Integrated Mesh Node

FAP4213-210

Installation and User Guide

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1. INTEGRATED MESH NODE OVERVIEW

Innovative Wireless Technologies' **Integrated Mesh Node (IMN)** is a fixed infrastructure device that acts as a repeater or router in an ad-hoc wireless communications network. The IMN is used primarily in underground industrial mining applications.

The mesh network supports voice communications, text messaging, and tracking of personnel. High reliability communications is inherent to the self-healing, self-configuring mesh network architecture by providing redundant communications paths from one device to another. In the event of any node failure, the system automatically re-routes signals to another device within radio frequency range.

Under normal operating conditions, the IMN is powered by an internal AC/DC power supply, but also has an internal backup battery option to ensure communications when main power is lost.

Some key features of the Integrated Mesh Node:

- Supports simultaneous Voice/Data/Tracking
- High reliability communications in underground environments
- Supports peer-to-peer communications with other Mesh Nodes
- High quality voice communications with minimal latency
- Internal battery backup

2. SAFETY INFORMATION

IMPORTANT! READ BEFORE USING THE INTEGRATED MESH NODE

This section contains important information on the safe operation of the IMN.

The IMN is intended for use in underground and above ground environments.

This device has NOT been evaluated by the Mine Safety and Health Administration (MSHA) per Title 30 Code of Federal Regulations Part 23 and cannot be installed in mines requiring MSHA intrinsic safety certification.

The antenna must be located a minimum 7.1 feet from any blasting circuits. Remember that the IMN will continue to run when line power is removed and may still be a hazard to nearby blasting. If blasting must be done near an IMN, be sure to turn the IMN power switch OFF and attach an appropriate warning tag.

When installed, power cables must not be intermingled or bundled with RF coaxial cables used to connect the antenna to the IMN.

Changes or modifications to this device not expressly approved by Innovative Wireless Technologies, Inc. may void the user's authority to operate this equipment.

2.1 PART 15 OF FEDERAL COMMUNICATIONS COMMISSION (FCC) RULES COMPLIANCE

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference.
2) This device must accept any interference received, including interference that may cause undesired operation.

FCC ID: SP8-FAP4213210

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1) *l'appareil ne doit pas produire de brouillage, et*
2) *l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

IC: 9568A-FAP4213210

This radio transmitter IC: 9568A-FAP4213210 has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

The approved antenna types that may be used are:

1) Directional yagi antenna with a maximum gain of +11 dBi
2) Omni-directional dipole antenna with a maximum gain of +5 dBi

IMPORTANT:

- To comply with FCC radio frequency (RF) exposure compliance requirements, the antenna used for this transceiver must not be co-located or operating in conjunction with any other antenna or transceiver.

- The *SENTINEL™* Integrated Mesh Node must be installed 20 cm or more from any personnel in order to comply with FCC and ISED exposure requirements.

NOTE: 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 RF energy which may cause harmful interference to radio communications if not installed and used in accordance with the instructions. It is important to note that proper installation does not guarantee interference will not occur. 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; or
- Consult the dealer or an experienced radio technician for help.

3. SPECIFICATIONS

(Typical unless otherwise specified)

Environmental	
Operating Temperature[1]	-20C to +60C
Storage Temperature	-25C to +60C
Operating Humidity	0 to 100%, non-condensing
Dimensions	11” x 5” x 4”
Weight – with internal battery	6 lbs
Enclosure Protection	IP65

Power	
Main AC Connector/ Cable	10 ft. power cable with NEMA 5-15P plug
AC Input Voltage	85-264 VAC, 47-63 Hz
Current	$0.03A_{avg}$, $0.05A_{peak}$ @ 120VAC
Internal Battery	6V sealed lead acid
Battery Life	>12 hours

Electrical	
Frequency Range	902 – 928 MHz
Receiver Sensitivity[2]	-94 dBm
RF Transmit Power	+22 dBm
RF input/output	50 ohms nominal (Type N connector)
Voice/Data channels[3]	1 channel, 250 kbps

Note 1: Ambient temperature. Battery charging may be limited above +50C.
Note 2: Conducted sensitivity measured at BER <2%
Note 3: Supports 2 simultaneous voice calls (TDMA)

4. DESCRIPTION

Before using the IMN, review the information below:

4.1 INPUTS AND OUTPUTS

The following is an explanation of the IMN inputs and outputs as shown in Figure 1:

CABLE 1: Main AC power input. Ten-foot power cord with North America NEMA 5-15P plug.

SWITCH: Power switch, alternate action pushbutton. Press to turn ON or OFF. Pushbutton is recessed when unit is ON.

LED1: The green network status LED indicates the status of network communication via a designated blink pattern (refer to Section 7.0)

LED2: The blue power LED indicates the status of the IMN's input power and backup battery via a designated blink pattern (refer to Section 7.0)

ANTENNA 1: 900 MHz antenna port. Type N connector for connection to coaxial cable, antennas, and RF accessories. Dust cap must be installed if no antenna cable is attached.

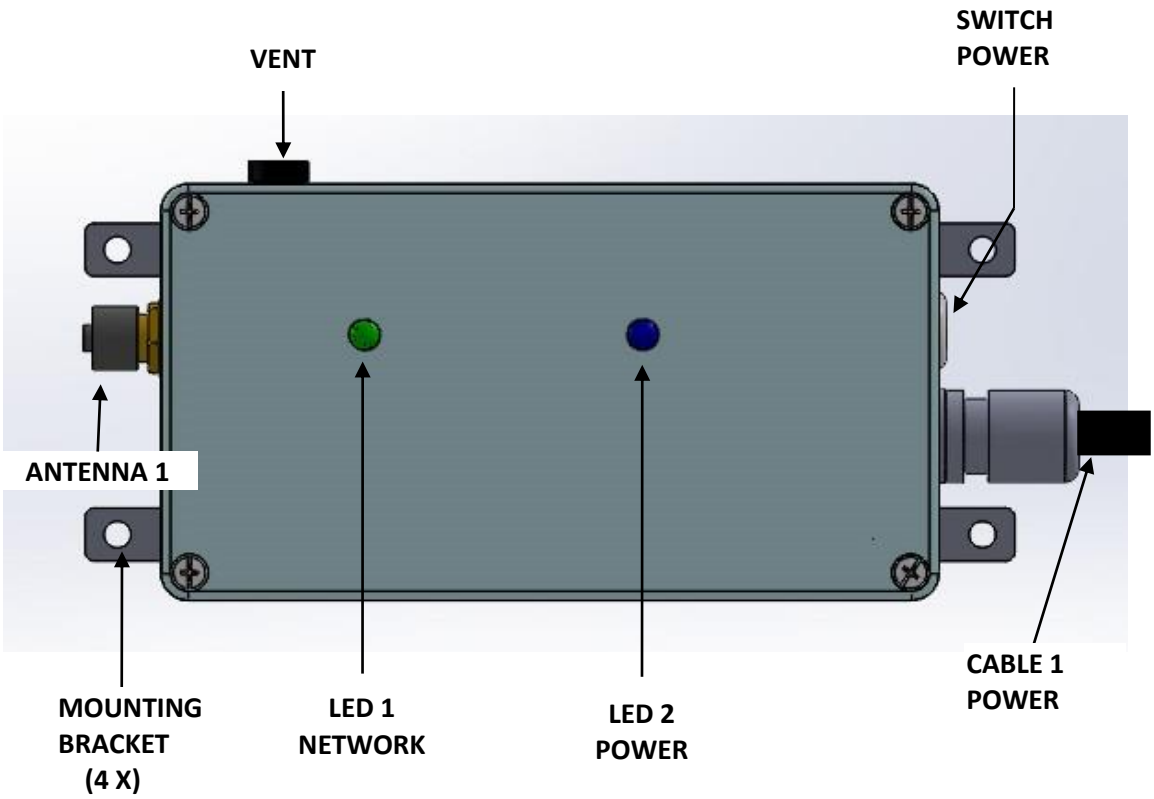

FIGURE 1: IMN CONNECTIONS

4.2 COMPONENTS NECESSARY FOR INSTALLATION

The IMN installation uses the following components and accessories (refer to Section 6.0 for basic installation instructions):

Mounting Hardware:
The IMN is supplied with mounting brackets at the four corners. A 0.3" diameter hole in the mounting bracket allows appropriate screws, hooks, etc. to be used for mounting.

Antenna (900 MHz):
The specific 900 MHz antenna connected to the IMN RF port depends on the location of the IMN. For below ground, use Yagi directional antenna assembly (IWT p/n: FAA9100-017) or Dipole omni-directional antenna assembly (IWT p/n: FAA9100-027).

RF Power Splitters, Couplers, Attenuators:
The use of 2-way, 3-way, or 4-way power splitters and other RF accessories depends on the specific IMN system installation configuration.

RF Cable:
The RF coaxial cable connecting the antenna port of the IMN to the 900 MHz antenna has Type N connectors on each end for connection to system equipment.

5. PRIOR TO INSTALLATION

IMPORTANT! TRAINED PERSONNEL MUST PROFESSIONALLY INSTALL THE IMN.

5.1 SITE SURVEY

Conduct a survey to determine the appropriate site(s) to install the IMN from an RF and power perspective.

5.2 VISUAL INSPECTION

Each IMN must be visually inspected to ensure the following:

- The enclosure is free from corrosion and defects.
- The enclosure has all connectors installed.
- The antenna connector must have the proper dust cap installed when not in use.
- Properly secure the enclosure lid with four (4) screws.

6. BASIC INSTALLATION INSTRUCTIONS

IMPORTANT SAFETY WARNINGS!

CONTENTS OF IMN INCLUDE A NONSPILLABLE SEALED LEAD ACID BATTERY.

DO NOT BLOCK VENT OPENING AT TOP OF ENCLOSURE.

DO NOT OPERATE IMN IN INVERTED POSITION.

AVOID EXPOSURE OF IMN TO HEAT. DO NOT PLACE IN CLOSE PROXIMITY TO HEAT SOURCE WITHOUT PROPER VENTILATION.

IMPORTANT NOTE!
THE IMN MUST BE PROFESSIONALLY INSTALLED BY TRAINED PERSONNEL.

6.1 Check that all appropriate clearance distances are met with regards to blasting circuits. Per the IME Safety Library Publication No. 20, the recommended clearance distance is a minimum 7.1 feet for the IMN.

The IMN must be mounted with the vent at, or near, the highest point of the enclosure. When wall mounted, the enclosure must be mounted with the vent side up. It must not be mounted with the vent side down. The IMN may also be mounted on a roof/ceiling with the lid side facing down.

Failure to observe orientation requirements may permit explosive gases to accumulate within the battery or the enclosure.

Insure that an appropriate AC receptacle or junction box is located within reach of the IMN's power cable.

6.2 For applications utilizing external antennas, determine the placements for the 900 MHz antennas to ensure proper RF propagation. The IMN may be connected to multiple 900 MHz antennas via RF power splitters connected to the output of the unit. Select locations that ensure proper RF communication. Antennas should not be placed in any location that presents a safety hazard or an opportunity to be damaged.

6.3 Locate a place to mount the IMN enclosure and RF power splitter.
Choose the appropriate splitter (2-way, 3-way, or 4-way) for a given IMN antenna configuration. The IMN and splitter should be installed in a convenient central location in order to minimize the amount of coaxial cable needed to connect the splitter box to the antennas.

6.4 Connect the IMN's 900 MHz output to the splitter and antennas. **External antenna (or proper terminator) must be connected to the IMN prior to applying power to the unit. Failure to connect antenna before applying power may result in damage to the IMN.**

6.5 Connect the IMN to a receptacle or junction box or power supply. Use a receptacle or junction box appropriate to the degree of waterproofing required. All electrical connections must comply with applicable electrical codes.

6.6 Press the POWER switch and the power indicator should blink with the ON-CHARGING pattern. (ON-50%, OFF - 50%). Refer to Section 7 for additional information on the status LEDs.

NOTE: Power button must be ON to charge battery.

6.7 Temporarily disconnect AC power and verify that the power indicator changes to the ON - BATTERY pattern (ON—10%, OFF—90%). Refer to Section 7 for additional information on the status LEDs.

7. OPERATING AND MAINTENANCE INSTRUCTIONS

7.1 POWER SWITCH

Press the power button to turn ON (pushbutton recessed).
Press the power button to turn OFF (pushbutton not recessed).

7.2 STATUS LEDS

The status of the IMN's connection to power and the network may be monitored by observing the blink pattern of the indicator LEDs mounted on the outside of the enclosure:

Green Network LED (LED1):

BLINK	IMN is connected to network using the external antenna
DOUBLE BLINK	IMN is connected to network using internal patch antenna
OFF	No network connectivity

Blue Power LED (LED2):

SOLID ON:	During initial power up or when battery is bad or missing Main AC Power ON
BLINK (ON—50%, OFF—50%):	Main AC Power ON / Battery Charging (Normal use condition)
WINK (ON—10%, OFF—90%):	Main AC Power OFF / Battery Discharging
OFF:	No Power to IMN

7.3 ROUTINE MAINTENANCE

The IMN requires little routine maintenance. Inspect each box periodically every 3-6 months to ensure that the box remains free of corrosion and defects. It is important that the box remains dust tight. Replace defective boxes immediately. Do not continue to use any boxes that may have had their dust seal compromised.

7.4 DISCONNECTING EXTERNAL ANTENNA

The IMN may be disconnected from power or the external antenna during maintenance or while being moved to a new location. Turn off power to the IMN using the power switch prior to disconnecting the external antenna to prevent discharging the internal battery or damaging the internal RF circuits. Place dust cap on the exposed antenna connector when not in use.

7.5 BATTERY CARE

To prevent permanent damage to the internal battery, do not store the IMN with the power switch in the ON position (recessed) or with the battery in a discharged state. When stored for an extended period of time, apply AC power to the IMN for 24 hours every six months to maintain the battery in a charged state.

To maintain maximum battery life and performance, a fully discharged battery should be charged as soon as possible. Batteries left in a fully discharged state for more than one (1) week may experience a permanent reduction in capacity.

Batteries will experience a reduction in capacity as they age. Batteries may also experience a reduction in capacity if exposed to elevated temperatures. In order to maintain battery performance and maximize backup time available for the IMNs, replace batteries according to the expected battery life chart below:

Average Ambient Temperature	Expected IMN Battery Life
+20C	4 years
+30C	2 years
+40C	1 year

7.6 BATTERY REPLACEMENT

To replace the internal battery:

1. Turn OFF the unit's power switch (pushbutton should not be recessed). Note the power switch does NOT disconnect AC power from inside the enclosure.
2. Disconnect AC power from the unit by unplugging the power cable.
3. Remove the four screws on the enclosure's lid. Verify power switch button is NOT recessed prior to removing enclosure lid.
4. Disconnect the two quick-disconnect fasteners from the battery (see Figure 2).
5. Remove battery from enclosure. Note battery is secured inside the enclosure with a Dual Lock™ fastener.
6. Connect the quick-disconnect fasteners to the battery terminals of the new battery noting battery polarity. Connect the RED wire to the battery's positive terminal (marked "+") and the BLACK wire to the battery's negative terminal (marked "-"). **Unit may be damaged if terminals are reversed!**
7. Insert the new battery (IWT P/N: FAP9100-015) in the battery compartment by lining up Dual Lock™ fastener on battery with Dual Lock™ fastener installed in unit (see Figure 3). Positive terminal of the battery should be facing bottom of enclosure.
8. Place lid on enclosure making sure LEDs align with lenses mounted in lid. Tighten all four lid screws.
9. Turn the unit power switch ON and confirm the POWER LED (LED2) indicates the unit is operating on battery power (ON—10%, OFF—90%).
10. Apply AC power to the unit by plugging in power cable and confirm the POWER LED indicates the battery is charging (ON—50%, OFF—50%).

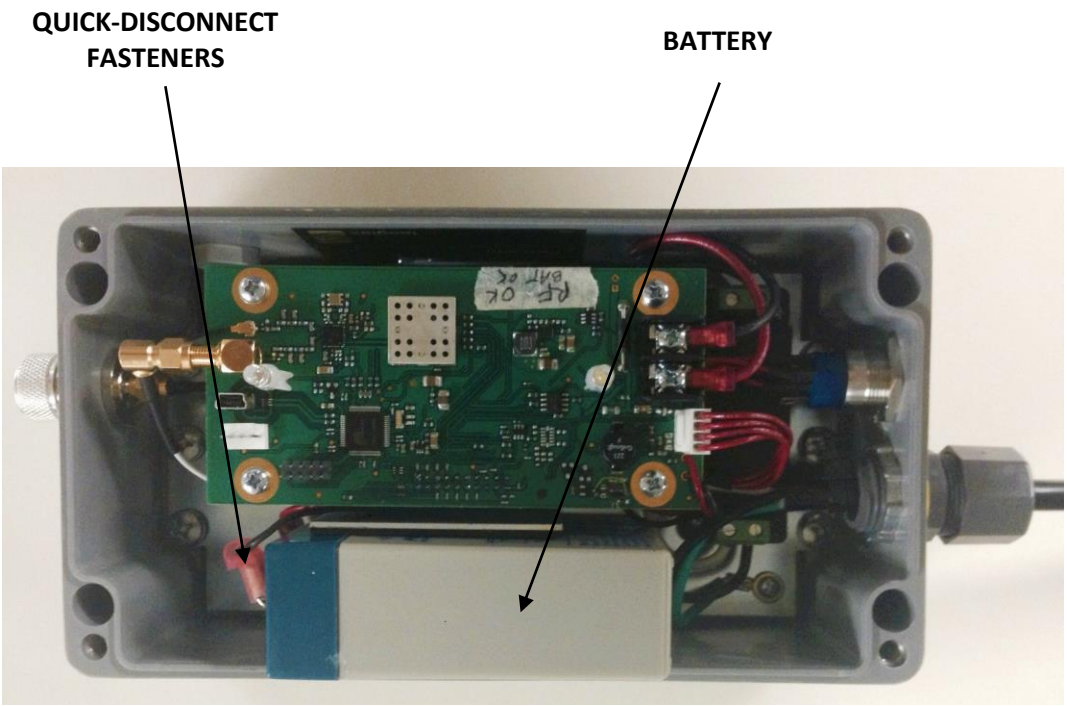

FIGURE 2: REPLACING IMN BATTERY

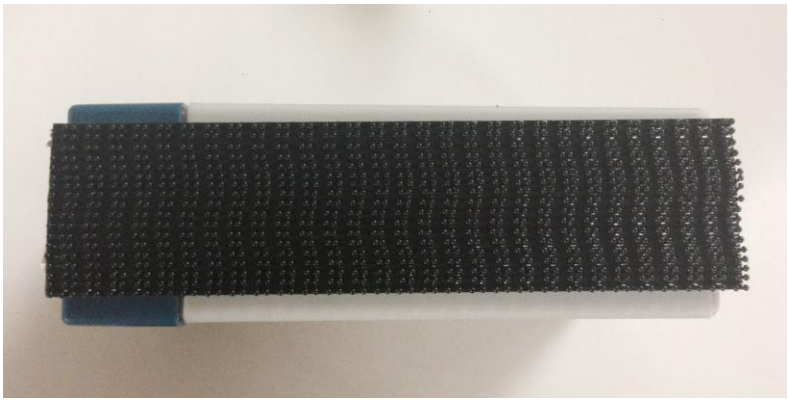

FIGURE 3 REPLACEMENT BATTERY WITH DUAL LOCK™ FASTENER (IWT P/N: FAP9100-015)

8. WARRANTY INFORMATION

Never disassemble the IMN, doing so will void the warranty.
If an IMN is damaged, do not use.