

RMU1

Installation and Configuration Guide

RMU1-MAN-001, 2.09

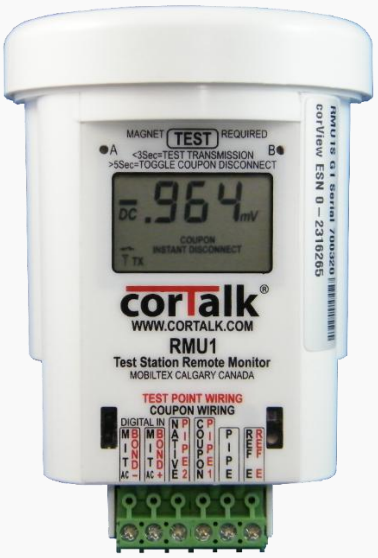
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MOBILTEX® DATA LTD.
Calgary, Alberta

www.mobiltex.com

RMU1



RMU1S/RMU1G



RMU1I



RMU1-LITE

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CURRENT REVISION APPROVALS (Revision 2.09)

NAME	LOCATION	JOB FUNCTION	SIGNATURE	DATE
Tony da Costa	Calgary	VP of Engineering		

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REV	START DATE	APPROVAL DATE	DESCRIPTION	PREPARED BY
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1 Introduction

The RMU1 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 RMU1 is a low cost, high reliability device intended for test stations to monitor coupons and bonds. The device is available in two satellite (RMU1S and RMU1I) and

one cellular (RMU1G) communication configurations. The field hardware consists of a single component that is usually mounted inside a plastic test station. The device operates for 10+ years from internal, low cost, field replaceable batteries. This self-powered solution can be used to monitor coupons and bonds without the requirement for nearby line or solar power sources. The RMU1 has integral high-energy surge suppression and provides unprecedented lightning immunity because there are no connections to electrical ground.

The RMU1 monitors and transmits eight channels of information. An integral IR proximity sensor can be used as a cap open sensor or tamper detection alarm. The RMU1 measures temperature and internal battery voltage. A user accessible magnetic switch allows the transmission of uniquely identified messages that can be used to record site visit information.

The INT1 is an accessory to the RMU1 Generation 4 (RMU1 G4) that allows for the interruption and monitoring of bonds and anode beds. It connects to the RMU1 via a short cable and fits within the 3” riser pipe with the RMU1. Like the RMU1, it uses field replaceable batteries and has excellent lightning immunity. Its major benefit is the capability to interrupt up to 7A with GPS synchronization through commands from our CorView servers to the RMU1. The RMU1 can also interrupt coupons in tandem with the INT1 if desired. Interruption does cause a significant drain on battery life and so if used, the user can expect to only get 5 years of life from the units before having to replace the batteries (assuming 2 weeks of interruption a year).

The RMU1-LITE is a cost-effective version of the RMU1 for use in monitoring test point potentials. It uses the same form factor with a few notable differences. There is no LCD display, many of the full RMU1 options are not available for the LITE, and only 14 or 30 day reporting is available along with the usual reporting of exceptions. Most significantly, the RMU1-LITE has only one measurement type. This measurement type has the unique capability of detecting the presence of interruption and providing a structure potential reading synchronized with the OFF cycle. The measurement type with interruption detection and synchronous potential readings is also supported in the latest firmware revision of standard RMU1 (G2 or higher) units. Since the RMU1-LITE does not have an LCD, any discussions related to the LCD do not apply to LITE devices.

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. With the proper credentials, CorView can be accessed using a web browser like Google Chrome or Internet Explorer. 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 RMU1 Communications Block Diagram

1.1 RMU1 Generation 4

The RMU1 Generation 4 (RMU1 G4) is the latest generation of the RMU1. The RMU1 G4 maintains all the same features and capabilities as the earlier generations of RMU1 and is backward compatible in all respects. i.e. an RMU1 G4 can be used as a drop-in replacement for an earlier generation RMU1. The RMU1 G4 includes a GPS time synchronized interruption feature. The RMU1 G4 can be used for coupon interruption and further interruption capabilities can be achieved with the addition of the INT1 accessory which can perform synchronized interruption of bonds and anode beds. The RMU1 G4 acts as a controller to the INT1 device. Communications between the two devices is achieved with a low power RS232 link. The communications connector located on the lower left in the figure below provides one end of the RS232 link. The presence of this connector differentiates RMU1 G4 units from older generation units.



Figure 2 RMU1 G4



Figure 3 RMU1 G4 with INT1

1.2 RMU1-LITE

The RMU1-LITE is a cost-effective version of the RMU1 for use in monitoring test point potentials. The unit has the capability of measuring AC and DC potentials for a single structure against two separate reference cells. This allows for validation of reference cell operation.

Also, the RMU1-LITE has the unique capability of detecting the presence of interruption and providing structure potential readings synchronized with the ON/OFF phases of the interruption cycle. Presence of interruption is detected at periodic 6 hour intervals. Upon detection or termination of interruption, the unit sends an exception message to CorView.

Only cellular (RMU1G-LITE) and Globalstar satellite (RMU1S-LITE) communications modes are available. Also, the unit does not support LCD display, cap detect, digital input, coupon measurement, or bond measurement functionality that is present in the normal RMU1.



Figure 4 RMU1-LITE in Standard Test Station

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 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

These terms may appear in this **manual**:

TERM	MEANING
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.

These terms may appear on the **product**:

TERM	MEANING
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.

The following symbols may appear on the **product**:

SYMBOL	MEANING
	CAUTION Refer to Manual
	Protective Ground (Earth) Terminal
	Functional Ground Terminal
	AC or DC Input

3 Kit Contents

3.1 RMU1S (Globalstar Simplex Satellite) Unit and Kits

PICTURE	DESCRIPTION
	RMU1S remote monitoring unit • Can only send messages to CorView, does not receive them (Simplex) • 1 pc – ½" #6-32 screw comes pre-attached to a mating nut in the RMU1 unit • Typically installed inside a test station
	RMU1S Kit (pre-installed unit) with Standard Test Station • Available with 8 standard bolts or 8 Banna jack, no wiring kit. • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1S Kit (pre-installed unit) with Flex PCB Test Station. Available with: • 8 standard bolts • 8 standard bolts with AC Coupon Adapter • 8 banana jack • 8 banana jack with AC Coupon Adapter • Optional Test Station standard cap (see RMU1 Optional Installation Items)

	RMU1S in Lockable NEMA4 Enclosure

Table 1 RMU1S Kit Contents

3.2 RMU1I (Iridium SBD Satellite) Unit and Kits

PICTURE	DESCRIPTION
	RMU1I remote monitoring unit • 1 pc – ½" #6-32 screw comes pre-attached to a mating nut in the RMU1 unit • Typically installed inside a test station.
	RMU1I Kit (pre-installed unit) with Standard Test Station • Available with 8 standard bolts or 8 Banna jack, no wiring kit. • Optional Test Station standard cap Mobiltex (see RMU1 Optional Installation Items)
	RMU1I Kit (pre-installed unit) with Flex PCB Test Station • 8 standard bolts • 8 standard bolts with AC Coupon Adapter • 8 banana jack • 8 banana jack with AC Coupon Adapter • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1I in Lockable NEMA4 Enclosure pre-installed no wiring kit)

Table 2 RMU1I Kit Contents

3.3 RMU1G (LTE Cellular) Unit and Kits

PICTURE	DESCRIPTION
	RMU1G remote monitoring unit • 1 pc – ½" #6-32 screw comes pre-attached to a mating nut in the RMU1 unit • Typically installed inside a test station
	RMU1G Kit (pre-installed unit) with Standard Test Station • Available with 8 standard bolts or 8 Banna jack, no wiring kit. • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1G Kit (pre-installed unit) with Flex PCB Test Station • 8 standard bolts • 8 standard bolts with AC Coupon Adapter • 8 banana jack • 8 banana jack with AC Coupon Adapter • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1G in Lockable NEMA4 Enclosure pre-installed no wiring kit)

Table 3 RMU1G Kit Contents

3.4 RMU1G-LITE (LTE Cellular) Unit and Kits

PICTURE	DESCRIPTION
	RMU1G-LITE remote monitoring unit • 1 pc – ½" #6-32 screw comes pre-attached to a mating nut in the RMU1 unit • Typically installed inside a test station
	RMU1G-LITE Kit (pre-installed unit) with Standard Test Station • Available with 8 standard bolts or 8 Banna jack, no wiring kit. • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1G-LITE Kit (pre-installed unit) with Flex PCB Test Station • 8 standard bolts • 8 standard bolts with AC Coupon Adapter • 8 banana jack • 8 banana jack with AC Coupon Adapter Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1G-LITE in Lockable NEMA4 Enclosure pre-installed no wiring kit)

Table 4 RMU1G-LITE Kit Contents

3.5 RMU1S-LITE (Globalstar Satellite) Unit and Kits

PICTURE	DESCRIPTION
	RMU1S-LITE remote monitoring unit • Can only send messages to CorView, does not receive them (Simplex) • 1 pc – ½" #6-32 screw comes pre-attached to a mating nut in the RMU1 unit • Typically installed inside a test station
	RMU1S-LITE Kit (pre-installed unit) with Standard Test Station • Available with 8 standard bolts or 8 Banna jack, no wiring kit. • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1S-LITE Kit (pre-installed unit) with Flex PCB Test Station • 8 standard bolts • 8 standard bolts with AC Coupon Adapter • 8 banana jack • 8 banana jack with AC Coupon Adapter • Optional Test Station standard cap (see RMU1 Optional Installation Items)
	RMU1S-LITE in Lockable NEMA4 Enclosure pre-installed no wiring kit)

Table 5 RMU1S-LITE Kit Contents

3.6 INT1 Unit and Kits

PICTURE	DESCRIPTION
	INT1 remote interruption unit • Requires a G4 RMU1I or RMU1G to use and • Add one INT1 to RMU1 cable
	RMU1/INT1 Down Tube Test Station kit (Pro-Mark) • Test Station standard cap (see RMU1 Optional Installation Items) **Note: must be used with a test station riser tube having an internal diameter greater than 3.125 inches.**
	RMU1/INT1 Large Cap Test Station kit (Pro-Mark), fits a 3” pipe • Add one of ARMU1CTSTxxx Test Station tall cap (see RMU1 Optional Installation Items)
	• RMU1/INT1 Lockable NEMA4X Enclosure pre-installed

Table 6 INT1 Kit Contents

3.7 ERP1 Unit and Kit Contents

PICTURE	DESCRIPTION
	ERP1 ER Probe Peripheral • Requires a G4 RMU1I or RMU1G to use running firmware version **V1.26** or newer
	RMU1/INT1 Large Cap Test Station kit (Pro-Mark), fits a 3” pipe • RMU1G/INT1 or RMU1I/INT1 • ERP1 ER Probe Peripheral • RDL1 Hanger Assembly Optional • Test Station tall cap (see RMU1 Optional Installation Items) • INT1 to RMU1 cable (see ERP1 Optional Installation Items) • ERP1 to ERP1 or INT1 Cable (see ERP1 Optional Installation Items)
	RMU1/INT1/ERP1 Lockable NEMA4X Enclosure

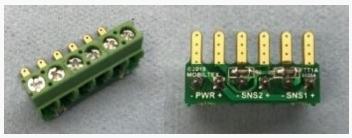
3.8 RMU1 Optional Installation Items

PICTURE	DESCRIPTION
	RMU1 Wiring Kit • 24 cm (10 in.) wiring harness with factory installed ¼" ring terminals, assorted extra crimp terminals, cable ties. The components of this kit are typically used to interconnect the measurement signals from the coupon or bond test station to the RMU1.
	Replacement Battery Pack • Kit of 4 AA batteries for maintenance purposes
	RMU1PGM-BT Programming Interface Kit • Capable of Bluetooth communications with a phone/tablet. Can also be used with a PC through the USB connection. Black USB cable. • Kit includes a carrying case and portable USB battery pack.
	RMU1ADP RMU2/3 Programmer Adapter • Allows an existing RMU2/3 Programming Interface to be used with RMU1 devices.

PICTURE	DESCRIPTION
 	RMU1/2/3-BT Programmer Kit • Universal programming kit for RMU1, RMU2, and RMU3 devices. Capable of Bluetooth communications with a phone/tablet. Can also be used with a PC through the USB connection. Kit Includes: • RMU1/2/3 BT base programmer • RMU1ADP • Lilon battery pack • Soft case
	INT1 to RMU1 cable
	Test Magnet
	Modified RMU1 Replacement Lid For Direct Installation In 3” Pipe • Only for RMU1S or RMU1G.
	Spacer Ring For 3” Test Stations Available in the following colours: • Black • Orange • Yellow • Green • White • Blue

PICTURE	DESCRIPTION
	• Red
	Test Station standard Cap/Ring and 2 Spacer Rings Available in the following colours: • Black • Orange • Yellow • Green • White • Blue • Red
	Test Station Tall Cap/Ring (15.5”) (Pro-Mark) Available in the following colours: • Black • Orange • Yellow • Green • White • Blue • Red
	Lockable bracket for Pro-Mark test station • Padlock & test station not included

PICTURE	DESCRIPTION
	Lockable NEMA4X Enclosure • 6.75”W x 7.5”H x 5.5”D (171mm x 190mm x 140mm) • Comes with RMU1 bracket.
	Adapter assembly for use with separate DC and AC coupon mode • Integral 10 Ohm shunt resistor
	Large opening (36mm/1.42”) AC mitigation measurement transformer • 1.57” x 1.63” x 2.64”(40mm x 41.4mm x 67mm) • Includes 3.3’(1m) leads • 126A AC full scale
	Medium opening (24mm/0.94”) AC mitigation measurement transformer. • 1.34” x 2” x 2.64”(34mm x 51mm x 67mm) • Includes 3.3’(1m) leads • 42A AC full scale
	Small opening (15.2mm/0.60”) AC mitigation measurement transformer • 1.22” x 1.26” x 1.81”(31mm x 32mm x 46mm) • Includes 3.3’(1m) leads • 31A AC full scale
	Electrical isolation shield. • Prevents accidental user contact with exposed test station termination screws.

PICTURE	DESCRIPTION
	Banana jack test point kit. • Replaces standard test point termination screws to provide banana jack functionality. Kit contains 5 replacement screws, washers and nuts.
	Test station with banana jack test points and shield. • Kit consists of 5 installed banana jack test point screws and a drilled test station shield. • The components are factory installed in the configuration shown. Alternative custom configurations are available for purchases of 100+ units. • Add one of Test Station standard cap.
	Test station with RMU1 to-test-station flex PCB • Connects the RMU1 6-pin connector directly to the test station bolts. • Add one of Test Station standard cap.
	Separate AC/DC Coupon Board for Test Station With Flex PCB • 10 Ohm shunt and link PCB allowing use of separate AC/DC coupons with test station flex PCB.
	4-20mA Adapter Board • Supports two 4-20mA transmitters and a connection point for an external power pack. Maximum loop drop through the RMU1 is 200mV.

PICTURE	DESCRIPTION
	Battery Holder • Waterproof battery holders for the 4-20mA Adapter Board. Installs down a 3” pipe that install to any test station. Will not provide extra battery power to the RMU1.
	RMU1PGM G4 Retrofit Kit • The RMU1 G4 no longer works with our previous programmers as the new communications port blocks the attachment of the programmer. The new programmer plate does a much better job of holding on to the RMU1, is compatible with previous generations of the RMU1 and is easy to retrofit to a RMU1PGM or a RMU3PGM with the RMU1 adaptors. • T10 Screwdriver required to retrofit not included, retrofit instructions provided with the retrofit kit.

Table 7 RMU1 Accessories

3.9 ERP1 Optional Installation Items

PICTURE	DESCRIPTION
	ER Probe Cable Assembly • Cable for connecting the ERP1 unit to the ER probe.
	Reference Cell & RTD Cable Assembly • Cable for connecting the ERP1 unit to a Reference Cell and RTD element.
	ERP1 to ERP1 or INT1 Cable Assembly • Cable for connecting the ERP1 unit to another ERP1 unit, or, when connecting the ERP1 to an INT1 unit. • Can also be used as an extension to connect the RMU1 to the ERP1, if a longer cable run is required.

Table 8 ERP1 Accessories

4 Quick Bench Test

1. For the RMU1S or RMU1I, locate the RMU1 outdoors with a clear view (120 degrees in all directions is optimum) of the sky and with the top dome with the molded CorTalk® logo of the device facing upwards towards the sky. RMU1I battery life will be significantly impacted by poor sky views since communication with the satellite constellation is attempted and re-attempted until the satellite system acknowledges the transmission. The RMU1G cellular antenna, located in the top dome area, requires a clear communications path to a cellular tower; optimal orientation will be site dependent.
2. Power on the RMU1 by twisting the lid clockwise until a switch click is heard. The LCD display will display “Init” (if programmer is attached) briefly followed by “bSY” for several seconds. For the RMU1-LITE, the A and B LEDs will flicker briefly. The lid should be rotated an additional 1/2 turn after the switch click is heard to fully engage the sealing gasket.
3. If the GPS receiver is enabled in the configuration (for the RMU1S, the GPS is always enabled at power-up), the RMU1 will display the ‘GPS’ icon on the LCD display and also show a number in the format of ‘X.YY’ where X is the number of satellites being received and YY is the average signal strength of those satellites. The RMU1 will not send a power-up message or display measurements on the LCD screen until GPS signal acquisition is complete.
4. CorView is accessed using a web browser at https://account.corview.cloud/ Enter the User Name and Password that were provided to you when your CorView account was setup.
5. 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.

NOTES

- Transmissions from field devices typically require from <1 minute (good antenna view of the sky) to 30 minutes (poor antenna view of the sky) 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 click on the refresh button (typically F5) in your browser.

If an INT1 is also connected, a second “New Unit” line will appear with the same ESN of the first unit and a -0 appended to it.

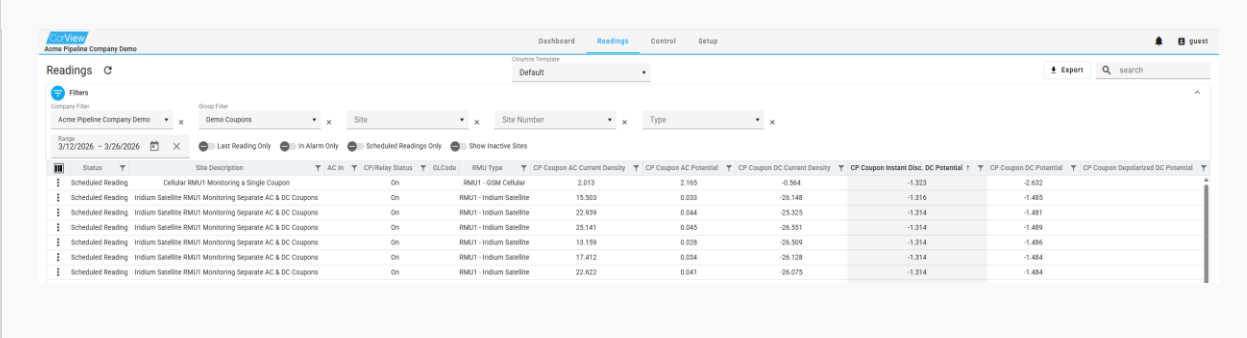


Figure 5 CorView All Readings Page

6. Pressing a magnet against the area marked “TEST” on the RMU1 for 1 to 5 seconds will force an immediate analog measurement and data transmission.
7. 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.
8. When the bench test is completed, simply loosen the cap on the RMU1 by twisting counter-clockwise until a switch click is again heard. This action forces the RMU1 device to power down. Rotate the lid an additional ½ turn to ensure the device remains powered down.

NOTES

- 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.

5 Installation

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

Installation consists of three steps: unit installation, wiring, and device configuration.

5.1 RMU1 Installation

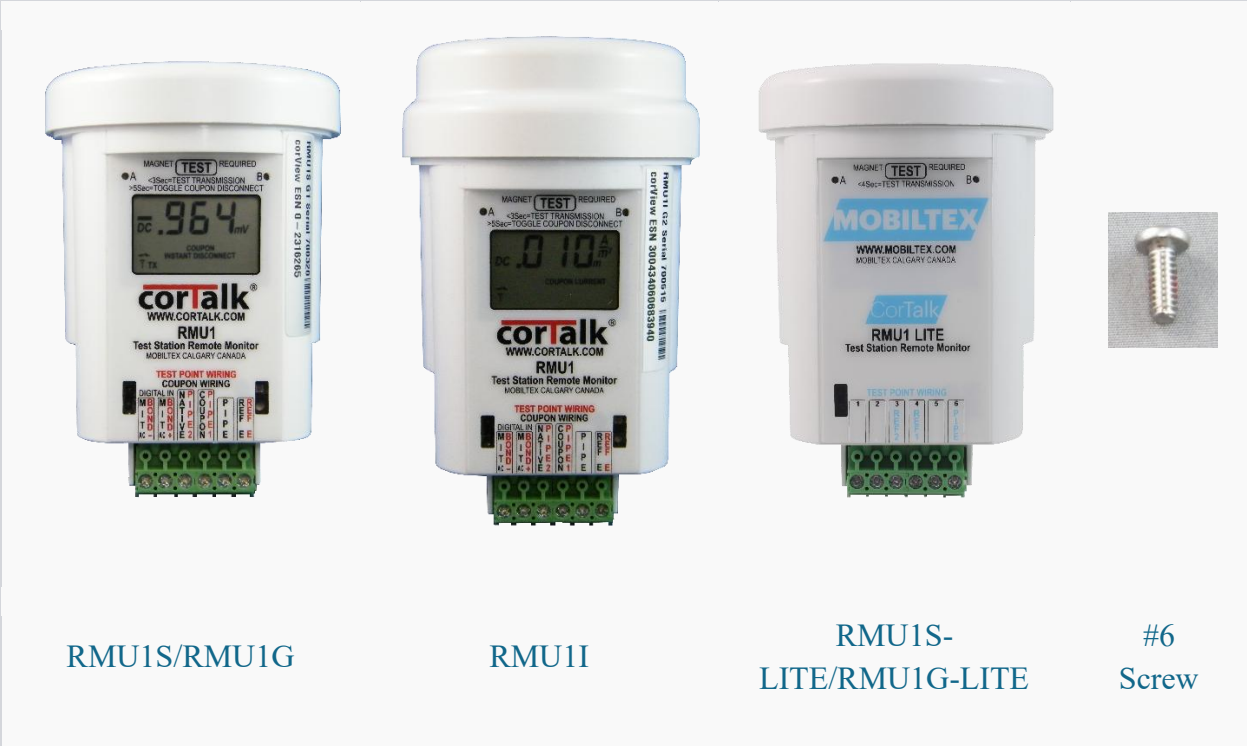


Figure 6 RMU1 Installation Hardware

- The RMU1 may be installed inside an industry standard test station, or with an optional cap, directly onto a 3” PVC pipe.
- To accommodate a standard test station, a spacer ring is required to raise the test station cap enough to allow the RMU1S or RMU1G to fit; for the RMU1I, two spacer rings are needed. The spacer ring attaches to the threaded portion of the lower test station mount.
- With specialized cover locking systems or for other special test station installations, it may also be possible to cut off part of the test station terminal

board to make room for the RMU1; in that case the spacer ring would not be needed.



Figure 6 RMU1 Installed In Test Station



Figure 7 Installation Inside NEMA4X Box

5.2 Measurement Type Wiring

The RMU1 can be wired in several different pre-defined configurations for single coupon, dual coupon, separate AC and DC coupons, and bond monitoring. The diagrams in the following pages illustrate typical installations for each measurement type. Each measurement type diagram contains a table indicating the six 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. Also note that the RMU1 measurement inputs must not be directly connected to mains AC power.

The following ranges apply to measured signals of the RMU1. For RMU1-LITE units, only the potential range applies.

Potential	+/-31VDC, 22VAC
Coupon Current	+/-6mADC, 4.25mAAC, Low Range +/-60mADC, 42.5mAAC, Med Range +/-200mADC, 140mAAC, High Range
Bond Shunt	+/-6mVDC, 4.25mVAC, Low Range +/-60mVDC, 42.5mVAC, Med Range +/-200mVDC, 140mVAC, High Range

The INT1 is similarly designed to be wired to monitor bonds or anode beds. It has an internal 20mOhm current shunt which makes for easy installation. The RMU1 used in conjunction with it should not be used to monitor the same bond as the INT1, but can be used to monitor coupons, test points, another bond or be disabled.

The following ranges apply to measured signals of the INT1:

Potential	+/-31VDC, 22VAC
Bond Shunt	+/-300mADC, 210mAAC, Low Range +/-3ADC, 2.1AAC, Med Range +/-10ADC, 7AAC, High Range

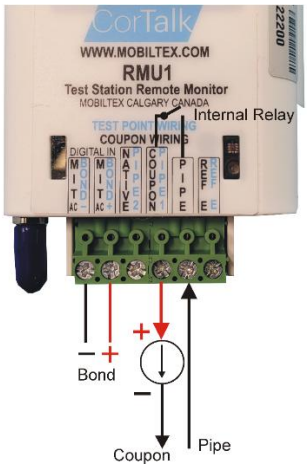


Figure 8 Polarity of RMU1 Current Measurements

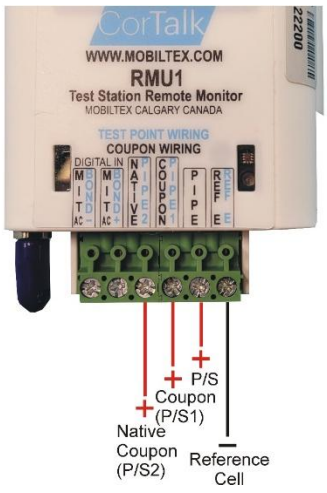
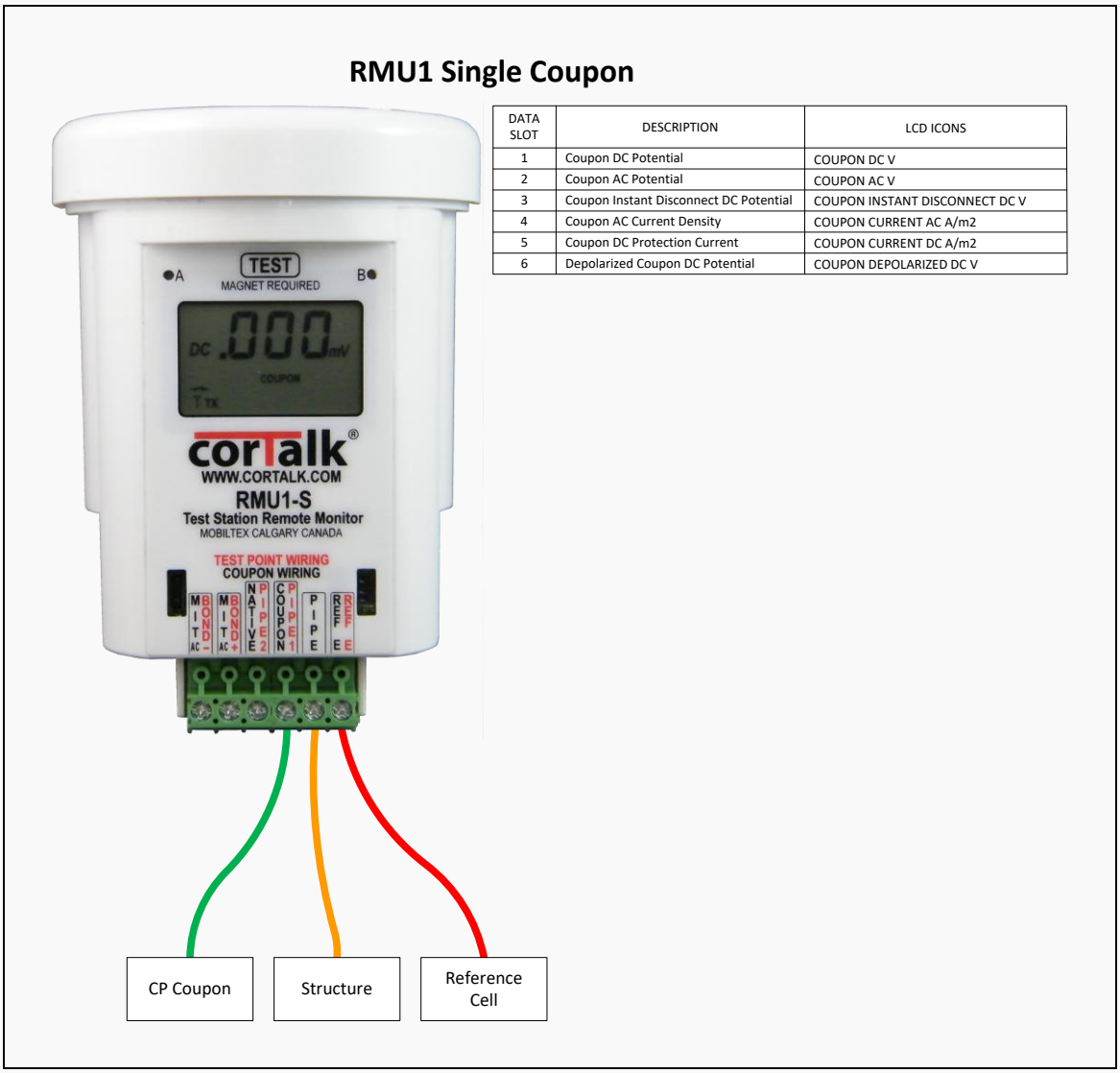


Figure 9 Polarity of RMU1 Voltage Measurements

Use Figures 9 and 10 above as a guide for how to connect a test multimeter to observe the same polarities (positive and negative values) as the RMU1 for all the measurement types listed below.



DATA SLOT	DESCRIPTION	LCD ICONS
1	Coupon DC Potential	COUPON DC V
2	Coupon AC Potential	COUPON AC V
3	Coupon Instant Disconnect DC Potential	COUPON INSTANT DISCONNECT DC V
4	Coupon AC Current Density	COUPON CURRENT AC A/m2
5	Coupon DC Protection Current	COUPON CURRENT DC A/m2
6	Depolarized Coupon DC Potential	COUPON DEPOLARIZED DC V

Figure 10 Single Coupon Wiring Diagram (CP33)

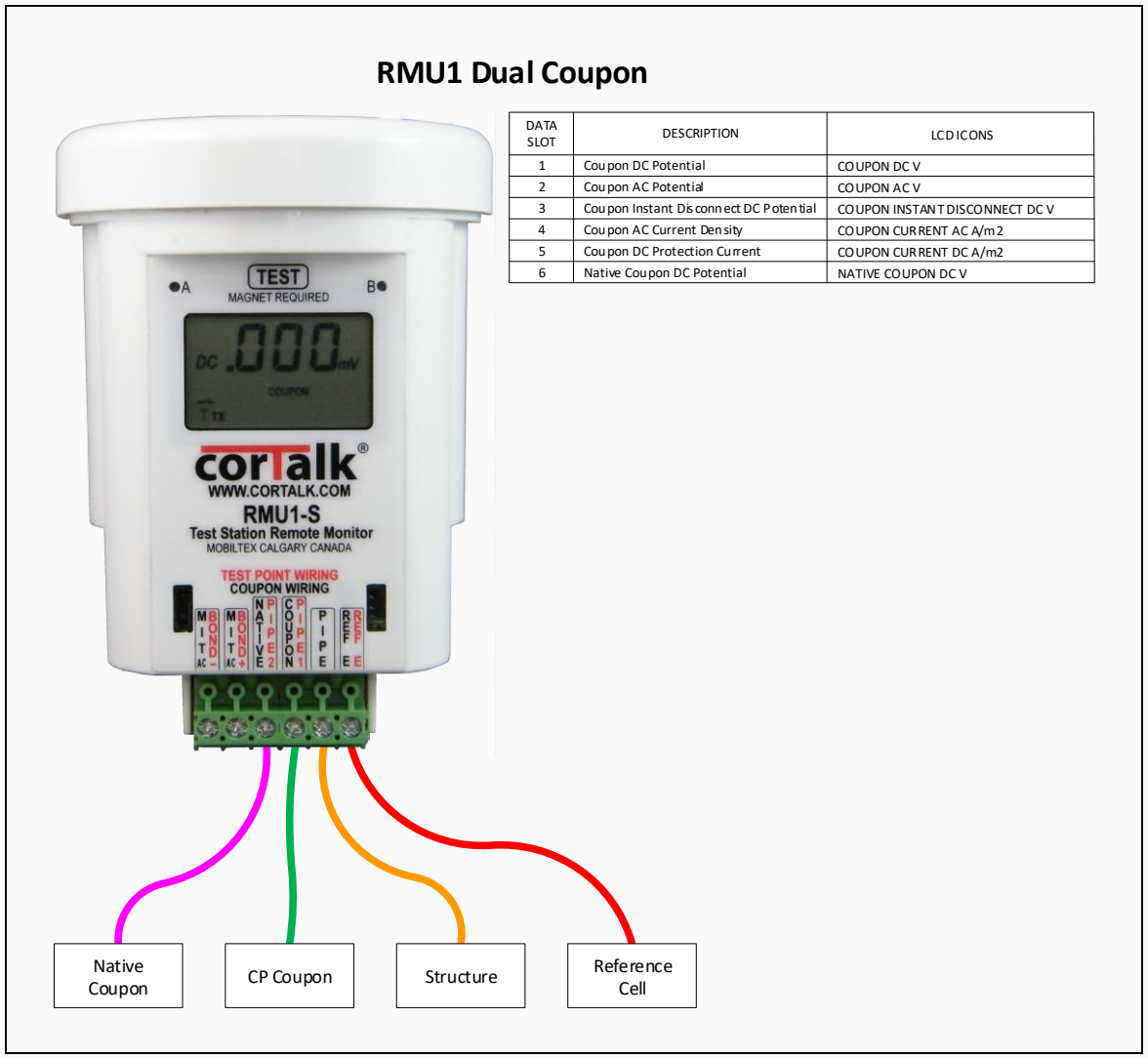


Figure 11 Dual Coupon Wiring Diagram (CP34)

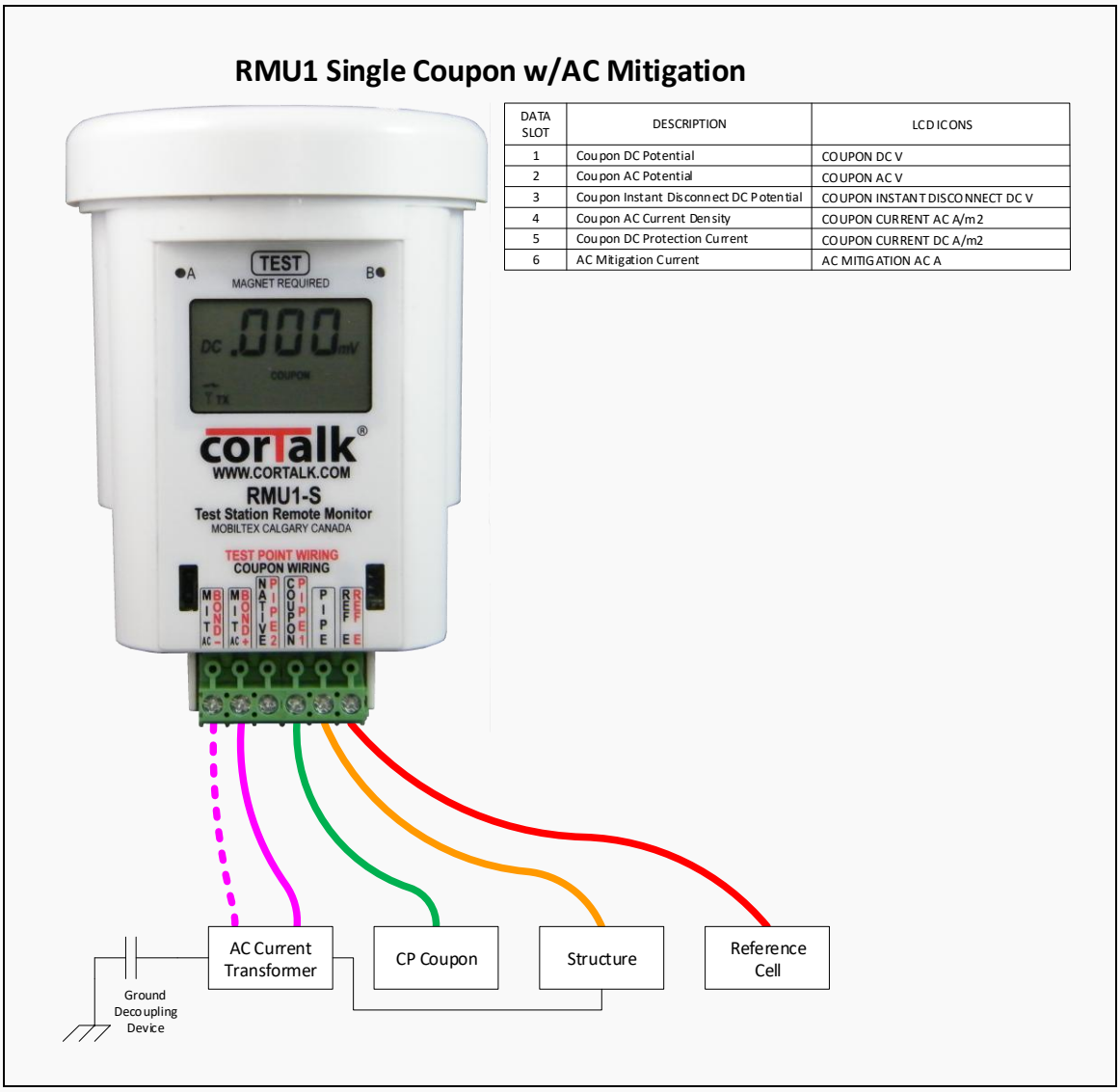


Figure 12 Single Coupon with AC Mitigation Wiring Diagram (CP35)

With this type of installation, a scaling factor must be entered for the AC mitigation slot in the RMU1 configuration. The scaling factor is dependent on the transformer and the burden/divider resistors. For Mobiltex supplied transformer kits, the required slot scale factor is printed on the transformer assembly. The slot input range must be set to 'HIGH' in the RMU1 configuration.

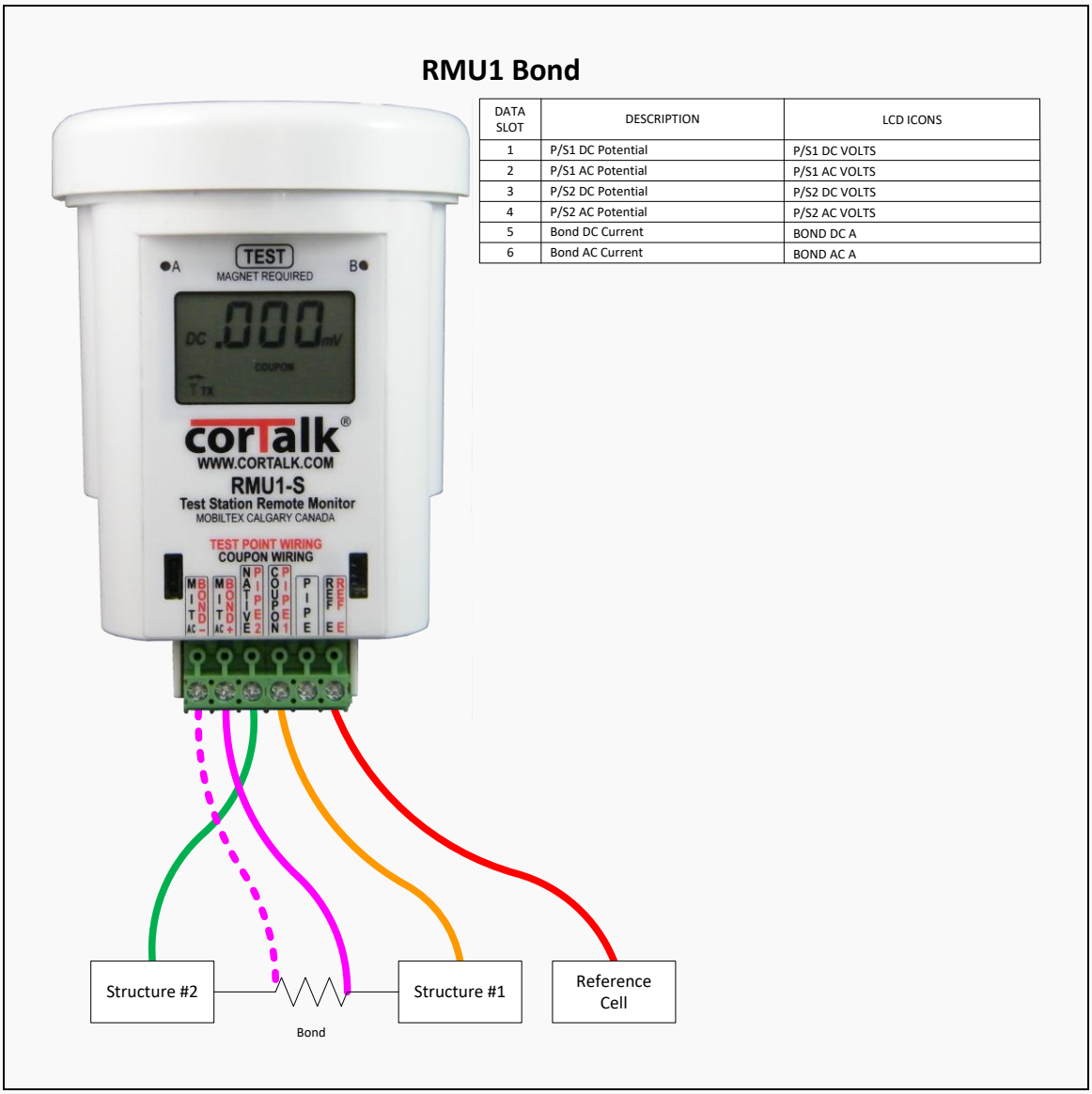


Figure 13 Bond Wiring Diagram (BOND36)

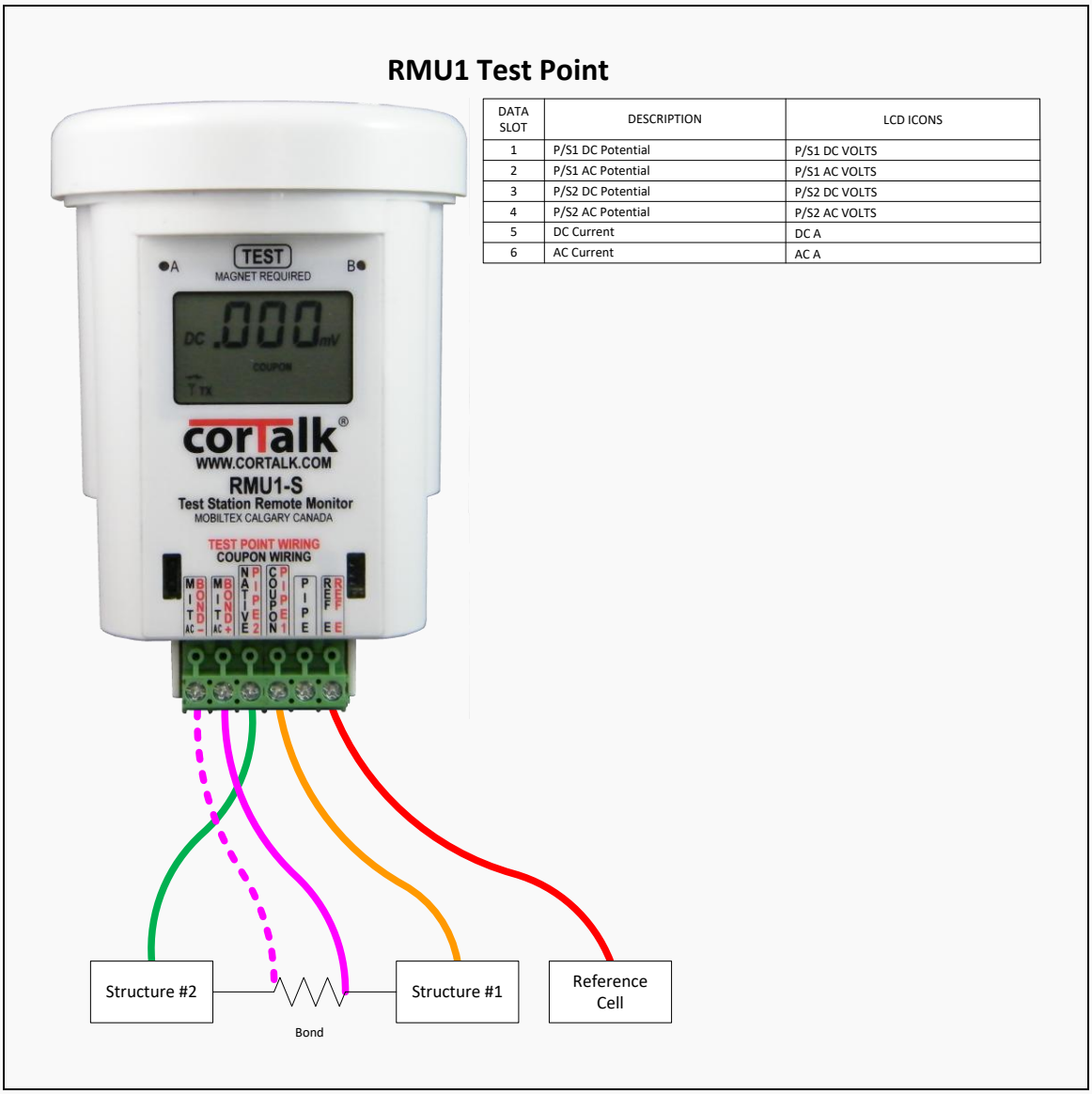


Figure 14 Test Point Wiring Diagram (TP37)

For RMU1-LITE devices this is one of the two measurement types that are supported. However, the Bond Current measurements (slot 5 and 6) are disabled for RMU1-LITE devices.

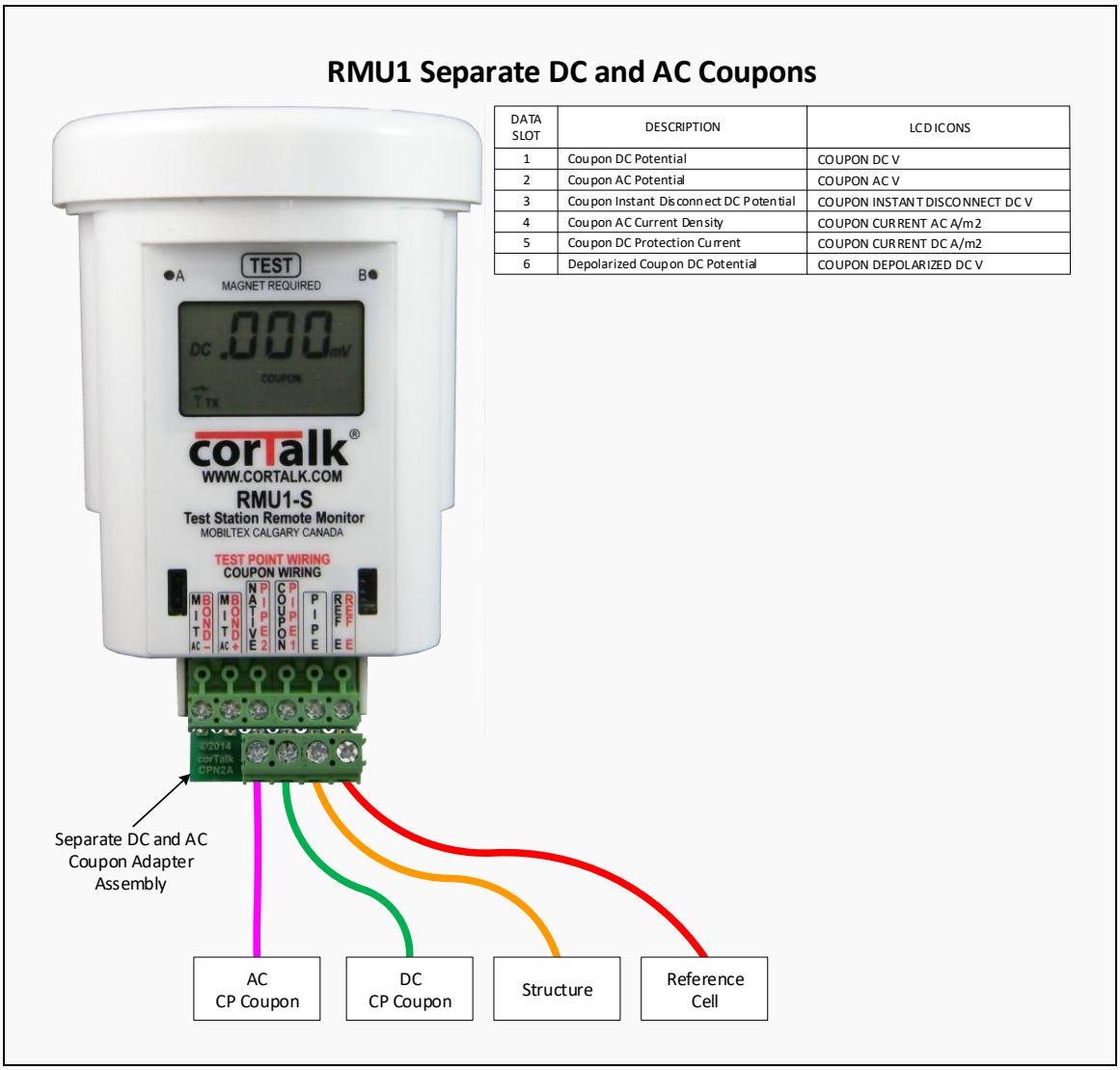


Figure 15 Separate DC and AC Coupons Wiring Diagram (CP38)

When using separate DC and AC coupons with the RMU1, an adapter board must be used. This adapter board contains a precision shunt resistor and provides a terminal block for connections to the coupons, structure and reference cell. The shunt is a 10ohm resistor; this shunt resistance must be used in the coupon calculator in the RMU1 configuration application to obtain correct readings.

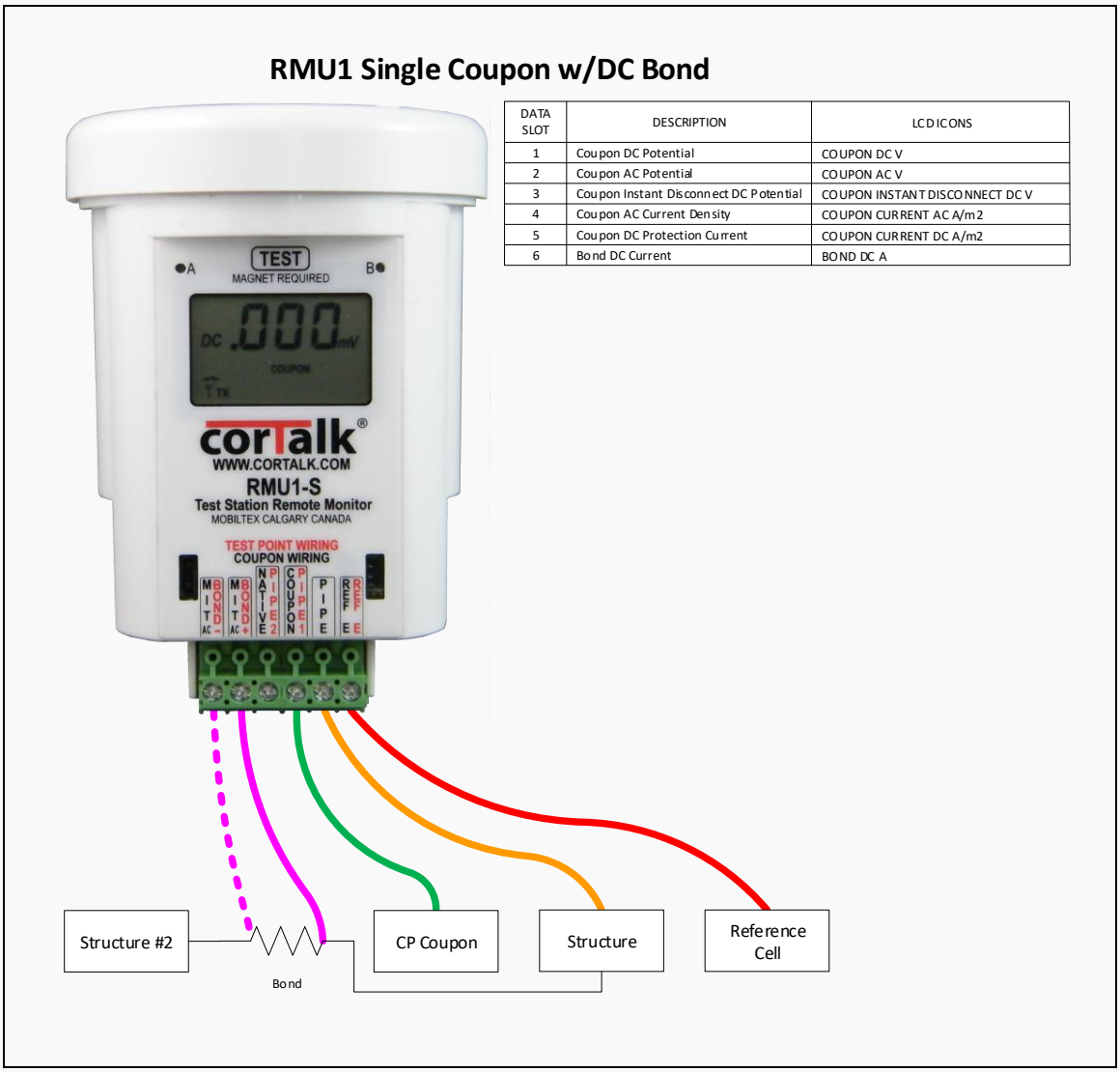


Figure 16 Single Coupon with DC Bond Wiring Diagram (CP39)

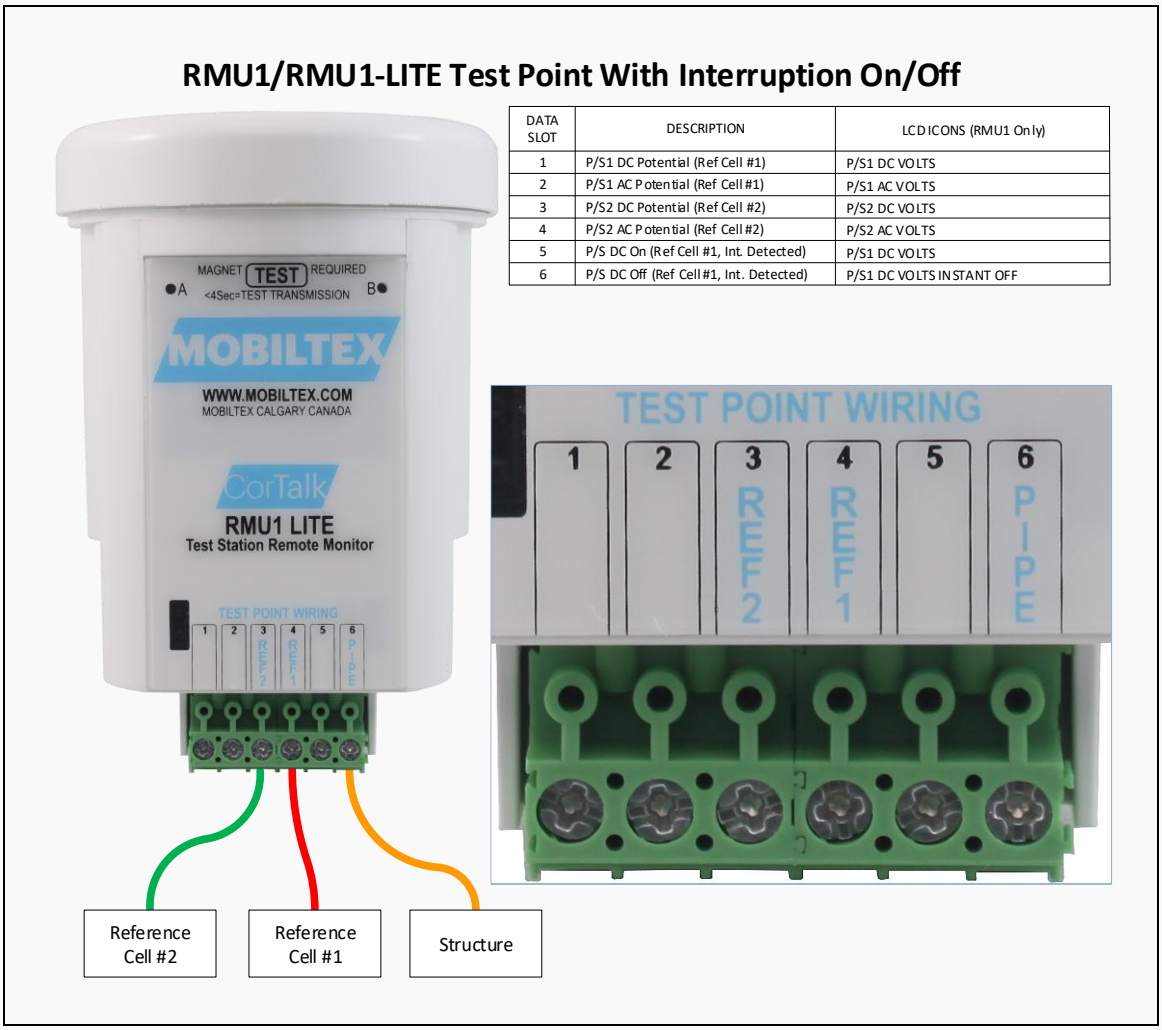


Figure 17 Interruption Detection with On/Off Measurements (TP40)

- For RMU1-LITE devices this is one of the two measurement types that are supported.
- This measurement type is also supported on full RMU1 G2/G3/G4 devices; however, note that connection points for the structure and reference cells differ from usual wiring on the RMU1.
- The first 4 slots are standard P/S measurements. Slots 5 and 6 support interruption detection.
- Two reference cell inputs are provided to allow for validation of reference cell operation over time.

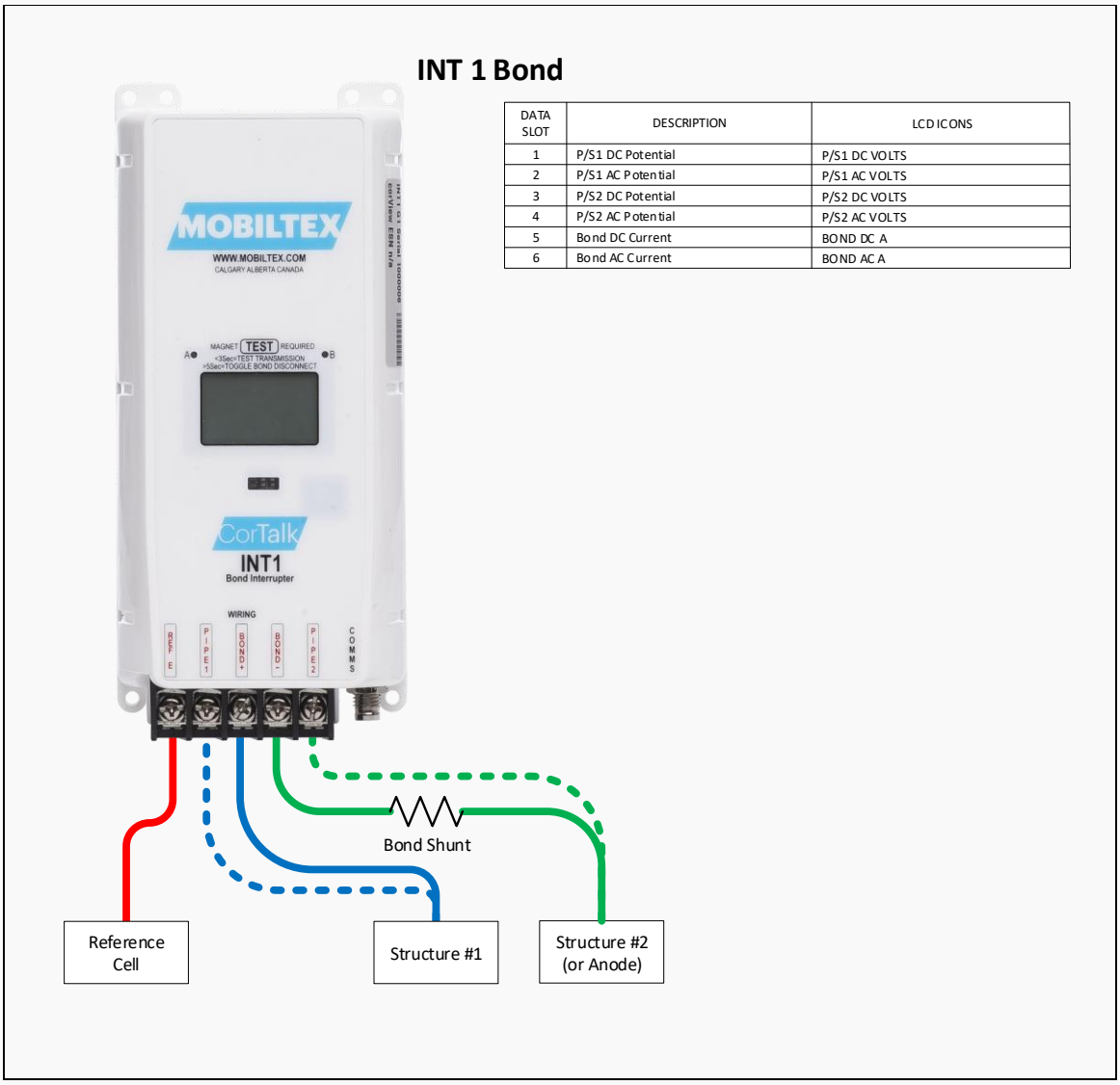
- The measurements on slots 1 and 2 are made relative to the 'REF1' input and the measurements on slots 3 and 4 are made relative to the 'REF2' input.
- Interruption measurements in slots 5 and 6 are only made against the 'REF1' input.
- When two reference cells are installed, it is then possible to compare the measurements from the two references on CorView. If the measurements are observed to diverge over time, it is an indication that one of the reference cells may need replacement.

NOTES

- If only one reference cell is used, it should be connected to the terminal labelled 'REF 1'.

- When using reference cells of different chemistry, e.g. CuCuSO4 and Zinc, the slot offset parameter for slots 1 or 3 can be used transmit equivalent reference measurements. As an example, if a CuCuSO4 reference is connected to 'REF1' and a Zinc reference is connected to 'REF2', the slot 3 offset parameter can be set to a value of -1.1 to send CuCuSO4 equivalent readings for both to CorView.
- **Int. Det. Threshold (mV):** This parameter indicates the minimum voltage difference between the P/S1 DC On Potential and P/S1 DC Off Potential for interruption to be detected. Any voltage fluctuation below its value will not be detected as an interruption.
- If interruption is detected, appropriate 'on' (slot 5) and 'instant off' (slot 6) measurements are taken. The instant off and on measurements are made relative in time to the interruption waveform transition edges according to the 'Instant Disconnect Offset' parameter. This interruption measurement check set is taken at power up and at exception check intervals.
- Because of the sampling involved, the measurement takes over 1 minute to complete.

- If interruption is not detected, these slots will be displayed as disabled on CorView. A change of state for interruption detection will generate an exception transmission to CorView.



DATA SLOT	DESCRIPTION	LCD ICONS
1	P/S1 DC Potential	P/S1 DC VOLTS
2	P/S1 AC Potential	P/S1 AC VOLTS
3	P/S2 DC Potential	P/S2 DC VOLTS
4	P/S2 AC Potential	P/S2 AC VOLTS
5	Bond DC Current	BOND DC A
6	Bond AC Current	BOND AC A

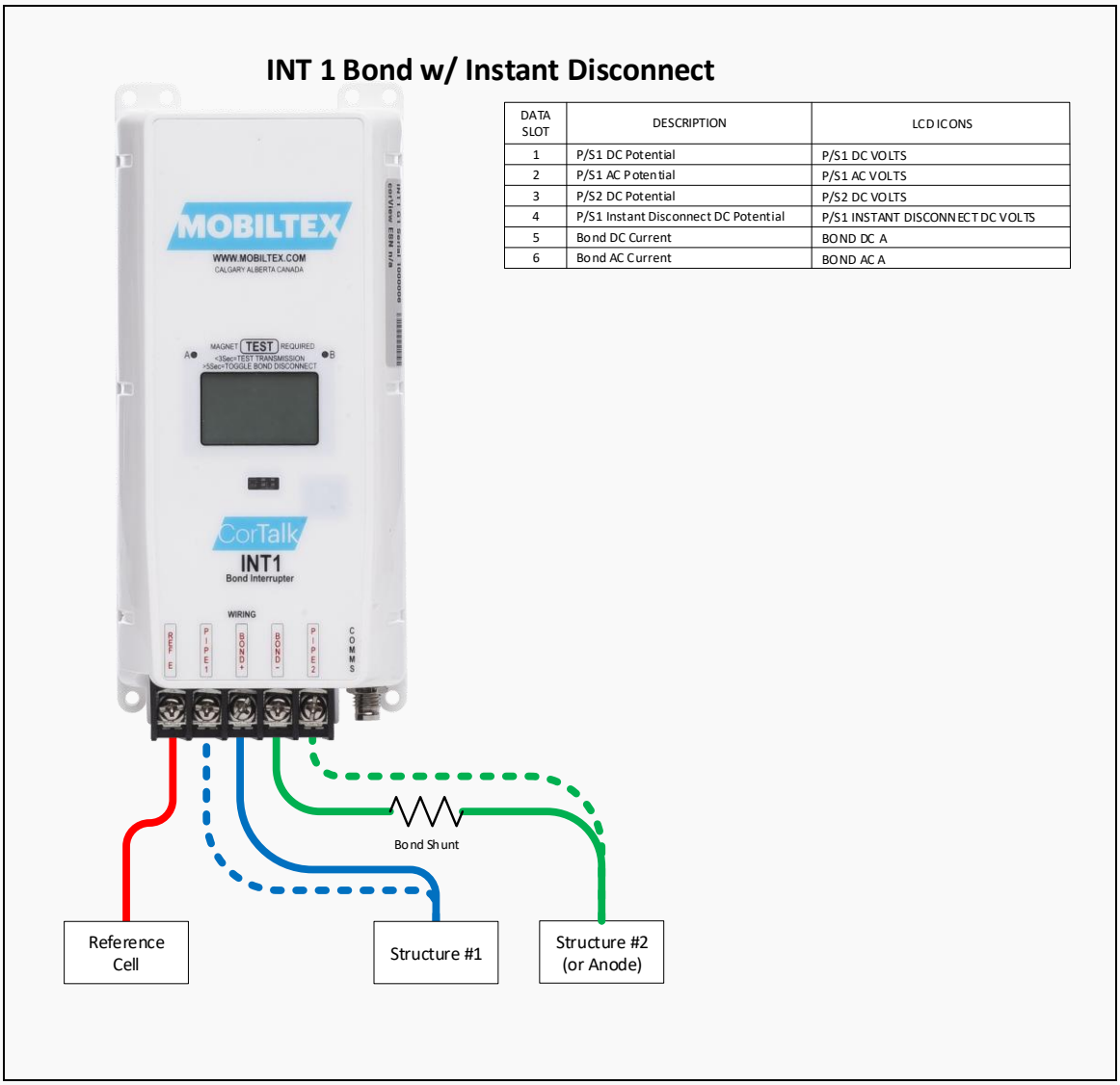
Figure 18 Bond (BOND44)

- The dashed lines are a second set of leads coming from the structures. This allows for accurate voltage measurements without the IR drop of the main leads or the bond shunt.

- If no second set of leads are present, the user can use a jumper wire between Pipe 2 and Bond- then a second jumper wire between Pipe 1 and Bond+. For

more precise measurements, test wires should be brought up in addition to the bond wires.

- The main interruption relay is between the Bond+ and Bond- inputs. If the user has no interest in voltage measurements, the INT1 can simply be used with 2 wires and disable the unused slots.



DATA SLOT	DESCRIPTION	LCD ICONS
1	P/S1 DC Potential	P/S1 DC VOLTS
2	P/S1 AC Potential	P/S1 AC VOLTS
3	P/S2 DC Potential	P/S2 DC VOLTS
4	P/S1 Instant Disconnect DC Potential	P/S1 INSTANT DISCONNECT DC VOLTS
5	Bond DC Current	BOND DC A
6	Bond AC Current	BOND AC A

Figure 19 Bond w/Instant Disconnect (BOND45)

- The dashed lines are a second set of leads coming from the structures. This allows for accurate voltage measurements without the IR drop of the main leads or the bond shunt.

- If no second set of leads are present, the user can use a jumper wire between Pipe 2 and Bond- then a second jumper wire between Pipe 1 and Bond+. For more precise measurements, test wires should be brought up in addition to the bond wires.
- The main interruption relay is between the Bond+ and Bond- inputs. If the user has no interest in voltage measurements, the INT1 can simply be used with 2 wires and disable the unused slots.
- The programmed “Measurement Type” will determine the signals monitored and the associated wiring connection requirements.
- Wire the appropriate measurement signals from the coupon or bond to the terminal block on the RMU1.
- The green terminal block is pluggable; it may be easier to remove it from the RMU1 while wiring. Strip ¼”(6mm) of insulation off the end of each measurement wire before inserting the wire into the terminal block.
- Use a small Philips-style or flat blade screwdriver to tighten the connector clamps to the measurement wiring.
- Unused analog input channels should be disabled using the programming interface.
- INT1 wire connections will accept 22AWG to 12AWG wire gauges.
- An optional wiring kit containing factory installed crimp terminals, wiring and cable ties, is available.

Electrical connections to the RMU1 can be made using direct wire connections (22 to 14 AWG wire size.

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.

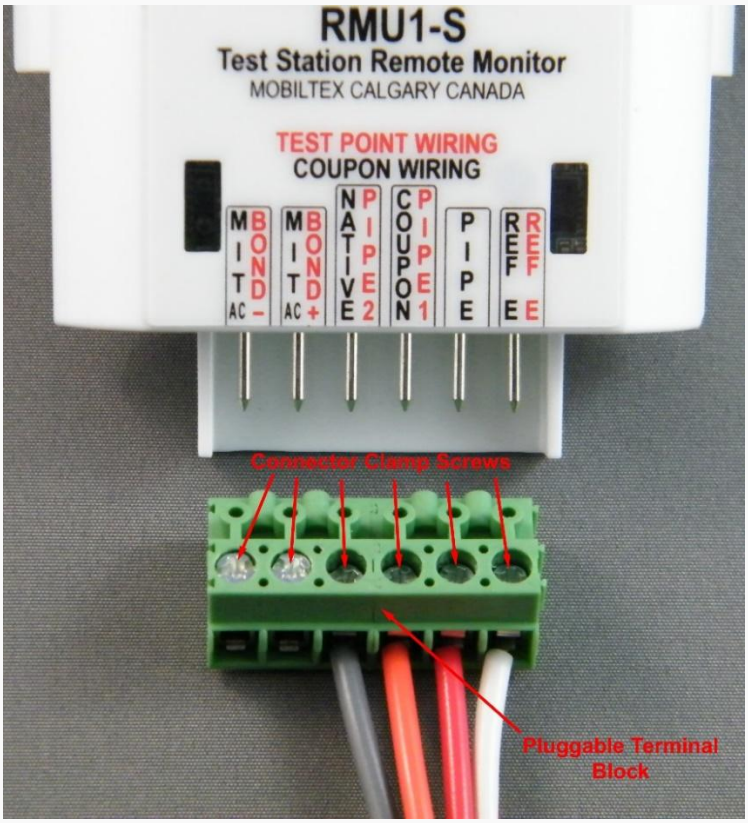


Figure 20 RMU1 Measurement Wiring Connections

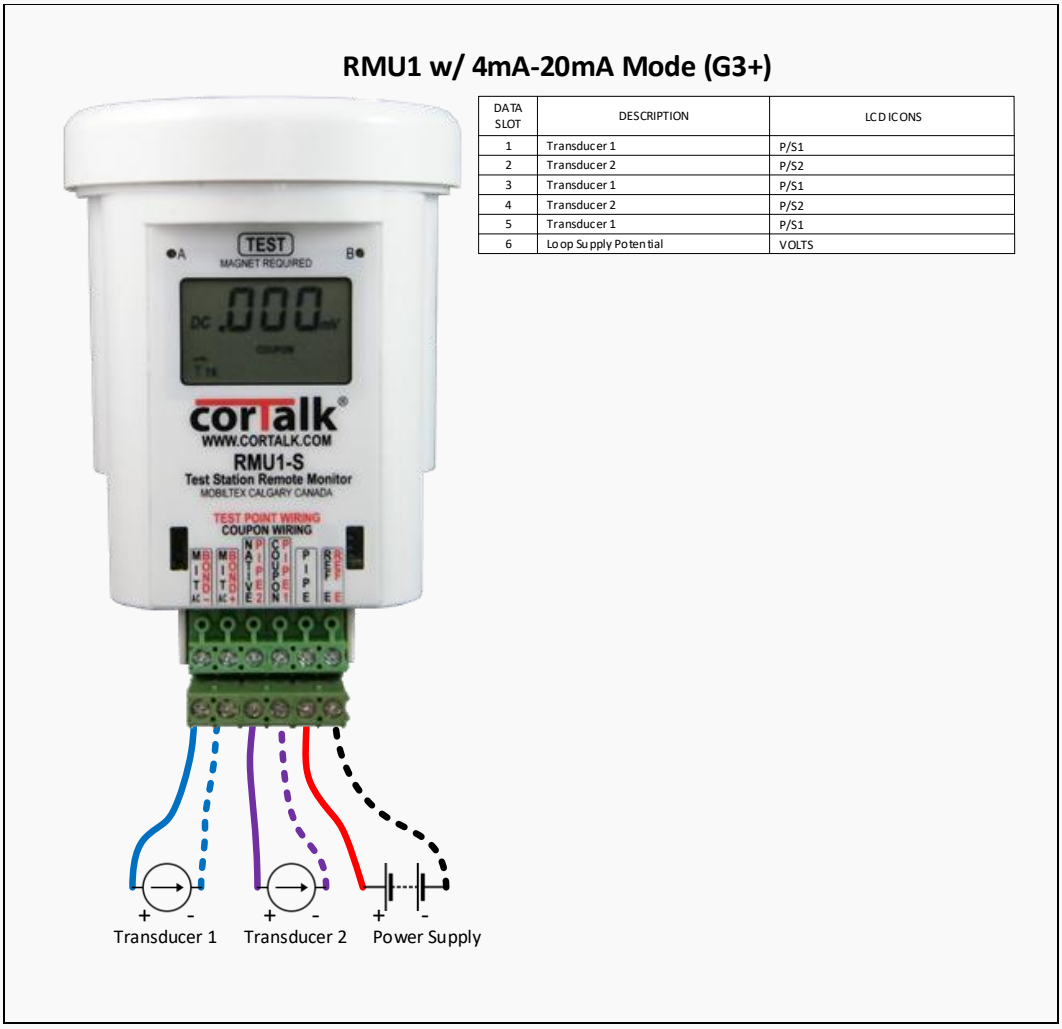


Figure 21 RMU1 w/ 4mA-20mA Mode (G3+)

- Mobiltex provides a battery pack that can be purchased with the RMU1 to act as a power supply (~18 Volts nominal).
- The battery packs have a small power button and the transducer measurements should be tested to ensure function before leaving the site.
- Users can provide their own power supply.
- Note the polarity of the power supply for correct readings.
- The 2 transducers are user provided.

5.3 Wiring With Flex PCB Equipped Test Station

As an optional accessory, a standard test station equipped with a flex PCB that connects the RMU1 6-pin connector directly to the test station bolts is available. All measurement sources are then connected directly to the test station bolts. Special kit configurations utilized for the monitoring of coupons, bonds or test points. The kits consists of the following items:

- 1pc: RMU1S Remote Monitoring Unit for Test Stations & Coupons - Satellite 1-way
- 1pc: Spacer to raise test station cap to allow RMU1 to fit inside standard test station – ORANGE

Or

- 1pc: RMU1I Remote Monitoring Unit for Test Stations & Coupons - Satellite 2-way Iridium
- 2pcs: Spacer to raise test station cap to allow RMU1 to fit inside standard test station – ORANGE

And

- 1pc: Test Station with 8 plated screws and top cover – ORANGE
- 1pc: Mobiltex FLEX3B custom interconnection Flex circuit assembly installed in above test station
- 1pc: Mobiltex SLD1A Front shield board
- 1pc: Rear Test Station shield for use with RMU1. Prevents user contact with test station bolts.

The following pictures illustrate the kit:



Complete unit with cover installed



Cover removed – front view



Cover removed – side view



Cover removed – rear view



Kit components – pre-installed in the test station



Rear safety shield removed



Front shield and Flex circuit

Figure 22 Kit With Flex PCB Test Station

Internally, the flex PCB connects the RMU1 to the test station bolts as shown here:

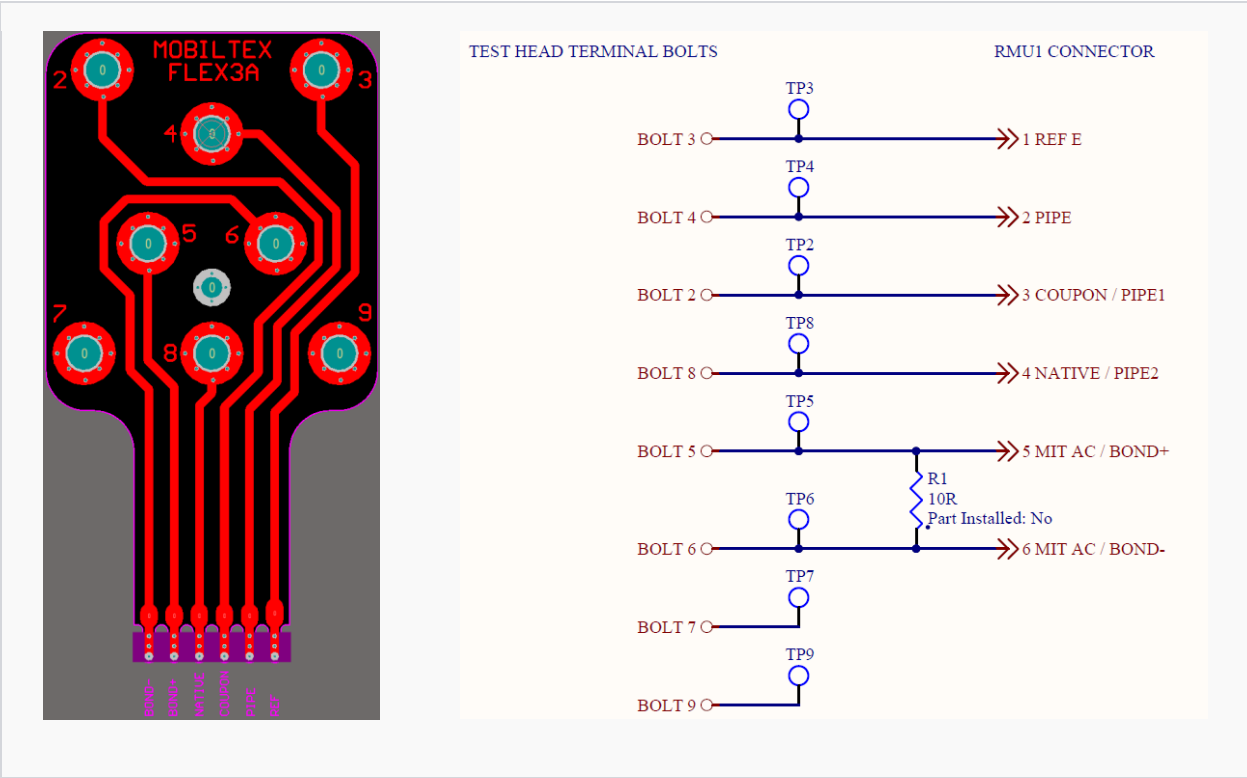
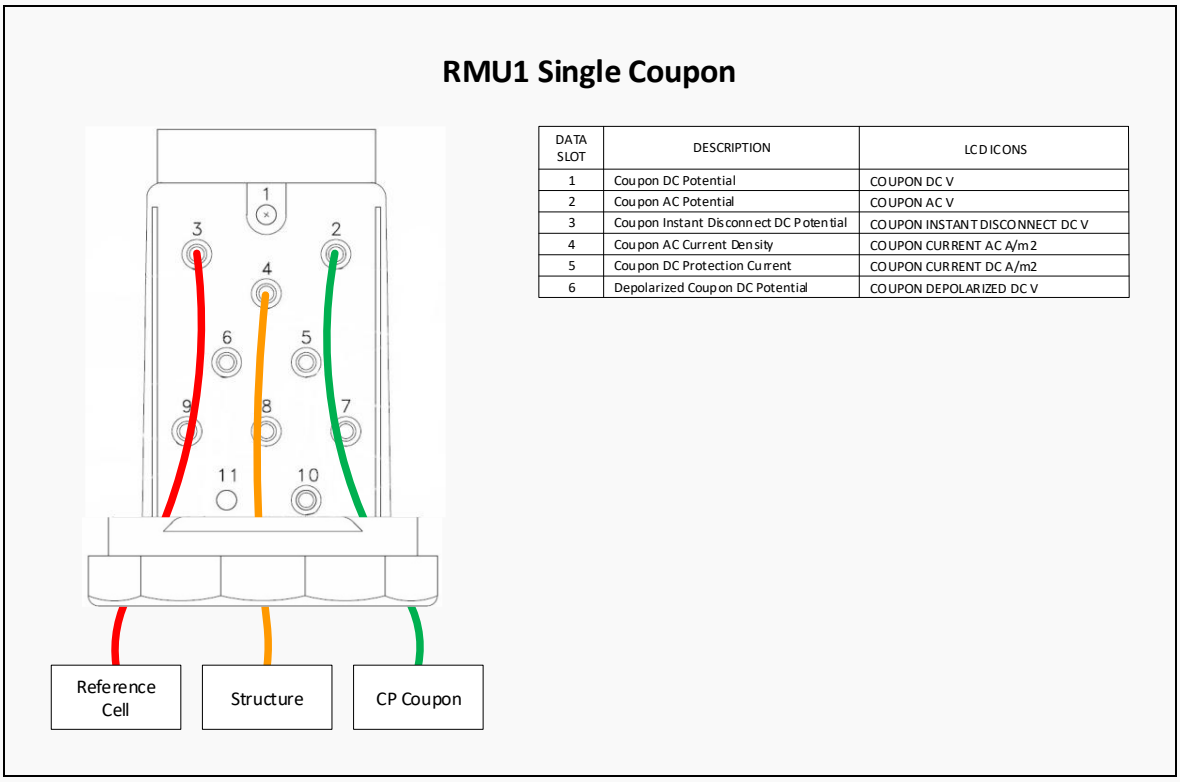


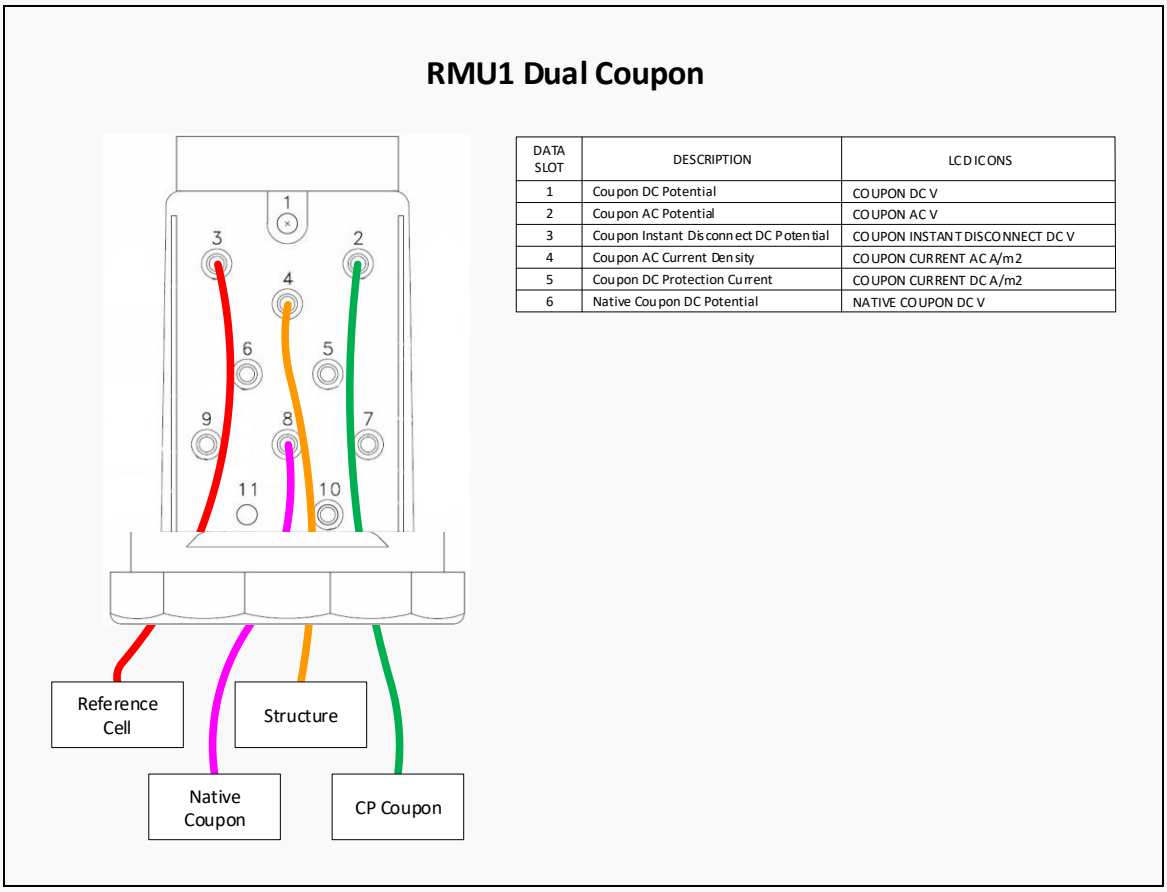
Figure 23 Test Station Flex PCB Connections

The following figures illustrate the necessary connections for each RMU1 measurement type.



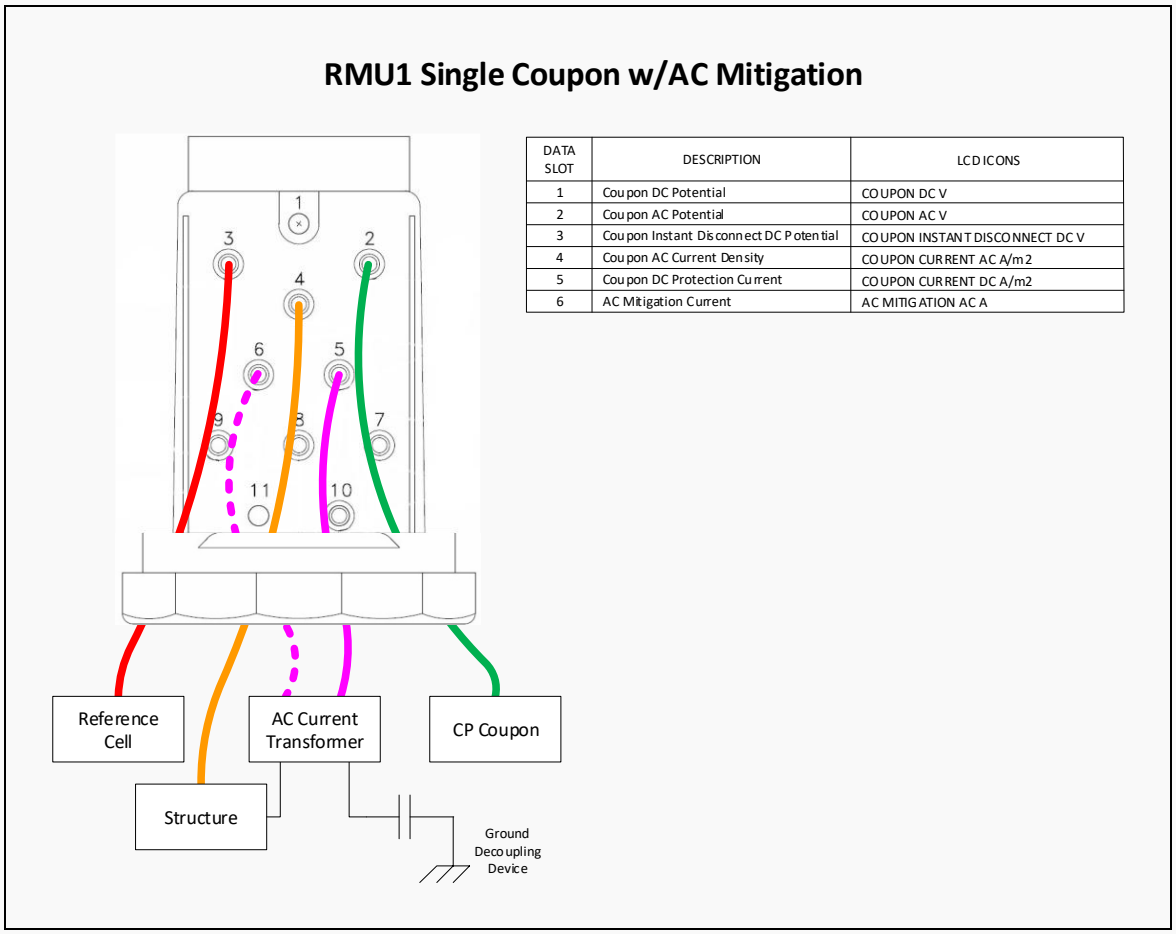
DATA SLOT	DESCRIPTION	LCD ICONS
1	Coupon DC Potential	COUPON DC V
2	Coupon AC Potential	COUPON AC V
3	Coupon Instant Disconnect DC Potential	COUPON INSTANT DISCONNECT DC V
4	Coupon AC Current Density	COUPON CURRENT AC A/m2
5	Coupon DC Protection Current	COUPON CURRENT DC A/m2
6	Depolarized Coupon DC Potential	COUPON DEPOLARIZED DC V

Figure 24 Single Coupon Flex Connections (CP33)



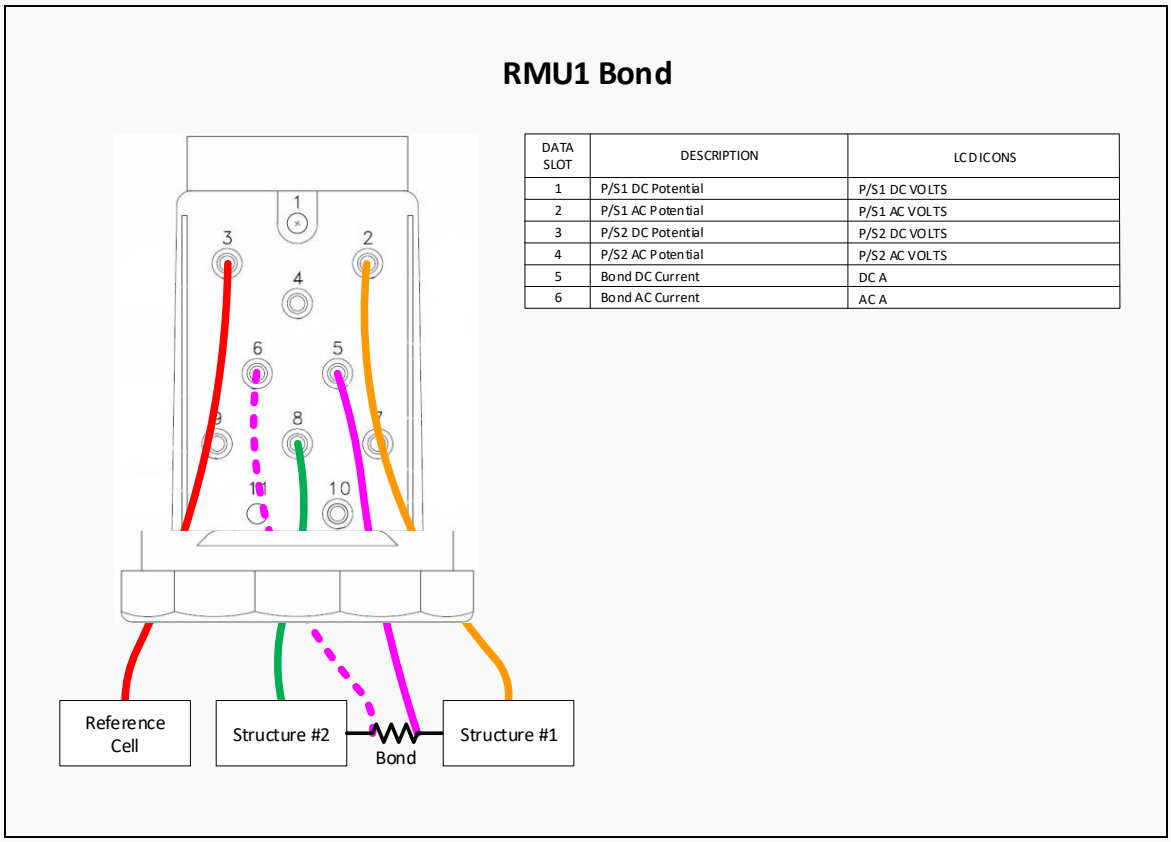
DATA SLOT	DESCRIPTION	LCD ICONS
1	Coupon DC Potential	COUPON DC V
2	Coupon AC Potential	COUPON AC V
3	Coupon Instant Disconnect DC Potential	COUPON INSTANT DISCONNECT DC V
4	Coupon AC Current Density	COUPON CURRENT AC A/m2
5	Coupon DC Protection Current	COUPON CURRENT DC A/m2
6	Native Coupon DC Potential	NATIVE COUPON DC V

Figure 25 Dual Coupon Flex Connections (CP34)



DATA SLOT	DESCRIPTION	LCD ICONS
1	Coupon DC Potential	COUPON DC V
2	Coupon AC Potential	COUPON AC V
3	Coupon Instant Disconnect DC Potential	COUPON INSTANT DISCONNECT DC V
4	Coupon AC Current Density	COUPON CURRENT AC A/m2
5	Coupon DC Protection Current	COUPON CURRENT DC A/m2
6	AC Mitigation Current	AC MITIGATION AC A

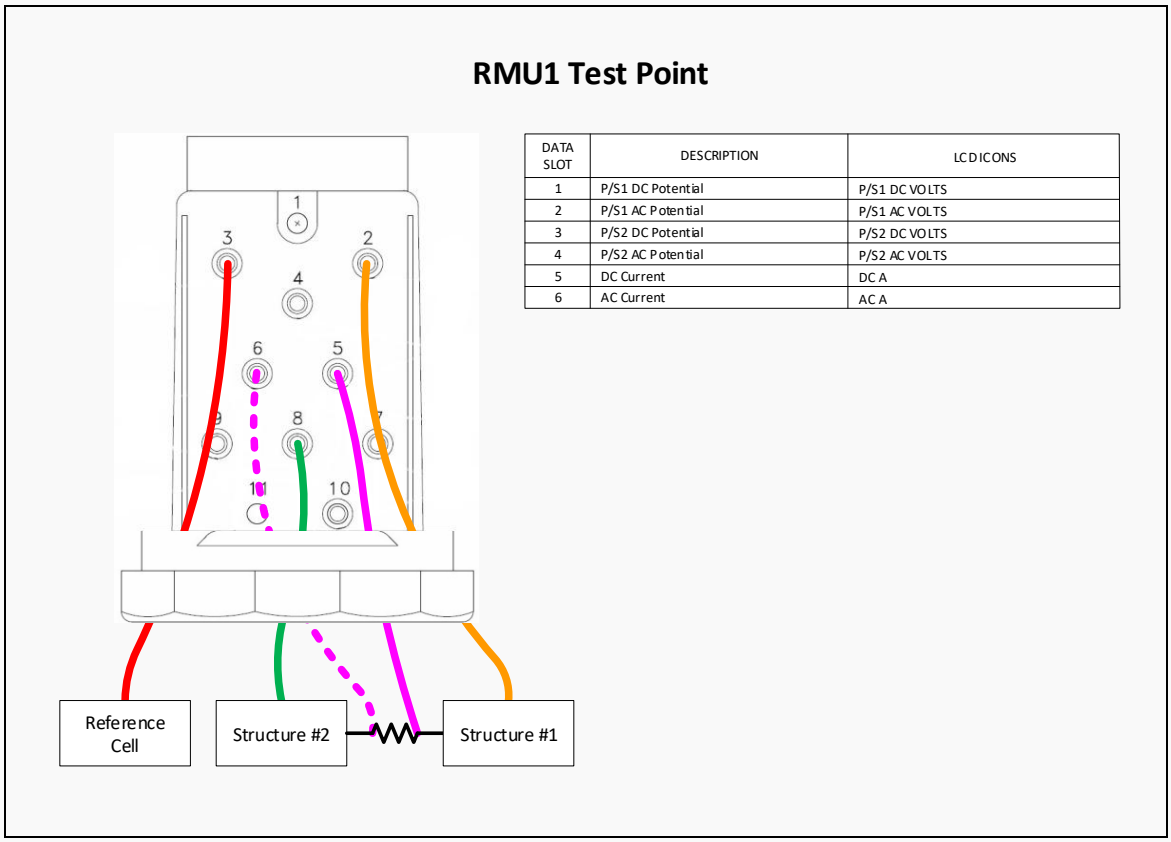
Figure 26 Single Coupon w/AC Mitigation Flex Connections (CP35)



DATA SLOT	DESCRIPTION	LCD ICONS
1	P/S1 DC Potential	P/S1 DC VOLTS
2	P/S1 AC Potential	P/S1 AC VOLTS
3	P/S2 DC Potential	P/S2 DC VOLTS
4	P/S2 AC Potential	P/S2 AC VOLTS
5	Bond DC Current	DC A
6	Bond AC Current	AC A

Figure 27 Bond Flex Connections (BOND36)

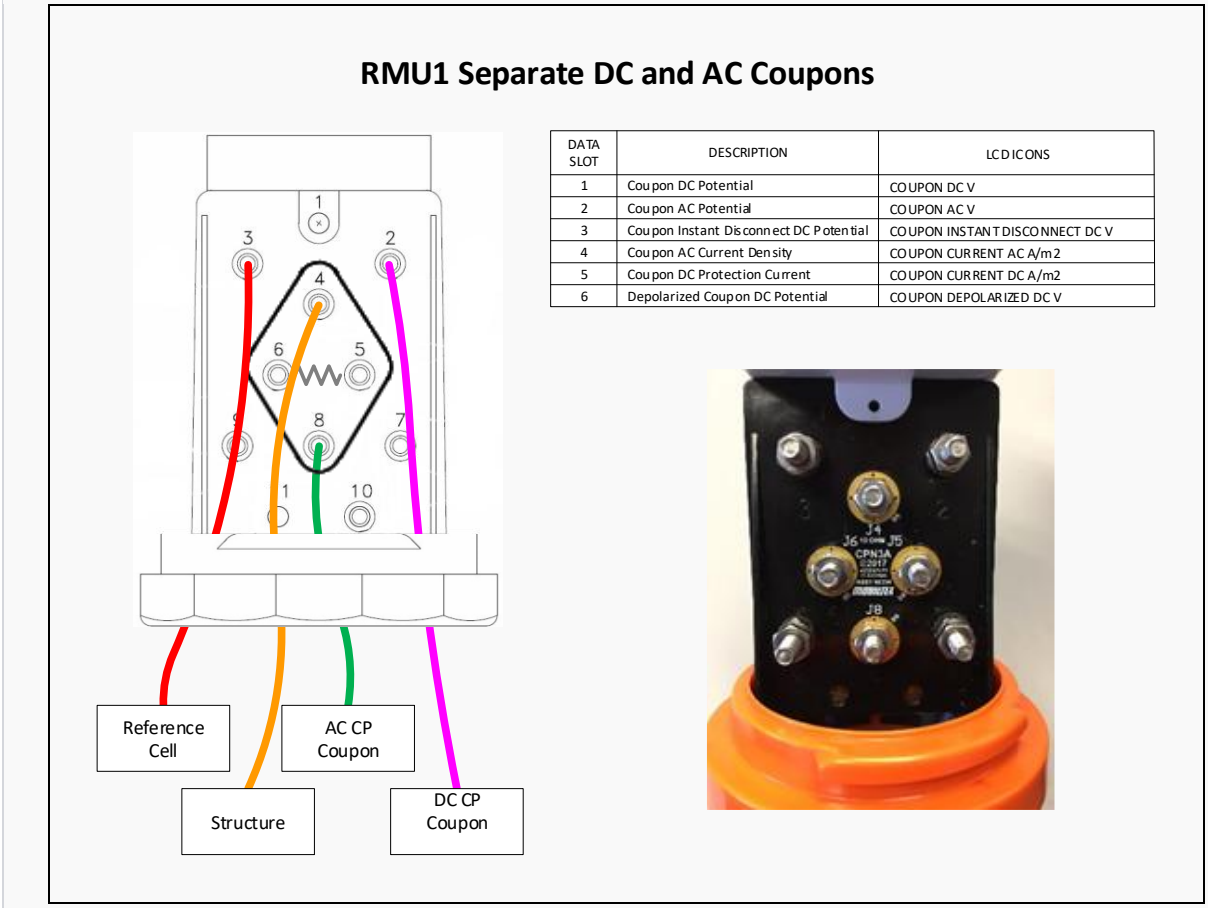
If BOND36 measurement type is selected when using the flex circuit, the Bond DC Current reading will have its polarity inverted. To mitigate this, please reverse the polarity of the scaling factor for the Bond DC Current (slot 5).



DATA SLOT	DESCRIPTION	LCD ICONS
1	P/S1 DC Potential	P/S1 DC VOLTS
2	P/S1 AC Potential	P/S1 AC VOLTS
3	P/S2 DC Potential	P/S2 DC VOLTS
4	P/S2 AC Potential	P/S2 AC VOLTS
5	DC Current	DC A
6	AC Current	AC A

Figure 28 Test Point Flex Connections (TP37)

If TP37 measurement type is selected when using the flex circuit, the DC Current reading will have its polarity inverted. To mitigate this, please reverse the polarity of the scaling factor for the DC Current (slot 5).



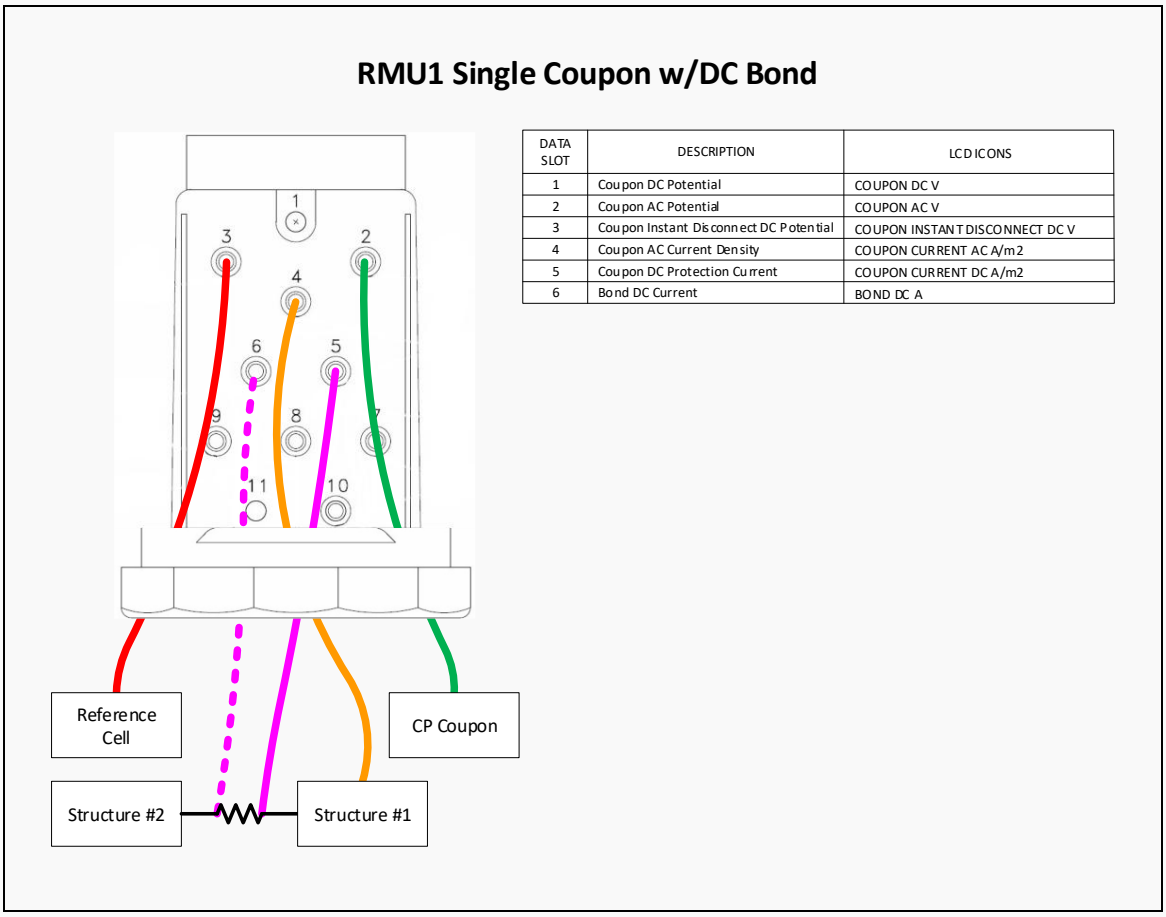
DATA SLOT	DESCRIPTION	LCD ICONS
1	Coupon DC Potential	COUPON DC V
2	Coupon AC Potential	COUPON AC V
3	Coupon Instant Disconnect DC Potential	COUPON INSTANT DISCONNECT DC V
4	Coupon AC Current Density	COUPON CURRENT AC A/m2
5	Coupon DC Protection Current	COUPON CURRENT DC A/m2
6	Depolarized Coupon DC Potential	COUPON DEPOLARIZED DC V

Figure 29 Separate AC/DC Coupons Flex Connections (CP38)

CPN3A can be installed as shown in the figure above; this board contains the necessary links and resistor.

Alternatively, external links between bolts 6-8 and 4-5 are needed. An external 10 ohm shunt resistor between bolts 5 and 6 is also needed.

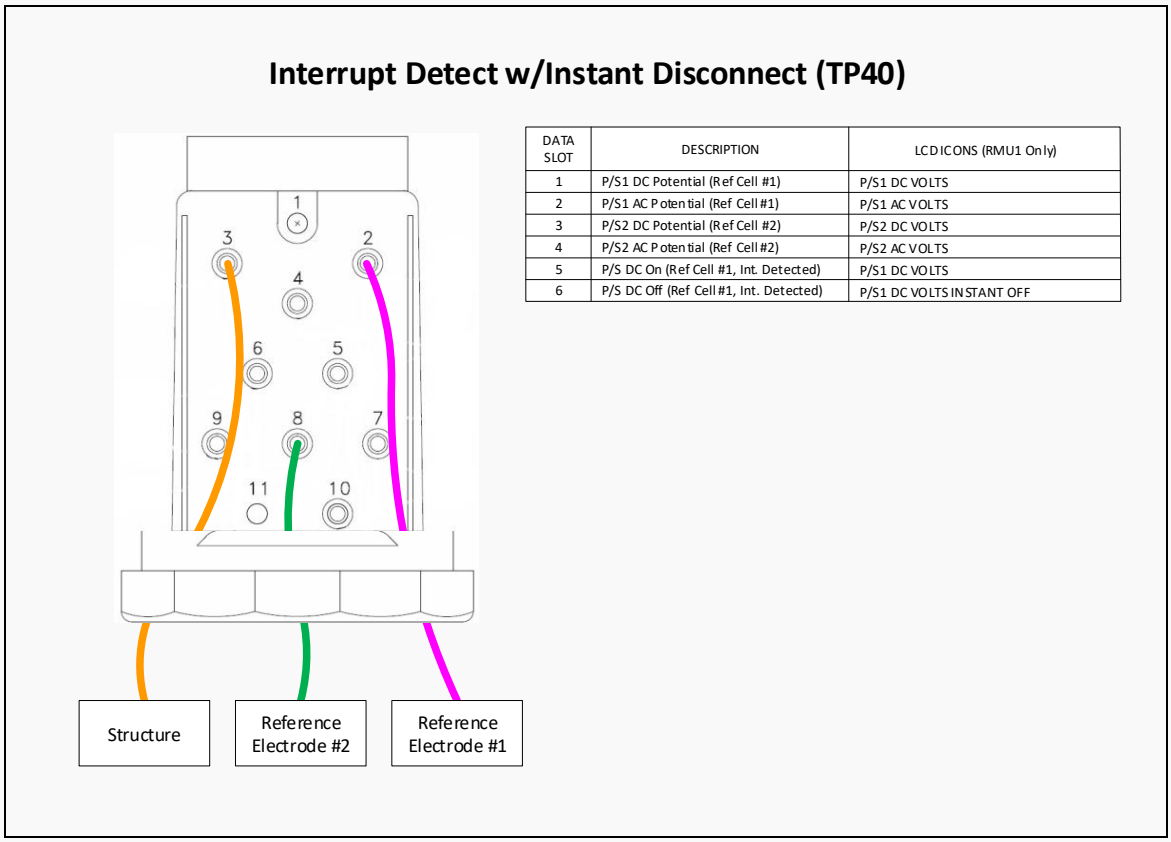
If the '**DC Current Density measurement from AC Coupon**' option is enabled with CP38 measurement type, and the hardware setup includes the flex circuit, the Coupon DC Current Density reading will have its polarity inverted. To mitigate this, please reverse the polarity of the scaling factor for the Coupon DC Current Density (slot 5).



DATA SLOT	DESCRIPTION	LCD ICONS
1	Coupon DC Potential	COUPON DC V
2	Coupon AC Potential	COUPON AC V
3	Coupon Instant Disconnect DC Potential	COUPON INSTANT DISCONNECT DC V
4	Coupon AC Current Density	COUPON CURRENT AC A/m2
5	Coupon DC Protection Current	COUPON CURRENT DC A/m2
6	Bond DC Current	BOND DC A

Figure 30 Single Coupon w/DC Bond Flex Connections (CP39)

If CP39 measurement type is selected when using the flex circuit, the Bond DC Current reading will have its polarity inverted. To mitigate this, please reverse the polarity of the scaling factor for the Bond DC Current (slot 6).



DATA SLOT	DESCRIPTION	LCD ICONS (RMU1 Only)
1	P/S1 DC Potential (Ref Cell #1)	P/S1 DC VOLTS
2	P/S1 AC Potential (Ref Cell #1)	P/S1 AC VOLTS
3	P/S2 DC Potential (Ref Cell #2)	P/S2 DC VOLTS
4	P/S2 AC Potential (Ref Cell #2)	P/S2 AC VOLTS
5	P/S DC On (Ref Cell #1, Int. Detected)	P/S1 DC VOLTS
6	P/S DC Off (Ref Cell #1, Int. Detected)	P/S1 DC VOLTS INSTANT OFF

Figure 31 Interruption Detection with On/Off Flex Connections (TP40)

Note that slots 5 and 6 map into CorView columns P/S3 DC Volts and P/S1 Instant Off respectively.

5.4 Isolated Digital Input

When enabled in the configuration, an isolated digital input is present on the pins labelled 'BOND-/MIT AC' and 'BOND+/MIT AC'. The input is bidirectional (polarity insensitive); an input signal with a magnitude greater than 3VDC will change the input to the active state. The digital input state may replace the transmission value for any data slot or the cap detector state by setting the appropriate options in the RMU1 configuration.

The isolated input may be used to monitor a dry set of contacts by wiring the contacts in series with an external power supply. See Figure 32 for a connection example. Other electronically switched voltage sources may also be used.

NOTES

- When using the isolated digital input, the analog measurement capability, for any measurement type slots that normally use the associated connector pins, will be disabled.
- The isolated digital input is not supported with the RMU1-LITE.

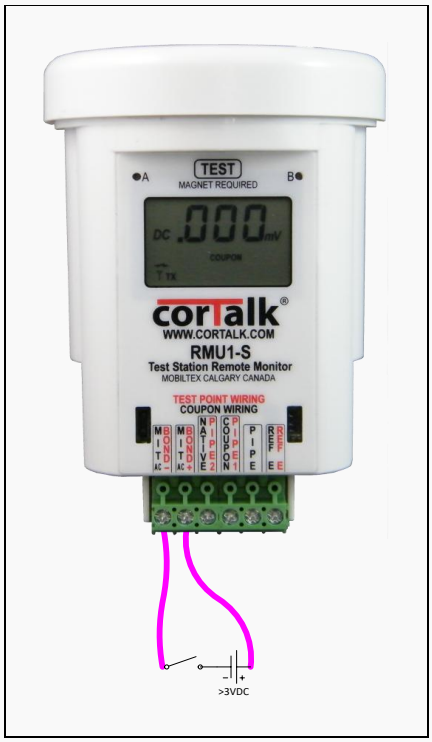


Figure 32 Isolated Digital Input Connection Example

5.5 Configuration

Once the coupon or bond is wired according to one of the diagrams, the measurement type, current shunt/transformer scaling factors (if used), and alarm limits (if used) should be programmed into the RMU1 using the RMU1PGM configuration tool (see section 6). The INT1 requires a new programmer cable, RMU1PGM, to accommodate the new port on the RMU1 G4.

5.6 Startup and Verification

- All wiring should be secured and inspected before the RMU1 is powered on.
- The RMU1 will start operation when the lid is screwed down. The lid should be turned an additional ½ turn after the switch click is heard in order to fully engage the sealing gasket.

Note that the unit will immediately power on when an INT1 or ERP1 is connected.

The lid on the RMU1 should still be screwed down to ensure full battery life of the unit.

- After the RMU1 is powered, observe that the RMU1 “Status” LCD indicator turns on (refer to section 5.7 for detailed LCD operation descriptions).

If the GPS receiver is enabled in the configuration, the RMU1 will display the ‘GPS’ icon on the LCD display and also show a number in the format of ‘X.YY’ where X is the number of satellites being received and YY is the average signal strength of those satellites.

The RMU1 will not send a power-up message or display measurements on the LCD screen until GPS signal acquisition is complete.

Note that transmissions from RMU1S field devices typically require from <1 minute (good antenna view of the sky) to 30 minutes (poor antenna view of the sky) to arrive at CorView. The delivery variability is because the RMU1S transmits the message a total of three times (for airtime plans with periodic reporting intervals greater than 6 hours) to help insure a high message delivery success rate, even under partially degraded sky view conditions.

The first transmission occurs within seconds of the measurement cycle.

Each of the two retransmissions occurs between 5 and 10 minutes of the prior transmission.

Transmissions from RMU1I and RMU1G devices should be received usually in less than one minute.

If the RMU1 programming interface is attached to the RMU1 at power-up, the power-up message will be delayed by 5 minutes.

- Place a magnet at the point labelled “TEST” on the RMU1 for between 1s and 5s to initiate an immediate measurement cycle and “Button Press” exception transmission to the CorView web host.

Note that a maximum of 6 “Test” transmissions are allowed during a 12-hour period.

Test transmissions are only possible after the initial RMU power-up message has been sent to CorView.

- 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 RMU1PGM configuration tool. 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.

5.7 Status Display



Figure 33 RMU1 Segment LCD and LED Status Indicators

The RMU1 has a segmented LCD display and two LED indicators (A and B, see Figure 33) that provide status information to the user. The RMU1-LITE does not have an LCD display, only the LED indicators are present.

The LCD and LEDs function as follows:

- The LED indicators are currently only used by the firmware loader function. They should remain off during normal operation.
- The LCD display is used to convey measurement value data and other status information.

A relay icon indicates when the coupon is connected/disconnected from the structure.

Additional icons indicate operation of the internal GPS receiver, transmitter activity, battery low status, and fault status.

The numeric display will cycle through all enabled measurement slots with a new slot shown approximately every three seconds.

The LCD display is active when the proximity sensor detects that the test station cap has been removed or when the programming interface is attached to the unit.

If the proximity sensor is not enabled, the LCD will only display for the first minute after the unit is powered on. To enable the LCD display in this case, place the test magnet in the location shown in Figure 34.

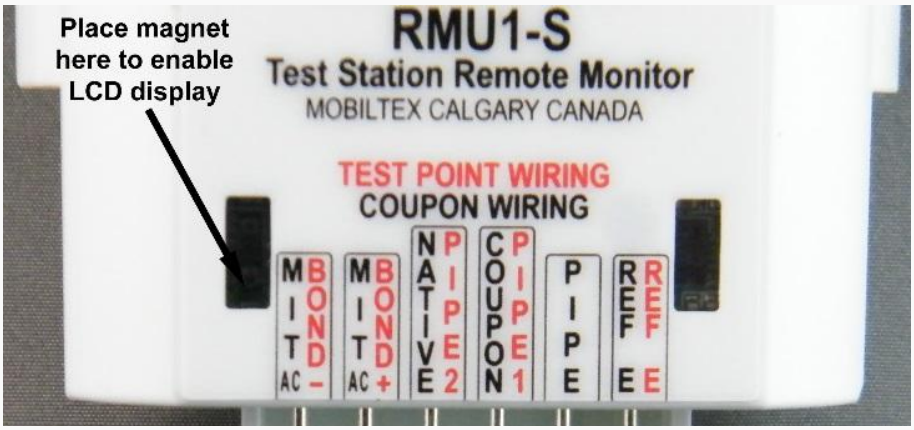


Figure 34 LCD Enable Magnet Location

- For details on icons displayed with each measurement, refer to section 5.2.
- A maximum magnitude of 1999 can be shown by the 3.5 digit display. Any values larger will be shown as 'OVR'.
- The following special icons are shown:

ICON	DESCRIPTION
	Coupon relay is closed. Pipe terminal is connected to coupon terminal.
	Coupon relay is open. Pipe terminal is disconnected from coupon terminal.
	Communications antenna is enabled. For the cellular or Iridium satellite version of the RMU1, an 'X' is shown through the antenna symbol if there is no coverage available. (Not used on the INT1)
	Communications antenna is transmitting. (Not used on the INT1)
	GPS receiver is powered on and acquiring position and time information. (Not used on the INT1)

WARN	Currently unused. Reserved for use in future firmware updates.
ALM	A fault condition exists. Use the RMU1 configuration software to retrieve further details.
LO BAT	The unit's batteries are low in capacity and should be changed at first opportunity.

Table 9 Description of Special LCD Icons

5.8 Coupon Disconnect

- The internal coupon to pipe connection relay may be manually placed into a disconnect state for single coupon measurement types (CP33 & CP38).
- Place a magnet over the "TEST" area for a duration longer than 5s to initiate this function. The LCD display will then show that the coupon relay has opened; in addition to the open switch symbol, the reading area will display '- [ ] -' while the function is enabled.
- Re-apply the magnet to the "TEST" area for an additional 5s to reconnect the coupon relay. The coupon relay will also automatically reconnect at the next wakeup interval of the RMU1.
- The coupon disconnect cannot be toggled if the RMU1 is currently performing a depolarization cycle. Note also that this function is only operational if the "Enable Depolarization" option is enabled in the unit configuration.

5.9 Accessory Installation

5.9.1 INT1 Cap Cover

- The INT1 may be provided pre-mounted to the mounting bracket with 4 #6 screws.
- When installing to the test station, the INT1 should be on the same side as the nuts of the test station terminal board. This allows the RMU1 to be easily

installed on the other side of the mounting and the connection cable to be easily routed between the two units.

- The two ends are different, with the smaller connecting to the RMU1 and the larger connecting to the INT1. This cable is critical for the INT1 to function.
- Once connected, the RMU1 will turn on, but be sure to still tighten the cap on the RMU1.

5.9.2 INT1 Down Pipe

- Test station riser tube must have an internal diameter greater than 3.125 inches (79.4mm).
- The INT1 may be provided pre-mounted to the mounting bracket with 4 #6 screws. It will be mounted upside down in the tube.
- The INT1 should be opposite the nuts of the test station terminal board and on the same side that the RMU1 will be installed on.
- The RMU1 is installed like normal at the top of the test station.
- After both are installed, use the cable provided to connect them. The two ends are different, with the smaller connecting to the RMU1 and the larger connecting to the INT1. This cable is critical for the INT1 to function.
- Once connected, the RMU1 will turn on, but be sure to still tighten the cap on the RMU1.

5.9.3 Test Station Shield for RMU1

This section details the CorTalk® test station shield for use with the RMU1 remote monitor. The shield provides electrical isolation intended to prevent users from contacting the exposed termination screws of a test station. Kit consists of a custom molded shield with integral mounting screw. The test station is not included with this kit. The shield is installed on the test station securing the RMU1 using the integral Philips head screw.



External View



Internal View



Typical Installation



Front and Side Views

Figure 35 Test Station Shield

The inside surface of the shield has 16 recessed circular locations that act as pilot drill locations to provide access to optional banana jack test point screws. The bottom portion of the cover has a recessed line that can be used as a cutting guide to remove the bottom portion of the cover for use in short test station applications.

5.9.4 Banana Jack Test Point Kit

This section details the CorTalk® banana jack test point kit. Kit contains:

- 5 banana jack test point ¼” screws
- 10 fiber washers
- 10 ¼” nuts
- 5 ¼” lock washers.

These screws provide an electrical termination point and the center of the screw includes a receptacle that accepts a standard test lead banana plug.

These banana jack test point screws replace the standard solid core ¼” screws utilized in most North American industry standard 3” test stations. Additional kits are required for test station installations requiring more than 5 termination points.



Kit Contents



Standard Screws



Screws Removed



Installed Kit

Figure 36 Banana Jack Test Point Kit

- The field installation process requires removal of the existing solid core ¼" screws present in the industry standard 3" test station.
- The banana jack test point screws are then installed in the desired hole locations of the test station.
- A fiber washer should be installed on the two surfaces that contact the plastic mounting surface of the test station.
- A ¼" nut is used to secure the banana jack test point screw and two fiber washers to the test station.
- The remaining ¼" nut and lock washer are used to secure the wiring termination.
- An optional test station shield can be installed to provide electrical isolation intended to prevent users from contacting the exposed termination screws of the test station.

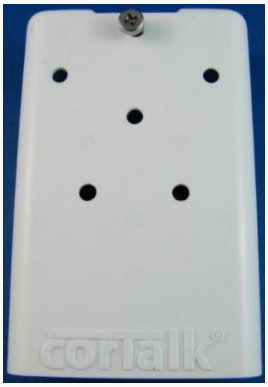
5.9.5 Shield Installation with Banana Jack Test Point Kit

The test station shield can be utilized with the banana jack test point kit to provide an electrically isolated enclosure with banana jack test lead access. The prior section details installation of the banana jack test point kit.

- For this application banana plug access holes need to be drilled into the test station shield. The inside surface of the shield has 16 recessed circular locations that act as pilot drill locations to provide access to the banana jack test point screws.
- Drill a 3/16” (4.5mm) hole in each location that banana jack test point access is required.
- The drilled shield is then installed on the test station securing the RMU1 using the Philips head screw.



Internal View c/w Drilled Holes



External View c/w Drilled Holes



Installed with RMU1



Banana Test Leads

Figure 37 Shield Installation with Banana Jack Test Point Kit

5.9.6 ERP1 Down Pipe

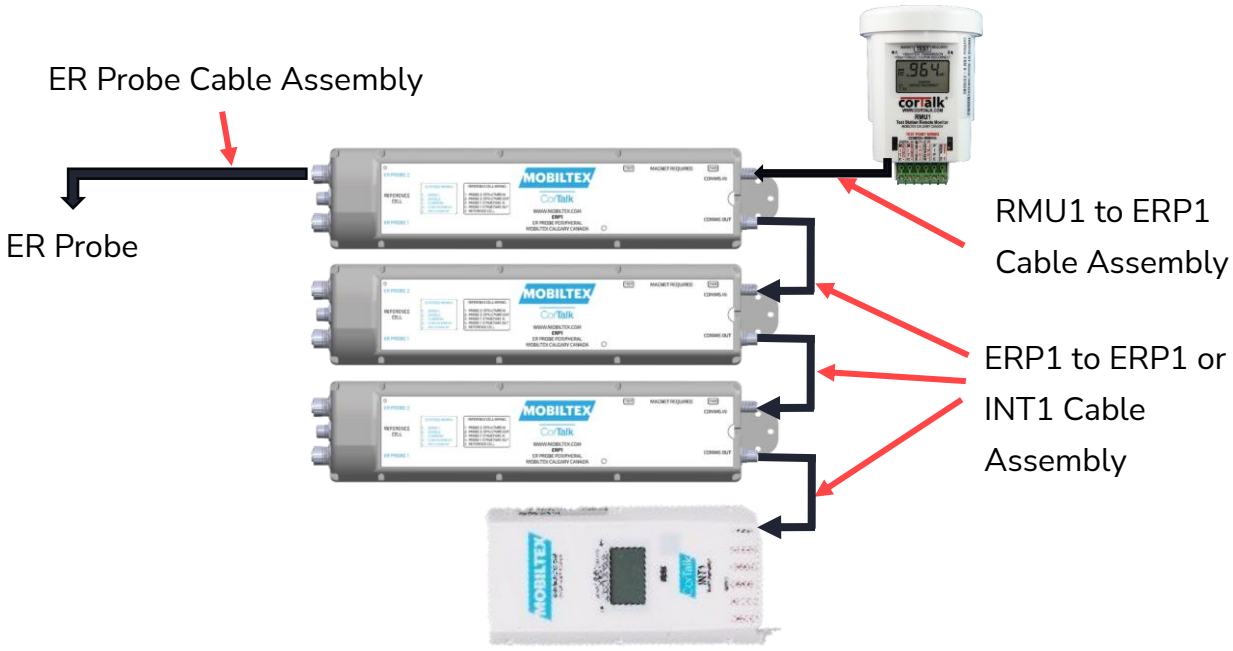
- Test station riser tube must have an internal diameter greater than 3.125 inches (79.4mm).
- The ERP1 may be provided pre-mounted to the mounting bracket with 4 #6 screws. It will be mounted upside down in the tube.
- The EPR1 should be opposite the nuts of the test station terminal board and on the same side that the RMU1 will be installed on.

- The RMU1 is installed like normal at the top of the test station.
- After both are installed, use the cable(s) provided to connect them. The two ends are different, with the smaller connecting to the RMU1 and the larger connecting to the INT1. This cable is critical for the ERP1 to function.
- Once connected, the RMU1 will turn on, but be sure to still tighten the cap on the RMU1.

5.9.7 ERP1 Down Pipe & INT In Tall Test Station

- Test station riser tube must have an internal diameter greater than 3.125 inches (79.4mm).
- The ERP1 may be provided pre-mounted to the mounting bracket with 4 #6 screws. It will be mounted upside down in the tube.
- The RMU1 & INT1 may be provided pre-mounted to tall test station as normal.
- The EPR1 should be opposite the nuts of the test station terminal board and on the same side that the RMU1 will be installed on.
- After all units are installed, use the cable(s) provided to connect them. The cable from the RMU1 may need to be extended using a M8 extension cable to reach the ERP1 down the pipe. Connecting the ERP1 to the INT1 can be done using M8 extension cable.
- Once connected, the RMU1 will turn on, but be sure to still tighten the cap on the RMU1.

5.9.8 ERP1 Wiring



5.9.8.1 ER Probe Setup

The wiring is the same for either channel i.e. ER PROBE 1 or ER PROBE 2

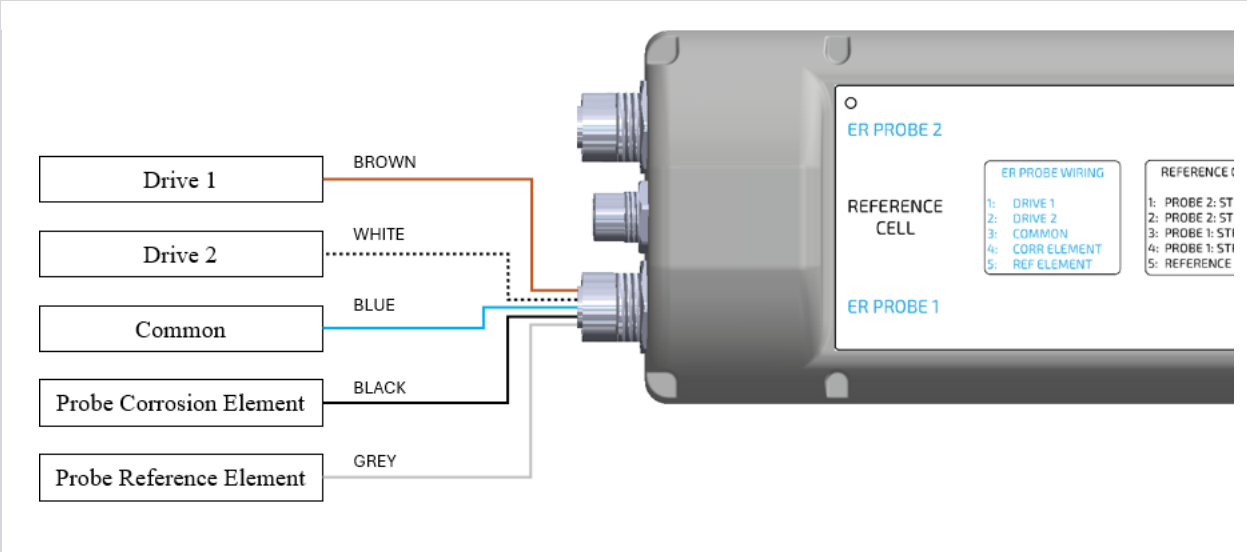


Figure 38: ER Probe Connections

5.9.8.2 Reference Cell & RTD Element Setup

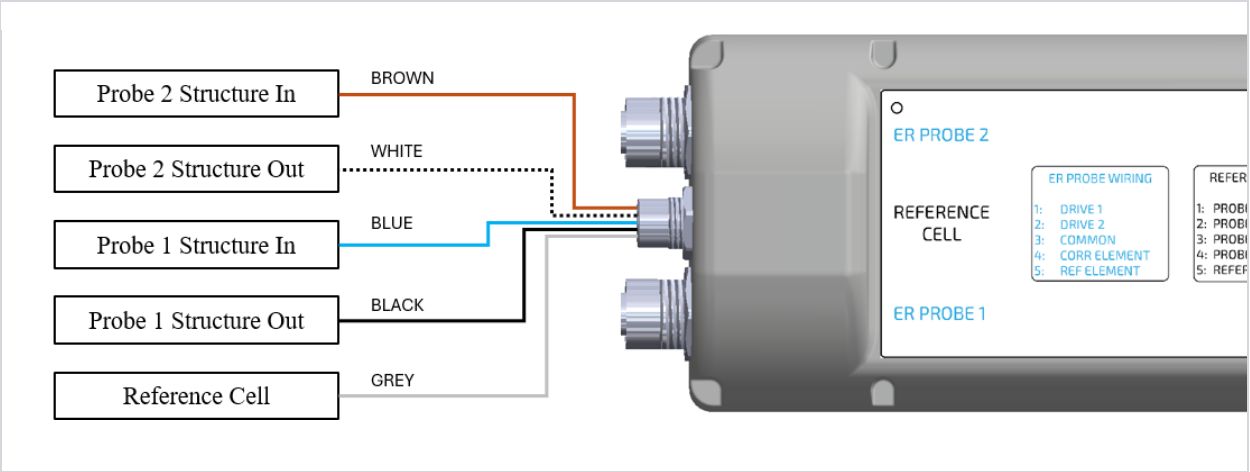


Figure 39: Reference Cell & RTD Element Connections

6 Configuration Using a PC

6.1 Configuration Equipment Requirements

The following items will be needed when configuring an RMU1.

1. RMU1 Programming Interface or RMU1/2/3 Programming Interface with RMU1ADP

The RMU1 programming interface is shown in Figure 40. It has one cable exiting, a USB cable that attaches to a PC. The interface is powered from the PC USB port, so an external power supply in not required.

The RMU1/2/3 programming interface and RMU1ADP adapter are shown in Figure 41. The RMU1ADP cable is plugged into circular connector on the RMU1/2/3 programming interface labelled 'TO RMU1/2/3 BASE". The interface is powered from the PC USB port, so an external power supply in not required.

2. Programming Application

Drivers and application for the RMU1 programming interface can be downloaded from the Mobiltex support site. Contact your Mobiltex representative for download instructions.

3. Personal Computer (PC)

The application software and drivers require that the PC be running Windows 7 or higher for an operating system. The PC must have an available USB port.



Figure 40 RMU1 Programming Interface



Figure 41 RMU1/2/3 Programmer With RMU1ADP

6.2 Software Installation

To install the configuration application and driver software, use Windows Explorer to navigate to the drive and directory containing the installation software downloaded from the Mobiltex support site. Double-click on the “CORTALKINSTALLER.exe” application. The dialog on Figure 42 will appear.

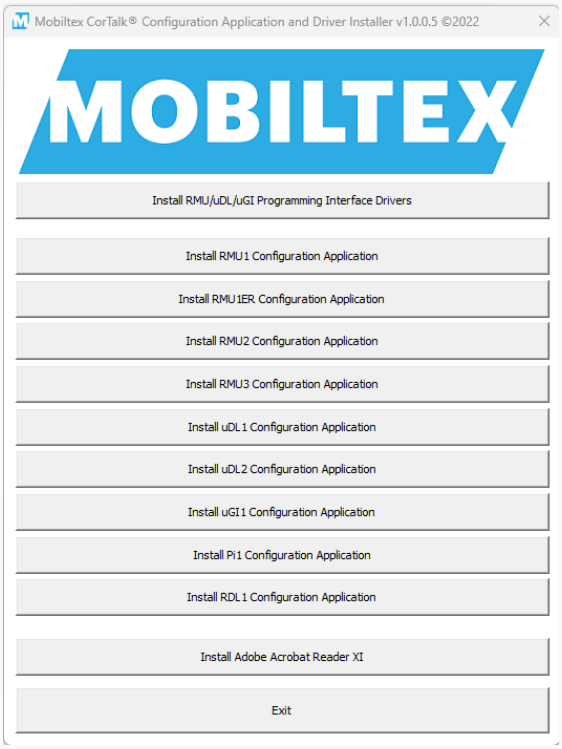


Figure 42 RMU1Installer Dialog

6.2.1 Driver Installation

From the RMU1 Installer screen, click the “Install RMU/uDL/uGI 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.

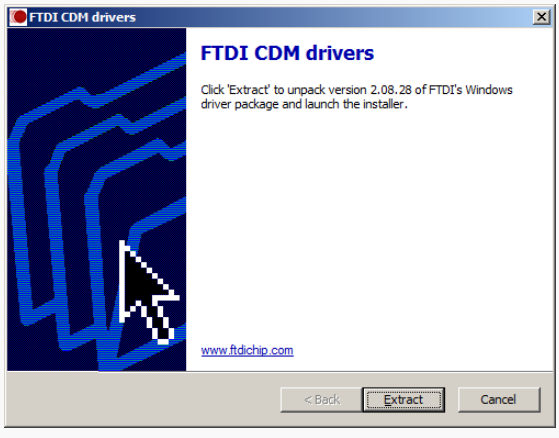


Figure 43 Driver Installation Screen

Once the driver installer completes, you may then plug in the RMU1 programming 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 RMU1 programming 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 44 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.

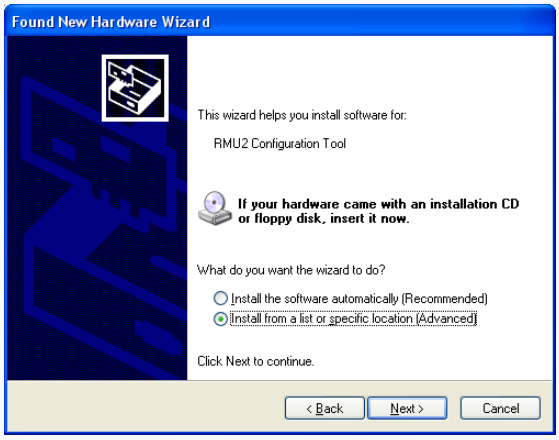


Figure 45 Driver Installation - Install From Specific Location

Choose to install from a specific location since you have the 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 46.

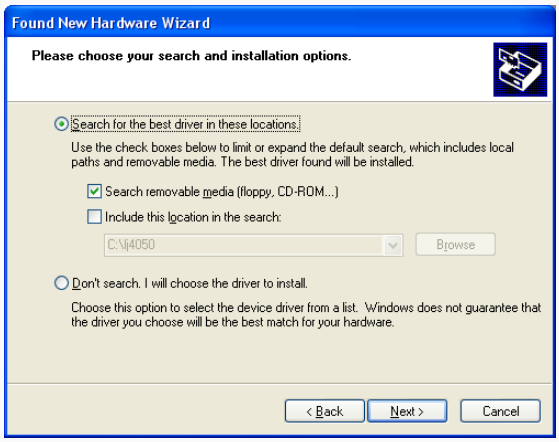


Figure 46 Driver Installation - Driver Location Selection

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.

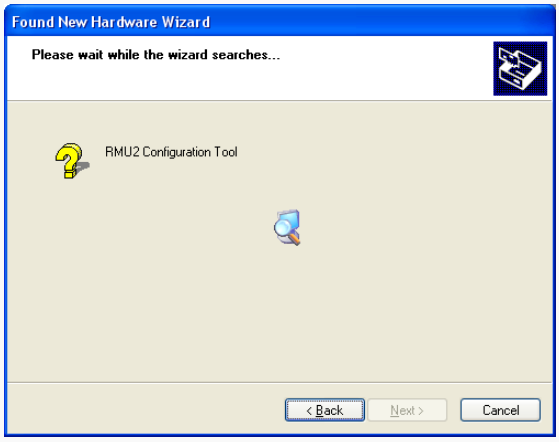


Figure 47 Driver Installation - Driver File Search

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.

6.2.2 Configuration Application Installation

Click on the “Install RMU1 Configuration Application” button to start the application installer. A security warning dialog may appear. Click the “Run” button to continue.

The following dialog should now appear:

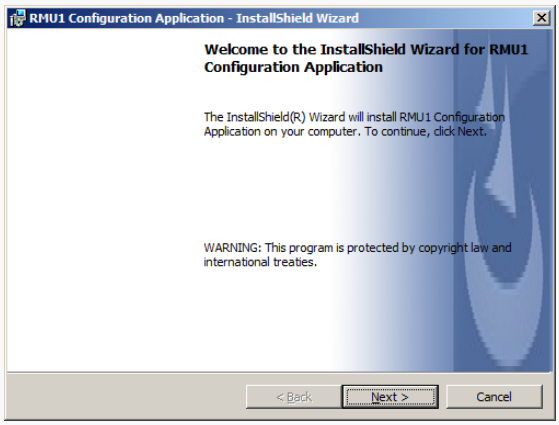


Figure 48 RMU1 Configuration Application Installation Dialog

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 49. Click “Close” to complete the installation.

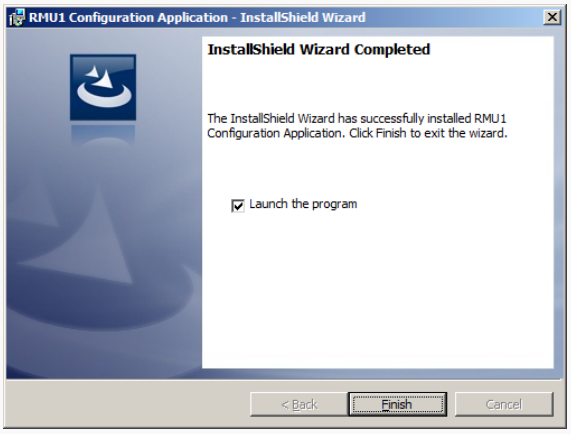


Figure 49 RMU1 Configuration Application Installation Complete

A shortcut to the configuration application and the RMU1 manual are created in the Windows start menu under the “RMU1 Configuration Application” folder.

6.3 RMU1 Configuration

- Attach the supplied USB cable between the PC and the programming interface.
- Place the programming interface on the RMU1 unit as shown in Figure 50. The programmer alignment plate will wedge between the green terminal block and the body of the RMU1.



Figure 50 RMU1 Programming Interface Installation

- Start the configuration software by clicking on “RMU1 Configuration” shortcut in Windows start menu, under the “RMU1 Configuration Application” folder.

- 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.

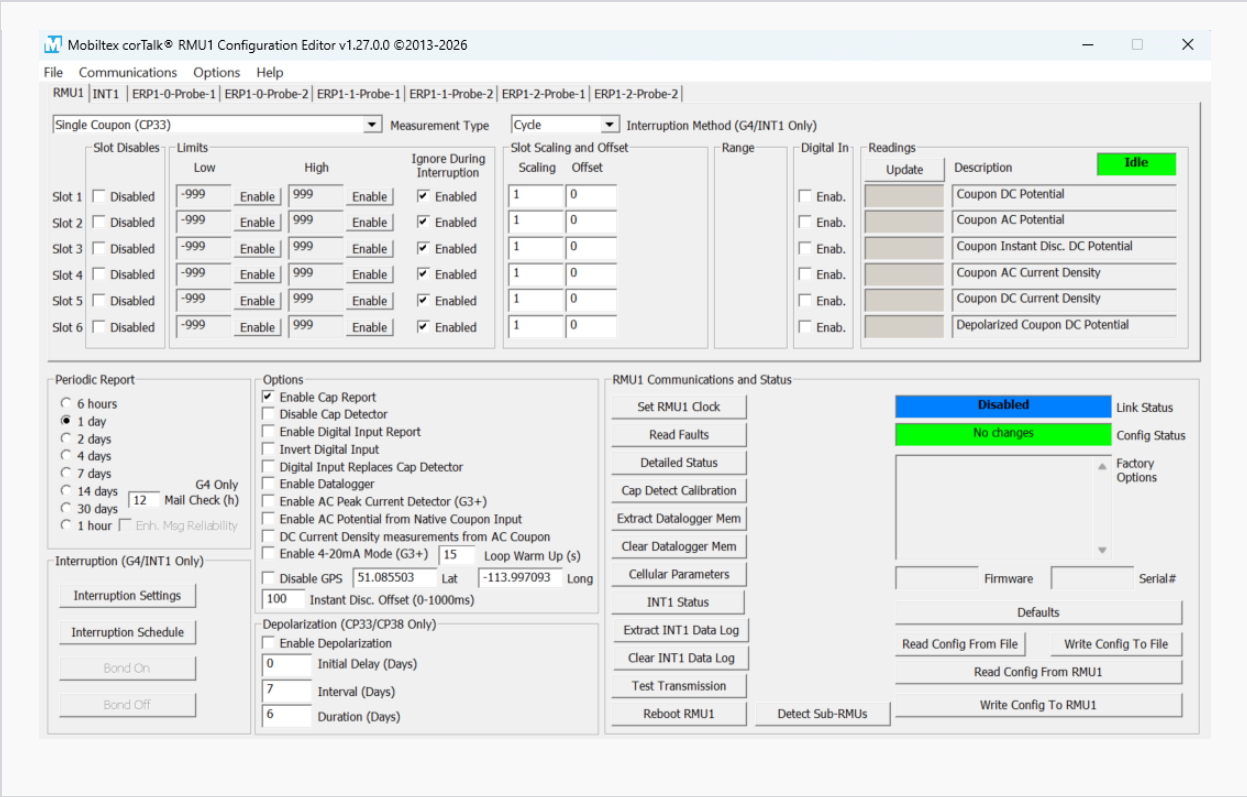


Figure 51 RMU1CONFIG Main Screen

- Next, attach the programming interface to the RMU1 that requires programming.
- The first step in configuring a device is to read in the current settings from the unit.

Click on “Read Config From RMU1”. The “Link Status” field will briefly show “Busy” as the current configuration parameters are read from the RMU1.

After the link status returns to “Idle”, you will see the configuration settings currently in the RMU1.

If the RMU1 is not responding or not connected, an error dialog will pop up.

- Once communications have been established with the RMU1, the RMU1 parameters can be configured for the requirements of a particular installation site.

6.3.1 RMU1 Communications and Status

"RMU1 Communications and Status" is used for reading and programming the RMU1. It also displays some status information.

6.3.1.1 Link Status

This field has three settings:

- **Disabled** – Serial port is not connected to the programmer
- **Idle** – Programmer is connected but there is no activity
- **Busy** – Programmer is trying to communicate with the RMU1

6.3.1.2 Firmware Version

This field contains the version number of the application code installed in the main processor of the RMU1. RMU1-LITE devices will be identified as "LITE".

6.3.1.3 Serial#

The manufacturing serial number of the RMU1 is indicated in this field.

6.3.1.4 Read Config From RMU1

This is used to get the current values configured in the RMU1. Note, if you have changed the values in any of the configuration groups, the changes will be over written by pressing this button.

6.3.1.5 Write Config To RMU1

Once all the configuration settings are set to the appropriate specifications, the unit can be configured by pressing the "Write Config to RMU1" button. The write can be confirmed by pressing the "Read From RMU1" button to ensure the values are the same.

6.3.1.6 Defaults

The RMU1 contains factory defaults that can be loaded using this button. This allows for easy return of a unit to a known state. "Write Config to RMU1" must be pressed to write the parameters to the active configuration in the RMU1. The programming interface must be attached to the RMU1 for this function to operate.

6.3.1.7 Set RMU1 Clock

When the GPS receiver is disabled in the configuration, the clock on the RMU1 may be updated from the PC using this button. Note that the RMU1 clock setting is lost whenever the RMU1 is powered down by unscrewing the lid.

6.3.1.8 Read Faults

If the RMU1 detects an operational fault, it will record the event in memory. Clicking the 'Read Faults' button will retrieve this history for display. The fault history may be cleared by clicking the 'Clear Fault History' button in the displayed dialog.

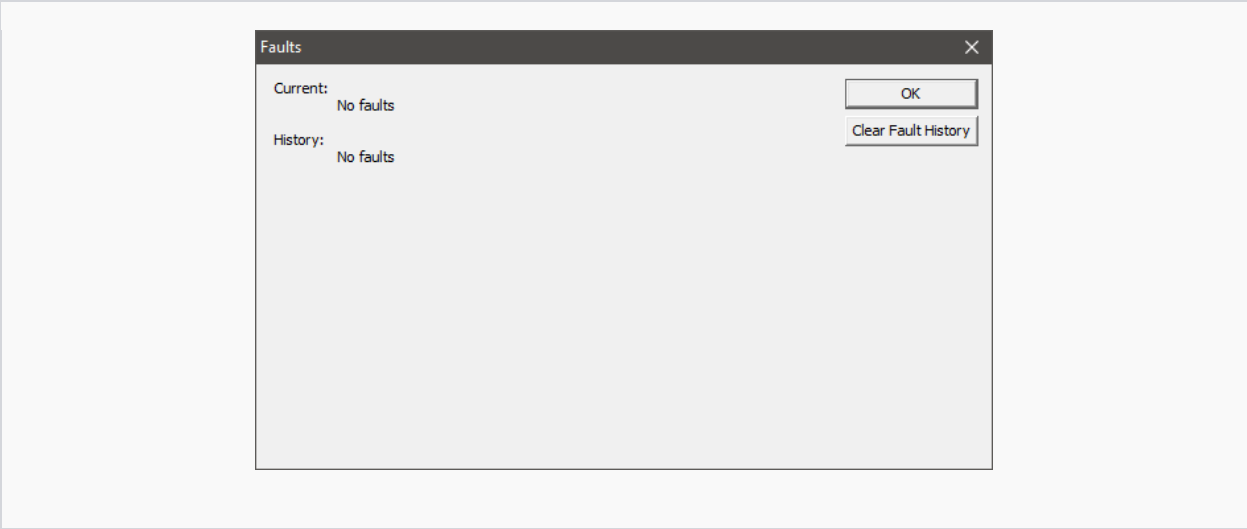


Figure 52 Faults Dialog

6.3.1.9 Detailed Status

Clicking the 'Detailed Status' button will display a dialog (see Figure 53) with detailed RMU1 information. The display is broken into several areas including GPS, communications, battery, faults, real time clock, and calibration. In the event that a problem is encountered with the operation of the RMU1, Mobiltex may request a screen shot of this dialog to aid in diagnostics.

The ESN shown in the comms status area is the value used by CorView to track communications with the device. Unit Type will be appended with "LITE" for RMU-LITE devices.

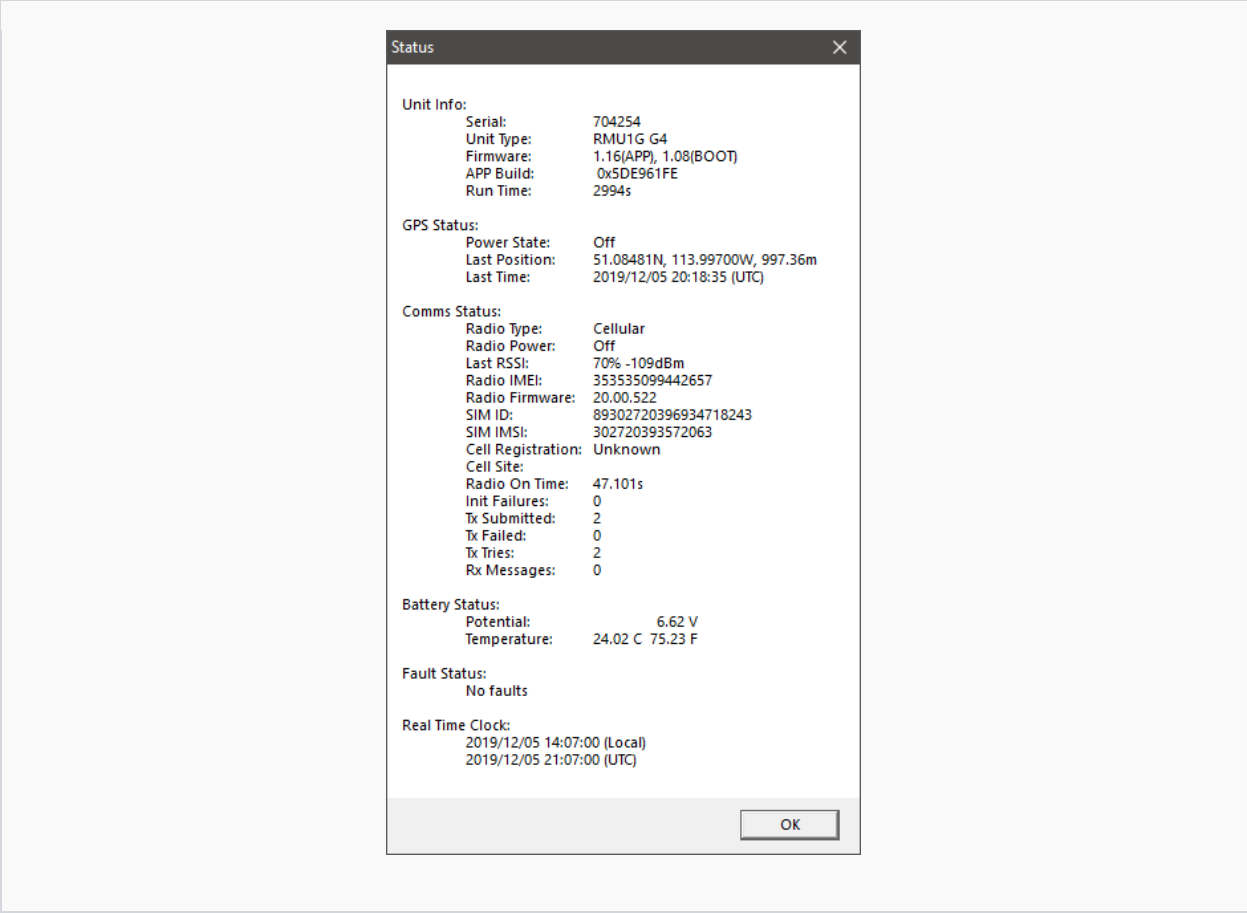


Figure 53 Detailed Status Dialog

6.3.1.10 Cap Detect Calibration

The RMU1 is equipped with a non-contact sensor (see Figure 55) that can detect when a test station cap is installed over the RMU1. This sensor may require calibration to operate correctly. In the event that a cap is not detected properly, click the 'Cap Detect Calibration' button. The following dialog will pop up.

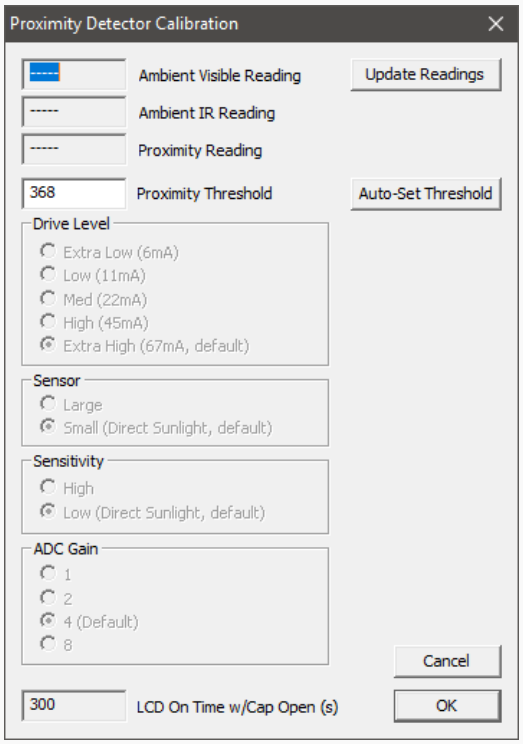


Figure 54 Cap Detect Sensor Calibration Dialog

- Click the 'Auto-Set Threshold' button while the test station cap is not installed. Ensure that nothing is obscuring the proximity sensor window on the RMU1.
- A new threshold value will be determined based on the current sense levels.

The new threshold will become active immediately after clicking the 'OK' button on the dialog.

Pressing 'Cancel' will revert to the prior threshold levels.

Cap Detect Calibration is not supported with RMU1-LITE devices.

- During normal operation, ensure that no wiring or any other objects are blocking the proximity sensor window from being able to 'see' the test station cap when it is installed.



Figure 55 RMU1 Cap Proximity Sensor

6.3.1.11 Extract Datalogger Mem

The 'Extract Datalogger Mem' button allows readings stored in the internal memory to be extracted to a comma-separated-value (CSV) file format that can be used with a spreadsheet application. This function requires the factory-enabled datalogger option be present on the RMU1.

- After clicking the button, the contents of the datalogger memory will be transferred from the RMU1.
- After the transfer is completed, a prompt will appear for the target file name.
- The resulting file may be opened for analysis in various applications that support the CSV format.

6.3.1.12 Clear Datalogger Mem

The 'Clear Datalogger Mem' button allows the RMU1 datalogger memory to be reset back to a blank state. This function requires the factory-enabled datalogger option be present on the RMU1.

- After clicking the button, a confirmation prompt will appear.
- If confirmation is given, then a progress display will be shown as the RMU1 memory is erased.

6.3.1.13 Test Transmission

A test message can be sent to CorView by clicking on the 'Test Transmission' button. The RMU limits the number of test transmissions possible to six in a 12 hour period. Subsequent test transmission attempts will be ignored.

6.3.1.14 Reboot RMU1

Click the 'Reboot RMU1' button to restart the RMU1.

6.3.1.15 Detect Sub-RMUs

When ERP1s and/or INT1 are connected to the RMU1, but their serial numbers do not appear under the "Connected sub-RMUs" section in Detailed Status dialog, click on the 'Detect Sub-RMUs' button. Wait for the "Detected subRMU command success" dialog, then click on 'Write Config To RMU1' to save the connected sub-RMU information to the RMU1. After the write, check Detailed Status again, and the serial number of the connected ERP1 and/or INT1 should appear under the Connected sub-RMUs section.

6.3.2 Measurement Type

Select the measurement type according to the installation application of the RMU1. Refer to section 5.2 for detailed descriptions of each measurement type.

6.3.3 Measurement slots Configuration

The RMU1 can transmit 6 slots of analog information to CorView. The INT1 allows for sending and addition 6 slots of information. The contents of each slot are determined by the selected measurement type. Refer to section 5.2 for detailed descriptions of each measurement type, including the information transported in each slot. A description of each data slot is also provided in the 'Readings' area of the configuration screen.

The RMU1 and INT1 slots are differentiated by tabs. Select the tab for the unit you want to configure. Both the RMU1 and INT1 configurations are sent to the RMU1 regardless of the active tab.

Each data slot may have the following attributes modified:

- The slot may be disabled if the measurement is not needed
- Low and high limit alarms may be set
- The limit check can be ignored during interruption (preventing spurious alarms)
- The reading taken at the physical inputs may be scaled and offset for transmission
- The input range may be selected for current inputs
- The data slot analog measurement may be replaced with the isolated digital input state

The following ranges apply to coupon current and bond shunt measurements for the RMU1:

Coupon Current	+/-6mADC, 4.25mAAC, Low Range +/-60mADC, 42.5mAAC, Med Range +/-200mADC, 140mAAC, High Range
Bond Shunt	+/-6mVDC, 4.25mVAC, Low Range +/-60mVDC, 42.5mVAC, Med Range +/-200mVDC, 140mVAC, High Range

A convenient coupon calculator is provided for setting the scaling factor when coupon current density or bond current is desired instead of raw current measurements.

The following ranges apply to bond current and structure potential measurements for the INT1:

Potential	+/-31VDC, 22VAC
Bond Current	+/-300mADC, 210mAAC, Low Range +/-3ADC, 2.1AAC, Med Range +/-10ADC, 7AAC, High Range

6.3.4 Depolarization (CP33 and CP38 Measurement Types Only)

Depolarization may be enabled in single coupon modes CP33 and CP38. Depolarization parameters allow the RMU1 to disconnect the DC coupon from the structure for configurable amounts of time at periodic intervals. Coupon potential readings taken at the end of depolarization cycle (assuming long enough disconnect duration is configured) will be equivalent to a native coupon potential reading.

- The '**Initial Delay**' parameter sets how long, in days that the RMU1 will wait after a power-up before initiating the first depolarization cycle. When set to a value of 0, the RMU1 will wait one wakeup cycle (6 hours) before disconnecting the coupon.
- The 'Interval' parameter sets how often a depolarization cycle occurs.
- The 'Duration' parameter set how long the coupon is disconnected from the structure for each depolarization cycle. The duration parameter must be less than the interval parameter.

6.3.5 Periodic Report Interval

The periodic report interval determines how often the RMU1 will send scheduled readings to CorView. This parameter is normally locked down at the factory according to the purchased airtime plan.

For 1 hour reporting plans, an extra option labelled 'Enh. Message Reliability' is present that is only applicable to the RMU1S. To increase battery life, this option should be left unchecked. However, if the unit is installed in a challenging RF environment and message loss is apparent, then the option should enabled.

Note that the RMU1I and the RMU1G will collect readings at a different rate than the transmission rate for readings periods less than a day. For example, units that take periodic readings every hour will transmit a batch of 12 readings every 12 hours. Similarly, units that take periodic readings every 6 hours will transmit a batch of 4 readings every 24 hours.

If satellite/cellular coverage is inadequate for successful data transmission at the scheduled time, the unit will continue to accumulate readings and try to send the data at a later periodic reading interval. The RMU1I/G can buffer up to 16 readings for

transmission; if the unit is unsuccessful at sending the readings to CorView at that point, the oldest reading in the buffer will be discarded to make room for the next periodic reading measurement.

The '**Mail Check (h)**' parameter works with RMU1 G4 units only. It defines how often the RMU1 checks for messages and commands from CorView. The interval is in hours and it must be a multiple of the RMU1's wake up interval. For a unit with a 1 hour Periodic Report plan, the wake up interval is 1 hour. For any other reporting plans, the wake up interval is 6 hours.

6.3.6 Interruption – RMU1 G4 and INT1 Only

Only RMU1 G4 units can handle interruption. Like our other interruption capable products, schedule and waveform parameters can be set by the configuration software. Unlike some of our other products, the relays are internal to the INT1 and the RMU1, so their dwell parameters are internal to the units.

- The Control page in CorView can be used to send interruption commands to the RMU1.
- The Interruption Settings and the Interruption Schedule apply to both the RMU1 and the INT1.
- The Interruption Method (under the unit tab) is independent and specific to its unit.
- The Cycle Time is the sum of the On Time and Off Time parameters.
- At the top of the minute the interruption cycle will be synchronized by resetting the cycle again regardless of its state. For this reason, it is wise to choose a Cycle Time that evenly divides into 60 seconds to eliminate any cycle clipping.
- The UTC Offset is used to synchronize the RMU1 operation to match another venders' equipment.

NOTES

- NOTE: The RMU1 G4 will only check in every 12 hours so interruption should be scheduled at least a day in advance.
- For more immediate operation, the interruption can be set using the configuration software locally while on site.

A UTC Offset of 0ms matches UTC time exactly.

An offset of 5000ms will lag the UTC time by 5 seconds and -2000ms will lead the UTC time by 2 seconds.

- The “On First” checkbox will reverse the order of interruption such that the on portion of the interruption cycle will start at the top of the minute. By default, it is unselected, and the off portion of the cycle will start at the top of the minute.
- The Interruption Schedule start time/date can be set in addition to its Duration and Daily Repeats. For example, if the interruption starts on Monday at 9am, it can be set to 480 minutes with 4 daily repeats to interrupt 8 hours every day until Friday.
- The INT1 bond connections can be directly tested with the Bond On and Bond Off commands. The continuity of the bond can then be tested with a multimeter.
- The Interruption Method is specific to the unit, so the INT1 and the RMU1 can have separate interruption methods. There are 3 interruption methods: Cycle, Envelope and Ignore.
- The Cycle method is what is normally considered interruption providing a square wave output by opening (disconnecting) and closing (connecting) the relay.

The Envelope method opens the relay for the entire period of the interruption each day. It then closes it when interruption is over.

The Ignore method keeps the relay closed for the duration of the interruption period.

Both the Envelope and Ignore method take an unsynchronized instant off measurement before starting interruption while the cycle method takes a synchronized instant off reading.

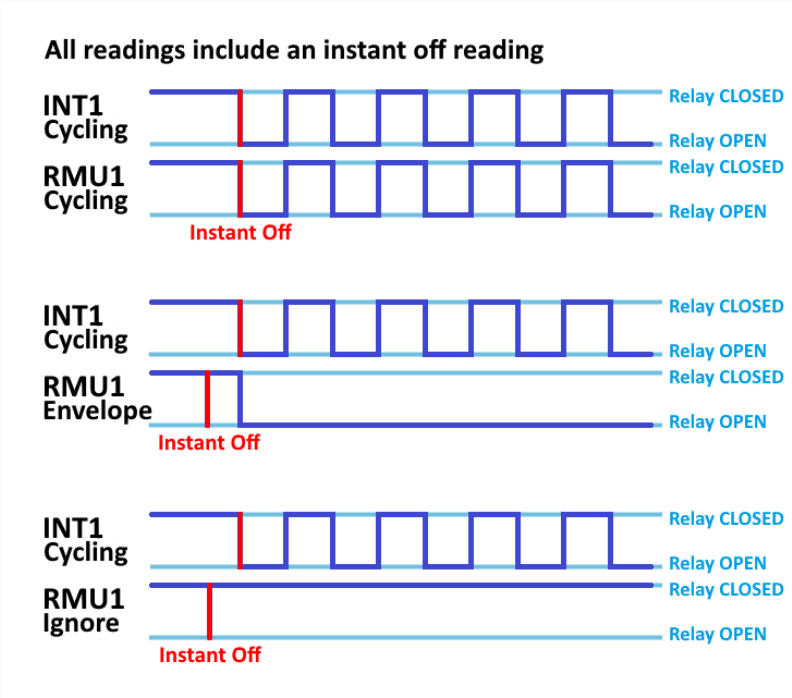


Figure 56 Interruption Methods

6.3.7 Options

Several options are available that affect the operation of the RMU1.

- The '**Enable Cap Report**' option allows the RMU1 to send an exception report to CorView whenever a transition is detected on the cap detection sensor. The cap detection sensor is an infrared proximity sensor unit that detects an installed cap by the amount of infrared light reflected by the cap.

If this option is enabled, every time the cap is removed or installed, a reading set will be taken and sent to CorView.

As with other exception messages, a maximum of 6 messages can be sent in a given 12 hour window; any additional transitions will be ignored.

This feature requires airtime Option 2 – "Add cover removal exception reports to any plan" (RMU1OPTION2). Not supported with RMU1-LITE devices.

- The '**Disable Cap Detector**' option disables the cap infrared proximity sensor. This option is typically used to increase battery life on the RMU1.

When cap detector is disabled, the LCD display will not turn on if the test station cap is removed.

To temporarily turn on the LCD when this option is checked, apply a magnet near the green measurement terminal block.

Not supported with RMU1-LITE devices.

- '**Enable Datalogger**' allows readings to be stored to local non-volatile memory. This option is usable only if the factory datalogger option (Option 3) is enabled on the RMU1.

The stored readings can be extracted by using the 'Extract Datalogger Mem' button under the 'RMU1 Communications and Status' area.

The datalogger memory will hold approximately 174,000 readings sets before filling.

At a 1 hour measurement rate, approximately 20 years of measurement data can be stored locally.

- '**Enable AC Peak Current** Detector' enables the AC peak current density detector mode on the RMU1. Firmware v1.10 or higher is needed with a G3 or newer RMU1.

When enabled, the RMU1 will, while sleeping, sample the coupon current density at set intervals (default 20s) and trigger a unit wake-up and full measurement if the sampled AC current density value is above the associated slot high limit (must be set for operation).

If activated, short AC transients (<30s) can be captured by the RMU1 and exception messages sent to CorView.

When the signal again drops below the threshold value, the RMU1 requires a minimum amount of time (default 5 min) of signal below threshold before a clear exception is sent to CorView.

Exception messages counts are limited in manner similar to the cap detector function. This feature requires RMU1 Option 5 to be purchased for operation.

The peak detector is inoperable while the RMU1 programming interface is attached.

This option is not available with the RMU1S or RMU1_LITE devices.

- '**Enable** Digital **Input Report**' causes an exception report to be sent to CorView when the state of the isolated digital input changes.

As with other exception messages, a maximum of 6 messages can be sent in a given 12 hour window; any additional transitions will be ignored.

This feature requires airtime Option 4.

Not supported with RMU1-LITE devices.

- '**Invert** Digital Input' inverts the reported state of the digital input.

- 'Digital Input Replaces Cap Detector' allows the digital isolated input to replace the cap state information that is transmitted to CorView. The digital input state would then be shown in CorView as the cap state.

Not supported with RMU1-LITE devices.

- The '**Disable GPS**' option turns off the RMU1 automatic location determination and real-time clock synchronization. The GPS receiver could be disabled for several reasons.

The first reason is to maximize battery life.

The second use would be if the RMU1 is installed in a location that does not have sufficient GPS coverage to attain a position lock. An example would be if the RMU1 is installed in a metal box or other challenging RF environment.

This option is not applicable to the RMU1S.

When the 'Disable GPS' option is checked, the latitude and longitude co-ordinates of the RMU1 should be entered into the appropriate boxes below the option check mark. This will allow the location of the RMU1 to still be transferred to CorView for use with mapping functions. In addition, the 'Set RMU1 Clock' button should be clicked after configuration is complete to set the internal real time clock.

- The '**Instant Disc. Offset**' parameter is used to adjust the delay between the disconnect of a coupon from the structure and when the acquisition of the instant

disconnect potential is performed. Typically this value is left as low as possible while still mitigating the effects of relay chatter that occur during the contact disconnect process.

- '**Enable AC Potential from Native Coupon Input**' works with any single coupon mode (CP33/CP35/CP39).

The user needs to add a jumper wire between the Pipe and Native Coupon input.

The Coupon AC Potential (slot 2) measurement will then be taken from the Native Coupon input of the Pipe AC voltage.

This provides a Pipe AC voltage reading unaffected by the coupon. Not supported with RMU1-LITE devices.

- '**DC Current Density measurement from AC Coupon**' works with CP38 mode only (Separate DC/AC Coupons).



Enabling this option will route the DC current density measurement (slot 5) through the AC coupon input. Both AC and DC current density measurements will then be taken from the same coupon used for AC measurement.

If the hardware setup includes the RMU1 to-test-station flex PCB (see image at the right), please reverse the polarity of the scaling factor for the DC current density measurement (slot 5) to obtain correct readings.

- '**Enable 4-20mA Mode (G3+)**' disconnects the coupon connection relay by default.

A 4-20mA adapter board is required and when used allows the user to connect 2 4-20mA transmitters and a battery pack power source.

This mode will disable normal channel mappings and should be used only with 4-20mA transmitters.

The loop warm up (in seconds) is the time the RMU1 should wait after switching on the batteries for the reading to stabilize.

See Figure 21 RMU1 w/ 4mA-20mA Mode (G3+) for wiring directions. Not supported with RMU1-LITE devices.

6.3.8 Readings

The 'Readings' group provides for the ability to validate the configuration of RMU1 and INT1. Clicking the 'Update' button will request that the RMU1 and INT1 perform a new conversion cycle on all of the readings slots (except depolarized coupon potential). A reading update will typically take under 15 seconds to complete.

6.3.9 ERP1 Configuration

RMU1 must be running firmware version **V1.26** or newer when connect to an ERP1.

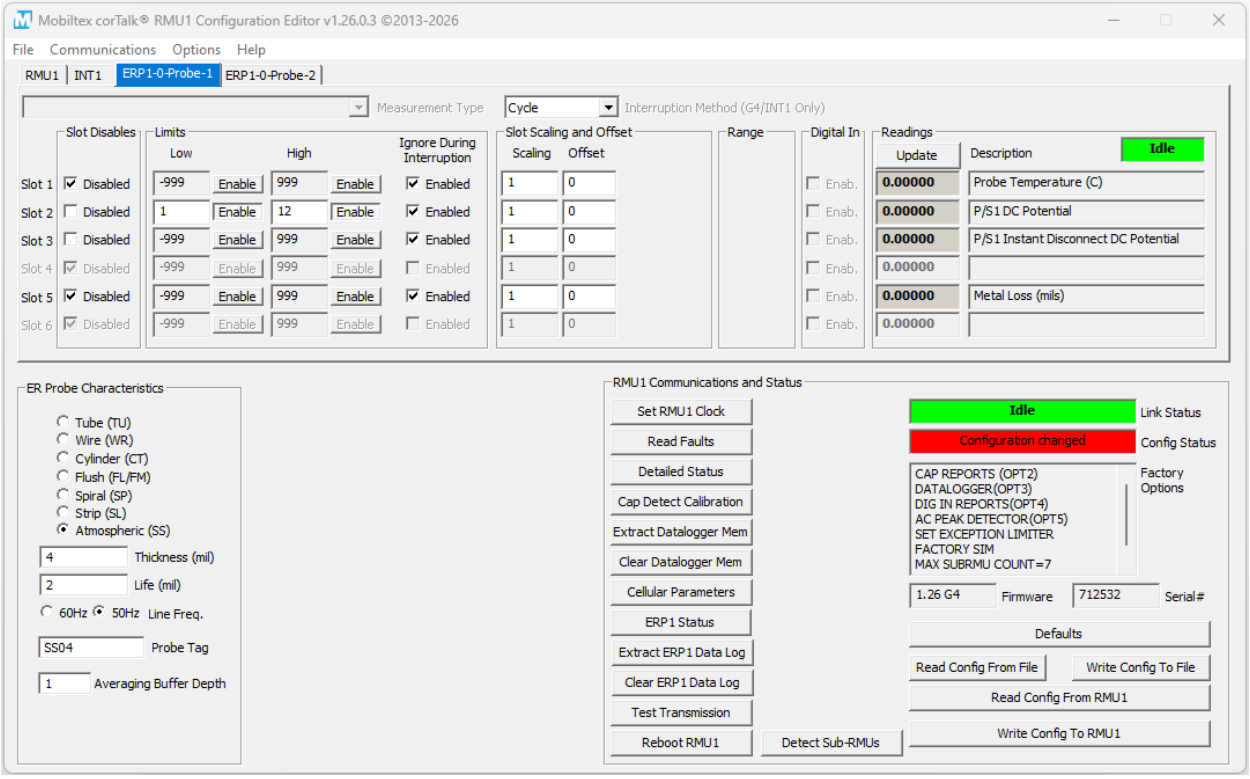
INT1 must be running firmware version **V1.03** or newer when connected to an ERP1.

RMU1 can support up to six probes across three ERP1 units.

The first step in configuring a device is to read in the current settings from the unit.

- Connect the ER probe(s), EPR1 unit(s), INT1 (If required), RMU1 and programming lead.
- Click on **Read Config From RMU1**. The "Link Status" field will briefly show "Busy" as the current configuration parameters are read from the RMU1.
- After the link status returns to "Idle", you will see the configuration settings currently.
- Based on the detected configuration, the corresponding **ERP1 configuration tabs** will be displayed.

If the RMU1 is not responding or not connected, an error dialog will pop up.



6.3.9.1 ER Probe Characteristics

Each probe must be configured individually. To configure the first probe:

- Click on the **ERP1-0-Probe-1** tab.

Each ER probe requires the following configuration parameters:

- Select the appropriate Probe Geometry Type for the probe. The following ER probe geometries are currently supported:
    - Tube Loop (TU)
    - Wire Loop (WR)
    - Cylindrical Tube (CT)
    - Flush Mount Strip (FL/FM)
    - Spiral Strip (SP)

- Strip Loop (SL)
- Atmospheric Surface Strip (SS).

- Enter the **Probe Thickness** and **Life** in 1/1000 inch (mil) units.
- Enter the ER probe identifier in the **Probe Tag** field.
- **Averaging Buffer Depth** defines how many metal loss readings the ERP1 unit averages to produce a single reported value. This setting can be configured between 1 and 24, with the effective time period determined by the Periodic Report configuration. Increasing the buffer depth reduces variation in the readings, resulting in a smoother output, however it also introduces a slower response time to changes in metal loss.

Repeat this configuration process for each ER probe connected by selecting the corresponding ERP1 Probe tab.

6.3.9.2 ER Probe Tags

Typically, the information needed for configuration is stamped on a tag plate that is included with the ER probe from the manufacturer. Figure 1Figure 57 shows an example of a typical ER probe information tag. The element type field describes the probe geometry and initial thickness. For this example, the ER probe would be configured for use with a flush mount probe that is 10mil thick.

In addition, the multiplier field indicates the usable probe thickness. Here, the probe usable life is 5 mil. The usable probe thickness could be entered in the metal loss slot high alarm to provide automated feedback through CorView when it is time to change the probe.

Probes, even when new, will not show a zero metal loss reading; this is not an issue as it is the metal loss rate (corrosion rate) that is most important, not the absolute metal loss reading. The initial field is stated in probe units (1/1000 of the usable probe life). Dividing the initial field by 1000 and then multiplying that result by the multiplier field will yield the expected initial metal loss reading in mil units. For this example, an initial reading of approximately 0.39 mil is expected.



Figure 57 ER Probe Information Tag

6.3.9.3 ERP1 Measurement Slot Configuration

The ERP1 unit is capable of transmitting 4 slots of analog information to CorView. The 4 slots of information are Probe temperature, metal loss, DC potential ON & DC Potential OFF.

Each data slot may have the following attributes modified:

- The slot may be disabled if the measurement is not needed
- Low and high limit alarms may be set
- The reading taken at the physical inputs may be scaled and offset for transmission

6.3.9.4 Write Config to ERP1

After all configuration parameters have been set to the desired specifications, the configuration must be written to the RMU:

- Click **Write Config To RMU1** to store the configuration.
- Click **Read Config From RMU1** to confirm that the configuration has been successfully written by verifying that the displayed values match the intended settings.

7 Mobile Device Configuration

The RMU1 may also be programmed with a compatible iOS or Android-based mobile device when an RMU1PGM-BT Bluetooth Interface cable is used. The RMU1PGM-BT cable shown in Figure 58) uses Bluetooth Smart (BLE) to enable a wireless connection to a compatible mobile device. The programming cable is also available as part of kit that includes a carrying case and a USB battery pack.

Note that only RMU1PGM cables with a black USB cable have Bluetooth capability; RMU1PGM cables with a white USB cable are not Bluetooth capable.



Figure 58 RMU1PGM-BT Bluetooth Interface Cable

An RMU1/2/3 Programming Interface with the RMU1ADP cable attached may also be used.





Figure 59 RMU1/2/3 Programming Interface with RMU1ADP

The mobile device must have the RMU1Config mobile app loaded from either the Apple App store or the Google Play store, as applicable. Simply search for 'RMU1' on each site to locate the download. Alternatively, use the following direct links:

- https://itunes.apple.com/us/app/rmu1-config/id1232422915 (Apple iOS)
- https://play.google.com/store/apps/details?id=com.mobiltex.RMU1config (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 RMU1PGM-BT 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 RMU1PGM-BT cable via a wireless Bluetooth connection. One limitation with the mobile app is that the datalogger on the RMU1 cannot be extracted; this is due to a speed limitation over the Bluetooth Smart connection.

For use with the Bluetooth connection, a portable USB battery pack is needed to power the RMU1PGM-BT interface cable or RMU1/2/3 Programming Interface. Prior to using the USB battery pack, charge the pack using a micro-USB to USB-A cable and a USB power source (see Figure 60, actual battery pack form factor and dimensions may differ from picture). Before use, charge for 10 hours or until the pack charge indicator shows full. A fully charged 3000mAh pack should allow over 60 hours of continuous operation for the RMU1PGM-BT cable or RMU1/2/3 Programming Interface.

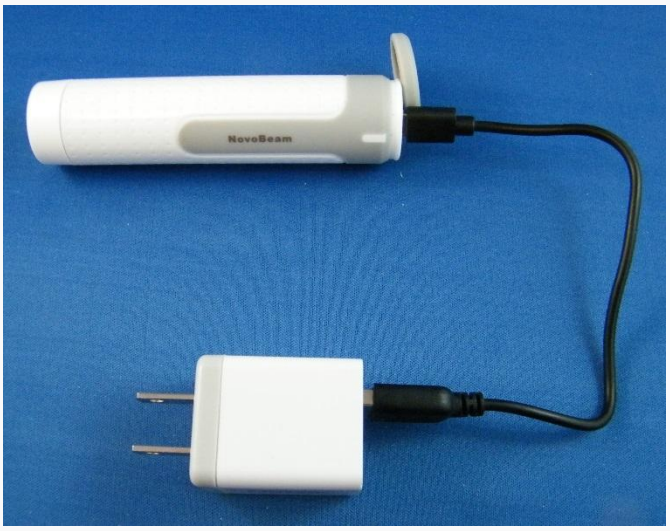


Figure 60 RMU1PGM-BT USB Battery Pack Charging

- Connect the RMU1PGM-BT or RMU1/2/3 Programming Interface USB connector into the matching connector on the battery pack. Some battery pack models may have a button that needs to be pressed to activate the power output.
- The 'PGM POWER' LED on the RMU1PGM-BT or 'PWR' LED on the RMU1/2/3 Programming Interface should light green when power is being delivered to the device.
- Place the RMU1PGM-BT on the RMU1 as shown in the Figure 61. The RMU1/2/3 Programming Interface with RMU1ADP cable attaches in a similar fashion.



Figure 61 RMU1PGM-BT Connected To Battery Pack and RMU1

- Once the cable is attached between the portable USB battery pack and the RMU1, the app on the mobile device is started by tapping on the appropriate app icon.

A connect button in the app initiates the process to connect with the programming interface.

A list of active interface cables in the area is brought up; each interface cable has a serial number label on it to identify the unit.

Once the unit is selected, if it is the first connection attempt between the portable device and that interface cable, 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 62 shows some sample screenshots from the iOS app; the Android app is similar in appearance.

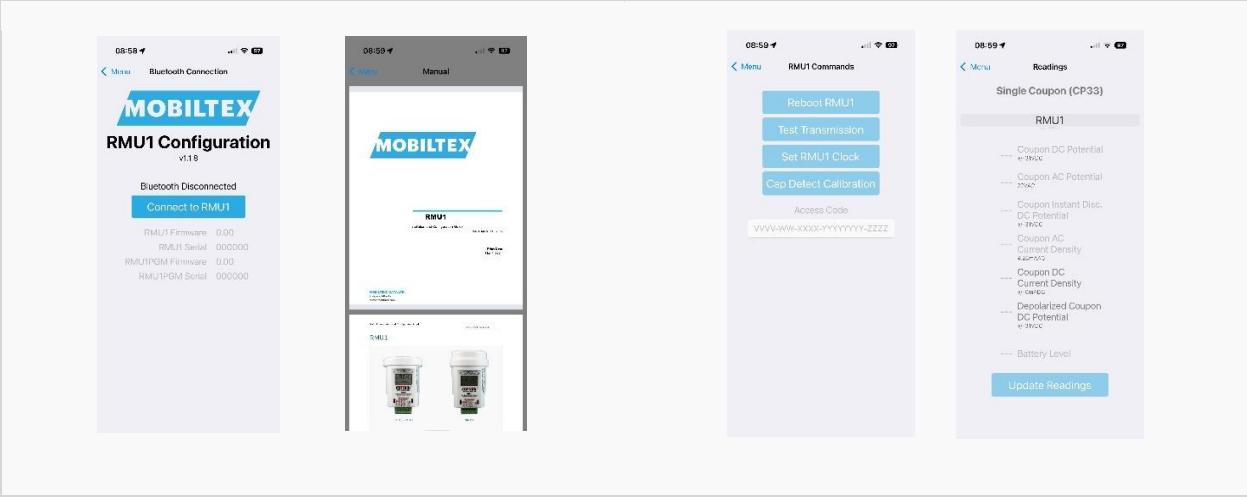


Figure 62 iOS App Sample Screenshots

Upon completion of configuration, disconnect the RMU1PGM-BT cable or RMU1/2/3 Programming Interface from the battery pack to conserve charge in the pack.

8 Battery Replacement

Batteries in the RMU1, INT1 and ERP1 must be replaced at the same time to ensure proper system operation.

Warning: The devices described in this document contain static sensitive components that are susceptible to damage from static charges. Ensure proper static dissipative measures are followed when handling the equipment while it is open.



8.1 RMU1

1. Remove the RMU1 from its mounting location.
2. Unscrew and remove the top plastic circular lid from the RMU1.
3. Remove the three screws that secure the transmitter board assembly to the unit as indicated in the pictures below. A T10 Torx driver is required for RMU1S or RMU1G units while a #1 Philips driver is required for the RMU1I units. Set aside the three screws and transmitter board for re-assembly after the batteries have been changed.

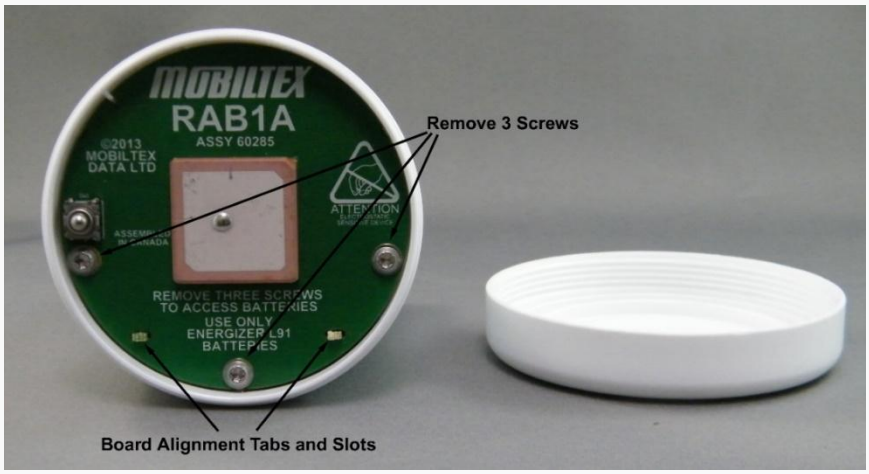


Figure 63 RMU1S (RMU1G similar) Transmitter Board Screws



Figure 64 RMU1I Transmitter Board Screws

4. Remove the old batteries by popping them out of the battery clips. Install four new AA batteries from the replacement battery kit (Mobiltex P/N B02221RMU10, 4x 1.5V Energizer Ultimate Lithium L91 AA batteries). The batteries are oriented according to the polarity markings shown on the main RMU1 logic circuit board.



Figure 65 Battery Polarity Markers

5. Re-attach the transmitter board. Make sure that the main PCB alignment tabs engage the matching slots in the antenna board. Then, re-install the previously removed three screws. Do not over-tighten the screws.
6. Re-install the plastic circular lid.
7. Re-install the RMU1 as instructed in section 5.1.
8. If an INT1 is present, also replace its batteries before reconnecting the units.

8.2 INT1

1. Remove the INT1 from its mounting location.
2. Unscrew and remove the 6 screws from the back of the INT1. A T10 Torx driver is required.
3. Set aside the screws for re-assembly after the batteries have been changed.
4. Remove the old batteries by popping them out of the battery clips. Install eight new AA batteries from the replacement battery kit. The batteries are oriented according to the polarity markings shown on the main INT1 battery board.



Figure 66 INT Battery Operation

5. Place the lid back on, note it only goes on in one direction. Ensure the gasket is within its grove. It not, use plastic or wood to push it back into place. Metal probes can damage the enclosure!
6. Tighten the screws in the order indicated in the following picture. Start by tightening each screw about halfway, then go back and continue tightening each screw one quarter turn until resistance is encountered. Do NOT over-tighten the screws may cause the plastics of the case to warp.



Figure 67 INT1 back tightening scheme

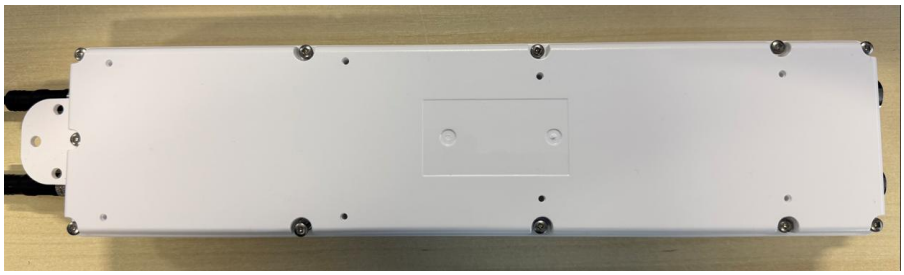
7. Re-install the INT1 as instructed in section 5.9.

8. If a RMU1 is present, also replace its batteries before reconnecting the units.

No other maintenance or cleaning is required.

8.3 ERP1

1. Remove the ERP1 from its mounting location.
2. Unscrew and remove the 11 screws from the back of the ERP1. A Torx T10 screwdriver is required.



3. Set aside the screws for re-assembly after the batteries have been changed.
4. Remove the old batteries by popping them out of the battery holder. Install twelve new AA batteries from the replacement battery kit. The batteries are oriented according to the polarity markings shown on the battery holder.



9 Technical Support

Technical assistance may be obtained from:

Mobiltex Data Ltd.

#36, 56 Freeport Cres. NE

Calgary, AB, Canada

T3J 0T7

Tel: (403)291-2770

Web: http://www.mobiltex.com

Service Email: service1@mobiltex.com

Service Website: http://service.mobiltex.com

10 Equipment Specifications

10.1 RMU1 Specifications

Operating Temperature	-40° to +60° C (-40° to +140° F)
Storage Temperature	-45° to +80° C (-49° to +176° F)
Maximum Altitude	5000 meters above sea level
Humidity	0 to 100% RH non-condensing
Weight	225 grams (0.5 lbs)
Size (RMU1G / RMU1S)	80mm x 80mm x 110mm (3.15”x3.15”x4.33”)
Size (RMU1I)	80mm x 80mm x 125mm (3.15”x3.15”x4.92”)
Enclosure	UV stable, wide temperature polycarbonate, IP54
Pollution Degree	3
External Analog Channels	2 potential, 1 bond shunt, 1 coupon current
Measurement Type	Category 1 (as per CSA C22.2 – 61010)

Analog Ranges (DC & AC True RMS)	Potential:	+/-31VDC, 22VAC	
	Current:	+/-6mADC, 4.25mAAC	Low Range
		+/-60mADC, 42.5mAAC	Med Range
		+/-200mADC, 140mAAC	High Range
	Bond Shunt:	+/-6mVDC, 4.25mVAC	Low Range
		+/-60mVDC, 42.5mVAC	Med Range
		+/-200mVDC, 140mVAC	High Range
AC Rejection on DC Readings	>65dB @ 50/60Hz		
Isolated Digital Input	+/-35VDC maximum <-3VDC or >3VDC for activation (bi-directional sense) Optically isolated (2500VRMS)		
Lightning Immunity	Survives multiple 20KV 10mS surges		
DC Measurement Accuracy (over operational temperature)	Potential:	+/-1% + 1mV	
	Current:	+/-0.75% + 10uA	Low Range
		+/-0.5% + 15uA	Med Range
		+/-0.5% + 35uA	High Range
	Bond Shunt:	+/-0.75% + 2uV	Low Range
		+/-0.5% + 5uV	Med Range
		+/-0.5% + 15uV	High Range
AC Measurement Accuracy (over operational temperature)	Potential:	+/-1.25% + 5mV, 20mV floor	
	Current:	+/-1% + 5uA, 5uA floor	Low Range
		+/-1% + 15uA, 50uA floor	Med Range
		+/-1% + 50uA, 150uA floor	High Range
	Bond Shunt:	+/-1.1% + 25 uV, 5uV floor	Low Range
		+/-1.1% + 35 uV, 50uV floor	Med Range
		+/-1.1% + 75uV, 150uV floor	High Range
Input Impedance	>20 Mohm (potential) 130 Kohm (bond current shunt)		
Coupon Current Shunt	1 ohm		
ADC Resolution	16 bits		

Temp. Measurement Accuracy	+/-4° C (+/-7° F) over -40° to +60° C (-40° to +140° F)
Power	Internal 4x Energizer L91 Ultimate Lithium AA 1.5V cells Typical 10 year life based on readings every 7 days. Typical 5 years life based on readings every 12 hours and 2 weeks of interruption per year
Internal Battery Measurement	OK, Warning and Low conditions displayed on CorView
Communications	Globalstar Simplex Satellite (RMU1S) Iridium SBD Satellite (RMU1I) Cellular LTE Cat M1 B2,4,5,12,13 (RMU1G-LTEM)
GPS Receiver	72-channel u-blox M8
Datalogger Storage (Factory Enabled Option)	1 million reading points

10.2 RMU1-LITE Specifications

Operating Temperature	-40° to +60° C (-40° to +140° F)
Storage Temperature	-45° to +80° C (-49° to +176° F)
Maximum Altitude	5000 meters above sea level
Humidity	0 to 100% RH non-condensing
Weight	220 grams (0.5 lbs)
Size	80mm x 80mm x 110mm (3.15”x3.15”x4.33”)
Enclosure	UV stable, wide temperature polycarbonate, IP54
Pollution Degree	3
External Analog Channels	2 potential
Measurement Type	Category 1 (as per CSA C22.2 – 61010)
Analog Ranges (DC & AC True RMS)	Potential: +/-31VDC, 22VAC

AC Rejection on DC Readings	>65dB @ 50/60Hz
Lightning Immunity	Survives multiple 20KV 10mS surges
DC Measurement Accuracy (over operational temperature)	Potential: +/-1% + 1mV
AC Measurement Accuracy (over operational temperature)	Potential: +/-1.25% + 5mV, 20mV floor
Input Impedance	>20 Mohm (potential)
ADC Resolution	16 bits
Temp. Measurement Accuracy	+/-4° C (+/-7° F) over -40° to +60° C (-40° to +140° F)
Power	Internal 4x Energizer L91 Ultimate Lithium AA 1.5V cells Typical 10 year life based on readings every 14 days and two exception transmissions per month.
Internal Battery Measurement	OK, Warning and Low conditions displayed on CorView
Communications	Globalstar Simplex Satellite (RMU1S-LITE) Cellular LTE Cat M1 B2,4,5,12,13 (RMU1G-LTEM-LITE)
GPS Receiver	72-channel u-blox M8
Datalogger Storage (Factory Enabled Option)	1 million reading points

INT1 Specifications

Operating Temperature	-40° to +60° C (-40° to +140° F)
Storage Temperature	-45° to +80° C (-49° to +176° F)
Maximum Altitude	5000 meters above sea level
Humidity	0 to 100% RH non-condensing
Weight	300 grams (0.7 lbs)
Size	80mm x 28mm x 172mm (3.15”x1.10”x6.80”)
Enclosure	UV stable, wide temperature polycarbonate, IP54
Pollution Degree	3
External Analog Channels	2 potential, 1 bond current
Measurement Type	Category 1 (as per CSA C22.2 – 61010)
Analog Ranges (DC & AC True RMS)	Potential: +/-31VDC, 22VAC Bond Current: +/-300mADC, 210mAAC Low Range +/-3ADC, 2.1AAC Med Range +/-10ADC, 7AAC High Range
AC Rejection on DC Readings	>65dB @ 50/60Hz
Lightning Immunity	Survives multiple 20KV 10mS surges
DC Measurement Accuracy (over operational temperature)	Potential: +/-1% + 1mV Bond Current: +/-1.0% + 210uA Low Range +/-1.0% + 4mA Med Range +/-1.0% + 14mA High Range
AC Measurement Accuracy (over operational temperature)	Potential: +/-1.25% + 5mV, 20mV floor Bond Current: +/-1% + 140uA, 920uA floor Low Range +/-1% + 2.5mA, 9.2mA floor Med Range +/-1% + 8mA, 31mA floor High Range
Input Impedance	>20 Mohm (potential) 130 Kohm (bond current shunt)
Bond Current Shunt	0.02 ohm
ADC Resolution	16 bits

Temp. Measurement Accuracy	+/-4° C (+/-7° F) over -40° to +60° C (-40° to +140° F)
Power	Internal 8x Energizer L91 Ultimate Lithium AA 1.5V cells Typical 5 year life based on readings every 12 hours and 2 weeks of interruption per year
Internal Battery Measurement	OK, Warning and Low conditions displayed on CorView
Datalogger Storage (Factory Enabled Option)	1 million reading points

10.3 ERP1 Specifications

Operating Temperature	-40° to +60° C (-40° to +140° F)
Storage Temperature	-45° to +60° C (-49° to +140° F)
Maximum Altitude	<2000 meters above sea level
Humidity	0 to 100% RH non-condensing
Weight	550 grams (1.2 lbs)
Size	340mm x 73mm x 50mm (13.39”x2.87”x1.97”)
Enclosure	UV stable, wide temperature polycarbonate, IP67
Pollution Degree	1
External Analog Channels	ER probe potential
Measurement Type	Category 1 (as per CSA C22.2 – 61010)
Lightning Immunity	Survives multiple 20KV 10mS surges
ERP1 Resolution	0.000001 mils
ERP1 Measurement Accuracy	+/-0.005% ~ +/- 0.03% (Probe dependant. Not including probe temperature variation)
Potential Input Impedance	>20 Mohm
Potential ADC Resolution	24 bits
Temp. Measurement Accuracy	+/-4° C (+/-7° F) over -40° to +60° C (-40° to +140° F)
Power	Internal 12 x Energizer L91 Ultimate Lithium AA 1.5V cells. Typically 6 years based on readings every 6 hours
Internal Battery Measurement	OK, Warning and Low conditions displayed on CorView

A. RMU1S Globalstar Simplex Satellite Coverage Map



Figure 68 Globalstar Simplex Satellite Coverage Map

B. RMU1I Iridium SBD Satellite Coverage Map



Iridium offers complete pole-to-pole coverage in all areas of the Earth due to its cross-linked polar orbiting constellation.

C. RMU1 Regulatory Statements

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

WARNING: Changes or modifications not expressly approved by Globalstar may render the device non-compliant to FCC and other regulatory body standards for operation and may void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This ClassA/ClassB digital apparatus complies with Canadian ICES-003.

NOTICE: This equipment complies with the FCC RF Exposure Limits. A minimum of 20 centimeters (8 inches) separation between the device and the user and all other persons should be maintained.

RMU1S
FCC ID: L2V-STX3
IC:3989A-STX3

RMU1I
FCC ID: Q639603N
IC:4629A-9603N

RMU1G
FCCID: RI7LE910NAV2
IC: 5131A-LE910NAV2

RMU1G-LTEM
FCCID: XMR201912BG77
IC: 10224A-201912BG77



Complies with FCC standards.
FOR HOME OR OFFICE USE