# Telog® Ru-35

## Recording Telemetry Unit
## User Guide


Version 1
July 2020

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## Revision History

| Date | Version | Content |
|---|---|---|
| 7/2020 | V1 | Initial publication of document |
| | | |

# Legal Notices

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**Release Notice**
This is the July 2020 release of the Ru-35 User Guide.

**Limited Warranty Terms and Conditions**
**Product Limited Warranty**. Subject to the terms and conditions set forth herein, Trimble Inc. ("Trimble") warrants that for a period of twelve (12) months from date of purchase this Trimble product (the "Product") will substantially conform to our publicly available specifications for the Product and that the hardware and any storage media components of the Product will be substantially free from defects in materials and workmanship.

**Warranty Remedies**. If the Product fails during the warranty period for reasons covered by this limited warranty and you notify us of such failure during the warranty period, we will repair OR replace the nonconforming Product with new, equivalent to new, or reconditioned parts or Product, OR refund the Product purchase price paid by you, at our option, upon your return of the Product in accordance with our product return procedures then in effect.

**Official Language**
THE OFFICIAL LANGUAGE OF THESE TERMS AND CONDITIONS IS ENGLISH. IN THE EVENT OF A CONFLICT BETWEEN ENGLISH AND OTHER LANGUAGE VERSIONS, THE ENGLISH LANGUAGE SHALL APPLY.

## Supplier's Declaration of Environmental Rating

Ru-35 is environmentally rated: NEMA 6 (IP68) to 9.8 feet (three meters) of depth.

# Contents

# Glossary of Terms

| Term | Definition |
|---|---|
| Analog | Using signals or information represented by a continuously variable physical quantity such as spatial position or voltage. |
| Communication/Tamper Switch Cable | A cable that connects to the 5-pin Communication port on the RTU to initiate a remote wireless call or local direct communication. |
| Bluetooth (BLE) Dongle | Bluetooth Low Energy device that plugs into a USB port on a PC to facilitate a local, wireless connection to the RTU. |
| Digital | Signals or data expressed as a series of the digits 0 and 1, typically represented by values of a physical quantity relating to, using, or storing data or information in the form of digital signals. |
| Flow | The direction water is moving. |
| Groundwater Level | The status of how high or low the water table is in a specified area. |
| Level | The status of how high or low the water is in a contained area. |
| Metering | The tracking of data related to the flow of liquid. |
| Pressure | Water under force that is measured in pounds per square inch (PSI). |
| PRV Monitoring | Tracking Pressure Reducing Valve (PRV) operations and flow. |
| Pump Monitoring | Awareness of pump on and off run times. |
| Sensors | Devices that measure quantifiable changes, such as fluid pressure, speed, or direction. |
| Tamper a Call | The act of forcing the RTU to initiate a wireless call, also referred to as a “Tamper Call”, “Tamper a recorder”, or “to tamper”. |
| Telog Enterprise | Provides remote access to the RTU using a PC to communicate with the RTU, configure the RTU, and view data and alarms from the RTU. |
| Telogers for Windows | Used to configure and program RTU operating parameters and data collection options with a PC. |
| Ru-35 | Telog Recording Telemetry Unit (RTU) model Ru-35. |
| Trimble Unity | Provides remote access to the RTU using a PC/tablet/computer/mobile device to view data and alarms from the RTU. |
| Velocity | The speed with which water is traveling; also referred to as flow rate. |

# Text Conventions

| Term | Definition |
|---|---|
| Click | Using a computer interface (such as a mouse cursor) to press on an online application button or menu option. |
| Select | Choosing between multiple menu options on the screen or a radio button. |
| Tap | Touching a mobile device screen to make a selection. |

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# About the Device



## Introduction

The Telog® Recording Telemetry Unit (RTU) model Ru-35 is a multi-channel, battery powered RTU that uses cellular communication to provide near real-time monitoring and alarming of flow, pressure and water quality instruments and sensors found in the harsh environments of sewers and underground water vaults. When you combine the Telog Ru-35 RTU with a Trimble Telog software option, you have a powerful system of wireless wastewater infrastructure monitoring that is consistently delivering near real-time data and alarms from the field, straight to your desktop or browser. This enables situational awareness of the performance of the collection system, improves regulatory compliance and enables network modeling calibration.

The Ru-35 functions by:

- Collecting data from externally connected sensors including flowmeters, level and pressure sensors, in recorder channel, it requires user configuration
- Collecting data from powers sources applied to the recorders in virtual channels, those channels do not require user configuration
- Stores data to internal memory to provide a reliable local backup
- Transfers data to an application based on a user-configured schedule and alarm triggers
- Receives configuration updates from the application after transferring the data
- Detects when sensor data crosses user defined thresholds- alarms, stores this information and makes it available to the host software to process as log and notification.

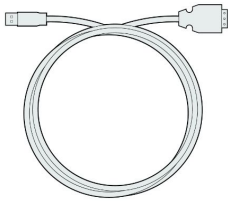
For detailed information and training about how to use the Trimble software applications, please reach out to Trimblewater_sales@trimblewater.com or call +1 888-835-6437 for Trimble Water Support. Trimble Water also offers a number of training options, including web-based and onsite delivery, for

more hands on training on the software applications needed for installation, configuration and data management of the hardware.

# Hardware

The RTU hardware and related equipment includes:

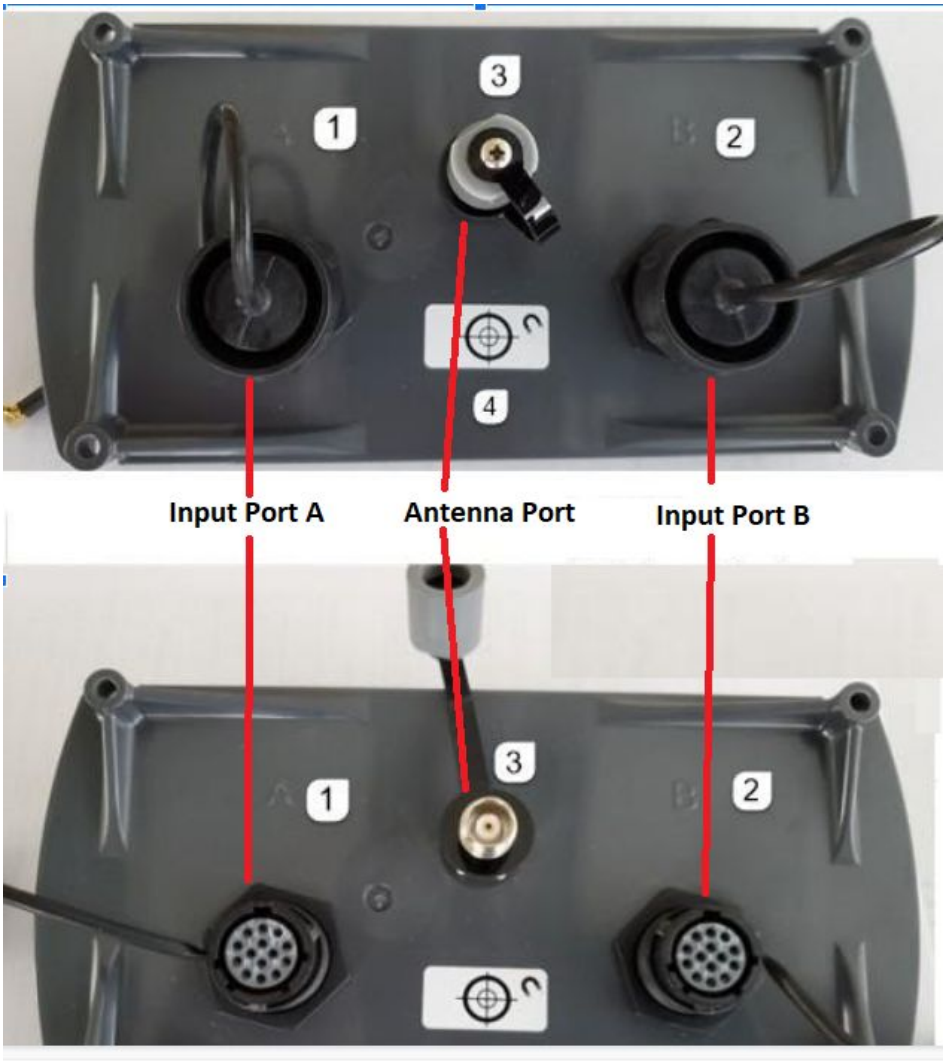
| Hardware | Description | Diagram |
|---|---|---|
| Ru-35 | The Ru-35 comes in an injection molded polycarbonate NEMA 6 (IP68) rated enclosure that weighs 9 pounds (4 Kg) and measures 7.3” (185mm) L by 4.2” (107mm) W by 11.5” (292mm) H |  |
| EB-10011 | Dual 6 VDC alkaline lantern battery for the Ru-35 that comes pre-installed in the unit from the factory.<br><br>RAYOVAC® 6-Volt Spring Terminals Alkaline F Cell \| 808 |  |
| A-MAG-2 | Small portable magnet that serves to tamper the communications on the Ru-35.<br><br>*Optional - Ordered separately* | |
| CU-RU-35-CTS | Communication/Tamper Switch cable is used to Tamper a Call or connect the Ru-35 to a PC.<br>Length: 8’<br><br>*Optional - Ordered separately*<br><br>**NOTE -** A C-USB-RS232 adapter cable may be necessary to complete the physical connection to a PC depending on the ports on the PC. | |

| | | |
|---|---|---|
| C-USB-RS232 | Serial to USB Adapter cable is used to connect the Communication/Tamper Switch cable to a USB port on a PC.<br><br>*Optional - Ordered separately* |  |
| C-BLE-D | Bluetooth Low Energy (BLE) Dongle is used to make a local wireless connection between the RTU and a PC running Telogers for Windows. Max range is 20' in an open field, line-of-site setting.<br><br>*Optional - Ordered separately* |  |
| Sensor(s) | Provides data for the RTU to record<br><br>*Ordered separately* | Refer to Sensor Inputs for a list of the different types of sensors that work with the Ru-35. |
| Antenna | Used to transmit the wireless cellular signal between the RTU and a cellular tower. The unit is provided with a panel mount TNC coax connector and will support a variety of certified antennas<br><br>*Ordered separately* | Refer to Appendix B - Antenna Compatibility for a list of Antennas that work with the Ru-35. |
| HM-10175 | Bracket mount for the Ru-35 to allow for vertical mounting.<br><br>*Optional - Ordered separately* | |
| **Tools** | **Description** | **Diagram** |
| Wrench | 24mm wrench | |
| Screwdriver | ⅛" Flat head screwdriver | |

# Ports and Connections

The Ru-35 provides four access ports and connection locations.

| Ports and Connections | Function |
|---|---|
| Input Ports **(1 and 2)** | 2 independent 14-pin inputs to allow connection to smart, analog or digital sensors. Also allows external power to be connected. |
| Antenna Port **(3)** | Used to connect the Antenna to the RTU |
| Tamper Magnet Target **(4)** | Marker label used to align tamper magnet to the device to initiate communications |



Both input ports (A and B) support the following input connections:

- One analog channel, 0-5VDC or 4-20mA.
    - Port A maps to Channel 1, Port B maps to Channel 2
- One digital channel (3VDC with 330k ohms pull-up, 5 ms min. pulse width).
    - Port A maps to Channel 3, Port B maps to Channel 4
- One external power input (9-15VDC at 1A max)
- Smart Sensor supporting the following HW interfaces
    - RS-232 or RS-485
    - I2C
    - SDI-12

# Inputs and Sensors

This section describes the various input and sensor types for the Ru-35.

## Analog Inputs

The Ru-35 provides two analog inputs, one each on Port A (Channel 1) and B (Channel 2), that may be configured to support a variety of analog sensors. The analog inputs are sampled at a user selected rate and stored at a user defined recording interval equal to or greater than the sample rate. Of the statistical data average is computed out of the samples, minimum and maximum are selected out of those and are available to select to store at the noted interval. Two types of analog inputs are supported for each channel. The analog inputs utilize the Ru-35 Common (Ground) as the return signal path for all types and ranges of analog inputs.

- Analog Voltage channel type has a 0-5VDC range
- Current Loop channel type has a 4-20mA range

The use of a Cu-Ru-35-ADP cable is required for the analog inputs.

## Digital Inputs

The Ru-35 provides two digital inputs, one on each Ports A (Channel 3) and B (Channel 4), to monitor the output of a contact closure or logic driven switch or sensor. The digital input may be selected to operate as a **pulse** totalizing or **event** recording type. The minimum pulse width for detection is 5 milliseconds and the maximum number of pulses per interval is 65,000.

- Pulse Totalizing Channel Type: the RTU counts the number of events (contact closures or pulses) that occur during a user defined interval period. For example, counting the number of tips from a rain gauge in 15 minute intervals or the number of pulses per minute produced
- Event Recording Channel Type: the RTU will record the timestamp of a positive and/or negative transition. For example, monitoring a float switch to identify when a site goes into surcharge and when it recovers. Event recorded data is provided with a date and time stamp to one second resolution.

The use of a Cu-Ru-35-ADP cable is required for the digital inputs.

## Power Diagnostic Data

The Ru-35 can provide RTU power diagnostic data without an additional input connection. This data can be logged on channel 5 with a user defined sample and interval rate. There are four different parameters / ranges that can be selected:

1. Current Draw 2: Logs current consumed by RTU from all power sources
2. Local Battery: Logs battery voltage of internal 12 V batteries
3. External DC A: Logs battery voltage of external DC input on Port A
4. External DC B: Logs battery voltage of external DC input on Port B

## Diagnostic Data-Virtual Channels

Battery Voltages and RTU current consumption are logged continuously in Virtual RTU Measurement and stored at an hourly interval by default. Virtual channels are sampled every 15 seconds and stored in hourly intervals. Enabling channel 5 is not required to view this hourly data.

Following power related virtual channels are stored by RTU:

- Local Battery (V)
- Remote Battery (V)
- External DC (V)
- Total Current (mA/sec)

Other virtual channels available in Ru35 are

- Temperature (F)
- Humidity (%)

Virtual channels data can be viewed locally using Telogers for Windows software.

## Sensor Inputs

The Ru-35 supports multiple sensor types utilizing one of the following serial interfaces: RS-232, RS-485, I2C and SDI-12. Each RTU Port can directly support one or more of the following sensors:

- Smart I2C level/pressure sensors (PT-DSu): May be combined with any other sensor on either port with one exception. FloDar sensor using Cu-Ru-35-FD-5V cable may not be used on the same port as PT-DSu sensor.
- Multiple Flow Meters, RS-232 and RS-485 (Interface cable required)
- Direct Connect Sensors such as the UT-35u ultrasonic level sensor.
- MODBUS devices, RS-232 and RS-485.

The RTU supports two sensors of any combination from above, one on each Port A and B. Additional sensors may be added using a Y-cable so that two or more sensors may be shared on the same port. Addressable sensors of the same type may be used on the same port as long as the sensor addresses are unique and configured in the software.

Selecting the type of sensor in the Telogers for Windows software configures the physical RTU port, A or B, to the correct sensor configuration including the hardware and communications protocol, control signals and excitation power and timing.

The following section summarizes the list of currently compatible Trimble, Smart and 3rd party flow meter sensors that are currently available.

### Compatible Trimble Sensors

These are direct connect sensors and do not need an additional connection cable.

| Trimble Sensors | | |
|---|---|---|
| **Pressure/ Level Telog PT-DSu** | Type | Digital Strain gauge pressure sensor |
| | Range | Available: 5(10ft), 10(20ft), 30(60ft), 100(200ft), 300(600ft) psi gauge (depth feet), 500 and 1000 psi absolute |
| | Accuracy | Accuracy over the calibrated temperature range, including zero and span setting and the effects of non-linearity, hysteresis, and repeatability: 0.25 % FS. |
| | Pressure Over Range | 2x full scale with negligible calibration change<br>6x containment pressure up to 2900 psi maximum |
| | Pressure Fitting | 1/4 in. NPT female |
| | Dimensions | L 4.5 in. (114 mm), Diameter 1.0 in. (25.5 mm) maximum |
| | Material | 316 stainless steel |
| | Cable | 30 ft.<br>Vented Polyurethane, Diameter 0.225 in.<br>(5.715 mm) Weight 0.027 lbs/ft |
| **Ultrasonic Level Telog UT-35u/95** | Type | Ultrasonic transmitter with ComSensor interface. |
| | Range | 1–13 ft. (0.3–4 m) |
| | Accuracy | ± 0.25 % over a range segment exceeding 2 in. (homogeneous environment) |
| | Beam Angle | 8° conical |
| | Frequency | 95 kHz |
| | Dimensions | L 3 in, (76.2 mm), Diameter 1.9 (48.3 mm) |
| | Material | CPVC |
| | Cable | 10 ft. or 30 ft. |
| **Flow and Level Telog PSA-35-AV (FloWav)** | Type | Area Velocity and Level |
| | Range | Velocity: -5–20 ft./s<br>Depth : 0–15 ft. |
| | Accuracy | Velocity: ± 2 % of reading<br>Depth: ± 0.25 % full scale ± 1 % of reading within 32–160° F |
| | Size | H 0.9 in. x W 1.85 in. x L 6 in. |
| | Cable | 30 ft. |

**Compatible 3rd Party Sensors**

| Flow Meters | | |
|---|---|---|
| **Smart Sensor/Meter Compatibility** | **Telogers for Windows Selection for Ru-35 Sensor Setup** | **Ru-35 Compatible Cable Part Number** |
| ADS FlowShark | ADS Flowshark | Cu-Ru-35-ADS |
| ADS Triton/Triton+ | ADS Triton(+) | Cu-Ru-35-ADS/TISC |
| | | |
| ISCO Signature series | ISCO SIGNATURE | Cu-Ru-35-CP1 |
| Hach/Marsh-McBirney FloDar and Flo-Tote 3** | Hach Flodar | Cu-Ru-35-FD-5V*** |
| Hach/Marsh-McBirney Flo-Logger* | Hach Flodar* | Cu-Ru-35-MMI* |
| Hach/Marsh-McBirney Flo-Station Internal* | Hach Flodar* | Cu-Ru-35-MFS* |
| Hach FL900 series | Hach FL900 | Cu-Ru-35-H/FL |
| Hach Sigma 900 series | Hach/Sigma 900 | Cu-Ru-35-H/S |
| Hach Hydrolab Sonde HL4 | MODBUS | Cu-Ru-35-HL4 |
| Hach Hydrolab Sonde HL4 w/12V RTU power | MODBUS | Cu-Ru-35-HL-SONDE-PWR |
| MGD ADFM and accQmin | ADFM Meter | Cu-Ru-35-MGD |
| ISCO 2100 series | ISCO 2100, ISCO 2160 | Cu-Ru-35-T/I |
| FloWav - PSA-AV | FloWav | No additional cable needed |
| **Generic Sensors** | | |
| Generic MODBUS interface RS-232 or RS-485 | MODBUS | Cu-Ru-35-CP1 |
| Adapter Cable, Various.** | Various | Cu-Ru-35-Adpt** |

* In the Communication Setup window select RS232 as the Hardware Interface.

** Ru-33 legacy Cu-FD-5V cable is not compatible with Cu-Ru-35-ADPT cable. Use Cu-Ru-35-FD-5V.

*** Hach FloDar may not be used on the same Port as the PT-DSu pressure sensor as it may cause damage to the sensor.

# Software Applications

Telog Ru-35 is compatible with the following software applications: Telogers for Windows®, Telog® Enterprise, Trimble Unity Web, Trimble Unity Mobile. This user guide focuses on using Telogers for Windows for installation, initial setup, programming configuration and RTU management for the Ru-35 and Trimble Unity Remote Monitoring for viewing the data from the RTU as the recommended good practice.

| Application | Devices Supported | Description |
|---|---|---|
| Telogers for Windows® | PC | Primary local configuration and RTU management software application that provides local access for device installation, programming setup and management.<br><br>**Note**: *Please refer to the Trimble Water - Software Downloads page to ensure you are always running the latest released version of the application.*<br><br>Contact Trimble Water Sales to acquire Telogers for Windows. Refer to the *Trimble Water - Support Document Library* for access to the ***Telogers Field Guide - Telogers 101*** for more in-depth information. |
| Telog® Enterprise | PC | Software application that can be deployed at customer site and on Trimble Water leased server and provides remote access to the installed RTU using a PC/computer to communicate with the RTU, receive data and alarms from the RTU, and configure the RTU.<br><br>**Note**: *Please refer to the Trimble Water - Software Downloads page to ensure you are always running the latest released version of the application.*<br><br>Contact Trimble Water Sales to acquire Telogers Enterprise. Refer to the *Trimble Water - Support Document Library* for access to the ***Telogers Enterprise Software Installation Manual*** for more in depth information. |
| Trimble Unity Web | PC<br>Tablet | Cloud-based software application that is accessed online with a PC/tablet web browser view the data for Ru-35.<br><br>Requires Trimble Unity account set up. Contact Trimble Water Sales to acquire a Trimble Unity license. |

| | | |
|---|---|---|
| Trimble Unity Mobile | Mobile Device Tablet | The software that once downloaded onto a mobile device or a tablet, can interface with Ru-35 data.<br><br>The mobile application can be downloaded from the App Store on Android/iOS devices. Requires Trimble Unity account set up. Contact Trimble Water Sales to acquire a Trimble Unity license. |

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# Getting Started

| | |
|---|---|
| ➢ | Planning the Installation |
| ➢ | Connect an Antenna |
| ➢ | Tamper a Call |

Trimble Water recommends that before the RTU is installed onsite, the user should complete the tasks in this document in the order they are presented, especially in the event of inclement weather conditions or locations that are difficult to access.

## Planning the Installation

1. Please ensure you have the latest version of Telogers for Windows installed before beginning the installation process. Instructions for download can be found here.
2. Complete site review to ensure each RTU location allows for the correct mounting of the RTU and associated sensors. Mounting details can be found here.
3. For each RTU location, go to the site to test the signal strength and identify restrictions in the surrounding area. These factors affect the choice of antenna. More than one type of antenna might be used for the set of RTUs in an area. See "Appendix B" for further information.
4. Verify the right sensor has been selected for the application being monitored. See list of compatible sensors here to make your selection.
5. Identify what configuration parameters need to be set up during installation, including sampling and interval rates, alarms and call schedule.
6. Estimate the battery life as per call schedule selection as outlined in the technical specifications. This helps determine if an external power input option is needed for the installation.
7. Ensure all cables and accessories are available before beginning installation.

# Connect an Antenna

All RTU installations require the use of an antenna. The Ru-35 requires the use of an external antenna. This unit is provided with a panel mount TNC coax connector and will support a variety of certified antennas. Refer to Appendix B - Antenna Compatibility for a list of compatible antennas.

To connect the antenna:

1) Unscrew the **gray waterproof cap** from the RTU antenna port.
2) Insert the **antenna connector** into the port and hand-tighten the locking collar.
3) Set the **location** of the attached antenna in accordance with the type of antenna and the instructions that are included with the antenna.

# Tamper a Call

Tampering a Call refers to triggering outbound communication from the RTU. This forces the RTU to make a wireless cellular call to the remote host software application. To initiate a tamper call, please place the tamper magnet on the tamper magnet target (see connections) for 5 seconds until a beep is heard. The call will be successful once the device shows up in the selected remote host application software. If unsuccessful, please attempt another call.

Additionally, Appendix C describes another method on how to tamper a call using a bluetooth dongle with the Ru-35.

## Initial Wake Up Tamper Call

Because the RTU is shipped in a dormant state, the user has to Tamper a Call to:

- Wake up the RTU and exit the dormant state
- Verify communication from the RTU to the remote host software application
- Deliver configuration information to the RTU
- Initiate data delivery
- Register the RTU with the Unity application (if Trimble Unity is being used)

## RTU In Service Tamper Call

- Force a wireless cellular connection to the remote host software application
- Provide latest data readings outside of call schedule
- Deliver configuration changes to the RTU outside of the call schedule

- Connect to the RTU for troubleshooting purposes

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# Installation and Configuration

| | |
|---|---|
| ➢ | Exit Dormant Mode |
| ➢ | Configure the RTU |
| ➢ | Configure the Smart Sensors |
| ➢ | Physical Mounting of the RTU |
| ➢ | Restore Dormant Mode |

**Note:** Data values shown in the screen captures examples in this section are for demonstration purposes only.

## Exit Dormant Mode

All devices shipped from the factory will be in dormant mode when initially received to preserve battery life. In dormant mode, the RTU does not collect data from any sensors and does not initiate calls. After exiting dormant mode, the RTU samples data and makes calls according to its specific configuration.

To exit dormant mode, a tamper call must be initiated by placing the tamper magnet on the tamper magnet target (see connections) for 5 seconds until a beep is heard. The beep indicates that the call has been initiated. If the call is successful, the Telog Ru-35 will exit dormant mode and continue beeping every 3 seconds until the call has ended.

## Configure the RTU

Telogers for Windows is required to configure Ru-35. When installing the RTU for the first time, please ensure all the site and RTU configuration parameters have been identified, including sample and interval rates, call schedule and any alarm setups. will be used to access the RTU configuration. After the initial installation has been completed, the configuration can be changed at any time. Changes made to the configuration after the initial setup take effect the next time the RTU calls the remote host software application as part of a routine scheduled call or tamper call.

The RTU must be configured to:

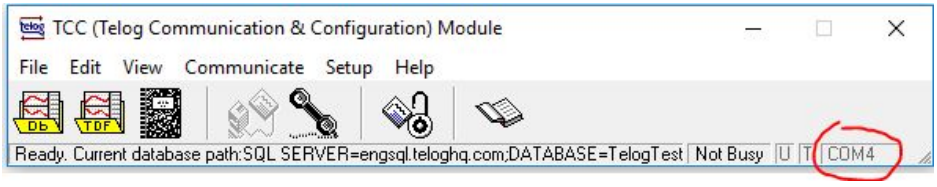
- Collect data at regular intervals (Sample Rate)
- Store the statistical data (Recording Interval)
- Deliver the recorder data to the remote host software application on a schedule (Call Schedule)
- Detect the states when user defined thresholds are met (Alarms)- optional

Additionally, the RTU can be configured to provide diagnostic data as needed.

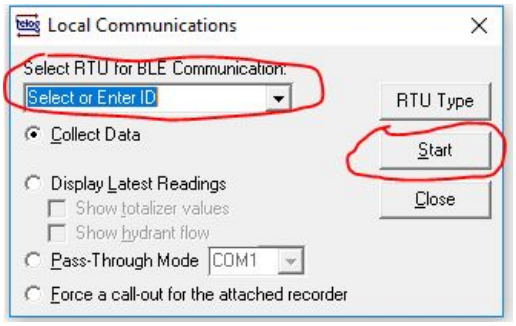
To configure Ru-35 with Telogers for Windows, please follow the following steps:

## Setup RTU Communication for Telogers Using Bluetooth (BLE) Dongle

1. Launch Telogers for Windows.
2. Select the communication port of the BLE dongle. In the lower right corner of the Telogers window, single click on the COMxx port, as circled below, and select the port labeled 'Telog Bluetooth Low Energy (COMxx)'. Once selected, double click to enable. The value is grayed out when disabled.




3. If the padlock is locked, unlock the padlock on the toolbar with a single mouse click. The padlock needs to be in the open position in order to push the configuration to an RTU.
4. If the recorder is not in the database then select 'Communicate' > 'with a local recorder' then type in the serial number of the RTU. Click on 'Start' once done. Once the communications has successfully completed the RTU will be added to the database.

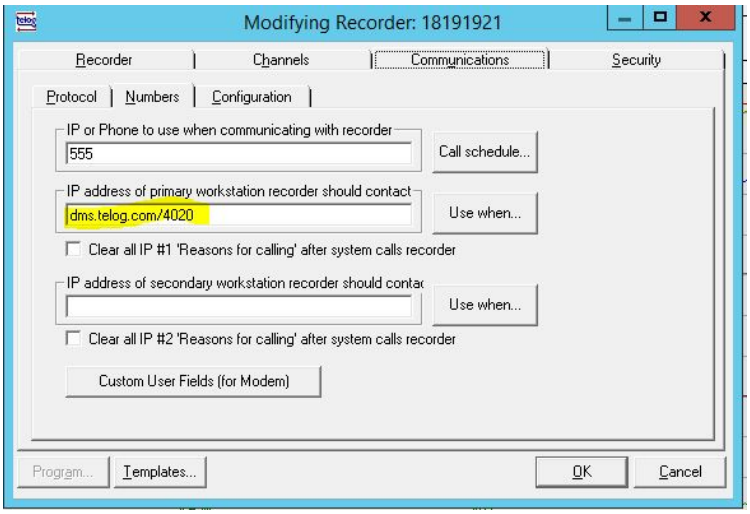



5. Click 'Setup' > 'Recorders' and select the Recorder ID or Serial Number of the RTU from the list. Click on 'Modify' once done. If the serial number does not appear in the list, refresh the list.
6. Use the following tabs In the 'Modifying Recorder' window to configure the RTU and its sensors:

- Communications
- Channels
- Recorder

## Enable Communication with the Server

1. In the ‘Modifying Recorder’ window, click the Communication tab,
2. Enter the server IP address/port of the Enterprise server or Trimble Unity application. This will depend on the remote host application being used for viewing the data.




3. In Use When… Ensure that at N is set to at least following options:
    a. Power-up
    b. Normal schedule
    c. Tamper/user initiated.

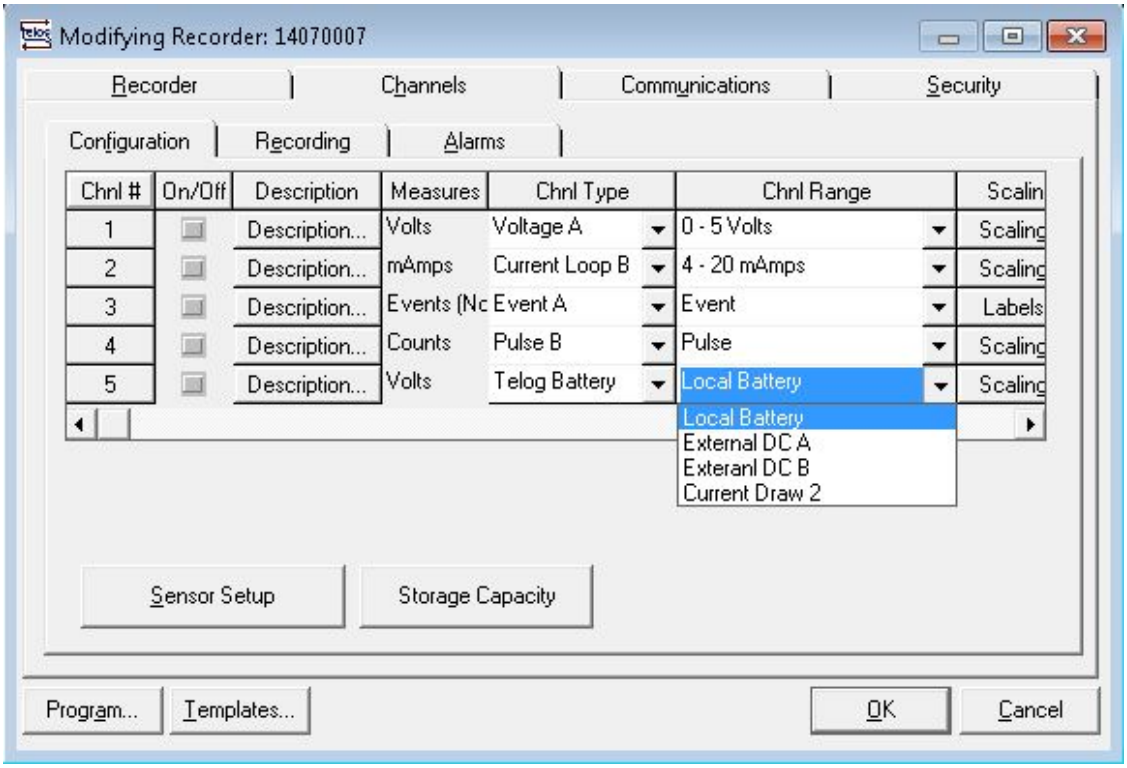
It is also suggested to enable Instant readings to at least one call a day by placing a checkbox in I for Instant readings every and setting in a window a value lesser than, or equal to 1440 minutes.

4. In the Call Schedule option ensure that in the tab Recorder calls system in Scheduling information window calls are set to repeatable schedule i.e.: By the day.

## Configure the Analog and Digital Input Channels

For the applications when either digital or analog sensors are utilized set the channels one through four according to the port where sensors are attached.

1. In the ‘Modifying Recorder’ window, click on the ‘Channels’ tab. The ‘Configuration’ subtab is displayed by default and allows for enabling or disabling logging on any specific channel.



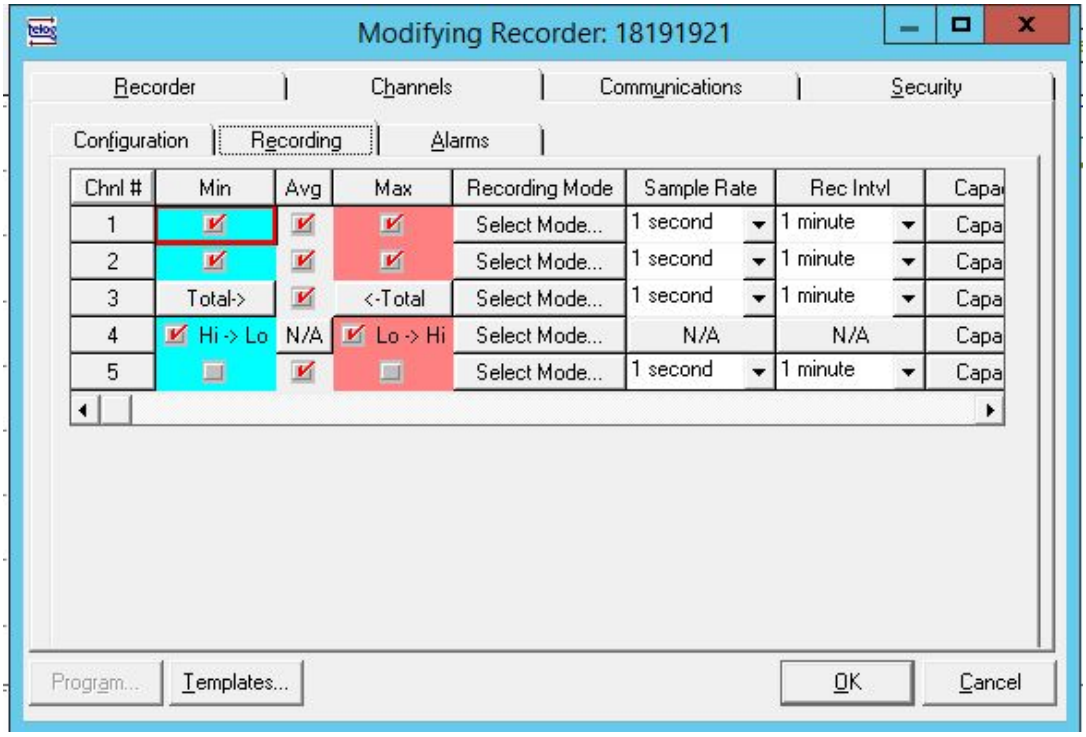

To specify the settings to be transmitted on each channel, use the following instructions:

1. **Analog channel 1** (Port A) and **Analog channel 2** (Port B) settings.
    a. On/Off: Check box to turn channel data logging on
    b. Chnl Type: Voltage or Current Loop
    c. Chnl Range: 0-5V (Voltage) or 4-20ma (Current Loop)
    d. Scaling: Scale the sensor data to user units. User configurable (See Telogers Help)
    e. Excitation Type: Sensor excitation 5V or 12V @ 100mA max
    f. Excitation Delay: Power up delay required for the sensor to stabilize before sampling.
2. **Digital channel 3** (Port A) and **Digital channel 4** (Port B) settings.
    a. On/Off: Check box to turn channel data logging on
    b. Chnl Type: Pulse or Event
    c. Chnl Range: Low speed (10ms minimum pulse width)
    d. Scaling: Scale the sensor data to user units. User configurable (See Telogers Help)
3. **RTU Power Information Channel 5**
    a. Current Draw 2: Log the current consumed by RTU
    b. Local Battery: Log battery voltage of internal 12V battery
    c. External DC A: Log battery voltage of external DC input on Port A
    d. External DC B: Log battery voltage of external DC input on Port B

All of the options for monitoring in the channel five are collected by the recorder as virtual channels. Enabling channel five recording is redundant to core functions already used in the recorder, however this option can be still utilized for specialized diagnostics applications.

## Setup RTU Sample and Recording Rates

1. Enable data logging statistics (Min, Max and/or Avg)
2. Select recording mode, typically set to Normal
3. Set sample and recording interval rate
4. View channel logging capacity in Days:hh:mm:ss



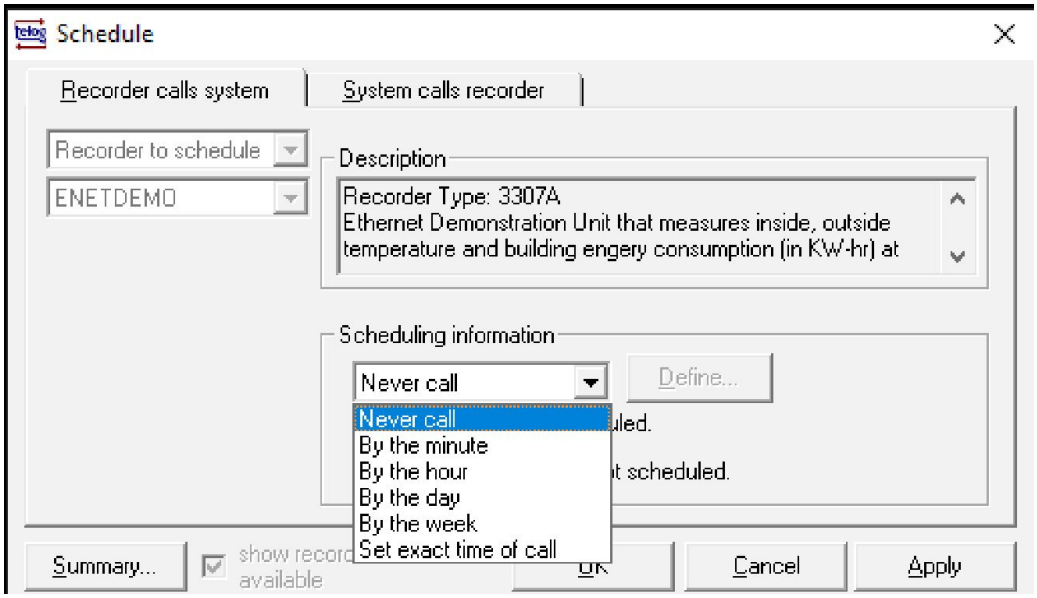

## Setup RTU Alarms

Enable and configure alarm thresholds and dwell times as per user requirements under the 'Alarms' tab. Four unique alarm levels (LoLo, Lo, Hi, HiHi) can be set for each of the applicable channels.


## Set the Call Schedule

The RTU calls the server on a schedule set by the user. To change the RTU call schedule, use the following instructions:

1. In the 'Modifying Recorder' window, click on the 'Communications' tab.
2. Click on the 'Call Schedule' button to display the Schedule window.




3. Select the interval type you want from the drop-down list.
4. Depending on the interval you select, specify the time for the interval. When you select Set exact time of call from the list, choose the date and time for the call.
5. Select OK to confirm the changes made.

**Note**: Call schedule directly impacts battery life as each call uses the internal cellular modem. A more frequent call schedule decreases the battery life. Trimble Water recommends a call frequency of 1/day for most routine applications. Please refer to the technical specifications for further details on battery life.

# Configure the Smart Sensors

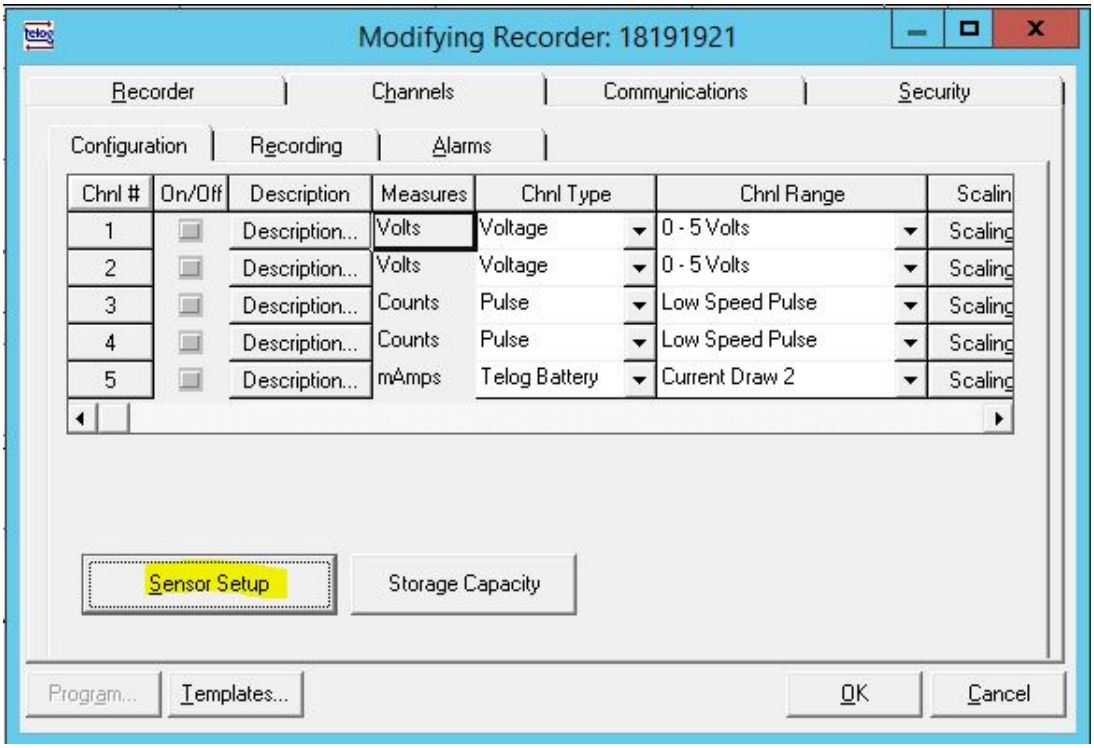
Before beginning sensor configuration, please determine which sensor or sensors are to connect to port A and B. Both ports are interchangeable and independent. The physical connection of the sensors to the RTU must match the configuration selection outlined in the instructions above. For instance, if a UT-35u ultrasonic sensor is connected to Port A, be sure to select the UT-35 sensor template and select Port A for the port (see channel configuration here).

To add multiple sensors on a single Port, a Y-cable is required. Please refer to the "Sensors and Inputs" section for additional details.

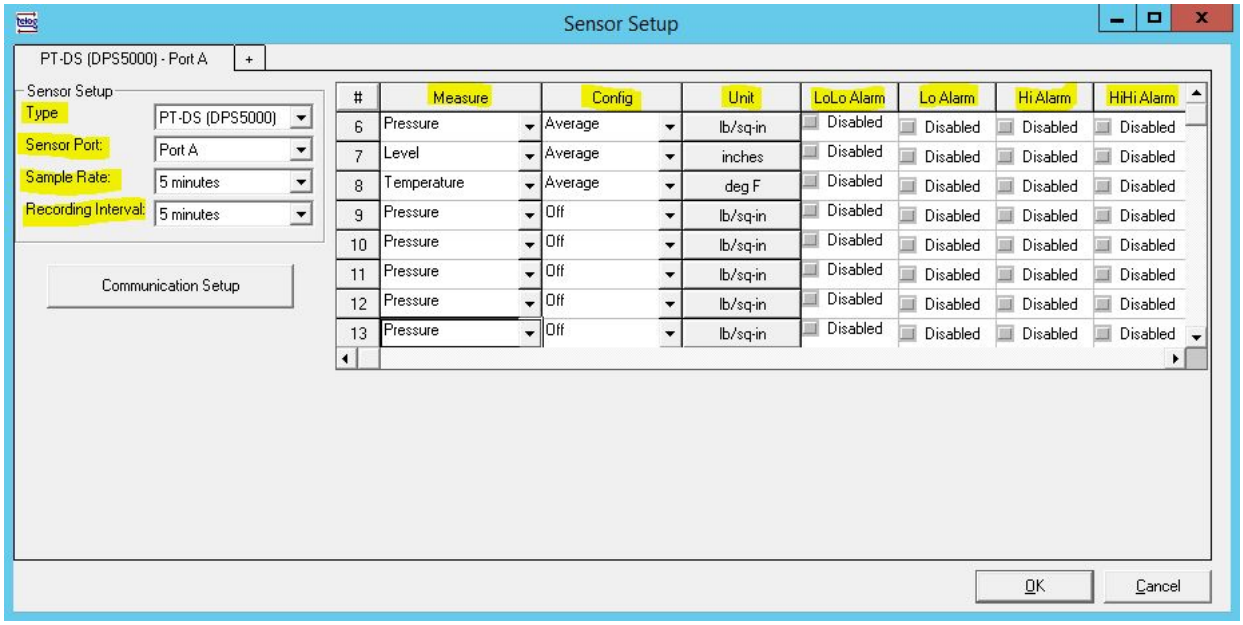
## Sensor Setup

It is important to note that each sensor has its own default values and settings. The following instructions provide a general procedure for configuring the sensors.

1. In the 'Modifying Recorder' window, click on the 'Channels' tab.


Modifying Recorder: 18191921
Recorder
Channels
Communications
Security
Configuration
Recording
Alarms
Chnl #
On/Off
Description
Measures
Chnl Type
Chnl Range
Scalin
1
Description...
Volts
Voltage
0 - 5 Volts
Scaling
2
Description...
Volts
Voltage
0 - 5 Volts
Scaling
3
Description...
Counts
Pulse
Low Speed Pulse
Scaling
4
Description...
Counts
Pulse
Low Speed Pulse
Scaling
5
Description...
mAmps
Telog Battery
Current Draw 2
Scaling
Sensor Setup
Storage Capacity
Program...
Templates...
OK
Cancel

2. Click on “Sensor Setup” button to enter the Sensor Setup Configuration Screen.

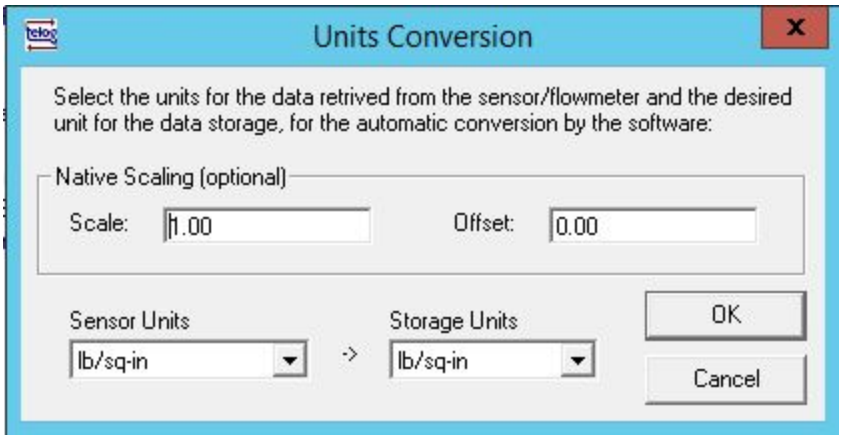



## Select Sensor Type

Refer to the sensor compatibility table for a list of Sensor Template names for each sensor type.

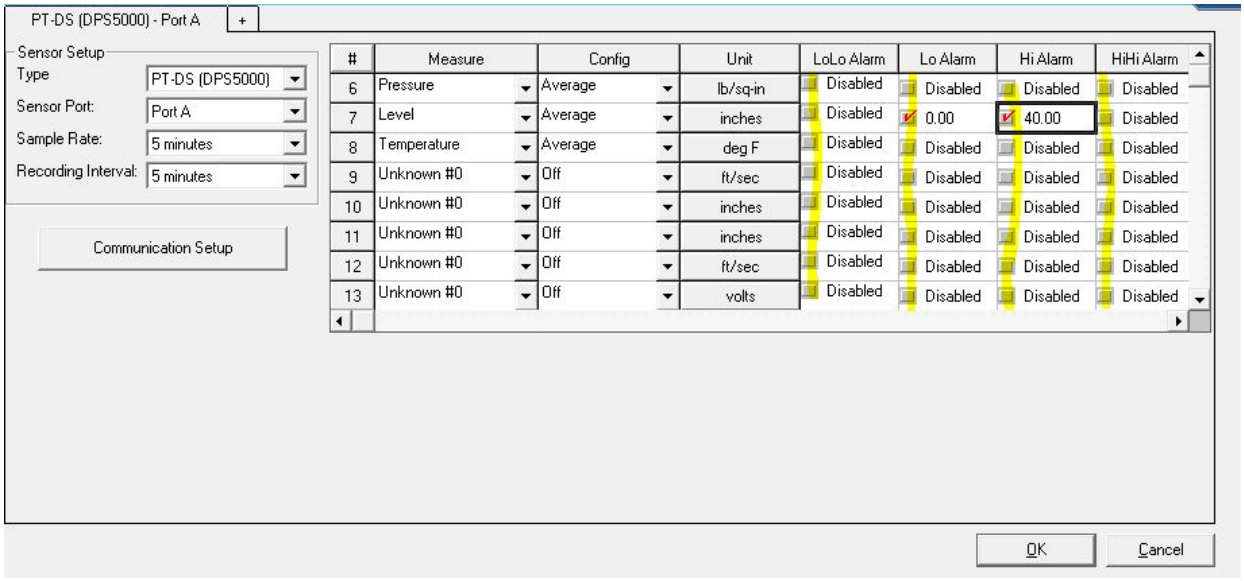
1. In Type click dropdown to see the list of the templates and select proper template.
2. Set the **sensor port (A or B)** to match physical sensor connection port on the Ru-35,
    a. Note that the name of the tab will match name of the selected port.
    b. If necessary to add a second sensor use a ‘+’ symbol next to the tab name.
3. Set the **sample rate** (how often sensor is sampled) and **recording interval** (rate at which data is stored).
4. Select the statistic to record on each interval under the **Config** column.
    a. Off - No data logged.
    b. Average - Log the average of all samples taken during the interval.
    c. Total - Log the total (sum) of the sample values taken during the interval.
    d. Min/Avg/Max - Log Minimum, Average and Maximum sample values for the interval.
    e. Min - Log the Minimum of the sample values for the interval.
    f. Max - Log the Minimum of the sample values for the interval.
5. Under the **Unit** column, click on the button to configure the scaling for the channel.
    a. Sensor Units - Units of the data read from the sensor, typically the default sensor units.
    b. Storage Units - Units in which the data will be stored in the database and viewed by the user.

    **Note**: Unit conversion is performed automatically. For instance, if ‘Sensor Units’ are set to inches and ‘Storage Units’ are set to feet, the software will convert all measurement data to Feet for storage and viewing.

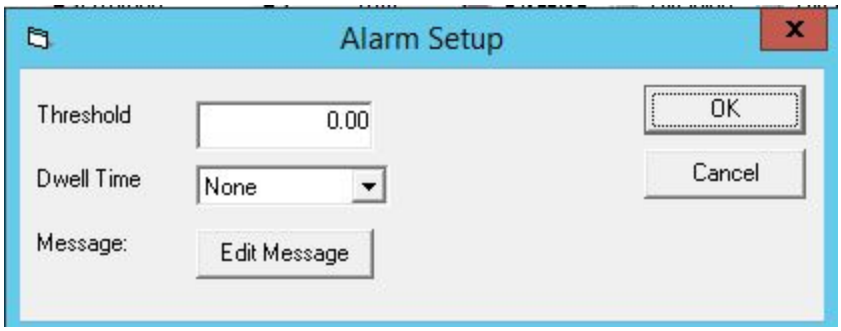



**Note**: Default scaling will remain unchanged if both units match or set as follows:
Scale: 1.00 and Offset: 0.00

6. Enable **Alarms** and set Threshold and Dwell Times, if needed. There are four unique alarm levels (LoLo, Lo, Hi, HiHi) that can be set for each of the applicable channels. Click on the checkbox under the alarm type to enable that alarm.

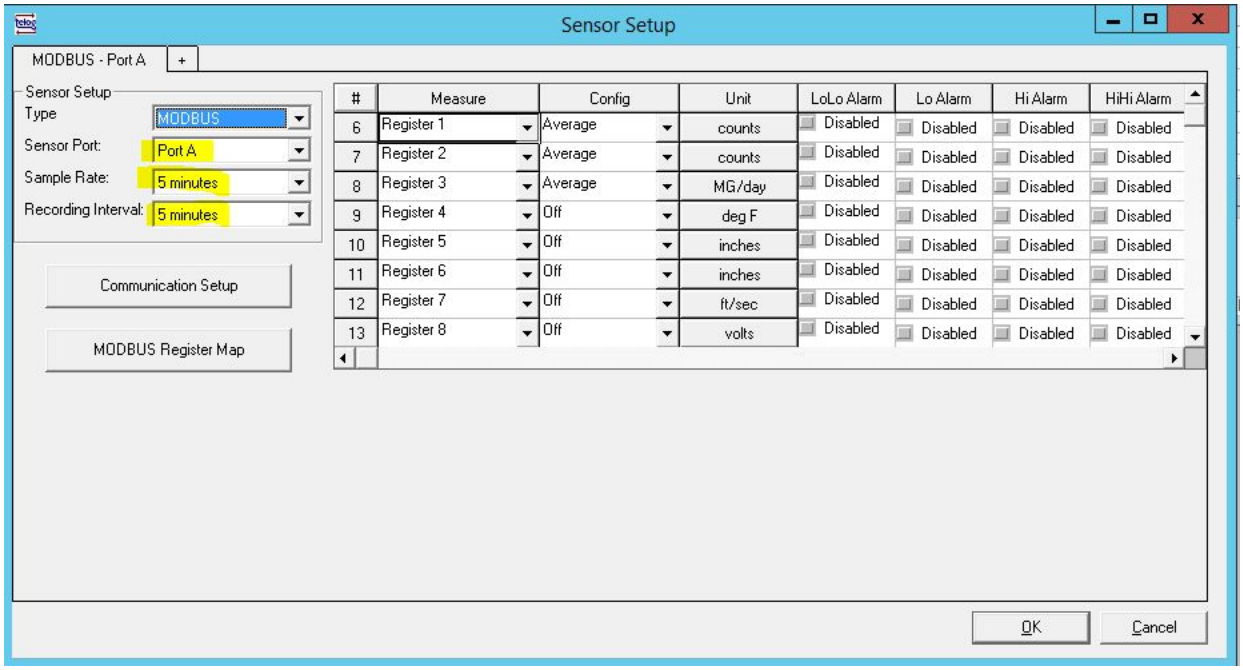



7. The ‘Alarm Threshold’, ‘Dwell Time’ and ‘Message’ will need to be set up in the alarm pop up window for the alarm to function properly.



## Generic MODBUS Sensor Type Configuration

1. Select ‘Sensor Type’ MODBUS and set the ‘Sensor Port’ to match the physical connection
2. Set ‘sample rate’ and ‘recording interval’



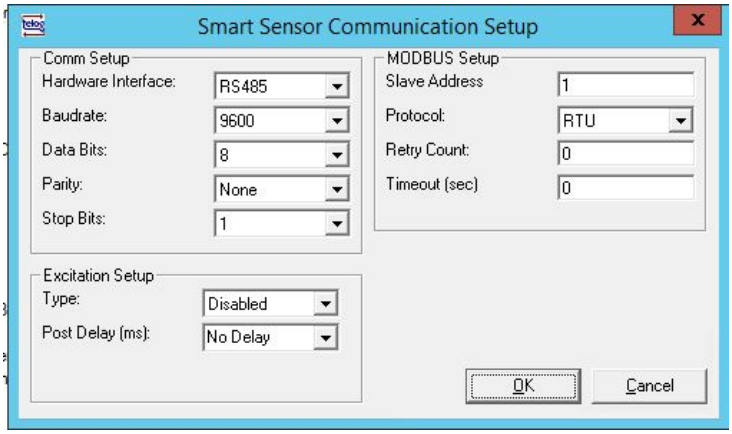

3. Select ‘Communication Setup’ to open the communications configuration window.
4. Set the communications settings to match your MODBUS device.

**Note**: **Ru-35** is always configured as the **MODBUS MASTER** device.

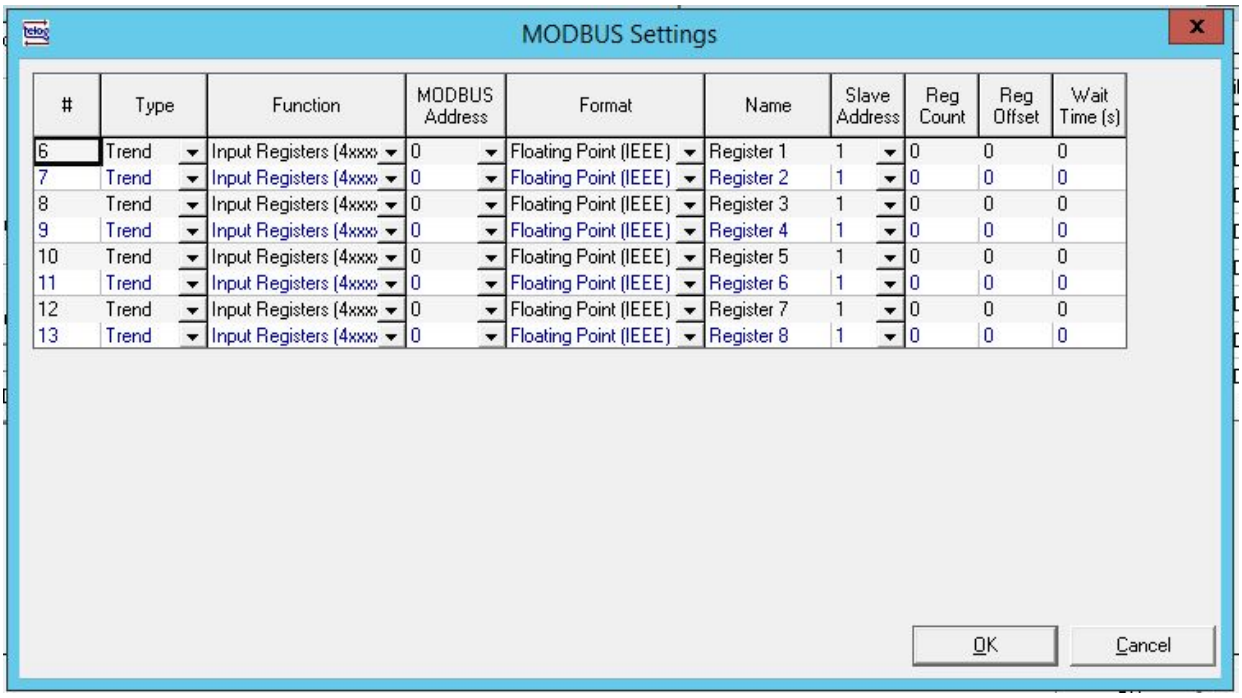
For the ‘Smart Sensor Communication Setup’, please use the following guidelines:

1. **Hardware Interface**: Select the correct interface to communicate with the MODBUS slave (i.e. RS232 or RS485).
2. **Protocol**: This is the MODBUS protocol mode and it should be either RTU or ASCII.
3. **Baud rate, Data bits, Stop bits and Parity**: Select the appropriate settings for these parameters.
4. **Response Timeout and Retry Count** can be changed if there are communication issues (due to line quality or response delays) but in general the default values should not be changed.

**Excitation Setup** is only required if the RTU is powering a connected device. Configure the excitation to match the device manufacturers specifications. The excitation will turn on and wait for the time set in the ‘Post Delay’ before it will attempt to send a MODBUS command to the device.



For the 'MODBUS Settings' window, please use the following instructions:

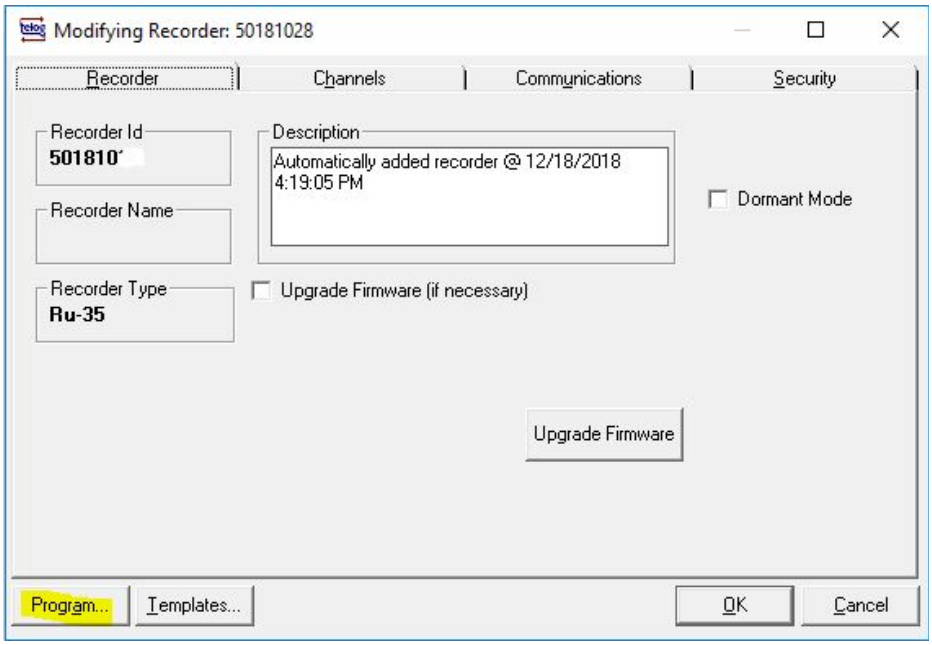



| # | Type | Function | MODBUS Address | Format | Name | Slave Address | Reg Count | Reg Offset | Wait Time (s) |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 1 | 1 | 0 | 0 | 0 |
| 7 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 2 | 1 | 0 | 0 | 0 |
| 8 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 3 | 1 | 0 | 0 | 0 |
| 9 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 4 | 1 | 0 | 0 | 0 |
| 10 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 5 | 1 | 0 | 0 | 0 |
| 11 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 6 | 1 | 0 | 0 | 0 |
| 12 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 7 | 1 | 0 | 0 | 0 |
| 13 | Trend | Input Registers (4xxx) | 0 | Floating Point (IEEE) | Register 8 | 1 | 0 | 0 | 0 |

1. Select the appropriate MODBUS parameters for each channel. These settings should be compatible with the attached MODBUS slave device (e.g. PLC). A brief description of each parameter is as follows:
    a. **Type**: Select Trend or Pulse or Event
    b. **Function**: Select appropriate MODBUS function
        i. Read Input Registers FC04
        ii. Read Holding Register FC03
        iii. Read Input Status FC02
        iv. Read Coil Status FC01
        v. Write Register FC06
    c. **MODBUS Address**: This is the register address to be read for the selected channel.
    d. **Format**: Select the correct data format in which the data is being stored in the MODBUS registers of the attached device.
    e. **Name**: The name of the measurement identifies the data retrieved from the mapped MODBUS register location. This is how the measurement data is identified in the RTU and software.
    f. **Slave Address**: Enter address of the connected MODBUS device.
    g. **Advanced Setting**: Reg Count, Reg Offset and Wait Time. Contact Trimble Water support for additional details.

Once the MODBUS specific settings have been entered, configure the other parameters appropriately and program the recorder.

To complete the Sensor Setup, click on 'Program' to send the new configuration to the RTU.




**Note**: Always confirm the RTU communication settings before programming to prevent unintended changes that may disable communications from the RTU to the host software.

# Physical Mounting of the RTU

Correct mounting of the RTU is crucial in ensuring proper operation of the device and prevents unwanted damage to the installed equipment. For correct installation, the RTU must be mounted in an upright position.

Depending on the site location, two mounting methods are possible:

- **Hanging Mount**:
  - Suspend the RTU from a chain or cable fixed to the cover of the site or from a bar fixed to the side of the site
  - *OR* Attach a stainless steel carabiner to opposite handles on the top of the RTU. Connect each carabiner to a stainless steel chain or cable.
  - *OR* Pass a rigid bar through both sides of the RTU.

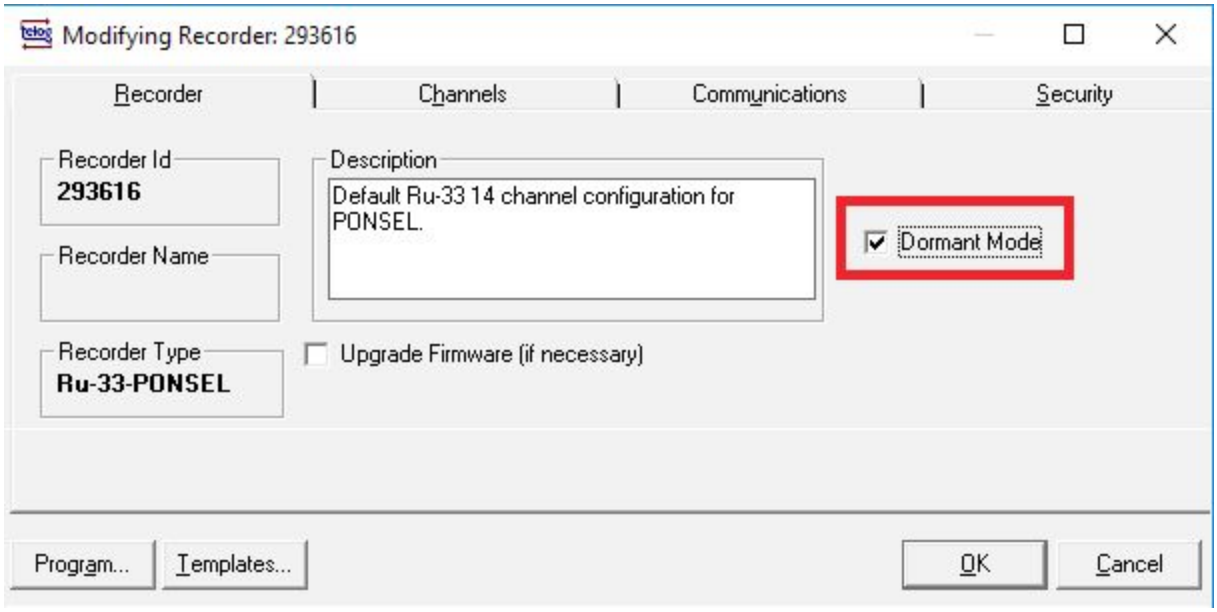
- **Bracket Mount**:
  - Add the HM-10175 bracket to the RTU to provide additional mounting options. The bracket has 0.26 in. holes for attaching the RTU to a vertical surface at 4 points. The recommended screw is 1/4 in. stainless steel. For a flexible attachment, a carabiner can be passed through both the bracket and the RTU.

# Restore Dormant Mode

Dormant mode turns off device sampling and calling to preserve battery life. It is recommended a RTU be put in dormant mode if it is not currently deployed.

To put a device in dormant mode, please use Telogers for Windows and follow these instructions:

1. Open Telogers for Windows and ensure communication has been set up appropriately for the RTU (as outlined here)
2. Unlock the padlock icon to allow configuration changes to be made.
3. Click on the 'Setup' menu and go to the 'Recorders' tab.
4. Select the relevant RTU from the list and click on 'Modify' to display the following window




5. Select the 'Dormant Mode' checkbox and click on 'Program'.
   **Note**: Please ensure that your computer is connected to the RTU through a tamper cable or through the bluetooth dongle till the change has been made.

# Maintaining the Device



## Device Storage

Avoid opening the RTU electronics chamber in the field. When you must open the RTU, unmount it and bring it to a controlled environment.

### Store the RTU

Put the configured RTU into dormant mode. See "Restore Dormant Mode"

Store the Telog Ru-35 in an environment within a temperature range of -40–149 °F (-4–65 °C).

## Replacing the Battery

### Replace the Battery or Modem

When the battery reaches its end of life, open the battery end of the Ru-35 as follows:

#### Battery Access

1. The battery compartment is located opposite the connector side of the Ru-35.
2. Loosen the four self-retaining bolts, lift the cover from the sides to separate from the housing. Bolts require a 9/64” hex driver for removal.
3. Replace both batteries with Rayovac 808 6V lantern batteries. Replace desiccant in the battery chamber each time the batteries are changed.
4. Liberally apply silicone grease to the O’ring before closing.
5. Tighten the screws until the cover makes contact with the gasket and housing. (Torque to: 6 LBF-IN) Do not overtighten as this could damage the housing.

**Note: Battery compartment screws require 9/64” hex driver.**

# Humidity and Desiccant Monitoring

**Below are the guidelines for using the RTU's humidity sensors to monitor the humidity inside the RTU enclosure.**

| Humidity Level (%) | Status | Recommendation |
|---|---|---|
| < 35 | Desiccant Active | No Action Required |
| 36-75 | Desiccant Saturated, Humidity Level OK | Continue to monitor - Humidity will stabilize to ambient humidity |
| 76-90 | Desiccant Saturated, Humidity High, Low Condensation Risk | Replace desiccant and inspect enclosure on next site visit |
| 91-100 | Desiccant Saturated, Humidity High, High Condensation Risk | Schedule a visit to replace desiccant and inspect enclosure |

**How to use the RTU's humidity sensor data:**

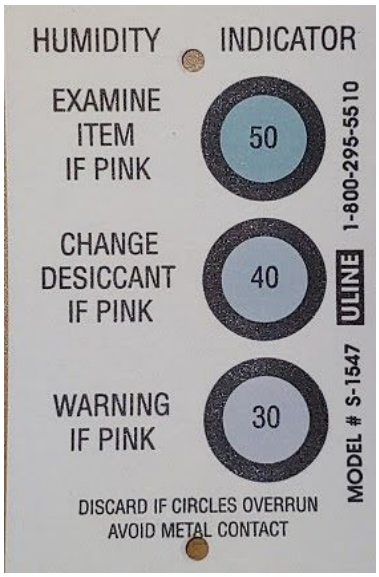
- Humidity below 75% is generally good, no need to replace desiccant unless the humidity continues to rise
- Desiccant will hold the humidity below 20% until it is saturated, at the time of saturation the humidity inside the enclosure will regulate itself to the ambient humidity
- After initial deployment the humidity will rise over time and will stabilize to the outside/ambient humidity once the desiccant is fully saturated. If the ambient humidity (outside the enclosure) is continuously high, >90% the humidity inside the enclosure will rise to this value. Temperature also plays a role in the humidity reading as well as the rate at which the humidity increases.
- Humidity greater than 75% should be flagged for desiccant replacement.
- Once humidity reaches levels above 85% it may start condensing on the internal circuitry, which may cause corrosion.
- It is normal for the humidity to fluctuate during temperature changes, as the temperature rises the humidity will typically drop since warm air holds more water vapor than cold air.
- Sudden spikes in humidity may indicate a breach in the enclosure sealing.

# Replacing the Desiccant Packs

Desiccant packs are placed inside the RTU housing to control the level of humidity. A Humidity Indicator card in the RTU housing indicates the status of the desiccant packs. When the Humidity Indicator on the card displays pink, the desiccant packs are exhausted and no longer able to control the level of moisture in the RTU and should be replaced.

These packs can be sourced through Trimble Sales.

To replace the desiccant packs, remove the exhausted packs and insert new desiccant packs.




8

# Troubleshooting

| | |
|---|---|
| ➢ | Device Diagnostic Data |
| ➢ | Possible Problems and Solutions |

## Device Diagnostic Data

### RTU Virtual Channel

The Ru-35 records its diagnostic information in virtual channels. The data can be viewed in host software in virtual measurements. The following diagnostic data is logged, note

| **Virtual Measurement Name** | **Virtual Channel** | **Measurement Description** | **Units of Measure** |
|---|---|---|---|
| Local Battery | Yes | Internal RTU Battery Voltage | Volts |
| Remote Battery (External DC A | Yes | Port A External Battery Voltage | Volts |
| External DC (External DC B) | Yes | Port B External Battery Voltage | Volts |
| Total Current | Yes | Total power consumed by RTU during the interval | Amp*Seconds |
| Temperature | Yes | Internal RTU Temperature (Electronics Chamber) | DegF (Default) |
| Humidity | Yes | Internal RTU Humidity (Electronics Chamber) | % |
| ModemOn Time | Yes | Time the modem is turned on | Seconds |
| SensorCommOn Time | Yes | Not Applicable to Ru-35 | NA |
| Call Log | No | Log of all calls that connect to the server | None |
| Total Bytes | No | Estimation of Data bytes transmitted over | None |

| | | | |
|---|---|---|---|
| | | wireless connection | |
| Total Packets | No | Data packets transmitted over wireless connection | None |
| Note: All Virtual channel trend data is sampled at a 15 second rate and the Min, Max and Avg statics are stored once per hour. | | | |

## Possible Problems and Solutions

| Problem | Possible Cause | Solution |
|---|---|---|
| Recorder not completing remote calls | Antenna not connected properly to the recorder | Inspect antenna port for damage or position of the antenna connector, unscrew and reattach the antenna. |
| Recorder not completing remote calls | Antenna not installed in the location that allows reception of wireless signal | Review antenna installation. Test with another antenna purchased for field troubleshooting.<br><br>For in-ground installation ensure that the medium used to cover the antenna is installed according to antenna manufacturer recommendations.<br><br>For underground installation- test communication with antenna extended above the cover used to protect the location.<br><br>For in the cabinet, or inside building test communication with the door to enclosure, or (and) building opened<br><br>For above open air installation test communication with antenna extended higher then original installation point |
| Recorder not collecting the data | Proper sensor cable not selected | Review the order and verify that the sensor cable installed matches Trimble Water recommendation for sensor selected for installation |
| Recorder not collecting the data | Sensor cable not plugged in as required | Inspect the way communication cable is plugged into the port A, or B; check the cable and port connectors for damage; remove and reattach the communication sensor |

| | | |
|---|---|---|
| Recorder not collecting the data | Sensor cable damaged | Inspect the cable between the recorder and sensor for any visible damage, replace if necessary |
| Recorder not collecting the data | Sensor cable plugged in to incorrect Ru35 port | Review the configuration of the Ru35 using the latest known configuration of the RTU and verify what port is listed for use with desired sensor |
| Recorder not collecting the data | Sensor cable leads connected to smart sensors not following recommended factory setting | Review the documentation obtained from Trimble Water and from the sensor manufacturer and compare to installed leads, change, if necessary |

| **Problem** | **Potential Cause** | **Solution** |
|---|---|---|
| No data recorded | Recorder still in Dormant mode | Use the tamper call procedure to force a wake-up call. |
| No Ru-35 response | Battery Flat | Replace the battery. Refer to the Battery replacement procedure for information. |
| No local Communication | Software version | Check for an application update. Upgrade if a newer version is available. |
| No available Tamper cable or BLE Dongle to Tamper a Call | Tamper the Ru-35 by removing the battery | Remove the battery to interrupt the power cycle. Wait 5 minutes, then reconnect the battery to Tamper a Call. Refer to the Battery replacement procedure for details. |
| No Local Communication | Cabling | Verify the Cu-Ru-35-CTS cable is connected between the PCB USB port and one of the sensor ports. Status LED on the cable should be flashing on once every five seconds. |
| No Local Communication | RTU making a remote call | If the Ru-35 is beeping once every three seconds or the Status LED on Cu-Ru-35-CTS cable is on solid, the RTU may be on a call. Wait for the call to complete. |
| No BLE Communications | BLE disabled in RTU | Enable RTU BLE option in the Unity or Telog software. |
| No BLE Communications | No BLE dongle on PC | If using a PC, verify C-BLE-D USB dongle is installed on the USB port and selected in the software. |
| No Wireless Communications | Modem activation taking place | If this is the first time initiating a call, the RTU may be activating the modem, which may take a few minutes. If the call is unsuccessful, initiate another call. |
| No Wireless Communications | Modem account not active | Verify the RTU modem account has been activated. |

| | | |
|---|---|---|
| No Wireless Communications | Low or no wireless signal strength | Verify wireless signal coverage in the area, move to a better location if the signal is poor. |

# Appendix A - Ru-35 Technical Specifications

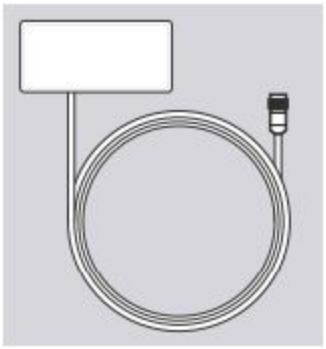
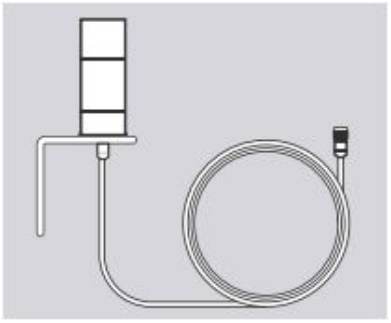
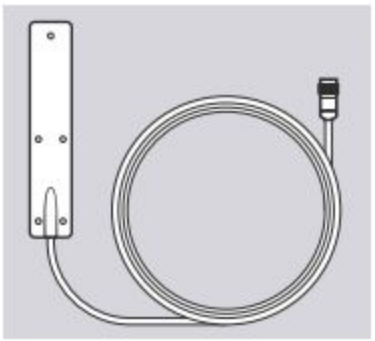
This information can also be found on the datasheet for Ru-35 on the Trimble website:
Telog Ru-35 Datasheet

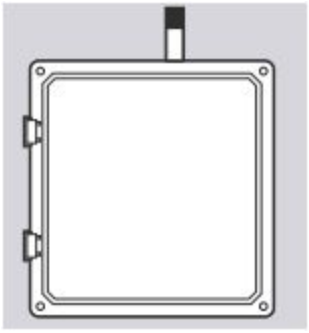
| | |
|---|---|
| **Type** | Multichannel, underground RTU with embedded cellular modem |
| **Recording** | |
| Sample rate | 1 per second to 1 per 8 hours; programmable |
| **Memory** | |
| Size | 1MB |
| Storage method | Wrap around (first-in; first-out) |
| Data Capacity | Analog input: 670,000 values<br>Pulse input: 500,000 values<br>Event input: 150,000 values<br>ComSensor input: 250,000 values |
| **Communication** | |
| Local RS-232 | Auto-selected baud rate to 115Kbps |
| Cellular | WM2/L cellular modem LTE Category 1 certified Verizon, Sprint<br>WM2/H HSPA modem certified on Bell in Canada |
| Bluetooth | Local Bluetooth BLE 4.1 |
| **Power** | |
| Battery | Factory installed, field replaceable Dual 6V alkaline lantern battery<br>Rayovac 6-Volt Spring Terminals Alkaline F Cell \| 808 |
| Battery Life | Up to 2800 data calls to host computer |
| Examples: | Call Frequency — Sampling Frequency — Battery Life<br>1/day — 5/second — 5 years<br>2/day — 1/second — 3 years<br>(@ medium to excellent signal strength) |
| External Power Input | 9-30VDC @ 1A max optional via customer supplied DC or solar.<br>Battery becomes back-up if External Power is lost. |

| | |
|---|---|
| **Enclosure** | |
| Size | 7.3” L x 4.2” W x 11.5” H [185 mm x 107 mm x 292 mm] |
| Weight | 9 lbs. [4 kg] |
| Material | Injection Molded Polycarbonate |
| **Environmental** | |
| Temperature | -22 °F to 160 °F [-30 °C to +70 °C] |
| Rating | NEMA 6 (IP68) |
| **Support Application** | |
| TW-UNITY | Trimble Unity |
| S-3PC | Telogers for Windows®6.77 or later |
| S-3EP | Telog® Enterprise 6.77 or later |

# Appendix B - Antenna Compatibility

This section describes the antennas that are supported by the Ru-35 RTU.
Refer to the LTE Antenna Specifications on the Trimble Water website for specification details.

| | | |
|---|---|---|
| **A-CBA-LTE Burial Antenna** | | |
| Installation Location | In the road surface and is typically used for long term installations. |  |
| **A-EMA-LTE Enclosure Mount Antenna** | | |
| Installation Location | On an enclosure |  |
| **A-PMA-LTE Pole Mount Antenna** | | |
| Installation Location | On a pole - Mounting kit included |  |
| **A-SB-LTE Blade Antenna** | | |
| Installation Location | On the road surface or non-conductive surface; typically used for temporary installations. |  |

| **A-ETV-LTE Enclosure Mount Vandal Resistant** | | |
|---|---|---|
| Installation Location | Enclosure Top Vandal Resistant Mount. ¾” mount |  |

# Appendix C - Tamper a Call

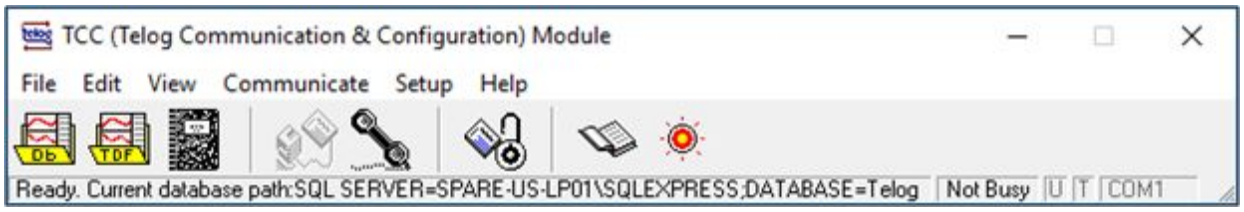
This procedure describes how to tamper a Call using a BLE Dongle and the Telogers for Windows (Telog TCC) application. This can be done to wake a device up from dormant mode, to make programming changes to the device, to test communications, to receive latest data from the device or for troubleshooting or diagnostic purposes.

Before starting, have on hand the:

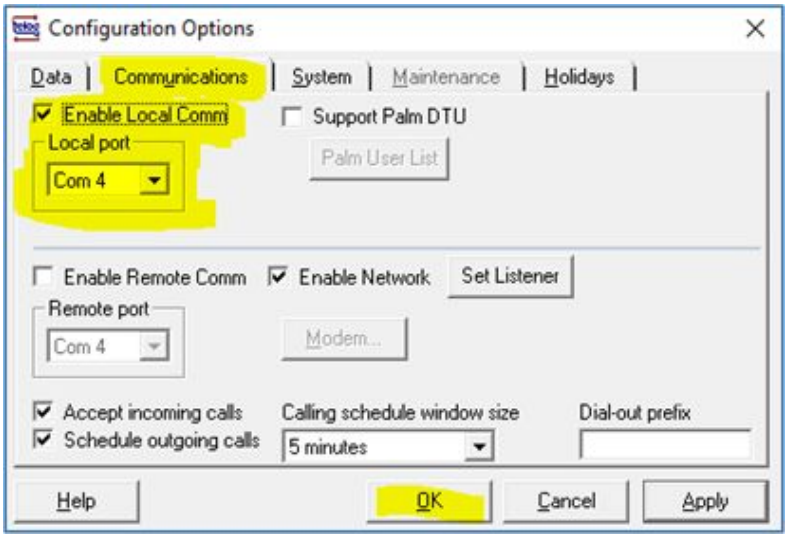
- RTU
- BLE Dongle
- PC with Telogers for Windows application installed. Refer to the Software Applications for information on how to acquire and use Telogers for Windows.
- Locate the PC within 20' of the RTU

To Tamper a Call using the BLE Dongle:

1. Insert the **BLE Dongle** into the PC being used to make the wake up call.
2. Open the **Telog TCC** application. The system displays the following main menu screen.

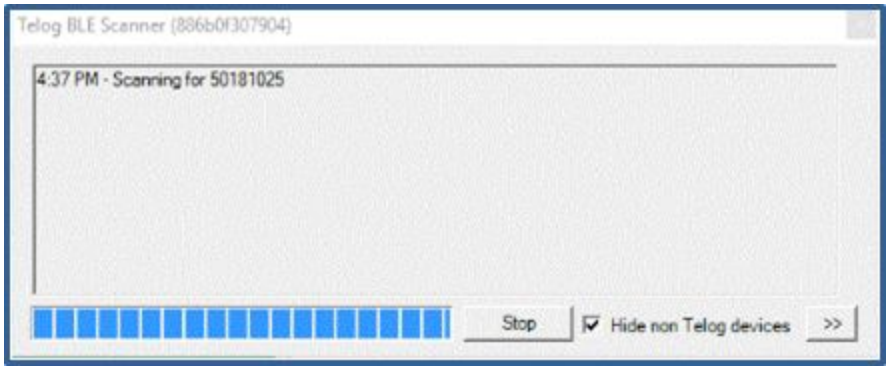



3. Click on **Setup-> Options**. The system displays the Configuration Options window.
4. Click on the **Communications** tab.
5. Select **Enable Local Comm** (click on the check box to select it).
6. Click on the drop down menu for **Local port** and select the PC port the BLE Dongle is plugged into.
7. Click on **OK**. The system closes the Configuration Options window.




8. Click on **Communicate** in the main menu.
9. Select **with Local recorder**.
10. Select **Force a call-out** for the attached recorder.

11. Select **RTU for BLE Communication**.
12. Enter the **ID of the RTU**.
13. Click on **Start**. The system displays two windows:
    - The Telog BLE Scanner window displays the status of the BLE Dongle scanning for the RTU and the connection status.




- The Local Communications window displays the communication status once the RTU and the PC are connected.


You are now connected to and communicating with the RTU.