

Cisco Ultra-Reliable Wireless Backhaul Routine radio transceiver maintenance

Routine hardware maintenance manual

(Formerly Fluidmesh)

Edition 1.0 (For all Fluidmesh hardware devices)

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1. HAZARDOUS CONDITION WARNINGS



IMPORTANT

In some jurisdictions, operation of any or all hardware that may be described in this manual may be subject to the following conditions:

1. The hardware may not cause harmful interference.
2. The hardware must accept any interference, including interference that may cause undesired operation.

Like all other global technology vendors, Fluidmesh is required to comply with all local health and government regulations in the locations in which we operate. This includes meeting radio frequency (RF) exposure limits for our products.

Our equipment is tested in accordance with regulatory requirements as a condition to our ability to market and sell in any given jurisdiction. As an equipment manufacturer, Fluidmesh defers to expert national and international health organizations responsible for guidance on the safety of RF signals, specifically the US Food and Drug Administration (FDA), Health Canada, the World Health Organization (WHO), and other national and global health agencies.

In May 2019, the FDA stated that there is "no link between adverse health effects and exposure at or under the current RF energy exposure limit", and that the current FCC RF exposure limits are sufficient to insure the safety of users.

If any Fluidmesh hardware unit breaks down or malfunctions, emits smoke or an unusual smell, if water or other foreign matter enters the unit enclosure, or if the unit is dropped onto a hard surface or damaged in any way, power off the unit immediately and contact an authorized Fluidmesh Networks dealer for assistance.

If you are adjusting and/or controlling a Fluidmesh device using control software such as the RACER™ interface or the device's local Configurator interface, do not make configuration changes unless you know with certainty that your changes will not negatively impact people or animals in the vicinity of the device and its antennas.

1.1. Water ingress hazard



CAUTION

In all circumstances where the will be installed in an outdoor location, it is compulsory to mount the inside an FM-SHIELD auxiliary mounting kit.

The FM-SHIELD auxiliary mounting kit is a proprietary Fluidmesh solution, and is designed specifically to assure the long-term durability and reliability of compatible radio transceivers that have been installed in outdoor environments.

If you need further information regarding the recommended usage of FM-SHIELD, contact your Fluidmesh Networks representative.

Relevant technical specifications for FM-SHIELD can be found in the *Fluidmesh FM-SHIELD installation manual*.

1.2. Radio-frequency transmission hazard



WARNING

The system shown in this manual is designed to be installed and operated in a way that avoids contact with the antennas by human beings. The legislation quoted in this section is designed to reduce overall exposure of human beings to RF radiation.

This section gives minimum separation distances between antennas and humans. It is strongly recommended that the system be installed in a location where these minimum separation distances can be maintained at all times.

United States: This system has been evaluated for RF exposure for humans, in accordance with FCC regulation CFR 47 Part 2.1091. To maintain compliance, the minimum separation distance from the antenna to general bystanders is 20cm/7.9in. (all FM Ponte kit and x200 radio transceivers), or 21cm/8.3 in. (all FM1300 Otto and x500 radio transceivers).

Canada: This system has been evaluated for RF exposure for humans, in accordance with ISED regulation RSS-102. To maintain compliance, the minimum separation distance from the antenna to general bystanders is 20cm/7.9in. for all Fluidmesh radio transceivers.

Europe / Australia / New Zealand: This system has been evaluated for RF exposure for humans, in accordance with standard EN 62232. To maintain compliance, the minimum separation distance from the antenna to general bystanders is 20cm/7.9in. for all Fluidmesh radio transceivers.

Before activating any device capable of transmitting RF signals, make sure that all persons and animals are protected from possible RF exposure.

Make sure that all RF feeds are securely connected to an appropriate antenna. Never activate any RF-capable device that is not connected to an antenna.

1.3. Optical radiation hazard



WARNING

If any Fluidmesh hardware device is equipped with one or more fiber-optic transceiver modules, it is classified as a Class 1 laser product. It may use laser-emitting components and/or very high-intensity light sources.

Do not look directly at the input/output end of the unit's **SFP** connector, or at the input/output end of any fiber-optic cable. Fiber-optic systems frequently use high-intensity light from laser or LED sources that may cause temporary or permanent blindness.

For additional guidance regarding the safe use of laser-based and LED-based fiber-optic technology, refer to *ANSI Z136.2 (Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources)*.



IMPORTANT

The is not shipped from the factory with fiber-optic transceivers installed unless the fiber-optic transceivers were specified as part of the purchase order.

To gain fiber-optic capability, the unit must be equipped with a separate fiber-optic transceiver module.

1.4. Hot surfaces hazard

**WARNING**

The outer surfaces of transceiver and gateway unit enclosures may become hot during normal operation. During normal operation, do not touch or handle the unit enclosure without personal protective equipment.

2. Reporting mistakes and recommending improvements

You can help improve this manual.

If you find any mistakes, or if you know of a way to improve the procedures that are given, please let us know by E-mailing your suggestions to documentation@fluidmesh.com.

3. Introduction

This manual is intended for use by wireless networking professionals who have been tasked with installing Fluidmesh radio transceivers and antennas, and connecting Fluidmesh hardware to wired backbone networks.

This manual describes routine maintenance procedures that must be done at periodic intervals. These procedures are designed to keep Fluidmesh radio transceivers and antennas in peak operating condition under normal circumstances.



IMPORTANT

As a Fluidmesh customer, you are the first and most important link in our Research and Development chain.

Fluidmesh Networks LLC is governed by a policy of continuous improvement. As a result, we rely heavily on customer feedback to identify and eliminate product weaknesses.

If during the course of routine transceiver maintenance, you notice any abnormal conditions, you are urged to notify your Fluidmesh Networks representative. All information and feedback will be noted and acted on by our R&D department, and used to build even better products.

Routine maintenance can only succeed in its goal of 100% uptime if it builds on a foundation of wisely-planned network design and equipment installation.

As a network engineer or maintenance technician, get into the habit of asking *Why?* and *What if?* Never assume that equipment will not fail just because it is part of a configuration that has not failed before, or that a procedure must be done a certain way because that's the way it's always been done.

To prevent personal injury and equipment damage, and to ensure optimum network performance:

- Wherever possible, install transceiver units where they cannot be physically damaged.
- Wherever possible, shield transceiver units from liquids (particularly from salt water and chemical spray).
- Keep a safe distance from all RF-radiating devices (such as external antennas and transceiver units with built-in antennas) when such devices are powered on.
- Make sure that all persons and animals are protected from possible RF exposure before activating any device capable of transmitting RF signals.

- Do not stand in line with powered RF-radiating devices such as external antennas or transceiver units with built-in antennas.
- Make sure that all RF feeds are securely connected to an appropriate antenna before activating any device capable of transmitting RF signals.
- Do not operate a transceiver unit for extended periods of time if its access cover has been removed.
- If a transceiver unit requires removal of a screw to gain access to the unit's *Reset* button, replace the screw as soon as practically possible.

4. Periodic maintenance schedule

It is recommended that the visual inspection tasks shown in this manual be done at *yearly* intervals (i.e. every twelve months).

5. Periodic maintenance tasks

Fluidmesh RF networking hardware is designed to withstand adverse environmental conditions, up to and including those specified by the ingress protection (IP) rating to which the hardware was designed.

To maintain the structural integrity that allows Fluidmesh hardware to achieve high impact and ingress ratings, it is important that the hardware is maintained in optimum condition as shown in this manual.

Failure to do the maintenance tasks shown in this manual may lead to hardware vulnerabilities (such as compromised water seals) and/or degraded system performance (such as reduced bandwidth or erratic connectivity).

6. Visual inspection tasks

Begin the yearly routine maintenance task list by doing the visual inspection tasks in this section.

1. If the hardware device being inspected is a radio transceiver, verify that there is a wireless connection of acceptable quality between the transceiver and other relevant transceivers in the network. You can do this using any of the following methods:
 - Check the readings given on the status and link/boot LEDs on the radio transceiver's outer enclosure as shown in the *Unit and link quality status* section of the *Fluidmesh Installation and Configuration Manual* for the relevant device.
 - Do a comprehensive wireless-link analysis using FMQuadro. For instructions on how to use Fluidmesh FMQuadro, refer to the FMQuadro section of the *Fluidmesh Installation and Configuration Manual* for the relevant device.
 - Do diagnostics on the wireless link using FM Monitor (if installed). For instructions on how to do wireless-link diagnostics using the Cisco FM Monitor application, refer to the *Fluidmesh Radio Monitoring Dashboard Configuration Manual*.



IMPORTANT

If a wireless connection of acceptable quality exists between the transceiver and other relevant transceivers, *do not adjust any settings, and do not attempt to change hardware or software configurations.*

If there is not a wireless connection of acceptable quality between the transceiver and other relevant transceivers, contact Fluidmesh Support at support@fluidmesh.com.

2. Note the result of the wireless connection inspection result above in an appropriate yearly log.
3. On all hardware device types, check that the device has not suffered any obvious damage to the exterior, such as cracks, dents, or missing parts. If any damage is found, contact your local Fluidmesh Networks representative for advice.
4. On all hardware device types, check that all self-adhesive labels and/or decals that are part of the device are in good condition, and are firmly attached to the device.

5. If the hardware device being inspected is an FM1000 gateway or FM1000 gateway gateway device, do the following steps:
 - Examine the data center in which the device is installed. Make sure that conditions are suitable for the storage of high-value, low-durability network devices. The data center must not suffer from water, dust or dirt ingress, or excessive heat or cold.
 - Remove all dust from the outer cover of the device by wiping with a damp (not wet), lint-free cloth.
 - Verify that the device is operating to an acceptable standard, according to its assigned role.
6. On all hardware device types, physically check that all external data and power connections are secured and have not suffered physical damage. This includes all Ethernet, fiber-optic, power and antenna cables and cable connectors.
7. If the hardware device being inspected is a radio transceiver or external antenna, verify that the horizontal and vertical alignment of the antenna connected to its relevant transceiver unit has remained constant, and that the received signal strength indication has not deteriorated since the device installation was commissioned. If needed, re-align the antenna. The relevant procedures are shown in the *Fluidmesh Acceptance Test Protocol (ATP)* document that was completed during commissioning of the installation, and in the *Antenna-alignment tools and physical statistics* section of the *Fluidmesh Installation and Configuration Manual* for the specific transceiver device.
8. Take a selection of photographs of the device, and of the surrounding installation.
 - Building a pictorial record of the installation over time allows easy visual comparison. This may help resolve Support tickets if unknown environmental factors are influencing the installation.

7. Hardware waterproofing

To eliminate the causes of water-related malfunctions and failures, follow all instructions in this section.



CAUTION

FM1000 Gateway and FM10000 Gateway gateway units are designed exclusively for sheltered, indoor conditions. Do not expose gateway units to moisture, high humidity, dust, dirt, or excessive heat or cold under any circumstances.

7.1. Maintaining radio transceiver waterproofing



IMPORTANT

Since the physical installation of all hardware is done outside our control, Fluidmesh Networks LLC cannot accept responsibility for equipment malfunction or failure as a result of water ingress.



CAUTION

Only disassemble a radio transceiver to check for water ingress *if the exterior enclosure of the transceiver is found to be damaged*. If it is difficult to judge the condition of the enclosure, ask your local Fluidmesh representative for advice.

If disassembling a radio transceiver, only disassemble the transceiver to the degree shown in this manual. Do not operate any transceiver that has been disassembled.

All Fluidmesh hardware is assembled using precision electronic components. By their nature, such components are sensitive to water and excessive humidity.

Depending on the design specification of each transceiver type, transceiver units are encased in specially ruggedized enclosures that are designed to withstand mechanical shock and vibration, and water and dust ingress to ingress-protection standard IP65, IP66 or IP67. However, to a large degree, the water resistance of transceiver enclosures depends on the amount of care that is taken during system assembly and system maintenance.



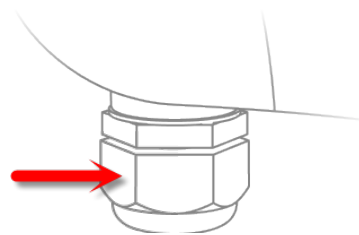
IMPORTANT

If there is a risk that a transceiver unit might be exposed to unduly hazardous conditions, such as extreme vibration, highly-pressurized hot and cold water, or destructive impacts from heavy objects, consider installing the unit inside an FM-SHIELD auxiliary mounting kit.

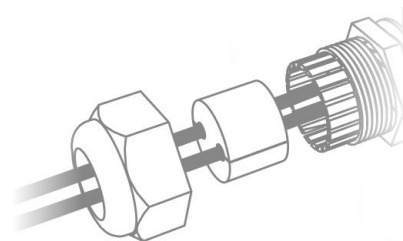
FM-SHIELD provides an easy-to-use, reliable, and robust method of installing Fluidmesh radios in extreme environments. For more details, consult your Fluidmesh representative.

Physically inspect the unit enclosure (and, if applicable, the bottom cover) for cracks, dents and other damage. If you find any damage to the exterior enclosure, contact your local Fluidmesh Networks representative for advice and do the following steps:

1. Inspect the unit for water ingress by doing the following steps:
 - FM Ponte kit and FM1200 Volo transceivers:
 1. Make sure the unit is in its upright, installed position.
 2. Unscrew the hexagonal nut (below).



3. Slide the hexagonal nut and rubber seal along the Ethernet cables, away from the cable gland (below).



4. Loosen the two screws on the opposing vertical sides of the unit (below). Note that only one screw is shown in the image below.



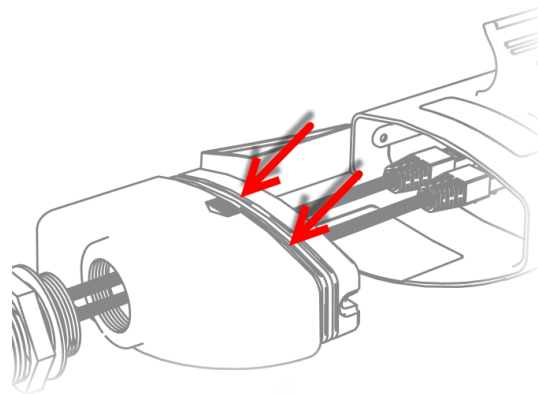
5. Carefully remove the cast aluminum bottom cover from the unit enclosure.



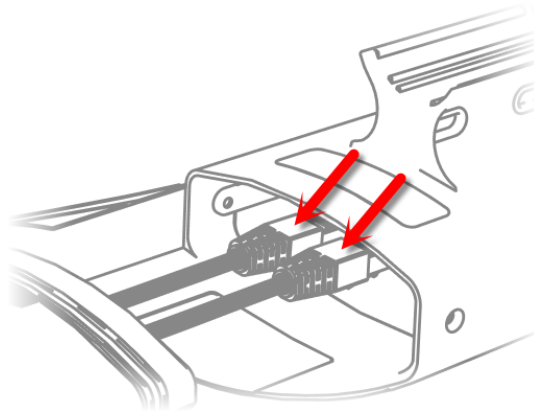
CAUTION

Do not remove the unit's cast aluminum bottom cover for any reason, other than to check for water ingress.

6. In the unlikely event that water is seen inside the bottom cover or inside the unit enclosure, contact your local Fluidmesh Networks representative for advice.
7. Carefully inspect the two sealing rings on the bottom cover for damage (below). If a sealing ring is damaged, replace it.



8. Make sure that the RJ45 connectors are securely inserted into their respective ports (below).



9. Re-install the bottom cover on the unit enclosure by following the directions above in reverse order.

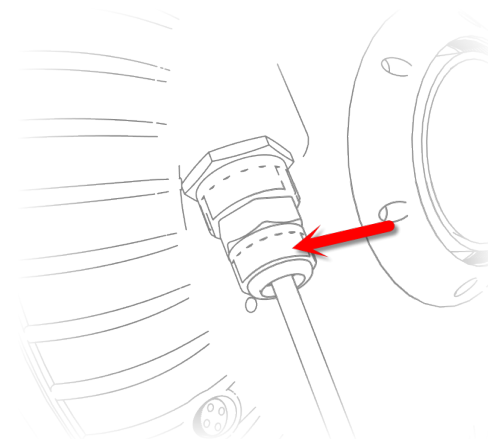
- FM1300 Otto transceivers:



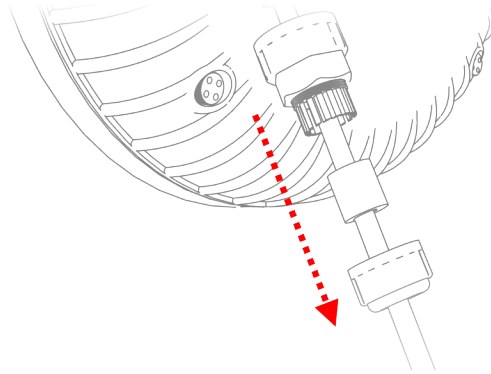
CAUTION

Do not attempt to open the FM1300 Otto transceiver unit enclosure. If there is obvious physical damage or malfunction, contact your local Fluidmesh Networks representative for assistance.

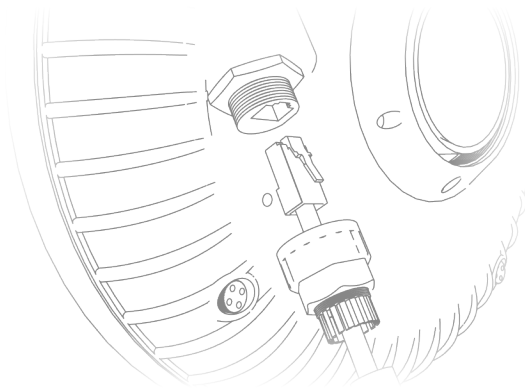
1. Make sure the unit is in its originally installed position.
2. Unscrew the seal compression nut (below).



3. Slide the seal compression nut and rubber seal down along the Ethernet cable, away from the cable gland (below).

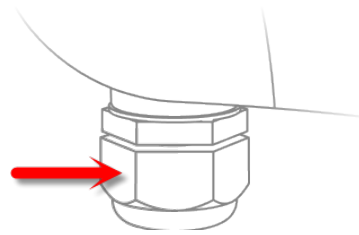


4. Unscrew the cable gland from the female RJ45 connector port and disconnect the male RJ45 connector from the female RJ45 port (below).

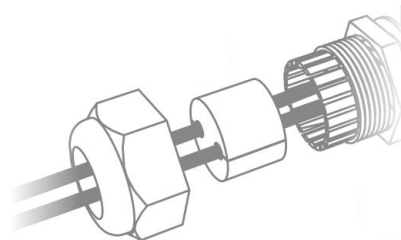


5. Inspect all components for damage, degradation and water ingress. Repair all damaged or degraded components as needed.
6. Insert the male RJ45 connector securely into the female RJ45 port.
7. Re-assemble the FM1300 Otto by following the directions above in reverse order. Make sure that:
 - The rubber seal is securely seated in the cable gland.
 - The Ethernet cable is a snug fit within the hole on the rubber seal.
 - The seal compression nut is screwed onto the cable gland with just enough torque to secure the nut and rubber seal.
- Cisco 3200-series and Cisco FM3500 Endo transceivers:
 1. Make sure the unit is in its upright, installed position.

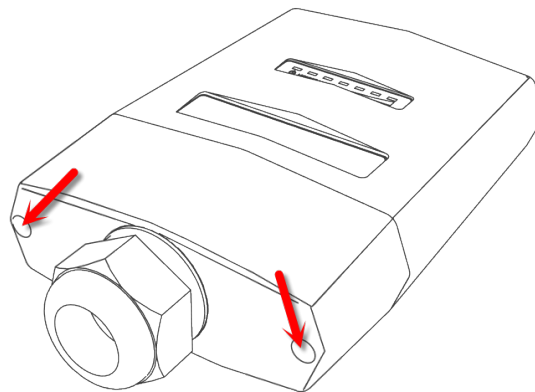
2. Unscrew the hexagonal nut (below). Note that a typical hexagonal nut is shown in the image below.



3. Slide the hexagonal nut and rubber seal along the Ethernet cables, away from the cable gland (below).



4. Loosen the two screws (below).



5. Carefully remove the cast aluminum bottom cover from the unit enclosure.



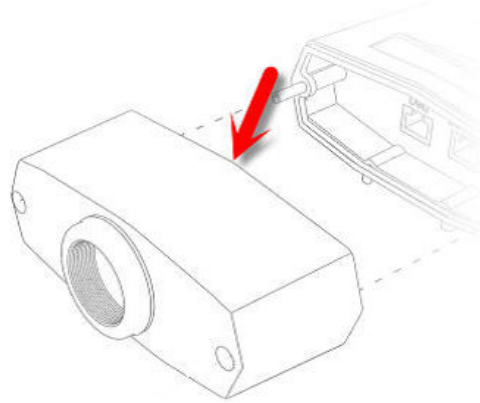
CAUTION

Do not remove the unit's cast aluminum bottom cover for any reason, other than to check for water ingress.

6. In the unlikely event that water is seen inside the bottom cover or the unit enclosure, contact your

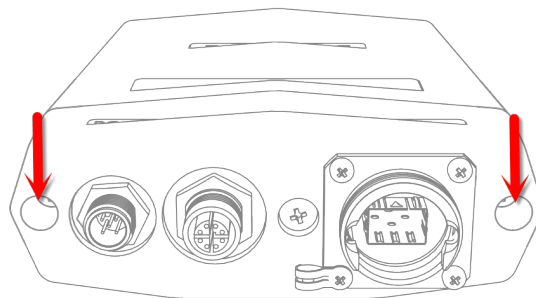
local Fluidmesh Networks representative for advice.

7. Inspect the recessed sealing ring on the lip of the bottom cover for damage (below). If the sealing ring is damaged, replace it.



8. Re-install the bottom cover on the unit enclosure and re-assemble the transceiver by following the directions above in reverse order.

- Cisco 4200-series and Cisco 4500-series transceivers:
 1. Make sure the unit is in its upright, installed position.
 2. Do not loosen or remove any M12 connectors, or the SFP connector (if fitted).
 3. Loosen the two screws (below). Note that a typical FIBER unit is shown below.



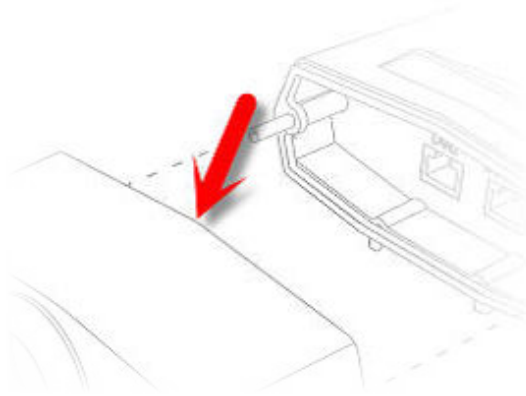
4. Carefully remove the cast aluminum bottom cover from the unit enclosure.



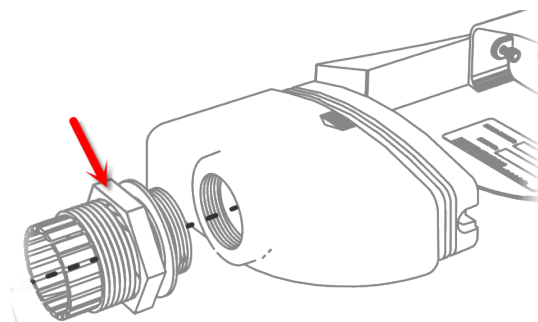
CAUTION

Do not remove the unit's cast aluminum bottom cover for any reason, other than to check for water ingress.

5. In the unlikely event that water is seen inside the bottom cover or the unit enclosure, contact your local Fluidmesh Networks representative for advice.
6. Inspect the recessed sealing ring on the lip of the bottom cover for damage (below). If the sealing ring is damaged, replace it.

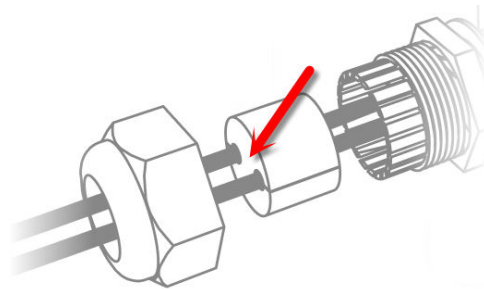


7. Re-install the bottom cover on the unit enclosure and re-assemble the transceiver by following the directions above in reverse order.
2. On FM Ponte kit, FM1200 Volo, Cisco 3200-series and Cisco FM3500 Endo transceivers, make sure that the cable gland (below) is securely screwed into the bottom cover. Do not over-tighten the cable gland.

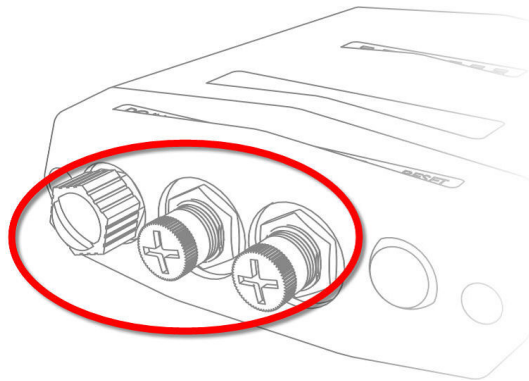


3. On FM Ponte kit, FM1200 Volo, Cisco 3200-series and Cisco FM3500 Endo transceivers, make sure that all unused cable

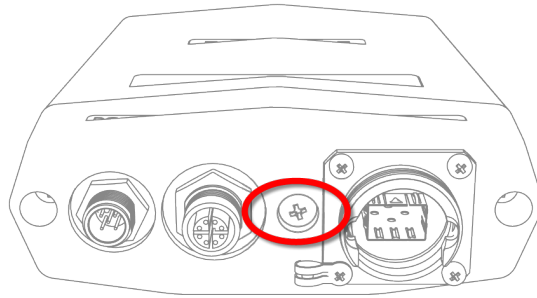
holes in the rubber seal are blocked (below). All unused holes must only be blocked using a single one-inch cable stub per hole.



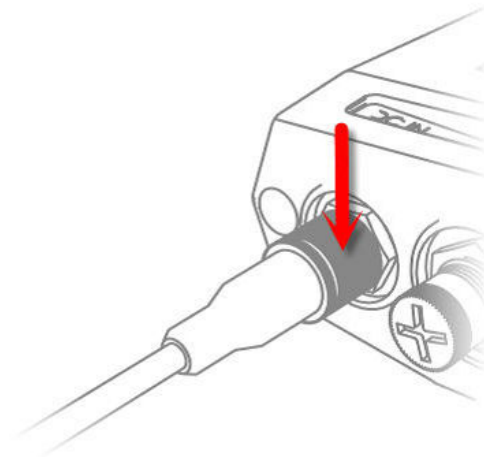
4. On FM Ponte kit, FM1200 Volo, FM1300 Otto, Cisco 3200-series and Cisco FM3500 Endo transceivers, make sure that:
 - The rubber seal is securely seated in the cable gland.
 - All Ethernet cables are a snug fit within their holes on the rubber seal.
 - The hexagonal nut is screwed onto the cable gland with just enough torque to secure the nut and rubber seal.
5. On all Cisco 4200-series and Cisco 4500-series transceivers, make sure that protective plastic caps are securely screwed onto all *DC IN* and *LAN* ports that are not in use (below).



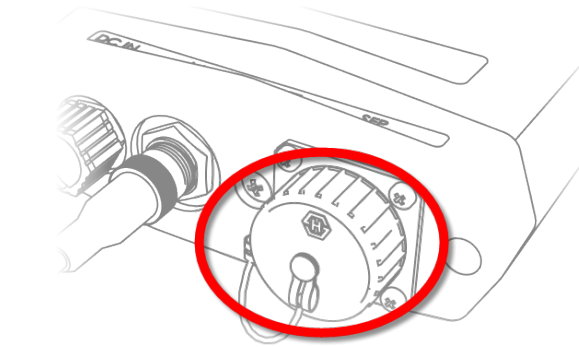
6. On FM4200 Fiber and FM4500 Fiber transceivers, make sure that the Phillips-head screw covering the RESET button port (below) is securely tightened.



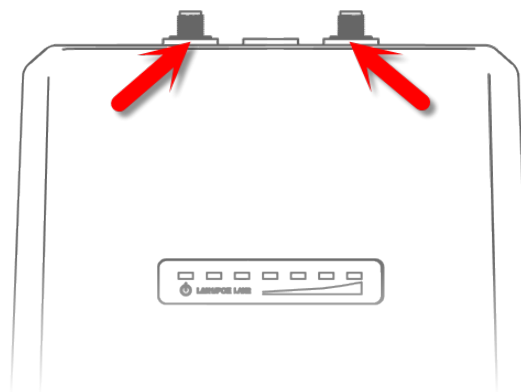
7. On all Cisco 4200-series and Cisco 4500-series transceivers, make sure that all M12A (DC IN) and M12X (LAN) connectors are sufficiently waterproofed by wrapping PTFE thread-sealing tape around the male threads of the transceiver's connectors (below) before screwing on the female cable connectors. Use enough PTFE tape to ensure a watertight seal.



8. On FM4200 Fiber and FM4500 Fiber transceivers, waterproof the SFP connector according to the instructions given by the manufacturer of the installed fiber-optic module. If no fiber-optic module is installed, make sure the threaded SFP port cap (below) is securely tightened.



9. On all transceivers equipped with external RPSMA or QMA antenna connectors, make sure that the connectors are waterproofed by doing the following steps:
 - a. Only remove the protective rubber sleeve from an RPSMA or QMA plug if an antenna will be connected to the plug.
 - b. Check the round, knurled nuts of the transceiver's RPSMA or QMA connectors (below) for tightness. If any round nuts are loose, tighten them by hand only.



- c. Slide a section of Nylon heat-shrinkable tubing over each unconnected antenna cable.
- d. Push the male RPSMA or QMA plug of the antenna cable onto the female RPSMA or QMA plug of the unit.
- e. Slide the Nylon heat-shrinkable tube over the connected RPSMA or QMA connectors.
- f. Use a heat gun to shrink the tubing onto the connectors.

If any of the repair procedures in this section have been done, re-check the antenna alignment and received signal strength indications, as shown in [“Verifying antenna alignment and RSSI”](#) (page 29).

7.2. Maintaining external antenna waterproofing

Outdoor-rated Fluidmesh antenna units are encased in specially ruggedized enclosures.

Depending on the design specification of the antenna type, each antenna is designed to withstand mechanical shock and vibration, and water and dust ingress to ingress-protection standard IP55, IP66 or IP67.

To ensure that your Fluidmesh transceiver antenna performs to the standards specified by its Ingress Protection (IP) rating, waterproof the RPSMA or QMA antenna connectors as shown in [“Maintaining radio transceiver waterproofing” \(page 17\)](#) above.

If any repairs have been done to an external antenna, re-check the antenna alignment and received signal strength indications, as shown in [“Verifying antenna alignment and RSSI” \(page 29\)](#).

8. Verifying antenna alignment and RSSI

Verify that the horizontal and vertical alignment of the antenna connected to the transceiver unit has remained constant, and that the received signal strength indication has not deteriorated since the device installation was commissioned.

If needed, re-align the antenna. The relevant procedures are shown in the *Fluidmesh Acceptance Test Protocol (ATP)* document that was completed during commissioning of the installation, and in the *Antenna-alignment tools and physical statistics* section of the *Fluidmesh Installation and Configuration Manual* for the specific transceiver device.

9. Notices and copyright



WARNING

Installation of Fluidmesh hardware devices and their supporting infrastructure must be done by suitably qualified personnel only. In some countries, installation by a certified electrician may be required.

Fluidmesh hardware installations must comply with all applicable local legislation.



WARNING

Never disassemble a Fluidmesh hardware device to any extent that is not described in the relevant device user's manual. Fluidmesh devices contain no user-serviceable parts. Disassembling a Fluidmesh hardware device will invalidate the device warranty, and may compromise the operational integrity of the device.

On some Fluidmesh radio transceiver devices, the lower access cover must be removed to gain access to the hardware *Reset* button. Do not operate a radio transceiver device for extended periods if its lower access cover has been removed.



WARNING

To avoid danger from non-ionizing radiation and/or electric shock and/or high-intensity laser or LED light sources, be sure to install the unit only in a location with restricted access.



WARNING

To avoid danger from electric shock, do not expose the unit to water or high humidity if the unit is powered ON, or if any access covers have been removed from the unit enclosure.

Do not place liquid-filled objects on or above the unit.

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10. Contact us

Worldwide Headquarters:

Fluidmesh Networks LLC

81 Prospect Street

Brooklyn, New York 11201

United States of America

Tel. +1 (617) 209 -6080

Fax. +1 (866) 458-1522

info@fluidmesh.com

Technical Support desk: support@fluidmesh.com

www.fluidmesh.com

Regional headquarters for Europe, the Middle East and Africa:

Tel. +39 02 0061 6189

Regional headquarters for the United Kingdom:

Tel. +44 2078 553 132

Regional headquarters for France:

Tel. +33 1 82 88 33 6

Regional headquarters for Australia and New Zealand:

Tel: +61 401 747 403