USER & INSTALLATION MANUAL
EDFAMUX 10G & 100G V2

Version 2.3.2 (April 2022)

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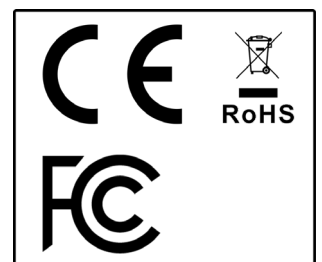UK: +44 (0) 8081 892446

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INTRODUCTION

Please note: Reading this entire manual is mandatory for a full understanding of the correct use of this product.

This manual is written with the intent to fully inform the user as to the specific installation instructions and safety requirements of the AddOn Networks EDFAMUX product line.

AddOn Networks' EDFAMUX products undergo extensive internal testing procedures in order to meet our strict quality control standards and are in full compliance with CE (including RoHS and REACH), WEEE, and FCC regulations.

This manual will first give an overview of specific warning symbols, prior to instructing the user on the technical aspects of the AddOn Networks EDFAMUX. The manual will then cover specific installation procedures while using the AddOn Networks EDFAMUX. Next, the manual will cover the specific risks and considerations when using, installing, or altering the AddOn Networks EDFAMUX. Finally, the manual covers what to do when a malfunction occurs or when maintenance needs to be performed. For contact details please refer to Chapter 9.

Please be advised that the AddOn Networks EDFAMUX is specifically designed and sold to customers in the business-to-business market. Only trained and experienced network professionals should install, remove, or service the AddOn Networks EDFAMUX. For any questions regarding the AddOn Networks EDFAMUX, including installation, malfunction, or maintenance - please contact our Technical Support Department at the email addresses and phone numbers listed in Chapter 9. This manual is not intended as part of any agreement and is merely used to provide the customer with general information regarding the installation of the AddOn Networks EDFAMUX.

Please read this manual carefully and ensure that you comply with all strict warnings provided herein. For specific product information, please refer to the datasheet of your respective AddOn Networks EDFAMUX. The latest version of each datasheet is published on our website and contains important technical requirements and other product specific information.

Should you have any comments on this manual, please direct them to:

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Fax: 949 266 9273	Email: salesemea@addonnetworks.com
Email: sales@addonnetworks.com	

WARRANTY & LIABLITY

We guarantee that the product you receive has been thoroughly tested to ensure that it meets its published specifications. The warranty included in the conditions of delivery is valid only if the product has been installed and used according to the instructions supplied by the company. We shall, in no event, be liable for incidental or consequential damages, including (without limitation): lost profits, loss of income, loss of business opportunities, loss of use and other related exposures, however caused, arising from the faulty and incorrect use of the product.

Contents

1. WARNINGS & SYMBOLS

	CAUTION: IMPORTANT SAFETY INSTRUCTIONS This warning symbol indicates that the reader should be cautious. Please take notice of the fact that when you use an item labelled with this symbol, improper use may cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.
	CAUTION: CLASS 1 LASER PRODUCT This warning indicates caution is necessary. There is visible laser radiation present. Avoid long-term viewing of the laser.
	DO NOT DISPOSE This symbol indicates that you may not dispose the equipment as unsorted municipal waste as per 2002/96/EC (WEEE directive). For proper recycling, return the equipment to your local supplier upon the purchase of equivalent new equipment, or dispose of it at designated collection points.
	RECYCLING This symbol indicates that the equipment (packaging) may require recycling in accordance with you own local laws. Contact your local regulatory authorities for more information.
CE	**CE MARK** This symbol indicates that the company tested the equipment in accordance with applicable standards and it is safe. The CE-symbol indicates that this product also complies with the requirements of Directive 2014/30/EU. It does not generate, or is not affected by, electromagnetic disturbance.
FC	**FCC MARK** This symbol indicates that the company tested the equipment in accordance with the applicable Federal Code Of Regulation (CFR) FCC 47 Part 15, subpart B and it is safe. The FCC-symbol indicates that the electromagnetic interference from the product is under limits approved by the Federal Communications Commission. It does not generate, or is not affected by, electromagnetic disturbance.
RoHS	**HAZARDOUS GOODS** This symbol indicates that the equipment complies with Directives 2011/65/EU (RoHS II) and 2002/95 EC (RoHS I).
Laser Class 1	**LASER CLASS 1** This symbol indicates that the equipment complies with 21 CFR 1040.10 and 1040.11, except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.
	ESD This symbol indicates that the user should only (dis)connect the equipment in an EPA (ESD Protected Area), while using only certified equipment and taking all necessary precautions.

COMPLIANCE STATEMENT

The AddOn Networks EDFAMUX product line complies with relevant Directives and Regulations of the European Union (EU) and the United States of America (US) such as the EMC- and ROHS- Directive, as well as the Reach Regulation.

Please consult your sales agent or our office for further detailed information on compliance and conformity statements.

2. TECHNICAL DESCRIPTION

The AddOn Networks EDFAMUX is an all-in-one optical transmission device which incorporates the functions of a Mux/Demux, Amplifier/s, and a Dispersion Compensator in order to aggregate multiple optical channels over long distances. It utilizes a non-harmful, Class 1 Laser which sends out light in the non-visible infrared spectrum. This equipment can operate with 110v AC, 220v AC and 48v DC, depending on which power supplies are installed. Please refer to the following list of part numbers to view our capabilities:

- ADD-EDFAMUX-16X100G-20-40
- ADD-EDFAMUX-16X100G-20-80
- ADD-EDFAMUX-16X100G-43-40
- ADD-EDFAMUX-16X100G-43-80
- ADD-EDFAMUX-8X100G-20-120
- ADD-EDFAMUX-8X100G-20-80
- ADD-EDFAMUX-8X100G-28-120
- ADD-EDFAMUX-8X100G-28-120-DC
- ADD-EDFAMUX-8X100G-44-80

- ADD-EDFAMUX-8X100G-28-80
- ADD-EDFAMUX-8X100G-28-80-DC
- ADD-EDFAMUX-8X100G-36-120
- ADD-EDFAMUX-8X100G-36-80
- ADD-EDFAMUX-8X100G-44-120

- AO-EDFAMUX-10X10G-28-200
- AO-EDFAMUX-10X10G-28-140
- AO-EDFAMUX-16X10G-20-140

3. CONFIGURATION

3.1. INITIAL CONFIGURATION

For visual step-by-step instructions on how to install the AddOn Networks EDFAMUX, please visit our website. The Support page provides you with easy video examples on how to properly install and remove the AddOn Networks EDFAMUX either for installation, or for maintenance (see Chapter 8).

For safety reasons, the EDFAMUX should not be switched on or in operation/processing data/running measurements when installing or removing it. Only trained and qualified network professionals should install, replace, or service the AddOn Networks EDFAMUX. For further safety warnings, please read Chapter 5 carefully.

To install the EDFAMUX, please follow the steps below:

1) At the first site of the network, connect the EDFAMUX to two different power sources to ensure electrical redundancy.

2) Connect the console cable to the EDFAMUX using a speed of 115200 bits/s.

3) Set the EDFAMUX IP address using the CLI:

   a. *Configure* (enter "admin" as password).

   b. *Set ethernet static.*

   c. *Set ethernet ip.*

   d. *Set ethernet mask.*

   e. *Set ethernet gw.*

   f. *Commit.*

4) Access the EDFAMUX with a web GUI (this is the management GUI) at the following address and use "admin" as password or continue with the CLI (see command line reference):

   a. Click "Optical," enter your Fiber Length **(1)**, and click "apply changes" **(4)**.

Figure 1

| HOME | SETTINGS | FIRMWARE | INFO |

SETTINGS

| OPTICAL | ETHERNET | SNMP | SYSTEM |

Modify pre- and post-amplifier

Manually override amplification values

TDCM (5-80 km)		Pre-amp EDFA (14-20)	Post-amp EDFA (14-20)
80	Km	20,00	20,00

Apply changes
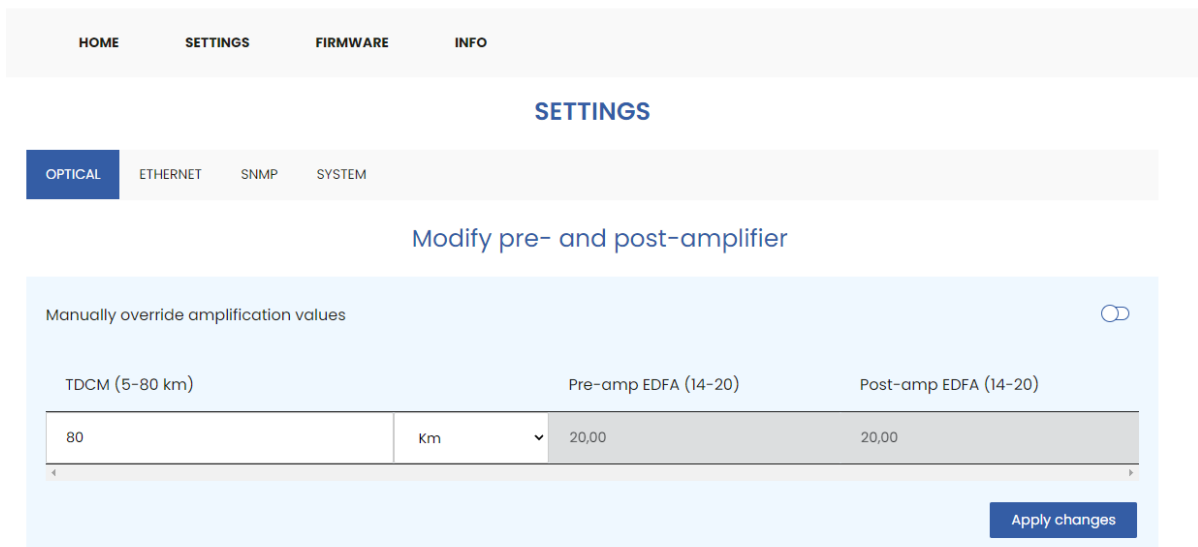
5) Insert all DWDM optical transceivers into your network equipment.

6) Using a single-mode fiber patch cable, connect each of the DWDM optical transceivers connected to your network equipment to the corresponding channel on the EDFAMUX.

7) Connect the main fiber line to the EDFAMUX COM Port.

8) On the EDFAMUX management GUI, verify that the EDFA BOOSTER (referred to as PRE EDFA on the management GUI) values match the table included in the "Recommended EDFA Values" part of this document. If the OUTPUT value is higher than the EDFAMUX's EDFA Booster Saturation value (referring to the EDFAMUX Datasheet), then lower this value.

9) At the second site of the network, repeat steps 1, 2, and 3.

10) Connect the other end of the main fiber line (see step 6) to the EDFAMUX COM Port.

11) On the EDFAMUX management GUI, verify that the EDFA Post Amp (referred to as POST EDFA on the management GUI) values match the table included in the "Recommended EDFA Values" part of this document. If the output value does not match, adjust the Booster and Post-Amp values accordingly.

11) Before connecting each DWDM optic to the corresponding channel on the EDFAMUX, use an optical power meter or a DWDM OSA meter to verify that the TX values of the EDFAMUX channel are lower than:

    a. In the case of the 100G EDFAMUX: **8dBm** (aggregate damage threshold of the optic).

    b. In the case of the 10G EDFAMUX: -**7dBm**.

12) If the values are under the limits as described in 11a and 11b, the optics may be connected to the corresponding channel on the EDFAMUX using single-mode fiber patch cables.

13) If values are too low, you can fine-tune the EDFAMUX configuration (based on Figure 1) using the following steps:

    a.   Click "manually override amplification values."

    b.   Modify the PRE and POST EDFA.

    c.   Click on "apply changes."

    d.   Repeat the operation in the second site of the EDFAMUX and verify the values before connecting the DWDM optics.

3.2. NETWORK CONFIGURATION

3.2.1. ETHERNET CONFIGURATION

In the Ethernet configuration submenu, the following operations can be performed:

1) Enable Static IP (by default the EDFAMUX will use DHCP) **(1).**

    a. When enabled, IP Address **(2)**, Gateway **(3),** and Subnet mask **(4)** must be configured.

    b. When changes are complete, click "save" **(5)**.

2) Perform a "Ping" (for troubleshooting or verification):

    a. Fill in the destination IP address **(6)** and click on "Ping" **(7)**.

3.2.2. SNMP CONFIGURATION

The AddOn Networks EDFAMUX uses SNMP version 2c - Please use the provided MIB file or visit the support page.

In the Ethernet configuration submenu, you can configure the Syscontact **(1)**, Syslocation **(2)**, SNMP port **(3)**, and the community string **(4)**.

Figure 2

HOME	SETTINGS	FIRMWARE	INFO

SETTINGS

OPTICAL	ETHERNET	SNMP	SYSTEM

SNMP version:	SNMPv2c
System name	SO8100EDF08000
System description	EDFAMUX-80KM
System contact	
System location	
Port	161
Community string	public
	Save

3.3. FIRMWARE UPGRADE

The Firmware page is used to upgrade the firmware and the website of the AddOn Networks EDFAMUX - Proceed as follows:

1) Upload the provided "firmware.bin" file **(1)** and click on **"Update" (2)**.

Figure 3

HOME	SETTINGS	FIRMWARE	INFO

FIRMWARE MANAGER

Update firmware

Current firmware version:	2.08.0
Current website version:	2.6
Firmware download page	
Upload new .bin	Choose File No file chosen
	Update
Note: after upgrade, password reverts to "admin"	

3.4. PASSWORD CONFIGURATION

The password configuration page is used to change the password used to access the SETTINGS and FIRMWARE pages. As a note, the password timeout is 15 minutes. Proceed as follows:

Input old password **(1)**, new password **(2)** and **(3)**, and click on "change" **(4)**.

Figure 4

3.5. COMMAND LINE REFERENCE

The connector for the serial console conforms to Cisco specification, Baud rate 115200 bits/s, 8 bits, 1 stop bit, no parity or flow control. Commands in red require authentication, commands in green are get only, and all other commands are get/set. All set commands require the user to be in configure mode. Exit can be used to leave configure mode without committing changes. The following commands are available:

```
-   get | show
-   set
-   configure
-   commit
-   exit
-   ping
-   clear | cls
-   reboot
-   help | ?
```

```
system          ↳
                ntp     ↳                   <enable | disable>
                    ip                      <ip address>
                    timezone                GMT<-12 - +14>
                    dst                     <enable | disable>

                time                        <d/m/y H:M:S>
                timeformat                  <12 | 24>
                dateformat                  <dmy | ymd>
                status
                apikey
                passwd


optical↳
                pre gain                    <float>
                post gain                   <float>
                dcm distance                <integer>



ethernet        ↳
                static                      <enable | disable>
                ip                          <ip address>
                gw                          <ip address>
                mask                        <ip address>
                dns                         <ip address>
                mac

monitor↳
                snmp    ↳
                    port                    <0-65535>
                    sysdescr                <string>
                    syscontact              <string>
                    sysname         <string>
                    syslocation             <string>
                    community               <string>
                syslog ↳
                    port                    <int>
                    ip                      <ip address>
```

3.6. HTTP API SPECIFICATION

All API requests are unsecured. Only the reboot command is protected with a basic authentication key which must be passed with the header, "Authorization" c.q. "Authorization: xxxxxxxx." The authentication key is generated from the system password and is shown on the "settings" page.

All data is returned as JSON objects.

1- Device data (serial number, firmware version, power supply status, and uptime).
2- WLAN data (Wi-Fi status, SSID, and password).
5- EDFA data (readings, min/max values, tunable/static, and DCM status).
6- Reboot device (see above).
10- SNMP data.
22- Sensor data (same data as in API 5/readings, but keyed as floating-point values for easy readouts).

END-OF-LIFE DISPOSAL

Please follow all local and national laws and regulations when disposing of the AddOn Networks EDFAMUX after deinstallation.

4. RECOMMENDED EDFA VALUES

The following recommended values are to be considered while using the maximum fiber length of your network. Booster values may need to be adjusted if a shorter fiber length is used.

The following values are based on a 10G SFP+ sending +1dBm of light power for the 10G 140km and 10G 200km AddOn Networks EDFAMUX models and a 100G QSFP sending -6.5dB of light power for the 100G AddOn Networks EDFAMUX models. The fiber attenuation values in this table are assuming a fiber without splices and a loss of 0.2dB/km.

EDFA Booster	Symbols	100G 80km	10G 140km	10G 200km
Input Power Range	dBm	-13 (1 channel) -4 (8 channels)	/	-4 (1 channel) +6 (10 channels)
Typical Pump Power	dB	Adjustable 14 to 20	/	Adjustable 14 to 20
Output Power Range	dBm	+3 (1 channel) +12 (8 channels)	/	+16 (1 channel) +20 (10 channels)
Dark Fiber	**Symbols**	**100G 80km**	**10G 140km**	**10G 200km**
Theoretical Attenuation	dB	18	28	40
EDFA Post Amp	**Symbols**	**100G 80km**	**10G 140km**	**10G 200km**
Input Power Range	dBm	-13 (1 channel) -4 (8 channels)	-29 (1 channel) -18 (10 channels)	-24 (1 channel) -20 (10 channel)
Typical Pump Power	dB	Adjustable 14 to 20	+20	+21
Output Power Range	dBm	+5 (1 channel) +16 (8 channels)	-9 (1 channel) +2 (10 channels)	-1 (1 channel) +3 (10 channels)

5. SAFETY GUIDELINES AND WARNINGS

When removing or (un)installing fiber-optic cables/EDFAMUX, please note the following warnings:

Warning - Class 1 Laser Product: Do not look directly into an EDFAMUX or into the ends of fiber-optic cables. EDFAMUX and fiber-optic cables that are connected to a transceiver emit laser light that can damage your eyes.

Do not leave an EDFAMUX uncovered except when inserting or removing a cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

Only trained and qualified personnel should be permitted to install, replace, and/or service the EDFAMUX.

GENERAL GUIDELINES:

- Use the EDFAMUX only for the purpose it was designed for.
- To avoid overheating the EDFAMUX, please use the appropriate and qualified rack space and only use the EDFAMUX in spaces designed to store/use regular network equipment (no harsh or extreme environments).
- To minimize shock hazard, the EDFAMUX must be connected to a properly grounded receptacle. Not properly grounding the EDFAMUX is considered dangerous and may lead to damage.
- Do not use the EDFAMUX in the presence of flammable gases or fumes.
- Do not allow unqualified persons to remove covers.
- Do not allow unqualified persons to replace components.
- Do not allow unqualified persons to make any internal adjustments.
- Always disconnect power, discharge circuits, and remove external voltage sources before touching any components.
- Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the EDFAMUX. In the case of malfunction and/or maintenance please read Chapters 7 and 8 of this manual.

REGARDING FIBER-OPTIC CABLES:

The AddOn Networks EDFAMUX is designed to include fiber-optic components/products, including optical connectors to connect optical cables. Unlike electrical wires, the insides of optical cables contain a fiber made of glass. Due to the different properties of optical fiber when compared to the copper used in electrical wires, some additional precautions must be taken as detailed below:

- Avoid bending fiber-optic cables beyond their minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems which are difficult to diagnose.
- Do not let fiber-optic cables hang free from the connector.
- Do not allow fastened loops of cable to dangle. If the loops dangle, the cables can become stressed at the fastened point.
- Secure cables in the cable management system so that they are not supporting their own weight.
- Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.

REGARDING THE LASER:

- The AddOn Networks EDFAMUX includes a Class 1 Laser which is generally harmless; however, extra precaution is still advised. These precautions are noted below:

  o Take care when connecting or disconnecting optical fiber cabling or optical transceivers.
  o Follow the instructions provided in the manuals of those products.
  o Do not open the casing of the EDFAMUX, especially when in operation.
  o Never look directly into the end of the fiber or in any opening of the EDFAMUX.
  o Never use a microscope, magnifying glass, or any kind of eye loop to observe a fiber end or in any opening of the EDFAMUX.
  o Always wear appropriate safety eyewear when working with the EDFAMUX.
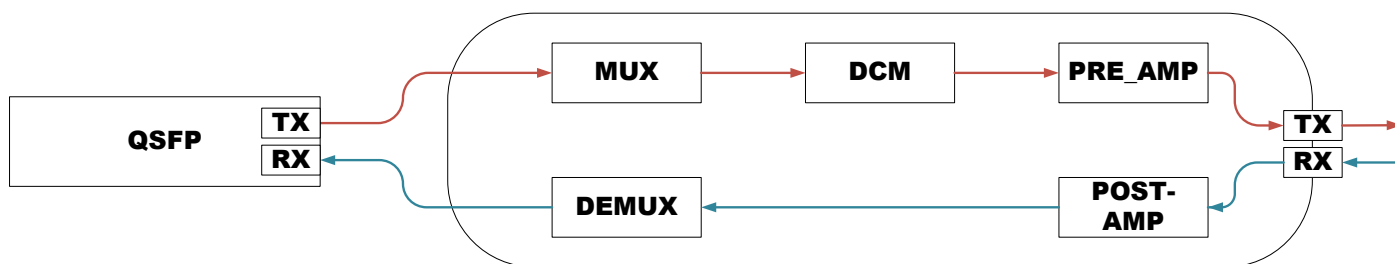
6. DRAWINGS, CIRCUIT DIAGRAMS, & PHOTOS

Figure 5

Outline Dimensions

EDFAMUX Interface Block Diagram

Figure 6

*QSFP included for connection clarification.

7. IN CASE OF MALFUNCTION:

If you encounter difficulties with the AddOn Networks EDFAMUX, please recheck the instructions and specifications as outlined in the previous pages of this manual.

Also, verify the following:

     1) Check that all cables/connectors have been properly connected (see Chapters 3 and 5).

     2) Check that the unit is receiving power.

     3) Replace the EDFAMUX with a known working EDFAMUX to see if the issue resolves, if possible.

In case a malfunction is not resolved, do not open the unit or attempt to alter or repair the EDFAMUX yourself. It contains no user-serviceable parts and may contain hazardous substances.

AddOn Networks' EDFAMUX units that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

For Technical Support, call your regional support number or send an email:

US: +1 877 292 1701	**Italy:** +39 800 69 4263
UK: +44 (0) 8081 892446	**Australia:** +61 1800 864 977
France: +33 80 59 81 400	**Fax:** 949 266 9273
	techsupport@addonnetworks.com

WARRANTY

We offer a 3-year warranty for normal usage of the EDFAMUX, provided that the user has not altered the EDFAMUX in any way or used it contrary to its intended purpose. For specific information regarding our warranty, please visit our website for our general terms and conditions.

8. MAINTENANCE

No maintenance is required for the AddOn Networks EDFAMUX when placed in a normal clean environment compliant to the requirements set forth in the specific datasheet applicable to the chosen AddOn Networks EDFAMUX model.

When connecting or disconnecting, follow the procedures as detailed in Chapter 3.

When connecting or disconnecting the AddOn Networks EDFAMUX, caution is advised.

For specific warnings, please refer to Chapter 5 of this manual.

9. CONTACT & REGULARITY INFORMATION

For the latest product information, contact your local supplier below or visit us online at addonnetworks.com.

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Version and Date	Effective Date	Author	Changes
Version 2.3.1 (October 2021)	10/04/21	H. Pierson	Revised copy.
Version 2.3.2 (April 2022)	04/06/22	H. Pierson	Updated contact information.

ATTACHMENT(S)

Please visit our website for the datasheet(s) related to your specific AddOn Networks EDFAMUX model.