

RDL1

Installation and Configuration Guide

RDL1-MAN-001, 1.07

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MOBILTEX® DATA LTD.
Calgary, Alberta

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RDL1



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NAME	LOCATION	JOB FUNCTION	SIGNATURE	DATE
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1 Introduction

The RDL1 Remote Data Logger 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 RDL1 is a portable, high reliability device designed to monitor coupons and bonds. The device utilizes cellular communication. The field hardware consists of a single component that is usually mounted inside a 3” plastic test station. The device operates for 10+ years from internal batteries depending on the reading configuration. This self-powered solution can be used to monitor coupons and bonds without the requirement for nearby line or solar power sources. External power can also be supplied to extend its battery life. The RDL1 has integral high-energy surge suppression and provides unprecedented lightning immunity because there are no connections to electrical ground.

The RDL1 monitors and transmits up to 16 channels of information. It uses GPS to synchronize coupon interruption and to precisely time fast sample events. It will record and transmit scheduled readings (1 per hour to 1 per week, plan dependent) and send them to CorView. The device can fast sample all readings simultaneously at up to 10Hz. After a fast sample event CorView will be notified, and the data can either be sent to CorView or retrieved locally. An integral IR proximity sensor can be used as a cap open sensor or tamper detection alarm. The RDL1 also 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 RDL1 that enables interruption and enhanced monitoring of bonds and anode beds. It connects to the RDL1 via a short cable and fits within the riser pipe with the RDL1. It uses field replaceable batteries and has unprecedented lightning immunity. Its major benefit is the capability to interrupt up to 7A with GPS synchronization through commands from our CorView servers to the RDL1. The RDL1 can also interrupt coupons in tandem with the INT1 if desired. Interruption does cause a significant drain on battery life and if used, the user should expect to get 5 years of life before having to replace the batteries (assuming 2 weeks of interruption a year). The INT1 does not support fast sampling on its measurement channels.

Measurement data is wirelessly transmitted to 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 Microsoft Edge. The measurement data is presented in an intuitive tabular format or graphical mapping display that color-codes abnormal measurement or site conditions for quick interpretation.

CorView provides near real-time email notification of abnormal measurement and alarm conditions. The new generation of CorView also allows greater control of RDL1s in the field including: interruption and fast sample scheduling, reading fast sample data and sending configuration information. The RDL1 will communicate with CorView every 12 hours to process any queued commands initiated by users. Therefore, time sensitive commands such as setting fast sample and interruption schedules should be placed **24 hours in advance** in order to allow the RDL1 to receive the command in time at its 12 hour mail check.

Figure 1. RDL1 Communications Block Diagram



1.1 RDL1 – Reporting Plans & Fast Sampling Tier

A range of reporting plans and fast sampling tiers are available. The Reporting Plan defines the frequency of scheduled readings and transmissions. The Fast Sampling Plan defines the minimum interval that data can be sampled and recorded under each plan. The reporting and fast sample plans can be mixed and matched depending on your needs.

Reporting Plans	Fast Sampling Plans
1 hour	Tier 0: None
6 hours	Tier 1: 10s Minimum Interval
1 day	Tier 2: 1s Minimum Interval
2 days	Tier 3: 100ms Minimum Interval*
7 days	

Table 1. CorView Reporting and Fast Sampling Plans

* Tier 3 Fast Sample will only fast sample for 3 hours every day when the radio is enabled, if fast sampling is set up with an interval less than 1 second. All the plans can fast sample at 100ms when the radio is disabled, allowing for standalone operation. The data can always be retrieved directly from the unit.

1.2 RDL1 – Battery Life & Max Acquisition Time

The RDL1 utilizes a non-rechargeable battery to provide a long operating life before a factory replacement is required. The rate of fast sampling, number of active channels and interruption frequency have the greatest effect on battery life, and variables such as cell and GPS reception along with environmental conditions also affect battery life. The reporting plan has less of an effect on battery life.

When performing fast sampling, the RDL1 datalogger overwrites the oldest records rather than stopping when its memory is full. The Max Acquisition Time is therefore the retention window — the time until the oldest samples begin to be overwritten. If the radio is enabled and the fast sample data has already been sent to CorView (which happens at least once a day if “Always send Fast Sample data to CorView” is enabled), the old data can be retrieved from there. However, if the radio is disabled and the device is simply storing readings locally, the overwritten data will be lost permanently.

The following table provides a battery life estimate and maximum acquisition time estimate based on the intensity of fast sampling at different fast sampling tiers. All the cases assume a single coupon setup that measures 4 readings for fast sampling: the DC and AC coupon voltages as well as their AC and DC current density.

Application	Battery Life Estimate	Max Acquisition Time Estimate
Single coupon setup, Tier 1, 10s fast sampling interval always active.	2.7 years	207 days
Single coupon setup, Tier 1, 10s fast sampling interval for 12 hours per day.	4.7 years	1.1 years
Single coupon setup, Tier 1, 10s fast sampling interval for 1 hour per day.	14.4 years	13.6 years
Single coupon setup, Tier 2, 1s fast sampling interval always active.	1.3 years	21 days
Single coupon setup, Tier 2, 1s fast sampling interval for 12 hours per day.	2.4 years	42 days
Single coupon setup, Tier 2, 1s fast sampling interval for 1 hour per day.	11.5 years	1.4 years
Single coupon setup, Tier 3, 200ms fast sampling interval always active*.	233 days	4 days
Single coupon setup, Tier 3, 200ms fast sampling interval for 12 hours per day*.	1.2 years	8 days
Single coupon setup, Tier 3, 200ms fast sampling interval for 1 hour per day.	10.1 years	100 days

Table 2. Expected Battery Life

* This setup must have radio disabled in order to fast sample with an interval less than 1 second for more than 3 hours per day.

Please note that the estimate assumes a new battery and 0% used memory in the RDL1. The configuration apps have a Battery Life Estimate and Max Acquisition Time Estimate that updates based on your configuration with the same assumption applied. If the Max Acquisition Time Estimate displays “--”, it means the current configuration will not initiate any datalogging.

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 main—-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

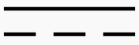
These terms may appear in this **manual**:

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
	DC-only Input

3 Kit Contents

3.1 RDL1GE-NA (LTE Cellular) External Antenna Kit

PICTURE	DESCRIPTION
	1 pc – RDL1GE external antenna remote monitoring unit. 1 pc – Cellular/GPS Antenna with 20cm (7.9”) leads 1 pc – USB A to USB Micro B Programming Cable 1 pc – RDL1 Wiring Cable 1 pc – RDL1 Mounting Kit Typically installed inside an enclosure that is not compatible with RF transmission

Table 3. RDL1GE Kit Contents

3.2 RDL1G-NA (LTE Cellular) Internal Antenna Kit

PICTURE	DESCRIPTION
	1 pc – RDL1G internal antenna remote monitoring unit. 1 pc – USB A to USB Micro B Programming Cable 1 pc – RDL1 Wiring Cable 1 pc – RDL1 Hanger Assembly 6pc ¼” ring terminals accessory Typically installed inside a test station down the riser. Separate mounting bracket for tall cap available.

Table 4. RDL1G Kit Contents

3.3 INT1

PICTURE	DESCRIPTION
	1 pc – INT1 remote interruption unit 1 pc – INT1 to RDL1 cable Requires a RDL1 to use

Table 5. INT1 Kit Contents

3.4 RDL1 Optional Installation Items

PICTURE	DESCRIPTION
	Standard Test Station Color Kit (Includes 2 Spacer Rings) - (Black) - (Orange) - (Yellow) - (Green) - (White) - (Blue) - (Red)
	Tall Test Station Color Kit (15.5”) - (Black) - (Orange) - (Yellow) - (Green) - (White) - (Blue) - (Red)
	RDL1 Down Riser Test Station Kit (fits a 3” pipe) RDL1G pre-installed RDL1G not pre-installed Add one of the standard Test Station Color Kits.

PICTURE	DESCRIPTION
	RDL1 Upright Test Station Kit with Tall Cap (fits a 3” pipe) RDL1G pre-installed RDL1G not pre-installed Add one of the Tall Test Stations Color Kits.
	RDL1 Mounting Kit An aluminium back plate and screws to allow for mounting in Nema boxes or other surfaces.
	1 pc – M8 extension cable (also used for connecting to the INT1) - 0.15m (5.9 inch) - 0.25m (9.8 inch) - 1m (3.2ft)
	Test Magnet
	6pc – ¼” terminal rings for 18-22 AWG cable.

PICTURE	DESCRIPTION
	Spacer Ring For 3” Test Stations - (Black) - (Orange) - (Yellow) - (Green) - (White) - (Blue) - (Red)
	Lockable bracket for Pro-Mark test station. (Padlock & test station not included)
	Large opening (36mm/1.42”) AC mitigation measurement transformer. 126A AC full scale. 1.57” x 1.63” x 2.64”(40mm x 41.4mm x 67mm) Includes 3.3’(1m) leads.
	Medium opening (24mm/0.94”) AC mitigation measurement transformer. 42A AC full scale. 1.34” x 2” x 2.64”(34mm x 51mm x 67mm) Includes 3.3’(1m) leads.
	Small opening (15.2mm/0.60”) AC mitigation measurement transformer. 31A AC full scale. 1.22” x 1.26” x 1.81”(31mm x 32mm x 46mm) Includes 3.3’(1m) leads
	Banana jack test point kit. Replaces standard test point termination screws to provide banana jack functionality. Kit contains replacement screws, washers and nuts.

PICTURE	DESCRIPTION
	RDL1 Hanger Assembly Hangs from a standard test post and holds the RDL1 safely underneath it. It is included in the Standard Test Station RDL1 Down Riser Kit.
	RDL1 Upright Mounting Bracket Kit Replacement item
	Replacement external antenna
	RMU1/2/3-BT Programmer Kit Universal Bluetooth programming kit for RMU1, RMU2, RMU3, and RDL1 devices. Includes RMU1/2/3 base programmer, RMU1ADP, Li-Ion battery pack, soft case, and USB stick with programming software. Capable of Bluetooth communications with a phone/tablet. Can also be used with a PC through the USB connection.
	RBT1 Bluetooth Interface Cable Allows programming of RDL1 using a Bluetooth Smart equipped smart phone or tablet.

Table 6. RDL1 Accessories

4 Quick Bench Test

The RDL1G cellular antenna requires a clear communications path to a cellular tower; optimal orientation will be site dependent.

Power on the RDL1 by pressing a magnet against the “Magnet Required PWR” label. The LCD display will display “Init” (if programmer is attached) briefly followed by “bSY” for several seconds.

The RDL1 will then 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 RDL1 will not send a power-up message or display measurements on the LCD screen until GPS signal acquisition is complete.

CorView is accessed using a web browser at https://www.corview.cloud/. Enter the User Name and Password that were provided to you when your CorView account was setup.

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.

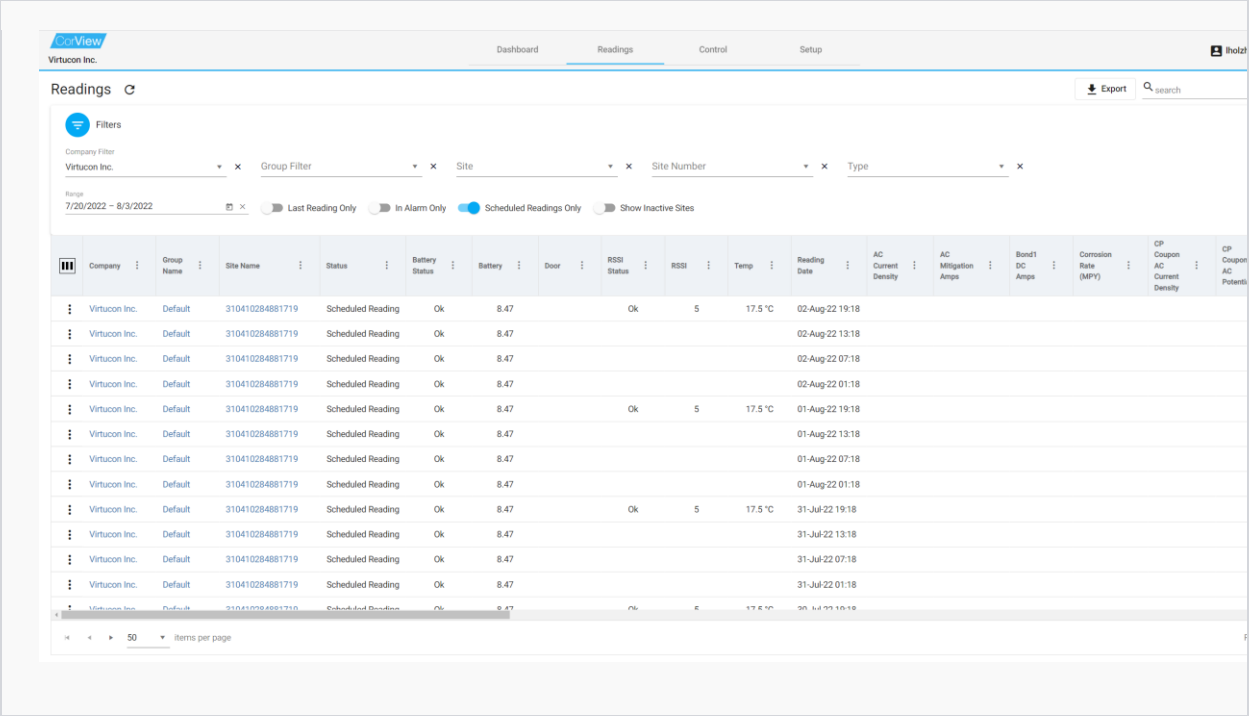


Figure 2. CorView All Readings Page

Pressing a magnet against the area marked “TEST” on the RDL1 for 1 to 5 seconds will force an immediate analog measurement and data transmission.

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.

When the bench test is completed, the RDL1 is powered off by pressing a magnet against the “Magnet Required PWR” label for more than 5 seconds.

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 RDL1 Installation

- The RDL1 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 lid to mate. The spacer ring attaches to the threaded portion of the lower test station mount. The RDL1 hangs below the test station so no additional spacer rings are required.
- 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 RDL1; in that case the spacer ring would not be needed.

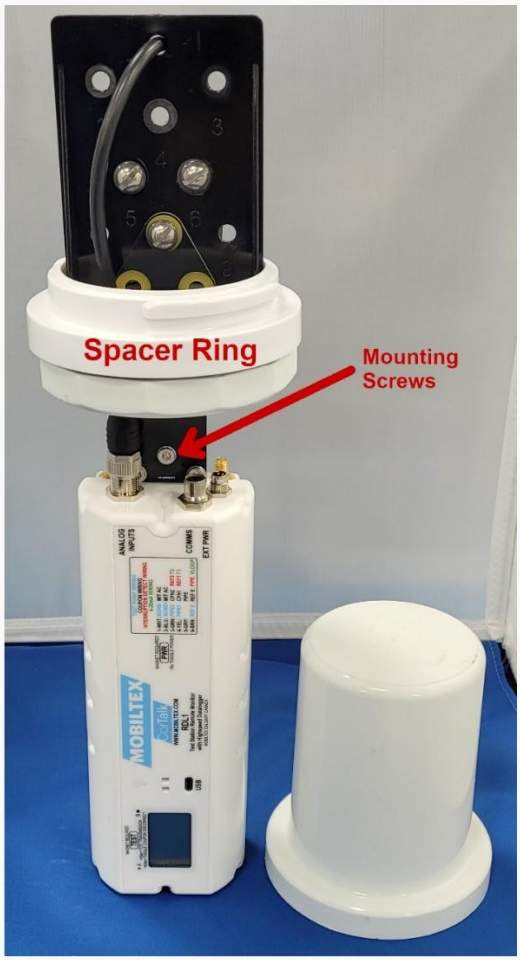


Figure 3. RDL1 Installed In Test Station

5.2 Test Station with Hanger

The RDL1 Remote Data Logger is installed in test stations with the use of the RDL1 Hanger Assembly (P/N A04060399A1) kit. The hanger is connected to the RDL1 as shown in Figure 4 using three 6/32 Philips screws that are included in the kit.

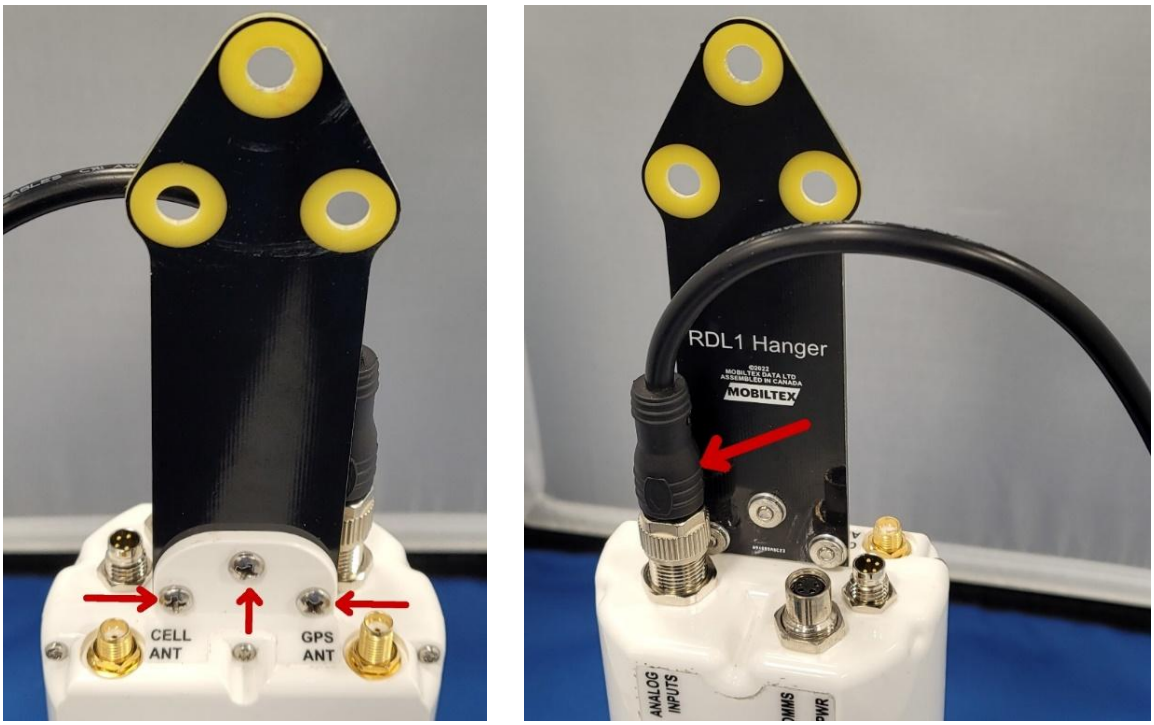


Figure 4. Hanger Assembly Screws and Wiring Cable



At this point, if an external antenna is being used, connect the GPS and Cellular antennas to the appropriately labelled connectors.

The RDL1 Measurement Cable (P/N J23611M1201) is connected to the RDL1 as shown above in Figure 4. The Hanger Assembly is then connected to the test station using the test point connection bolts and nuts through aligned holes. Only the top screw to the test station is required. The RDL1 Measurement cable should come up on the side opposite of the screws. It then can either loop over the top of the test station as shown or be run through one of the test point holes and connected to the terminals on the other side.

Figure 5. Connection to Test Station

5.3 Tall Test Station with Mounting Bracket

The RDL1 Remote Data Logger can also be installed upright with a tall test station assembly, which includes a tall test station head with 9 standard bolts and mounting bracket (ARMU1A0C0000). A tall test station colour kit is also required.

First, using a #8 Torx Driver install the 4 screws to connect the RDL1 to the tall test station support as shown in Figure 6:

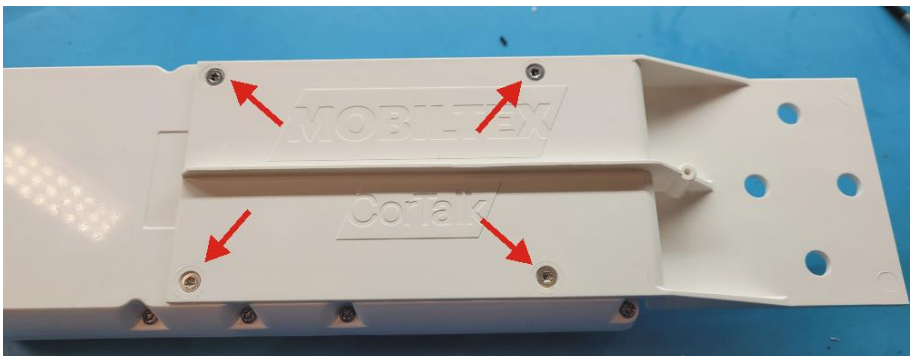


Figure 6. Connecting Mounting Bracket

Using a #8 Torx Driver install the 1 screw on the opposite side to finish the connection of the RDL1 to the tall test station support as shown in Figure 7:

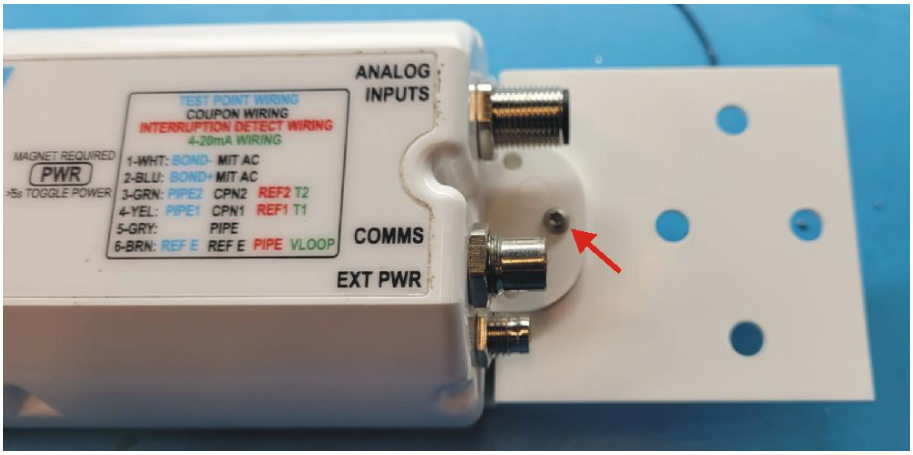


Figure 7. Connecting Mounting Bracket 2

Place a fiber washer over each of the screws. This is labelled as “1” in the zoomed picture below labelled with numbers. Attach the test station terminal block to the RDL1 tall test station support so that the side with the bulge is facing the front of the RDL1, as shown in Figure 8.

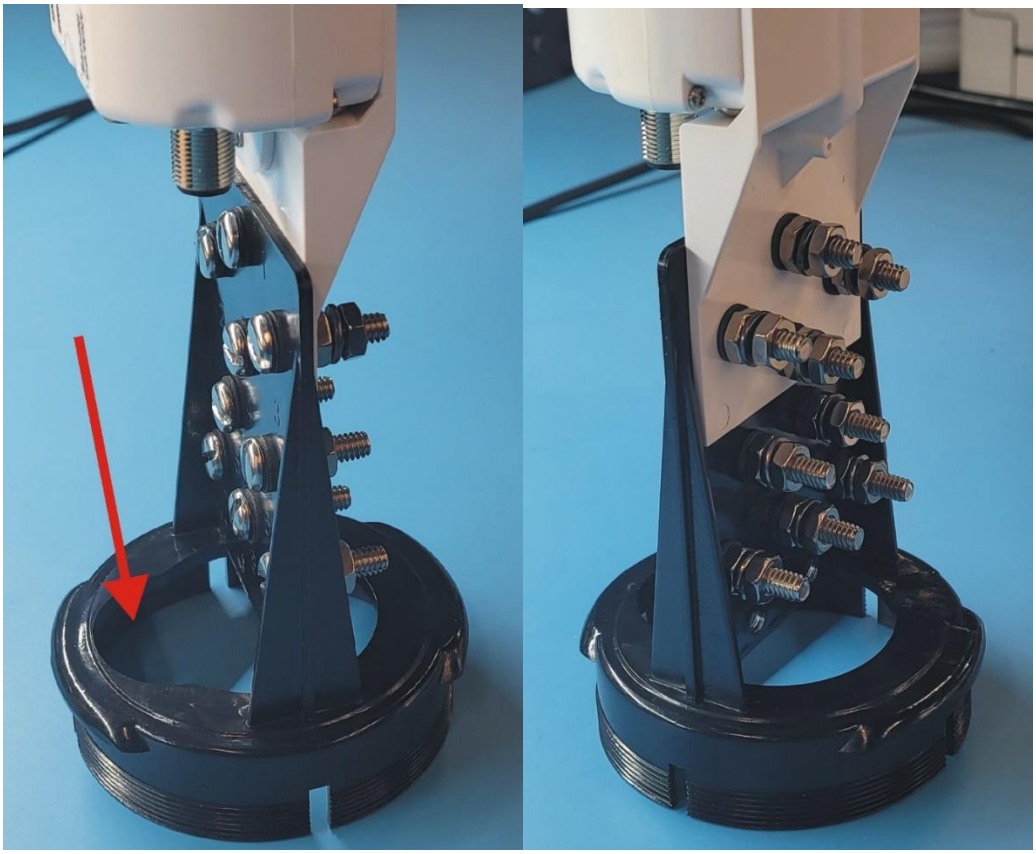


Figure 8. Bracket Orientation

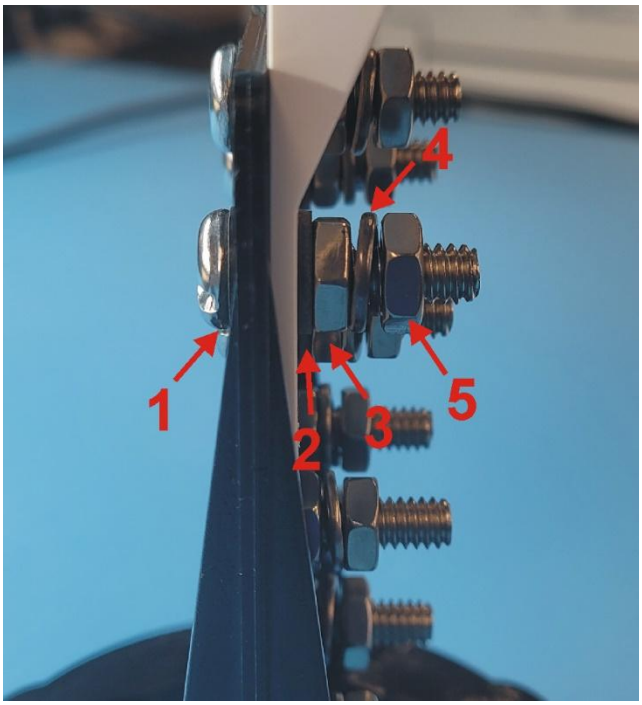


Figure 9. Washers and Nuts

Place another fiber washer over each of the screws (shown at “2”), and then a jam nut. Use a flathead screwdriver to hold it steady, then secure the nuts to 2.7Nm using the ¼” torque driver (shown as “3”). Place a split washer (“4”) and another jam nut (“5”) over each of the screws and tighten to hand tight.

5.4 Fixed Install with Mounting Plate

The RDL1 Remote Data Logger is installed in NEMA boxes with the use of the RDL1 Mounting Plate Assembly Kit.

First, place the metal plate from the assembly kit on the back of the RDL1 such that the beveled holes are visible. Make sure that the RDL1 label is visible and the beveled holes align with the screw holes at the back of the RDL1 as shown in Figure 10. Then, use the 4x¼” Philips screws that are included in the kit to install the mounting plate onto the RDL1. Tighten them until the screwheads are nearly flush against the surface of the plate, but do not overtighten as they can damage the case.

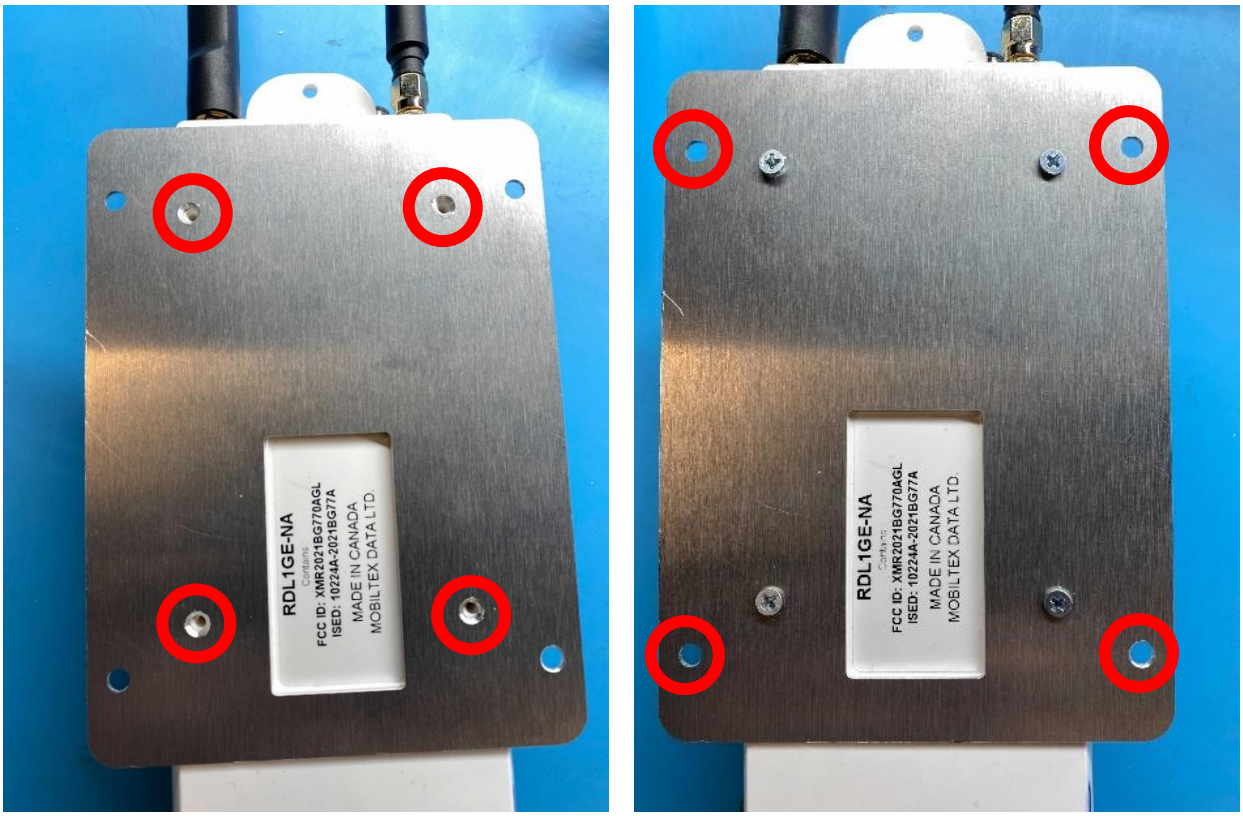


Figure 10. Inner Screws to RDL1 (left), Outer Mounting Points (right)

Then install the unit as desired using the 4 outer mounting points. We advise using them as a template, predrilling holes and then mounting the RDL1 with nuts and bolts, but installation may vary.

5.5 Measurement Type Wiring

The RDL1 employs a flexible measurement typology. Up to 16 measurements can be sent to CorView at a time. Each measurement has a unique key. At present, these measurements fall into four setup categories:

- **Coupon**: Single coupon, dual coupon, native coupons, and AC mitigation
- **Test Point or Bond**: Pipe to soil potentials and current measurements over a shunt resistor
- **Interruption Detection**: Dual reference cell interruption detection on a structure
- **4-20mA Mode**: Two transducers current measurements and loop supply

The diagrams and wiring tables in the following pages illustrate typical installations that encompass all setups and measurement types.

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 RDL1 measurement inputs must not be directly connected to mains AC power.

The following ranges apply to measured signals of the RDL1.

Potential	+/-75VDC, 53VAC
Coupon Current	+/-12mADC, 8.50mAAC, Low Range +/-120mADC, 85.0mAAC, Med Range +/-400mADC, 280mAAC, High Range
Bond Shunt	+/-12mVDC, 8.50mVAC, Low Range +/-120mVDC, 85.0mVAC, Med Range +/-400mVDC, 280mVAC, 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 RDL1 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

5.5.1 Coupon Setup

NOT ALL WIRES HAVE TO BE CONNECTED. Just those required for the desired measurements. The diagram below shows a fully connected RDL1.

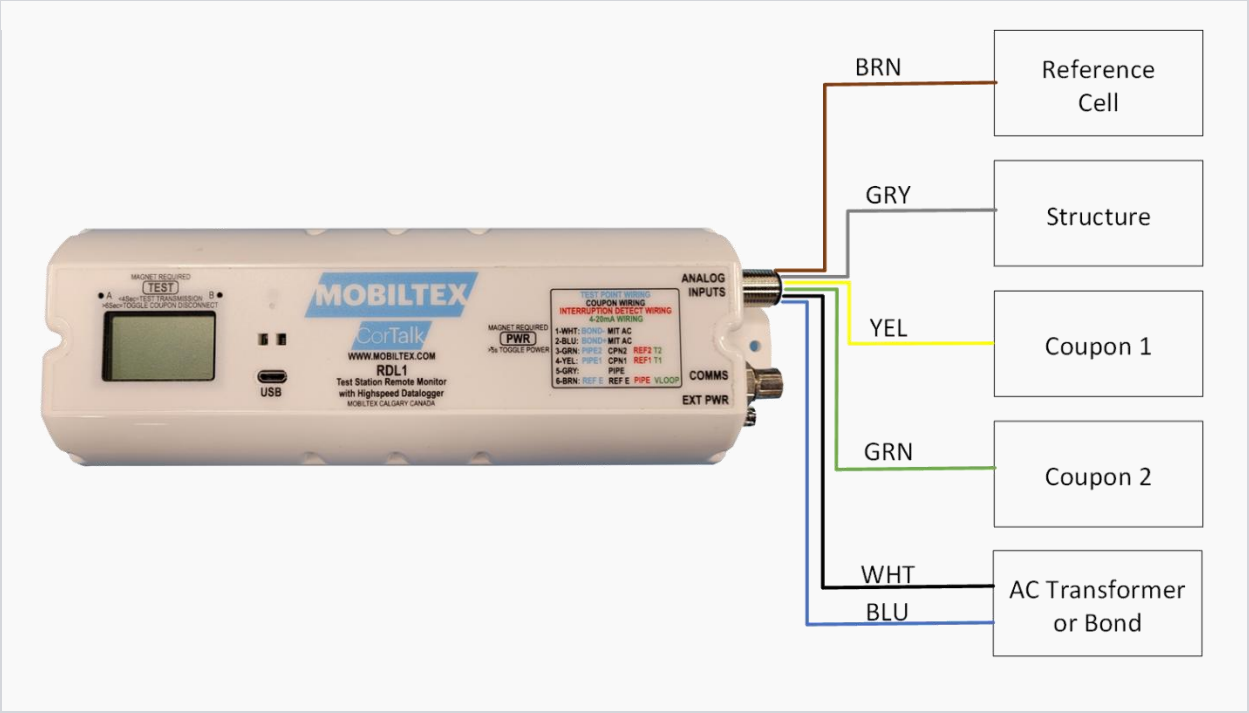


Figure 11. Coupon Setup Connections

DESCRIPTION	LCD ICONS	WIRING
Coupon 1 DC Potential	COUPON DC V	BRN/YEL
Coupon 1 AC Potential	COUPON AC V	BRN/YEL
Coupon 1 Instant Disconnect DC Potential	COUPON INSTANTDISCONNECT DC V	BRN/YEL
Depolarized Coupon 1 DC Potential	COUPON DEPOLARIZED DC V	BRN/YEL
Native Coupon 1 DC Potential	NATIVE COUPON DC V	BRN/YEL
Native Coupon 1 AC Potential	NATIVE COUPON AC V	BRN/YEL
Coupon 2 DC Potential	COUPON DC V	BRN/GRN
Coupon 2 AC Potential	COUPON AC V	BRN/GRN

Coupon 2 Instant Disconnect DC Potential	COUPON INSTANTDISCONNECT DC V	BRN/GRN
Depolarized Coupon 2 DC Potential	COUPON DEPOLARIZED DC V	BRN/GRN
Native Coupon 2 DC Potential	NATIVE COUPON DC V	BRN/GRN
Native Coupon 2 AC Potential	NATIVE COUPON AC V	BRN/GRN
Coupon 1 DC Current Density	COUPON CURRENT DC A/m2	YEL/GRY
Coupon 1 AC Current Density	COUPON CURRENT AC A/m2	YEL/GRY
Coupon 2 DC Current Density	COUPON CURRENT DC A/m2	GRN/GRY
Coupon 2 AC Current Density	COUPON CURRENT AC A/m2	GRN/GRY
Bond DC Current	BOND DC A	WHT/BLU
Bond AC Current	BOND AC A	WHT/BLU
AC Mitigation Current	AC MITIGATION AC A	WHT/BLU

NOTES:

- Any native coupon measurements cannot be mixed with non-native voltage or current measurements on the same coupon (but Coupon 1 can be native with Coupon 2 protected).
- For separate AC/DC coupons, connect one coupon to Coupon 1 (say DC) and the other to Coupon 2 (say AC). Then add the Coupon 1 DC measurement and Coupon 2 AC measurement to the desired readings.
- AC Mitigation Current uses the same measurement unit as the Coupon 2 Current Density (AC and DC) and Bond Current. As such, they are exclusive, and only one of the three can be added to the setup.
- AC Mitigation Current will require a scaling factor 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 should be set to ‘HIGH’ in the RDL1 configuration.

5.5.2 Test Point or Bond Setup

NOT ALL WIRES HAVE TO BE CONNECTED. Just those required for the desired measurements. The diagram below shows a fully connected RDL1.

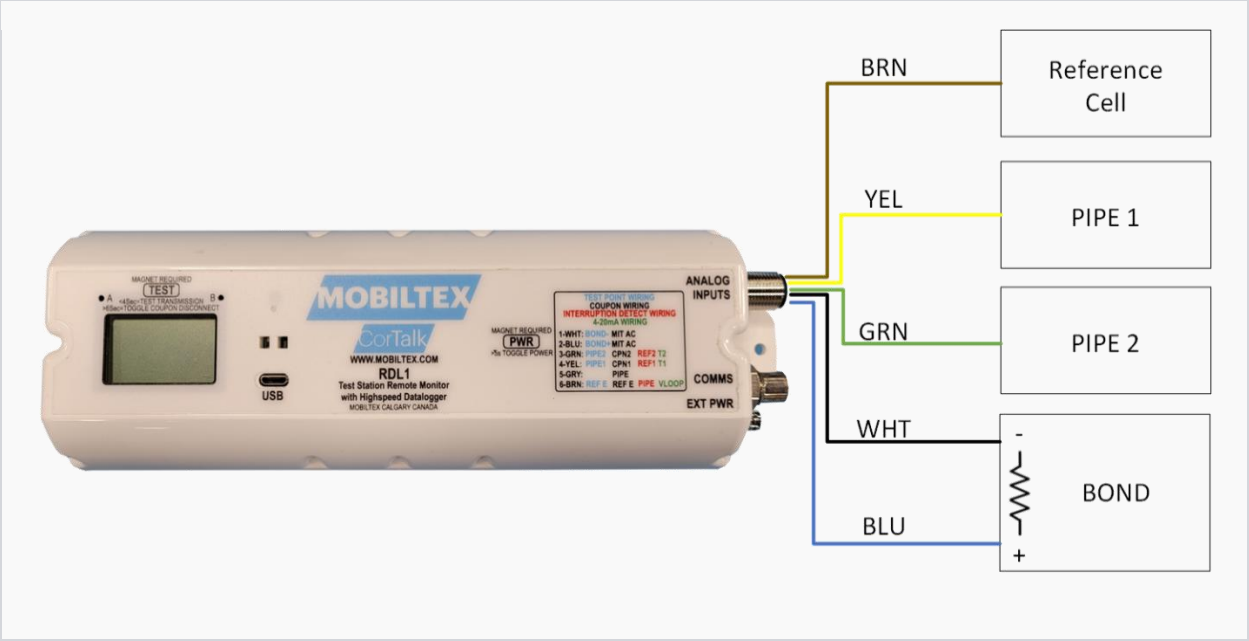


Figure 12. Test Point or Bond Setup Connections

DESCRIPTION	LCD ICONS	WIRING
P/S1 DC Potential	P/S1 DC VOLTS	BRN/YEL
P/S1 AC Potential	P/S1 AC VOLTS	BRN/YEL
P/S2 DC Potential	P/S2 DC VOLTS	BRN/GRN
P/S2 AC Potential	P/S2 AC VOLTS	BRN/GRN
DC Current	DC CURRENT A	BLU/WHT
AC Current	AC CURRENT A	BLU/WHT
Bond DC Current	DC CURRENT A	BLU/WHT
Bond AC Current	AC CURRENT A	BLU/WHT

NOTES:

- The current and bond current measurements are exclusive and only one set or the other can be used.

5.5.3 Interruption Detection Setup

NOT ALL WIRES HAVE TO BE CONNECTED. Just those required for the desired measurements. The diagram below shows a fully connected RDL1.

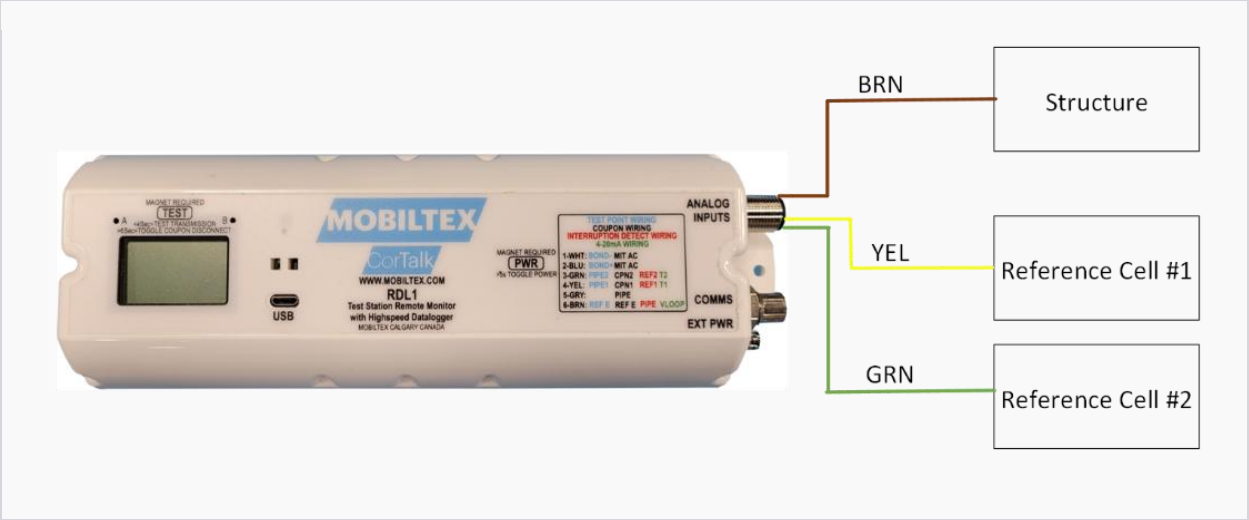


Figure 13. Interruption Detection Setup Connections

DESCRIPTION	LCD ICONS	WIRING
P/S1 DC Potential	P/S1 DC VOLTS	BRN/YEL
P/S1 AC Potential	P/S1 AC VOLTS	BRN/YEL
P/S2 DC Potential	P/S2 DC VOLTS	BRN/GRN
P/S2 AC Potential	P/S2 AC VOLTS	BRN/GRN
P/S1 Int. Det. DC On Potential	P/S1 DC VOLTS	BRN/YEL
P/S1 Int. Det. DC Off Potential	P/S1 DC VOLTS INSTANT OFF	BRN/YEL

NOTES:

- If only one reference cell is used, it should be connected to Reference Cell #1 (YLW) wire.
- Two reference cell inputs are provided to allow for validation of reference cell operation over time.
- 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.

- When using reference cells of different chemistry, e.g. CuCuSO4 and Zinc, the offset parameter 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 P/S2 offset parameter can be set to a value of -1.1 to send CuCuSO4 equivalent readings for both to CorView.

- If interruption is detected, On and Instant Off measurements are taken. They will be sent instead of the pipe to soil readings. The instant off measurement is 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, interruption detection takes over 1 minute to complete.

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

5.5.4 4-20mA Mode Setup

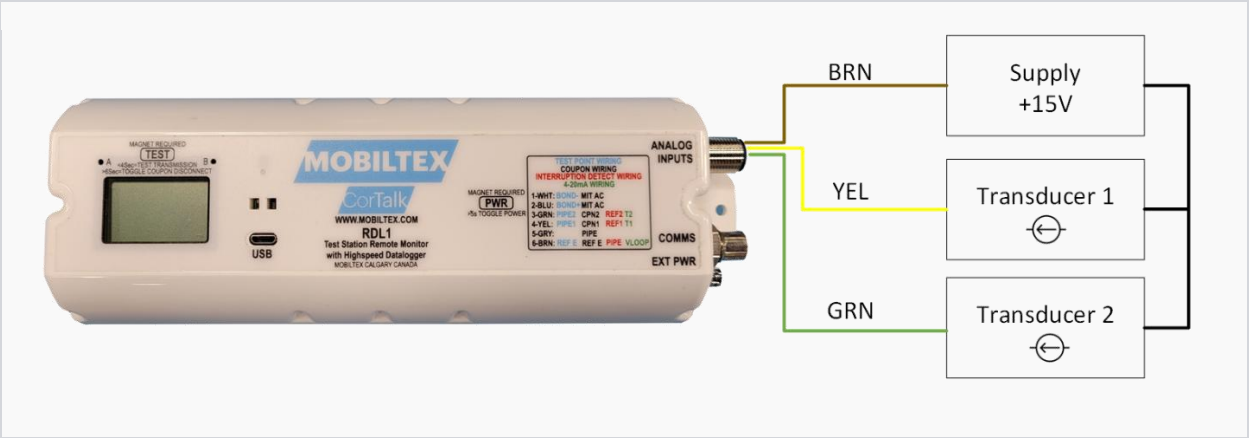


Figure 14. 4-20mA Mode Connections

DESCRIPTION	LCD ICONS	WIRING
Loop Supply DC Potential	DC VOLTS	
Transducer 1 DC Current	DC CURRENT A	YEL/BRN
Transducer 2 DC Current	DC CURRENT A	GRN/BRN

NOTES:

- The loop supply DC potential is measured within the unit and does not need any wiring.

5.5.5 INT1 Setup

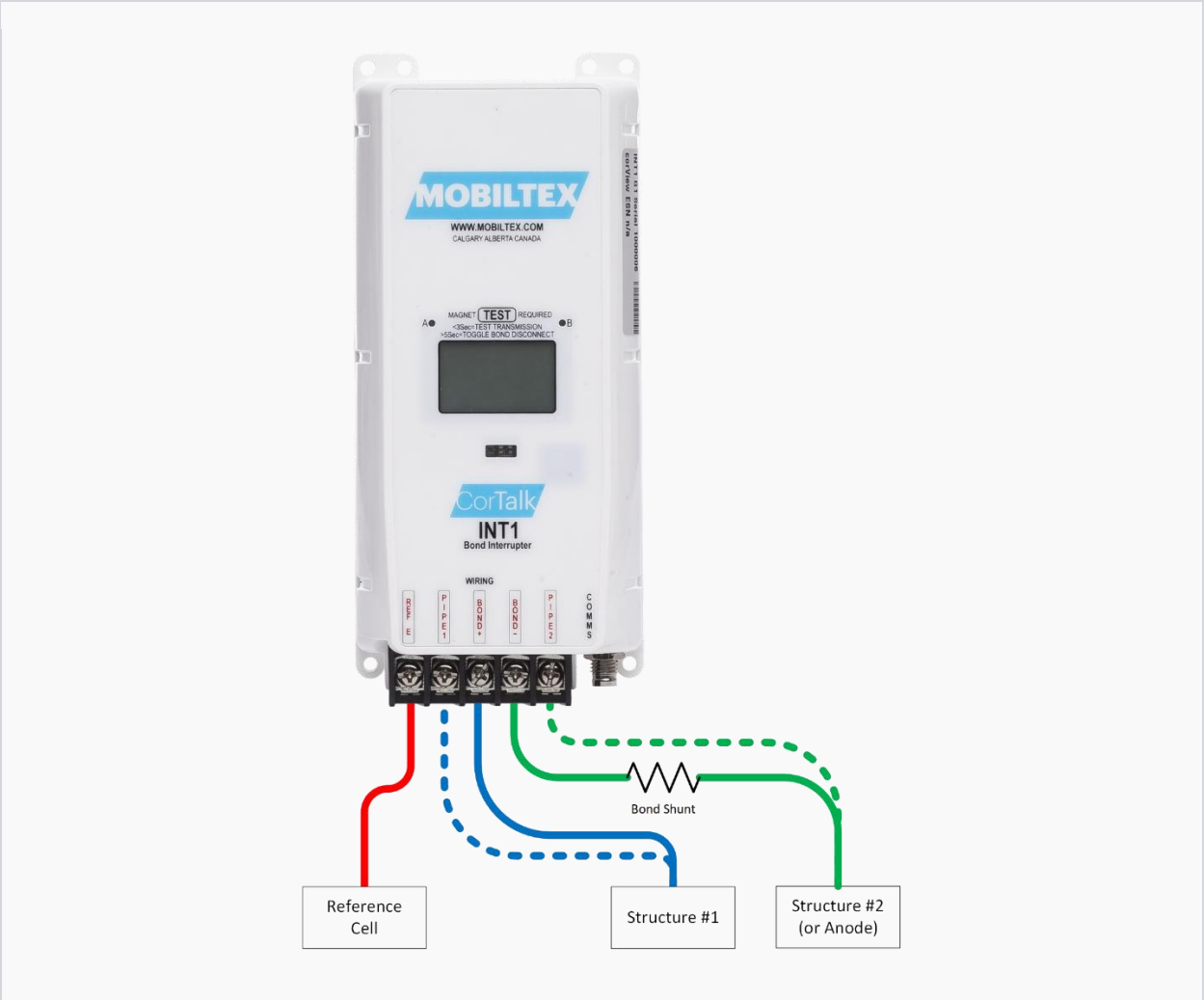


Figure 15. INT1 Connections

DESCRIPTION	LCD ICONS	WIRING
INT1 P/S1 DC Potential	P/S1 DC VOLTS	REF/PIPE1
INT1 P/S1 AC Potential	P/S1 AC VOLTS	REF/PIPE1
INT1 P/S1 Instant Disc. DC Potential	P/S1 DC VOLTS	REF/PIPE1
INT1 P/S2 DC Potential	P/S2 DC VOLTS	REF/PIPE2
INT1 P/S2 AC Potential	P/S2 AC VOLTS	REF/PIPE2
INT1 Bond DC Current	BOND DC CURRENT A	BOND+/BOND-
INT1 Bond AC Current	BOND AC CURRENT A	BOND+/BOND-

- 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.

5.6 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 RDL1 using the RDL1PGM configuration tool (see section 6). The INT1 requires a M8 cable to connect to the RDL1

5.7 Startup and Verification

All wiring should be secured and inspected before the RDL1 is powered on. The RDL1 will start operation when a magnet is placed against the “MAGNET REQUIRED” “PWR” indicator. Once powered, the RDL1 can be turned off by placing a magnet in the same location for a period greater than 5 seconds. Note that the unit will immediately power on when an INT1 or the USB cable is connected.

After the RDL1 is powered, observe that the RDL1 “Status” LCD indicator turns on (refer to section 5.8 for detailed LCD operation descriptions). The RDL1 will display the ‘GPS’ icon on the LCD display and 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 RDL1 will not send a power-up message or display measurements on the LCD screen until GPS signal acquisition is complete. Transmissions from RDL1 devices should be received usually in less than one minute. If the RDL1 programming interface or USB is attached to the RDL1 at power-up, the power-up message will be delayed by 5 minutes.

After the power up has shown up in CorView, place a magnet at the point labelled “TEST” on the RDL1 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.

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 a USB cable and the 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.

5.8 Status Display

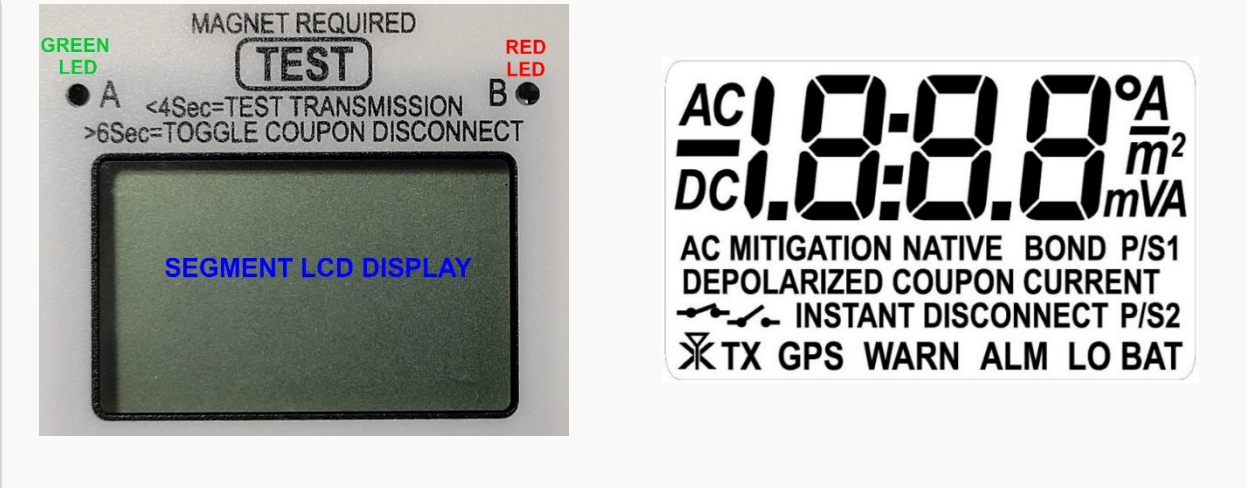


Figure 16. RDL1 Segment LCD and LED Status Indicators

The RDL1 has a segmented LCD display and two LED indicators (A and B, see Figure 16) that provide status information to the user.

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.

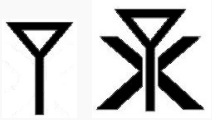
- The LCD display is active when the proximity sensor detects that the test station cap has been removed or when the programming interface is attached to the unit.
- If the proximity sensor is not enabled, the LCD will only display for the first minute after the unit is powered on. To enable the LCD display in this case, connect a USB cable between the RDL1 and host computer as shown in the figure below. The letters 'Usb' will appear briefly on the display.



Figure 17. USB Connected

- For details on icons displayed with each measurement, refer to section 5.5.
- 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 RDL1, an 'X' is shown through the antenna symbol if there is no coverage available. (Not used on the INT1)

TX	Communications antenna is transmitting. (Not used on the INT1)
GPS	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 RDL1 configuration software to retrieve further details.
LO BAT	The unit's batteries are low in capacity and should be changed at first opportunity.

Table 7. Description of Special LCD Icons

5.9 Coupon Disconnect

The internal coupon to pipe connection relay may be manually placed into a disconnect state for DC and AC coupons if a depolarization measurement type is part of the setup.

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 RDL1.

The coupon disconnect cannot be toggled if the RDL1 is currently performing a depolarization cycle.

5.10 External Power

Only approved Mobiltex external power accessories should be used with the RDL1.

5.11 Accessory Installation

5.11.1 INT1 Down Pipe

- The INT1 may be provided pre-mounted to the mounting bracket with 4 #6 screws, as shown in Figure 18. It will be mounted upside down in the tube.



Figure 18. INT1 On Mounting Bracket

- Attach the INT1 mounting bracket to the bottom of the test station terminal block. The INT1 should be opposite the nuts of the test station terminal board and on the same side that the RDL1 will be installed on. Place a fiber washer over the screw, push it through the test station terminal block, then attach the INT1 mounting bracket. Then place another fiber washer over the screw, and then a jam nut. Use a flathead screwdriver to hold it steady, then secure the nuts to 5.42Nm. Place a split washer and another jam nut over the screw and tighten to hand tight.

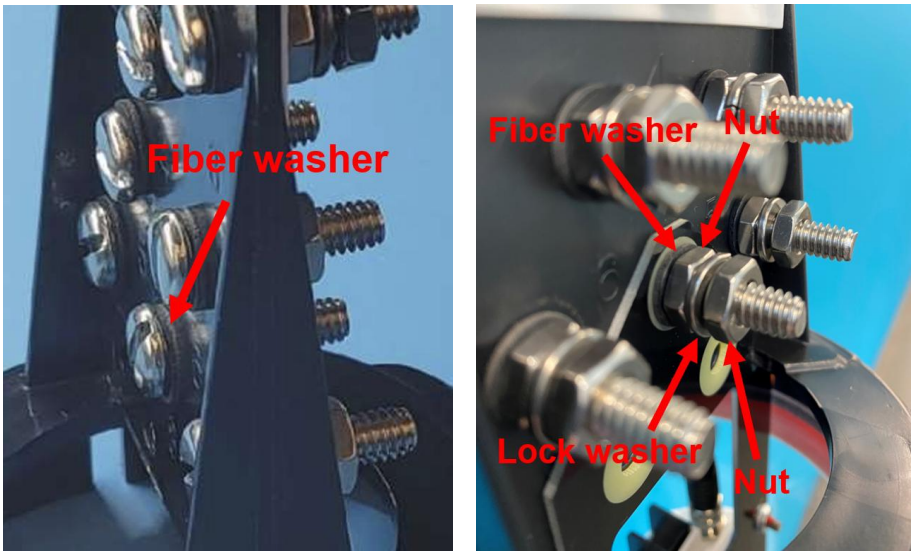


Figure 19. Attach INT1 Mounting Bracket to Test Station Terminal Block

- The RDL1 is installed with Mounting Bracket at the top of the test station. For details, refer to section 5.3 of this manual.

- After both are installed, use the INT1 to RDL1 cable provided to connect them. One end of the cable should go to the COMMS port on the RDL1, and the other end should go to the COMMS port on the INT1. This cable is critical for the INT1 to function.

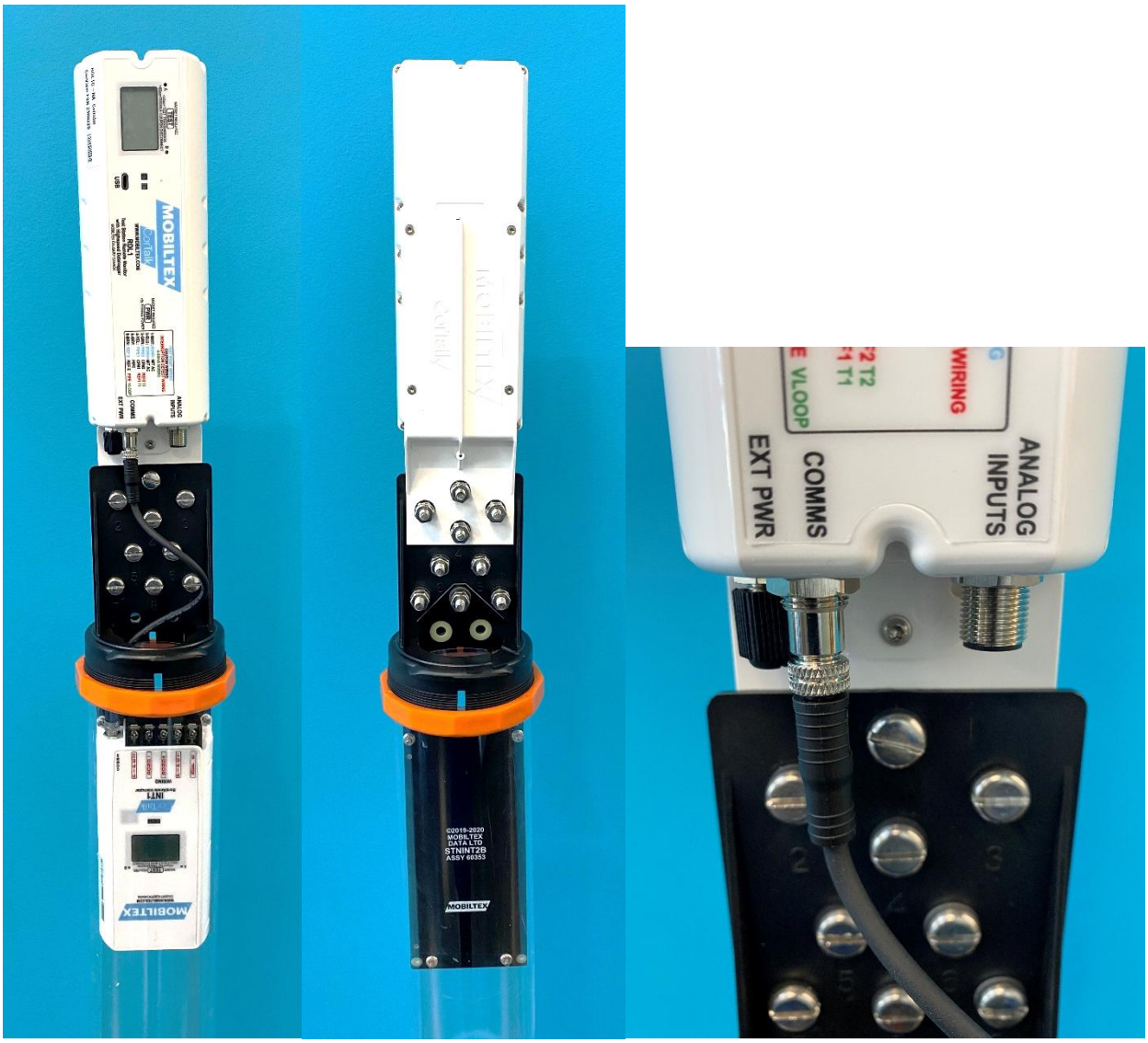


Figure 20. RDL1 and INT1 Installed

- Once connected, swipe a magnet over the “Magnet Required PWR” label on the RDL1. It will turn both the RDL1 and INT1 on.

5.11.2 Banana Jack Test Point Kit

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

- 8 banana jack test point ¼” screws
- 16 fiber washers

- 16 ¼” nuts
- 8 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.

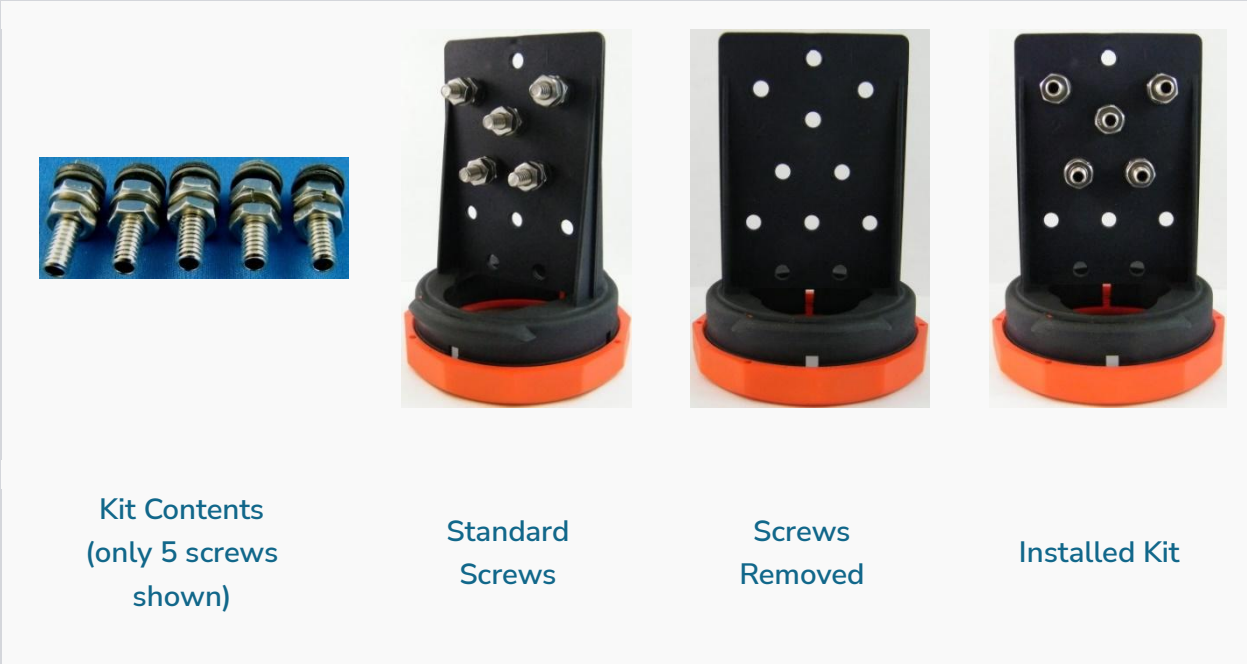


Figure 21. Banana Jack Test Point Kit A20100RDL10

- 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.

6 Configuration Using a PC

6.1 Configuration Equipment Requirements

The following items will be needed when configuring an RDL1.

- USB type A to micro cable, shown in Figure 22. It is connected between a PC and the RDL1. The USB does NOT power the RDL1 so be sure to disconnect it when not in use.

Programming Application

- Drivers and application for the RDL1 programming interface can be downloaded from the Mobiltex support site at https://www.mobiltex.com/support/software-documents/. Scroll down until you see the section for CORTALK RDL1 and choose “CorTalk RDL1 Install Pack” to download the installation software to your local drive. Contact your Mobiltex representative if you are having trouble with the installation.

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 22. USB Cable -Type A to Micro

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. Double-click on the “CORTALKINSTALLER.exe” application. The dialog on Figure 23 will appear.

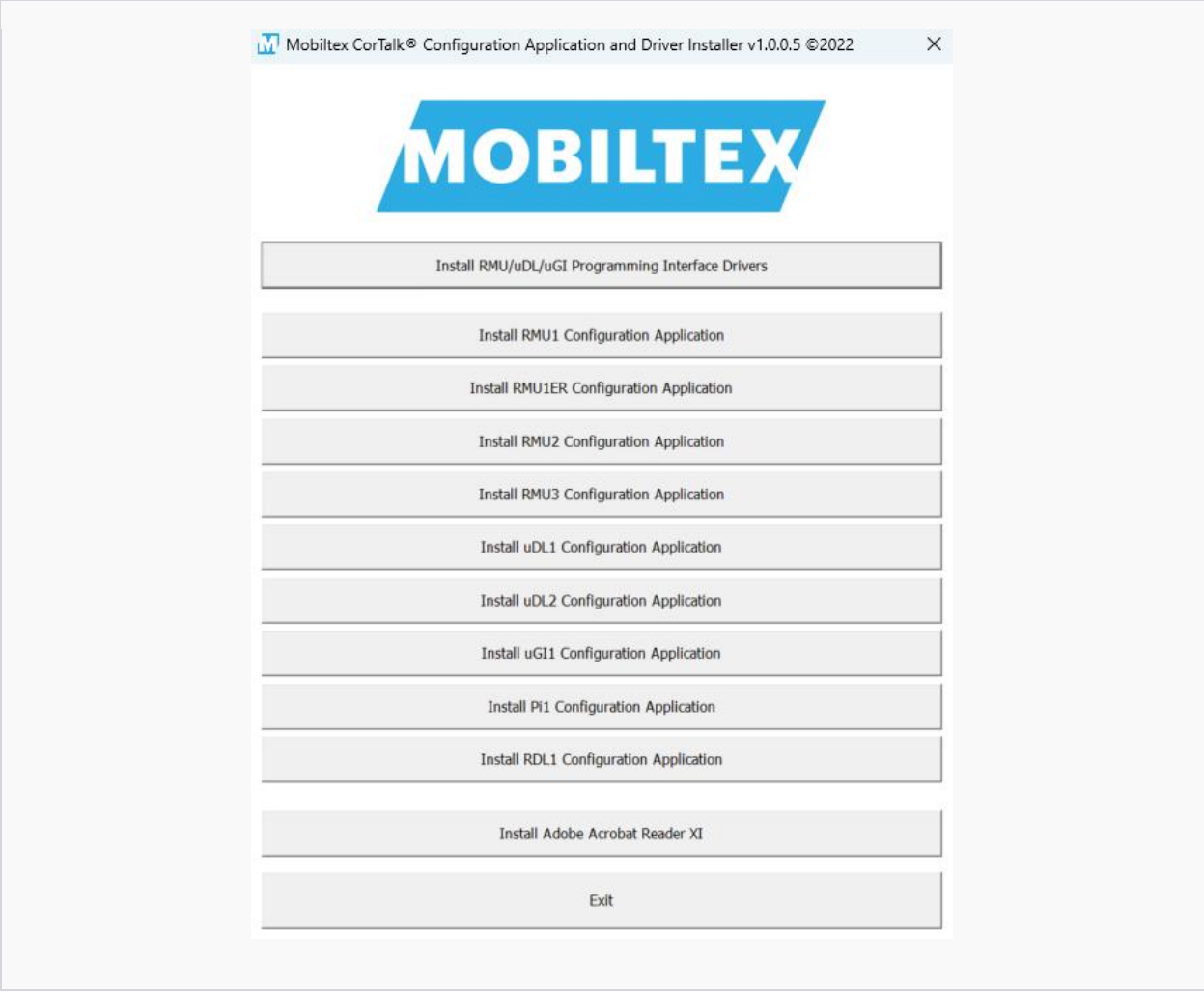


Figure 23. RDL1 Installer Dialog

6.2.1 Driver Installation

From the RDL1 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.

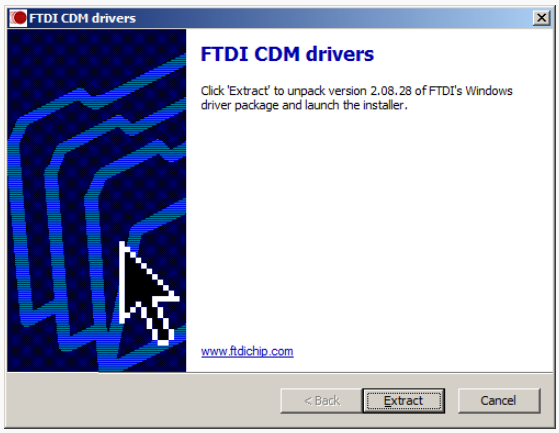


Figure 24. Driver Installation Screen

Once the driver installer completes, you may then plug in the RDL1 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 RDL1 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 25. 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.

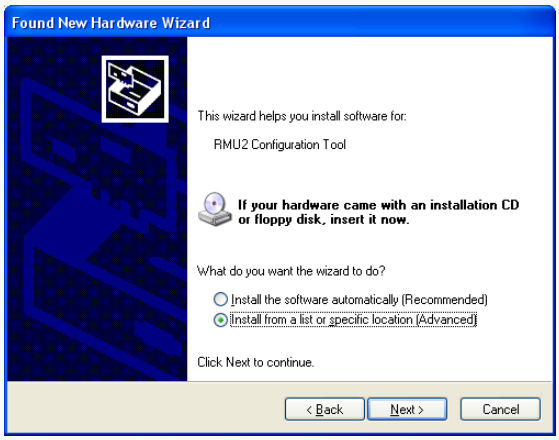


Figure 26. Driver Installation - Install From Specific Location

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 27.

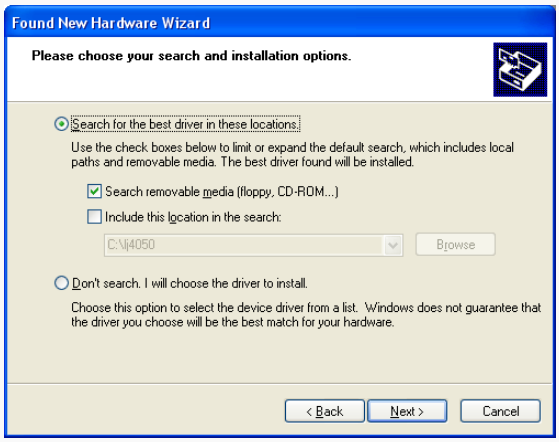


Figure 27. Driver Installation - Driver Location Selection

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.

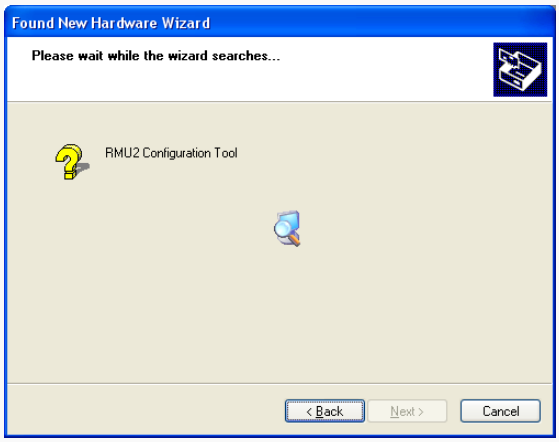


Figure 28. Driver Installation - Driver File Search

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 RDL1 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:

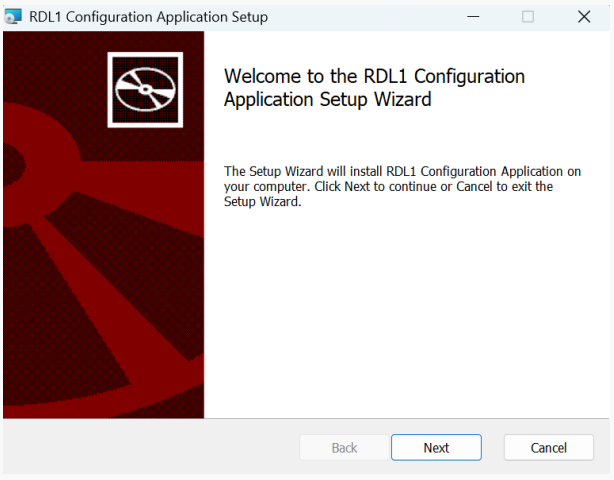


Figure 29. RDL1 Configuration Application Installation Dialog

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 30. Click “Finish” to complete the installation.

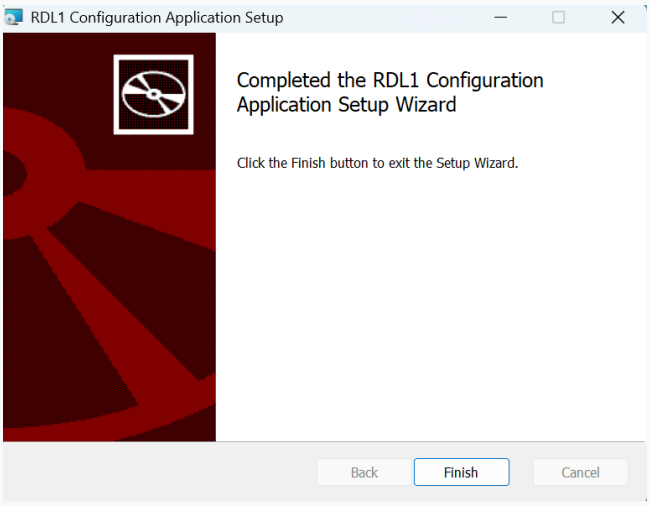


Figure 30. RDL1 Configuration Application Installation Complete

A shortcut to the configuration application and the RDL1 manual are created in the Windows start menu under the “RDL1 Configuration Application” folder.

6.2.3 Adobe Acrobat Reader XI

Adobe Acrobat Reader XI is provided in the installation package to allow viewing of the PDF version of the RDL1 manual. If Acrobat Reader is already installed on the PC, it is not necessary to re-install it. To install Acrobat Reader, click on the “Install Adobe Acrobat Reader XI” button on the RDL1 Installer dialog, and follow the instructions provided by the Acrobat Reader installation application.

6.3 RDL1 Configuration

- Attach the supplied USB cable between the PC and the RDL1.



Figure 31. RDL1 Programming Cable - USB Type A to Micro

- Start the configuration software by clicking on “RDL1 Configuration” shortcut in Windows start menu, under the “RDL1 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.

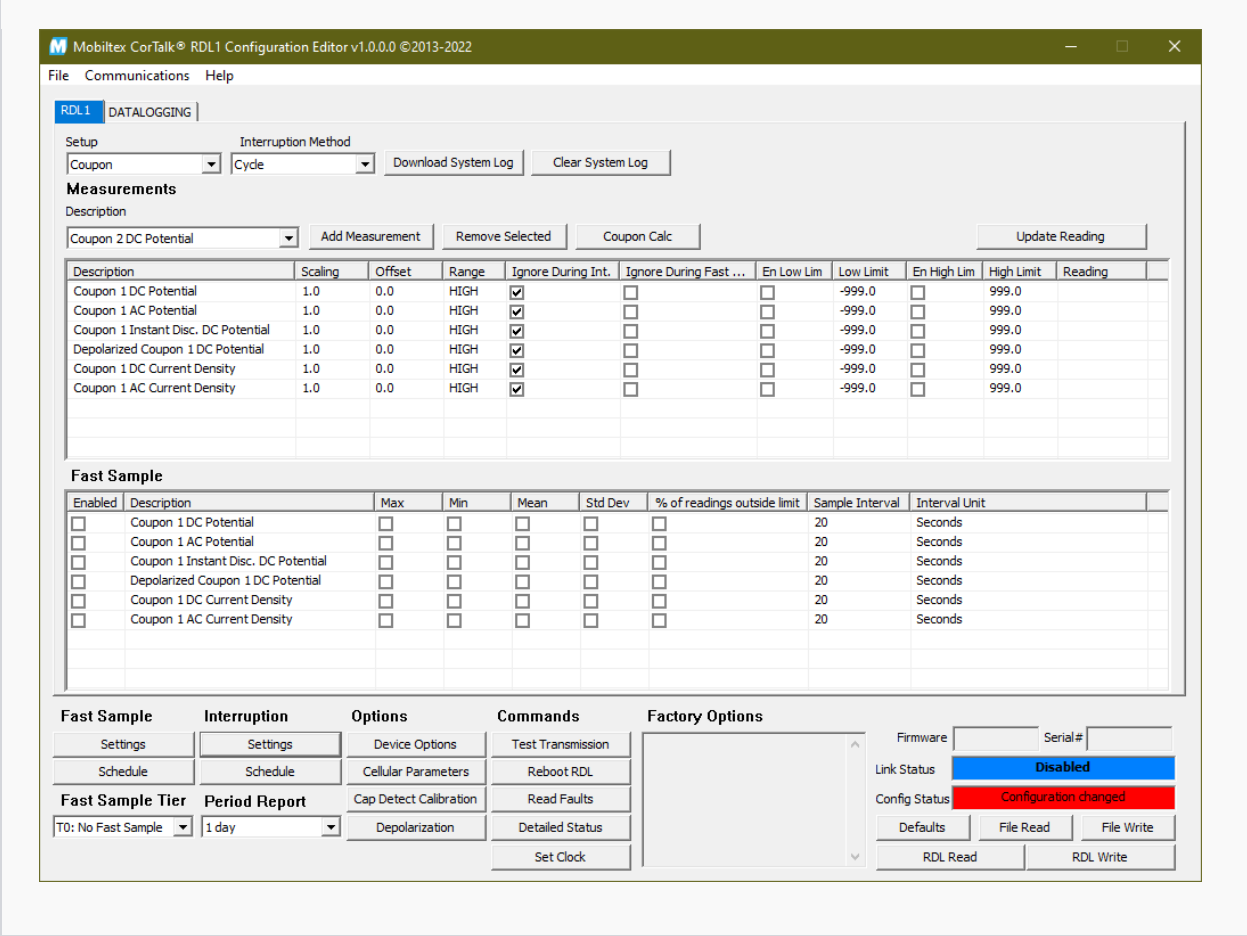


Figure 32. RDL1 Configuration Editor Main Screen

- Next, attach the programming interface to the RDL1 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 RDL1”. The “Link Status” field will briefly show “Busy” as the current configuration parameters are read from the RDL1.
  - After the link status returns to “Idle”, you will see the configuration settings currently in the RDL1.
  - If the RDL1 is not responding or not connected, an error dialog will pop up.

- Once communications have been established with the RDL1, the RDL1 parameters can be configured for the requirements of a particular installation site.

6.3.1 RDL1 Communications and Status

"RDL1 Communications and Status" is used for reading and programming the RDL1. 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 RDL1

6.3.1.2 Firmware Version

This field contains the version number of the application code installed in the main processor of the RDL1.

6.3.1.3 Serial#

The manufacturing serial number of the RDL1 is indicated in this field. This is also the ESN of the device.

6.3.1.4 Read Config From RDL1

This is used to get the current values configured in the RDL1. Note, if you have changed the values in any of the configuration groups, the changes will be overwritten by pressing this button.

6.3.1.5 Write Config To RDL1

Once all the configuration settings are set to the appropriate specifications, the unit can be configured by pressing the "Write Config to RDL1" button. The write can be confirmed by pressing the "Read From RDL1" button to ensure the values are the same.

6.3.1.6 Defaults

The RDL1 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 RDL1" must be pressed to write the parameters to the active configuration in the RDL1. The programming interface must be attached to the RDL1 for this function to operate.

6.3.1.7 Set RDL1 Clock

The clock on the RDL1 may be updated from the PC using this button. Note that the RDL1 clock setting is lost whenever the RDL1 is powered down.

6.3.1.8 Test Transmission

A test message can be sent to CorView by clicking on the 'Test Transmission' button. The RDL1 limits the number of test transmissions possible to six in a 12 hour period. Subsequent test transmission attempts will be ignored.

6.3.1.9 Reboot RDL1

Click the 'Reboot RDL1' button to restart the RDL1.

6.3.1.10 Read Faults

If the RDL1 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.

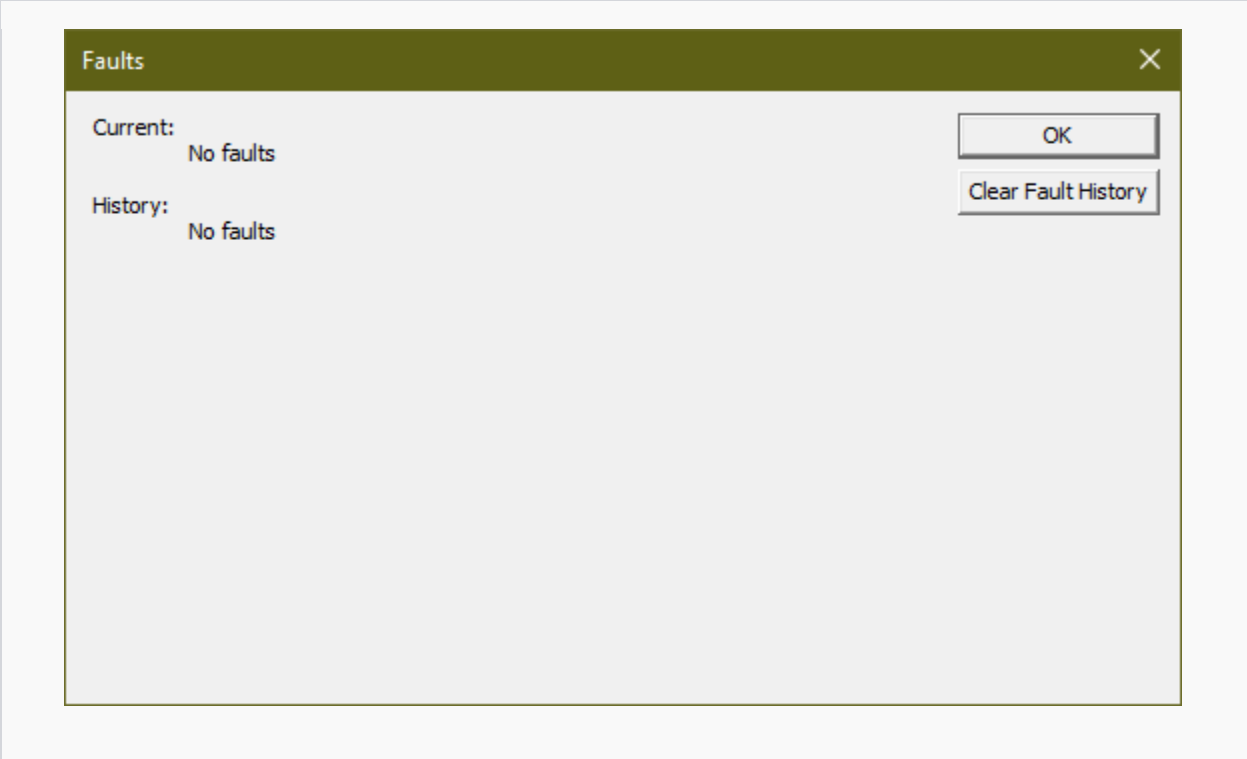


Figure 33. Faults Dialog

6.3.1.11 Detailed Status

Clicking the 'Detailed Status' button will display a dialog (see Figure 34) with detailed RDL1 information. The display is broken into several areas including GPS, communications, battery, faults, real time clock, and calibration. If a problem is encountered with the operation of the RDL1, Mobiltex may request a screen shot of this dialog to aid in diagnostics.

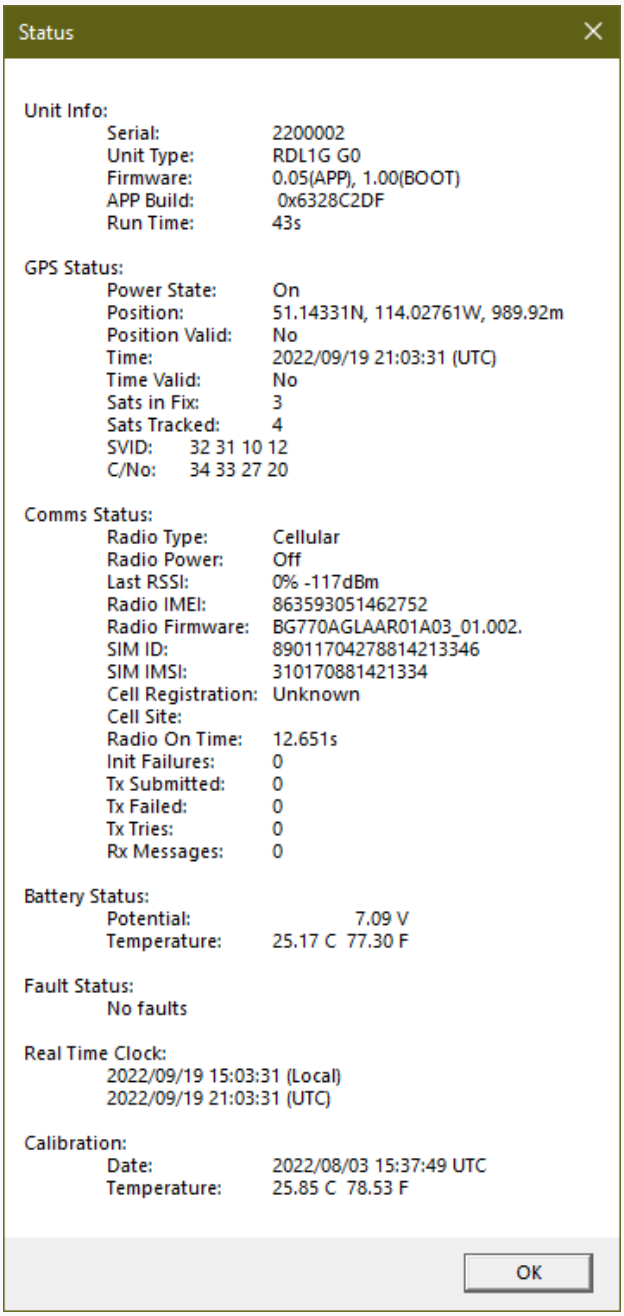


Figure 34. Detailed Status Dialog

6.3.1.12Cap Detect Calibration

The RDL1 is equipped with a non-contact sensor (see Figure 35) that can detect when a test station cap is installed over the RDL1. 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.

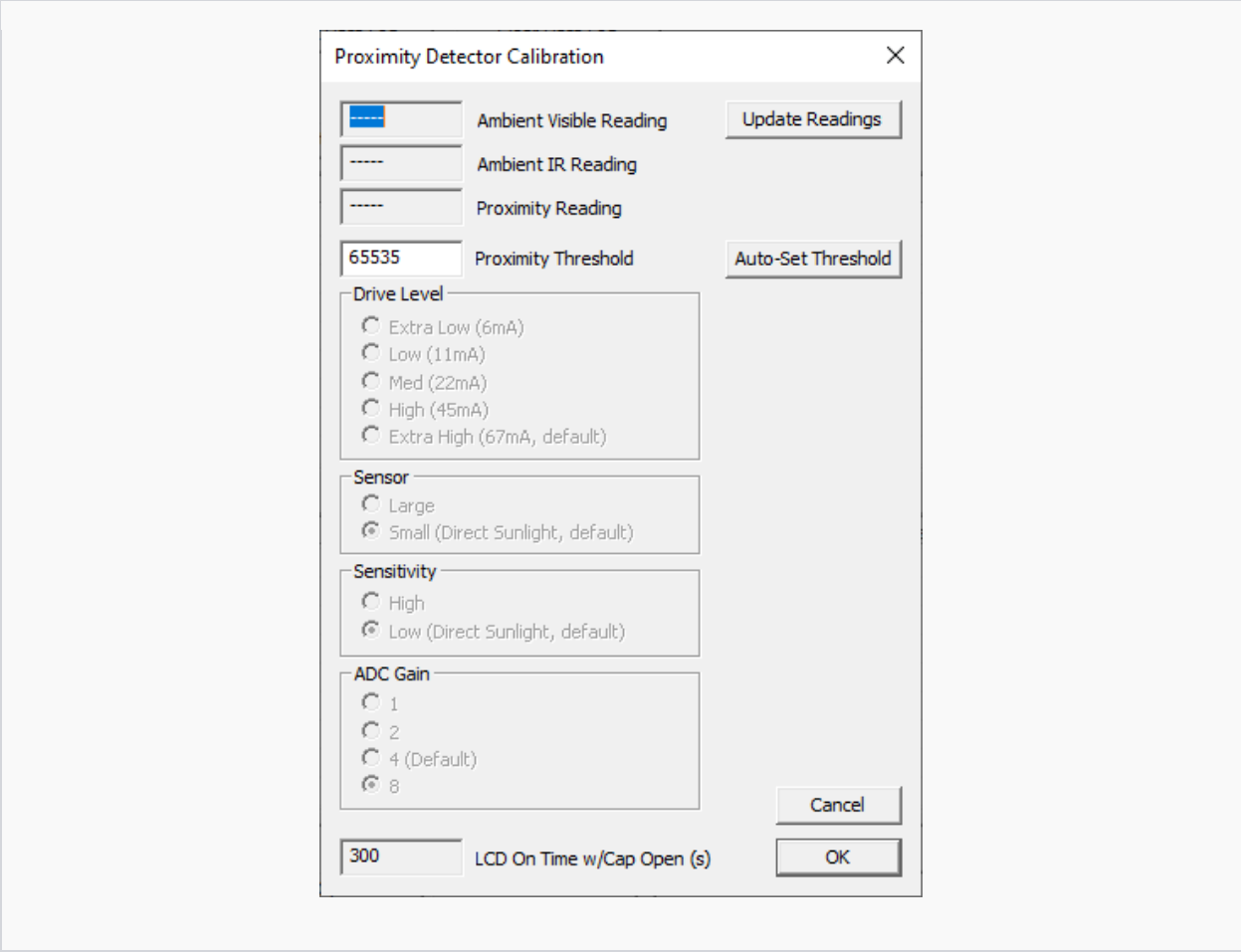


Figure 35. Cap Detect Sensor Calibration Dialog

- 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 RDL1.
- 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.
- 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 36. RDL1 Cap Proximity Sensor

6.3.2 Datalogging

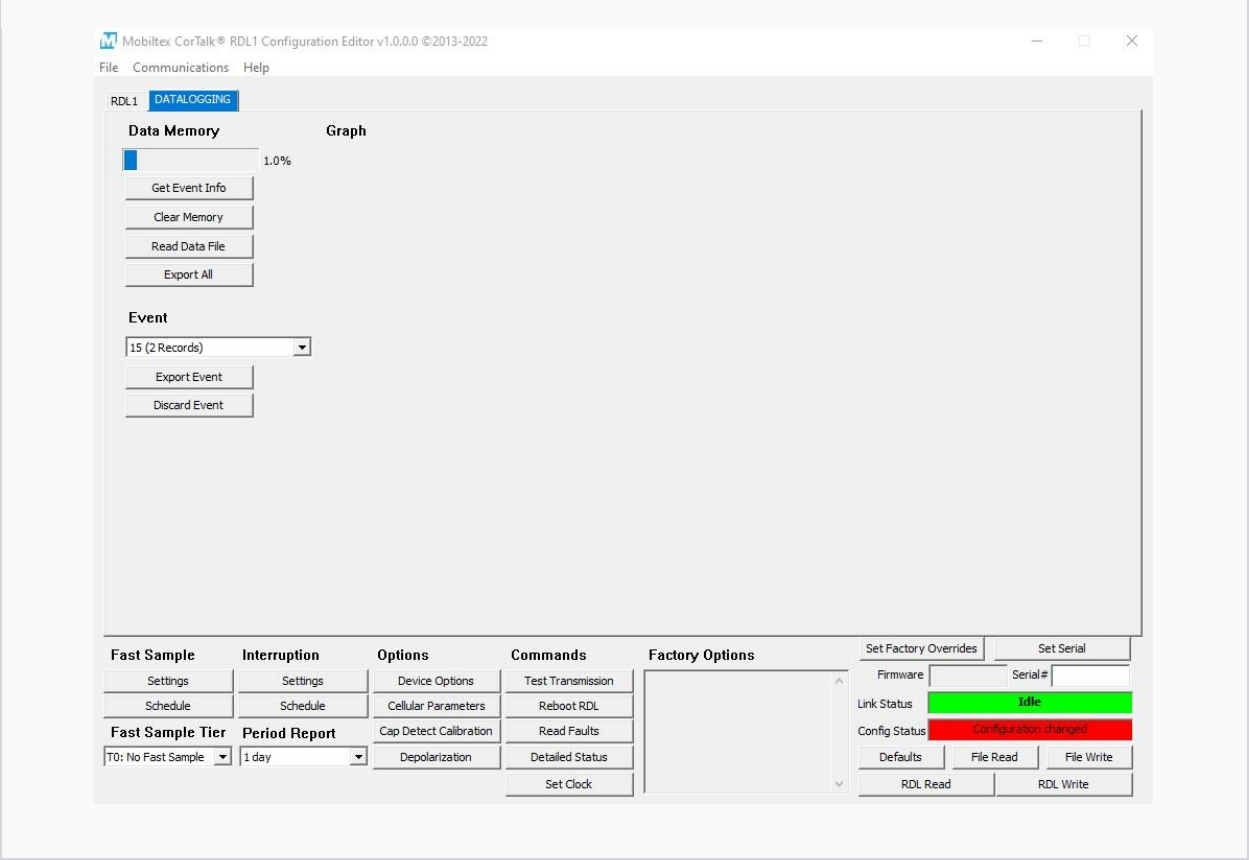


Figure 37. Datalogging

6.3.2.1 Get Event Info

When the USB cable is plugged into the RDL1 clicking 'Get Event Info' will read the stored events in the RDL1. Data memory usage will be updated.

6.3.2.2 Clear Datalogger Mem

The 'Clear Datalogger Mem' button allows the RDL1 datalogger memory to be reset back to a blank state.

- After clicking the button, a confirmation prompt will appear.
- If confirmation is given, then a progress display will be shown as the RDL1 memory is erased.
- This can take 5 minutes or more.

6.3.2.3 Read Data File

Clicking on 'Read Data File' allows for the opening of a binary data file containing fast sample data and converting it to Excel csv format.

6.3.2.4 Export All

All RDL1 events can be saved at once into separate files by clicking 'Export All'.

6.3.2.5 Individual Events

Individual events can be selected using the 'Event' dropdown and either exported using 'Export Event' or discarded using 'Discard Event'.

6.3.3 Setup

Select the setup type according to the installation application of the RDL1. Refer to section 5.5 for detailed descriptions of each measurement type. The setup determines the Measurements available. The 4 setups are:

- Coupon
- Test Point or Bond
- Interruption Detection
- 4-20mA Mode

6.3.4 Measurements

Depending on the setup type, the RDL1 can transmit up to 16 configured measurements to CorView (including those from the INT1). A description of each reading is provided in the "Measurements" panel of the main configuration screen.

The RDL1 and INT1 slots are differentiated by tabs. Select the tab for the unit you want to configure. Both the RDL1 and INT1 configurations are sent to the RDL1 regardless of the active tab or whether an INT1 is intended to be used. If no INT1 is detected, its configuration will be ignored. A RDL1 and INT setup can only handle a maximum of 16 measurements combined.

Each measurement may have the following attributes modified:

- Measurements can be added or removed from the list depending on the needs of the user
- **Scaling and offsets** can be applied to readings before being sent to CorView
- **Range** can be selected for current inputs. The voltage range is locked to HIGH.

The following ranges apply to coupon current and bond shunt measurements for the RDL1:

Coupon Current	+/-12mADC, 8.50mAAC, LOW Range +/-120mADC, 85.0mAAC, MED Range +/-400mADC, 280mAAC, HIGH Range
Bond Shunt	+/-12mVDC, 8.50mVAC, LOW Range +/-120mVDC, 85.0mVAC, MED Range +/-400mVDC, 280mVAC, HIGH Range

- **Ignore during Int**. will ignore the limits when the unit is interrupting
- **Ignore during Fast Sample** will ignore the limits when the unit is fast sampling
- **Low and High Limit** alarms may be enabled and set. If the limit is exceeded an exception message will be sent to CorView. Exception checks are every hour.
    - If the low limit threshold is set above the high limit, the RDL1 looks for an inclusive alarm for that measurement. In this case it will send an exception if the reading is measured in the band between the low and high limit.
    - These limits apply to both regular readings and during fast sampling. A configurable hysteresis of 0.5% is applied to the limits during fast sampling to reduce the number of transient alarms.

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

6.3.5 Update Readings

Clicking the '**Update Readings'** button will request that the RDL1 and INT1 perform a new conversion cycle on all the reading's slots (except for the depolarized coupon potential). A reading update will typically take under 5 seconds to complete.

6.3.6 Depolarization

Depolarization is enabled by using the Coupon Setup and adding one or both Depolarized Coupon DC Potential measurements. Depolarization parameters allow the RDL1 to disconnect the 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 RDL1 will wait after a power-up before initiating the first depolarization cycle.
- 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.

6.3.7 Periodic Report Interval

The periodic report interval determines how often the RDL1 will send scheduled readings to CorView. This parameter is normally locked down at the factory according to the purchased airtime plan.

Readings are taken every hour to check for exceptions. If the unit's reporting plan is 6 or 1 hour, the readings are saved and buffered. All the saved readings are then transmitted every 12 hours when the unit contacts CorView. When the unit takes a reading and limits are enabled, it will check if the readings exceed the limits. If they do, the RDL1 will immediately send a limit exception message to CorView with the readings. Exception messages are limited to 6 exceptions in a 12-hour window.

If radio 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 RDL1 can buffer up to 48 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.

6.3.8 Fast Sample Tier

The fast sample tier determines the maximum frequency that the RDL1 can sample at. This parameter is locked down at the factory according to the purchased Data Services and Tier Plan.

If the radio is disabled in device options, the tier gets set to Tier 3: 100ms. The unit can then fast sample at any frequency but will not transmit any readings to CorView. The data can be retrieved locally.

6.3.9 Fast Sample

Every measurement that is enabled (added to the measurement panel) can also be enabled for fast sampling by checking the "Enabled" checkbox in the "Fast Sample" panel. Only measurements enabled for fast sampling will be part of fast sampling. This allows the user to have a larger set of readings for their usual schedule but focus on a subset of them for fast sampling.

Fast sampling is supported on most readings, but not on any instant disconnect readings or interruption detection. The INT1 also does not support fast sampling.

Fast sample data is stored in the onboard data flash and statistics can be generated from the data and sent to CorView as snapshot of the event. Supported statistics are:

- Maximum
- Minimum
- Mean
- Standard Deviation (Std. Dev.)
- Percentage of acquired readings outside the measurement limits

AC PEAK DETECTION

- To set the unit up for AC peak detection to mimic the RMU1:
- Add the AC Current Density to the measurements (Setup: Coupon)
- Set a high limit for the AC Current Density reading
- Set the Fast Sample schedule to Always Active
- Enable Fast Sampling for the AC Current Density and set the interval to 20s (or less).
- Select the "Max" and "% of readings outside limit" checkboxes to get the statistics sent to CorView.
- Optionally uncheck "Always send Fast Sample data to CorView" in Fast Sample settings if you only want statistical data sent to CorView.
- Ensure no other enabled Fast Sample intervals are <1 second as this will limit the maximum fast sample duration to 1 hour.
- Fast Sample events will be sent to CorView every 24 hours. Alarm Exceptions will be sent

Regardless of whether any statistics are configured, the unit will send a fast sample Start and Finish message to CorView with a unique Event ID. This can be either always sent to CorView or retrieved through CorView if of interest. (See 'Fast Sample Settings')

The sample interval can be configured from an interval of 100ms to 16383 minutes for DC readings, but AC readings have a minimum of 200ms between readings. The minimum sample

reading is dependent on the unit's Fast Sample Tier. See Table 1. CorView Reporting and Fast Sampling Plans.

The fast sample event timing is not affected by depolarization. If the unit is configured to depolarize during a fast sample event, it will do so. The fast sample event will start at the appointed time and readings that are no longer valid will be stopped (like Coupon DC Potential). Any valid readings will either continue (for AC mitigation or Bond measurements for example) or start (like Depolarized Coupon DC Potential). Similarly, when depolarization ends, the unit will return to taking the fast sample readings that are now valid like Coupon DC Potential and stop the Depolarized Coupon DC Potential readings.

Instant disconnect events are disabled during fast sampling because they can affect other readings when they disconnect the coupon.

When the RDL1 datalogger's memory reaches capacity, it continues logging by overwriting the oldest stored records with new data. If old Fast Sample data is already sent to CorView, they can be downloaded from there. Otherwise, retrieve the data locally before memory reaches capacity to prevent loss of data.

6.3.9.1 Standalone Usage

The Fast Sample Tier will be ignored if the radio is disabled. This allows using the RDL1 as a standalone datalogger and the data will have to retrieved locally. No scheduled readings or Fast Sample Events will be sent to CorView. In 'Device Options' select 'Disable Radio'. This will allow the unit to sample at Tier 3.

6.3.9.2 Fast Sample Settings

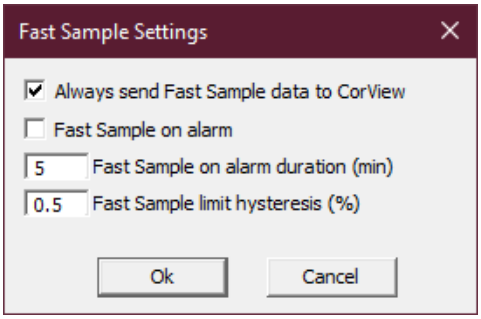


Figure 38. Fast Sample Settings

- **'Always send Fast Sample data to CorView'** will immediately send the Fast Sample data to CorView after the event is complete. It does not wait for the user to request it from the device through CorView.
- **'Fast Sample on alarm'** will start fast sampling for a pre-determined number of minutes on the configured Fast Sample slots after the unit detects it has caught a reading exception (when it sends a reading to CorView). If already Fast Sampling, this is ignored. The exception must be cleared before the Fast Sample on alarm occurs again.
- **'Fast Sample on alarm duration (min)'** is the number of minutes to Fast Sample after a reading exception is detected. It can be between 1-10 minutes.
- **'Fast Sample limit hysteresis (%)'** helps prevent spurious alarm messages while fast sampling if the samples are very near the limit. It creates a dead band around the limit. This

only applies during fast sampling. For example, if the high limit is -1V, and the hysteresis is 0.5%, the unit will only send an alarm message while fast sampling when the readings exceed -0.995V and clear upon -1.005V.

6.3.9.3 Fast Sample Schedule

The Fast Sample Schedule has four different modes and allows setting active days and the time zone for the device.

- Disabled Fast Sampling: Fast Sample will not occur until the schedule is changed by the user.
- Always Fast Sampling: Fast Sample will start and continue until the schedule is changed by the user.
- Continuous Fast Sampling with Start/Stop Schedule: The schedule will start on the Start date and time selected by the user and continue until the Stop date and time. If any days are set to be inactive, the unit will not fast sample for those 24 hours starting at midnight.
    - For example: Fast Sampling goes from Monday 8am to Friday 6pm. Wednesday is inactive.
- Daily Fast Sampling with Start/Stop Schedule: The schedule will start on the Start date and time selected by the user. It will stop ON THE SAME DAY at the Stop time selected by the user. This will repeat until the selected Stop day. There will be no fast sampling on any inactive days.
    - For example: Fast Sampling goes from Monday-Friday, 8am - 6pm. Wednesday is inactive.

NOTE

- The RDL1 only allows fast sampling at less than 1 second interval for 3 hours a day if the radio is enabled. After that the event will end regardless of the schedule. If the radio is disabled, the Tier level is unlocked and there are no limits on fast sampling.

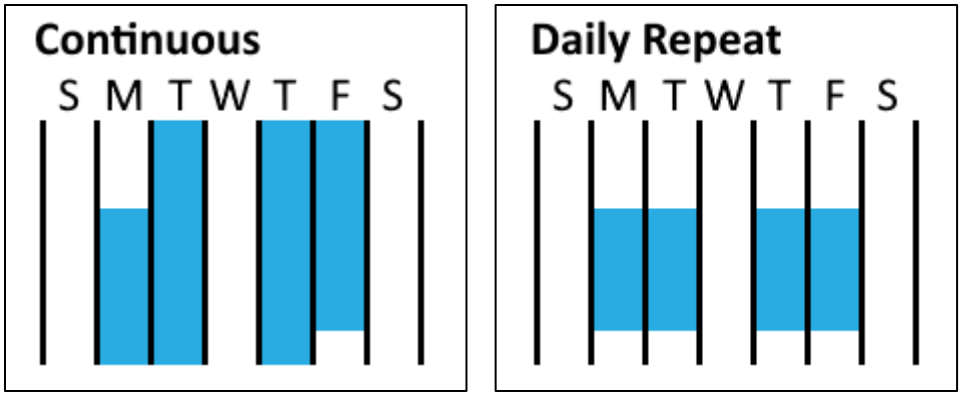


Figure 39. Continuous Example (left) and Daily Repeat Example (right)

6.3.10 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 RDL1, so their dwell parameters are internal to the units. The Control page in CorView can be used to send interruption commands to the RDL1.

NOTES

- The RDL1 only contacts CorView every 12 hours. Fast sampling and interruption should be scheduled at least 24 hours in advance.
- For more immediate operation, fast sampling and interruption can be set using the configuration software locally while on site.

The Interruption Settings and the Interruption Schedule apply to both the RDL1 and the INT1. However, the Interruption method is distinct between them. This allows the INT1 to interrupt while not affecting coupons connected to the RDL1. 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.

6.3.10.1 Interruption Settings

When configuring the Interruption Setting, 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 RDL1 operation to match other vendors' equipment. 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.

6.3.10.2 Interruption Schedule

The Interruption Schedule is configured in a similar manner to the Fast Sample Schedule. See Section 6.3.9.3 Fast Sample Schedule for more information.

6.3.10.3 Interruption Method

The Interruption Method is specific to the unit, so the INT1 and the RDL1 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 if an instant off measurement is part of the setup.

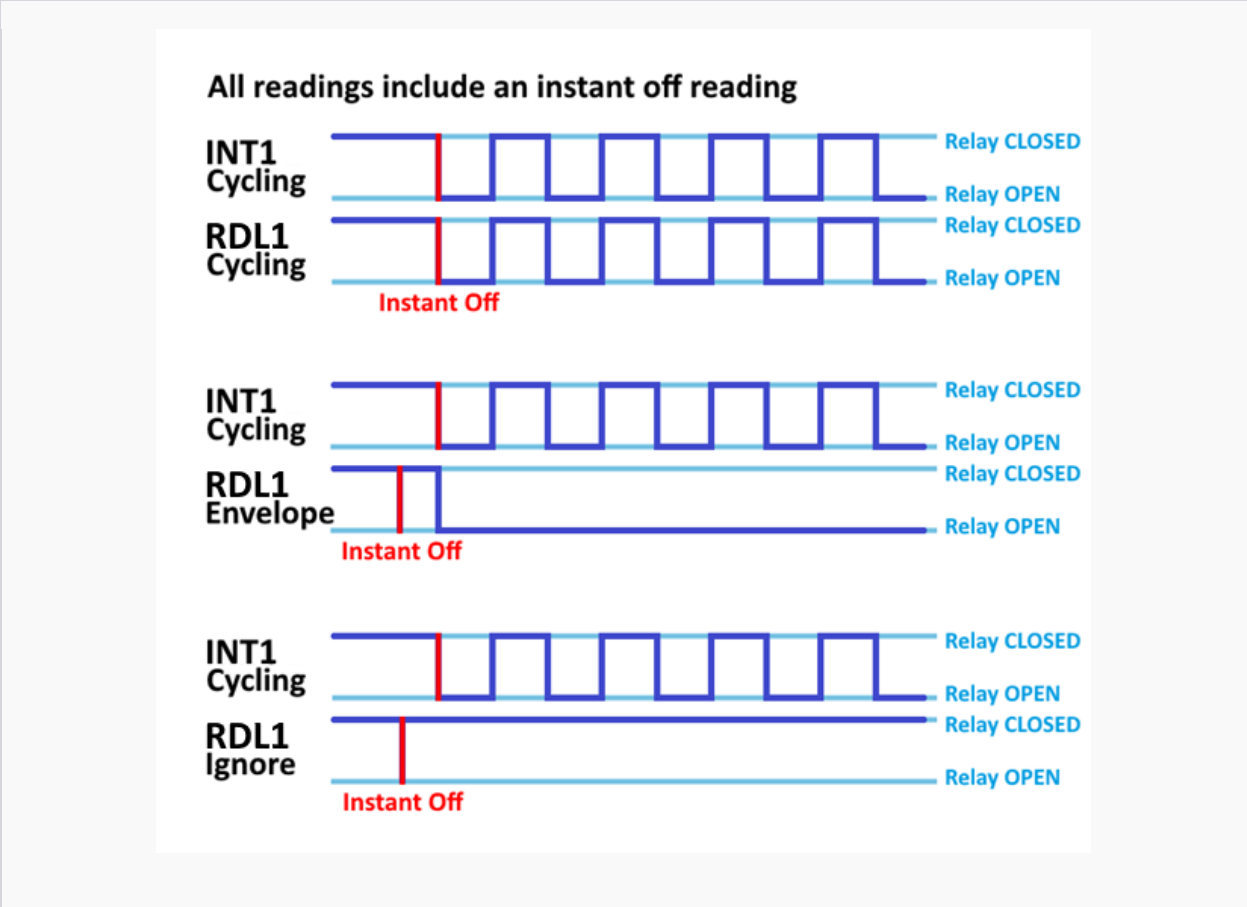


Figure 40. Interruption Methods

6.3.11 Device Options

Several options are available that affect the operation of the RDL1.

- The **'Instant Disconnect 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. By default, it is 100ms.

- The '**Enable Cap Report**' option allows the RDL1 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" (RDL1OPTION2).

- The '**Disable Cap Detector**' option disables the cap infrared proximity sensor. This option is typically used to increase battery life on the RDL1.

  - 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.

- The '**Disable Radio'** option disables the radio allowing the unit to operate as a standalone datalogger.

  - This allows for sampling at 100ms regardless of the Fast Sample Tier purchased.

- The '**Disconnect DC for AC current density readings'** option is for when 2 coupons are connected. During an AC current density reading, the other coupon will be disconnected allowing for a more accurate reading. The reading is then taken after the current Instant Disconnect Offset value (usually 100ms).

  - During fast sampling, this is ignored, and the other coupon remains connected.

7 Mobile Device Configuration

The RDL1 may also be programmed with a compatible iOS or Android-based mobile device when an RBT1 Bluetooth Interface cable or RMU1/2/3 Programming Interface is used. The RBT1 cable (shown in Figure 41) uses Bluetooth Smart (BLE) to enable a wireless connection to a compatible mobile device.



Figure 41. RBT1 Bluetooth Interface Cable

An RMU1/2/3 Programming Interface (Kit A20A0333101) is shown in Figure 42.



Figure 42. RMU1/2/3 Programming Interface

The mobile device must have the RDL1 Config mobile app loaded from either the Apple App store or the Google Play store, as applicable. Direct links:

- https://apps.apple.com/th/app/rdl1-config/id6443991683 (Apple iOS)

  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.

- https://play.google.com/store/apps/details?id=com.mobiltex.rdl1config (Android)

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

With the RBT1 or RMU1/2/3 programming interface and the app, the need for a PC is eliminated. All configuration functions can be performed with the mobile device through the programming interface via a wireless Bluetooth connection.

- The RMU1/2/3 programming interface is connected to the RDL1 with an M8 (round 4-pin connector) cable. One end of the cable goes to the COMMS port of the RDL1, and the other end goes to the middle port of the RMU1/2/3 programming interface.
- The RBT1 cable has one end connected to the COMMS port of the RDL1 and the other end dangling.
- Once the cable is attached, the app on the mobile device can be started.
- A connect button in the app initiates the process to connect with the RBT1 or RMU1/2/3 programming interface.
- A list of active RBT1 cables or RMU1/2/3 programming interfaces in the area is brought up; each RBT1 or RMU1/2/3 programming interface has a serial number cable on it to identify the unit.
- Once the unit is selected, if it is the first connection attempt between the mobile device and that programming interface, a pop-up will show up requesting a pairing code. The default pairing code is '123456' (this can be changed).
- After the connection is established, capabilities are similar to the PC application, the configuration can be read, modified and written and status information can be pulled.
- To configure an INT1 with an RDL1:
    - Make sure the INT1 is **NOT** connected to the RDL1 (for example, through the RBT1 cable).
    - Enable "Show SubRMU1 (INT1)" in the app's Application Settings, and make changes to the configuration as needed.
    - Write the configuration to the RDL1, then disconnect the programming interface from the RDL1.
    - Connect the INT1 and RDL1 with a M8 cable, and the INT1 will get the new configuration.

Figure 43 shows some sample screenshots from the Android app; the iOS app is similar in appearance.

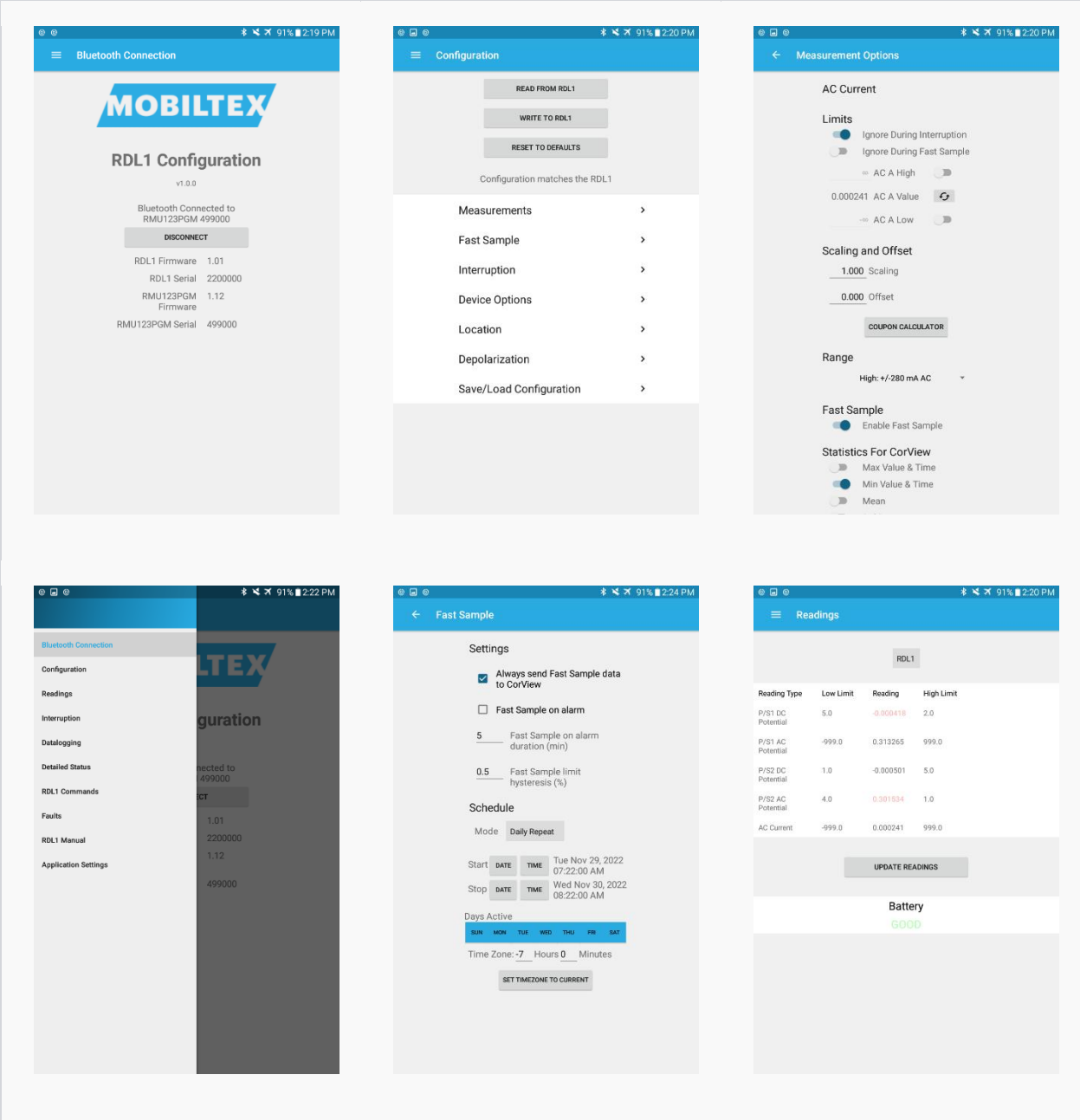


Figure 43. Android App Sample Screenshots

8 Battery Replacement

8.1 RDL1

Contact Mobiltex Technical Support regarding battery replacement.

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 (2x Mobiltex P/N B02221RDL10). The batteries are oriented according to the polarity markings shown on the main INT1 battery board.



Figure 44. INT Battery Operation

5. Place the lid back on, note it only goes on in one direction. Ensure the gasket is within its grove. If it's 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, it may cause the plastics of the case to warp.



Figure 45. INT1 back tightening scheme

7. Re-install the INT1 as instructed in section 5.11.1.

No other maintenance or cleaning is required.

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: https://www.mobiltex.com/

Service Email: service1@mobiltex.com

Service Website: https://www.mobiltex.com/support/

A. Equipment Specifications

RDL1 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	550 grams (1.2 lbs)		
Environmental	IP68 1 metre, 60 minutes		
Size	220mm x 75mm x 50mm (8.66”x2.95”x1.97”)		
Enclosure	UV stable, wide temperature polycarbonate		
Pollution Degree	3		
External Analog Channels	2 potential, 1 bond shunt, 2 coupon current		
Measurement Type	Category 1 (as per CSA C22.2 – 61010)		
Analog Ranges (DC & AC True RMS)	Potential:	+/-75VDC or 53VAC	
	Current:	+/-12mADC, 8.50mAAC	Low Range
		+/-120mADC, 85.0mAAC	Med Range
		+/-400mADC, 280mAAC	High Range
	Bond Shunt:	+/-12mVDC, 8.50mVAC	Low Range
		+/-120mVDC, 85.0mVAC	Med Range
		+/-400mVDC, 280mVAC	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	
	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	>40 Mohm (potential) 100 Gohm (bond current shunt)
Coupon Current Shunt	1 ohm
ADC Resolution	24 bits
Temp. Measurement Accuracy	+/-4° C (+/-7° F) over -40° to +60° C (-40° to +140° F)
Internal Battery	Proprietary Li-SOCl2 Pack, 7.2V/18Ah Battery Life: Typically 10 years+ based on readings every 7 days. Typically 5 years+ based on readings every 12 hours and 2 weeks of fast sampling and interruption per year
External Power	Only Mobiltex external power accessories can be used ⎓ 6.5-11Vdc, 1A max
Internal Battery Measurement	OK, Warning and Low conditions displayed on CorView
Communications	Cellular LTE Cat M1/NBIoT B2,4,5,12,13 (RDL1G-LTEM)
GPS Receiver	72-channel u-blox M8
Datalogger Storage	8 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
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)	
Battery Life	Typically 5 years 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	

B. RDL1 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.

RDL1G
FCCID: XMR2021BG770AGL
IC: 10224A-2021BG770A

Complies with FCC standards.
FOR HOME OR OFFICE USE