# RMU3/3XL

## Installation and Configuration Guide







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# CURRENT REVISION APPROVALS (Revision 1.12)

| Name | Location | Job Function | Signature | Date |
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| | | | | |

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| 1.02 | Mar 30, 2011 | | Fixed wiring diagram for P/S2 on RECT13. Added CSA statement to specifications. | Tony da Costa |
| 1.03 | Jan 19, 2012 | | Added datalogger information.<br>Updated measurement types for TP18, TP19 and BOND30. | Tony da Costa |
| 1.04 | June 24, 2013 | | Added measurement type TP17.<br>Updated installer screen shots. | Tony da Costa |
| 1.05 | Jan 21, 2015 | | Updated three-phase relay pictures and HE-90 compatibility notes. | Tony da Costa |
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| | | | | |

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# 1 Introduction

The RMU3/3XL Remote Monitoring Unit is part of the Mobiltex Data Ltd. CorTalk® family of cathodic monitoring and control products. Mobiltex Data Ltd. was formed in 1985 and specializes in the design and manufacture of high reliability, industrial mobile data systems for the communications, transportation and utility markets. Mobiltex has been providing solutions for the cathodic monitoring industry since 1991.

The RMU3/3XL is a low cost, high reliability device intended to control and monitor rectifiers, bonds and test points. The device provides GPS synchronized interruption functionality and is available in cellular (RMU3-G) or satellite (RMU3-S) communication configurations. The field hardware consists of two primary components: a measurement terminal block (small 4-channel RMU3-B for RMU3 or larger 44-channel RMU3X-B for RMU3XL) that is usually mounted inside the rectifier or a separate NEMA4 enclosure, and the antenna transceiver that is typically externally mounted. The RMU3X-B base is organized as 11 banks (primary RMU + 10 subRMUs) of 4 channels each, in effect making it look like 11 RMU3-B bases. The device operates from a low voltage source such as a Class 2 transformer and has an internal battery backup system for short-term operation during power outages. The very low power consumption of the device makes it suitable for TEG and solar applications. The RMU3 has integral high-energy surge suppression and provides unprecedented lightning immunity because there are no connections to electrical ground.

The RMU3 (and each subRMU of the RMU3XL or MUX3) each monitors and transmits nine channels of information. Four high accuracy, galvanically isolated, AC/DC capable analog inputs are typically used to monitor volts, amps and / or 4-20mA signals from external equipment. An integral power source sensor can be used to determine if supply voltage or AC line voltage is present. An integral magnetic sensor (optically isolated external dry/wet contact input for RMU3X-B) can be used as a rectifier door sensor or tamper detection alarm. The RMU3 measures temperature and internal backup battery voltage. A user accessible switch allows the transmission of uniquely identified messages that can be used to record site visit information. The RMU3/3XL is available with an optional "Measurement Recorder" which will measure and save all the analog readings every 6 hours. With a maximum memory capacity of 16384 records, the RMU3 will store approximately 8 years of readings while a fully utilized RMU3XL will store approximately ¾ year of readings.

Measurement data is wirelessly transmitted to the Mobiltex CorView servers. CorView manages all field data communications, maintains three years of measurement data, sends alarm exception and system performance emails, and provides password protected remote customer access. Remote interruption control of the RMU3 equipped rectifier is available via CorView. With the proper credentials, CorView can be accessed using an Internet Explorer web browser. The measurement data is presented in an intuitive tabular format or graphical mapping display that color-codes abnormal measurement or site conditions for quick user interpretation. CorView can also provide near real-time email notification of abnormal measurement and alarm conditions.

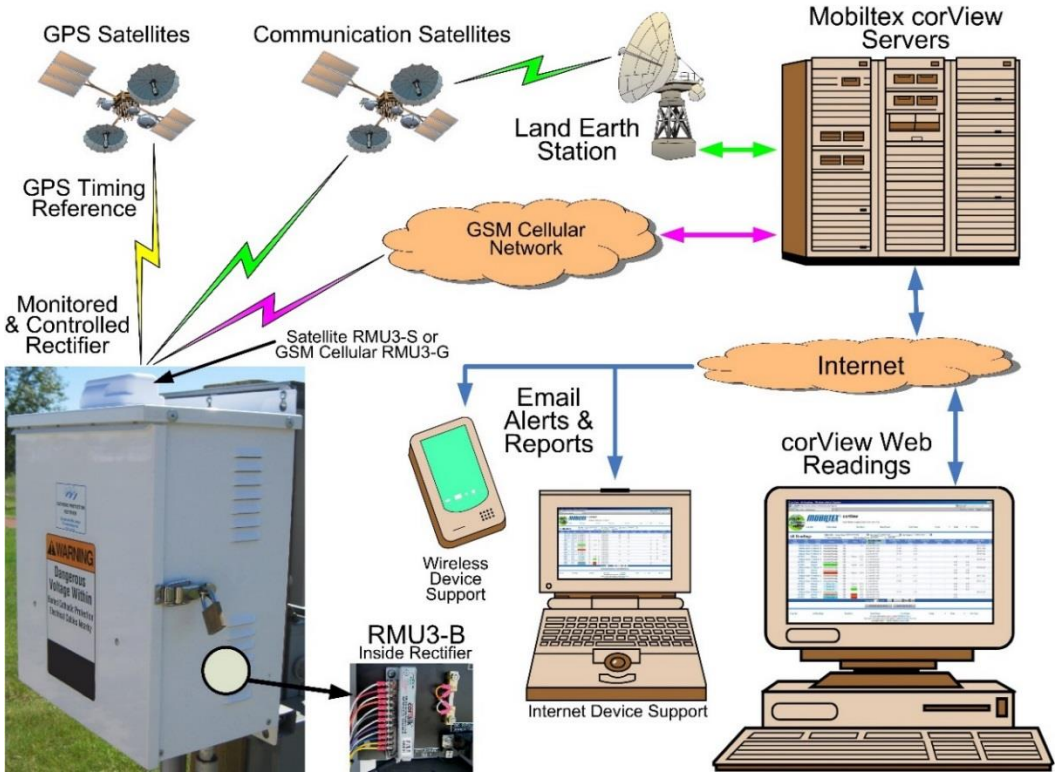



**Figure 1 RMU3 Communications Block Diagram**

# 2 General Safety Information

The following safety precautions must be reviewed to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component's manuals for warnings and cautions related to operating the system.

## To Avoid Fire or Personal Injury

**Connect and Disconnect Properly.** Do not connect or disconnect terminal wiring while the wires are connected to a voltage source.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product. Do not use an input marked with measurement category I for measurements within measurement categories II, III or IV. Do not connect category II inputs directly to AC mains--a Class 2 CSA/UL transformer must be used for isolation.

**Do Not Operate Without Covers.** Do not operate this product with covers or panels removed.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do Not Operate in Wet/Damp Conditions.**

**Keep Internal Product Surfaces Clean and Dry.**

## Symbols and Terms

**Terms in this Manual.** These terms may appear in this manual:

**WARNING.** Warning statements identify conditions or practices that could result in injury or loss of life.

**CAUTION.** Caution statements identify conditions or practices that could result in damage to this product or other property.

**Terms on the Product.** These terms may appear on the product:

**DANGER.** Danger indicates an injury hazard immediately accessible as you read the marking.

**WARNING.** Warning indicates an injury hazard not immediately accessible as you read the marking.

**CAUTION.** Caution indicates a hazard to property including the product.

**Symbols on the Product.** The following symbols may appear on the product:

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| CAUTION Refer to Manual | Protective Ground (Earth) Terminal | Functional Ground Terminal | AC or DC Input | This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements. |

# 3 RMU3 Theory of Operation

The RMU3 field hardware consists of two components, the RMU3-B or RMU3X-B – a measurement terminal block that is typically mounted inside the rectifier or inside a weather protected enclosure and the RMU3-G GPS / cellular antenna or RMU3-S GPS / satellite antenna which is mounted outside the rectifier with a clear view of the sky. Both components are environmentally sealed Type 3 enclosures and are electrically isolated from earth ground to provide exceptional lightning immunity. A molded M8 instrumentation cable connects the devices together.

The device is powered from an AC or DC Class 2 source that is between 9 and 18VAC or 9 and 22VDC. A Class 2 transformer is typically utilized for AC line powered applications. An integral battery backup system powers the device for approximately 16 hours (RMU3-G) or 10 hours (RMU3-S) during power outages.

The RMU3-B and RMU3X-B have a "Test" button to allow field personal to manually initiate a measurement cycle and near immediate cellular transmission. This transmission is uniquely identified on the CorView web site so this feature can be used to record site visits or inspection activities. The RMU3-B has a dual color LED indicator that provides the installer with device status information. The device can be field configured using the optional RMU3-PGM configuration interface and a PC computer with an available USB port.

A power-up message containing device configuration information and readings is transmitted shortly after the RMU3-G/S and RMU3-B/RMU3X-B devices are connected together. The device will enter a low power state after it completes the measurements and will wake up every 6 hours there-after and take another set of measurements. The device can also be immediately wakened by opening or closing the magnetic door switch (if enabled) or by pressing the "Test" push button on the RMU3-B. The magnetic door switch has a 5 second de-bounce timer and software logic to limit satellite or cellular transmissions in the case of intermittent door sensing.

The device measures 4 external analog channels (11 groups of 4 analog channels for RMU3X-B), a supply voltage presence sensor, a digital magnetic door sensor (optically isolated dry/wet contact digital input for RMU3X-B), internal RMU3-B/RMU3X-B temperature, and internal battery voltage. The external analog channels are high impedance and galvanically isolated with multistage lightning protection. Each of these analog channels is capable of measuring DC (bipolar) or AC (true RMS) signals up to 150 VDC / 105 VRMS. A >65dB 50/60Hz AC rejection filter is utilized for DC measurements to provide maximum DC accuracy. Each channel supports several voltage ranges (150mVDC, 22VDC, 150VDC, 16VAC, 105VAC FS) to accommodate a wide range of sensors (current shunts, reference cells, and direct voltage measurement). The measurement application (rectifier, bond, test point), channel mapping, range selection and AC / DC selection is defined by the "measurement type" configuration parameter that is factory or field programmed into the RMU3/3XL. An optional external AC Line Voltage Divider is required for applications that measure 110/120 or 220/240 VAC line voltages.

For special applications, any of the external analog channels can be field configured for use with 4-20mA current transducers. An external 7.5 or 250 ohm precision resistor is required across each measurement channel that is used for 4-20mA current loop sensing. The desired readings at the 4mA and 20mA levels for each analog channel must be programmed into the RMU3/3XL using the RMU3/3XL configuration software.

The device can be factory configured for one of four types of data reporting plans: readings every 6 hours, readings every 24 hours, readings every 48 hours, and readings every 7 days. The device can also be factory configured to monitor the door switch and provide near immediate transmissions when the rectifier door has been opened or closed.

Irrespective of the data plan, the device wakes up every 6 hours and takes a set of measurements. The measurements are compared with optional (field configured) alarm high limit and alarm low limit values. The device will immediately initiate a transmission if a new alarm or cleared alarm condition(s) is detected. The device can be configured to suppress alarm limit exception transmissions during interruption.

The report by exception scheme allows timely (i.e. sample every 6 hours) reporting of out of limit measurements while maintaining a low messaging cost due to infrequent periodic transmissions. The CorView web site has a watchdog feature that monitors the periodic transmissions and alarms sites that have not reported within the expected time window. CorView can be user configured to automatically email alarms, alarm clears and system fault information to the appropriate field personal.

As an optional feature, the RMU3/3XL can be factory equipped with a measurement data recorder. This feature allows the RMU3 to automatically record the measurements on all active analog channels, the temperature, the presence of supply voltage, the door switch state, that battery status, and the channel limit alarm status every six hours. The measurements are locally stored in non-volatile memory, allowing the RMU3 to retain the data without power attached. The memory will store eight years of measurements with an RMU3-B; eight months of data store is accommodated with an RMU3X-B. Data is extracted using the RMU3-PGM configuration interface tool (or a direct USB connection to an RMU3X-B) and the RMU3 configuration software. The data is then saved to a file on a PC in a common comma separated value format.

# 4 Kit Contents

## 4.1 RMU3: RMU3-G/RMU3-B (Cellular) A20A00RMU31 or RMU3-S/RMU3-B (Satellite) A20A00RMU30

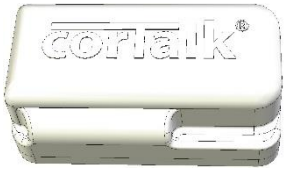
| | |
|---|---|
|  | 1 pc - RMU3-B Measurement Terminal Block.<br>Installed inside the rectifier enclosure and connects to the RMU3-G or RMU3-S.<br>Mobiltex Part Number A15000RMU30 |
|  | 1 pc - RMU3-G GPS / Cellular Antenna Transceiver (A15000GTX30)<br>or<br>1 pc - RMU3-S GPS / Satellite Antenna Transceiver (A15000STX30)<br>Externally installed with the dome requiring a clear view of the sky. |
|  | 1 pc – ½" Plastic Male Conduit Fitting.<br>Secures the base of the RMU3-G or RMU3-S to the rectifier enclosure.<br>Mobiltex Part Number H355210TA05 |
|  | 1 pc – RMU3 Interconnection Cable.<br>Length 1 meter (3.2 feet). Interconnects RMU3-B and RMU3-G or RMU3-S.<br>Mobiltex Part Number W16400RMU03 |
|  | 1 pc – Magnet For Door Switch Alarm.<br>Used for optional door switch alarm with labelled side of RMU3-B.<br>Mobiltex Part Number H00000MAG01 |
|  | 1 pc – Field Installable User Label Set.<br>Can be installed on the RMU3-B to indicate electrical connections for selected Measurement Type.<br>Mobiltex Part Number S17600RMU27 |
|  | 1 kit – RMU3-B Mounting Hardware.<br>2x #10 1.25" Tek Screws, 2x 10-32 1.25" Screws, 2x #10 Lock Nut.<br>Mobiltex Part Number A20100RMU20 |

**Table 1 RMU3: RMU3-S/RMU3-G w/RMU3-B Kit Contents**

## 4.2 RMU3XL: RMU3-G/RMU3X-B (Cellular) A20A00RMU36 or RMU3-S/RMU3X-B (Satellite) A20A00RMU35

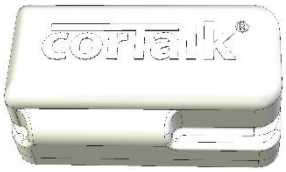
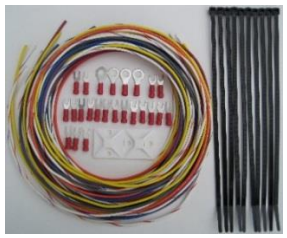
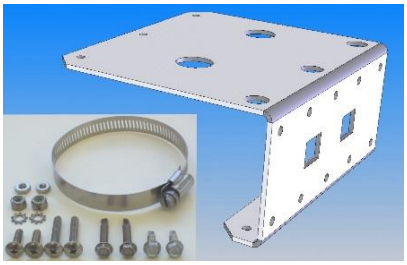
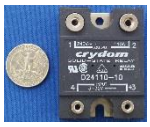
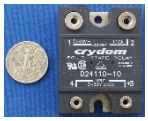
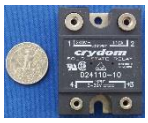
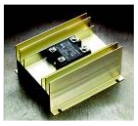
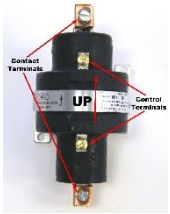
| | |
|---|---|
|  | 1 pc - RMU3X-B Measurement Terminal Block.<br>Installed inside the rectifier enclosure and connects to the RMU3-G or RMU3-S.<br>Mobiltex Part Number A1506031301 |
|  | 1 pc - RMU3-G GPS / GSM Cellular Antenna Transceiver (A15000GTX30)<br>or<br>1 pc - RMU3-S GPS / Satellite Antenna Transceiver (A15000STX30)<br>Externally installed with the dome requiring a clear view of the sky. |
|  | 1 pc – ½" Plastic Male Conduit Fitting.<br>Secures the base of the RMU3-G or RMU3-S to the rectifier enclosure.<br>Mobiltex Part Number H355210TA05 |
|  | 1 pc – RMU3 Interconnection Cable.<br>Length 1 meter (3.2 feet). Interconnects RMU3-B and RMU3-G or RMU3-S.<br>Mobiltex Part Number W16400RMU03 |
|  | 3 kits – Mounting Hardware.<br>2x #10 1.25" Tek Screws, 2x 10-32 1.25" Screws, 2x #10 Lock Nut.<br>Mobiltex Part Number A20100RMU20 |
|  | USB A to USB mini-B Cable (RMU3X-B only)<br>Cable to allow RMU3XL to be programmed without the need for a separate RMU3 Programming Interface. The RMU3X-B acts as the programming interface with this cable.<br>Mobiltex Part Number W160DJ06USB |

**Table 2 RMU3XL: RMU3-S/RMU3-G w/RMU3X-B Kit Contents**

## 4.3 RMU3 Optional Installation Items

| | |
|---|---|
|  | RMU3 Wiring Kit<br>1 meter (3.2 ft) wiring harness, assorted crimp terminals, cable ties, adhesive tie mounts. The components of this kit are typically used to interconnect the measurement signals from the rectifier, test point or bond to the RMU3-B.<br>Mobiltex Part Number A20103RMU30 |

| | |
|---|---|
|  | RMU3 Universal Mounting Bracket<br><br>Aluminium bracket, pipe clamp, and bracket mounting screws. This kit can be used for installations that require the RMU3-G or RMU3-S to be mounted in a configuration other then the top of the rectifier lid or applications using standard ½" NPT electrical fittings. This kit allows mounting on either vertical or horizontal surfaces as well as vertical pipe or pole installations.<br><br>Mobiltex Part Number A20103RMU31 |
|  | Interconnect Cable<br><br>1 meter (3.2 ft) long interconnection / extension cable c/w molded waterproof connectors.<br><br>Mobiltex Part Number W16400RMU03 |
|  | Interconnect Cable<br><br>3 meter (9.8 ft) long interconnection / extension cable c/w molded waterproof connectors.<br><br>Mobiltex Part Number W16400RMU01 |
|  | Interconnect Cable<br><br>8 meter (26.2 ft) long interconnection / extension cable c/w molded waterproof connectors.<br><br>Mobiltex Part Number W16400RMU02 |
|  | Class 2 Transformer<br><br>120 or 230 VAC to 12VAC 20VA. Lightning resistant 5,000V insulation. Foot or ½" conduit hub mount.<br><br>Mobiltex Part Number T01A42TR201 |
|  | Solid State AC Relay - 24-280 VAC RMS 50 Amps max (0-8A=No Heatsink, 8-50A=Needs HE-54)<br><br>Mobiltex Part Number K0513245010 |
|  | Solid State AC Relay - 24-280 VAC RMS 110 Amps max (0-8A=No Heatsink, 8-60A=HE-54, 60-110A=HE-90)<br><br>Mobiltex Part Number K0513211010 |
|  | Solid State AC Relay - 48-530 VAC RMS 50 Amps max (0-8A=No Heatsink, 8-50A=Needs HE-54)<br><br>Mobiltex Part Number K0513285010 |
|  | Solid State AC Relay - 3 phase, 48-530 VAC RMS 50 Amps max (0-4A=No Heatsink, 4-30A HE-90)<br><br>Mobiltex Part Number K05232R5016 |
|  | Small Heatsink for Solid State Relay – HF92B<br><br>Mobiltex Part Number X0301292B80 |
|  | Medium Heatsink for Solid State Relay - HE-54<br><br>Mobiltex Part Number X030120HE54 |

| | |
|---|---|
|  | Large Heatsink for Solid State Relay - HE-90<br>Mobiltex Part Number X030320HE90 |
|  | Solid State DC Relay (DCR1) - 0-60 VDC 50 Amps max (Complete unit including heatsink)<br>Mobiltex Part Number A15060255C1 |
|  | Solid State DC Relay (DCR1+) - 0-100 VDC 100 Amps max (Complete unit including heatsink)<br>Mobiltex Part Number A15060255C2 |
|  | Mercury Relay - 240 VAC @ 100 A, 48 VDC @ 100 A, 125 VDC @ 50 A<br>Mobiltex Part Number K07111NC12D |
|  | External 3:1 Voltage Divider<br>Required for applications that measure greater than 150VDC or 105VAC. Typically used when actual AC line voltage (110/120 or 220/230 VAC) measurement is desired.<br>Mobiltex Part Number A01160RMU21 |
|  | 4-20mA Transducer Shunt Kit (Not applicable to RMU3X-B)<br>Kit of 4 precision 250 ohm resistors for installations using 4-20mA measurement transducers.<br>Mobiltex Part Number A20003RMU21 |
| <br> | RMU1/2/3-BT Programmer Kit<br>Mobiltex P/N A20A0333101<br>Universal programming kit for RMU1, RMU2, and RMU3 devices. Includes RMU1/2/3 base programmer (A1506033101), RMU1ADP (A1506033001), LiIon battery pack, soft case and USB stick with programming software. Capable of Bluetooth communications with a phone/tablet. Can also be used with a PC through the USB connection. |
|  | RBT1 Bluetooth Interface Cable<br>Allows programming of RMU3 using a Bluetooth Smart equipped smart phone or tablet.<br>Mobiltex Part Number A1506032101 |

| | |
|---|---|
|  | MUX3 Channel Expansion Base Multiplexer<br><br>Allows up to four RMU3-B bases to be used with a single RMU3 antenna. Expands channel capacity to a maximum of 16 channels. Bases and interconnect cables are purchased separately.<br><br>Mobiltex Part Number A1506030901 |

**Table 3 RMU3 Optional Accessories**

# 5 Quick Bench Test

1. For the RMU3-G, locate the RMU3-G (GPS & cellular antenna) in an area with cellular coverage for the provider associated with the subscriber identity module (SIM) card installed in the device. Orient the CorTalk® logo on the RMU3-G facing upward. In North America, Mobiltex generally provides the device with a factory installed SIM card.

   For the RMU3-S, locate the RMU3-S (GPS & Satellite antenna) outdoors with a clear view (120 degrees in all directions is optimal) of the sky and the CorTalk® logo facing upward towards the sky.

2. Connect the 4-pin male cable connector to the RMU3-G/S antenna. Connect the 4-pin female cable connector to the RMU3-B or RMU3X-B (measurement terminal block). Attach and turn-on the supply voltage to the PWR IN terminals on the RMU3-B or RMU3X-B device. The "Status" LED on the RMU3-B or RMU3X-B should illuminate. If a CorView host acknowledgement has not yet been received, the green LED will flash at a rate of 250ms on, 250ms off. The "Status" LED will flash green (100ms on / 100 ms off) if an out-of-limits measurement condition is detected. A steady state green LED indicates all measurements are within the predefined limits, supply voltage is present a CorView host acknowledgement has been received.

   Note: The cable connection should be made only after the antenna has been properly positioned, as the device will transmit a data message to the CorView host within a few seconds of the two devices being connected. If you wish to send an actual voltage measurement you can connect a DC voltage source (typically a battery) to "CH1".

3. The CorTalk host is accessed using a web browser at https://corview.cortalk.com. Enter the User Name and Password that were provided to you when your CorView account was setup.

4. Upon successful login to CorView you will be presented with an "All Readings" screen that will display the readings for all your RMU device(s). You should see a status of "New Unit" or "Power Up" along with the readings from the device that you just connected.

   Note that transmissions from field devices typically require approximately 1 to 2 minutes to arrive at CorView. The displayed measurement screen on CorView will refresh automatically every 5 minutes. If you wish to see more immediate readings, simply press on one of the "All Readings", "Rectifiers", "Bond Points" or "Test Points" buttons.

   CorView can be configured to automatically send emails containing the measurement readings to an individual or group of email users. Because these emails are short and wireless-friendly, many clients send the readings directly to their field installer's wireless email device(s) for near immediate end-to-end operation confirmation and verification of measurement values.

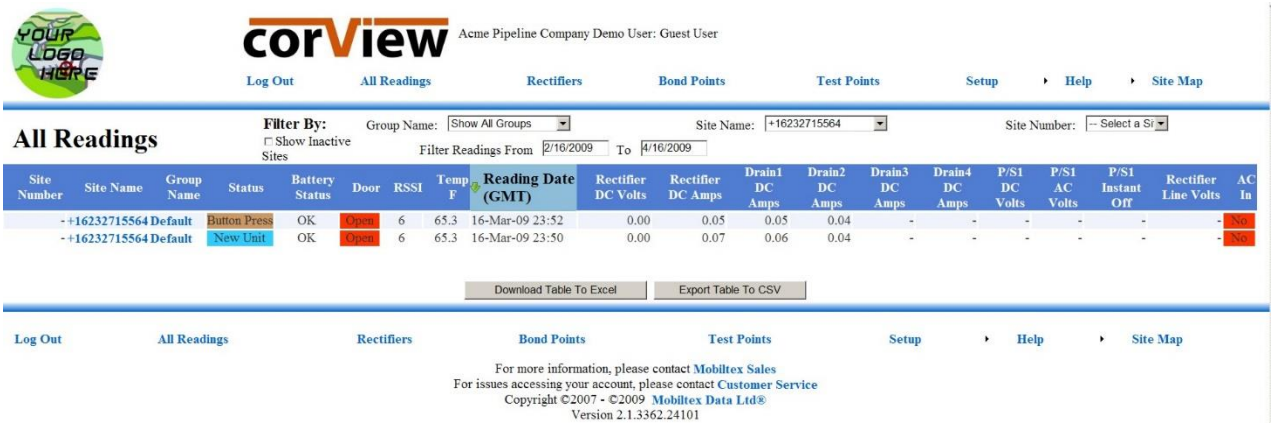



**Figure 2 CorView All Readings Page**

5. Pressing the "Test" button on the RMU3-B or RMU3X-B measurement terminal block will force an immediate analog measurement and data transmission.

6. After the device has transmitted the measurements, CorView should display a new status of "Button Press" along with the associated analog readings for the device.

7. When the bench test is completed, remove the Class 2 power source and disconnect the cable that interconnects the two devices. This action forces the RMU3 devices to power down and turns off the battery backup function.

# 6 Installation

**Warning: Only properly qualified personnel should work on installation of this equipment. Company and industry safety procedures must be followed.**

**Disconnect rectifier AC line power (with proper breaker safety lockouts) before starting the installation.**

Installation consists of six steps: transmitter installation, base installation, Class 2 transformer installation, interruption relay installation, wiring, and device configuration.

## 6.1 Transmitter Installation

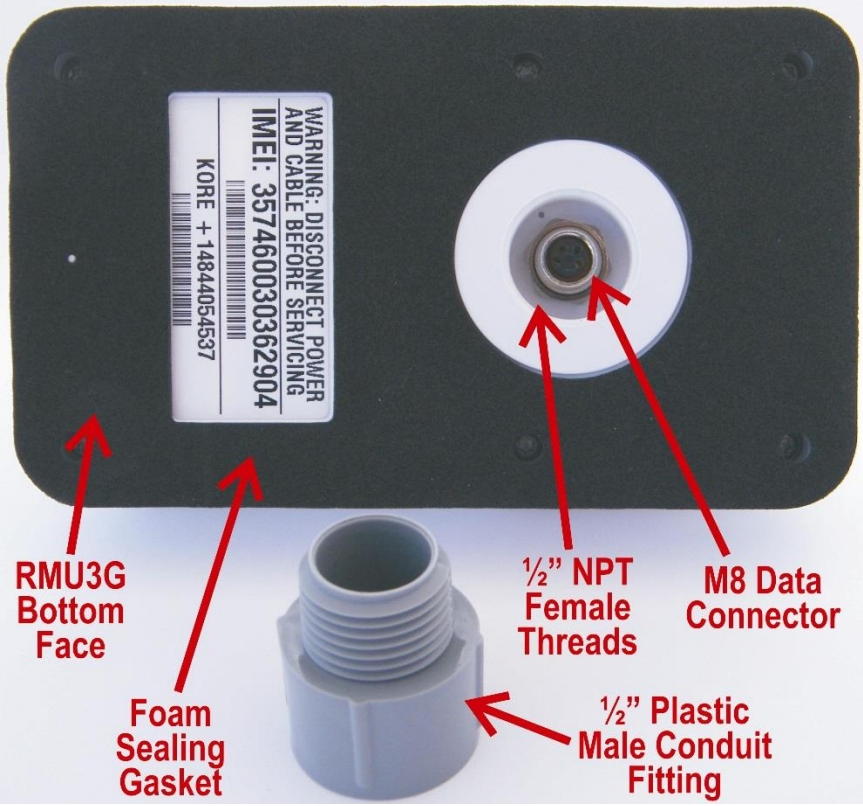



**Figure 3 RMU3-G/S Installation Hardware**

The RMU3-G/S transceiver module can be installed directly on top of a rectifier by drilling a 7/8" (0.875", 22mm) hole in the top of the rectifier. The selected location requires a minimum of 1.5" (38mm) of clearance in the area of the drilled hole between the rectifier lid and internal rectifier components. Debur the drilled hole so there are no sharp edges. Clean and wipe the top surface around the drilled hole.

Carefully mate the cable male connector with the female M8-style receptacle located on the bottom of the RMU3-G/S device. Hand tighten the connector by rotating the knurled connector nut clockwise. Do not over tighten. Pass the un-attached female end of the interconnection cable through the hole in the rectifier lid. Place the bottom face of the RMU3-G/S transmitter on the rectifier lid.

From inside the rectifier, pass the threaded end of the supplied ½" plastic male conduit fitting over the un-attached female end of the interconnect cable. Slide the fitting all the way up to the 7/8" hole in the rectifier and thread it into the mating threads on the RMU3-G/S. Hand tighten the conduit fitting adequately to ensure compression of the integral foam sealing gasket. Do not over tighten.

If direct attachment to the top of the rectifier is not desirable, the RMU3 may also be attached directly to a plastic or metal conduit that has ½" NPT fittings. An optional universal mounting bracket kit (Mobiltex part number A20103RMU31) is also available for mounting to other surfaces or poles. Optional additional length interconnect cables may be required for these alternate mounting types. When using alternate mounting methods, ensure that the RMU3 transmitter has the CorTalk® logo pointing straight up into the sky. The RMU3-G/S transceiver should always have as much view of the entire sky as possible for best GPS satellite coverage. The following pictures illustrate various mounting schemes for the RMU3-G/S.




**Figure 4 RMU3-G/S Installation Examples**

In the case of **rigid conduit mounting, a conduit nut must be used to limit the thread depth to ½" maximum.** Otherwise, the conduit can punch through the plastics and damage the antenna.

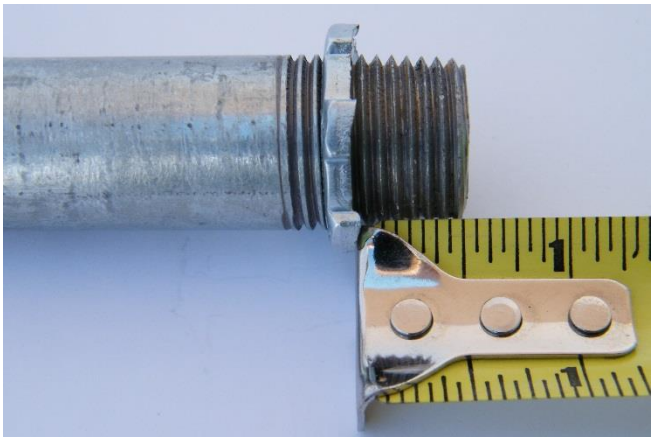


**Figure 5 RMU3-G/S Conduit Nut Spacing**



**Figure 6 RMU3-G/S Conduit Punch Though Example**

When mounting the antenna to the conduit, hold the nut on the conduit at the required maximum ½" thread depth while threading the antenna onto the conduit threads. Stop threading once the antenna base is resting firmly against the nut.

## 6.2 Base Unit Installation

### 6.2.1 RMU3-B (4 Analog Input Channels Base)

The RMU3-B base block is a 4 analog input channel unit. The following figure shows the external features.

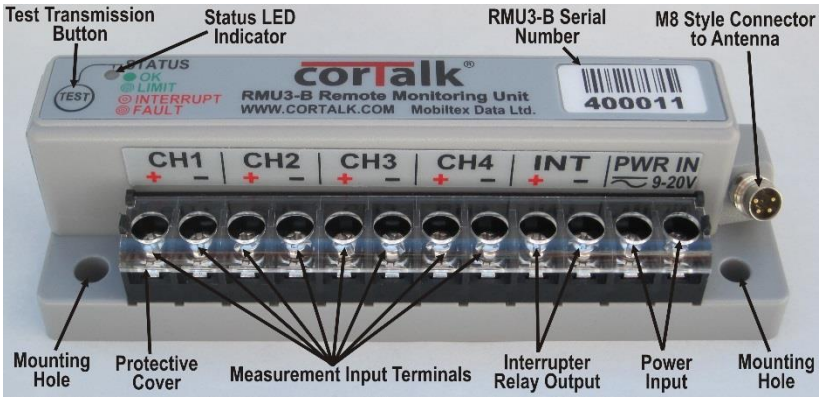



**Figure 7 RMU3-B Base Unit Features**

#### 6.2.1.1 Mounting

The RMU3-B base unit is environmentally sealed, but it must be mounted in an enclosure (e.g. rectifier cabinet) to satisfy electrical safety requirements. The RMU3-B can be installed on any flat surface using the supplied hardware. When choosing the installation location, consideration must be made if the door switch feature of the RMU3 is used—refer to section 6.2.1.2. Also, the top "Test" button on the RMU3-B should be user accessible. The RMU3-B should be separated from strong magnetic sources (i.e. rectifier transformer) by a minimum of 4 inches (106mm).

If the supplied bolts and nuts are used, a pair of 13/64" (0.2", 5.08mm) holes with 4.5" between centers must be drilled in the installation surface to match the two mounting holes in the RMU3-B. Pass the bolts through the RMU3-B mounting holes and apply the nuts from below the mounting surface.

If mounting to a thin sheet metal or wooden surface, the supplied self-drilling #10 Tek screws may be used to attach the unit without pre-drilling.




**Figure 8 RMU3-B Installation Hardware**

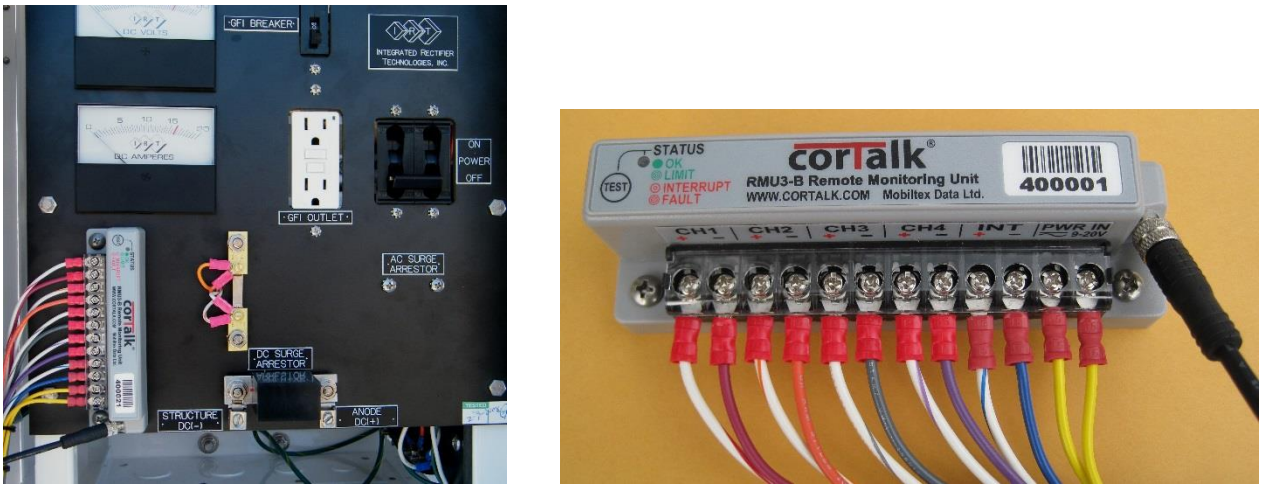



**Figure 9 RMU3-B Installation Examples**

### 6.2.1.2 Door Switch

The RMU3-B contains an internal magnetically activated switch that can be used to report rectifier cabinet door openings. Supplied with the RMU3 is a magnet with a self-adhesive mounting pad and mounting screws. The magnet must be mounted such that it aligns with the white area on the left side of the RMU3-B labelled "DOOR SWITCH SENSOR AREA". See Figure 10. When the door is closed, the magnet should not be separated by more than 0.15" (3.81mm) from the sensor area.

If using only the self-adhesive pad on the magnet for attachment, ensure that the surface being attached to is clean—dirt and oil free. For wooden surfaces, the provided screws may also be used for attachment.

Additional custom brackets, spacers, or bolts/nuts may be needed depending on the rectifier construction. It will be up to the installer to determine and source the additional parts.

Installation of the door switch magnet is optional. The RMU3 will operate without it installed. If it is not installed, the RMU3 software should be configured to not report door switch state.




**Figure 10 Door Switch Magnet Installation**

## 6.2.2 MUX3 Base Multiplexer Installation

The MUX3 Base Multiplexer allows up to four RMU3-B bases to be connected to a single RMU3 antenna for an expanded channel count of up to 16 analog inputs. Figure 11 shows the connection points and mounting foot print dimensions. The MUX3 may be mounted to a flat surface using two #8 screws.

Connections between the MUX3 and the RMU3-B bases use the same M8 cables that normally connect the antenna to the base. Figure 12 shows how the interconnect cables should be attached. The interconnect cable between the RMU3G/S and the MUX3 can be a maximum of 8 meters(26 feet) in length. The interconnect cables between the MUX3 and the individual bases may be up to 16 meters (52 feet) in length.

When programming the RMU3 with the RBT1 Bluetooth Interface or the RMU2/3 PC Programming Interface, the programming cable must be inserted between the MUX3 and the RMU3G/S.

Each installed RMU3-B measurement base must be supplied by its own individual power supply through the PWRIN terminals. All power requirements remain the same as a single base installation.

Only the door switch input on the primary subRMU block is available for use. The door switch inputs on the additional RMU3-B blocks are ignored.

Each base may be used to drive an interruption relay. Wiring to the relays is the same as a single base installation.

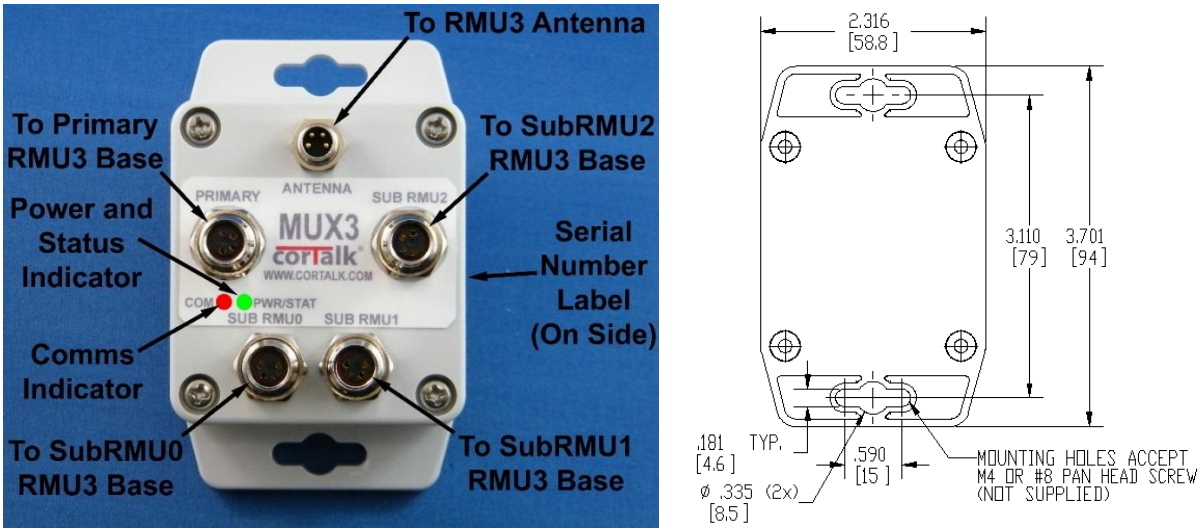



**Figure 11 MUX3 Base Multiplexer Features**

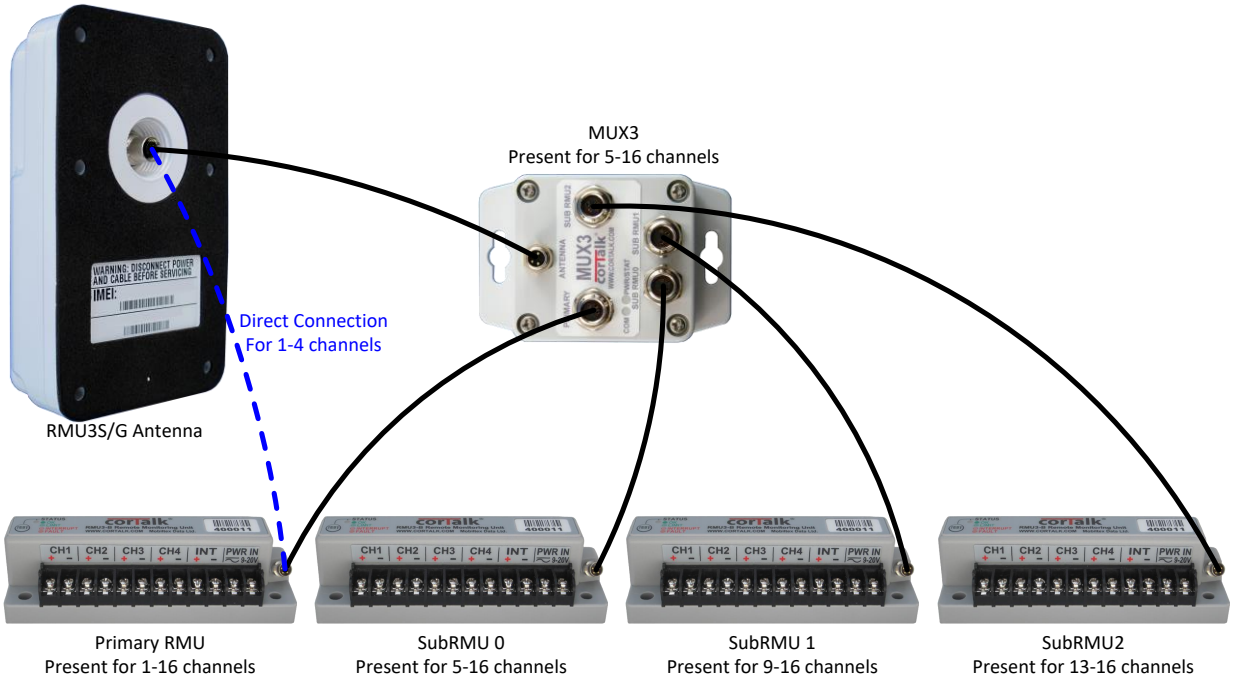



**Figure 12 MUX3 Cable Connections**

### 6.2.3 RMU3X-B (44 Analog Input Channels Base)

The RMU3X-B base block is a 44 analog input channel unit. The following figure shows the external features.

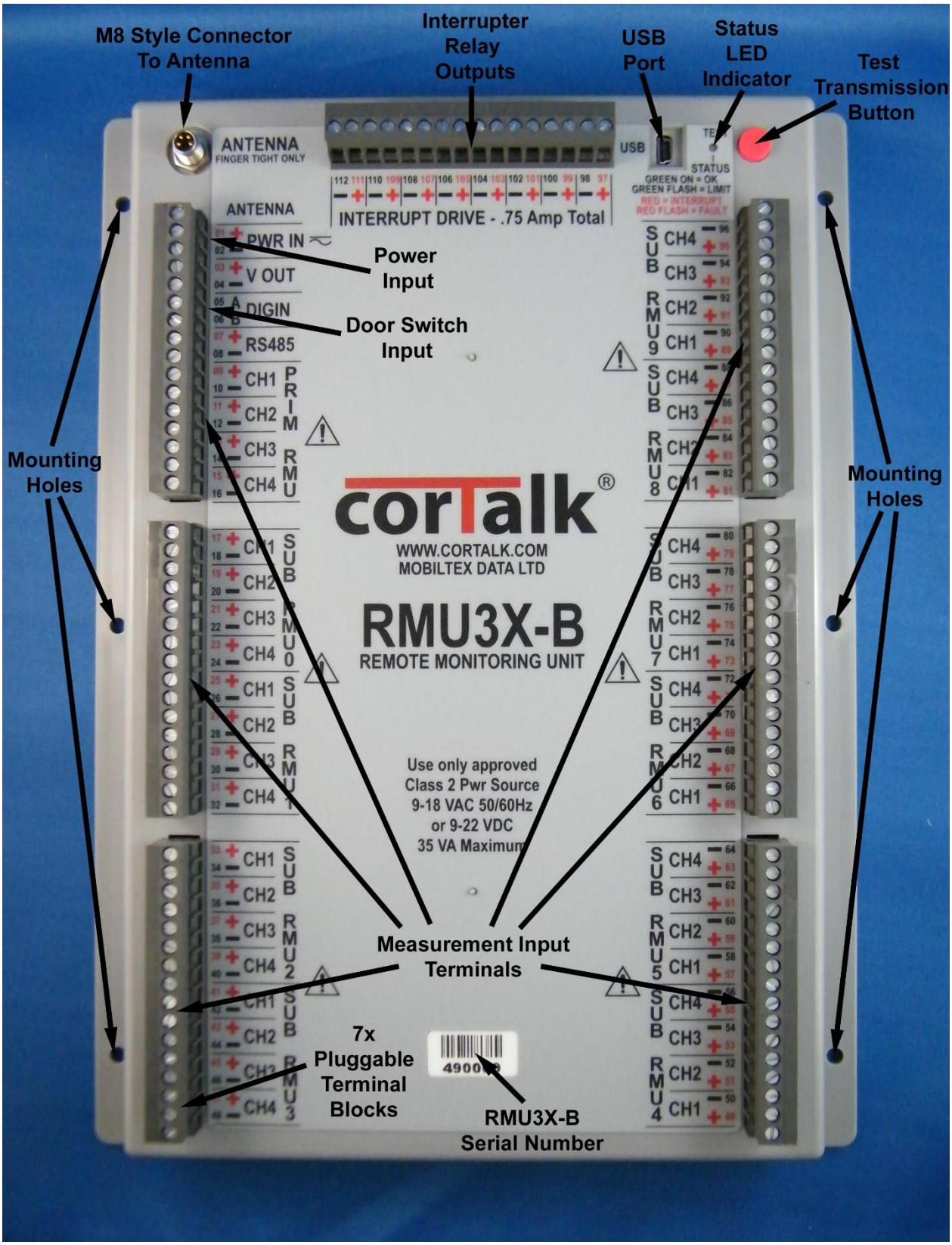



**Figure 13 RMU3X-B Base Unit Features**

### 6.2.3.1 Mounting

The RMU3X-B base unit is not dust/water tight. As such, it must be mounted in an environmentally hardened enclosure (NEMA4/IP67). The RMU3X-B can be installed on any flat surface large enough to accommodate the case outline.

Figure 14 shows the dimensions of the RMU3X-B, including the dimensions and locations of the mounting holes. If mounting to a thin sheet metal or wooden surface, self-drilling #10 Tek screws may be used to attach the unit without pre-drilling. Figure 15 shows an example of the RMU3X-B mounted in a NEMA4 enclosure.

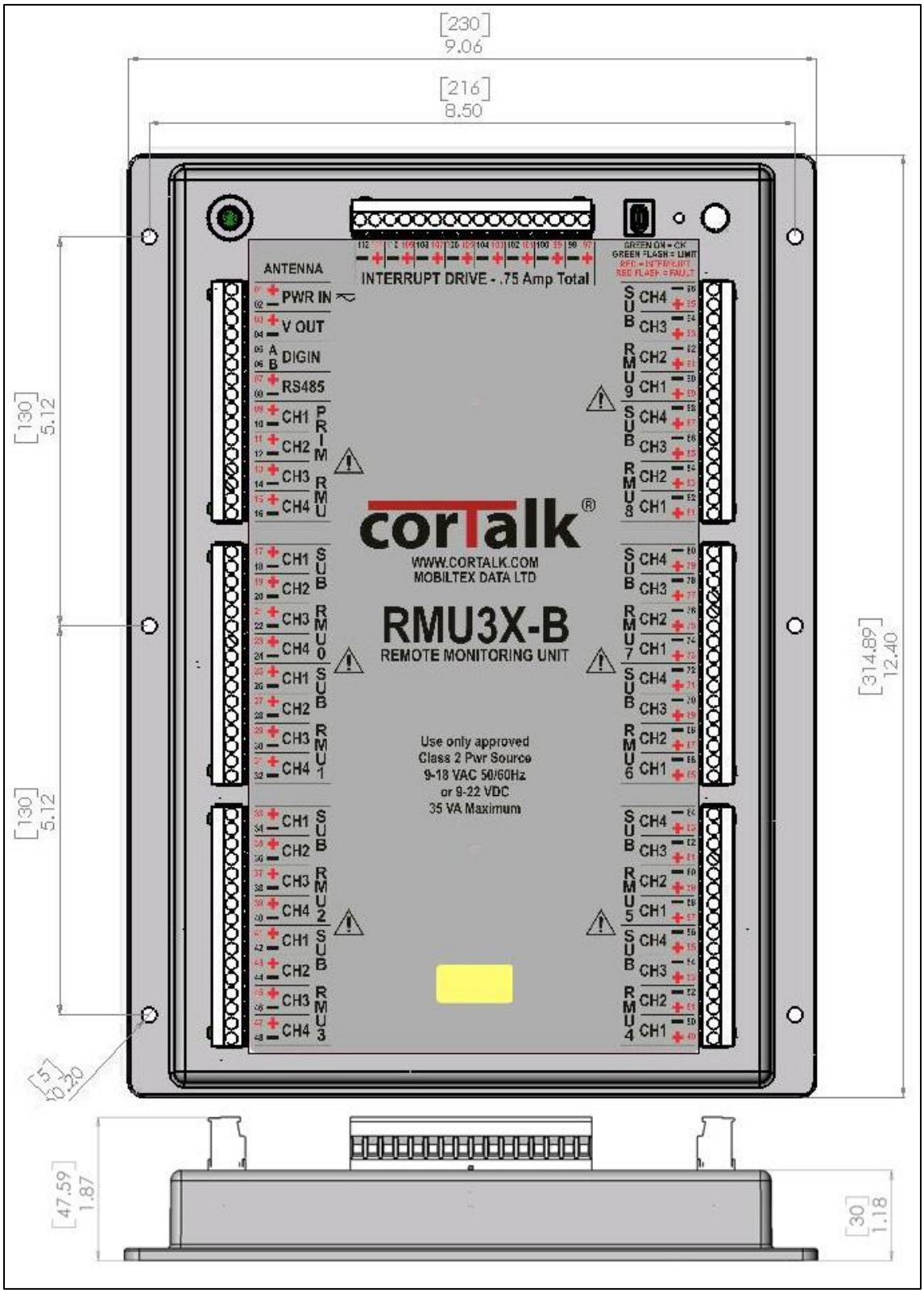



**Figure 14 RMU3X-B Dimensions**




**Figure 15 RMU3X-B Mounted in a NEMA4 Enclosure**

### 6.2.3.2 Door Switch

The door switch input (DIGIN terminals) on the RMU3X-B differs from the RMU3-B in that it is an electrical connection instead of a magnetic sensor. As the RMU3X-B is much larger than the RMU3-B, it is easier to use a separate switch that is remote mounted. The RMU3X-B door switch input is optically isolated and will accept either a voltage signal or a dry set of contacts. When a dry set of contacts is used, the VOUT pins on the RMU3X-B are used to provide a power source. Connect a jumper wire between the VOUT+ and the DIGIN-A terminal; attach the switch contact connections to the VOUT- and DIGIN-B terminals as shown in Figure 16.

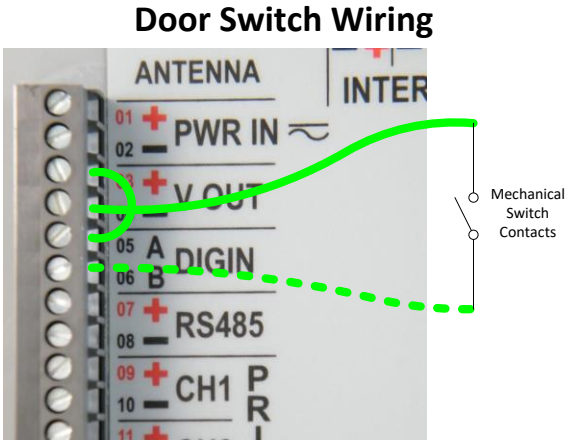



**Figure 16 RMU3X-B Door Switch Wiring**

### 6.2.4 Power Source

For AC powered installations, an external Class 2 transformer must be installed in the rectifier to provide 12VAC typical to the RMU3 for power. The AC operating voltage range is 9 to 18VAC. For installations using a mercury interruption relay a minimum rating of 25VA is required, For installations using a solid state interruption relay a minimum rating of 7VA is required. The exact model of transformer is installation dependent due to varying supply voltages feeding rectifiers. The transformer must be a Class 2 device that is UL and/or CSA approved.

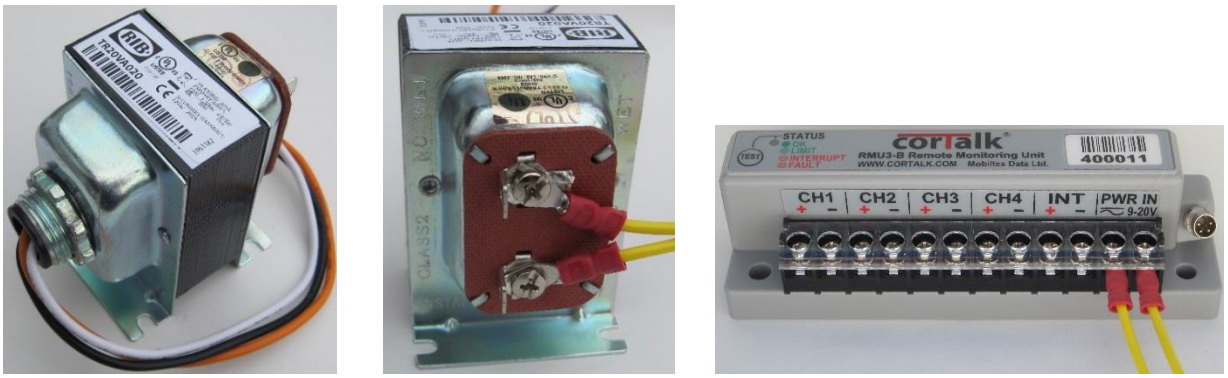



**Figure 17 Mobiltex 12VAC Output Class 2 Transformer**

Figure 17 shows the most common Class 2 transformer that may be supplied by Mobiltex for use with the RMU3. Mobiltex P/N T01A42TR201 can be used with 110V, 120V, 208V, 220V or 240VAC line voltages. This custom transformer has a special 5,000 volt insulation system that makes it more lightning immune then most off-the-shelf Class 2 transformers. Please contact Mobiltex for alternate AC line voltage transformers.

The primary input voltage is determined by the power system available at the RMU3 installation site. Connect the appropriate primary side taps of the transformer to the L1 and L2/N line input connection points on the device being monitored. An external circuit-breaker or external overcurrent protection device (sized to the transformer specifications) should be installed on the primary connections of the transformer.

With the T01A42TR201 the BLACK and WHITE wires are used for 110/120VAC installations, with the ORANGE wire being capped. With the T01A42TR201 the BLACK and ORANGE wires are used for 208/220/240VAC installations, with the WHITE wire being capped. For other transformer types please consult the documentation provided by the transformer manufacturer to determine the correct primary tap wires required for a particular input voltage.

**Note: When installing transformers with multiple primary taps, ensure that un-used tap wire(s) are properly capped!**

Before connecting the secondary wires to the RMU3-B or RMU3X-B, enable primary power to the transformer, and by using a multimeter, verify that the transformer secondary output is within the range of 9 to 18VAC.

**If the transformer output voltage is below or above that range, re-verification of the transformer primary tap selection will be necessary.**

Shut off primary power to the transformer before continuing. Next, run wires (22 AWG minimum wire size) from the transformer 12VAC secondary terminals to the RMU3-B or RMU3X-B "PWR IN" terminals. For maximum lightning immunity route these secondary wires away from other wires, especially line side AC wiring. Lightning immunity is further enhanced by utilizing 600 volt, 105C rated wiring (as supplied with the optional wiring kit) which has a thicker insulation system and higher voltage breakdown rating as compared to more common 300 volt rated wiring systems.

For solar or TEG installations the RMU3 can be powered by a Class 2 or LPS DC voltage source. The DC voltage source should be between 9 and 22 VDC. The typical average power draw of the RMU3 is less than 1 watt (less than 3 watts with an RMU3X-B base), with a peak requirement of less than 4 watts (6 watts with an RMU3X-B base) during battery charge or data transmission. When a mechanical or mercury relay is utilized, the relay coil current draw will need to be factored into the device power requirements.

The relay drive voltage is derived from the supply voltage input, so the supply voltage will impact the required coil voltage of a mechanical or mercury relay. There is approximately a 1 volt drop between the supply input voltage and the relay drive voltage. This means that if a 12 volt relay coil is used, it would be desirable to have a DC supply source of around 13 volts.

The solar or TEG voltage source should be fused (typically between 2 and 5 amps) before being applied to the "PWR IN" terminals of the RMU3.

### 6.2.5 Interruption Relay Wiring

Wiring of the interruption relay requires some consideration for the type and size of rectifier being interrupted. Consideration for lightning immunity is another issue that will affect relay type and installation point. Table 4 lists the most common relay types along with their associated pros and cons. Note that the RMU3 will not drive the interruption relay coil when the RMU3 is operating from its internal battery backup (i.e. no supply voltage present).

| Relay Type | Pros | Cons |
|---|---|---|
| Mechanical<br><br>Normally closed contact type | Inexpensive | Short contact life (thousands of cycles)<br>Low current capacity (<25A)<br>Contact migration with DC loads<br>On/off activation times<br>High control current consumption |
| Mercury Displacement<br><br>Normally closed contact type | Moderate cost<br>High current capacity<br>Low power loss (<10W w/100A load)<br>No heatsink required<br>Long contact life (millions of cycles)<br>Good lightning damage-immunity | Environmental concerns<br>Transportation regulations<br>Disposal regulations<br>On/off activation times<br>High control current consumption |
| Solid State Triac (AC-only)<br><br>Installed on transformer primary<br>or<br>Installed on transformer sec. tap | Moderate cost<br>Good lightning damage-immunity<br>Fast switching<br>Low control current<br>High voltage switching(<=690VAC)<br>High current switching (<=125A)<br>Does not require external clamp diodes<br>No contact degradation over time | Requires heatsink<br>Large current surge (primary side) |
| Solid State MOSFET (DC-only)<br><br>Installed after rectifier diodes | Least impact on pipeline waveforms<br>Fast switching<br>Lower switching surge<br>Low control current consumption<br>No contact degradation over time | Expensive<br>Moderate lightning damage-immunity<br>Requires large heatsink<br>Requires clamp diodes<br>Limited installation points<br>Maximum voltage/current tradeoff<br>Susceptible to lightning damage |

**Table 4 Relay Types Pros/Cons**

The following figures show the most common connection methods for each of the relay types when installed on an AC rectifier. The selected relay must be sized according to specifications from the relay manufacturer.

When using an alternate DC power source, such as thermo-electric generation or solar, only DC capable relays such as mechanical, mercury displacement, or DC solid state MOSFET can be used on the output to the protected structure.

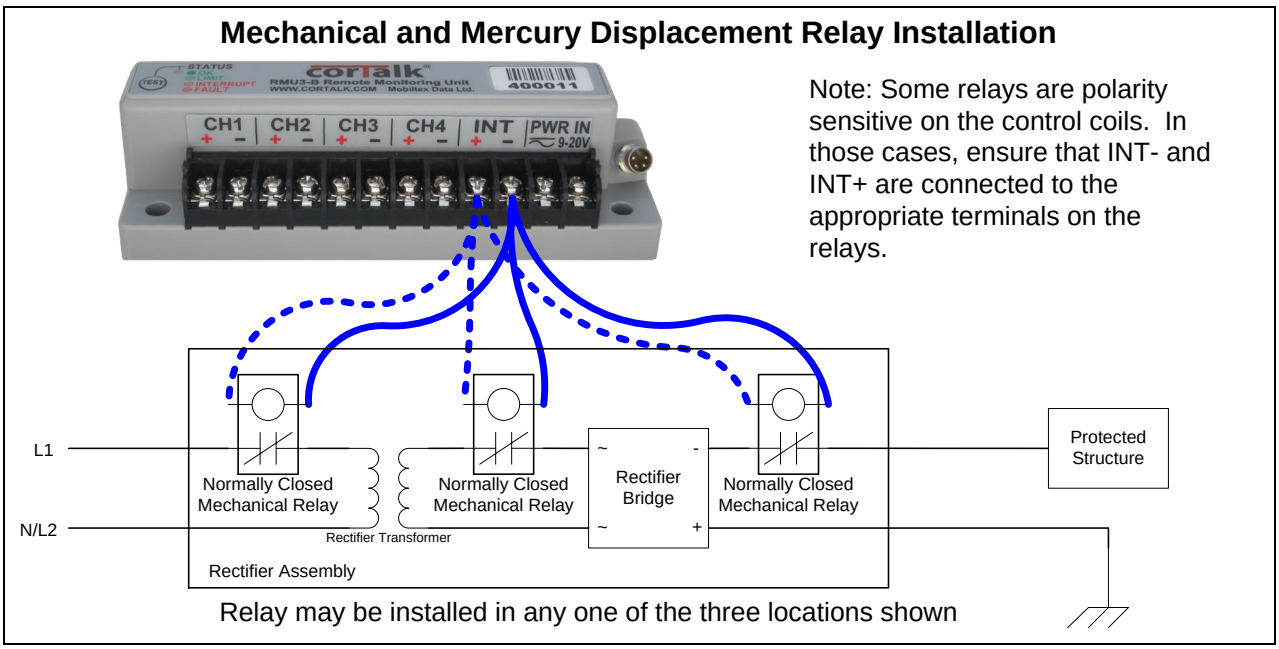



**Figure 18 Mechanical and Mercury Displacement Relay Installation**

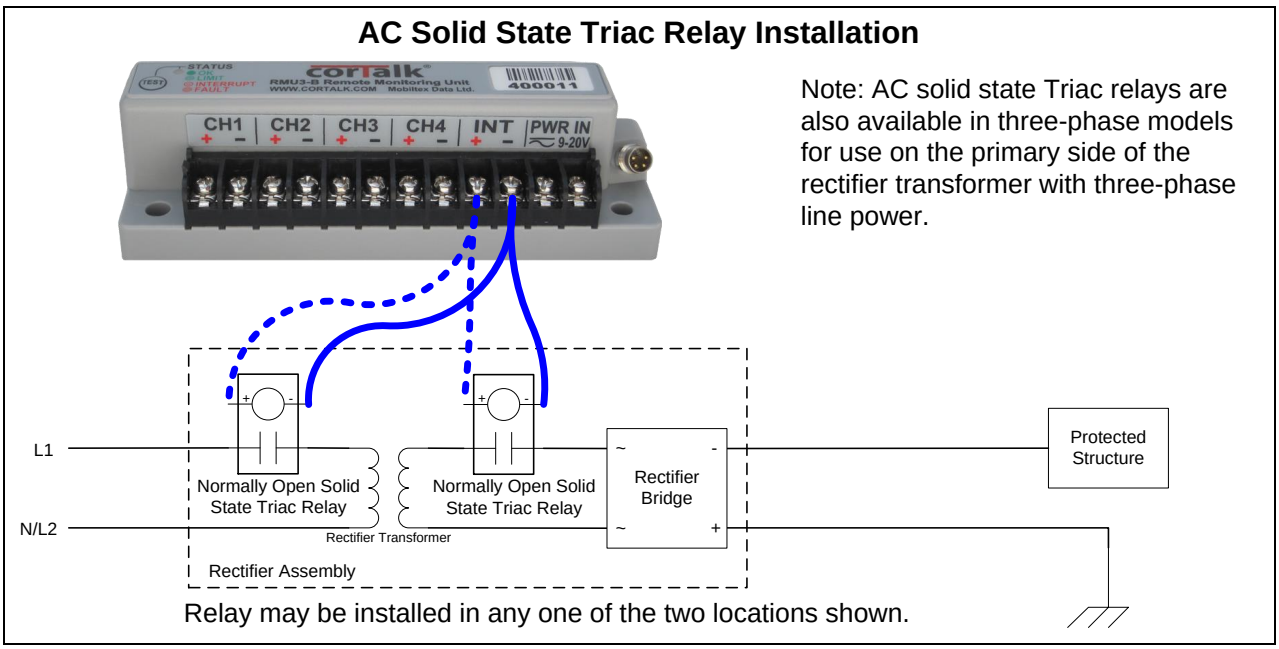



**Figure 19 AC Solid State Triac Relay Installation**

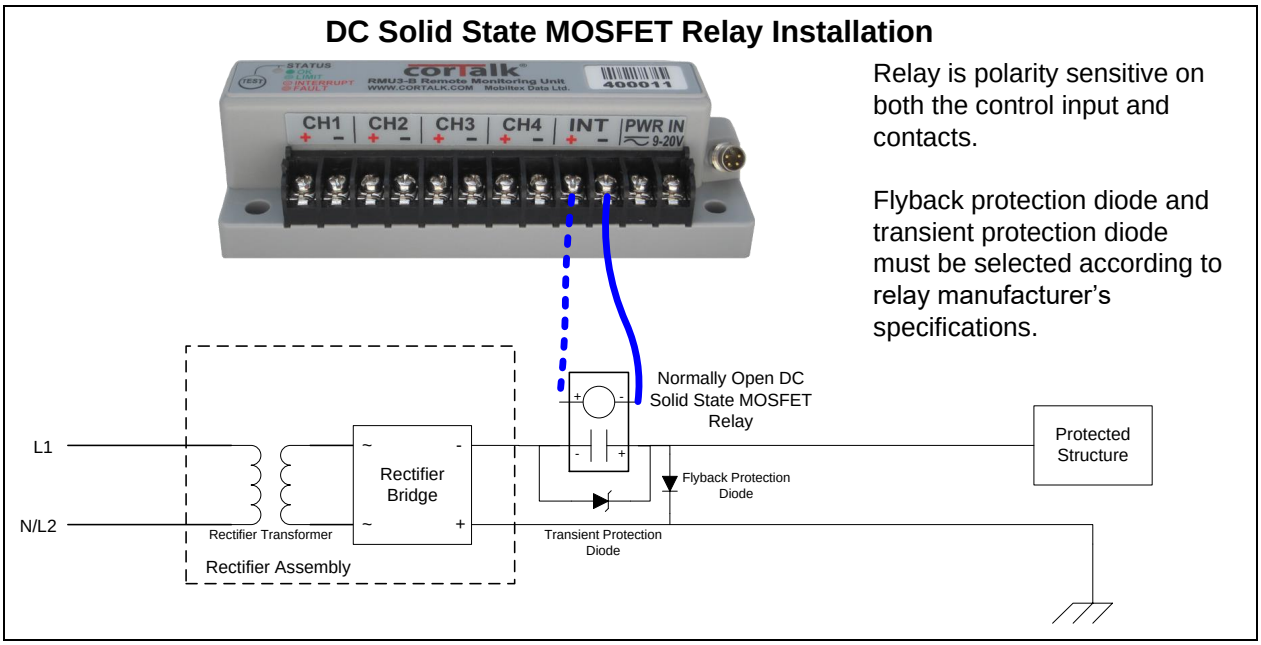



**Figure 20 DC Solid State MOSFET Relay Installation**

The RMU3X-B base features a separate terminal block with multiple INT+/INT- terminals. All of the INT+ terminals are internally connected together as are the INT- terminals. Independent control of the different INT+/INT- connections is not possible; all relays will be driven on or off at the same time. Multiple INT+/- terminals allows multiple relays to be connected to the base without having to connect excessive numbers of wires to the same terminal. Note that the total summed current used by all relays must be less than 750mA. Figure 21 shows 12 separate relays wired into the interruption output drives on the RMU3X-B. Each terminal connection can accommodate up to 2 or 3 wire connections depending on the wire gauge.

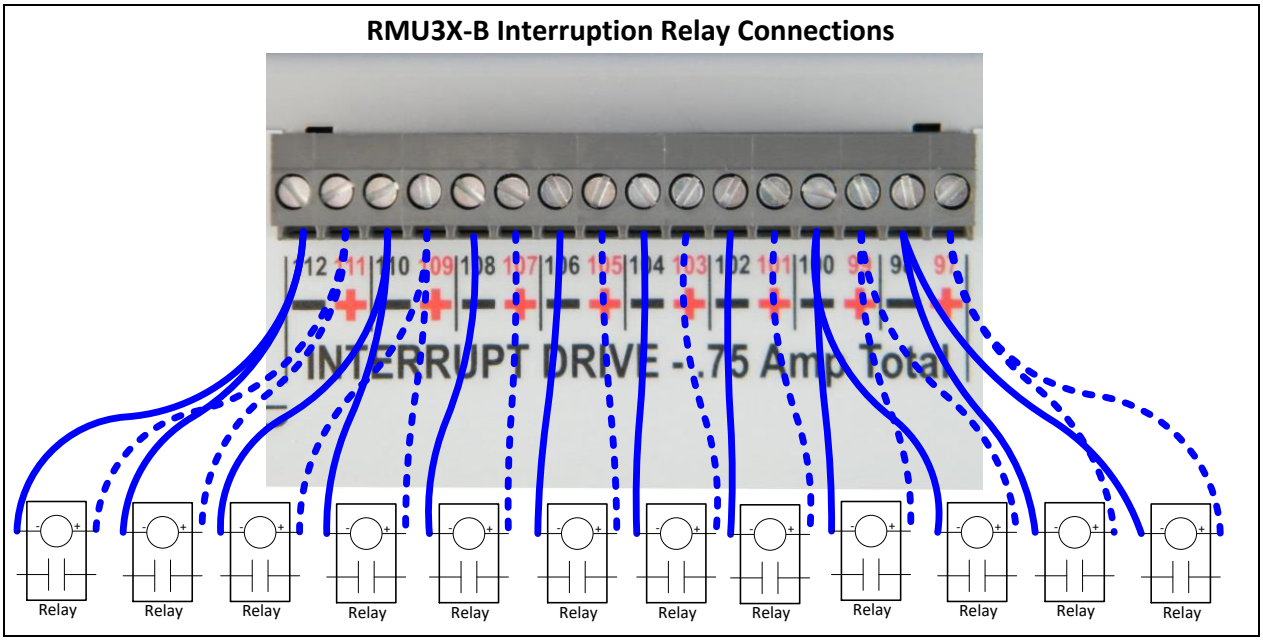



**Figure 21 RMU3X-B Interruption Relay Connections**

### 6.2.5.1 AC Solid State Relays

The preferred relay to use in most cases is the AC solid state TRIAC relay on the primary-side of the rectifier transformer. Mobiltex has several standard AC relays and heatsinks available as optional components for the RMU3.

K0513245010 AC Relay - 24-280 VAC RMS 50 Amps max. 0-8A=No Heatsink, 8-50A=HE-54
K0513211010 AC Relay - 24-280 VAC RMS 110 Amps max. 0-8A=No Heatsink, 8-60A=HE-54, 60-110A=HE-90
K0513285010 AC Relay - 48-530 VAC RMS 50 Amps max. 0-8A=No Heatsink, 8-50A=HE-54

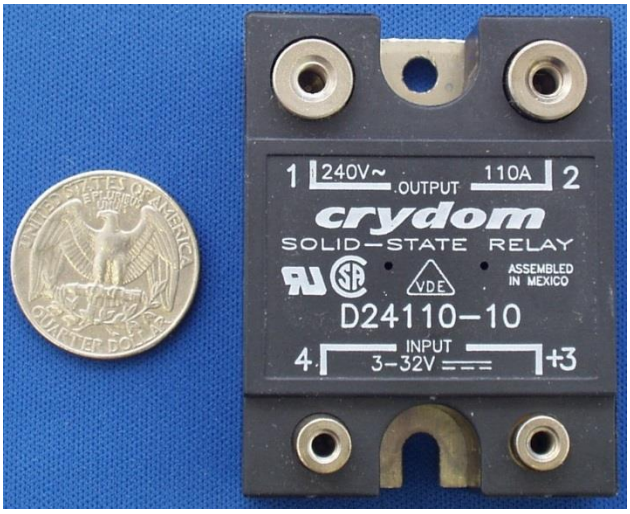



**Figure 22 Mobiltex Standard Single Phase Solid State AC Relays**

All 3 different relays are about the same physical size and look very similar. The heatsink requirements are listed above. These relays can be used to either interrupt the primary line AC (for 120 & 230 volt rectifiers) or the secondary AC of the rectifier.

K05232R5016 AC Relay - 3 phase, 48-530 VAC RMS 50 Amps max. 0-4A=No Heatsink, 4-30A=HE-90




**Figure 23 Mobiltex Standard Three Phase AC Solid State Relay**

The relay shown in Figure 23 is used to interrupt the primary AC of 3-phase rectifiers.

### 6.2.5.2 AC Solid State Relay Heatsinks

X030120HE54 Medium Heatsink for Solid State Relay - HE-54

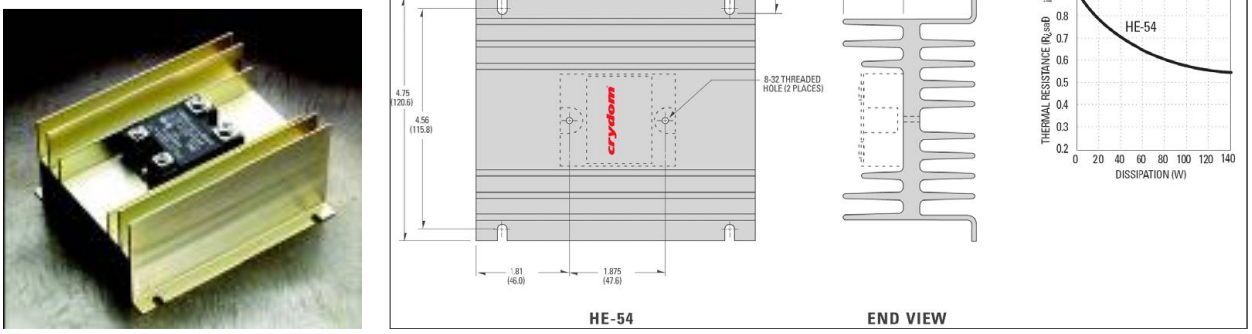



**Figure 24 X030120HE54 Medium Heatsink**

Note that there needs to be physical space inside the rectifier to mount the solid-state relay and heatsink.

X030320HE90 Large Heatsink for Solid State Relay - HE-90

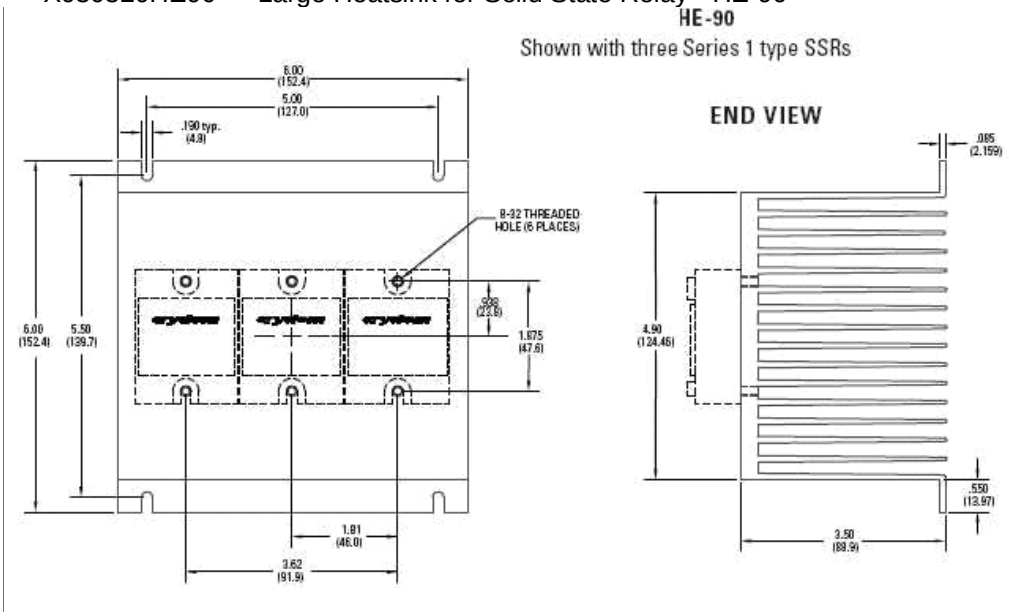





**Figure 25 X030320HE90 Large Heatsink**

Figure 25 shows the AC Relay - 24-280 VAC RMS 110 Amps max (K0513211010) on the HE-90 heatsink. This heatsink will directly accept all standard Mobiltex AC solid-state relays.

### 6.2.5.3 Mercury Displacement Relays

Mobiltex provides, as an option for the RMU3, a 100A/240VAC normally-closed mercury displacement relay (K07111NC12D). This relay is shown in Figure 27. The relay must be mounted with the UP arrow within +/-10 degrees of vertical for the relay to operate properly.

The relay manufacturer recommends no more than 900 cycles per hour. Depending on the interruption cycle used, it is possible to exceed 900 cycles per hour, which could shorten the relay contact life.

Contact de-rating is shown in Figure 26.

| Source Voltage | Maximum Load Current |
|---|---|
| 240V AC | 100A |
| 480V AC | 80A |
| 600V AC | 70A |
| 48V DC | 100A |
| 125V DC | 50A |
| 250V DC | 30A |

**Figure 26 Mercury Displacement Relay Contact De-rating**

When working with mercury relays, all locally applicable transport and disposal regulations must be followed.

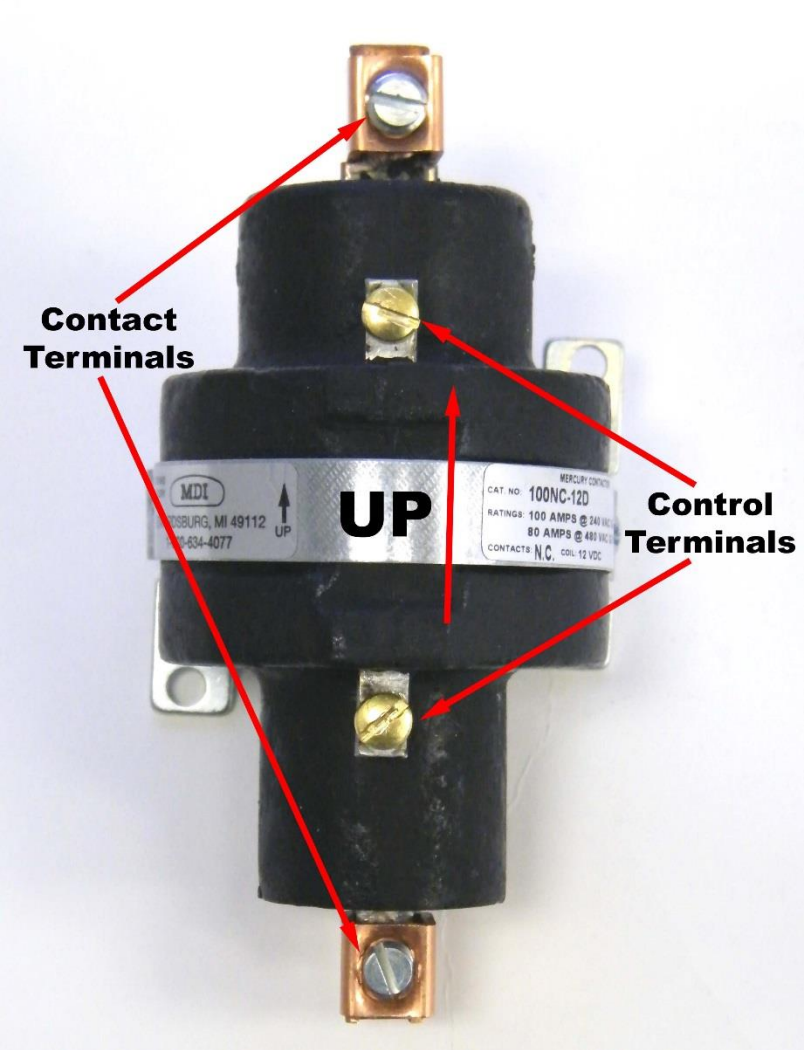



**Figure 27 K07111NC12D 100A Mercury Displacement Relay**

### 6.2.6 Measurement Type Wiring

The RMU3-B (and each sub-RMU for the RMU3X-B) can be wired in several different pre-defined configurations for rectifier, test point, and bond monitoring. Figure 28 summarizes all currently available measurement types. The diagrams in the following pages illustrate typical installations for each measurement type. Each measurement type diagram contains a table indicating the four measurement points (Slots) that are transmitted to the CorView server.

Note that for pipe-to-soil measurements, as shown in the installation diagrams, the readings sent to CorView will be negative. If positive pipe-to-soil measurements are desired, switch the positive and negative wires on the physical input channel.

**RMU3 Measurement Types:**

| Type | Rectifier - Detail | Slot #1 | Slot #2 | Slot #3 | Slot #4 |
|---|---|---|---|---|---|
| RECT1 | **Rect Volts & Rect Amps & 2 Drains** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Amps 3 - Drain 1 | DC Amps 4 - Drain 2 |
| RECT2 | **Rect Volts & 3 Drains** | DC Volts 1 - Rect V | DC Amps 2 - Drain 1 | DC Amps 3 - Drain 2 | DC Amps 4 - Drain 3 |
| RECT3 | **Rect Volts & Rect Amps & 1 Drain & AC Line Volts** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Amps 3 - Drain 1 | AC Volts 4 - Line |
| RECT4 | **Rect Volts & 2 drains & AC Line Volts** | DC Volts 1 - Rect V | DC Amps 2 - Drain 1 | DC Amps 3 - Drain 2 | AC Volts 4 - Line |
| RECT5 | **Rect Volts & Rect Amps & PS c/w induced AC** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Volts 3 - P/S | AC Volts 3 - P/S |
| RECT6 | **Rect Volts & Rect Amps & PS DC only & AC Line Volts** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Volts 3 - P/S | AC Volts 4 - Line |
| RECT7 | **Rect Volts AC/DC & Rect Amps & AC Line Volts** | DC Volts 1 - Rect V | DC Amps 2 - Total | AC Volts 1 - Rect AC | AC Volts 4 - Line |
| RECT8 | **Rect Volts AC/DC & Rect Amps & PS DC only** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Volts 3 - P/S | AC Volts 1 - Rect AC |
| RECT9 | **Rect Volts & Rect Amps & 1 Drain & TEG DC Volts In** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Amps 3 - Drain 1 | DC Volts 4 - TEG In |
| RECT10 | **Rect Volts & 2 drains & TEG DC Volts In** | DC Volts 1 - Rect V | DC Amps 2 - Drain 1 | DC Amps 3 - Drain 2 | DC Volts 4 - TEG In |
| RECT11 | **Rect Volts & Rect Amps & PS DC only & TEG DC Volts In** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Volts 3 - P/S | DC Volts 4 - TEG In |
| RECT12 | **Rect1 Volts & Amps + Rect2 Volts & Amps** | DC Volts 1 - Rect1 V | DC Amps 2 - Total1 | DC Volts 3 - Rect2 V | DC Amps 4 - Total2 |
| RECT13 | **Rect Volts & Rect Amps & 2 PS DC only** | DC Volts 1 - Rect V | DC Amps 2 - Total | DC Volts 3 - P/S 1 | DC Volts 4 - P/S 2 |
| RECT14 | **Rect1 Volts & Amps + PS DC + Amps** | DC Volts 1 - Rect1 V | DC Amps 2 - Total1 | DC Volts 3 - P/S 1 | DC Amps 4 – Bond1 |
| RECT15 | **Rect Volts & Rect Amps & AC Line Amps & AC Line Volts** | DC Volts 1 - Rect V | DC Amps 2 - Total | AC Amps 3 - Line | AC Volts 4 - Line |

| Type | TEST POINT - Detail | Slot #1 | Slot #2 | Slot #3 | Slot #4 |
|---|---|---|---|---|---|
| TP17 | **One P/S AC/DC, Current Density AC/DC** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | AC Amps 2 – AC Mitigation Current | AC Amps 4 – AC Current Density |
| TP18 | **One P/S AC/DC, Current Density AC/DC** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Amps 2 – DC Current Density | AC Amps 4 – AC Current Density |
| TP19 | **One P/S c/w Induced AC, 1 Point Bond, Current Density AC** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Volts 2 – P/S 2 | AC Amps 4 – AC Current Density |
| TP20 | **Four P/S DC, Test Point** | DC Volts 1 - P/S 1 | DC Volts 2 - P/S 2 | DC Volts 3 - P/S 3 | DC Volts 4 - P/S 4 |
| TP21 | **Two P/S c/w Induced AC, Test Point** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Volts 2 - P/S 2 | AC Volts 2 - P/S 2 |

| Type | BONDS - Detail | Slot #1 | Slot #2 | Slot #3 | Slot #4 |
|---|---|---|---|---|---|
| BOND22 | **Two P/S DC Only, 2 Point Bond** | DC Volts 1 - P/S 1 | DC Volts 2 - P/S 2 | DC Amps 3 - Bond 1 | DC Amps 4 - Bond 2 |
| BOND23 | **One P/S DC Only, 3 Point Bond** | DC Volts 1 - P/S 1 | DC Amps 2 - Bond 1 | DC Amps 3 - Bond 2 | DC Amps 4 - Bond 3 |
| BOND24 | **One P/S c/w Induced AC, 2 Point Bond** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Amps 2 - Bond 1 | DC Amps 3 - Bond 2 |
| BOND25 | **Two P/S c/w Induced AC, 0 Point Bond** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Volts 2 - P/S 2 | AC Volts 2 - P/S 2 |
| BOND26 | **No P/S, 4 Point Bond** | DC Amps 1 - Bond 1 | DC Amps 2 - Bond 2 | DC Amps 3 - Bond 3 | DC Amps 4 - Bond 4 |
| BOND27 | **One P/S c/w Induced AC, 1 Point Bond, AC Mitigation Current** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Amps 2 - Bond 1 | AC Amps 4 – AC Mitigation Current |
| BOND28 | **One P/S DC Only, 2 Point Bond, AC Mitigation Current** | DC Volts 1 - P/S 1 | DC Amps 2 - Bond 1 | DC Amps 3 - Bond 2 | AC Amps 4 – AC Mitigation Current |
| BOND29 | **Three P/S DC, 1 Point Bond** | DC Volts 1 - P/S 1 | DC Volts 2 - P/S 2 | DC Volts 3 - P/S 3 | DC Amps 4 - Bond 1 |
| BOND30 | **One P/S AC/DC, 1 P/S DC, AC Mitigation Current** | DC Volts 1 - P/S 1 | AC Volts 1 - P/S 1 | DC Volts 2 – P/S 2 | AC Amps 4 – AC Mitigation Current |

| Type | RESERVED - Future Use |
|---|---|
| 16 | Future use - determined by factory |
| 31-32 | Future use - determined by factory |

| Range | Max | Comment |
|---|---|---|
| Rect Volts DC | 150 VDC | |
| Rect Volts AC | 105 VAC | |
| Rect DC Amps | 150 mV DC | 50mV or 100mV shunt |
| Rect DC Amps Drain | 150 mV DC | 50mV or 100mV shunt |
| P/S DC | 20 VDC Hi Z | |
| P/S AC | 14 VAC Hi Z | |
| AC Line Volts | 115 VAC | Using the AC sense wire channel. Fig 14 |
| AC Line Current | 14 VAC | Requires external current transformer with internal protection |
| TEG DC Volts In | 119 VDC | |
| AC Mitigation Current | 14 VAC | Requires external current transformer with internal protection |

**Figure 28 Measurement Types**

Notes:

-The RMU3 measurement inputs must not be directly connected to AC mains.

-AC Current transformers for AC Mitigation Current Measurement shall be of internal protection type.

### 6.2.6.1 Rectifier Measurement Type Diagrams

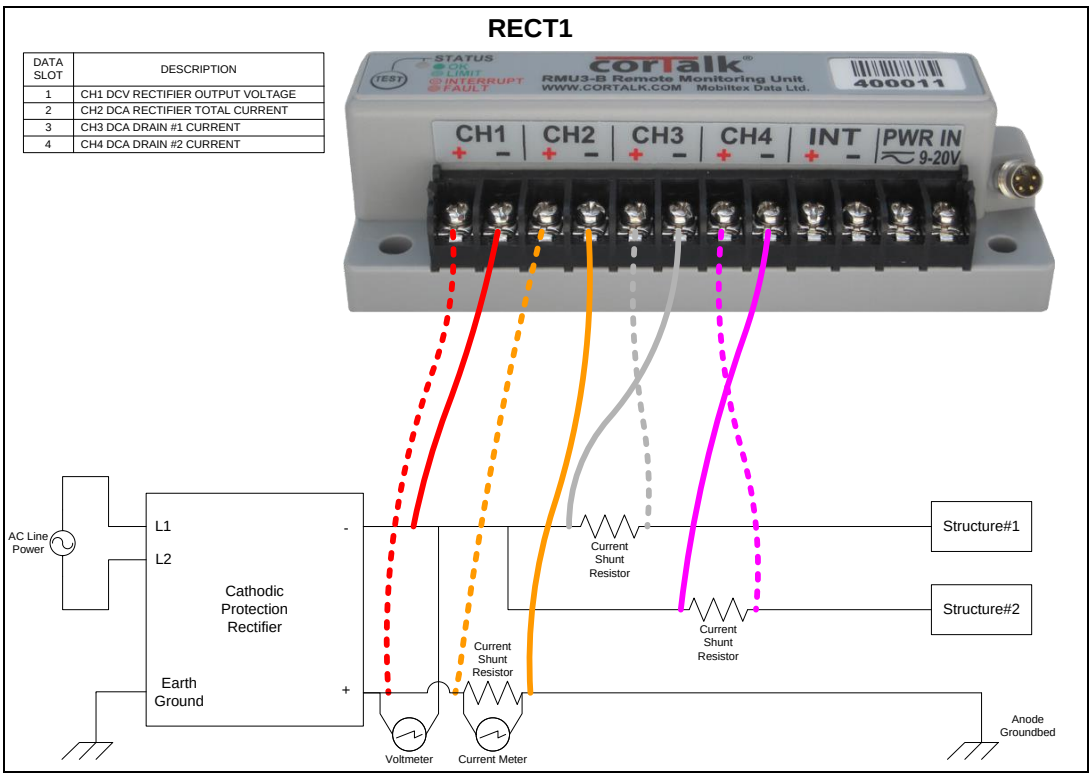



**Figure 29 RECT1 Rectifier – Output Volts, Total Amps, and 2 Drains**

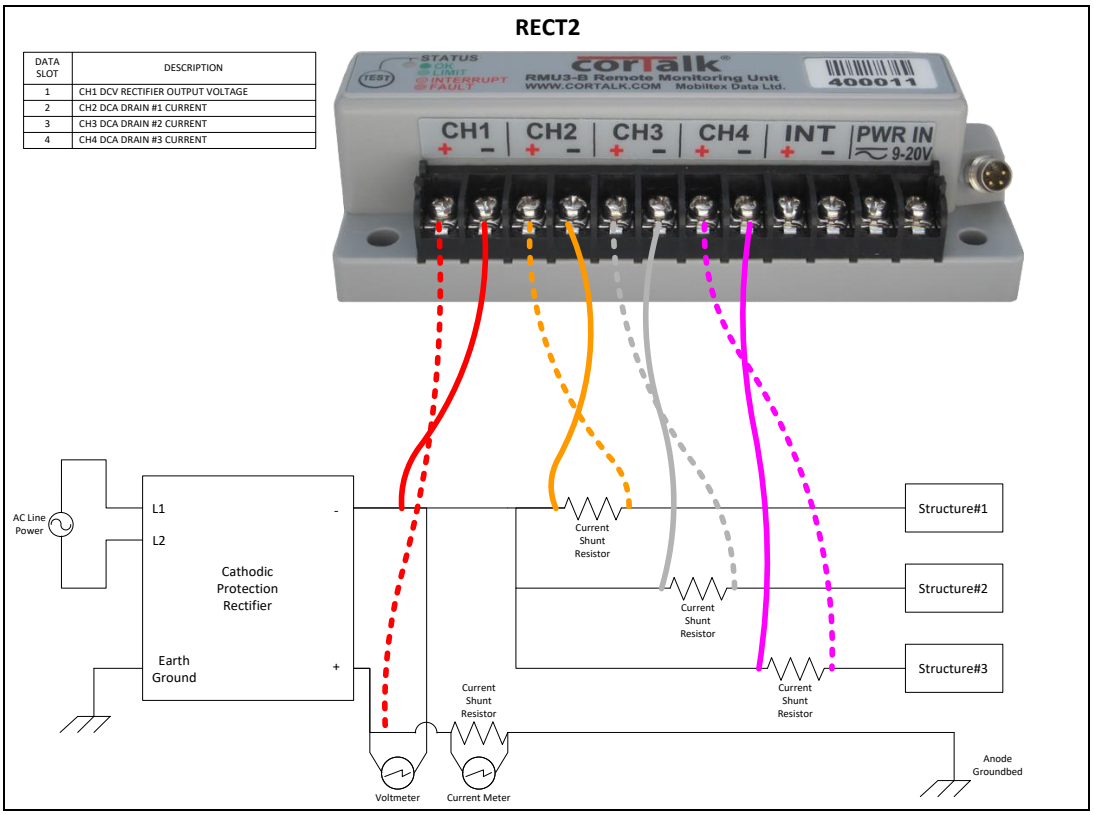


**Figure 30 RECT2 Rectifier – Output Volts and 3 Drains**

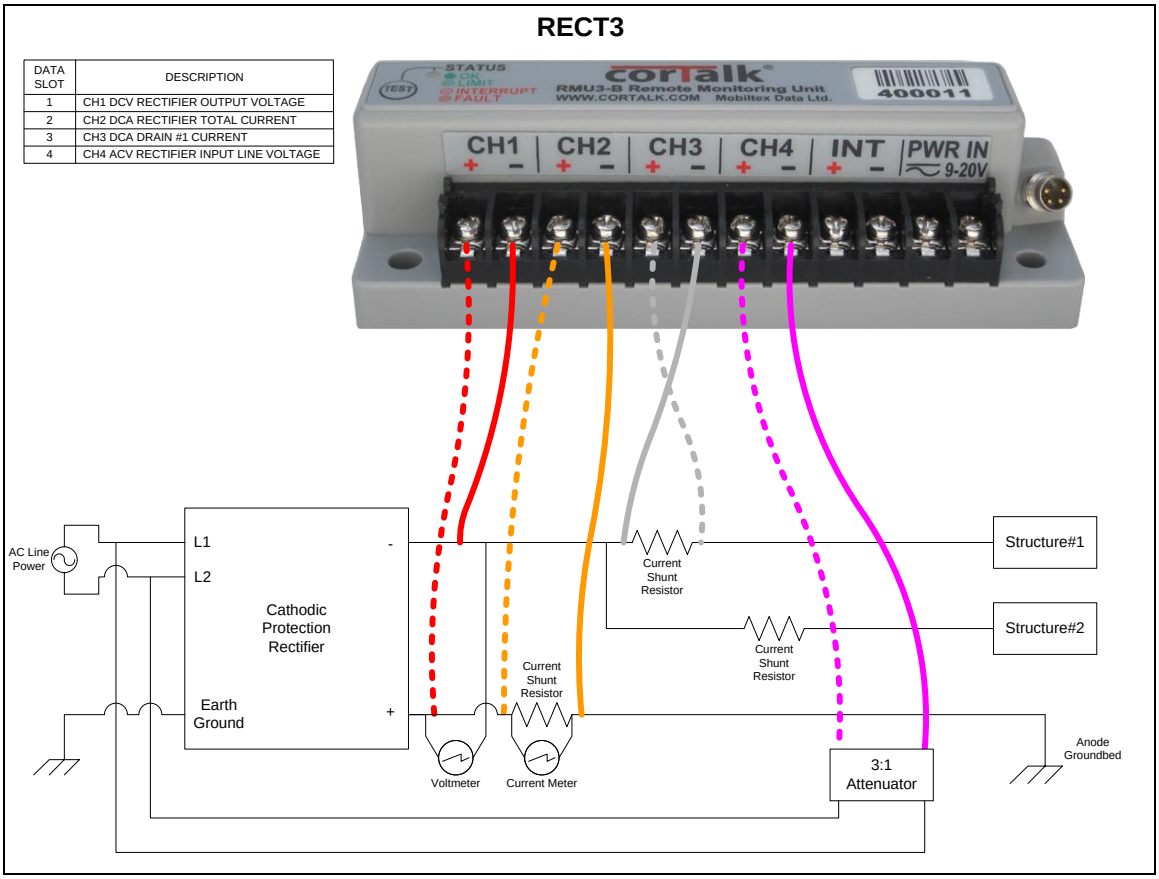



**Figure 31 RECT3 Rectifier – Output Volts, Total Amps, Drain, and Input AC Volts**

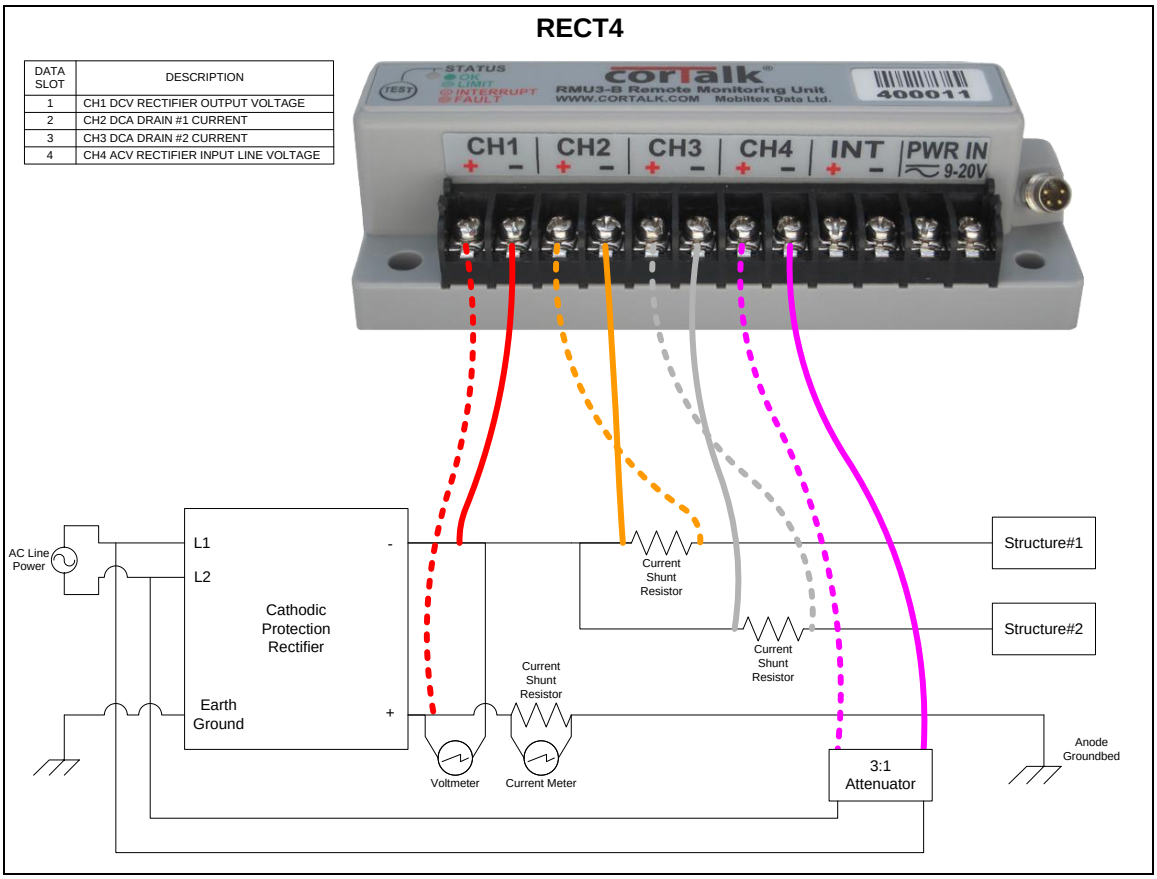


**Figure 32 RECT4 Rectifier - Output Volts, 2 Drains, and Input AC Volts**

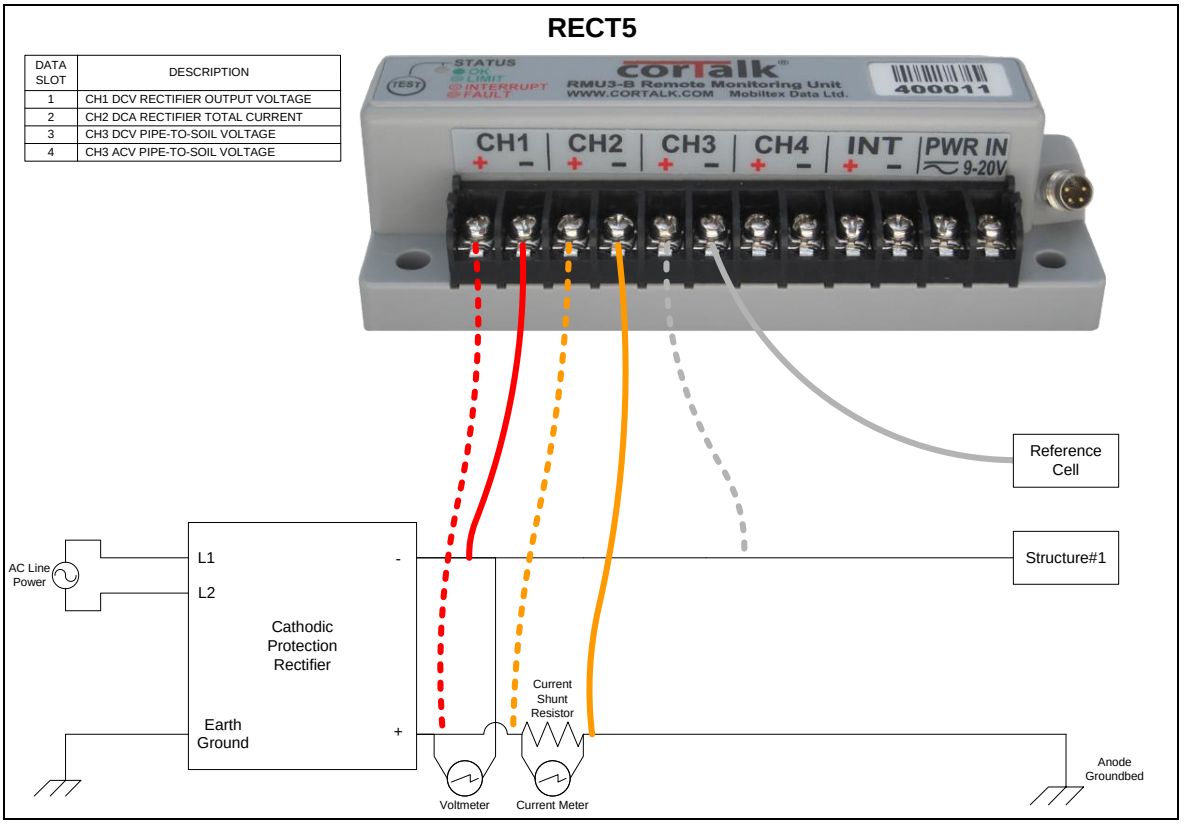



**Figure 33 RECT5 Rectifier – Output Volts, Total Current, and Pipe-To-Soil AC/DC**

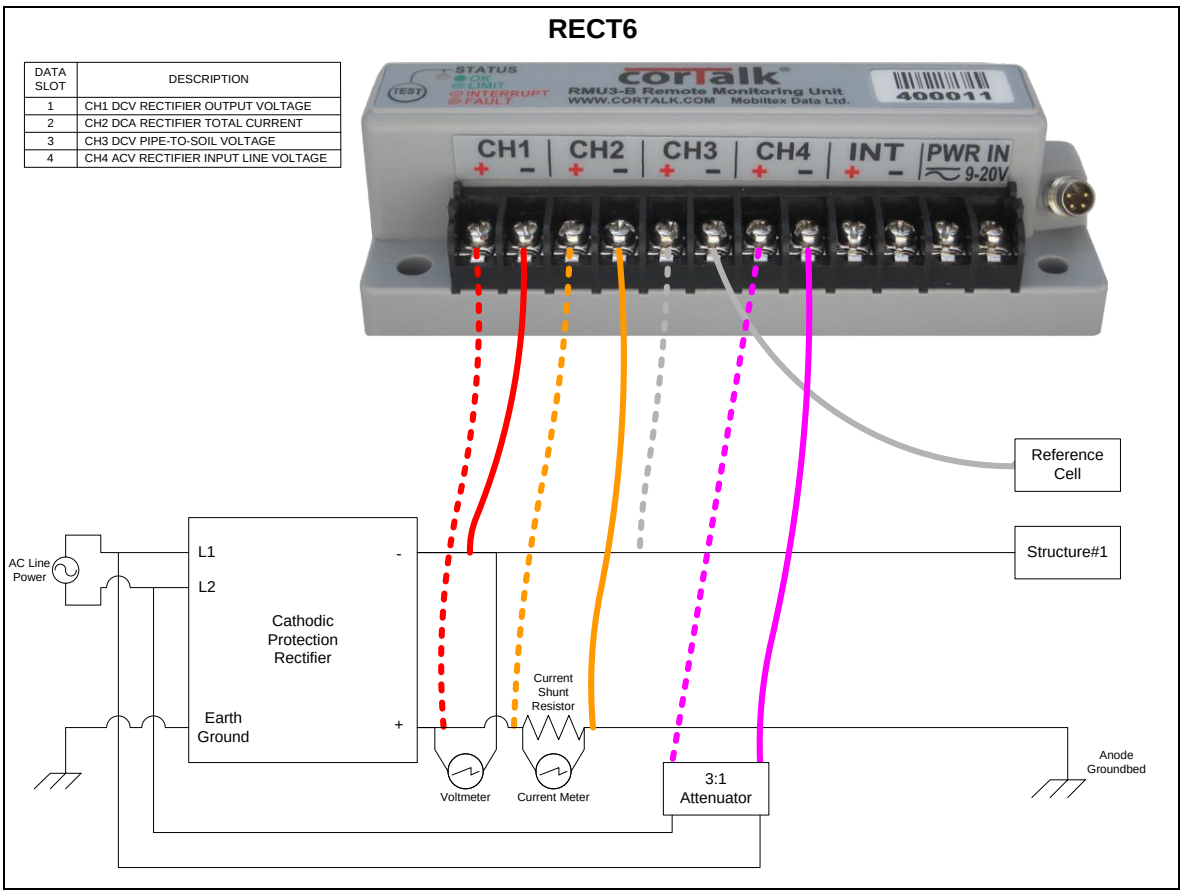



**Figure 34 RECT6 Rectifier – Output Volts, Total Current, Pipe-To-Soil and Input AC Volts**

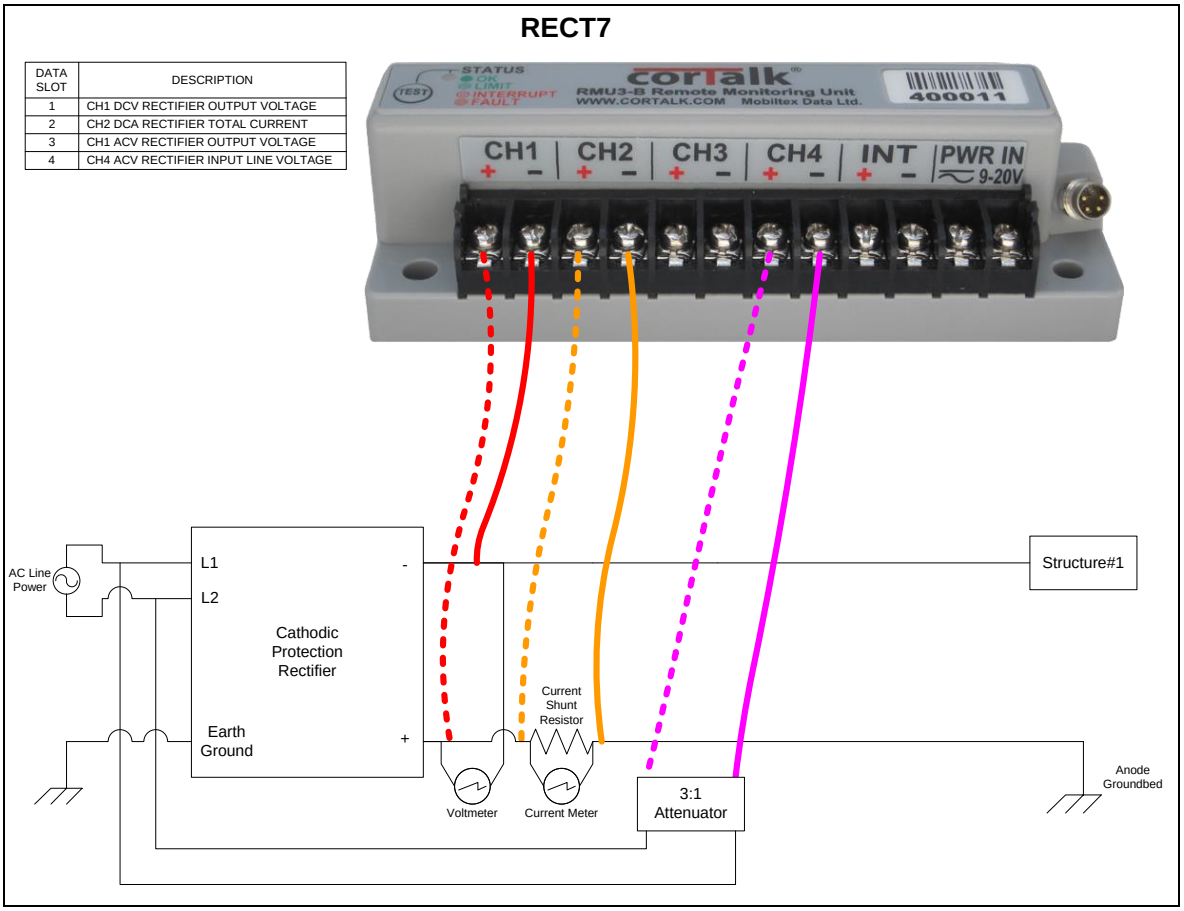



**Figure 35 RECT7 Rectifier – Output Volts AC/DC, Total Current, and Input AC Volts**

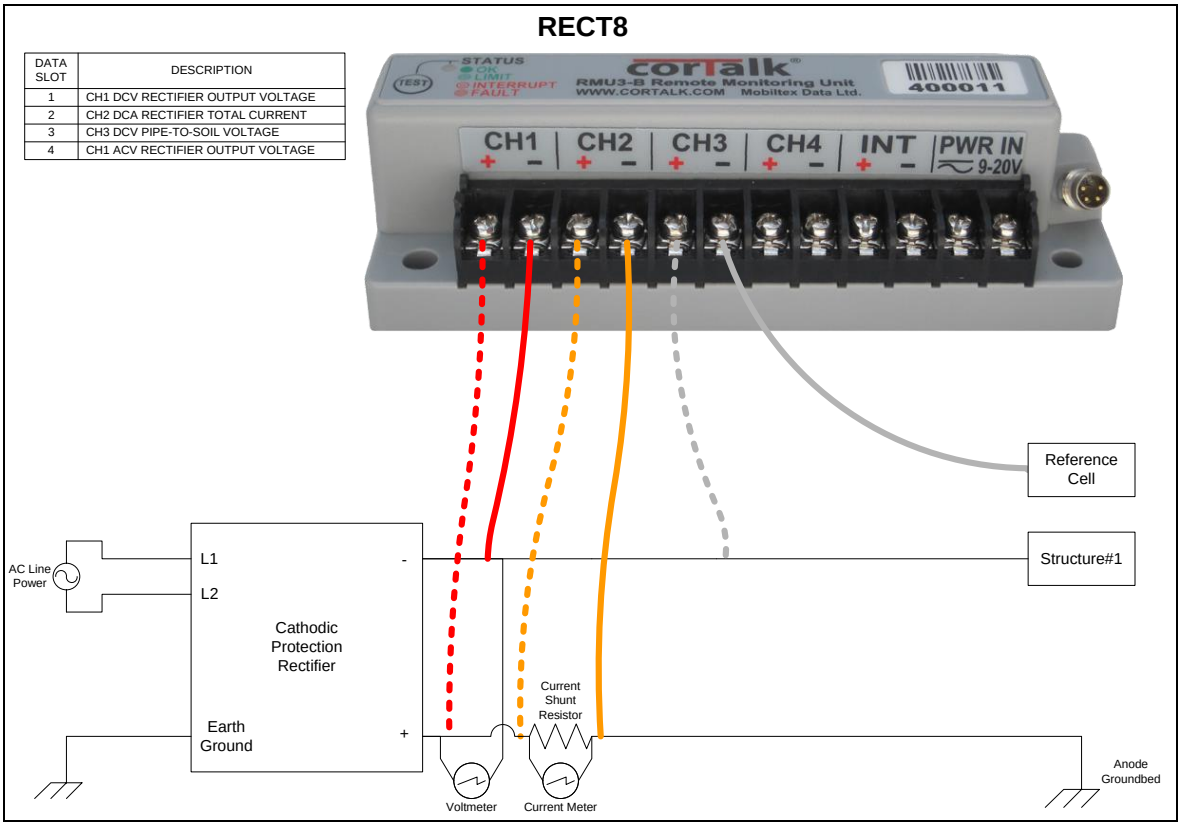



**Figure 36 RECT8 Rectifier – Output Volts AC/DC, Total Current, and Pipe-To-Soil**

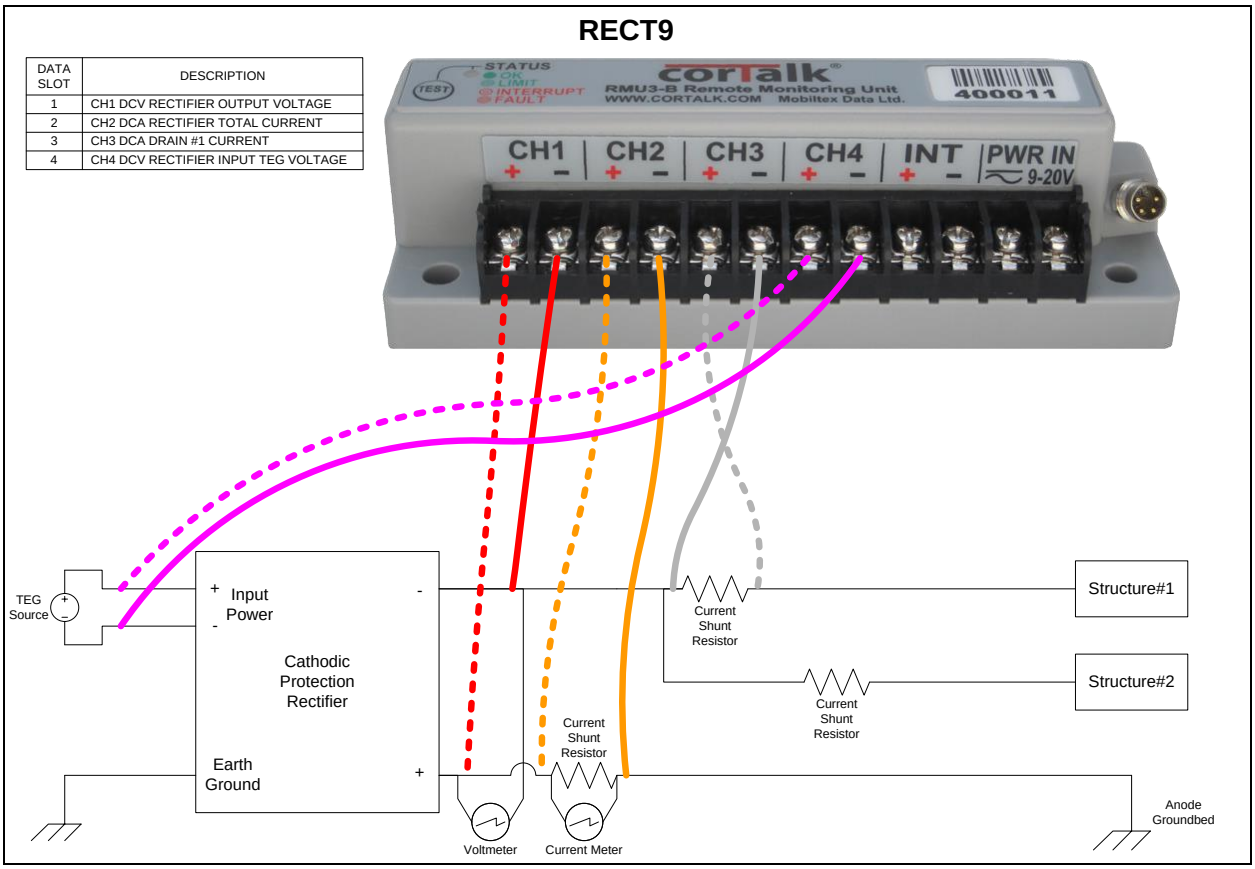



**Figure 37 RECT9 TEG or Solar – Output Volts, Total Current, Drain, and Input DC Volts**

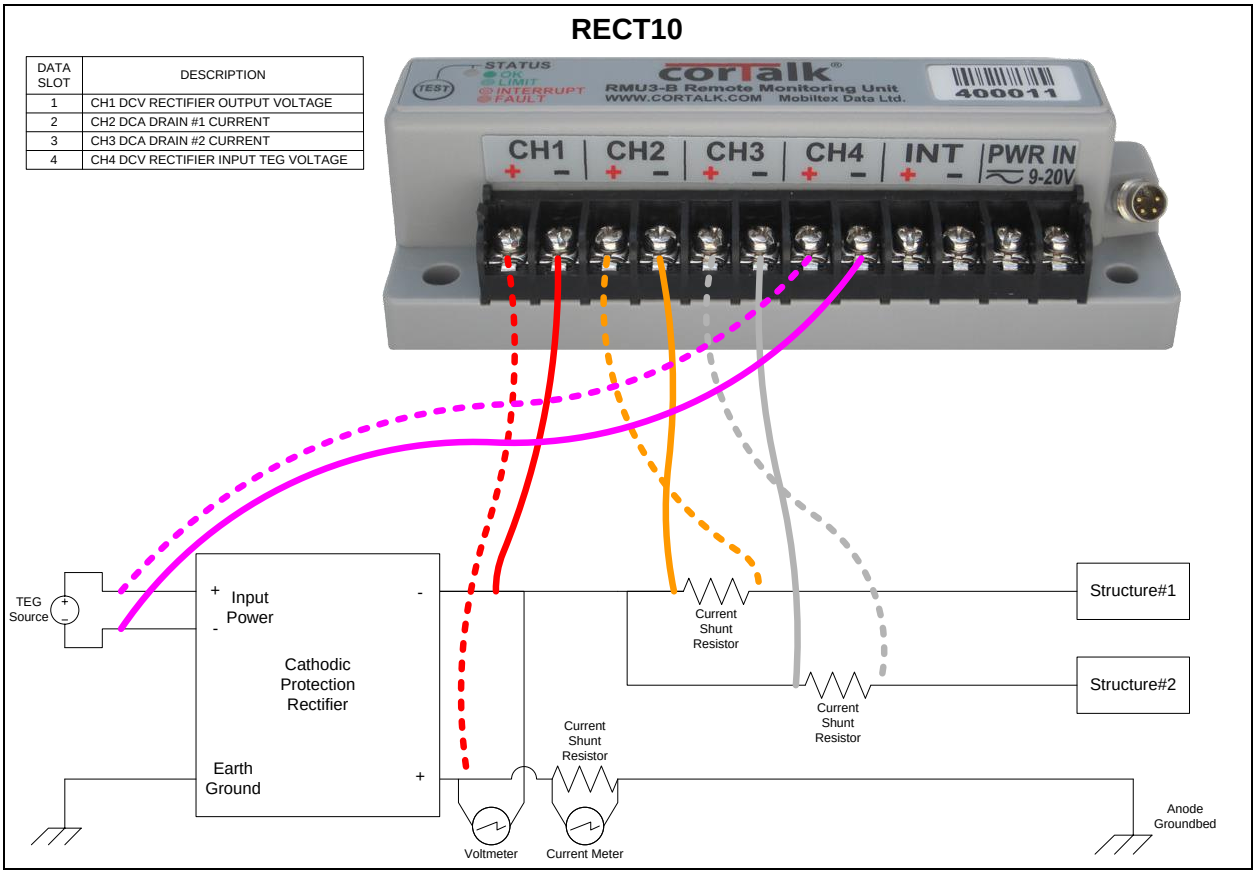



**Figure 38 RECT10 TEG or Solar – Output Volts, 2 Drains, and Input DC Volts**

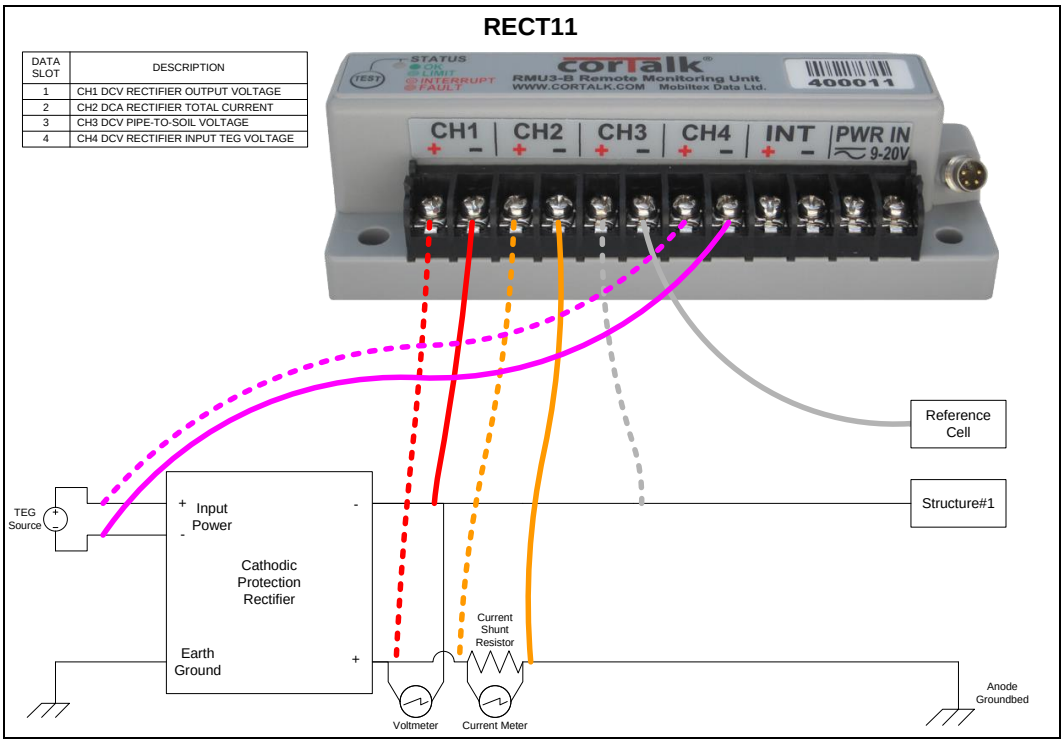



**Figure 39 RECT11 TEG or Solar – Output Volts, Total Current, Pipe-To-Soil, and Input DC Volt**

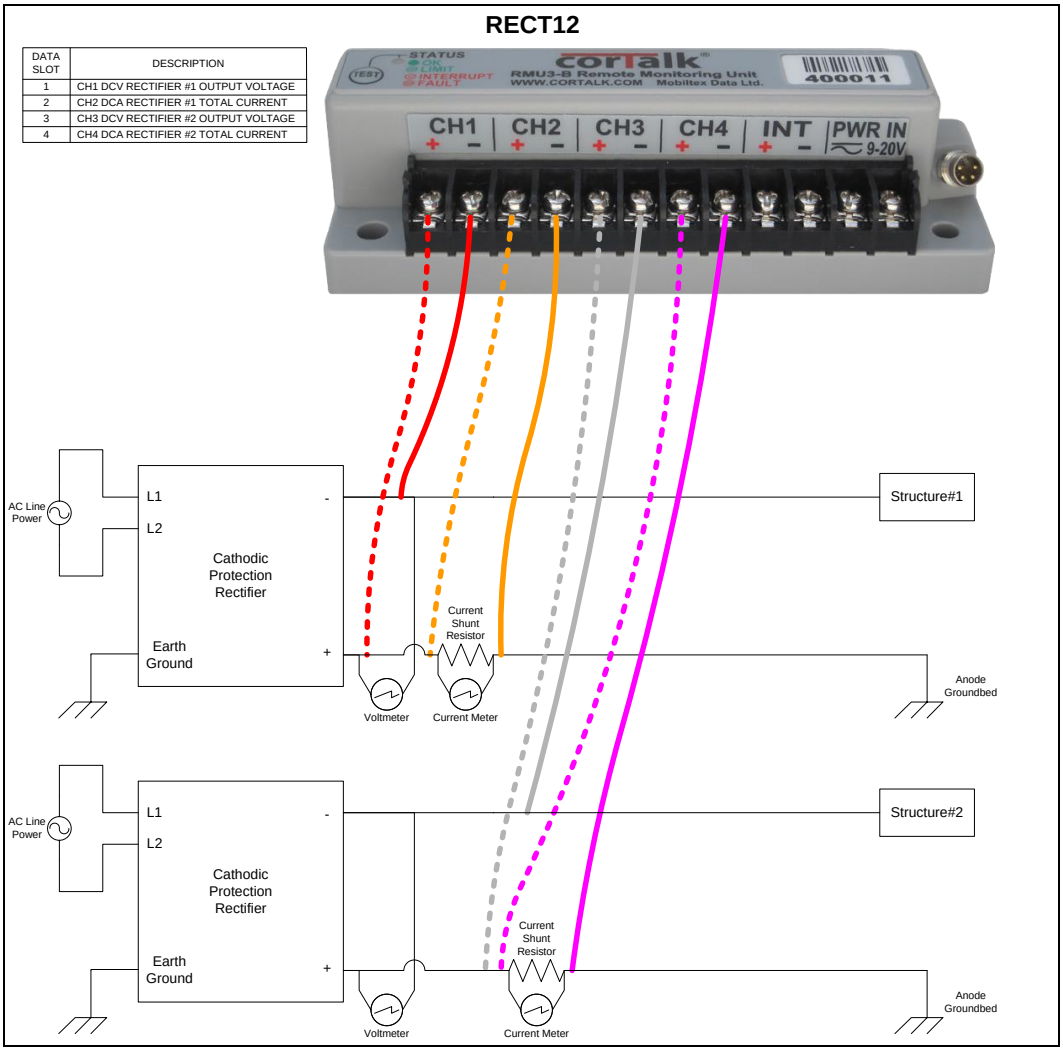



**Figure 40 RECT12 Two Co-located Rectifiers – Rect #1/2 Output Volts, and Rect #1/2 Current**

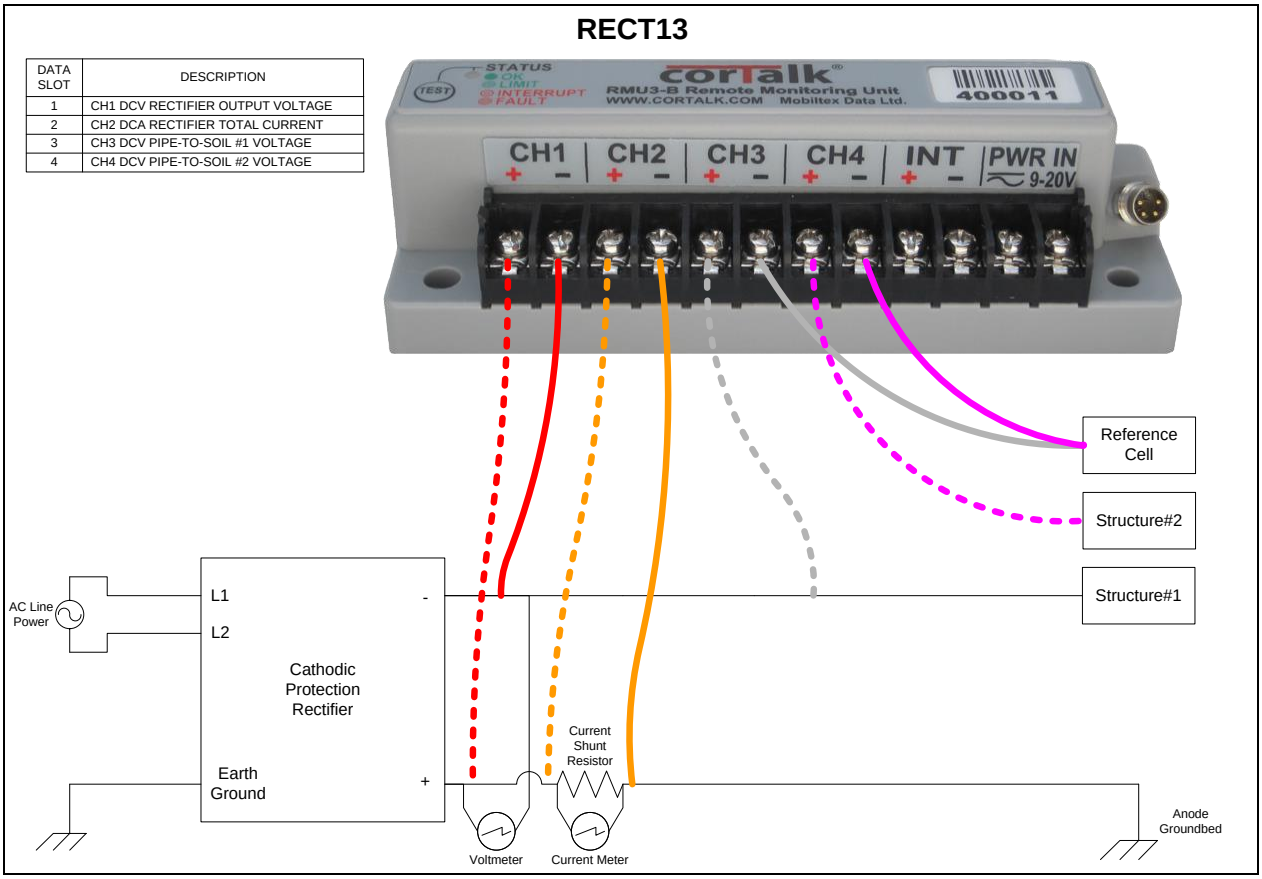



**Figure 41 RECT13 Rectifier – Output Volts, Total Current, and 2 Pipe-To-Soil DC**

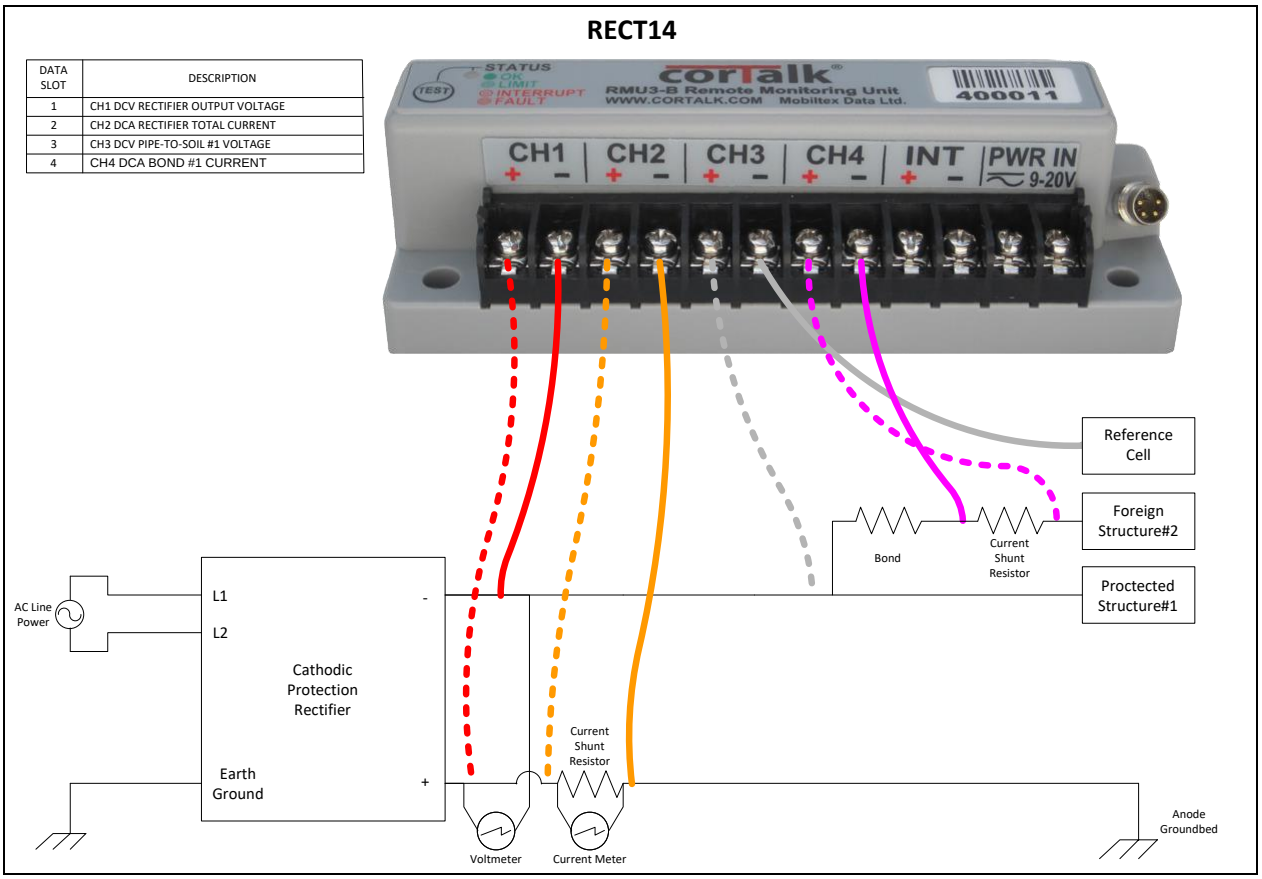



**Figure 42 RECT14 Rectifier – Output Volts, Total Current, 1 Pipe-To-Soil DC, and 1 Bond Current DC**

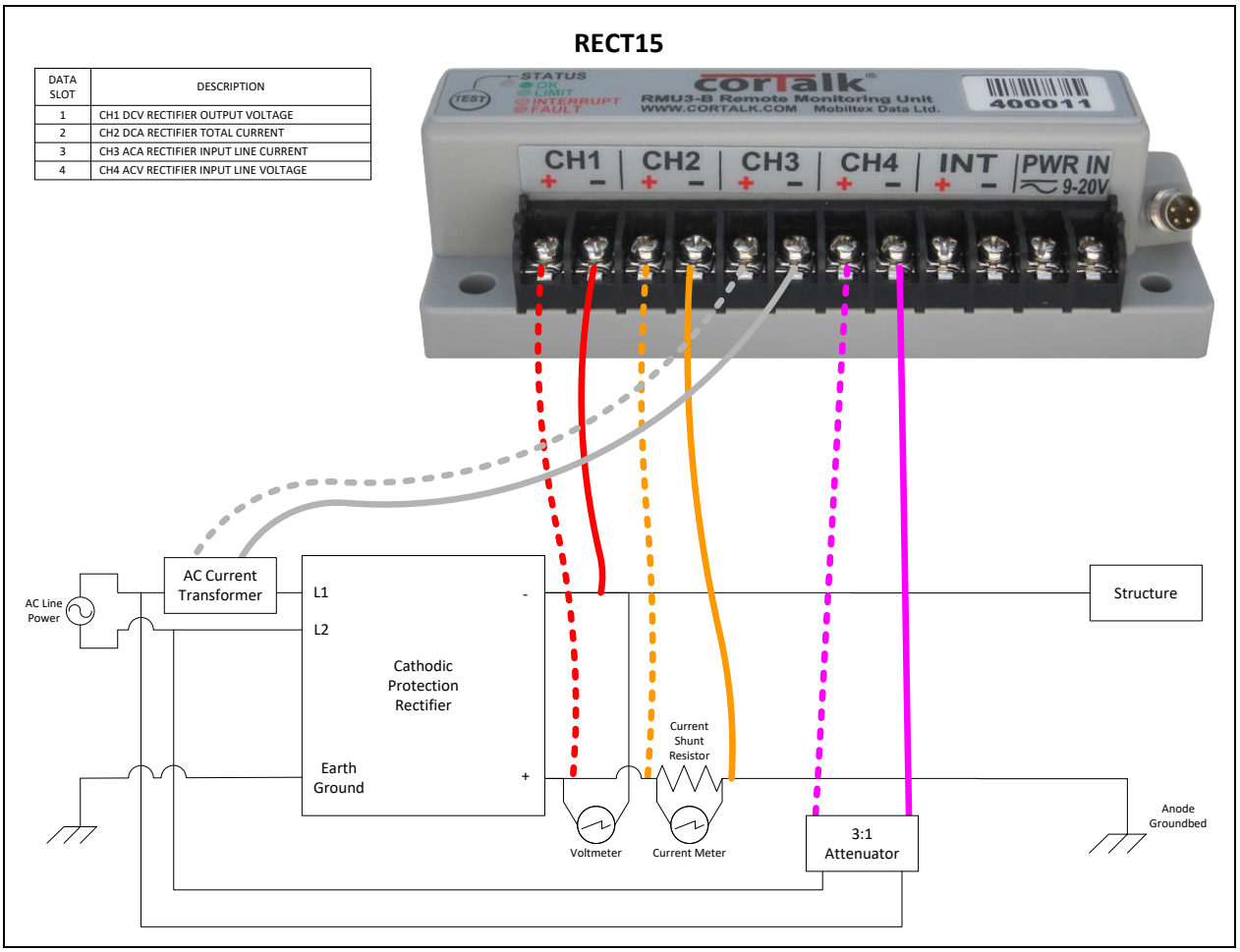



**Figure 43 RECT15 Rectifier – Output Volts, Total Current, Input AC Amps and Input AC Volts**

## 6.2.6.2 Test Point Measurement Type Diagrams

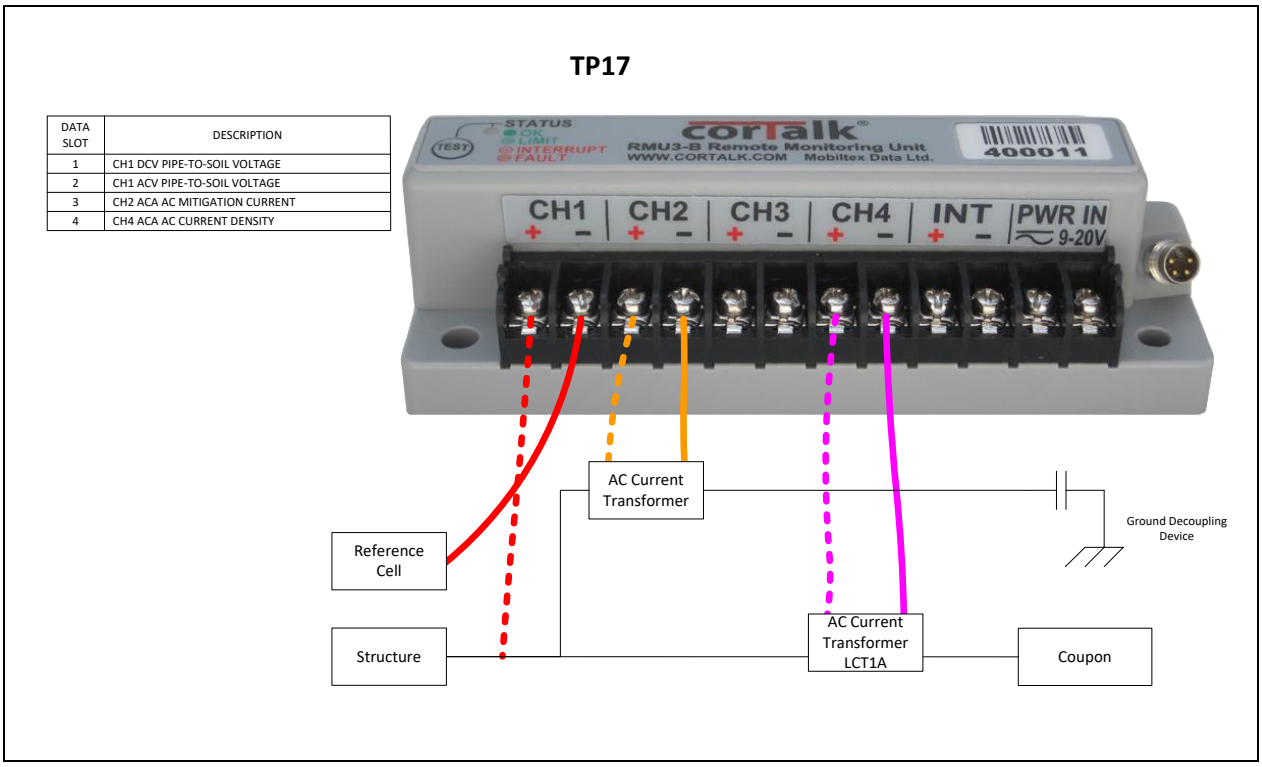



**Figure 44 TP17 Testpoint – Pipe-To-Soil DC/AC, AC Mitigation Current, and AC Current Density**

**TP18**

| DATA SLOT | DESCRIPTION |
|---|---|
| 1 | CH1 DCV PIPE-TO-SOIL VOLTAGE |
| 2 | CH1 ACV PIPE-TO-SOIL VOLTAGE |
| 3 | CH2 DCA DC CURRENT DENSITY |
| 4 | CH4 ACA AC CURRENT DENSITY |

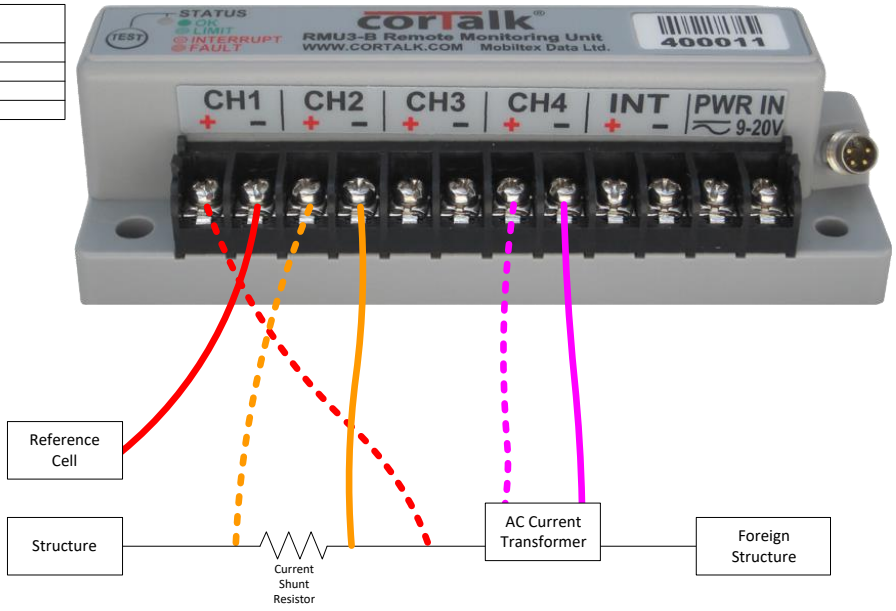



**Figure 45 TP18 Testpoint – Pipe-To-Soil DC/AC, DC Current Density, and AC Current Density**

**TP19**

| DATA SLOT | DESCRIPTION |
|---|---|
| 1 | CH1 DCV PIPE-TO-SOIL #1 VOLTAGE |
| 2 | CH1 ACV PIPE-TO-SOIL #1 VOLTAGE |
| 3 | CH2 DCV PIPE-TO-SOIL #2 VOLTAGE |
| 4 | CH4 ACA AC CURRENT DENSITY |

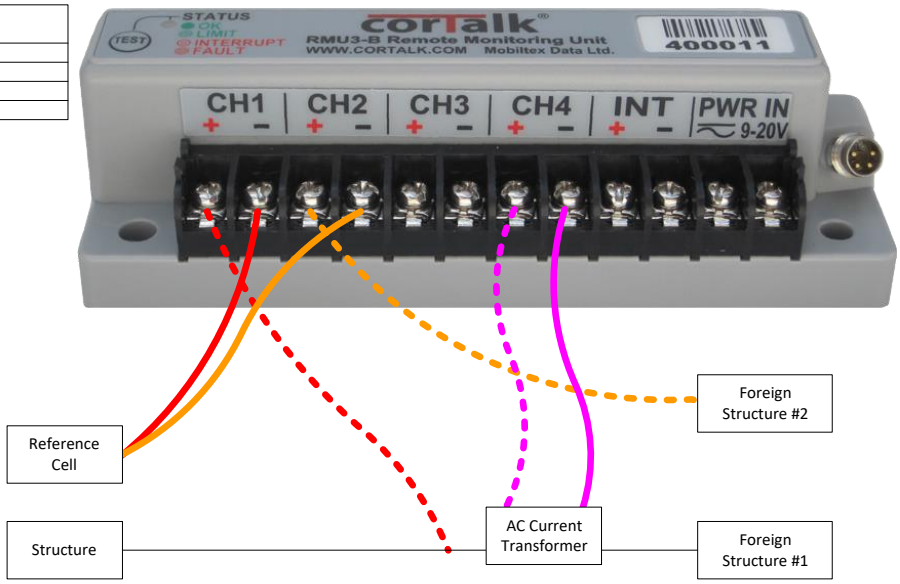



**Figure 46 TP19 Testpoint – Pipe-To-Soil 1 DC/AC, Pipe-To-Soil 2 DC, and AC Current Density**

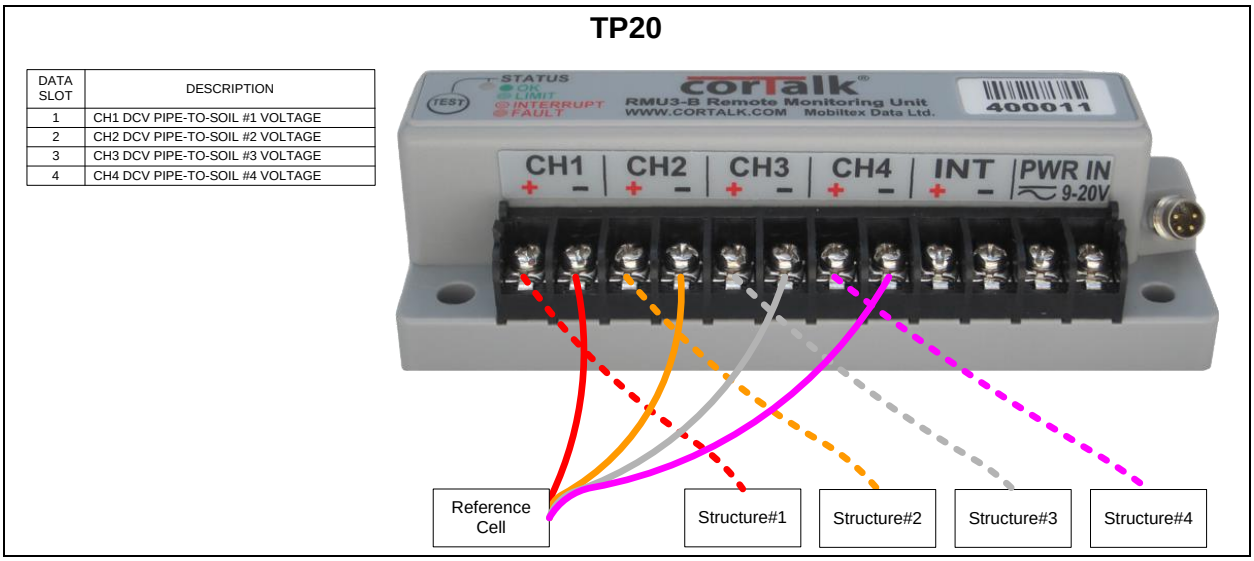



**Figure 47 TP20 Testpoint – 4 Pipe-To-Soil DC**

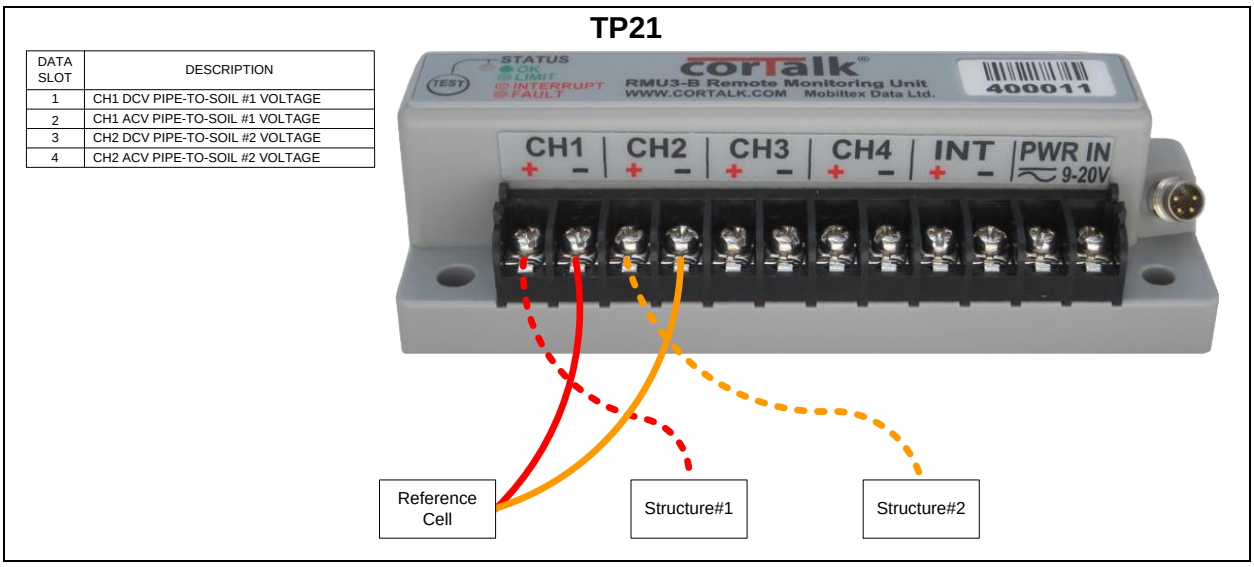



**Figure 48 TP21 Testpoint – 2 Pipe-To-Soil AC/DC**

### 6.2.6.3 Bond Measurement Type Diagrams

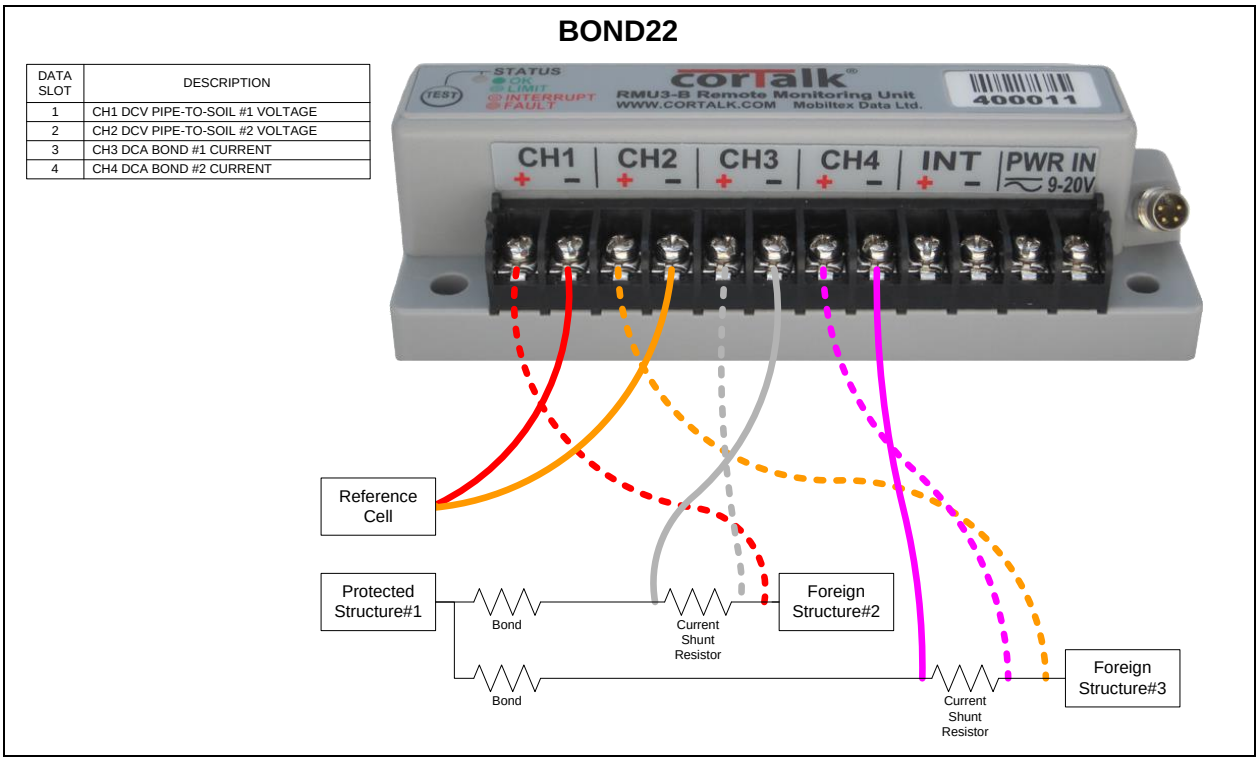



**Figure 49 BOND22 Bond – 2 Pipe-To-Soil, and 2 Bond Currents**

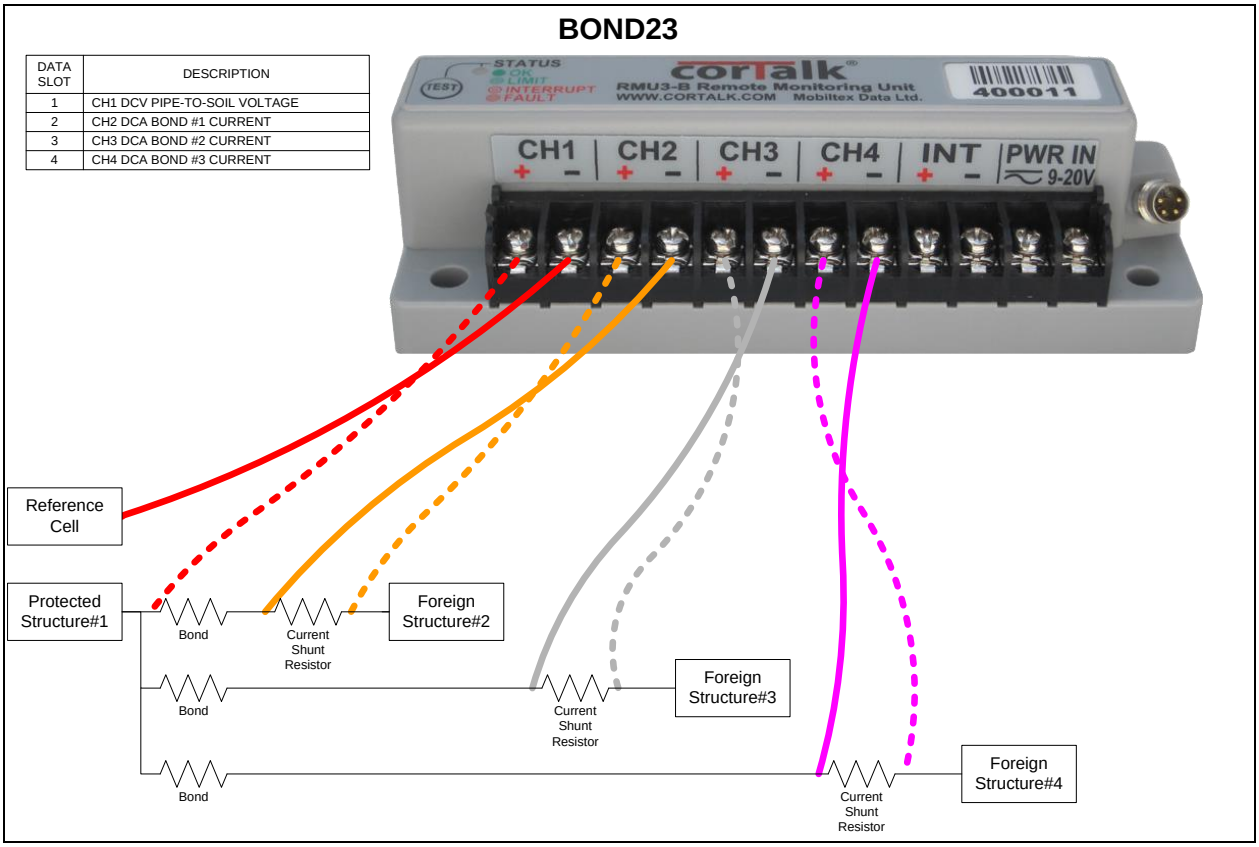



**Figure 50 BOND23 Bond – Pipe-To-Soil, and 3 Bond Currents**

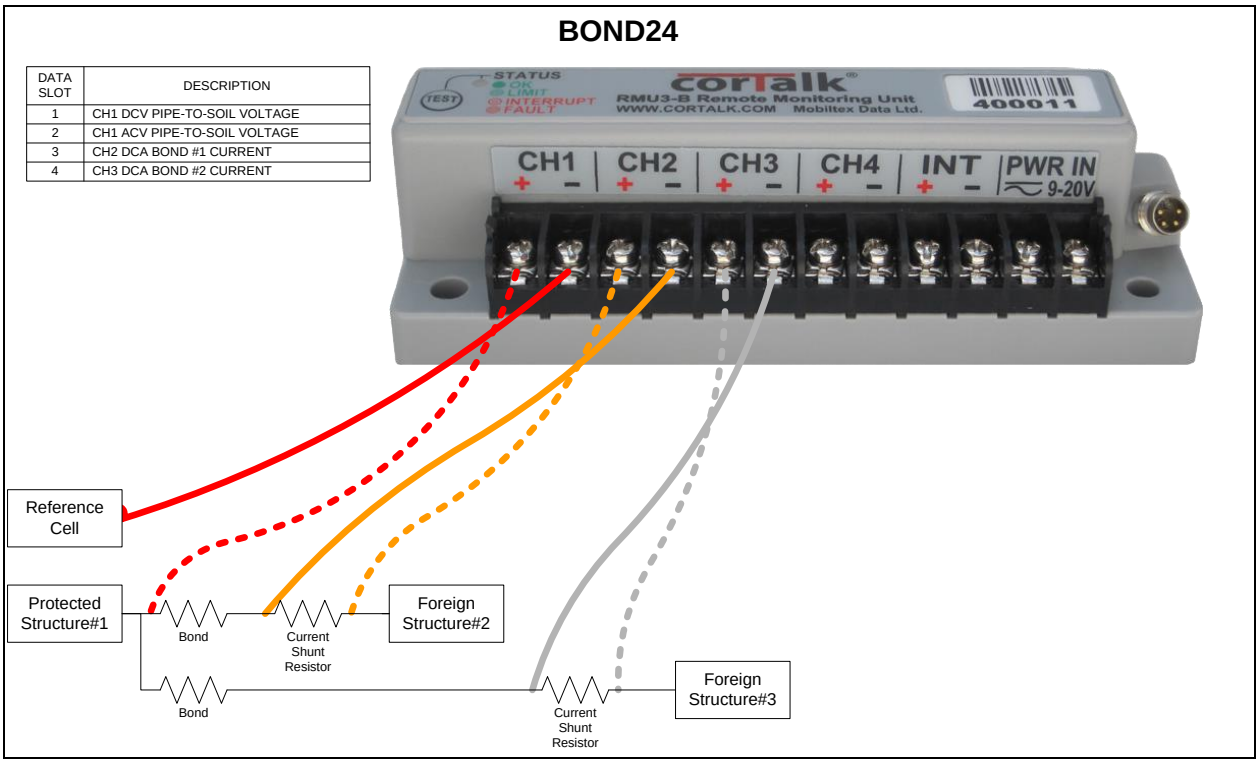



**Figure 51 BOND24 Bond – Pipe-To-Soil AC/DC, and 2 Bond Currents**

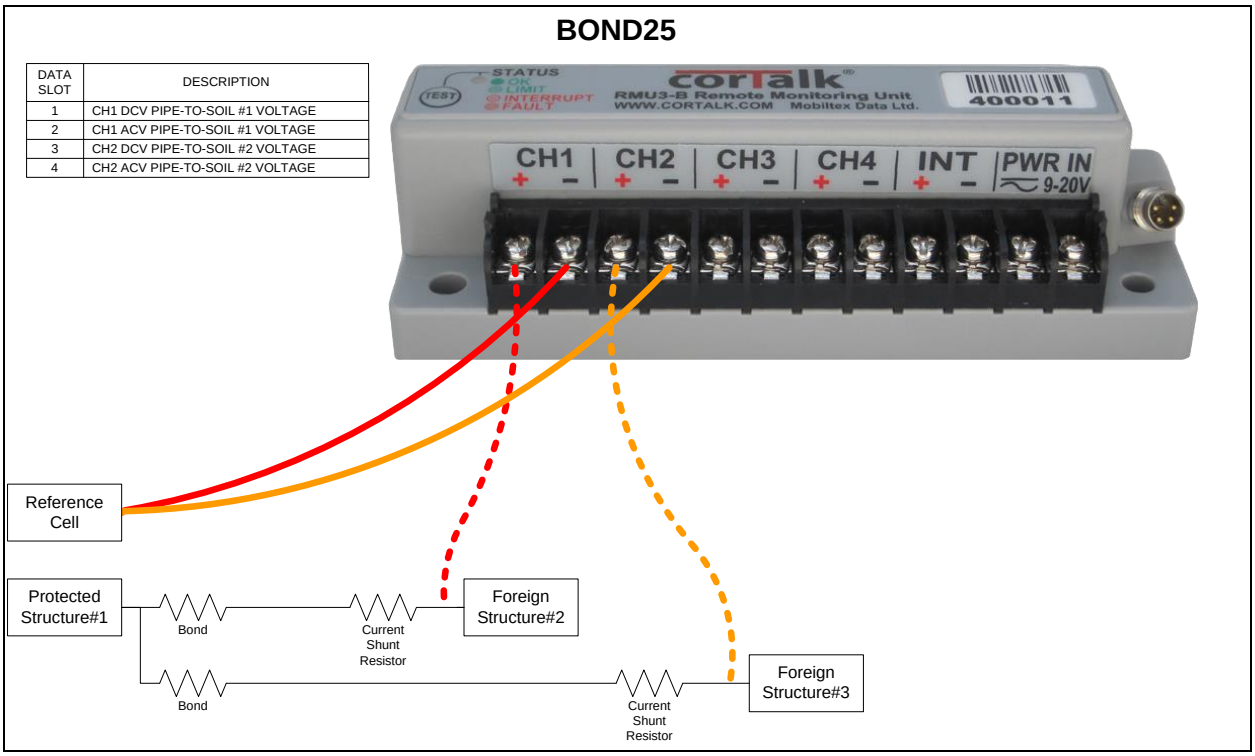



**Figure 52 BOND25 Bond – 2 Pipe-To-Soil AC/DC**

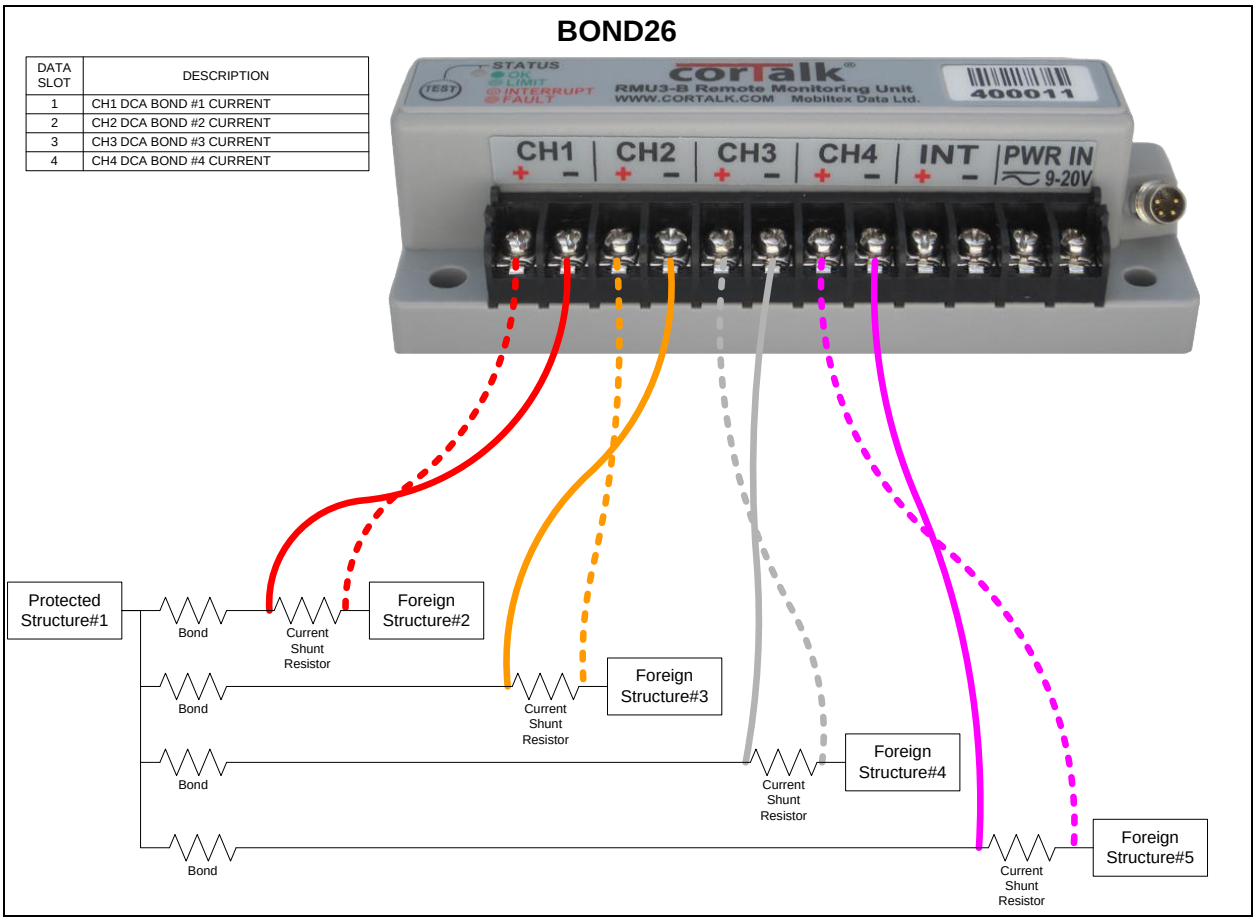



**Figure 53 BOND26 Bond – 4 Bond Currents**

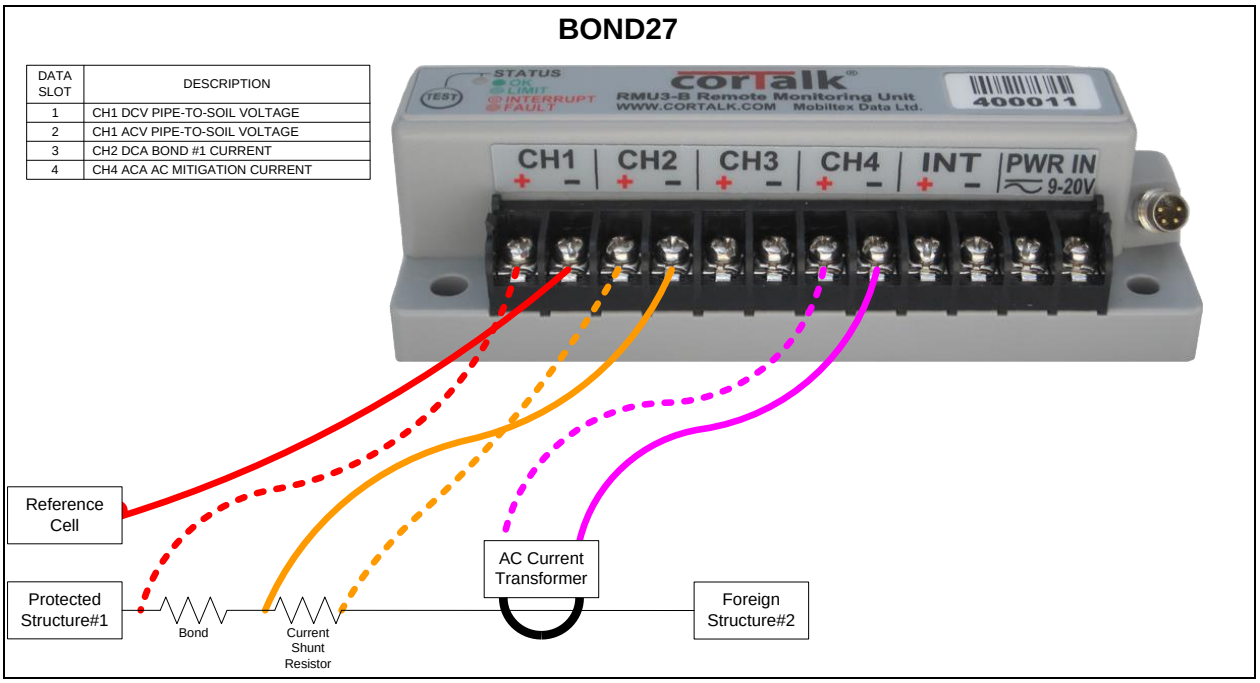



**Figure 54 BOND27 Bond – Pipe-To-Soil DC/AC, 1 Bond Current, and AC Mitigation Current**

Note: AC Current transformers require internal protection.

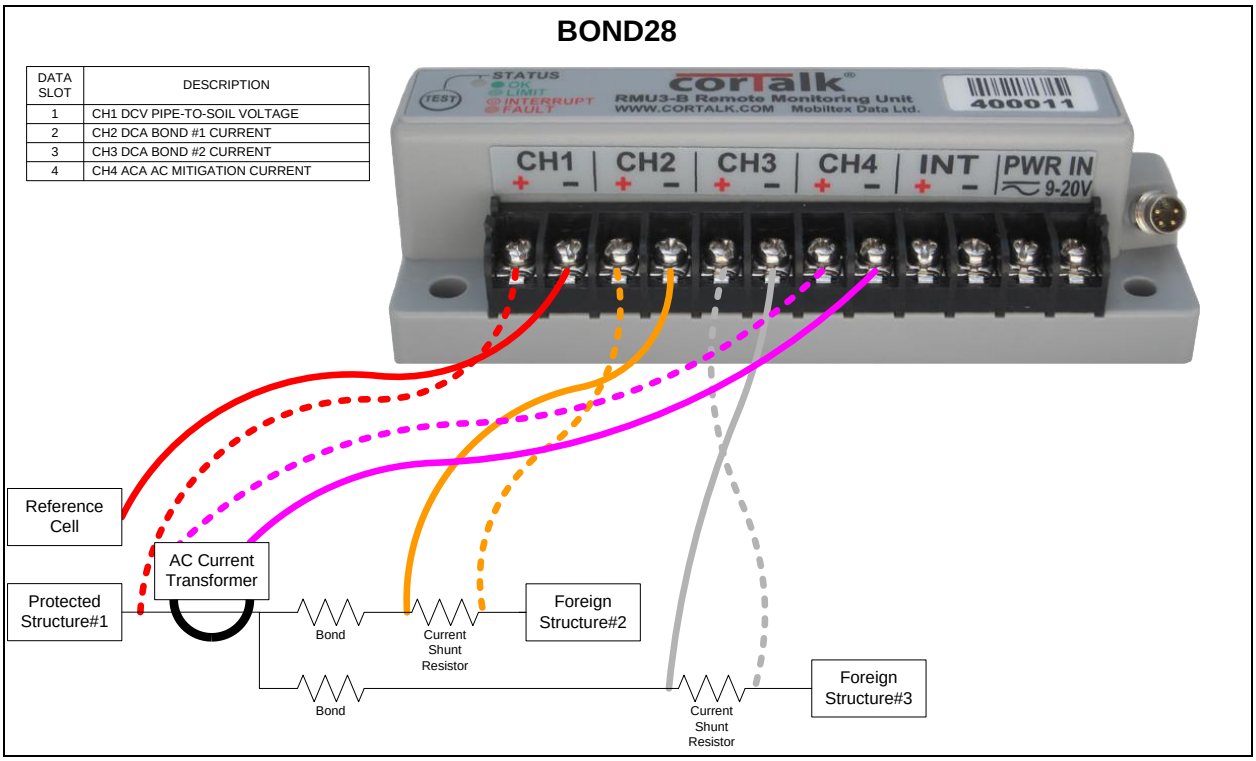



**Figure 55 BOND28 Bond – Pipe-To-Soil DC, 2 Bond Currents, and AC Mitigation Current**

Note: AC current transformers require internal protection.

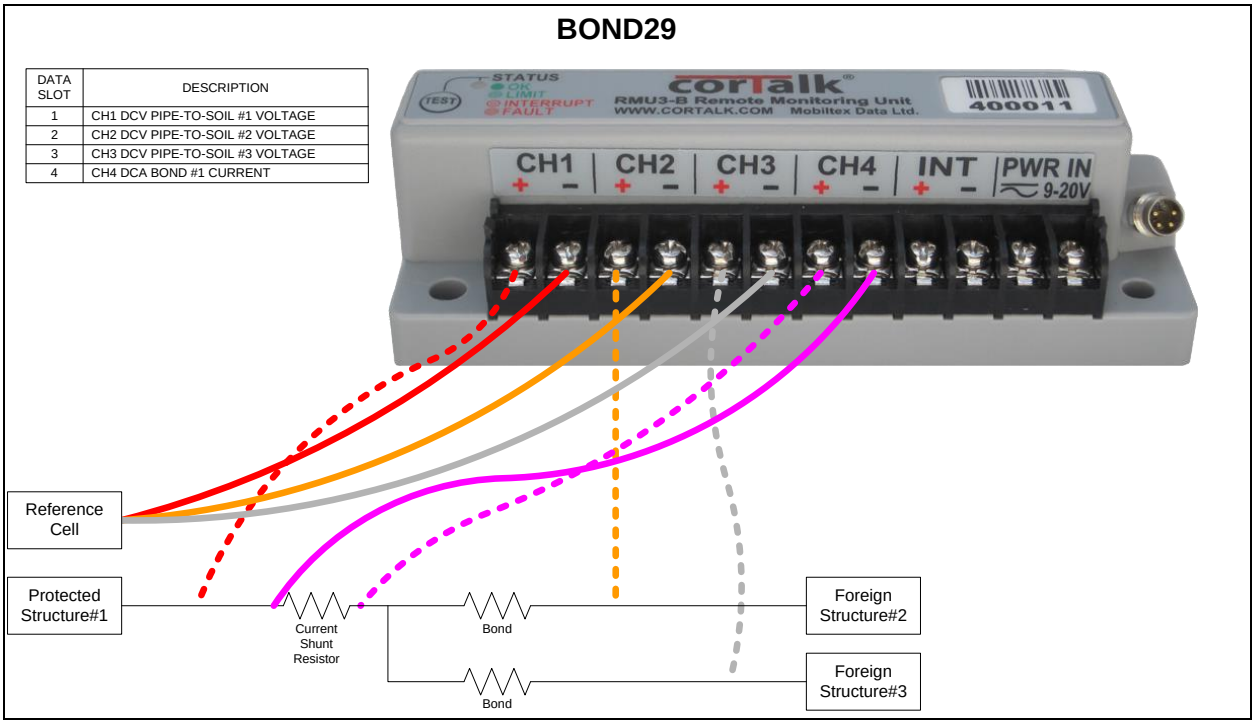



**Figure 56 BOND29 Bond – Three Pipe-To-Soil DC, 1 Bond Current**

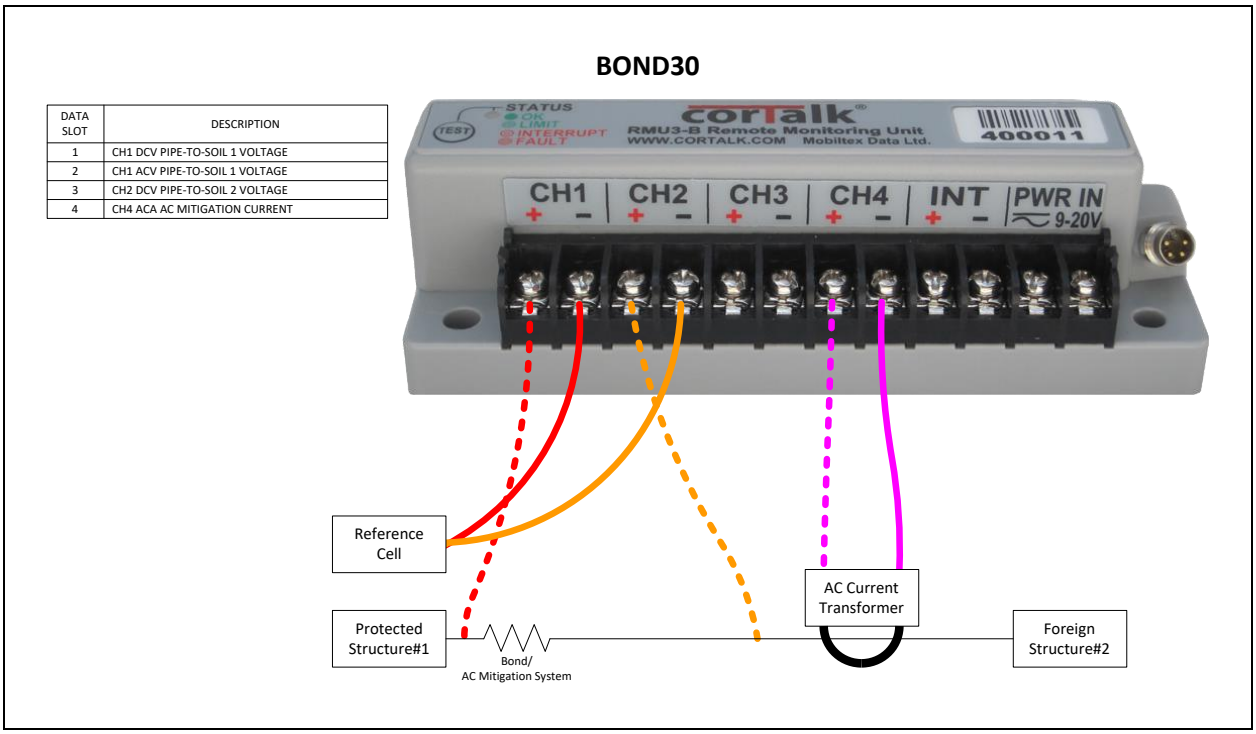



**Figure 57 BOND30 Bond – Pipe-To-Soil 1 DC/AC, Pipe-To-Soil 2 DC, and AC Mitigation Current**

### 6.2.6.4 Field Installable User Label Set (RMU3-B only)

The standard RMU3 kit includes a "Field Installable User Label Set" that contains pre-printed labels for the different measurement configuration types. The installer can optionally apply the proper label to either the bottom or top of the terminal block on the RMU3-B to indicate actual wiring connections associated with that specific measurement type. The red number located at the bottom-center of each label indicates the actual measurement type.

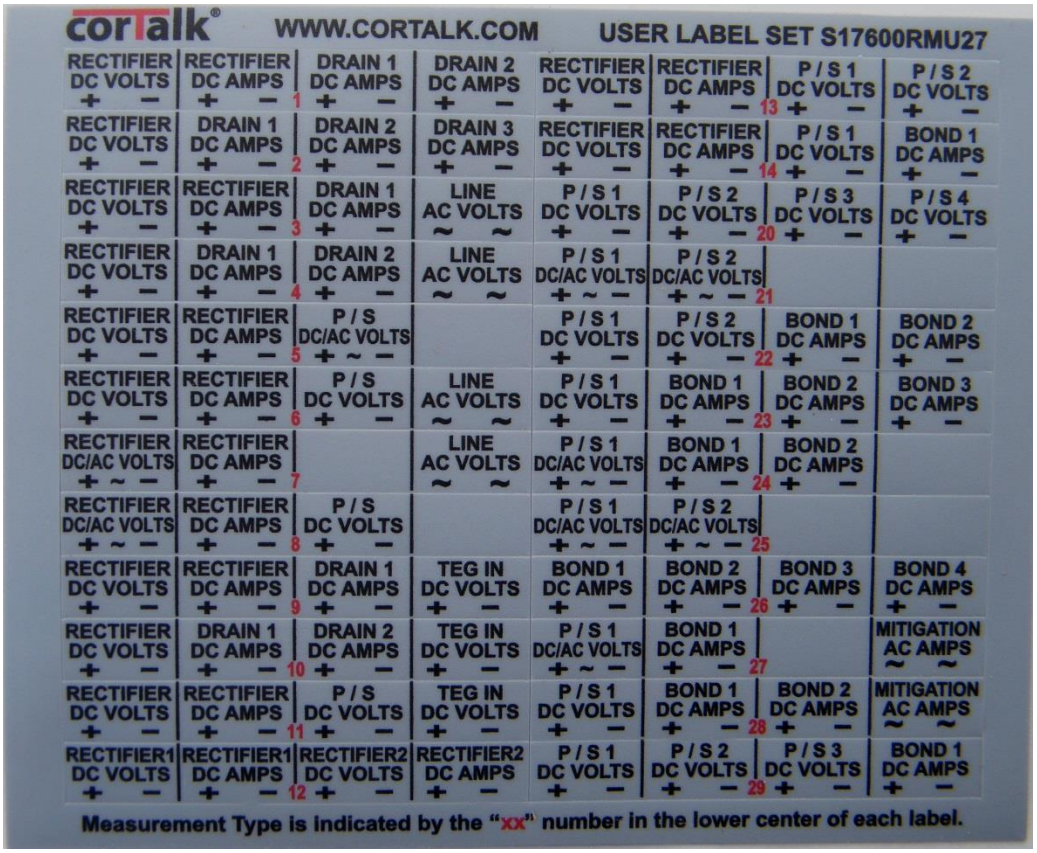



**Figure 58 Field Installable User Label Set**




**Figure 59 Example of Label on Bottom of Terminal Block**




**Figure 60 Example of Label on Top of Terminal Block**

### 6.2.6.5 Measurement Wiring Connections

The programmed "Measurement Type" will determine the signals monitored and the associated wiring connection requirements. Wire the appropriate measurement signals from the rectifier, test point or bond to the terminal block on the RMU3-B. In most applications, it is convenient to parallel tap the analog signals from the existing rectifier meters. Unused analog input channels should be disabled using the RMU3 configuration software or alternatively, a shorting wire should be installed between the two terminals of the unused channel.

An optional wiring kit (A20103RMU30), containing a variety of crimp terminals, wiring, cable ties and cable tie mounts, is available. Electrical connections to the RMU3-B or RMU3X-B can be made using either direct wire connections (22 to 14 AWG wire size) or crimped spade lug terminal connectors (0.275" or 7mm maximum spade lug width). Lightning immunity is enhanced by utilizing 600 volt, 105C rated wiring (as supplied with the optional wiring kit) which has a thicker insulation system and higher voltage breakdown rating as compared to more common 300 volt rated wiring systems. In the case of the RMU3X-B, the terminal block for each sub-RMU bank is pluggable and removable to allow easy replacement of the RMU3X-B without having to remove all of the wiring from the screw terminals.







## 6.3 Interconnection Cable

Route the previously installed interconnection cable from the RMU3-G/S to the RMU3-B/RMU3X-B. For maximum lightning immunity this cable should be physically routed away from other wiring, especially AC line level connections.

The un-terminated M8-style female connector going to the RMU3-B should remain disconnected until the RMU3 has been configured. The interconnect cable may be extended up to a **maximum length of 24 meters (78 feet)** by screwing together extension cables.

Note that an installation that uses the MUX3 multiplexer has additional limitations on cable lengths. Refer to section 6.2.2.

## 6.4 Startup and Verification

Once the rectifier, test point, or bond is wired according to one of the diagrams, the measurement type, current shunt scaling factors (if used), and alarm limits (if used) should be programmed into the RMU3 using the RMU3 configuration software tool, (see section 7).

All wiring should be secured and inspected before the RMU3-G/S and RMU3-B/RMU3X-B are connected together. The RMU3 will start operation when the interconnection cable coming from the RMU3-G/S is connected to the M8-style connector on the RMU3-B/RMU3X-B or MUX3 antenna port.

After the interconnect cable is attached between the RMU3-B or MUX3 and the RMU3-G/S transmitter, observe the RMU3-B "Status" LED indicator (refer to section 6.5 for detailed LED operation descriptions). Transmissions from RMU3-G/S field devices typically require from about 1 to 2 minutes (5 minutes maximum) to arrive at CorView.

After inspecting the installation, re-apply power to the rectifier and verify proper rectifier operation.

Once the rectifier is operating, press the "Test" button on the RMU3-B/RMU3X-B to initiate an immediate measurement cycle and "Button Press" exception transmission to the CorView web host.

If the installation utilizes the door switch function, then the rectifier door should be closed to verify operation. Wait a minimum of 2 minutes after closing the door to allow the measurement and "door closed" transmission to occur. Note that a maximum of 6 door switch or "Test" button transmissions are allowed during a 6-hour period.

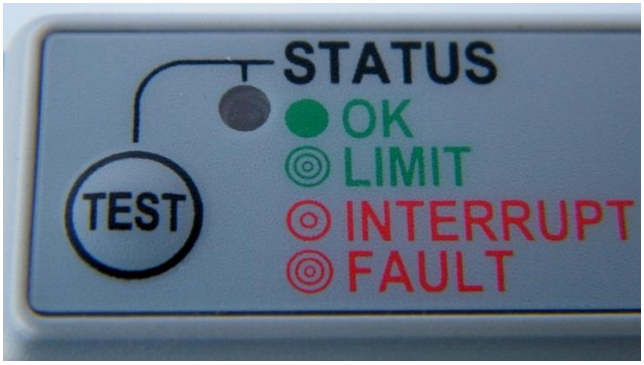
The actual measurement readings from the site should appear on CorView shortly after the message was transmitted. CorView can be configured to automatically send emails containing the measurement readings to an individual or group of email users. Because these emails are short and wireless-friendly, many clients send the readings directly to their field installers wireless email device(s) for near immediate end-to-end operation confirmation and verification of measurement values. Alternatively, the measurement readings can be locally retrieved and displayed using the RMU3PGM configuration tool or the RBT1 Bluetooth interface. It is good practice to confirm that all the measurements are as expected and that they are not too close to any programmed alarm limits (if utilized).

The installation and site should be inspected a final time before properly securing the equipment and leaving the site.

## 6.5 Status LED

The RMU3-B/RMU3X-B has a dual color "Status" LED (see Figure 61) that provides status information to the user. The LED functions as follows:

- Green LED Operation: If the battery voltage is OK, Power In voltage sense is present or not enabled, and readings are within the configured limits, the green LED turns on when the RMU3-B has supply voltage from the Class 2 source. If Power In voltage sense is enabled and there is no voltage sense signal, the green LED will not illuminate. If limits are enabled and there is a reading that is outside the limits, the green LED will flash at a rate of 100ms on, 100ms off. If a CorView host acknowledgement has not yet been received, the green LED will flash at a rate of 250ms on, 250ms off. After the CorView host acknowledgement has been successfully received the green LED will be on at a steady state condition or flashing rapidly to indicate a limits violation.
- Fault: The red LED will blink with a cadence of 500ms on, 500ms off. The flashing will start as soon as the fault is detected. Specific fault information may then be retrieved and reset from the RMU3-B using the configuration tool.
- Exception limit exceeded: The red LED will blink with a cadence of 250 ms on, 250 ms off. The flashing will start immediately after the test button is pressed, or the door switch state is changed. The RMU3 will allow a maximum of 6 exception messages in a 6 hour period. If this limit is exceeded, test button and door switch exceptions are ignored until the next 6 hour period starts. For every 6 hour period after the limit is exceeded, the exception counter decrements by 1.
- Interruption: The red LED will blink at the cadence of the interruption signal. When the red LED is on, current from the rectifier is being interrupted.




RMU3-B




RMU3X-B

**Figure 61 RMU3 LED Status Indicator**

# 7 PC Configuration

## 7.1 Configuration Equipment Requirements

The following items will be needed when configuring an RMU3 with a PC.

1. RMU1/2/3 Configuration Interface (Kit A20A0333101) (Optional with RMU3X-B)

   The configuration interface is housed in a plastic enclosure (see Figure 62). It has three cables exiting from the enclosure: a USB cable that attaches to a PC, an M8 (round 4-pin connector) female cable that attaches to the RMU3-B/RMU3X-B base unit or MUX3 antenna port, and an M8 male cable that attaches to the RMU3-G/S antenna unit. All cables are field replaceable.

   The interface is powered from the PC USB port, so an external power supply in not required.

   The configuration interface has a strong magnet located on the bottom of the case (see Figure 63) that allows the configuration interface to be temporarily attached to a ferrous surface. The magnet is covered by a non-marring label to prevent damage to the surface to which it is being attached.

   Two LED indicators on the side of the configuration interface show the current state of the device. The green PWR LED lights up when power is being delivered to the RMU3 device that is being programmed. The red DATA LED flashes when information is transferred over the USB connection to the PC.

2. USB A to USB mini-B cable (W160DJ06USB) (Optional for RMU3X-B, not used with RMU3-B)

   With an RMU3X-B base, it is possible to program the RMU3 without the RMU3 Configuration Interface. Instead, a standard USB A to USB mini-B cable may be attached between the PC and the USB port on the RMU3X-B. The RMU3X-B base acts as the programming interface in this case. When programming the RMU3, power must be supplied to the PWRIN terminals on the RMU3X-B. If the USB A to USB mini-B cable is used, then the RMU3 Configuration Interface must not be connected at the same time.

3. Programming Application and Driver USB Drive Stick

   To use the configuration interface, you will require the USB drive stick that shipped with the configuration interface box. The USB drive contains drivers and an application for the RMU3 configuration interface. If you do not have the USB drive, the contents can be downloaded from the Mobiltex support site. Contact your Mobiltex representative for download instructions.

4. Personal Computer (PC)

   The application software and drivers require that the PC be running Windows XP SP2 or higher for an operating system. The PC must have an available USB port.

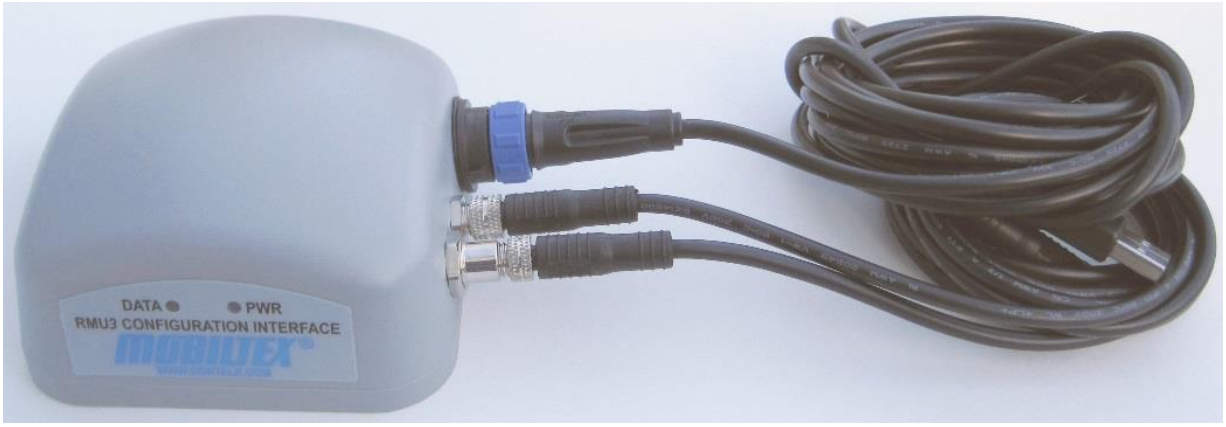



**Figure 62 RMU1/2/3 Configuration Interface**

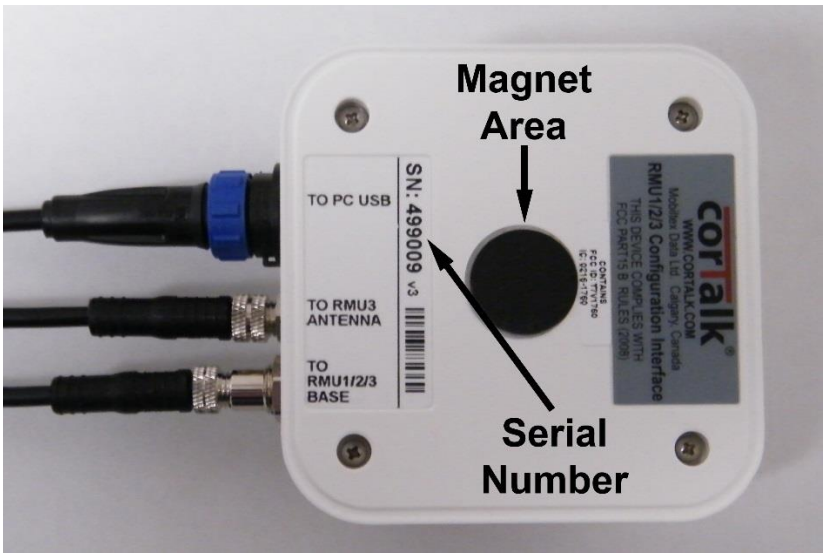



**Figure 63 RMU3 Configuration Interface Bottom View**

## 7.2 Software Installation

To install the configuration application and driver software, insert the USB drive that came with the configuration interface into an available USB port on the PC. If "autorun" is enabled on the PC, the following screen in Figure 64 will appear.

If "autorun" is not enabled, or the contents of the USB drive have been copied to a local directory, use Windows Explorer to navigate to the drive or the directory containing the installation software. Double-click on the "RMUINSTALLER.exe" application. The dialog on Figure 64 will appear.

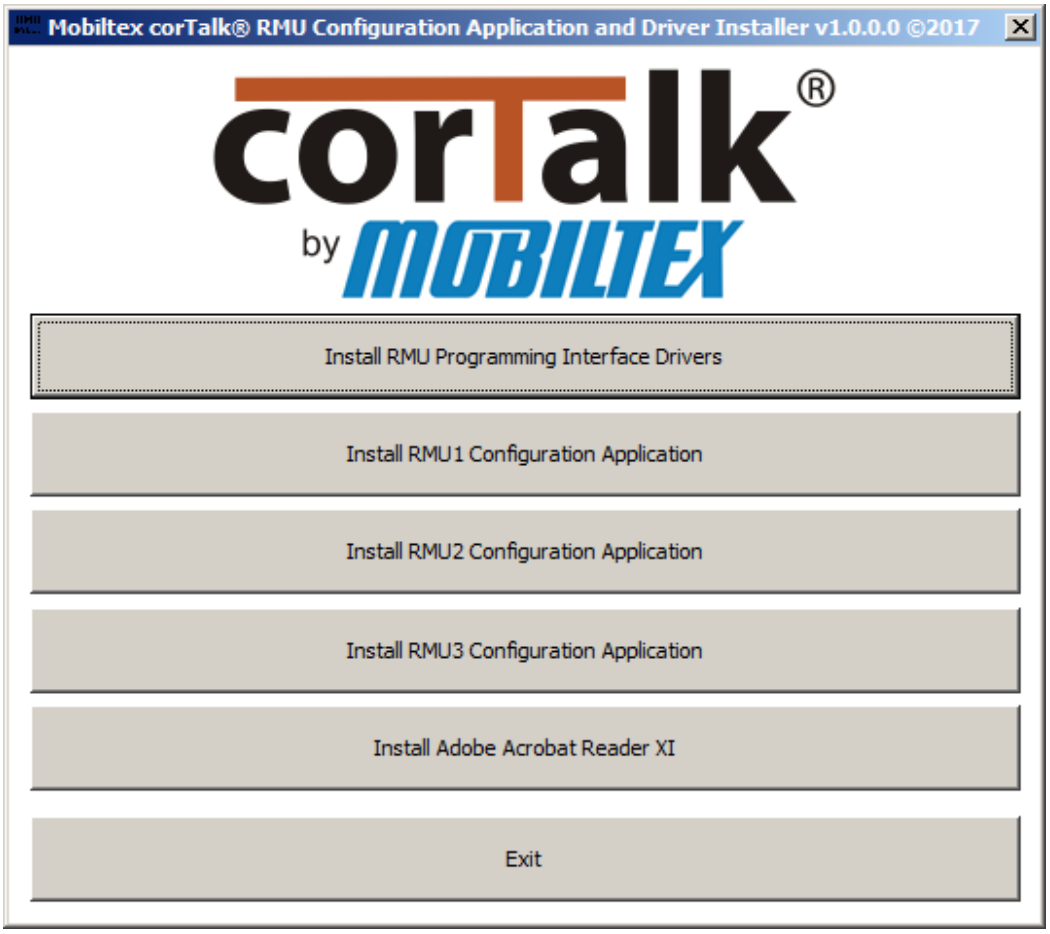



**Figure 64 RMUInstaller Dialog**

### 7.2.1 Configuration Application Installation

Click on the "Install RMU3 Configuration Application" button to start the application installer. The following dialog may appear. Click the "Run" button to continue.

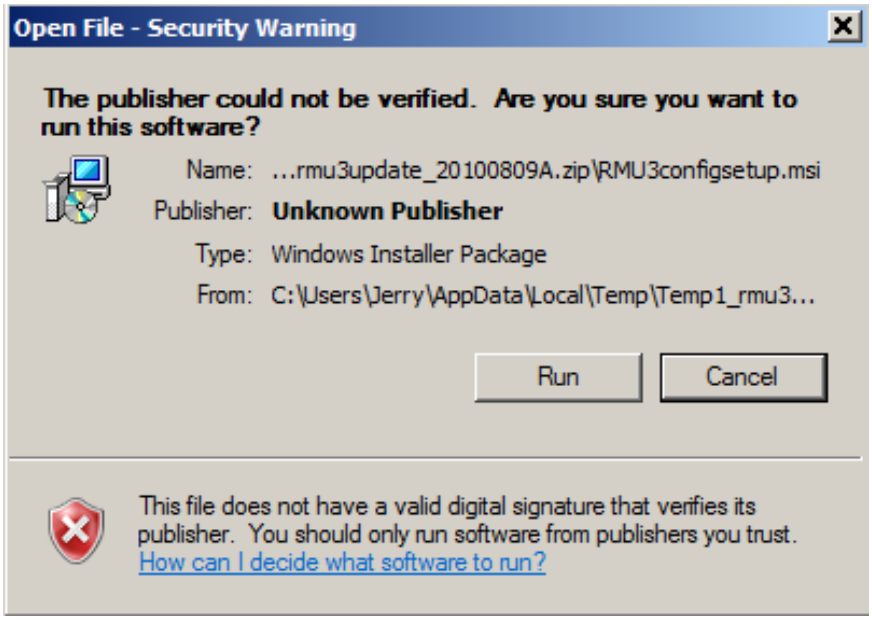



**Figure 65 RMU3ConfigSetup.msi Security Warning Dialog**

The following dialog should now appear:




**Figure 66 RMU3 Configuration Application Installation Dialog**

Follow the instructions presented in the installation screens, clicking "Next" to move to the next screen each time. Some screens may pause for tens of seconds as the Windows installation procedure is processing. The final screen should show the screen in Figure 67. Click "Close" to complete the installation.

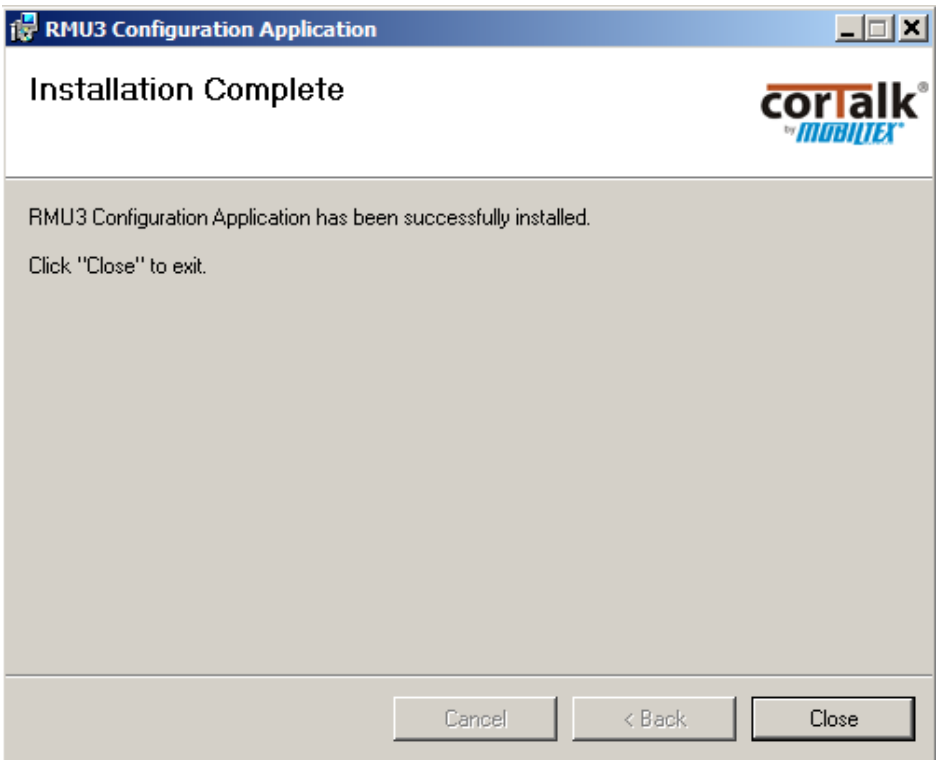



**Figure 67 RMU3 Configuration Application Installation Complete**

A shortcut to the configuration application and the RMU3 manual are created in the Windows start menu under the "RMU3 Configuration Application" folder.

### 7.2.2 Driver Installation

From the RMU3 Installer screen, click the "Install RMU3 Programming Interface Drivers" button. **Note that to install drivers, you must be logged into the PC with an account that has administrative privileges.** The following screen should display. Follow the installation instructions presented by the driver installer application.

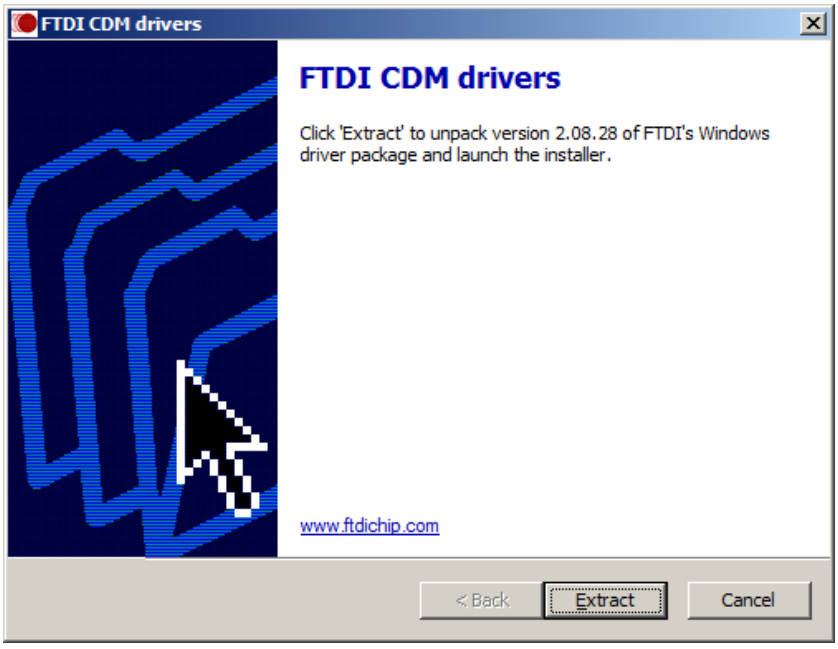



**Figure 68 Driver Installation Screen**

Once the driver installer completes, you may then plug in the RMU3 configuration interface hardware into an available USB port on the PC.

As an alternative method, the drivers may be installed using the Windows "Found New Hardware Wizard" by plugging the RMU3 configuration interface into the PC first. If the "Found New Hardware Wizard" does not appear, it is possible that drivers for the programming interface are already installed. Complete the following steps:




**Figure 69 Driver Installation - Found New Hardware**

From the three choices, select the "No, not this time" radio button and click "Next >".

The following screen will ask you if you would like to install the software automatically or from a specific location.

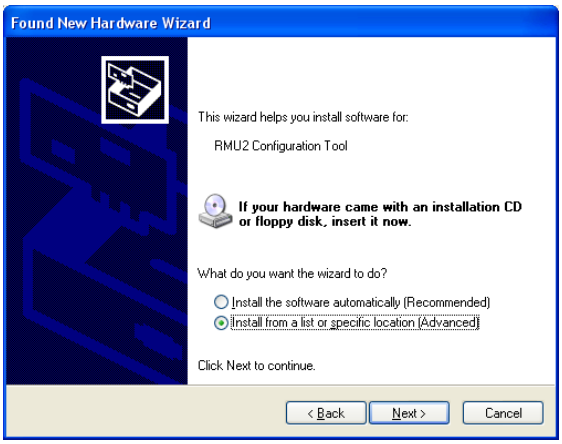



**Figure 70 Driver Installation - Install From Specific Location**

Choose to install from a specific location since you have the installation CD or downloaded files. Click the "Next >" button.

The next window will appear and ask you where to search for the drivers. The default selection is shown in Figure 71.

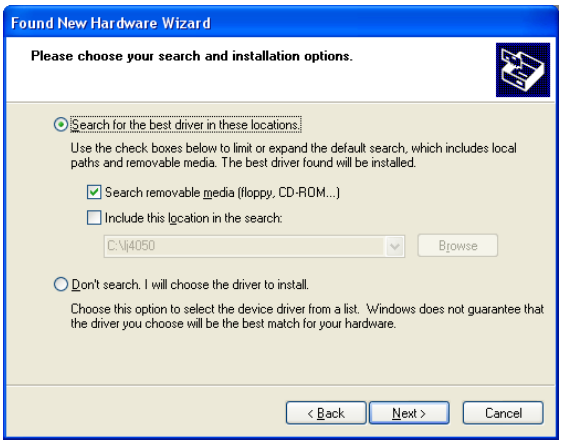



**Figure 71 Driver Installation - Driver Location Selection**

Insert the CD that came with the configuration interface.

If you do not have the installation CD and know where to find the drivers, check off "Include this location in the search:" and browse for the driver on your computer or network. You can uncheck "Search removable media (floppy, CD-ROM…)" to save time in this case.

Once you click "Next" the following screen will appear until the operating system has found the appropriate driver.

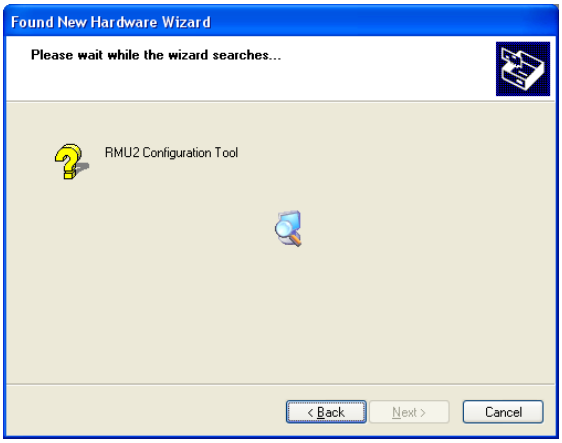



**Figure 72 Driver Installation - Driver File Search**

Once the correct driver has been found, it will install automatically and the completed screen should appear. Simply click the "Finish" button to complete the driver installation.

### 7.2.3 Adobe Acrobat Reader XI

Adobe Acrobat Reader XI is provided on the CD to allow viewing of the PDF version of the RMU3 manual. If Acrobat Reader is already installed on the PC, it is not necessary to re-install it. To install Acrobat Reader, click on the "Install Adobe Acrobat Reader XI" button on the RMU3 Installer dialog, and follow the instructions provided by the Acrobat Reader installation application.

## 7.3 RMU3 Configuration Application

When using an RMU3 Configuration Interface with either the RMU3 or the RMU3XL, attach the supplied USB cable between the PC and the RMU3 configuration interface. **Make sure that the locking ring on the RMU3 configuration interface side is securely tightened, otherwise adequate electrical contact may not be assured.** Next, attach the two M8 connector cables from the configuration interface to the RMU3-B and RMU3-G/S that require programming.

When programming an RMU3XL (RMU3X-B base + RMU3G/S antenna), a USB A to USB mini-B cable may be connected between the PC and the USB port on the RMU3X-B instead of using an RMU3 Configuration Interface. The RMU3X-B can itself act as the programming interface. However, power must be supplied to the RMU3X-B through the PWRIN terminals while the configuration is being performed. The M8 cable between the RMU3X-B and the RMU3G/S must remain connected.

Start the configuration software by clicking on "RMU3 Configuration" shortcut in Windows start menu, under the "RMU3 Configuration Application" folder. The application will automatically connect to the RMU3 set and load the current parameter set. If the programmer is not connected to one of your USB ports, you will get an error message. Simply connect the USB cable to the computer and try again. The following screen will appear.

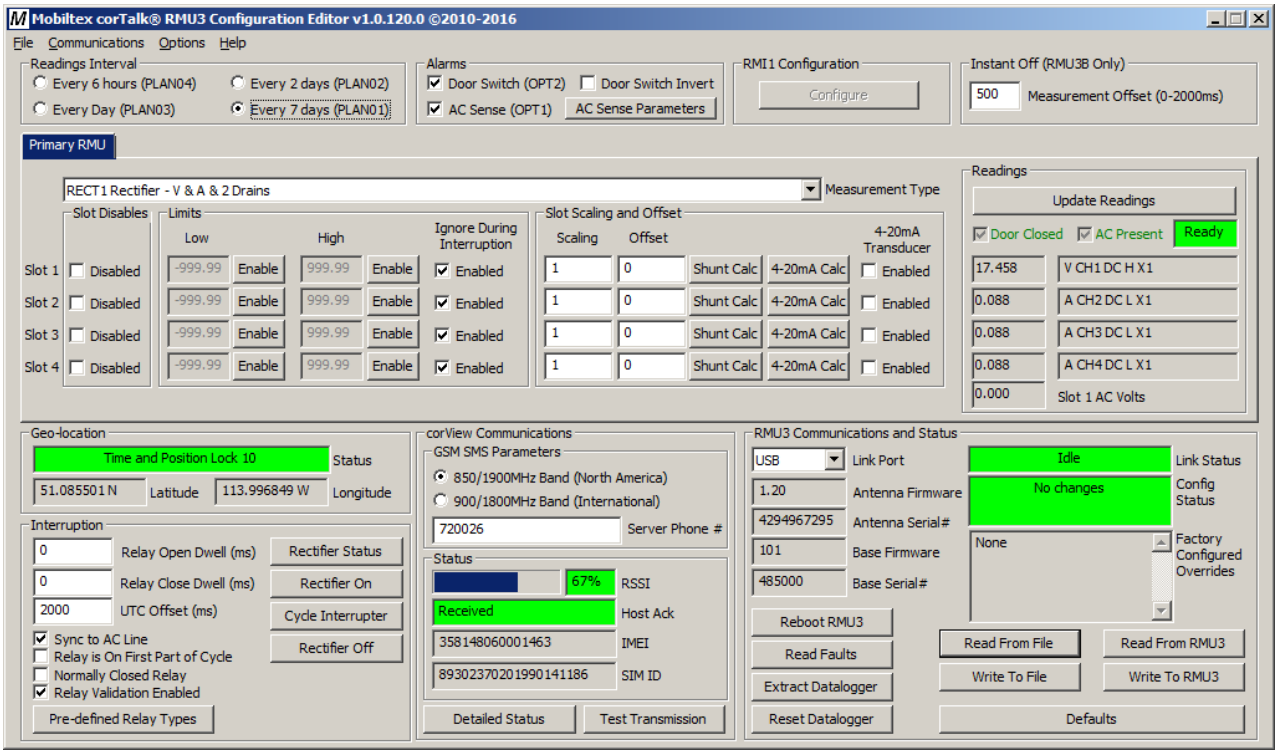



**Figure 73 RMU3 Configuration Application Dialog**

If the configuration software is being used with an RMU3XL unit (RMU3-G/S antenna + RMU3X-B base) or with a MUX3 multiplexer, then set the 'Enable Sub-RMUs' option in the 'Options' menu. Once set, additional tabs will be shown to allow configuration of the additional subRMU channels available on the RMU3X-B base. The following should be shown once the option is enabled; the additional available tabs are highlighted in red:

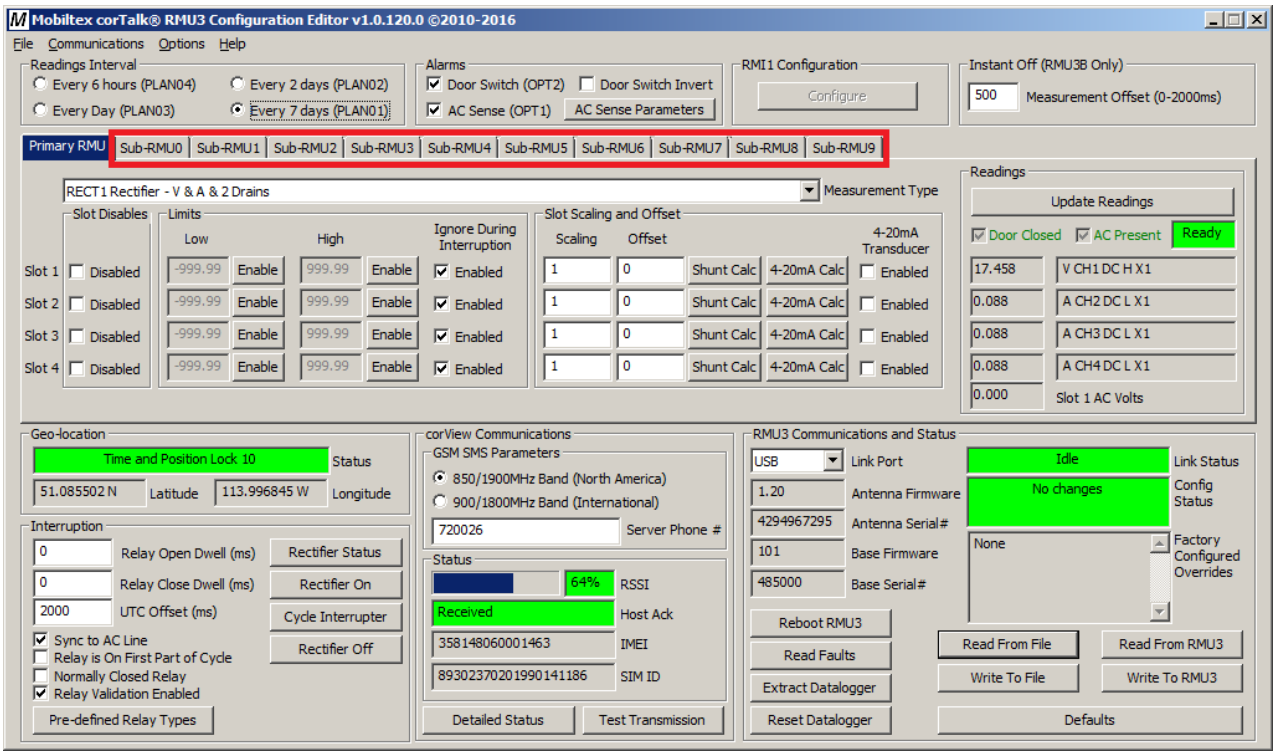



**Figure 74 RMU3 Configuration Application With SubRMUs Enabled**

### 7.3.1 Report Configuration

#### 7.3.1.1 Measurement Type

Based on the measurement type determined during wiring, select the same measurement type from the pull-down field. This will map the physical channels to the data slots that CorView expects. To minimize service transport costs, this mode of communications only transports 5 slots of data readings. To select the data being transported, the slot-to-channel mapping must be selected. Figure 28 shows the various mappings that are applicable to the CorView web site.

Note that a slot and a channel are not the same. "Slot 1" does not have to be equated to the physical "CH1". Slot merely defines which data slot of the over-the-air communications protocol the information will be placed into when being sent to the CorView server. In this way, one physical channel can be used to read both AC and DC volts or AC and DC current.

When an RMU3X-B base or MUX3 multiplexer is used, each of the subRMU channel banks will also have to be configured for their intended measurement type. Select the tab corresponding to each subRMU to allow configuration of each bank.

#### 7.3.1.2 Readings Interval

The Readings Interval grouping allows the periodic report interval to be set. The setting of the reporting plan here must match the airtime plan subscribed to on CorView. This plan is fixed in the RMU3 and can not be changed by the user. The airtime plans currently available are: readings every 6 hours, readings every day, readings every 2 days and readings every 7 days.

#### 7.3.1.3 Alarms

The RMU3 is capable of sending exception reports based on the state of two internal sense points.

The first is a magnetically actuated switch (or external contact set for the RMU3X-B) that is normally used to determine the state of a door on an enclosure surrounding the RMU3. This can be used as a means of tamper detection. If the "Door Switch" alarm check box is enabled, the RMU3 will send a message to the CorView each time the magnetic switch changes states. The door switch magnetic contacts are debounced 10 seconds before a state transition is registered. The RMU3 continuously monitors the state of the door switch contact. The detection state of the door switch may be inverted by checking the 'Door Switch Invert' check box.

The door switch function is factory defined based on the "AirTime Package" that is purchased for the unit. The door switch AirTime Plan must be selected to enable the door switch function. This function is factory defined at time of equipment order.

The second sense point detects the presence of AC line voltage or DC supply voltage (for TEG & solar sites) using the PWR IN input. The PWR IN is normally attached to line power through a transformer. This allows the RMU3 to sense the presence of line power. When the "AC Sense" alarm check box is enabled, an alarm is sent to CorView after a one hour debounce period if the state of AC presence has changed from present to not present. A clear indication is sent after a debounce period of 10 minutes. The debounce periods can be changed by clicking on the 'AC Sense Parameters' button.

The AC Sense function is factory defined based on the "AirTime Package" that is purchased for the unit at time of equipment order.

#### 7.3.1.4 Instant Off (Single RMU3-B Only)

Starting with v1.19 firmware, the RMU3 with the RMU3-B 4-channel base can perform instant-off measurements on the primary DC pipe-to-soil channel for a rectifier measurement type. The RMU3 must be connected to an interruption relay on the rectifier. Instant-off measurements are initiated from the CorView website through the RMU control page.

The RMU3 has one single parameter for this function, the measurement offset delay. This parameter determines how long the RMU will wait after turning off the rectifier before sampling the pipe-to-soil potential. The default value is 500ms, which should give enough time for transients to settle after the relay is turned off. This parameter is adjustable between 0 and 2000ms.

#### 7.3.1.5 Slot Disables

Each data slot may be individually disabled if it is not being used on a particular installation. The RMU3 will communicate a measurement value of zero for any slot that is disabled. Unused slots should be disabled to prevent alarms and transmissions due to stray noise pickup.

### 7.3.1.6 Limits

"Limits" defines what the minimum or maximum reading can be before the RMU3 will send an alarm. These values should be left loose **(~ +/- 50% of actual acceptable operating range)** as the unit will transmit every time an alarm occurs or is cleared. This could result in large transmission costs that could result in higher "AirTime Package" costing. The standard "AirTime Packages" offered by Mobiltex assume a maximum of two alarm and two clear events per RMU per month, averaged over the customer fleet for the Plan Period.

Alarms do not wait until the scheduled transmission but will send immediately upon detection at a 6 hour boundary. Likewise, a slot that was previously in alarm but is now cleared will send a "Cleared" message. In either case, the scheduled reports will not be affected.

Type the desired numeric value (-327.67 to 327.67) into each of the required limits fields. If a limit is not used, pressing the "Disable" button next to the setting will place a value of "-999.99" or "999.99" in the field. To re-enable a limit, click the "Enable" button next to the setting.

Also, associated with each slot limit is an "Ignore During Interruption" check box. When this box is checked, slot limits are not verified for that slot if the RMU3 is currently cycling the interruption relay output. This prevents false limit alarms from being transmitted when a survey operation is under way.

### 7.3.1.7 Slot Scaling and Offset

"Slot Scaling" defines the software multiplication that will be given to the reading. This is used in most cases for current readings taken using a shunt resistor. If a shunt is to read 50mV at 100A, the scaling factor would be 100 / 0.05 = 2000.

A slot scaling calculator is provided for use with current shunts. Next to each slot scaling entry is a button labeled "Shunt Calc". Clicking the button for the slot to be configured brings up the following dialog box:

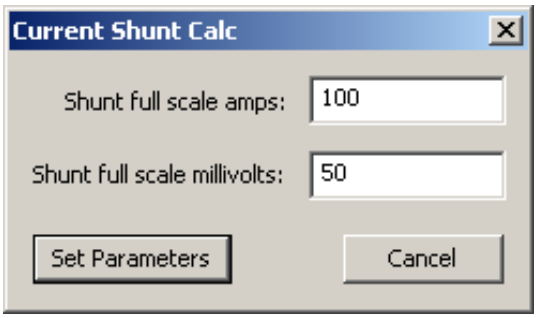



**Figure 75 Current Shunt Calculator Dialog**

Entering the two parameters for the shunt and pressing "Set Parameters" will update the slot scaling value in the RMU3 configuration with the appropriate value for the shunt.

Scaling is also used when an external attenuator is attached between the measurement source and the RMU3 sense terminals. As an example, reading voltages 115VAC RMS or higher requires that an external 3:1 Voltage Divider is used because the RMU cannot tolerate voltages greater than +/-165V (peak). In that example, the slot scaling would be set to a value of 3.

"Slot Offset" is most commonly used when reading 4-20mA transducers. If an external 4-20mA transducer is used with a particular slot, first check the "4-20mA Transducer" enable box for that slot. Next, click the "4-20mA Calc" button for that slot. This will bring up the following dialog box:

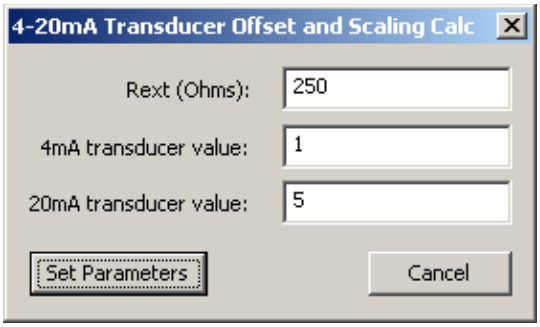



**Figure 76 4-20mA Transducer Calculator**

Note that an external shunt resistor must be placed across the + and – terminals for the physical channel associated with the data slot transporting the 4-20mA transducer data. This resistor is typically a 250 ohm 0.1% tolerance device. The current from the transducer is passed through this shunt resistor. Enter the value of the resistor into the "Rext (Ohms)" field of the calculator. Attachment and current flow direction should be as shown in Figure 77. Ensure that the isolated supply feeding the current loop is capable of producing a 5V drop across the shunt resistor, when the loop is outputting 20mA.

The current flow from the transducer should be as shown in the following picture. When current is flowing from the transducer, if a multimeter is placed across the two channel input terminals, the + terminal should have a higher potential than the – terminal.

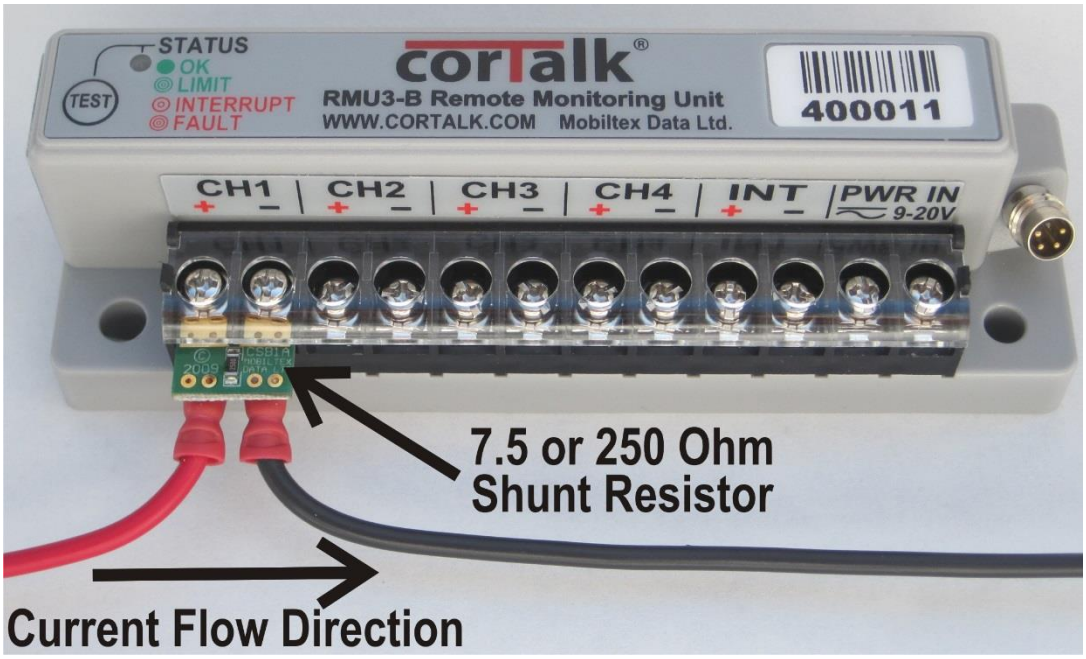



**Figure 77 4-20mA Transducer Shunt Resistor Installation**

There are several types of 4-20mA transducers—some have integral isolated power supplies, and others rely on external isolated power supplies to drive the current loop. The RMU3 will work with any of these types of transducers. Wiring should be installed as instructed by the 4-20mA transducer manufacturer. The following diagram shows a typical transducer installation:

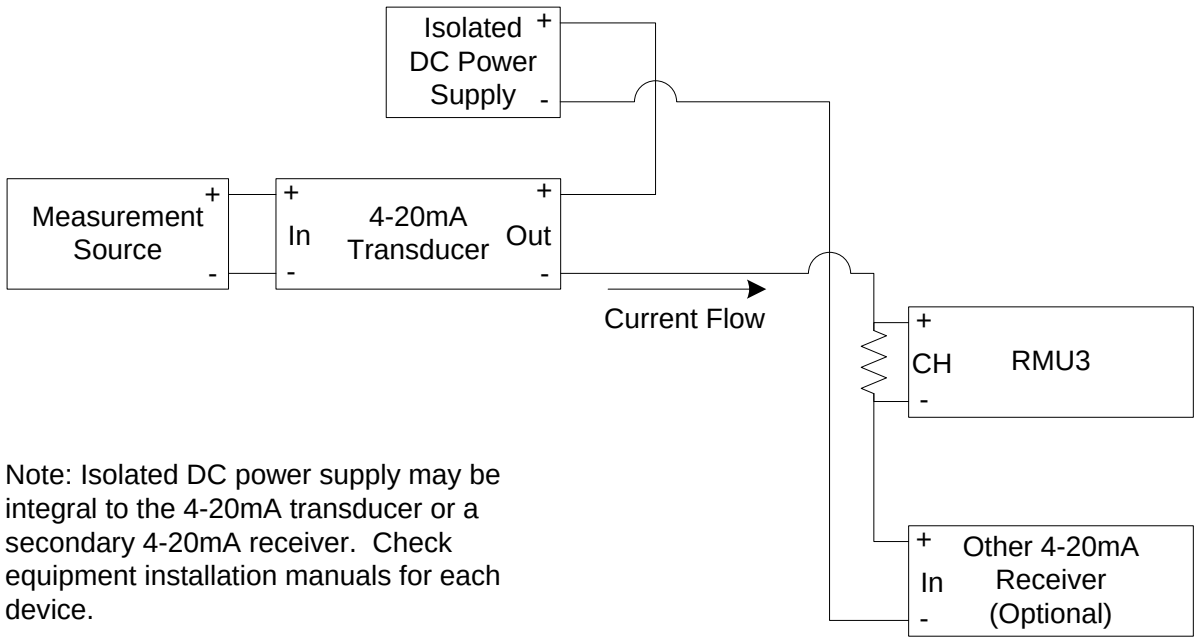



**Figure 78 4-20mA Transducer Typical Installation**

From the transducer specifications, determine the reading value at 4mA loop current, and the reading value at 20mA loop current. Enter these two parameters into the appropriate calculator fields. Press the "Set Parameters" button to set the slot scaling and offset for the affected slot.

After completing the wiring, use the "Update" button in the RMU3CONFIG "Reading" grouping to verify the reading from the 4-20mA transducer.

### 7.3.2 Readings

The grouping labeled "Readings" contains the current readings of the RMU3 device. This grouping is used to validate the RMU3 configuration and connections to the monitored equipment. Note once again that 'slot' does not define the physical channel that is being read. The last column defines what type of reading was taken at what range and from which channel.

Readings are updated by clicking the "Update Readings" button. A reading update may take up to 30 seconds to complete. During that time, a "Busy" indication will be shown in the status area.

**Ensure that any changes to the configuration of the unit have been written to the RMU3 prior to using the values from the reading grouping, otherwise the parameters in the RMU3 will be used to compute these reading values.**

For an RMU3X-B base or MUX3 multiplexer, the readings displayed correspond to the currently selected subRMU tab. To view readings for the different subRMUs, select the associated tab.

### 7.3.3 Interruption

The "Interruption" grouping specifies parameters for the rectifier interruption relay operation. Six parameters define the operation.

The "Relay Open Dwell (ms)" parameter should be matched to the relay being installed. This specifies how long it takes for the relay contacts to open from when the control signal transitions. In the case of a solid state relay, this parameter is usually set to a value of 0. For mechanical relays, this value will usually be in the range of 10 to 50ms. For mercury displacement relays, this value will usually be in the range of 40 to 80ms. Check the relay data sheet for the appropriate value. For use with Mobiltex mercury relay K07111NC12D, set this to 45ms.

The "Relay Close Dwell (ms)" parameter should be matched to the relay being installed. This specifies how long it takes for the relay contacts to close from when the control signal transitions. In the case of a solid state relay, this parameter is usually set to a value of 0. For mechanical relays, this value will usually be in the range of 10 to 50ms.

For mercury displacement relays, this value will usually be in the range of 50 to 80ms. Check the relay data sheet for the appropriate value. For use with Mobiltex mercury relay K07111NC12D, set this to 60ms.

The "UTC Offset (ms)" parameter is used to synchronize the RMU3 operation to match other vendors' equipment. A value of 2000 is default—at this value, the start of an interruption cycle will begin at exactly the top of the minute referenced to UTC time. A value of zero will lead UTC by two seconds. A value of 5000 will lag UTC by 3 seconds. This parameter should be left at the default of 2000 unless there is some specific requirement due to other vendors' equipment being used in the same survey areas.

The "Sync to AC Line" parameter allows the RMU3 to control when the transition of the relay control signal occurs relative to the line AC waveform. To minimize current inrush when a relay is placed on the primary of a rectifier transformer, it is desirable to have this parameter enabled. The relay will be turned on at the peak of the AC waveform, which is the lower AC current point for a reactive load. When used with an AC solid state TRIAC relay, the relay must allow for random turn on (i.e. it must not turn on only at zero crossings).

The "Relay is On First Part of Cycle" parameter defines the order of the interruption cycle. When this option is not checked, the off portion of the interruption cycle will start at the top of the minute. When this option is checked, the on portion of the interruption cycle will start at the top of the minute.

The "Normally Closed Relay" parameter defines the type of relay contacts being used. If this parameter is not checked, then the RMU3 will output 12V to the relay coil to close the contacts and will output 0V to the relay coil to open the contacts. If this parameter is checked, then the RMU3 will output 0V to the relay coil to close the contacts and will output 12V to the relay coil to open the contacts.

The "Relay Validation Enabled" check box enables or disables the relay validation functionality. If enabled, at the start of interruption and the end of interruption, the RMU will take two measurements, one with the relay open and one with the relay closed. If the two measurements are on the appropriate side of the rectifier DC amps low limit, then the RMU3 deems the relay to be functional. The status of the relay validation is sent to CorView for display to users. Relay validation will not occur if a rectifier DC amps low limit is not set.

The button labeled "Pre-defined Relay Types" allows for a quick method of setting the open dwell, close dwell, AC line sync, and normally closed parameters for common relay types. Clicking this button will bring up the dialog in Figure 79. Select the appropriate relay type and click 'OK' to set the parameters for that relay type.

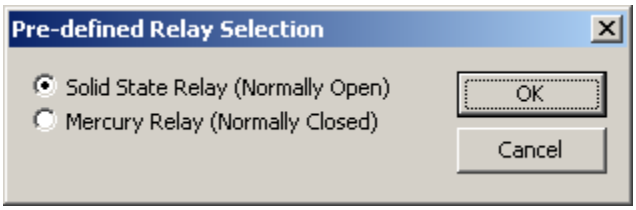



**Figure 79 Pre-defined Relay Type Selection Dialog**

Four buttons are provided to test the operation of the interruption mechanism. Ensure that the parameters have been written to the RMU3 prior to using these buttons.

The "Rectifier Status" button will bring up the current status for the rectifier interruption relay. The following dialog will appear. The status may be on, off, or cycling. When cycling, the timing parameters for the cycle are shown.

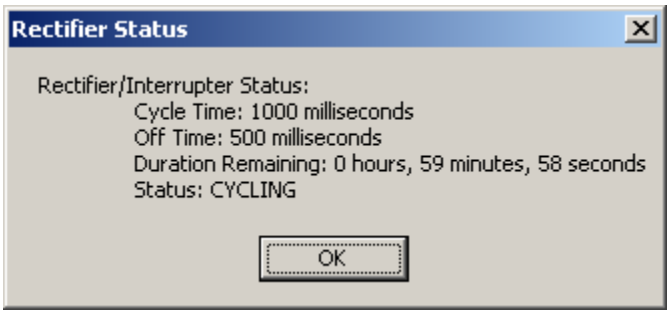



**Figure 80 Interruption Rectifier Status**

The "Rectifier On" button will close the interruption relay contacts, turning on rectifier power to the protected structure.

The "Cycle Interrupter" button will bring up the following dialog. Enter the cycle parameters and press OK. The interruption relay contacts will start opening and closing according to the parameters entered, for the duration entered. The interruption cycle may be terminated earlier by clicking on the "Rectifier On" button.

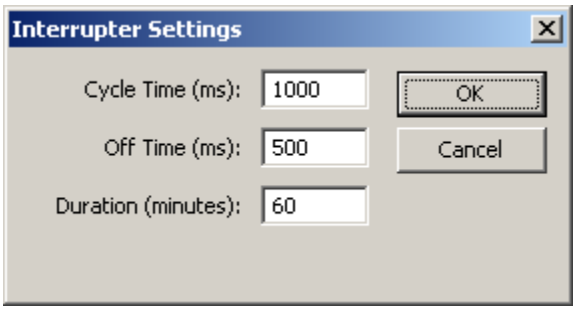



**Figure 81 Interruption Cycle Rectifier**

The "Rectifier Off" button will open the interruption relay contacts, turning off rectifier power to the protected structure.

### 7.3.4 Geo-location

The "Geo-location" grouping provides status on the RMU3 GPS module. The first field indicates the GPS signal lock status. The status box will indicate "Tracking", "Position Lock", or "Time Lock" followed by the number of satellites tracked or in the solution. Interruption operations are only possible when "Time Lock" is indicated.

The two additional boxes indicate the current latitude and longitude location of the RMU3.

### 7.3.5 CorView Communications Parameters

#### 7.3.5.1 GSM SMS Parameters

Only two parameters are necessary for operation using the GSM SMS mode.

The first parameter is the band of operation. For North America, select '850/1900MHz Band'. For most of the rest of the world, select '900/1800MHz Band'. If un-sure of the required setting, contact Mobiltex for assistance.

The second parameter is the phone number or SMS short code of the server. For use with Mobiltex provided Kore M2MSecureLink SIM cards, this field should be set to a value of '0305'. For Kore USA SIMs set a value of '20020431'. For Kore Canada SIMs set a value of '720026'. For m2mair Canada and m2mair Gold SIMs, set to a value of '87194704'. For use with other providers' SIM cards, please contact Mobiltex for additional information.

#### 7.3.5.2 Status

The status grouping shows four pieces of information in real time. These are received signal strength indication (RSSI), host acknowledgement state, IMEI and SIM ID.

The RSSI is displayed as both a bar graph and percentage value. Ideally, the RSSI should be higher than 20%.

The host acknowledgment state indicates whether or not an acknowledgement message has been received from the CorView host. When this field displays "Received", then bi-directional communications with CorView has been verified. If this field displays "Not Received" after 5 minutes, check the RSSI value, and check the "Detailed Status" information dialog for additional information.

The IMEI and SIM ID fields are used to identify the electronic serial numbers of the GSM radio and the subscriber identity module (SIM) installed in the RMU3.

#### 7.3.5.3 Detailed Status

The "Detailed Status" button can be used to determine the status of the connection to the cellular provider. Other detailed information on the RMU3 operation is also presented. Click this button to bring up the following dialog.

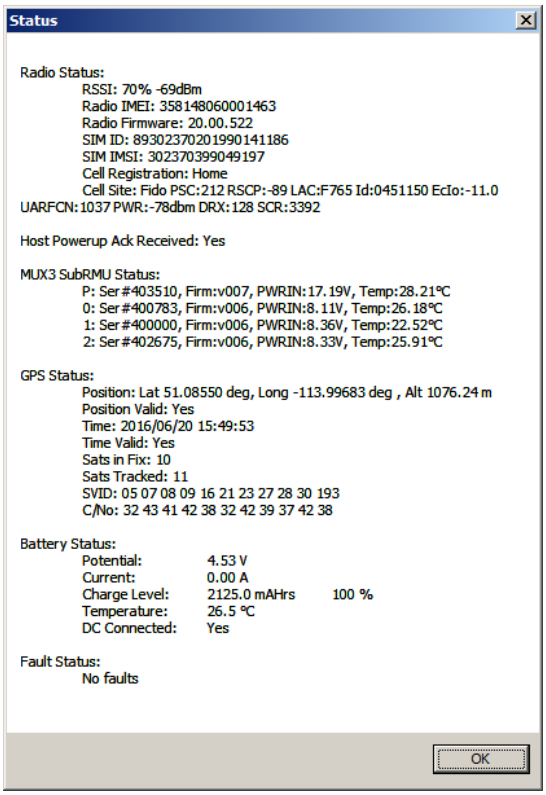



**Figure 82 GSM SMS Detailed Status**

If issues with communications are noted, the information in this dialog should be sent to Mobiltex for analysis.

After power-up, it may take up to 2 minutes for the cellular transceiver to lock onto the service provider. In the status screen, the 'Cell Registration' field should indicate 'Home' or 'Roaming. The "Signal Strength" field should also show a value greater than 30 for optimal communications.

The "Host Powerup Ack Received" field will show "Yes" if the power-up message from the RMU3 to CorView has been acknowledged from CorView. This may take up to 5 minutes after power-up to indicate "Yes". If after 5 minutes, this does not indicate "Yes", check CorView to see if the power up message was received. The RMU3-G/S transceiver antenna may have to be re-oriented if communications is marginal.

#### 7.3.5.4 Test Transmission

The "Test Transmission" button allows a test message to be sent to the CorView system. The RMU3 will automatically send a message to CorView at power-up. This test transmission should only be used if there are communications issues suspected some time (i.e. days) after installation has occurred.

### 7.3.6 RMU3 Communications and Status

The "RMU3 Communications and Status" grouping provides status information about the currently attached RMU3, and allows reading and writing of the RMU3 parameter set.

The "Link Port" pulldown allows the USB connection to the RMU3 to be disconnected or re-connected. Set to "Disabled" to disconnect, and "USB" to re-connect.

The "Link Status" field indicates the current operation that is occurring between the configuration application and the RMU3.

The "Antenna Firmware" field indicates the firmware version of the currently connected RMU3-G/S.

The "Antenna Serial#" field indicates the electronic serial number of the currently connected RMU3-G/S.

The "Base Firmware" field indicates the firmware version of the currently connected RMU3-B (or MUX3).

The "Base Serial#" field indicates the electronic serial number of the currently connected RMU3-B (or MUX3).

The "Config Status" field shows whether any parameters have been edited. It is green when the configuration in the application matches that of the RMU3. If any of the parameters are edited, it will turn red, indicating that the modified configuration should be written to the RMU3 for those changes to take effect.

The "Read Faults" button allows fault information to be retrieved from the RMU3. If the LED on the RMU3 is blinking red, and the RMU3 is not in an interruption mode, a fault flag is set. Use this button to retrieve the specific fault detected.

The "Defaults" button sets the parameter set in the configuration application to factory defaults. After using this button, it is still necessary to write the parameter set to the RMU3 to have it become active.

The "Write To File" and "Read From File" buttons allow configurations to be stored on disk or retrieved from disk. Configuration files may be saved as templates for use on multiple RMU3 devices with identical requirements.

The "Extract Datalogger" button will retrieve the stored readings information from the RMU3 and write the data to a CSV file. This function only works with RMU3 devices that have the datalogger option installed. Readings are stored at power-up, periodically every 6 hours, and for all exception transmissions.

The "Reset Datalogger" button will clear the RMU3 datalogger memory. This function only works with RMU3 devices that have the datalogger option installed.

The "Write to RMU3" and "Read From RMU3" buttons allow configurations to be saved or read from the RMU3. Upon initial connection to the RMU3, an automatic read of parameters will occur. After making any edits to the parameter set in the configuration application, the "Write to RMU3" button must be pressed to make the changes active on the RMU3 device. After a write to the RMU3, the RMU3 application will re-start.

## 7.4 Post Configuration

When using an RMU3 configuration interface, after configuring the necessary RMU3 parameters, disconnect the configuration interface from the two RMU3 components. Re-connect the M8 cable between RMU3-B/RMU3X-B and the RMU3-G/S or the cable between the MUX3 and the RMU3-G/S. If using a direct USB connection with an RMU3X-B, disconnect the USB cable between the PC and the RMU3X-B. Log on to the CorView web site and validate the data received from the RMU3 installation.

# 8 Mobile Device Configuration

The RMU3 may also be programmed with a compatible iOS or Android-based mobile device when an RBT1 Bluetooth Interface cable or RMU1/2/3 Programming Interface is used. The RBT1 cable (shown in Figure 83) uses Bluetooth Smart (BLE) to enable a wireless connection to a compatible mobile device.




**Figure 83 RBT1 Bluetooth Interface Cable**

An RMU1/2/3 Programming Interface (Kit A20A0333101) is shown in Figure 84.




Figure 84 RMU1/2/3 Programming Interface

The mobile device must have the RMU3 Config mobile app loaded from either the Apple App store or the Google Play store, as applicable.

Direct links:
https://itunes.apple.com/th/app/rmu3-config/id1089017766 (Apple iOS)
https://play.google.com/store/apps/details?id=com.mobiltex.rmu3config (Android)

The iOS app is compatible with any Apple device that has Bluetooth Smart (BLE) capabilities—for the iPhone, model 4S or higher. A list of compatible devices is on the App Store.

The Android app is compatible with any Android device that has Bluetooth Smart (BLE) capabilities and is running Android 4.4.2 or higher. Refer to your device specifications to determine Bluetooth capabilities.

With the RBT1 or RMU1/2/3 programming interface and the app, the need for a PC is eliminated. All configuration functions can be performed with the iPhone/iPad through the programming interface via a wireless Bluetooth connection. One limitation with the app is that the datalogger on the RMU3 cannot be extracted; this is due to a bandwidth limitation over the Bluetooth Smart connection.

The RMU1/2/3 programming interface is connected in the same manner as when it is used with a PC, except that the USB cable is unused. The RBT1 cable looks like a standard M8 interconnect cable that is used to connect the RMU3G/S antenna to the RMU3-B base or MUX3 antenna port. The cable is waterproof and can be left permanently attached between the antenna and the base if there is a need to connect to the RMU3 in the field without the need to

open the rectifier cabinet. For transient applications, the existing M8 cable can be disconnected from the base (or MUX3 antenna port) and the RBT1 temporarily connected between the base (or MUX3 antenna port) and existing M8 cable.

Once the cable is attached between the base and the antenna and the base supplied with power, the app on the mobile device is started. A connect button in the app initiates the process to connect with the RBT1. A list of active RBT1 cables or RMU1/2/3 programming interfaces in the area is brought up; each RBT1 or RMU1/2/3 programming interface has a serial number cable on it to identify the unit. Once the unit is selected, if it is the first connection attempt between the portable device and that programming interface, a pop-up will show up requesting a pairing code. The default pairing code is '123456' (this can be changed).

After the connection is established, capabilities are similar to the PC application, the configuration can be read, modified and written and status information can be polled. Figure 85 shows some sample screenshots from the iOS app; the Android app is similar in appearance.

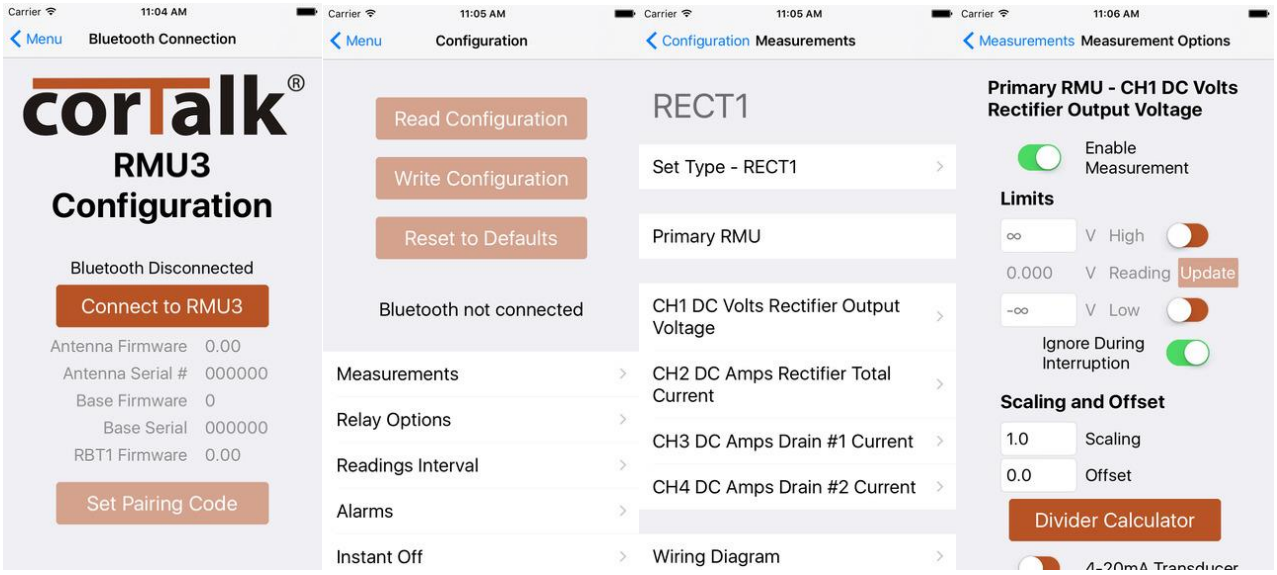



**Figure 85 iOS App Sample Screenshots**

# 9 Servicing

The RMU3 contains no user serviceable components. In case of failure, return the complete unit to Mobiltex for servicing.

The internal sealed-lead acid backup battery should only be replaced by Mobiltex.

No cleaning is required.

The most current manual, firmware, and configuration applications can also be downloaded from the following URL:

http://www.mobiltex.com/cathodic/rmu3

Technical assistance may be obtained from:

Attn: Service & Support
Mobiltex Data Ltd.
3640-26th Street NE
Calgary, AB T1Y 4T7
Canada
Tel: (403)291-2770
Web: http://www.CorTalk.com
Email: service1@mobiltex.com

# A. Equipment Specifications

RMU3-B (4 Analog Input Channels Base Unit)

Environmental:

| | |
|---|---|
| Operating Temperature: | -40° to +70° C (-40° to +158° F) |
| Storage Temperature: | -45° to +80° C (-49° to +176° F) |
| Humidity: | 0 to 100% RH non-condensing |
| Pollution Degree: | 1 |
| Maximum Altitude: | 5000 meters above sea level |

Physical:

| | |
|---|---|
| Size: | 135mm x 38mm x 38mm (5.3" x 1.5" x 1.5") |
| Weight: | 200 grams (7 oz) |
| Enclosure: | UV stable, wide temperature polycarbonate |
| Mounting | Mounted inside a rectifier |

Power:

| | |
|---|---|
| PWR IN Operating voltage range: | 9 to 18 volts AC (50/60Hz) or 9 to 22 volts DC |
| Power (less relay drive): | 5 VA maximum (Including RMU3-G/S) |
| Power (with relay drive): | 25 VA maximum (Including RMU3-G/S) |
| Power Source: | LPS or Class 2 CSA/UL approved (CSA 60950-1 or UL 60650-1) |

Measurement Inputs:

| | |
|---|---|
| Analog Measurement Type: | Category 2 (as per CSA C22.2 – 61010) |
| Analog Ranges (DC & AC): | +/- 150mVDC only<br>+/- 22VDC, 16V true RMS, +/-22Vpeak<br>+/-150VDC(+/- 119VDC for TEG sources), 105V true RMS, +/-150Vpeak<br>4-20mA (with external precision shunt resistor) |
| AC Rejection on DC Readings: | >65dB @ 50/60Hz |
| External Analog Channels : | 4 galvanically isolated, high impedance |
| Lightning Immunity: | Survives multiple 20KV 10mS surges |
| DC Measurement Accuracy: | +/- 0.5% of full-scale |
| AC Measurement Accuracy: | +/- 1.0% of full-scale |
| ADC Resolution: | 16 bits |
| Temp. Measurement Accuracy: | +/-4° C (+/-7° F) |
| Door / Tamper Switch: | Activated by external magnet (included with device kit) |

Interruption Output:

| | |
|---|---|
| Relay drive voltage: | 12 volts DC (Pwr In – 1VDC) |
| Relay drive current: | 0.75 Amps maximum |
| Relay contact close dwell: | 0-100 ms |
| Relay contact open dwell: | 0-100 ms |
| Relay contact type: | NO or NC |
| Relay type: | Solid state or mechanical |

## RMU3X-B (44 Analog Input Channels Base Unit)

Environmental:

| | |
|---|---|
| Operating Temperature: | -40° to +70° C (-40° to +158° F) |
| Storage Temperature: | -45° to +80° C (-49° to +176° F) |
| Humidity: | 0 to 100% RH non-condensing |
| Pollution Degree: | 1 |
| Maximum Altitude: | 5000 meters above sea level |

Physical:

| | |
|---|---|
| Size: | 314.9mm x 230mm x 47.6mm (12.4” x 9.06” x 1.87”) |
| Weight: | 1280 grams (45.2 ozs) |
| Enclosure: | UV stable, wide temperature polycarbonate |
| Mounting | Must be mounted inside a weather proof enclosure (NEMA4/IP66) |

Power:

| | |
|---|---|
| PWR IN Operating voltage range: | 9 to 18 volts AC (50/60Hz) or 9 to 22 volts DC |
| Power (less relay drive): | 7 VA maximum (Including RMU3-G/S) |
| Power (with relay drive): | 35 VA maximum (Including RMU3-G/S) |
| Power Source: | LPS or Class 2 CSA/UL approved (CSA 60950-1 or UL 60650-1) |

Measurement Inputs:

| | |
|---|---|
| Analog Measurement Type: | Category 2 (as per CSA C22.2 – 61010) |
| Analog Ranges (DC & AC): | +/- 150mVDC only<br>+/- 22VDC, 16V true RMS<br>+/-150VDC, 105V true RMS (+/- 119VDC for TEG sources)<br>4-20mA (with external precision shunt resistor) |
| AC Rejection on DC Readings: | >65dB @ 50/60Hz |
| External Analog Channels : | 44 galvanically isolated, high impedance |
| Lightning Immunity: | Survives multiple 20KV 10mS surges |
| DC Measurement Accuracy: | +/- 0.5% of full-scale |
| AC Measurement Accuracy: | +/- 1.0% of full-scale |
| ADC Resolution: | 16 bits |
| Temp. Measurement Accuracy: | +/-4° C (+/-7° F) |
| Door / Tamper Switch: | Activated by external contact set |

Interruption Output:

| | |
|---|---|
| Relay drive voltage: | 12 volts DC (Pwr In – 1VDC) |
| Relay drive current: | 0.75 Amps maximum |
| Relay contact close dwell: | 0-100 ms |
| Relay contact open dwell: | 0-100 ms |
| Relay contact type: | NO or NC |
| Relay type: | Solid state or mechanical |

## MUX3 (4 Base Multiplexer Unit)

Environmental:

| | |
|---|---|
| Operating Temperature: | -40° to +70° C (-40° to +158° F) |
| Storage Temperature: | -45° to +80° C (-49° to +176° F) |
| Humidity: | 0 to 100% RH non-condensing |
| Pollution Degree: | 1 |
| Maximum Altitude: | 5000 meters above sea level |

Physical:

| | |
|---|---|
| Size: | 94mm x 59mm x 48mm (3.7” x 2.32” x 1.89”) |
| Weight: | 130 grams (4.6 ozs) |
| Enclosure: | Watertight, UV stable, wide temperature polycarbonate |
| Mounting | Type 3 Enclosure - Suitable for outdoor use |

Power:

| | |
|---|---|
| Operating voltage range: | 8.5VDC nominal, supplied from RMU3-B |
| Power: | 0.225W maximum (internal consumption only, antenna port feed extra) |
| Antenna Feed: | Pass-through from summed RMU3-B ports |

## RMU3-G GPS & GSM Cellular (Antenna Unit)

Environmental:

| | |
|---|---|
| Operating Temperature: | -40° to +70° C (-40° to +158° F) |
| Storage Temperature: | -45° to +80° C (-49° to +176° F) |
| Humidity | 0 to 100% RH non-condensing |
| Pollution Degree | 2 |
| Mounting | Type 3 Enclosure - Suitable for outdoor use |

Power:

| | |
|---|---|
| Operating voltage range: | 8.5VDC nominal, supplied from RMU3-B |
| Power: | 4W maximum |

Physical:

| | |
|---|---|
| Size | 53mm x 77mm x 134mm (2.1" x 3.0" x 5.3") |
| Weight | 550 grams (1.2lb) |
| Enclosure | Watertight, UV stable, wide temperature polycarbonate |
| Backup Battery: | Internal 4V/2.8AHr extended temperature sealed lead acid |

Communications:

| | |
|---|---|
| Radio: | Quad-band GSM Cellular (850/900/1800/1900MHz) (2G Model) |
| | Quad-band GSM Cellular (850/900/1800/1900MHz) and Tri-band UMTS+ Cellular (850/1700/1900) (4G Model) |
| | Dual-band UMTS+ (850/1900MHz) and Penta-band LTE (850/1900/B4/B12/B13)(LTE Model) |

Interruption Timing:

| | |
|---|---|
| GPS Receiver: | Internal 20 channel (2G Model)<br>Internal 56 channel (4G Model)<br>Internal 72 channel (LTE Model) |
| GPS Antenna: | Internal patch |
| Timing accuracy: | +/-0.5 ms (AC line sync disabled)<br>+8.8/-0.5 ms (AC line sync enabled) |
| Off Time: | 100 – 60,000ms in 1ms steps |
| Cycle Time: | 200 – 60,000ms in 1ms steps |

Processing Core:

| | |
|---|---|
| CPU: | 72MHz ARM Cortex-M3 Core |
| Memory: | 1MB Flash, 64KB RAM, 8KB EEPROM |

RMU3-S GPS & Satellite (Antenna Unit)

Environmental:

| | |
|---|---|
| Operating Temperature: | -40° to +70° C (-40° to +158° F) |
| Storage Temperature: | -45° to +80° C (-49° to +176° F) |
| Humidity | 0 to 100% RH non-condensing |
| Pollution Degree | 2 |
| Mounting | Type 3 Enclosure - Suitable for outdoor use |

Power:

| | |
|---|---|
| Operating voltage range: | 8.5VDC nominal, supplied from RMU3-B |
| Power: | 4W maximum |

Physical:

| | |
|---|---|
| Size | 53mm x 77mm x 134mm (2.1” x 3.0” x 5.3”) |
| Weight | 550 grams (1.2lb) |
| Enclosure | Watertight, UV stable, wide temperature polycarbonate |
| Backup Battery: | Internal 4V/2.8AHr extended temperature sealed lead acid |

Communications:

| | |
|---|---|
| Radio: | Iridium SBD satellite |

Interruption Timing:

| | |
|---|---|
| GPS Receiver: | Internal 20 channel |
| GPS Antenna: | Internal patch |
| Timing accuracy: | +/-0.5 ms (AC line sync disabled)<br>+8.8/-0.5 ms (AC line sync enabled) |
| Off Time: | 100 – 60,000ms in 1ms steps |
| Cycle Time: | 200 – 60,000ms in 1ms steps |

Processing Core:

| | |
|---|---|
| CPU: | 72MHz ARM Cortex-M3 Core |
| Memory: | 1MB Flash, 64KB RAM, 8KB EEPROM |

PERMANENTLY CONNECTED EQUIPMENT requires special considerations to satisfy the CEC and the Canadian deviations in the standard, including overcurrent and fault protection as required.