Installation Guide

Keysight N6841A RF Sensor

KEYSIGHT TECHNOLOGIES

Notices

Manual Part Number

N6841-90002

Edition

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Version History

Version	Summary of Change	Written by	Date
This edition 1.0	Initial version	R. Shen	1 Sep 2014
1.01	Added shielded Ethernet cable	R. Shen	1 Sep 2015

Content

1 Overview

The N6841A RF Sensor provides an extremely cost effective way to improve spectral awareness. The RF Sensor is enclosed in a weatherproof case allowing wide area, close-proximity signal monitoring, detection and location in any environment. Its open programming interface allows users to dynamically link to a wide range of software applications. An Ethernet TCP/IP network connection allows for remote deployment of a network of multiple sensors within a single room, throughout a city, or across the world. This document discusses the physical installation of the RF Sensor.

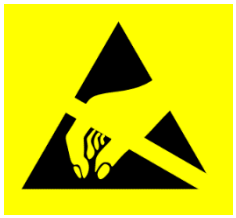
The table below lists other manuals pertinent to the N6841A RF Sensor.

Part Number	Title	Publication Date
N6841-90000	N6841A Quick Install Guide	Sep 2014
N6851-90001	RF Sensor Software User Guide	Sep 2014
N6854-90000	Geolocation Server User Guide	Sep 2014
	Application Programming Overview	Sep 2014
N6851-90004	System Planning Tool User Guide	Sep 2014

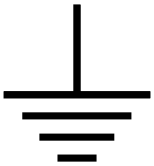
2 Important Safety Instructions

Be aware of these safety symbols found on the RF Sensor and in the RF Sensor documents:

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.



The hand within a triangle and crossed by a bar is intended to alert the user to the hazard of electrostatic discharge. Use the proper preventative measures, including grounding yourself, before working with the RF Sensor.



The grounding symbol shows the location on the RF Sensor where all cable grounds must terminate and an earth ground must be connected.

Caution:

- Read these instructions.
- Follow all instructions in this manual.
- Heed all warnings.
- Do not defeat the safety purpose of grounding.
- Keep a copy of these instructions.
- Use the RF Sensor only as specified in these manuals.

2.1 Servicing Information

Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damage in any way, such as when an antenna cable or Ethernet cable or connector is damaged, the unit has dropped from height, the receiver’s casing has been opened, or the device does not operate normally.

2.2 Regulatory Information

All Keysight Technologies Inc. devices are designed to be compliant with rules and regulations in locations they are sold and will be labeled as required. Any changes or modifications to Keysight equipment, not expressly approved by Keysight, could void the user's authority to operate the equipment.

When Keysight devices are professionally installed, the Radio Frequency Output Power will not exceed the maximum allowable limit for the country of operation.

Unauthorized modifications or attachments could cause equipment damage and may violate regulations.

3 The RF Sensor at a Glance

Below are the RF Sensor's physical, electrical, and data characteristics.

Physical	
Dimensions	Width: 291.80mm Height: 245.73 mm (casing only) 268.93 mm (casing and connectors) Depth: 53.70 mm
Housing	Aluminum Case
Weight	3.7 kg (8.2 lbs)
Rack Mounting	½ width 19 inch rack 2U height (requires additional air flow for cooling)
Environmental	
Temperature	-15°C to 55°C (Operating not in direct sunlight),
Humidity	15% to 95% Non-condensing
Altitude	21000 feet/6096 m @50°C (Operating)
Wind Loading	Max 158 N (35.6 lbs) @ 160 kph (100 mph)
Electrostatic Discharge	15kV (air) @ 50% rh, 8kV (contact) @ 50% r
Enclosure Rating	IP67 (for ingress of dust & water)
Electrical	
Operating Voltage	15–24Vdc (Nominal)
Power Consumption	25 Watts (Nominal), 30 Watts (Maximum)
Optional Power Supply	
Input Voltage	90 to 264 Vrms at 50/60 Hz
Rated Output Voltage	15 VDC (Nominal) @ 4 amps
Antenna Specifications	
RF Inputs	2 Type N (50 Ω) electronically switched inputs (for diversity or multi-band antennas)

CAUTION	Never exceed +20 dBm input on RF Inputs. Never exceed 24VDC+20% on DC Power Input Connector.

4 Preparing for Installation

The N6841A RF Sensor must be installed by a trained professional or systems integrator who is familiar with RF planning issues and regulatory limits defined by the governing body of the country in which the unit will be installed. This section lists the required equipment and model numbers and explains how to prepare the installation site.

WARNING To ensure safe and durable wiring, installation of the Minnow Receiver must follow appropriate electrical and building codes. Follow the National Electrical Code (NEC) requirements, unless local codes in your area take precedence over the NEC code.

4.1 What's in the Package

What is included in the package:

- N6841A RF Sensor
- Mounting bracket kit
- Ethernet LAN cable weatherproof boot
- Ethernet connectors
- Certificate of compliance
- Quick Install Procedure
- Software CD
- GPS antenna (optional)
- GPS antenna Cable (optional)
- Power connector (optional)
- Power cable weatherproof connector
- +15VDC power supply (optional)

4.1.1 Power Supply

The N6841A RF Sensor can come with an optional indoor AC power supply and may only be used for indoor sensor installations. The power supply is Keysight PN N6841-64501. This power supply has a 1.8 meter (6 foot), country-specific AC cord. Additionally, the power supply has a 1.8 meter (6 foot) DC power cord. Therefore, the RF Sensor site must have a mains connection within 3.8 meters (12 feet).

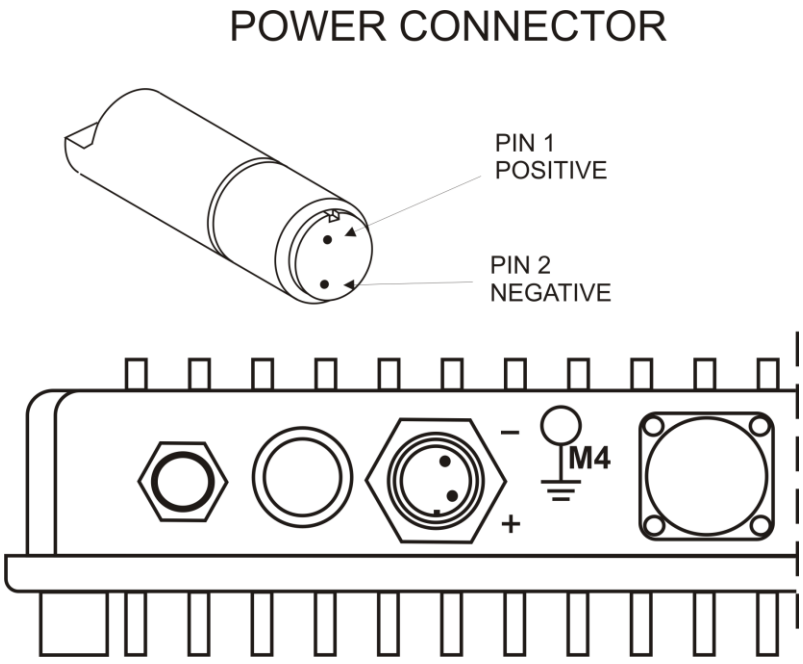
WARNING: The optional power supply, PN N6841-64501 is for indoor use only, and may only be used when the RF Sensor is indoors.

If your installation is not using the optional indoor power supply:

- Use a power supply with appropriate voltage, current and environmental ratings.
- Use a power cable with appropriate environmental ratings, and with conductors properly sized for the length of run, to ensure the voltage at the sensor is not below the minimum 15V.
- Use a power supply with the safety agency approvals for your location.

The provided connector has solder cups, and will work for up to 16 AWG wire size, and an outside cable diameter of .22-.25 inch (5.6-6.3 mm).

The following illustration shows the polarity of the power connector plug and the connection on the RF Sensor casing. The connector is a Switchcraft SF6382-2SG-520.



4.1.2 Mounting Kit

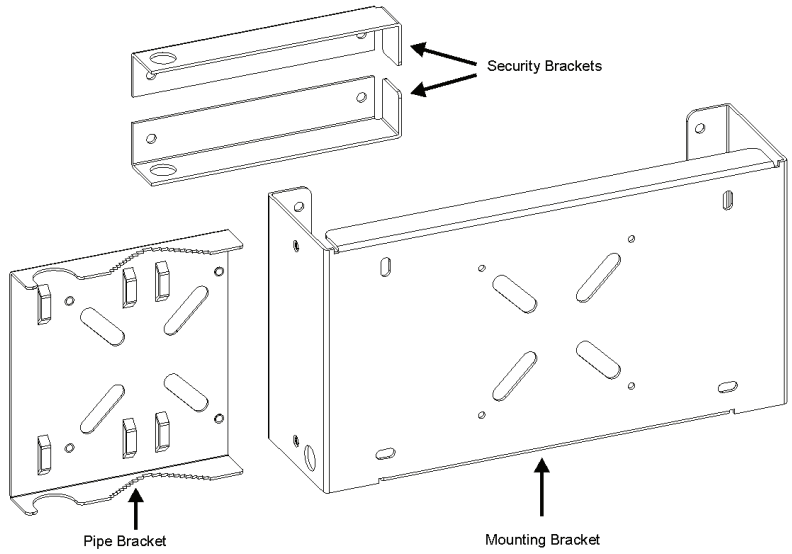
The N6841A RF Sensor comes with a mounting kit that allows it to be installed in both indoor and outdoor locations. Included in the kit are:

Mounting Bracket—Used by itself, this bracket allows the Sensor to be wall mounted.

WARNING The installer is responsible to ensure the wall attachment can support 15 kg or more.

Pipe Bracket—Connected to the Mounting Bracket, the Pipe Bracket allows the Sensor to be mounted on a either a horizontal or vertical pipe. To mount the sensor to a pipe with a diameter equal to or less than 60mm (2 3/8 inches), use a U-bolt of the appropriate size. To mount the sensor to a pipe with a diameter greater than 60mm (2 3/8 inches), use a hose clamps of the appropriate size.

Security Brackets—Connected to the Sensor, they allow the Sensor to be secured to the Mounting Bracket with padlocks. These brackets also bear the weight of the Sensor while the final screws are installed.



4.2 Site Survey

Due to variations in component configuration, placement, and physical environment, each installation is unique. Before installing the Minnow Receiver, perform a site survey to determine the optimum placement of units for maximum range, coverage, and network performance. Consider also the availability of power and network connections. Consider the following factors when performing a site survey:

- Antenna type and placement—Proper antenna configuration is a critical factor in maximizing radio range. As a general rule, range increases in proportion to gain and antenna height measured from the ground.

- Availability of power—The N6841A can come with a 15—24 VDC indoor power supply. A user-supplied 24 VDC Class 2 or LPS rated power supply is required for longer runs. Ensure that there is a mains connection close enough for the power supply.

- Ethernet connection—The N6841A comes with a waterproof Ethernet cable connector housing and Ethernet connectors. The customer must supply a standard Ethernet (Cat5) cable.

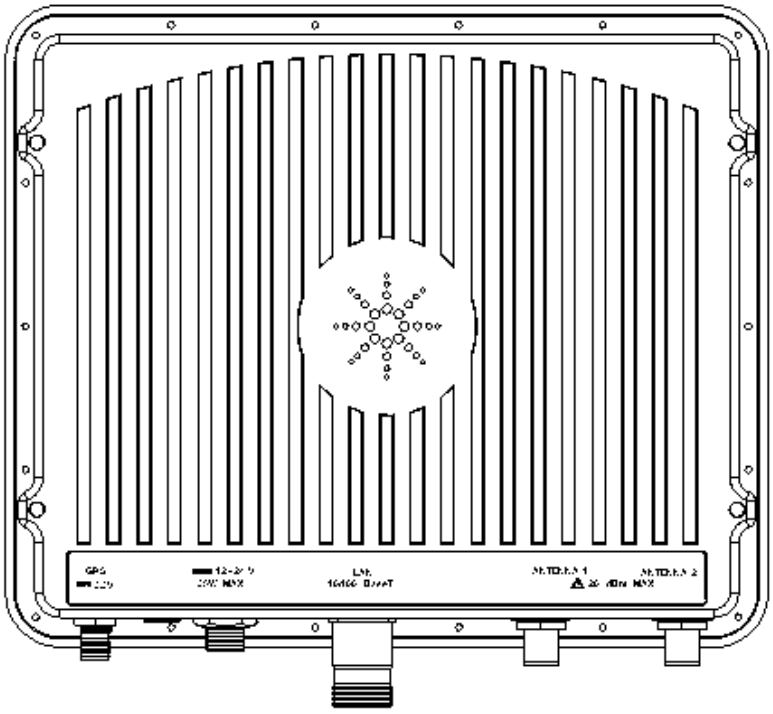
4.3 Tool List

To install the Minnow Receiver, you will need the following tools.

- 10 mm box wrench.
- #2 Pozidrive or Phillips screwdriver (for the ground screw.)
- Wall mounting only: the appropriate connectors for the specific wall type.
- Wood pole mounting only: two 5/8-inch diameter, 3-inch long lag bolts
- Tower mounting only: supply stainless or galvanized steel channel stock and 1/2-inch or 5/8-inch nuts, bolts, and washers to connect to the tower arm.

4.4 Mounting Strategies

The Minnow RF Receiver is designed to be mounted either indoors or outdoors, on a wall or a vertical or horizontal pipe or strut. The Minnow Receiver is installed in the position shown in Figure 1. Note that the unit is installed so that the antenna and LAN connectors are positioned facing down.



When choosing mounting locations, consider the available mounting structures and unit clearance. The Minnow Receiver should always be mounted with the top of the unit horizontal and level, and with the antenna and internet connectors facing downward.

The user should supply shielding in hot climates if the unit is to be mounted where it will receive direct sunlight.

You must provide clearance room for transient arrestors, grounding connections, and airflow.

WARNING

Do not impede convection airflow around the product. Do not stack units flat on top of each other without space for airflow. Do not enclose the unit in a container, such as a box or backpack, without providing active cooling.

Enclosing or covering the unit without adequate ventilation will lead to high temperatures and create the possibility of burn hazards.

5 Mounting Instructions

This section describes the steps needed to install the RF Sensor in various locations.

NOTE Before you install an RF Sensor, make a note of the Sensor's serial number (located on the lower front of the housing, near the LAN connector). This is especially helpful if you are installing the RF Sensor so that the serial number plate is hidden or obscured in the final installation.

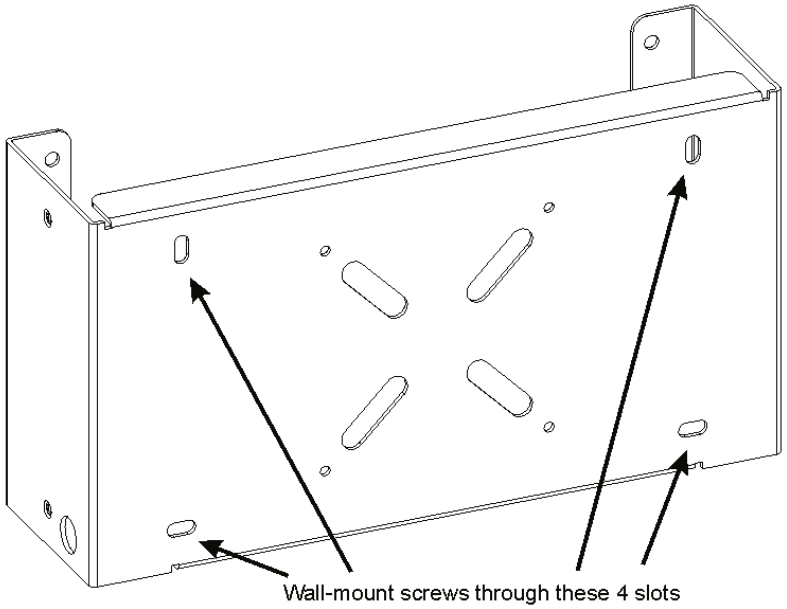
5.1 Wall Mounting Instructions

To install the RF Sensor to a wall, use the following steps:

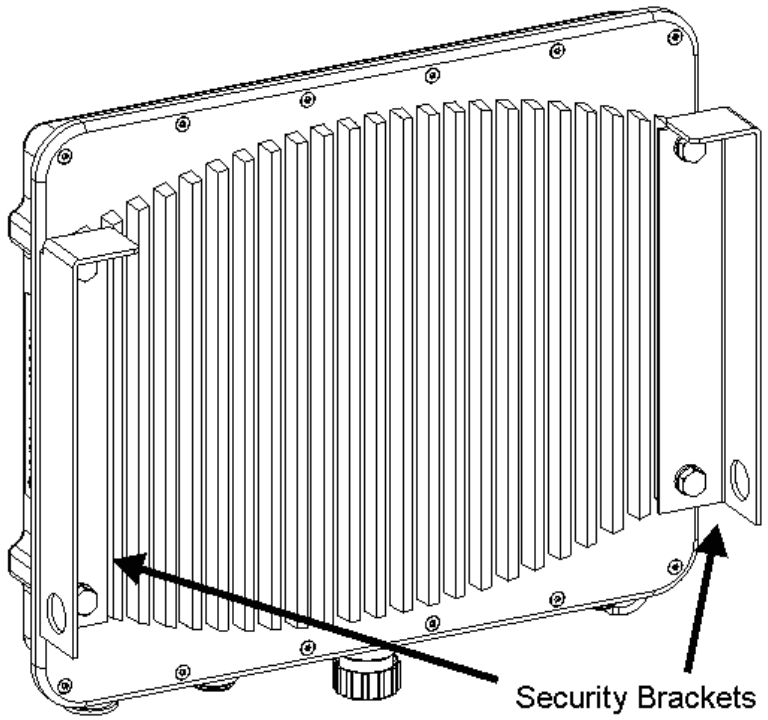
1. Place the base bracket of the Mounting Kit against the wall at the desired location.

2. Mount the base bracket to the wall with the appropriate customer-supplied screws and washers. Use the four mounting screw holes on the base bracket. These slotted holes accept screws up to 6.3mm (1/4 inch).

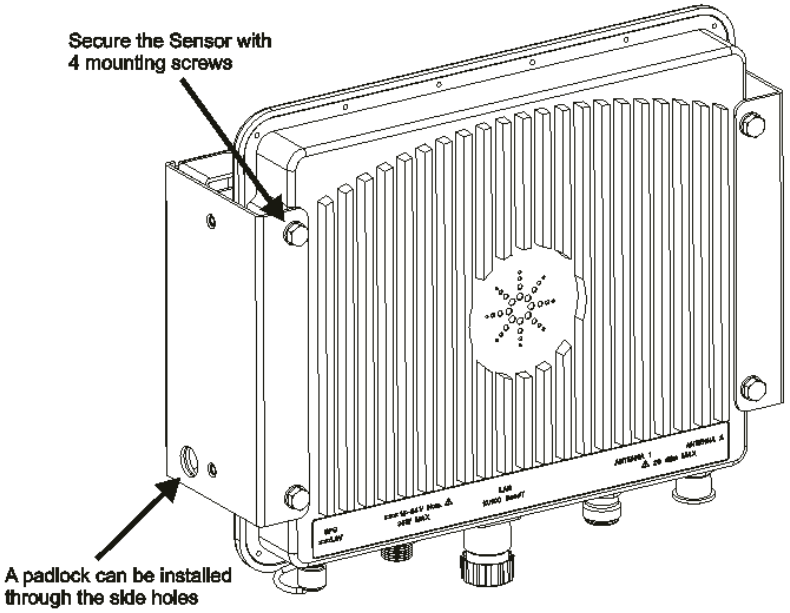
WARNING Use appropriate mounting hardware for the type of wall in use. Hardware and mounting method must be capable of supporting 15 kg (33 lbs) plus the weight of cables and accessories.



3. Secure left and right security brackets to the Sensor housing with four each of the M6 screws, flat washers, and lock washers included in the Mounting Kit. Install the brackets as shown so that the open side faces towards the unit's bottom (towards the power and antenna connectors.)



4. Gently slide the Sensor into the mounting bracket until the left and right security brackets rest on the main brackets.



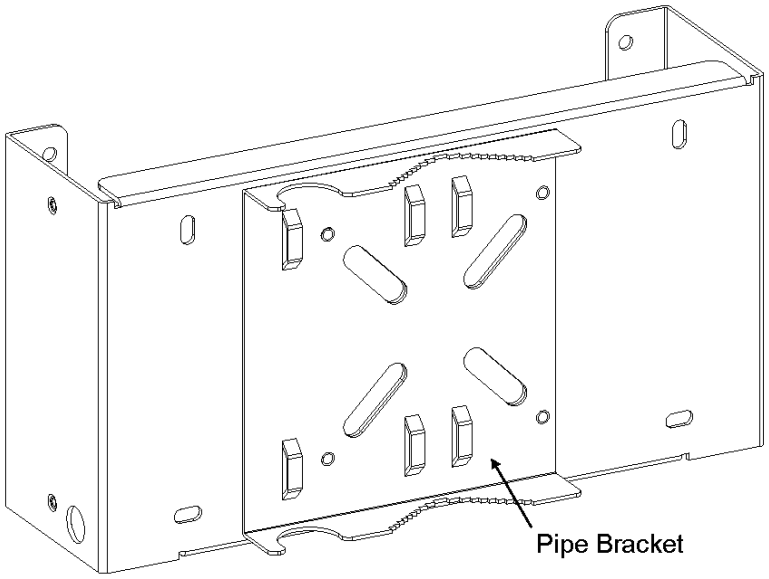
5. Secure the Sensor with four each of the M6 screws, flat washers, and lock washers included in the Mounting Kit.

6. If desired, insert a padlock through the Mounting Bracket's side holes to secure the Sensor.

5.2 Pole and Tower Mounting Instructions

To mount the RF Sensor to a pipe, use the following steps:

1. Place the pipe bracket to the Mounting Bracket, placing the four pipe bracket studs through the proper holes in the Mounting Bracket.

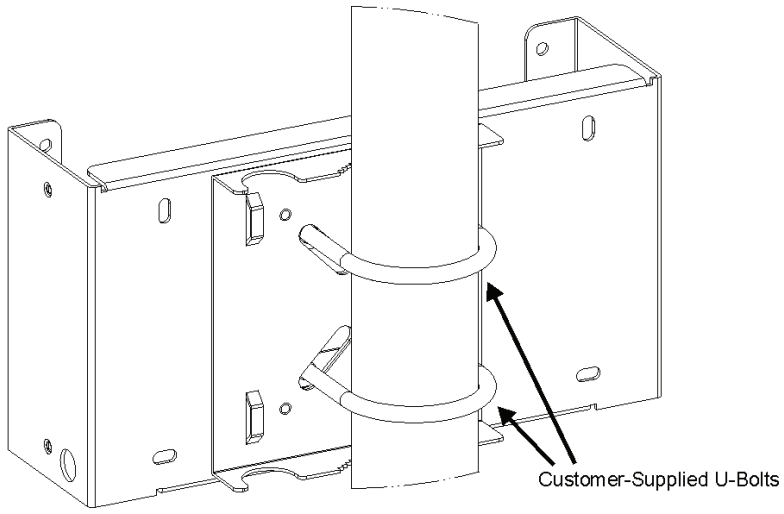


Note that the illustration shows the pipe bracket installed for a vertical pipe mount, but the pipe bracket can be rotated 90 degrees and installed so that the sensor can be mounted on a horizontal pipe.

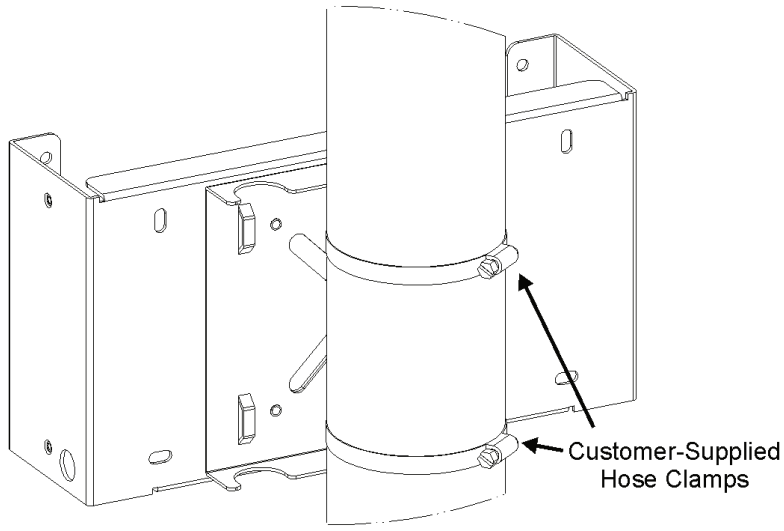
2. Secure the pipe bracket to the Sensor Mounting Bracket using 4 M4 lock nuts.

WARNING The pole, tower, or pipe must be anchored and capable of supporting 15 kg (33 lbs) plus the weight of cables and accessories.

3. To mount to a pipe smaller than 60mm (2 3/8 inches), mount bracket to pipe using customer-supplied U-bolts and backing plates.



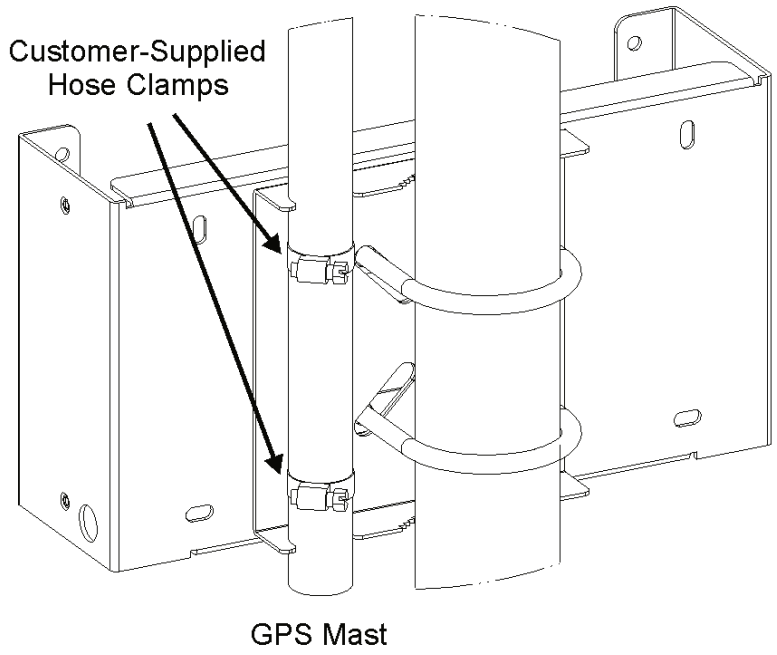
To mount to a pipe larger than 60mm (2 3/8 inches), mount bracket to pipe using customer-supplied hose clamps. Pass the clamps through the raised slots on the pipe mounting bracket and around the pipe.



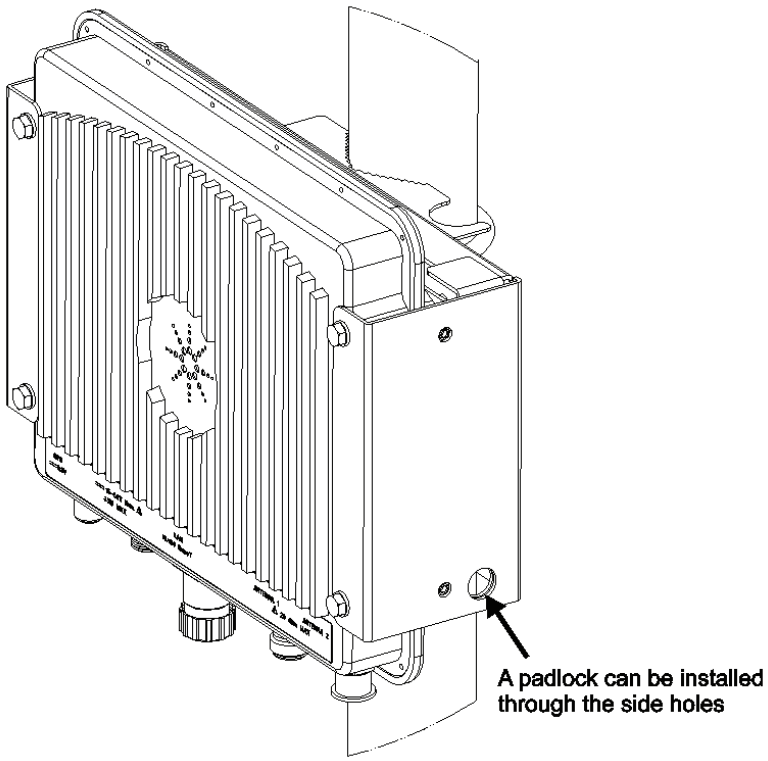
4. To add and optional GPS mast, secure the mast to the notch on the pipe bracket using customer-supplied hose clamps. The notch fits a 26 mm (1.05 inch) diameter pipe (3/4 inch nominal.)

NOTE

The GPS mast can be attached with the pipe bracket only if the mounting pipe is vertical. It you are mounting the Sensor to a horizontal pipe; some other method must be used to mount the GPS mast.



5. Gently lower the Sensor into the mounting bracket until the left and right security brackets rest on the Mounting Bracket.



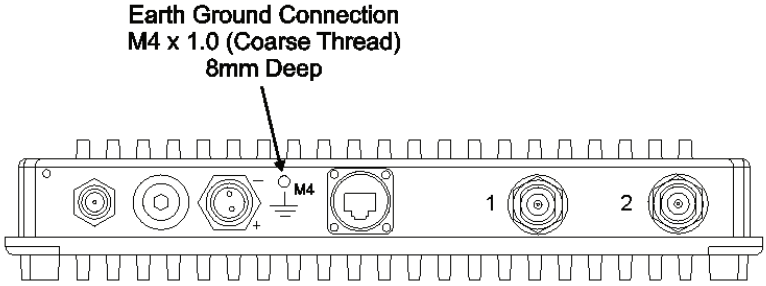
6. Secure the sensor with four M6 screws, flat washers, and lock washers.

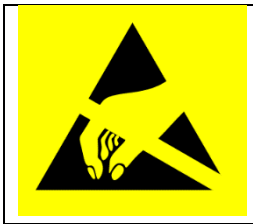
7. If desired, insert a padlock through the Mounting Bracket's side holes to secure the Sensor.

5.3 Installing the Antenna Cables

Refer to the instructions that are provided with the antenna. In all cases, install in a manner consistent with good practices and local electrical codes.

Ground all antenna connections to the Sensor's ground connection point, shown in the following illustration.



	4kV of ESD protection is provided for bare antenna connections. Protecting bare antennas from human touch and other ESD sources will improve reliability.
	Transient arrestors are required when the antennas are mounted outdoors, or when the system is potentially subject to lightning surges. (Hyperlink Technologies AL6-NMNFB-9 or equivalent.)

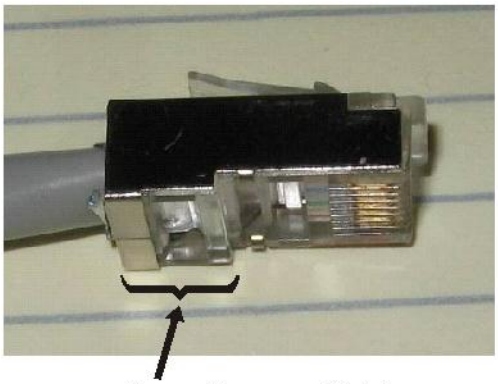
5.4 Preparing the Ethernet Cable

The RF Sensor uses Ethernet to communicate to a PC.

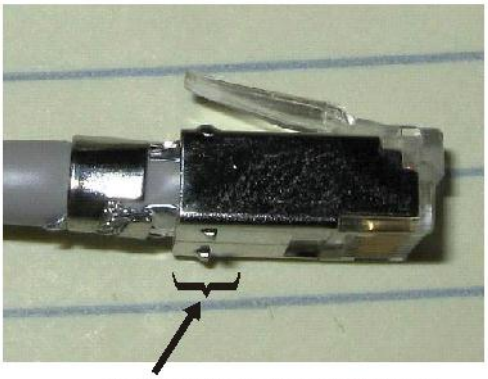
The RF Receiver's Ethernet connector will accept any standard 8P8C (RJ45) plug. We recommend a shielded cable to prevent excessive emissions from the cable.

To use the weatherproof boot in outdoor installations, the RF Receiver end of the Ethernet cable must use a connector that does not have a bump, flange, or tabs in the crimp section.

The illustration below shows an incompatible RJ45 plug and a compatible RJ45 plug.



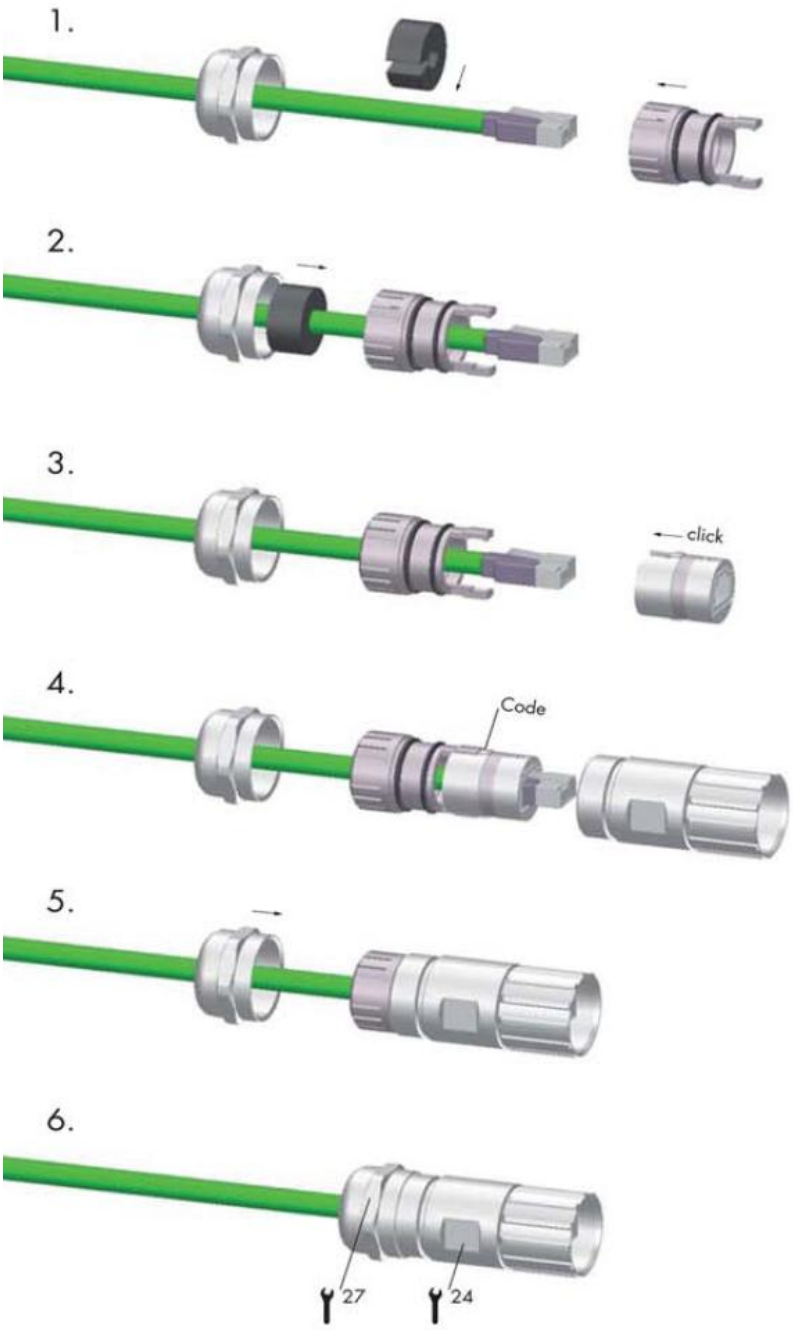
Bump (Incompatible)



Tangs (Flatten with Pliers)

The following illustrations show how to install the Ethernet connector's waterproof boot.

Assemble the weatherproof boot as shown in the following illustration:


1.
2.
3.
click
4.
Code
5.
6.
27
24

Installing the RF Sensor Software

The software to operate the Keysight RF Sensor is provided on the software DVD included in the RF Sensor package. The software consists of:

SMT—the Sensor Management Tool allows you to verify a sensor's status, configure a sensor, reboot a sensor, and launch sensor programs. The SMT communicates with a server using the SMS.

SMS—the Sensor Management Server handles requests from the SMT and maintains a database entry for every sensor it manages.

SAL—the Sensor Access Library, an API allowing you to include sensor access calls in user-written programs.

N6841A to KML- This tool enables porting geolcation results to a KML viewer such as Google Earth ™.

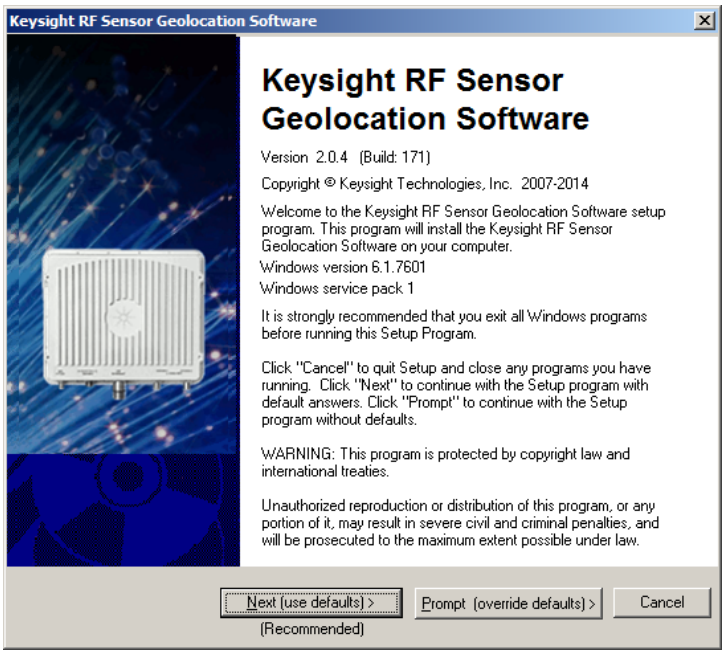
System Planning and Optimization Tool – This tool aids in planning where to place sensors and to predict coverage range depending on signal power, format, antenna type, cables and preamplifier characteristics, as well as sensor sensitivity.

The software is designed to operate on Microsoft Windows XP and Windows 7 (both 32 and 64 bit) operating systems.

To install the RF Sensor Software, use the following steps:

1. Place the DVD in the DVD drive of the laptop or workstation that you will use to control the sensor.

2. If the PC has the autorun option enabled, the software installation program starts automatically. If the autorun option is disabled, from the DVD drive, run the program \winnt\setup.exe.



3. Click the “Next (use defaults)” button to continue the installation.

4. Review the license agreements and select “AGREE” to proceed. There are separate agreements for the Keysight and Mathworks software.

5. In addition to SMS/SMT, this installer installs seven third party tools. The automatic process assumes these installers install without a problem, and in many cases, if there is a problem the process indicates which installer had the problem. These installers are found in the installer under the folders “Java”, “MATLAB”, and “Microsoft”, and can be re-run individually if there are problems. The third party tools installed are:

    a. Oracle Java 1.6, service pack 33: “jre-6u33-windows-i568.exe”

    b. Microsoft Visual Studio C++ 2005 Redistributable: “vcredist_x86_vs2005.exe”

    c. Microsoft Visual Studio C++ 2010 32 bit Redistributable: “vcredist_x86_vs2010.exe”

    d. Microsoft Visual Studio C++ 2010 64 bit Redistributable: “vcredist_x64_vs2010.exe”

    e. Microsoft .NET2.0: “dotnetfx20.exe”

    f. Microsoft .NET4.0: “dotnetfx40.exe”

    g. The Mathworks MATLAB Runtime redistributable: “MCRInstaller.exe”

Depending on the operating system you are using and what of the runtime libraries are already installed, a different number of re-boots will be required. For Windows XP, up to three reboots maybe required.

When the installation process is complete, verify that the program appears in the Windows Start menu.

7 Verifying the operation of the RF Sensor

Because the Keysight RF Sensor has no external switches, lights, or other indicators, there are two methods to ensure that the sensor is correctly completing the power-up sequence. These two methods, the Power-on self test and the Sensor Management Tool are described below.

7.1 Power-On Self Test

When power is applied to the Keysight RF Sensor, it performs a quick test of some of its major functions. If the sensor fails one of the self-tests, it emits a set of audible beeps, indicating which test the sensor failed. The tests are:

- PCI test—If the sensor fails this test, it emits one long beep.
- Capture SDRAM test—This test performs a quick write/read test of the sensor's capture SDRAM. If the sensor fails this test, it emits two long beeps.
- LO Unlock test—This test verifies that all the LO oscillators can sweep through their tuning ranges without unlock. If the sensor fails this test, the sensor emits four long beeps.

7.2 Verifying Operation Using the SMT

The SMT was designed to control Keysight RF Sensors, and so it provides the best verification that a sensor is operating. For more complete information on using the RF Sensor Software, refer to the manual *RF Sensor Software User Guide*.

This method of connecting to the RF sensor requires either a Ethernet crossover cable or a Ethernet hub or switch.

1. Using an Ethernet cable, connect the sensor directly to the workstation or laptop on which you have installed the RF Sensor software.

   Or, connect to the sensor to the workstation or laptop using an Ethernet hub or switch.

2. Start your copy of SMT.
3. If necessary, set the SMS preferences to "localhost."

NOTE While connected to an RF Sensor directly you cannot launch Surveyor or block tools.

4. Click on the Configuration icon.
5. Select the Discover Sensors tab on the right hand side of the window.
6. At the bottom of the window, click the "Find Available Sensors" button.
7. The sensor's information, including its IP address, is displayed in the Discovered Sensor list.

8 Maintaining the RF Sensor

The RF Sensor is designed to be very low maintenance. The Sensor has no user-serviceable components; nor does it have any physically accessible adjustments. Do not open the sensor case.

To maintain the RF sensor, it should be checked occasionally to verify that it has not accumulated excessive dust, dirt, or sand. It should be cleaned of any bird droppings with a damp cloth. Ensure that the cooling fins are not blocked by twigs or wind-borne debris.

	Do not clean the RF Sensor with pressurized water.

If an AC power supply cord requires replacement, only use a cord rated for the proper voltage and current, and one that has a safety agency approval mark appropriate for the country of installation. Contact Keysight Technologies for a suitable replacement cord set.

9 Java Update Problems

9.1 Symptoms

If your SMS and SMT have been working fine, but you update Java while SMS and/or SMT is running, in many cases, the Java update will not update completely, leaving you with a broken Java. In this state SMS and SMT will not work.

9.2 Recommend Procedure to fix broken Java

If you did not stop SMS before running the Java update, you now have a broken Java installation. The recommended fix is to manually re-run the java 6 update 33 installer, while SMS is stopped. This will fix Java, and keep it up to date.

http://www.oracle.com/technetwork/java/javase/downloads/jre6-downloads-1637595.html

1. Get the Windows x86 Offline jre-6u33-windows-i586.exe (XP or other 32 bit windows OS)
2. Save to local disk
3. Close browsers
4. Stop SMT and SMS (these probably are not running anyway)
5. Run jre-6u33 installer
    a. When prompted “This software has already been installed on your computer. Would you like to reinstall it?”
    b. Select ‘Yes’

9.3 Recommend Java Update Procedure

We recommend you stop the SMS service, as well as SMT prior to accepting any Java updates. To stop the SMS service go to:

- Right click on “my computer”
- Select Manage
- Expand Services and Applications
- Select Services
- Select Keysight SMS
- Select “Stop” the service
- When done updating Java
- Select “Start” the service for Keysight SMS.

(This can also be done from the command line) Run CMD as Administrator

- CMD:
- C: sc start KeysightSMS
- You will get a message with State : 1 Stopped

```
C:\Windows\System32>sc stop KeysightSMS

SERVICE_NAME: KeysightSMS
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 1  STOPPED
        WIN32_EXIT_CODE    : 0  (0x0)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0

C:\Windows\System32>sc start KeysightSMS

SERVICE_NAME: KeysightSMS
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 2  START_PENDING
                               (NOT_STOPPABLE, NOT_PAUSABLE, IGNORES_SHUTDOWN)
        WIN32_EXIT_CODE    : 0  (0x0)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x1
        WAIT_HINT          : 0xbb8
        PID                : 7396
        FLAGS              :

C:\Windows\System32>
```

After installing the Java update, go back and start the service

- C: sc start KeysightSMS

Note this command is case sensitive.

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