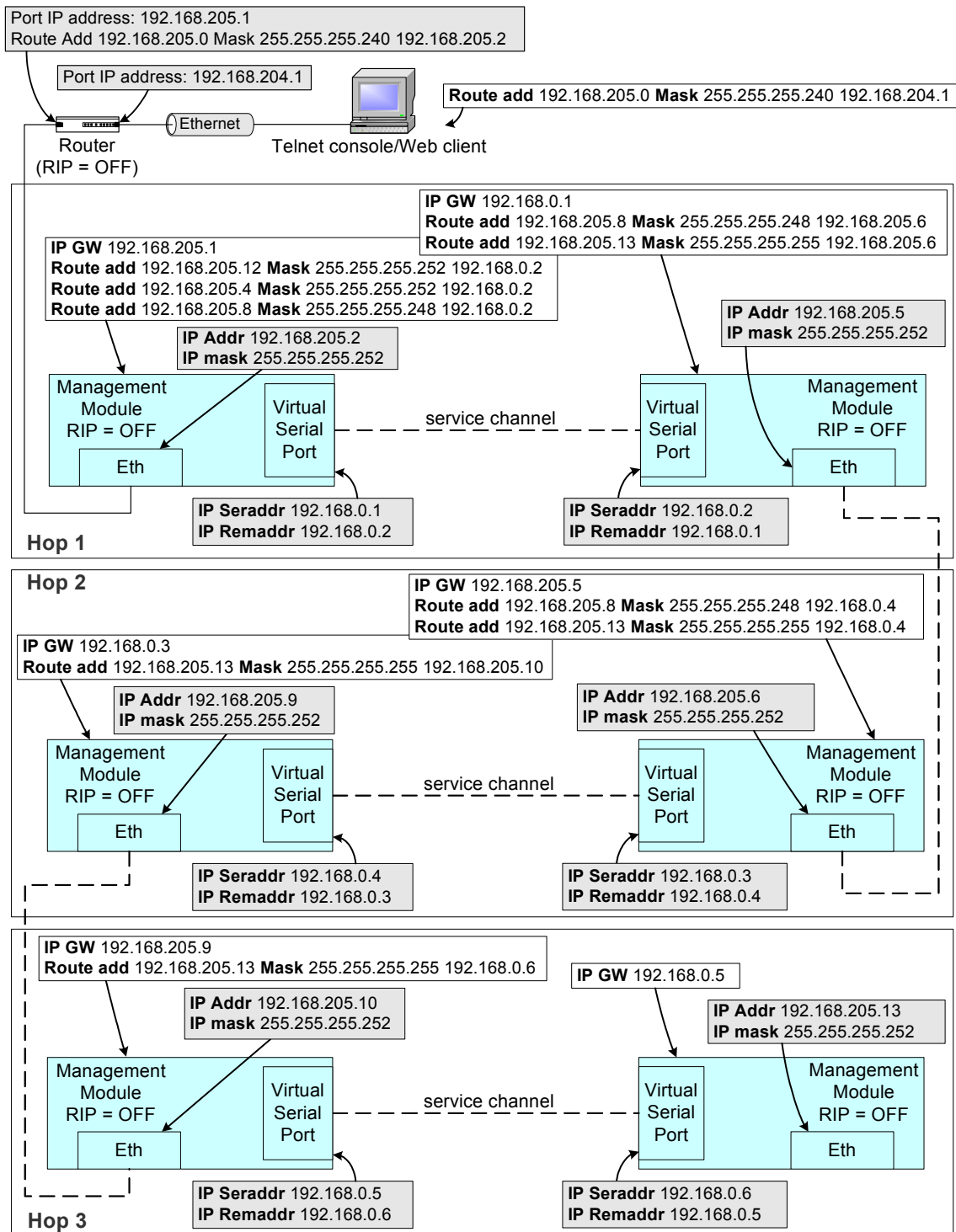


Figure 5

System Reboot

The whole terminal (IDU and ODU) can be rebooted in one way only – by switching the power supply off and on. This will restart all individual modules in IDU and ODU, and will reset all counters, such as up-time and down-time counter.

If the `restartcpu` command is entered from the Telnet or ASCII terminal, or if 'Restart CPU' option is performed from IDU panel, the IDU management controller is restarted, but this will not reboot the entire site. Thereby rebooting the management controller does not affect the payload traffic.

4 IDU Installation

Space Requirements

IDU is intended for installation in 19" communications rack.

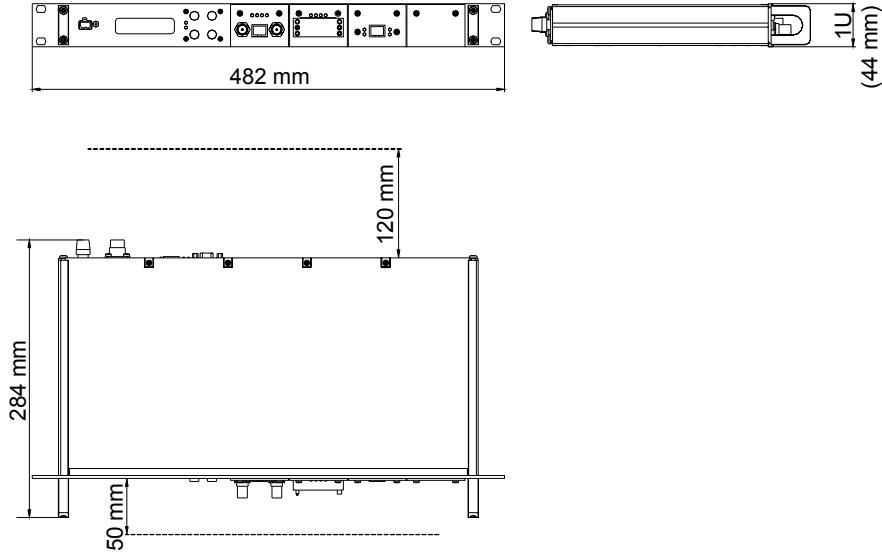
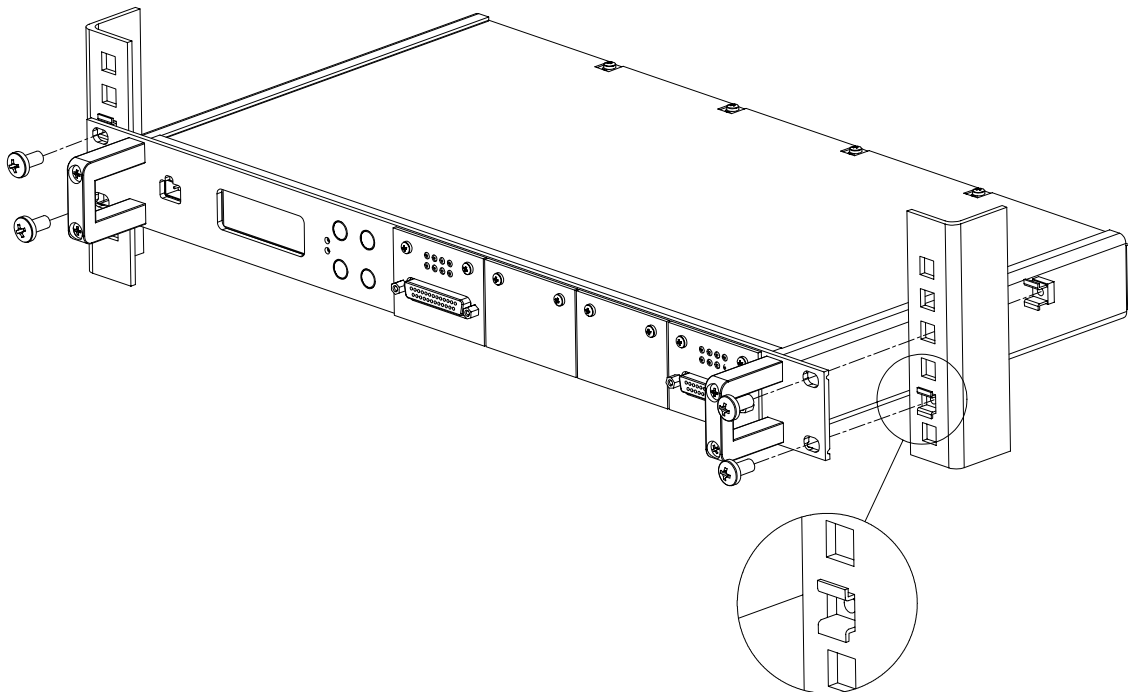


Figure 6.

IDU Rack Mounting

- Position the IDU in the communications rack at the desired height. Secure the IDU brackets to the communication rack.



- Connect the site ground to the grounding screw provided on the rear panel of the IDU chassis

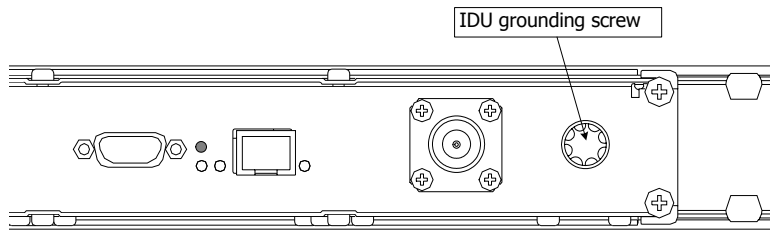
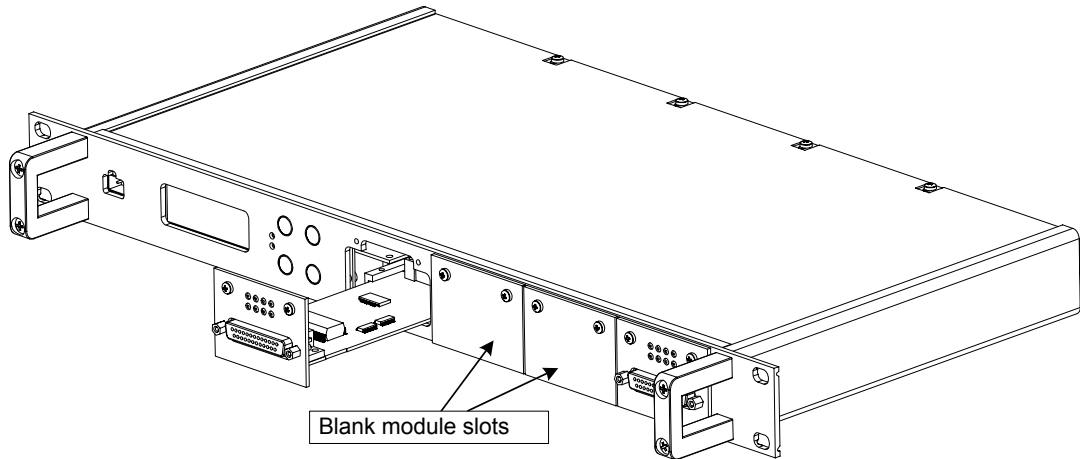


Figure 7.

IDU Module Installation

- Switch off the power to the IDU.
- Remove the protective cover plate from the IDU slot where the new module will be inserted, use torx-head screwdriver (torx M3x6 screws).



- Slide the module into the slot rail until the faceplate of the module is close to the IDU chassis
- Secure the module into the IDU chassis with the locking screws

5 ODU and Antenna Installation

Polarization Considerations

The position of the ODU determines the polarization of the radio signal. The waveguide flange can be used as the indicator, see picture below.

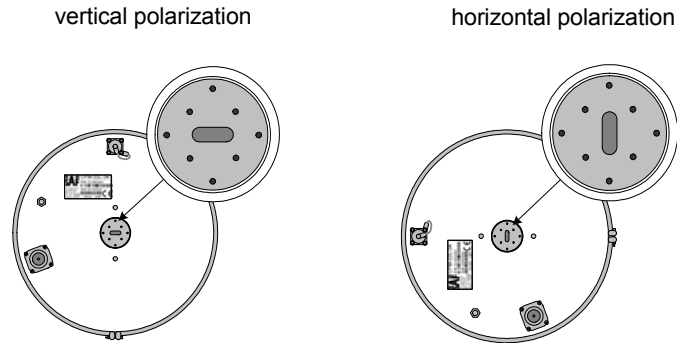
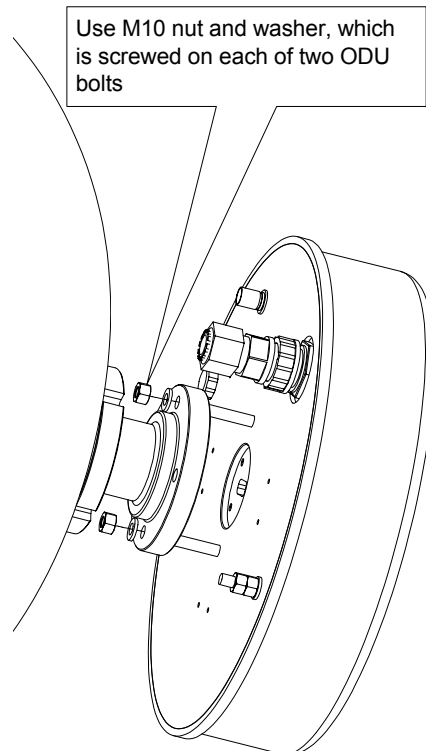


Figure 8. Position of ODU waveguide flange for vertical polarization and for horizontal polarization

When attaching ODU to the antenna, the antenna waveguide transition polarization must match with the ODU polarization.

Attaching ODU to Antenna



For further information how to attach ODU to antenna, please refer to the documentation found in ODU delivery package.

Antenna Alignment

Calculating Expected Receive Signal Level (RSL)

The expected RSL (receive signal level) can be calculated using "path calculator" provided by SAF Tehnika.

Alignment Procedure

The antenna alignment procedure can be made easier by placing one person at each antenna location during alignment process. However, alignment should be performed on one antenna at a time, each person alternatively turns antenna until the RSL is optimized.

The following steps are required to properly align the antennas:

1. Start at one end of the link, connect a voltmeter to the RSSI port on the ODU. Ensure the voltmeter is set to DC voltage and set on a range 0 – 2 volts.
2. Loosen the antenna hardware that is used for securing the antenna movement in the azimuth directions.
3. Roughly aim the antenna directing the main lobe to the far-end antenna.
4. Slowly sweep the antenna while observing the readings on the voltmeter. The higher is the voltage, the higher is the RSL.
5. Secure the azimuth adjustment hardware once main lobe is found and the highest signal level is achieved.
6. Loosen the antenna hardware that is used for securing the antenna movement in the elevation direction. Slowly sweep the antenna while observing the voltmeter. Once the signal is peaked, the elevation adjustment hardware can be secured.
7. Perform steps 1 through 6 on the opposite end of the link until the signal level is peaked for both azimuth and elevation.

After the AGC voltages have been peaked on both ends of the link, observe the RSL indicated on IDU LCD. Ensure that the RSL is within +/- 5dB of calculated RSL.

AGC Readings

The relationship of the antenna alignment voltage (RSSI voltage) vs. the receive signal level is different for each ODU; the maximum level of RSSI voltage (at peak RSL) may vary from 1.2 up to 2 volts.

Grounding the ODU

Attach the site ground to the ODU using the grounding screw provided on the ODU housing, the location of the grounding screw is depicted in the picture below.

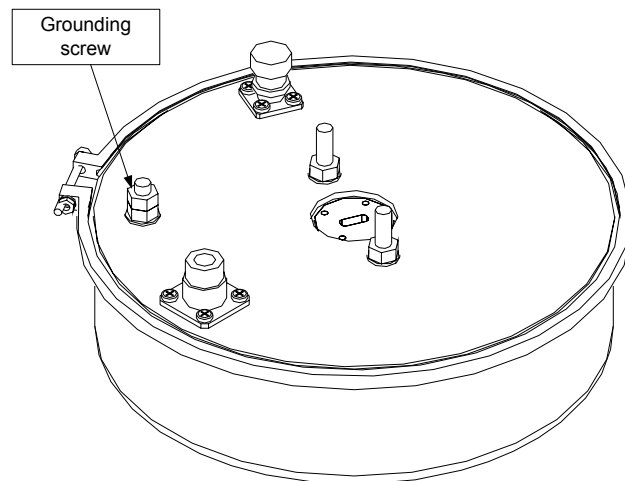


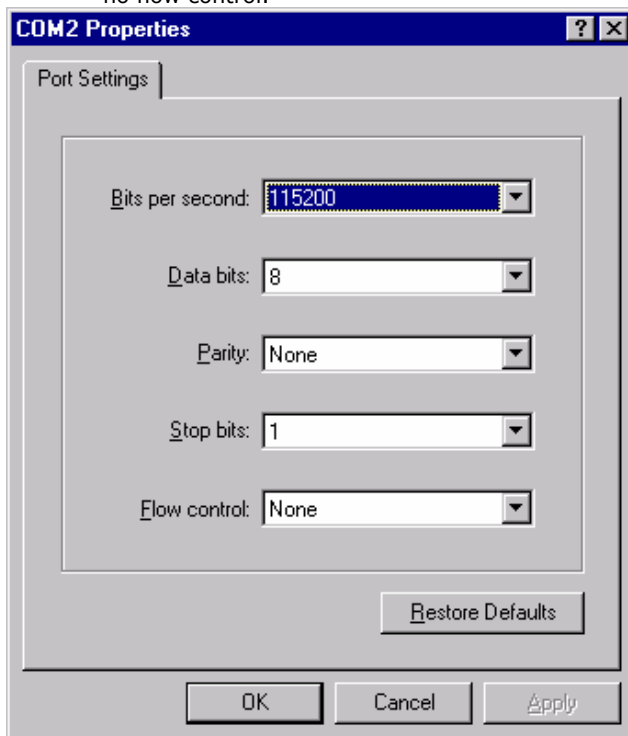
Figure 9.

6 Performing Software Update

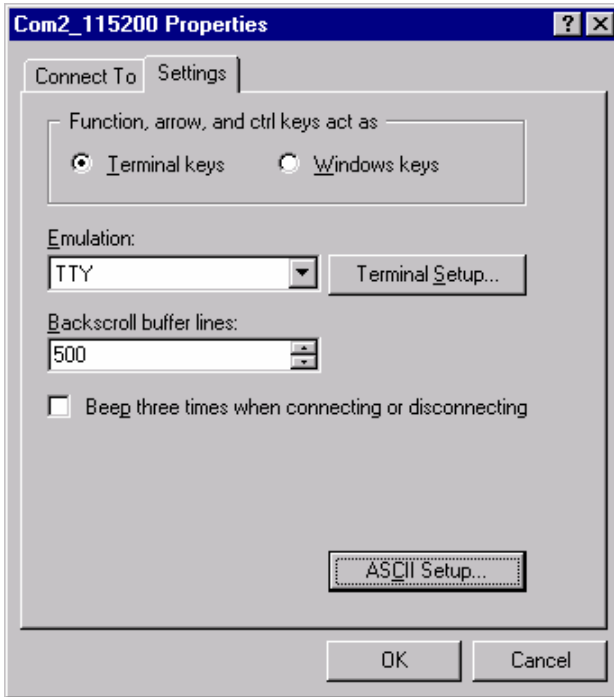
The software update is performed by loading the newer version of management software in the EPROM. The management software file (with extension .hex, or .txt) can be obtained by contacting local SAF Tehnika reseller.

The software is uploaded from the ASCII terminal to IDU management controller, which stores it in the Flash memory (Flash EPROM). Prior to upload the new management software, the current content of management software in the Flash memory must be erased. The update is performed through the following steps:

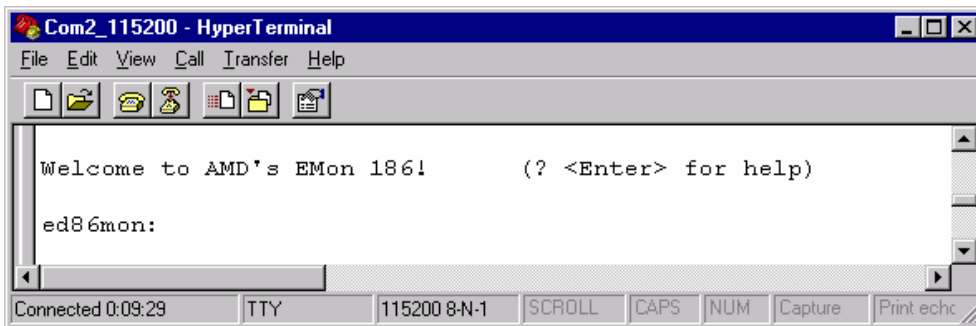
1. Connect a PC to the RS232 management port,
2. Run the MS Hyper Terminal program, and configure the corresponding COM port as follows:
 - 115200 baud,
 - 8 data bits,
 - no parity,
 - 1 stop bit,
 - no flow control.



3. Configure terminal emulation parameters to values shown in the following picture

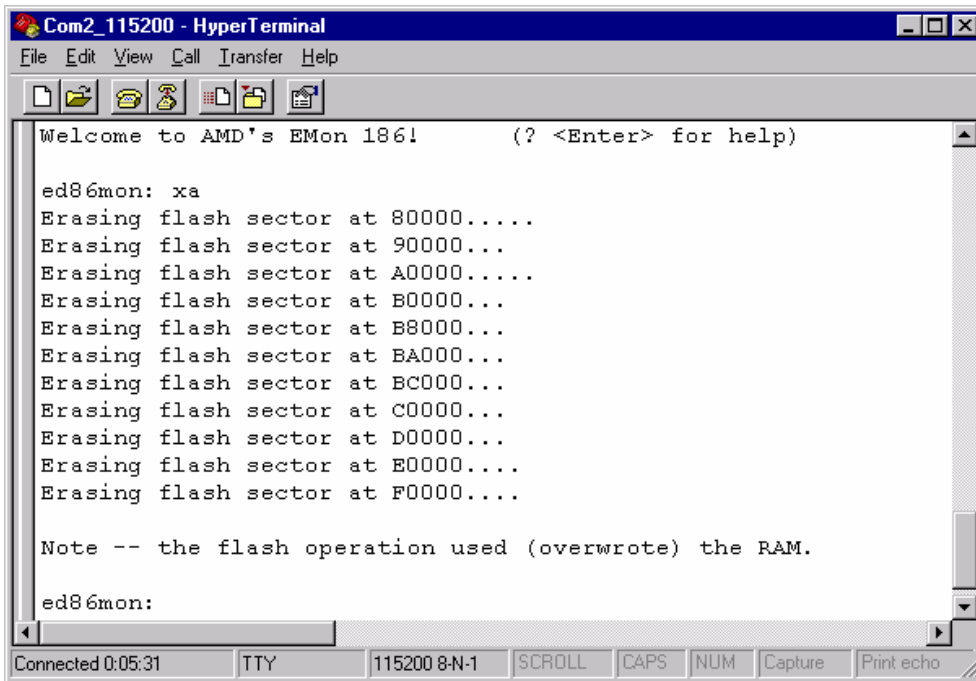


4. Unplug power supply or use the reset button (on the rear side) to restart the IDU and press "A" key several times (over 10 times) until the message appears as shown in the picture below. While pressing the "A" key (holding the key down won't work) the EPROM monitor program stored in the Flash EPROM is executed and the port speed auto-detection is carried out.

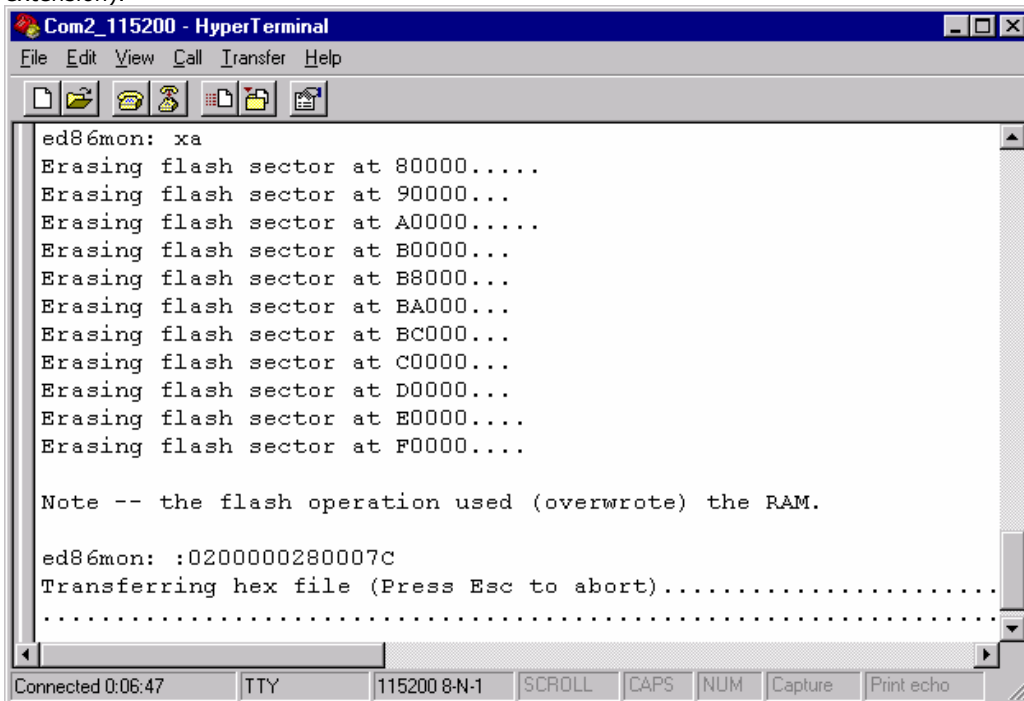


When message appears press Enter (on the keyboard) two times.

5. Enter the command "xa" to erase the current contents of management software from Flash EPROM. Note that this command will not erase the EPROM monitor program (which currently runs to perform the upload) but only the section of management software.
Note: While the new software will not be loaded, the management system will not work!



6. On the **Transfer menu**, click **Send Text File...**, choose and open the file (it may have "txt" or "hex" extension).



After about 10 minutes the following notification "Device programmed successfully" should appear (see the following picture), otherwise an error message will be returned.

7 References

All the documents comprised in this chapter can be ordered from SAF Tehnika or its sales representatives.

- **Technical Descriptions**

There are two technical descriptions available:

- *SAF CFM-LM Product Family Technical Description* - a generic technical description of the CFM-LM series products, it comprises the installation and commissioning issues and accessories, functional description, technical data, a.o.
- *SAF CFM-L4 Product Family Technical Description* - a generic technical description of the CFM-L4 series products.

- **Management System Technical description and Configuration Guide**

The following configuration guides are available:

- *CFM Series E1 Indoor Units*
- *CFM Modular Multiplexer Indoor Units*
- *CFM-4-REB and CFM-8-REB Ethernet Bridge*
- *CFM-34-E3 Indoor Unit*
- *Modular Fast Ethernet Bridge Indoor Units*
- *2xE1 Full Outdoor Unit*
- *4xE1 Full Outdoor Unit*