Spectrum®
Technologies, Inc.
"To Measure Is To Know"

WatchDog® Retriever & Pup Wireless Network Product Manual

INTRODUCTION

Thank you for purchasing a WatchDog Retriever & Pups Wireless Sensor Network. The WatchDog Retriever & Pups Wireless Sensor Network is a technologically advanced solution that provides growers the ability to capture real-time, site-specific data in various micro-climates.

The Wireless Network consists of one Retriever and many Pups. There are four types of Pups: 3000 Pups, Sensor Pups, Station Pups, and Repeater Pups. Each Sensor Pup within the network is compatible with a diverse number of sensors and offers flexibility by allowing the grower to monitor the sensor inputs they care about in the locations they care about. Station Pups are compatible with WatchDog 2000 Series Weather & Mini Stations and offer the ability to plug in and transmit the full data set to the end receiver along with data from other Sensor Pups across the growing environment. Repeater Pups do not have sensor inputs. They can be used to provide additional paths to extend the network.
All data acquired by the Pups is transmitted back to the Retriever—the central point that collects, logs, and transmits the data.

The communication options are cellular modem, Wi-Fi, direct connection to PC, and USB flash drive. Communication options allow for automatic upload of the data to a computer or the web for further analysis.
Growers can monitor their crops on their computer or smartphone and make real-time decisions that improve yield and quality, conserve resources, and increase profits.

TABLE OF CONTENTS

This manual will familiarize you with the features and operation of your new WatchDog Retriever & Pups Wireless Network. Please read this manual thoroughly before launching the units.

For customer support or to place an order, call Spectrum Technologies, Inc. at 800-248-8873 or 815-436-4440, FAX at 815-436-4460, or e-mail at info@specmeters.com.

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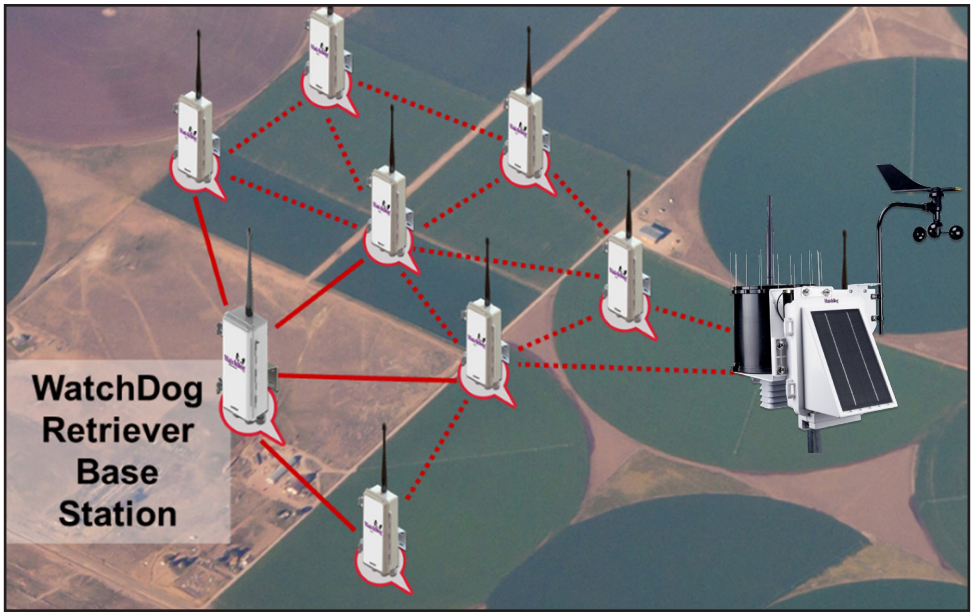
GENERAL OVERVIEW

Wireless Mesh Network

The Retriever & Pups wireless sensor network uses a mesh style of communication, which allows any Pup within the network to wirelessly route data from another Pup back to the Retriever. The size of a network can vary by growing conditions, topography, and user preference. The mesh network is constrained to a maximum number of 12 Pups per network at a distance of 2500 ft (about ½ mile or ¾ kilometer), or less between Pups, with no more than four hops back to the Retriever for the most remote Pups.

Pups have the ability to send their sensor data to the Retriever within minutes of measurement. The data can be sent directly to the Retriever, which logs the sensor data, or hopping via other Pups within the mesh network. All Retriever and Pup units are time synchronized. Because of this, the entire wireless network can 'go to sleep' for periods of time to conserve battery life. When the network 'wakes up', the Pups all communicate to the Retriever and share any sensor data they have recorded while the network was sleeping.



Components

The mesh network is made up of one Retriever and a user-defined number of Pups. 868 MHz, 900 MHz, and 2.4 GHz radios are available. Item number designations in following table.

Device Type	868MHz	900MHz	2.4GHz
Sensor Pup	3930	3900	3905
Station Pup*	3931	3901	3906
Repeater Pup	3932	3902	3907
Retriever (Regular)	3912, 3912T	3910, 3910T	3911, 3911T
Retriever (Solar)	3912S	3910S	3911S
ET Pup Station	3930ET	3900ET	3905ET
Weather Station Pup	3930WS	3900WS	3905WS
Plant Disease Pup	3930PD	3900PD	3905PD
Plant Growth Pup	3930PG	3900PG	3905PG
3000 Pup Stations	32(X)0DU	32(X)0DE	NA

*Requires firmware: Weather Station ≥ v7.6 (2800 - v3.5), Mini Station ≥ v4.1

Device Description

Retriever: Receives data from the Pup network and communicates the data via DataScout Modem (sold separately), USB flash drive, or PC connection. The Retriever can use batteries, DC power supply or solar power.
Sensor Pup: Connects 4 sensor inputs. Transmits data to Retriever.
Station Pup: Connects to a WatchDog 2000 Series full or mini weather station.
Repeater Pup: Has no sensor inputs. Serves as a hopping node to extend range or to bypass obstacles.
ET Pup: Measures rain, temperature/RH, solar radiation, and wind speed/direction. No additional sensor ports.
Weather Station Pup: Measures rain, temperature/RH, and wind speed/direction. One additional sensor port.
Plant Disease Pup: Measures rain, temperature/RH, and leaf wetness. One additional sensor port.
Plant Growth Pup: Measures PAR light and temperature/RH with as-pirated radiation shield. Two additional sensor ports.
3000 Pup: Measures rain, temperature/RH, solar radiation, and wind speed/direction. No additional sensor ports.

Device	Temp/RH	Rain	Wind	Light	Ports
Plant Growth Pup	X			PAR	2
3000 Rain Station	X	X			2
3000 Plant Growth Station	X			PAR	1
3000 Weather Station	X	X	X		2
3000 ET Station	X	X	X	Solar	1

EXTERNAL PORTS

Retriever

The Retriever ports are identified in Figure 1

1. DC port for power cord (item 3926 or 3927) or DC adapter to connect solar panel*
2. USB port for external USB flash drive (external memory & configuration file transfer)
3. 3.5mm stereo port for PC interface cable (item 3661U or 3927)*
4. AUX port for wireless communication connection (DataScout Cellular or WiFi) or data power cord (item 3927C75)

Figure 1 - Retriever External Ports

**To connect a solar panel or PC direct connection cable, the cable must pass through the gland before inserting the bare wires into the DC adapter terminals. Confirm the wires are held tightly.*
RED - positive (+) BLACK - negative (-)

Sensor Pups

With the Sensor Pup, any Watch-Dog environmental sensor can be connected to any port

3000 Pups

The 3000 Pups have pre-programmed sensors as well as ports for WatchDog environmental sensors

Station Pups

The Station Pup is shipped with two cables. Each has 2 modular connectors. One end plugs into the weather station's "AUX" port. The other end plugs into the Station Pup's "AUX2" port. The "AUX1" port is not used.

1. The white cable only provides communication between the Pup and the station. In this case, the weather station must have batteries installed.
2. The gray cable can also be used to supply power to the weather station. The gray cable should be connected to both units before powering up the Pup. Current Station Pups are built to allow the Pup to transmit power to the station. If you have an older unit and want to check if it has been updated to include this feature, install batteries in the Pup, remove the batteries from the station, and connect the two units with the gray cable. If the station powers up, the Pup is able to transmit power to the station.

Caution: When a gray cable is used with a Pup that can transmit power to the station, remove the batteries from that station to prevent damage to the station.

GETTING STARTED

Get your wireless network running in the following nine steps. Find a tutorial video online at www.specmeters.com/videos.

QUICK OVERVIEW

1 — Power Up Retriever

Retriever should be in setup mode (flashing amber)

Connect its antenna

2 — Connect to PC or DataScout

Use USB cable and PC port on Retriever

3 — Open Launch Software or Power Up DataScout

RPLU program loaded on USB flash drive or from Spectrum website

4 — Select Channel, then Power Up and Configure Pups

3000 Pups
Configure with WD Mobile App

5 — Pups Will Join Retriever's Network

Save settings from RPLU or SpecConnect to Retriever

6 — Deploy Retriever

Place in a position to achieve line-of-sight communication to nearest Pups

7 — Deploy Pups

Check signal strength

Press button 2 seconds for Station/Sensor Pups or 6-9 seconds for 3000 Pups

8 — Change to Active Mode

Return to Retriever and switch mode by pressing button for 2 seconds

SETUP

Installing the Retriever & Pup Launch Utility software (RPLU)
The installation program is available on the USB flash drive that shipped with the Retriever and on the Spectrum website. Run the RPLU setup.exe file to install the launch utility. The RPLU desktop icon (right) can then be used to open the program.

Powering Up and Syncing the Retriever to Sensor/Station Pups
For new systems, it is recommended that this process is done before taking devices to the field

1. Verify that all the Retriever and Pup units are on the same channel by checking the Network Channel Selection switch. If not, use a screwdriver to change the channel selection. If using multiple wireless networks, each network should use a unique channel.
2. Attach the antenna **only to the Retriever.**
3. Apply power to the Retriever. The LED will light green while powering up. Following power-up, the Retriever should be in Setup mode (flashing amber). If it isn't, hold Retriever's button for 2 seconds.
4. Put the Pups within proximity of the Retriever and power them up. The LED will flash green several times. They will automatically broadcast a request to join the Retriever's network following power up. This is indicated by several flashes (successful reply). If the Pups don't automatically join within one minute, hold the Pup's button for 8 seconds to manually join. The Retriever's amber flash sequence will accelerate. The Pup's connection status can also be seen in the RPLU software.
5. See Configuration (Page 6-8) for details on configuring Retrievers, Station and Sensor Pups. Configuration can be done with RPLU software. Retrievers connected to a DataScout modem can also be configured with the SpecConnect web utility.

Powering Up and Syncing the Retriever to 3000 Pups

For new systems, it is recommended that this process is done before taking devices to the field

1. Put the Pups within proximity of the Retriever. Power them up by sliding the power switch to the ON position. The LED will light green to indicate start up is occuring. It will flash green/amber/red when complete.
2. Verify that all the Retriever and Pup units are on the same channel by checking the Radio Channel field on the Configuration screen of the WatchDog Mobile App (see 3000 Series Manual for details). Update the Pup channel if necessary. If using multiple wireless networks, each network should use a unique channel.
3. Attach the antenna **only to the Retriever.**
4. Apply power to the Retriever. The LED will flash green while powering up. Following power-up, the Retriever should be in Setup mode (flashing amber). If it isn't, hold Retriever's button for 2 seconds.
5. Confirm the connection status by pressing the button on the Pup for 6 to 9 seconds.
6. Once the Pup connects, the Retriever's amber flash sequence will accelerate. The Pup's connection status can also be seen in the RPLU sofware.
7. See Configuration (Pages 6-8) for details on configuring Retrievers, Station and Sensor Pups. Configuration can be done with RPLU software. Retrievers connected to a DataScout modem can also be configured with the SpecConnect web utility. Refer to the 3000 Series Manual if configuring a 3000 Pup with the WatchDog Mobile App.

CONFIGURATION

A Pup can be configured by connecting the Retriever directly to a PC, a USB flash drive, or the SpecConnect web portal. The flash drive is used when adding a Pup to a previously configured system that is already in the field.

Configuration via Direct Connection to Retriever

If the Retriever is not in Setup mode (amber light flashing continuously), hold the button for 2 seconds (see Retriever/Pup Operation, Page 9). Connect the Retriever to a Windows computer using the USB to 3.5mm stereo plug cable (item 3661U, included). Open the RPLU program using the desktop icon.

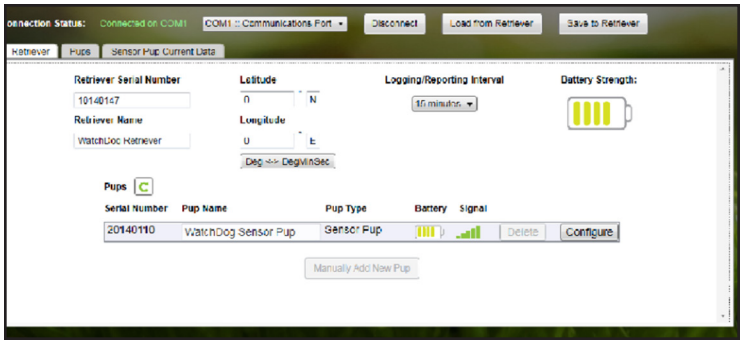
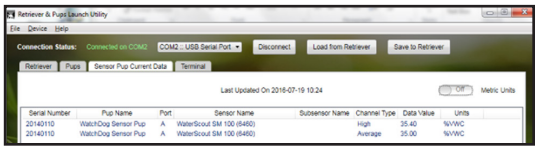


Figure 2 - Retriever Settings Screen

1. Upon start-up, RPLU will automatically recognize any COM ports on your computer. If the Retriever does not automatically connect, select the COM port of the USB serial cable. Click the "Connect" button to establish communication to the Retriever. If the list includes more than one COM port, you can check in your computer's Device Manager or simply go through them one by one.
2. From the Retriever Settings screen (Figure 2), set the Retriever parameters. The Retriever's name is entered in the text box. The Pup logging interval is selected from the drop down menu. Entering latitude and longitude is optional. These can be entered in decimal or Degree/Minute/Second format.
3. A list of Pups will be visible on the Retriever Settings screen. Verify that the Pups are communicating with the Retriever. When a Pup becomes active, the battery and signal icons will change from gray to colored.
4. Clicking a Configure button will bring up the Settings screen for that specific Pup (Figure 3). The Pups settings screens can also be brought up by clicking on the Pups tab.

Figure 3 - Pup Settings Screen

5. Set the Pup's parameters in the Pup Settings screen. The Pup's name is entered in the text box. The type is automatically determined from the Pup's serial number. Entering latitude and longitude is optional. These can be entered in decimal or Degree/Minute/Second format. For Sensor Pups, select the sensor type from the drop down menu for each port. Select up to 4 channels per port using the toggle buttons (see Data Logging & Storage, page 13). Note that most Pup stations have most sensors pre-defined. Sensors cannot be selected for stations connected to Station Pups. These must be set using SpecWare software or the WatchDog Configuration Utility (see pages 6-8). The station can also be configured with the keypad on the station.
6. To configure additional Pups, select each serial number in turn from the "Pup Serial Number" drop down menu on the Pup setting screen. Alternately, you can select a Pup from the list on the Retriever settings screen (see step 3).
7. Once the Retriever and all Pup units are set, click the "Save To Retriever" button. The Retriever will wirelessly send the settings to the Pups.
8. Go to the Sensor Pup Current Data tab to verify the expected data parameters are coming in from each pup. If a sensor is not connected, a dash will be displayed in the Data Value column. For Station Pups, the current condition can only be seen in the Pups tab.
   The Retriever can now be disconnected from the computer.



Configuration via USB Flash Drive

The Retriever configuration can be stored to a flash drive and transferred to a Retriever in the field. The configuration process is similar to the one for the direct PC connection except the Retriever and Pup information must be entered manually.

1. Insert the flash drive into the PC and bring up the RPLU software. Open the "File" menu (Figure 4).
2. If a configuration for the desired Retriever is already stored on the flash drive, click the "Open Configuration" option to modify that configuration. Skip to step 5.
3. For new setups, click the "New Configuration" option to configure a new Retriever. This will bring up the "Start a New Configuration" screen. Type the serial number for the Retriever, hit Enter, and click "OK".
4. In the Retriever Settings screen, click the "Manually Add New Pup" Button. This will bring up the "Add a Pup to Retriever Configuration" screen. Type the serial number for the Pup, hit Enter, and click "Add". Repeat this process for all Pups.
5. The Pup(s) will appear in the Retriever Settings screen and as an option in the Pup Settings screen. Begin the process as in step 3 of the configuration for a directly connected Retriever (Page 6). When all Pups have been configured, click the "Save Configuration As" option from the File menu (Figure 4). The program will bring up a browser screen. Save the configuration to the root directory of the flash drive. The configuration file will have the name setup.txt.

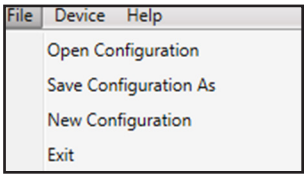
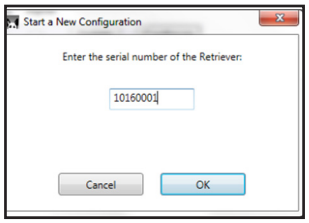
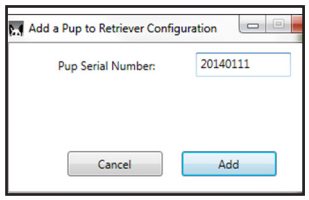
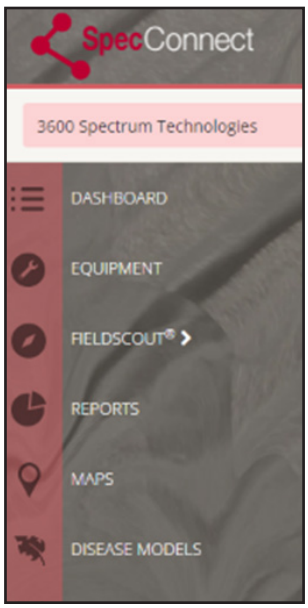


Figure 4 - RPLU File





Eject the flash drive from computer. In the field, put the Retriever in Setup mode by pressing the button for 2 seconds (LED will flash amber). Plug the flash drive into the Retriever. Initiate the transfer of configuration settings with a short press of the button (see Retriever/Pup Operation, Page 9).



Configuration via the SpecConnect Web Portal

1. Log in to your account at www.SpecConnect.net.
2. Open the Retriever configuration page by clicking the "Equipment" option in the upper left corner. Click on the "Configure" button for the Retriever to bring up the Configure WatchDog screen.

3. In the "Configure Retriever" screen (Figure 5), set the Retriever parameters. The latitude, longitude & altitude (optional) can be keyed in. Alternately, if the pindrop icon is clicked, a map image will be displayed that allows you to locate the device. The logging interval is how often a Pup sends data to the Retriever. The Upload interval is how often the DataScout reports records to SpecConnect. In most installations, it is recommended for the logging interval to match the upload interval. See Data Logging & Storage (Page 13) for details on the logging and web upload intervals. Click "Save" to store any changes.

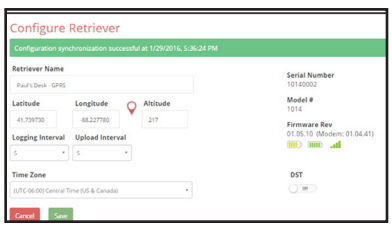


Figure 5 - SpecConnect Retriever Configuration Screen

4. Return to the equipment list and open the first Pup configuration page.
5. In the “Configure Sensor Pup” screen (Figure 6), set the Pup parameters. The latitude, longitude & altitude (optional) can be keyed in. Alternately, if the pindrop icon is clicked, a map image will be displayed that allows you to locate the device. See Data Logging & Storage (Page 13) for details on setting the data channels. Clicking the screwdriver/wrench icon brings up a screen for entering calibration offsets. Click “Save” to store any changes. Repeat for all Pups.

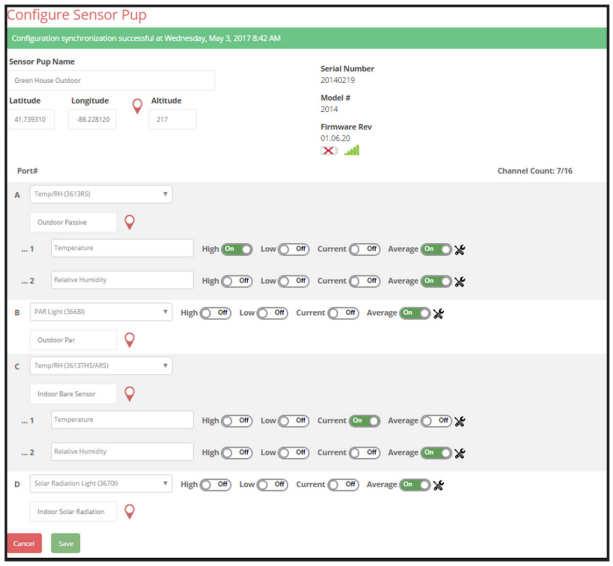


Figure 6 - SpecConnect Pup Configuration Screen

6. The configuration will be sent to the DataScout modem which communicates the settings to the Retriever.

Configuring Weather Station Connected to a Station Pup

WatchDog 2000-series stations used with a Station Pup must be configured* with SpecWare Pro software or with the WatchDog Configuration Utility.

- Requires SpecWare Pro v9.6 or later, update online at www.specmeters.com/updates/
- Minimum firmware requirements:

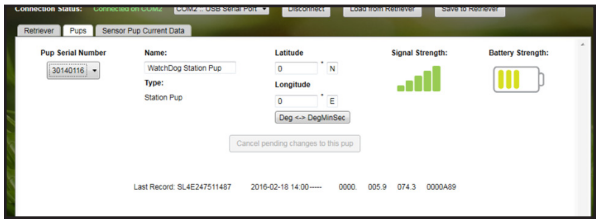
Weather station (except model 2800)	v 7.6
2800 Weather Station	v 3.5
Mini Station	v 4.1

Configure the WatchDog mini or full weather station using Spec9 Pro

1. Connect the WatchDog mini or weather station to a PC.
2. In Specware 9 Pro, open the WatchDog Properties using the WatchDog Manager or the “Launch/Set Properties for 1000 or 2000 Series” button. In the WatchDog Configuration Utility, click the “Configure” button.
3. Enter the name, logging interval, and sensor configuration.
4. Set Repeat-Transmit Interval to Send Log Data at Log Interval.
5. For mini stations set Format to 4 Text (RP/SC).

6. For full weather stations set Format to 5 Text (RP/SC).

7. Save the settings by clicking “OK”. * *No configuration is necessary if only the internal sensors are used.*
8. Connect the 2000-series station to the Station Pup using the provided cable.
9. The 2000 Series station will send its logged data to the Station Pup at the selected interval and the Sation Pup will send this log to the Retriever as part of the wireless network. This can be confirmed by connecting the Retriever to the Retriever and Pup Launch Utility. The latest data record will appear in the Pups tab under the Station Pup’s serial number. These values are updated every time the station logs a new data record.



RETRIEVER/PUP OPERATION

The LED on the Retriever or Pup is used to convey information about the status and functioning of each device. The small red button can be used to request most of this information. For Retrievers, the button can also be used to prompt the device to perform certain actions. A label summarizing these features is affixed to the inside door of the device. These are explained in greater detail below.

Retriever

The Retriever operates in one of two modes: Setup and Active. In Setup mode, the Retriever interacts every 20 seconds with the Pups. Therefore, information will be sent to, and received from, the Pups more quickly. This mode is used when configuring the system or when troubleshooting. This mode is indicated by a flashing amber LED. While in Active mode, the Retriever and Pups communicate every 5 minutes. This longer communication interval is used to conserve battery life. To switch between Active mode and Setup mode, press and hold the button for two seconds. The LED will initially blink slowly but transition to rapid amber flashing when the unit is in the new mode.

Retriever configuration and data transfer can be done with the Retriever & Pup Launch Utility (Page 6-7), the SpecConnect Web Portal (Page 7), or a USB flash drive (Page 7). If the Retriever is in Setup mode, a short button press will instruct the Retriever to read a USB flash drive for new configuration settings. If the Retriever is in Active mode, a short button press will initiate two actions; 1.) The LED will briefly indicate the battery strength and 2.) Any new data will be offloaded to the flash drive (see Data Export - USB Flash Drive, Page 14).

The Retriever will periodically flash green when it communicates with the network of Pups. These green flashes will occasionally overlap with other LED indications. The explanation of the different LED colors is shown in Figure 7.

Sensor/Station Pups

The red button on the Pup is used for in-field diagnostics. A short press requests the battery strength. Pressing and holding for 2 seconds, until the LED turns on, prompts the Pup to indicate if it has optimal communication with network. If the Pup does not have desirable signal strength, find another location to deploy the Pup or follow the recommendations in Installation (Page 11). The requested status is indicated by the LED. The explanation of the different LED colors is shown in Figure 8. Additionally, the LED on the Pup will flash green when it is receiving data from the Retriever and amber when it is transmitting data to the Retriever. These green flashes will occasionally overlap with other LED indications.

WatchDog Retriever Button and LED Information

Button Push	*Active Mode*	*Setup Mode*
Short Press	Battery State & Download to USB	Load Settings from USB
2 Sec Hold	Toggle Between Active and Setup Mode	

LED Color	*Battery State*	*USB Activity*	*Flashing*
Green	Good	Done	Data TX/RX
Amber	Low	Working	Setup Mode
Red	Replace	Error	Error

Figure 7 - Retriever button and LED information labels

WatchDog Pup Button and LED Information

Button Push	Response
Short Press	Battery State
2 Sec Hold	Signal Strength

LED Color	*Battery State*	*Signal Strength*	*Flashing*
Green	Good	Good	Data RX
Amber	Low	Marginal	Data TX
Red	Replace	Bad or None	Error

Figure 8 - Pup button and LED information label

3000 Series Pups

Refer to the 3000 Series Manual for details on operation of the 3000 Pup.

Factory Reset

To issue a factory reset to either the Retriever or Pup units, disconnect power and power-up the unit while holding the button for 8 seconds, until the LED flashes red and green. Pups must rejoin the network after disconnecting power. If a Retriever is factory reset, the configuration of the unit must be re-sent using the RPLU or SpecConnect (see Setup, Page 5-6).

BEST PLACEMENT PRACTICES

Take time to plan your network. Draw out a map or use internet imagery to identify desired locations for your devices (Figure 9). Try to identify obstructions and think about how growing crops or trees may change line of sight throughout the growing season. The mesh network will be more reliable if each Pup has more than one path back to the Retriever. Although systems will work “point-to-point”, a system where each Pup can see more than one other device will be more reliable.

Mounting the Retriever antenna high on a roof top or tower with a good view of all devices will improve reliability of the mesh network and allow devices at further distances to be reached. When mounting devices on buildings or other structures, try to mount the device as high as possible and avoid mounting under roof eaves (Figure 10), especially on metal buildings. Mounting antennas very close to metal buildings or structures may cause communication issues. Best practice is to ensure no metal is within 3 feet of the radio antenna (Figure 11). Large metal surfaces can also reflect radio signals. Try to keep devices clear of large metal surfaces if possible (Figure 12).

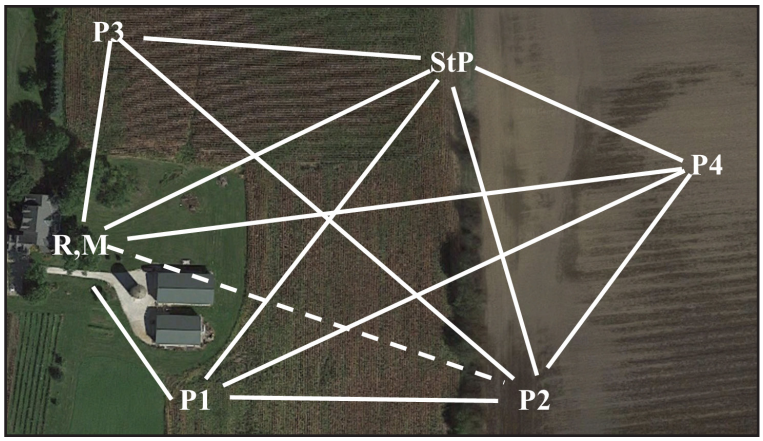


Figure 9 - Map of device locations
R-Retriever, M-Modem,
StP-Station Pup connected to a weather station
P - Sensor Pup or 3000 Series Pup
Solid lines are radios that have line of sight
Dashed line indicates impeded view

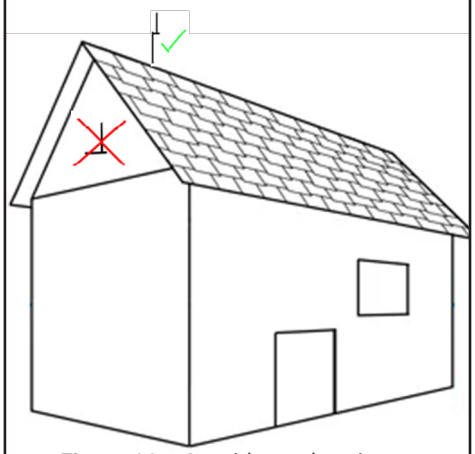


Figure 10 - Good (upper) and poor (lower) antenna placement on a roof

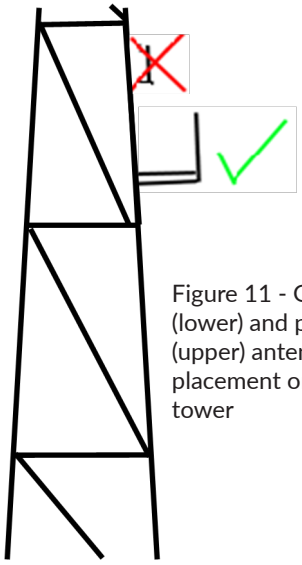
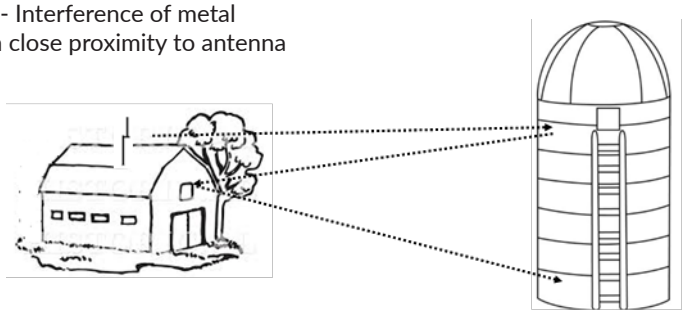


Figure 11 - Good (lower) and poor (upper) antenna placement on a tower

Figure 12 - Interference of metal building in close proximity to antenna



Always make an effort to mount Pup radio antennas as high as possible (Figure 13). It is recommended that a minimum of 3ft (1 m) above the crop be maintained throughout the growing season. Higher antenna locations generally mean longer allowable distances between devices.

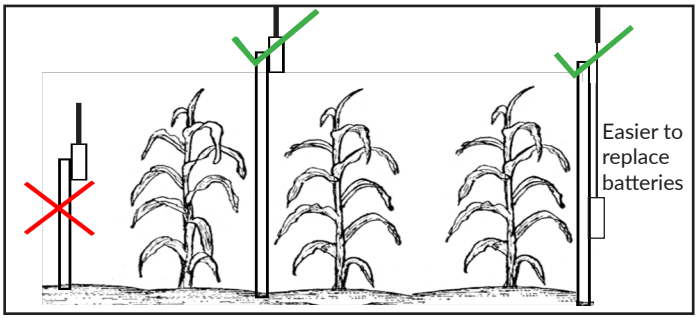


Figure 13 - Improper (left) and proper (right) placement of Sensor Pups in a crop

When transmitting under tree canopies, allowable distances will be greatly reduced, so keep this in mind when planning out your network. Adding repeater Pups (Figure 14) to the network in between devices can help alleviate communication problems under tree canopies.

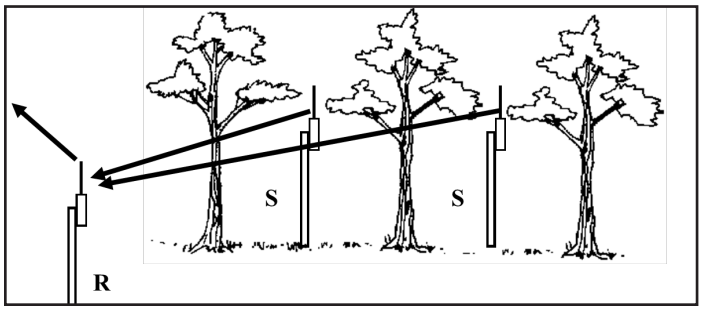
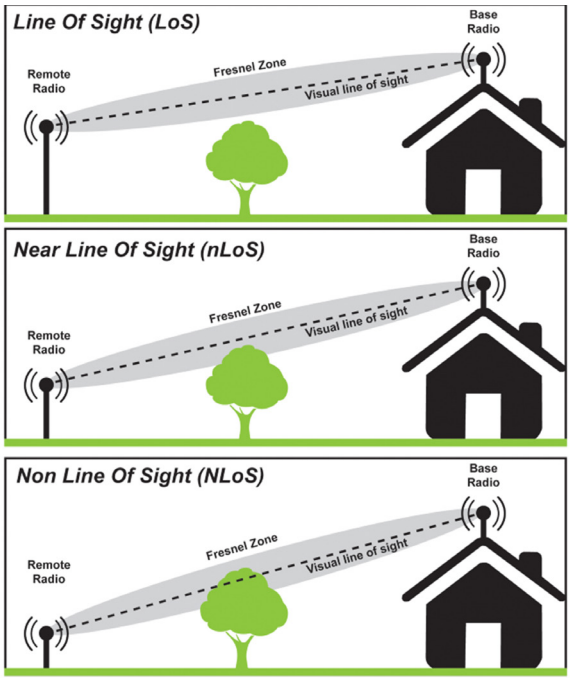


Figure 14 - Placement of a Repeater Pup (R) to extend the range of Sensor Pups (S)

The Retriever and Pups will function optimally when the units are placed in a condition that allows direct line-of-sight. The optimum signal will occur when the football-shaped Fresnel Zone is clear of obstructions such as hilly terrain, foliage, and structures.



To achieve line-of-sight communication when obstructions are present, we recommend using:

- Repeater Pups (item 3902/3907/3932, see Components, Page 3) to Route communication around obstructions
- Antenna extensions (Item 3925 see Accessories, page 15) to Route communication above obstructions and allow unit to be lower to ground, giving better access to sensor ports and batteries.

The maximum range between Pups is 2500 ft (about ½ mile or ¾ kilometer) for 900MHz, 400m for 868MHz, and 300m for 2.4GHz. The most remote Pup should not exceed 4 hops back to the Retriever.

The Retriever and Pups should be configured before deployment. Configuration should be done while communicating in Setup mode (see Configuration, Page 6-8).

INSTALLATION

Tools recommended for installation

- 7/16" (11mm) wrench
- Phillips screwdriver for tightening the mounting bracket screws on back of units
- Antenna stabilizer (included) prevents antenna from bending when mounted vertically but can be removed to allow a bent antenna for horizontal mounting (see Figure 15).

Deploy the Retriever

1. It is important that the Retriever antenna be placed as high and clear of obstructions as possible, since all Pup data is routed to the Retriever.
2. Mount using provided hardware (bracket, u-bolt, nuts, screws).
3. Mount solar panel (if being used). Connect to Retriever with DC adapter (see Page 12).

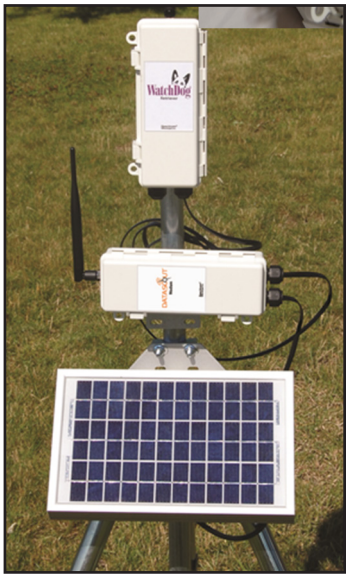


Figure 15 - Retriever and DataScout setup with solar panel

Deploy the Pups

1. It is recommended to start with the Pup that will be nearest to the Retriever and move outwards to create the mesh network.
2. Upon arrival at each desired location, attach an antenna to the Pup.
3. Check the signal strength of the Pup at the location by holding the Pup's button:
   - Sensor/Station Pup - for 2 seconds until the LED turns on (see Retriever/Pup Operation, Page 9)
   - 6 to 9 seconds until the LED changes to amber
4. If signal strength is poor, move closer to either the Retriever or nearest Pup, use an antenna extension, or add a Repeater.
5. Mount using provided hardware and tighten screws using a Phillips screwdriver (see Figure 16). Although the antenna should be vertical, the housing can be oriented horizontally or vertically.

Figure 16 - Attaching the mounting bracket

6. Attach sensors - make sure the cable glands are tightened around the sensor cables.

Final Steps

1. After the last Pup is deployed, return to the Retriever and hold the button for 2 seconds to enter Active mode (the LED's will stop flashing amber) which saves battery life. Otherwise, the Retriever will automatically transition to Active mode after 4 hours.
2. After at least one logging interval, check that all the Pups are communicating with the Retriever.
   - If using SpecConnect, check for current data on the web portal.
   - If using a direct connection from the Retriever to a PC, use the RPLU to check for current data.
   - If using the USB flash drive for data transfer, check it in a PC to confirm Pup data files are being logged on the flash drive (see Data Export, Pages 14-15). Re-insert flash drive in the Retriever.

Adding Pups to an Established Network

Be sure the Retriever is in Setup mode (flashing amber). If it isn't, press the button for 2 seconds. It may take up to 5 minutes for the Retriever to transition to Setup mode.

Sensor/Station Pups

- Install batteries in the new Pup. The Pup will flash amber while it tries to join. When successful, it will flash green 3 times. If it doesn't join, hold the red button on the Pup for 8-10 seconds. This will re-start the meshing sequence. The Pup may or may not flash amber but will flash green 3 times when it has meshed.
- Once meshed, the Pup will periodically flash green and amber to indicate communication to the Retriever.

3000 Pups

- Turn on the 3000 Pup with its power switch.
- Press and release the 3000 Pup's Select button to turn on Bluetooth.
- Refer to the 3000 Station Manual for details on configuring the channel with the WatchDog Mobile App so it matches that of the Retriever.
- Use the app's Bluetooth current conditions mode to monitor the connection status using the signal strength value. Once the 3000 Pup connects to the Retriever, the signal strength will change from 99 to a value between 40 and 99.
- Once meshed, the 3000 Pup will periodically flash green as records are transferred to the Retriever.

DATA LOGGING & STORAGE

Data Logging

- The Retriever logs sensor data from its network of Pups (maximum of 12 Pups per network).
- The Pup logging intervals are: 5, 10, 15, 30, or 60 minutes.
- Pups read the sensors every 20 seconds. So, for example, the logged value for a Pup on a 5 minute interval will be composed of 15 measurements.
- A single logging interval is selected in the Retriever Settings screen because all Pups have the same interval.
- If communication to a Pup is lost for a period of time, all other Pups will continue functioning normally. When non-communicating Pups are reconnected, they will send all their missing data to the Retriever.
- Shorter intervals allow for more frequent updates to SpecConnect, but also consume more modem battery power.
- For installations with many Pups (10 or more), it may be beneficial to set the upload interval to be shorter than the logging interval.

Sensor Pup Data Channels

- Up to four data types, can be recorded for each Sensor Pup. These data channels are defined as follows:

Average: The average of all measurements taken during the logging interval
Current: The most recent measurement
High & Low: The maximum and minimum values measured during the logging interval

- Each Sensor Pup can log a maximum of 16 data channels.
- When using multi-sensors, a different configuration of data channels can be chosen for each parameter.
- Rain and wind sensors have pre-selected data channels.

Data Storage

- The flash memory on the Retriever will hold approximately 6 months of data for a 10 Pup network using 15 minute logging intervals. When the logging capacity is reached, older data on the Retriever will be overwritten.
- If communication to the Retriever is interrupted, the internal memory on the Pups buffers sensor data for at least 3 months until a connection to the Retriever is re-established.
- Non-volatile memory on the Retriever and Pups preserves the logged data, even when power is lost.

UPDATING FIRMWARE

A summary of the firmware update procedures are given below. Firmware for the WatchDog Retriever and Pups is available at: www.specmeters.com/software.

Retriever

- Load the latest version of the Retriever firmware (RFxxxxxx.bin) onto the flash drive.
- Remove all power from the Retriever and insert flash drive.
- Re-attach the battery.
- Update is complete when LED begins to flash green.

Retriever will return to Setup mode (flashing amber)

Pup

- Load the latest version of the Pup firmware (sPupFw.bin for the Sensor Pups, wsPupFw.bin for the Station and Repeater Pups and csPupFw.bin for 3000 Series Pups) onto the flash drive.
- Pups must be paired with Retriever and the Retriever must be in Setup mode (flashing amber).
- Plug USB flash drive with firmware file into USB port on the Retriever.
- Press and quickly release button on Retriever to initiate file transfer to the Pup. Retriever LED will flash red/green.
- When the Pup's firmware is updated, its LED will briefly flash red/green then return to normal operation.

Delete the Pup firmware from the flash drive

DATA EXPORT

Gathering Data from a Retriever on a USB Flash Drive

The USB flash drive can be temporarily inserted to offload data stored in the Retriever's memory.
To offload data to a newly inserted flash drive, the Retriever must be in Active mode (no regular LED flashing) before initiating the download. If the Retriever is in Setup mode (LED flashing amber), press and hold the button for two seconds to put it into Active mode. While in Active mode, initiate the download by quickly pressing and releasing the button. The LED will show the battery state, then glow amber until the data transfer is complete.
The Retriever creates a single file with all the historical data on the Retriever. The name for this file will be the serial number of the Retriever. This is the only file available for a flash drive inserted at the time of data collection.
It is recommended that data be cleared from the USB stick once it is transferred to a safe location.

Importing Data with SpecWare Pro Software

Sensor and Station Pups require v. 9.6 or greater. Networks with 3000 Pups require v 10.0 or greater.
Pup data can be imported into SpecWare Pro. From the main SpecWare screen, click the Retriever & Pups icon from the toolbar. This will bring up the Retriever & Pups screen (Figure 17).

There are 3 Possible Data Sources:

1. **PC connected directly to Retriever**
   - Connect the PC direct-connection cable to the "PC" port on the Retriever. The COM port is selected in the File - Preferences - Communication tab - Direct Connection field (Figure 18).

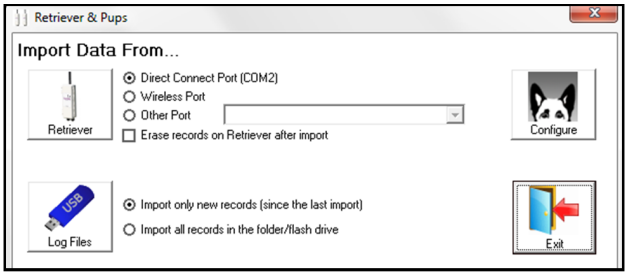


Figure 17 - SpecWare Retriever & Pups

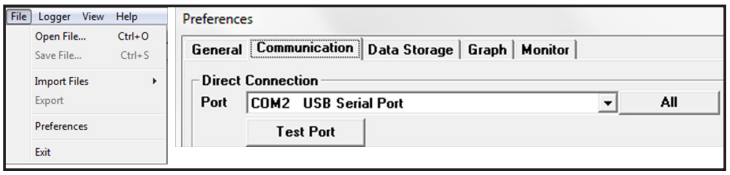


Figure 18 - SpecWare port selection screen

   - Click the Retriever button (Figure 17) to download the data received from the Pups. The Erase records from Retriever option is recommended to speed up download times.
2. **Transferring data from USB flash drive**
   - Click the Log Files button (Figure 17) to browse for the data files saved to a flash drive (see Page 7). You must browse to the directory the data is being pulled from because the default is the SpecWare directory, not the flash drive.
   - Note: A little care may be required when processing data imported via one of the two preceding methods. If you are using SpecWare to process data from one or more WatchDog Weather Stations connected to Station Pups, SpecWare must know how the station is configured. To record the configuration, the station must be launched by the PC running SpecWare.
   - Subsequent downloads to the station will then be processed smoothly.
3. **SpecConnect Exports**
   - In SpecWare, click File - Import Files - Import SpecConnect Data Files to import a SpecConnect export file (Figure 19).

See SpecConnect Web Portal (below) for information on exporting data from the web portal.

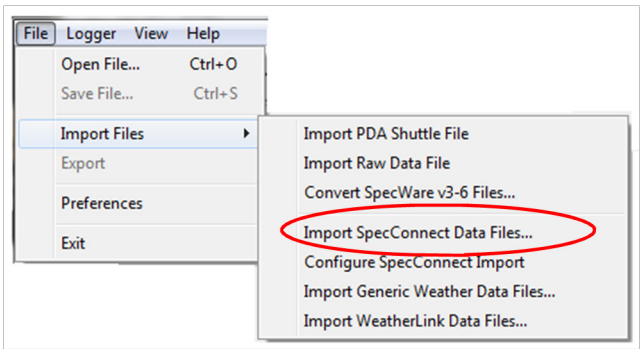


Figure 19 - Import SpecConnect Data Files Button

Exporting Reports From the SpecConnect Web Portal

Data exports from SpecConnect are done from the Reports feature. Select the desired report type from the Reports screen (Figure 20). Select the Pup date range and any other necessary parameters (equipment, sensors, ...) for the exported data file (Figure 21). Use the export button to download the data. The data is stored in comma-delimited (.csv) format.

Figure 20 - Reports Screen

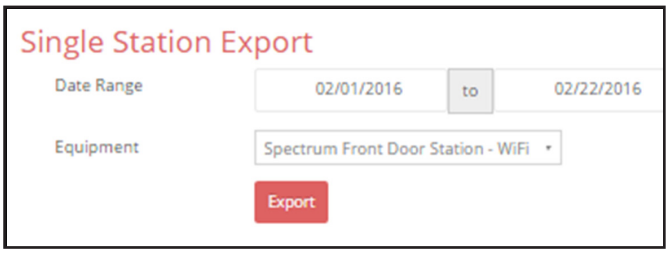


Figure 21 - Sample Report Options Screen

ACCESSORIES

Optional Accessories

- Tripod, item 3396TP
- Antenna extension 10-ft cable and mounting hardware (item 3925)
- AC-DC power supply (item 3926)
- Solar Power Module (item 3999)
- PC Direct-connection 50' cable kit (item 3297)
- USB flash drive (item 3388USB)
- 75' Powered Direct Connect
- 75' Retriever Extension Cable Kit (3927C75)
- DataScout Cellular or WiFi modem (multiple item numbers)

Tripod (item 3396TP)

AC/DC Power Supply (Item 3926)

10 Foot Antenna Extension Cable and Mounting Kit (Item 3925)

SPECIFICATIONS

Mounting Hardware	1¼" u-bolt, aluminum bracket
Enclosure	3.75" x 2" x 8" (9.5cm x 5.2cm x 20.2cm) IP65, UV resistant ABS plastic
Weight	Non Solar: 1.6lb (0.7kg) Solar: 5.5lb (2.5kg)
Power Options (Non-Solar)	6 x AA batteries DC power port (maximum 17 VDC)
Power Options (Solar)	5W solar panel with rechargeable battery pack (4.5 Ah, 6U SLA)
Sensor/Station Pup Battery Life	8 months (typical for 6 AA batteries)
Operating Temperature	-22°F to 130°F (-30°C to 55°C) (with non-rechargeable AA batteries) 14°F to 130°F (-10°C to 55°C) (with rechargeable battery pack)
PC/Aux Port Baud Rate	9600 bps (default, adjustable)
Frequency Bands	**868 MHz ISM Band:** (3930, 3931, 3932, 3912, 3912S) **902-928 MHz ISM Band:** (3900, 3901, 3902, 3910, 3910S) **2.4 GHz ISM Band:** (3905, 3906, 3907, 3911, 3911S)
Antenna	Reverse Polarity SMA
Range	**868 MHz:** 2000' (~600m), line of sight **900 MHz:** 2500' (~750m), line of sight **2.4 GHz:** 300m, line of sight
Output Power	**868 MHz:** 14dBm (25mW) Transmitter power **900 MHz:** 24dBm (250mW) Transmitter power **2.4 GHz:** 10dBm (10mW)

POWER

Station and Sensor Pups

Although the 3999 solar panel is highly recommended, Station and Sensor Pups can be powered by 6 Li batteries. The battery status can be checked by quickly pressing and releasing the button. Any time the batteries are changed on a Pup, it must rejoin the network. This is done when the unit powers on or by holding the button for 8 seconds. The LED will rapidly flash green 3 times when it has joined.

Warning: Operating a Pup with low battery levels for a long period of time might negatively affect the Pup's firmware.

3000 Pups

3000 Pups have a built in solar panel and battery. Flip the switch to ON to power up the Pup.

Retrievers

Although the 3999 solar panel is highly recommended, Retrievers can be powered by 6 AA batteries. A solar retriever uses a 6V SLA battery pack. When connected to a DataScout, the units will share power. If using an AC-DC adapter or PC direct-connection cable to power the Retriever, it is recommended that the 6 AA batteries be removed after the DataScout (or other constant power source) is connected. The solar panel or AC-DC adapter will keep the attached unit powered without need of additional batteries. While no immediate damage will occur if the AA batteries are left in, unused AA batteries tend to corrode over time and can damage the device. A solar Retriever (3910S) can also be connected to an AC-DC adapter or PC direct-connection cable. However, the rechargeable battery pack must remain connected at all times.

Changing batteries in a Pup in the Field

The procedure is the same as for adding a new Pup (Page 12).

Changing batteries in Retriever or restarting a system if Retriever Powers Off

Simply replace the batteries in the Retriever. The Retriever will start up in Setup mode (flashing amber) and begin looking for all the Pups it has previously communicated with. If a new Pup is being added to the system, it is recommended that the new Pup be powered up after powering up the Retriever so it meshes faster. Otherwise, the Pup can be put into setup mode by pressing the button for 8-10 seconds. In that case, it may take up to 5 minutes for the Retriever to transition to Setup mode.

TROUBLESHOOTING

1. The RPLU will not communicate with the Retriever:
   - Check your PC's Device Manager to see if the computer recognizes the USB cable. The driver should automatically download if the PC is connected to the internet. Also available at www.specmeters.com/updates.
   - Only one program can communicate with the USB cable at a time (SpecWare and RPLU can interfere with each other). In this case, close both programs then reopen the one to be used.
2. The LED doesn't flash at all:
   - Check that the snap connector is securely connected to the battery holder and that all the AA batteries are inserted in the correct orientation.
   - If using the 3999 solar power module, check that it is plugged in correctly.
3. Single Pup not updating in SpecConnect:
   - Confirm that the Pup is on the same channel as the rest of the network.
   - The batteries may be dead. Check last reported value for battery strength in SpecConnect and/or visit the site and perform a quick button press.
   - Check to see if the Pup is knocked to the ground or damaged. This includes water damage or corrosion inside the housing.
   - Check the signal strength of the Pup at location.
   - See Setup (Page 5-6) for instructions on how to sync the Pup with the Retriever. After successfully meshing the Pup, perform a 2-second press on the Retriever button to return it to Active mode (flashing amber).
4. Single Pup is updating intermittently in SpecConnect:
   - Check that the antenna is firmly attached in an upright orientation, is not blocked by foliage, and is sufficiently above the crop canopy.
5. No Pups are updating in SpecConnect:
   - This is most likely the result of a problem with the modem or the Retriever.
   - Check for damage or water in the Retriever and modem enclosures.
   - Check that the Retriever is getting power (batteries or solar panel).
   - Check that the modem has power (quick push of button) and good signal strength (2-second button push).
   - Check that the modem and Retriever antennas are firmly attached in an upright orientation.
6. Not seeing data from an individual Pup sensor:
   - Check that sensors are fully seated in port connectors.
   - Check sensor wires for damage.
   - Swap sensors (and reconfigure through SpecConnect or RPLU) to check for potential port failure.
7. Solid or blinks once on second green LED on Sensor/Station Pup:
   - Loss of firmware caused by operating Pups with dead batteries.

REGULATORY INFORMATION

900MHz
USA: FCC ID – MCQ-XB900HP
Canada: IC – 1846A-XB900HP
Australia: C-Tick approval

868 MHz
Europe: CE, ETSI approval, UKCA

2.4GHz
Europe: CE, ETSI approval
Japan: Telec R201WWog215111

PACKAGE CONTENTS

Your WatchDog Retriever & Pups package should contain the following components:

- Product Manual
- Retriever and Pup units (labeled on enclosure & inside)
- USB flash drive, preloaded with Retriever and Pup Launch Utility software
- USB to 3.5mm Stereo Plug Cable (item 3661U)

Each Retriever or Pup unit should also be accompanied by a parts box containing the following:

- Antenna & antenna stabilizer sleeve
- 6 AA batteries
- Mounting bracket
- U-bolt, clamp, and nuts
- Screws (2) for back of unit
- Station connection cable (Station Pup only)

WARRANTY

This product is warranted to be free from defects in material or workmanship for one year from the date of purchase. During the warranty period Spectrum will, at its option, either repair or replace products that prove to be defective. This warranty does not cover damage due to improper installation or use, lightning, negligence, accident, or unauthorized modifications, or to incidental or consequential damages beyond the Spectrum product. Before returning a failed unit, you must obtain a Returned Materials Authorization (RMA) from Spectrum. Spectrum is not responsible for any package that is returned without a valid RMA number or for the loss of the package by any shipping company.

DECLARATION OF CONFORMITY

Spectrum Technologies, Inc.
3600 Thayer Court
Aurora, IL 60504 USA

Model Numbers:	3900, 3901, 3902, 3905, 3906, 3907, 3910, 3910S, 3911, 3911S, 3912, 3912S, 3930, 3931, 3932
Description:	WatchDog Retriever & Pup Mesh Network
Type:	Electrical equipment for measurement, control, and laboratory use
Directive:	2014/30/EU EMC 1999/5/EC (R&TTE)
Standards:	EN 61000-6-1: 2007 EN 61000-6-3: 2007 IEC 61000-4-2: 2008 IEC 61000-4-3:2006, +A1:2007 +A2:2010 EN 55022:2010 EN 60950-1:2006+A2:2013 EN 62479:2010 EN 301 489-17 V1.9.2 (2011-09) EN 301 489-17 V2.2.1 (2012-09) EN 300 328 V1.8.1 (2012-06)

Paul Martis, Project Manager—Weather March 11, 2015

USA and Canada Conformity Standards:
FCC Part 15 CFR Title 47: 2014
ICES-003: 2012 Digital Apparatus (Industry Canada)

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