RADIORANGER®

WIRELESS FAULT INDICATION SYSTEM

Instruction Manual

Product Overview

The RadioRANGER® Wireless Fault Indication System helps troubleshooting crews locate faults at street level, reducing the number of subsurface vaults they need to access. As a result, the system dramatically reduces fault-locating time and troubleshooting costs, while improving reliability and personnel safety. The RadioRANGER system consists of a submersible Wireless Interface radio, faulted circuit indicators (FCIs), and a hand-held Remote Fault Reader.

As shown in *Figure 1*, the SEL fault indicators connect to the Wireless Interface via magnetic probes. The Wireless Interface communicates fault status via radio to the hand-held Remote Fault Reader.

Figure 1 RadioRANGER System Setup

Options and Accessories

Fault Indicators Compatible With the Wireless Interface

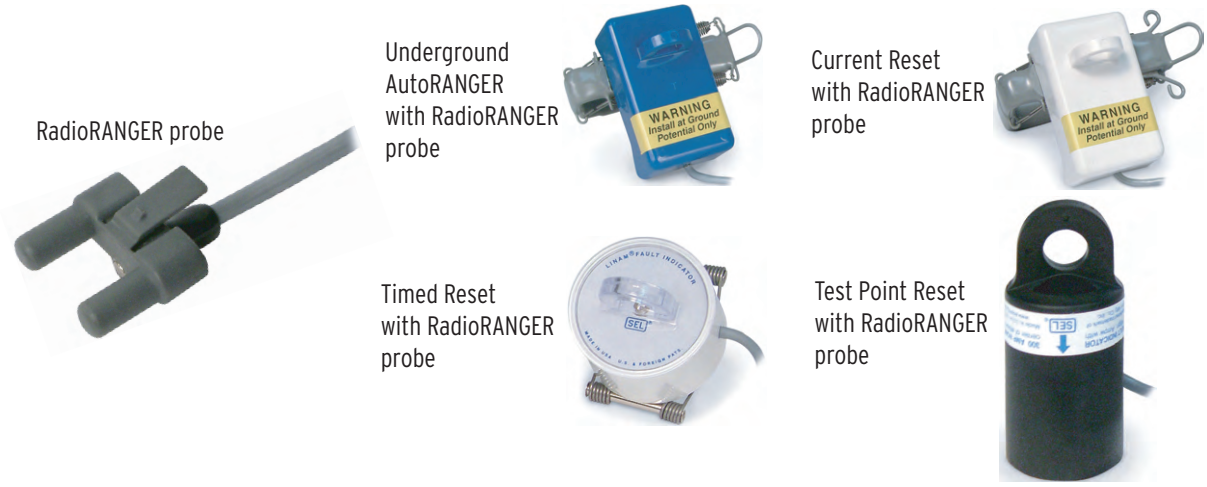

Figure 2 Each Fault Indicator Model Is Equipped With a RadioRANGER Probe

Wireless Interface Remote Antenna Option

TIP FROM RANGER: If you need the remote antenna option for the Wireless Interface, you must select it at time of order. The remote antenna cannot be added to a Wireless Interface in the field.

In vaults where flooding is common or where the FCI cable length is insufficient for optimal installation, order Wireless Interfaces with the remote antenna (see *Figure 3*). The remote antenna provides an extra 15 feet of cable length and improves range.

Figure 3 Wireless Interface With Remote Antenna

Operating Range

The RadioRANGER system is designed to provide a street-level operational range of 30 feet from a Wireless Interface installed in a subsurface vault. However, testing has shown that actual ranges can be as far as 160 feet or more. The actual operating range at each vault may vary because of a number of factors including:

- Vault construction.
- Subsurface RF impediments such as vault equipment.
- Height of Wireless Interface antenna relative to the top of the vault. A higher antenna location typically provides better range. The Wireless Interface can be ordered with a remote antenna to facilitate higher antenna mounting (see *Wireless Interface Remote Antenna Option*).
- Street-level RF impediments such as buildings, vehicles, etc.
- Orientation of the Remote Fault Reader antenna (see *Figure 4*).

Remote Fault Reader Orientation

The orientation of the Remote Fault Reader antenna (integral or remote) is a critical factor of the RadioRANGER operating range. Because of the Wireless Interface antenna radiation pattern, operators should always ensure that the Remote Fault Reader antenna is oriented vertically (see *Figure 4*). Never point the Remote Fault Reader antenna directly at the manhole or directly at the location of the Wireless Interface. Doing so will dramatically reduce the operating range of the RadioRANGER system.

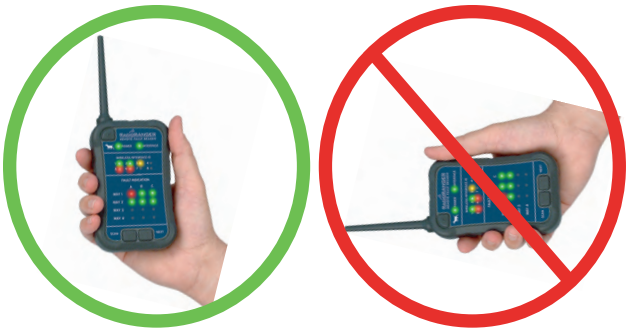

Figure 4 Position the Remote Fault Reader As Shown at Left

Installing the Wireless Interface (SEL-8300 and SEL-8300X1)

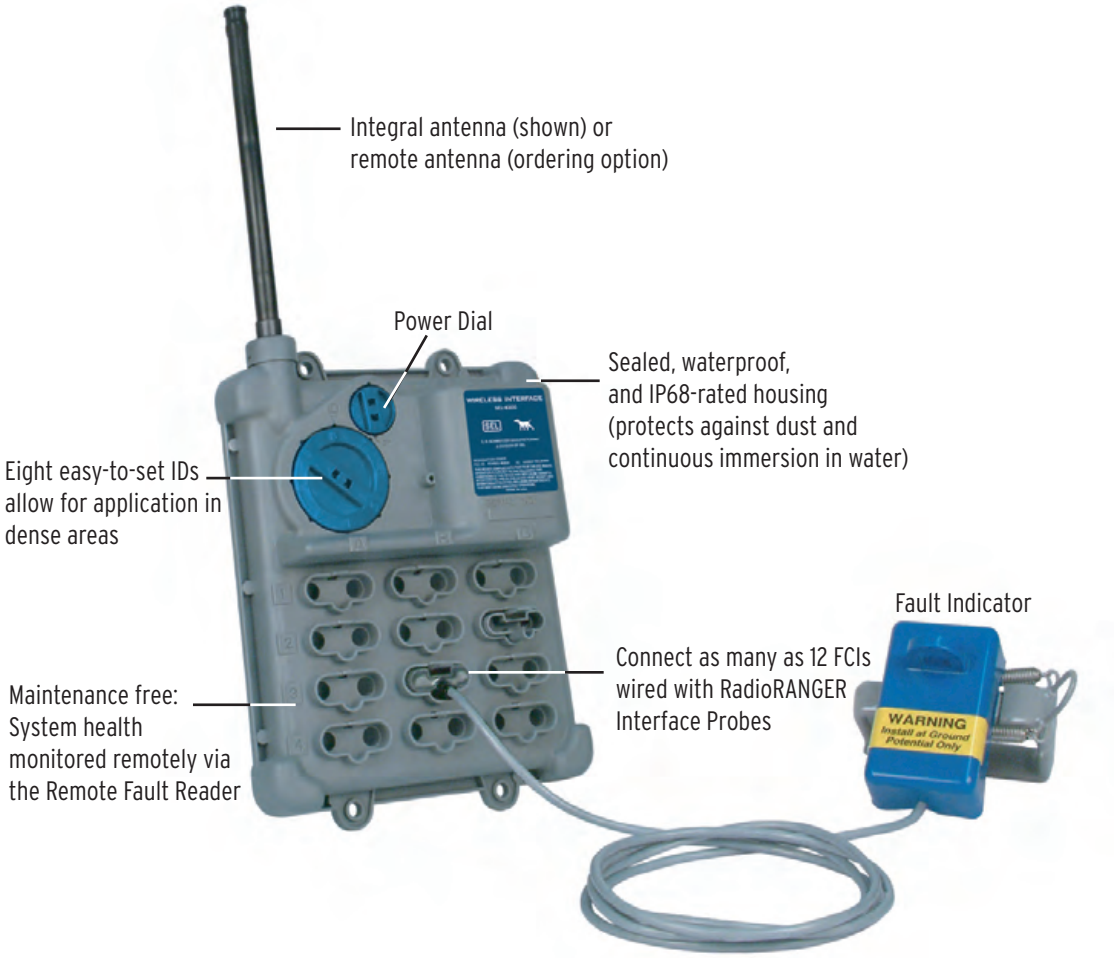

Figure 5 RadioRANGER Wireless Interface (SEL-8300 and SEL-8300X1)

Setting Up the Wireless Interface

The Wireless Interface collects the status of as many as 12 FCIs and communicates their status to a Remote Fault Reader. The following steps will guide you in setting up and installing the Wireless Interface.

Step 1. Select a location for the Wireless Interface that provides access to all FCI magnetic probes.

Standard cable length for FCI magnetic probe outputs is 12 feet (you can specify other cable lengths when ordering). The RadioRANGER system communicates via 902–928 MHz (915–928 MHz in X1 models only); to improve the range, install the Wireless Interface in locations with few RF impediments (such as below a grate) if possible. RF performance can also be compromised in flooded vaults. In vaults where flooding is common or where the FCI cable length is insufficient for optimal installation, order Wireless Interfaces with the optional remote antenna, which provides an extra 15 feet of antenna cable length.

TIP FROM RANGER: Always install the Wireless Interface vertically to ensure optimal integral antenna position and to maximize battery life.

Step 2. Securely mount the Wireless Interface by using four 1/4 inch-diameter (6.0 mm) fasteners (not included) designed for your installation surface.

To protect the polycarbonate housing, use a flat washer in conjunction with each fastener. SEL recommends that you install each fastener with a torque of 25 in-lb not to exceed 50 in-lb.

Step 3. Install each fault indicator on the monitored cable according to the installation instructions included in each fault indicator's box.

Step 4. Insert the fault indicator's magnetic probe into the Wireless Interface port corresponding to the Phase and Way you want the FCI to represent (see *Figure 6*).

The Wireless Interface has 12 FCI magnetic probe interface ports aligned in a 4 x 3 matrix. The rows represent Ways 1, 2, 3, and 4 of a multiway switch. The columns represent Phases A, B, and C. For example, a probe installed in the top left position would correspond to Phase A of Way 1. The location of each FCI probe corresponds to how the probes are displayed on the Remote Fault Reader.

Step 5. Rotate the **ID** dial to one of the eight detent positions.

The **ID** dial on the Wireless Interface correlates to the Wireless Interface **ID** LEDs on the Remote Fault Reader. To prevent communications collisions, select different IDs if you install multiple Wireless Interfaces within a 150-foot radius.

TIP FROM RANGER: The ID also accommodates customer-specific naming conventions to indicate the nature of certain installations. For example, use the IDs to represent specific vault configurations, voltages classes, etc.

Step 6. Turn the **PWR** dial arrow to the PWR position to turn on the Wireless Interface.

SEL designed the RadioRANGER system to optimize battery life without compromising RF range. As such, the Wireless Interface is expected to provide at least 15 years of service life under normal operating conditions.

Step 7. Test the communications range (see *Testing the Wireless Interface*).

Always install the Wireless Interface vertically to ensure optimal integral antenna position and to maximize battery life. The lifetime of the battery will be significantly reduced if the Wireless Interface is not installed vertically. For best results when using the remote antenna, orient it vertically so that it points toward the surface.

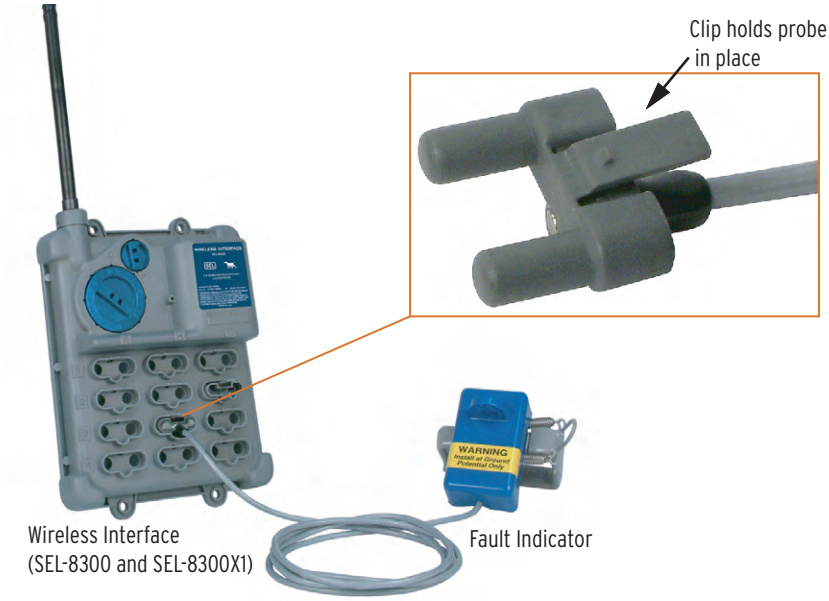

Figure 6 Plug the FCI Magnetic Probes Into the Wireless Interface

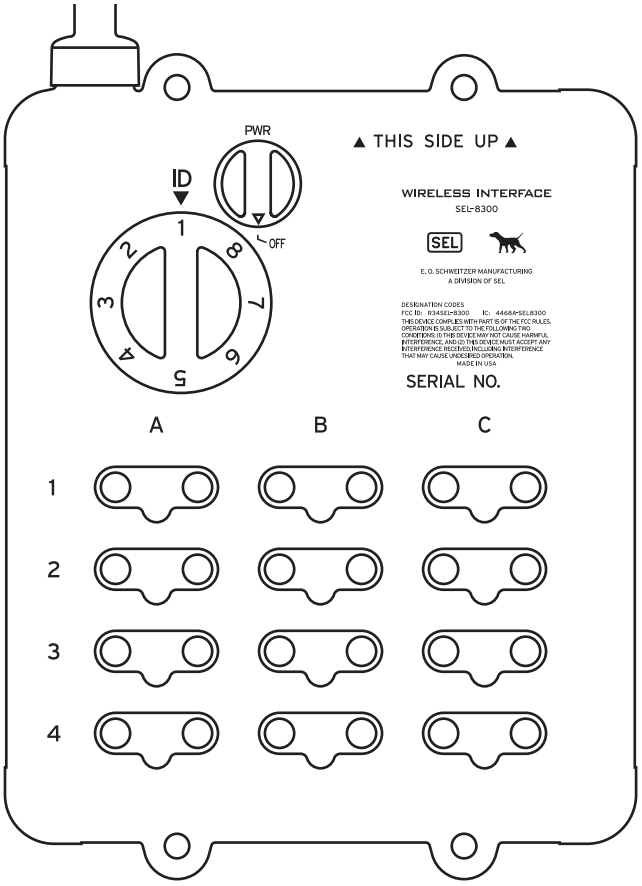

Figure 7 Wireless Interface Front Panel

Testing the Wireless Interface

TIP FROM RANGER: Always test the communications range of the Wireless Interface at each installation.

Test the Wireless Interface operation and verify the communications range. After completing *Step 1* through *Step 6* from *Setting Up the Wireless Interface*, perform the following steps to make sure all FCIs are connected properly to the Wireless Interface. Keep the Wireless Interface and Remote Fault Reader at least four feet apart.

Step 1. Turn on the Remote Fault Reader and wait three seconds.

Step 2. Press the **Scan** button on the Remote Fault Reader and verify that its display of the ID and fault indicator probes matches the Wireless Interface.

Step 3. After verifying that the Remote Fault Reader displays the correct ID and fault indicator information, exit the subsurface vault and repeat *Step 2* to verify that the communications range is adequate. Always close the vault when determining communications range.

Step 4. If the range is not adequate, move the Wireless Interface to a different location, possibly a higher point in the vault.

If moving the Wireless Interface does not provide adequate communications range outside of the vault, you may need to order a Wireless Interface with an external antenna that mounts near the top of the vault.

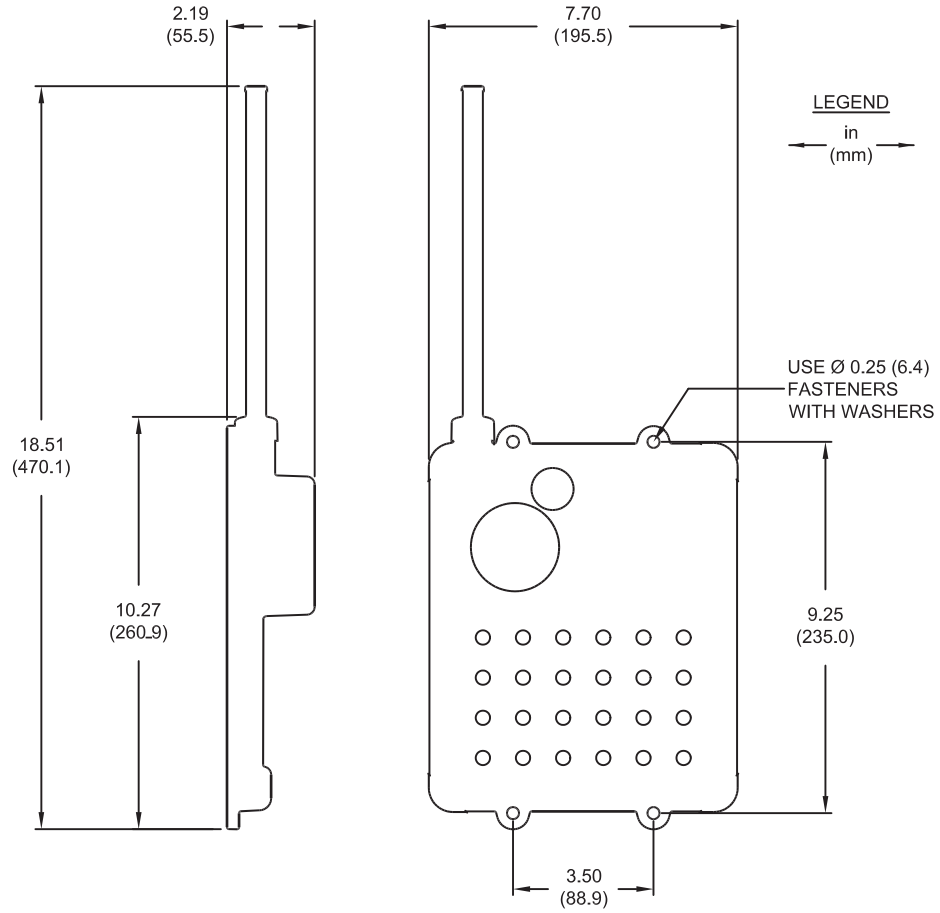

Figure 8 Wireless Interface Dimensions

Using the Remote Fault Reader (SEL-8310 and SEL-8310X1)

The hand-held Remote Fault Reader communicates fault indicator status information from any Wireless Interface within range, allowing utility personnel to identify the location of a fault without opening and entering multiple vaults. The Remote Fault Reader indicates the presence of Wireless Interfaces within range, and the status of all fault indicators connected to them.

The Remote Fault Reader displays its power status and battery health via a **Power** LED. The **Interface** LED indicates the health of the Wireless Interface, conveying any self-test problems and the battery health.

The Remote Fault Reader communicates the status of FCIs connected to as many as eight different Wireless Interfaces within range via LEDs. The **Fault Indication** area on the front of the Remote Fault Reader has 12 LEDs arranged in a 4 x 3 matrix. The rows represent Ways 1, 2, 3, and 4. The columns represent Phases A, B, and C. For example, the status displayed in the top left position would correspond to an FCI monitoring Phase A of Way 1. Each LED corresponds to the position of each FCI probe installed in the Wireless Interface.

Figure 9 Remote Fault Reader Front and Back Views

Power Requirements

The Remote Fault Reader uses three AA batteries (alkaline or rechargeable). To open the battery cover, turn the fastener 1/4 turn counterclockwise. You can unhinge and remove the battery cover to access the battery holder and control (DIP) switches. To replace the battery cover, insert the two tabs of the cover under the hinge and lay the cover flat against the batteries. To secure the battery cover, turn the fastener 1/4 turn clockwise.

Turning on the Remote Fault Reader

Press the **Power** button in the upper left-hand corner.

If the battery voltage is 3.0 volts or above and the Remote Fault Reader passes self-tests, the device successfully turns on. If the battery voltage is below 3.0 volts, the device will turn off to prevent damage to rechargeable batteries.

The **Power** LED indicates the battery life, as well as any internal memory issues.

- A solid green LED indicates the voltage is above 3.2 V.
- A solid yellow LED indicates the voltage is at or below 3.2 V.
- A flashing red LED indicates a failed memory self-check. Please contact customer service (see *Technical Assistance*).

Scanning for and Retrieving Data

Press the **Scan** button to initiate a scan for Wireless Interfaces within range. The pulsing of yellow **Wireless Interface ID** LEDs indicates the scan sequence has begun.

When a scan is initiated, the Remote Fault Reader clears any previously acquired data. The scan sequence ends when one of the following occurs:

- A valid response is received for all eight Wireless Interface IDs.
- The **Scan** button is pressed, canceling the current scan, and beginning a new one.
- Fifteen seconds pass after the first valid response from a Wireless Interface.
- The Remote Fault Reader enters the HMI (Human Machine Interface) Adjust Mode (see *Adjusting the LED Brightness*).
- The Remote Fault Reader turns off 15 minutes after the **Scan** button is pressed and no valid responses have been received.

TIP FROM RANGER: Pressing the **Scan** button while a scan is already in progress causes the Remote Fault Reader to abort the current scan, clear all acquired data, and initiate a new scan.

After a scan is complete, the **Wireless Interface ID** area displays all Wireless Interfaces within range. The first valid Wireless Interface identified with at least one tripped FCI flashes yellow, and its fault indicators' status is depicted in the **Fault Indication** area of the Remote Fault Reader. Use the **Next** button to cycle through and display the status of fault indicators connected to Wireless Interfaces within range.

Remote Fault Readers communicate with all Wireless Interfaces within range that have *distinct* ID settings. If multiple Wireless Interfaces with the *same* ID setting are communicating to a Remote Fault Reader, the Remote Fault Reader will display a collision notification (see *Interpreting the Remote Fault Reader LEDs*). To differentiate between two Wireless Interfaces in this situation, move closer to the intended vault or orient yourself between the Remote Fault Reader and the adjacent vault. Change the ID on one of the Wireless Interfaces to prevent future data collisions.

When using two Remote Fault Readers in the same area, do not scan both units simultaneously. In this situation, the Remote Fault Readers may not properly communicate with Wireless Interfaces within range. However, two Remote Fault Readers can be used simultaneously within the same range if the

units are in Single Frequency Operation Mode and are not operating at the same frequency. Please see *Control (DIP) Switch Settings* for more information on how to enable this mode.

Interpreting the Remote Fault Reader LEDs

Table 1 Remote Fault Reader LED Indication Description

LED Label	Color	Representation
Power	Green (solid)	Good Remote Fault Reader battery
	Yellow (solid)	Weak Remote Fault Reader battery
	Red (flashing)	Self-test error
Interface (corresponds to "Active" Wireless Interface ID)	Green (solid)	Wireless Interface in service < 12 years
	Yellow (solid)	Wireless Interface in service > 12 years
	Red (flashing)	Wireless Interface imminent battery failure
Wireless Interface ID	Yellow (short pulse)	Scan in progress, no response received
	Yellow (flashing)	"Active" Wireless Interface ID
	Red (solid)	Indicates communication with a Wireless Interface (not currently displayed in the **Fault Indication** section) with corresponding ID—connected to at least one tripped FCI
	Green (solid)	Indicates communication to a Wireless Interface with corresponding ID—connected to no tripped FCIs
Fault Indication (Ways 1, 2, 3, and 4 and Phases A, B, and C)	Red (flashing)	FCI connected to the Wireless Interface is faulted
	Green (solid)	FCI connected to the Wireless Interface is NOT faulted
	Off	No FCI probe is connected to the Wireless Interface

Figure 10 Interpreting Wireless Interface ID and Fault Indication LEDs

Identifying Fault Indicator Status

Each fault indicator sends a Trip (faulted) or Reset (unfaulted) signal to the Wireless Interface through its magnetic probe interface. The Wireless Interface communicates this FCI data to the Remote Fault Reader when an operator within range presses the **Scan** button. The Remote Fault Reader then displays FCI status information under the **Fault Indication** area. A flashing red LED indicates a tripped FCI; a solid green LED indicates a reset FCI. By providing both tripped and reset indications, the system allows the user to retrieve the status of the FCIs beyond the fault to validate the fault location.

Enabling and Disabling Low-Power Mode

To preserve battery life, the Remote Fault Reader enters Low-Power Mode one minute after ending a scan or one minute after the last **Next** button press, whichever occurs later. When the Remote Fault Reader enters Low-Power Mode, all **Wireless Interface ID** and **Fault Indication** LEDs turn off. The **Power** LED will emit short pulses, 2 seconds apart, in the color used by the LED before entering Low-Power Mode. While the Remote Fault Reader is in Low-Power Mode, pressing either the **Scan** or the **Next** button returns the device to the normal mode and displays the data it showed prior to entering Low-Power Mode. All data received from the last scan are still available via the **Next** button.

Control (DIP) Switch Settings

The Remote Fault Reader supports single-frequency operation, selectable via the control (DIP) switch block located under the battery cover. Do not adjust Control (DIP) Switches 1, 2, 5, 6, 7, and 8. The factory-default setting for Switches 1 and 2 is ON and Switches 5, 6, 7, and 8 is OFF.

Single-frequency operation allows two Remote Fault Readers to operate simultaneously within the same area, with each device on a different frequency. *Table 2* shows the control (DIP) switch settings that enable this functionality.

Table 2 Positioning Control (DIP) Switches for Single-Frequency Operation

Position of Switch	Control (DIP) Switch 3 Functionality	Control (DIP) Switch 4 Functionality
OFF	Single-Frequency Operation Disabled	Use Frequency 1
ON	Single-Frequency Operation Enabled	Use Frequency 2

When Control (DIP) Switch 3 is in the ON position, Control (DIP) Switch 4 determines the single frequency to be used. If Control (DIP) Switch 3 is in the OFF position, then Control (DIP) Switch 4 has no effect. If using two Remote Fault Readers in the same area, both units should have Control (DIP) Switch 3 set to ON and one of the units should have Control (DIP) Switch 4 set to ON.

Adjusting the LED Brightness

Adjust the Remote Fault Reader LED brightness to accommodate user and situational preference. Pressing and holding both the **Scan** and **Next** buttons simultaneously for one second places the Remote Fault Reader in the HMI Adjust Mode. In this mode, the **Fault Indication** LEDs are off. The **Wireless Interface ID** LEDs now correspond to LED intensity. The Remote Fault Reader will exit the HMI Adjust Mode five seconds after the last button press or after pressing and holding both the **Scan** and **Next** buttons simultaneously for one second. Following HMI Adjust Mode termination, the Remote Fault Reader reenters Normal Mode. The same data displayed prior to entering HMI Adjust Mode will be available.

In HMI Adjust Mode, pressing the **Next** button cycles through three possible LED brightness levels. The brightness is indicated by the **Wireless Interface ID** LEDs, where each illuminated yellow LED represents the brightness level. The solid yellow LEDs also adjust their brightness when you press the **Next** button. Each **Next** button press selects the next highest brightness level until the maximum level is reached. At that point, pressing the **Next** button selects

the lowest brightness level (default). Adjustments to the brightness level are updated when the Remote Fault Reader reenters Normal Mode.

Testing and Troubleshooting

Self-Tests

The Wireless Interface and Remote Fault Reader perform periodic self-tests to verify proper operation. A self-test failure of either product is indicated via the Remote Fault Reader LED display. A flashing red **Power** LED indicates a Remote Fault Reader self-test failure. A flashing red **Interface** LED indicates a Wireless Interface self-test failure. Please contact Schweitzer Engineering Laboratories (see *Technical Assistance*) if your device indicates a self-test failure.

Troubleshooting the Wireless Interface

When troubleshooting the Wireless Interface, first look for system communication and battery life issues. *Table 3* lists possible issues and responses.

Table 3 Troubleshooting the Wireless Interface

Issue	Response
Wireless Interface is not identified after the Remote Fault Reader **Scan** button is pressed	Ensure the device is on. Ensure ID selector is situated in a detent and rescan. Ensure antenna points vertically and is not submerged. Ensure the Remote Fault Reader is within range.
Interface LED is solid yellow on the Remote Fault Reader	Wireless Interface has been in service for 12 years or longer.
Interface LED is pulsing red on the Remote Fault Reader	Wireless Interface battery is weak. Order a replacement Wireless Interface.
Interface LED is flashing red on the Remote Fault Reader	If the LED is flashing red during a collision (i.e., Remote Fault Reader is communicating with two Wireless Interfaces with the same ID), the Wireless Interface battery is weak. If the LED is flashing red without a collision, a self-test has failed. Please contact Schweitzer Engineering Laboratories.
Wireless ID is displayed, but FCI status is not	Ensure that probes are interfaced and mated correctly. Ensure the device is on.
Wireless ID is displayed, but ID is inconsistent with ID setting	Ensure the device is on. Ensure the ID selector is situated within 1 of the 8 detents. Ensure that the antenna is unobstructed.

Troubleshooting the Remote Fault Reader

When troubleshooting the Remote Fault Reader, first look for system communication, battery life, and LED indications issues. *Table 4* lists possible troubleshooting issues and user responses.

Table 4 Troubleshooting the Remote Fault Reader (Sheet 1 of 2)

Issue	Response
Nothing happens after pressing the **Power** button	Check that batteries have sufficient voltage and are installed with correct polarity.
Remote Fault Reader illuminates all LEDs in green, yellow, and red sequence and then shuts off	Battery voltage is less than 3.0 V. Replace batteries.
Power LED is yellow	Battery voltage is between 3.0 and 3.2 V. Replace batteries soon.
Power LED is flashing red	Self-test failure. Contact Schweitzer Engineering Laboratories customer service for assistance.

Table 4 Troubleshooting the Remote Fault Reader (Sheet 2 of 2)

Issue	Response
LEDs are too bright or too dim	Adjust LED brightness in HMI Adjust Mode.
Multiple ID and FCI data are displayed that are inconsistent with the actual system within range	Ensure that Control (DIP) Switches 5–8 are in the OFF position.
Poor range between Wireless Interface and Remote Fault Reader	Ensure the Wireless Interface antenna is unobstructed. Ensure the Remote Fault Reader is oriented properly (antenna points vertically).

Battery Safety

⚠CAUTION

This product is shipped with or contains a lithium metal cell. Lithium metal cells and batteries may present a risk of fire or explosion. Do not short circuit, recharge, puncture, incinerate, crush, drop, disassemble, immerse, or incorrectly install lithium metal cells or batteries. Do not expose lithium metal cells or batteries to temperatures that are above the declared operating temperature range of this product. This product must be disposed of in accordance with all applicable rules, laws, and regulations, such as EPA's Universal Waste Rule, the EU Batteries Directive and other local rules.

This product is shipped with or contains a lithium metal cell. Lithium metal cells are often classified as dangerous goods by dangerous goods shipment regulations. These regulations along with your package carrier specify the packaging and labeling to be used, along with the information to be provided when shipping dangerous goods. This product must be transported in accordance with all applicable rules, laws, and regulations, such as the rules published by the Pipeline and Hazardous Materials Safety Administration; the International Civil Aviation Organization; the International Air Transport Association; the Maritime Dangerous Goods Code; the UN Model Regulations on the Transport of Dangerous Goods and rules for inland, waterways, road and rail transportation, and others. Please consult any applicable regulations and your package carrier for proper handling of this product.

Specifications

Compliance

FCC:	15.249
IC:	RSS-210
Cofetel:	Article 24, Appendix A, Section XVIII
ANATEL:	Resolution 242
AU/NZ:	AS/NZS A268:2008

Operating Temperature Range

–40° to +85°C (–40° to +185°F)

5 to 95% humidity (noncondensing)

Type Tests

Electromagnetic Compatibility Immunity

Electrostatic Discharge Immunity:	IEC 60255-22-2:1996 [EN 60255-22-2:1997] IEC 61000-4-2:1995 [EN 61000-4-2:1995 + A1:1999 + A2:2001] IEEE C37.90.3–2001 Severity Level: 2, 4, 6, 8 kV contact discharge; 2, 4, 8, 15 kV air discharge
Radio Frequency Interference Immunity:	IEC 61000-4-3:2002 [EN 61000-4-3:2002] IEC 60255-22-3:2000 [EN 60255-22-3:2001] Severity Level: 10 V/m IEEE C37.90.2–2004 Severity Level: 35 V/m
Power Frequency Magnetic Field Immunity:	IEC 61000-4-8:2001 [EN 61000-4-8:1994 + A1:2001] Severity Level: 100 A/m (60 Sec), 1000 A/m (3 Sec), Level 5
Pulse Magnetic Field Immunity:	IEC 61000-4-9:1993:2001 [EN 61000-4-9:1994 + A1:2001] Severity Level: 1000 A/m, Level 5
Damped Oscillatory Magnetic Field Immunity:	IEC 61000-4-10:2001 [EN 61000-4-10:1994 + A1:2001] Severity Level: 100 A/m, Level 5
Radiated Radio Frequency:	ENV 50204:1995, 10 V/m (900 MHz and 1.89 GHz with modulation)
Emissions:	FCC Part 15, Class B

Note: 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 when the equipment is operated in a commercial environment.

Type Test Compliance Criteria:

1) This device may not cause harmful interference.

2) This device must accept any interference received, including interference that may cause undesired operation.

Environmental Tests

Cold:	IEC 60068-2-1:1990 + A1:1993 + A2:1994 [EN 600068-2-1:1993 + A2:1995]
Temperature Shock on SEL-8310:	MIL-STD-810F Method 503.4 –40°C (–40°F) and +70°C (+158°F) with temperature stabilized inside the unit.
Dry Heat:	IEC 60068-2-2:1974 + A1:1993 + A2:1994 [EN 60068-2-2:1993 + A1:1995]
Damp Heat, Cyclic:	IEC 60068-2-30:1980 + A1:1985 [EN 60068-2-30:1999]
Vibration Resistance:	IEC 60255-21-1:1988 [EN 60255-21-1:1996 + A1:1996]
Vibration Endurance:	Severity Class 1
Vibration Response:	Severity Class 2
Shock Resistance:	IEC 60255-21-2:1988 [EN 60255-21-2:1996 + A1:1996]
Bump Test:	Severity Class 1
Shock Withstand:	Severity Class 1
Shock Response:	Severity Class 2
Seismic (Quake Response):	IEC 60255-21-3:1993 [EN 60255-21-3:1995 + A1:1995] Severity Level: Class 2 IEC 60529:2001 + CRDG:2003 [BS EN 60529:1992 Protection Class + REAF:2004]
Ingress Protection:	SEL-8300 and SEL-8300X1= IP68 (4.5 m [15 feet]) SEL-8310 and SEL-8310X1 = IP54

Firmware and Manual Versions

Firmware Version

This manual covers the RadioRANGER system with firmware version numbers listed in *Table 5*. This table also lists a description of modifications and the instruction manual date code that corresponds to firmware versions. The most recent firmware version is listed first.

Table 5 Firmware Revision History

Firmware Identification (FID) Number	Summary of Revisions	Manual Date Code
SEL-8310-R100-V0-Z001001-D20070320 SEL-8300-R100-V0-Z001001-D20070320	➤ Initial version.	20070320

Manual Version

The date code at the bottom of each page of this manual reflects the creation or revision date.

Table 6 lists the instruction manual release dates and a description of modifications. The most recent instruction manual revisions are listed at the top.

Table 6 Manual Revision History

Revision Date	Summary of Revisions
20200129	➤ Removed audio-related information throughout.
20171010	➤ Added *Battery Safety.* ➤ Renamed Certifications to Compliance in *Specifications*.
20100203	➤ Added references to the SEL-8300X1 and SEL-8310X1 devices. ➤ Removed information regarding the optional Vehicle Accessory Kit. ➤ Updated Certifications in *Specifications*.
20070320	➤ Initial version.

Technical Assistance

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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Email: info@selinc.com

Notes

⚠CAUTION

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the user will be required to correct the interference at their own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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