INSTALLATION AND USER'S GUIDE

for

FIXED MESH NODE FAP4210-001

GATEWAY NODE FAP2210-001

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1.0 PRODUCT OVERVIEW

Innovative Wireless Technologies' Fixed Mesh Node (FMN) and Gateway Node (GWN) are transceivers designed primarily for use in industrial mining applications.

The **FAP4210-001 Fixed Mesh Nodes (FMN)** is a fixed infrastructure device which acts as a repeater or router in an ad-hoc wireless communications network. Voice communications, text messaging, and tracking capability of personnel are supported over the mesh network. 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.

The FMN is mains powered but also has a backup battery option to ensure communications when main power is lost.

The **FAP2210-001 Gateway Node (GWN)** is electrically and mechanically identical to the FMN, but contains the addition of an Ethernet port. The GWN Ethernet port provides a gateway to a wired network for system management.

Some key features of the FMN / GWN:

- Supports simultaneous Voice/Data/Tracking
- High reliability communications in underground environments
- Supports peer-to-peer communications with other Fixed Mesh Nodes
- High quality voice communications with minimal latency
- Battery backup option (IWT Product No: FAP9100-002)
- Intrinsically safe (Mine Safety and Health Administration I.S. Evaluation No. 23-ISA080005-0)

2.0 SAFETY INFORMATION

IMPORTANT INFORMATION ON SAFE OPERATION. READ THIS INFORMATION BEFORE INSTALLING AND OPERATING THE FIXED MESH NODE OR GATEWAY NODE.

2.1 DEVICES INSTALLED ABOVE GROUND (FMN / GWN):

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.

FCC ID: SP8-FAP2210-001

When operated above ground, the FMN / GWN must be professionally installed with the following antenna connected to the 900 MHz RF port:

Laird Technologies Model No. OD9-5 or equivalent.

IMPORTANT NOTE: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The FMN / GWN must be installed 20 cm or more from any personnel in order to comply with FCC exposure requirements.

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

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2.2 DEVICES INSTALLED IN UNDERGROUND COAL MINES (FMN ONLY):

This device has been evaluated by the Mine Safety and Health Administration (MSHA) per Title 30 Code of Federal Regulations Part 23.

MSHA Intrinsic Safety Evaluation Number: 23-ISA080005-0

Per MSHA's evaluation, this product has been determined to be intrinsically safe under the following conditions:

- The FMN is installed ONLY in areas where permissible equipment is not required.
- The FMN is installed with the following intrinsically safe backup battery assembly:
  Innovative Wireless Technologies FAP9100-002
- The FMN is installed with the following 900 MHz antenna:
  M-2 Antenna Systems, Inc. Model No. 902-5 or 902-5MA

  The antenna must be located a minimum 7.1 feet from any blasting circuits.
- When installed underground in coal mines, the FMN must be installed as part of a MSHA approved system. The FMN must be installed per installation instructions described in 5.0 as well as per any instructions / documentation applicable to the specific MSHA approved system.

3.0 SPECIFICATIONS FOR FAP4210-001 / FAP2210-001

ENVIRONMENTAL	
Operating Temperature	-30 to +60C ambient
Dimensions	11.8” x 11” x 4.25”
Weight	11.4 lbs
Enclosure	IP65
POWER	
Main DC	
Connector	Universal Mate-N-Lock (keyed)
Voltage	+13V - +26VDC
Current	$0.15A_{avg}$, $0.40A_{peak}$ @ 24VDC
Current w/ battery charging	$0.30A_{avg}$, $0.40A_{peak}$ @ 24VDC
IS Battery (Optional)	
Connector	Universal Mate-N-Lock (keyed)
Voltage	+5.9V to +7.2VDC (Open-Circuit)
Current	$1.2A_{avg}$, $3.5A_{peak}$ @ 6.9VDC (O.C. Bat.)
ELECTRICAL	
Frequency Range	902 – 928 MHz
Receiver Sensitivity[1]	-100 dBm
RF Transmit Power – below ground	+28 dBm
RF Transmit Power – above ground	+13 dBm
RF input/output	50 ohms nominal (N connector)
Voice channels/FMN[2]	4 channels
Data channels/FMN	2 channels, 250 kbps

Note 1 Conducted sensitivity measured at BER < 2%
Note 2 Supports 4 simultaneous voice calls (TDMA)

4.0 FIXED MESH NODE / GATEWAY DESCRIPTION

4.1 INPUTS / OUTPUTS

The following is an explanation of the FMN / GWN inputs and outputs shown in FIGURE 1:

CON1: Main power input. Four-pin Universal Mate-n-Lok connector. Receives input from DC supply (16-24 VDC, 3 Amps nominal)

CON2: Backup battery input. Four-pin Universal Mate-n-Lok connector. Receives input from 6V sealed lead acid battery. IWT FAP9100-002 intrinsically safe backup battery assembly is required for applications where MSHA approval is necessary.

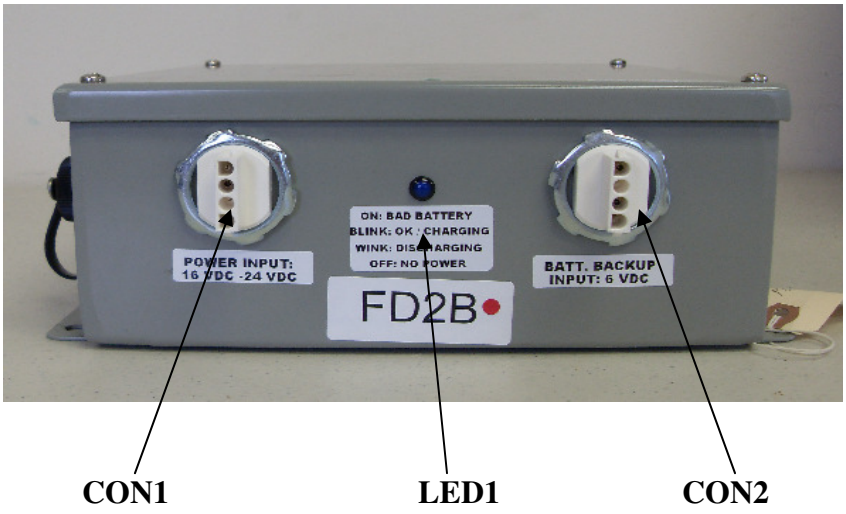
LED1: The blue power LED indicates the status of the FMN and backup battery via a designated blink pattern (see section 7.0)

CON3: Ethernet connector for Gateway Nodes (GWN ONLY)

ANTENNA PORT 1: 900 MHz antenna port. N-connector.

ANTENNA PORT 2: Alternate antenna port for future applications. Not used with FMN / GWN (no electrical connection). Dust cap must be on connector at all times.

CONN4: RS-232 connector. Not used with FMN / GWN. Dust cap must be on connector at all times.



ANTENNA PORT 1

CON3 (GWN ONLY)

CON4

ANTENNA PORT 2

FIGURE 1: FMN / GWN CONNECTIONS

4.2 COMPONENTS NECESSARY FOR INSTALLATION

The following components and accessories are used when installing and operating the FMN / GWN as part of a system (see section 6.0 for installation instructions):

Power cable (IWT P/N: FAA4200-007*):*
The power cable for the DC supply input CON1 is an MSHA approved flame resistant, 2-conductor, 18 AWG with a 4-pin Universal Mate-n-Lok connector.

Power Supply:
The specific power supply used to power the FMNs and GWNs will depend on the requirements of the system in which they are installed. The DC power supply must be capable of supplying 16VDC – 24VDC and 3 Amps to the FMN / GWN.

Backup battery assembly (IWT P/N: FAP9100-001):
The backup battery is a 6V sealed lead acid battery housed in a rugged plastic enclosure. The battery assembly connects to the FMN CON2 via an MSHA approved flame resistant cable with a Universal Mate-n-Lok connector. The battery supplies a 6V intrinsically safe input to the FMN. Only the FAP9100-001 battery assembly has been approved by MSHA for use with the FMN when installed in coal mines.

Antenna (900 MHz):
The specific 900 MHz antenna connected to the FMN / GWN RF port depends on the location of the FMN / GWN.

Above Ground (FCC Certified): Laird Technologies OD9-5 or equivalent
Below Ground (MSHA Approved): M-2 Antenna Systems, Inc. 902-5 or 902-5MA

The particular antenna models listed are the ONLY antennas that may be used with the FMN / GWN in applications where either FCC or MSHA requirements must be met.

RF Power Splitter:
A 2-way, 3-way, or 4-way power splitter may be used depending on the specific FMN installation configuration used – i.e. the FMN may be installed with up to four 900 MHz antennas.

RF Coax cable (IWT P/N: RCL4100-001):
The coax cable connecting the antenna port of the FMN to the 900 MHz antenna is a MSHA approved, flame resistant cable with N-connectors.

5.0 PRIOR TO INSTALLATION

IMPORTANT NOTE:
THE FIXED MESH NODE MUST BE PROFESSIONALLY INSTALLED BY TRAINED PERSONNEL

5.1 Conduct a survey to determine the appropriate sites to install the nodes from an RF and Power perspective.

- 5.1.1 FMNs / GWNs may be supplied with a line voltage between 16VDC and 24VDC
- 5.1.2 Follow approved system installation guidelines pertaining to length of both power and RF cables.
- 5.1.3 Be sure that nodes are an appropriate distance away from any blasting circuits. Per the IME Safety Library Publication No. 20, the recommended clearance distance is a minimum 7.1 feet.

5.2. Visually inspect each FMN / GWN to ensure that:

- 5.2.1 The box is free from corrosion and defects.
- 5.2.2 All connectors are installed and there are no holes in the box.
- 5.2.3 The RS232 port has the proper dust cap installed.
- 5.2.4 If not used, the battery input connector has the proper dust cap installed.
- 5.2.5 The lid is properly secured with 4 screws.

6.0 INSTALLATION INSTRUCTIONS

IMPORTANT NOTE:
THE FMN / GWN MUST BE PROFESSIONALLY INSTALLED BY TRAINED PERSONNEL.

6.1 INSTALLATIONS BELOW GROUND (FMN ONLY)

IMPORTANT NOTE:
WHEN USED IN AN UNDERGROUND COAL MINING APPLICATION, THE FMN MUST BE INSTALLED AS PART OF A MSHA APPROVED SYSTEM. FIXED MESH NODES MUST BE INSTALLED PER REQUIREMENTS SPECIFIC TO THE APPROVED SYSTEM INCLUDING CABLE LENGTHS, CABLE TYPES, AND POWER SUPPLIES.

At each of the sites determined by the survey described in 5.1:

6.1.1 Determine the placements for the 900 MHz antennas to ensure proper RF propagation. The FMN / GWN may be connected to up to four 900 MHz antennas. For units installed in coal mines below ground (FMN only), mount the antennas to roof bolts using magnetic antenna mount. 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.

6.1.2 Locate a place to mount the FMN / GWN and RF power splitter.
Choose the appropriate splitter (2-way, 3-way, or 4-way) for a given FMN / GWN antenna configuration. The FMN and splitter should be installed in a convenient central location in order to minimize the amount of coax cable needed to connect the splitter box to the antennas. The FMN can be mounted either on a wall or the ceiling. If the FMN is mounted on the wall, the orientation of the box is not relevant. If the FMN is mounted on the ceiling, be sure that the lid of the box faces up. This will prevent water from accumulating in the lip of the lid.

6.1.3 Connect the FMN box, Splitter and Antennas.
The node should be connected to the splitter box with RCL4100-001 cable. Connect one end of the cable to RF1 on the FMN and the other end to the side of the splitter that has only one connector. Connect each of the remaining splitter connections to an antenna using RCL4100-001 cable.

6.1.4. Connect the FMN box to the Junction box or Power Supply.
The FMN should be connected to a junction box or Power Supply with a FAA4200-007 cable. The cable has a Universal Mate-n-Lok connecter on one end and spade lugs on the other. Install the Mate-n-Lok to the main DC power connector of the FMN (CON1). The connector will not fit properly into the wrong mate. DO NOT force the connector in.

The connector should mate smoothly and lock in place with an audible click. If the connector does not mate properly check for obstructions and try again.

Connect the other end of the cable to a junction box or power supply via the attached spade lugs. The black wire is ground. The other wire should be connected to line voltage. Make sure that the cable is properly secured.

6.1.5 Before applying power to the system, be sure to recheck 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 M-2 Antenna Systems 900 MHz antenna.

6.1.6 Backup Battery Installation

6.1.6.1 If a backup battery is required for the node being installed, determine a place to mount the FAP9100-002 battery enclosure. Inspect the enclosure to make sure that it is not damaged and that it is latched closed. Make sure that the mounting does not interfere with proper venting of the battery enclosure (vent hole is located near handle of battery enclosure).

6.1.6.2 Before installing the battery enclosure, be sure to recheck 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 M-2 Antenna Systems 900 MHz antenna. Remember that a system with a battery installed will continue to run when line power is removed and may still be a hazard to nearby blasting. If blasting must be done near a node with a battery installed, be sure to unplug the battery and de-energize the main system power. Install dust caps on exposed battery connector (CON2).

6.1.6.3 Remove the dust cap from the FMN battery connector.

6.1.6.4 Connect the battery enclosure to the FMN with a FAA4200-008 battery cable that is part of the FAP9100-002 battery assembly. It will only fit into the FMN battery power connector. DO NOT force the connector in. The connector should mate smoothly and lock in place with an audible click. If the connector does not mate properly with the FMN battery input connector, check for obstructions and try again. Make sure that the cable is properly secured.

IMPORTANT SAFETY WARNINGS!

CONTENTS OF FMN BATTERY ASSEMBLY INCLUDE A NONSPILLABLE SEALED LEAD ACID BATTERY.

DO NOT BLOCK VENT OPENING NEAR HANDLE OF ASSEMBLY ENCLOSURE>

DO NOT CHARGE BATTERY IN INVERTED POSITION.

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

6.2 INSTALLATIONS ABOVE GROUND (FMN / GWN)

At each of the sites determined by the survey described in 5.1:

6.2.1 Follow installation instructions of 6.1.

6.2.2 FMNs and GWNs installed above ground are not required to be part of a MSHA approved system. MSHA-specific system restrictions on cable lengths, gauges, power supplies, and backup battery may not apply.

6.2.3 Follow all FCC guidelines listed in Section 2.0.

7.0 OPERATING AND MAINTENANCE INSTRUCTIONS

The FMN / GWN does not have any direct user interface.

The status of the FMN / GWN and its connected backup battery may be monitored by observing the external LED1 blink pattern:

SOLID ON:	Bad or missing battery (also solid during initial booting of device)
BLINK (1 sec ON, 1 sec OFF):	Battery charging (normal use condition)
WINK (50 msec ON, 1 sec OFF):	Battery discharging
OFF:	No Power

The FMN / GWN requires little routine maintenance. Each box should be periodically inspected every 3-6 months to insure 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.

The FMN / GWN may be disconnected from power, backup battery, or antennas during maintenance or while being moved to a new location. When removing FMN / GWN power or RF connections, place dust caps on all exposed connectors.