Operation

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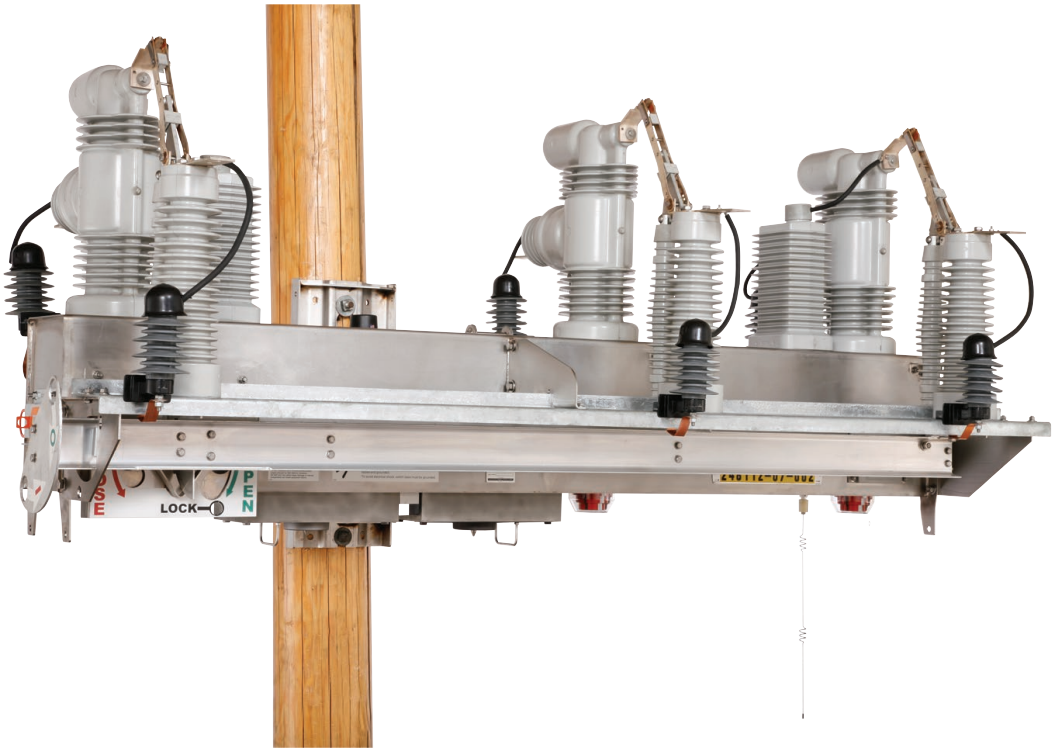

February 26, 2024

Qualified Persons

⚠ WARNING

Only qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone who is trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive parts of electrical equipment
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed
- The proper use of special precautionary techniques, personal protective equipment, insulated and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

These instructions are intended ONLY for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read this Instruction Sheet

NOTICE

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating the IntelliRupter PulseCloser Fault Interrupter. Familiarize yourself with the Safety Information and Safety Precautions on pages 4 and 5. The latest version of this publication is available online in PDF format at **sandc.com/en/support/product-literature/**.

Retain this Instruction Sheet

This instruction sheet is a permanent part of the IntelliRupter® fault interrupter. Designate a location where you can easily retrieve and refer to this publication.

Proper Application

⚠ WARNING

The equipment in this publication is only intended for a specific application. The application must be within the ratings furnished for the equipment. Ratings for the IntelliRupter fault interrupter are listed in the ratings table in Specification Bulletin 766-31.

Special Warranty Provisions

The standard warranty contained in seller's standard conditions of sale, as set forth in Price Sheets 150 and 181, applies to the IntelliRupter fault interrupter and its associated options except for the control group as applicable. For these devices, the first and second paragraphs of said warranty are replaced by the following:

General: The seller warrants to the immediate purchaser or end user for a period of 10 years from the date of shipment that the equipment delivered, with the exception of a radio, will be of the kind and quality specified in the contract description and will be free of defects of workmanship and material. Should any failure to conform to this warranty appear under proper and normal use within 10 years after the date of shipment, the seller agrees, upon prompt notification thereof and confirmation

that the equipment has been stored, installed, operated, and maintained in accordance with recommendations of the seller and standard industry practice, to correct the nonconformity either by repairing any damaged or defective parts of the equipment or (at seller's option) by shipment of necessary replacement parts.

The seller's warranty does not apply to any equipment that has been disassembled, repaired, or altered by anyone other than the seller. This limited warranty is granted only to the immediate purchaser or, if the equipment is purchased by a third party for installation in third-party equipment, the end user of the equipment. The seller's duty to perform under any warranty may be delayed, at the seller's sole option, until the seller has been paid in full for all goods purchased by the immediate purchaser. No such delay shall extend the warranty period.

The seller further warrants to the immediate purchaser or end user that for a period of two years from the date of shipment the software will perform substantially in accordance with the then-current release of specifications if properly used in accordance with the procedures described in seller's instructions. The seller's liability regarding any of the software is expressly limited to exercising its reasonable efforts in supplying or replacing any media found to be physically defective or in correcting defects in the software during the warranty period. Seller does not warrant the use of the software will be uninterrupted or error-free.

For equipment/services packages, the seller warrants, for a period of one year after commissioning, that the IntelliRupter fault interrupters will provide automatic fault isolation and system reconfiguration per agreed-upon service levels. The remedy shall be additional system analysis and reconfiguration of the IntelliTeam SG Automatic Restoration System until the desired result is achieved.

Warranty Qualifications

The standard warranty contained in seller's standard conditions of sale, as set forth in Price Sheets 150 and 181, does not apply to major components not of S&C manufacture, such as batteries, customer-specified remote terminal units and communication devices, as well as hardware, software, resolution of protocol-related matters, and notification of upgrades or fixes for those devices. The seller will assign to the immediate purchaser or end user all manufacturers' warranties that apply to such major components.

The seller's standard warranty does not apply to any components not of S&C manufacture that are supplied and installed by the purchaser or to the ability of seller's equipment to work with such components.

Warranty of equipment/services packages is contingent upon receipt of adequate information on the user's distribution system, sufficiently detailed to prepare a technical analysis. The seller is not liable if an act of nature or parties beyond S&C's control negatively impact performance of equipment/services packages; for example, new construction that impedes radio communication, or changes to the distribution system that affect protection systems, available fault currents, or system loading characteristics.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the IntelliRupter PulseCloser Fault Interrupter. Familiarize yourself with these types of messages and the importance of these various signal words:

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards that will result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices that can result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that can result in minor personal injury if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that can result in product or property damage if instructions are not followed.

Following Safety Instructions

If you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website **sandc.com**, or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating the IntelliRupter PulseCloser Fault Interrupter.

If you need additional copies of this instruction sheet, contact your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

Replacement Instructions and Labels

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting your nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

⚠ DANGER

IntelliRupter PulseCloser Fault Interrupters operate at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS.** Access to an IntelliRupter fault interrupter must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **OPERATING MECHANISM AND BASE.** IntelliRupter fault interrupters contain fast-moving parts that can severely injure fingers. Do not remove or disassemble operating mechanisms or remove access panels on the IntelliRupter fault interrupter base unless directed by S&C Electric Company.
6. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded. The integrated power module (IPM) contains components that can retain a voltage charge for many days after the IntelliRupter fault interrupter has been de-energized and can derive a static charge when in close proximity to a high-voltage source. Voltage levels can be as high as the peak line-to-ground voltage last applied to the unit. Units that have been energized or installed near energized lines should be considered live until tested and grounded.
7. **GROUNDING.** The IntelliRupter fault interrupter base must be connected to a suitable earth ground at the base of the utility pole, or to a suitable building ground for testing, before energizing an IntelliRupter fault interrupter, and at all times when energized.

   The ground wire(s) must be bonded to the system neutral, if present. If the system neutral is not resent, proper precautions must be taken to ensure that the local earth ground, or building ground, cannot be severed or removed.
8. **VACUUM INTERRUPTER POSITION.** Always confirm the **Open**/**Close** position of each interrupter by visually observing its indicator.

   Interrupters, terminal pads, and disconnect blades on disconnect style models may be energized with the interrupters in any position.

   Interrupters, terminal pads, and disconnect blades on disconnect style models may be energized from either side of the IntelliRupter fault interrupter.
9. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.

Applicable Software

This instruction sheet is used with software version IntelliRupterInstaller-7.6.x.exe. The "x" can indicate any number from 0 to 255. Other related software component version information is found on the *Setup>General>Revisions* screen. IntelliRupter Installer-7.6.x.exe is the name of the installer file available at the S&C Automation Customer Support Portal.

⚠ WARNING

Serious risk of personal injury or death may result from contact with electric distribution equipment when electrical isolation and grounding procedures are not followed. The equipment described in this document must be operated and maintained by qualified persons who are thoroughly trained and understand any hazards that may be involved. This document is written only for such qualified persons and is not a substitute for adequate training and experience in safety procedures for accessing high-voltage equipment.

⚠ WARNING

These instructions do **NOT** replace the need for utility operation standards. Any conflict between the information in this document and utility practices should be reviewed by appropriate utility personnel and a decision made as to the correct procedures to follow.

The IntelliRupter fault interrupter operates at primary voltage levels. High voltage may be present during certain disruptions in the wiring system or grounding system because of a problem in the IntelliRupter fault interrupter itself. For this reason, access to the fault interrupter should be treated with the same safety precautions that would be applied when accessing other high-voltage lines and equipment. Follow all locally approved safety procedures when working on or around the fault interrupter.

Before attempting to access an existing fault interrupter installation, check carefully for visible or audible signs of electrical or physical malfunction (do this before touching or operating the fault interrupter or any other part of the installation). These warning signs include such things as smoke, fire, open fuses, crackling noises, loud buzzing, etc. If a malfunction is suspected, treat all components of the installation, including the fault interrupter and associated mounting hardware, as though they were elevated to primary (high) voltage.

Whenever you are manually reconfiguring the circuit (for example, during repairs), follow your company's operating procedures to disable automatic operation of the IntelliTeam SG Automatic Restoration System. This prevents any unexpected operation of a team member.

You can disable the IntelliTeam SG Automatic Restoration System by selecting the **Prohibit Restoration** option in any member of the team to be disabled.

Modes of Operation

Operating Levers—Hookstick-operated levers are provided for manually opening and closing the interrupters and for applying and removing a hot line tag. A separate lever, if provided, blocks tripping on ground overcurrent elements. The integrated disconnect on disconnect-style models is also hookstick-operated. See Figure 1 on page 7 and Figure 2 on page 7.

Opening and Closing Interrupters

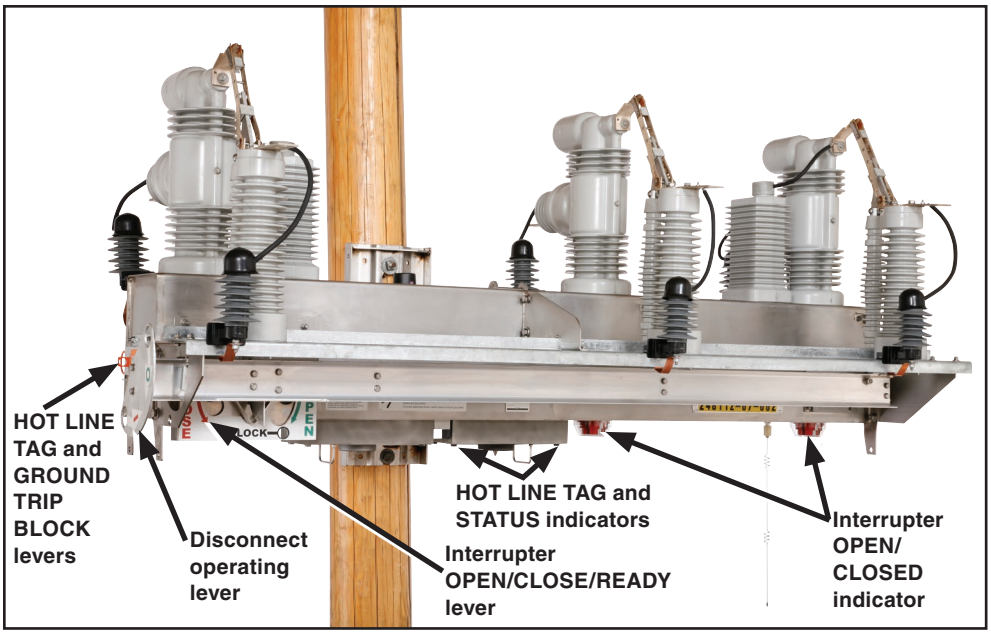

Figure 1. The 15.5-kV and 27-kV IntelliRupter fault interrupter operating levers and indicators.

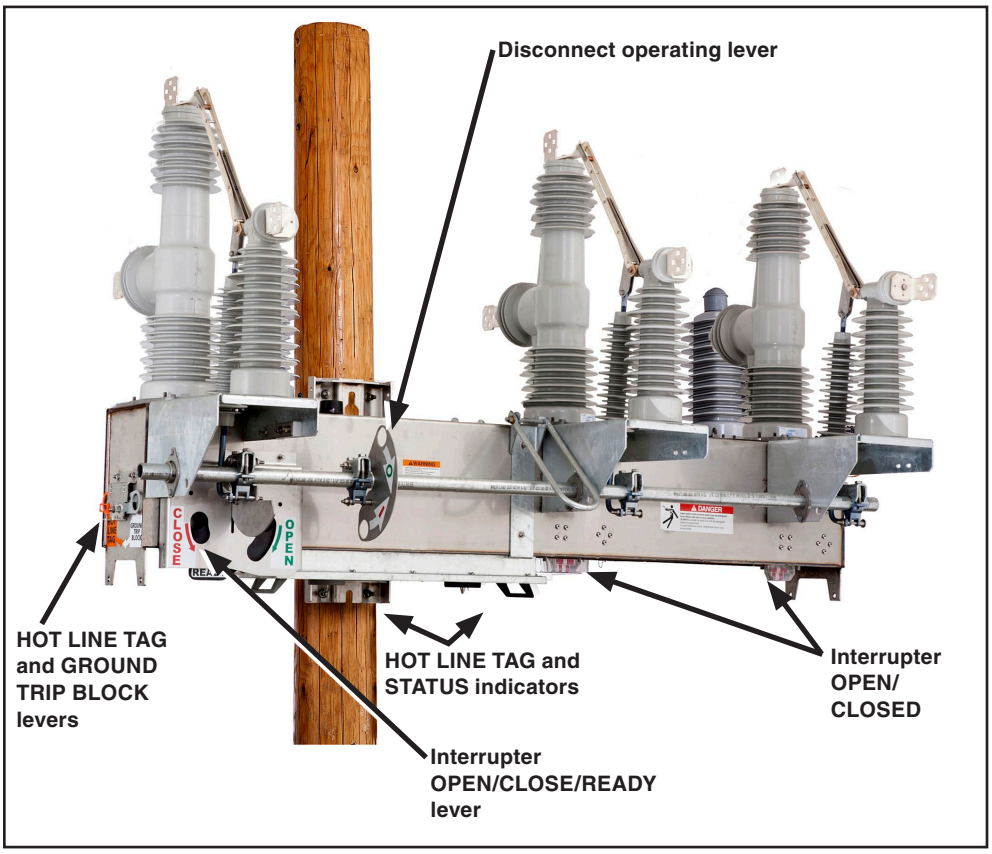

Figure 2. The 38-kV IntelliRupter fault interrupter operating levers and indicators.

Single-Phase or Three-Phase Tripping—Each operation of the overcurrent circuit-testing sequence can be configured for either **Single-Phase Trip** or **Three-Phase Trip** mode. The last test operation specifies whether a **Single-Phase Lockout** operation is acceptable or a **Three-Phase Lockout** operation is required.

IntelliLink® Setup Software—IntelliRupter fault interrupters can be configured and operated locally from the safety and security of a vehicle parked near the base of the pole by means of a secure Wi-Fi communication link to a laptop computer.

SCADA Operation—When furnished with a suitable user-specified radio, IntelliRupter fault interrupters can be operated by a SCADA system using DNP 3.0 Protocol.

IntelliLink Remote Setup Software—IntelliRupter fault interrupters can be configured and interrogated remotely using a desktop computer over a communication system using DNP 3.0 Protocol.

READY—In the **Ready** state, the left and right sections of the OPEN/CLOSE/READY lever are in the upper position. The IntelliRupter fault interrupter uses the configured protection profile.

OPEN (and **LOCK-OPEN**)**—**When the right section of the OPEN/CLOSE/READY lever is moved to this position, the three interrupter actuators are mechanically opened. A mechanical block is inserted into each actuator mechanism that prevents closing, even if a malfunction causes the actuator closing coil to be energized. The lever can be tagged or padlocked in the **Open** position. Moving the lever back to the **Ready** position removes the mechanical block from the actuators.

NOTICE

When the **External Interface** option (catalog number suffix "-C11") is present, the **Maintenance Mode Input** state may change the behavior of the OPEN/CLOSE/READY lever. Refer to the "Block Manual Lever If Maintenance Mode" section in S&C Instruction Sheet 766-530, "IntelliRupter® PulseCloser® Fault Interrupter: *Protection and Communication Setup*."

CLOSE—When the left section of the OPEN/CLOSE/READY lever is moved to the **Close** position, the IntelliRupter fault interrupter uses the closing protection profile to electrically close the interrupters. This is a momentary contact and a spring forces the lever to return to the **Ready** position when the lever is released.

Opening Interrupters—Control power is not required. Follow these steps to open the interrupters:

STEP 1. Insert a hookstick into the hole in the right section of the OPEN/CLOSE/READY lever. See Figure 3 on page 9.

STEP 2. Pull down on the right lever section. The three interrupters will open.

STEP 3. If desired, tag or padlock the lever in this position. See Figure 4 on page 9.

STEP 4. Check the interrupter OPEN/CLOSE indicator. See Figure 5 on page 10. They should show an "O" indication.

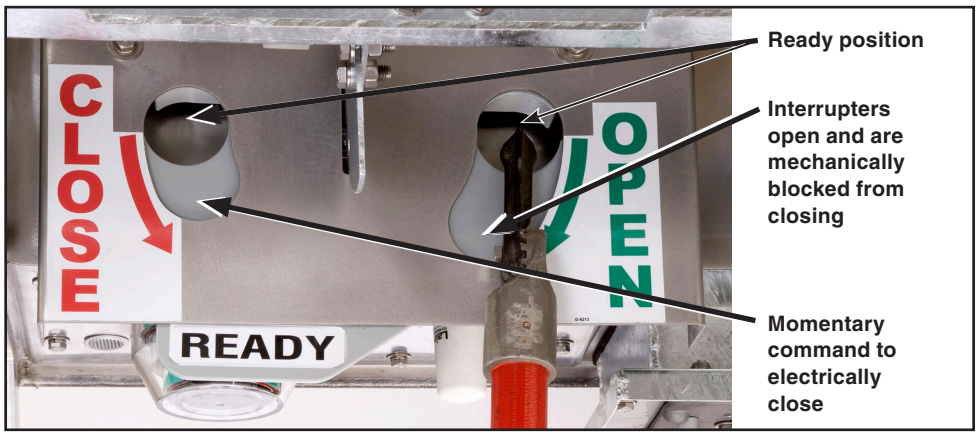

Figure 3. Opening and closing the interrupters with a hookstick.

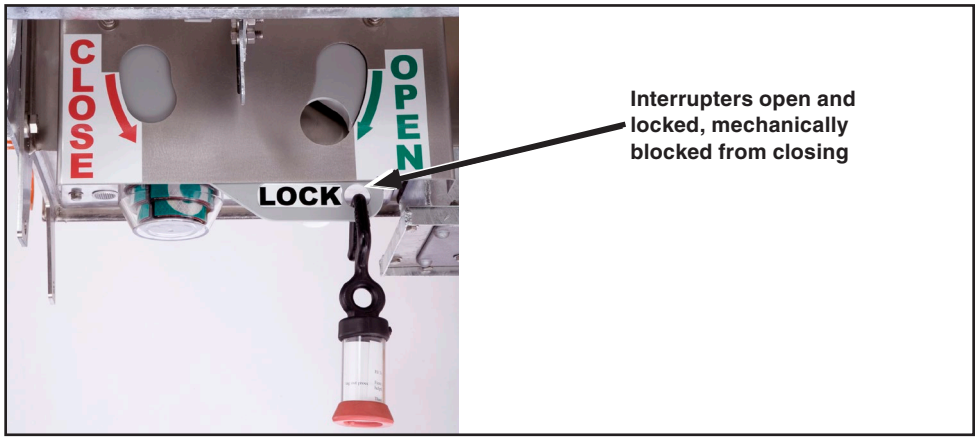

Figure 4. The interrupters locked open.

Closing Interrupters—Control power is required. Follow these steps to close the interrupters:

STEP 1. Remove the tag or lock on the OPEN/CLOSE/READY lever, if applicable.

STEP 2. If the lever is not already in the **Ready** position, then insert a hookstick into the hole in the right lever section and push up on the right lever section. This places the OPEN/CLOSE/READY lever in the **Ready** position.

STEP 3. Remove the hookstick and insert it into the hole in the left lever section. To use the **First Closing Profile** feature, pull down once on the left lever section. The three interrupters will close.

STEP 4. To use the **Second Closing Profile** feature, pull down twice on the left lever section within the time set for the **Manual Lever Closing Delay** timer.

STEP 5. Check the interrupter OPEN/CLOSE indicators. See Figure 5 on page 10 and Figure 6 on page 10. They should show the "I" indication.

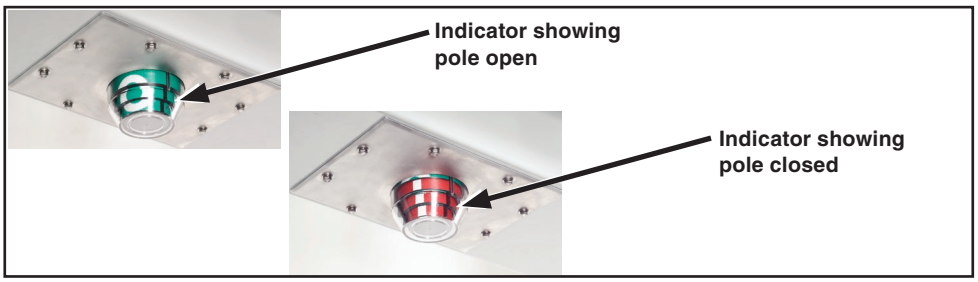

Figure 5. The 15.5-kV and 27-kV interrupter OPEN/CLOSED indicator, one at each pole.

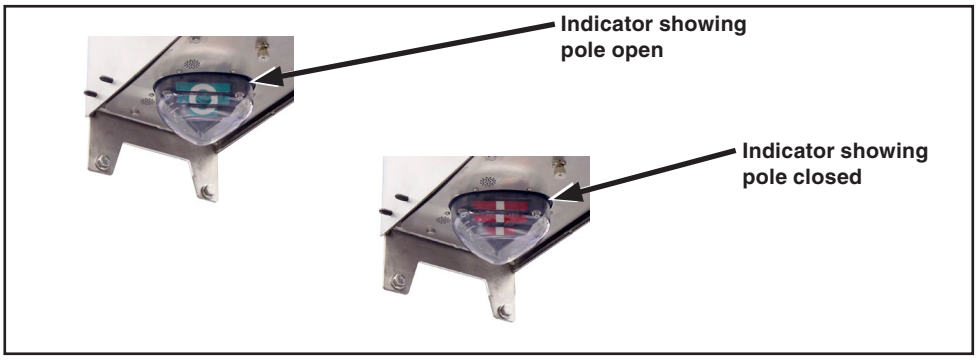

Figure 6. The 38-kV interrupter OPEN/CLOSED indicator, one at each pole.

Manual Hot Line Tag

The **Hot Line Tag** mode can be set locally using the HOT LINE TAG lever or remotely using a SCADA or IntelliLink software command. The **Hot Line Tag** mode is normally removed using the same method by which it was applied; however, the HOT LINE TAG lever can be used to remove electronically set tags as well. The **Hot Line Tag** mode will only be cleared when all manually set and electronically set tags have been cleared. This approach satisfies NESC 442.E requirements, which allow local removal of a remotely set **Hot Line Tag** mode if local indication of the electronically set **Hot Line Tag** mode is provided.

To locally apply the **Hot Line Tag** mode, pull down on the HOT LINE TAG lever. It can be "tagged " in this position using conventional procedures. See Figure 8 on page 12. To remove the locally set **Hot Line Tag** mode, push up on the HOT LINE TAG lever.

To remove a SCADA- or IntelliLink software-applied **Hot Line Tag** mode when a local **Hot Line Tag** mode has also been applied, push up on the HOT LINE TAG lever. Then, pull down and push up on the HOT LINE TAG lever once, without delay. To remove a SCADA- or IntelliLink software-applied tag when a local **Hot Line Tag** mode has not been applied, pull down and push up on the HOT LINE TAG lever twice, without delay.

The HOT LINE TAG indicator is located on the protection and control module. See Figure 9 on page 14. When the **Hot Line Tag** mode is set, the HOT LINE TAG indicator flashes for a ½ second every 2 seconds. Any trip in the **Hot Line Tag** profile will be performed as a **Three-Phase Trip** operation. When the **Hot Line Tag** mode is removed, the HOT LINE TAG indicator is off.

Manually Applying a Hot Line Tag

Follow these steps to manually apply a hot line tag:

STEP 1. Insert the hookstick into the ring on the HOT LINE TAG lever. See Figure 7.

STEP 2. Pull down on the lever. If desired, tag or lock it in this position. See Figure 8 on page 12.

STEP 3. Observe the amber HOT LINE TAG indicator on the protection and control module. See Figure 9 on page 14. When the **Hot Line Tag** mode is applied, the indicator will flash amber for a ½ second every 2 seconds.

Clearing a Manually Applied Hot Line Tag

Follow these steps to clear a manually applied **Hot Line Tag** mode:

STEP 1. Remove the tag or lock on the HOT LINE TAG lever, if applicable.

STEP 2. Insert the hookstick into the ring on the HOT LINE TAG lever and push up on the lever.

STEP 3. Observe the amber HOT LINE TAG indicator. When the **Hot Line Tag** mode is cleared, the HOT LINE TAG indicator will be off.

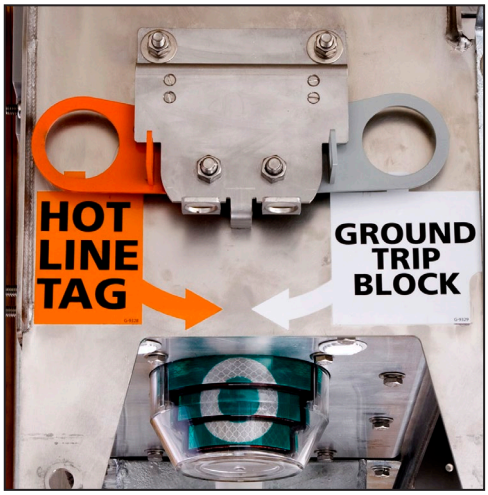

Figure 7. Pull down with a hookstick to manually apply the Hot Line Tag mode or to manually apply the Ground Trip Block mode.

Manual Ground Trip Block (if furnished)

The **Ground Trip Block** mode can be set locally with the GROUND TRIP BLOCK lever or remotely using a SCADA or IntelliLink software command. The **Ground Trip Block** mode can only be removed by the method used to set it and (unlike the **Hot Line Tag** mode) the manual lever cannot remove the **Ground Trip Block** mode set by SCADA or IntelliLink software.

To locally apply the **Ground Trip Block** mode, pull down on the GROUND TRIP BLOCK lever. See Figure 8. It can be tagged using conventional procedures. To remove a locally applied **Ground Trip Block** mode, push up on the GROUND TRIP BLOCK lever. When the **Ground Trip Block** is either set or removed, the STATUS indicator will light at 100% brightness for 10 seconds to indicate the GROUND TRIP BLOCK lever command has been received. See Figure 9 on page 14.

Ground Trip Block removed—In this mode, the **Overcurrent Protection** feature will operate normally. When a **Ground Overcurrent Protection** element is configured for the active profile, it will respond to a fault event. When a **Ground Overcurrent Protection** element is not configured in the active profile, removing the **Ground Trip Block** mode does not create a ground TCC nor does it enable the element.

Ground Trip Block set—Enabling the **Ground Trip Block** mode will immediately disable and reset all selected elements, even when they were timing for a fault when the GROUND TRIP BLOCK lever was moved. The GROUND TRIP BLOCK lever is effective for any profile: all **General** profiles, both **Closing** profiles, and the **Hot Line Tag** mode.

The elements available for selection are: **Ground**, **Negative Sequence**, and **Sensitive Earth Overcurrent** elements. When the GROUND TRIP BLOCK lever is configured to block circuit testing, circuit testing will immediately terminate. When the test sequence was in the middle of an open interval when circuit testing was terminated, the sequence will immediately go to the **Lockout** state. When the test sequence was not in an open interval when the test sequence was terminated, the next trip will result in a **Lockout** state.

When the GROUND TRIP BLOCK lever is configured for an alternate **General** profile, the designated **General** profile becomes the active profile unless the unit is testing. When the unit is testing, the alternate **General** profile does not become active until the active test sequence has completed. **Closing** profiles and **Hot Line Tag** profiles are not affected by the position of the GROUND TRIP BLOCK lever. SCADA or software commands to change the **General** profile while using the **Alternate** profile are accepted, but the IntelliRupter fault interrupter will not revert to the commanded **General** profile until the GROUND TRIP BLOCK lever has been returned to the **Unblocked** position.

Figure 8. The Hot Line Tag mode manually applied and "tagged."

Electronically Applied Hot Line Tag

An electronically set **Hot Line Tag** mode can be removed using the HOT LINE TAG lever. This procedure satisfies NESC 442E requirements, which allow local removal of an electronically set **Hot Line Tag** mode when local indication of the electronic tag is provided.

Clearing an Electronically Applied Hot Line Tag

A **Hot Line Tag** mode applied by a software command, or a SCADA command is normally removed using the same method by which it was applied. However, the hookstick lever can be used to remove the electronically set **Hot Line Tag** mode as well.

Follow these steps to clear an electronically applied **Hot Line Tag** mode when it was applied manually:

STEP 1. Observe the amber HOT LINE TAG indicator on the protection and control module. See Figure 9 on page 14. When a hot line tag is applied, the indicator will flash for a ½ second every 2 seconds.

STEP 2. Insert the hookstick into the ring on the HOT LINE TAG lever. Push up on the lever, then pull down and push up the lever *once*, *without delay*. See Figure 7 on page 11.

STEP 3. Observe the HOT LINE TAG indicator. When the **Hot Line Tag** mode is cleared, the indicator will be off.

Follow these steps to clear an electronically applied **Hot Line Tag** mode when it was not applied manually:

STEP 1. Observe the amber HOT LINE TAG indicator on the protection and control module. See Figure 9 on page 14. When a **Hot Line Tag** mode is applied, the indicator will flash for a ½ second every seconds.

STEP 2. Insert the hookstick into the ring on the HOT LINE TAG lever. Pull down and push up on the lever *twice*, *without delay*. See Figure 7 on page 11.

STEP 3. Observe the HOT LINE TAG indicator. When the **Hot Line Tag** mode is cleared, the indicator will be off.

Figure 9. The HOT LINE TAG and STATUS indicators on the protection and control module.

Status Indicator

The white STATUS indicator on the protection and control module indicates the operational status of the IntelliRupter fault interrupter. See Figure 9.

Observe the flashing sequence to determine the operational status of an IntelliRupter fault interrupter:

Off:

- The IntelliRupter fault interrupter is not powered.
- An internal error occurred and the IntelliRupter fault interrupter is not functioning correctly.

On continuously:

- The **Remote Operation** mode is in the **Disabled** state (when configured by the user).

On continuously for 10 seconds, then flashes for a ½ second every 30 seconds:

- The IntelliRupter fault interrupter has just been energized.
- The Wi-Fi connection has just been terminated.
- The OPEN/CLOSE/READY lever has been moved from the **Ready** to **Open** position (and lock), from the **Ready** to **Close** position, or from the **Open** (and lock) to **Ready** position.
- The GROUND TRIP BLOCK lever has been moved to the **Set** state or to the **Removed** state.

Flashes for a ½ second every 30 seconds:

- This is the normal operational state.

Flashes 3 times (½ second on, ½ second off) every 30 seconds:

- The **Automatic Restoration** mode is in the **Ready** state. This applies to the **Loop Restoration** mode or the **IntelliTeam SG** mode.

Pulses dim to bright:

- The Wi-Fi connection to a local laptop computer is operating.

Flashes for ½ second every second:

- Any **Error** state is active.
- The **Settings Mismatch** state is active.
- The **Battery Low**, **Battery Bad**, or **Battery Disconnected** state is active (when configured by the user).

Hot Line Tag Indicator

The HOT LINE TAG indicator (amber LED) shows the **Hot Line Tag** mode status. See Figure 9 on page 14.

Off: All **Hot Line Tag** mode settings have been removed.

Flashes for a ½ second every 2 seconds: The **Hot Line Tag** mode has been applied.

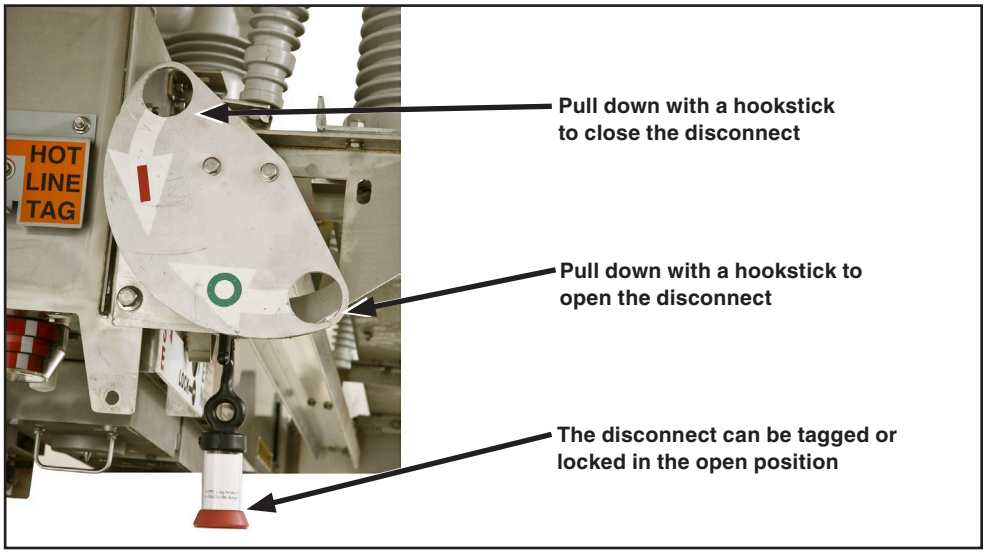

Figure 10. The DISCONNECT operating lever in the Locked Open state.

Opening and Closing the Disconnect

The hookstick-operated three-pole disconnect on disconnect-style models cannot be operated until the interrupters have been opened and the OPEN/CLOSE/READY lever is in the **Locked** position.

Opening the Disconnect

Follow these steps to open the visible disconnect:

STEP 1. Insert a hookstick into the hole in the right section of the OPEN/CLOSE/READY lever. See Figure 3 on page 9.

STEP 2. Pull down on the right lever section. The three interrupters will open.

STEP 3. If desired, tag or lock the OPEN/CLOSE/READY lever in this position. See Figure 4 on page 9.

STEP 4. Check the interrupter OPEN/CLOSED indicators. See Figure 5 on page 10 and Figure 6 on page 10. They should show a "O" indication.

STEP 5. Insert the hookstick into the right hole of the DISCONNECT operating lever, above the "O." See Figure 10. Pull down on the lever. The disconnect will open.

STEP 6. If desired, tag or lock the DISCONNECT operating lever in this position. The interrupters may be operated with the disconnect in the **Open** position.

Closing the Disconnect

Follow these steps to close the visible disconnect:

STEP 1. Remove the tags or locks on the DISCONNECT operating lever and the OPEN/CLOSE/READY lever, if applicable. See Figure 4 on page 9, and Figure 10 on page 15.

STEP 2. Insert a hookstick into the hole in the right section of the OPEN/CLOSE/READY lever. See Figure 3 on page 9.

STEP 3. Pull down on the right lever section. The three interrupters will open.

STEP 4. Insert the hookstick into the left hole of the disconnect operating lever, above the "I." See Figure 10 on page 15. Pull down on the lever. The disconnect will close.

STEP 5. Insert a hookstick into the hole in the right lever section of the OPEN/CLOSE/READY lever.

STEP 6. Push up on the right lever section.

STEP 7. Remove the hookstick and insert it into the hole in the left lever section.

STEP 8. To use the **First Closing** profile, pull down once on the left lever section. The three interrupters will close.

To use the **Second Closing** profile, pull down twice on the left lever section (within the time set for the **Manual Lever Closing Delay** timer).

STEP 9. Check the interrupter OPEN/CLOSE indicators. See Figure 5 on page 10 and Figure 6 on page 10. They should show the "I" indication.

Starting IntelliLink Setup Software

After the IntelliRupter fault interrupter and the computer have been configured and set up for Wi-Fi communication, connection is automatically accomplished with IntelliLink Setup Software.

To connect to an IntelliRupter fault interrupter with IntelliLink Setup Software, see the "Wi-Fi Connection to an IntelliRupter with IntelliLink" section in Instruction Sheet 766-571, "IntelliRupter® PulseCloser® Fault Interrupter: *Software Installation*."

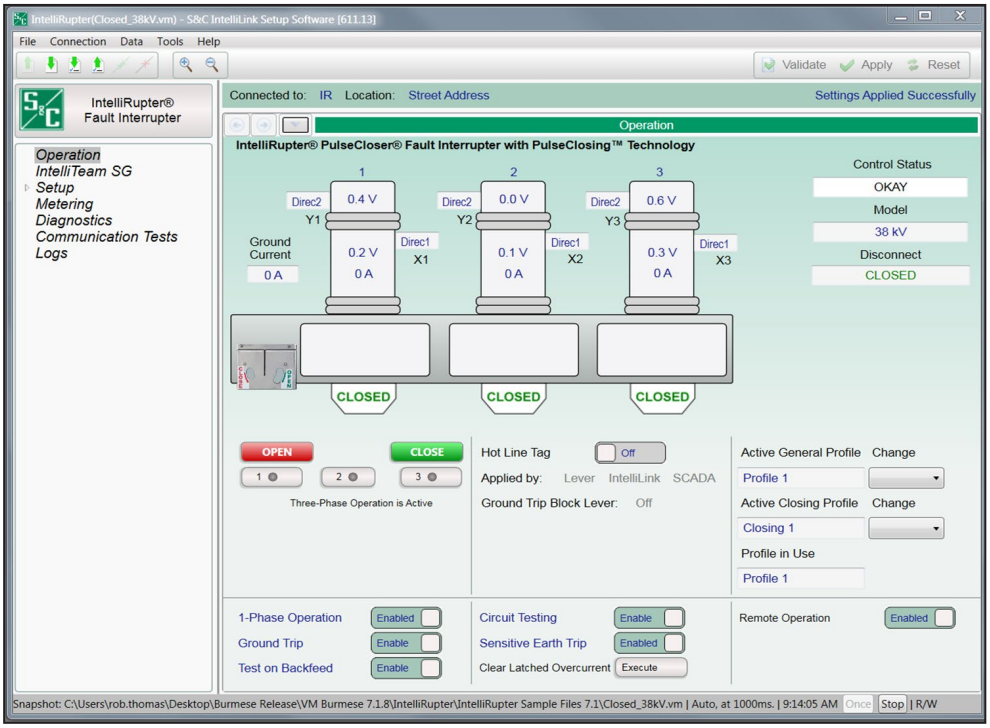

Figure 11. The IntelliRupter fault interrupter *Operation* screen.

Operation Screen

NOTICE

With software later than version 7.3.100, the default passwords for all user accounts, including the admin account, must be changed before the IntelliLink software can connect to and configure a control. See Instruction Sheet 766-530, "IntelliRupter® PulseCloser® Fault Interrupter: *Protection and Communication Setup,*" for more information.

After password verification, the *Operation* screen opens. It presents IntelliRupter fault interrupter status information and is used to operate the device. See Figure 11. User-assigned IntelliRupter fault interrupter identification information, the **Connected to:** and **Location:** options, are shown at the top of every screen.

An electronic representation of the IntelliRupter fault interrupter OPEN/CLOSE/READY lever side is shown. Poles 1, 2, and 3 are displayed left to right (in this case labeled 1, 2, and 3). The upper terminal pads are labeled Y1, Y2, Y3, and the lower terminal pads are labeled X1, X2, X3.

Phase-to-ground or phase-to-phase voltage at each terminal pad is shown on the associated pole-unit, and the voltage units are user-assigned.

NOTICE

Because the IntelliRupter fault interrupter voltage sensors are high-impedance sensing devices, they will indicate a presence of voltage on the Y-side terminals when the optional disconnect is installed and open. The voltage reading is an artifact of leakage current resulting from parasitic capacitance; therefore, the readings can be quite variable from unit to unit and pole to pole. Humidity and other weather-related conditions add to the variability at a given unit.

Measured current at each pole-unit is displayed below the lower terminal pad voltage, along with an arrow indicating the three-phase power-flow direction. When the arrow points right, current is flowing from the upper to the lower terminal pad. When the arrow points left, current is flowing from the lower to upper terminal pad. Current flow is determined by the **Three-Phase Directional Power** element, so all arrows point the same way. Reported current is zero and directional arrows are not shown when the IntelliRupter fault interrupter is in the **Open** state.

Each interrupter position is shown at the bottom in the **Open** or **Closed** state.

When the IntelliRupter fault interrupter has tripped open because of a fault, the Status box at each pole-unit will show more information:

- **TESTING—**Displays when the IntelliRupter fault interrupter is in the **Open** state and still testing
- **TESTING-SEF—**Displays when the IntelliRupter fault interrupter is in the **Open** state and still testing for a sensitive earth fault
- **PICKUP—**Displays when one of the elements has exceeded its pickup value and is timing to trip

  Additionally:

  –OC displays when timing began because of an **Overcurrent** condition

  –VOLT displays when timing began because of a **Voltage** condition

  –FREQ displays when timing began because of a **Frequency** condition

  –GOC displays when timing began because of a **Ground Overcurrent** condition

  –NSOC displays when timing began because of a **Negative Sequence** condition

  –SECT displays when timing began because of a **Sectionalizing** condition

  –SEF displays when timing began because of a **Sensitive Earth Fault** condition
- **LOCKED OPEN—**Displays when the OPEN/CLOSE/READY lever is locked open
- **LOCKOUT—**Displays when the IntelliRupter fault interrupter has completed testing and gone to the **Lockout** state

  Additionally:

  –PulseClosing displays when the test using PulseClosing® Technology issued a **Fault** condition and has gone to the **Lockout** state

  –OC displays when tripping was because of an **Overcurrent** condition

  –VOLT displays when tripping was because of a **Voltage** condition

–FREQ displays when tripping was because of a **Frequency** condition

–SECT displays when tripping was because of a **Sectionalizing** condition

–SEF displays when tripping was because of a **Sensitive Earth Fault** condition

- **Close Blkd-Sync Check—**Displays when the IntelliRupter fault interrupter was attempting to close, the **Sync Check** mode was in operation, and there was a difference in frequency, voltage magnitude, or voltage angle between the X and Y sides that exceeded the settings in the **Closing** profile that resulted in the IntelliRupter fault interrupter not closing
- **Close Blkd Pulse Inop—**Displays when the IntelliRupter fault interrupter was attempting to close and did not, the test using PulseClosing Technology was not available, and the user setting for **Conventional Close If PulseClosing Not Available** mode was set to the **No** state
- **Close Blkd No Energy—**Displays when the IntelliRupter fault interrupter was attempting to close and did not because of insufficient storage-capacitor energy
- **Fault-PulseClosing—**Displays when the IntelliRupter fault interrupter has completed the test using PulseClosing Technology and gone to the **Lockout** state
- **SETTINGS MISMATCH—**Displays when the settings in the control are incompatible with the settings in the base memory module, no settings are active and protection and restoration functions are not active (This can happen when a control with an updated setpoint file is placed into an IntelliRupter fault interrupter base that previously had an older, incompatible setpoint file in the base memory module. Issuing the **Apply** settings command will remove this condition, and the previous settings stored in the base memory module will be overwritten and lost.)

When the **Lockout** state was caused by an **Overcurrent** condition, the current occurring at each pole-unit at the time of the initial trip will be shown. A fault flag in the form of a red lightning bolt will be shown at the pole-unit(s) at which the **Overcurrent** condition was sensed by the phase element to indicate the direction of the fault. The fault flags are also available as DNP Status points that are described in S&C Instruction Sheet 766-560, "IntelliRupter® Pulse Closer® Fault Interrupter: *DNP Points List and Implementation*."

The fault flag will be set in response to an **Overcurrent** event for any phase that has timed beyond 20% of trip when an **Overcurrent** element has tripped, or for any phase that was timing when a **Ground Overcurrent** element tripped. When a **Ground Overcurrent** element trips and none of the phases are picked up, a fault flag will be set for each phase.

Control Status Indicator

This indicator has the same flashing sequence as the white STATUS indicator on the protection and control module. See the "Status Indicator" section on page 14. The Control Status message box displays one of the following:

- **OKAY—**Displays when the IntelliRupter fault interrupter is functioning normally
- **ALARM—**Displays when the IntelliRupter fault interrupter is functioning normally but maintenance is required (for example, a **Wi-Fi Intrusion** alarm is active)
- **WARNING—**Displays when some function has been lost, but the IntelliRupter fault interrupter can function in a limited capacity (for example, a **Battery Low** or **Battery Bad** state)

- **ERROR—**Displays when the IntelliRupter fault interrupter cannot function properly and may not be able to open or close
- **MAINT MODE—**Displays when the IntelliRupter fault interrupter cannot function properly, and an application program needs to be loaded

Model

This displays the IntelliRupter fault interrupter line-voltage rating.

Disconnect Indicator

On Disconnect-Style IntelliRupter fault interrupters, the message box shows whether the disconnect is in the **Open** or **Closed** state. For non-disconnect-style IntelliRupter fault interrupters, the message box displays "Not Installed."

Loop Restoration or Communication Enhanced Coordination Status Indicators

- The **Loop Restoration** status indicator is displayed when the **Loop Restoration** mode is used.
- The **Communication Enhanced Coordination** status indicator is displayed when the **Communication Enhanced Coordination** mode is used.
- The **No** status indicator is displayed for the **Radial Configuration** mode.

Loop Restoration Status

Ready Indicator

The **Ready** status is indicated when:

- The IntelliRupter fault interrupter is in the **Closed** state and has a Normally Closed configuration.
- The IntelliRupter fault interrupter is in the **Open** state, has a Normally Open configuration, and is not in the **Locked-Out** mode.
- The OPEN/CLOSE/READY lever is in the **Ready** position.
- A **General** profile is active (for example, the **Hot Line Tag** mode is not applied).
- The **Loop Restoration** feature is enabled on both the *Operation* screen and for the presently active **General** profile.
- The IntelliRupter fault interrupter is not in an **Error** state.

Timing Indicator

The **Timing** indicator shows when the **Loop Restoration** timers are running. If the **Timing** indicator is in the **On** state, the IntelliRupter fault interrupter is testing and some of the conditions for the **Ready** status may not be valid.

Reconfigured Indicator

The **Loop Restoration Reconfigured** status is indicated when:

- An IntelliRupter fault interrupter configured for a **Normally Closed** operation is opened by a **Loop Restoration** operation.
- An IntelliRupter fault interrupter is configured for a **Normally Closed** operation but is serving load in the opposite direction because of a **Loop Restoration** operation.

- An IntelliRupter fault interrupter configured for a **Normally Closed** operation is closed by a **Loop Restoration** operation.

GOOSE: Enabled/Disabled (SDA-4540R3 control only)

This indicates whether the **GOOSE Messing** feature is enabled or disabled. The value can be modified on the *Setup>Protection>GOOSE Messaging>General* screen.

Active GOOSE Messaging (SDA-4540R3 control only)

This displays the last action taken as the result of receiving a GOOSE message: **TOC Shift**, **TOC Unshift**, **DTT**, or **GOOSE Communication Loss** status can be displayed. If no action has been active, the display is blank. When a GOOSE action is active, that value will be displayed in perpetuity until another GOOSE message becomes active. This status can be cleared by disabling GOOSE Messaging and re-enabling GOOSE Messaging.

Communication Enhanced Coordination (CEC) Status

Ready Indicator

The **Ready** status is indicated with red text when the IntelliRupter fault interrupter is a member of a **CEC Pair**, **CEC** mode is enabled, the correct **General** profile is active, and there are no **Error** conditions.

To enable CEC status information on the *Operation* screen, both the **Coordination Mode** setpoint in one or more of the general profiles must be set to the **Communication Enhanced Coordination** mode found on the *Setup>Protection>General Profile 1-4>Direction 1 Current>TCC's for Coordination* screen, and the **Mode of Operation** setpoint must be set to the **IntelliTeam SG** mode found on the *Setup>General>Site-Related* screen.

Shift X Indicator

Communication Enhanced Coordination Shift for X Terminal—On when the IntelliRupter fault interrupter has shifted to the slower curve for the X terminal. Otherwise, off.

Shift Y Indicator

Communication Enhanced Coordination Shift for Y Terminal—On when the IntelliRupter fault interrupter has shifted to the slower curve for the Y terminal. Otherwise, off.

OPEN and CLOSE Buttons

These buttons issue an **Open** or **Close** command when device operation is authorized.

Single-Phase Operation Buttons

When "Single-Phase Operation Is Active" is displayed and device operation is authorized, one phase can be operated manually by selecting that phase and clicking on the **Open** or **Close** button.

1-Phase Operation

This function enables or blocks both manual and automatic **Single-Phase** operation.

Ground Trip

When blocked, this function prevents the IntelliRupter fault interrupter from tripping because of a **Ground Overcurrent** element. It is commonly used when work is performed on one phase, that would be seen as a larger-than-normal load imbalance. This function does not activate a **Ground Overcurrent** element if one has not been set up in the active profile.

Test on Backfeed

When enabled, this function allows the use of PulseClosing Technology or close testing after an initial trip when there is voltage on both sides of the IntelliRupter fault interrupter. Testing is usually blocked in applications involving distributed generation to prevent closing on the other generator if it has not yet tripped offline. When the **Test on Backfeed** mode is blocked, the IntelliRupter fault interrupter does not immediately go to the **Lockout** state after tripping but instead waits for the voltage to go away on one side before resuming the specified time periods in the test sequence. If voltage remains on both sides for an interval of 5 minutes, the IntelliRupter fault interrupter goes to the **Lockout** state. When configured to block testing, the **Test on Backfeed** mode is only enforced when all three poles are open; it is not enforced when in a **Pole Mismatch** state.

Hot Line Tag

The **Hot Line Tag** mode can be applied by clicking on the **On** button; the "IntelliLink" indication will be displayed. When the **Hot Line Tag** mode is applied by SCADA, the "SCADA" indication will be displayed. When the **Hot Line Tag** mode is applied using the HOT LINE TAG lever, the "Lever" indication will be displayed. When the **External Trip** option is present and the **Hot Line Tag** mode is applied by the External Trip interface, "External" will be displayed. The "External" indication will not be displayed on the *Operation* screen unless the option is present. The **Hot Line Tag** mode is normally removed using the same method by which it was applied. However, a second operation of the HOT LINE TAG lever will clear an electronically set **Hot Line Tag** mode.

Ground Trip Block Lever

This field indicates the position of the GROUND TRIP BLOCK lever.

Ground Trip Block External (SDA-4540R2 control only)

When the **External Trip** option is present, this field indicates the External Interface **Ground Trip Block** input is active when "On" is displayed.

Maintenance Mode External (SDA-4540R2 control only)

When the **External Trip** option is present, this field indicates the External Interface **Maintenance Mode** input is active when "On" is displayed.

External Port Link (SDA-4540R2 control only)

When the **External Trip** option is present, this field indicates the **External Port** data flow is active when "On" is displayed.

Circuit Testing

When enabled, this function allows for the use of PulseClosing Technology or close testing after the initial trip. When blocked, the IntelliRupter fault interrupter goes immediately to the **Lockout** state after tripping.

Sensitive Earth Trip

When enabled, this function allows the IntelliRupter fault interrupter to trip for a **Sensitive Earth Overcurrent** element. This function does not activate a **Sensitive Earth Overcurrent** element if one has not been set up in the active profile. When blocked, this function prevents the IntelliRupter fault interrupter from tripping because of a **Sensitive Earth Overcurrent** element if one has not been set up in the profile.

Clear Latched Overcurrent Button

Clears the **Latch Overcurrent** status point 119 if set when this button is activated.

Active General Profile

This status box shows the user-assigned name of the active profile. It may be one of the four **General** profiles or the **Hot Line Tag** profile.

Active Closing Profile

This status box shows the user-assigned name of one of the two **Closing** profiles.

Profile in Use

This status box shows the active profile, which is the protection profile the IntelliRupter fault interrupter is presently using. Options are **General Profile 1** through **4**, **Closing Profile 1** or **2**, and the **Hot Line Tag** profile.

Remote Operation Button

When line work is planned, it may be necessary to block the IntelliRupter fault interrupter operation via SCADA or remote IntelliLink Software. To block remote operation, set this to the **Disabled** state.

NOTICE

When the **Remote Operation** mode is set to the **Disabled** state, **Remote Operation** mode can only be set to the **Enabled** state by a Wi-Fi command at the IntelliRupter fault interrupter site.

Loop Restoration Button

The **Loop Restoration** mode can be enabled or disabled by a SCADA command or with this button on the *Operation* screen.

IntelliTeam SG Restoration Button

The **IntelliTeam SG Restoration** mode can be enabled or disabled by a SCADA command, with this button on the *Operation* screen, or with the **IntelliTeam SG Restoraton** selector button on the *IntelliTeam SG>Setup>Team Summary* screen.

Closed-Loop Break Switch

When "On," this indicates **IntelliTeam** logic has set this control as the designated load-center switch and, if enabled in the active profile, the **Sectionalizing Trip Loss of Voltage Only** element will trip on one loss-of-voltage count regardless of its **Counts to Trip** setting value and without current supervision. This switch will break the loop if an event occurs.

Single Phase Operation Button

When enabled, this function allows single-phase user commands and automatic operations when the test sequence is configured for the **Single-Phase** tripping mode. When blocked, all automatic operations or IntelliLink software user commands will be executed in the **Three-Phase** mode, and single-phase SCADA commands will be rejected.

Open-Source Sectionalizing Button

This button is only visible when the **Open-Source Operation Screen Control** configuration on the *Setup>General>User Commands* screen is set to the **Show Control** state. This button can enable or block the **Open-Source Sectionalizing** element. The **Open-Source Sectionalizing** element is only active when it is set to the **Yes**, **IntelliTeam SG**, or **Loop Only** state in the active profile.

When the **Open-Source Sectionalizing** button is set to the **Blocked** state and the **Open-Source Sectionalizing** element is set to the **Yes**, **IntelliTeam SG**, or **Loop Only** state in the active profile, a device restart will set the **Open-Source Sectionalizing** button to the **Enabled** state.

Enabling SCADA Operation

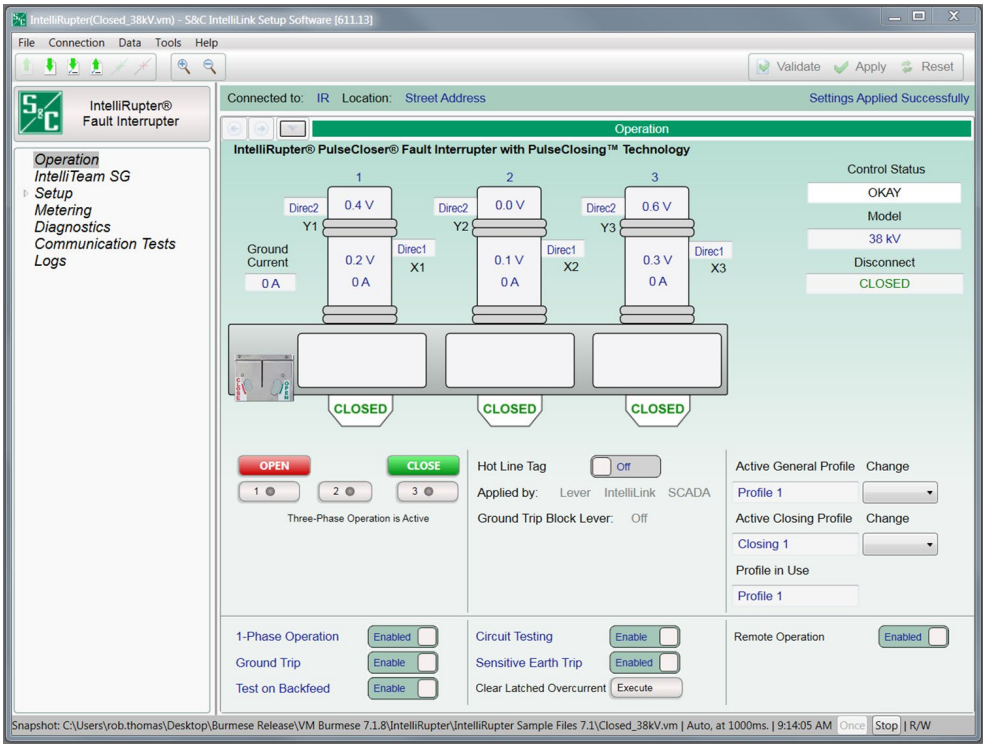

Figure 12. Enabling SCADA operation on the *Operation* screen.

Remote Operation Button

When line work is planned, the IntelliRupter fault interrupter operation can be blocked via SCADA or remotely with IntelliLink software. To block remote operation, set this to the **Disabled** state. See Figure 12.

NOTICE

When the **Remote Operation** mode is set to the **Disabled** state with a SCADA command or a remote IntelliLink software command—the **Remote Operation** mode can only be set to the **Enabled** state by a Wi-Fi command at the IntelliRupter fault interrupter site.

A number of DNP control points are available to remotely operate the IntelliRupter fault interrupter with SCADA commands.

DNP points are mapped to conform to the SCADA system requirements. See Instruction Sheet 766-530, "IntelliRupter® PulseCloser® Fault Interrupter: *Protection and Communication Setup Instructions*," and Instruction Sheet 766-560, "IntelliRupter® PulseCloser® Fault Interrupter: *DNP Points List and Implementation*."

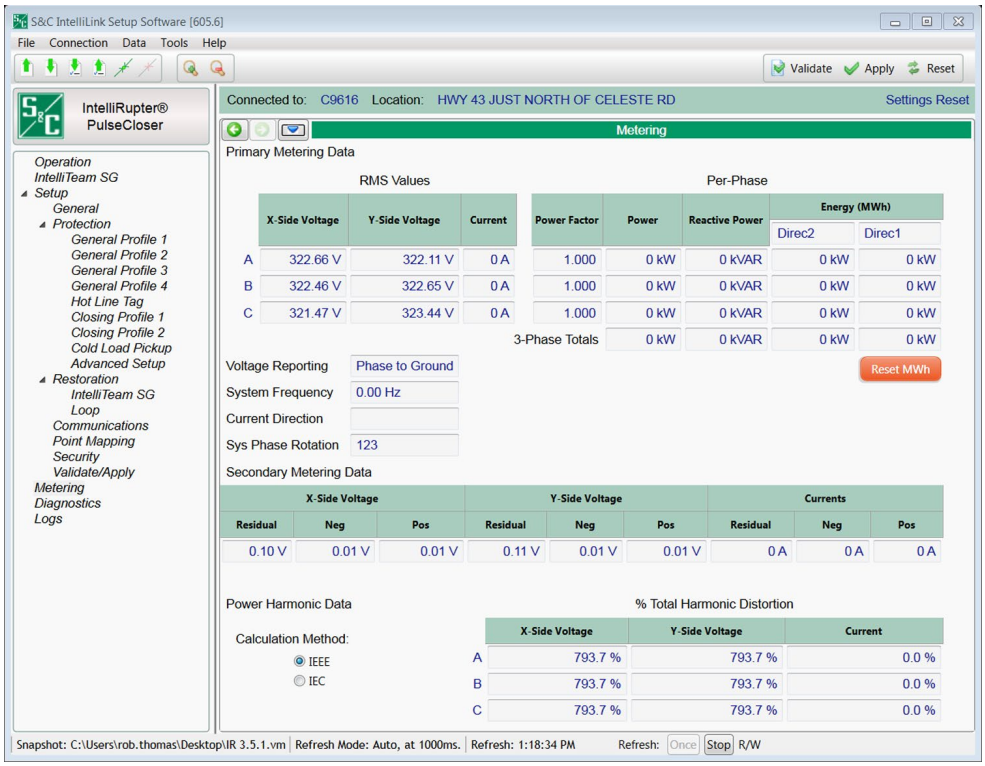

Figure 13. The *Metering* screen.

All values are time-averaged and reported locally and via SCADA on a one-second interval. See Figure 13.

Primary Metering Data

X-Side and Y-Side Voltage—True RMS values of phase voltages in Volts are reported. Either the **Phase-Ground** or **Phase-Phase** measurement setting is configured in the **Voltage Reporting** setpoint on the *Setup>General>Site-Related>System* screen.

Current—True RMS values of phase current in amperes are reported. Fundamental (phasor) derivatives are calculated for the residual current.

Power Factor—True per-phase power factor, based on the X-side voltages, are displayed in kilowatts. Power factor is calculated as the cosine of the corrected phase angle. The leading power factor is represented by a negative number.

Power—True per-phase and three-phase total power in kW are based on X-side phase voltages.

Reactive Power—Measured reactive power is displayed in kvars and is based on X-side phase voltages.

Energy—Phase energy and three-phase total energy, in total kilowatt hours, accumulated since the last **Reset MWh** command, are based on X-side and Y-side phase voltages.

Reset MWh—Click on the **Reset MWh** button to reset all energy readings to zero.

Voltage Reporting—System-voltage measurements displayed as either Phase-to-Phase or Phase-to-Ground.

System Frequency—Measured system frequency displayed in Hertz.

Delta Frequency—The measured system-frequency difference between the X and Y sides of an open IntelliRupter fault interrupter is displayed in Hertz.

Current Direction—This indicates the direction of current flow, either Direction 1 or Direction 2.

System Phase Rotation—This indicates the detected system phase rotation as 123, 132, or Indeterminate.

Secondary Metering Data

Residual-, negative-, and positive-sequence components are calculated for X-side voltage, Y-side voltage, and current. Voltage sequence components are derived by summing the product of the VAB and VCB inputs, with the latter multiplied by a unit vector having either +120 degree (positive sequence) or –120 degree (negative sequence) phase angle. The sum is divided by three, yielding a value nominally equal to VAN voltage (positive sequence). The sum is equal to V phase-ground (positive sequence) regardless of the choice made for the **Voltage Reporting** setpoint on the *Setup>General>Site-Related* screen. Negative sequence voltage and current are nominally zero in a balanced system.

Power Harmonic Data

Use the **Calculation Method:** button to select the desired calculation method.

Total Harmonic Distortion is defined by the formula where:

Xi = the amplitude of the nth harmonic of voltage or current, and

Xl = the amplitude of the fundamental of voltage or current

THD is actually computed using the true RMS and fundamental RMS voltage and current values developed by the IntelliRupter fault interrupter, using the formula where:

RMSTrue = True RMS of current or voltage, and

RMSFund = Fundamental (1st Harmonic) RMS of current or voltage

Saving a Setup Configuration

If two or more IntelliRupter fault interrupters use a similar set-up configuration and have the same software version, the configuration from one IntelliRupter fault interrupter can be saved and loaded into others. Only the setpoints that are different need to be adjusted.

In IntelliTeam II system applications, this procedure can be used to save the setpoint values on the IntelliTeam II software screens. By loading these setpoints into each team member, the screens will be identical for all team members.

Follow these steps to save a setup configuration:

STEP 1. Start IntelliLink software and connect to the IntelliRupter fault interrupter that has the set-up configuration to be saved.

STEP 2. Select the **File** pull-down menu and click on the Save Setpoints entry or click on the Save Setpoints... entry in the tool bar.

STEP 3. In the Save Setpoints dialog box, select the setpoint values to be saved. See Figure 14.

STEP 4. To save specific setpoint groups, click the check boxes for the desired setpoint groups. Some groups can be expanded to allow smaller sub-groups to be selected or unselected.

To save all setpoint values (including values for setpoint groups that may not have been configured), click on the **Select all** button.

Note: The Security Setpoint Group configuration is not included when the **Select All** button is clicked on. It can be included by manually selecting its check box.

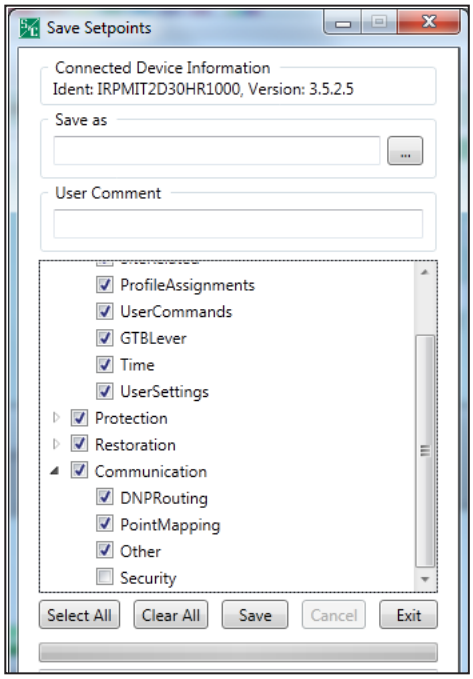

Figure 14. The Save Setpoints dialog box.

STEP 5. In the Save Setpoints dialog box, specify a name and location for this configuration (use the **"..."** button for more file and folder information). Then, click on the **Save** button.

Be sure to name the team setpoint profiles logically. For example, use Team2 for Team 2 setpoints. When the setpoint profile is loaded into another team member, the IntelliLink software automatically places the profile information on the *Setup>Restoration>IntelliTeam SG>Team X* screen with the matching team number. User comments can be added in the **User Comment** field. Note that the "&" character is not allowed.

Loading a Setup Configuration

Follow these steps to load a setup configuration:

STEP 1. Start IntelliLink software and connect to the IntelliRupter fault interrupter from which the saved configuration will be loaded.

STEP 2. Select the **File** pull-down menu and click on the Load Setpoints entry or click on the Load Setpoints... entry in the tool bar.

STEP 3. In the Load Setpoints dialog box, click on the "**...**" button and browse to the configuration file to be loaded. Select the configuration file, and then click on the **Open** button.

STEP 4. Select the desired setpoint groups using their check boxes. Or select all the setpoint groups using the **Select All** button. Click on the **Load** button to load the selected setpoints.

Viewing Screens and Help File

IntelliLink Setup Software for IntelliRupter fault interrupters functions somewhat differently from IntelliLink software for other S&C automatic controls.

Only snapshot (.vm) files and the Help file may be viewed offline while not connected to an IntelliRupter fault interrupter. A snapshot consists of IntelliRupter data from a specific point in time. It is typically used for diagnosing an event sequence.

Example snapshot files are included with the IntelliRupter Software Installer. Refer to the appropriate directory (usually *C:\Documents and Settings\All Users\Documents\S&C Electric\Products\IntelliRupter* for Windows XP or *C:\Users\Public\Documents\S&C Electric\Products* for Windows 7).

Using Snapshots

Follow these steps to save settings and data to a snapshot:

STEP 1. Start the IntelliLink software and connect to the IntelliRupter fault interrupter from which the information will be saved.

STEP 2. Select the **File** pull-down menu and click on the Save Snapshot entry.

STEP 3. In the dialog box, specify a filename and location for the snapshot, then click on the **Save** button.

Follow these steps to view a snapshot:

STEP 1. Start the IntelliLink Offline software.

STEP 2. Open the desired snapshot file.

STEP 3. To change any settings, click on the **Yes** option for updating the file. Changes will automatically be saved to the same snapshot file immediately when each change is made on the screen.

STEP 4. To save a separate setpoints file (.xadt), select the **File** pull-down menu and click on the Save Setpoints entry.

STEP 5. To view another snapshot file, exit the **IntelliLink Offline** software, restart the **IntelliLink Offline** software, and open the new snapshot file.

NOTICE

When using IntelliLink software without a connection, the **Copy** command cannot be used to copy settings from one profile to another or from one direction to another, and the **Validate** or **Apply** commands cannot be used for the settings.

Battery Management

Battery capacity is affected by age, temperature, load cycling, and load. The battery-management system ensures available battery capacity will operate the IntelliRupter fault interrupter, and it gives advanced warning about a weak battery condition.

The protection and control module continuously monitors battery voltage and runs scheduled battery tests. Test intervals are determined by battery operating conditions:

- During battery discharge, the test runs hourly.
- After a power outage, the test runs every two hours for 24 hours to monitor battery status during the recharge.
- After 24 hours of continuous operation on ac power, the test runs once a day.

Note: A battery test can be started at any time with the **Battery Test** button on the *Diagnostics>Test* screen or with a SCADA command.

The test applies various loads to determine how the battery will perform under load. The test reports indicate:

- Actual battery voltage—the true open circuit battery voltage
- Battery impedance—the internal impedance of the battery (Battery impedance determines the predicted switch operating voltage.)
- Calculated voltage under load—the minimum voltage predicted during an operation (When operating on battery power, the control module continuously evaluates calculated voltage under load. When operating on ac power, this value is only computed during a battery test cycle.)

IntelliRupter fault interrupter operation based on battery monitoring and test results:

- When the battery calculated voltage under load drops below the **Battery Low** value of 11.31 Vdc, "Battery Low" is shown as the **Battery System** state on the *Diagnostics>Control Power* screen, and the **Battery System Low** DNP Status point is reported.
- When the calculated voltage under load drops below the **Battery Bad** value of 10.72 Vdc, "Battery Bad" is shown as the **Battery System** state on the *Diagnostics>Control Power* screen, and the **Battery System Bad** DNP Status point is reported.
- When battery steady-state voltage drops below 10.72 Volts while the IntelliRupter fault interrupter is operating on battery power, the control module automatically disconnects all load to prevent deep discharge. Power is restored to load when ac power comes on or the battery is replaced.
- When battery voltage falls outside the proper range of 10.72 to 16.0 Volts while the IntelliRupter fault interrupter is operating on ac power, "Battery Bad" is shown as the **Battery System** state on the *Diagnostics>Control Power* screen, and the **Battery System Bad** DNP Status point is reported.

Based on field experience, a weak battery may fail the battery test in very cold temperatures but pass when the ambient temperature rises. If a **Battery Low or Battery Bad** alarm occurs, schedule battery replacement. In warmer climates or seasons, when a battery test indicates the battery is low, the battery may last another week or two.

NOTICE

IntelliRupter fault interrupters with Control Group C1 or C7 have a battery in the communication module. Batteries are charged about a week before leaving the factory, and the charge date is indicated on the battery. To ensure the battery in an uninstalled IntelliRupter fault interrupter is not damaged by extended storage, it should be removed and charged for at least 24 hours within six months of the last charge date.

When an installed IntelliRupter fault interrupter has lost line voltage, the battery will operate it for approximately four hours until the battery voltage drops to the **Battery Low Disconnect** setpoint level. A discharged battery has a service life of approximately one month. When line voltage will be off for a month or more, we recommend removing the battery from the communication module and recharging it.

Battery Care and Maintenance

The following maintenance procedures are recommended:

- Store batteries at room temperature. To maximize battery life, store all sealed lead-acid batteries at or below room temperature. When in service, the battery will be exposed to higher temperatures that impact its lifespan. However, proper storage avoids accelerating the aging process.
- Keep batteries charged during storage. Sealed lead-acid gel-cell batteries usually have a 6-month maximum shelf life. This means they can survive shelf storage without recharging for 6 months and not incur substantial damage. For storage longer than 6 months, periodic recharging is critical. With monthly recharging, sealed lead-acid batteries can be stored for years without significant damage. Recharge the battery by installing it in an operating communication module or by connecting it to a battery charger. The battery-charger output harness, catalog number 007-001551-01, can connect a SDA-4605 Battery Pack to a variety of commercially available battery chargers. The best approach to battery storage is to maintain the smallest inventory possible and rotate inventory to use the oldest batteries first.
- Test every battery before installation and use only those you know are good. The service-call labor cost to replace a bad battery is usually more expensive than the cost of a new battery. Line switches have a brief but large power requirement that may exceed the capacity of a weak battery.