CopperLink CL-SFP Series
SFP Copper Wire Modems

User Manual

This is a Class A device and is not intended for use in a residential environment.

REGULATORY MODEL NUMBER: CLSFPD4-001

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Part Number: **50000150, Rev. A0**
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Trademark Statement

Warranty Information

The software described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license.

Patton LLC warrants all CopperLink extender components to be free from defects, and will—at our option—repair or replace the product should it fail within one year from the first date of the shipment.

This warranty is limited to defects in workmanship or materials, and does not cover customer damage, abuse or unauthorized modification. If the product fails to perform as warranted, your sole recourse shall be repair or replacement as described above. Under no condition shall **Patton LLC** be liable for any damages incurred by the use of this product. These damages include, but are not limited to, the following: lost profits, lost savings and incidental or consequential damages arising from the use of or inability to use this product. **Patton LLC** specifically disclaims all other warranties, expressed or implied, and the installation or use of this product shall be deemed an acceptance of these terms by the user.

About this guide

This guide describes the CopperLink CL-SFP Series hardware, installation and basic configuration.

Audience

This guide is intended for the following users:

- Operators
- Installers
- Maintenance technicians

Structure

This guide contains the following chapters and appendices:

- Chapter 1 describes the characteristics and typical configurations of your unit.
- Chapter 2 explains how to install and connect the CL-SFP.
- Chapter 3 describes the front panel displays and switches as well as their use.
- Chapter 4 describes typical applications and use cases..
- Chapter 5 explains how to configure the unit.
- Chapter 6 lists all the CopperLink CL-SFP technical characteristics.
- Chapter 7 will help you to troubleshoot difficulties encountered during the installation and operation of the unit.
- Chapter 8 describes the connector cabling.

For best results, read the contents of this guide *before* you install the CopperLink Ethernet Extender.

Table of Contents

Safety When Working With Electricity

The CopperLink unit contains no user serviceable parts, and is not be opened by the user. The equipment shall be returned to Patton LLC for repairs or repaired by qualified service personnel.

Do not work on the system or connect or disconnect cables during periods of lightning activity.

Before operating the equipment, carefully read this user manual. Patton LLC refuses taking any responsibility or granting any warranty to any SFP modem malfunctioning or incurring any damages due to failure to comply with the requirements stated in the manual(s), especially in the section covering Service Instructions.

Improper use of our equipment, use in any other environment, or improper installation and maintenance might lead to harmful conditions. Failure to follow these precautions may result in death, severe injury, or property damage. Patton LLC refuses taking responsibility nor does it grant any warranty in such cases.

Electronic modules can be damaged or decrease in reliability by static electrical discharge. Before handling modules, wear an antistatic discharge wrist strap to prevent damage to electronic components. Place modules in antistatic packing material when transporting or storing them. When working on modules, always place them on an approved antistatic mat that is electrically grounded. To prevent electrical shock, do not install equipment in a wet location or during a lightning storm.

The protective ground connection must be applied to the host unit. Make sure that the host unit and all equipment connected to it use the same protective ground for the purpose of reducing noise interference and safety hazards.

1 General Information

The **CopperLink CL-SFP** is a single pair, low power SFP (Small Form-factor Pluggable) Ethernet copper wire modem. The modem is optimized for a duplex connection speed in the range of 1.5…18Mbps over a pair of copper wires up to 6200 meters.

The **CopperLink CL-SFP** modem can be plugged into any Ethernet device with SFP ports that support 100BASE-FX and/or 1000BASE-X.

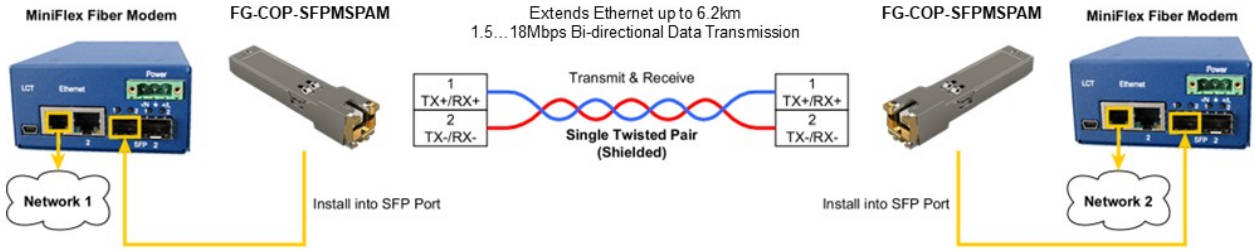


FIGURE 1.1 APPLICATION EXAMPLE.

The **CopperLink CL-SFP** modem uses the transmission friendly Pulse Amplitude Modulation (PAM) technology. It means a much smaller frequency bandwidth than comparable modules with VDSL/ADSL technology. This technology influences the other systems less and the transmission on copper cables is more save and for harsh environments.

The modem supports fixed and automatic transmission rate selection. The training or recovery time for the copper line connection (link synchronization) in Fixed Rate Mode is very fast and happens within 2..10 seconds. In Auto Rate Mode, SFP modems automatically adjust the transmission rate to the optimum performance that line conditions can support.

The Link Quality Monitoring provides performance information of a specific link and can be used during installation and maintenance procedures.

Devices also support Fast Link Recovery that helps fast connection re-establishing in case of short, less than 2 seconds, transmission losses caused by such phenomena as over voltage spikes, short interruptions or short cuts caused by over voltage protection.

The Automatic Active Device Detection feature allows SFP modem to detect the presence of an active device on the remote side of the line or to recognize the line failure.

The SFP copper line interface has 1500V RMS or 2250V DC isolation and its protection meets ITU-T Rec. K.20/K.21.

The configuration is possible by Web or Telnet access. For security purposes, Telnet and/or WEB access can be disabled after configuring.

2 Service Instructions (Before You Begin...)

Service Instructions

- Before unpacking, check if the packing box is intact and if the SFP model is equal to that specified in the purchase order/contract.
- Before installation of the SFP, read carefully the present technical description and service instructions. Take care about all Warnings inside this manual! Remember that the guarantee and the free-of-charge repair will not be granted under the following conditions: a) If the SFP or any of its parts fails due to improper installation, testing or operation. b) damages resulting from:

  1) Misuse and improper installation, including but not limited to:

  - to use the product for its normal purpose or in accordance with the all the instructions for the proper use and maintenance,

  - installation and use of the product in a conflicting way with the actual technical or safety standards in the country where it is installed.

  2) Maintenance or repair performed by unauthorized service centers and dealers.

  3) Operation of a malfunctioning SFP.

  4) Accidents, lightning strokes, flooding, water, fire, improper ventilation, voltage drops, ingress of moisture and insects inside the equipment as well as other reasons, for example, electromagnetic and other interferences which are beyond the supplier control and do not correspond to specified technical conditions.

  5) Transportation except when the shipping is performed by an authorized dealer or a service center.

  7) Defects of the system (host equipment) into which this product is included.
- Before installation of the SFP make sure that the host equipment properly grounded.
- Environment requirements: Temperature: from -40 to +85 °C; Relative air humidity: from

  5% to 95% at +25 °C. Exceptions are units that are specified from the manufacturer to differ from these requirements, because there is a special application.
- It is strictly prohibited:

  a) to alter, delete, remove or make illegible the serial number of the SFP.

  b) to adapt, adjust and change the equipment in order to improve it or extend its applications without the prior written consent of the manufacturer.

  c) to alter or to adjust the equipment without the consent of the manufacturer.

3 Quick Installation Guide

The **CopperLink** CL-SFP modem can be installed in any SFP port of any host equipment (for instance, switch or router), which supports 100Base-FX or 1000Base-X, i.e., Fast- or Gigabit Ethernet SFP port.

All **CopperLink** CL-SFP modems are delivered with the following factory default settings:

- IP: 192.168.0.1
- Subnet mask: 255.255.255.0
- Default gateway: 192.168.0.254

> **NOTE**
> For initial configuring your network and network settings of your PC and the host, where the SFP modem is installed, must allow accessing the default SFP modem IP address 192.168.0.1.

3.1 Resetting the SFP modem to its factory settings (optional)

To reset the CL-SFP modem to its factory settings, a special switch located on the underside of the SFP modem's PCB can be used. To do this, follow these steps:

1. Carefully move the switch to the right position as shown below:

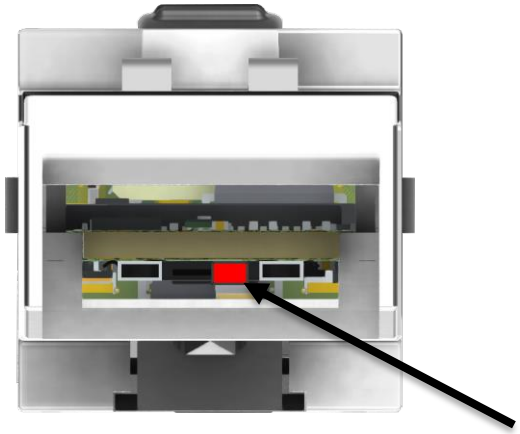


FIGURE 3.1 SFP MODEM REAR VIEW, SWITCH IS IN THE RIGHT POSITION (FACTORY DEFAULT).

2. Insert SFP modem into any SFP port of powered Host and wait about 30 seconds.
3. Extract SFP modem from the Host and return the switch to the left as shown below:

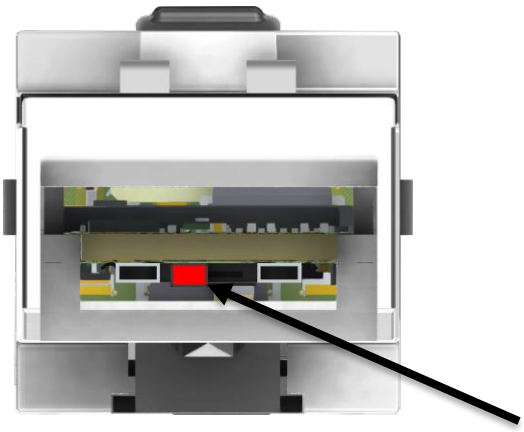


FIGURE 3.2 SFP MODEM REAR VIEW, SWITCH IS IN THE LEFT POSITION (NORMAL OPERATION).

Now the Factory Default settings are set and SFP modem is ready for initial configuring.

3.2 Enter CopperLink SFP Copper Wire Modem

To log in to an **CopperLink** CL-SFP modem, use a terminal emulation program with Telnet or go with WEB.

For security purposes, you can disable Telnet and/or WEB access after configuring. If both, Telnet and WEB are disabled, then it will be necessary to reset the SFP modem to its factory settings to restore access . This can be done by using the switch, described in Chapter 5.1 above.

3.2.1 Access with Telnet

1. Open a program with Telnet protocol
2. Open the Telnet session with address 192.168.0.1 3. Press Enter. The Main Menu will be displayed:

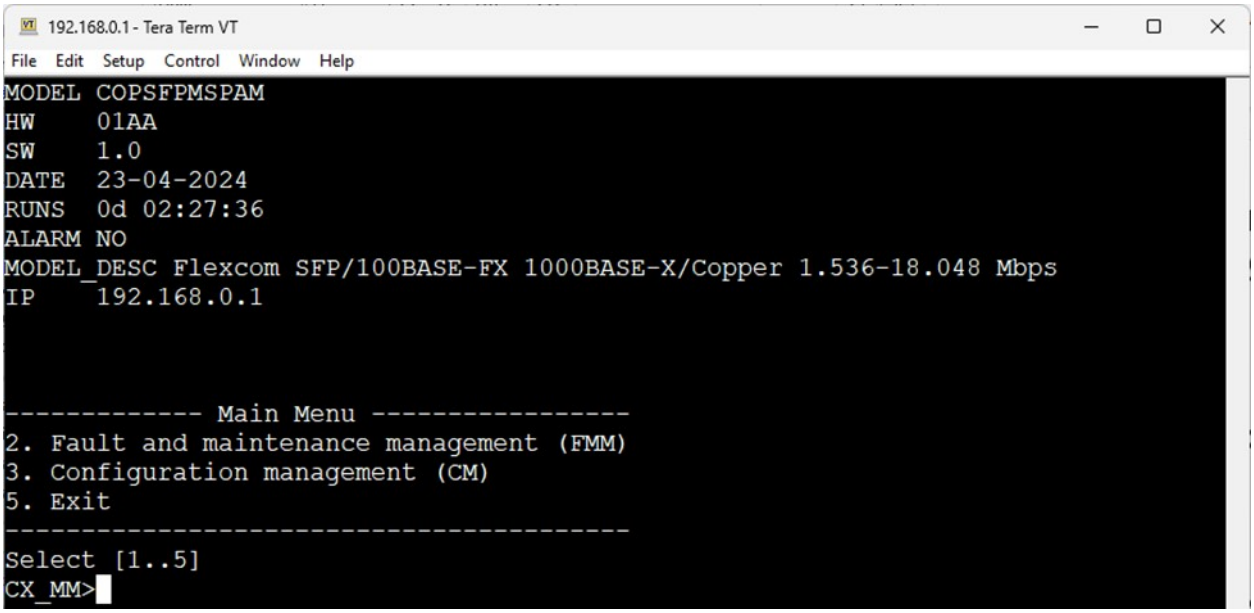


FIGURE 3.3 MAIN MENU (TELNET)

3.2.2 Access with WEB

Enter the command: **http://192.168.0.1** in the WEB browser. After the connection is established the summary window of the modems WEB-GUI will be displayed:

FIGURE 3.4 SUMMARY SCREEN (WEB)

3.3 Configure CopperLink SFP Modem

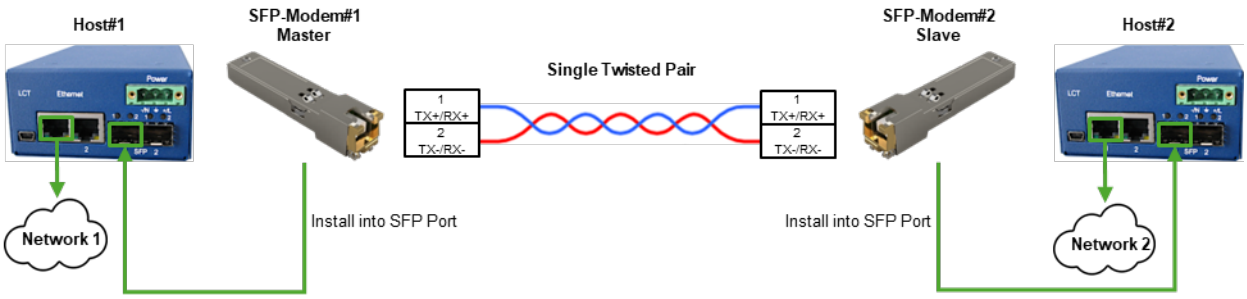


FIGURE 3.5 TYPICAL APPLICATION

The Figure above represents a typical application of the SFP modems. Two standard configuration examples are given in this Chapter, one for ***Fixed Rate Mode*** and another for ***Auto Rate Mode***.

Alternatively, it is possible to set the Master modem (SFP-Modem#1) to ***Fixed Rate Mode*** and the Slave modem (SFP-Modem#2) to ***Auto Rate Mode***.

Please find below the description of ***Fixed Rate*** and ***Auto Rate*** modes and recommendations for mode selection.

3.3.1 Description of Operating Modes

The modem supports two operating modes: ***Fixed Rate Mode*** and ***Auto Rate Mode***.

1. Fixed Rate Mode (fast link establishing)

- This mode allows for fast link establishment within 2..10 seconds, depending on selected Baserate and provided that the line conditions support the specified speed.

- This mode ensures fast link establishment both after short, less than 2 seconds, interruptions and also after long line disconnections.
- In this mode, the connection speed is fixed and determined by the **Baserate** parameter, which must be set identically on both modems.
- It is very important to ensure that the line can handle the set speed; otherwise, the connection will not be established. If the line is too long or has poor quality, the **Baserate** may need to be lowered on both modems to establish a stable link. **Be aware that if the Baserate is set too high and the connection cannot be established, lowering the Baserate on one modem will not allow the connection unless it is also lowered on the remote modem. This could require the presence of personnel at the remote site to reconfigure the modem settings manually, as there might be no remote access to the modem for adjustments.**

2. Auto Rate Mode (automatic speed adjustment)

- This mode automatically adjusts the speed to match the optimal performance that the line conditions can support.
- Although it can take longer to establish the link (from 30 seconds to 3 minutes), it ensures that the connection is made at the highest possible speed that the line can sustain with a good signal-to-noise ratio (SNR).
- Thanks to the Fast Link Recovery feature, in Auto Rate Mode the device will quickly, within 2..10 seconds) restore the connection in case of short, less than 2 seconds, connection interruptions.

3.3.2 Recommendations for Mode Selection

- **Use Fixed Rate Mode** on both modems if you are confident in the quality of the line and know that it can support the specified **Baserate**. This mode is ideal for environments where rapid connection establishment is critical. Fixed Rate Mode is also optimal for short lines (for instance, less than 400 meters for standard Ethernet cables). For longer lines, you should consult the connection range estimates provided in 5.5 Approximate transmission range to determine if the line can support the desired speed. **Please note that the data in Section 5.5 is for reference only, and the actual transmission range can vary significantly based on the specific conditions of the cable.**
- **Use Auto Rate Mode** on both modems if there is any uncertainty about the line quality or if you are setting up the connection for the first time. After the connection is established, observe the **Baserate** achieved by the modems in Auto Rate Mode. You can then configure both modems with this **Baserate** in Fixed Rate Mode for future quick reconnections.
- **Alternatively, set the Master modem to Fixed Rate Mode and the Slave modem to Auto Rate Mode.** In this configuration, the master modem determines the transmission speed, and the slave modem adjusts to match it. This allows for manual speed adjustment from the Master side only, eliminating the need for personnel at the remote site (Slave). However, the connection establishment time will be similar to using Auto Rate Mode on both modems. **Once the connection with optimal Baserate is established, you can then switch the Slave modem to Fixed Rate Mode with the same Baserate as the Master modem. This will ensure quick reconnection in the future.**

This approach ensures that you initially secure a reliable connection and then optimize for speed and efficiency in subsequent connections.

Please pay attention also to the table below that shows the reconnection time depending on the duration of the link interruption and selected operation modes:

Mode	Failure duration

Master	Slave	< 2 seconds	> 2 seconds
Fixed Rate	Fixed Rate	fast recovery (2..10 sec.)	fast recovery (2..10 sec.)
Fixed or Auto Rate	Auto Rate	fast recovery (2..10 sec.)	full handshake (30.300 sec.)

TABLE 3.1 CONNECTION RECOVERY DEPENDING ON THE FAILURE TYPE AND CONFIGURATION

3.3.3 Configuring Fixed Rate Mode via Telnet

SFP-Modem#1: Enter to SFP-Modem#1 with Telnet then perform the following commands:

(The IP address, netmask and gateway shown here are for example purposes only)

Type following commands	Description
<Enter>	Enter the Main Menu
3 <Enter>	Go to Configuration Management (CM)
<MASTER ON> <Enter>	Configure modem as Master
<BASERATE 200> <Enter>	Set Fixed Rate Mode with Baserate 200
<SETIP 192.168.0.184> <Enter>	Set the IP-address of the modem
<NETMASK 255.255.255.0> <Enter>	Set the subnet mask
<GATEWAY 192.168.0.254> <Enter>	Set the default gateway
<APPLY> <Enter>	Apply and save all configurations (the SFP will restart and the Telnet connection will be closed)

TABLE 3.2 INITIAL CONFIGURING OF MASTER MODEM IN FIXED RATE MODE (TELNET)

Because IP address, netmask and gateway of the SFP-Modem#1 were changed, it might be necessary to change the settings of the Host#1 to access SFP-Modem#1 again.

SFP-Modem#2: Enter to SFP-Modem#2 with Telnet then perform the following commands:

(The IP address, netmask and gateway shown here are for example purposes only)

Type following commands	Description
<Enter>	Enter the Main Menu
3 <Enter>	Go to Configuration Management (CM)
<MASTER OFF> <Enter>	Configure modem as Slave
<BASERATE 200> <Enter>	Set Fixed Rate Mode with Baserate 200
<SETIP 192.168.0.183> <Enter>	Set the IP-address of the modem
<NETMASK 255.255.255.0> <Enter>	Set the subnet mask
<GATEWAY 192.168.0.254> <Enter>	Set the default gateway
<APPLY> <Enter>	Apply and save all configurations (the SFP will restart and the Telnet connection will be closed)

TABLE 3.3 INITIAL CONFIGURING OF SLAVE MODEM IN FIXED RATE MODE (TELNET)

Because IP address, netmask and gateway of the SFP-Modem#2 were changed, it might be necessary to change the settings of the Host#2 to access SFP-Modem#2 again.

You can check the configuration after re-establishing of Telnet connection to the SFP modems:

In Menu Configuration Management (CM) of the SFP modem, you can type NETCONFIG to check the configuration.

SFP-Modem#1:

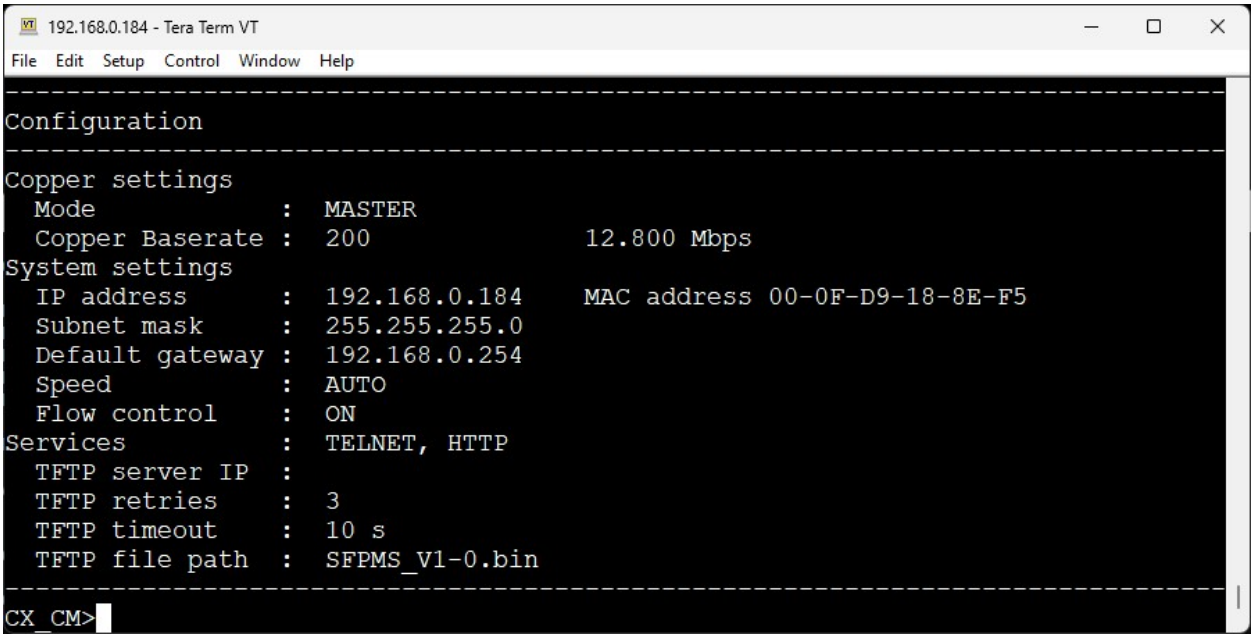


FIGURE 3.6 EXAMPLE CONFIGURATION OF MASTER MODEM IN FIXED RATE MODE (TELNET)

SFP-Modem#2:

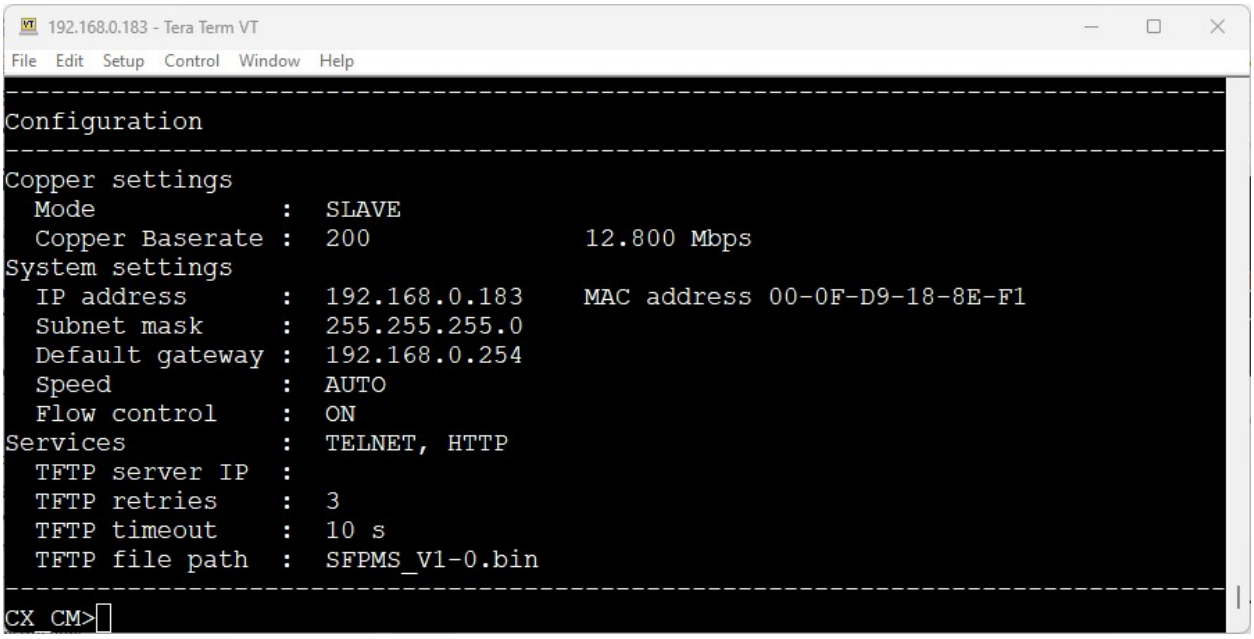


FIGURE 3.7 EXAMPLE CONFIGURATION OF SLAVE MODEM IN FIXED RATE MODE (TELNET)

3.3.4 Configuring Fixed Rate Mode via WEB

SFP-Modem#1:

1. Enter to SFP-Modem#1 via WEB, then configure the following parameters in CONFIGURATION screen and click **Save** button:

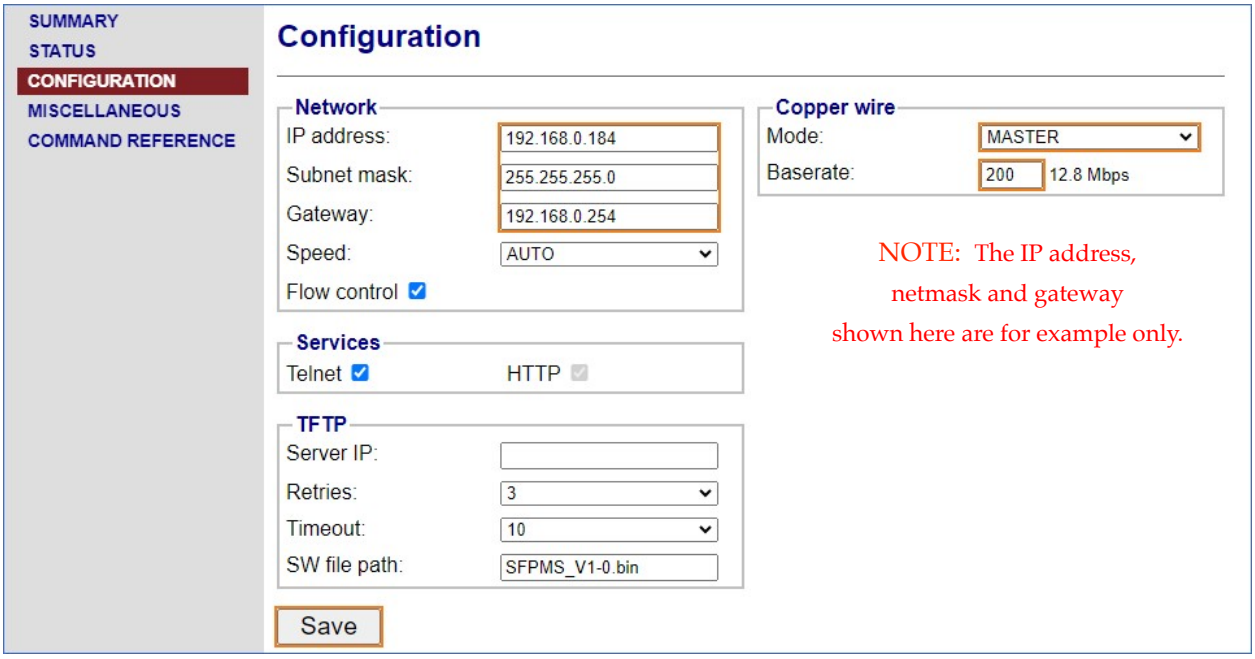


FIGURE 3.8 CONFIGURING OF MASTER MODEM IN FIXED RATE MODE (WEB)

2. Click **Apply** button:

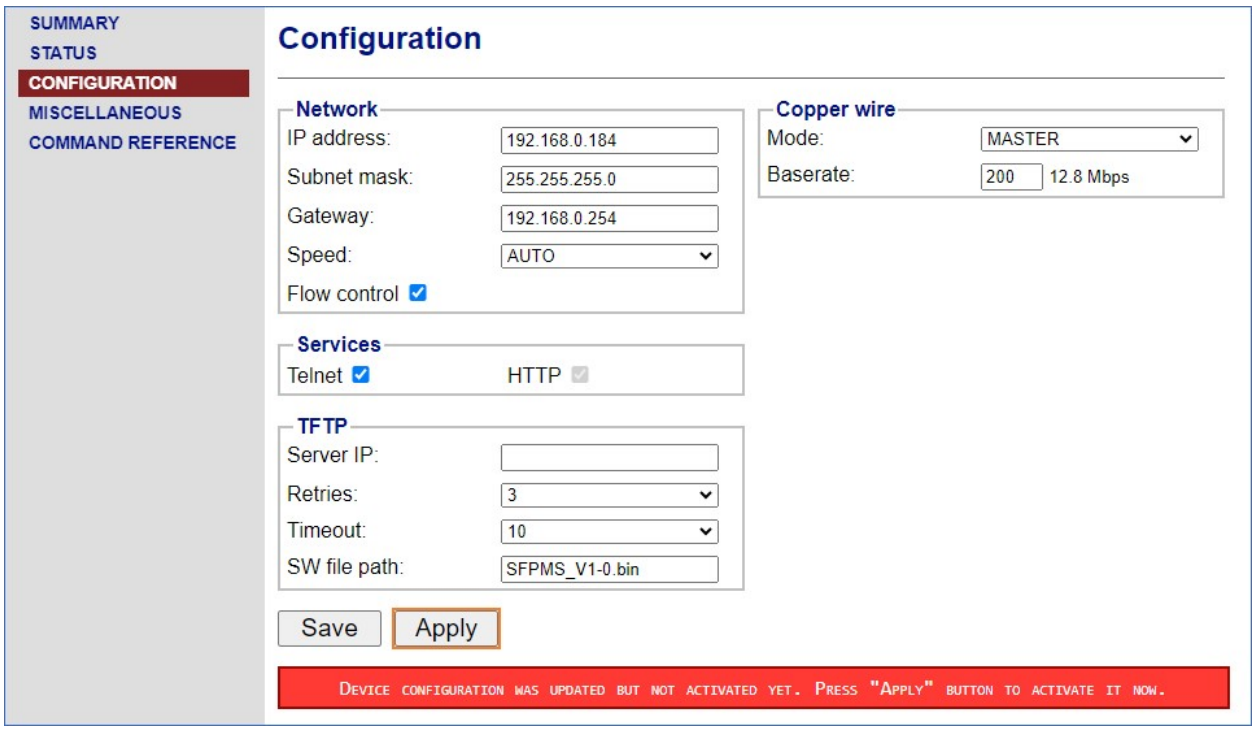


FIGURE 3.9 APPLYING OF THE CONFIGURATION (WEB)

3. The SFP modem will restart and the WEB-page will become unavailable. Because IP address, netmask and gateway of the SFP-Modem#1 were changed, it might be necessary to change the settings of the Host#1 to access SFP-Modem#1 again.

SFP-Modem#2:

1. Enter to SFP-Modem#2 via WEB, then configure the following parameters in CONFIGURATION screen and click **Save** button:

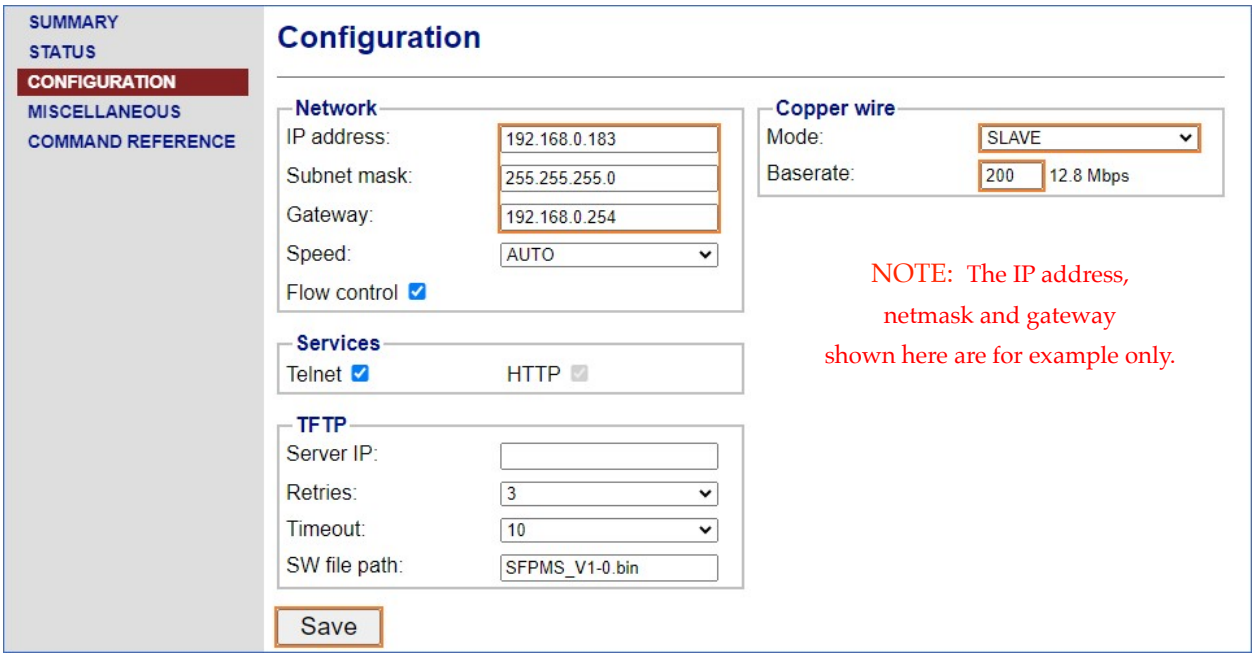


FIGURE 3.10 CONFIGURING OF SLAVE MODEM IN FIXED RATE MODE (WEB)

2. Click **Apply** button:

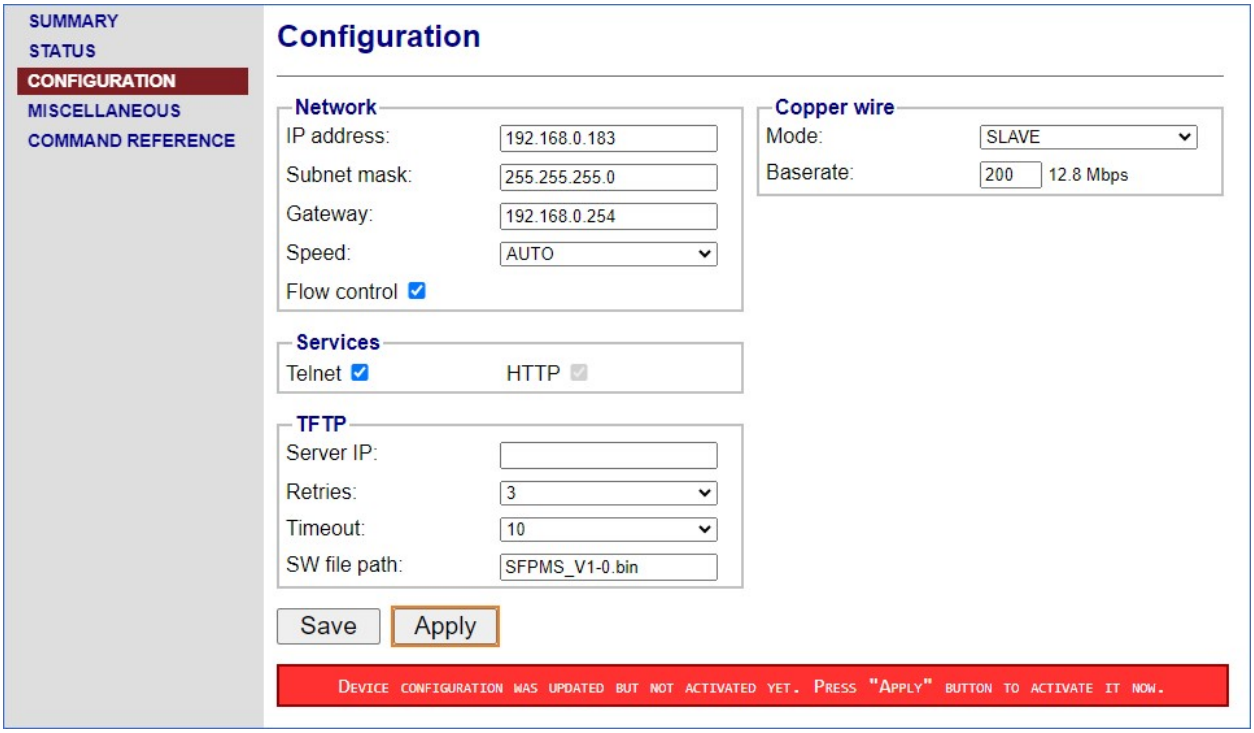


FIGURE 3.11 APPLYING OF THE CONFIGURATION (WEB)

3. The SFP modem will restart and the WEB-page will become unavailable. Because IP address, netmask and gateway of the SFP-Modem#2 were changed, it might be necessary to change the settings of the Host#2 to access SFP-Modem#2 again.

You can check the configuration after re-establishing of WEB connection to the SFP modems:

SFP-Modem#1:

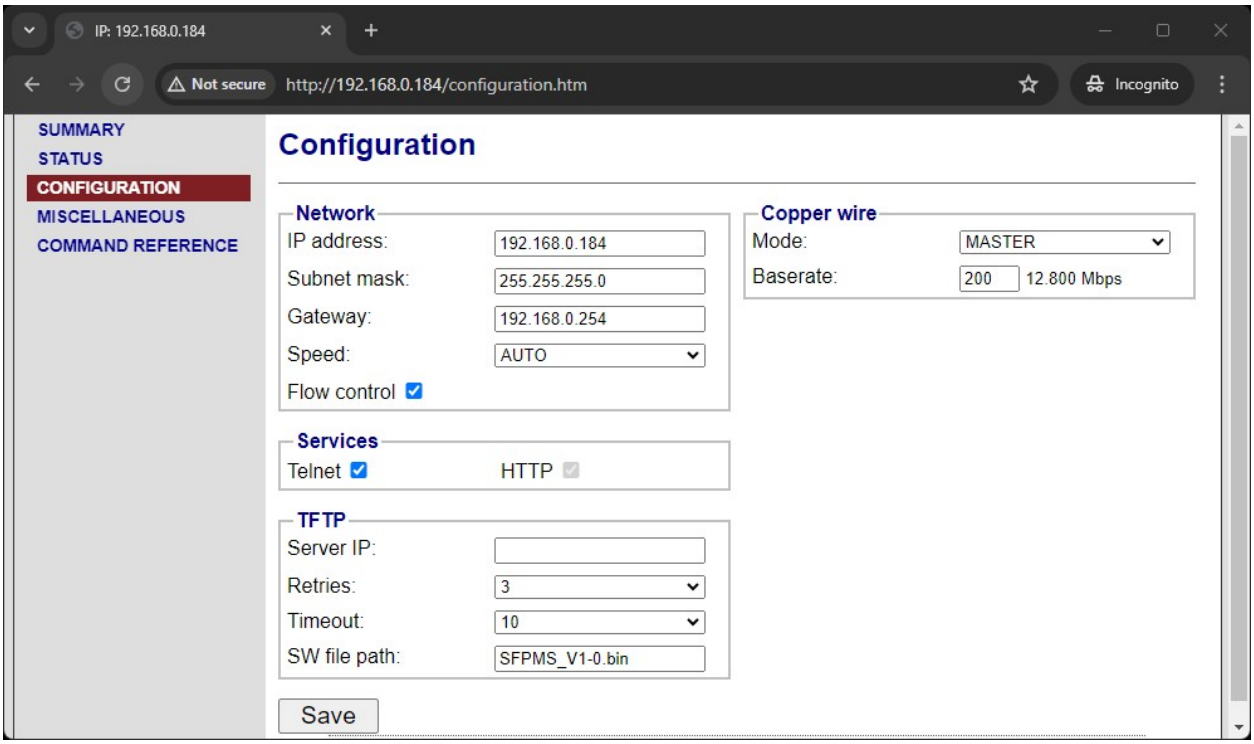


FIGURE 3.12 EXAMPLE CONFIGURATION OF MASTER MODEM IN FIXED RATE MODE (WEB)

SFP-Modem#2:

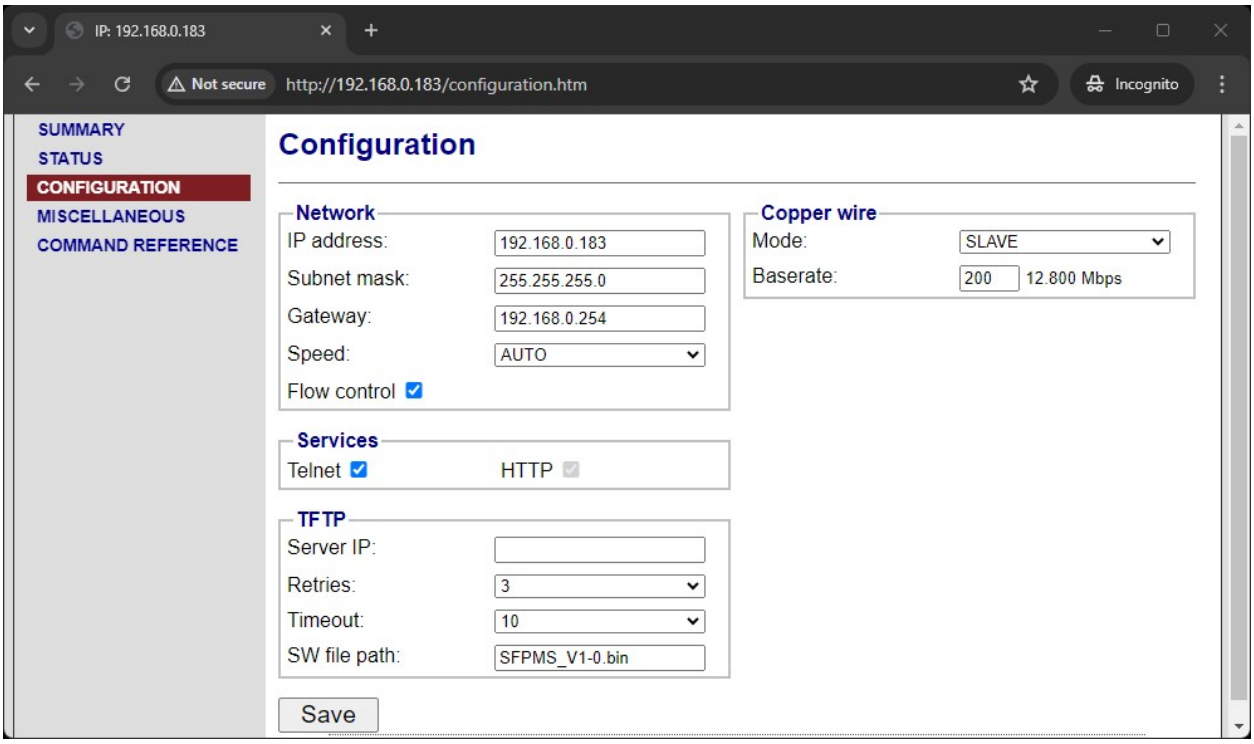


FIGURE 3.13 EXAMPLE CONFIGURATION OF SLAVE MODEM IN FIXED RATE MODE (WEB)

3.3.5 Configuring Auto Rate Mode via Telnet

SFP-Modem#1: Enter to SFP-Modem#1 with Telnet then perform the following commands:

(The IP address, netmask and gateway shown here are for example purposes only)

Type following commands	Description
<Enter>	Enter the Main Menu
3 <Enter>	Go to Configuration Management (CM)
<MASTER ON> <Enter>	Configure modem as Master
<BASERATE AUTO> <Enter>	Set Auto Rate Mode
<SETIP 192.168.0.184> <Enter>	Set the IP-address of the modem
<NETMASK 255.255.255.0> <Enter>	Set the subnet mask
<GATEWAY 192.168.0.254> <Enter>	Set the default gateway
<APPLY> <Enter>	Apply and save all configurations (the SFP will restart and the Telnet connection will be closed)

TABLE 3.4 INITIAL CONFIGURING OF MASTER MODEM IN AUTO RATE MODE (TELNET)

Because IP address, netmask and gateway of the SFP-Modem#1 were changed, it might be necessary to change the settings of the Host#1 to access SFP-Modem#1 again.

SFP-Modem#2: Enter to SFP-Modem#2 with Telnet then perform the following commands:

(The IP address, netmask and gateway shown here are for example purposes only.)

Type following commands	Description
<Enter>	Enter the Main Menu
3 <Enter>	Go to Configuration Management (CM)
<MASTER OFF> <Enter>	Configure modem as Slave
<BASERATE AUTO> <Enter>	Set Auto Rate Mode
<SETIP 192.168.0.183> <Enter>	Set the IP-address of the modem
<NETMASK 255.255.255.0> <Enter>	Set the subnet mask
<GATEWAY 192.168.0.254> <Enter>	Set the default gateway
<APPLY> <Enter>	Apply and save all configurations (the SFP will restart and the Telnet connection will be closed)

TABLE 3.5 INITIAL CONFIGURING OF SLAVE MODEM IN AUTO RATE MODE (TELNET)

Because IP address, netmask and gateway of the SFP-Modem#2 were changed, it might be necessary to change the settings of the Host#2 to access SFP-Modem#2 again.

You can check the configuration after re-establishing of Telnet connection to the SFP modems:

In Menu Configuration Management (CM) of the SFP modem, you can type NETCONFIG to check the configuration.

SFP-Modem#1:

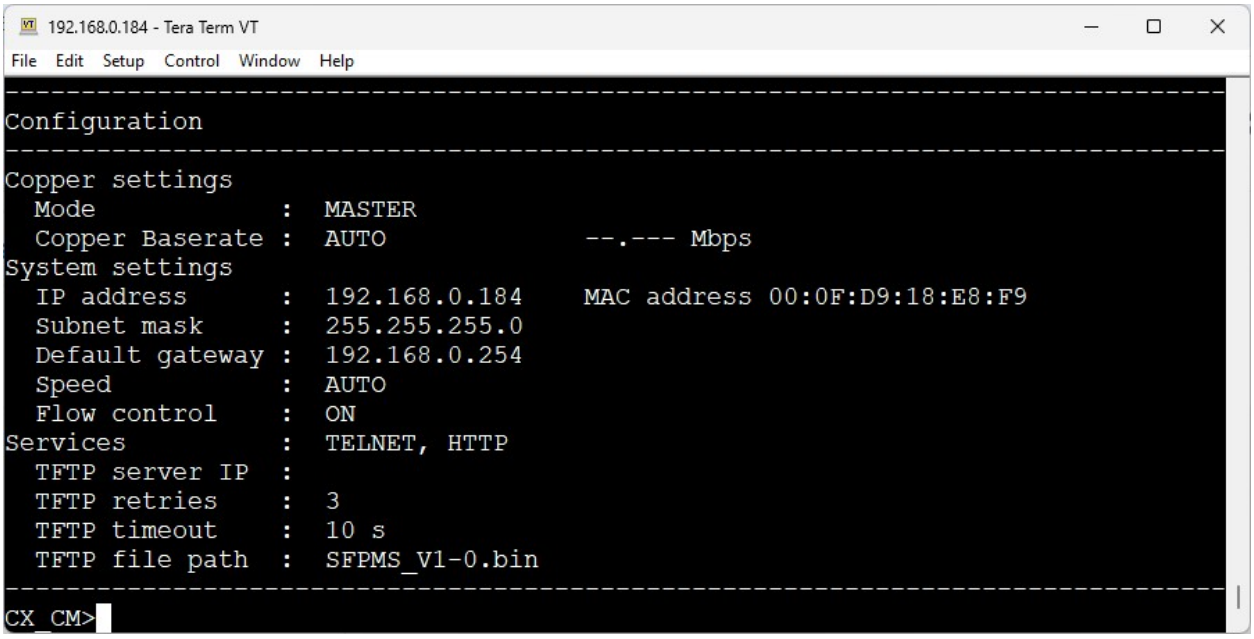


FIGURE 3.14 EXAMPLE CONFIGURATION OF MASTER MODEM IN AUTO RATE MODE (TELNET)

SFP-Modem#2:

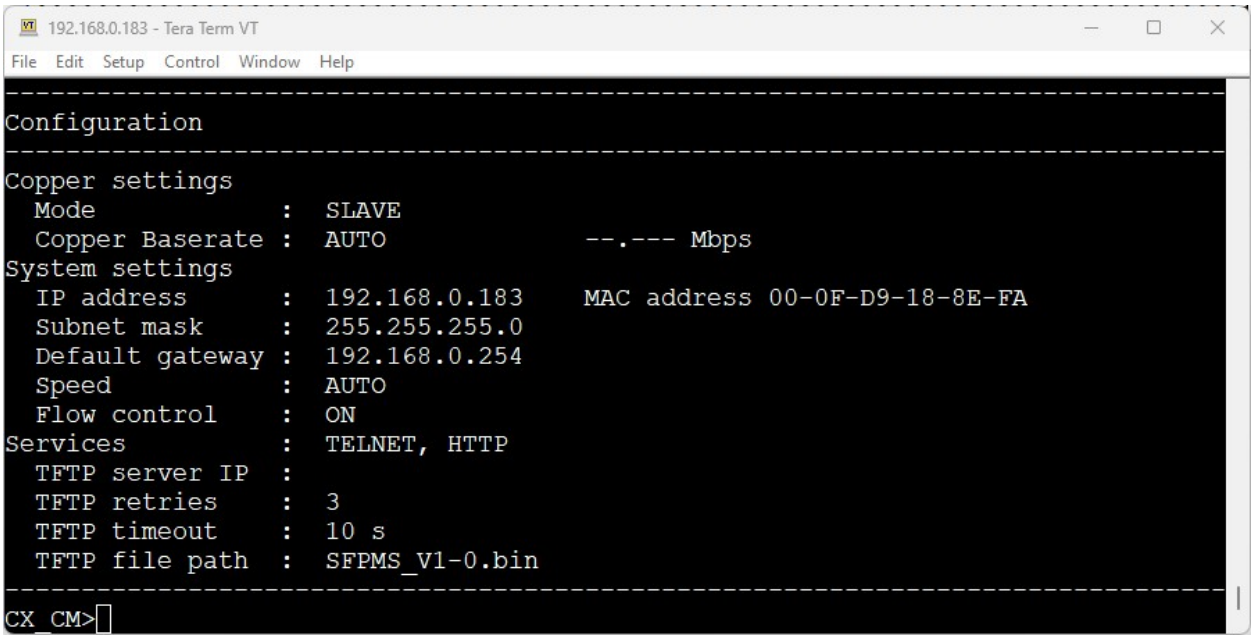


FIGURE 3.15 EXAMPLE CONFIGURATION OF SLAVE MODEM IN AUTO RATE MODE (TELNET)

3.3.6 Configuring Auto Rate Mode via WEB

SFP-Modem#1:

4. Enter to SFP-Modem#1 via WEB, then configure the following parameters in CONFIGURATION screen and click **Save** button:

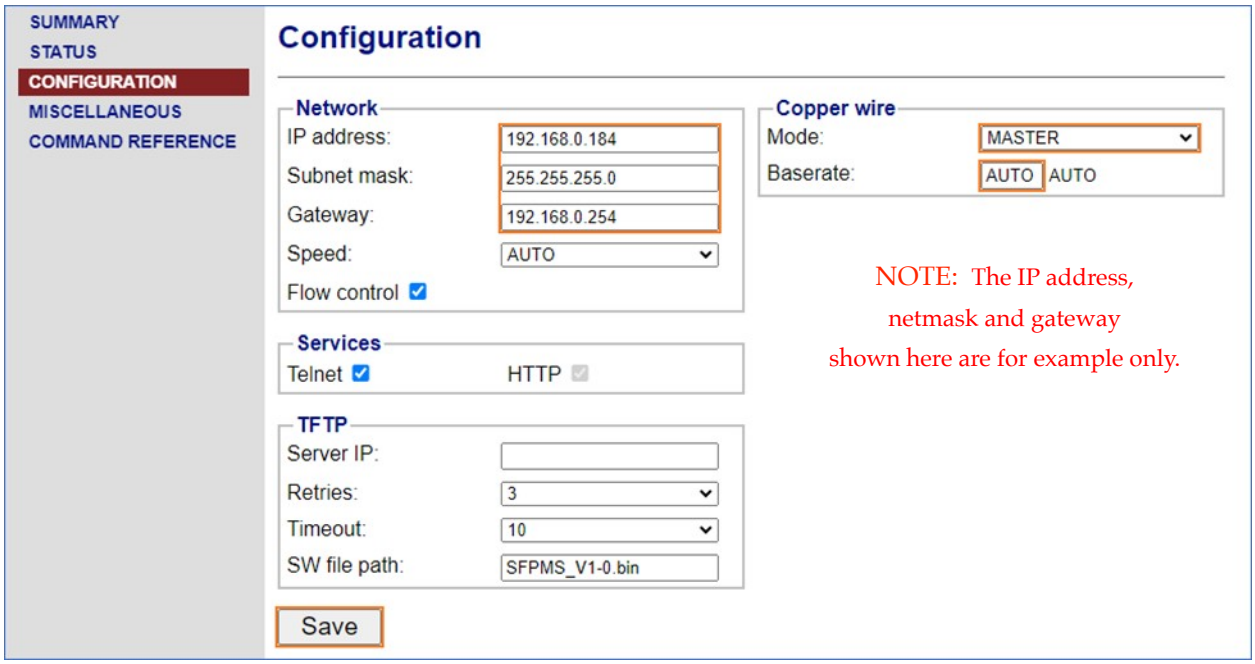


FIGURE 3.16 CONFIGURING OF MASTER MODEM IN AUTO RATE MODE (WEB)

5. Click **Apply** button:

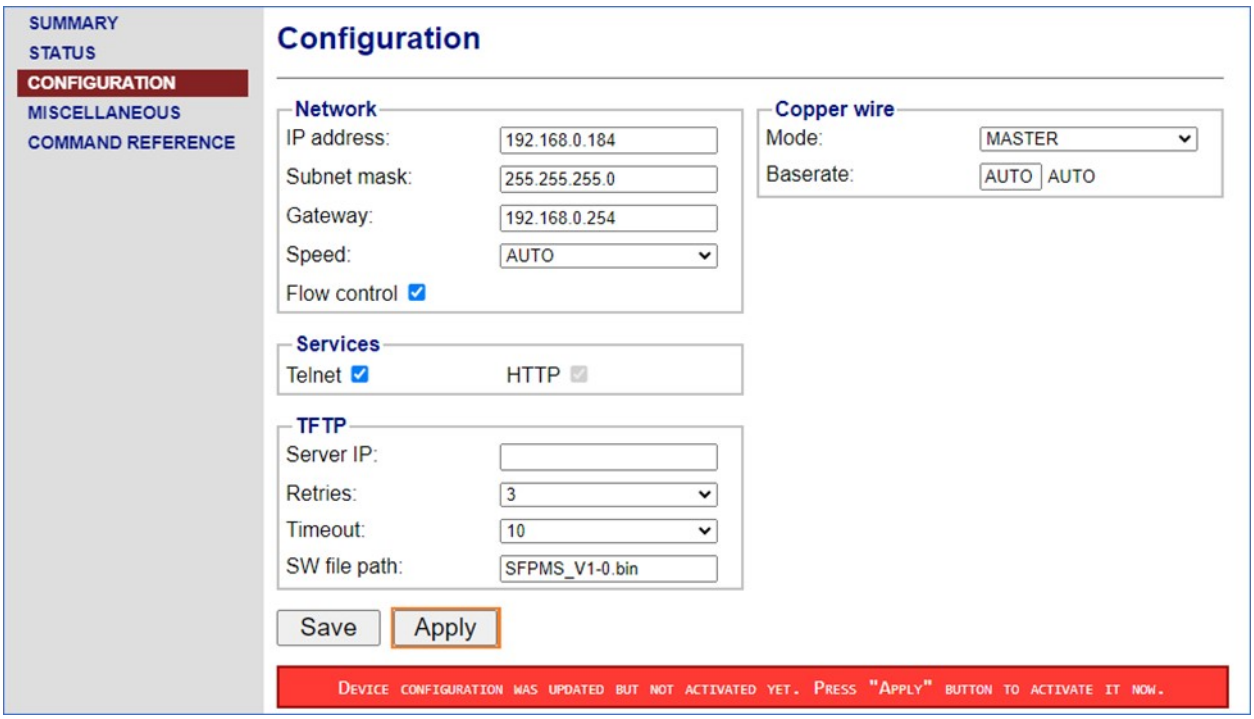


FIGURE 3.17 APPLYING OF THE CONFIGURATION (WEB)

6. The SFP modem will restart and the WEB-page will become unavailable. Because IP address, netmask and gateway of the SFP-Modem#1 were changed, it might be necessary to change the settings of the Host#1 to access SFP-Modem#1 again.

SFP-Modem#2:

5. Enter to SFP-Modem#2 via WEB, then configure the following parameters in CONFIGURATION screen and click **Save** button:

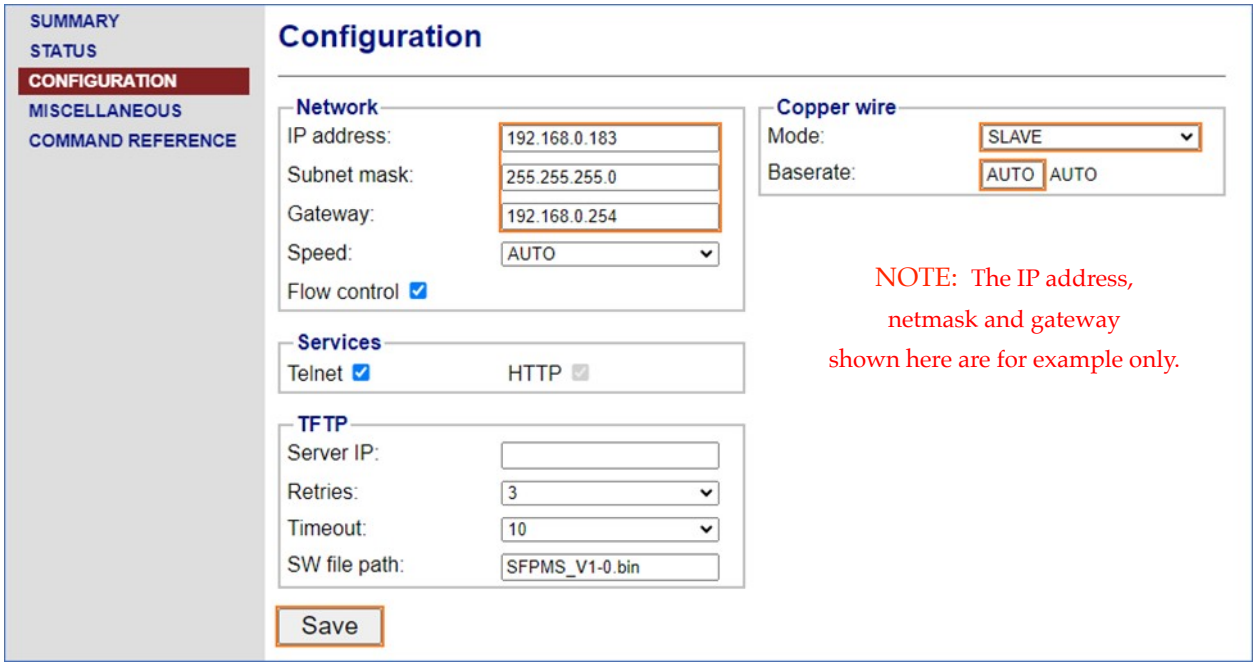


FIGURE 3.18 CONFIGURING OF SLAVE MODEM IN AUTO RATE MODE (WEB)

6. Click **Apply** button:

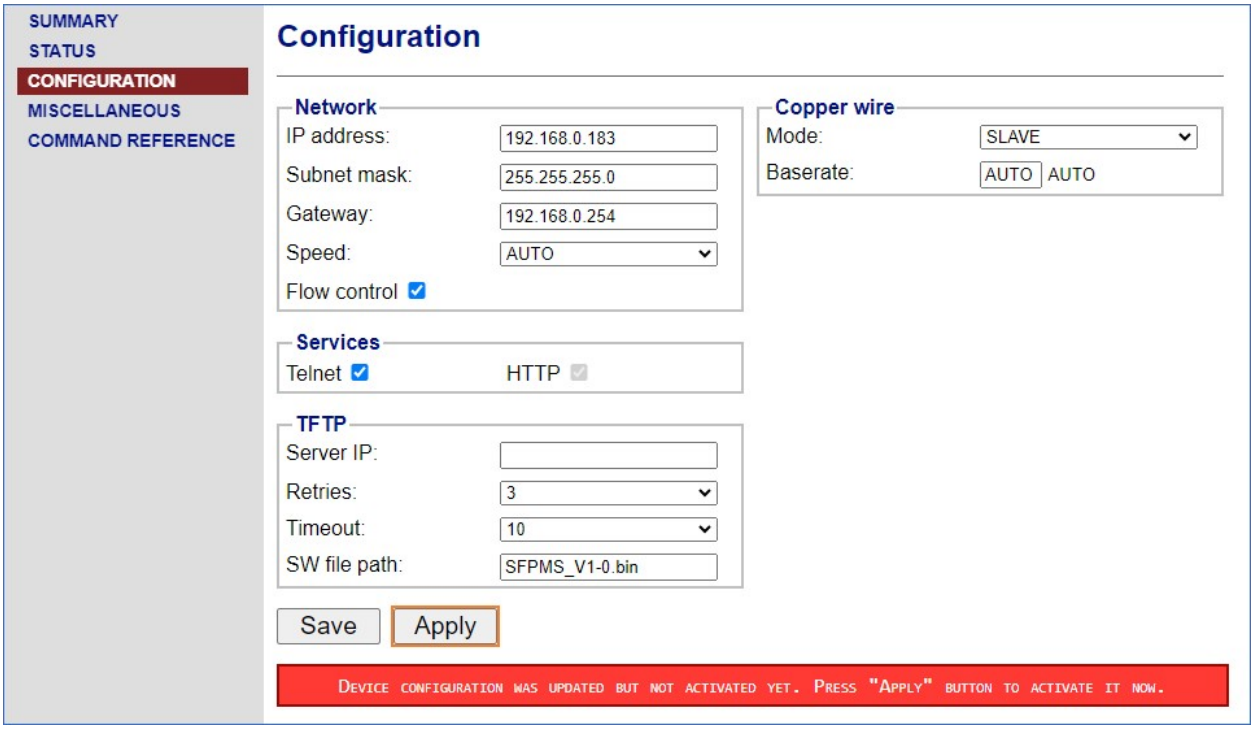


FIGURE 3.19 APPLYING OF THE CONFIGURATION (WEB)

7. The SFP modem will restart and the WEB-page will become unavailable. Because IP address, netmask and gateway of the SFP-Modem#2 were changed, it might be necessary to change the settings of the Host#2 to access SFP-Modem#2 again.

You can check the configuration after re-establishing of WEB connection to the SFP modems:

SFP-Modem#1:

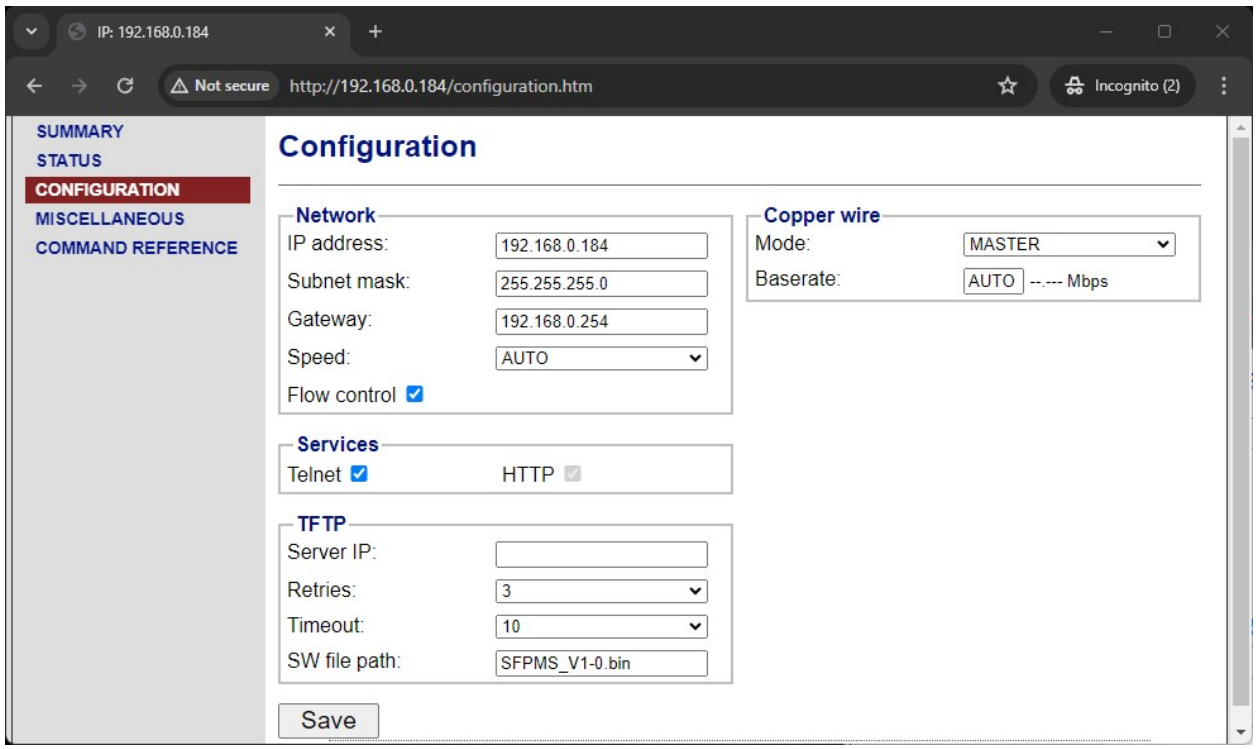


FIGURE 3.20 EXAMPLE CONFIGURATION OF MASTER MODEM IN AUTO RATE MODE (WEB)

SFP-Modem#2:

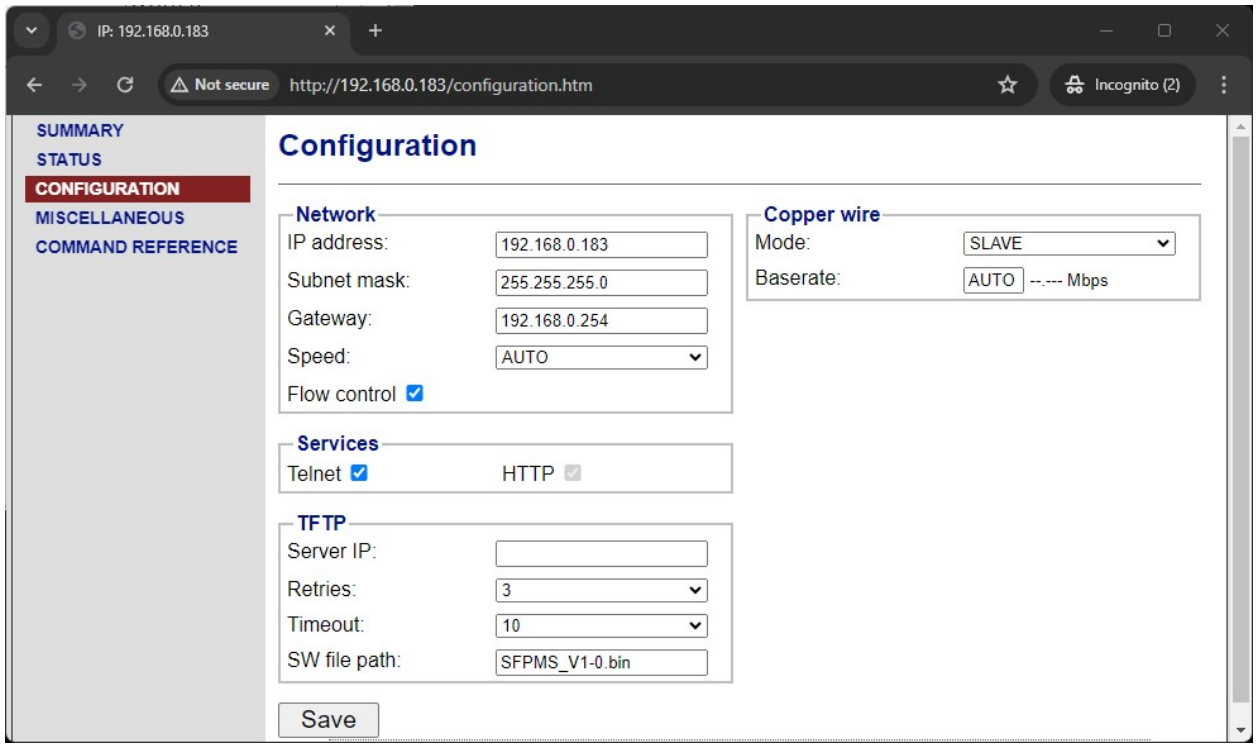


FIGURE 3.21 EXAMPLE CONFIGURATION OF SLAVE MODEM IN AUTO RATE MODE (WEB)

3.4 Checking of Link Quality and Baserate adjustment

ATTENTION

- In **Fixed Rate** mode the link is established in 2..10 seconds if line parameters allow it.
- Depending on the line parameters, in **Auto Rate** mode it may take from 30 seconds to 3 minutes to establish a link.
- **The better the line parameters, the faster the connection will be established.**

1. After link establishing, check the transmission status of the devices. To do this, enter the STATUS command in the second menu of the Telnet session or switch to the Status screen in the WEB interface:

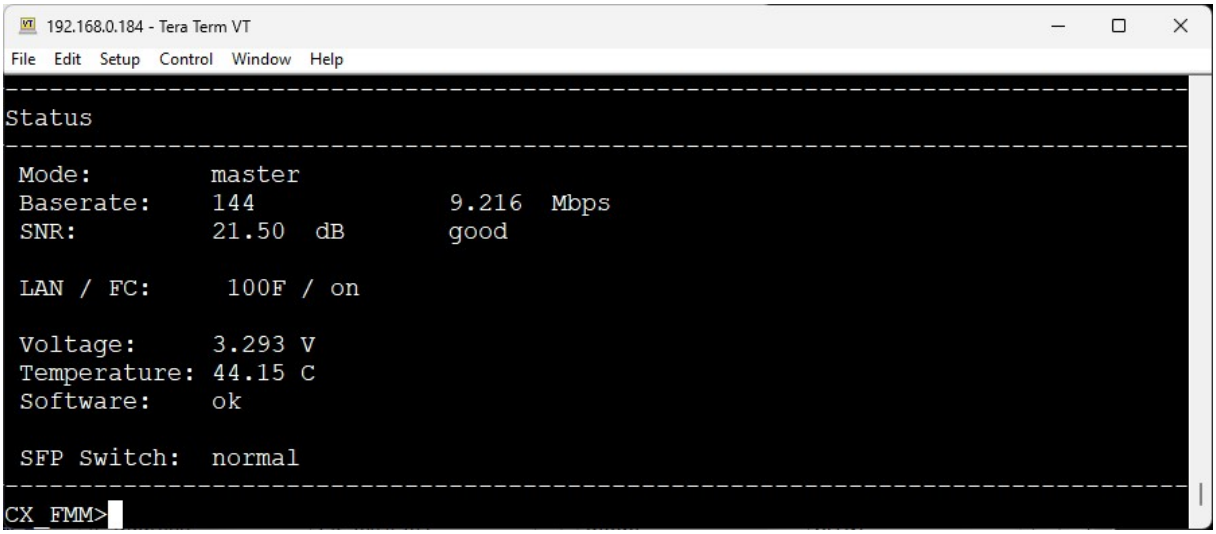


FIGURE 3.22 STATUS COMMAND (TELNET)

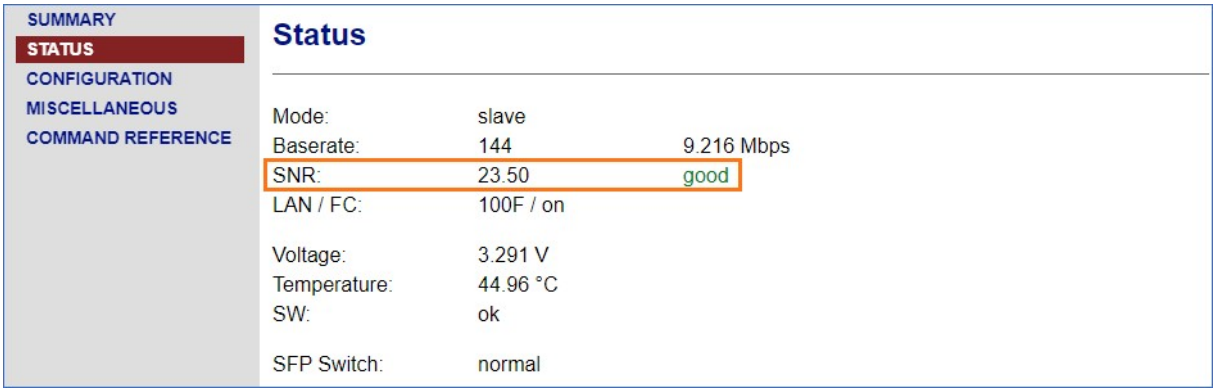


FIGURE 3.23 STATUS SCREEN (WEB)

2. Check if the SNR value is at least 20.5 and the link quality indicates “good”.
   - If SNR is less than 20.5 and connection quality indicates "marginal" or "poor" on either Master or Slave side, then decrease connection Baserate by 10%. Wait until connection is established, then check Status again.
   - If SNR is constantly greater than 23 on both, Master and Slave sides, you may try to increase the Baserate on 10%. Wait until connection is established, then check Status again. If the link quality is not “good”, then return to the previously achieved Baserate.

3. **After the optimal Baserate is reached, at which the link quality is stably "good", it is recommended set a fixed Baserate for both, Master and Slave modem.** This will allow modems in the future to quickly restore the link in case of connection loss.

3.5 Approximate transmission range

The real transmission distance may differ from the data in the table below, because of:

- noisy environment or multi-pair cable with additional disruptive services
- differences in cable values (bandwidth, crosstalk etc), just same diameter
- bad installation, cables are not twisted, not using a paired cable

Cable Type	Wire Diameter	Distance (Meter) @ speed:					
		1536 kbps	4352 kbps	7168 kbps	10000 kbps	14016 kbps	18048 kbps
Cable U72 (installation cable)	0.4mm, AWG-26	1600	1100	950	800	650	450
Cable U72 (installation cable)	0.5mm, AWG-24	2100	1400	1100	950	750	500
Cable U72 (installation cable)	0.8mm, AWG-20	3800	2500	2100	1800	1400	1000
Siemens 6XV1830-5EH10 (PROFIBUS cable)	1.0mm, AWG-18	6200	4100	3400	2900	2300	1600

TABLE 3.6 BASERATE SETTINGS AND TRANSMISSION DATA RATE

3.6 Problem with CopperLink SFP Modem

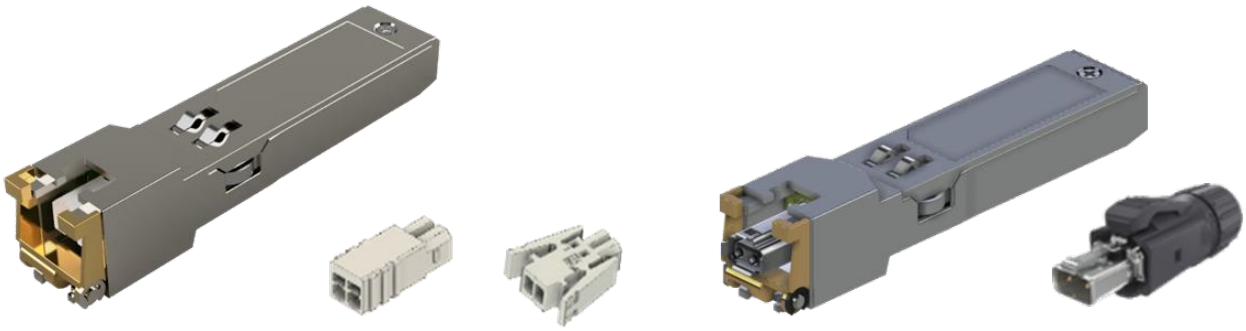
If you have a problem with the **CopperLink** SFP modems, please send following details to your Patton support contact:

- Application Description
- Main Menu picture (Telnet session) or SUMMARY screen (WEB interface) of every modem
- Configuration and status of every modem: perform the SFPVIEW command and save its output into txt-file

4 Technical Description

4.1 Description of CopperLink SFP Modems

The **CopperLink** CL-SFP copper wire modems are available as a Small Form-factor Pluggable (SFP) device. There are two models with different line connectors (see also Selection Guide):



CL-SFP/XC CL-SFP/SPE

FIGURE 4.1 COPPERLINK CL-SFP MODEM

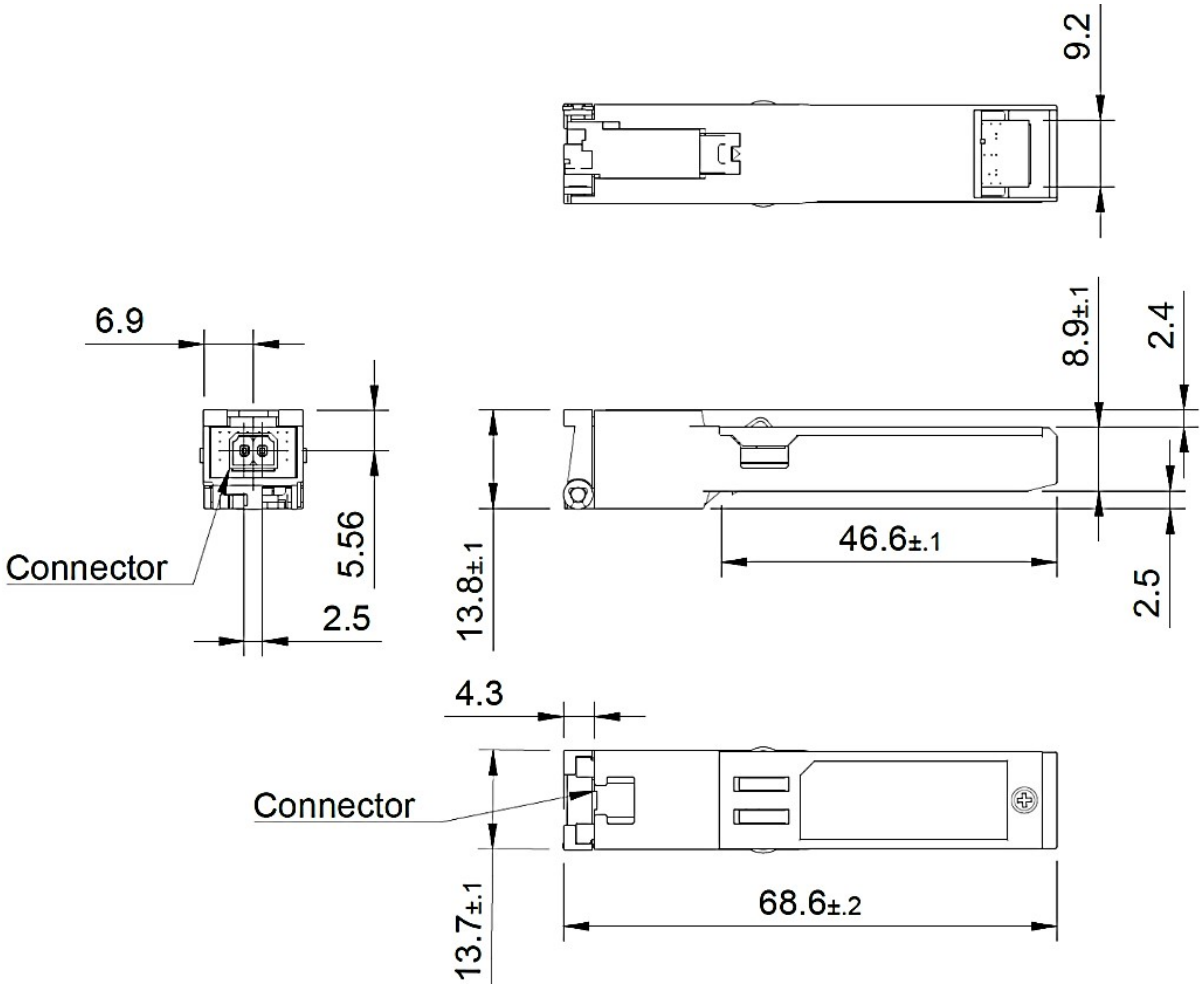


FIGURE 4.2 CL-SFP/XC DIMENSIONS

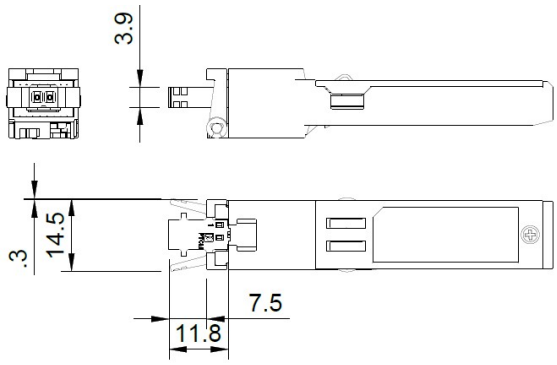


FIGURE 4.3 CL-SFP/XC WITH CONNECTOR 1015464

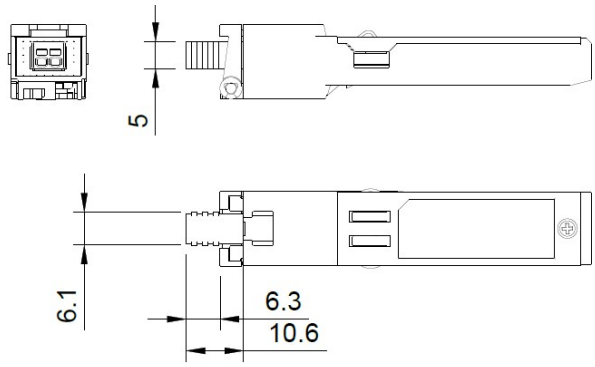


FIGURE 4.4 CL-SFP/SPE WITH CONNECTOR 1704853

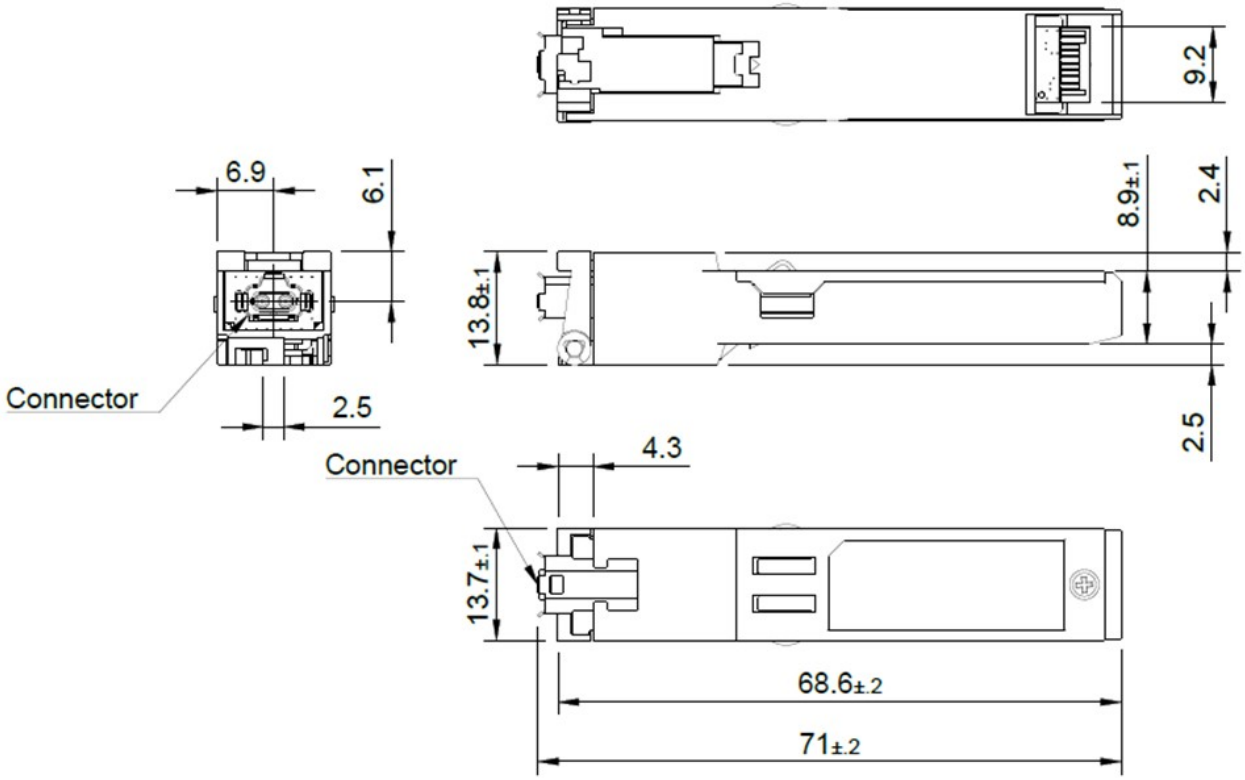


FIGURE 4.5 CL-SFP/SPE DIMENSIONS

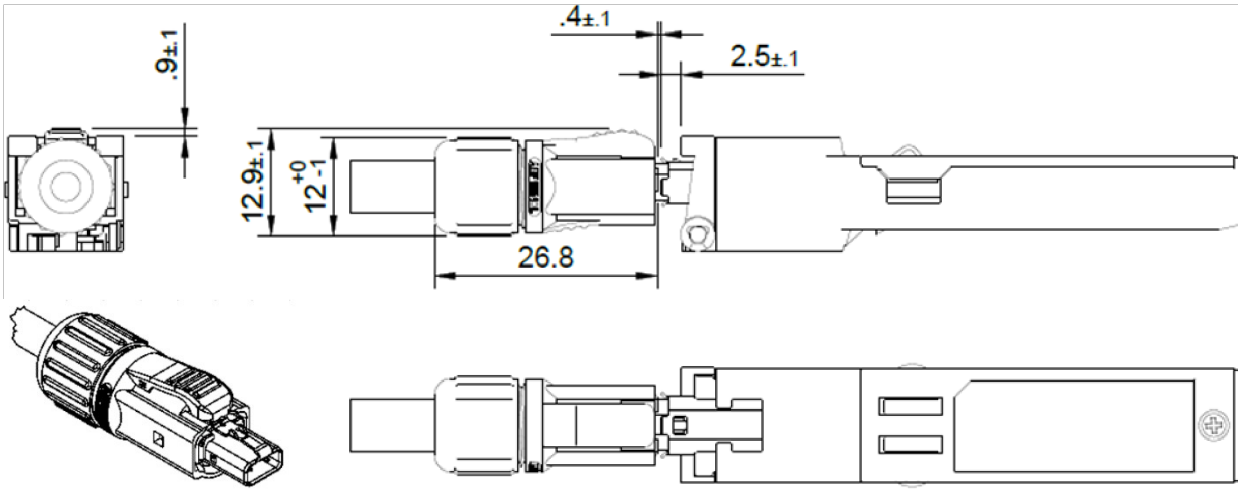


FIGURE 4.6 CL-SFP/SPE WITH CONNECTOR MSPE-P2L0-2A0XX

4.2 Interface Description

4.2.1 Copper Wire modem Interface

The **CopperLink** SFP modem has a single modem interface that provides full-duplex connectivity at speeds in the range of 1536..18048 kbps over a pair of copper wires. The transmission speed is defined by Baserate parameter and can be selected with the steps of 64kbps. To select the Transmission Rate, use the BASERATE command in Telnet or set the Baserate parameter on the WEB interface Configuration screen.

Baserate	Transmission Data Rate
24..282	Baserate*64kbps=1536..18048kbps

Table 4.1 Baserate settings and transmission Data Rate

The **CopperLink** SFP modem uses the Pulse Amplitude Modulation (PAM) technology.

4.2.1.1 Master/Slave

To establish a connection, it is necessary that one SFP modem is configured as Master and the other as Slave. In this case, the connection is controlled by the Master modem.

In case both modems are set to the same mode, the mode of one modem might be changed automatically during handshake process. Despite this, it is recommended to set one modem to Master mode and the other to Slave mode, as this will reduce the connection establishment time.

The Factory Default setting is Master.

4.2.1.2 Fixed and Auto Rate Modes

The **CopperLink** SFP modems can operate in Fixed and Auto Rate Modes.

4.2.1.2.1 Fixed Rate Mode

The SFP modem will operate in Fixed Rate Mode if the Baserate parameter is set as an integer from the range 24..282. In this case, the modem will primarily try to establish a connection at a speed of Baserate*64 kbps.

If both SFP modems are in Fixed Rate Mode with the same Baserate, then establishing a connection usually takes within 2..10 seconds. The line parameters must allow link establishing with the specified Baserate, otherwise the communication will not be established.

If both modems are set to Fixed Rate Mode, but with different Baserate, then the communication will not be established.

4.2.1.2.2 Auto Rate Mode

The Auto Rate Mode is activated by setting Baserate parameter to AUTO.

If both modems in a link are set to Auto Rate Mode, the connection will be established at the highest possible speed that will ensure a stable connection.

If Master modem is set to Fixed Rate Mode and the Slave is set to Auto Rate Mode, the connection rate will be defined by the Master modem. However, line parameters must allow link establishing with the specified Baserate, otherwise the communication will not be established.

If Master modem is set to Auto Rate Mode then the Slave modem must be set to Auto Rate too.

Using of Auto Rate Mode will increase the link establishing time; depending on the line parameters it may take from 30 seconds to 3 minutes.

The Factory Default setting is Auto Rate Mode.

4.2.1.3 Link Quality Monitoring

The Signal to Noise Ratio (SNR) provides qualitative performance information of a specific link and can be used during installation and maintenance procedures. The SNR value and link quality indicator are shown by STATUS command in the Telnet session or on the Status screen in the WEB interface:

```
CX_FMM>STATUS
--------------------------------------------------------------------------------
Status
--------------------------------------------------------------------------------
 Mode:         slave
 Baserate:     144              9.216  Mbps
 SNR:          22.00  dB        good

 LAN / FC:      100F / on

 Voltage:      3.292 V
 Temperature: 44.68 C
 Software:     ok

 SFP Switch:  normal
--------------------------------------------------------------------------------
CX_FMM>
```

FIGURE 4.7 SNR VALUE AND LINK QUALITY INDICATOR (STATUS COMMAND, TELNET SESSION)

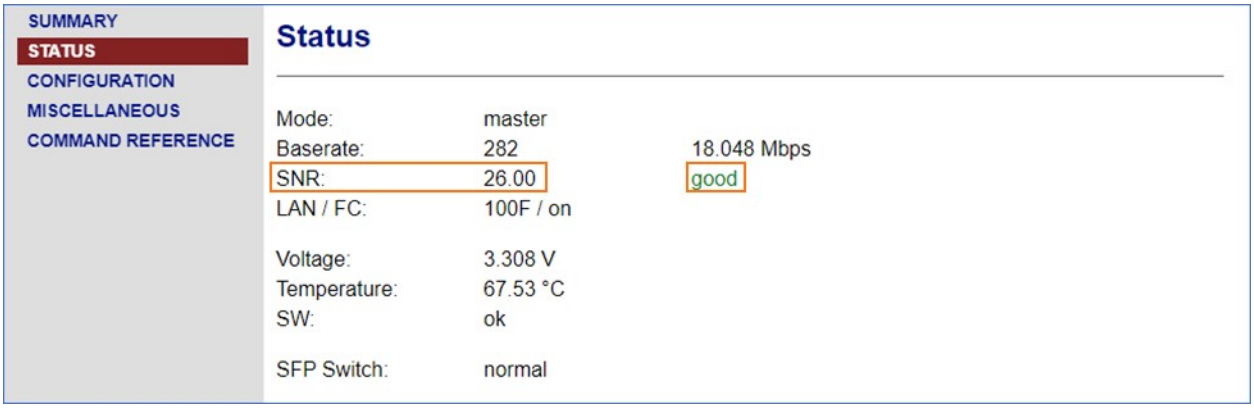


FIGURE 4.8 SNR VALUE AND LINK QUALITY INDICATOR (STATUS SCREEN, WEB INTERFACE)

During acceptance testing, it is recommended to set the line rate or choose cable pairs (at a fixed line rate) so that the SNR value is at least 20.5 dB (link quality must indicate “good”).

4.2.1.4 Fast Link Recovery

In case of link interruption , the device will first try to re-establish the connection using the internal settings of the copper transceiver with which the previous connection was established. Thus, in case of short, less than 2 seconds, transmission losses caused by such phenomena as over voltage spikes, short interruptions or short cuts caused by over voltage protection, the connection will be re-established in 2..10 seconds, without using the full handshake procedure.

If the fast link recovery fails, device will reset the parameters of the copper interface and start a new handshake procedure, according to device configuration settings.

Please refer to the Table 3.1 in Chapter 3.3.2.

4.2.1.5 Automatic Active Remote Device Detection

The SFP modem automatically detects the presence of an active device on the remote side of the line. If there is another active SFP modem on the remote side, the SFP modem starts the handshake procedure.

If the SFP modem cannot detect the presence of an active remote device, it will wait until to appear, and a cable problem message will be displayed on the STATUS command in the Telnet session or on the Status screen of the WEB interface:

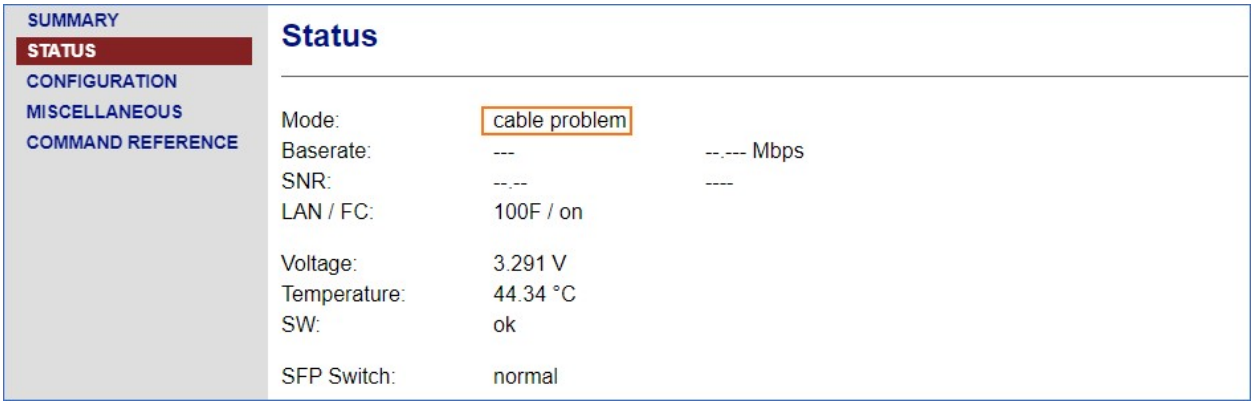


FIGURE 4.9 CABLE PROBLEM MESSAGE (STATUS SCREEN, WEB INTERFACE)

The appearance of the "cable problem" message may mean:

- cable break

- short circuit in the cable
- remote module is not connected to the line
- no power supply to the remote module
- too much resistance (length) of the cable

4.2.2 Ethernet Interface (SFP Host Interface)

The Ethernet interface of **CopperLink** SFP modem fulfill the standard IEEE 802.3. The SFP supports operation in any 100BASE-FX or 1000BASE-X Host Equipment (Switch, Router etc.) The SFP modem supports 100BASE-FX/1000BASE-X automatic adjustment.

The SFP Ethernet interface operates in a mixed (hybrid) mode, i.e., tagged and untagged traffic is allowed, which is transmitted over a copper link to the remote side. Only control packets (Telnet or WEB) intended for the internal microcontroller are switched to it by the internal switch.

4.2.3 Alarm Description

The alarm status is indicated in the Main Menu of the Telnet session and on the Summary screen of the WEB interface:

```
MODEL CL-SFP/XC
HW    01AA
SW    1.0
DATE  23-04-2024
RUNS  0d 00:15:49
ALARM NOT URGENT (SW)
MODEL_DESC CL-SFP/XC  100BASE-FX 1000BASE-X/Copper 1.536-18.048 Mbps
IP    192.168.0.182


------------- Main Menu -----------------
2.  Fault and maintenance management (FMM)
3.  Configuration management (CM)
5. Exit
-----------------------------------------
Select [1..5]
CX_MM>
```

FIGURE 4.10 ALARM STATUS STRING IN THE MAIN MENU (TELNET SESSION)

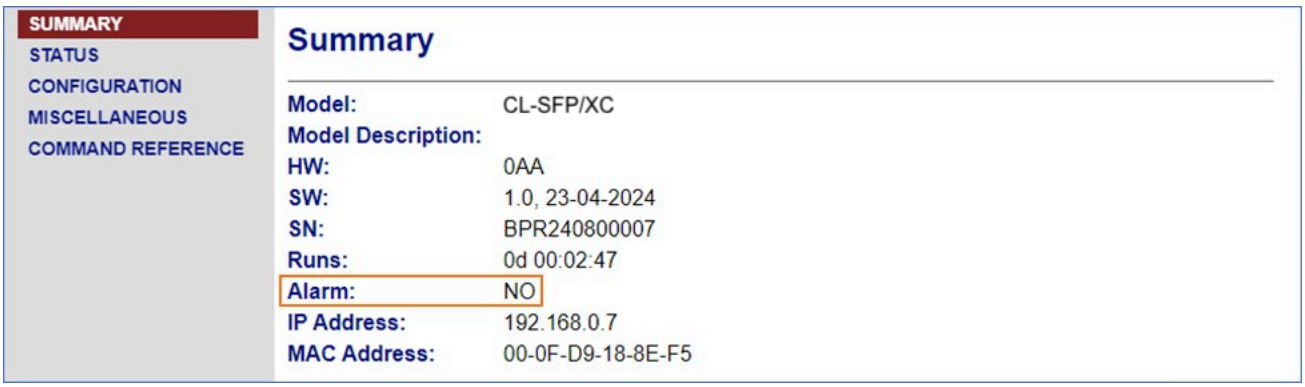


FIGURE 4.11 ALARM STATUS STRING ON THE SUMMARY SCREEN (WEB INTERFACE)

Name	Alarm status	Description
SW	Non-urgent	One of the software banks is not programmed
LNK	Urgent	Copper Wire link is not established

TABLE 4.2 COPPERLINK SFP MODEM ALARMS

4.3 Management of CopperLink SFP Copper Wire Modem

The **CopperLink** SFP modems have integrated management and diagnostic functionality. The access to this functionality is possible via IP network by accessing over Telnet or by using the WEB interface.

The management and diagnostic functionality are used to configure the modems and to receive additional information like link quality.

For security purposes, you can disable Telnet and/or WEB access after configuring. If both, Telnet and WEB are disabled, then it will be necessary to reset the SFP modem to its factory settings to restore access . This can be done by using the switch, described in Chapter 3.1 above.

4.3.1 Default IP Address

The default IP address for the **CopperLink** SFP modem is 192.168.0.1.

4.3.2 Telnet

The **TELNET** (TELecommunication NETwork) access is made through the Ethernet network. With any computer and a program with the Telnet protocol **CopperLink** SFP modems can be fully managed.

Open the Telnet session, press Enter and the modem main menu is displayed:

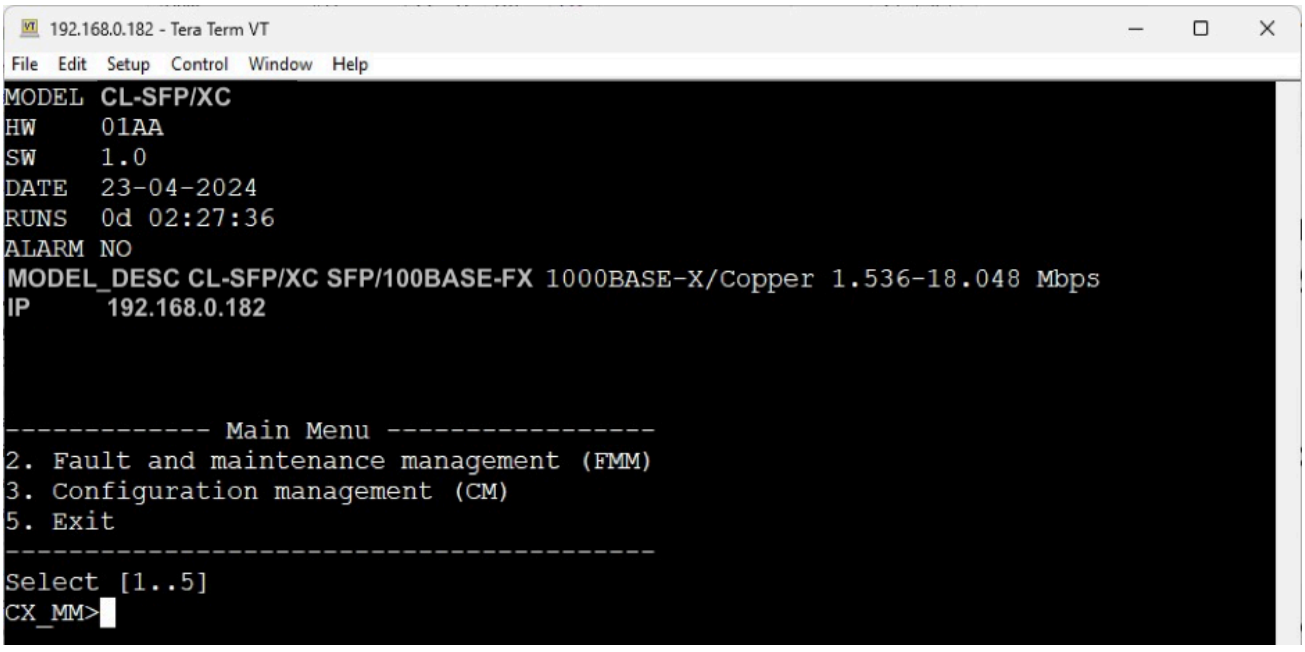


FIGURE 4.12 MAIN MENU (TELNET SESSION)

If no symbols are received by the SFP modem over the telnet connection within 5 minutes, this session breaks.

4.3.3 WEB

The WEB interface is used to display status and to do configuration. Any WEB browser can be used to access the WEB interface. To enter SFP WEB interface, you should enter the command: **http://X.X.X.X** in the WEB browser. (X.X.X.X is the IP-address of the modem).

After the connection is established, the Summary screen appears and it is possible to check the status and/or change the configuration:

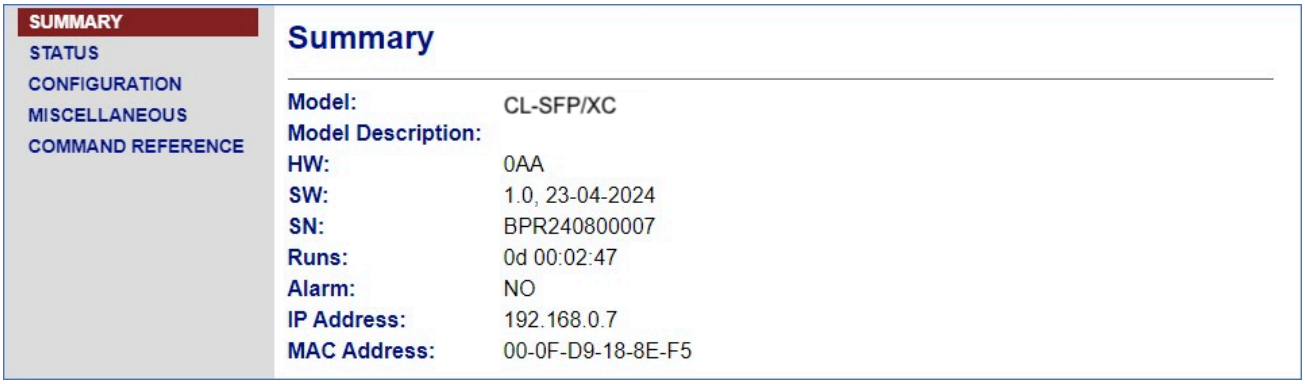


FIGURE 4.13 SUMMARY SCREEN (WEB INTERFACE)

The WEB interface has following tabs: Status, Configuration, Miscellaneous and Command Reference. Select in the left part of the window to display the necessary table.

The Status table is displayed dynamically and refreshed every 5 seconds:

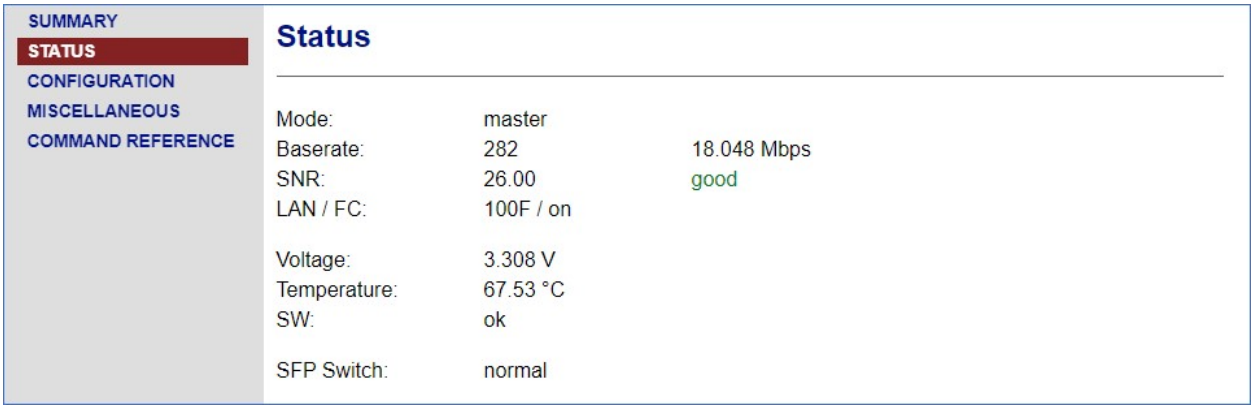


FIGURE 4.14 STATUS SCREEN (WEB INTERFACE)

On the configuration screen, you will find the configuration options. If you need clarification on any setting, please refer to the Command Reference. After changing the configuration, you must press the **Save** button. To apply configuration changes and to store them, press the **Apply** button. SFP will restart with new configuration.

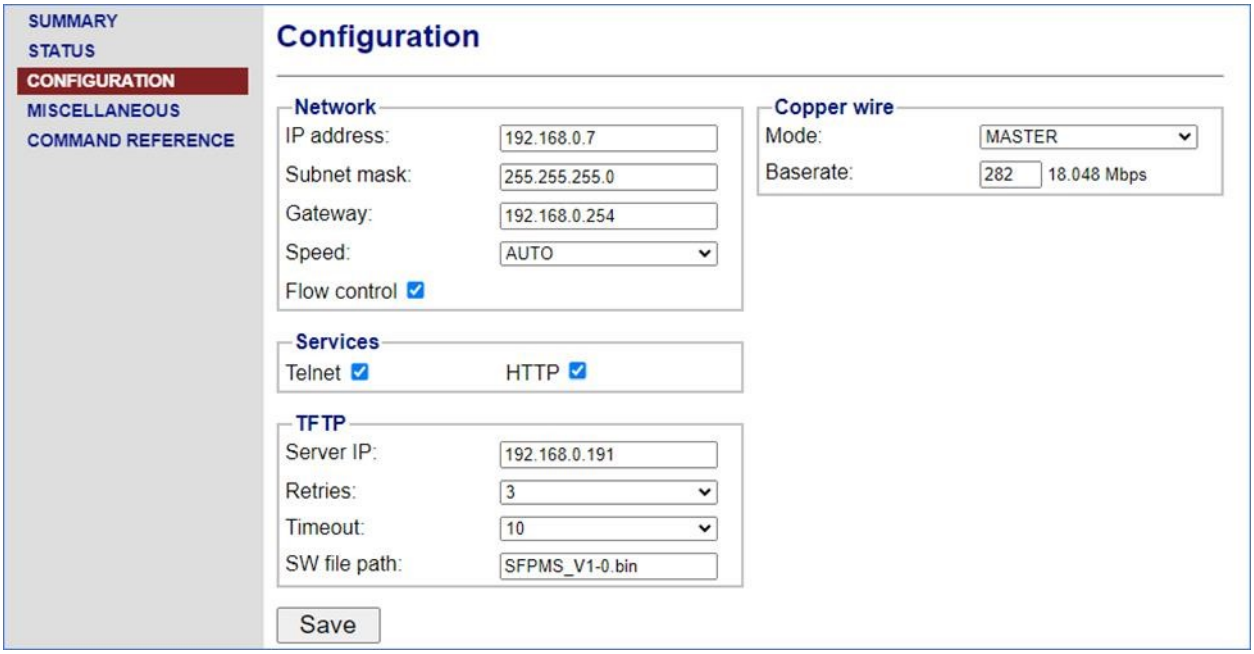


FIGURE 4.15 CONFIGURATION SCREEN (WEB INTERFACE)

On the Miscellaneous screen you will find some important control possibilities like “Factory Default”, “Restart” and “TFTP SW Update” buttons. There is also a section for selecting an active software bank:

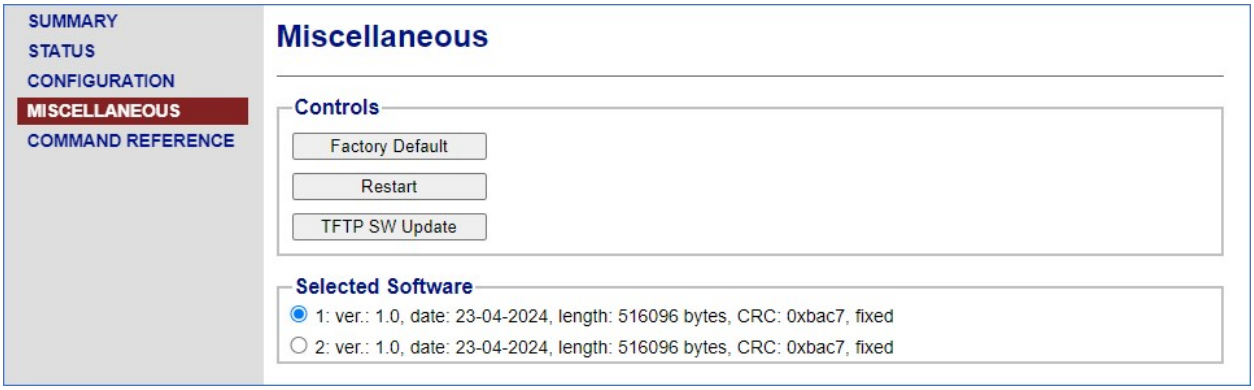


FIGURE 4.16 MISCELLANEOUS (WEB INTERFACE)

5 Diagnostic And Control/Status Fields Memory Map

The SFF-8472 specification (Management Interface for SFP+) defines an enhanced memory map with a digital diagnostic monitoring (DDM) interface for SFP transceivers that allows pseudo real time access to device operating parameters. It defines a 256 bytes memory map which is accessible over a 2-wire serial interface at the 8-bit address 1010000X (A0h), the ID fields. The digital diagnostic monitoring interface makes use of the 8-bit address 1010001X (A2h).

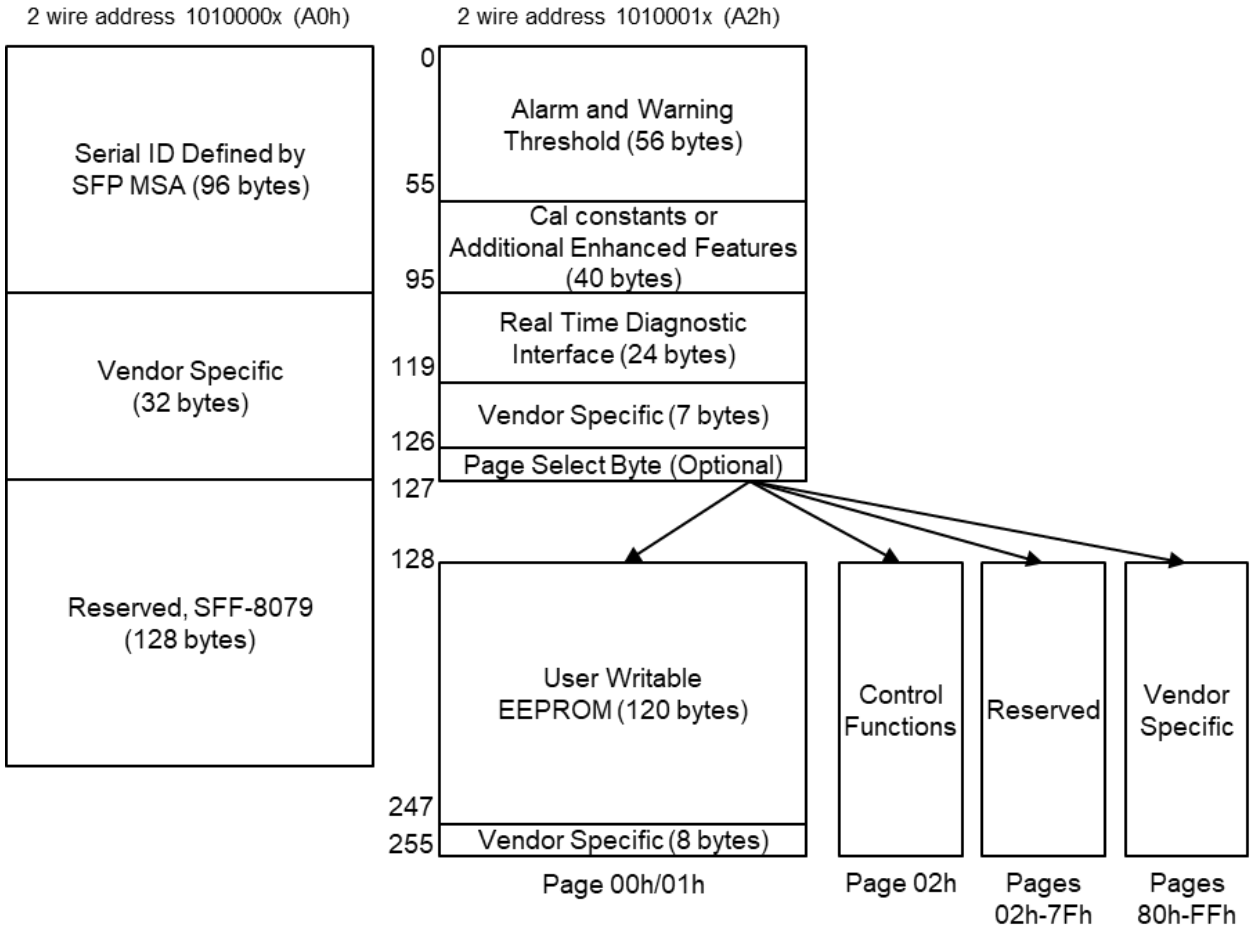


FIGURE 5.1 DIGITAL DIAGNOSTIC MEMORY MAP SPECIFIC DATA FIELD DESCRIPTIONS

Address	Name	Content (Hex)	Description
0	Identifier	03	SFP
1	Ext. Identifier	04	SFP function is defined by 2-wire interface ID
2	Connector	00	Unspecified
3-10	Transceiver	00 00 00 00 00 00 40 00	Twisted Pair (TP)
11	Encoding	00	Unspecified
12	Signaling Rate, Nominal	00	Unspecified
13	Rate Identifier	00	Unspecified
14-17	Link length fiber	00 00 00 00	

18	Length copper cable	C8	Minimum 200 meter
19	Supported length copper cable	FA	5800 meters
20-35	Vendor name	46 6C 65 78 44 53 4C 20 20 20 20 20 20 20 20 20	Patton
36	Transceiver compliance	00	Not specified
37-39	Vendor OUI	00 0F D9	00 0F D9
40-55	Vendor PN	43 4F 50 53 46 50 4D 53 50 41 4D 20 20 20 20 20	CL-SFP/XC
56-59	Vendor rev	31 2E 30 20	1.0
60-61	Wavelength	00 00	
62	Fiber Channel Speed 2	00	
63	CC_BASE	xx	Check code for Base ID Fields (addresses 0-62)
64-65	Options	00 12	TX_DISABLE and Loss of Signal implemented
66	Signaling Rate, max	00	Unspecified
67	Signaling Rate, min	00	Unspecified
68-83	Vendor Serial Number	xx	
84-91	Date code	yy yy mm mm dd dd 20 20	Year yy yy, Month: mm mm, Day: dd dd, Lot:
92	Diagnostic Monitoring Type	20	Internally calibrated
93	Enhanced Options	00	
94	SFF-8472 Compliance	09	Includes functionality described in Rev 12.4 of SFF-8472
95	CC_EXT	xx	Check code for the Extended ID Fields (addresses 64-94)
96-106	Vendor Specific	xx	CL-SFP
107-118	Vendor Specific	xx	Manufacturer/Year/Week/SerialNumber
119-124	Vendor Specific, MAC-address	00 0F D9 xx yy zz	00:0F:D9:xx:yy:zz
125-127	Vendor Specific		Unspecified
128-255	Reserved		

TABLE 5.1 BASE/EXTENDED ID FIELDS, ADDRESS A0H

Address	Name	Content (Hex)	Description
0-119	Standard DDM values	00	Unspecified
96	Temperature MSB	xx	Internally measured temperature, according SFF-8472
97	Temperature LSB	xx	Internally measured temperature, according SFF-8472
96	Supply Voltage MSB	xx	Internally measured supply voltage, according SFF-8472
97	Supply Voltage LSB	xx	Internally measured supply voltage, according SFF-8472
120	SW Version MSB	zz	Value zz.yy
121	SW Version LSB	yy	Value zz.yy
122	RX SNR MSB	zz	Value in dB zz.yy
123	RX SNR LSB	yy	Value in dB zz.yy
124	TX Voltage	00 or 01	0 = 1.2V_{p2p}, 1 = 2.4V_{p2p}

125-126	Vendor Specific	00	Unspecified
127	Optional Page Select	00	

TABLE 5.2 DIAGNOSTIC AND CONTROL/STATUS FIELDS, ADDRESS A2H

6 Programming Guide

6.1 Command Structure

Main Menu		
PM Performance management	Fault and maintenance **FMM** management	Configuration **CM** management
	SFPVIEW	MASTER
	RESET	BASERATE
	SERNUM	ETHSD
	SOFTUPDATE	FC
	SOFTINFO	GATEWAY
	STATUS	NETCONFIG
	TFTP SOFTUPDATE	NETMASK
	M(AIN)	SETIP
	H(ELP)	TFTPIP
		TFTP RETRIES
		TFTP TIMEOUT
		TFTP FILEPATH
		TELNET ON/OFF
		HTTP ON/OFF
		SOFTSELECT 1/2
		FACTORY DEFAULT
		APPLY
		M(AIN)
		H(ELP)

TABLE 6.1 COMMAND STRUCTURE ACCORDING TO ITU-T REC. M.3400

(TELECOMMUNICATION MANAGEMENT NETWORKS)

6.2 CopperLink Software

The **CopperLink** SFP modem stores up to two software copies in the memory (EEPROM): one active software (which is working) and one upgradeable software. Device is always start from the active software. User can switch the device between software banks by using SOFTSELECT command in CLI or by selecting a corresponding radio-button in Miscellaneous tab in WEB.

After selecting of another software bank, the unit restarts from newly selected software. This software becomes active, while another software bank becomes upgradable.

User can download a new software version into upgradable software bank by using 1K-XMOEM or TFTP protocols, see Chapter 7 Software download.

During upgrade, the downloaded software overwrites the upgradeable software. After successful download, a message appears that the SW was loaded successfully and user can use SOFTSELECT command to activate the downloaded software.

If downloading was interrupted or there was a failure in the data transmission, a message is displayed. The SOFTINFO command in CLI or Miscellaneous tab in WEB show that no valid software is loaded. In this case a new attempt of downloading can be performed by user.

6.3 Configuration and Application Storage

The device has three configurations: running configuration, startup configuration and a new configuration.

The **running configuration** contains all configuration values guarantee the current operation of the modem. If two modems have the same version of the software and the same running configuration they should operate equally. The running configuration is stored in the RAM of the modem. The current parameters determine the operation until the next restart or any actions on the running configuration (storage and etc.). During initialization, the initial parameters of the running configuration are loaded from the startup configuration.

The **startup configuration** contains all configuration values which will be used to configure the modem after its restart. The startup configuration is stored in EEPROM and is used to initialize the running configuration during the system start-up.

The **new configuration** stores changes in configuration parameters. The new configuration is stored in the modem RAM. After setting all necessary changes, the system administrator applies changes, and new configuration values are written from the new configuration into the running and startup configurations.

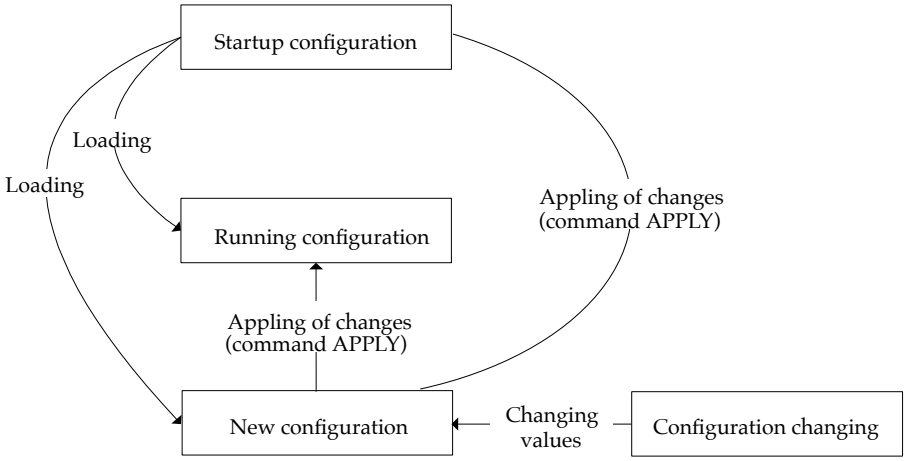


FIGURE 6.1 OPERATIONS OF CONFIGURATION PARAMETERS THAT SHOULD BE CONFIRMED

6.4 Command Syntax

The following rules are used to describe commands:

- parameters in angular brackets **< >** are obligatory
- parameters in direct brackets **[ ]** are not obligatory
- the symbol (**/**) between parameters requires to enter one of the listed parameters

- in real commands brackets and vertical line are not entered, they are used for description
- after the command is typed, press **<enter>**

6.5 Commands

6.5.1 Main Menu

The main menu is presented as shown below:

```
MODEL CL-SFP/XC
HW    01AA
SW    1.0
DATE  23-04-2024
RUNS  0d 00:15:49
ALARM NOT URGENT (SW)
MODEL_DESC CL-SFP/XC   100BASE-FX 1000BASE-X/Copper 1.536-18.048 Mbps
IP    192.168.0.182



------------- Main Menu -----------------
2.  Fault and maintenance management (FMM)
3.  Configuration management (CM)
5. Exit
-----------------------------------------
Select [1..5] CX_MM>
```

To select the desired sub-menu, type the appropriate number: “2” or “3” and press <enter>.

Type “5” and press <enter> to exit telnet session.

6.5.1.1 System Invitation

The following format of the system invitation is used in all menus: CX_<**sf**>>

sf is the short form of the current menu:

- MM – Main Menu
- FMM – Fault and Maintenance Management
- CM – Configuration Management).

For example: CO_CM> means the modem is in the Master mode and we are in the Configuration Management menu.

6.5.2 General Commands

6.5.2.1 <H> Command

After the <H> command is entered the modem displays the help table.

6.5.2.2 <M> Command

After this command is entered the device jumps to and displays the main menu.

6.5.3 Fault and Maintenance Management Menu

After typing “2” in the main menu and pressing <enter>, the following message is displayed:

```
Fault and maintenance management activated
Enter 'M' to return to MAIN, or 'H' for HELP information

CX_FMM>
```

6.5.3.1 <H> Command

Type **H** and the monitor lists all available commands in the fault and maintenance sub-menu. If you type **H [command]** you will get additional help on [command].

```
-------------------------------------------------------------------------------
Type 'H [command]' to get additional help on [command]
SFPVIEW          Collect status and modem configuration
RESET            Hardware reset of the unit
SERNUM           Show serial number
SOFTUPDATE       Update software
SOFTINFO         List loaded software
STATUS           Show system information
TFTP SOFTUPDATE  Perform maintenance over TFTP
M                Return to Main Menu
H                Show available commands
-------------------------------------------------------------------------------
CX_FMM>
```

6.5.3.2 <SFPVIEW> Command

This is a single command that collects and displays the SFP module configuration, its status in a readable format. It is helpful to get an overview of the modem with just one command:

```
CX_FMM>SFPVIEW
MODEL CL-SFP/XC
HW    01AA
SW    1.0
DATE  23-04-2024
RUNS  0d 00:41:41
ALARM NOT URGENT (SW)
MODEL_DESC CL-SFP/XC    100BASE-FX 1000BASE-X/Copper 1.536-18.048 Mbps
IP    192.168.0.182



------------ Main Menu -----------------
2.  Fault and maintenance management (FMM)
3.  Configuration management (CM)
5. Exit
----------------------------------------
Select [1..5]

1: *  ver.: 1.0, date: 23-04-2024, length: 516096 bytes, CRC: 0xbac7, fixed
2:    ver.: No valid software loaded
FPGA  ver.: 31-10-2023
```

```
--------------------------------------------------------------------------------
Status
--------------------------------------------------------------------------------
 Mode:        master
 Baserate:    282             18.048 Mbps
 SNR:         24.50  dB       good

 LAN / FC:     100F / on

 Voltage:     3.275 V
 Temperature: 47.35 C
 Software:    bank 2 not programmed

 SFP Switch:  normal
--------------------------------------------------------------------------------
--------------------------------------------------------------------------------
Configuration
--------------------------------------------------------------------------------
Copper settings
  Mode            :  MASTER
  Copper Baserate :  282             18.048 Mbps
System settings
  IP address      :  192.168.0.182    MAC address 00-0F-D9-18-8E-FB
  Subnet mask     :  255.255.255.0
  Default gateway :  192.168.0.254
  Speed           :  AUTO
  Flow control    :  ON
Services          :  TELNET, HTTP
  TFTP server IP  :  192.168.0.191
  TFTP retries    :  3
  TFTP timeout    :  10 s
  TFTP file path  :  SFPMS_V1-0.bin
--------------------------------------------------------------------------------
A0 EEPROM
000 0x03,04,00,00,00,00,00,00    , , , , , , , ,
008 0x00,40,00,00,00,00,00,00    ,@, , , , , ,
016 0x00,00,c8,fa,46,6c,65,78    , , , ,F,l,e,x
024 0x44,53,4c,20,20,20,20,20   D,S,L, , , , ,
032 0x20,20,20,20,00,00,0f,d9    , , , , , , , ,
040 0x43,4f,50,53,46,50,4d,53   C,O,P,S,F,P,M,S
048 0x50,41,4d,20,20,20,20,20   P,A,M, , , , ,
056 0x31,2e,30,20,00,00,00,1b   1, ,0, , , , ,
064 0x00,12,00,00,20,20,20,20    , , , , , , , ,
072 0x20,20,20,20,20,20,20,20    , , , , , , , ,
080 0x20,20,20,20,20,20,20,20    , , , , , , , ,
088 0x20,20,20,20,20,00,09,3b    , , , , , , , ,
096 0x00,00,00,00,00,00,00,00    , , , , , , , ,
104 0x00,00,00,00,00,00,00,00    , , , , , , , ,
112 0x00,00,00,00,00,00,00,00    , , , , , , , ,
120 0x0f,d9,00,00,01,00,00,00    , , , , , , , ,
128 0x00,00,00,00,00,00,00,00    , , , , , , , ,
136 0x00,00,00,00,00,00,00,00    , , , , , , , ,
144 0x00,00,00,00,00,00,00,00    , , , , , , , ,
152 0x00,00,00,00,00,00,00,00    , , , , , , , ,
```

```
160 0x00,00,00,00,00,00,00,00    , , , , , , , ,
168 0x00,00,00,00,00,00,00,00    , , , , , , , ,
176 0x00,00,00,00,00,00,00,00    , , , , , , , ,
184 0x00,00,00,00,00,00,00,00    , , , , , , , ,
192 0x00,00,00,00,00,00,00,00    , , , , , , , ,
200 0x00,00,00,00,00,00,00,00    , , , , , , , ,
208 0x00,00,00,00,00,00,00,00    , , , , , , , ,
216 0x00,00,00,00,00,00,00,00    , , , , , , , ,
224 0x00,00,00,00,00,00,00,00    , , , , , , , ,
232 0x00,00,00,00,00,00,00,00    , , , , , , , ,
240 0x00,00,00,00,00,00,00,00    , , , , , , , ,
248 0x00,00,00,00,00,00,00,00    , , , , , , , ,

A2 EEPROM
000 0x00,00,00,00,00,00,00,00    , , , , , , , ,
008 0x00,00,00,00,00,00,00,00    , , , , , , , ,
016 0x00,00,00,00,00,00,00,00    , , , , , , , ,
024 0x00,00,00,00,00,00,00,00    , , , , , , , ,
032 0x00,00,00,00,00,00,00,00    , , , , , , , ,
040 0x00,00,00,00,00,00,00,00    , , , , , , , ,
048 0x00,00,00,00,00,00,00,00    , , , , , , , ,
056 0x00,00,00,00,00,00,00,00    , , , , , , , ,
064 0x00,00,00,00,00,00,00,00    , , , , , , , ,
072 0x00,00,00,00,00,00,00,00    , , , , , , , ,
080 0x00,00,00,00,00,00,00,00    , , , , , , , ,
088 0x00,00,00,00,00,00,00,00    , , , , , , , ,
096 0x2f,6e,7f,ee,00,00,00,00    ,n, , , , , , ,
104 0x00,00,00,00,00,00,00,00    , , , , , , , ,
112 0x00,00,00,00,00,00,00,00    , , , , , , , ,
120 0x01,00,1d,00,01,00,00,00    , , , , , , , ,
128 0x00,00,00,00,00,00,00,00    , , , , , , , ,
136 0x00,00,00,00,00,00,00,00    , , , , , , , ,
144 0x00,00,00,00,00,00,00,00    , , , , , , , ,
152 0x00,00,00,00,00,00,00,00    , , , , , , , ,
160 0x00,00,00,00,00,00,00,00    , , , , , , , ,
168 0x00,00,00,00,00,00,00,00    , , , , , , , ,
176 0x00,00,00,00,00,00,00,00    , , , , , , , ,
184 0x00,00,00,00,00,00,00,00    , , , , , , , ,
192 0x00,00,00,00,00,00,00,00    , , , , , , , ,
200 0x00,00,00,00,00,00,00,00    , , , , , , , ,
208 0x00,00,00,00,00,00,00,00    , , , , , , , ,
216 0x00,00,00,00,00,00,00,00    , , , , , , , ,
224 0x00,00,00,00,00,00,00,00    , , , , , , , ,
232 0x00,00,00,00,00,00,00,00    , , , , , , , ,
240 0x00,00,00,00,00,00,00,00    , , , , , , , ,
248 0x00,00,00,00,00,00,00,00    , , , , , , , ,

CX_FMM>
```

6.5.3.3 <RESET> Command

This command restarts the modem.

```
CX_FMM>RESET
```

6.5.3.4 <SERNUM> Command

This command shows the production serial number of the unit.

```
CX_FMM>SERNUM
BPR242200002
CX_FMM>
```

6.5.3.5 <SOFTUPDATE> Command

This command lets you update software of the device. When prompted, send new software using 1K-XModem from your terminal application.

```
CX_FMM>SOFTUPDATE
Erase Memory
Start Softupdate via XModem or 1K XModem CCC
```

After successful download, a message appears:

```
Softupdate ok.
To activate the downloaded software use the SOFTSELECT command in the CM menu CX_FMM>
```

If the downloading failed or was interrupted, a message is displayed too, and the modem returns to the usual operation mode. (The operator can try again to download the software.):

```
CX_FMM>SOFTUPDATE
Erase Memory
Start Softupdate via XModem or 1K XModem
C
Softupdate failed
CX_FMM>
```

6.5.3.6 <SOFTINFO> Command

This command lists information on software and FPGA loaded into device. The list has two software entries. The Running software version is marked with an asterisk.

```
CX_FMM>SOFTINFO
1: *  ver.: 1.0, date: 23-04-2024, length: 516096 bytes, CRC: 0xbac7, fixed
2:    ver.: 1.0, date: 23-04-2024, length: 516096 bytes, CRC: 0xbac7, fixed
FPGA  ver.: 31-10-2023


CX_FMM>
```

- ver – The number of the software version.
- date – The date of the software creation.
- length – The size in bytes.
- CRC – The CRC of the image.
- FPGA ver - The date of the FPGA firmware loaded

If a software update is executed, the new software will be loaded to the bank with no asterisk.

If the downloading failed, the downloading was interrupted or the software is damaged then it is shown in the list:

```
CX_FMM>SOFTINFO
1: *  ver.: 1.0, date: 23-04-2024, length: 516096 bytes, CRC: 0xbac7, fixed
2:    ver.: No valid software loaded
FPGA  ver.: 31-10-2023
```

```
CX_FMM>
```

6.5.3.7 <STATUS> Command

This command displays the actual status of the SFP module:

```
-------------------------------------------------------------------------------
Status
-------------------------------------------------------------------------------
 Mode:        master
 Baserate:    282             18.048 Mbps
 SNR:         30.00  dB       good

 LAN / FC:     100F / on

 Voltage:     3.276 V
 Temperature: 47.45 C
 Software:    bank 2 not programmed

 SFP Switch:  normal
-------------------------------------------------------------------------------
CX_FMM>
```

Parameter	Value / Description
Mode	• master: connection to remote side is established, SFP is in the master mode • slave: connection to remote side is established, SFP is in the slave mode • training: active SFP at the remote side is detected, handshake is in progress • cable problem: the remote SFP is inactive or cable is broken/shorted/too long
Baserate	Achieved Baserate (Achieved data transmission rate in Mbps)
SNR	• Signal to noise ratio in dB • Link quality: poor / marginal / good
LAN	Operation mode of the host Ethernet interface: • 100F: 100Mbit/s, full-duplex (100Base-FX) • 1000F: 1000Mbit/s, full-duplex (1000Base-X)
FC	Flow control mode of the host Ethernet interface
Voltage	The measured VCC voltage coming to SFP from the host in Volts.
Temperature	SFP temperature [C°]
Software	Software status: ok / bank x not programmed
SFP Switch	normal / factory default position

TABLE 6.2 LIST OF PARAMETERS AND THEIR POSSIBLE VALUES

6.5.3.8 <TFTP SOFTUPDATE [FILEPATH]> Command

This command updates software from TFTP server. If no FILEPATH is entered, then the file path entered in Configuration Menu will be used.

Examples:

- TFTP SOFTUPDATE – SW update with file and path from configuration menu
- TFTP SOFTUPDATE APP.BIN – SW update with APP.BIN file located in the default tftp directory

```
CX_FMM>TFTP SOFTUPDATE
Start Softupdate via TFTP
#
```

After successful download, a message appears:

```
Received 516096 bytes


Softupdate ok.
To activate the downloaded software use the SOFTSELECT command in the CM menu CX_FMM>
```

If the downloading failed or was interrupted, a message is displayed too, and the modem returns to the usual operation mode. (The operator can try again to download the software.):

```
Softupdate failed
CX_FMM>
```

6.5.4 Configuration Management Menu

After typing “3” in the main menu and pressing <enter>, the following message is displayed:

```
Configuration management activated
Enter 'M' to return to MAIN, or 'H' for HELP information


CX_CM>
```

6.5.4.1 <H> Command

Type **H** and the monitor lists all available commands in the configuration management sub-menu. If you type **H [command]** you will get additional help on [command].

```
-------------------------------------------------------------------------------
Type 'H [command]' to get additional help on [command]

MASTER           Set Master mode
BASERATE         Set Baserate to M*64k
ETHSD            Set Ethernet port speed
FC               Set Ethernet port flow control
GATEWAY          Set IPv4 gateway address
NETCONFIG        Show network configuration
NETMASK          Set IPv4 netmask address
SETIP            Set IPv4 ip address
TFTPIP           Set IPv4 tftp address
TFTP RETRIES     Set number of retries for TFTP server
TFTP TIMEOUT     Set TFTP response timeout (s) TFTP
FILEPATH    Set TFTP filename and path
TELNET           Enable/disable TELNET service
HTTP             Enable/disable HTTP service
SOFTSELECT       Select execution software 1 or 2
FACTORY DEFAULT  Setup the Factory DEFAULT
APPLY            Apply and save changes
M                Return to Main Menu
H                Show available commands
-------------------------------------------------------------------------------
CX_CM>
```

6.5.4.2 <MASTER ON/OFF> Command

This command sets Master/Slave mode of Copper Wire link.

Examples:

- MASTER ON – set Master mode
- MASTER OFF – set Slave mode

```
CX_CM>MASTER ON
```

Note: Usually, in a data transmission systems one device should be configured as a Master, while the device at the other side of the line must be configured as a Slave.

CopperLink SFP modems are able to detect during the handshake process what mode the opposite SFP modem is set to. In case both SFP modems are set to the same mode, the mode of one SFP modem might be changed automatically. Despite this, it is recommended to set one SFP modem to Master mode and the other to Slave mode, as this will reduce the connection establishment time.

The Factory Default setting is Master.

6.5.4.3 <BASERATE M/AUTO> Command

The BASERATE M command sets speed of the copper link. Parameter M defines transmission rate in the copper link in 64 kbps/s increments in the range from 24 (1.536 Mbps) to 282 (18.048 Mbps) and sets Fixed Rate Mode:

Example:

- BASERATE 282 – set speed of Copper Wire connection to 282 x 64kbps = 18.048Mbps

```
CX_CM>BASERATE 282
```

If both modems in a link operate in Fixed Rate Mode, then their BASERATEs must be equal. In this case the connection will be established fast, within 2..10 seconds. However, line parameters must allow link establishing with the specified BASERATE, otherwise the communication will not be established.

If both modems are set to Fixed Rate Mode, but with different BASERATE, then the communication will not be established.

The BASERATE command with parameter AUTO sets Auto Rate Mode:

Example:

- BASERATE AUTO – set Auto Rate Mode

```
CX_CM>BASERATE AUTO
```

If both modems in a link are set to Auto Rate Mode, the link will be established at the maximum possible speed, at which the signal/noise ratio (SNR) will be in the "good" range (see <STATUS> Command).

If Master modem is set to Fixed Rate Mode and the Slave is set to Auto Rate Mode, the connection will be established at the BASERATE of the modem in Fixed Rate Mode. However, line parameters must allow link establishing with the specified BASERATE, otherwise the communication will not be established.

If Master modem is set to Auto Rate Mode then the Slave modem must be set to Auto Rate Mode too.

The Factory Default setting is Auto Rate Mode (BASERATE AUTO).

6.5.4.4 <ETHSD 100/1000/AUTO> Command

The <ETHSD 100/1000> command sets the operating mode of the SFP Ethernet port toward host, where 100/1000 is the rate of 100 Mbit/s (i.e., 100Base-FX) or 1000 Mbit/s (1000Base-X).

The <ETHSD AUTO> command activates the rate auto detection.

```
CX_CM>ETHSD 100
CX_CM>ETHSD AUTO
```

The Factory Default setting is AUTO.

6.5.4.5 <FC ON/OFF> Command

This command enables and disables IEEE 802.3x flow control on SFP Ethernet port toward host.

```
CX_CM>FC ON
```

The Factory Default setting is ON.

6.5.4.6 <GATEWAY X.X.X.X> Command

This command sets the default IP address of the router.

```
CX_CM>GATEWAY 192.168.0.254
```

The Factory Default setting is 192.168.0.254

6.5.4.7 <NETCONFIG> Command

This command displays the running configuration:

```
--------------------------------------------------------------------------------
Configuration
--------------------------------------------------------------------------------
Copper settings
  Mode            :  MASTER
  Copper Baserate :  282              18.048 Mbps
System settings
  IP address      :  192.168.0.182    MAC address 00-0F-D9-18-8E-FB
  Subnet mask     :  255.255.255.0
  Default gateway :  192.168.0.254
  Speed           :  AUTO
  Flow control    :  ON
Services          :  TELNET, HTTP
  TFTP server IP  :  192.168.0.191
  TFTP retries    :  3
  TFTP timeout    :  10 s
  TFTP file path  :  SFPMS_V1-0.bin
--------------------------------------------------------------------------------
CX_CM>
```

Copper settings	
Mode	Master / Slave mode of Copper Wire connection
Baserate	Baserate and data transmission rate in Mbps or Auto in Auto Rate mode.
System settings	
IP address	IP address of the SFP modem

MAC address	MAC address of the SFP modem
Subnet Mask	Network mask of the SFP modem
Default Gateway	Default gateway of the SFP modem
Speed	Operation mode of the Ethernet interface toward host
Flow control	Flow control mode of the Ethernet interface toward host
Priv password	Privacy password (SNMP v3)
Services	
Services	List of running management servers
TFTP server IP	IP address of the TFTP server
TFTP retries	Number of attempts to query the TFTP server
TFTP timeout	Time out for TFTP server response
TFTP file path	SW update filename and the TFTP server directory

TABLE 6.3 LIST OF SETTINGS AND SERVICES

After successful execution of a command that changes any parameter showed by NETCONFIG, the new configuration is shown. The warning message explaining that user should apply the settings and the unit will restart:

```
Enter APPLY to activate and save the new Parameter
The unit will restart
CX_CM>
```

6.5.4.8 <NETMASK X.X.X.X> Command

This command sets the subnet mask of the SFP modem.

```
CX_CM>NETMASK 255.255.255.0
```

The Factory Default setting is 255.255.255.0

6.5.4.9 <SETIP X.X.X.X> Command

The <SETIP A.B.C.D> command sets the IP-address of the SFP modem. The parameter A, B, C and D can take values from 0 to 255 (note that neither address of the network nor the address of the node can be equal to 0, or to 255).

```
CX_CM>SETIP 192.168.0.182
```

The Factory Default setting is 192.168.0.1

6.5.4.10 <TFTPIP IP/OFF> Command

This command sets TFTP address of TFTP server.

```
CX_CM>TFTPIP 192.168.0.191
```

The Factory Default setting is no TFTP address.

6.5.4.11 <TFTP RETRIES [1..10]> Command

This command configures number of attempts to query the TFTP server.

```
CX_CM>TFTP RETRIES 3
```

The Factory Default setting is 3.

6.5.4.12 <TFTP TIMEOUT [1..60]> Command

This command defines how long modem should wait for a response of TFTP server. Then modem will repeat request as many times as configured with TFTP RETRIES command.

```
CX_CM>TFTP TIMEOUT 10
```

The Factory Default setting is 10.

6.5.4.13 <TFTP FILEPATH [str]> Command

This command defines the SW update filename and the TFTP server directory. The string length [str] is limited to 80 char.

```
TFTP FILEPATH SFPMS_V1-0.BIN
```

The Factory Default setting is SFPMS_V1-0.BIN

6.5.4.14 <TELNET ON/OFF> Command

This command turns TELNET service ON and OFF.

Note: Default running management servers are TELNET and HTTP

6.5.4.15 <HTTP ON/OFF> Command

This command turns HTTP service ON and OFF.

```
CX_CM>HTTP ON
```

Note: Default running management servers are TELNET and HTTP

6.5.4.16 <SOFTSELECT 1/2> Command

This command is used to select the active software bank from software banks 1 or 2.

```
CX_CM>SOFTSELECT 2
Selected SW ok. Will restart in 3 seconds
```

6.5.4.17 <FACTORY DEFAULT> Command

This command reset SFP modem settings to their factory default values.

```
CX_CM>FACTORY DEFAULT
Do You really want to setup the Unit to its factory defaults? (Y/N) Y
Factory default done. Will restart in 3 seconds
```

The factory default configuration is following:

```
--------------------------------------------------------------------------------
Configuration
--------------------------------------------------------------------------------
Copper settings
  Mode            :  MASTER
  Copper Baserate :  AUTO             --.--- Mbps
System settings
  IP address      :  192.168.0.1      MAC address 00-0F-D9-18-8E-FB
  Subnet mask     :  255.255.255.0
  Default gateway :  192.168.0.254
  Speed           :  AUTO
```

```
   Flow control    :  ON
 Services          :  TELNET, HTTP
   TFTP server IP  :  (not set)
   TFTP retries    :  3
   TFTP timeout    :  10 s
   TFTP file path  :  SFPMS_V1-0.bin
 ------------------------------------------------------------------------------
 CX_CM>
```

6.5.4.18 <APPLY> Command

This command is used to apply and save configuration changes.

```
CX_CM>APPLY
```

7 Software Download

The **CopperLink** SFP modem supports downloading new/old software versions to get some additional features or to protect the modems with a released only software version. The download of the software can be performed in following ways:

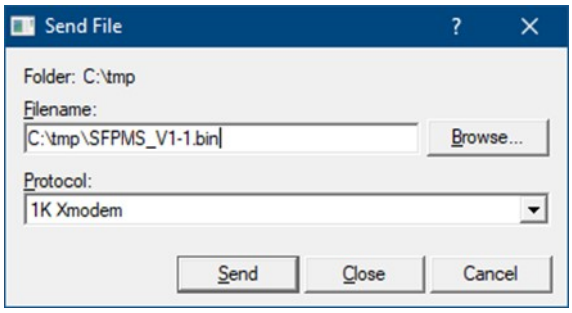
- via Ethernet (in CLI TELNET session) by using the 1K XMODEM protocol
- via Ethernet over TFTP (in CLI TELNET session or in WEB interface)

7.1 Using SOFTUPDATE cmd with 1K-XMODEM (fastest method)

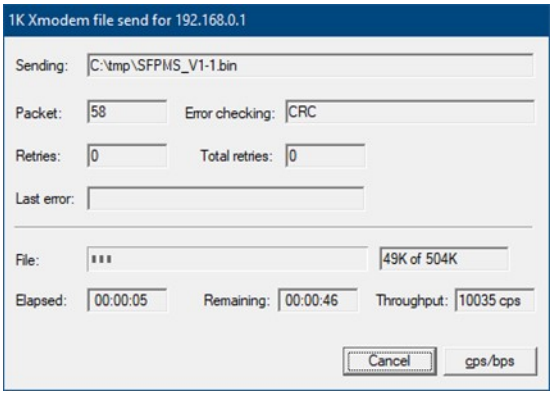
- Run the Hyper Terminal program (hypertrm.exe) and open a TCP/IP(Winsock) Telnet session
- Open the FMM menu and enter SOFTUPDATE

```
CX_FMM>SOFTUPDATE
Erase Memory
Start Softupdate via XModem or 1K XModem CC
```

- When the message above arises open “Send File” in the “Transfer” menu



- Select 1K-Xmodem in the “Protocol” drop-down menu. Browse the SFPMS_Vx.x.bin file in the “Filename” field (the name of the file depends on the software version). Click “Send.” The Hyper Terminal starts downloading the file and saves it to the memory bank. After the Send button is clicked, the “1K-Xmodem file send for…” window pops up.



- After loading the software, the "1K Xmodem file send for..." window will close automatically and the following message must appear.

```
Softupdate ok.
To activate the downloaded software use the SOFTSELECT command in the CM menu
```

- Change to the CM menu and enter SOFTSELECT x where x is the selected software (1 or 2)
- Wait until the unit finishes rebooting
- Open the FMM menu and enter SOFTINFO cmd, check if the desired software is activated

```
CX_FMM>SOFTINFO
```

```
1: *  ver.: 1.0, date: 23-04-2024, length: 516096 bytes, CRC: 0xbac7, fixed
2:    ver.: 1.1, date: 09-09-2024, length: 516096 bytes, CRC: 0x77de, fixed
FPGA  ver.: 31-10-2023


CX_FMM>
```

7.2 Using TFTP SOFTUPDATE cmd

- Run the Hyper Terminal program (hypertrm.exe) and open a TCP/IP(Winsock) Telnet session
- Open the CM menu and setup the TFTP parameters TFTPIP and TFTP FILEPATH
- Open the TFTP Server and make sure the software file is located in the filepath selected from the TFTP server (and FILEPATH)
- Change to the FMM meu and enter <TFTP SOFTUPDATE> cmd. After a successfully softupdate the following screen will be displayed:

```
CX_FMM>TFTP SOFTUPDATE
Start Softupdate via TFTP
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################
Received 516096 bytes


Softupdate ok.
To activate the downloaded software use the SOFTSELECT command in the CM menu
CX_FMM>
```

- Change to the CM menu and enter <SOFTSELECT x> where x determines the selected software (1 or 2)
- Wait until the unit finishes rebooting
- Open the FMM menu and enter <SOFTINFO> cmd, check if the desired software is activated

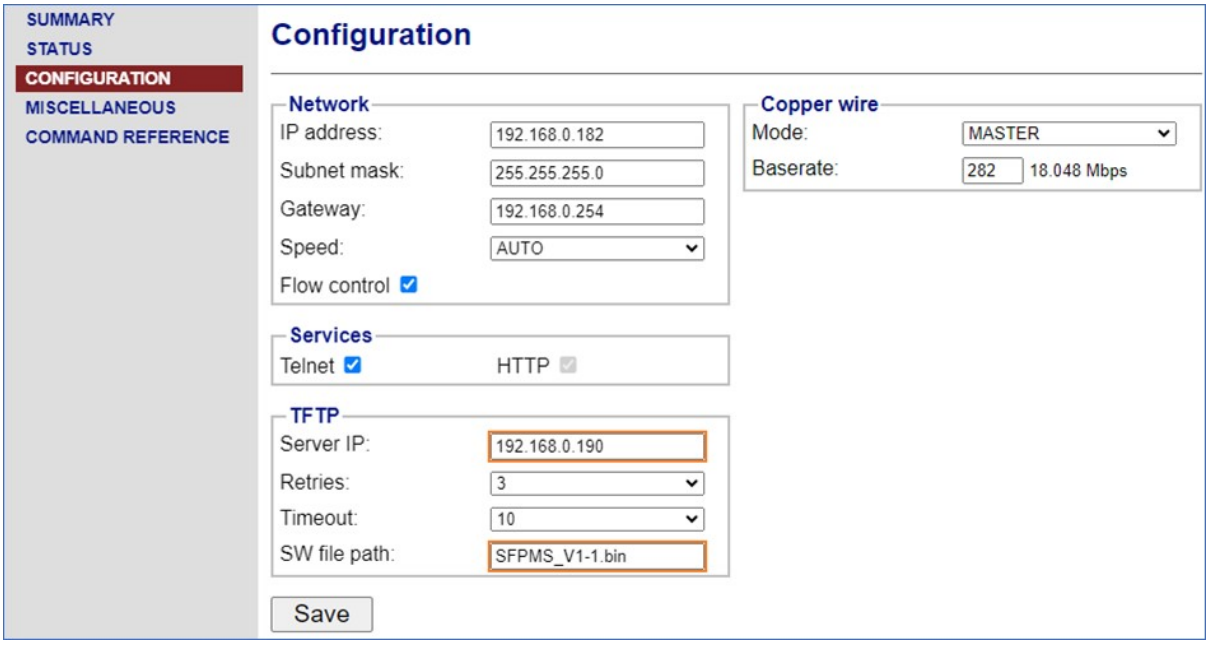
```
CX_FMM>SOFTINFO
1:    ver.: 1.0, date: 23-04-2024, length: 516096 bytes, CRC: 0xbac7, fixed
2: *  ver.: 1.1, date: 09-09-2024, length: 516096 bytes, CRC: 0x77de, fixed FPGA
ver.: 31-10-2023


CX_FMM>
```

7.3 SW Update using WEB

SW Update over WEB interface can only be done by using a TFTP web server.

7.3.1 Configuring through WEB

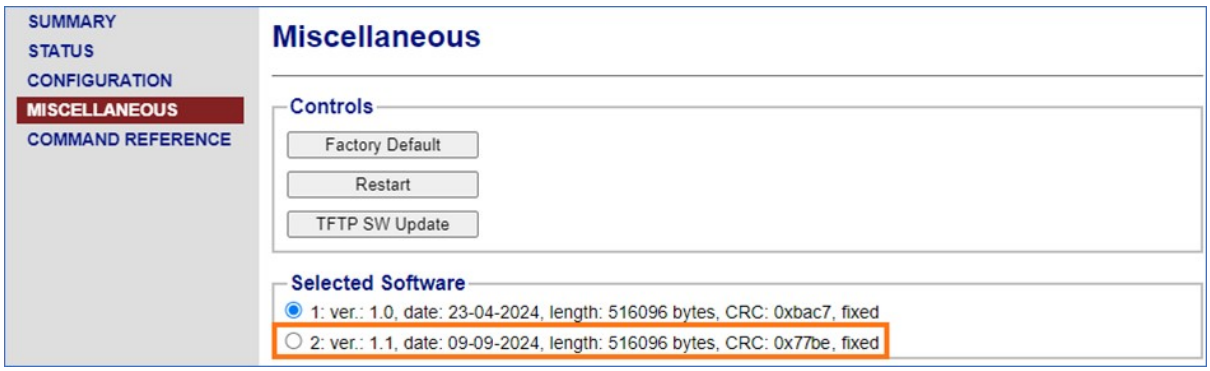
- Open the CONFIGURATION page in the WEB and setup the marked parameters below according to Your requirements.
- Open the TFTP Server and make sure the software file is in the file path selected from the TFTP server (and FILEPATH)



- Press the <Save> and <APPLY> button and wait until the unit finishes rebooting (approx. 15 seconds)

7.3.2 Software update through WEB

- Open the MISCELLANEOUS page in the WEB and press the <TFTP SW Update> button
- A Status window will popup that indicates the SW update is in progress. After the SW update
- The new installed SW will be in the not selected SW bank (marked amber)



- To activate the new software, press the radio button in the marked area
- Press the OK button in the message box that raises up after pressing the radio button. A Status window will popup that indicates the activation of the selected SW and the unit will reboot

8 Connector Description

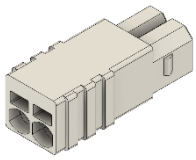
8.1 SFP Modem Connector

8.1.1 SFP Module CL-SFP/XC

Type – Phoenix Contact, 1815264, PTSM 0,5/ 2-HV-2,5-THR WH R32 (male), 2 pins.

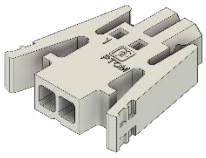
Pin No.	Description
1	Analog TX+/RX+
2	Analog TX-/RX-

Matching Type for the cable:
Phoenix Contact, 1704853
PTSM 0,5/ 2-P-2,5 WH
For AWG 24-20



Area 0.2–0.5 mm² or Diameter 0.5-0.8 mm

Phoenix Contact, 1015464
PTCM 0,5/ 2-PL-2,5 WH
For AWG 18-26
Area 0.14–0.75 mm² or Diameter 0.4-1.0 mm

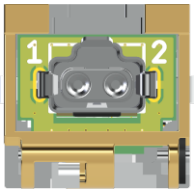


With crimp contacts:

Phoenix Contact, 1013780 [2])
PTCM-MP-P 0,34-0,75 (for 0.34-0.75 mm or
Phoenix Contact, 1013781
PTCM-MP-P 0,14-0,5 (for 0.14-0.5 mm²)

8.1.2 SFP Module CL-SFP/SPE

Type – AMPHENOL MSPE-J2L0-E00 (female), 2 pins.



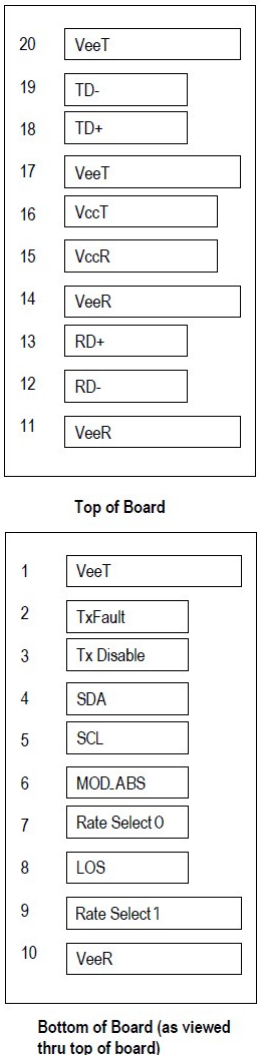
Pin No.	Description
1	Analog TX+/RX+
2	Analog TX-/RX-

Matching Type for the cable:
AMPHENOL
MSPE-P2L0-2A0
For AWG 28-18

Area 0.08–0.75 mm² or Diameter 0.32-1.0 mm

8.2 SFP Host Connector

Type – realized as a PCB-Connector according to SFF-8432, chapter 4 and SFF-8419



Pin No.	Signal	Description
1	VeeT	Transmit ground
2	TxFault	Transmit fault indication
3	Tx Disable	Transmit disable
4	SDA	SDA line (I2C)
5	SCL	SCL line (I2C)
6	MOD_ABS	Module absent
7	Rate Select 0	Rate select 0
8	LOS	Loss of signal indication
9	Rate Select 1	Rate select 1
10	VeeR	Receive ground
11	VeeR	Receive ground
12	RD-	Receive data -
13	RD+	Receive data +
14	VeeR	Receive ground
15	VccR	Receive VCC
16	VccT	Transmit VCC
17	VeeT	Transmit ground
18	TD+	Transmit data +
19	TD-	Transmit data -
20	VeeT	Transmit ground

9 TECHNICAL SPECIFICATION

9.1 Interfaces

9.1.1 CL-SFP Modem Interface

Output Voltage	2.0..2.6 Vp2p
Line Impedance	Typ. 114W
Transmit Bandwidth	50kHz…36MHz
Number of Pairs	1
Bit Rate	1536 to 18048kbit/s
Connector Type:	
CL-SFP/XC	Phoenix Contact, 1815264, 2 pin
CL-SFP/SPE	AMPHENOL MSPE-J2L0-E00, 2 pin
Overvoltage Protection	ITU-T Rec. K.20/K.21

9.1.2 SFP Host Interface

Standard:	IEEE-802.3
Data Rate	100Base-FX / 1000Base-X
Connector Type	SFP Host Connector Data (MSA Compliant)

9.2 Power Supply (SFP Host Connector Power, MSA Compliant)

Input Voltage	3.135..3.465 VDC
Input Current	Max. 255 mA
Power Consumption (DSL link up @18.048 Mbps, 1000Base-X host)	Typ. 0.73 Watt

9.3 SFP Latency

Latency (max.):	@1536 kbps	@10000 kbps	@18048 kbps
64-byte packets	0.788 ms	0.137 ms	0.085 ms
128-byte packets	1.144 ms	0.283 ms	0.136 ms
256-byte packets	1.670 ms	0.390 ms	0.239 ms
512-byte packets	2.980 ms	0.658 ms	0.444 ms
1024-byte packets	6.131 ms	1.250 ms	0.856 ms
1280-byte packets	7.557 ms	1.614 ms	1.061 ms

1518-byte packets	8.641 ms	1.852 ms	1.252 ms
2048-byte packets	11.530 ms	2.439 ms	1.678 ms

For a link connection (SFP to SFP) you must double this value.

9.4 SFP Jitter

Jitter (max.):	
1536 kbps	3.2 us
10000 kbps	1.0 us
18048 kbps	1.2 us

9.5 Environment

Storage:	ETS 300 019-1-1 Class 1.2	(-40°C … +85°C) extended temperature range
Transportation:	ETS 300 019-1-2 Class 2.3	(-40°C … +70°C)
Operation:	ETS 300 019-1-3 Class 3.2	(-40°C … +85°C) extended temperature range

9.5.2 EMC and Safety Standards

Safety	EN 62368-1:2020/A11:2020 IEC 62368-1:2020/A11:2020	
EMC	EN 300 386 V2.1.1:2016	
	EN 55032:2015/A11:2020	class B
	EN 55035:2017/A11:2020	criterion A
	EN 61000-4-2:2009	± 8 kV contac discharge,
		± 15 kV air discharge
	EN 61000-4-3:2020	10 V/m (80-1000 MHz)
	EN 61000-4-4:2012	± 4 kV data line
	EN 61000-4-5:2014 + A1:2017	± 2 kV data line
	EN 61000-4-6:2014	10 V (150 kHz-80 MHz)

9.6 ROHS / WEEE

RoHS	RoHS2 Directive 2011/65/EU and 2015/863/EU
WEEE	WEEE Directive 2012/19/EU

9.7 MTBF

MTBF	Lifetime: 1’158’748 H, λ (10^{-9} h^{-1}) = 863, Siemens Norm SN 29500, Temperature 40°C

9.8 Mechanical Specification

Dimension CL-SFP/XC: w/o connector: with connector 1704853: with snap-in connector 1015464	13.7(W)x68.6(D)x13.8(H) mm 13.7(W)x74.9(D)x13.8(H) mm 14.5(W)x76.1(D)x13.8(H) mm
Dimension CL-SFP/SPE: w/o connector:	13.7(W)x71.2(D)x13.8(H) mm
with connector MSPE-P2L0-2A0XX	13.7(W)x98.4(D)x13.8(H) mm
Weight w/o connector	< 0.03kg

Appendix A - Contacting Patton For Assistance

Introduction

This chapter contains the following information:

- "Contact information"—describes how to contact Patton technical support for assistance.
- "Warranty Service and Returned Merchandise Authorizations (RMAs)"—contains information about the warranty and obtaining a return merchandise authorization (RMA).

Contact information

Patton LLC offers a wide array of free technical services. If you have questions about any of our other products we recommend you begin your search for answers by using our technical knowledge base. Here, we have gathered together many of the more commonly asked questions and compiled them into a searchable database to help you quickly solve your problems.

Contacting Patton Technical Services for Free Support

REGION	North America	Western Europe	Central & Eastern Europe
Location	**Maryland, USA**	**Bern, Switzerland**	**Budapest, Hungary**
Time Zone	EST/EDT UTC/GMT - 4/5 hours	CET/CEDT UTC/GMT + 1/2 hours	CET/CEDT UTC/GMT + 1/2 hours
Business Hours	Monday-Friday 8:00am to 5:00pm	Monday-Friday 09:00 to 12:00 13:30 to 17:30	Monday-Friday 8:30 to 17:00
Email	support@patton.com	support@patton.com	support@patton.com
Phone	+ 1 301 975 1007	+41 31 985 25 55	+36 439 3835
Fax	+1 301 869 9293	+41 31 985 2526	

Warranty Service and Returned Merchandise Authorizations (RMAs)

Patton LLC is an ISO-9001 certified manufacturer and our products are carefully tested before shipment. All of our products are backed by a comprehensive warranty program.

Note If you purchased your equipment from a Patton LLC reseller, ask your reseller how you should proceed with warranty service. It is often more convenient for you to work with your local reseller to obtain a replacement. Patton services our products no matter how you acquired them.

Warranty coverage

Our products are under warranty to be free from defects, and we will, at our option, repair or replace the product should it fail within one year from the first date of shipment. Our warranty is limited to defects in

workmanship or materials, and does not cover customer damage, lightning or power surge damage, abuse, or unauthorized modification.

Out-of-warranty service

Patton services what we sell, no matter how you acquired it, including malfunctioning products that are no longer under warranty. Our products have a flat fee for repairs. Units damaged by lightning or other catastrophes may require replacement.

Returns for credit

Customer satisfaction is important to us, therefore any product may be returned with authorization within 30 days from the shipment date for a full credit of the purchase price. If you have ordered the wrong equipment or you are dissatisfied in any way, please contact us to request an RMA number to accept your return. Patton is not responsible for equipment returned without a Return Authorization.

Return for credit policy

- Less than 30 days: No Charge. Your credit will be issued upon receipt and inspection of the equipment.
- 30 to 60 days: We will add a 20% restocking charge (crediting your account with 80% of the purchase price).
- Over 60 days: Products will be accepted for repairs only.

RMA numbers

RMA numbers are required for all product returns. You can obtain an RMA by doing one of the following:

- Completing a request on the RMA Request page in the *Support* section at **www.patton.com**
- By calling **+1 (301) 975-1007** and speaking to a Technical Support Engineer
- By sending an e-mail to **returns@patton.com**

All returned units must have the RMA number clearly visible on the outside of the shipping container. Please use the original packing material that the device came in or pack the unit securely to avoid damage during shipping.

Shipping instructions

The RMA number should be clearly visible on the address label. Our shipping address is as follows:

Patton LLC
RMA#: xxxx
7622 Rickenbacker Dr.
Gaithersburg, MD 20879-4773 USA

Patton will ship the equipment back to you in the same manner you ship it to us. Patton will pay the return shipping costs.

Appendix B - End User License Agreement

By opening this package, operating the Designated Equipment or downloading the Program(s) electronically, the End User agrees to the following conditions:

1. Definitions

A) "Effective Date" shall mean the earliest date of purchase or download of a product containing the Patton LLC Program(s) or the Program(s) themselves.

B) "Program(s)" shall mean all software, software documentation, source code, object code, or executable code.

C) "End User" shall mean the person or organization which has valid title to the Designated Equipment.

D) "Designated Equipment" shall mean the hardware on which the Program(s) have been designed and provided to operate by the End User.

2. Title

Title to the Program(s), all copies of the Program(s), all patent rights, copyrights, trade secrets and proprietary information in the Program(s), worldwide, remains with Patton LLC or its licensors.

Patton does not convey any intellectual property title or rights in the Licensed Products to Licensee. All Licensed Products furnished by Patton, and all copies thereof, and compilations, programmatic extension, and all Patches, Updates, Upgrades and Platform Releases, are and shall remain the property of Patton or Patton's licensors, as applicable. Further, the Licensed Products provided under this Agreement are not custom software but are standard commercial software. Except for the license use rights otherwise expressly provided in this Agreement, no right, title or interest in Patton Licensed Products is granted hereunder. Licensee shall not use any proprietary information of Patton to create any computer software program or user documentation, which is substantially similar to the Licensed Products.

3. Term

The term of this Agreement is from the Effective Date until title of the Designated Equipment is transferred by End User or unless the license is terminated earlier as defined in section "6. Termination" on page 62.

4. Grant of License

A) During the term of this Agreement, Patton LLC grants a personal, non-transferable, non-assignable and non-exclusive license to the End User to use the Program(s) only with the Designated Equipment at a site owned or leased by the End User.

B) The End User may copy licensed Program(s) as necessary for backup purposes only for use with the Designated Equipment that was first purchased or used or its temporary or permanent replacement.

C) The End User is prohibited from disassembling; decompiling, reverse-engineering or otherwise attempting to discover or disclose the Program(s), source code, methods or concepts embodied in the Program(s) or having the same done by another party.

D) Should End User transfer title of the Designated Equipment to a third party after entering into this license agreement, End User is obligated to inform the third party in writing that a separate End User License Agreement from Patton LLC is required to operate the Designated Equipment.

5. Warranty

The Program(s) are provided "as is" without warranty of any kind. Patton LLC and its licensors disclaim all warranties, either express or implied, including but not limited to the implied warranties of merchantability, fitness for a particular purpose or non-infringement. In no event shall Patton LLC or its licensors be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use of or inability to use the Program(s), even if Patton LLC has been advised of the possibility of such damages. Because some states do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply to you.

If the Program(s) are acquired by or on behalf of a unit or agency of the United States Government, the Government agrees that such Program(s) are "commercial computer software" or "computer software documentation" and that, absent a written agreement to the contrary, the Government's rights with respect to such Program(s) are limited by the terms of this Agreement, pursuant to Federal Acquisition Regulations 12.212(a) and/or DEARS 227.7202-1(a) and/or sub-paragraphs (a) through (d) of the "Commercial Computer Software—Restricted Rights" clause at 48 C.F.R. 52.227-19 of the Federal Acquisition Regulations as applicable.

6. Termination

A) The End User may terminate this agreement by returning the Designated Equipment and destroying all copies of the licensed Program(s).

B) Patton LLC may terminate this Agreement should End User violate any of the provisions of section "4. Grant of License" on page 61.

C) Upon termination for **A** or **B** above or the end of the Term, End User is required to destroy all copies of the licensed Program(s).

7. Notices

Patton devices may log, collect and report data related to installed software, licenses, feature utilization, product performance, device management, service quality and other parameters which is used for quality control, product improvement, license management, service level management and technical support. Collected data may be reported to Patton or a service provider delivering its services connected to the device.

Patton may use this information for other business purposes, such as to alerting you to updated products or services, securing access to software updates, and assisting in order processing.

Any and all information collected by Patton or its assigns will be kept strictly confidential and will not be sold, rented, loaned, or otherwise disclosed to any third party except as required by law.

8. Other Licenses

The Program may be subject to licenses extended by third parties. Accordingly, Patton LLC licenses the Programs subject to the terms and conditions dictated by third parties. Third party software identified to the Programs includes:

The LGPL (Lesser General Public License) open source license distributed to you pursuant to the LGPL license terms (**http://www.gnu.org/licenses/lgpl.html**).

RedBoot (Red Hat Embedded Debug and Bootstrap) embedded system debug/bootstrap environment from Red Hat distributed to you pursuant to the eCos license terms (**ecos.sourceware.org/license-overview.html**) and GNU General Public License (GPL) terms (**www.gnu.org/copyleft/gpl.html**). Source code is available upon request.

9. Unenforceable Provisions

If any part of these terms and conditions are found to be invalid or unenforceable under applicable law, such part will be ineffective to the extent of such invalid or unenforceable part only, without in any way affecting the remaining parts of these terms and conditions.

10. Governing Law

The rights and obligations of the parties pursuant to these terms and conditions are governed by, and shall be construed in accordance with, the laws of the State of Maryland, USA.

User may be subject to other local, provincial or state and national laws. User hereby irrevocably submits to the exclusive jurisdiction of the courts of the State of Maryland, USA for any dispute arising under or relating to this agreement and waives user's right to institute legal proceedings in any other jurisdiction. Patton shall be entitled to institute legal proceedings in connection with any matter arising under this agreement in any jurisdiction where User resides, does business, or has assets.

11. Waiver

No waiver of any of the provisions of these terms and conditions will be deemed to constitute a waiver of any other provision nor shall such a waiver constitute a continuing waiver unless otherwise expressly provided in writing duly executed by the party to be bound thereby. Any other terms and conditions of sale, to the extent not inconsistent herein, regarding a Patton device, program, license or service remain in full force and effect.