FLUIDMESH
NETWORKS
A CARRICK BEND COMPANY

Fluidmesh 1100/1200VOLO/3100 MITO series

User manual

Firmware Version 6.0.×

Fluidmesh 1100/1200VOLO/3100 MITO Series
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WARNING

ONLY QUALIFIED PERSONNEL SHOULD INSTALL THIS UNIT. THE INSTALLATION SHOULD CONFORM TO ALL LOCAL CODES. IN SOME COUNTRIES, A CERTIFIED ELECTRICIAN MAY BE REQUIRED.

CAUTION

When open, the apparatus should not be dripping or splashing. No object filled with liquid shall be placed on the apparatus.

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Contents

1 Manual Overview **6**

2 Precautions **7**

3 Installation and System Set-up **8**

3.1 Fluidmesh 1100 MITO Series 8

3.1.1 Proper Installation Procedures 9

3.1.2 Powering on an FM1100 9

3.1.3 Status and Link LEDs 10

3.1.4 Factory Default Hardware Reset 10

3.1.5 Integrated Panel Antenna 11

3.2 Fluidmesh 3100 MITO Series 12

3.2.1 Proper Installation Procedures 13

3.2.2 Powering on an FM3100 13

3.2.3 Status and Link LEDs 14

3.2.4 Factory Default Hardware Reset 14

3.2.5 Integrated Panel Antenna 15

3.3 Fluidmesh 1200VOLO 16

3.3.1 Proper Installation Procedures 17

3.3.2 Powering on an 1200VOLO. 17

3.3.3 Status and Link LEDs 18

3.3.4 Factory Default Hardware Reset 18

3.3.5 Integrated Panel Antenna 19

4 Fluidmesh Architecture Overview **20**

4.1 Point-to-Point Wireless Bridge 20

4.2 Mesh Network Architecture 21

4.3 Point-to-Multipoint Architecture: FluidMAX™ 22

5 Fluidmesh Network Addressing 24
5.1 Bridge IP Addressing 24
5.1.1 Connecting and Configuring IP Devices and Cameras 25
5.2 Mesh Addressing 25
5.2.1 Network Addressing 26

6 Software Plug-ins 29
6.1 Plug-in Activation/Deactivation Procedure 30

7 Web-based Interface and Configuration 33
7.1 Software and Hardware Requirements 33
7.2 Logging-in to the Web-based Interface 34
7.3 End-user License Agreement and Region of Operation 35
7.4 MeshWizard™ 37
7.5 Web-based Interface Menus 37
7.6 General Mode 38
7.7 Wireless Settings 38
7.8 Advanced Wireless Settings 42
7.9 Antenna Alignment Tools and Physical Statistics 43
7.10 Frequency Scan Tool 45
7.11 FMQuadro™ (Mesh End only) 47
7.11.1 VLAN Tagging Configuration (Software Plug-in Required) 53
7.12 Firmware Upgrade 54
7.13 Plug-in Management 56
7.14 Advanced Tools 57
7.15 Multicast 58
7.16 PoE Passthrough (FM1100 and FM1200 only) 59
7.17 Change Password 59
7.18 Status 59
7.19 Reboot and Reset to Factory Default 60
7.20 On-line Help 60

8 Troubleshooting **61**

8.1 I am unable to get the log-in screen 61

8.2 I am unable to log-in into the Web-based interface 61

8.3 I forgot the administrator password 62

8.4 In Bridge Mode I get no Link or the Link LED is always red or I am getting a weak Wireless link (below 60% signal strength) 62

1 Manual Overview

This manual describes how to install and operate the Fluidmesh VOLO and MITO series products. More specifically, this manual contains a general overview of the Fluidmesh 1100 MITO, Fluidmesh 1200 VOLO and the Fluidmesh 3100 MITO in Section 3.1, Section 3.2 and Section 3.3 respectively. Please refer to Fig. 1.1(a), Fig. 1.1(b) and Fig.1.1(c) for a representation of each product. This user's manual also includes a complete overview of the network architectures that can be created using Fluidmesh technology, and is discussed in Section 4. The Fluidmesh network addressing is described in Section 5. The use of Fluidmesh software plug-ins, their features, and their installation procedures in a network follows in Section 6. The Web-based Graphical User Interface (GUI) is then described in Section 7. Please note that, unless otherwise explicitly specified, the Web GUI presentation refers to the Fluidmesh 1100, Fluidemesh 1200 and the Fluidmesh 3100. Screenshots shown in this manual are explanatory examples and may be different from the ones that appear when you run the Web-based configuration software.

(a) Fluidmesh 1100 MITO (b) Fluidmesh 3100 MITO (c) Fluidmesh 1200 VOLO

Figure 1.1: Fluidmesh 1100 MITO, Fluidmesh 1200 VOLO and Fluidmesh 3100 MITO front view.

2 Precautions

Fluidmesh Networks products are for professional use only.

Fluidmesh Networks products have been designed with safety in mind. However, if not used properly, they can cause fires which may lead to serious bodily injuries. To avoid such accidents, make sure that you are properly qualified to install these products.

In Case of Breakdown

In case of system breakdown, discontinue use and immediately contact your authorized Fluidmesh Networks dealer or Fluidmesh Networks LLC. directly.

In Case of Abnormal Operations

If the unit emits smoke or an unusual smell, if water or other foreign matter enters the enclosure, or if your drop the unit or damage the enclosure, power off the unit immediately and contact your authorized Fluidmesh Networks dealer or Fluidmesh Networks LLC directly.

3 Installation and System Set-up

This section describes how to install and set up Fluidmesh products. Specifically, the Fluidmesh 1100 MITO, Fluidmesh 1200 VOLO and Fluidmesh 3100 MITO series are described in Section 3.1, Section 3.2 and Section 3.3 respectively.

3.1 Fluidmesh 1100 MITO Series

The Fluidmesh 1100 MITO (part number FM1100M-HW, for simplicity referred to as FM1100) is designed for wireless operations .
The hardware is multi-band panel an-tenna which can be mounted and oriented using the supplied pole-mounting adapter as depicted in Fig. 3.1 and Fig. 3.2

Figure 3.1: Fluidmesh 1100 enclosure (back).

The FM1100 can operate both as a **point-to-point wireless bridge** or as a single radio **mesh unit**. The former operating mode is described in Section 4.1 whereas the latter is discussed in Section 4.2.

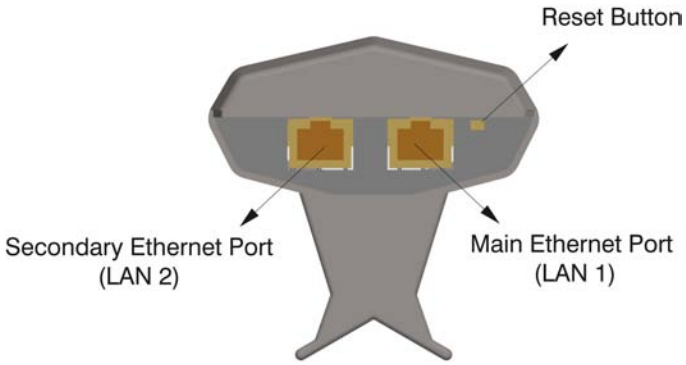


Figure 3.2: Fluidmesh 1100 pole mounting adapter, Ethernet ports and reset button.

3.1.1 Proper Installation Procedures

The FM1100 comes with a pole-mounting adapter, shown in Fig. 3.2, that allows the installer to change the alignment of the antenna along the horizontal axis. Plastic or metal tie wraps can be used to install the unit on a pole.

3.1.2 Powering on an FM1100

The unit can be powered only with the Power-over-Ethernet injector provided with the FM1100 (Fig. 3.3). The PoE injector does **not** comply with the 802.3af standard and therefore it cannot be substituted with a different injector.

Figure 3.3: Fluidmesh 1100 Power-over-Ethernet injector.

The PoE injector must be powered 100-240V 50-60Hz AC using the AC

LED # (Color)	Boot Status	Link Quality
1 (Red)	Booting core system	poor/link absent
2 (Orange)	Booting wireless system	fair
3 (Green)	Booting routing engine	good
4 (Green)	Booting unit configuration	very good

Table 3.1: FM1100 Boot/Link Status LEDs Color Scheme

adapter included.

3.1.3 Status and Link LEDs

A panel on the back of the FM1100, shown in Fig. 3.4, provides seven (7) LEDs which can be used to check the unit and the link quality status. From the left-hand side, the first 3 green LEDs indicate the unit power, the Ethernet port #1 activity and the Ethernet port #2 activity, respectively. The remaining 4 colored LEDs indicate the level of the link signal and can be used for antenna alignment purposes. During the unit boot-up process, the 4 colored LEDs indicate the boot status and can be used for problem detection. In fact, the LEDs light up in sequence from the leftmost one (red) to rightmost one (bright green). If the LEDs lighting up sequence does not complete, then an error has been detected during the booting process. Please refer to Table 3.1 for details.

Figure 3.4: From left to right status LEDs, link/boot LEDs.

3.1.4 Factory Default Hardware Reset

The FM1100 can be reset to factory default using the RESET button placed nearby the Ethernet ports as shown in Fig. 3.2. To reset the FM1100 to factory default settings, power up the unit and wait approximately 40 seconds for the unit to boot up. Once the unit is up and running, press the reset button for 5 seconds. The FM1100 will restore the factory default settings and automatically reboot. After the reset, the default IP address of 192.168.0.10/255.255.255.0 is restored and the administrator password is set to *admin*.
The RESET button can also be used to reboot the unit when pressed for 1 second.

3.1.5 Integrated Panel Antenna

The FM1100 has an integrated panel antenna that can operate at 4.9-6.0 GHz. A separate or external antenna cannot be installed or mounted. The gain of the antenna is 15 dBi at 4.9-6.0 GHz. The specifications of the integrated panel antenna are reported Table 3.2.

Gain at 4.9-6.0 GHz	14.6-16.1 dBi
Frequency Range	4940-6075 MHz
Polarization	Dual Linear
3 dB Beam Angle @ 5470 MHz	43 degrees
Front to Back Ratio	22 dB

Table 3.2: Antenna Specifications

3.2 Fluidmesh 3100 MITO Series

The Fluidmesh 3100 MITO (part number FM3100M-HW, for simplicity referred to as FM3100) is designed for wireless operations.
The hardware is multi-band sector antenna which can be mounted and oriented using the supplied pole-mounting adapter as depicted in Fig. 3.5 and Fig. 3.6.

Figure 3.5: Fluidmesh 3100 enclosure.

The FM3100 can operate both as a **point-to-point wireless bridge** or as a single radio **mesh unit**. The former operating mode is described in Section 4.1 whereas the latter is discussed in Section 4.2.

Figure 3.6: Fluidmesh 3100 pole mounting adapter.

3.2.1 Proper Installation Procedures

The FM3100 comes with a pole-mounting adapter, shown in Fig. 3.6, that allows the installer to change the alignment of the antenna along both the vertical and the horizontal axis.

3.2.2 Powering on an FM3100

The unit can be powered only with the Power-over-Ethernet injector provided with the FM3100 (Fig. 3.7). The PoE injector does **not** comply with the 802.3af standard and therefore it cannot be substituted with a different injector.

Figure 3.7: Fluidmesh 3100 Power-over-Ethernet injector.

The PoE injector must be powered 100-240V 50-60Hz AC using the AC adapter included.

LED # (Color)	Boot Status	Link Quality
1 (Red)	Booting core system	poor/link absent
2 (Orange)	Booting wireless system	fair
3 (Green)	Booting routing engine	good
4 (Green)	Booting unit configuration	very good

Table 3.3: FM3100 Boot/Link Status LEDs Color Scheme

3.2.3 Status and Link LEDs

A panel on the back of the FM3100, shown in Fig. 3.8, provides six (6) LEDs which can be used to check the unit and the link quality status. From the left-hand side, the first 2 green LEDs indicate the unit power, the Ethernet port activity, respectively. The remaining 4 colored LEDs indicate the level of the link signal and can be used for antenna alignment purposes. During the unit boot-up process, the LEDs indicate the boot status and can be used for problem detection. Specifically, the 4 colored LEDs light up in sequence from the leftmost one (red) to rightmost one (bright green). If the LEDs lighting up sequence does not complete, then an error has been detected during the booting process. Please refer to Table 3.3 for details.

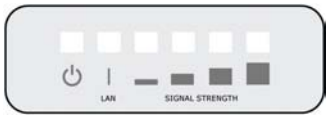


Figure 3.8: From left to right status LEDs, link/boot LEDs.

3.2.4 Factory Default Hardware Reset

The FM3100 can be reset to factory default using the proper RESET button present on the PoE injector provided with the unit as shown in Fig. 3.7.
To reset the FM3100 to factory default settings, power up the unit and wait approximately 40 seconds for the unit to boot up. Once the unit is up and running, press the reset button for 5 seconds. The FM3100 will restore the factory default settings and automatically reboot. The LEDs will blink when the unit receives the reset to factory default signal. After the reset, the default IP address of 192.168.0.10/255.255.255.0 is restored and the administrator password is set to *admin*.
The RESET button can also be used to reboot the unit when pressed for 1 second.

3.2.5 Integrated Panel Antenna

The FM3100 has an integrated 93 degrees sector antenna that can operate at 4.9-6.0 GHz. A separate or external antenna cannot be installed or mounted. The gain of the antenna is 15 dBi at 4.9-6.0 GHz. The specifications of the integrated panel antenna are reported Table 3.4.

Gain at 4.9-6.0 GHz	15 dBi
Frequency Range	4940-6075 MHz
Polarization	Dual Linear
3 dB Beam Angle @ 5470 MHz	93 degrees
Front to Back Ratio	22 dB

Table 3.4: Antenna Specifications

3.3 Fluidmesh 1200VOLO

The Fluidmesh 1200 VOLO(part number FM1200V-HW, for simplicity referred to as FM1200) is designed for wireless operations.
The hardware is multi-band sector antenna which can be mounted and oriented using the supplied pole-mounting adapter as depicted in Fig. 3.9 and Fig. 3.10.

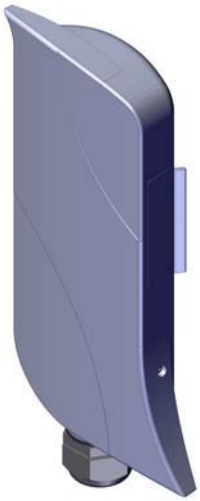


Figure 3.9: Fluidmesh 1200enclosure.

The FM1200 can operate both as a **point-to-point wireless bridge** or as a single radio **mesh unit**. The former operating mode is described in Sec-tion 4.1 whereas the latter is discussed in Section 4.2.

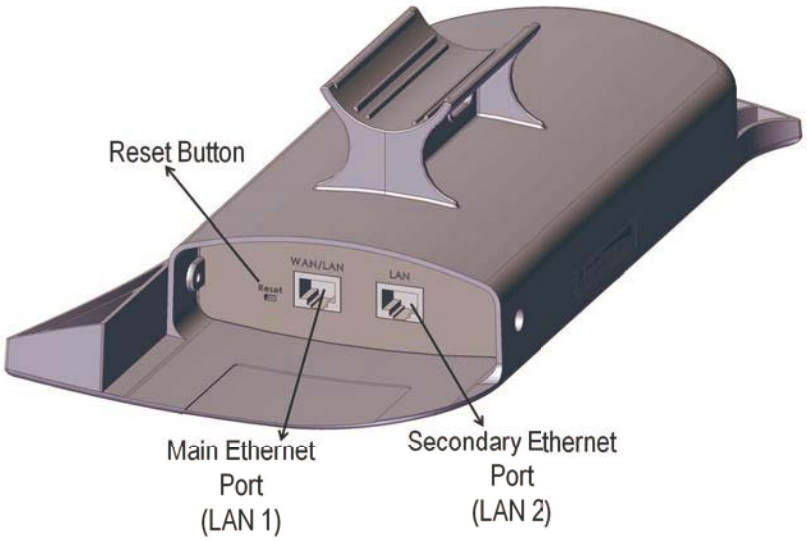


Figure 3.10: Fluidmesh 1200 pole mounting adapter, Ethernet ports and reset button.

3.3.1 Proper Installation Procedures

The FM1200 comes with a pole-mounting adapter, shown in Fig. 3.10, that allows the installer to change the alignment of the antenna along the horizontal axis. Plastic or metal tie wraps can be used to install the unit on a pole.

3.3.2 Powering on an FM1200

The unit can be powered only with the Power-over-Ethernet injector provided with the FM1200 (Fig. 3.11). The PoE injector does **not** comply with the 802.3af standard and therefore it cannot be substituted with a different injector.

Figure 3.11: Fluidmesh 1200 Power-over-Ethernet injector.

The PoE injector must be powered 100-240V 50-60Hz AC using the AC

LED # (Color)	Boot Status	Link Quality
1 (Red)	Booting core system	poor/link absent
2 (Orange)	Booting wireless system	fair
3 (Green)	Booting routing engine	good
4 (Green)	Booting unit con□guration	very good

Table 3.5: FM1200 Boot/Link Status LEDs Color Scheme

3.3.3 Status and Link LEDs

A panel on the side of the FM1200, shown in Fig. 3.12, provides six (6) LEDs which can be used to check the unit and the link quality status. From the buttom up, the first 2 green LEDs indicate the unit power, the Ethernet port activity, respectively. The remaining 4 colored LEDs indicate the level of the link signal and can be used for antenna alignment purposes. During the unit boot-up process, the LEDs indicate the boot status and can be used for problem detection. Specifically, the 4 colored LEDs light up in sequence from the leftmost one (red) to rightmost one (bright green). If the LEDs lighting up sequence does not complete, then an error has been detected during the booting process. Please refer to Table 3.5 for details.

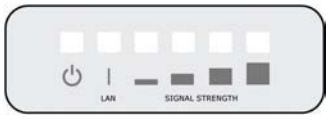


Figure 3.12: From buttom up status LEDs, link/boot LEDs.

3.3.4 Factory Default Hardware Reset

The FM1200 can be reset to factory default using the proper RESET button present on the PoE injector provided with the unit as shown in Fig. 3.11. To reset the FM1200 to factory default settings, power up the unit and wait approximately 40 seconds for the unit to boot up. Once the unit is up and running, press the reset button for 5 seconds. The FM1200 will restore the factory default settings and automatically reboot. The LEDs will blink when the unit receives the reset to factory default signal. After the reset, the default IP address of 192.168.0.10/255.255.255.0 is restored and the administrator password is set to *admin*.
The RESET button can also be used to reboot the unit when pressed for 1 second.

3.3.5 Integrated Panel Antenna

The FM1200 has an integrated 93 degrees sector antenna that can operate at 4.9-6.0 GHz. A separate or external antenna cannot be installed or mounted. The gain of the antenna is 15 dBi at 4.9-6.0 GHz. The specifications of the integrated panel antenna are reported Table 3.4.

Gain at 4.9-6.0 GHz	15 dBi
Frequency Range	4940-6075 MHz
Polarization	Dual Linear
3 dB Beam Angle @ 5470 MHz	93 degrees
Front to Back Ratio	22 dB

Table 3.6: Antenna Specifications

4 Fluidmesh Architecture Overview

The FM1100, FM1200 and the FM3100 series can be used to create any kind of network architecture such as point-to-point links and mesh networks. More-over, thanks to the innovative FluidMAX™ patent pending technology, point-to-multipoint links can be created. This also gives to the user the ability to create mixed networks architectures leading to higher performance and flexibility in the deployment. In the following section we describe how to build point-to-point, point-to- multipoint, and mesh networks with the Fluidmesh products.

4.1 Point-to-Point Wireless Bridge

A wireless bridge enables two local networks (i.e., network segments) to communicate with each other . The wireless bridge

is defined as “transparent” because its activity is transparent to the network hosts. In other words, the wireless bridge forwards packets from one network segment to the other according to a “forwarding table” which is built by learning the network topology from the analysis of the incoming traffic. In this configuration, no explicit interaction between the wireless bridge and the network hosts takes place. The two network segments, connected to both sides of the wireless bridge, will share the same IP addressing class. Thus, each network host must use a unique IP address, i.e., it is not allowed to have two devices sharing the same IP address.

4.2 Mesh Network Architecture

This section describes the Fluidmesh mesh networking architecture and the basic functionalities of the FM1100/FM1200/FM3100 series. For the sake of clarity, we will refer to a generic FM unit whenever the discussion applies to the FM1100, FM1200 and the FM3100 series.

Fluidmesh Networks develops wireless networking solutions based on the innovative mesh networking architecture which presents unmatched advantages in terms of reliability and flexibility compared to any traditional wireless solution. Using Fluidmesh technology for your network allows you to take advantage of this powerful architecture. An example of wireless mesh network is shown in Fig. 4.3. In a wireless mesh network, every FM unit transmits the data packets coming from the devices directly attached to it and also acts as an “intelligent router” able to forward packets coming from other FM units through the optimal path.

In a redundant and reliable mesh network, every stream of data packets has multiple available paths to reach the base station, and the network forwards the packets through the optimal path at any point in time. The absence of any single point of failure increases its reliability compared to any other transmission technology, either wireless or wired.

4.3 Point-to-Multipoint Architecture: FluidMAX™

Developing FluidMAX[1], Fluidmesh embraced the Point-to-Multipoint architecture improving its features and capabilities to meet the needs of system integrators in the security and industrial automation indus-try.
The FluidMAX technology is based on a centralized Medium Access Control (MAC) protocol and allows Fluidmesh customers to create point-to-multipoint networks using the FM units.

With the FluidMAX technology, an FM unit can thus be used at the center of the star topology in a point-to-multipoint fashion using sector antennas or antenna splitters with multiple directional antennas. The unit operating at the center of the star topology plays the role of Master and is in charge of coordinating communications to and from the other units which thus act as Slaves. As a result, the hidden and exposed terminal problems are eliminated by the centralized FluidMAX MAC protocol which supports up

[1]Patent pending.

to 100 Mb/s maximum throughput.[2] By reducing the number of slaves, the supported rate per slave can be increased provided that the sum of the throughput requirements of the slaves is lower than or equal to 100 Mb/s.

FluidMAX is fully automatic and integrated within the mesh architecture. By continuously monitoring the network topology, FM units are able to automatically select whether to operate the FluidMAX MAC protocol or remain in the initial mesh operating mode. Consequently, no additional configuration is needed to enable the FluidMAX features because the communication protocol is automatically chosen by the FluidMAX protocol based on the detected network topology.

[2]We assume the default channel width of 40 MHz.

5 Fluidmesh Network Addressing

5.1 Bridge IP Addressing

The FM unit can be operated in bridge mode to create a single point-to-point connection between two network segments as described in Section 4.1.
Each FM unit is provided with a default IP address for its wired Ethernet port(s), which is:

192.168.0.10

No IP address is associated to the wireless interface.

When you set up a wireless bridge using two FM units for the first time, both units will have the same default IP address equal to 192.168.0.10. It is recommended to change the IP address of one of the two units in order to unambiguously address and configure the system with no confusion (see Fig. 5.1).

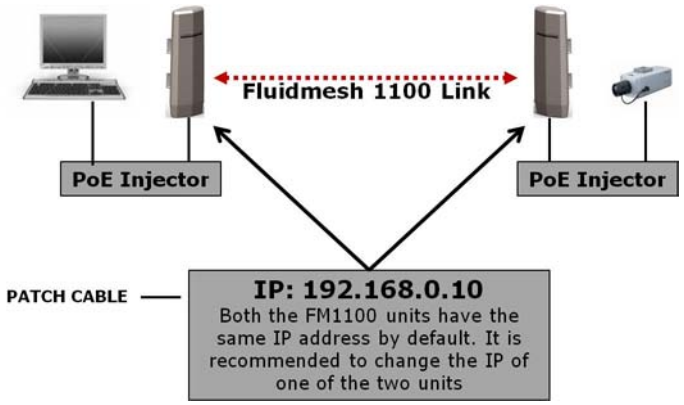


Figure 5.1: Wireless network architecture and initial bridge configuration.

5.1.1 Connecting and Configuring IP Devices and Cameras

The FM3100 mounts one Ethernet port and the FM1100 and FM1200 is equipped with 2 Ethernet ports that can be used to connect a camera or other Ethernet-compatible device. You should directly connect any device using an Ethernet cable to the PoE injector. Use a patch Ethernet cable to connect the PoE injector to the FM unit.
FM1100 the second Ethernet port can be used to power any 12-18V passive PoE device. Therefore, multiple FM unit can be connected together in a daisy chain fashion if required.

The camera or the device attached to the FM unit should use an IP address belonging to the same class of the devices on the other network segment of the wireless bridge.

The default IP address class is 192.168.0.0/255.255.255.0.

5.2 Mesh Addressing

The FM units have two modes of operation which are used to develop mesh network architectures:

- **Mesh Point** Mode
- **Mesh End** Mode

Mesh Point Mode: it is the default mode for the FM unit. Each unit in the field that is **not** connected to the wired LAN backbone must be set in **Mesh Point** Mode.
Mesh End Mode: in the Fluidmesh network, an FM unit that is connected to the main wired LAN must be set in **Mesh End** Mode. The **Mesh End** unit is the junction point between the wireless network and any IP-based wired network.

Regardless of its configuration, any FM unit comes from the factory with a unique unit ID with the following format:

5.a.b.c

where the triplet (a,b,c) unambiguously identifies the unit and cannot be changed. The unit ID is used to identify the units throughout the Web-based Graphical User Interface (GUI).

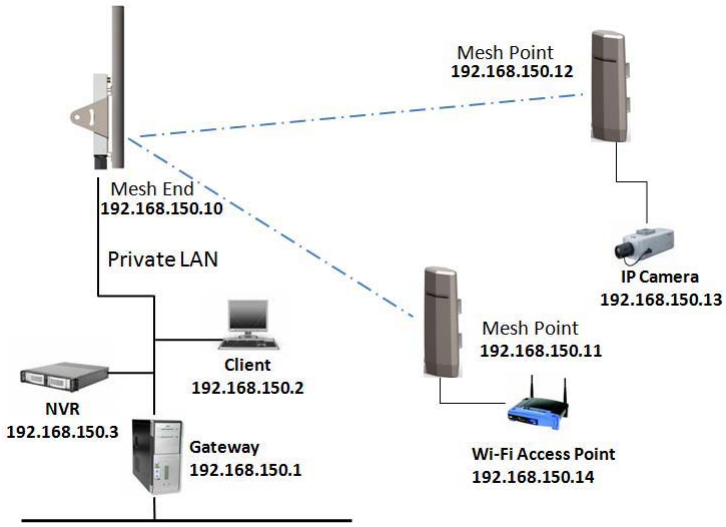


Figure 5.2: Fluidmesh network addressing.

5.2.1 Network Addressing

The Fluidmesh layer 2 addressing allows configuring each FM unit and each device connected to the FM units according to the IP address class used within the private LAN to which the Mesh End unit is connected. A sample network configuration is shown in Fig. 5.2.
The Fluidmesh network logically becomes part of the private LAN where (usually) the control room resides. Therefore, both the FM units and any other edge device should be provided with a private LAN IP address and will be accessed through that specified IP address.

Consider the example depicted in Fig. 5.2 where the private LAN IP address class is 192.168.150.0 with netmask 255.255.255.0. Each device is configured with an IP address belonging to this class. Please note that each IP address must be univocal within the entire network to avoid address conflicts. The default IP address of each FM unit is 192.168.0.10 with netmask 255.255.255.0. Finally, please note that the default factory-set 5.a.b.c unit IDs are still valid and used to unambiguously identify each FM unit.

Multiple FM units can be connected together through a network switch to form clusters of radios if needed. The Fluidmesh proprietary routing protocol will be run automatically on the cabled segment of the network. Please note that the units must be operated in Mesh Point mode only to activate the cluster feature.

Connecting and Configuring an Ethernet Edge-device

The FM unit Ethernet ports can be used to connect all kinds of Ethernet edge devices (e.g. IP Cameras, Video-Servers, Wi-Fi Access Points, etc.). Any Ethernet device can be configured either manually or automatically through a DHCP server.
A manual IP setting is recommended in any video-surveillance system where the cameras need to have a fixed custom IP address to be accessed by the video-recording software.

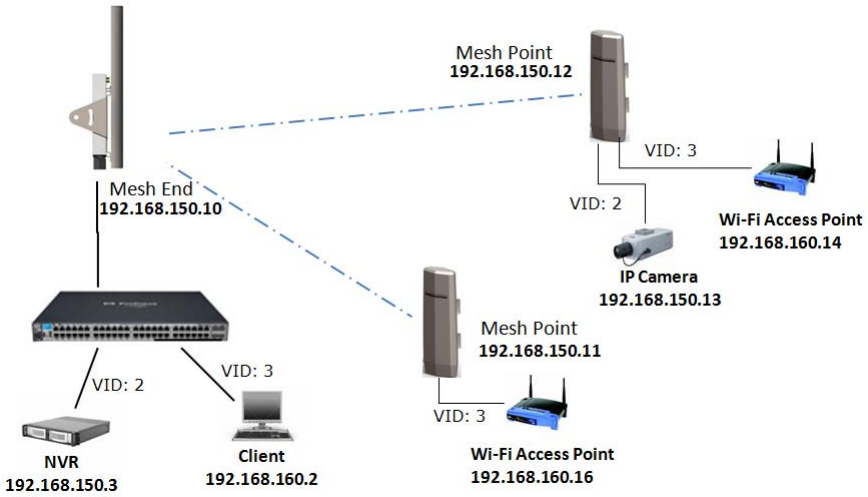


Figure 5.3: Network configuration with two port-based VLANs.

VLAN Tagging (Software Plug-in Required)

Virtual LAN (VLAN) tagging (or IEEE 802.1q) is a networking standard allowing multiple switched networks to transparently share the same physical hardware without the leakage of information between networks. For example, consider a company with several departments. With VLAN tagging, a separate private logical network is made available for each department while using only one physical corporate network. Each VLAN is identified by a specific number called VLAN ID (VID) which is also used for tagging packets belonging to the same VLAN. Because VLANs are based on logical instead of physical connections, several types of VLANs exist based on the criteria adopted to logically separate networks. The traditional VLAN scheme is *port-based* where each physical Ethernet port is configured specifying membership in a VLAN. However, if there are requirements that

individuals or devices must be segregated regardless of their physical location, the *MAC-based* VLANs can be used. In this case, the network is configured with an access list mapping individual MAC addresses to VLAN membership. Other, less common, types of VLANs exist like the *protocol-based* VLANs, where the protocol type is used to separate networks.

VLAN tagging is usually supported by network switches with advanced capabilities. The wireless networks can be viewed as a large distributed switch with VLAN support. Two different types of VLAN tagging mechanisms are supported: **port-based** and **mac-based** VLANs. Fig 5.3 reports a network configuration example where two VLANs are set up, i.e. using VID #2 and VID #3. Each VLAN uses a separate IP address class and the devices belonging to the VLANs must be configured accordingly.

The Fluidmesh VLAN implementation is compatible with the specification of the IEEE 802.1q standard and, thus, the Fluidmesh network can interoperate with other VLAN-aware network devices. VLAN trunking between the Fluidmesh network and the Ethernet switches is also supported to enable carrying VLAN membership information throughout the wireless and wired network segments.

The VLAN tagging can be enabled and configured through the Web interface as described in Section 7.11.1.

Multicast Streaming

To enable multicast video-streams from IP cameras or video-encoders, no multicast group setting is required. Every multicast packet will be forwarded by the **Mesh Point** unit towards the closest **Mesh End** unit. Please refer to Section 7.15 for additional details.

6 Software Plug-ins

The Fluidmesh 1100 MITO (part number FM1100M-HW), Fluidmesh 1200VOLO (part number FM1200V-HW)and the Fluidmesh 3100 MITO (part number FM3100M-HW) feature the innovative FluidThrot-tle™ technology which provides a variable software-upgradable capacity of the Ethernet port based on the user's needs. On the Fluidmesh 1100 and Fluidemsh1200, the user can purchase software-based Plug-ins to increase the maximum capacity of the Ethernet port from 1 Mb/s to 100 Mb/s depending on the system's bandwidth requirements. On the Fluidmesh 3100, the user can purchase software-based Plug-ins to increase the maximum capacity of the Ethernet port from 10 Mb/s to 100 Mb/s depending on the system's band-width requirements. The FluidThrottle technology follows the cost-effective "What You Need Is What You Get" philosophy which provides the user with maximum flexibility in choosing (and paying for) what he/she exactly needs. FM1100M-HW and FM1200V-HW part numbers include the hardware and the default Ethernet Port Capacity of 1 Mb/s. FM3100M-HW part number includes the hardware and the default Ethernet Port Capacity of 10 Mb/s.

Part Number	**Description**	**FM1100**	**FM3100**
FM1100M-02	Ethernet Capacity up to 2.5 Mb/s	✓	
FM1100M-05	Ethernet Capacity up to 5 Mb/s	✓	
FM1100M-10	Ethernet Capacity up to 10 Mb/s	✓	
FM1100M-30	Ethernet Capacity up to 30 Mb/s	✓	
FM1100M-60	Ethernet Capacity up to 60 Mb/s	✓	
FM1100M-UN	Ethernet Capacity up to 100 Mb/s		
FM3100M-30	Ethernet Capacity up to 30 Mb/s		✓
FM3100M-60	Ethernet Capacity up to 60 Mb/s		✓
FM3100M-UN	Ethernet Capacity up to 100 Mb/s		✓
FM-AES	128-bit AES Encryption	✓	✓
FM-49	4.9 GHz Band	✓	✓
FM-LF	Licensed Frequencies	✓	✓

Table 6.1: Software Plug-in upgrades.

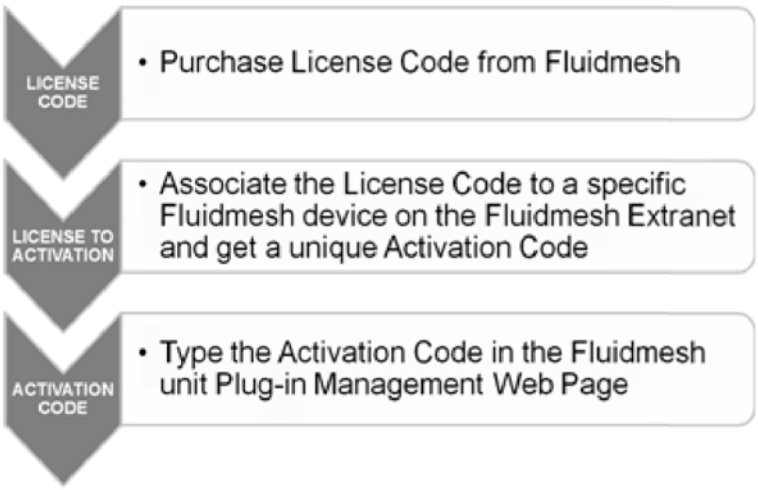


Figure 6.1: Plug-in installation procedure.

Additionally, the FM1100, the FM1200 and the FM3100 can be upgraded to support the 128-bit AES industry-grade data encryption, the 4.9 GHz U.S. public safety band[1], and the 6 GHz licensed frequencies band. A summary of the available Plug-ins for the FM units is reported in Table 6.1.

6.1 Plug-in Activation/Deactivation Procedure

The Plug-in management procedure has been standardized for maximum flexibility as follows. When a customer purchases a Fluidmesh Plug-in, a generic 16-digit License Code is provided. Because the License Code is generic and not associated with any device, it needs to be activated before it can be used on a Fluidmesh device. In order to activate a License Code, the user can access the Fluidmesh website[2] (www.fluidmesh.com) and bind the License Code to the specific Fluidmesh Unit ID or Fluidmesh Product Serial Number to which the Plug-in should be applied. By doing so, the Fluidmesh website will provide the user with a specific eight digit Activation Code that can be applied to the specific device to activate the Plug-in functionalities. The overall process is depicted in Fig. 6.1.

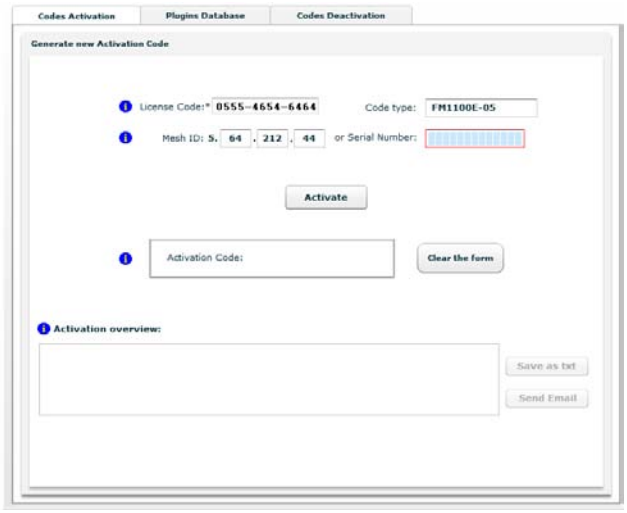
Fig. 6.2(a) depicts the Fluidmesh Web extranet interface to generate Activation Codes available at www.fluidmesh.com. As indicated, the purchased License Code must be bound to the unit's unique ID (both the unit ID and

[1] Not available in Brazil.

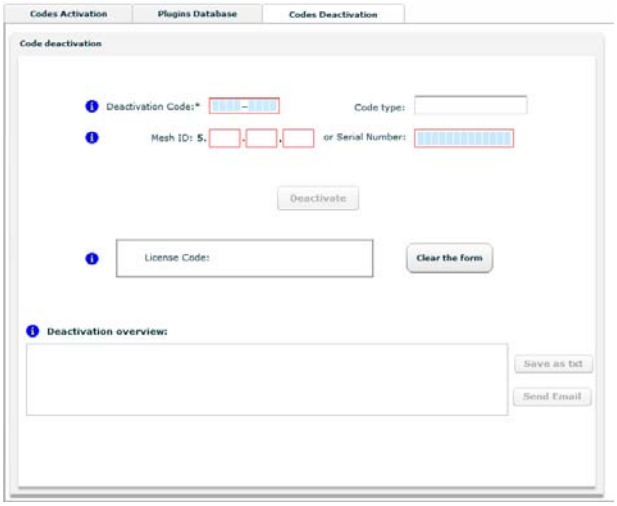
[2] In order to access the Fluidmesh extranet, users need to register on the Fluidmesh website at www.fluidmesh.com. Registration is free of charge.

the Serial Number are accepted) in order to get the Activation Code. Please refer to Section 7.13 to input the Activation Code into the unit Web interface.

To provide the maximum flexibility in the Plug-in management, Fluidmesh allows the deactivation of any installed Plug-in in order to transfer it to another Fluidmesh unit. Specifically, each Plug-in can be deactivated via the Web interface of the unit according to the procedure described in Section 7.13. A Deactivation Code is provided by the unit which can be input in the Fluidmesh Plug-in Management Web Page on Fluidmesh Extranet to generate a fresh License Code as depicted in Fig. 6.2(b). The latter can then be used to generate a new Activation Code to activate the Plug-in for a different unit.



(a) Plug-in Activation



(b) Plug-in Deactivation

Figure 6.2: Activation/Deactivation Code Generation Web interface available at www.fluidmesh.com.

7 Web-based Interface and Configuration

Every FM unit can be configured and managed using a Web-based Graphical User Interface (GUI). By default, each FM unit is configured in **Bridge** Mode with the Bridge IP address 192.168.0.10 and netmask 255.255.255.0.

To change the settings on the units, you need to log-in to the Web-based interface.

7.1 Software and Hardware Requirements

To log-in to the Web GUI, you need a PC with a Web-browser, an Ethernet port, and an Ethernet cable.

Requirements List:

- Cat5 Crossover Ethernet cable with RJ45 connectors.
- PC with the following characteristics:
  - **Windows XP or Windows 2000.** In this manual, we assume use of Windows XP and every instruction or screenshot is based on this assumption. The device can also be configured using other operating systems, such as Linux, MAC OS, or older versions of Windows.
  - **Microsoft Internet Explorer 6.** In this manual, we assume use of Microsoft Internet Explorer 6 or newer. A Fluidmesh device can also be configured using other browsers such as older versions of Internet Explorer, Firefox or Safari but the configuration using these browsers has not been thoroughly tested.
  - **Wired Ethernet Network Card.**
  - **Hardware Requirements.** Typical PC hardware allowing for proper operations of Windows XP and Microsoft Internet Explorer 6.

Figure 7.1: Log-in window.

7.2 Logging-in to the Web-based Interface

Power up the device after making sure the antennas are properly connected. Wait for about one minute for the initialization to be completed. Connect an Ethernet cable with RJ45 connectors between a computer and the Fluidmesh device that you want to configure.

Configure the wired Ethernet port of **your** computer according to the default class "C" IP address of the device, e.g., IP: 192.168.0.30, Netmask: 255.255.255.0.

If you do not know how to configure your Windows PC, please refer to Section 8 where the manual IP configuration process is described. Disable the **Access the Internet using a proxy server** function. To disable this function, go to **Control Panel** > **Internet Options** > **Connections** > **LAN Settings** and uncheck the Enable box. Disable the wireless Wi-Fi card of your PC if present to avoid routing issues between the two network interfaces of your computer. Open a Web-browser such as Internet Explorer and type the following URL:

http://192.168.0.10

Make sure not to omit the initial "http://". Some browsers might not work without the "http://" prefix preceding the numeric address. A log-in form asking for a username and a password should appear as shown in Fig. 7.1.

To preserve the security of your system, make sure you change the default password once the entire installation is completed. In case the log-in form does not appear, please refer to Section 8.

The default username and a password are:

Username: admin
Password: admin

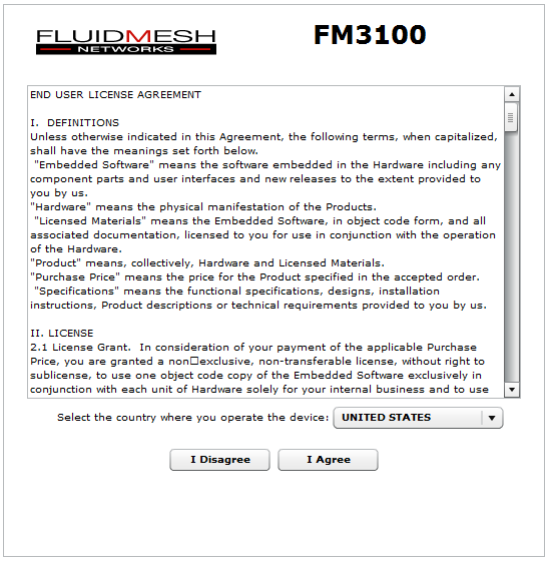


Figure 7.2: End-user license agreement.

7.3 End-user License Agreement and Region of Operation

The first time you log-in, you will be asked to accept the terms of the end-user license agreement and select the country where you will be operating the unit (Fig. 7.2 is an example for an FM1100 unit). You must accept the terms of the license agreement in order to activate the device. If you do not wish to accept the terms of the license agreement, please turn off the unit and contact Fluidmesh Networks. Choosing a wrong country/regulatory domain setting may lead to an illegal wireless configuration.

Once the license is accepted, the unit can be configured. Two configuration methods are available as shown in Fig. 7.3(a): MeshWizard™ and Classic. The former consists of a simple four step wizard to configure the basic settings of the unit (see Section 7.4), whereas the latter is the classic Fluidmesh Web-based GUI for advanced configuration (see Section 7.5).

(a) Step 1

(b) Step 2

(c) Step 3

(d) Step 4

Figure 7.3: MeshWizard™ FM unit configuration steps.

7.4 MeshWizard™

MeshWizard is a simple yet effective tool to configure the basic settings of an FM unit based on the following four steps:

1. Step 1, Fig. 7.3(a): click on the “Wizard” button to start configuring the unit;
2. Step 2, Fig. 7.3(b): unit IP configuration;
3. Step 3, Fig. 7.3(c): wireless radio frequencies configuration;
4. Step 4, Fig. 7.3(d): settings summary and configuration save.

7.5 Web-based Interface Menus

Once logged in successfully, the ***general mode*** page will appear as shown in Fig. 7.4. Through this page you can change the mode of operation of the FM unit. The item list menu on the left can be used to set/modify the configuration of the unit.

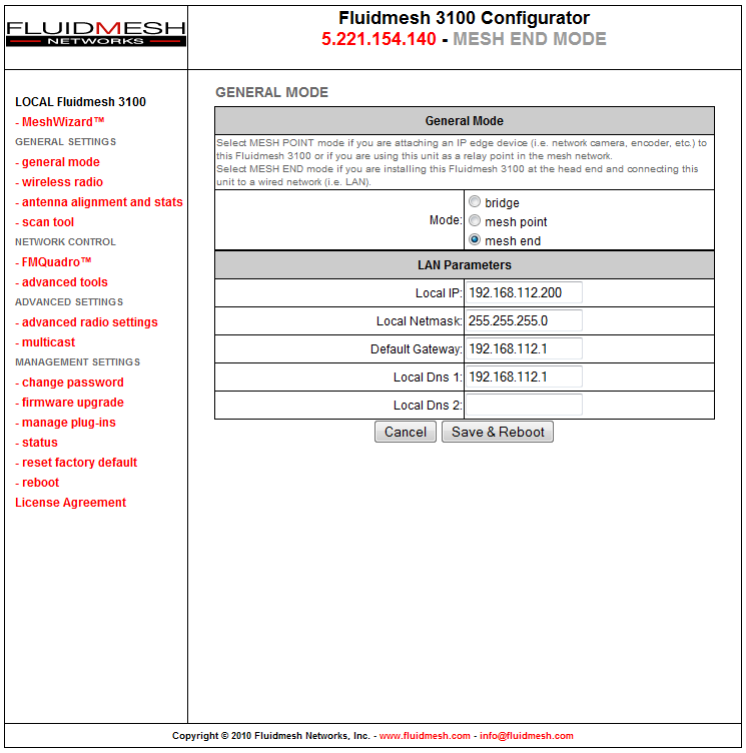


Figure 7.4: FM unit general configuration window.

7.6 General Mode

Every FM unit has three possible modes of operations:

- **Bridge** Mode
- **Mesh Point** Mode
- **Mesh End** Mode

The FM unit factory default mode is **Bridge**. The **Mesh Point** mode must be used for any unit deployed in the field. On the other hand, the FM unit must be set in **Mesh End** whenever it is connected to the main cabled network where the control room (usually) resides. You will need to input the settings of the wired network (LAN) to which the FM unit unit will be connected. The default IP address of the FM unit is 192.168.0.10 and the default Netmask is 255.255.255.0. If you do not know the LAN settings, contact the local network administrator before changing the settings of the gateway.

Please remember that a Mesh End unit is always necessary for the correct mesh network operations, even for small networks (e.g., 2 FM units).

7.7 Wireless Settings

The wireless settings menu is used to configure the radio present in the FM unit and can be accessed by clicking on ***wireless radio***. The wireless settings menu is available in either *Basic* (Fig. 7.5) or *Advanced* mode (Fig. 7.6). The former provides the basic radio configuration options whereas the latter can be enabled by expert users for tuning the radio channel width or using non-standard carriers. The following wireless parameters are available:

Shared Passphrase. The shared passphrase is a shared secret that must be set in every FM unit forming a wireless network. Any Fluidmesh device that does not have the correct passphrase will not be able to be part of the network. Different passphrases can also be used to create separate Fluidmesh networks in the same area and sharing the same frequencies.

Country. You need to specify the **country** where you will operate the unit. Different countries have different telecommunications regulations. Setting the country properly allows you to operate in compliance with national regulations. The available frequencies and other settings related to the RF operation will vary based on the selected country. Choosing the wrong country/regulatory domain may lead to an illegal operation of the unit. Please

Figure 7.5: Wireless parameters configuration. Basic mode

make sure the country has been properly specified before changing the frequency of the system.

Frequency Selectors. All Fluidmesh units are equipped with multi-band radios capable of operating on the 4.9-6 GHz bands.[1] You can change the frequency of each radio in order to minimize interference with other wireless networks operating in the same area. The frequencies listed on the Frequency Selector are the carrier frequencies. In Basic mode, each radio operates using fixed channel carriers with 40 MHz channel widths as specified by the local country regulations. In Advanced mode, the user is allowed to select any channel carrier in the local country frequency band with a 5 MHz granularity. The channel width can be set through the specific selector (see below). Make sure you pick non-overlapping channels if you need to operate more than one unit in the same area.

In Advanced mode, the following selectors are also available:

[1] 4.9 GHz and 6 GHz are licensed bands which must be enabled through the proper software plug-in. Please refer to Section 7.13 for details.

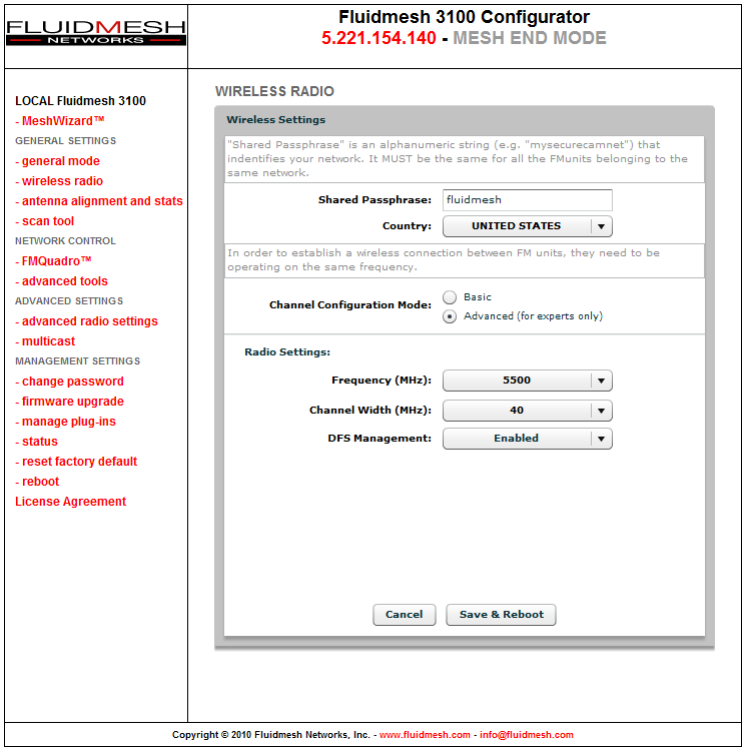


Figure 7.6: Wireless parameters configuration. Advanced mode

Width	Data Rate	Throughput
20 MHz	150 Mb/s	60 Mb/s
40 MHz	300 Mb/s	100 Mb/s

Table 7.1: Available radio channel widths.

Channel Width. The width of the operating radio channel can be set through this selector. The available options are described in Table 7.1 where the theoretic data rate and the achievable throughput are also indicated for each channel width.

Whenever possible, setting the radio to operate on a narrower channel can be useful to reduce the interference in the network and to increase the number of available channels. Please remember to set the **same** channel width on both sides of the wireless link. A channel width mismatch will prevent the FM units from communicating properly. Please note that changing the channel width may violate the local telecommunication authorities guide-

lines and lead to illegal wireless operations.

IN NO EVENT SHALL FLUIDMESH NETWORKS, INC. BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, WHETHER BASED ON TORT, CONTRACT, OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH IMPROPER USE OR OPERATION OF THE CHANNEL WIDTH FUNCTIONALITIES.

DFS Management. Each device implements a proprietary distributed channel switching algorithm which is used when a radar is detected to comply with the Dynamic Frequency Selection (DFS) international regulations. Upon radar detection, two communicating Fluidmesh units agree to switch to the next radar-free channel so that they can continue to communicate on that channel. The DFS is automatically enabled in the following frequency ranges: 5.250 GHz – 5.350 GHz and 5.470 GHz – 5.725 GHz. The DFS management can be manually disabled. The number of detected radars is reported as well. Outside these mandatory frequency bands, the DFS is not required and it is disabled by default. Please note the DFS is required by law in many countries and by disabling it you might incur fines and criminal charges by the local telecommunication authorities.

IN NO EVENT SHALL FLUIDMESH NETWORKS, INC. BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, WHETHER BASED ON TORT, CONTRACT, OR OTHERWISE, ARISING OUT OF OR IN CONNECTION WITH IMPROPER USE OR OPERATION OF THE DFS FUNCTIONALITIES.

Option	Specification
AUTO	The FluidMAX engine is enabled and the unit role is set automatically.
MASTER	The FluidMAX engine is enabled and the unit role is set to MASTER. This is used to force the FluidMAX role of the Fluidmesh unit at the center of the star topology to be a MASTER.
SLAVE	The FluidMAX engine is enabled and the unit role is set to SLAVE. This is used to force the FluidMAX role of the unit which is NOT the center of the star topology to be a SLAVE.
OFF	The FluidMAX engine is disabled.

Table 7.2: FluidMAX Management options.

7.8 Advanced Wireless Settings

The advanced wireless settings menu (Fig. 7.7) can be used to configure advanced wireless parameters:

FluidMAX Management. Although the FluidMAX engine automatically selects the most appropriate MAC protocol to be used according to the detected network topology, convenient selectors are included in the Web GUI to force the FluidMAX operations and control the FluidMAX role of the unit. Please refer to Table 7.2 for the available options and their specification.

Transmission Rate Selection. Each FM unit implements a proprietary data-rate selection algorithm which is able to adapt to the specific radio channel conditions. Through this setting, it is possible to force the rate selection algorithm to limit the modulation speed at a specific rate. This option might be useful with unstable channel conditions.

Maximum TX Power. This setting controls the output power of the radio. By decreasing the output power of a radio, you can decrease the overall E.I.R.P. By default, the radio transmission power is controlled automatically by the innovative Fluidmesh Transmission Power Control (TPC) algorithm. The Fluidmesh TPC algorithm tries to obtain an optimal link signal strength (about -55 dBm) on both sides of the link while not exceeding the maximum TX power which can be set by the user through the selector. Note that the maximum transmission power may vary depending on the operating frequency channel of the radio.

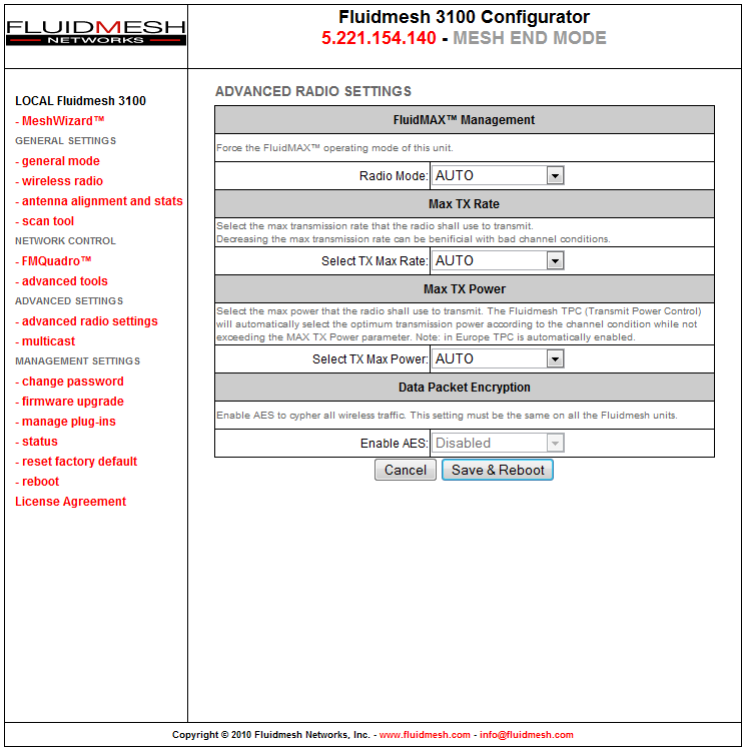


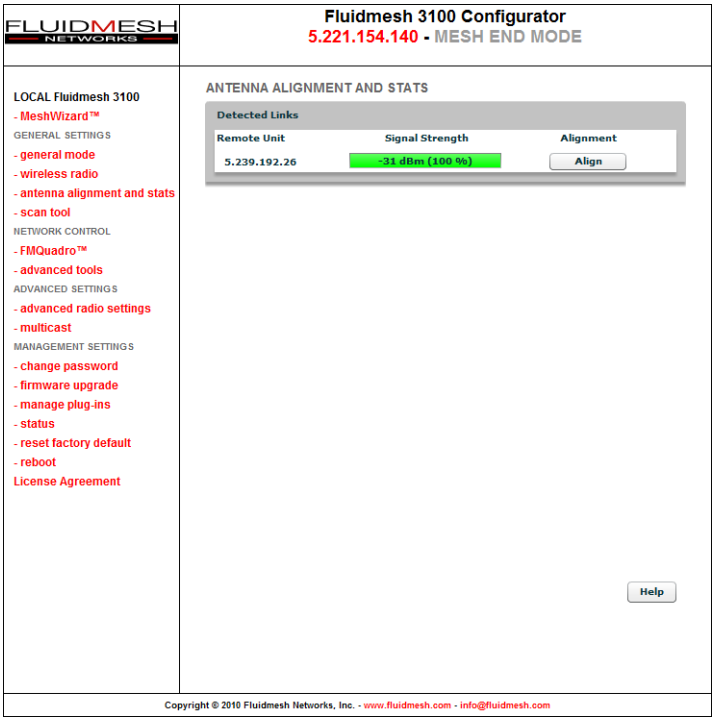
Figure 7.7: Advanced wireless parameters configuration.

Data Packet Encryption (Software Plug-in Required). Advanced Encryption Standard (AES) 128 bit encryption can be enabled at the link-level for wireless data transmission. This feature is available in addition to the default Fluidmesh proprietary encoding algorithm for maximum industry-grade network security. A software Plug-in is required to activate this option. Please contact your Fluidmesh Networks' representative for details.

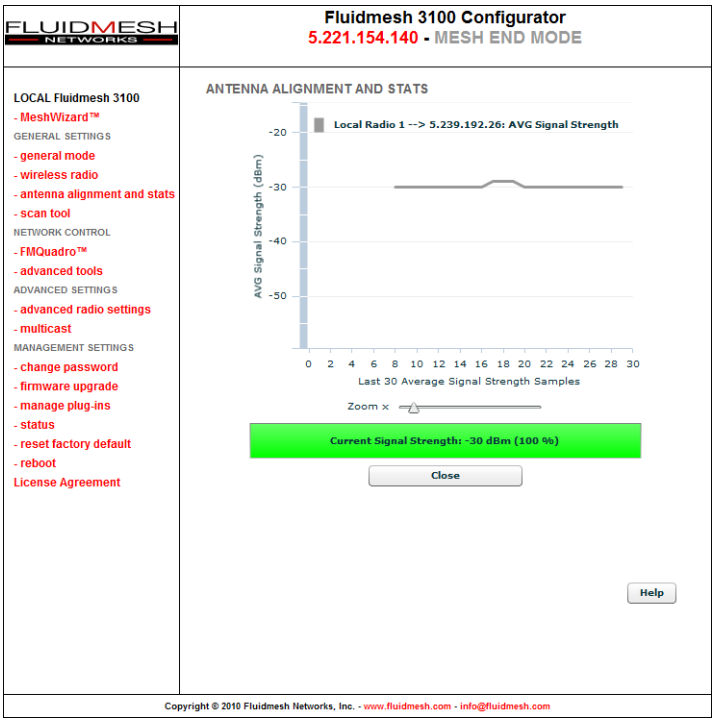
7.9 Antenna Alignment Tools and Physical Statistics

The **antenna alignment and stats** page provides a powerful tool which can be used to check the current link status during the normal unit operation and the physical installation of the antennas. Specifically, the web page shows the list of links detected by the local unit and the relative signal strengths (in dBm) on each radio as shown in Fig. 7.8(a).

To perform an accurate antenna alignment for a specific link, click on the "Align" button to open the antenna alignment tool as depicted in Fig. 7.8(b).



(a) Link selection



(b) Alignment

Figure 7.8: Antenna Alignment tool.

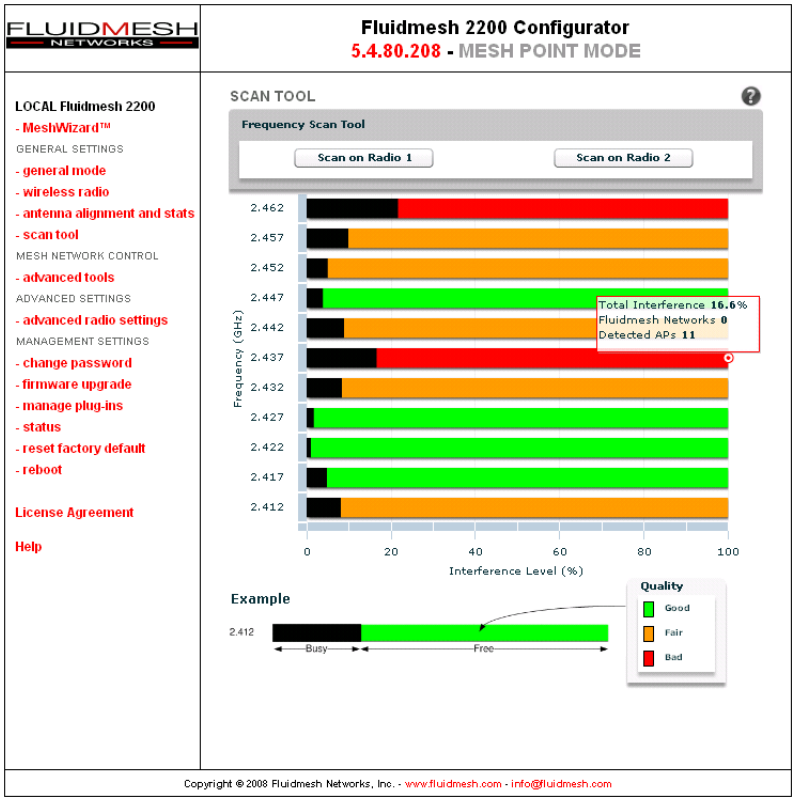


Figure 7.9: Frequency Scan Tool results.

The user is warned that the proprietary Fluidmesh TPC algorithm (see Section 7.8) will be disabled during the alignment process so as to avoid unwanted interactions with the tools. The antenna alignment tool consists of a real-time graph and a bar which report the *average signal strength* and the *current signal strength* detected at the local unit receiver, respectively. During the physical antenna alignment process, the graph and the bar can be monitored to obtain optimal link quality.

7.10 Frequency Scan Tool

The **Scan Tool** page provides a powerful tool for analyzing the status of the radio interference in the available channels. The channel scan can be started on each radio separately by means of the buttons at the top of the page (see Fig. 7.9). As soon as the scanning is complete, a bar chart will appear indicating the current interference level and the overall quality of each channel.

As shown in Fig. 7.9, each bar in the chart consists of two sections. The black section represents the amount of interference detected in the channel, whereas the colored one gives a qualitative idea of the status of the channel according to the following table:

Color	**Channel Quality**
GREEN	GOOD
YELLOW	FAIR
RED	BAD

Additional information such as number of Fluidmesh units and access points detected is available by bringing the cursor of the mouse over the frequency channel bars. Please note that in a network with overlapping channels, the number of Fluidmesh units detected by the scan tool might be higher than the actual number of units deployed.

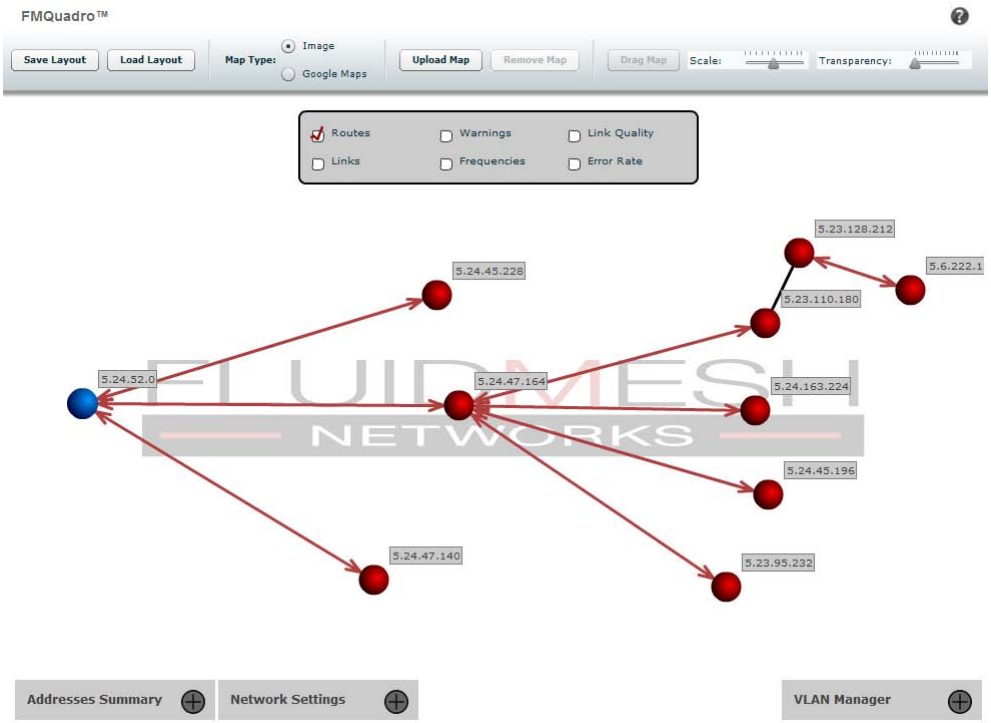


Figure 7.10: FMQuadro.

7.11 FMQuadro™ (Mesh End only)

This feature is available only in FM units configured in Mesh End mode. The innovative FMQuadro engine provides an interactive graph representation of the Fluidmesh network where vertices and edges represent FM units and wireless links, respectively, as shown in Fig. 7.10. The links which are currently in use by every packet generated/relayed by a Fluidmesh device to reach a possible destination in the network (i.e., the routing table) are depicted as a continuous lines.

Backup links are depicted as dashed lines, and they are not shown by default. Backup links can be viewed by selecting the appropriate field in the top panel of the FMQuadro window.

This panel also includes other fields which can be selected to display additional always-on link information such as the link frequency, the link error rate, and the link quality.

In the graph, **blue** is the color of a mesh end whereas mesh points are depicted in **red**. The unit color becomes **yellow** if any anomalous condition is detected on the unit.

Each element displayed in FMQuadro is interactive, and can be dragged and/or clicked to get additional real-time information based on the context.

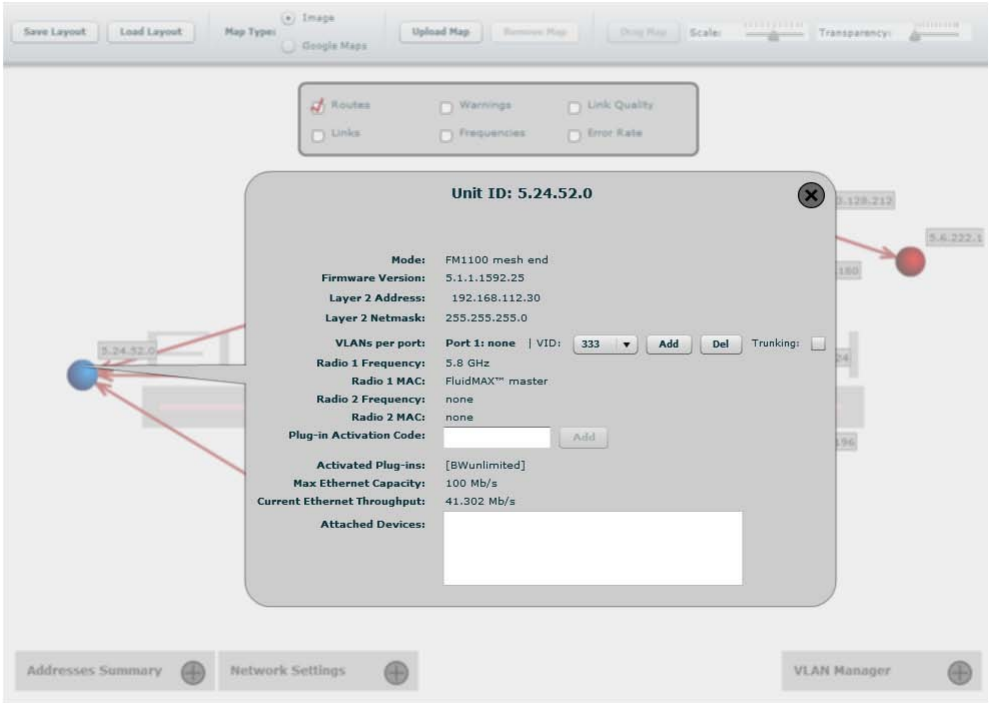


Figure 7.11: FMQuadro. **Unit** information.

For example, by clicking on a specific unit, information about the remote unit selected is displayed in a callout as shown in Fig. 7.11. This information includes the Layer 2 IP address, current FluidMAX status of the unit, the radio frequencies currently in use, and the details of the data traffic flows generated by the edge devices connected to the unit.

The list of currently active Plug-ins is visible. Furthermore, any Plug-in Activation Code can be conveniently added to the specific remote unit using the form available in the callout. Finally, current throughput and maximum capacity of the Ethernet port is reported in order to monitor the Ethernet ports utilization and detect whether the Ethernet port is over-utilized with respect to the installed FluidThrottle Plug-in.

Similarly, the status of a wireless link connecting any two units can be mon-

itored by clicking on the related line, as reported in Fig. 7.12. Several real-time parameters are displayed including the current signal strength, the packet error rate, and the link utilization of both link directions (i.e. the link from a unit to the other and vice-versa). Additionally, the current congestion level of the link is monitored. A detailed description of the available parameters is reported in Table 7.3. Visual alarms and warnings are triggered whenever anomalous conditions are detected, as described in Table 7.4. Warnings are of two types: *link* and *unit*. When unit warnings are triggered, the unit color becomes yellow. The warning details are available by clicking on the unit element. The link warnings notification can be disabled by removing the "Warning" flag in the FMQuadro top panel.

Metric	**Description**
Current TX Rate	Current link transmission rate in Mb/s.
Packet Error Rate	Percentage of packet dropped due to excessive transmission errors.
Link Error Rate	Percentage of packet retransmissions due to transmission errors.
Signal Strength	Current received signal level in dBm.
Link Utilization	Percentage of the current link utilization for data transmission in a pie chart format.

Table 7.3: Link metrics description.

Warning	**Type**	**Cause**
Low Signal Strength	Link	Link Signal Strength $<$ 60%.
High Error Rate	Link	Packet Error Rate $>$ 5%.
High Link Congestion	Link	Link Utilization $>$ 80%.
Ethernet Capacity Overflow	Unit	Plug-in capacity exceeded.
Hidden Terminal Detected	Unit	Hidden terminal detected by the FluidMAX engine.

Table 7.4: FMQuadro warning description.

Through the link status callout, the user can also check the level of interference of the selected link by clicking on the "Check for Interference" button. The link interference is analyzed on both sides of the link by the FMQuadro engine and the interface suggests, in case of detected problems, a set of preferred channel frequencies that the radio link is recommended to be set to.

All the link metrics are continuously monitored by the FMQuadro engine

and statistics are logged and can be displayed by clicking on any link metric button, as shown in Fig. 7.13. By default, the last 48 hour's statistics are recorded with a metrics' sampling interval of 5 minutes. The statistics recording time can be increased up to 24 days at the cost of increasing the metrics's sample interval proportionally.

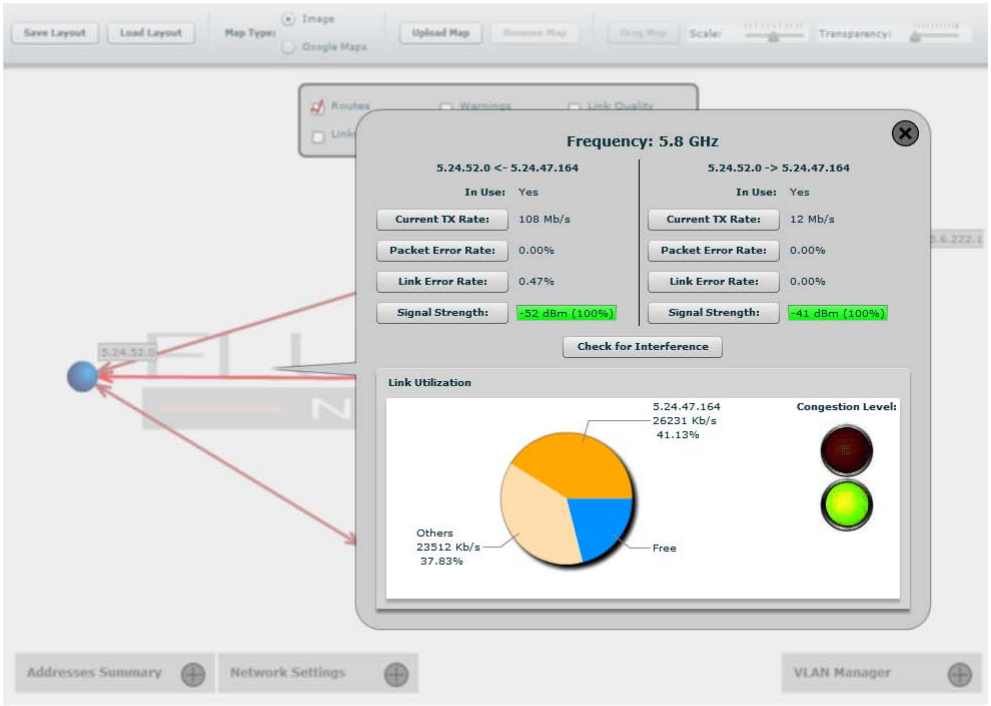


Figure 7.12: FMQuadro. **Link** information.

A table, placed at the bottom of the window, reports the network units' address summary and can be viewed by clicking on the proper button as reported in Fig. 7.14. It is possible to assign a name to each of the Fluidmesh units. This may be especially convenient with a large mesh network.

Furthermore, through the "Network Settings" table, placed at the bottom of the window, you can check whether the DFS settings are consistent the network, e.g., the DFS is enabled in the all the units. The Network Settings table allows for harmonizing the DFS settings in the whole network with a single mouse click.

FMQuadro is an accurate representation of the network, so it can be use-

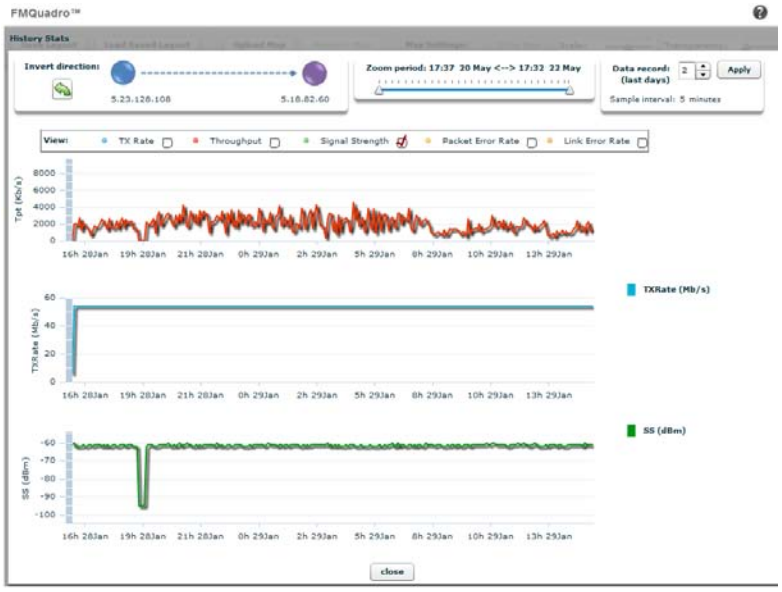


Figure 7.13: FMQuadro. Last 48 hours **Link** information.

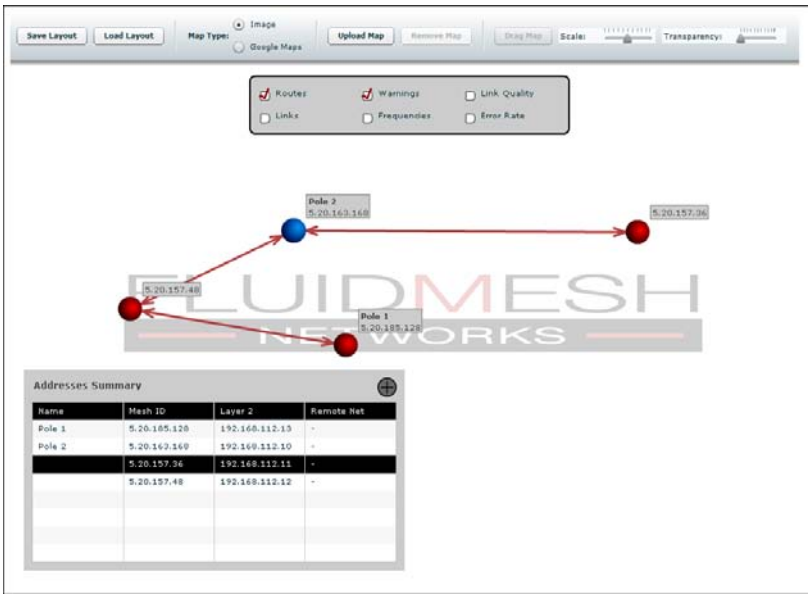


Figure 7.14: FMQuadro. Addresses Summary table.

ful to add a map of the area in which the Fluidmesh system is deployed.[2] Map images can be uploaded to the Mesh End unit using the proper button placed in the FMQuadro top toolbar. Common image formats are supported including png, jpg and bmp. Furthermore, whenever an Internet connection is available to the user PC used to configure the Fluidmesh network, Google Maps map can be used to set the background of FMQuadro.[3] The top toolbar provides several intuitive buttons to drag & drop the background map and control its transparency and scale. Once the map is set up, the FM units can be dragged to their actual installation places. Finally, the modified layout can be saved and used again in the future.

As the FMQuadro engine collects statistics from the entire network through the Mesh End unit, it is no longer necessary to directly connect to remote units. The overall network status and individual device status can be monitored real-time through the FMQuadro interface on Mesh End unit.

[2] Aerial images can be downloaded using Google Earth (http://earth.google.com/).

[3] Please note the you need an Internet connection to use the Google Maps background feature.

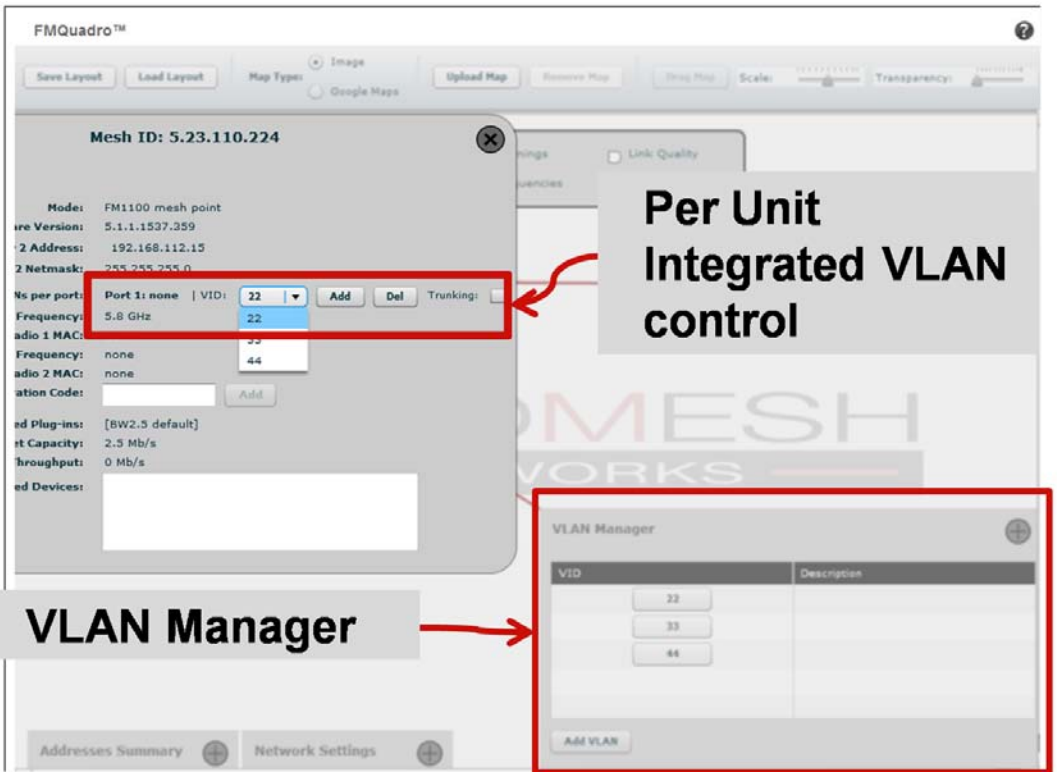


Figure 7.15: VLAN configuration steps.

7.11.1 VLAN Tagging Configuration (Software Plug-in Required)

Each VLAN can be configured via FMQuadro with a simple two steps procedure as described below. Please note that VLANs require some network configuration expertise and should be used by advanced users only. Please refer to Section 5.2.1 for further details.

1. **VLAN ID creation:** a new VID can be created using the VLAN manager control placed at the bottom-right hand of the FMQuadro window as shown in Fig. 7.15. You must specify the VID number and, optionally, a description of the VLAN. Once the VID is created you can specify the Ethernet ports and/or the MAC addresses membership.

2. **Ports and/or MAC membership:** FM unit ethernet ports can be added to the created VLAN by using the specific callout of the unit as shown in Fig. 7.15. On the other hand, MAC addresses membership can be specified in the VLAN manager control.

The Fluidmesh VLAN implementation is compatible with the specification of the IEEE 802.1q standard and, thus, the Fluidmesh network can interoperate with other VLAN-aware network devices. VLAN trunking between the Fluidmesh network and Ethernet switches is also supported and can be enabled by selecting the proper control in the unit's callout window. Enabling VLAN trunking on a specific port instructs the FM unit to forward VLAN membership information to the device connected to the port, thus extending VLANs across multiple network devices.

To simplify the configuration of the units when trunking is enabled, a special VID #1 is available. Simply configuring the network switch with a VLAN #1 will allow any PC belonging to the VLAN #1 to access the web interface of the FM units without the need for additional settings of the FM units.

7.12 Firmware Upgrade

Through the ***firmware upgrade*** page (Fig. 7.16), it is possible to upgrade the Firmware of the devices to the latest version available. To do so, download the latest Firmware upgrade file to your PC from the Fluidmesh Networks Web site at www.fluidmesh.com.[4] Select the correct file on your hard disk, and upload it. This operation might take several minutes. The unit will automatically reboot at the end of the upgrade process.

Upgrading a working system is always a delicate and somewhat risky operation. Fluidmesh discourages anybody from upgrading a functional system except if there is an issue to fix.

Recommended upgrading procedure for running systems:
1. Download the latest firmware release available for your hardware/firmware family;

2. Power off the whole network;

3. Power on one device at a time;

4. Connect directly to the Fluidmesh unit to be upgraded directly through an Ethernet cable;

5. Write down the unit configuration (at least network settings and wireless settings);

[4] An approved Fluidmesh extranet account is required. Please register for a an on-line account and contact Fluidmesh for approval.

6. Upgrade the device with the chosen firmware;

7. Once the upgrade is completed, wait for the system to reboot;

WARNING: DO NOT RESTART OR POWER OFF THE UNIT WHILE UPGRADING THE FIRMWARE. RESTARTING OR POWERING OFF THE UNIT BEFORE THE UPGRADE IS COMPLETED MIGHT DAMAGE THE UNIT.

When the upgrade is completed, check the **firmware upgrade** page in order to make sure that the new firmware version has been correctly updated. If the firmware version has not been changed, the upgrade process has failed. Therefore, please repeat the upgrading procedure from the beginning.

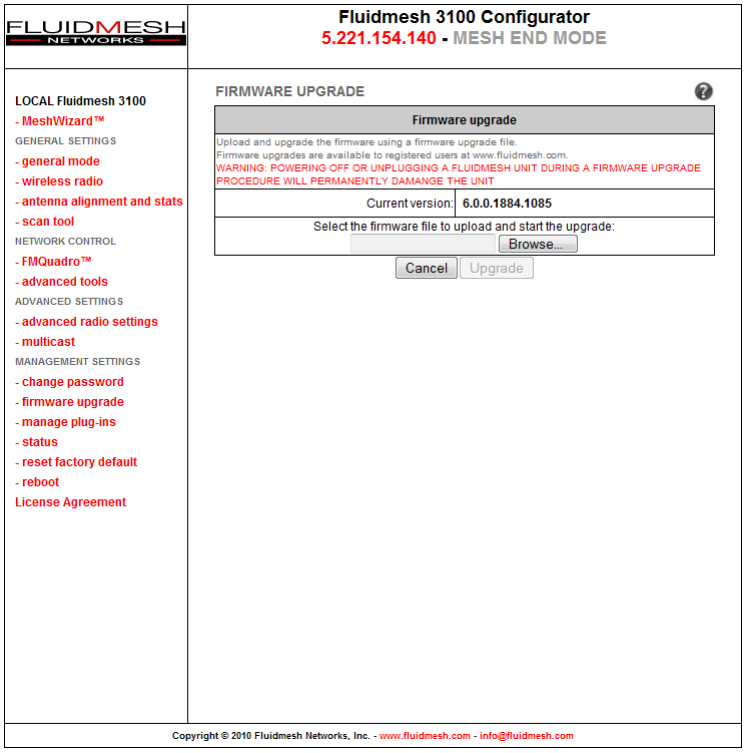


Figure 7.16: Firmware upgrade Web page.

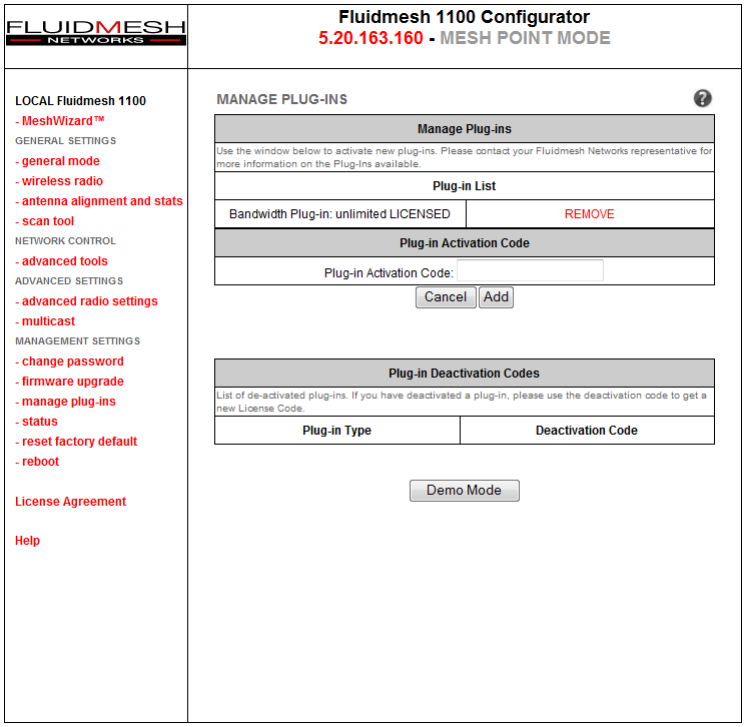


Figure 7.17: Plug-ins management Web page.

7.13 Plug-in Management

The **manage plug-ins** page (Fig. 7.17) shows the installed Plug-ins and allows the user to add Plug-in Activation Codes. Additionally, a Plug-in can be deactivated to, for example, transfer it from one unit to another. Once the Plug-in has been deactivated, you will be provided with a Deactivation Code displayed at the bottom of the page. In order to get a fresh Activation Code to use it in another device, you **must** complete the unit deactivation procedure at the Fluidmesh Networks website (www.fluidmesh.com). Please refer to Section 6 for details on the software Plug-in activation/deactivation procedures.

A 8 hour plug-in trial is available by clicking on the “Demo Mode” button at the bottom of the page. The plug-in demo mode includes the 4.9 GHz[5], the AES and the Unlimited plug-in trials all at once. The unit will reboot on the 8 hours plug-in trial expiration.

[5]Not available in Brazil.

7.14 Advanced Tools

Through the **advanced tools** page, it is possible to run tests to verify network connectivity and the achievable throughput on a network path. As shown in Fig. 7.18, network connectivity can be tested by issuing a "Ping Test" towards a specific destination. Additionally, the "Bandwidth Test" tool generates a stream of packets at a specified rate to test the available network path throughput.[6]

In order to run a Ping or a Bandwidth Test, write the destination IP in the proper window and click run. The Bandwidth Test allows you to select the throughput from a value of 4Mb/s to 20 Mb/s. Both tests can be run on top of a loaded network to test operational performances, or on top of an unloaded network to test installed capacity.

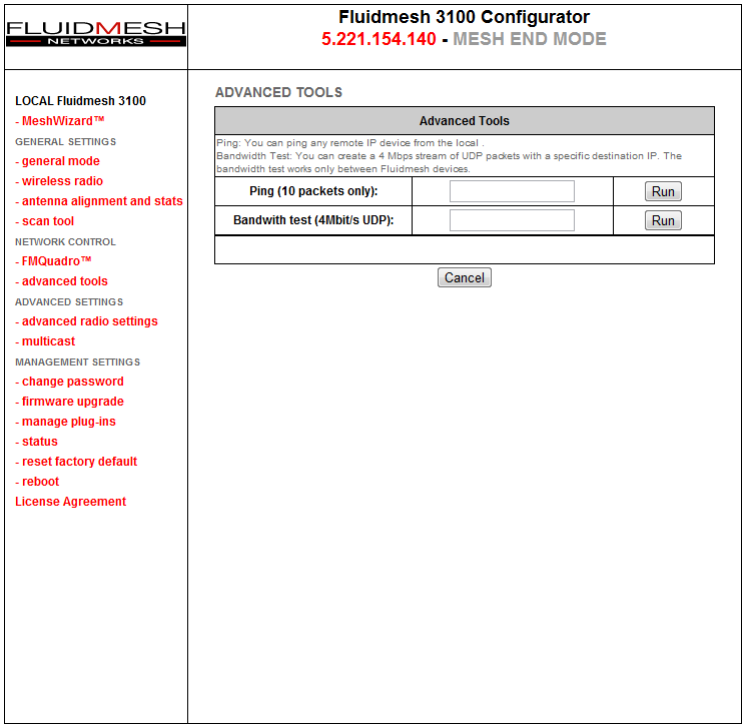


Figure 7.18: Advanced Tools Web page.

[6] Please note that the achievable rate computation is cpu-intensive and only indicative. Results may be not accurate. Usually the bandwidth tests tend to underestimate the real throughput of the link.

7.15 Multicast

By default, FM units operating in **Mesh Point** mode forward all the multicast traffic generated by the cameras to their closest **Mesh End** unit. However, in some network configurations, it may be convenient to forward the multicast traffic from a **Mesh Point** to others, e.g., to remotely record the video flow.

By default, the unit operating in **Mesh End** mode does NOT forward any multicast traffic[7] to the wireless networks.

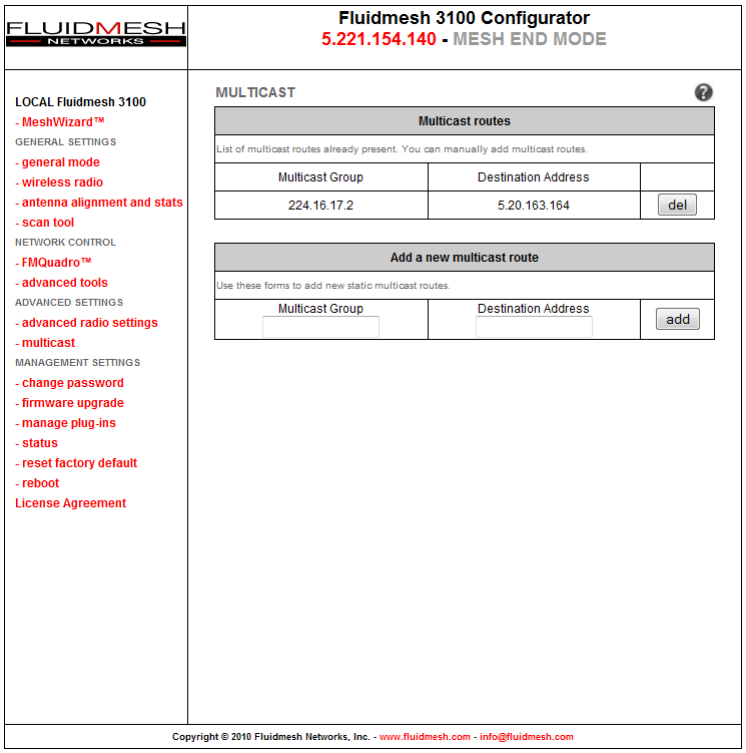


Figure 7.19: Add/Remove multicast routes towards **Mesh Points**.

To redirect a traffic flow to a **Mesh Point**, you must specify all the multicast flows redirection information within the **Mesh End** multicast page as shown in Fig 7.19.

[7] With the exception of UPnP and IGMP traffic.

7.16 PoE Passthrough (FM1100 and FM1200 only)

The second Ethernet port present on the FM1100 and FM1200 can be used to power up other passive 12-18 V PoE devices such as cameras and FM units. This feature can be enabled through the PoE passthrough page as depicted in Fig. 7.20.

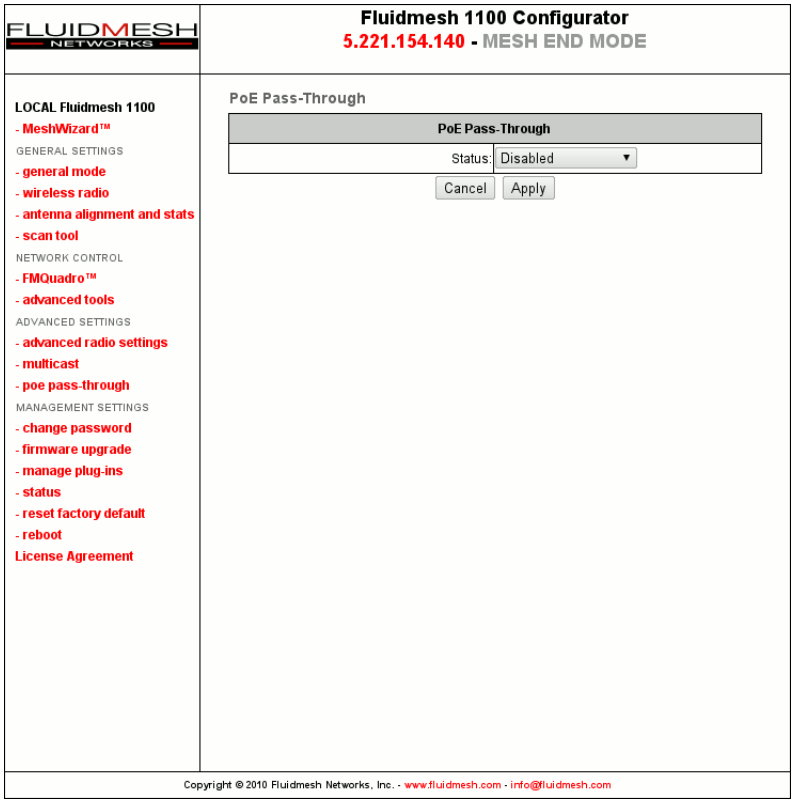


Figure 7.20: Enable the PoE passthrough feature.

7.17 Change Password

Use this page to change the password to access the unit Web GUI.

7.18 Status

This page reports a summary of the status of the unit. Additionally, in case of system malfunctions, the unit's diagnostic file dump can be downloaded

through this page and emailed to the Fluidmesh technical support to facilitate the problem diagnosis.

7.19 Reboot and Reset to Factory Default

Use the **Reboot** page to restart the unit. Use the **Reset to Factory Default** page to restore the unit default factory settings.

7.20 On-line Help

The electronic version of this manual is available by accessing the **Help** web page. Additionally, specific manual sections can be consulted by clicking on the question mark present at the upper right corner of every page of the Web GUI.

8 Troubleshooting

The troubleshooting section will allow you to solve the most common problems encountered when configuring and installing Fludimesh products.

8.1 I am unable to get the log-in screen

If you are unable to get the log-in form on your computer screen, you should check the following:

Is your computer set to a valid IP address? You should manually set the correct network settings as follows:

1. In Windows Explorer, right-click “My Network Places” and select *Properties*.
2. Right-click Local Area Network and select *Properties*.
3. Right-click Internet Protocol (TCP/IP) and select *Properties*.
4. Set the IP address to 192.168.0.30 (or any other IP address belonging to the subnet 192.168.0.0/255.255.255.0), Netmask to 255.255.255.0.
5. Click *OK*, then *OK* again.

Have you disabled the “Access the Internet using a proxy server” function? To disable the **Access the Internet using a proxy server** function, go to **Control Panel** $>$ **Internet Options** $>$ **Connections** $>$ **LAN Settings** and uncheck the enable box.

8.2 I am unable to log-in into the Web-based interface

If you are unable to log-in into the Web-based interface, check your user name and password settings.
The user name cannot be changed by the user and corresponds to:

admin

The password can be changed, so make sure you are using the right password. The default password is:

admin

If you forgot the password, check Section 8.3 to fix the problem.

8.3 I forgot the administrator password

If you forgot the password and need to access the Web-based interface, you must physically access the unit, open the enclosure in a weather-safe situation and reset to the factory default settings. Please refer to the instructions of Section 3.1.4 for FM1100, Section 3.3.4 for FM1200and Section 3.2.4 for FM3100 units.

8.4 In Bridge Mode I get no Link or the Link LED is always red or I am getting a weak Wireless link (below 60% signal strength)

To improve your link strength, please check the following:

- Antenna Alignment: the two antennas must be aligned toward each other.
- Line of Sight: you must have clear line of sight between the two antennas.
- Antenna Polarization: both antennas must have the same polarization. Check antenna polarity.
- Power: check if the FM unit is properly powered-on with the provided PoE injector.
- Channel: both FM unit units must be operating on the same channel.

APPENDIX A

FCC Notices

This device complies with Part 15 of the FCC Rules. Operation is subject to the following
two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
--Reorient or relocate the receiving antenna.
--Increase the separation between the equipment and receiver.
--Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
--Consult the dealer or an experienced radio/TV technician for help.

CAUTION:
Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

RF exposure warning

This equipment must be installed and operated in accordance with
provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 40 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

This device is operation in 5.15 – 5.25GHz frequency range, then restricted in indoor use only, Outdoor operations in the 5150~5250MHz is prohibit.

The availability of some specific channels and / or operational frequency bands are country dependent and are firmware programmed at factory to match the intended destination. The firmware setting is not accessible by the end user.
This device is Master equipment, the transmission is disabled in the 5600-5650MHz band.

Industry Canada

Radio Frequency (RF) Exposure Information

The radiated output power of the Wireless Device is below the Industry Canada (IC) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.

This device has also been evaluated and shown compliant with the IC RF Exposure limits under mobile exposure conditions. (antennas are greater than 20cm from a person's body).

Informations concernant l'exposition aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil de façon à minimiser les contacts humains lors du fonctionnement normal.

Ce périphérique a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles (les antennes se situent à moins de 40 cm du corps d'une personne).

APPENDIX C

Contact Information

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