

Installation and Technical Manual for the Limitless™ Point-to-Point Wireless Pressure Sensor, WPS Series

Issue 1

32305925

Used in conjunction with Limitless™ WMPR Series Receiver

⚠ WARNING **PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

Honeywell does not recommend using devices for critical control applications where there is, or may be, a single point of failure or where single points of failure may result in an unsafe condition. It is up to the end-user to weigh the risks and benefits to determine if the products are appropriate for the application based on security, safety and performance. Additionally, it is up to the end-user to ensure that the control strategy results in a safe operating condition if any crucial segment of the control solution fails. Honeywell customers assume full responsibility for learning and meeting the required Declaration of Conformity, Regulations, Guidelines, etc. for each country in their distribution market.

⚠ WARNING **RF EXPOSURE**

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm [7.87 in] or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna used for this transmission must not be co-located in conjunction with any other antenna or transmitter.

Failure to comply with these instructions could result in death or serious injury.

⚠ WARNING

The WPS must be installed in accordance with the requirements specified in this document in order to comply with the specific Country Communication Agency requirements (i.e., FCC, IC, ETSI, ACMA, etc.). See Section 5.1 as this requires choosing the correct Country Use Code and thus allowable antenna and/or cable usage.

Intended Audience

This guide is intended for people who are responsible for planning, configuring, administering, and operating the Limitless™ wireless point-to-point network.

Prerequisite Skills

It is assumed that you are familiar with the operation of Honeywell Limitless™ WMPR Receiver.

About this Document

This document outlines professional installation requirements for the Limitless™ Wireless Pressure Sensor, WPS Series. Professional installation is required to comply with certification agency and legal requirements. This document must be adhered to for all installations of the Limitless™ Wireless Pressure Sensor, WPS Series.

These devices are not intended for critical control where there is a single point of failure or where single points of failure result in unsafe conditions. As with any process control solution, it is the end users' responsibility to weigh the risks and benefits to determine if the products used are the right match for the application based on security, safety, regulations, and performance.

Revision Information

Document name	Document ID	Publication Date
Installation and Technical Manual for the Limitless™ WPS Series Wireless Pressure Sensor	32305925	August 2015
New	32305925, Issue 1	August 2015

References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Document title	Document No.
Installation and Technical Manual for the Limitless™ WMPR Receiver	32309669, Issue 1
Limitless™ WMPR Receiver Product Sheet	002391-1-EN, July 2015

TABLE OF CONTENTS

1	PRODUCT DESCRIPTION	1	5	ANTENNA, CABLE & MOUNTING OPTIONS	11
1.1	General	1	5.1	Approved Antenna Options	11
1.2	Principle of Operation	1			
1.3	Product Nomenclature	2	6	ANTENNA SELECTION, ADJUSTMENT & MOUNTING	13
1.4	Abbreviations and Definitions	3	6.1	Warnings	13
2	SPECIFICATIONS, CERTIFICATIONS, AND APPROVALS	4	6.1.1	General Installation Warnings	13
2.1	Intended Country Usage	4	6.1.2	Outdoor Installation Warnings	13
2.2	Certifications and Approvals	5	6.2	Antenna Design Considerations	14
2.3	Radio Module Specifications	5	6.2.1	Omni-directional Antenna Design	14
2.4	Battery Specifications	5	6.3	Antenna Mounting Considerations	15
2.5	EMC Specifications	5	6.3.1	Antenna Mounting Location with Respect to RF Signal	15
2.6	Functional Specifications	5	6.4	Antenna Options	16
2.7	Environmental Specifications	5	6.5	Antenna Connections, Styles, and Mounting Options	18
2.8	Limitless™ Wireless Pressure Sensor, WPS Series Power Specifications	6	6.5.1	Antenna Connection	18
2.9	Weight	6	6.5.2	Cable Requirement	19
2.10	Antenna Connection	6	6.5.3	Antenna Styles and Mounting	19
2.11	Certifications and Approvals	6	6.5.4	Antenna Adjustment Considerations	20
2.11.1	FCC Compliance Statements	6	6.5.5	Grounding Remote Antennas	21
2.11.2	IC Compliance Statements	6	6.6	Antenna Environmental Usage	22
2.11.3	RF Safety Statements	6	6.6.1	Choosing an Antenna/Cable	22
2.12	Declaration of Conformity	7	6.6.2	Protection of Antenna Connections	22
3	GENERAL DESCRIPTION	8	6.6.3	Outdoor Antenna Installations	23
3.1	Intended Use	8	6.6.4	Lightning Arrestor	23
3.2	WPS Series Sensor Diagrams	8	6.6.5	Site Selection	23
3.3	Process Connection	8	6.6.6	Antenna Mounting in Respect to Antenna Location	23
3.4	WPS Series Sensor Location	8	6.7	RF Interference Considerations	24
3.4.1	Recommended Locations	8	6.7.1	General	24
3.5	Conduit/Cable Entries	8	6.7.2	WiFi Networks	24
3.6	Bracket Mounting	8	6.7.3	Smart Phone “Apps”	24
3.7	Pressure Port	8	6.7.4	Bluetooth® Devices	24
4	PROCESS INSERTION	9	6.7.5	Wireless Video Camera & Video Links	24
4.1	Pressure Sensing	9	6.7.6	Microwave Ovens	24
4.1.1	Piping	9	6.7.7	Cordless Phones/Baby Monitors	24
4.1.2	Process Connections	9	6.8	Choosing Antenna GAin (dBi) with Acceptable Fade In Margin	25
4.1.3	General Piping Guidelines	10	6.9	Wireless Link Quality Measurements	26
4.1.4	Sensor Housing Swiveling	10	6.9.1	Link Measurements	26
			6.9.2	Connection Quality Labels	26

Installation and Technical Manual for the Limitless™ Wireless Pressure Sensor, WPS Series

ISSUE 1 **32305925**

7 OPERATING THE WPS INTERFACE WITH THE WMPR	27	10 MAINTENANCE & REPAIR	37
7.1 Overview of the P2P Interface	27	10.1 Parts	37
7.2 Starting the WPS with the WMPR	27	10.2 Replacing Batteries	37
7.2.1 Powering Up the System	27	10.2.1 When to Replace	37
7.3 Start-Up or Re-sequence Start Mode	27	10.2.2 Battery Storage.	37
7.3.1 Zero Switches or Sensors Paired to WMPR.	27	10.2.3 Transporting Batteries	37
7.3.2 One or More Switches or Sensors Paired to WMPR	28	10.2.4 Tools Required	37
7.3.3 Pairing the WPS to the WMPR	29	10.3 Replacing Antenna and Radome	39
7.4 Reading WPS Pressure Value.	30	10.3.1 Tools Required	39
7.5 Setting Update Rate and Display Timing	30	10.4 Software Updates.	39
7.5.1 Setting the Update Rate.	30		
7.5.2 Setting the LCD Time Display	31		
7.6 Setting TX Power	32		
7.6.1 TX Power Setting Policy	32		
7.7 Reading Battery Status.	32		
7.8 Restore to Factory Defaults	32		
7.9 Calibrating the Sensor	33		
8 FUNCTION BLOCKS	33	11 FAULT CODE & LINK STATUS INFO	40
8.1 Introduction	33		
8.1.1 Configuration	33		
8.2 Data Block Description	33		
8.2.1 Data Block Types	33		
8.2.2 Sensor Module	34		
8.2.3 Interface Board.	34		
8.2.4 Radio Board	34		
8.2.5 LCD Display	34		
8.2.6 Battery	35		
8.2.7 Battery Life	35		
9 OPERATION	35	12 AGENCY LABEL INFORMATION	40
9.1 Overview.	35	12.1 External FCC/IC Labels	40
9.1.1 Display Modes	35	12.2 Internal Labels	40
9.2 Sensor PV Display	35		
9.3 Battery Considerations.	36		
9.4 Other User Settings	37		
		13 ACCESSORIES	41
		14 INSTALLATION DRAWING	42

List of Figures

Figure 1.	Limitless™ Wireless Pressure Sensor Nomenclature	2
Figure 2.	Declaration of Conformity	7
Figure 3.	WPS Series Sensor with Radome	8
Figure 4.	Typical Arrangement for 1/2 NPT Piping	9
Figure 5.	Process Connection - Pipe Fitting	9
Figure 6.	Process Connection	10
Figure 7.	Radiation Pattern of Omni-Directional Antenna	14
Figure 8.	WPS to WMPR Free of Obstacles	15
Figure 9.	WPS to WMPR Affected by Obstacles	15
Figure 10.	WPS Standard Antenna Options	17
Figure 11.	RP-SMA, Direct Mount	18
Figure 12.	RP-SMA, Remote Mount	18
Figure 13.	Adhesive Mounting Steps	19
Figure 14.	Mast Mounting Antenna	20
Figure 15.	Mast Mounting Antenna	20
Figure 16.	Magnetic Mount Antenna with Base	20
Figure 17.	Magnetic Mount Antenna, WAN09RSP	20
Figure 18.	Magnetic Mount Antenna, WAN10RSP	20
Figure 19.	Thru-hole Mount Antenna	20
Figure 20.	Highest RF Signal when in Parallel	21
Figure 21.	Application of Protective Tape	22
Figure 22.	RF Link Shown on WMPR	26
Figure 23.	Splash Screen	27
Figure 24.	Ethernet/IP MAC ID and IP Address	27
Figure 25.	Main Menu	27
Figure 26.	Splash Screen	28
Figure 27.	System Start Up	28
Figure 28.	Ethernet/IP MAC ID and IP Address	28
Figure 29.	Main Menu	28
Figure 30.	WPS Pressure Value and no RF Link Messages	28
Figure 31.	Action Menu	29
Figure 32.	Configuration Menu	29
Figure 33.	Pair Mode Screen	29
Figure 34.	Pairing In-Progress Screen	29
Figure 35.	Join Network Notice in WMPR	30
Figure 36.	Successful Pairing Screen	30
Figure 37.	Node Status Screen	30
Figure 38.	WMPR Configuration Menu Screen	31
Figure 39.	WMPR Node Update Rate Screen	31
Figure 40.	WMPR Node Update Rate Screen 2	31
Figure 41.	WMPR Node LCD	31
Figure 42.	WMPR Node LCD Time Screen	31
Figure 43.	Battery Status	32
Figure 44.	Location of Reset Button	33
Figure 45.	WPS Functional Diagram	34
Figure 46.	Battery Insulator Tab Location	36
Figure 47.	Sensor Battery Replacement	38
Figure 48.	Antenna Replacement	39
Figure 49.	WPS Dimensions	42















List of Tables

Table 1.	Table Symbol Definitions	iii
Table 2.	Pressure Range Conversion Chart	2
Table 3.	Abbreviations and Definitions	3
Table 4.	Intended Country Use - North America	4
Table 5.	Intended Country Use - Australia	4
Table 6.	Intended Country Use - European Union	4
Table 7.	Intended Country Use - Other European Countries	4
Table 8.	Communication Approvals and Ratings	5
Table 9.	Radio Module Specifications	5
Table 10.	Battery Specifications	5
Table 11.	Sensor Specifications	5
Table 12.	Environmental Specifications	5
Table 13.	WPS Series, GP or AP	8
Table 14.	Antenna Options - Country Code A	11
Table 15.	Antenna Options - Country Code B	12
Table 16.	WPS Standard Antennas	16
Table 17.	Grounding the Antenna	21
Table 18.	Environmental Protection Steps	22
Table 19.	WPS Connection Quality Labels	26
Table 20.	PV Display	35
Table 21.	PV Engineering Units	35
Table 22.	Sensor Link Status Display	35
Table 23.	Sensor Error Codes	36
Table 24.	WPS Replacement Parts	37
Table 25.	Battery Replacement Procedure	38
Table 26.	Antenna Replacement Procedure	39
Table 27.	Antenna Accessories	41

Symbol Definitions

The following table lists those symbols used in this document to denote certain conditions.

Table 1. Table Symbol Definitions

Symbol	Definition
	ATTENTION: Identifies information that requires special consideration.
	TIP: Identifies advice or hints for the user, often in terms of performing a task.
CAUTION	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
	CAUTION symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death.
	WARNING symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.
	WARNING, Risk of electrical shock: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible.
	ESD HAZARD: Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.
	Protective Earth (PE) terminal: Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground: Functional earth connection. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.
	C-Tick Mark. The C-Tick Mark is a certification trade mark registered to ACMA (Australian Communications and Media Authority) in Australia under the Trade Marks Act 1995 and to RSM in New Zealand under section 47 of the NZ Trade Marks Act. The mark is only to be used in accordance with conditions laid down by ACMA and RSM. This mark is equal to the CE Mark used in the European Union.
	Notified Body. For radio equipment used in the European Union in accordance with the R&TTE Directive, the CE Mark and the notified body (NB) identification number is used when the NB is involved in the conformity assessment procedure.

Installation and Technical Manual for the
Limitless™ Wireless Pressure Sensor, WPS Series

ISSUE 1 **32305925**

1 | PRODUCT DESCRIPTION

1.1 | General

Limitless™ Wireless Pressure Sensors (WPS Series) are WPAN 802.15.4 compliant wireless point-to-point (P2P) devices, and offers a variety of remote or built-in antenna options.

It features a rugged plastic enclosure, corrosion-resistant construction, and is suitable for outdoor applications in harsh environments due to its IP67 sealed enclosure. Its 316L stainless steel pressure port has a Hastelloy® C-276 pressure diaphragm, making it resilient to the harshest of process media. The direct- or remote-mount antenna options add flexibility for adaptation to different applications.

The WPS is especially beneficial for remote pressure monitoring applications where wiring or wire maintenance is not physically possible or economically feasible. Combining this greater flexibility with proven harsh-duty packaging can result in increased efficiencies and ease in establishing remote, cost-effective process sensing.

This document describes the Limitless™ P2P Wireless Pressure Sensor, WPS Series' function, operation, and maintenance.

The document includes:

- Details of topics that relate uniquely to the Limitless™ P2P Wireless Pressure Sensor, WPS Series
- Installation and mounting
- Antenna and cable options and mounting

1.2 | Principle of Operation

The Limitless™ P2P Wireless Network is an all-digital, serial, two-way communication Point-to-Point wireless network that connects industrial field sensors to a WMPR (Wireless Multi-Protocol Receiver). This system uses a standard WPAN 802.15.4 protocol for Point-to-Point (P2P) communication.

The sensor supports one input channel. This channel is available as either:

- Gage pressure or,
- Absolute pressure

The sensor measures this analog pressure and transmits a digital output signal proportional to the measured value. See Figure 45 for the functional diagram. The WPS Pressure Sensor supports no electrical signal inputs and is powered by a replaceable, non-rechargeable battery.

1.3 | Product Nomenclature

This document is valid for the Limitless™ Wireless Pressure Sensor, WPS Series in the following variations:

Figure 1. Limitless™ Wireless Pressure Sensor, WPS Series Nomenclature

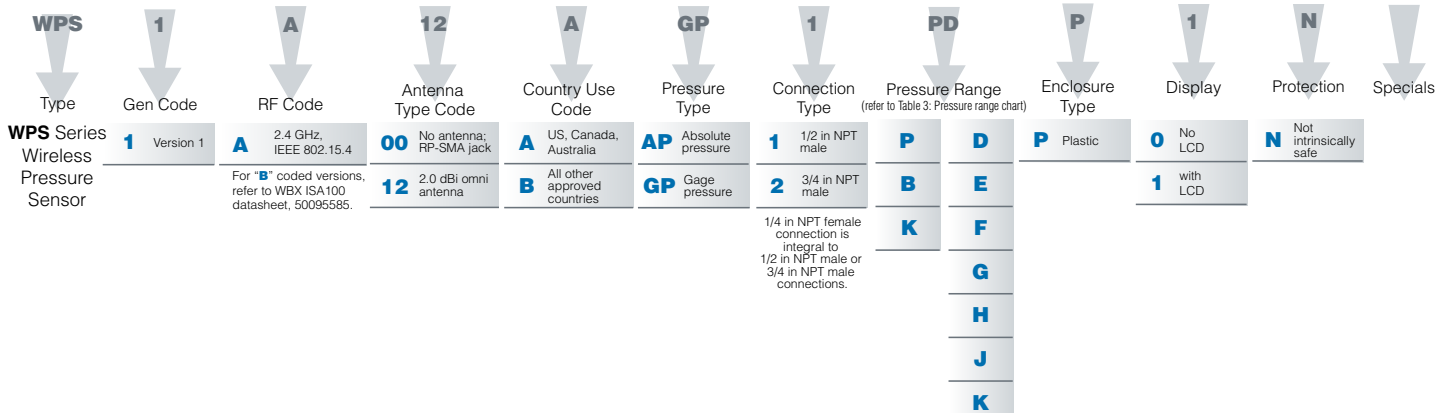


Table 2. Pressure Range Conversion Chart

Unit Code	Description	Pressure Range						
		D	E	F	G	H	J	K
P	psi	0 to 50	0 to 200	0 to 500	0 to 1000	0 to 1500	0 to 5000	0 to 10000
B	bar	0 to 3.45	0 to 13.8	0 to 34.5	0 to 68.9	0 to 103.4	0 to 344.7	0 to 689.5
K	kPa	0 to 344.7	0 to 1379	0 to 3447.4	0 to 6894.7	0 to 10342	0 to 34473	0 to 68947

1.4 | Abbreviations and Definitions

Table 3. Table of Abbreviations and Definitions

ACMA	Australian Communications and Media Authority
ANATEL	National Agency of Telecommunication (Agência Nacional de Telecomunicação)
AWG	American Wire Gauge
dB	Decibel
dB_i	Decibel Isotropic
dBm	Decibel above or below 1 milliwatt
DSSS	Direct Sequence Spread Spectrum
EIRP	Equivalent isotropic radiated power
EMC	Electromagnetic Compatibility
Ethernet	a family of computer networking technologies for wired local area networks such as IEEE 802.3
ETSI	European Telecommunications Standards Institute
EU	European Union
FCC	Federal Communications Committee
GHz	GigaHertz
IC	Industry Canada
ICES	Industry Canada Electrical Specification
IEEE	Institute of Electrical and Electronics Engineers
kbps	KiloBits Per Second
LED	Light Emitting Diode
MHz	MegaHertz
MPE	Maximum Permissible Exposure
NA	North America – United States of America and Canada
N-m	Newton meter
NEMA	National Electrical Manufacturers Association
PCBa	Printed Circuit Board Assembly
psi	Pounds per square inch (unit of pressure)
R&TTE	Radio and Telecommunications Terminal Equipment
RJ-45	Registered Jack - 45, a standard connector used for Ethernet connections
RP-SMA	Reverse Polarity SMA connector
RF	Radio Frequency
TX	Transmit
Wi-Fi	Wireless Local Area Network based on IEEE 802.11 Specifications
WLAN	Wireless Local Area Network (aka WIFI)
WMPR	Wireless Multi-Protocol Receiver

2 | SPECIFICATIONS, CERTIFICATIONS, AND APPROVALS

2.1 | Intended Country Usage

Table 4. North America

Country	ISO 3166 2 letter code
UNITED STATES	US
CANADA	CA

Table 5. Australia

Country	ISO 3166 2 letter code
AUSTRALIA	AU

Table 6. European Union

Country	ISO 3166 2 letter code	Country	ISO 3166 2 letter code
Austria	AT	Latvia	LV
Belgium	BE	Lithuania	LT
Bulgaria	BG	Luxembourg	LU
Cyprus	CY	Malta	MT
Czech Republic	CZ	Netherlands	NL
Denmark	DK	Poland	PL
Estonia	EE	Portugal	PT
Finland	FI	Romania	RO
France	FR	Slovak Republic	SK
Germany	DE	Slovenia	SI
Greece	GR	Spain	ES
Hungary	HU	Sweden	SE
Ireland	IE	United Kingdom	BG
Italy	IT		

Table 7. Other European Countries

Country	ISO 3166 2 letter code	Country	ISO 3166 2 letter code
Bosnia and Herzegovina	BA	Norway	NO
Croatia	HR	Russian Federation	RU
Iceland	IS	Serbia	RS
Liechtenstein	LI	Switzerland	CH
Macedonia	MK	Turkey	TR

Installation and Technical Manual for the Limitless™ Wireless Pressure Sensor, WPS Series

ISSUE 1 **32305925**

2.2 | Certifications and Approvals

See product labels for applicable approvals and ratings.

Table 8. Communication Approvals and Standards

Approval/Item	Ratings/Description	
Communication agency approvals and standards	16 dBm	FCC Part 15.247 and 15.209
		Industry Canada RSS 210 Issue 8
		ACMA, C-Tick mark
	8 dBm	ETSI, CE mark
Enclosure type	IP65, IP67	

FCC ID: XJLWPS001

IC ID: 9832A-WPS001IC

⚠ WARNING

The WPS Pressure Sensor must be installed in accordance with the requirements specified in this document in order to comply with the specific Country Communication Agency requirements (i.e., FCC, IC, ETSI, ACMA)

2.3 | Radio Module Specifications

Table 9. Radio Module Specifications

Item	Specification
Radio module	Honeywell RF-PCBa
Wireless standard	IEEE Standard: 802.15.4; 2.4 GHz global, license-free bands Protocol: Limitless™ point-to-point
Data rate	250 kbps
Operating frequency	ISM 2.4 GHz
Module transmit power (max.)	Country code A: 16 dBm max; Country code B: 8 dBm max
Receive sensitivity (typ.)	-98 dBm

2.4 | Battery Specifications

Table 10. Battery Specifications

Item	Specification
Battery	3.6 Vdc Lithium Thionyl Chloride; D size, Qty: 2; Manufacturer: Honeywell, WBT5 (includes two units); Xeno Energy, P/N XL-205F; Tadiran, P/N TL-5930/S

2.5 | EMC Specifications

The latest applicable EMC Standards are as follows:

- EN 300 328, V1.8.1
- EN 61326-1 (2012)
- EN 301 489-1, V1.9.2
- EN 301 489-17, V2.2.1

STOP ATTENTION

The antenna cables should not be modified (i.e. cut short and/or re-terminated) as it may affect Communication Agency approval. Approved antenna (refer to Section 5.1) are the only antennas allowed for use with the WPS.

2.6 | Functional Specifications

Table 11. Sensor Specifications

Item	Specification
Total error band	±2.0 %FSS max.
Resolution	0.04 %FS
Pressure ranges	0 psi to 50 psi through 0 psi to 10000 psi
Pressure type	gage or absolute
Overload safe pressure	4X FS or 3000 psi, whichever is less for ≤1000 psi 4X FS or 15000 psi, whichever is less for >1000 psi
Burst pressure	3000 psi for ≤1000 psi 4X FS or 15000 psi, whichever is less for >1000 psi
Diaphragm material	Hastelloy® C276

2.7 | Environmental Specifications

Table 12. Environmental Specifications

Item	Specification
Operating temperature	-40 °C to 70 °C [-40 °F to 158 °F]
Storage temperature	-40 °C to 70 °C [-40 °F to 158 °F]
Operating humidity	0 %RH to 100 %RH
Vibration	5 Hz to 200 Hz, 4 g, Sinusoidal as per IEC 60068-2-6
Shock	40 g as per IEC 60068-2-27
Sealing	IP65, IP67

2.8 | Limitless™ Wireless Pressure Sensor, WPS Series Power Specifications

The WPS Series sensors operate from two (2) D-size 3.6 V Lithium Thionyl Chloride (Li/SOCl₂) batteries. These are joined in series to produce a maximum voltage of 7.2 Vdc. There is no provision for external power.

2.9 | Weight

All versions of the WPS Series sensor have a maximum weight of 1,0 kg [2 lb, 3 oz] (weight tolerance of ±50 g) These weights do not include remote cables, antennas, or external pipe thread adapters.

2.10 | Antenna Connection

Antennas connect to an RP-SMA male connector on the upper surface of the WPS. For straight antenna variants, a radome is fastened to the WPS housing, protecting the antenna and connectors from the environment. Alternatively, a remote antenna and/or a lightning arrestor may be connected to the RP-SMA connector; when ordered without any antenna fitted to the WPS product.

2.11 | Certifications and Approvals

2.11.1 | FCC Compliance Statements

- This device complies with Part 15 of FCC Rules and Regulations. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.
- This equipment has been tested and found to comply with the limits for a Class A 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 radiofrequency energy and, if not installed and used in accordance with these instructions, 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.
- Intentional or unintentional changes or modifications must not be made to the WPS Series unless under the express consent of the party responsible for compliance. Any such modifications could void the user's authority to operate the equipment and will void the manufacturer's warranty

2.11.2 | Industry Canada (IC) Compliance Statements

- To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropic radiated power (EIRP) is not more than that permitted for successful communication.
- 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.
- This Class A digital apparatus complies with Industry Canada RSS 210 Issue 8.
- Pour réduire les interférences radio potentielles aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de telle sorte que l'équivalent isotrope puissance rayonnée (PIRE) ne est pas supérieure à celle permise pour une communication réussie.
- Son fonctionnement est soumis aux deux conditions suivantes: (1) ce dispositif ne doit pas causer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.
- Cet appareil numérique de classe A est conforme avec Industrie Canada RSS 210 Numéro 8.

2.11.3 | RF Safety Statements

- To comply with FCC's and Industry Canada's RF exposure requirements, the following antenna installation and device operating configurations must be satisfied.
- Remote point-to-point antenna(s) for this unit must be fixed and mounted on outdoor permanent structures with a separation distance between the antenna(s) of greater than 20 cm [7.87 in] and a separation distance of at least 20 cm [7.87 in] from all persons.
- Furthermore, when using an integral antenna the WPS Series unit must not be co-located with any other antenna or sensor device and have a separation distance of at least 20 cm [7.87 in] from all persons.

2.12 | Declaration of Conformity

Figure 2. Declaration of Conformity

Honeywell

Honeywell Control Systems Ltd.,
Newhouse Industrial Estate,
Motherwell, Lanarkshire, ML1 5SB,
Scotland, United Kingdom.

Tel.: +44 (0)1698 481000
Fax: +44 (0)1698 481011

A subsidiary of Honeywell Control Systems Ltd.,

Registered Office: Honeywell House,
Arlington Business Park,
Bracknell, Berkshire,
R12 1EB.

Registered No 217808 (England)

EC Declaration of Conformity

Honeywell Control Systems Ltd. hereby declare that the products identified below conform to the essential requirements of the EC Directive(s) listed below and that the products supplied are in conformity with the type described in any EC Type Examination Certificate (EC TEC) identified below.

Manufacturer: Honeywell Sensing and Control
Sensotec Sensors
Lebow Products
2080 Arlingate Lane
Columbus
OH 43228 USA

Product: Pressure Sensor
WPS Series Wireless Pressure Sensor

Directive (Amendments)

Conformity Details

1999/5/EC and 2004/108/EC

Standards applied:

EN 61326-1: 2012
ETSI EN 300 328 V1.8.1
ETSI EN 301 489-1 V1.9.2 and -17 V2.2.1

Signed on behalf of Honeywell Control Systems Ltd. :


.....
Colin O'Neil, quality Eng. Manager, Newhouse

DoC No: A487

DoC Issue: 2

DoC Date: 24/11/2014

Page 1 of 2

3 | GENERAL DESCRIPTION

3.1 | Intended Use

The Limitless™ P2P Wireless Pressure Sensor, WPS Series complies with the IEEE 802.15.4 standard, and uses a low-powered 2.4 GHz radio to communicate with a Wireless Multi-Protocol Receiver (WMPR).

This receiver includes an RJ-45 Ethernet connector which allows connection to an EtherNet™-compliant Master device.

Initial provisioning and setting of user parameters is accomplished over-the-air through the WMPR receiver.

3.2 | WPS Series Sensor Diagrams

Figure 3. WPS Series Sensor with Radome



3.3 | Process Connection

Wireless Pressure Sensors have the following standard connection fitting for mounting on the process pipe: 1/2 NPT male, 3/4 NPT male. Either of these connections will also support a 1/4 NPT female connection.

3.4 | WPS Series Sensor Location

3.4.1 | Recommended Locations

Table 13. WPS Series, GP or AP

Process	Suggested location	Explanation
Gases	Above the gas line	The condensate drains away from the sensor.
Liquids	Below but close to the elevation of the process connection.	This minimizes the static head effect of the condensate.
	Level with or above the process connection	This requires a siphon to protect the sensor from process steam. The siphon retains water as a "fill fluid."

3.5 | Conduit / Cable Entries

There are no conduit/cable entries for the WPS Series sensor.

3.6 | Bracket Mounting

There is no bracket mounting for the WPS Series sensor. It is supported by the pipe fitting on the pressure sensor module.

3.7 | Pressure Port

Materials:

- 316L Stainless Steel (pressure port body)
- Hastelloy® C-276 (diaphragm)

Process Connection:

- Threads: 1/2 NPT male or 3/4 NPT male or 1/4 NPT female. Note: both the 1/2 NPT male and the 3/4 NPT male will support the 1/4 NPT female
- Swivel: The WPS Series sensor body will swivel 350° with respect to the pressure port body, to optimize readability of the LCD.

4 | PROCESS INSERTION

4.1 | Pressure Sensing

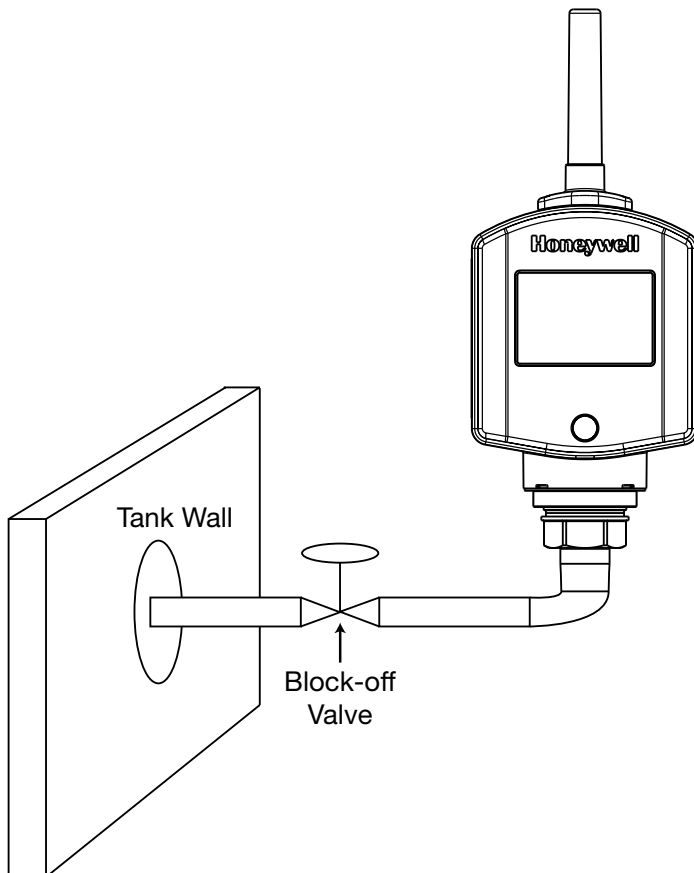
4.1.1 | Piping

The actual piping arrangement will vary depending upon the process measurement requirements and the sensor model. Process connections are made to 1/2 NPT male, 3/4 NPT male, or 1/4 NPT female connections in the head of the sensor's body. Elbow fittings may be utilized as required.

The most common type of pipe used is 1/2 inch Schedule 80 steel pipe. Many piping arrangements use a three-valve manifold to connect the process piping to the sensor. A manifold makes it easy to install and remove a sensor without interrupting the process. It also accommodates the installation of blow-down valves to clear debris from pressure lines to the sensor.

Another piping arrangement uses a block-off valve and a tee connector in the process piping to the sensor as shown in Figure 4.

Figure 4. Typical Arrangement for 1/2 NPT Process Connection Piping



STOP ATTENTION

For liquid or steam, the piping should slope a minimum of 25,4 mm [1 in] per 305 mm [1 ft]. Slope the piping down towards the sensor, if the sensor is below the process connection so the bubbles may rise back into the piping through the liquid. If the sensor is located above the process connection, the piping should rise vertically above the sensor; then slope down towards the flowline with a vent valve at the high point. For gas measurement, use a condensate leg and drain at the low point (freeze protection may be required here).

CAUTION

Property damage may result if operating temperature limits of sensor are exceeded. Sensor housing must not exceed 70 °C [158 °F]. To reduce the temperature of the process that comes into contact with the sensor body, install impulse piping. As a general rule, there is a 56 °C drop [100 °F] in the temperature of the process for every foot (305 mm) of 1/2 inch uninsulated piping.

4.1.2 | Process Connections

Figure 5. Process Connection - Pipe Fitting



4.1.3 | General piping guidelines

When measuring fluids containing suspended solids, install permanent valves at regular intervals to blow-down piping.

Blow-down all lines on new installations with compressed air or steam and flush them with process fluids (where possible) before connecting these lines to the sensor's port.

Be sure all the valves in the blow-down lines are closed tight after the initial blow-down procedure and each maintenance procedure after that.

Mount sensor vertically to assure best accuracy, and to obtain optimum R.F. link performance.

4.1.4 | Sensor Housing Swiveling

The WPS Series sensor housing will swivel through a 350° range to facilitate easy reading of the LCD display. To adjust the swivel mounting:

1. Ensure that the process connector (threaded fitting) is in its final position and is fully tightened, using a wrench on the hex-nut area above the threads (do NOT tighten using the sensor body).
2. Loosen the large nut just below the housing using a 45 mm [1.77 in] crescent wrench.

Figure 6. Process Connection - Large and Hex Nuts



3. Swivel sensor housing as needed.
4. While holding the sensor body in place, gently tighten the large nut with a 45 mm [1.77 in] crescent wrench to 14 Nm \pm 1 Nm [10.32 ft-lb \pm 0.74 ft-lb].

⚠ WARNING

POTENTIAL ELECTROSTATIC CHARGING HAZARD

The sensor housing is made of plastic polycarbonate and has a surface resistivity of >1 Gohm per square. When this device is being installed, care should be taken not to electrostatically charge the enclosure surface by rubbing the surface with a cloth, or cleaning the surface with a solvent.

5 | ANTENNA, CABLE, & MOUNTING OPTIONS

5.1 | Approved Antenna Options

This section defines the antenna options that can be used in a particular country of interest; reference Section 2.1 for a list of Countries per Country Use Code. It is important to determine the country the WPS will be used in. Thereby, noting the correct Country Use Code in the WPS nomenclature will help ensure proper selection of antenna and/or cable options. The direct antenna mounts directly to the WPS RP-SMA jack while the remote antenna mounts to the WPS RP-SMA jack via a cable assembly (see Section 6.5.1). Further technical information on the WAN Series antennas, WAMM Series magnetic mounts and WCA Series cable assemblies can be found in Section 6.5.3.

ATTENTION

The antenna cables should not be modified (i.e. cut short and/or re-terminated) as it may affect communication agency approval.

WARNING

The WPS must be installed in accordance with the requirements specified in this document in order to comply with the specific Country Communication Agency requirements. (i.e. FCC, IC, ETSI, ACMA, etc.) See Section 5 as it requires choosing the correct Country Use Code and thus allowable antenna and/or cable usage.

CAUTION

Power to the WPS should not be applied during installation of an antenna as damage could occur to the WMPR electronics.

Table 14. Country Code Use “A” Antenna/Cable/Mounting Options

ANTENNAS FOR USE IN COUNTRY CODE A (Note: all columns are independent of each other)					
Antenna Type Code (antenna provided with product)	Direct-Mount Antennas (allowed for use)	Remote Mount Antennas (allowed for use)	Magnetic Remote Mount Assemblies/Antennas WAMM100RSP-005 WAMM100RSP-010 (allowed for use)	Extension Cable Assemblies/Antennas for Remote Mount WCA200RSJRSP-002 WCA200RSJRSP-005 WCA200RSJRSP-010 WCA200RSJRSP-015 WCA200RSJRSP-020 (allowed for use)	Extension Cable Assemblies/Antennas for Remote Mount WCA200RNPRSP-002 WCA200RNPRSP-010 (allowed for use)
00	WAN12RSP	WAN03RSP	WAN04RSP	WAN03RSP	WAN06RNJ
12		WAN09RSP	WAN05RSP	WAN04RSP	
		WAN10RSP		WAN05RSP	
		WAN11RSP		WAN09RSP	
				WAN10RSP	
				WAN11RSP	

Note:

Direct mount: Antennas have an RP-SMA plug that connects directly to the WPS RP-SMA jack

Remote mount: Remote mount antenna uses a cable with a RP-SMA plug that connects directly to the WPS RP-SMA jack

Table 15. Country Code Use “B” Antenna/Cable/Mounting Options

ANTENNAS FOR USE IN COUNTRY CODE B (Note: all columns are independent of each other)				
Antenna Type Code (antenna provided with product)	Direct-Mount Antennas (allowed for use)	Remote Mount Antennas (allowed for use)	Extension Cable Assemblies/Antennas for Remote Mount WCA200RSJRSP-010 (allowed for use)	Extension Cable Assemblies/Antennas for Remote Mount WCA200RSJRSP-005 WCA200RSJRSP-010 WCA200RSJRSP-015 WCA200RSJRSP-020 (allowed for use)
00	WAN12RSP	WAN03RSP	WAN04RSP	WAN03RSP
12		WAN09RSP WAN10RSP		WAN09RSP WAN10RSP WAN11RSP

Note:

Direct mount: Antennas have an RP-SMA plug that connects directly to the WPS RP-SMA jack

Remote mount: Remote mount antenna uses a cable with a RP-SMA plug that connects directly to the WPS RP-SMA jack



ATTENTION

If using the WPS in a portable application (for example, the WMPR is used in a handheld device and the antenna is less than 20 cm from the human body when the device is in operation): The integrator is responsible for passing additional SAR (Specific Absorption Rate) testing based on FCC rules 2.1091 and FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, OET Bulletin and Supplement C. The testing results will be submitted to the FCC for approval prior to selling the integrated unit. The required SAR testing measures emissions from the module and how they affect the person.

Note for Section 7.1, Tables 14 and 15:

1. Industry Canada Compliance Statement: This device has been designed to operate with the antenna types listed in this document, and having a maximum gain of 9 dBi. Antenna types not included in this list or having a gain greater than 9 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 Ohm.

6 | ANTENNA SELECTION, ADJUSTMENT, AND MOUNTING

6.1 | Warnings

6.1.1 | General Installation Warnings

ATTENTION

- Professional Installation is required to ensure conformity with Federal Communications Commission (FCC) in the USA, Industry Canada (IC) in Canada and the Radio and Telecommunications Terminal Equipment Directive, 1999/5/EC (R&TTE), in the European Union (EU).
- Professional installation is required for the selection and installation of approved antennas and setup of the maximum allowable radiated power from the Limitless™ WPS Series as configured for the particular installation site.
- The antenna used for this sensor must be installed to provide a separation distance of at least 20 cm [7.87 in] from all persons and must not be co-located or operating in conjunction with any other antenna or sensor.
- For remote antenna, see antenna installation requirements to satisfy FCC RF exposure requirements.

ATTENTION

Federal Communications Commission (FCC):

- The Limitless™ WPS Series 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.

Industry Canada (IC):

- L'installateur de cette radio doit s'assurer que l'antenne est située ou orientée de manière à ne pas émettre de radiofréquences excédant les limites permises par Santé Canada pour la population générale. Veuillez consulter le Code de sécurité 6 de Santé Canada au www.hc-sc.gc.ca/rpb.

6.1.2 | Outdoor Installation Warnings

WARNING

LIVES MAY BE AT RISK!

Carefully observe these instructions and any special instructions included with the equipment being installed.

WARNING

CONTACTING POWER LINES COULD BE FATAL

Look over the site before beginning any installation and anticipate possible hazards, especially these:

- Make sure no power lines are near where possible contact can be made. Antennas, masts, towers, guy wires, or cables may lean or fall and contact these lines. People may be injured or killed if they are touching or holding any part of equipment when it contacts electric lines. Make sure there is NO possibility that equipment or personnel can come in contact directly or indirectly with power lines.
- Assume all overhead lines are power lines.
- The horizontal distance from a tower, mast, or antenna to the nearest power line should be at least twice the total length of the mast/antenna combination. This will ensure that the mast will not contact power if it falls during either installation or later.

WARNING

TO AVOID FALLING, USE SAFE PROCEDURES WHEN WORKING AT HEIGHTS ABOVE GROUND

- Select equipment locations that will allow safe, simple equipment installation
- Don't work alone. A friend or co-worker can save a life if an accident happens.
- Use approved, non-conducting ladders and other safety equipment. Make sure all equipment is in good repair.
- If a tower or mast begins falling, don't attempt to catch it. Stand back and let it fall.
- If anything such as a wire or mast does come in contact with a power line, DON'T TOUCH IT OR ATTEMPT TO MOVE IT. Instead, save a life by calling the power company.
- Don't attempt to erect antennas or towers on windy days.

WARNING

MAKE SURE ALL TOWERS AND MASTS ARE SECURELY GROUNDED, AND ELECTRICAL CABLES CONNECTED TO ANTENNAS HAVE LIGHTNING ARRESTORS.

This will help prevent fire damage or human injury in case of lightning, static build up, or short circuit within equipment connected to antenna.

- The base of the antenna mast or tower must be connected directly to the building protective ground or to one-or-more approved grounding rods, using 1 AWG ground wire and corrosion-resistant connectors.
- Refer to the National Electrical Code for grounding details.
- Lightning arrestors for antenna feed coaxial cables are available from electrical supply houses.

⚠ WARNING

If a person comes in contact with electrical power, and cannot move

DO NOT TOUCH THAT PERSON OR RISK ELECTROCUTION.

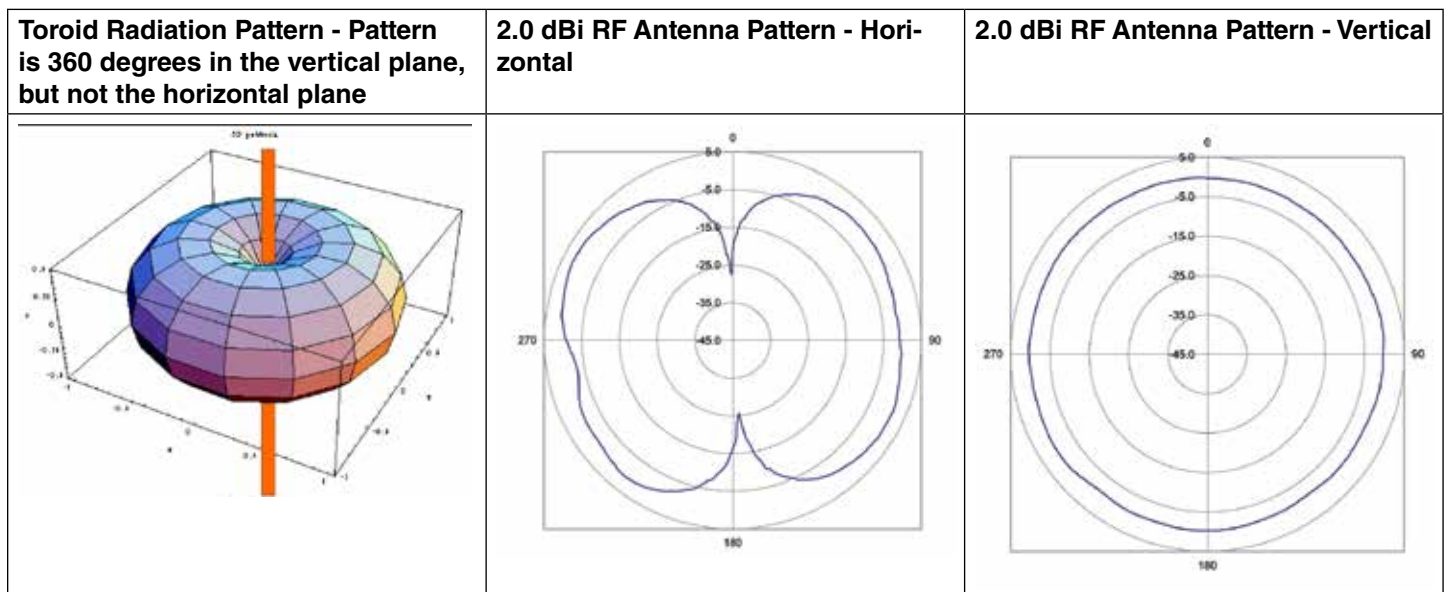
- Use a non-conductive dry board, stick, or rope to push, pull, or drag them so they no longer are in contact with electrical power.
- Once they are no longer contacting electrical power, administer CPR if certified, and make sure emergency medical aid has been requested.

6.2 | Antenna Designs and Considerations

6.2.1 | Omni-directional Antenna Design

The Limitless™ Series omni-directional antennas were chosen for their ability to be used in applications where transmit-and-receiver antennas may be moving with respect to each other or could be stationary. These monopole and dipole antennas radiate power (power from the internal radio of the WPS) in a 360° outward pattern in a plane perpendicular to the length of the antenna element. The term “omni” may suggest that the antenna radiates power in all directions, but that is not the case. The actual antenna radiation pattern looks more like a toroid (doughnut-shape) as shown in Figure 7.

Figure 7. Radiation Pattern of an Omni-directional Antenna



The antenna radiates virtually zero power in the Z axis and most of the power in the X and Y axis. Increasing the antenna's gain will increase the power only in the X and Y axis. As a result, the radiation pattern becomes narrower. For instance, this is analogous to the reflector in an automobile's headlight. The reflector does not add light or increase the luminous intensity of the light bulb, rather it simply directs all the light energy in the forward direction where the light is needed most.

6.3 | Antenna Mounting and Considerations

6.3.1 | Antenna Mounting Location with Respect to RF Signal

⚠ WARNING

RF EXPOSURE

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm [7.87 in] or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna used for this transmission must not be co-located in conjunction with any other antenna or transmitter.

Failure to comply with these instructions could result in death or serious injury.

There are several environmental factors to consider when determining antenna location during installation. These factors can affect the radio frequency (RF) signal strength being both transmitted and received by the Limitless™ WPS and corresponding WMPR. It is desirable for the antenna to be mounted in a place that will limit exposure of adjacent materials/objects between the WPS and WMPR, as they have an effect on RF signal strength. If the mounting location for an omni-directional antenna is on the side of a building or tower, the antenna pattern will be degraded on the building or tower side.

Obstacles that affect antenna patterns and RF signal strength:

- Indoor: Concrete, wood, drywall, metal walls, etc.
- Outdoor: Vehicles, buildings, trees, structures, topology, weather conditions, chain link fence, major power cables, etc.

The best performance is achieved when both the Limitless™ WPS and WMPR antennas are mounted at the same height and in a direct line of sight (LOS) with no obstructions. Generally, the higher the antenna is above ground, the better it performs. Another concern is RF interference, discussed in Section 6.7.

Figure 8. Limitless™ WPS to WMPR with RF Signal Line of Sight (LOS) Free From Obstacles

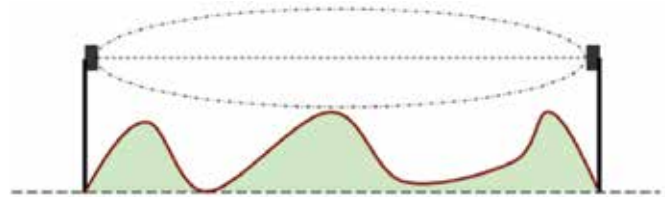
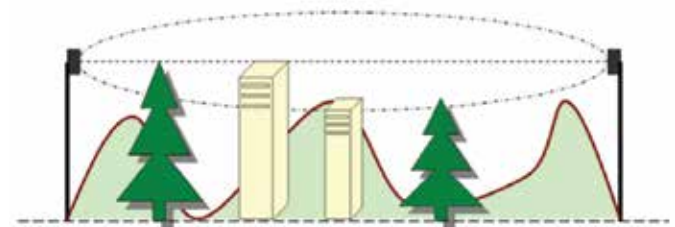


Figure 9. Limitless™ WPS to WMPR with RF Signal Line of Sight (LOS) Affected by Obstacles



6.4 | Antenna Options

The following chart lists the antenna options along with the various characteristics that will be referenced throughout this section. This section is intended to assist an end user in determining which antenna(s) are worth investigating and subjecting to application requirements for proof of suitability.

Table 16. Antenna Options

Part number	Replacement antenna mount or cable	Antenna design	Ant. gain (max.)	Connector/mounting	Dimensions	Antenna material	Cable material/type	Mount material
WAN03RSP	–	flat	3.0 dBi	RP-SMA plug/adhesive mount	Ø 7,87 mm x 22,1 mm W x 4,57 mm D [Ø 0.31 in x 0.87 in W x 0.18 in D] 3 m [9 ft] cable	UV stable ABS	UV stable PVC/ RG-174 coax	–
WAN04RSP	WAMM100RSP-005 base with 1,52 m [5 ft] of cable	tilt/ swivel	5.5 dBi	RP-SMA plug/direct mount	Ø 12,7 mm x 208,28 mm L [Ø 0.50 in x 8.20 in L]	UV stable molded polyurethane	UV stable PVC/ RG-174 coax	UV stable black ABS
WAN04RSP	WAMM100RSP-010 base with 3,05 m [10 ft] of cable	tilt/ swivel	5.5 dBi	RP-SMA plug/direct mount	Ø 12,7 mm x 208,28 mm L [Ø 0.50 in x 8.20 in L]	UV stable molded polyurethane	UV stable PVC/ RG-174 coax	UV stable black ABS
WAN05RSP	WAMM100RSP-005 base with 1,52 m [5 ft] of cable	tilt/ swivel	9.0 dBi	RP-SMA plug/direct mount	Ø 12,7 mm x 384,05 mm L [Ø 0.50 in x 15.12 in L]	UV stable molded polyurethane	UV stable PVC/ RG-174 coax	UV stable black ABS
WAN05RSP	WAMM100RSP-010 base with 3,05 m [10 ft] of cable	tilt/ swivel	9.0 dBi	RP-SMA plug/direct mount	Ø 12,7 mm x 384,05 mm L [Ø 0.50 in x 15.12 in L]	UV stable molded polyurethane	UV stable PVC/ RG-174 coax	UV stable black ABS
WAN06RNJ	WCA200RNPRSP-002 coax cable assembly 0,682 m [2 ft]	straight	8.0 dBi	RP-N jack/ bracket	Ø 33,5 mm x 427,9 mm L [Ø 1.32 in x 16.85 in L]	UV stable fiberglass	UV stable PVC/RG-316 coax, UV stable Polyethylene/200 Series coax	300 series SST aluminum alloy
WAN06RNJ	WCA200RNPRSP-010 coax cable assembly 3,05 m [10 ft]	straight	8.0 dBi	RP-N jack/ bracket	Ø 33,5 mm x 427,9 mm L [Ø 1.32 in x 16.85 in L]	UV stable fiberglass	UV stable PVC/RG-316 coax, UV stable Polyethylene/200 Series coax	300 series SST aluminum alloy
WAN09RSP	–	low profile mobile	3.0 dBi	RP-SMA plug/magnetic	Ø 76,2 mm x 115 mm L [Ø 3.0 in x 4.54 in L] 4,57 m [15 ft] cable	UV stable ABS plastic	UV stable black PVC	Nickel-plated steel
WAN10RSP	–	straight	5.0 dBi	RP-SMA plug/magnetic	Ø 76,2 mm x 230,1 mm L [Ø 3.0 in x 9.06 in L] 4,57 m [15 ft] cable	Nickel-plated steel	UV stable black PVC	Nickel-plated steel
WAN11RSP	–	low profile mobile	4.0 dBi	RP-SMA plug/thru-hole screw	Ø 39 mm x 42,4 mm L [Ø 1.54 in x 1.67 in L]	UV stable black PVC	UV stable black PVC	Nickel-plated steel
WAN12RSP	–	straight	2.0 dBi	RP-SMA plug/direct mount	Ø 10 mm x 79,5 mm L [Ø 0.39 in. x 3.13 in. L]	UV stable ABS plastic	–	–

*Reference Limitless™ nomenclature (i.e. WMPR Series, WDRR Series, WPMM Series, WGLA Series, etc.)

**Reference Limitless™ Environment Usage section 6.6 for further details

STOP ATTENTION

The antenna cables should not be modified (i.e. cut short and/or re-terminated) as it may affect communication agency approval.

WARNING

The WPS Series sensor must be professionally installed in accordance with the requirements specified in this document. Only the specified power settings, antenna types and gains and cable lengths (attenuation) as outlined in this document are valid for Limitless™ Point-to-Point Wireless Pressure Sensor, WPS Series installations.

Figure 10. WPS Standard Antenna Options

Antenna Type Code 00	Antenna Type Code 12	Antenna Type Code 12: Radome Installed
No antenna. RP-SMA antenna jack on top is used	2.0 dBi gain omni-directional antenna (radome not shown)	(note: only one size radome available)
		

6.5 | Antenna Connection, Styles, and Mounting Options

⚠ WARNING

RF EXPOSURE

To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm [7.87 in] or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna used for this transmission must not be co-located in conjunction with any other antenna or transmitter.

Failure to comply with these instructions could result in death or serious injury.

⊘ CAUTION

Power to the WPS should not be applied during installation of an antenna as damage could occur to the WPS electronics.

6.5.1 | Antenna Connection

Physical connection of the antenna to the WPS is accomplished by using mating RP-SMA connectors: plug and jack. Direct-mount antennas have an RP-SMA plug that connects directly to the WPS RP-SMA jack. The remote mount antenna uses a cable with a RP-SMA plug that connects directly to the WPS RP-SMA jack allowing the antenna to be remotely mounted away from the WPS. Mounting options are based on user preference, communication agency approvals, WPS mounting location, and obstacles as discussed in Section 6.6.6.

A direct- or remote-mount antenna can be easily mounted by threading the mating RP-SMA plug of the antenna to the WPS's RP-SMA jack. Reference section 6.6.2 for further details on extra environmental protection of RP-SMA connections. Tighten the RP-SMA connection until finger tight. See Figures 11 and 12.

Figure 11. Limitless™ WPS RP-SMA Connection, Direct-Mount



Figure 12. Limitless™ WPS RP-SMA Connection, Remote-Mount



6.5.2 | Cable Requirement

Some remote mount antennas have an antenna cable permanently attached, with an RP-SMA plug, that is simply connected to the jack on the WPS. Other remote mount antennas do not include cable, and require the use of an extension cable. This extension cable will normally need to have one end with an RP-SMA plug (inside threads), which will connect to the sensor, and one end with an RP-SMA jack (outside threads). The jack of the extension cable will mate with the antenna or the lightning arrestor. If a lightning arrestor is connected this way, the antenna may be directly connected to the arrestor.

Note that at 2.4 GHz., typical antenna cables types have 0.5 dB of loss per meter (almost 5 dB for a ten meter cable, plus connector losses). Excessively long cable runs should be avoided if possible.

Refer to Section 5.1 for approved antenna and cable options.

6.5.3 | Antenna Styles and Mounting Options

Choosing an antenna mounting style depends on application conditions, antenna benefits and/or features, and user preference. The antenna's gain (discussed further in Section 6.4, Table 16) to some extent determines physical size. Another consideration is the amount of room available in the application.

Straight with Radome: A benefit of the straight antenna radome is rigid design and resistance to being repositioned (shock, vibration, wind, etc.).

Catalog listing: WAN12RSP

WAN12RSP

Straight wireless antenna with 2.2 dBi gain, reverse polarity SMA plug, connector mount (RP-SMA)



Adhesive mount: The benefit of a remote adhesive mount antenna is mounting flexibility to a number of surfaces and in various orientations. Remember, the surface an antenna is being mounted to will affect the radiation pattern. Use masking tape to temporarily attach the antenna. Perform fade-margin testing, as described in Section 6.8 before permanently mounting.

Catalog listing: WAN03RSP

Permanent mounting: Pre-clean the antenna's mounting surface with an alcohol wipe. Peel paper protection from adhesive strip and mount to the cleaned surface.

Figure 13. Adhesive Mounting Steps

**Adhesive Mount Antenna –
Step 1. Pre-clean the surface**



**Adhesive Mount Antenna –
Step 2. Peel Protection from Adhesive
Strip**



**Adhesive Mount Antenna –
Step 3. Mount the Antenna**



Installation and Technical Manual for the Limitless™ Wireless Pressure Sensor, WPS Series

ISSUE 1 **32305925**

Mast mount: The benefit of the mast-mount antenna is its rigid design and resistance to displacement when subjected to shock, vibration, wind, etc. It can be easily mounted high above the ground to obtain greater RF signal performance and it withstands winds up to 100 mph.

Catalog listing: WAN06RNJ

Mast-mount bracket (Included with the 8 dBi antenna): Attach antenna to its mounting bracket. Tighten nut. Assemble two U-clamps around mast and tighten nuts. Ensure provided lock washers are compressed to a flat condition.

Figure 14. Mast Mount Antenna – Tighten nut on mounting bracket



Figure 15. Mast Mount Antenna – Side View with Attachment to Pipe



Magnetic mount: The benefit of the magnetic-mount antenna is its ability to mount on any ferrous-metal surface and in various orientations. A smooth metal surface is preferred to allow the best attraction of the magnet to the surface. First, determine if the magnetic attraction is sufficient to hold the antenna in the desired position (i.e., shock, vibration, etc. in the application). Placing the antenna in a location where it cannot be inadvertently displaced may help.

Catalog listings: WAMM100RSP-005 & WAMM100RSP-010: These magnetic-mount bases are not designed for mobile applications.

Catalog listings: WAN09RSP & WAN10RSP: These magnetic-mount antennas are designed for mobile applications and can withstand winds at >150 mph.

Use Magnetic Mounts with the following antenna catalog listings: WAN04RSP and WAN05RSP

Figure 16. Magnetic Mount Base with Antenna – Mounted on Steel Surface



Figure 17. WAN09RSP Magnetic Mount Antenna



Figure 18. WAN10RSP Magnetic Mount Antenna



Thru-hole mount: The benefit of the thru-hole mount antenna is it allows the cable to run “thru” the mounting surface. There is also an adhesive material between the antenna housing and the mounting surface for seal protection. This is a very low profile, rugged design [approximately 30 mm (1.18 in) height] when mounted and can also be used in mobile applications.

Catalog listing: WAN11RSP

Figure 19. Thru-hole mount antenna

WAN11RSP



6.5.4 | Antenna Adjustment Considerations

The antennas of the WPS and WMPR receiver should be oriented in parallel as best as possible. This will, in most cases, allow the longest range and highest RF signal. The least RF signal is normally in-line with the top of the antenna, so avoid having the antennas pointed directly toward or directly away from each other.

Installation and Technical Manual for the Limitless™ Wireless Pressure Sensor. WPS Series

ISSUE 1 **32305925**

Figure 20. Highest RF signal when antennas are as parallel to each other as possible (parallel arrangement shown with the Limitless™ WMPR monitor and WPS sensor)



6.5.5 | Grounding the Remote Antenna

Follow these guidelines to ground the antenna in accordance with national electrical code instructions.

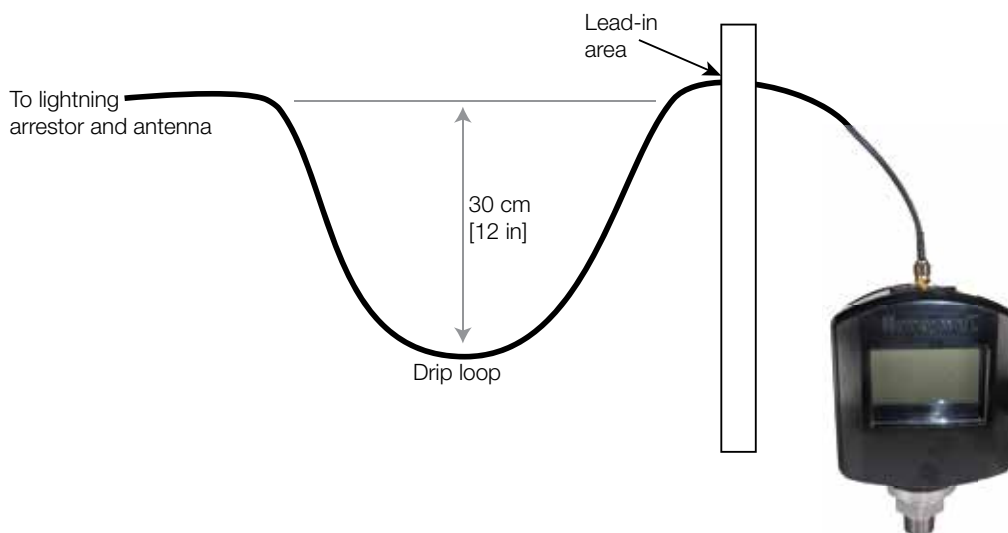
Table 17. Grounding the Antenna

Step	Action
1	Use No. 10 AWG copper or No. 8 or larger copper-clad steel or bronze wire as ground wires for both mast and lead-in. Securely clamp the wire to the bottom of the mast.
2	Secure the lead-in wire to a lightning arrestor and mast ground wire to the building with stand-off insulators spaced from 1,2 m [4 ft] to 1,8 m [8 ft] apart.
3	The lightning arrestor must be bonded to earth ground in order to function properly. Due to the small diameter coaxial cables used with the RP-SMA connectors, the lightning arrestor must be grounded independent of the antennas, using number 10 solid wire. This wire must be connected directly to a solid ground. It may be the same ground as is used for the antenna tower.
4	Drill a hole in the building's wall as close as possible to the equipment to which you will connect the lead-in cable. Use a rubber grommet or feedthru tube to protect the cable from abrasion.

⚠ CAUTION

There may be wires in the wall. Before drilling check that the area is clear of any obstructions or other hazards.

- 5 Pull the cable through the hole and form a drip loop on the outside close to where the cable enters the building. The drip loop should have a radius of at least 30 cm [11.81 in].



- 6 Thoroughly waterproof the lead-in area.
- 7 Connect the lead-in cable to the WPS Series sensor. Tighten cables by hand only; do not use tools or you could overtighten and damage the RF cable on the sensor.

6.6 | Antenna Environmental Usage/Concerns

6.6.1 | Choosing an Antenna/Cable to Meet Application Exposure Conditions

There is no antenna or cable design impervious to every environmental condition it could be exposed to. Review the application environment as follows:

Table 18. Environmental Protection Steps

Step	Action
1	Determine where the antenna will be installed and the application conditions: indoor, outdoor, or limited outdoor exposure. Even if the antenna is going to be used indoors, an outdoor antenna may be more suitable (i.e., resistant to fluids, rigid construction, etc.)
2	Determine what the antenna may be subjected to (i.e., fluids, chemicals, oils, wind, shock, vibration, etc.)

3	<p>A. Review antenna and/or cable materials (listed in Section 6.4) with respect to resistance of chemicals and fluids in the application. If choosing an adhesive mount, adhesive resistance testing may be necessary.</p> <p>B. If shock, vibration, wind, rain, sleet/snow, etc. are in the application, choose an antenna rated for outdoors and has a rigid design as defined in Section 6.5.3.</p>
4	<p>This step may be required to provide an extra level of protection, especially if the application may be subjecting antennas and cables to liquids. The RP-SMA connections, tilt/swivel joints, and cable entrances are potential leak paths that could lead to corrosion. The following procedure is one way to provide extra protection to these connections and joints.</p> <p>See Section 6.6.2 for further detail.</p>

In the end, the antenna/cable choice may need to be tested in the actual application conditions to prove suitability.

6.6.2 | Protection of Antenna Connections

If the antenna and connectors are not protected by the radome, the connector and threads should be protected from the elements through an application of protective tape.

- A recommended protective tape is COAX-SEAL® #104 Hand Moldable Plastic Weatherproofing Tape, available from electrical supply houses.
- Also acceptable is Scotch® Premium Vinyl Electrical Tape 88-Super tape, available from 3M.

Figure 21. Application of Protective Tape

Step 1 - Remove radome.



Step 2 - First apply 1/2 inch wide COAX-SEAL® (flexible and moldable material)



Step 3 - Secondly, apply 3M Scotch® Premium Vinyl Electrical Tape 88-Super



Ultimately, the antenna/cable choice may need to be tested in the actual application conditions to prove suitability for the environment.

6.6.3 | Outdoor Antenna Installations - Lightning Concerns

Outdoor antenna installations can lead to the possible damage caused by nearby lightning strikes that induce charges or surges on the antenna and/or antenna extension cables.

A lightning arrestor such as the AL6-RSPRSJBW-9 from L-COM Global Connectivity can be reviewed against application requirements.

ATTENTION

National, local, and/or regulatory agencies may require the use of a lightning arrestor and possibly other requirements for an antenna system installation. It is recommended that the customer review and adhere to these requirements.

6.6.4 | Lightning Arrestor

The lightning arrestor may be mounted directly on the sensor, or at the far end of the antenna cable, mounted to a sheet of metal in a through-hole. Generally, the choice should be made based on having the shortest, most direct path to a good, solid ground.

If the lightning arrestor is mounted directly on the sensor, use caution when attaching a grounding wire to the arrestor to avoid putting undue stress on the sensor's antenna connector.

If the coax cable is to enter a building, then the lightning arrestor should be mounted as close as possible to where the lead-in wire enters the building. The lightning arrestor recommended by Honeywell (AL6-RSPRSJBW-9 from L-COM Global Connectivity) features a bulkhead RP-SMA connector with a rubber "O"-ring seal which can be used for mounting through an enclosure wall. Both connector ports of the lightning arrestor provide equal protection no matter which way it is installed. Either port can face the antenna and either port can face the sensor.

6.6.5 | Site Selection

Before attempting to install your antenna, consider the best place to install the antenna for safety and performance.

Follow these steps to determine a safe distance from wires, power lines, and trees.

Step	Action
1	Measure the height of the antenna.
2	Add this length to the length of the tower or mast and then double this total for the minimum recommended safe distance.

Generally speaking, the higher the antenna is above the ground, the better it performs. Good practice is to install your antenna about 1,5 m to 3 m [5 ft to 10 ft] above the roof line and away

from all power lines and obstructions. If possible, find a mounting place directly above the wireless device so the lead-in cable can be as direct as possible.

6.6.6 | Antenna Mounting Location with Respect to Antenna Location

There are several environmental factors to consider with respect to antenna location during installation. These factors can affect the radio frequency (RF) signal strength being both transmitted and received by the Limitless™ WPS sensor and the Wireless Multi-Protocol Receiver (WMPR). It is desirable for the antenna to be mounted to limit exposure of adjacent materials/objects between the Limitless™ WPS sensor and the WMPR, as they will have an effect on RF signal strength. If the mounting location for an omni-directional antenna is on the side of a building or tower, the antenna pattern will be degraded on the building or tower side.

Obstacles that affect antenna patterns and RF signal strength:

- Indoor: Concrete, wood, drywall, and metal walls, etc.
- Outdoor: Vehicles, buildings, trees, structures, topology, weather conditions, chain link fence, major power cables, etc.

Rain and moisture: Wireless sensors compliant with IEEE 802.15.4 operate in a 2.4 GHz band. As the peak absorption frequency of water molecules is approximately 22 GHz, the total signal attenuation due to rain, fog or moisture is negligible (less than 0.1 dB/mile for a heavy downpour).

6.7 | R.F. Interference Considerations

6.7.1 | General

The 802.15.4 specification provides a high resistance to interference. Within the 2.4 GHz band, there are 16 channels, each using approximately 2 MHz of bandwidth. The channel used may be rapidly changed depending on the presence of other signals sensed in that channel. Thus narrow band interfering signals may have no effect, while broadband noise sources may cause loss. The effect of light to moderate interference is not to make the system fail, but to increase the rate of “lost packets” of data. These “lost packets” are simply retransmitted as needed, so the user may not notice any problem. More serious interference can cause loss of more data updates, and error messages reported by the WMPR, as well as shorter battery life.

6.7.2 | WiFi Networks

Most WiFi (WLAN) networks operate in the same 2.4 GHz range and use wider bands within that range. Also, the faster protocols (802.11n or AC), may utilize multiple channels. Factors affecting R.F. interference would be channel separation, distance separation, and duty cycle.

- Channel separation: Studies have shown that a channel separation of 7 MHz will make interference less likely. WiFi routers can be set to use different channels as needed, and auto channel modes can be disabled. If possible, switching to a 5 GHz-only protocol (using 802.11n or AC), would eliminate any possibility of 2.4 GHz interference.
- Distance separation: A physical separation of 10 meters or more will reduce possibility of interference.
- Duty Cycle: Generally the duty cycle of WiFi routers is very low for simple uses as e-mailing, messaging, most web browsing, and voice protocols. However, a video camera or multiple users streaming video would cause a significant increase in bandwidth usage and increase the possibility of interference, making channel or distance separation more desirable.

Regarding the WiFi client (laptop, smartphone, tablet), they are much less of a problem as they generally operate with a much reduced duty cycle (most data is received by the device), and may operate with much lower transmit power

6.7.3 | Smart Phone “Apps”

Smart phone “apps” are available to display consumer WiFi signal strengths or download/upload speeds. These apps will not display the 802.15.4 signals as the packet format is different. However, if a suspected interference source causes a large reduction in consumer WiFi download speed, it is likely it could also cause interference to the 802.15.4 data used by the WPS.

6.7.4 | Bluetooth® Devices

Bluetooth® interference is less of an issue, due to the very narrow bandwidth of Bluetooth® signals, the low transmit power, and the rapid “frequency hopping” of the signals. If the 802.15.4 device misses a packet of data due to a Bluetooth® burst of data, the re-transmission of the 802.15.4 data will likely succeed, as the Bluetooth® will have hopped to a different channel by then.

6.7.5 | Wireless Video Camera and Video Links

Wireless video links operating in the 2.4 GHz band can cause serious interference as they are operating continuously, use a wide (6 MHz) bandwidth, and may be more powerful. Interference from wireless video could cause the “NO RF” indication in severe cases. As mentioned, frequency and/or distance separation may be required.

- Frequency Separation: Many video links have four or more channels selectable. Changing channels may help. Additionally, wireless video links are available in the 900 MHz band, and the 1.2 GHz band. Switching to one of those would eliminate interference issues with 802.15.4 (and 802.11x).
- Distance Separation: Separating the video link sensor from the wireless sensor would be very desirable. Alternatively, utilizing directional antennas on the wireless sensor, and /or on the wireless video link would help greatly.

6.7.6 | Microwave Ovens

Microwave ovens operate in the 2.4 GHz range, they are powerful, and a high-duty cycle. However, they may not be a problem to a modern 802.15.4 network. The magnetron in a microwave oven is driven by half-wave rectified AC, so the R.F. output is actually off for one half of the 60 Hz or 50 Hz power line cycle (8.33 msec or 10.0 msec). During that part of the cycle, the packets of 802.15.4 data may succeed. However, close to half of the packets may require retransmission, so data throughput could be greatly reduced.

6.7.7 | Cordless Phones/Baby Monitors/ Intercoms

A 2.4 GHz cordless phone in very close proximity to a wireless sensor could cause lost packets, while the phone is in use, but is not a very likely cause. If monitoring the link quality as in “link measurements” above, shows interference, a simple remedy is to switch to a DECT 6.0 cordless phone operating on 1.9 GHz.

6.8 | Choosing an Antenna Gain (dBi) with Acceptable Fade-Margin

There are several different Limitless™ Series antenna gain options to choose from. This section helps determine the antenna version(s) that will provide suitable RF signal performance for specific applications.

The Limitless™ Series antenna's actual gain is measured by how much of the input power from the WPS's internal radio is concentrated in a particular direction. The WPS antenna transmits RF signals, and also receives RF signals from a Limitless™ WMPPR receiver. In a particular application, transmit signal strength may be better than the receive signal strength or vice versa. The intent is to choose an antenna with the optimum gain relative to application conditions for both transmitting and receiving.

Fade-margin is the amount of excess power available above and beyond what is necessary to maintain a reliable RF signal between the transmitter and receiver. Normally, an acceptable threshold of excess power to ensure effective operation in a variety of environmental conditions is 10 dB. A simple way to determine if the signal strength is sufficient is to temporarily install a 10 dB attenuator* between the RP-SMA plug of the antenna or remote cable and WPS's RP-SMA jack. This should be completed in an operating application environment with good nominal environmental conditions. Starting with the antenna chosen in Sections 5 & 6, install the attenuator and operate the system until exposure of all normal application conditions is completed while monitoring the Lost RF Signal Output. If

the fade-margin is unacceptable, the lost RF signal output changes state) indicating the antenna position on the Limitless™ WPS and/or WMPPR receiver will need to be changed and/or another antenna type should be chosen. The RF Signal indication within the Node Status menu or Node Information Menu is useful in indicating the RF Link Strength; refer to Section 6.9 for more information.

Try several mounting locations and/or antennas along with retesting each with the attenuator to determine the optimal set-up that provides an acceptable fade-margin. Remove the attenuator after testing is completed.

*Suggested sources/part numbers

- 10 dB attenuator (i.e. Crystek – Part number: CATTEN-0100)
- RP-SMA female to SMA male connector adaptor (i.e. Connector City – Part number : ADP-SMAM-RPSF)
- RP-SMA male to SMA female connector adaptor (i.e. Connector City – Part number : ADP-RPSM-SMAF)

6.9 | Wireless Link Quality Measurements

6.9.1 | Link Measurements

There are two methods of observing the R.F. link performance

- **The LCD on the WPS sensor** will display the R.F. link quality as one of five values; BEST, GOOD, BAD, POOR and NO RF, based upon the link analysis.
- The applicable data block on the WMPR receiver will show RSSI. (Refer to Section 7.4 or the WMPR Installation and Technical Manual.)
- The Node Detail or Node Status screen on the WMPR will show the RSSI value for each active node (see Figure 22)

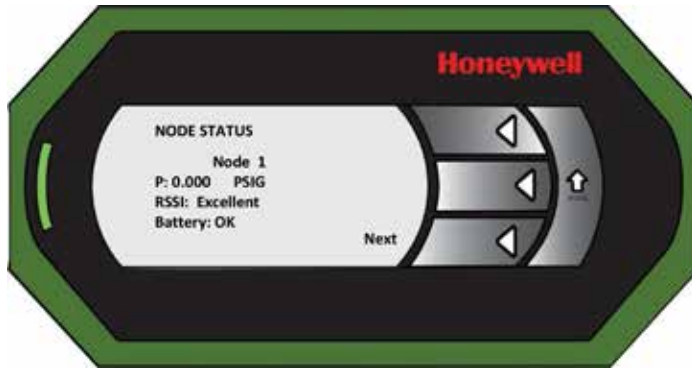
6.9.2 | Connection Quality Labels

Link quality details can be categorized as poor, fair, good, etc. The default numerical criteria for these labels as per the WMPR I&T manual are

Table 19. WPS Connection Quality Labels

Quality Detail	Numerical Value	Label
RSSI range	> -50	Excellent/Best
	-60 to -50	Good
	-85 to -60	Fair
	< -85	Poor

Figure 22. R.F. Link Quality shown on WMPR



RSSI is the Received Signal Strength Indicator value, lowest value/highest value. The less negative the values, the stronger the signal (-60 dBm is stronger than -70 dBm).

The required antenna impedance is 50 ohms.

7 | OPERATING THE WPS P2P INTERFACE WITH THE WMPR

7.1 | Overview of the P2P User Interface

The WPS Sensor is paired with a WMPR receiver, which provides

- A means of pairing/purging the WPS on the P2P network
- A readout of the measured process variable from WPS
- Status of the WPS (received signal, battery status)
- A means to set parameters used by the WPS (measurement update rate, display update rate)
- An interface to an existing EtherNet/IP™ compliant Master device

7.2 | Starting the WPS with the WMPR

Note: Before proceeding with the pairing process it is suggested that a “system map” be created listing which wireless devices (WPS or others) are to be paired with the WMPR, and at which “Node”. Each of these devices will be paired with one of the 14 available “Nodes” in the WMPR.

7.2.1 | Powering up the system

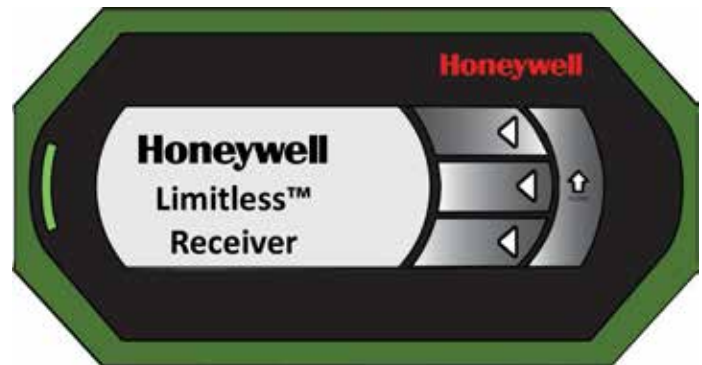
1. Insure that the WPS has fresh batteries installed and the battery insulator is not installed (see Figure 46)
2. If the WPS has been paired with any other WMPR, perform a Restore to Factory Defaults (see Factory Reset, Section 7.8)
3. Insure that the WMPR is connected to a EtherNet/IP™ compliant Master device through the RJ-45 Ethernet connection
(If this is not done, the WMPR will remain on the initial splash screen)
4. Apply a source of +10 to +30 Vdc to the power terminals of the WMPR (refer to WMPR I&T Manual).

7.3 | Start-up or Re-start Sequence Mode (EtherNet/IP™ Active Connection and Power Supplied to WMPR)

7.3.1 | Zero Switches or Sensors Paired to WMPR

Zero switches/sensors paired to the WMPR: EtherNet/IP™ active connection is made and then applying power to the WMPR will result in the LCD Menu sequencing through the following displays before entering the Main Menu.

Figure 23. Honeywell Splash Screen (momentarily shown)



EtherNet/MAC ID screen appears (see Figure 24). (Record the MAC ID, IP Address, and then touch the “Next” function button to move to the Main Menu) (see Figure 25).

Figure 24. Ethernet/IP MAC ID & IP Address

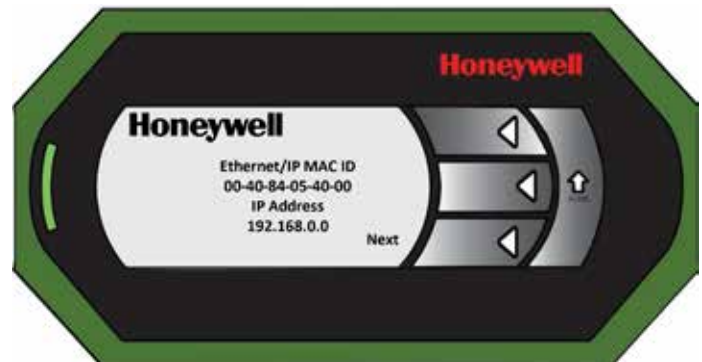
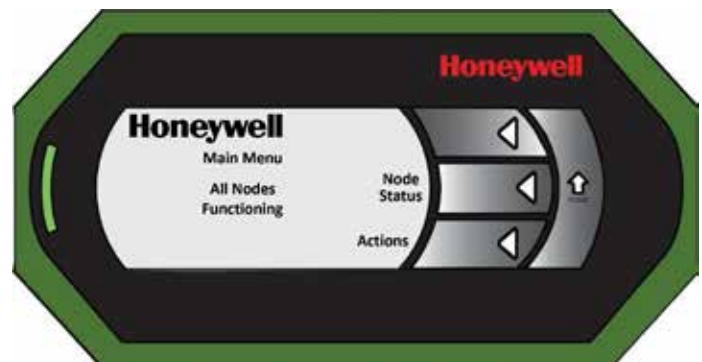


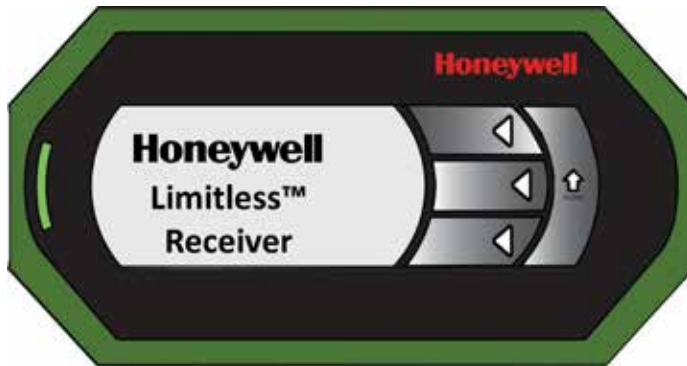
Figure 25. Main Menu



7.3.2 | One or More Switches or Sensors Paired to WMPR

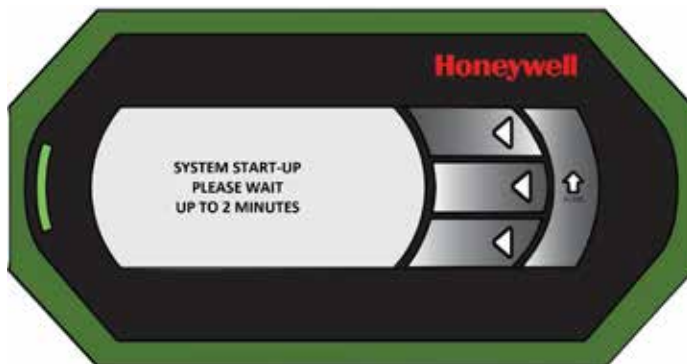
One or more switches/sensors paired to the WMPR: EtherNet/IP™ active connection is made and then applying power to the WMPR will result in the LCD Menu scrolling through the following displays before entering the Main Menu:

Figure 26. Honeywell Splash Screen (momentarily shown)



System start-up screen (see Figure 27) will take up to two (2) minutes before displaying EtherNet/IP MAC ID & IP address (see Figure 28) screen.

Figure 27. System Start Up



EtherNet/MAC ID screen appears (see Figure 28). (Record the MAC ID, IP Address, and then touch the “Next” function button to move to the Main Menu) (see Figure 29).

Figure 28. Ethernet/IP MAC ID & IP Address

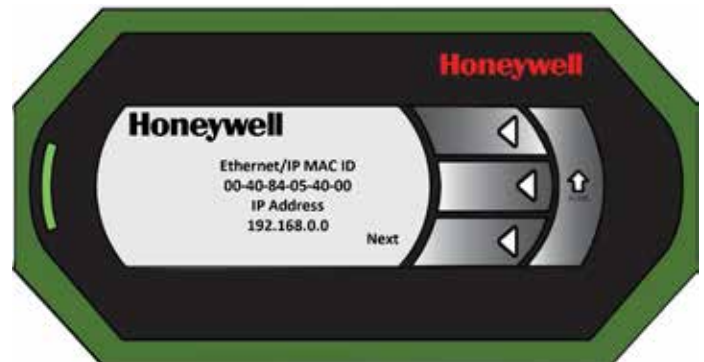
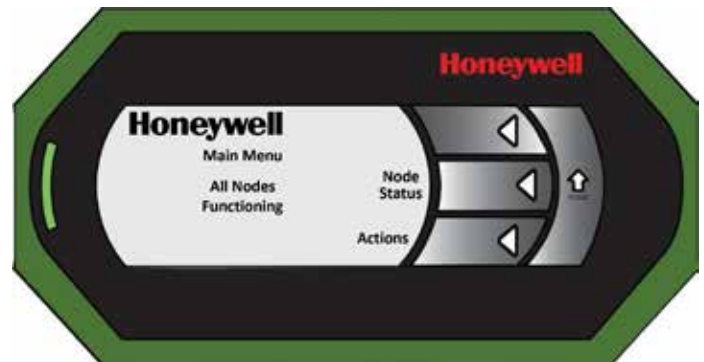


Figure 29. Main Menu



- The display on the WPS toggles between pressure value and “No RF” when not paired to WMPR. Note, this is only applicable for the LCD variant of the WPS.

Figure 30. Limitless™ WPS Pressure Value and no RF Messages



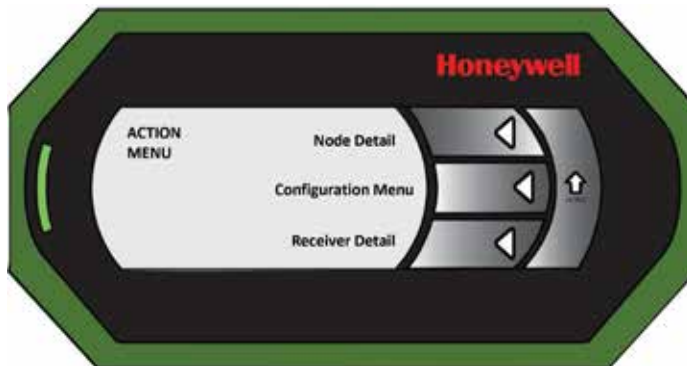
STOP ATTENTION

If there are multiple WMPRs being used in the application, apply power to previously paired WMPRs first (if any) and then to one WMPR at a time. **Allow time for each WMPR to complete its start-up sequence before applying power to the next WMPR. There is a maximum of five WMPRs that can be used in the same localized area. Contact Honeywell Application Engineering at 800-537-6945 if more than five WMPRs are desired to be used in the same localized area.**

7.3.3 | Pairing the WPS with the WMPR

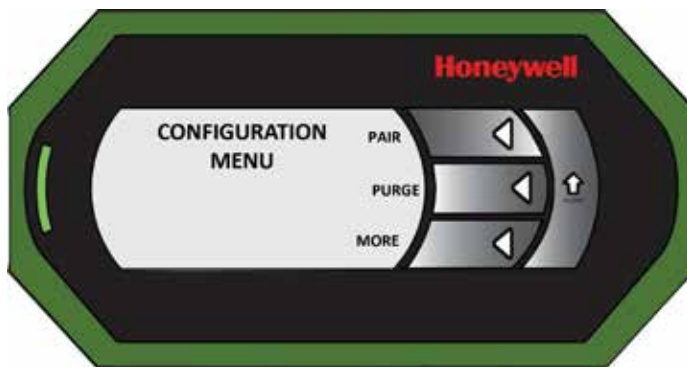
1. With the **Main Menu** Page displayed, touch the lower button next to **Actions** (see Figure 29).

Figure 31. Action Menu



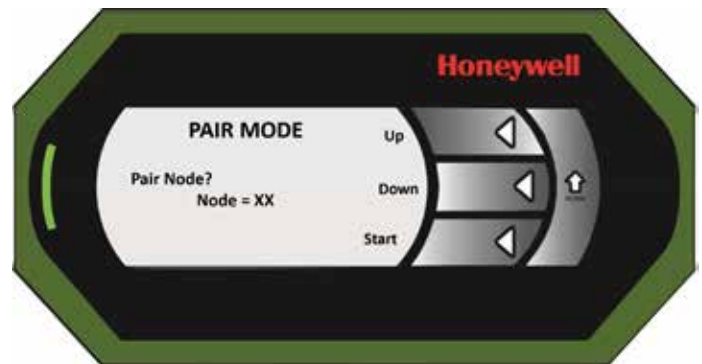
2. Touch the center button next to **Configuration Menu** (see Figure 31)

Figure 32. Configuration Menu



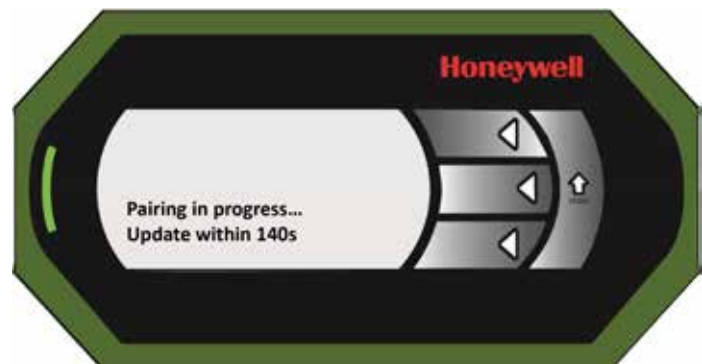
3. If the WMPR has been previously paired with the desired node, touch **Purge** (see Figure 32) and perform the required steps. (Refer to Purge Mode in WMPR Installation & Technical Manual.)
4. Touch the upper button next to **Pair** (see Figure 32)

Figure 33. Pair Mode Screen



5. Referring to the system “Map” for this installation, determine which node the current WPS is to be paired into. Scroll “UP” or “DOWN” to the desired node # (see Figure 33).
6. If not already done, remove the rear cover of the WPS, and carefully remove the interior rubber cover, allowing access to the reset button and green LED (see Figure 44).
7. On the WMPR, touch the **Start** button on the Pair Mode screen (see Figure 33) which will start the Pairing process (see Figure 34).

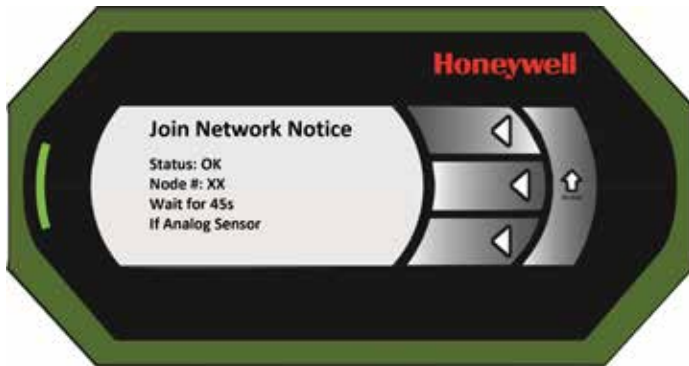
Figure 34. Pairing In-Progress Screen



8. Within 140 seconds, press the reset button inside the WPS (see Figure 44), for more than five seconds and less than 12 seconds. Observe that the green LED is lit when first pressed, and then goes out as the button is released. The green LED continues to flash ON/OFF (1second interval) during the pairing operation for 30seconds maximum. Upon successful pairing, the green LED flashes faster for four seconds (0.25 seconds interval) and then turns OFF.
Note: If pairing is unsuccessful, the LED will stop flashing ON/OFF (1second interval) after 30 seconds from commencement.

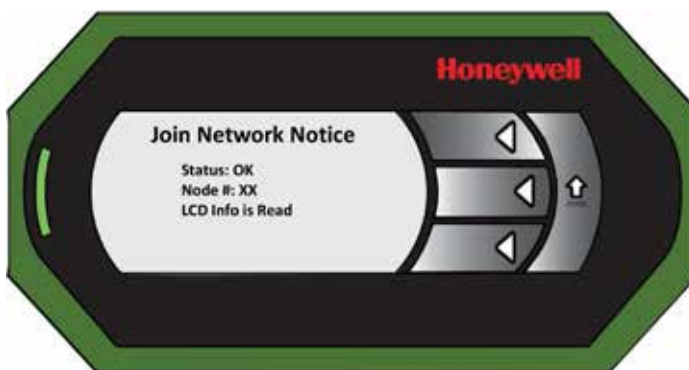
9. Upon successful pairing, observe the Join Network Notice on WMPR LCD screen (See Figure 35). Verify that Status is OK, and the Device Address is the Node number desired. On WPS LCD variant (the signal connection should indicate either GOOD or BEST based on signal strength).

Figure 35. Join Network Notice in WMPR



10. Wait at the above screen (Figure 35) for 45 seconds maximum. Verify the WPS device type is read successfully and WMPR should display **LCD info is read** (see Figure 36). If, WPS device type read is unsuccessful, the WMPR screen displays Node Pairing Failed or Not Paired, it is possible that either the WPS or WMPR were not purged correctly. Perform Reset to Factory Defaults on the WPS (Section 7.8), purge the particular node of interest on WMPR, and repeat steps 1 through 10.

Figure 36. Successful Pairing Screen



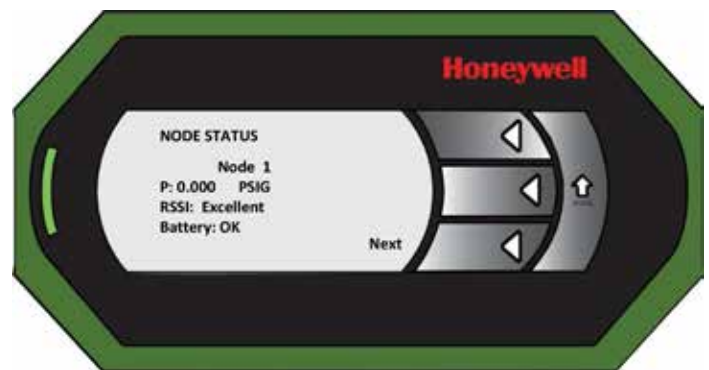
11. Replace interior rubber cover inside WPS, and replace rear cover of WPS and tighten the rear cover screws to 0,6 Nm max. torque.

7.4 | Reading WPS Pressure Value on the WMPR

1. From WMPR Main Menu screen, select **Node Status** (See Figure 29).
2. Scroll through the different pages, by touching button next to "UP" or "DOWN", to view the appropriate Node. Next to the "P" will be the pressure value and measurement unit (see Figure 37).

Note: Depending on the update interval of the node, the WMPR may display Loading Data... on the screen while the data is being retrieved from the node.

Figure 37. Node Status Screen

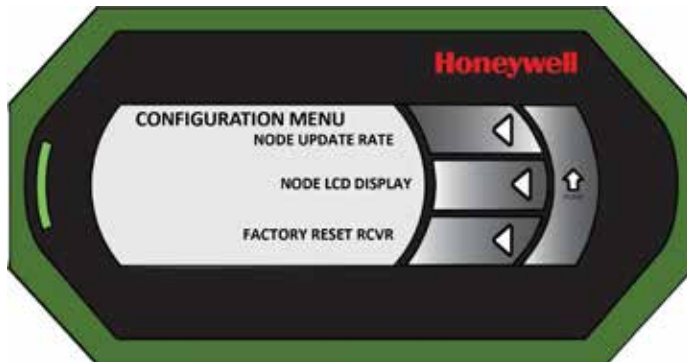


7.5 | Setting Update Rate and Display Timing of WPS

7.5.1 | Setting the Update Rate

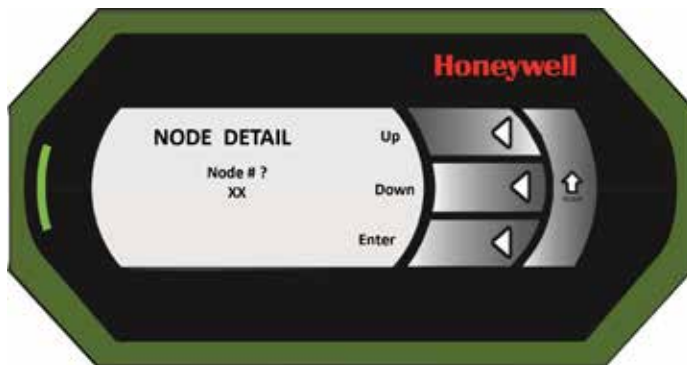
1. From the WMPR Main Menu, touch the lower button next to **Actions** (see Figure 29).
2. From the Action menu, touch the center button next to **Configuration** (see Figure 31).
3. From the Configuration page, press the lower button next to **More**. (see Figure 32).

Figure 38. WMPR Configuration Menu Screen, Cont.



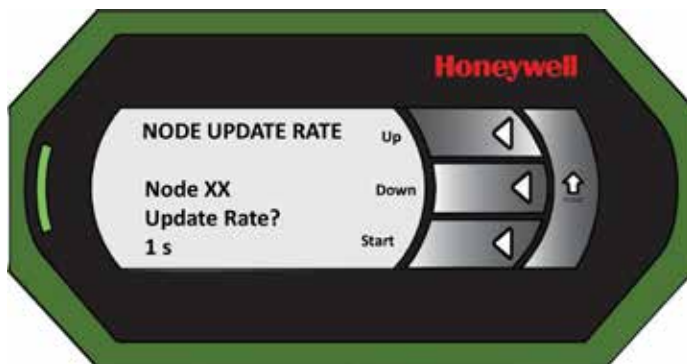
- To set the Update Rate for a node, press the upper button next to **Node Update Rate** (see Figure 38).

Figure 39. WMPR Node Update Rate Screen



- As needed, scroll "Up" or "Down" to desired Node # (see Figure 39).
- Touch Enter, after 45 seconds maximum, the page refreshes to then allow the installer to set the update rate (see Figure 40).

Figure 40. WMPR Node Update Rate Screen 2

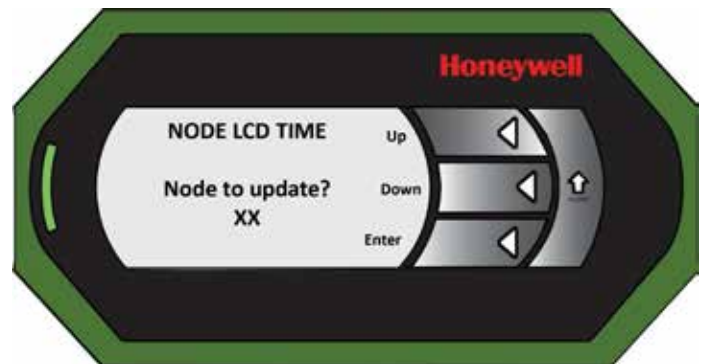


- Choose the desired Update Rate by touching the **Up or Down** buttons. When the desired Update Rate is displayed, press **Start** (see Figure 40).
- Observe that the message "Update is Sent!" appears on the display.

7.5.2 | Setting the LCD Time Display

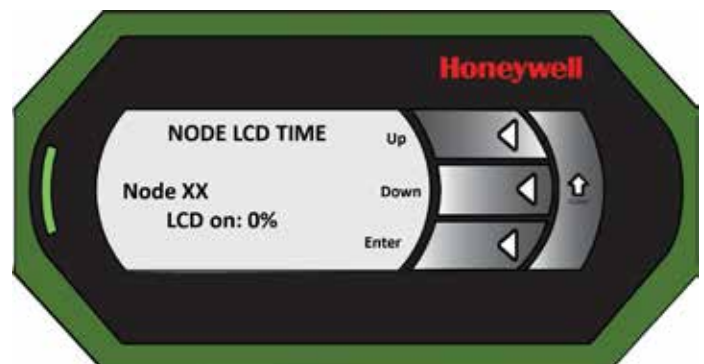
- From the WMPR Main Menu, touch the lower button next to **Actions** (see Figure 29).
- From the Action menu, touch the center button next to **Configuration** (see Figure 31).
- From the Configuration page, press the lower button next to **More**. (see Figure 32).
- Touch **Node LCD Display** to select the Node LCD Time screen (see Figure 41).

Figure 41. WMPR Node LCD Display



- As needed, select which node to update by using the **Up or Down** buttons (See Figure 41).
- Touch **Enter** to view current Node LCD Time setting (see Figure 42).

Figure 42. WMPR Node LCD Time Screen



7. Change the LCD “On” Time by touching the **Up** or **Down** buttons. When the desired LCD “On” Time is displayed, touch **Enter** (see Figure 42).
8. Observe that the message “Update is Sent!” appears on the display.

7.6 | Setting TX Power

7.6.1 | TX Power Setting Policy

⚠ WARNING

The P2P Wireless Pressure Sensor, WPS Series must be professionally installed in accordance with the requirements specified in this document. Only the specified WPS part numbers, antenna types and gains and cable lengths (attenuation) as outlined in this document are valid for Limitless™ P2P Wireless Pressure Sensor, WPS Series installations.

Failure to comply with these instructions could result in death or serious injury.

The WPS Series as shipped from the factory will have its TX power value set according to its model part number and this value is consistent with those values allowed for the applicable countries.

Therefore, it is not permissible to operate a WPS Sensor in a country not specifically listed in the applicable table.

The TX power setting for the WPS Sensor is set at factory and not adjustable through any field procedure, dip switch, or software commands.

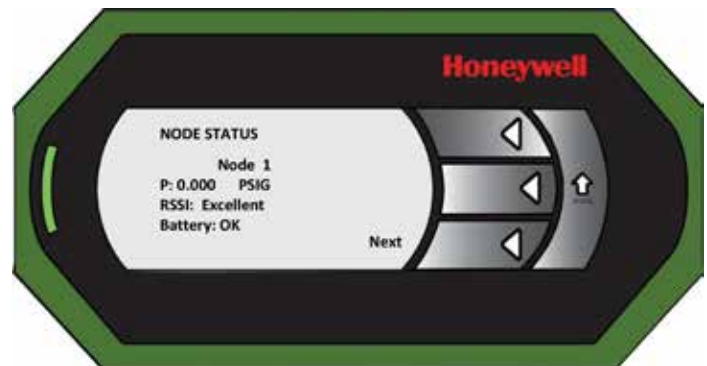
7.7 | Reading Battery Status

Battery status of the WPS sensor may be read on the WMPR on the Node Status Screen. The options are OK or LOW, based on a measurement of the actual battery voltage.

If the battery status is LOW, the batteries must be changed immediately to avoid loss of service (see Section 10.2).

1. From the Main Menu screen, touch the middle button next to Node Status (see Figure 28)
2. Scroll through the different pages, by touching button next to “**UP**” or “**DOWN**”, to the appropriate Node and view the **Battery**: status (see Figure 43)

Figure 43. Battery Status



7.8 | Restore to Factory Defaults

The WPS device can be restored to factory default settings by pressing and holding the reset button for >12 seconds. The reset button must be held pressed until the reset (green) LED turns off, indicating successful restoration to factory defaults. Figure 44 shows the location of the reset button and LED.

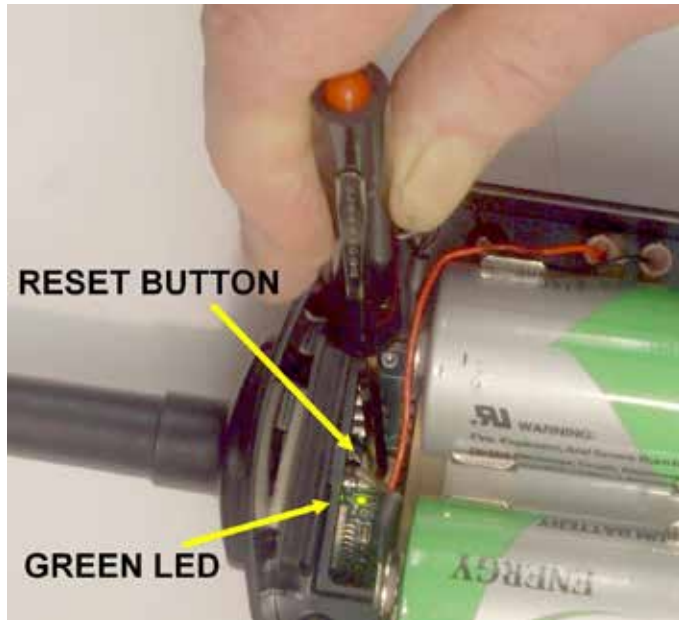
STOP CAUTION

Use care to avoid moving or applying pressure to the small coaxial cable passing above the reset button. This cable connects the antenna jack to the receiver board. Pressing on this cable could cause the cable to disconnect from the receiver board and cause permanent damage to the 2.4 GHz transmitter.

Restoring the WPS to factory default also includes removing any existing pairing. It is necessary to remove the pairing any time a WPS has been paired with a WMPR, and later, needs to be paired with a different WMPR. The Restore to Factory Default must be done prior to pairing the WPS with the new WMPR.

Note that there is an equivalent process in the WMPR which removes the pairing for a paired node. This is called “Purge” in the WMPR menu. See WMPR Installation and Technical Manual for details.

Figure 44. Location of Reset Button



7.9 | Calibrating the Sensor

The Limitless™ P2P Wireless Pressure Sensor, WPS Series is factory calibrated at time of manufacture. The calibration parameters are permanently stored in flash memory of microcontroller in the interface board. There is no user calibration routine available.

8 | FUNCTION BLOCKS

8.1 | Introduction

This section explains the construction and contents of the WPS Series sensor function blocks

8.1.1 | Configuration

The WPS Series sensor contains an electronics interface compatible for connecting to the WMPR. An operator uses the WMPR User Interface to configure the sensor (pair it to the WMPR), and to change operating parameters such as update rate and display timing.

8.2 | Hardware Description

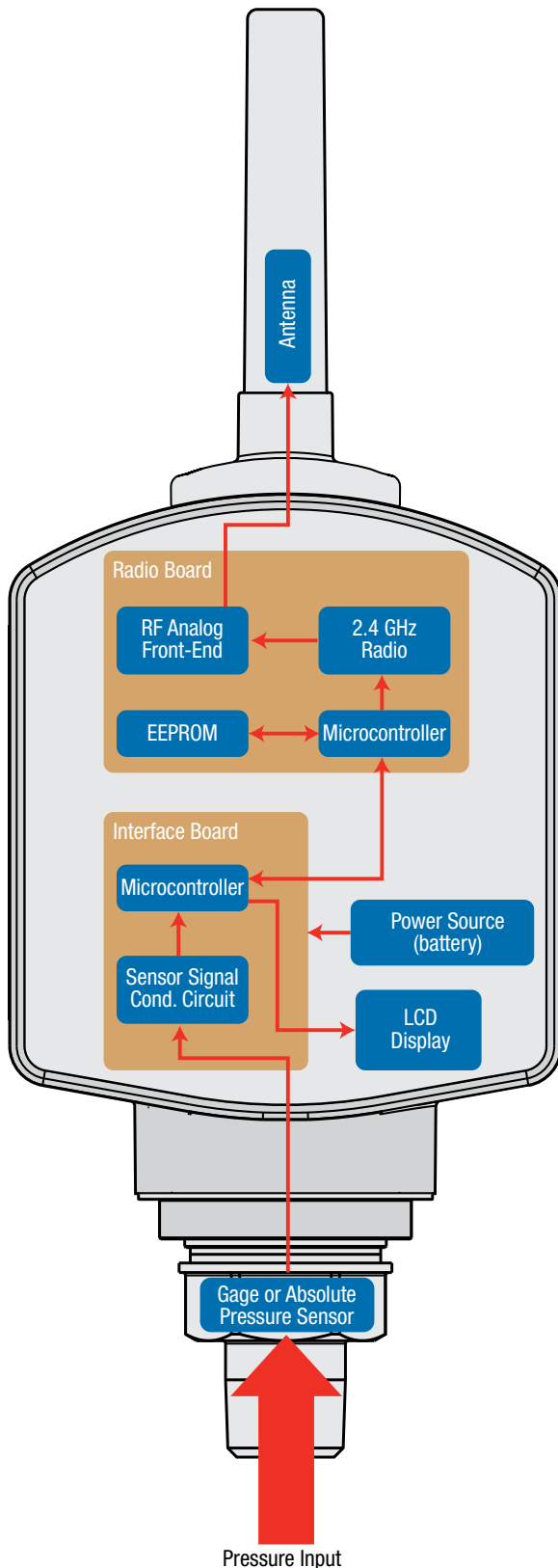
8.2.1 | Detailed Block Diagram

The Limitless™ P2P Wireless Pressure Sensor, WPS Series contains the following functional components:

1. Sensor module
2. Interface board
3. Radio board
4. LCD display
5. Battery

Figure 45 shows the detailed block diagram of the WPS Series sensor.

Figure 45. WPS Functional Diagram



8.2.2 | Sensor Module

Two versions are available, GP (gauge pressure), or AP (absolute pressure). For the gauge pressure models, a vent feature is provided on the front cover. Electrical signals from the sensor connect to signal conditioning circuit on the interface board.

8.2.3 | Interface Board

The microprocessor internally constitutes of a flash, non-volatile memory containing:

- Characterization data, loaded at time of manufacture, that identifies the specific measurement hardware installed, pressure range, burst pressure, GP or AP type, etc. Also stored are the default user settings. After a hard reset (cold restart), any user settings are replaced with the default user settings (i.e., update rate is read from DIP switch, LCD display timing is based on DIP setting, upon cold re-start). None of the characterization data is user changeable.
- Calibration data, from the factory calibration procedure. This data is not erasable or changeable.
- User settings, selected through the WMPR Receiver User Interface, such as update rate, LCD display timing, etc.

A small reset button and green LED are mounted on the interface board, used to cause a restore to factory default state.

8.2.4 | Radio Board

The radio board contains a microprocessor with EEPROM to store its program code and operating parameters. A small R.F. connector on the radio board is connected to a short cable assembly containing the sensor external antenna connector.

STOP CAUTION

Applying power to the device/product with no antenna connected to the radio board could cause permanent damage to the device or the radio board.

8.2.5 | LCD Display

The optional LCD display is connected through a cable assembly to the interface board. It is activated as required, by the interface board, in accordance with the LCD timing user options.

8.2.6 | Battery

The battery consists of two each, D-sized Lithium Thionyl Chloride cells. Each cell provides 3.6 Vdc and the two cells are wired in series to provide 7.2 Vdc to operate all circuits in the sensor. There is no on/off switching, so when the batteries are installed, the sensor is active. See Section 10.2 for battery considerations and see Table 25 for battery replacement procedures.

8.2.7 | Battery Life

The battery life depends on three factors:

- Update rate - Setting a higher periodic update interval increases battery consumption
- LCD display timing - Setting the LCD to display continuously or for longer periods will increase battery consumption.
- R.F. link data re-transmissions - When the Limitless™ P2P Wireless Pressure Sensor, WPS Series needs to send a packet of data to the WMPR, it transmits the packet and waits for an acknowledgement. Normally, it receives the acknowledgement immediately, stops, and waits for the next scheduled transmission time. A long R.F. path, interfering materials (metal structures, etc.), or R.F. interference from other nearby transmitters, may cause the transmitted packet to be “dropped”. If this occurs, the sensor will re-try to send the packet. It will re-try two more times, waiting for an acknowledgement. These extra re-transmissions will greatly increase the battery usage and reduce battery life.

Typical battery life is estimated to be as much as 6.5 years for 60 second periodic update intervals, 5 years for 5 second periodic update intervals, and as low as 2.5 years for 1 second periodic update intervals.

9 | OPERATION

9.1 | Overview

9.1.1 | Display Modes

The sensor has the following display modes.

- PV display: Displays the process value and units
- Connection (Link) status: Displays a label calculated from the link signal amplitude
- Battery status: Displays a warning label in the event of a low battery condition

9.2 | Sensor PV Display

On the LCD display, the following information is displayed in sequence. First, the PV will be displayed for three seconds, then the link status will be displayed for two seconds. This sequence will repeat at a rate determined by the periodic update interval and the LCD display rate.

Table 20. PV Display

Item Displayed	Example	Details
PV value	50.0	Latest PV value
PV engineering units	psig	See Table 21
Link status	GOOD	Received signal strength - See Table 22 Sensor Link Status Display

Table 21. PV Engineering Units

Item Displayed	Details
Pa	Pascals ¹
kPa	KiloPascals
bar	bar ²
mbar	Millibar
psia	Pounds per square inch absolute
psig	Pounds per square inch gage

¹ Values greater than 10,000 Pa will be automatically converted to kPa and displayed on the LCD.

² Values lesser than 1 bar will be automatically converted to mbar (millibar) and displayed on the LCD.

Table 22. Sensor Link Status Display

Display	Meaning	Suggested Action
BEST	Best strength – approx. -50 dBm to -25 dBm	• No action required
GOOD	Good strength – approx. -60 dBm to -50 dBm	• No action required
BAD	Weak signal – approx. -85 dBm to -60 dBm	• Troubleshoot antenna, antenna cables • Evaluate signal path and distance to the WMPR • Substitute other paired sensor into same location
POOR	Very weak signal – approx. -95 dBm to -85 dBm	
NoRF	Unusable signal level - no link possible	• Troubleshoot antenna, antenna cables • Evaluate signal path and distance to WMPR • Verify sensor is properly paired with appropriate WMPR, in case there are more than one WMPR at the location • Substitute other paired sensor into same location

Table 23. Sensor Error Codes

Sensor Display	WMPR LCD Display	Definition	What to do
E-1	Electrical failure	Diagnostics detected defect with analog-to-digital converter.	Restart the device (remove and re-insert one of the batteries). If condition persists, interface board has failed, sensor must be replaced.
E-2	Low battery	Battery voltage critically low, below 6.6 Vdc	Replace batteries as soon as possible. See Section 10.2.
E-3	Characterization error	Startup diagnostics detected invalid sensor nonvolatile memory characterization data	Restart the device. If condition persists, interface board has failed, sensor must be replaced.
E-5	Sensor overpressure	The input pressure has crossed the sensor maximum limit as stored in the characterization data. Note that this error will clear when the input pressure is measured as 1 % or more below the maximum limit.	Cross-check input pressure with other means, if actual pressure is less than the sensor maximum limit, the pressure sensor within the unit has failed, sensor must be replaced.

9.3 | Battery Considerations

As shipped from the factory, the sensor will have two battery cells installed. There will be a small battery insulator tab installed over the positive terminal of one cell, to inactivate the sensor electronics (see Figure 46). The following are suggested policies:

- Do not remove the tab until the unit is ready for use, as battery life will be considerably shortened. The unit will transmit frequently, trying to establish communication with a node. This node establishment will not succeed, if the network has not yet been provisioned for that sensor.
- Do not remove the tab and provision the unit until the unit is in its intended location, as it will try to establish links with whatever WMPRs are nearby. This will cause unnecessary transmissions through the network to occur, wasting battery power and using bandwidth.
- When a sensor is removed from service, and is to be stored, it is recommended that the insulating tab be installed, or the batteries removed, so as to preserve battery life and avoid unnecessary data transmissions.

Refer to Section 10.2 for battery replacement procedures.

Figure 46. Battery Insulator Tab Location



9.4 | Other User Settings

The following user settings may be set over the air, using the WMPR LCD User Interface (refer to WMPR Installation and Technical Manual).

- Update rate - frequency of transmitting data packets, 0.1, 0.25, 0.5, 1, 5, 10, 30, or 90 seconds
- LCD Display Options - LCD always ON, LCD always OFF, LCD default time

10 | MAINTENANCE/REPAIR

10.1 | Parts

The following replacement parts may be ordered from Honeywell Sensing and Productivity Solutions.

Table 24. WPS Replacement Parts

Part number	Qty.	Description
WBT5	1	3.6 V Lithium Thionyl Chloride (Li-SOCl ₂) battery, D size (2nos)
WAN12RSP	1	2.4 GHz 2.0 dBi RP-SMA WLAN Antenna
WAN21RAD	1	WPS Radome replacement kit

The above batteries are also available from the Xeno Energy, part number XL-205F or Tadiran, part number TL-5930/S. Refer to battery specifications, Table 7.

10.2 | Replacing Batteries

10.2.1 | When to Replace

When the sensor displays an E-2 message on the WMPR displays a low battery warning message, there are two- to four-weeks of operation remaining before the batteries expire, unless the update rate is operating at one update per second or faster (< one second), then there is a maximum of one week of operation remaining.

When batteries are removed or expired, all sensor configuration data, calibration data, and program data is retained in the sensor's flash memory.

Batteries may be replaced while the sensor remains connected to the pressure being measured.

10.2.2 | Battery Storage

Batteries should be kept in pairs, not mixed together with others from different vendors or of different shipments.

10.2.3 | Transporting Batteries

When transporting or shipping Lithium Thionyl Chloride batteries, be aware that many regulations and restrictions apply. These batteries are not permitted for transport aboard passenger aircraft. For shipping purposes, two "D" sized Lithium Thionyl Chloride cells weigh approximately 194 grams and contain approximately 10 grams of lithium.

10.2.4 | Tools Required

- #2 Phillips screwdriver
- Torque screwdriver with #2 bit

ATTENTION

Both batteries to be replaced together.

WARNINGS

- Risk of death or serious injury by explosion.
- When not in use the batteries must be stored in a safe area.
- The batteries used in this device may present a risk of fire or chemical burn if mistreated. Do not recharge, disassemble, heat above 100 °C [212 °F], or incinerate. Do not expose batteries to water.
- When installing batteries do not snag the battery terminal on the clip or the battery may be damaged. Do not apply excessive force.
- Do not drop. Dropping the battery may cause damage. If a battery is dropped, do not install the dropped battery into the sensor. Dispose of dropped battery promptly per local regulations or per the battery manufacturer's recommendations.

Figure 47. Sensor Battery Replacement

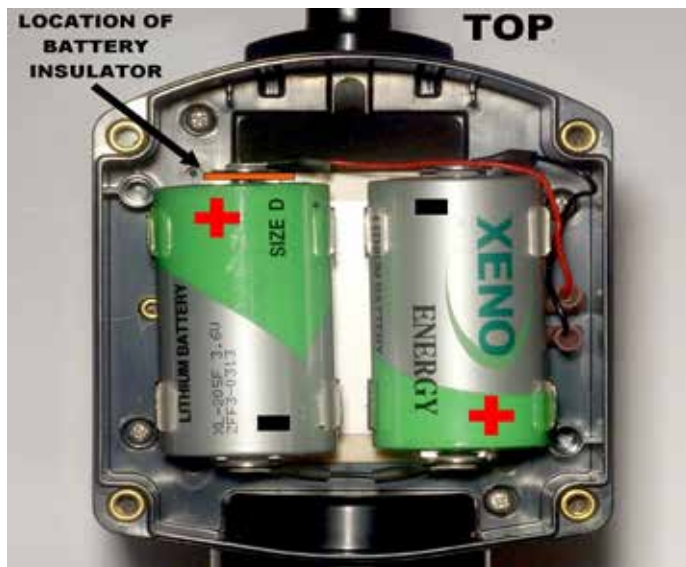


Table 25. Battery Replacement Procedure

Step	Action
1	On the rear of the WPS Series sensor, unscrew the four captive screws and remove the cover.
2	Using thumb and forefinger, carefully pry each battery out, lifting first one end, then the other. Caution! Do not scratch the battery outside covering on the sharp edges of the battery clips. Do not use sharp tools, knives, or screwdrivers.
3	Remove the old batteries and dispose of them promptly according to local regulations or the battery manufacturer's recommendations.
4	Orient two new batteries with polarity as shown in Figure 47. Battery polarity is also shown on battery holder. Insert the two new batteries one after the other into the battery clips; insert the battery negative end first, at an angle, and push down the battery into position. Repeat the same with other battery. Ensure batteries are properly seated and making contact. Caution! Do not scratch the battery outside covering on the sharp edges of the battery clips.
5	Re-install the rear sensor cover and tighten screws to 0,6 Nm \pm 0,1 Nm

⚠ WARNING

POTENTIAL ELECTROSTATIC CHARGING HAZARD

The sensor housing is made of plastic and has a surface resistivity of >1 Gohm per square. When this device is being installed care should be taken not to electrostatically charge the enclosure surface by rubbing the surface with a cloth, or cleaning the surface with a solvent.

⚠ WARNING

RISK OF DEATH OR SERIOUS INJURY FROM EXPLOSION OR FIRE

Both batteries must be the same model from the same manufacturer. Mixing old and new batteries or different manufacturers is not permitted. Use only the following 3.6 V lithium thionyl chloride (Li-SOCl₂) battery (non-rechargeable), size D. Always replace both batteries at the same time. WBT5 is Honeywell-supplied batteries for use in the WPS Series.

Recommended batteries for use are:

- XENO Energy, part number: XL-205F
- Tadiran, part number: TL-5930/S

10.3 | Replacing Antenna and Radome

10.3.1 | Tools Required

- #1 Phillips screwdriver
- Torque screwdriver with #1 bit

STOP ATTENTION

You must replace your antenna with the same type and gain, that is, straight or remote. Changing to a different antenna type is not permitted by approval agencies.

CAUTION

Take precautions against electrostatic discharge to prevent damaging the sensor module.

WARNING

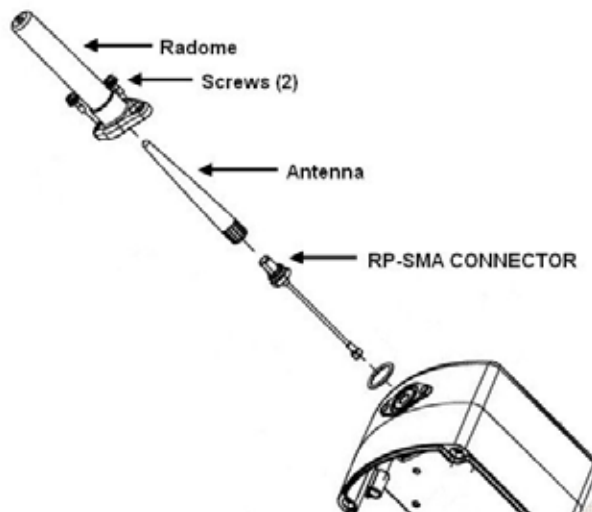
POTENTIAL ELECTROSTATIC CHARGING HAZARD

The sensor housing is made of plastic polycarbonate and has a surface resistivity of >1 Gohm per square. When this device is being installed care should be taken not to electrostatically charge the enclosure surface by rubbing the surface with a cloth, or cleaning the surface with a solvent.

Table 26. Antenna Replacement Procedure

Step	Action
1	Honeywell recommends that the sensor be removed from service and moved to a clean area before servicing. Remove the batteries (refer to Section 10.2) or disconnect the power to the device by introducing the insulator tab (Refer to Figure 35) before initiating antenna replacement.
2	Loosen the two captive screws holding the antenna radome to the sensor housing.
3	Unthread the antenna from the RP-SMA connector.
4	Inspect both antenna and sensor RP-SMA connectors for damage or debris, clean as needed.
5	Thread the new antenna's connector on to the antenna jack on the sensor housing.
6	Hand tighten antenna connector snugly by holding the antenna above the straight knurl portion. Caution! Do not overtighten antenna as it could twist in the housing and damage the antenna cable, or separate it from the R.F. board.
7	Re-install antenna radome, fastening it with two screws, and tighten screws to 0,5 Nm ±0,1 Nm. Ensure o-ring is back in place before re-installing the radome and tightening the screws.
8	Reinstate the power to the WPS device by either re-installing the batteries (refer to Section 10.2) or remove the insulator tab (see Figure 46)

Figure 48. Antenna Replacement



10.4 Software Updates

The WPS device can be loaded with software only in the factory. There is no option to upgrade to a newer software version in the field.

11 | FAULT CODES AND LINK STATUS INFO

The following fault codes may be detected by the measurement board microprocessor, and transmitted to the WMPR Receiver.

- E-1:** Electronics failure
- E-2:** Low battery warning
- E-3:** Characterization error
- E-5:** Sensor overpressure warning

Link status will be displayed on the LCD as:

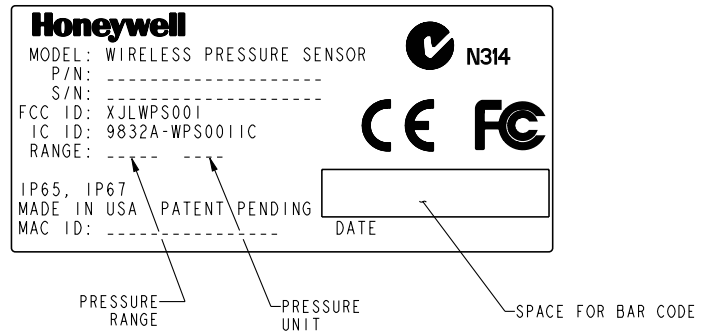
“BEST”, “GOOD”, “BAD”, “POOR”, “NoRF”

A complete description of all fault codes and link status labels, along with recommended action, may be found in Section 9.2, PV Display, in this document.

12 | AGENCY LABEL INFORMATION

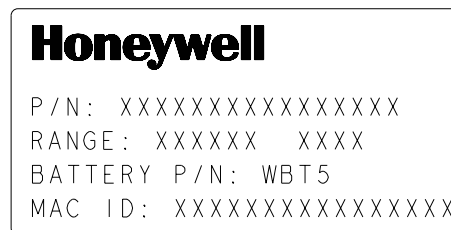
The following information shall be clearly and permanently labeled on the WPS Series sensor

12.1 External FCC/IC Labels



12.2 Internal Labels

This label is applied in the battery compartment of the product.











Installation and Technical Manual for the Limitless™ Wireless Pressure Sensor, WPS Series

ISSUE 1 **32305925**

13 | ACCESSORIES

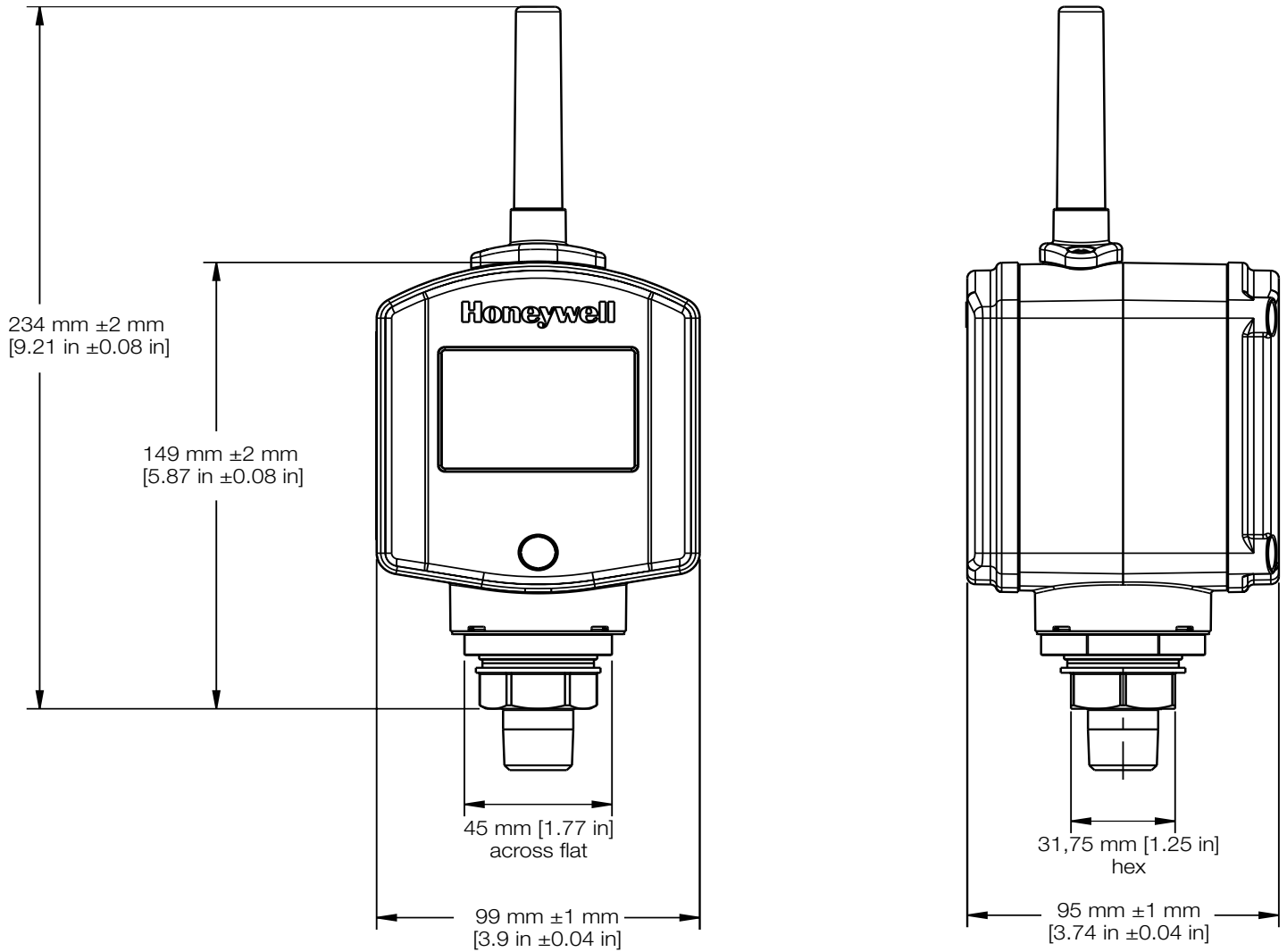
Table 27. Limitless™ Antennas

	Part Number	Antenna Type Code (if ordered with a wireless switch)		Antenna Design	Antenna Gain (dBi)	Connector/ Mounting	Dimensions
	WAN03RSP	03		flat	3.0	RP-SMA plug/adhesive mount	Ø 7,87 mm x 22,1 mm W x 4,57 mm D [Ø 0.31 in x 0.87 in W x 0.18 in D] 3 m [9 ft] cable
	WAN04RSP*	04** with a WAMM100RSP-005 base with 1,52 m [5 ft] of cable	05** with a WAMM100RSP-010 base with 3,05 m [10 ft] of cable	tilt/swivel	5.5	RP-SMA plug/direct mount	Ø 12,7 mm x 208,28 mm L [Ø 0.50 in x 8.20 in L]
	WAN05RSP*	06** with a WAMM100RSP-005 base with 1,52 m [5 ft] of cable	07** with a WAMM100RSP-010 base with 3,05 m [10 ft] of cable	tilt/swivel	9.0	RP-SMA plug/direct mount	Ø 12,7 mm x 384,05 mm L [Ø 0.50 in x 15.12 in L]
	WAN06RNJ*	08** with a WCA200RNPRSP-002 coax cable assembly 0,682 m [2 ft]	09** with a WCA200RNPRSP-010 coax cable assembly 3,05 m [10 ft]	straight	8.0	RP-N jack/ bracket	Ø 33,5 mm x 427,9 mm L [Ø 1.32 in x 16.85 in L]
	WAN09RSP	-		low profile mobile	3.0	RP-SMA plug/magnetic	Ø 76,2 mm x 115 mm L [Ø 3.0 in x 4.54 in L] 4,57 m [15 ft] cable
	WAN10RSP	-		straight	5.0	RP-SMA plug/magnetic	Ø 76,2 mm x 230,1 mm L [Ø 3.0 in x 9.06 in L] 1,52 m [5 ft] cable
	WAN11RSP*	-		low profile mobile dome	4.0	RP-SMA plug/thru- hole screw	Ø 39 mm x 42,4 mm L [Ø 1.54 in x 1.67 in L]
	WAN12RSP	-		straight	2.0	RP-SMA plug/direct mount	Ø 10 mm x 79,5 mm L [Ø 0.39 in x 3.13 in L]

* Not allowed for use with Country Use Code "B" Limitless™ products

14 | INSTALLATION DRAWING

Figure 49. Dimensions of Limitless™ Wireless Pressure Sensor, WPS Series



Installation and Technical Manual for the **Limitless™ Wireless Pressure Sensor, WPS Series**

ISSUE 1 **32305925**

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

Notices and Trademarks

While this information is presented in good faith and believed to be accurate, Honeywell disclaims the implied warranties of merchantability and fitness for a particular purpose and makes no express warranties except as may be stated in its written agreement with and for its customers.

In no event is Honeywell liable to anyone for any indirect, special or consequential damages. The information and specifications in this document are subject to change without notice.

Honeywell is a registered trademarks of Honeywell International Inc.

Other brand or product names are trademarks of their respective owners.

SALES AND SERVICE

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

E-mail: info.sc@honeywell.com
Internet: sensing.honeywell.com

Phone and Fax:

Asia Pacific	+65 6355-2828 +65 6445-3033 Fax
Europe	+44 (0) 1698 481481 +44 (0) 1698 481676 Fax
Latin America	+1-305-805-8188 +1-305-883-8257 Fax
USA/Canada	+1-800-537-6945 +1-815-235-6847 +1-815-235-6545 Fax

Sensing and Productivity Solutions
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422
sensing.honeywell.com



50095583-1-EN IL50 GLO Printed in USA.

September 2015

© 2015 Honeywell International Inc. All rights reserved.
Hastelloy® is the registered trademark of Haynes International, Inc.
COAX-SEAL® is the registered trademark of Universal Electronics.
Bluetooth® is the registered trademark of Bluetooth SIG
Scotch® is the registered trademark of 3M.