Maven Wireless Exo and Strato Off Air Repeater

Installation User Manual

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CONFIDENTIAL

Revision history

Date	Rev	Description	Signed
2021-09-23	A1	Initial version	BRPA
2024-03-07	A2	Firmware upgrade	BRPA
2024-03-18	A3	US Version	GG

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Warranty

Standard product warranty is 12 months or as otherwise agreed.

All outdoor antennas must be installed with lightning protection. Damage to modules, as a result of lightning, is not covered by the warranty.

Antennas must be connected before switching on AC or DC power. Energising the equipment prior to the connection of the antenna cable(s) is regarded as a faulty installation procedure and therefore not covered by the Maven Wireless warranty.

Unauthorized changes to equipment

Any changes or modifications not expressly approved by Maven Wireless (who are responsible for compliance) could void the user's authority to operate the equipment.
The equipment must be installed and operated in accordance with any license required from the radio authorities in the country concerned. In most cases a failure to obtain or the contravention of a license is a criminal offence. It is the user's responsibility to ensure any required licenses are obtained, that system installations are commissioned in accordance with their terms and that no changes can later be made which contravene them.

Standards and approvals

The Maven DAS complies with the following standards

- EMC Directive 2004/108/EC
- Low Voltage Directive 73/23/EEC
- R&TTE Directive 1999/5/EC
- UL 62368-1, CSA C22.2, NEMA 4X
- FCC 15B, ICES-003; FCC 22, 24, 27, 90

General Safety Warnings and Compliance

Always observe standard safety precautions during installation, operation and maintenance of this product.

Safety to personnel

Before installing, replacing or modifying any of the equipment, the entire manual should be read and understood. The user needs to supply the appropriate AC or DC power to the equipment. Incorrect power setting can damage the equipment and may cause injury to the user.
Be aware that the equipment can in certain conditions become very warm and can cause minor injuries if handled without protection such as gloves.

Electrical Shock

To prevent electrical shock when installing, modifying or replacing the system power wiring, disconnect the wiring at the power source before working with uninsulated wires or terminals.

Non-Ionizing Radiation

The repeater unit outputs Radio Frequencies at high power. The connected antenna system must be engineered to comply with the requirements of 1999/519/EC: Council Recommendation of the limitation of exposure of the general public to electromagnetic fields 0Hz to 300GHz. Otherwise, in cases where the general public is not admitted to the coverage area, such other occupational limits may be applicable.

Maven Wireless customers must adhere to the standards when designing and commissioning coverage systems by ensuring that the combination of output power, splitting losses, antenna gains and separation distances to accessible areas yield field strengths below safe levels.

Note that in some instances it will be necessary to shut down units in order for work to be performed on or near system antennas. Adequate warning notices should be posted to ensure every installation is safe.

RF Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, this equipment should be installed and operated with minimum distance 20 cm (7.9 inches) between the antenna and your body during normal operation. Users must follow the specific operating instructions for satisfying RF exposure compliance.

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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. Please note that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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Maven Wireless customers must adhere to the standards when designing and commissioning coverage systems by ensuring that the combination of output power, splitting losses, antenna gains and separation distances to accessible areas yield field strengths below safe levels.

Note that in some instances it will be necessary to shut down units in order for work to be performed on or near system antennas. Adequate warning notices should be posted to ensure every installation is safe.

Unit Weight

The repeater unit weighs 25kg. It can be lifted by one man but due care with handling is required. Personnel should have received suitable training and be provided with adequate PPE, at a minimum safety shoes, preferably a lifting belt.

For use only by Trained Personnel

The devices should be installed and energized only by trained personnel who are familiar with the type of equipment and the associated hazards.

The repeater has an access cover protected by keys. The keys should only be issued to suitably trained persons. There are no user serviceable parts inside and maintenance must be carried out by trained staff in workshop conditions. Apart from the access cover, the devices must not be opened on site.

Login details of user accounts must be controlled so that only competent persons possess the privilege to adjust frequency bands and operating levels.

Use in accordance with this manual

The protection provided by the equipment may be impaired if installed and used in a manner not specified by the manufacturer. Follow all guidance contained in this manual.

Electrical & Environmental Ratings

Voltage Rating	115-230V AC alternatively -48 VDC telecom standard
AC Frequency	50/60 Hz
Current	5.2-2.6 A RMS AC
Temperature	-25 to +55 ºC (-13 to 131 ºF)
Relative Humidity	10 to 100 % Non-Condensing
Indoor/Outdoor Use	Indoor/Outdoor

Environment	Weather Protected, Not Temperature Controlled - EN 300-019-1-3, Class 3.2, NEMA 4X
Operational Spacing	Horizontal side by side - 300 mm (12 in) Horizontal front to back - 300 mm (12 in) Vertical top to bottom - 500 mm (20 in)
Dimensions	670 x 383 x 270 mm (26 x 15 x 10.5 in)
Weight	25 kg (55 lb)

Table of Contents

General description

Maven digital off-air repeater operating principles

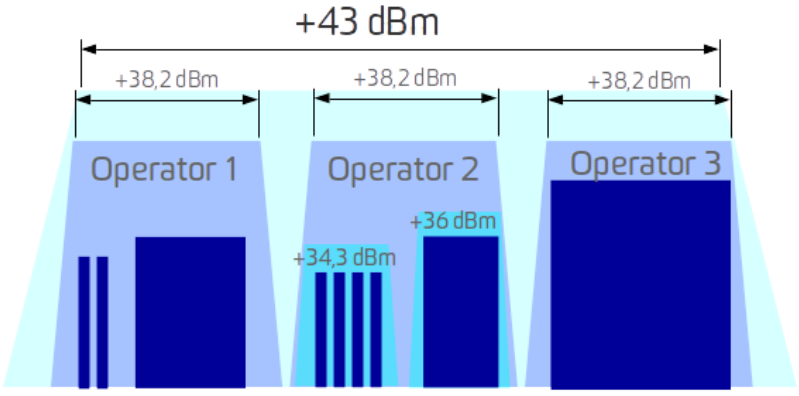
The Maven digital off-air repeater is a bidirectional frequency-selective amplifier:

- Downlink signals from the base (donor) antenna port are digitized, the signals which should be amplified are selected by digital filtering and are re-transmitted with the wanted gain on the mobile (server) antenna port.
- Uplink signals from the mobile (server) antenna port are similarly filtered and re-transmitted on the base (donor) port.
- In both directions, excessive signal levels are limited by fast-acting automatic level control (ALC), and the isolation between the antennas is monitored to prevent oscillation in case of inadequate isolation margin.

Coverage in the Maven digital off-air repeater is software-defined: each operator specifies in the management GUI which frequency ranges they are using for their carriers, which are then known to the system as a named “sector input”. These sector inputs are filtered into separate bidirectional (downlink /uplink) digital data streams. Each operator can then decide:

- What sector inputs should be enabled (establishing the flow of signals between base and mobile antenna ports).
- What downlink and uplink gain should be provided for each enabled sector input. Uplink gain can either be specified as a fixed value, or relative to the downlink gain.
- What share of the maximum output power at each antenna port is allocated to each operator, and for each operator how they allocate that power to sector inputs of different technologies.

The separation of sector inputs by digital filtering allows the signals from several operators to be combined with different power levels, while still allowing each operator to define their own coverage parameters without being affected by changes in the other operator signals. In the uplink, only the signals specified by the operator are passed by the filtering which means that signals from uncoordinated mobile terminals do not appear as an interfering signal at the base stations. Coverage parameters can be changed at any time via the management GUI, allowing signals to be added or removed, power levels to be changed or sectorization adjusted remotely.



Separate sector inputs enabled with different power levels per technology and operator (Exo shown)

Migration from analog repeaters

Maven digital off-air repeaters offer a flexibility in system design which does not exist with analogue band-selective products. In an analogue band-selective repeater, all signals in the frequency band experience the same amplification. There is no choice in which signals are carried: the entire frequency range connected at one end is hard-wired to appear at the other end, and there is no selectivity to prevent unwanted signals from interfering. Also, relative signal levels are fixed for each operator as they appear at the antenna input, with no scope to set different gains or maximum signal levels for different carriers.

The Maven digital repeater offers high-speed precise automatic level control and squelch per carrier, as well as advanced diagnostic and control functions such as oscillation prevention.

Analog band-selective repeater

- Combined input signals transmitted between fixed base and mobile ports.
- No selectivity against unwanted downlink or uplink signals.
- No option to apply different gain or maximum signal level to different signals.
- Only indirect measurements of signal properties.

Maven digital repeater

- Input signals split into individual sector inputs which can be separately controlled.
- Unwanted downlink / uplink signals removed by digital filtering.
- High speed ALC and squelch per carrier, directly in the digital data path.
- Advanced diagnostic and control functions based on the digital signal data, such as oscillation prevention.

Overview of the Maven Digital Off Air Repeater

This manual describes two different repeaters in the Maven Off Air product range:

- **Exo** - this is a high-power unit (+43 dBm/Band) for up to 2 frequency bands
- **Strato** - this is a medium power unit (30dBm/Band) for up to 3 frequency bands.

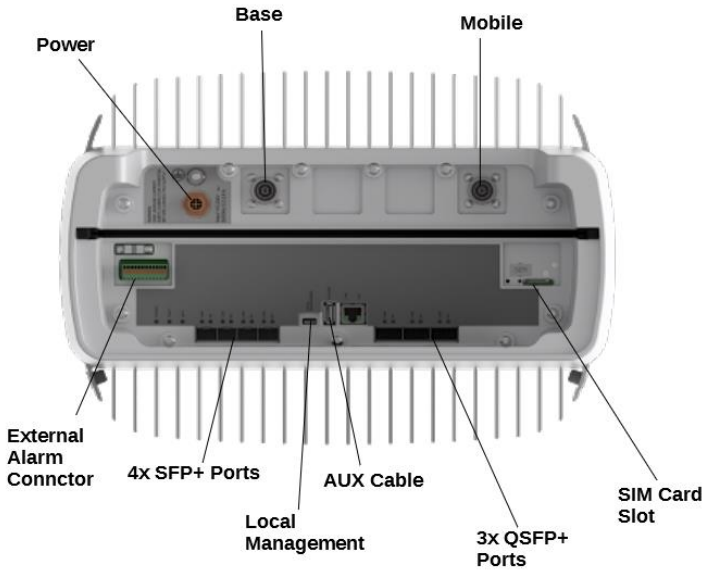
Both are constructed in the same lightweight alloy chassis.

Two power supply variants are available, 115 to 230 VAC or -48 VDC

In most variants two antenna ports are fitted using 4.3-10 female connectors. One antenna faces the Base (Donor) while the other faces the Mobile (Server). At each antenna port the supported bands are combined by filter multiplexers with very high rejection between bands. The unit is specifically designed for very low Passive Intermodulation Levels (PIM).

The off-air repeater can be provided with additional antenna connectors for specific requirements such as MIMO or separated band outputs. The unit can be fitted with a built-in modem for remote supervision, operating through the Base (Donor) antenna port using an internal directional coupler.

Connectors and LEDs



Connections and slots

The repeater has the following connectors / slots presented on the bottom panel:

1 x 12-pin External alarm connector - see later section

1 x USB 2.0 Type A Jack - AUX USB, provided for connection of USB device (prepared for future use)

1 x USB 2.0, micro, 5-pin Jack - LOCAL MANAGEMENT, connect a laptop or other compatible device to control via a web browser.

1 x RJ45 Ethernet connector - unit can be connected to a LAN for remote access

Depending on revision of repeater there might also be slots for fiber optic modules - these are not used in the Off air repeaters.

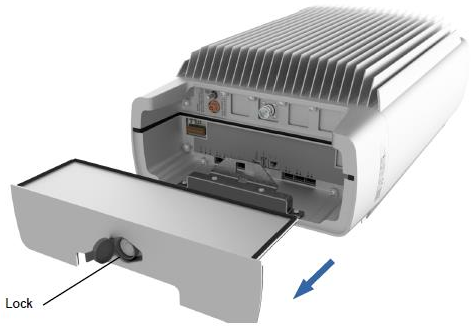
LED descriptions

The repeater contains a number of different LEDs to give the user at site a clear indication of the status of the unit:

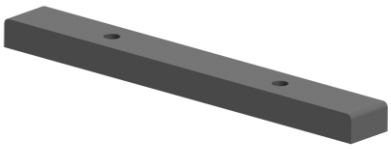
LED Text	Color	Indication
LINK	Green	Not used in Off air repeaters
RF	Yellow	Not used in Off air repeaters
POWER	Green	Constantly lit except short blink, to indicate that the unit is powered up and software is operational.
FAULT	Red	Blinks if there are one or more errors in this unit. Short blink on regular intervals to indicate that the LED is working.
INFO	Yellow	Prepared for future use.
LINK/LAN	Green	Indicates that there is an Ethernet connection over the LAN cable.
ACT	Yellow	Activity LED when traffic is present over the Ethernet connection.

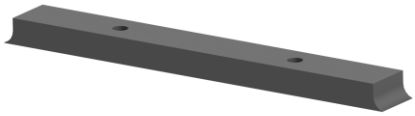
Access cover

The access cover covers the LAN, USB and External Alarm Connections
To remove the access cover open the sealing lid over the lock and unlock using the keys provided.
Slide the access cover down the slot to remove.



To prevent the ingress of water and dust, a film of mounting grease (supplied) should be applied to the lid gasket and the cable sealing gland.





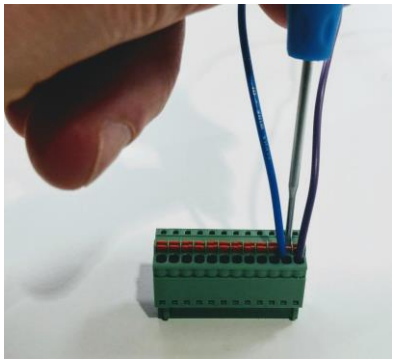
Under the access cover is a bracket and grommet system which secures the permanent cables in place to seal them and to provide strain relief. It is released by removing the four pozidriv screws as shown in the picture below.The grommet holes should be adjusted by removing the concentric rubber layers until each cable is a neat and weatherproof fit in the slot.

As it is impossible to reach any of the cables or connections without opening the cover it has a sensor which also functions as a tamper alarm. If the cover is not securely shut an Access Cover Alarm will be indicated.
On replacing the cover, always lock it in place and close the sealing lid of the lock.

External alarm and relay connection

The External Alarm Connector is a cage type with clamping spring terminals on a 0.1” Pitch in an Orange Insulating body. The acceptable range of wire gauge is 20-28 AWG. Stranded wire is recommended.
The cage spring of each terminal is released by the adjacent actuating lever. It is helpful to have a fine bladed screwdriver to depress the lever for wire insertion or removal.

The connector itself can be unplugged from the unit, allowing to do all the connections externally and then plug the connector back into the unit once all cabling is done.



External alarm input contains a series resistor of 2.2 kΩ internally to limit the current through the photodiode. For maximum ratings of the inputs, see next section.

External Alarm Input Ratings

The external alarm inputs are via photodiodes in an Opto-Coupler. To cater for as many different interface scenarios as possible they are isolated from one another and from Earth.

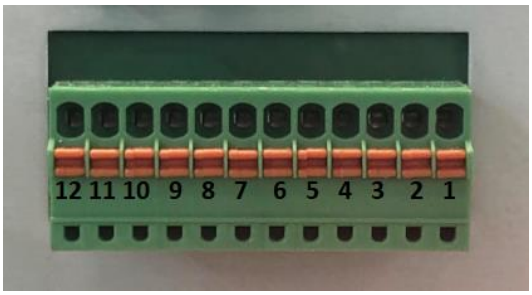
Parameter	Value
Maximum input level	30 V
Isolation between adjacent circuits	Do not exceed 100 V AC/DC

Alarm Relay Contact Ratings

Parameter	Value
Max Switching Voltage	30 V
Rated Current	1 A DC, 0.3 A AC
Max Switched Power	30 W, 30 VA (resistive load)

Minimum Switching Voltage	100 uV
Contact Resistance	< 100 mΩ

Connector Pinout



Pin	Function / Usage
12	External Alarm Input 1 - Isolated Photodiode, Cathode –Ve
11	External Alarm Input 1 - Isolated Photodiode, Anode +Ve
10	External Alarm Input 2 - Isolated Photodiode, Cathode –Ve
9	External Alarm Input 2 - Isolated Photodiode, Anode +Ve
8	External Alarm Input 3 - Isolated Photodiode, Cathode –Ve
7	External Alarm Input 3 - Isolated Photodiode, Anode +Ve
6	External Alarm Input 4 - Isolated Photodiode, Cathode –Ve
5	External Alarm Input 4 - Isolated Photodiode, Anode +Ve
4	Spare – Not Used, do not connect
3	External Alarm Relay Normally Closed Connected to Common when Alarm is BAD or Power OFF
2	External Alarm Relay Common
1	External Alarm Relay Normally Open Connected to Common when Alarm is GOOD

This document describes Hardware installation of Exo / Strato units solely. For commissioning and configuration refer to the Maven wireless commissioning manual.

Installing the Maven Digital Off Air Repeater

Handling of Repeater Units

The repeater weighs 25 kg. While this is an allowable one man lift appropriate PPE e.g. toe protecting shoes, lifting belt and gloves should be provided.
Transportation to the installation site over uneven ground, ramps, rails, stairs etc. should be considered.
Protect the unit from mechanical shock by the use of suitable buffering materials.
Use handling aids such as stair climbing trolleys or for units to be installed at height hoists, lifting platforms etc. Protect access to the work site in a suitable manner.
All these matters should be reviewed in a risk assessment before every installation.

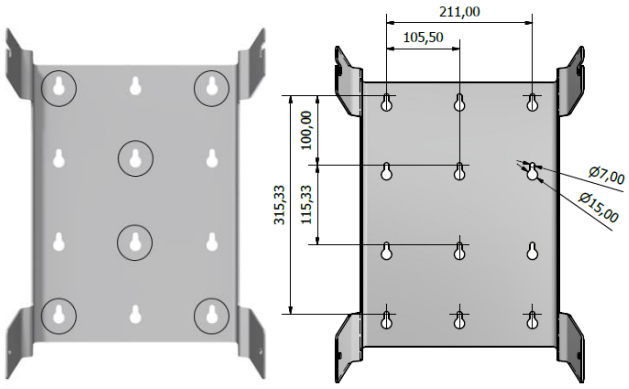
Installation of unit using wall bracket

Wall mounting package contents

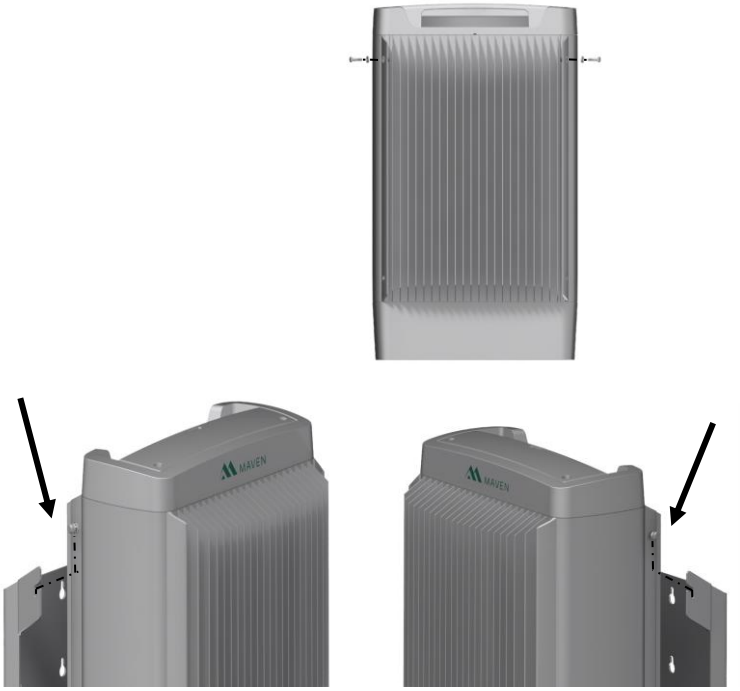
- 1 pcs repeater
- 4 pcs M6 mounting bolts
- 4 pcs washers Nordlock NL6SP
- 1 pcs wall mounting bracket
- 1 pcs power cable, length 2 meters
- 1 pcs USB cable

Installation procedure

1. Assess the strength of the wall at the proposed mounting location. Studwork & Plasterboard walls are generally unsuitable to carry the weight of the repeater unless considerable reinforcement is added. In case of doubt consult a structural expert.
   Brick, Blockwork and Concrete Walls are generally suitable types. Procure the correct type of M6 mounting bolts to secure the mounting bracket to the wall in question in a safe manner. A minimum of 5 bolts should be used.
2. Mount the mounting bracket on the wall. Marked mounting holes are preferred and the plate can be used as a template for that step. Drill holes of diameter and depth as specified by the mounting bolt hardware. Four bolts should be mounted at the outer corner holes. A fifth should be fitted in either upper or lower center position.
3. Mount the unit in the brackets using a set of hexagon head screws (M6x16) 4x and washers (NordLock NL6) 4x Mount the two upper mounting screws and washers. Leave a space of 5 mm, with the washers outermost under the screw head, to hook the unit into the wall mount bracket.



4. Place the unit into the mount plate engaging the two upper pre-mounted screws - washers must be **outside** the bracket faces.



5. Adjust the position of the unit in the bracket for alignment of the lower holes and insert these screws and washers. Fully tighten the two upper screws followed by the two lower screws.

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Installation of unit using 19” rack bracket

Rack Mounting package contents

- 1 pcs repeater
- 4 pcs M6 mounting bolts
- 4 pcs washers Nordlock NL6SP
- 2 pcs rack mounting brackets
- 1 pcs power cable, length 2 meters
- 1 pcs USB cable

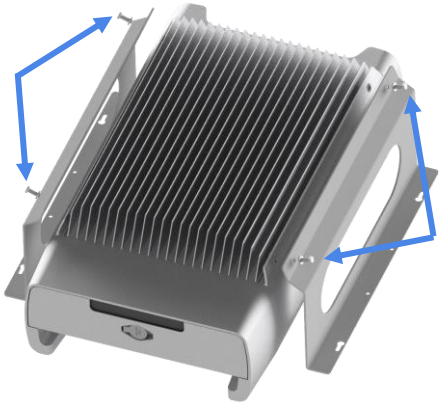
Installation procedure

Before mounting the supplied brackets to the unit they can be used as templates to fit cage nuts in the rack uprights at the correct positions.

1. Locate the two upper cage nuts in the uprights at an appropriate height, ensuring that they are level.
2. Partially insert screws into the two cage nuts, having first ensured that the screw heads can pass through the circular holes of the keyway slots in the mounting brackets.
3. Hang the brackets in position on the upper screws and mount the lower cage nuts to correspond with the narrow portion of the keyway slots at the bottom of the brackets. The cage nuts are now located and the brackets can be fitted to the unit.

> *The screws in the upper cage nuts should **remain** in place for the following step.*

4. Dismantle the pre-mounted screws and washers on the repeater outer heat fins.
5. Mount the 19 inch brackets using included set of hexagon head screws (M6x16) 4x nd washers (NordLock NL6) 4x, ensure the tightness of all fastenings.



Attachment points for rack mounting bracket -
note orientation of bottom of Unit (with Access Cover)

6. Now the repeater can be lifted and hung in place in the rack using the screws which were left in the upper cage nuts. It will hang on them with the main body slightly forward of true vertical.
7. Inward pressure against the body of the unit will swing it into the vertical position allowing the lower screws to be inserted into the bottom cage nuts and tightened.
8. Tighten the upper screws and check all is secure.

AC Power arrangements for Maven Digital Off Air Repeater units.

The repeater is supplied complete with a matching AC power supply cable, 2 m long,
Binder part number 77-0690-0000-50704-0200. The AC connector is pre-terminated and it must not be disassembled.

The cable has 4 cores of 1.5mm^2, 3 power wires are identified by numbers printed in White at intervals in the Black outer insulation. The Earth wire is colored Yellow/Green. The whole is molded over with a strong protective jacket.

Pin assignments and wire labellings:

Pin	Usage	Colour	Label
1	Neutral	Black	Printed with number 1
2	Not used	Black	Printed with number 2. It can be cut short as it is not required.
3	Live (phase)	Black	Printed with number 3
4	Earth / Ground	Green / Yellow	

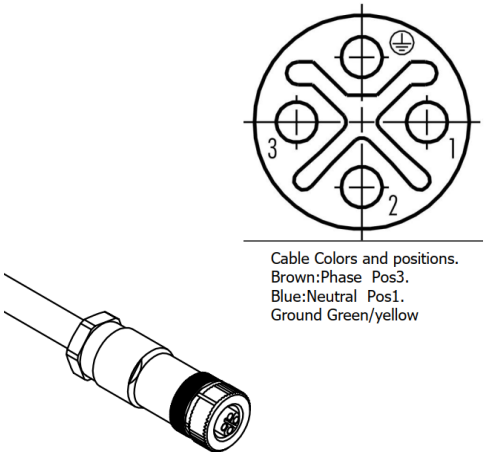
As the repeater is intended for continuous operation and because it should not be easy to accidentally interrupt the service, the equipment does not have a power switch. In most circumstances the use of standard AC plugs and sockets to power a permanent installation will be quite unsuitable, however, these may be fitted for testing in a laboratory environment.

As the European 2-pin and Earth plug and socket combination is unfused the rating of the fuse which supplies the circuit to a repeater should be a maximum of 10A.

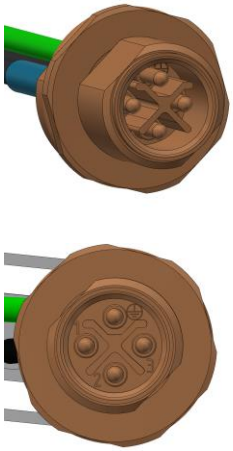
Mating the AC Power Connectors

Please note that the Binder AC power connectors include a shaped keying arrangement as part of the design. This ensures the correct orientation of the connections but it requires care when mating the connectors together.

The route of the AC cable should be a gentle curve where there is enough slack for the free AC cable socket to reach the Remote Unit panel mounted plug without undue sideways strain. The AC socket should be offered up to the panel mounted plug and the body gently rotated until the keyways align and first engagement can be felt. Now push the two further together and tighten the outer locking ring on the power cable socket.



AC at cable end



AC connector at unit end

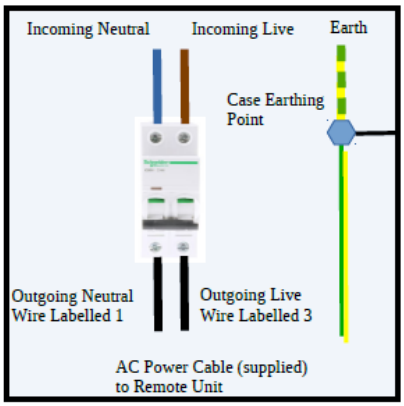
Gently fix the curved shape from cable to socket fixed in the unit. Once it is aligned in position push it gently inside the socket and tighten up with the outer ring on the power cable.

Isolating the equipment when servicing is important for safety and for this reason, if the power cable is to be permanently wired, an external circuit breaker or switch & fuse box must be fitted with a maximum rating of 10 A. This provides means to isolate the equipment and it provides fault protection for the power cable and connections before the protection contained in the internal power supply.

The circuit breaker or switch & fuse box should be located in the vicinity of the equipment, in such a location that it cannot be operated by accident. The switch status should be clearly visible from the repeater position. If this cannot be arranged it should be possible to protect the switch state by a locking device so that power cannot be restored while personnel are working on the equipment.

The Binder power connectors are **not** rated for connection or disconnection under load. For this reason, power to the unit must be switched at the circuit breaker or switch before and after the front panel connector is matted or unmatted. As a secondary precaution this connector should remain disconnected while working on the equipment.

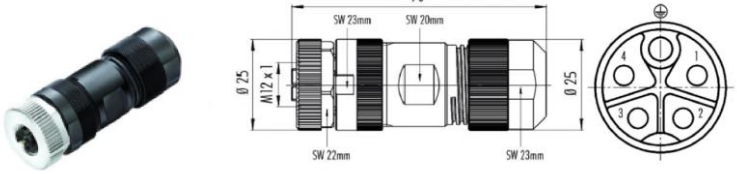
It is recommended that any circuit breaker or switch should be of the double pole type interrupting both the Line and Neutral and conductors. In many situations a single pole in the live conductor alone might be sufficient but the double pole type offers additional protection should the Neutral Voltage rise significantly above Earth in fault conditions. In some areas AC supplies can be presented as two line conductors with Voltages which are balanced with respect to Earth. In this case the two pole types **must** be used.



The conductors used for incoming AC power wiring must have a cross sectional area of ***at least*** 1.5 mm^2 and comply with the National Regulations of the country of use.

DC Power arrangements for Maven Digital Off Air Repeater units.

The repeater is supplied complete with a matching DC power supply connector, Binder part number 99-0700-29-05.



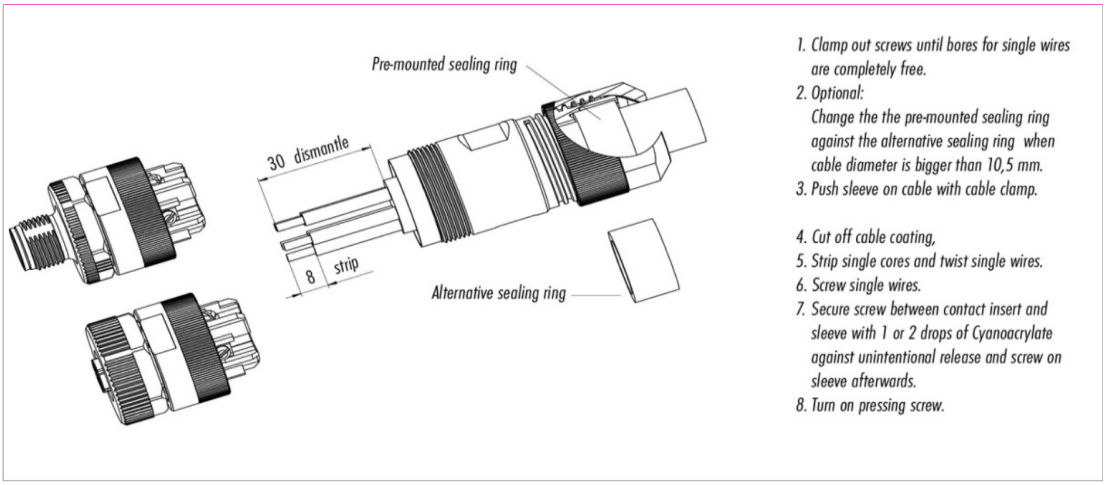
Maximum Wire Gauge is 2.5 mm^2, a minimum 2.05 mm^2 is recommended.

Pin assignments and usage:

Pin	Usage
1	PSU A Positive
2	PSU A Negative
3	PSU B Negative (not connected in single PSU variants)
4	PSU B Positive (not connected in single PSU variants)
5	Earth / Ground

The DC inputs are isolated from Earth for use at sites with either Positive or Negative Earth convention in the power supply arrangements.

The connector is assembled as shown below. Select the sealing ring to suit the cable in use.



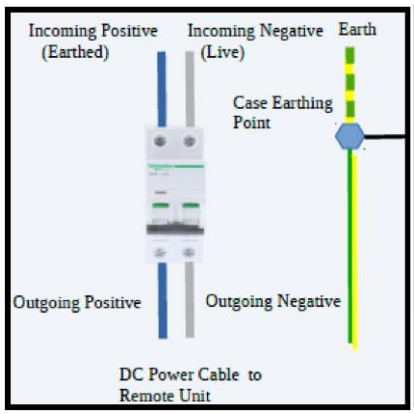
As the equipment is intended for continuous operation and because it should not be easy to accidentally interrupt the service, it does **not** have a power switch.

The Binder power connectors are not rated for connection or disconnection under load. For this reason, power to the unit must be switched at the circuit breaker or switch before and after the front panel connector is matted or unmatted. As a secondary precaution, the connector should remain disconnected while working on the equipment.

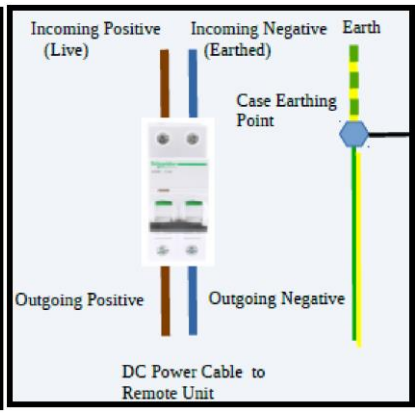
Isolating the equipment when servicing is important for safety and for this reason, if the power cable is to be permanently wired, an external circuit breaker or switch & fuse box with a maximum rating of 10 A. This provides means to isolate the equipment and it provides fault protection for the power cable and connections before the protection contained in the internal power supply.

The circuit breaker or switch & fuse box should be located in the vicinity of the equipment, in such a location that it cannot be operated by accident. The switch status should be clearly visible from the equipment position. If this cannot be arranged it should be possible to protect the switch state by a locking device so that power cannot be restored while personnel are working on the equipment.

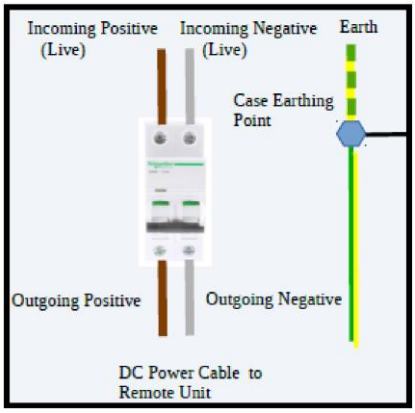
It is recommended that any circuit breaker or switch should be of the double pole type interrupting both the Positive and Negative conductors. For DC Installations it is usual practice that one conductor pole is also ground. In such cases, at the discretion of the responsible site engineer, the circuit breaker or switch & fuse can be a single pole type placed in the ”live” (Non Earthed) conductor.



Positive Earth Convention



Negative Earth Convention



Floating Earth Convention

Earthing the Maven Digital Off Air Repeater.

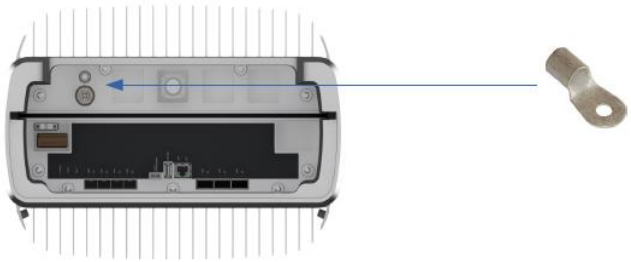
AC Powered units have a Protection Earth (PE) connection via the power cable.

The AC input filter, required to ensure minimal disturbance from mains borne interference, means the unit has some Earth leakage current and a secondary Earth connection must be maintained at all times. For this reason and to cater for the situation when the power cable is removed from the unit breaking the Earth connection, a secondary Earth connection must be fitted. A notice to this effect is given on the front panel.

In some installations the Earthing of units and associated antenna system cables will be mandated by additional safety considerations - these must be followed.

First provision for Protection Earth (PE) comes through the power cable connector itself, A second provision for connecting Protection Earth (PE) is realized by means of an M6 Earth stud. This is located adjacent to the Power & Antenna connections on the bottom panel. An Earthing cable must be connected here, stranded copper with minimum cross sectional area of 5 mm² with Green/Yellow over jacket is recommended.

The opposite end of the Earthing cable should be connected to other metalwork already well bonded to Earth or otherwise the cable should run all the way to the site common Earthing point.



Uninsulated ring terminals should be used, such as that shown, securely soldered or crimped to the cable. (The joint should be left unsleeved to permit the condition of the connection to be periodically inspected)

Repeater power up sequence

Connect the power connector before switching CB ON.

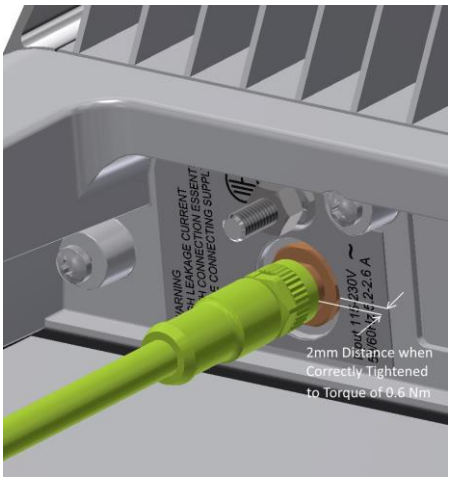
Repeater power down sequence

Switch CB OFF before removing the power connector.

Attaching Power cable

To ensure proper power cable connection Maven wireless highly recommends the use of proper tools.

When correctly tightened the connector should sit fully home as indicated in the diagram.



Cooling requirements

To ensure the unit is operating within the allowed temperature range, proper cooling is required. Thermal dissipation is maximum 360 Watts for a quadband operating at maximum output power in all bands.

- Mount the unit vertically with connectors / access cover down.
- Make sure the environmental operating temperature stated in the data sheet is not exceeded.
- Do not mount in direct sunlight

Antenna connection and PIM

The Antenna Connections are via a 4.3-10 Male Connector the performance of which is critical to avoiding system interference from Passive Intermodulation (PIM).

The quality of connectors, cables and all antenna system components is vital to the avoidance of PIM. PIM tested components with 4.3-10 Connectors should therefore be used throughout antenna system sections that carry high power.

In particular, the use of N type connectors and the "on site" manufacturing of antenna cables or jumpers is to be avoided. Braided screen cables are specifically not recommended.

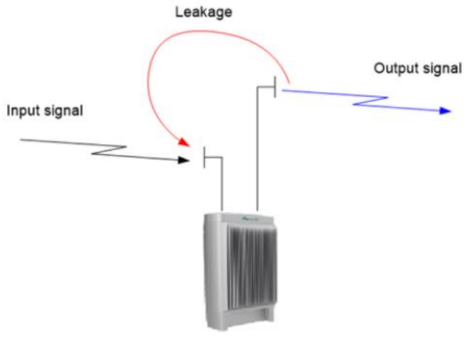
Dirt, moisture or the slightest physical damage to connector mating surfaces will damage performance and may generate PIM. For this reason, please observe the following:

- All connector protective end caps must remain in place until the cables are ready to be joined.
- The physical condition of both connectors should be carefully examined before they are mated. If any irregularity is detected do not proceed until it has been corrected.
- Strict cleanliness must be observed during the mating operation. It should take place in dry conditions.
- Ensure that the connectors are carefully "offered up" to one another in a square orientation. Off axis alignment will damage the mating surfaces.
- Connector lock nuts must be tightened to the specified torque.

- Connector bodies and pins must not be allowed to rotate against one another during the tightening process. Support them using suitable soft jawed grips to hold their position.
- After mating apply any additional weather sealing necessary.

As faulty RF connectors inevitably cause irreversible damage to the sockets to which they are connected lack of care in connector mating can require equipment downtime and expensive repairs.

Antenna Isolation



Measuring Antenna isolation:

- Isolation is the loss between Downlink (Mobile Facing) and Uplink (Base Facing) antennas.
- Isolation must exceed gain by a suitable margin to avoid ringing around which degrades signal quality and may create interference.
- A repeater needs a minimum of 10 dB more isolation than the gain
- If the isolation is marginal, ensure oscillation prevention feature is enabled

Inject a signal into the software and measure the received signal on the Service Antenna.

For detailed functioning and measuring antenna isolation on GUI refer to the Maven wireless commissioning manual

Maintenance

The repeater is designed to not require any maintenance. The unit has no user serviceable parts. In all cases of suspected malfunction contact Maven Wireless Support.

However, if the unit is installed in a very dusty area which over time might decrease the air flow around the unit and hence decreasing cooling it is recommended to perform periodic cleaning of the unit.

- Dust should be swept from the heatsink fins using a long bristled brush.
- The outside of the unit can be cleaned using a damp cloth with water or mild domestic cleaning fluids as required.