Diagnostics

Table of Contents

Introduction

Qualified Persons

⚠ WARNING
Only qualified persons 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 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.

Review this Instruction Sheet

NOTICE
Thoroughly and carefully read this instruction sheet before installing or operating an IntelliRupter PulseCloser Fault Interrupter. Become familiar with the Safety Information on page 3 and Safety Precautions on page 4. 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 users 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 S&C Specification Bulletin 766-31.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these various signal words:

⚠ DANGER
"DANGER" identifies the most serious and immediate hazards that will likely 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 any portion of this instruction sheet is unclear and assistance is needed, contact the 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 the IntelliRupter fault interrupter.

Replacement Instructions and Labels

If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, S&C Authorized Distributor, S&C Headquarters, or S&C Electric Canada Ltd.

It is important that any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting the 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 to do so by S&C Electric Company.

6. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded. The integrated power module 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 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 present, proper precautions must be taken to ensure 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 from either side of the IntelliRupter fault interrupter.

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

9. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.

These instructions cover procedures for troubleshooting an IntelliRupter fault interrupter on-site and remotely. IntelliRupter fault interrupters can be accessed for diagnosis several ways:

- **Visually, on-site**. Status of an IntelliRupter fault interrupter can be determined by observing the STATUS indicator (white LED display), HOT LINE TAG indicator (amber LED display), and positions of the interrupter OPEN/CLOSE/READY lever, HOT LINE TAG lever, and, if applicable, the DISCONNECT operating lever.

- **Through secure Wi-Fi connection, on-site**. Using IntelliLink® Setup Software running on a laptop computer, connect to the IntelliRupter fault interrupter and access the various configuration screens the *Operation* screen, and download historical data. Logged events are configured on the *Logs>Log Management* screen and saved in memory. The Data log is viewed on the *Logs>Historic Events* screen. Logs are automatically maintained for status points, special event counters, and system startup history.

- **Through SCADA, remotely**. The IntelliRupter fault interrupter fully supports DNP 3.0 protocol. If the communication and control module has been furnished with a suitable radio, all DNP points are available through SCADA. Further, when IntelliLink® Setup Software has been furnished, the IntelliRupter fault interrupter and other S&C automation products that communicate using DNP 3.0 protocol can be accessed from any computer connected to the DNP network. Any member of the IntelliTeam® SG Automatic Restoration System can also be accessed.

This instruction sheet is used with software version IntelliRupterECInstaller-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. IntelliRupterECInstaller-7.6.x.exe is the name of the installer file available at the S&C Automation Customer Support portal.

NOTICE
If the suggested diagnostic procedures do not resolve the problem, call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE
If possible, call the S&C Global Support and Monitoring Center for support before removing an IntelliRupter fault interrupter from service. Do not swap control modules to troubleshoot unless explicitly advised to do so in this document or by S&C personnel.

Overview

<table>
<tr><td colspan="1">⚠ WARNING</td></tr>
</table>

⚠ **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 is connected to high voltage. For this reason, access 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 device.

Before attempting to access an existing switch installation, check carefully for visible or audible signs of electrical or physical malfunction (do this before touching or operating the switch control 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 switch control and associated mounting hardware, as if they were elevated to primary (high) voltage.

Whenever 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.

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

The STATUS indicator, located on the underside of the IntelliRupter fault interrupter base, on the face of the protection and control module, indicates operational status. The white LED is visible up to 30 degrees from the center line of the base. See Figure 1.

When the IntelliRupter fault interrupter is powered, the indicator is on continuously for 10 seconds. When all conditions are normal it then starts flashing for a ½ second every 30 seconds.

When a Wi-Fi connection to a local laptop computer is in progress, the indicator pulsates dim to bright. When the Wi-Fi connection is terminated, the indicator is again on continuously for 10 seconds and then starts flashing for a ½ second every 30 seconds.

Figure 1. The STATUS and HOT LINE TAG indicators, located on the face of the protection and control module.

If the interrupter OPEN/CLOSE/READY lever is moved (from **Ready** to **Open**, **Ready** to **Close**, or the **Open** to **Ready** state), or the GROUND TRIP BLOCK lever is moved (from the **Removed** to **Set** or from **Set** to **Removed** state), the indicator is again on continuously for 10 seconds and then starts flashing for a ½ second every 30 seconds.

If any **Error** state is active or a **Settings Mismatch** state is active, the indicator flashes on for a ½ second every second.

When the STATUS indicator is off:

● If the line is not energized, energize the side with the integral power module.

● If the line is energized, view the active **Error** conditions on the IntelliLink Software *Diagnostics>Error Diagnostics* screen. Clear the **Error** conditions, or replace the protection and control module.

When the STATUS indicator does not indicate a Wi-Fi connection

- If the line is energized, move the computer at least 20 feet closer to the fault interrupter.

- Make sure the Wi-Fi connection was not inadvertently made to a different IntelliRupter fault interrupter or it made a connection without the appropriate security keys.

- Try another computer furnished with IntelliLink Setup Software and appropriate security keys.

- Replace the communication module.

HOT LINE TAG Indicator

The HOT LINE TAG indicator, located on the underside of the IntelliRupter fault interrupter base on the face of the protection and control module, indicates **Hot Line Tag** status. The amber LED is visible up to 30 degrees from the center line of the base. See Figure 1 on page 7.

When a **Hot Line Tag** mode has been applied, either manually using the HOT LINE TAG lever or electronically by Wi-Fi connection or SCADA, the indicator flashes for a ½ second every 30 seconds.

When the **Hot Line Tag** mode has been removed, the indicator is off.

Interrupter OPEN/CLOSE/ READY Lever

READY. In the **Ready** position, the left and right sections of the interrupter OPEN/CLOSE/READY lever are in the upper position. The IntelliRupter fault interrupter uses the configured **General** profile. See Figure 2 on page 9 and Figure 3 on page 9.

OPEN (and **LOCK-OPEN**). When the right section of the interrupter 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.

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

Ready position

Interrupters open and mechanically blocked from closing

Momentary command to electrically close
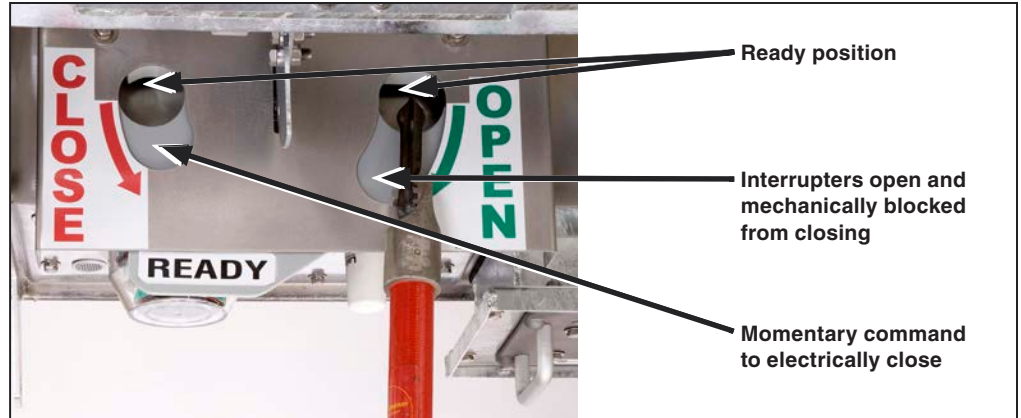
Figure 2. Opening and closing interrupters with a hookstick.

Interrupters open and locked, mechanically blocked from closing
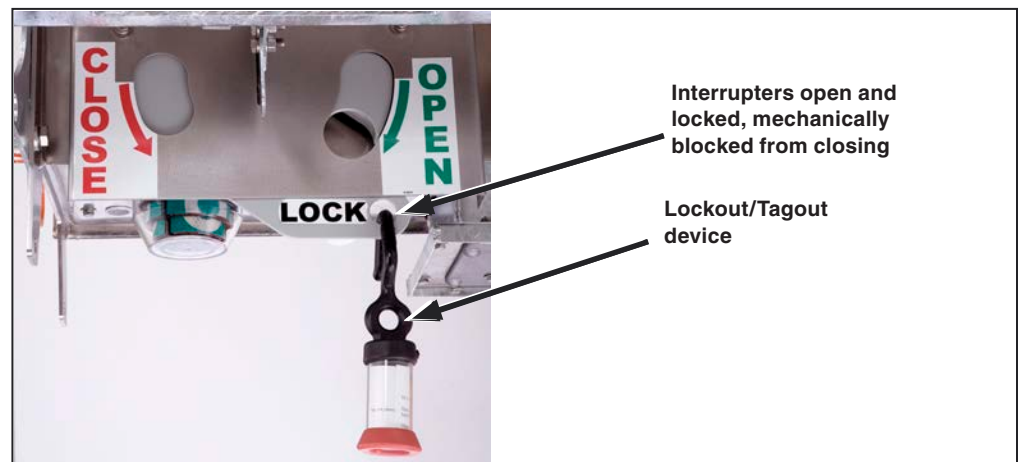
Lockout/Tagout device

Figure 3. IntelliRupter fault interrupter locked open.

Manual Hot Line Tag

The **Hot Line Tag** mode can be applied manually using the hookstick lever, by an Intelli-Link software command, or by a SCADA 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. 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. A **Hot Line Tag** mode will only be cleared when all command types have been cleared.

The hookstick lever mechanically sets or clears its **Hot Line Tag** mode and can be tagged or locked using conventional tagging procedures. See Figure 4 and Figure 5 on page 11.

When the HOT LINE TAG indicator is on the **Hot Line Tag** mode should be cleared:

- *If a hot line tag was applied manually:* Push up on the HOT LINE TAG lever.

- *If a hot line tag was applied electronically and a hot line tag was applied manually:* Push up on the HOT LINE TAG lever. Then, pull down and push up on the HOT LINE TAG lever *once, without delay.*

- *If a hot line tag was applied electronically and a hot line tag was not applied manually:* Pull down and push up on the HOT LINE TAG lever *twice, without delay.*

Pull down with a hookstick to manually apply Hot Line Tag mode
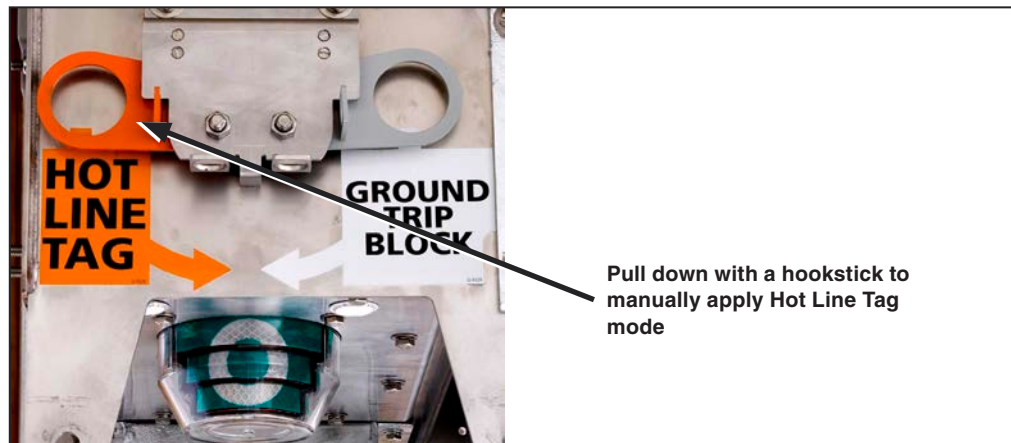
Figure 4. Manually applying the Hot Line Tag mode.

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 an IntelliLink software command. A **Ground Trip Block** mode can only be removed by the method used to set it, and (unlike the HOT LINE TAG lever) the GROUND TRIP BLOCK lever cannot remove a **Ground Trip Block** mode set by a SCADA or IntelliLink software command.

To apply a local **Ground Trip Block** mode, pull down on the GROUND TRIP BLOCK lever. It can be tagged using a tag or other conventional method. See Figure 4 and Figure 5 on page 11. To remove a local **Ground Trip Block** mode, push up on the GROUND TRIP BLOCK lever. The STATUS indicator (white LED display) is located on the control module.

See Figure 1 on page 7. When a **Ground Trip Block** mode 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.

Figure 5. Hot line tag mode applied and tagged.

When Ground Trip Block mode is removed—Overcurrent protection operates normally. If a **Ground-Overcurrent** element is configured for the active profile, then it will respond to a Fault event. When a **Ground-Overcurrent** eleme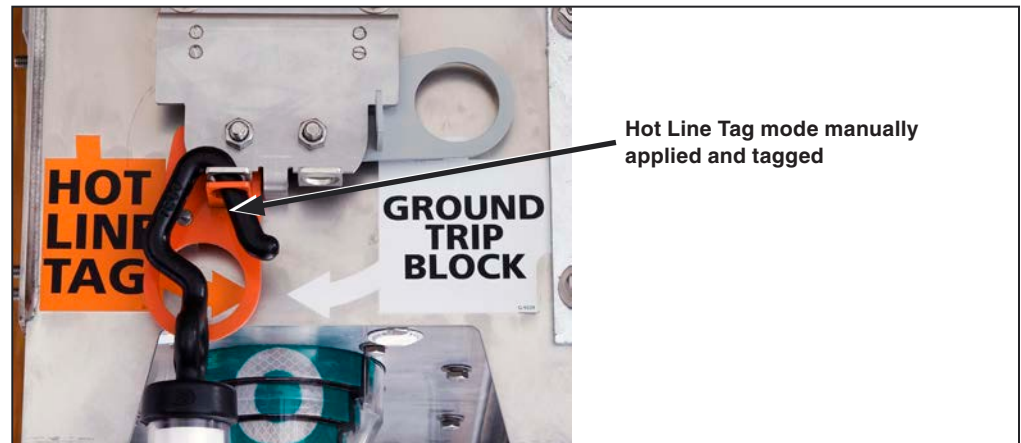nt is not configured in the active profile, removing the **Ground Trip Block** mode does not create a ground TCC nor does it enable the element.

When Ground Trip Block mode is 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 lever was moved. The GROUND TRIP BLOCK lever is effective for any profile: all **General** profiles, both **Closing** profiles, and **Hot Line Tag** mode.

The elements available for selection are: **Ground**, **Negative Sequence**, and **Sensitive Earth Overcurrent**. When the GROUND TRIP BLOCK lever is configured to block circuit testing, circuit testing immediately terminates.

If 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. If the test sequence was not in an open interval when the test sequence was terminated, the next trip will result in a **Lockout** state.

If 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. If 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 IntelliLink 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.

DISCONNECT Operating Lever

The hookstick-operated three-pole DISCONNECT lever on disconnect-style models cannot be operated until the interrupters have been opened. See Figure 6.

The interrupters can be closed and opened with the disconnect in the **Open** position.

Pull down with a hookstick to close disconnect

Pull down with a hookstick to open disconnect

Disconnect can be tagged or locked in the open position
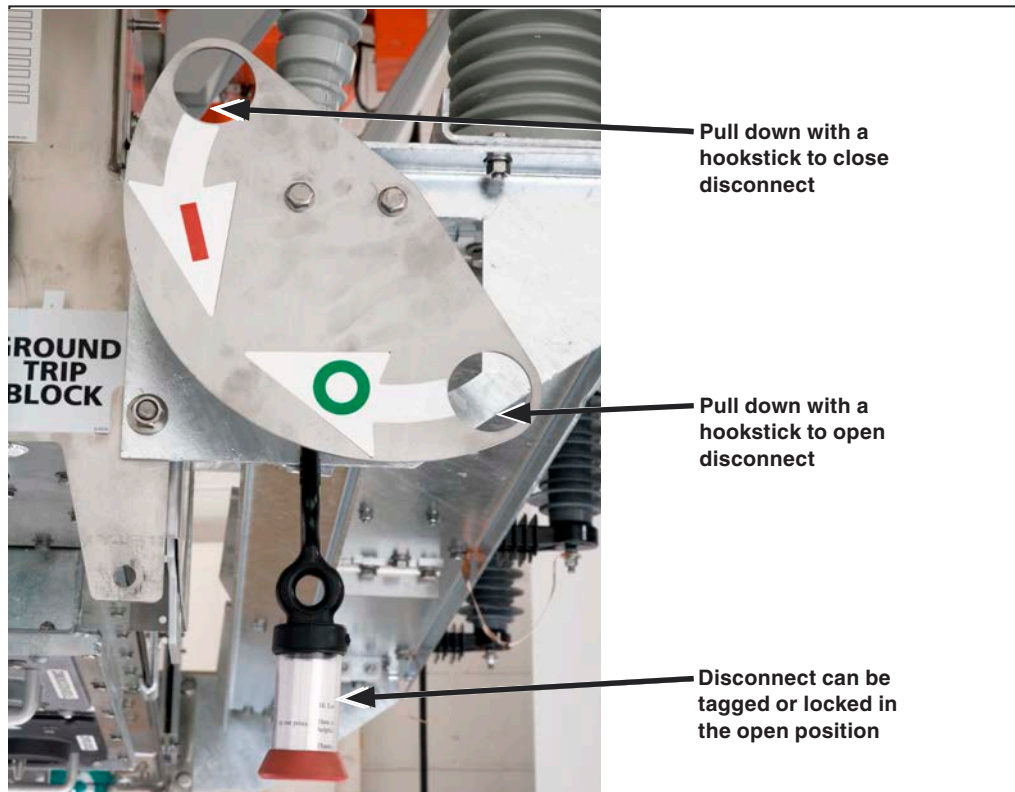
Figure 6. The DISCONNECT operating lever locked open.

**Interrupter OPEN/
CLOSED Indicators**

An OPEN/CLOSED indicator is provided for each interrupter on the underside of the IntelliRupter fault interrupter base. See Figure 7.

When an interrupter is in the **Open** position, its indicator shows "**O**" on a green background. When an interrupter is in the **Closed** position, its indicator shows "**I**" on a red background. The reflective indicators are easily visible in low light; at night they can be checked from the ground with a flashlight.

NOTICE
Target colors are reversed on IntelliRupter fault interrupters furnished with catalog number suffix "-F2."

Indicator showing pole open

Indicator showing pole closed
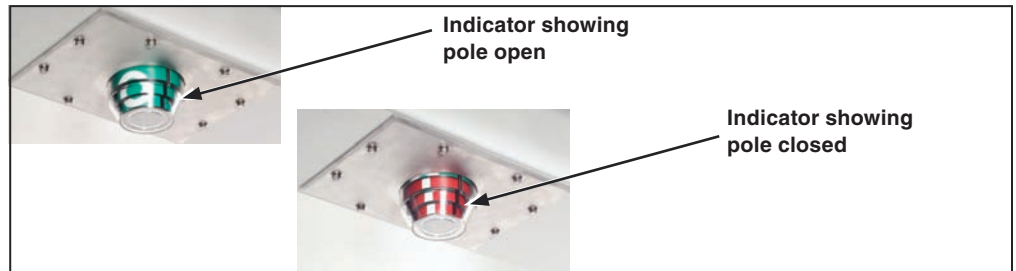
Figure 7. The interrupter OPEN/CLOSED indicator, one at each pole.

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

DNP points include:

- **DNP Status Points.** These points indicate that conditions are true or active. Status points include interrupter **Open** or **Closed** state, active profiles, **Hot Line Tag** state, **Ground Trip Block** state, and **Circuit Test Block** state. Also, the status of protection elements and the IntelliTeam® SG Automatic Restoration System **Alarm**, **Warning**, and **Error** states.

- **DNP Analog Input Points.** These points measure circuit parameters such as voltage, current, frequency, harmonic distortion, power factor, kvars, phase angle, fault current, etc. Site temperature and battery voltage are also reported.

- **DNP Analog Output Points.** These points are sent from SCADA and define specific analog settings for the IntelliRupter fault interrupter.

- **DNP Control Points.** These points issue operation commands; they allow selection of the **General** and **Closing** profiles as well as the **Hot Line Tag**, **Prohibit Restoration**, **Block Ground Trip**, and **Block Circuit Testing** modes. **Waveform Capture**, **Clear Errors**, and **Start a Battery Test** commands can also be issued.

Follow these steps for an IntelliRupter fault interrupter that is not operational but has been previously commissioned as operational:

STEP 1. Attempt to connect to the unit with both SCADA and Wi-Fi.

STEP 2. If connections cannot be made, verify line voltage is being supplied to at least one integral power module.

STEP 3. If power is present, verify the status light is not active/blinking. Typically, this light blinks once every 30 seconds.

When unable to connect, power is present, and the status light is not active, no further troubleshooting is required. Contact the S&C Global Support and Monitoring Center to obtain a Return Material Authorization.

Capacitor Verification

These troubleshooting screens show possible IntelliRupter fault interrupter status points and indications that may be associated with an issue with the primary or secondary capacitor banks. All points or combination of points may not be present at any given time, but the presence of any of these may indicate a capacitor bank is the problem.

NOTICE
DO NOT remove or replace control modules on IntelliRupter fault interrupters purchased before 2017 (serial number 08-0013000 and lower). Controls purchased before 2017 may not connect when power is present and the status light is not active. DO NOT troubleshoot the control by removing it and moving it to another IntelliRupter fault interrupter. The pre-2017 control will cause damage to the fault interrupter.
If the IntelliRupter fault interrupter was purchased after 2017 (serial number 08-0013001 and higher), it is acceptable to troubleshoot capacitor related issues (alarms, warnings, and errors) by swapping the control into another IntelliRupter fault interrupter.

If a capacitor bank is the problem, contact the S&C Global Support and Monitoring Center at 1-888-762-1100. See Figures 8 and 9 on page 16, Figures 10 and 11 on page 17.
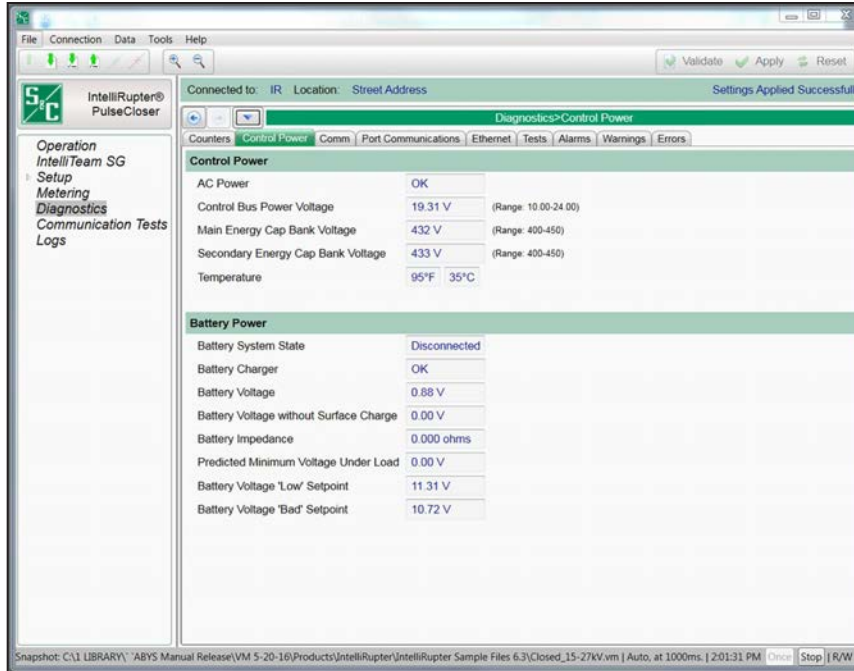
Figure 8. The IntelliRupter *Diagnostics>Control Power* screen.
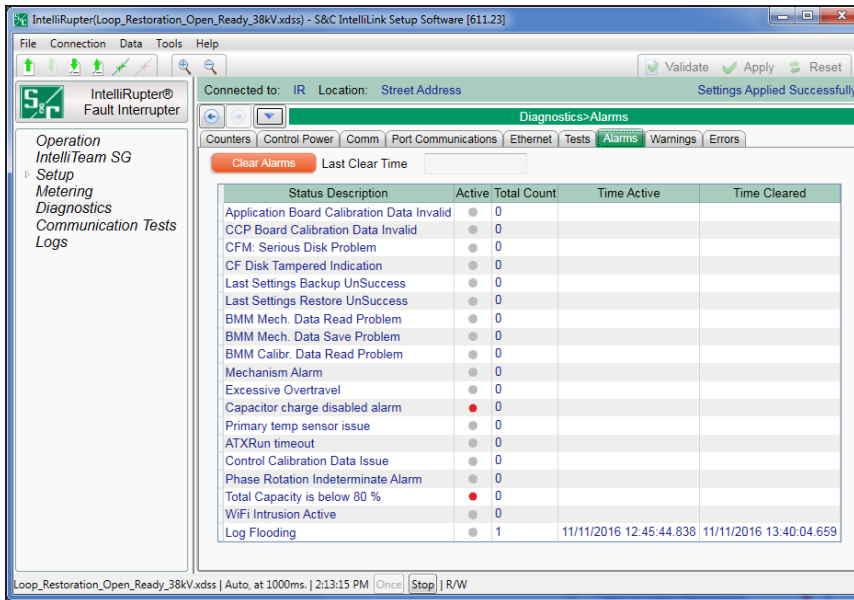
Figure 9. The Diagnostics>Alarms screen tab. The active capacitor alarm points will be indicated in red.

For a description of these alarms, see the "Alarms" section on page 48.
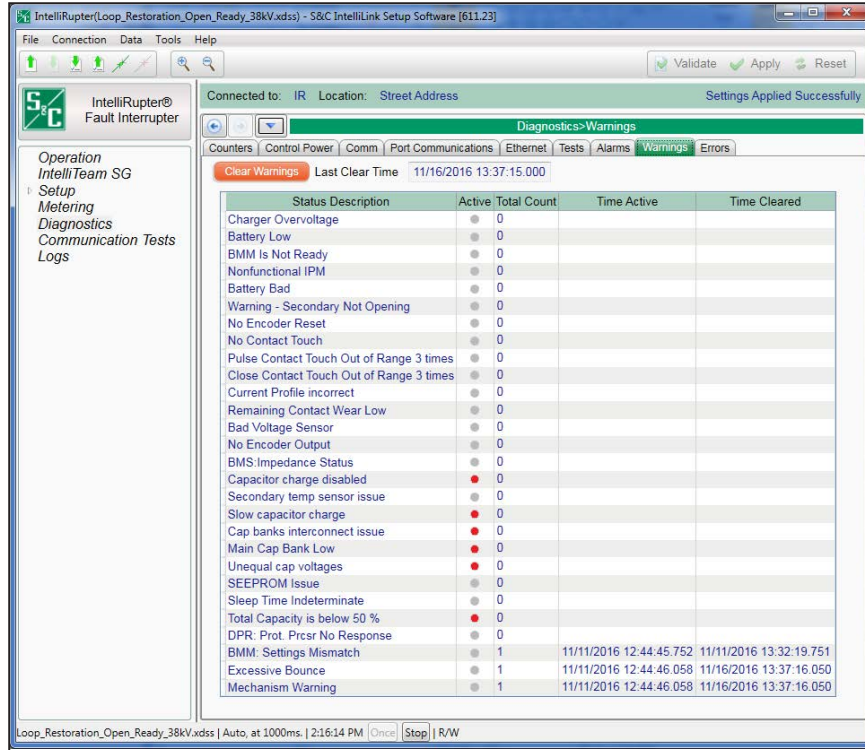
Figure 11. The *Diagnostics>Warnings* screen.

For a description of these warnings, see the "Warnings" section on page 52.
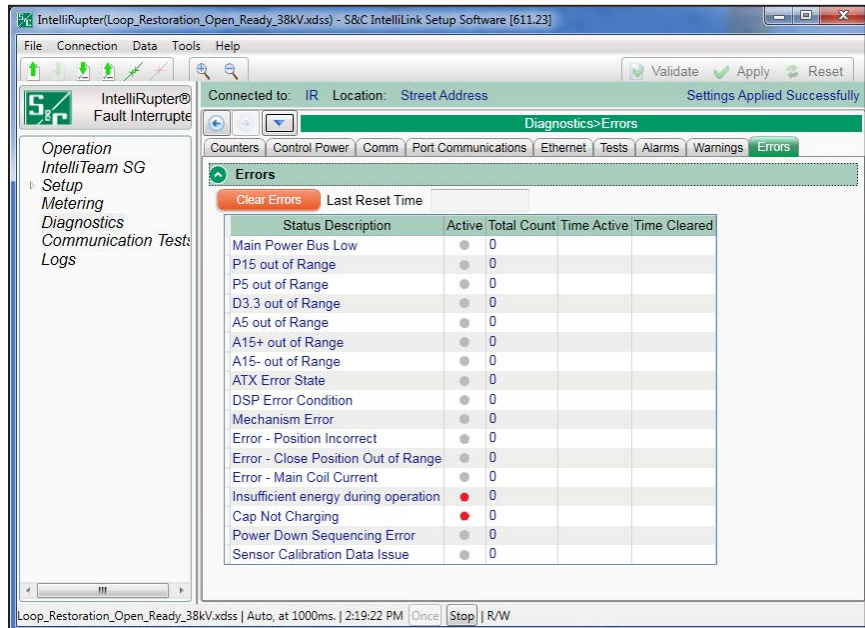
Figure 10. The *Diagnostics>Errors* screen.

For a description of these errors, see the "Errors" section on page 59.

**Start IntelliLink
Software**

Using IntelliLink Setup Software, the status of an IntelliRupter fault interrupter, other team members, and team operations can be checked and the cause of team problems investigated. IntelliLink software is used on-site with a secure Wi-Fi link from the laptop computer to a specific IntelliRupter fault interrupter. IntelliLink software can also be used remotely, through a computer connected to the DNP network.

After the computer is configured and set up for Wi-Fi communication, connection is automatically accomplished through the IntelliLink Setup Software.

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

| 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 S&C Instruction Sheet 766-530, "IntelliRupter® PulseCloser® Fault Interrupter: *Protection and Communication Setup,*" for more information. |

Operation

After password verification, the *Operation* screen opens. It presents IntelliRupter fault interrupter status information and is used to operate the device. See Figure 12 on page 19. User-assigned IntelliRupter fault interrupter identification information (Connected to: and Location:) is shown at the top of every screen.
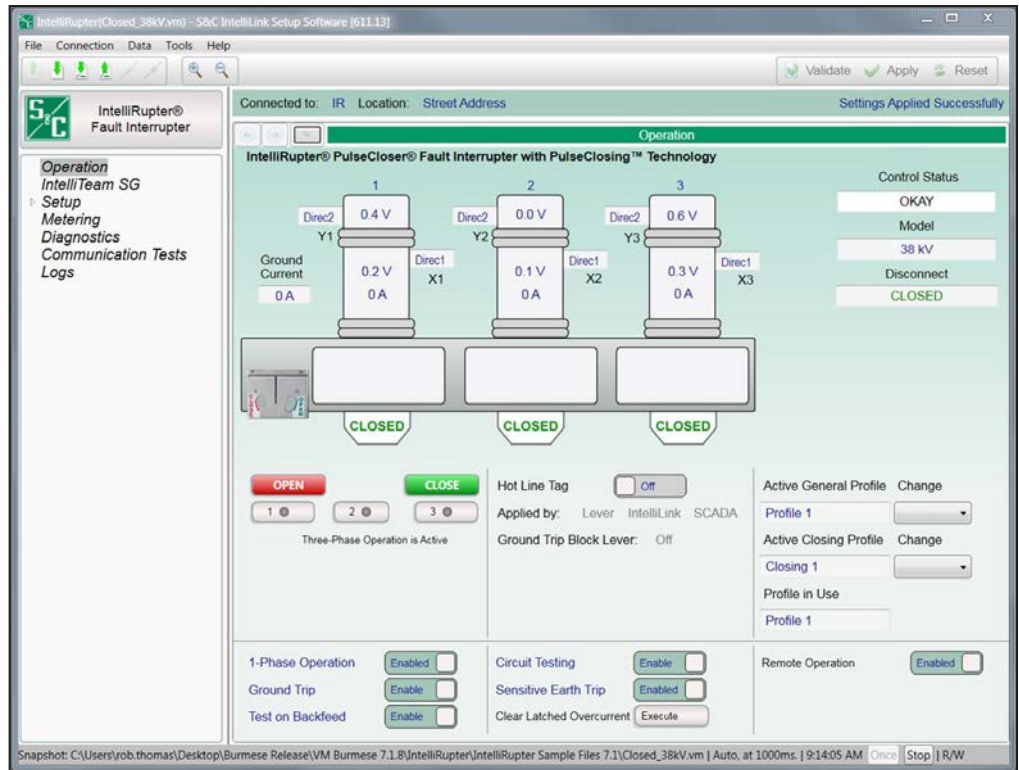
Figure 12. The IntelliRupter fault interrupter *Operation* screen.

An electronic representation of the IntelliRupter fault interrupter OPEN/CLOSE/READY lever side is shown in Figure 12. 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 voltage at each terminal pad (for example, A-grd) or phase-to-phase voltage at each terminal pad (for example, A-B) 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 to indicate three-phase power-flow direction. Current is flowing from the upper to the lower terminal pad when the arrow points right. Current is flowing from the lower to upper terminal pad when the arrow points left.

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.

When the IntelliRupter fault interrupter trips 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 is still testing

● **TESTING-SEF**—Display when the IntelliRupter fault interrupter is in the **Open** state and is still testing for a sensitive earth fault

● **PICKUP**—Display 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

–**VOLTS**—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 has 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

–**VOLTS**—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 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 PulseClosing Technology test was not available, and the user setting for **Conventional Close if PulseClosing Not Available** was set to "No."

- **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 has gone to the **Lockout** state

- **SETTINGS MISMATCH**—Displays when the settings in the control module 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 module 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. 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 **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® PulseCloser® Fault Interrupter: *DNP Points List and Implementation.*"

The **Fault** flag is 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 is set for each phase.

Control status will normally show "Okay." If a problem exists, **Alarm**, **Warning**, **Error**, or **Maint Mode** will be displayed. If **Alarm**, **Warning**, or **Error** mode is displayed, navigate to the applicable diagnostics screen to view the active conditions.

MAINT MODE (Maintenance mode) indicates one or more of the application programs have suspended. Restarting the control or reloading the control code are typical remedies for this condition. If the condition persists after attempting these remedies, contact the S&C Global Support and Monitoring Center at (888) 762-1100.

When **Hot Line Tag** mode is applied, it will be indicated by "On," and the method of application is displayed. The active profile and other features are indicated on this screen. See the "Operation Screen" section in S&C Instruction Sheet 766-540, "IntelliRupter® PulseCloser® Fault Interrupter: *Operation.*"

Metering
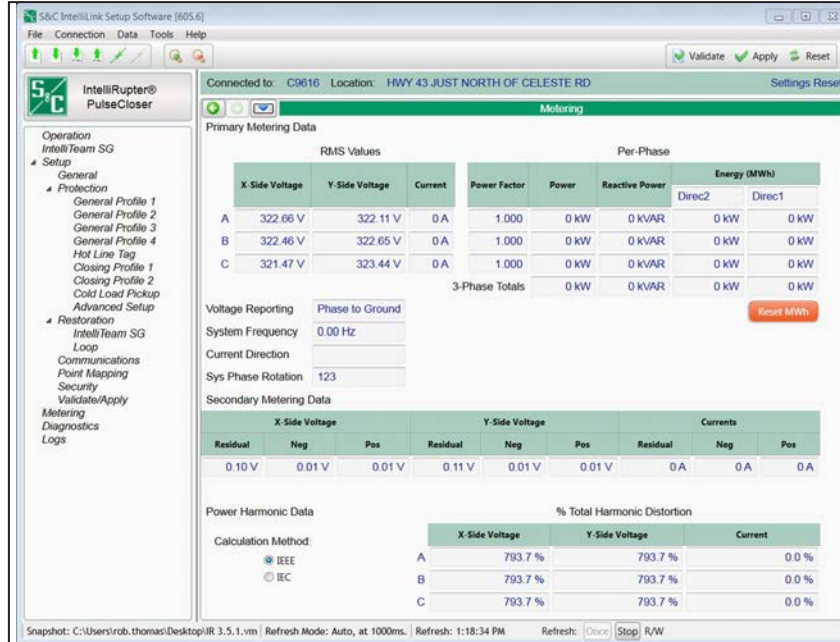
Figure 13. The *Metering* screen.

All values are time-averaged, 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 Phase-Ground or Phase-Phase measurement may be selected, as configured with 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, is 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 are displayed as either phase to phase, or phase to ground.

System Frequency

Measured system frequency is 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° (positive sequence) or –120° (negative sequence) phase angle.

The sum is equal to V phase-ground (positive sequence) when configured for phase-to-ground reporting or V phase-to-phase (positive sequence) when configured for phase-to-phase reporting. 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 the current or voltage, and RMSFund= Fundamental (1st Harmonic) RMS of the current or voltage.

Sync-Check Metering
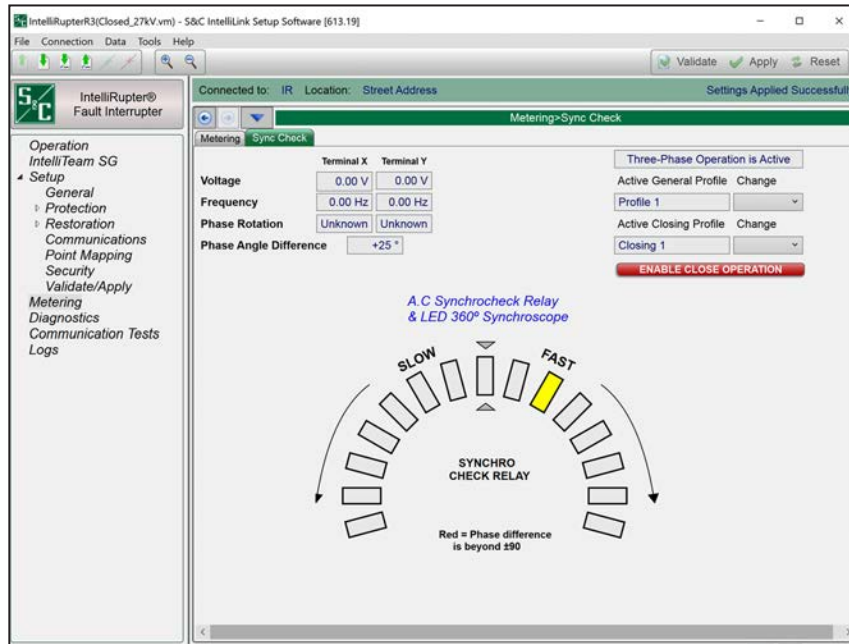
Figure 14. The *Metering-Sync Check* screen.

All values are time-averaged and are reported locally on a one-second interval. See Figure 14.

Sync-Check Metering Data

Voltage

Terminal X and terminal Y positive-sequence RMS voltages are displayed either on a phase-to-phase basis (for example, A-B) or on a phase-to-ground basis (for example, A-gnd), as configured on the *Setup>General>Site Related>System>Voltage Reporting* screen. The voltage values are determined by the **Voltage Reporting Base** setpoint on the *Setup>-General>Site Related>System>Voltage Reporting Base* screen and are reported with a 0.01-unit resolution.

When three-phase voltage is applied to both terminal X and terminal Y, voltage (as defined above) may initially be measured as negative-sequence voltage. However, if the phase rotation is equal for both terminal X and terminal Y. Regardless of whether they match the **Phase Rotation** setpoint on the *Setup>General>Site Related>System>Phase Rotation* screen, these metering values will change to positive-sequence voltage in roughly one minute. Therefore, it may take a minute or so for voltage values to appear in both the terminal X and terminal Y voltage displays.

Conversely, if phase rotation is unequal, one terminal will be measuring positive-sequence voltage, and the other terminal will be measuring negative-sequence voltage. When this occurs, the terminal measuring negative-sequence voltage will have no value in the voltage display because the terminal X and terminal Y voltage displays only show positive-sequence voltage.

Frequency

Terminal X- and terminal Y-measured system frequency is displayed in Hertz (Hz) with a 0.01-Hz resolution.

Phase Rotation

Terminal X and terminal Y phase rotation are displayed as "1 2 3," "1 3 2," or "**Unknown**."

When the terminal X and terminal Y phase rotations are unequal (for example, X side is "1 2 3" and Y side is "1 3 2"), both terminal X and terminal Y phase-rotation displays are highlighted in red.

The X-side and Y-side phase rotations are displayed based on the predominance of positive- or negative-sequence voltage. A predominance of positive- or negative-sequence voltage is defined as either the measured positive- or negative-sequence voltage being greater than the percentage value entered for the active General Profile's **Good Source Voltage Indication** setpoint on the *Setup>Protection>General Profile>Voltage, Frequency, and Sectionalizing>Voltage Trip>Good Source Voltage Indication* screen or the configured **System Phase-to-Phase Voltage** setpoint on the *Setup>General> System>System Phase-to-Phase Voltage* screen.

For example, the **System Phase-to-Phase Voltage** setpoint is 12.47 kV and the active **General Profile Good Source Voltage Indication** setpoint is 90% (11.223 kV). When the measured X-side positive-sequence voltage minus the X-side negative-sequence voltage is greater than 11.223 kV, the X side has a predominance of positive-sequence voltage.

A predominance of positive-sequence voltage (X side or Y side) results in a phase-rotation indication of "1 2 3," and a predominance of negative-sequence voltage produces a phase-rotation indication of "1 3 2." However, if the phase rotation for both X and Y terminals is equal, phase rotation for X and Y will always be displayed as "1 2 3." This is because, as with the voltage display, equal phase rotation always results in the measured voltage being displayed as positive-sequence.

If a predominance of X-side or Y-side positive- or negative-sequence voltage (as defined above) is not present, "**Unknown**" is displayed for the phase rotation.

For example, the **System Phase-to-Phase Voltage** setpoint is 12.47 kV and the active **General Profile Good Source Voltage Indication** setpoint is 90% (11.223 kV). When the measured X-side positive-sequence voltage minus the X-side negative-sequence voltage is less than 11.223 kV, the X side has an "**Unknown**" phase rotation.

Phase Angle Difference

The phase-angle difference between the X side (pole no. 2) and the Y side (pole no. 2) is displayed in degrees with polarity (plus or minus). A positive (plus) phase-angle difference denotes the X-side (pole no. 2) voltage is leading the Y-side (pole no. 2) voltage, and a negative (minus) phase-angle difference indicates the X side is lagging the Y side.

AC Synchrocheck Relay and LED 360-Degree Synchroscope

The 15 cells are oriented in a semicircle, and the top center cell represents 0 degrees. The cells change color to show the phase-angle difference determination described above.

The seven cells to the left and below the top center cell are labeled "Slow," with an arrow pointing in a counterclockwise direction. The six cells to the left and below the top center cell indicate lagging phase angles in 15-degree increments.

The seven cells to the right and below the top center cell are labeled "Fast," with an arrow pointing in a clockwise direction. The six cells to the right and below the top center cell denote leading phase angles in 15-degree increments.

The bottom left (Slow or lagging) and right (Fast or leading) cells represent phase angles greater than 90 degrees and are colored red when the phase-angle difference between the X side (pole no. 2) and Y side (pole no. 2) is lagging or leading by greater than 90 degrees.

The first six cells to the left (Slow) and right (Fast) of the top center cell are yellow when the X side and Y side measured phase angle is +/-7 degrees of the cell-angle value. The first cells to the left and right of the top center cell have a phase angle value of 15 degrees. The second cells to the left and right of the top center cell have a phase angle value of 30 degrees, and so on.

The top-center (0 degree) cell turns green when the X side and Y side phase-angle difference is 0 degrees, +/-7 degrees.

For example, if the phase-angle difference between the X side and Y side is between 37 degrees- and 23 degrees-leading, the second cell (30 degrees Fast) to the right of the top-center cell will be yellow. Similarly, if the phase-angle difference is between 8 degrees- and 22 degrees-lagging, the first cell (15 degrees Slow) to the left of the top-center cell will be yellow.

The color of these phase-angle cells will typically transition clockwise (lagging to leading) or counterclockwise (leading to lagging), based on the changing phase-angle relationship between the X side and Y side. However, because all metering-screen values are time-averaged and are reported locally on a one-second interval, the transition of cell angles may sometimes appear erratic. As an example, if the rate-of-change of the phase-angle difference is rapid because of appreciable frequency-differences between the X side and Y side, the transition of cell color may skip cells due to the one-second screen-re-fresh rate.

Single-Phase or Three-Phase Operation is Active

When the display indicates "**Single-Phase Operation is Active**," switch operations will be single-phase and automatic operations will be single-phase when the test sequence is configured for single-phase tripping. When the display indicates "**Three-Phase Opera-tion is Active**," all automatic operations or IntelliLink software user commands will be executed three-phase, and single-phase SCADA commands will be rejected.

Active General Profile

This displays the user-assigned name of the active general profile. It may be one of the four general profiles. Change it by clicking on the **Change** drop-down selection button.

Active Closing Profile

This displays the user-assigned name of one of the two closing profiles. Change it by clicking on the **Change** drop-down selection button.

ENABLE CLOSE OPERATION

This button commands a **Close** operation.

Counters
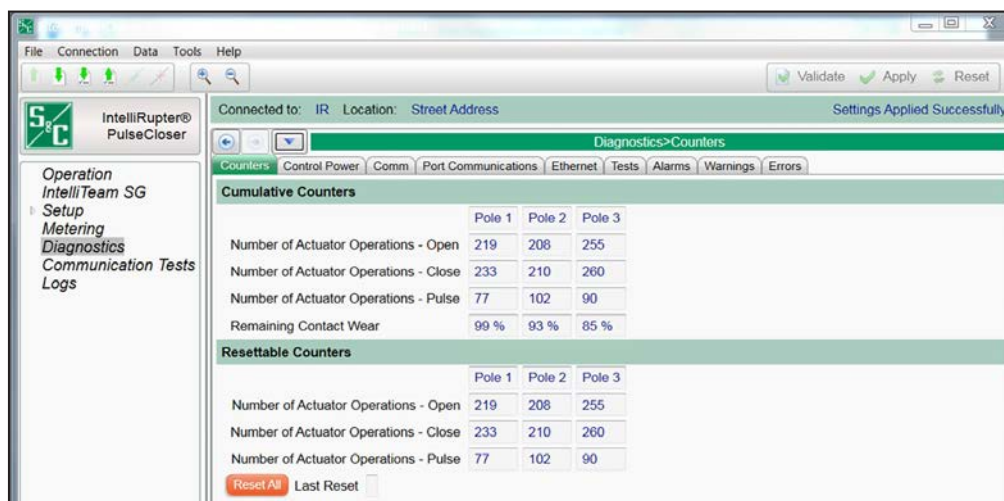
Figure 15. The *Diagnostics>Counters* screen.

The counters show the number of **Open**, **Close**, and **Pulse** operations for each pole-unit interrupter. See Figure 15.

Cumulative Counters

These counters indicate the percentage of remaining contact wear for each pole and cannot be reset.

Resettable Counters

These counters can be reset to zero as a group with a **Reset All** button command.

Last Reset

This time stamp indicates the date and time the resettable counters received a **Reset All** button command.

Control Power

Figure 16. The *Diagnostics>Control Power* screen.

The screen shows the status of system power, the battery system, and temperature of the control module. See Figure 16.

Control Power

AC Power

Reports that control power is either "OK" or "Off."

Control Bus Power Voltage

Reports in volts dc. (Range: 10.00-24.00)

Main Energy Cap Bank Voltage

Reports in volts dc. (Range: 400-450)

Secondary Energy Cap Bank Voltage

Reports in Volts dc. (Range: 400-450)

Temperature

Temperature is measured inside the control module and reports as whole degrees in Fahrenheit and Centigrade.

Battery Power

Battery System State

The following states are reported: **Normal**, **Battery Low**, **Battery Bad**, **Low Impedance**, **Disconnected**, or **Testing**.

Battery Charger

The following states are reported: **OK**, **Over Voltage**, **Low Impedance**, or **Over Voltage + Low Impedance**.

Battery Voltage

Reports to the nearest .01 Vdc.

Battery Voltage without Surface Charge

Reports to the nearest .01 Vdc.

Battery Impedance

Reports to the nearest .001 Ohm.

Predicted Minimum Voltage Under Load

This value is calculated during the battery test and reported to the nearest .01 Vdc.

Battery Voltage "Low" Setpoint

This is the factory-set value of the voltage threshold for reporting the **Battery Voltage Low** status.

Battery Voltage "Bad" Setpoint

This is the factory-set value of the voltage threshold for reporting the **Battery Voltage Bad** status.

**Diagnostics
Communication Data**
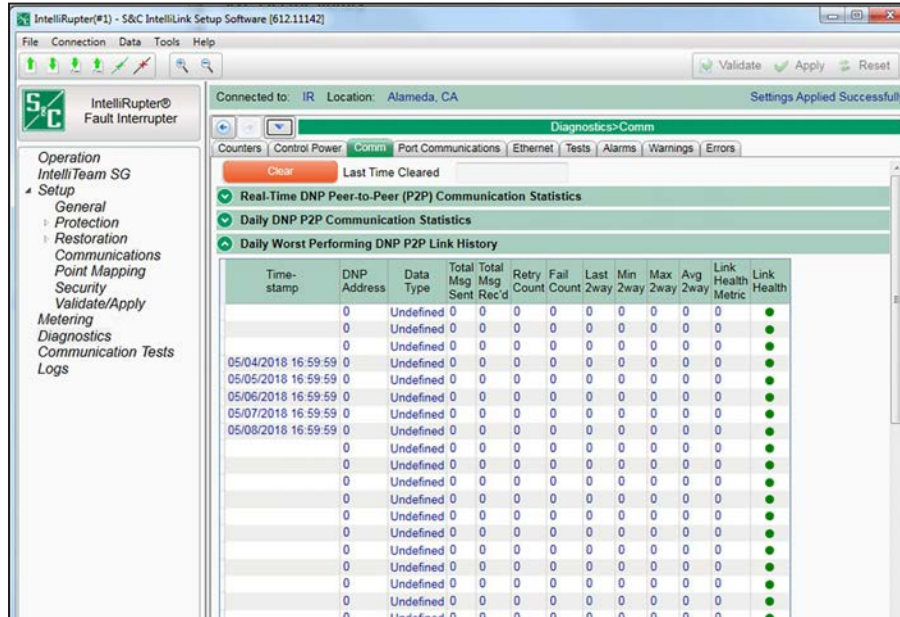
Figure 17. The *Diagnostics>Comm* screen.

Clear Button

This button clears all data on the *Diagnostics>Comm* screen and enters a time stamp in the **Last Time Cleared** field. See Figure 17. These parameters are reported:

Last Time Cleared

This is the time stamp of the last **Clear** command. Recently cleared counters represent present communication performance more accurately.

Real-Time DNP Peer-to-Peer (P2P) Communication Statistics

This report shows the counters and statistics associated with peer communication for each team in which this control is a member.

DNP Address

This is the DNP/RTU address of the team member associated with the displayed counts.

Data Type

The **Data Type** setting is configured on the *Setup>Communications> Communication Tests* screen. Possible values are: **Undefined**, **General**, **Internal DNP**, **Coach**, **Runner**, **Contract Agent**, **Netlist Transfer**, **Alley Oop RSH**, **IT-II Events**, **Protection**, **Data Load Mgmt PRLM**, **CEC Signal**, **Diagnostics**, or **NetObjectMgmt**.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Total Messages Received

This is the number of responses received from the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communication failures for the team member.

Daily DNP P2P Communication Statistics

The counters and statistics associated with daily peer communication for each team in which this control is a member. These parameters are reported:

DNP Address

This is the DNP/RTU address of the team member associated with the displayed counts.

Data Type

The **Data Type** setting is configured on the *Setup>Communications>Communication Tests* screen. Possible values are: **Undefined**, **General**, **Internal DNP**, **Coach**, **Runner**, **Contract Agent**, **Netlist Transfer**, **Alley Oop RSH**, **IT-II Events**, **Protection**, **Data Load Mgmt PRLM**, **CEC Signal**, **Diagnostics**, or **NetObjectMgmt**.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Total Messages Received

This is the number of responses received from the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communication failures for the team member.

Last 2way

This is the latency, in seconds, associated with the last request sent to the team member.

Min 2way

This is the minimum latency, in seconds, recorded for a request sent to the team member.

Max 2way

This is the maximum latency, in seconds, recorded for a request sent to the team member.

Avg 2way

This is the average latency, in seconds, recorded for requests sent to the team member.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the ACK'd XMit Count divided by the Total XMit Count.

Link Health

This shows a color indication for the link health metric:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

These threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the *Setup>Communications>DNP Diagnostics* screen.

Daily Worst Performing DNP P2P Link History

This report shows the counters and statistics associated with peer communication for the worst performing link. These parameters are reported:

Time stamp

This is the time of the transmission.

DNP Address

This is the DNP/RTU address of the team member associated with the counts shown.

Data Type

The **Data Type** setting is configured on the *Setup>Communications> Communication Tests* screen. Possible values are: **Undefined**, **General**, **Internal DNP**, **Coach**, **Runner**, **Contract Agent**, **Netlist Transfer**, **Alley Oop RSH**, **IT-II Events**, **Protection**, **Data Load Mgmt PRLM**, **CEC Signal**, **Diagnostics**, or **NetObjectMgmt**.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Total Messages Received

This is the number of responses received from the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communication failures for the team member.

Last 2way

This is the latency (in seconds) associated with the last request sent to the team member.

Min 2way

This is the minimum latency (in seconds) recorded for a request sent to the team member.

Max 2way

This is the maximum latency (in seconds) recorded for a request sent to the team member.

Avg 2way

This is the average latency (in seconds) recorded for requests sent to the team member.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the ACK'd XMit count divided by the Total XMit count.

Link Health

This shows a color indication for the link health metric:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

These threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the *Setup>Communications>DNP Diagnostics* screen.

DNP V3 Real-Time Communication Statistics

This report shows the counters and statistics associated with DNP communications. These parameters are reported:

DNP Address

This is the DNP/RTU address of the team member associated with the counts shown.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communication failures for the team member.

Last 2way

This is the latency (in seconds) associated with the last request sent to the team member.

Min 2way

This is the minimum latency (in seconds) recorded for a request sent to the team member.

Max 2way

This is the maximum latency (in seconds) recorded for a request sent to the team member.

Avg 2way

This is the average latency (in seconds) recorded for requests sent to the team member.

Daily DNP V3 Communication Statistics

This report shows the counters and statistics associated with DNP communications.

DNP Address

This is the DNP/RTU address of the team member associated with the counts shown.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communication failures for the team member.

Last 2way

This is the latency, in seconds, associated with the last request sent to the team member.

Min 2way

This is the minimum latency, in seconds, recorded for a request sent to the team member.

Max 2way

This is the maximum latency, in seconds, recorded for a request sent to the team member.

Avgd 2way

This is the average latency, in seconds, recorded for requests sent to the team member.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the ACK'd XMit count divided by the Total XMit count.

Link Health

This shows a color indication for the link health metric:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

These threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the *Setup>Communications>DNP Diagnostics* screen.

Peer-SCADA Master Communication Statistics

These parameters are reported:

Master

This is the master station identifier.

DNP Address

This is the DNP address of the master station associated with the counts shown.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communications failures for the team member.

Last 2way

This is the latency (in seconds) associated with the last request sent to the team member.

Min 2way

This is the minimum latency (in seconds) recorded for a request sent to the team member.

Max 2way

This is the maximum latency (in seconds) recorded for a request sent to the team member.

Avgd 2way

This is the average latency (in seconds) recorded for requests sent to the team member.

Daily Worst Performing DNP V3 Link History

This report shows the counters and statistics associated with DNP communications. These parameters are reported:

Time stamp

This is the time of the message transmission.

DNP Address

This is the DNP/RTU address of the team member associated with the counts shown.

Total Messages Sent

This is the number of original packets transmitted to the team member.

Retry Count

This is the number of packets retransmitted to the team member.

Fail Count

This is the number of communications failures for the team member.

Last 2way

This is the latency, in seconds, associated with the last request sent to the team member.

Min 2way

This is the minimum latency, in seconds, recorded for a request sent to the team member.

Max 2way

This is the maximum latency, in seconds, recorded for a request sent to the team member.

Avg 2way

This is the average latency, in seconds, recorded for requests sent to the team member.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the ACK'd XMit count divided by the Total XMit count.

Link Health

This shows a color indication for the link health metric:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

These threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the Setup>Communications>DNP Diagnostics screen.

DNP Counts

These are counts of diagnostic information for DNP communications-related buffers within this control. These parameters are reported:

Transport Function Receive List

This is the number of DNP frames received and placed in the transport function frame buffer. A frame may remain in the buffer if it is part of a multi-frame fragment for which all frames have not been received. It may also remain in the buffer for a limited time if the application layer is busy and cannot accept the new frame.

Transport Function Transmit List

This is the number of DNP fragments processed by the application layer and waiting for a data link layer service. A fragment may remain in the buffer for a limited time if the data link layer is busy.

Application Layer Message List

This is the number of application layer messages waiting to be processed or serviced by the transport function, primarily consisting of originated messages to team members for which responses are expected. The messages remain in the buffer until a response is received or until the retry time and count have expired.

Peer Device List

This is the number of peer devices or team members registered with DNP for which an association is maintained.

Special Function List

This is the number of application processes registered with DNP that will be triggered by read or write operations to special predefined virtual memory locations.

URBE Function List

This is the number of functions or application processes registered with DNP that will be triggered by unsolicited event messages from specific peer devices.

Binary Input Point List

This is the total number of binary input points that may be mapped to SCADA point numbers. It is the size of the buffer, not the actual number of mapped points.

Double-Bit Binary Input Point List *(Only for SG6801, SG6802Vista, and SG68023PM)*

This is the total number of double-bit binary input points that may be mapped to SCADA point numbers. It is the size of the buffer, not the actual number of mapped points.

Analog Input Point List

This is the total number of analog input points that may be mapped to SCADA point numbers. It is the size of the buffer, not the actual number of mapped points.

Control Input Point List

This is the total number of control input points that may be mapped to SCADA point numbers. It is the size of the buffer, not the actual number of mapped points.

Analog Output Point List

This is the total number of analog output points that may be mapped to SCADA point numbers. It is the size of the buffer, not the actual number of mapped points.

Route Table List

This is the number of routing table entries registered with DNP. They originate from the *Setup>Communications Routing* screen.

Master Event Counts

Binary Inputs

This is the number of binary input events queued and ready to be sent in the next event data request or in the next unsolicited event report.

Analog Inputs

This is the number of analog input events queued and ready to be sent in the next event data request or in the next unsolicited event report.

Port Communications Diagnostics
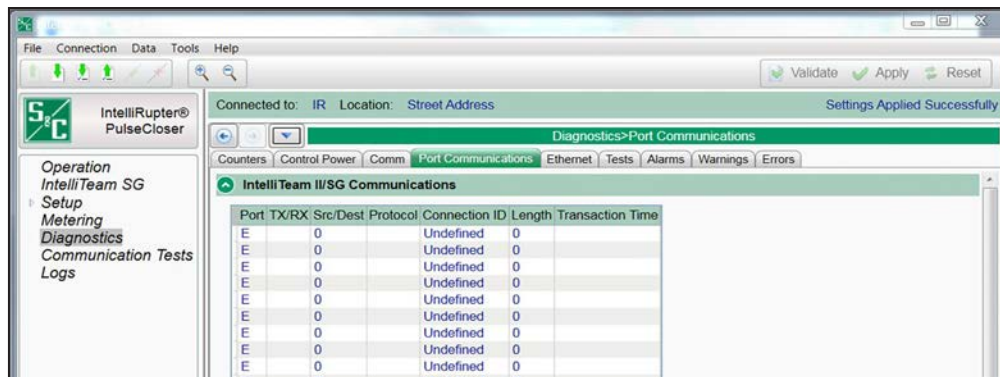
Figure 18. The *Diagnostics>Port Communications* screen.

IntelliTeam II/SG Communications

(Only for controls using the IntelliTeam II/SG Automatic Restoration System)

See Figure 18. These counters and statistics are associated with peer communications for each team in which this control is a member:

Port

This is the port connected to the control.

TX/RX

This report indicates whether the packet was transmitted or received.

Src/Dest

This is the destination address for a transmitted message and the source address for a received message.

Protocol

The protocol is only peer-to-peer and is reported as "DNPP2P."

Data Type

This report notes the message type as: **Undefined**, **General**, **Internal DNP**, **Coach**, **Runner**, **Contract Agent**, **Netlist Transfer**, **Alley Oop RSH**, **IT-II Events**, **Protection**, **Data Load Management PRLM**, **CEC Signal**, **Diagnostics**, **NetObjectMgmt**.

Length

This is the number of bytes in the message packet.

Transaction Time

This is the time stamp of the packet.

IntelliTeam II/SG Communications Totals

TxFragCount

This is the number of packets transmitted. Each packet is a fragment.

RxFragCount

This is the number of packets received. Each packet is a fragment.

TxTotalCount

This is the total number of bytes transmitted.

RxTotalCount

This is the total number of bytes received.

SCADA Master Communications

The counters and statistics are associated with peer communications for each SCADA master.

Port

The port connected to the control.

TX/RX

This indicates whether the packet was transmitted or received.

Scr/Dest

This is the destination address for a transmitted message and the source address for a received message.

Application Control

This is part of the DNPV3 message header.

Function Control

This is part of the DNPV3 message header.

IIN 1

This is part of the DNPV3 message header.

IIN 2

This is part of the DNPV3 message header.

Length

This is the packet length in number of bytes.

Transaction Time

This is the time stamp of the packet.

SCADA Master Communications Totals

TxFragCount

This is the number of packets transmitted. Each packet is a fragment.

RxFragCount

This is the number of packets received. Each packet is a fragment.

TxTotalCount

This is the total number of bytes transmitted.

RxTotalCount

This is the total number of bytes received.

Other DNP V3 Communications

This report notes the counters and statistics associated with peer communications for DNP V3 Communications.

Port

This is the port connected to the control.

TX/RX

This report indicates whether the packet was transmitted or received.

Scr/Dest

This is the destination address for a transmitted message and the source address for a received message.

Application Control

This is part of the DNPV3 message header.

Function Control

This is part of the DNPV3 message header.

IIN 1

This is part of the DNPV3 message header.

IIN 2

This is part of the DNPV3 message header.

Length

This is the packet length in number of bytes.

Transaction Time

This is the time stamp of the packet.

Other DNP V3 Communications Totals

TxFragCount

The fragment is the packet. This is the number of packets transmitted.

RxFragCount

The fragment is the packet. This is the number of packets received.

TxTotalCount

This is the total number of bytes transmitted.

RxTotalCount

This is the total number of bytes received.

**Ethernet
Diagnostics**

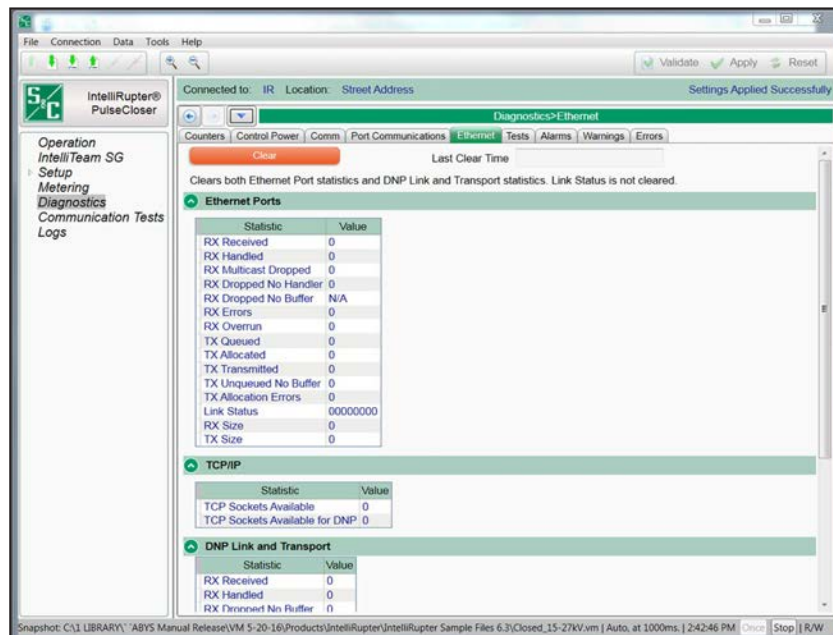**Figure 19. The *Diagnostics>Ethernet* screen.**

Clear Button

This button clears the DNP link and transport statistics. It also enters a time stamp in the **Last Clear Time** field. See Figure 19. The following parameters are reported:

Last Clear Time

This time stamp registers the last **Clear** command. Recently cleared counters represent present communications performance more accurately.

Ethernet Ports

These counts show Native and Add-On Port link status.

For IntelliRupter fault interrupters, the catalog number SDA-4540R3 control module has Ethernet 1 and Ethernet 2 ports. Ethernet 1 is the Native port and Ethernet 2 is the Add-On port.

RX Received

This is the total number of received packets. The total is calculated with this equation:

RX_RECEIVED = RX_HANDLED + RX_MULTICAST + RX_FAULTS + RX_DROPPED

RX Handled

This is the total number of recognized and handled packets.

RX Multicast Dropped

This is the total number of multicast packets received. S&C controls do not support multicast packets. Therefore, all received multicast packets are dropped.

RX Dropped No Handler

This is the total number of dropped packets with no handler.

RX Dropped No Buffer

This is the total number of dropped packets with no buffer.

RX Errors

This is the total number of erroneous packets: misaligned packed, broken CRC, or wrong length. This statistic is only available for the add-on Ethernet port.

RX Overrun

This is the number of detected hardware (chip) errors.

TX Queued

This is the total number of packets queued for sending.

TX Allocated

This is the total number of allocation requests.

TX Transmitted

This is the total number of successfully transmitted packets.

TX Unqueued No Buffer

This is the total number of packets not queued because of a lack of buffer space.

TX Allocation Errors

This is the total number of allocation request failures. This statistic is only available for the add-on Ethernet port.

Link Status

This report shows the PHY Link Status Registers:

PHY registers 1, 18 of SMSC LAN91C111 chip for add-on Ethernet port.

PHY registers 1, 18 of AM79C874 or 1, 16 for DP83848 chip for native Ethernet port.

TCP/IP

This report shows the following parameters:

TCP Sockets Available

This is the number of available TCP sockets.

TCP Sockets Available for DNP

This is the number of available TCP sockets for DNP3 traffic only. DNP-P2P does not use the TCP/IP protocol.

DNP Link and Transport

This is the counters associated with DNP communications.

RX Received

This is the number of DNP packets recognized in the input stream. The total is calculated with this equation:

RX_RECEIVED = RX_HANDLED + RX_FAILURES

RX Handled

This is the number of DNP packets routed and passed to the application layer.

RX Dropped No Buffer

This is the number of DNP/UDP frames dropped because of a lack of free packet buffers.

RX Overrun

This is the RX buffer of a given port was overrun and its contents were dropped.

RX Dispatch Self

This is the dispatcher recognized the RTU address equal to FFFC (65,532), the DNP Self Address.

RX Dispatch Local

This is the dispatcher recognized the RTU address equal to one of the local addresses or FFFC (65,532), the DNP Self Address.

RX Dispatch Remote

This is the dispatcher recognized the RTU address equal to one of the remote addresses to be routed.

RX Dispatch Broadcast

This is the dispatcher recognized the RTU address equal to one of the broadcast addresses: FFFD-FFFF; 65,633-65,535.

RX Dispatch Application

This is the packet is dispatched to the application layer.

RX Dispatch EOS

This is the packet is dispatched to the EOS simplified DNP sockets.

RX Out of Sockets

This is the packet that failed to be dispatched to the EOS-simplified DNP sockets because of a lack of available sockets.

RX Bad Config

This is the packets violate routing tables, with wrong destination ports, etc.

TX Queued

This is the packets are queued for transmission to serial ports or are waiting for MAC resolution via ARP.

TX Transmitted

This is the packets have been successfully sent.

TX Failures

These are the packets that failed to be sent because of a changed serial protocol or a UDP/IP problem.

OOB Size

This is the out-of-bound data and skipped traffic.

RX Size

This is the received packet bytes.

TX Size

This is the transmitted packet bytes for all serial ports.

Tests
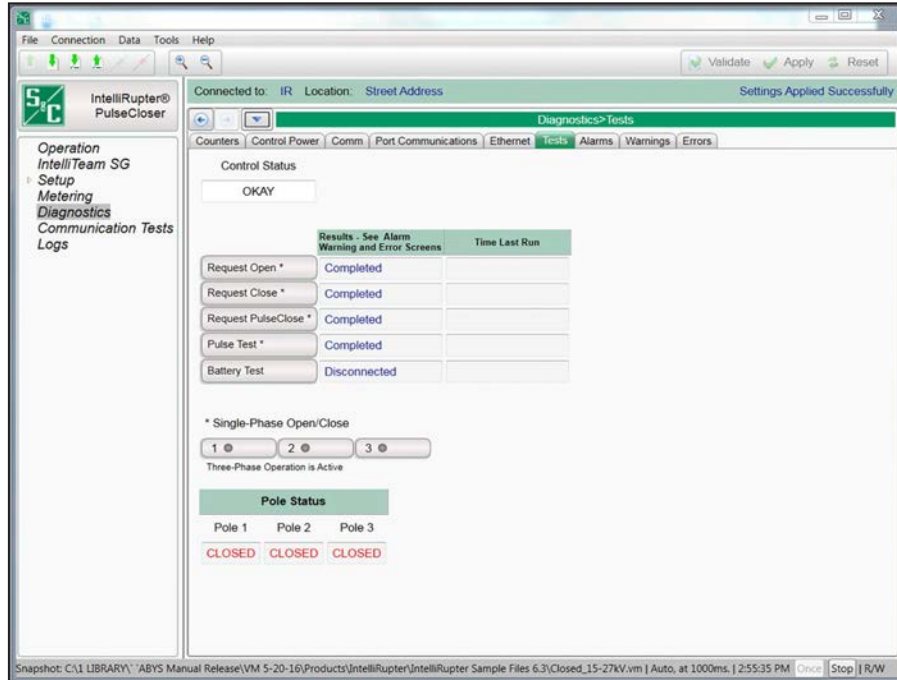
Figure 20. The *Diagnostics>Tests* screen.

The screen in Figure 20 enables conducting Open, point-on-wave (POW) Close (this function is labeled Close on the R2 control), Fast Close (R3 control only), Pulse Test, PulseClosing® Technology, and Battery tests. The test results are shown on the *Diagnostics>Alarms*, *Diagnostics>Warnings*, and *Diagnostics>Errors* screens.

Control Status

This field shows the same data displayed for the **Control Status** state on the *Operation* screen.

Request Open

The open test may be performed with the IntelliRupter fault interrupter in the **Closed** position and in an **Error** state.

Point-On-Wave (POW) Close Test *(labeled close on the "R2" control)*

When this test is performed when selected, the IntelliRupter fault interrupter will execute a point-on-wave closing where each pole is independently closed on a voltage peak.

PulseClosing Technology Test

When this test is performed when selected, the IntelliRupter fault interrupter will execute a test using a pulse on each pole before closing it.

Request Fast Close *("R3" control only)*

When this test is performed when selected, the IntelliRupter fault interrupter will close all three poles in ≤ 2 milliseconds.

Pulse Test

This test performs a pulse and inverse pulse on the poles selected by the **Single-Phase Open/Close** buttons. The IntelliRupter fault interrupter does not perform a **Close** operation at the end of the test, even when no fault is detected. When both the pulse and inverse pulse detect a fault, a "PulseClosing detected a fault" message appears on the *Operation* screen, and the corresponding DNP Status Points 55, 91, 92, and/or 93 will go active.

If the **Single-Phase Tripping** mode is enabled, any combination of poles can be selected to run a test using a pulse. One or more poles can be selected on this screen with the **Pole Selection** buttons, and the pulse-test execution will pulse and inverse-pulse test the selected poles one pole at a time. The single-phase **Pulse Test** operations execute even when one or two poles are presently in the **Closed** position.

If the **Single-Phase Trip** mode is disabled, the test is performed on all three poles. All poles must be in the **Open** position or the **Pulse Test** command will be ignored. If any pole detects a fault on both the pulse and inverse pulse, a "PulseClosing detected a fault" message is displayed on the *Operations* screen, and the corresponding DNP Status Points 55, 91, 92, and 93 are set.

The **Pulse Test** command uses a select-before-operate command, so clicking on the **Pulse Test** button opens a dialog box, where the user confirms execution of the switch action.

Battery Test

This test displays one of these results:

Normal—Enough charge is present to operate the electronics.

Battery Low—The battery is in marginal condition.

Battery Bad—The battery charge is too low to operate the electronics.

Low Impedance—The calculated battery impedance is too low to be valid.

Disconnected—The battery is not connected.

Testing—The battery test has not completed.

Single-Phase Open/Close

These buttons select a single-phase test operation on the selected phase(s). The five-minute **Enable Operation Timer** operation starts when one of the phases is selected. When the timer is running, it restarts when a test is started. These buttons only function if the **Single-Phase Trip** mode has been enabled in the profile and has not been blocked by a user command. The state is changed by clicking on the button.

Pole Status

The present **Open** or **Closed** status is indicated for each pole.
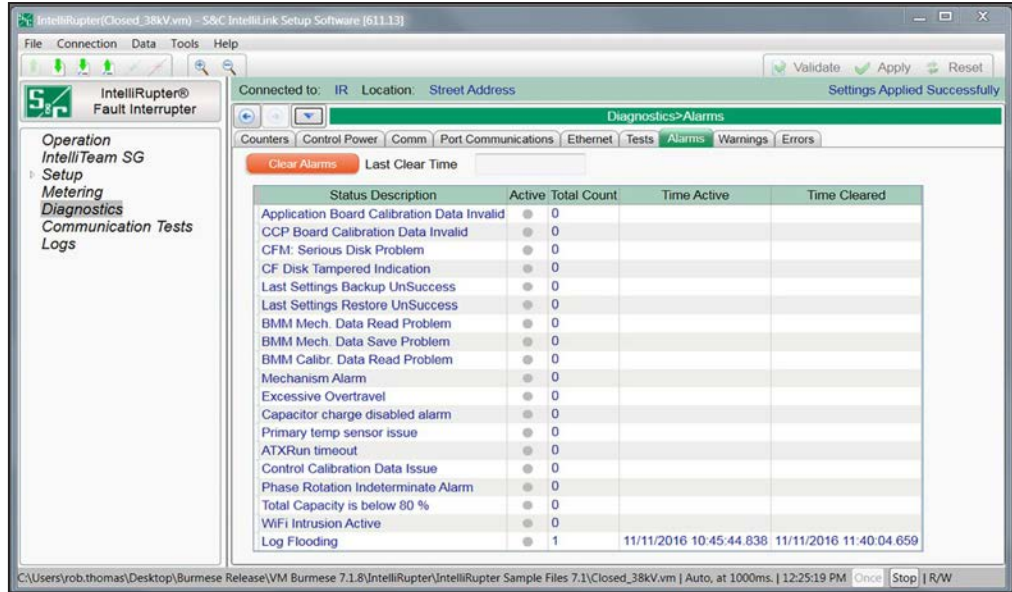
Diagnostics

Alarms

Figure 21. The *Diagnostics>Alarms* screen.

Clicking on the **Clear Alarms** button will reset any active alarms and update the **Last Clear Time** and **Time Cleared** fields. Approximately one second after an alarm is cleared it will reassert if the alarm check is a system check and the condition still exists. Issues with capacitor charging, mechanism operations, and some other operational checks will reassert the alarm on the next operation attempt if the condition still exists. See Figure 21 and Table 1.

Table 1. Alarms

Status Description	Active When	Clear When	Impact	Recommended Action
Application Board Calibration Data Invalid	Application board calibration data is invalid at startup	Application board calibration data is okay	Sensing accuracy may be compromised when these alarms are active	Restarting the control may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact the S&C Global Support and Monitoring Center (GSMC) for further diagnosis
ATXRun Timeout	MCU processor did not issue a command issued by the ATX automatic operations logic in a timely fashion. Suspended protection mode started	Handshake completed, ATXRun command received by DSP from MCU in the allotted time	No protection and no automatic functions	Automatic function has been suspended on startup. Try restarting the control or reloading firmware. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
BMM Calibr. Data Read Problem	Not able to load calibration data from the base memory module	Calibration data was successfully loaded from the base memory module	Sensing accuracy may be compromised when these alarms are active	Restarting the control may correct this condition. If it does not, contact S&C GSMC for further diagnosis

TABLE CONTINUED ▶

Table 1. Alarms—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
BMM Mech. Data Read Problem	Mechanical operation data was not successfully read from the base memory module	Mechanical operation data was successfully read from the base memory module	Sensing accuracy is compromised when these alarms are active	Issue a **Clear Alarms** command on the *Diagnostics>Alarms>Clear Alarms* screen. If the Alarm does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the alarm still does not clear or it returns, then stop. Save a memory snapshot and mech file. Contact S&C GSMC for support
BMM Mech. Data Save Problem	Mechanical operation data could not be saved to the base memory module	Mechanical operation data was successfully saved to the base memory module	None	Restarting the control may correct this condition. If it does not, contact S&C GSMC for further diagnosis
Capacitor Charge Disabled Alarm	Capacitor charger is turned off due to excessive capacitor voltage	Capacitor voltage falls to 400 V and the chargers are turned back on	May be an indication of aging capacitors. May affect operation if alarm condition does not end before the capacitor charge drops below 200 V	Monitor. Typically corrects next charge cycle. If the indication persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis. The capacitors may need changing, or the power supply may need service
CCP Board Calibration Data Invalid	CCP board calibration data is invalid at startup	CCP board calibration data is okay	Sensing accuracy may be compromised when these alarms are active	Restarting the control may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
CF Disk Tampered Indication	Compact flash directory contents corruption was detected on startup	Compact flash directory contents corruption was not detected on startup	Event data may be lost	Restarting the control may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
CFM: Serious Disk Problem	Problem with compact flash card	No problem with compact flash card	Data cannot be logged	Restarting the control or applying settings may correct this condition. If it does not, contact S&C GSMC for further diagnosis
Coil Current Samples Problem (SDA-4540R3 only)	When coil diver current measurements are outside acceptable parameters	Cleared on the next successful operation where current measurements are within acceptable parameters	Re-occurrence can be an indicator of a mechanical issue or coil driver board issues	Issue a **Clear Alarms** command on the *Diagnostics>Alarms>Clear Alarms* screen. If the alarm does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the alarm still does not clear or it returns, stop and save a snapshot and mech file. Contact S&C GSMC for support
Control Calibration Data Issue	Either the application board or CCP board calibration data CRC is bad	All control calibration data CRCs are okay	Sensing accuracy may be compromised when these alarms are active	Restarting the control may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis

TABLE CONTINUED ▶

Diagnostics

Table 1. Alarms—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
CPLD Communication Problem (SDA-4540R3 only)	When a communication issue exists between the CPLD and other devices on the control board	Communications are normal	Possible hardware issue	Issue a **Clear Alarms** command on the *Diagnostics>Alarms>Clear Alarms* screen. If the alarm does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the alarm still does not clear or it returns, stop and save a snapshot and contact S&C GSMC for support
Excessive Over-travel	Mechanism travel during operation is too large	Mechanism travel during operation is okay	None. May be an indication of wear	Monitor. Typically self-corrects after an operation or two
IntelliLink Intrusion	IntelliLink software access was attempted by an unauthorized user	Manually cleared	Security violation attempt	Review software access procedures
Last Settings Backup UnSuccess	An issue was encountered storing user settings to the base memory module. The settings were not successfully stored	User configurable settings successfully stored to the base memory module	Settings could be lost if the control is restarted or changed	Applying settings may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Last Settings Restore UnSuccess	An issue was encountered restoring user settings from the base memory module. The settings were not restored	User configurable settings successfully restored from the base memory module	Settings may not be up to date, resulting in unexpected operation	Restarting the control may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Leakage Current Check Alarm	Vacuum interrupter leakage current is detected	Leakage current is no longer detected	Problem with the vacuum interrupter may require maintenance	Contact S&C GSMC
Log Flooding (SDA-4540R3 only)	During an event with an unexpectedly high number of log entries	After a **Clear Alarms** command and the log entries have stopped	Important information in the logs may be lost	Download the logs and issue a **Clear Alarms** command on the *Diagnostics>Alarms>Clear Alarms* screen. If the alarm does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the alarm still does not clear or it returns, stop and contact S&C GSMC for support
Mechanism Alarm	Rollup point for any mechanism alarm active	No mechanism alarm active	None. This alarm is a rollup point for any mechanism-related alarm that is active	Gather information on the other alarm(s) that are active and follow each troubleshooting procedure
Phase Rotation Indeterminate Alarm	Phase rotation cannot be determined	Phase rotation can be determined	Directionality not functional; three-phase voltage elements, open source element, and sectionalizer are blocked	Wait 5 minutes for control to recalculate or apply settings

TABLE CONTINUED ▶

Table 1. Alarms—Continued

| Status Description	Active When	Clear When	Impact	Recommended Action
POW Long Delay (SDA-4540R3 only)	When time to complete a **Point on Wave Close** operation exceeds expected limits	Cleared on the next successful **Point on Wave Close** operation has been completed	Re-occurrence can be an indicator of a mechanical issue	Issue a **Clear Alarms** command on the *Diagnostics>Alarms>Clear Alarms* screen. If the alarm does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the alarm still does not clear or it returns, stop and save a snapshot and mech file. Contact S&C GSMC for support
Primary Temp Sensor Issue	Temperature sensor output is out of expected range. Readings are less than -40°C (-40°F) or greater than +85°C (185°F)	Temperature sensor output is within the expected range	Capacitor-capacity calculation is compromised and may result in a capacity alarm	Issue a **Clear Alarms** command on the *Diagnostics>Alarms>Clear Alarms* screen. If the alarm does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the alarm still does not clear or it returns, then stop. Save a memory snapshot and mech file. Contact S&C GSMC for support
Total Capacity is Below 80%	Energy storage capacity has dropped below 80% of its nominal value	Energy storage capacity is at least 80% of its nominal value	None	Bypass the IntelliRupter fault interrupter and manually operate the IntelliRupter fault interrupter. If the alarm does not clear, contact S&C GSMC for support. If the alarm does clear but then returns after the next operation, contact S&C GSMC for support. Do not swap control modules in an attempt to troubleshoot
Wi-Fi Intrusion Active	Wi-Fi intrusion activated by attempted access by unauthorized user	Wi-Fi intrusion cleared	Possible Wi-Fi intrusion attempt	Implement your company's security policy for equipment intrusion

Warnings
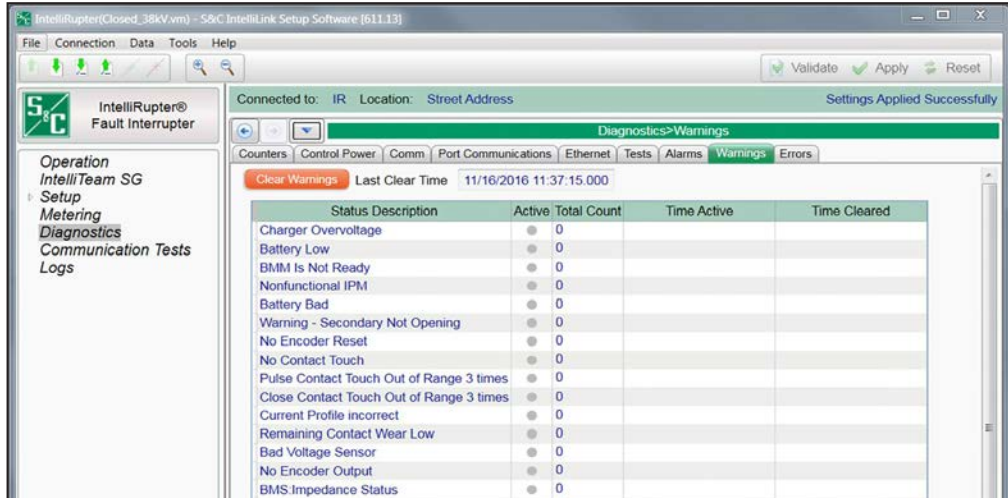
Figure 22. The *Warning Diagnostics* screen.

Clicking on the **Clear Warnings** button will reset any active warnings and update the **Last Clear Time** and **Time Cleared** fields. Approximately one second after a warning is cleared, it will reassert if the warning check is a system check and the condition still exists. Issues with capacitor charging, mechanism operations, and some other operational checks will reassert the warning on the next operation attempt if the condition still exists. See Figure 22 and Table 2.

Table 2. Warnings

Status Description	Active When	Clear When	Impact	Recommended Action
Bad Voltage Sensor	The Bad Voltage Sensor warning is activated when any of the six voltage sensors is above 300% of nominal system phase-to-ground voltage for four consecutive 1-second samples. Also, a Bad Voltage Sensor warning is activated when the difference between the X and Y side voltages of a pole exceeds 12.5% of system nominal phase-to-ground voltage for four consecutive 1-second samples while the pole is closed	Bad Voltage Sensor cleared	Warning will also place all IntelliTeam software-related teams (if used) into a **Not Ready** state. The Bad Voltage Sensor will also trigger the rollup Warning: Mechanism Warning. When this warning is active, protective functions such as voltage trip and automatic functions such as sectionalizing may be compromised. It is recommended these functions be disabled until this condition is resolved. Loop Restoration (if used) will be "Not Ready"	Issue the **Clear Warnings** command on the *Diagnostics> Warning>Clear Warnings* screen. If the warning does not clear, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the warning clears after the restart, monitor for recurrence. If the warning comes back every two to three days, then stop. If the warning still does not clear after the restart or for firmware 6.1.x and higher if voltages are in the red, then stop. Save a memory snapshot and the latest Compact Flash Wave Form Capture (*.wfc). Then, contact S&C GSMC for support. Do not swap control modules to troubleshoot

Table 2. Warnings—Continued

Status Descrip-tion	Active When	Clear When	Impact	Recommended Action
Battery Bad	The battery voltage is less than or equal to the **Battery Voltage Bad** setpoint found on the *Diagnostics>Control Power* screen	The battery voltage is greater than the **Battery Voltage Bad** setpoint	The IntelliRupter fault interrupter will not operate if system power is lost when this condition exists	Replace battery
Battery Low	The battery voltage is less than or equal to the **Battery Voltage Low** setpoint found on the *Diagnostics>Control Power* screen	The battery voltage is greater than the **Battery Voltage Low** setpoint	Battery is at the **Battery Voltage Low** setpoint shown on the *Diagnostic>Control Power* screen	This condition is normal after an extended period of time without system voltage, or right after a restart from and extended outage that led to battery disconnect. If this condition occurs when there hasn't been an interruption of system power, it is an indication there may be a problem with the battery or battery charger. Under these circumstances, replace the battery. If the condition persists, save a memory snapshot (*.vm file) and contact the S&C Global Support and Monitoring Center (GSMC) for further diagnosis
BMS: Impedance Status	Battery Impedance Low	Battery Impedance Normal	Battery impedance is an indica-tion of battery health. If this error is persistent, it is an indication the battery performance will be limited if the system is operating in a **Battery Backup** mode	Issue a battery test. If the condition does not clear, replace the battery or the communication module with one that has a known good battery. If the condition does not clear, there may be an issue with the battery charger in the control module. Save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
BMM: Is Not Ready	A base memory module, BMM, was not detected on power up, or did not respond to a read or write request	BMM is ready	Sensing accuracy may be compro-mised when this warning is active. Setting changes may be lost when this warning is active. Manufacturing data may be incorrect. Operation data may be incorrect. Command status may not be stored. Netlist copy in the BMM may not be current	If the warning persists, save a memory snapshot (*.vm file), and contact S&C GSMC for further diagnosis

Diagnostics

Table 2. Warnings—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
BMM: Settings Mismatch	User configurable settings in the base memory module are not of a compatible version with the firmware in the control, so they cannot be restored	User configurable settings have been applied	The settings in the BMM cannot be used by the control	If the settings in the BMM are the correct settings to be used for the IntelliRupter fault interrupter, it may be necessary to reconfigure the control with a backup of the original settings. If a backup does not exist, downgrading the control to the previous version in use should allow retrieval of the settings. Create a backup of the settings, upgrade the control, and set the control to overwrite the BMM on next power up. If the settings in the control are appropriate for the IntelliRupter fault interrupter, applying settings and pressing the **Clear Warnings** button, or restarting the control, may clear the warning. If the warning persists, save a memory snapshot (*.vm file), save Event Logs from Compact Flash, and contact S&C GSMC for further diagnosis
Cap Banks Interconnect Issue	Secondary capacitor bank is charging before the main bank reaches 380 V. That may indicate the main and secondary capacitor bank isolating diodes are short-circuited	Main and secondary capacitor bank isolating diodes are okay	Operating the IntelliRupter fault interrupter with this condition may result in serious damage to the IntelliRupter fault interrupter	It is recommended that the control module be replaced and sent to S&C for further analysis. S&C Field Service should be consulted before operating the IntelliRupter fault interrupter with a replacement control. Save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Capacitor Charge Disabled	Self-diagnosis has detected a possible charger problem and has disabled capacitor charging	Capacitor charging is okay	May affect operation if the warning condition does not end before the capacitor charge drops below 200 V. If the capacitor charge drops below 200 V the IntelliRupter fault interrupter will not operate	Pressing the **Clear Warnings** button and restarting the control may clear the warning. If the alarm persists, save a memory snapshot (*.vm file), save event logs from compact flash, and contact S&C GSMC for further diagnosis
Charger Overvoltage	Battery Charger Overvoltage	Battery Charger Normal	The battery will be overcharged and possibly damaged. Battery damage may compromise operation of the IntelliRupter fault interrupter when system power is lost	There may be an open thermistor in the communication module or an issue with the battery charger in the control module. Swapping communication modules is the simplest way to isolate the source of the issue. Pressing the **Clear Warnings** button may also correct this condition. If problem persists and the user cannot determine which module the problem is in, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis. Otherwise, contact S&C GSMC to make arrangements for the return and repair of the affected communication or control module

TABLE CONTINUED ▶

Table 2. Warnings—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
Close Contact Touch Out of Range 3 Times	Contact touch during three consecutive **Close** operations out of range	Contact touch during a **Close** operation okay	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block operation	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Current Exceeds Max Interrupting Current	Current exceeds the **Maximum Interrupting Current** setting.	Current is below the **Maximum Interrupting Current** setting	Indicates the current is higher than the **Maximum Interrupting** setting. The IntelliRupter fault interrupter will not trip open for this high current value and will rely on the upstream circuit breaker to clear the fault	The condition will self-correct after the current falls below the **Maximum Interrupting Current** setting
Current Profile Incorrect	The coil driver Current Profile contains points that are out of range for three consecutive operations	Current Profile does not contain points that are out of range	This warning will be generated when testing a control module with a secondary injection test system using a mechanical simulator. The warning will automatically clear after the control operates an actual IntelliRupter fault interrupter. It may also be cleared by pressing the **Clear Warnings** button on the IntelliLink *Diagnostics* screen. When the control is installed in an IntelliRupter fault interrupter, this warning indicates a mechanism or control module issue may be developing. No impact on operation until it develops into an error, which will then block operation	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
DPR: Prot. Prcsr No Response	The DSP processor is not responding	The DSP processor is responding	Protection may not be available when this warning is active. Loop Restoration (if used) will be in the **Not Ready** state. The DSP also may not respond to commands issued through IntelliLink software or SCADA, or originating in the MCU application	Pressing the **Clear Warnings** button, or restarting the control may clear the warning. If the warning persists, save a memory snapshot (*.vm file), save event logs from Compact Flash, and contact S&C GSMC for further diagnosis
Excessive Bounce	Excessive contact bounce during an operation using Pulse-Closing Technology	Contact bounce okay	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block the operation. However, this issue may result in a **Close** operation instead of an operation using PulseClosing Technology	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Leakage Current Check Warning	Vacuum interrupter leakage current is detected	Vacuum interrupter leakage current is no longer detected	Problem with the vacuum interrupter may require maintenance	Contact S&C GSMC

Diagnostics

Table 2. Warnings—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
Main Cap Bank Low	Main capacitor bank voltage is below 380 V 180 seconds after startup	Main capacitor bank voltage is > 380 V 180 seconds after a restart	Operation is inhibited until capacitors are charged to 400 V	System voltages below the IPM rating or excessive loads in the communication module can result in this condition. Pressing the **Clear Warnings** button may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Mechanism Warning	Rollup point for any mechanism warning active	No mechanism warning active	See other Mechanism Warnings	See other Mechanism Warnings
No Contact Touch	No contact touch for two consecutive operations using PulseClosing Technology	Adequate contact touch for operations using PulseClosing Technology	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block operation	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
No Encoder Output	Encoder output too low during an operation using PulseClosing Technology	Encoder output okay	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block operation	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
No Encoder Reset	Encoder does not reset to 0 counts prior to an operation using PulseClosing Technology or before a **Close** operation	Encoder does reset to 0 counts prior to an operation using PulseClosing Technology or before a **Close** operation	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block operation	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Nonfunctional IPM	One or both Integral Power Modules are not functioning	All IPMs are okay	The battery and capacitor banks may not be properly changing when this warning is active	System voltages below the IPM rating or excessive loads in the communication module can result in this condition. Pressing the **Clear Warnings** button may correct this condition. If problem persists save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Pulse Contact Touch Out of Range 3 Times	Contact touch during three consecutive **Pulse** operations out of range	Contact touch during **Pulse** operation okay	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block operation. However, this issue may result in a **Close** operation instead of an operation using PulseClosing Technology	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis

Table 2. Warnings—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
Remaining Contact Wear Low	Remaining contact wear less than or equal to 10%	Remaining contact wear is greater than 10% of new	The IntelliRupter fault interrupter is nearing end of life. No impact on operation until the contacts can no longer perform to specification	Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Secondary Not Opening	Secondary plunger does not open during an operation using PulseClosing Technology	Secondary plunger does open during an operation using Pulse-Closing Technology	Indicates a mechanism issue may be developing. No impact on operation until it develops into an error, which will then block operation. However, this issue may result in a **Close** operation instead of an operation using PulseClosing Technology	This condition will self-correct after a successful operation. Press the **Clear Warnings** button to clear this warning. If the warning persists after several operations, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Secondary Temp Sensor Issue	Output of both primary and secondary temperature sensors are out of range. Readings are less than -40°C (-40°F) or greater than +85°C (185°F)	Output of primary or secondary temperature sensor is within allowable range	Capacitor-capacity calculation is compromised and may result in a capacity alarm	Pressing the **Clear Warnings** button and restarting the control may clear the warning. If the alarm persists, save a memory snapshot (*.vm file), save compact-flash event logs, and contact S&C GSMC for further diagnosis
SEEPROM Issue	Problems with serial EEPROM operations	No more problems with serial EEPROM operations	Sensing accuracy may be compromised when these alarms are active	Pressing the **Clear Warnings** button may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Sleep Time Indeterminate	Control has tripped by VSLCE element and the duration of last power outage could not be determined	Control has tripped by VSLCE and the duration of last power outage is determined	No automatic close-back is taken after control power is restored	Pressing the **Clear Warnings** button may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Slow Capacitor Charge	Capacitor charging too slow under normal operation	Capacitor charging at normal rate	Slow charging could affect open interval times in a test sequence configured with the minimum delay times between tests	System voltages below the IPM rating or excessive loads in the communication module can result in this condition. Pressing the **Clear Warnings** button may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Total Capacity Is Below 50%	Energy storage capacity has dropped below 50% of its nominal value	Energy storage capacity is greater than 50% of its nominal value	**ATX Error** state is entered. No protection and no automatic functions. This condition could be the result of a temperature-sensor issue. Otherwise, the operation may be affected while the conditions resulting in this warning exist. Low capacity could affect open interval times in a test sequence configured with the minimum delay times between tests	Save a memory snapshot and mech file. Contact S&C GSMC for support. Do not swap control modules in an attempt to troubleshoot

Diagnostics

Table 2. Warnings—Continued

Status Description	Active When	Clear When	Impact	Recommended Action
Unequal Cap Voltages	Main and secondary capacitor bank isolating diodes have an open circuit	Main and secondary capacitor bank isolating diodes are okay	Operating the IntelliRupter fault interrupter with this condition may result in serious damage to the IntelliRupter fault interrupter	It is recommended that the control module be replaced and sent to S&C for further analysis. S&C Field Service should be consulted before operating the IntelliRupter fault interrupter with a replacement control. Save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis

Errors

Figure 23. The *Diagnostics>Errors* screen.

Clicking on the **Clear Errors** button will reset any active errors and update the **Last Clear Time** and **Time Cleared** fields. Approximately one second after an error is cleared it will reassert if the error check is a system check and the condition still exists.

Issues with capacitor charging, mechanism operations, and some other operational checks will reassert the error on the next operation attempt if the condition still exists. **Close** operations are blocked while in the **Error** state. See Figure 23 and Table 3 on page 60.

NOTICE
When an **Error** state is present, the IntelliRupter fault interrupter can accept an **Open** command, but not a **Close** command, and the IntelliTeam® SG Automatic Restoration System or the **Loop Restoration** mode will not go into the **Ready** state.

NOTICE
A **Clear Errors** command restarts the control.

Table 3. Errors

Status Description	Active When	Clear When	Impact	Recommended Action
The following Errors are reported by both Control Modules SDA-4540R2 and SDA-4540R3				
ATX Error State	The automatic operations logic, ATX, is in an Error state	ATX **Error** state off	The IntelliTeam system and protection are shut down. Operation is blocked. Protection and automatic operation may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Restarting the control and pressing the **Clear Errors** button may clear this error. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. If this condition persists, save a memory snapshot (*.vm file), replace the control module, and contact the S&C Global Support and Monitoring Center (GSMC) for further diagnosis
Cap Not Charging	One of the capacitor banks is not charging	Capacitor bank charging is okay	Operation is suspended after the capacitor voltage drops below 200 V	Save a mech file in additional to the memory snapshot. Do not swap control modules in an attempt to troubleshoot.
DSP Error Condition	DSP processor Error condition on. Rollup point for various errors and warnings detected by DSP processor	DSP processor Error condition off	The IntelliTeam system and protection are shut down. Operation is blocked. Protection and automatic operation may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Restarting the control and pressing the **Clear Errors** button may clear this error. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. If this condition persists, save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
Error—Close Position Out of Range	Stable mechanism close position measured out of range	Stable mechanism close position measured in range	The IntelliTeam system and protection are shut down. Operation is blocked. Mechanical operation may be compromised	Save a mech file in additional to the memory snapshot. Do not swap control modules in an attempt to troubleshoot.

NOTICE

Do not replace or separate the control module from the IntelliRupter fault interrupter with a **Close Position Out of Range** error. This error cannot be cleared. Moving a control module with this error will disable the IntelliRupter fault interrupter into which the control is installed.

Error—Main Coil Current	Coil driver circuit test has detected a problem	Successful coil driver circuit test	The IntelliTeam system and protection are shut down. Operation is blocked. Mechanical operation may be compromised	Restart the control using the IntelliLink software menu: **Tool> Device Maintenance>Restart Control** option. If the error does not clear, reinstall the existing firmware on the module already installed in the IntelliRupter fault interrupter. If the error does not clear, replace the control module with a known good module and clear errors. If an error returns immediately or after the next operation, then stop. Save the memory snapshot and mech file. Contact S&C GSMC for support

TABLE CONTINUED ▶

Table 3. Errors—Continued

Table 2. Warnings— Continued	Active When	Clear When	Impact	Recommended Action
Error— Position Incorrect	Pole does not finish in the correct position after operation (i.e. If a **Close** command results in an open interrupter or vice versa)	Pole moves to the expected position when commanded	The IntelliTeam system and protection are shut down. Operation is blocked. Mechanical operation may be compromised	If the error returns after the next operation, restart the control using the IntelliLink software menu: **Tool>Device Maintenance>Restart Control** option. If the error returns again after the next operation, reinstall the existing firmware on the module already installed in the IntelliRupter fault interrupter. If the error returns again after the next operation, replace the control module with a known good module and clear errors. If an error returns immediately or after next operation, then stop. Save a memory snapshot and mech file Contact S&C GSMC for support
Insufficient Energy During Operation	Available energy was less than calculated and resulted in insufficient energy to complete an operation	Energy availability calculation was sufficient for the last operation	The IntelliTeam system and protection are shut down. Operation is blocked. Mechanical operation may be compromised	Restarting the control and pressing the **Clear Errors** button may clear this error. Replacing the control module may return the IntelliRupter fault interrupter to normal operating conditions. If this condition persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
Leakage Current Check Error	Vacuum interrupter leakage current is detected	Leakage current is no longer detected	Problem with the vacuum interrupter requires maintenance	Contact S&C GSMC
Main Power Bus Low	Analog value Main Power Bus Low	Analog value Main Power Bus Normal	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
Mechanism Error	Rollup point for any mechanism error active	No mechanism error active	See above mechanism related errors	Save a mech file in additional to the memory snapshot. Do not swap control modules in an attempt to troubleshoot.
P5 Out of Range	Analog value P5 out of range	Analog value P5 in range	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis

Table 3. Errors—Continued

Table 2. Warnings— Continued	Active When	Clear When	Impact	Recommended Action
P15 Out of Range	Analog value P15 out of range	Analog value P15 in range	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
Power Down Sequencing Error	Error during power down sequencing. Control is still operating 30 minutes after power down event has been detected	Normal power down sequencing	The IntelliTeam system and protection are shut down. Operation is blocked. Protection and automatic operation may be compromised	Restarting the control and pressing the **Clear Errors** button may clear this error. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. If this condition persists, save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
Sensor Calibration Data Issue	Sensor calibration data CRC is bad	Sensor calibration data CRC is okay	The IntelliTeam system and protection are shut down. Operation is blocked. Mechanical operation may be compromised. Sensing accuracy may be compromised	Restarting the control or replacing the control may correct this condition. If problem persists, save a memory snapshot (*.vm file) and contact S&C GSMC for further diagnosis
The following Errors are only reported by Control Module SDA-4540R2				
A5 out of Range	Analog value A5 out of range	Analog value A5 in range	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
A15 out of Range	Analog value A15 out of range	Analog value A15 in range	See above	See above
A15+ out of Range	Analog value A15+ out of range	Analog value A15+ in range	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
D3.3 out of Range	Analog value D3.3 out of range	Analog value D3.3 in range	See above	See above

Table 3. Errors—Continued

| Status Description	Active When	Clear When	Impact	Recommended Action
The following Errors are only reported by Control Module SDA-4540R3				
CCP_PWR out of Range	Main Power supply out of range	Main Power supply in range	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
DSP_3V3 out of Range	DSP 3.3 V supply out of range	DSP 3.3 V supply in range	See above	See above
DSP_2V5 out of Range	DSP 2.5 V supply out of range	DSP 2.5 V supply in range	See above	See above
DSP_1V8 out of Range	DSP 1.8 V supply out of range	DSP 1.8 V supply in range	See above	See above
DSP_P15V out of Range	DSP +15 V out of range	DSP +15 V in range	See above	See above
DSP_M15V out of Range	DSP -15 V supply out of range	DSP -15 V supply in range	The IntelliTeam system and protection are shut down. Operation is blocked. Sensing accuracy may be compromised. Loop Restoration (if used) will be in the **Not Ready** state	Pressing the **Clear Errors** button may clear this error long enough to allow an emergency operation. Replacing the control module will return the IntelliRupter fault interrupter to normal operating conditions. Save a memory snapshot (*.vm file), replace the control module, and contact S&C GSMC for further diagnosis
DSP_1V2 out of Range	DSP 1.2 V supply out of range	DSP 1.2 V supply in range	See above	See above
DSP_5V out of Range	DSP +5 V supply out of range	DSP +5 V supply in range	See above	See above
PG_5V6 out of Range	+5.6 V supply out of range	+5.6 V supply in range	See above	See above
PG_1V3 out of Range	+1.3 V supply out of range	+1.3 V supply in range	See above	See above
PG_5V out of Range	+5 V supply out of range	+5 V supply in range	See above	See above

Communication Tests
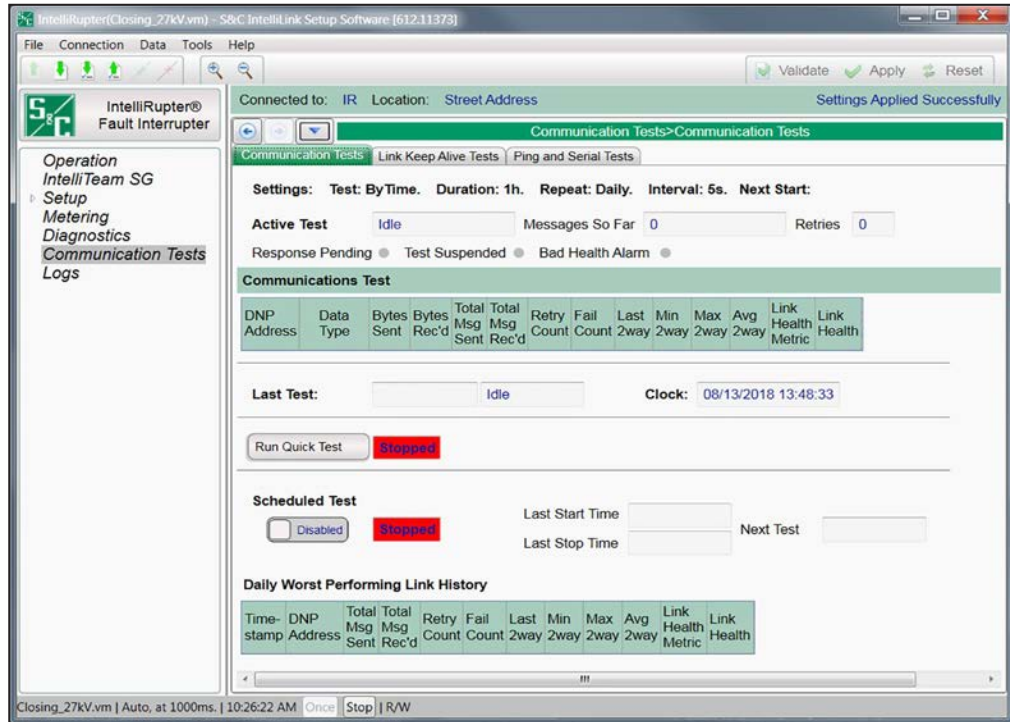
Figure 24. The *Communication Tests>Communication Tests* screen.

Diagnostic communication tests determine whether nodes are responding to communication and how quickly they respond. Periodically scheduled tests run for one hour and record response time, failure, and retry statistics. Any network node can send tests to other network nodes. Test messages (Connection IDs) do not contain real data, but they can be configured to mimic a typical coach or runner message. See Figure 24. These parameters are reported:

Settings

These settings are configured on the *Setup>Communications>Communication Tests* screen and displayed here for convenience.

Active Test

For the test in progress it can display: "Idle" (no test running), "Quick Diagnostic" (manually started Diagnostic Test), "Scheduled" (scheduled diagnostic test), "Quick Keep Alive" (manually started Keep Alive), or "Keep Alive" (scheduled Keep Alive).

Note: This reports for any test running on either the **Diagnostic Communication Tests** tab or the **Link Keep Alive Tests** tab.

Messages So Far

This is the total number of messages transmitted by the running test.

Retries

This is the number of retry transmissions sent when a node did not respond to the message transmission within the number of seconds specified by the **Time Delay Between Retries** setting on the *Setup>Communications>DNP* screen.

Response Pending

This indicates the test has transmitted a message and is waiting for a node response.

Test Suspended

This indicates a higher priority communication system event, such as a circuit event or an IntelliTeam system operation, preempted the test. The test resumes when that event is complete.

Bad Health Alarm

This indicates when any **Link Health** indicator is red (bad health) and resets when all red **Link Health** indicators are off.

Communications Test

This test reports statistics for each message type sent to each node. The report sequence follows this example if there are 2 nodes and 3 message types:

Node 1, Message Type 0

Node 1, Message Type 1

Node 1, Message Type 2

Node 2, Message Type 0

Node 2, Message Type 1

Node 2, Message Type 2

These parameters are reported:

DNP Address

This is the node address of the message.

Data Type ID

This is the message type, such as coach or runner.

Bytes Sent

This is the number of bytes sent in the message.

Bytes Received

This is the number of bytes received for the message.

Total Messages Sent

This is the number of transmissions for the message type.

Total Messages Received

This is the number of responses for the message type.

Retry Count

This is the number of times a response was not received for this message type and the message was retransmitted. The **Number of Retries for Confirm** setting is on the *Setup>Communications>DNP* screen.

Fail Count

This is the number of times the message type was sent and no response was received, even after the allotted number of retries.

Last 2way

This is the response time in milliseconds for the last two-way message-type response. This is the interval from the start of transmission to receipt of the response. If a messages fails, there is no two-way transmission report data. A completed retry counts as a two-way transmission, and the timeout delay will be included in all two-way statistics.

Min 2way

This is the shortest response time in milliseconds for all two-way responses for this message type.

Max 2way

This is the longest response time in milliseconds for all two-way responses for this message type.

Avg 2way

This is the average response time in milliseconds for all two-way responses for this message type.

Link Health Metric

This is the percentage of tests for this message type that had a response even if a retry was required. This is the Total Messages Received count divided by the Total Messages Sent count.

Link Health

This shows a color indication of the link health metric for this message type:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

These threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the *Setup>Communications>DNP Diagnostics* screen.

Last Test

This is the time stamp of the last test statistics displayed. The test type can be reported as: "Quick Diagnostic," "Schedule," or "Idle" (no test was run).

Clock

This is the present date and time.

Run Quick Test Button

This starts a quick test. The indicator shows the quick test status: **Running**, **Stopped**, or **Suspended**. A quick test sends only one message (the first message type configured) to each node and stops.

Scheduled Test

This enables or disables running the scheduled test. The indicator shows the scheduled test status: **Running**, **Stopped**, or **Suspended**.

Last Start Time

This is the time stamp of the start of the last scheduled test.

Last Stop Time

This is the time stamp of the end of the last scheduled test.

Next Test

This is the scheduled time of the next test.

Daily Worst Performing Link History

This report shows the worst link performance for the last 10 scheduled tests. It aggregates all message types sent to each node and reports statistics for the node with the worst link health. These parameters are reported:

Time stamp

This is the time of the scheduled test.

DNP Address

This is the RTU address of the node.

Total Messages Sent

This is the number of transmissions for this message type to this node.

Total Messages Received

This is the number of responses for this message type received from this node.

Retry Count

This is the number of times a response was not received for this message type from this node and the message was retransmitted. The number of retries is configured in the **Number of Retries for Confirm** setting on the *Setup>Communications>DNP* screen.

Fail Count

This is the number of times a message for this message type to this node was sent and no response was received, even after the allotted number of retries.

Last 2way

This is the response time in milliseconds for the last two-way message response, this is the interval from when a message was sent to when the response was received. If a message fails, there will be no two-way transmission report data. A completed retry counts as a two-way transmission, and the timeout delay will be included in all two-way statistics.

Min 2way

This is the shortest response time in milliseconds for all two-way message responses.

Max 2way

This is the longest response time in milliseconds for all two-way message responses.

Avg 2way

This is the average response time in milliseconds for all two-way message responses.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the Total Messages Received count divided by the Total Messages Sent count.

Link Health

This shows a color indication for link health metric:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

The threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the *Setup>Communications>DNP Diagnostics* screen.
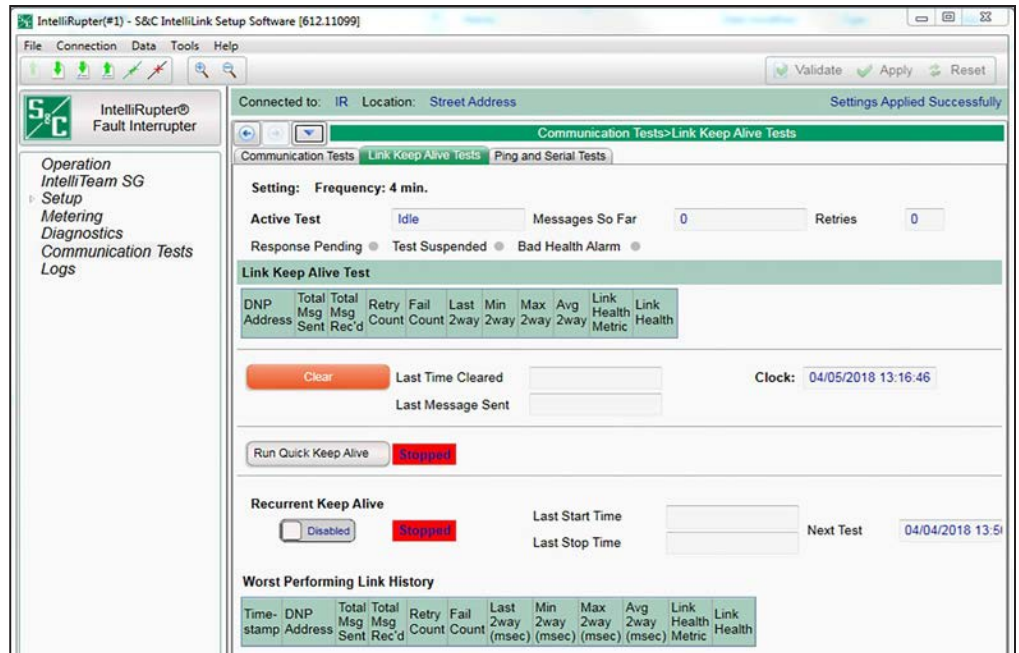
Link Keep Alive Tests

Figure 25. The *Communication Tests>Link Keep Alive Tests* screen.

The **Link Keep Alive** process periodically sends a single message to every node to keep all links active because an idle TCP connection may be shut down. When more than one message is configure d for a scheduled test, the **Link Keep Alive** process only sends the first configured message and records statistics for the message transmissions. See Figure 25. These parameters are reported:

Settings

These settings are configured on the *Setup>Communications>Communication Tests* screen and displayed here for convenience.

Active Test

For the test in progress, the screen can display: "Idle" (no test running), "Quick Diagnostic" (manually started diagnostic test), "Scheduled" (scheduled diagnostic test), "Quick Keep Alive" (manually started Keep Alive process), or "Keep Alive" (scheduled Keep Alive process).

Messages So Far

This is the total number of messages transmitted by the running test.

Retries

This is the number of retry transmissions sent when a node did not respond to the message transmission within the number of seconds specified by the **Time Delay Between Retries** setting on the *Setup>Communications>DNP* screen.

Response Pending

This indicates the test has transmitted a message and is waiting for a node response.

Test Suspended

This indicates a higher priority communication system event, such as a circuit event or an IntelliTeam system operation, preempted the test. The test resumes when that event is complete.

Bad Health Alarm

This indicates when any **Link Health** indicator is red (bad health) and resets when all **Link Health** indicators are off.

Link Keep Alive Test

Only the first message type (Data Type ID) is sent to each node. This report shows statistics for each node that aggregates until the statistics are cleared manually or clear automatically at midnight. These parameters are reported:

DNP Address

This is the node address for the message.

Total Messages Sent

This is the number of transmissions for this node.

Total Messages Received

This is the number of responses received for this node.

Retry Count

This is the number of times a response was not received from this node and the message was retransmitted. The number of retries is configured in the **Number of Retries for Confirm** field on the *Setup>Communications>DNP* screen.

Fail Count

This is the number of times the message was sent and no response was received, even after the allotted number of retries.

Last 2way

This is the response time in milliseconds for the last two-way message response, this is the interval from the start of the transmission to receipt of the response. If a messages fails, there is no two-way transmission report data. A completed retry counts as a two-way transmission, and the timeout delay will be included in all two-way statistics.

Min 2way

This is the shortest response time in milliseconds for all two-way message responses.

Max 2way

This is the longest response time in milliseconds for all two-way message responses.

Avg 2way

This is the average response time in milliseconds for all two-way message responses.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the total messages received divided by the total messages sent.

Link Health

This shows a color indication for the link health metric for this message:

Green—The last **Keep Alive** message was received successfully without any retries.

Yellow—The last **Keep Alive** message was received successfully with retries.

Red—The last **Keep Alive** message was not received successfully.

Note: For Keep Alive tests, the link-health calculations are based on the last message, but for the Diagnostic Tests and Worst Performing Link History, the calculations are based on averages.

Clear Button

This clears link keep alive test data.

Last Time Cleared

This is the time stamp of the last time statistics were cleared, either manually or automatically, at midnight.

Last Message Sent

This is the time stamp of the last message transmission.

Clock

This notes the present date and time.

Run Quick Keep Alive Button

This button starts a quick keep alive test. The indicator shows the quick keep alive test status: **Running**, **Stopped**, or **Suspended**. The quick keep alive test sends only one message—the first message type configured—to each node and stops.

Recurrent Keep Alive Button

This button enables or disables running a recurrent keep alive test. The indicator shows the recurrent keep alive test status: **Running**, **Stopped**, or **Suspended**.

Last Start Time

This is the time stamp of the last test start time.

Last Stop Time

This is the time stamp of the last test stop time.

Next Test

This is the start time of the next recurrent keep alive test.

Daily Worst Performing Link History

This report shows performance of the worst link for the past 24 hours. At midnight, the report aggregates all message types sent to each node and reports performance of the node with the worst link health. It also clears the link keep alive table. These parameters are reported:

Time stamp

This is the time of the node transmission.

DNP Address

This is the DNP address of the node.

Total Messages Sent

This is the number of messages sent to this node.

Total Messages Received

This is the number of messages received by this node.

Retry Count

This is the number of times a response was not received from this node and the message was retransmitted. The number of retries is configured in the **Number of Retries for Confirm** setting on the *Setup>Communications>DNP* screen.

Fail Count

This is the number of times a message for this node was sent and no response was received, even after the allotted number of retries.

Last 2way (msec)

This is the response time, in milliseconds, for the last two-way message response, this is the interval from when a message was sent to when the response was received. If a message fails, there will be no two-way transmission report data. A completed retry counts as a two-way transmission, and the timeout delay will be included in all two-way statistics.

Min 2way (msec)

This is the shortest response time, in milliseconds, for all two-way message responses.

Max 2way (msec)

This is the longest response time, in milliseconds, for all two-way message responses.

Avg 2way (msec)

This is the average response time, in milliseconds, for all two-way message responses.

Link Health Metric

This is the percentage of tests that had a response even if a retry was required. This is the total messages received divided by the total messages sent.

Link Health

This shows a color indication for the link health metric:

Gray–Less than 100 transmissions have been sent.

Red–Bad; link health metric is less than 25%.

Yellow–Marginal; link health metric is 25% or greater and less than 95%.

Green–Good; link health metric is 95% or greater.

Note: Link health in this table indicates the average of all messages, but Link Health in the link keep alive table indicates the health for the last message sent.

These threshold settings can be adjusted in the "Peer Communications Statistics Configuration" section of the *Setup>Communications>DNP Diagnostics* screen.
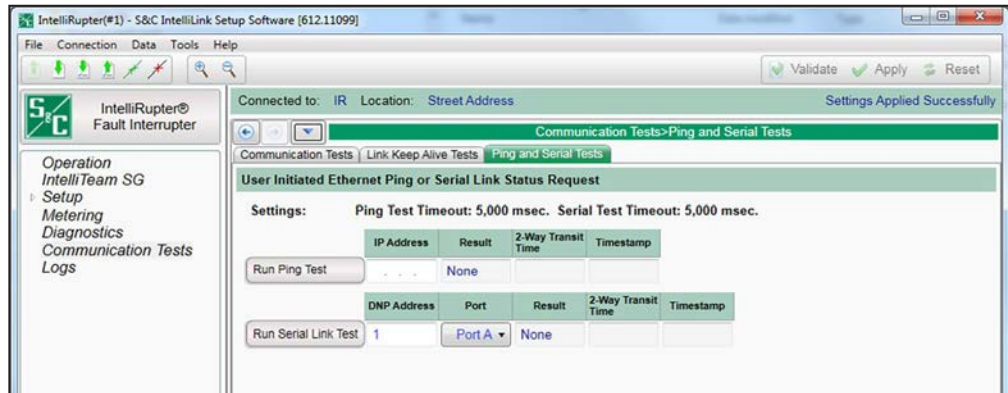
**Ping and
Serial Tests**

Figure 26. The *Communication Tests>Ping and Serial Tests* screen.

User-Initiated Ethernet Ping or Serial Link Status Request

The user can manually ping a node at the network level to test response time. This is useful when statistics indicate a node is not responding at the messaging level and the user must check that the node is responding at the network level. See Figure 26. These parameters are reported:

Settings

These settings are configured on the *Setup>Communications>Communication Tests* screen and are displayed here for convenience.

Run Ping Test Button

This button starts a ping test to the specified IP address.

IP Address

This is the IP address of the tested node.

Result

This is the **Ping Test** status reported as: "Pending" (waiting for a response), "Success," "Timeout," "Bad Address or No Route," "Interface Down," "Unknown," or "None" (no test done yet).

2-Way Transit Time

This is the response time, in milliseconds, for the two-way message response.

Time stamp

This is the time stamp of the last ping sent or the response received.

Run Serial Link Test Button

This button starts a serial link test to the specified DNP address.

DNP Address

This is the address of the tested node.

Port

This is the serial port used for transmission.

Result

This is the **Serial Link Test** status reported as: "Pending" (waiting for a response), "Success," "Timeout," "Bad Address or No Route," "Interface Down," "Unknown," or "None" (no test done yet).

2-Way Transit Time

This is the response time, in milliseconds, for the two-way message response.

Time stamp

This is the time stamp of the last serial link test or the response received.
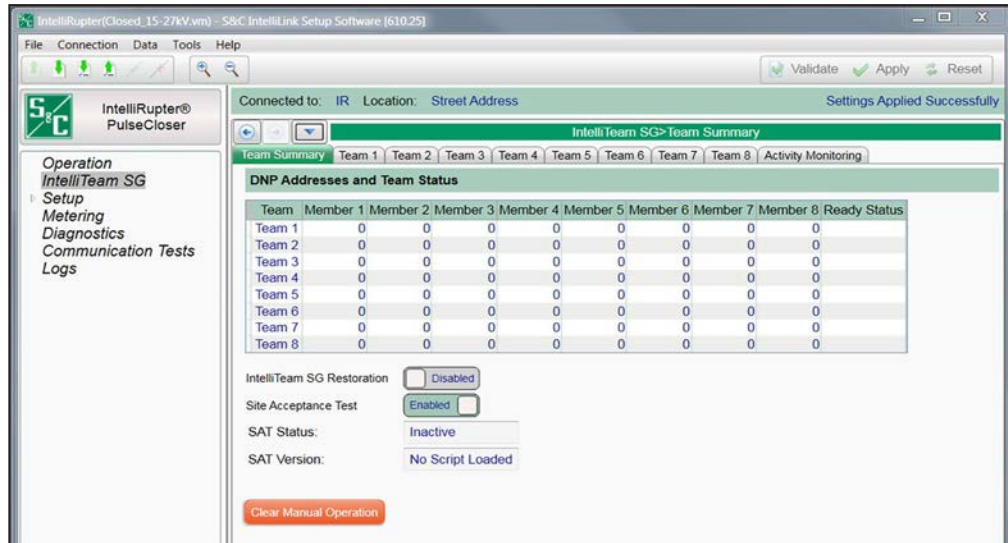
Team Summary

Figure 27. The *IntelliTeam SG>Team Summary* screen.

The **Ready** status is indicated for each team. If a manual operation is issued, the team(s) will go out of the **Ready** state. The manual operation can be cleared by clicking on the **Clear Manual Operation** button at the bottom of the screen. See Figure 27.

All teams must be in the **Ready** state and the **IntelliTeam SG Restoration** mode must be enabled for the IntelliTeam SG system to operate. To view individual team information, click on the **Team 1** through **Team 8** tabs. The following parameters are reported:

Team
This is the team number for the listed data.

Member 1 through Member 8
This is the DNP address of the team member.

Ready Status
This is the **Ready** state of the team.

IntelliTeam SG Restoration
This slide control is used to enable or disable the IntelliTeam SG Restoration System from this screen.

Site Acceptance Test
This slide control is used to enable or disable a Site Acceptance Test (SAT) script. Leave this set to the **Disabled** state for normal operation.

SAT Status
This indicates status information for a Site Acceptance Test. During normal operation, this indicator displays "Inactive."

SAT Version:

This indicator shows version identification for the Site Acceptance Test script. If a SAT script is not present in the control, this displays "No Script Loaded."

Clear Manual Operation

Click on this button to clear a manual operation command issued from the local user interface or by a SCADA command.

Team Information

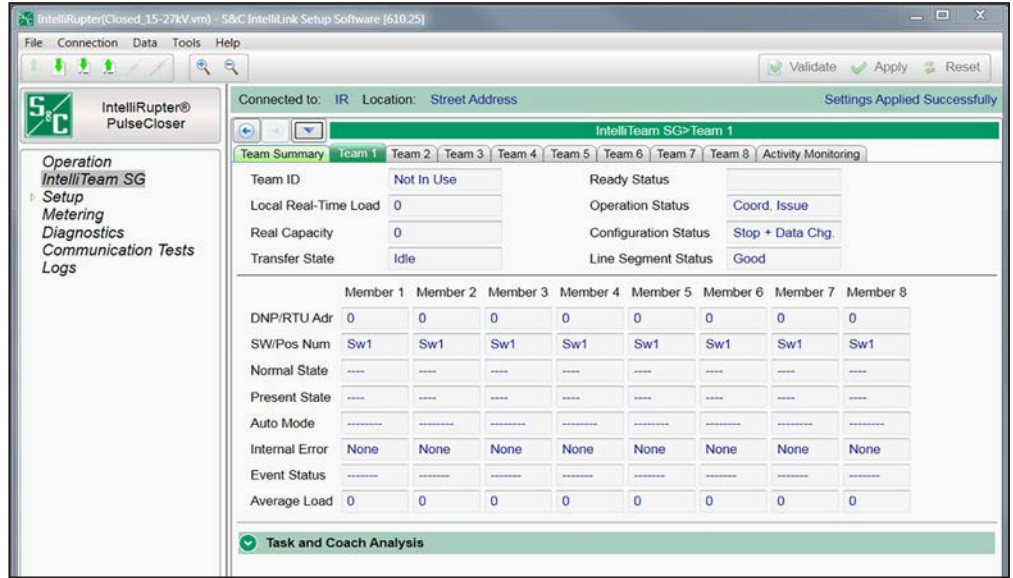Figure 28. The *IntelliTeam SG>Team 1* screen.

The *IntelliTeam SG> Team 1* screen displays team-related parameters and information about each team member. See Figure 28. The following parameters are reported:

Team ID

This is the name entered in the **Team ID** field on the *Setup>Restoration>IntelliTeam SG>Team x* screen.

Local Real-Time Load

This is the two-minute average three-phase load (in amperes) measured on the line segment protected by this team. It does not include load outside the local line segment.

Real Capacity

This is the load capacity available on the line segment protected by this team. It takes into account the real capacity of source-side teams, the maximum capacity of the team's present source device, and any load already transferred during circuit reconfiguration.

Transfer State

This is the present state of any transfer operation. Possible values displayed:

Idle—Team configuration is normal. No **Transfer** or **Return-to-Normal** operations are taking place.

Init—Data are being collected from team members in preparation for a Transfer event.

Rqst—The line segment is requesting service restoration from an adjacent line segment.

Grant—The line segment is being asked to grant service restoration to an adjacent line segment.

Wait—The team configuration is not normal. The team is waiting for an additional circuit reconfiguration or **Return-to-Normal** operation.

RTN—The team is returning to normal configuration.

Stop—An error has occurred, stopping a **Transfer** operation.

Fault—The team is presently isolating a fault.

Hold—The team has begun a Transfer event but the line segment is not yet fully de-energized.

Ready Status

This is the present **Ready** state. Possible values displayed:

Ready—When **Operation** status, **Configuration** status, and **Line Segment** status all indicate no errors are present.

Alarm—When errors are present.

Fault—The team is isolating a faulted line segment.

PLI—The team is isolating a Phase Loss event.

OverCurrent—The team is isolating an Overcurrent event.

Operation Status

This is the system operation status. Possible values displayed:

None—No **Error** conditions exist and team members can perform team operations.

Coordination—The team coach is not passing through the team, causing a lack of team coordination.

Config Mismatch—The configuration of a team member is not consistent with the configuration of this IntelliTeam system device.

Remote Problem—At least one active team member contains **Error** conditions or the team logic has been disabled.

Local Problem—The local team member contains **Error** conditions.

Logic Disabled—Team logic has been disabled on the *Setup>Restoration>IntelliTeam SG>Team x* screen.

Not In Use—This team is not in use.

No 2nd Contin.—The team is in a transferred state and no further restoration activity is allowed.

Configuration Status

This is the status of user-configured parameters essential for team operation. Possible values displayed:

None—No **Error** conditions exist in team configuration.

NoRTU Addr— No RTU address is specified on the *Setup>Communications* screen.

Stopped—The **Set Team** mode is in the **Stopped** state on the *Setup> Restoration> IntelliTeam SG>Team x* screen.

Data Change—The team's setup data have a CRC error.

Stop + Change—The **Set Team** status is in the **Stopped** state and the team's setup data have a CRC error.

Record Count—The count of team member records on the *Setup> Restoration> IntelliTeam SG>Team x* screen is incorrect. The team database requires at least one record to be valid.

Not 1 Source—An incorrect number of source devices was configured on the *Setup> Restoration>IntelliTeam SG>Team x* screen. A team may have only one source switch.

No Local Rec—No local record was found in the team database. One of the team records must contain a DNP Address configuration that matches the **DNP Address** setting entered on the *Setup>Communications>DNP* screen.

Line Segment Status

This displays the status of the line segment protected by this team of IntelliTeam system devices. Possible values displayed:

Good—No faults or voltage loss is detected on the line segment.

Segment Dead (Dd)—The line segment is de-energized.

Segment Open (Op)—All team members are in the **Open** position in preparation for a circuit reconfiguration.

Overcurrent (OC)—An overcurrent is detected on this line segment.

Voltage Loss (VL)—A voltage loss is detected on this line segment.

Team Error (Er)—An error is detected.

Alt Source (AS)—The line segment is being fed by an alternate source, either directly from an adjacent line segment or indirectly from another location.

Individual Team Member Status

DNP/RTU Adr

This is the DNP/RTU address of each team member, as entered on the *Setup>Restoration>IntelliTeam SG>Team x* screen.

Sw/Pos Num

This is the position number associated with the team member, for example "Sw1" for a single overhead switch, as entered on the *Setup>Restoration>IntelliTeam SG>Team x* screen.

Normal State

This is the state of each team member when the circuit is configured normally, as entered on the *Setup>Restoration>IntelliTeam SG>Team x* screen.

Present State

This is the present position of each team member displayed as:

Open—Team member is open.

Closed—Team member is closed.

---- **—The position of the team member switch is unknown or the record is not in use. This is considered an **Error condition during normal operation.

Auto Mode

This report notes the automatic features enabled for each team member, as entered on the *Setup>Restoration>IntelliTeam SG>Team x* screen. This also indicates when the team member has been temporarily placed in manual operation mode. A combination of values can be displayed:

B—This switch is temporarily blocked from use as a valid source for the team during the Reconfiguration event. This may be because of a loss of voltage at this switch, or this switch is used to shed load following a reconfiguration.

M—The team member is temporarily placed in manual.

A—**Automatic Sectionalizing** logic is enabled.

V—**Sectionalizing on Loss-of-Voltage** logic only is enabled.

T—**Automatic Transfer** logic is enabled.

P—**Sectionalizing on Phase Loss** logic is enabled.

Ro—**Return-to-Normal** logic using **Open Transition** mode is enabled.

Rc—**Return-to-Normal** logic using **Closed Transition** mode has been enabled.

Internal Error

Possible values displayed:

None—No internal errors are present in a team member.

Trouble—A team member is disabled because of a bad battery or other condition.

NotAuto—A team member is in a non-automatic condition.

ManOR—The **Open/Close** state of a team member is manually overridden.

No Op—A **Close** or **Open** operation was requested but the team member is unable to perform the operation.

Note: For all IntelliTeam SG devices, **ManOR** and **No Op** status can be cleared on the *IntelliTeam SG>Team Summary* screen by clicking the **Clear Manual Operation** button or with a SCADA command.

ProRes—The team member has been sent a **Prohibit Restoration** command.

Event Status

This report notes the present status of events related to this team member. A combination of values can be displayed:

O—Latched On for an Overcurrent event

V—Latched On for a voltage loss on any or all phases

P—Latched On for a phase loss during a Sectionalizing event

Vr—Real-time voltage loss on any phase

3Vr—Three-phase real-time voltage loss

C—A team member is in the **Cycling** state

Average Load

This is the two-minute average three-phase load reported by each team member. It is used to determine the **Local Real-Time Load** value. To ensure the team uses pre-event values during a transfer, it is frozen after the event at the last value reported before the event began. The value is not updated until the transfer is complete.

Load Current Direction

This is the direction of load current. Possible values displayed:

N/A—There is presently no current flowing in the team.

No Dir—Load current direction is presently unavailable.

Out of Team—Load current is flowing out of the team. The switch is the load/tie point of the team.

Into Team—Load current is flowing into the team. The switch is the present source of the team.

Fault Current Direction

This is the direction of fault current. Possible values displayed:

N/A—There is presently no fault in the team.

No Dir—Fault current direction is presently unavailable.

Out of Team—Fault current is flowing out of the team. The switch is the load/tie point of the team.

Into Team—Fault current is flowing into the team. The switch is the present source of the team.
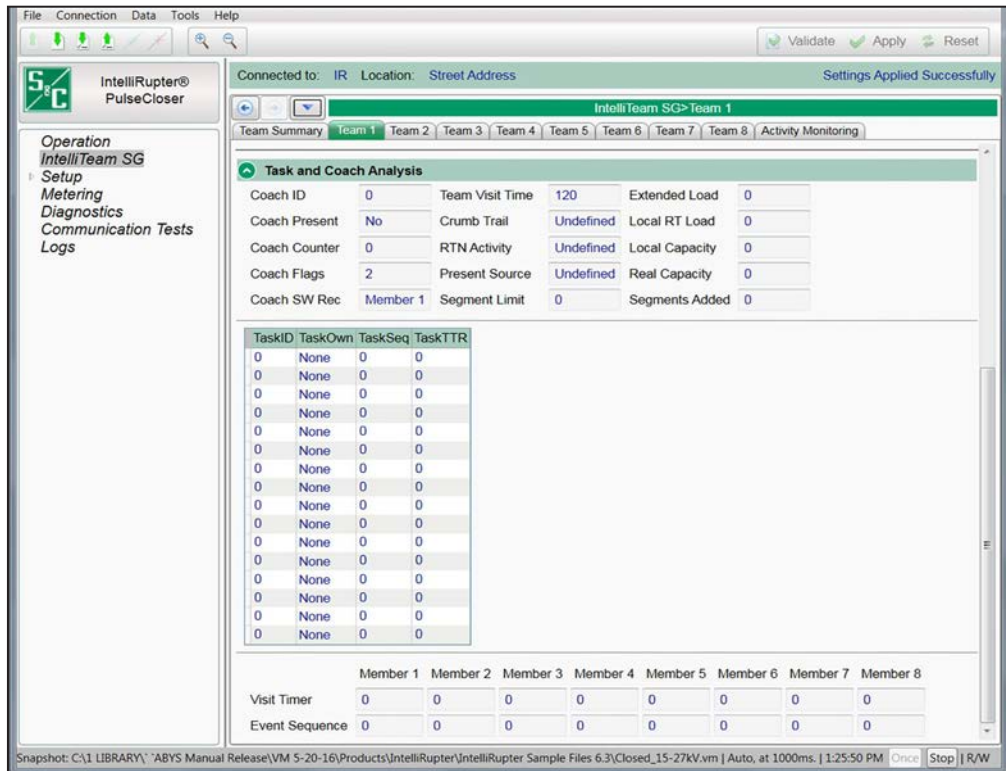
Task and Coach Analysis

Figure 29. The *IntelliTeam SG>Team 1>Task and Coach Analysis* screen.

Task and Coach Analysis

This screen displays team-related parameters and information about each team member. See Figure 29. The following parameters are reported:

Coach ID

This is the identification number of the present team coach. When the coach is lost, the next coach generated will have a higher ID number.

Coach Present

This indicates the team coach is present at this team member and shows the coach status.

Coach Counter

This is the number of times the present coach has arrived at team members. This is used with the Coach ID to validate the coach when it arrives.

Coach Flags

This indicates the coach has arrived and left this team member. It shows that team data has been refreshed.

Coach Sw Rec

This indicates the coach is present at this team, it indicates where the coach is executing.

Team Visit Time

This indicates the remaining time in seconds before a new coach is generated. This timer is refreshed while the coach is present. This team member will generate a new coach if the coach does not return and the timer expires.

Crumb Trail

This is a database record allowing team functions to span multiple teams. Provides a path back to the originating team.

RTN Activity

This is a database record indicating where the **Return to Normal** process originated.

Present Source

This is a database record showing the team member through which the line segment is presently receiving power.

Segment Limit

This is the number of line segments allowed to be restored on this circuit. It is the lesser of the limit configured by the **Line Segment Limit** setpoint on the *Setup>Restoration>IntelliTeam SG>Team x* screen and the limits set in the adjacent source-side teams.

Extended Load

This report notes extended team loading, which includes the line-segment loading and all downstream load.

Local RT Load

This is the local real-time load on the line segment protected by this team.

Local Capacity

This is the loading capacity of the local team. This value is compared with the remote capacity of the adjacent source-side team to determine the real capacity of the team.

Real Capacity

This is the loading capacity available on the line segment protected by this team.

Segments Added

This is the number of segments presently added. The team compares this value to the **Line Segment Limit** setting on the *Setup>Restoration>IntelliTeam SG>Team x* screen when a Transfer event occurs

The table in the center of the *Task and Coach Analysis* screen shows tasks presently being executed. S&C Electric Company uses this information for diagnostic purposes.

TaskID

This identifies the task being executed.

TaskOwn

This indicates the team in which the task is being executed. A task may require global execution at all team members.

TaskSeq

This is the sequence number of the task being executed.

TaskTTR

This is the time-to-run for the task being executed.

Visit Timer

This indicates the remaining time in seconds before the coach should visit a specific team member. The coach carries the timer, which will only update while the coach is at the team member.

Event Sequence

This is the sequence number of the last event received from this team member.
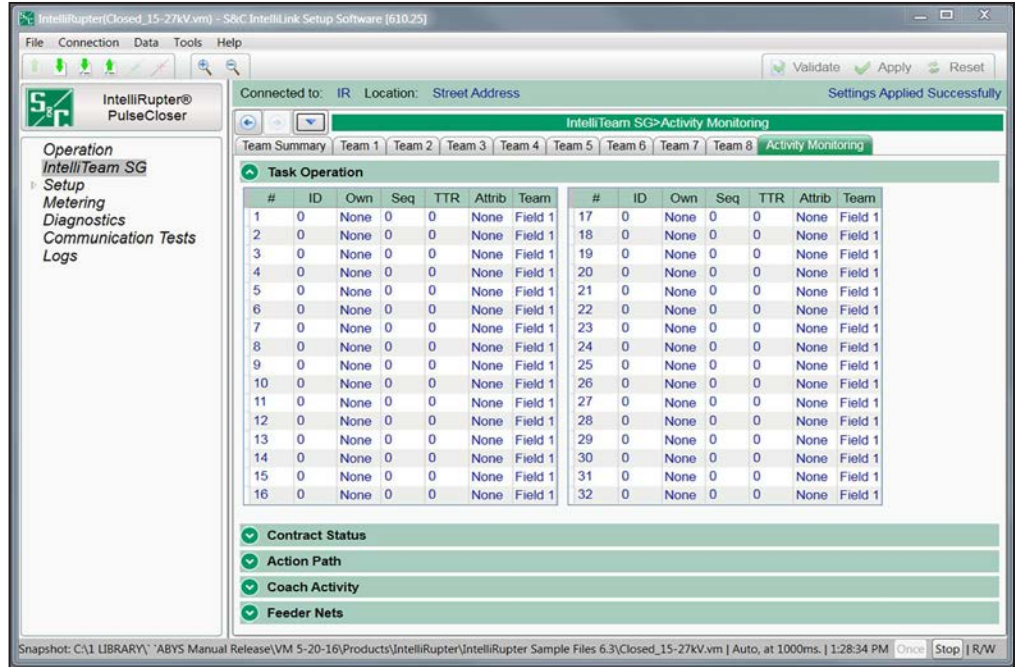
Task Operation

Figure 30. The *IntelliTeam SG>Activity Monitoring>Task Operation* screen.

Figure 30 shows tasks presently being executed by the team member. S&C Electric Company uses this information for diagnostic purposes. The following parameters are reported:

ID
This identifies the task being executed.

Own
This is the team database record associated with the execution of this task.

Seq
This is the sequence number of the task being executed.

TTR
This is the time to run for the task being executed.

Attrib
This is the lock and execute attributes associated with the task being executed.

Team
This is the team number associated with execution of this task.
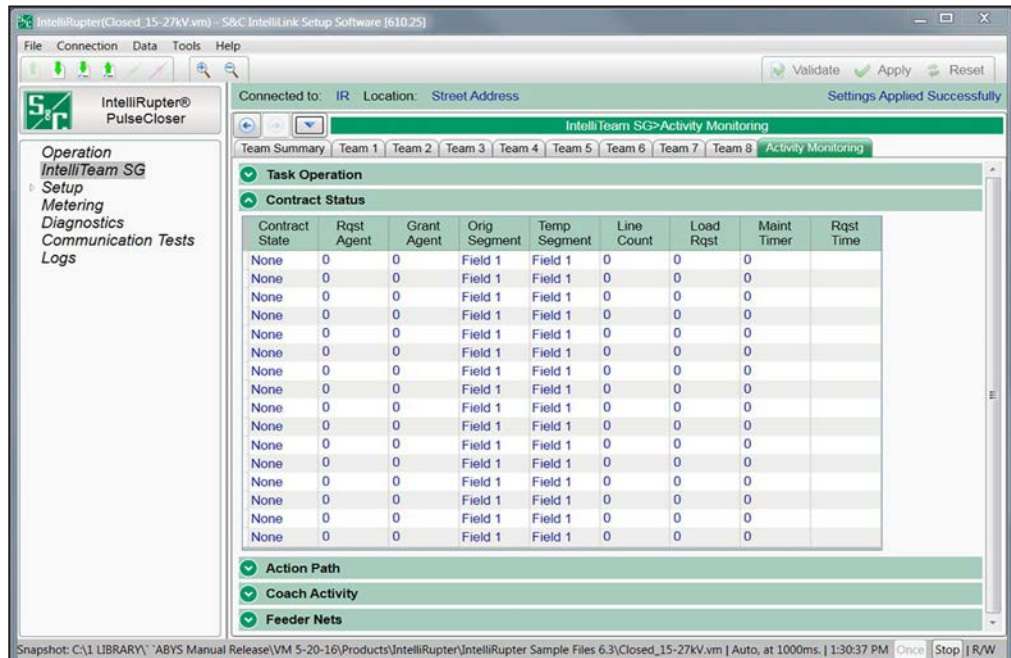
Contract Status

Figure 31. The *IntelliTeam SG>Activity Monitoring>Contract Status* screen.

Figure 31 shows information about contracts associated with this team member. S&C Electric Company uses this information for diagnostic purposes.

When a contract is required for a particular line segment, the contract agent is used to track and secure the contract. Every contract request is uniquely identified by the requesting agent and the originating segment, and it is time stamped when the request is made.

Contract State

This field shows the present state of the contract. Possible values are:

Active—The contract has been granted and is presently active.

Rqst unsent—The contract agent received a contract request from the team member, but has not yet sent the request to the next contract agent.

Rqst pending—The contract request is pending.

Rqst travel—The contract agent is forwarding the contract because the decision to grant the contract cannot be made at this location.

Rqst accept—The contract request was accepted by this agent and contract approval is traveling to the originating agent. The contract is approved when contract approval arrives at the originating agent.

Rqst decline—The contract request was declined by this agent. The request is returned to the originating agent.

Decline cont.—A declined message is being transmitted to the requesting agent.

Dissolve start—An agent (usually the requesting agent) is dissolving the contract.

Dissolve cont.—A dissolve message is being transmitted.

Maint start—The maintenance timer on an active contract has expired, causing the maintenance action to occur.

Maint tickle—The contract agent has not recently received a maintenance message for the contract and sends a reminder to the requesting agent to determine whether the contract is still required.

Maint travel—A maintenance message is being transmitted from the requesting agent to other agents along the contract route.

Maint tra NF—The contract agent received a maintenance message for a contract that is not found in its list.

Maint tra NF rt—A **Maint tra NF** message is being returned to the requesting agent. This message can also appear at other agents along the contract route.

Maint tic NF—The contract agent received a tickle message for a contract that is not found in its list.

Maint tic NF rt—A **Maint tic NF** message is being returned to the agent that initiated the tickle. This message can also appear at other agents along the contract route.

Maint restart—The requesting agent confirmed that it still needs the contract, and the maintenance timer is restarted.

Maint res cont.—A **Restart** message is being passed to other agents along the contract route.

Rqst Agent

This is the agent that requested the contract.

Grant Agent

This is the agent that approved the contract.

Orig Segment

This is the database record number for the segment where the contract request originated.

Temp Segment

This is the database record number for the present location of the contract request.

Line Count

This is the number of line segments that will be picked up if the contract request is granted. This value is usually 1.

Load Rqst

This is the amount of load that will be picked up if the contract request is granted.

Maint Timer

After a contract request is granted, this is the time remaining before contract maintenance should be performed. When a contract is no longer needed, the requesting agent sends a message to dissolve the contract. If the local contract agent does not receive a response within the timer setting, it checks with the requesting agent. The requesting agent can extend the contract if it is still needed or dissolve the contract if it is no longer required.

Rqst Time

This is the date and time when the contract was requested.

Action Path

The *IntelliTeam SG>Activity Monitoring>Action Path* screen shows a table of the actions taken during the execution of a switch operation. This information is used for diagnostic purposes when working with S&C support engineers. See Figure 32.

Some switchgear requires different steps to be taken during the operation of the switch than other gear. These steps are often further changed by the configuration of switch parameters, the team parameters, and the conditions of the event. Together the steps are called the action path. The action path displayed in this table is created on the fly based on the present conditions during each event.
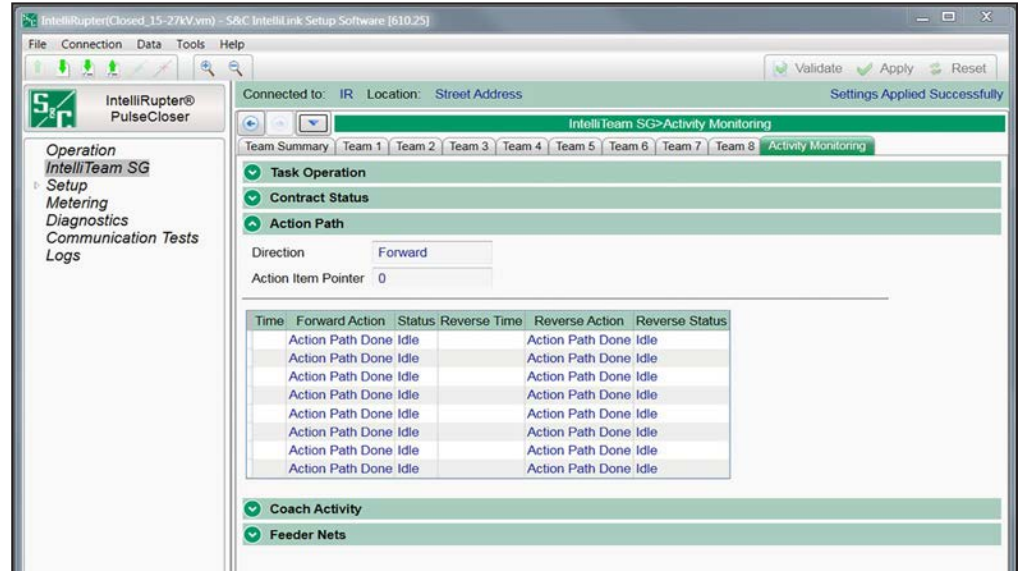

Figure 32. The *IntelliTeam SG>Activity Monitoring>Action Path* screen.

The screen shown in Figure 32 reports the actions taken during execution of a team member operation. S&C Electric Company uses this information for diagnostic purposes.

Backing out of an action path may occur when one of the steps cannot be performed. This will require that the team member be returned to its normal state.

The following information is reported for the action path:

Direction

This is the direction the action path is presently taking. Reversing the action path will only occur if the forward path is stopped before completion.

Action Item Pointer

This is the record within the action path that is presently being executed. S&C Electric Company uses this information for diagnostic purposes.

Time or Reverse Time

This is the time stamp of the action.

Forward Action / Reverse Action

This is the name of the step to be taken during execution of the action path and the time stamp at the start of that step. Step names that may be displayed include:

- Action path done
- Close for xfer
- Contract request
- Contract terminate
- Block recloser
- Unblock recloser
- Block ground trip
- Unblock ground trip
- Alternate settings
- Normal settings
- Status

Status

This is the status of the associated step in the action path and the relative time at which this step occurred. The status can be reported as: **Idle**, **Running**, **Failed**, or **Success**.
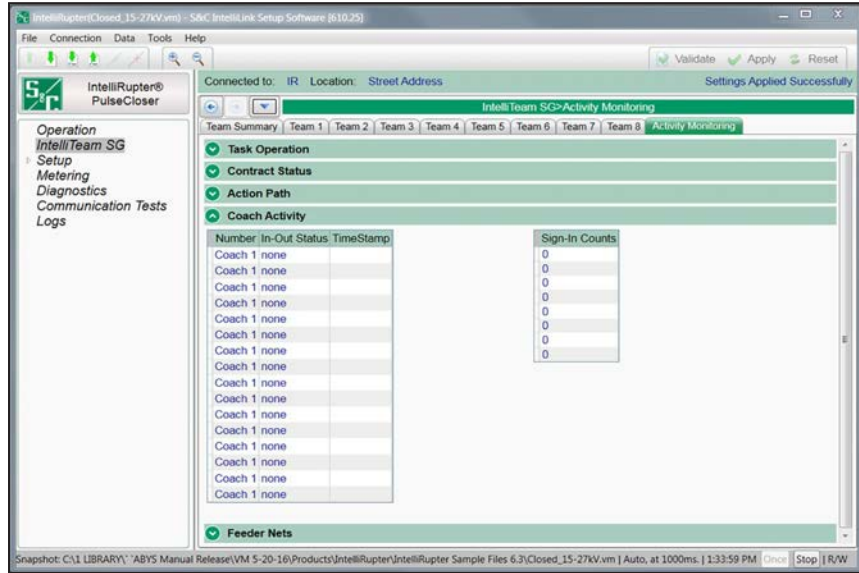
Coach Activity

Figure 33. The *IntelliTeam SG>Activity Monitoring>Coach Activity* screen.

The screen shown in Figure 33 has time stamps for basic coach activities and the counter for each team's coach. It includes the following information:

Number

This is the coach/team number.

In-Out Status

This is the coach activity signing in or going to the specified team member (Rec 1, Rec 2, etc.).

Time Stamp

This is the date and time when the activity occurred.

Sign-In Counts

This is the ongoing count for each team's coach.
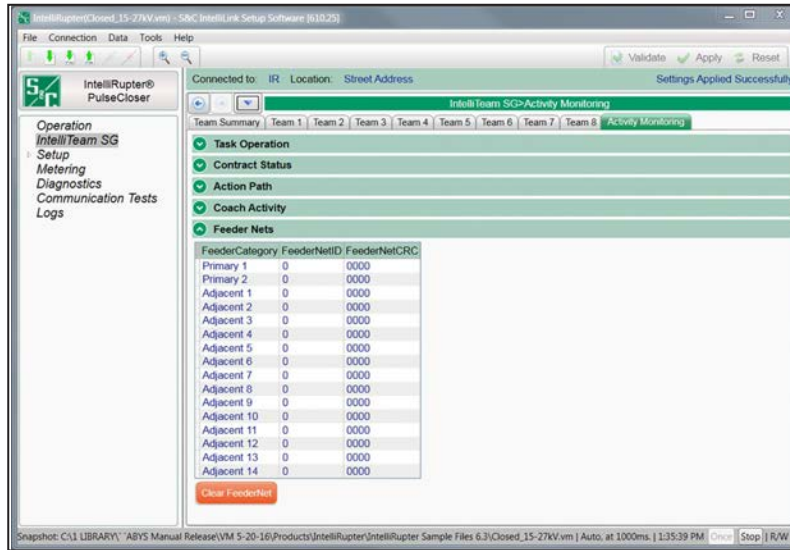
FeederNets

Figure 34. The *IntelliTeam SG>Activity Monitoring>Feeder Nets* screen.

The screen shown in Figure 34 contains data associated with the Feeder Netlists. The following parameters are displayed:

Feeder Category

The FeederNet is a database of the teams and controls that use the same breaker at a substation (or equivalent source) as their primary power source. These categories may be displayed:

Primary 1—Every switch has a Primary 1 FeederNet associated with its primary substation breaker.

Primary 2—Only a tie-point control will have a Primary 2 FeederNet associated with the adjacent substation breaker for this tie point.

Adjacent—This is the FeederNet on the other side of the tie point. These are listed for every tie point on the primary feeder. There will generally be as many adjacent FeederNets listed as there are alternate sources for the primary feeder.

FeederNet ID

This is the unique identifier assigned by the IntelliTeam® Designer system that defines a specific substation breaker (or equivalent) and the circuit it supplies out to the end loads and/or open tie points.

FeederNet CRC

This is the cyclic redundancy check (CRC), a value calculated for a specific FeederNet configuration. The CRC changes when any FeederNet data are changed. It is used to identify a specific FeederNet configuration version.

Clear FeederNet Button

This command clears the stored FeederNet data. When cleared, a new FeederNet list must be pushed.
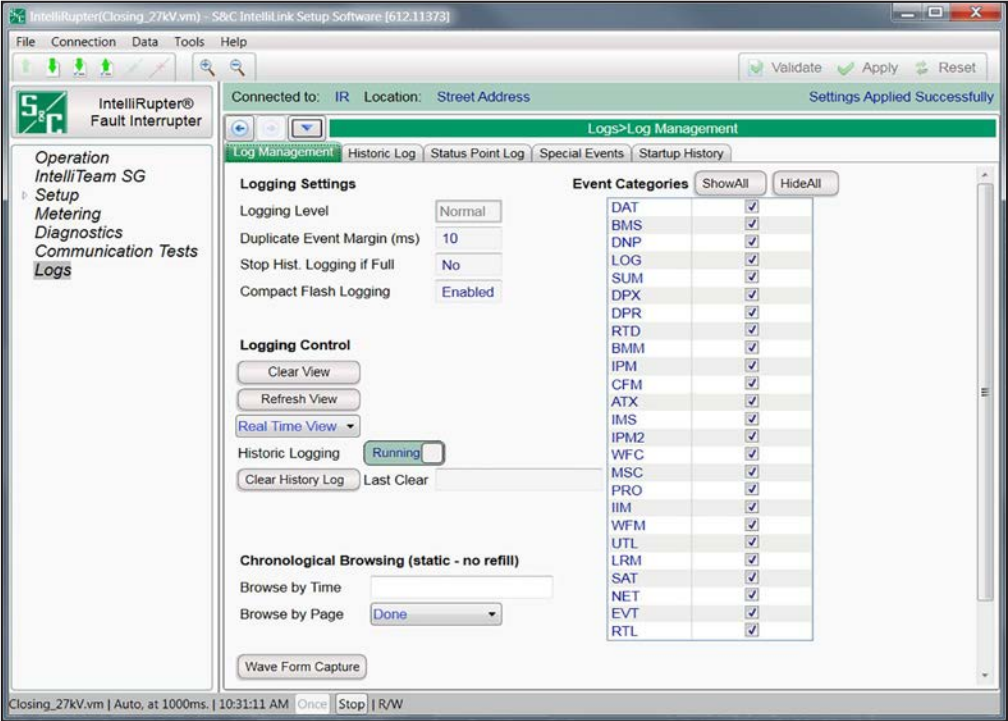
Data Logging Setup

Figure 35. The *Logs>Log Management* screen.

The screen shown in Figure 35 is used to configure the filter settings for viewing log screens. The Administrative login is required to execute any of the log-control functions. The following parameters are shown:

Logging Settings

Logging Level

The logging level selected determines the type of data-log messages captured in the base memory module (for an IntelliRupter fault interrupter) and is displayed on the *Logs>Historic Log* screen. Every data-log message is assigned a specific log level:

Normal—User information

Extended—User information and internal status

All—User information, internal status, and internal trace/debugging information

Duplicate Event Margin (milliseconds)

Storing identical events in a short time period can flood internal memory and does not provide useful diagnostic information. By configuring the time between duplicate-event log entries, this setpoint determines which data will be stored in the internal memory and be displayed on the *Logs>Historic Log* screen. It has no effect on an alternating sequence of events.

Two events are considered duplicates when every element of their event records match, such as when the **Duplicate Event Margin** setting is 10 ms. and the sequence of events ABABAB (where A and B are different) has every event occur 1 ms after the previous one. The identical events occur within 2 ms, well within the value of the set point, but all events will be logged because events are alternating. (Range = 0-30, increment = 1.)

Stop Historic Logging if Full

This setting stops logging events when the Historic log is full and subsequent events are discarded without overwriting contents of the log. Flash memory logging and the **Status Point Log** and **Special Events** counter logging are not affected by this setpoint. This setting factory set to the **No** setting to ensure continued event logging.

Compact Flash Logging

When enabled, every historic event generated is written to flash memory. **Logging Level** and **Duplicate Event Margin** setpoints do not prevent an event from being written to flash memory. Flash memory logging preserves as much data as possible. Flash memory data can be retrieved with IntelliLink Setup Software. Open the **Tools** option on the menu bar and click on the **Compact Flash Access** option. Select and save any files needed. S&C strongly recommends enabling the **Compact Flash Logging** setting to simplify diagnostic and troubleshooting work.

Event Categories

Select the categories that will be displayed on the *Logs>Historic Log* screen. To display only the most important operation information, select the EVT category and click the **Refresh View** button. Utility operation data will be displayed and log information for software troubleshooting and debugging will be omitted.

Logging Control

Complete data are stored in the Historic log in flash memory. Flash memory files can be downloaded by opening the **File** option on the menu bar and clicking on the **Flash Memory Files** option. The complete Historic log (up to a million events) cannot be viewed through IntelliLink software, but a small subset of the Historic log (160 events) is displayed on the *Logs>Historic Log* screen. Event filters can be applied to the *Logs>Historic Log* screen, but these filters do not affect entry of events in the Historic Event Log.

Clear View

This button clears all data on the *Logs>Historic Log* screen. In **Real-Time View** mode, the next qualifying event will be placed at the top of the *Logs>Historic Log* screen. In **Static View** mode, the *Logs>Historic Log* screen will remain empty until it is completely refilled.

Refresh View

This button clears the present contents of the *Logs>Historic Log* screen and loads up 160 events from the Historic log in ascending chronological order. Only events satisfying the checked **Event Categories** options are displayed on the *Logs>Historic Log* screen.

Real Time View or Static View

Use this drop-down menu to select the view mode. **Real Time View** mode loads the latest data on the screen, and **Static View** mode freezes data on the *Logs>Historic Log* screen.

Historic Logging

Running—Starts the Historic log but does not affect flash memory logging, Status Point Log entries, or Special Events logging.

Stopped—This setting stops the Historic log but does not affect flash memory logging, Status Point Log entries, or Special Events logging. Subsequent events will not be put into the Historic log, preventing newer events from overwriting older events. Be sure to return the **Historic Logging** mode to the **Running** setting so future events will be logged.

Clear History Log

This button clears all data in the Historic log. It does not affect flash memory logging, Status Point log entries, or Special Events logging. The date and time of the last **Clear History Log** command are displayed. Clearing the Historic log permanently deletes all event data. If needing to preserve event data, generate an HTML report of logged data before clearing the log.

Chronological Browsing (static – no refill)

Chronological browsing is only available in the **Static View** mode. It is not available in the **Real Time View** mode. Because the size of the *Logs>Historic Log* screen is only a fraction of that of the Historic log, the Historic log must be navigated chronologically, either in **Browse By Time** mode or **Browse By Page** mode.

Browse By Time

This loads up to 160 events that occurred at or after the specific time entered. Only events that satisfy the event categories criterion are placed in the *Logs>Historic Log* screen. If all events in the Historic log occurred before the specified time, the oldest-available events are placed in the *Logs>Historic Log* screen. The *Logs>Historic Log* screen is refilled as soon as the specific time is entered; the specified time is cleared when the refill is complete.

Browse By Page

Historic Log pages can be browsed four ways:

Oldest 8 Pages—Loads up to 160 of the oldest-qualifying events from the Historic Event Log

Newest 8 Pages—Loads up to 160 of the newest-qualifying events from the Historic Event Log

Previous 8 Pages—Loads up to 160 previous events relative to the events currently in the *Logs>Historic Log* screen

Next 8 Pages—Loads up to 160 next events relative to the events currently in the *Logs>Historic Log* screen

When the selection is entered, the *Logs>Historic Log* screen is refilled immediately. Because the Historic log is circular, selecting the **Previous 8 Pages** option may cause the newest events to be displayed (if the *Logs>Historic Log* screen presently holds the oldest). Similarly, selecting the **Next 8 Pages** option may cause the oldest events to be displayed (if the *Logs>Historic Log* screen presently holds the newest).

Waveform Capture

Manual Commands Trigger a Waveform Capture

- Click on the **Wave Form Capture** button

- Issue the SCADA **Execute Waveform Capture** command

Automatic Actions Trigger a Waveform Capture

- Any Open, Close, or Trip event

- Any protection element enters a timing state

- When a protection element is still timing additional waveform captures are triggered to record the entire event

- A test using PulseClosing Technology starts (Additional wave form captures are not triggered during the **PulseTest** sequence.)

Protection Elements Trigger a Waveform Capture

- **Overcurrent** elements

- **Definite Time**, **Current Supervised Under Voltage** element (used for sectionalizing)

- **Definite Time Under/Over Voltage** element

- **Definite Time Under/Over Frequency** element

- **Ground Trip Delay** element

- **Negative Sequence Trip Delay** element

Abnormal Change of State Triggers a Waveform Capture

- Pole errors

- Loss of power

- **IMS Low Charge Rate** alarm

- **IPM Charge Disabled** alarm

- **Leakage Current Check** error

- Leakage current survey (test)

The waveform captures are stored in compact flash memory. Select the **Tools> Compact Flash Access** menu options to retrieve the file.
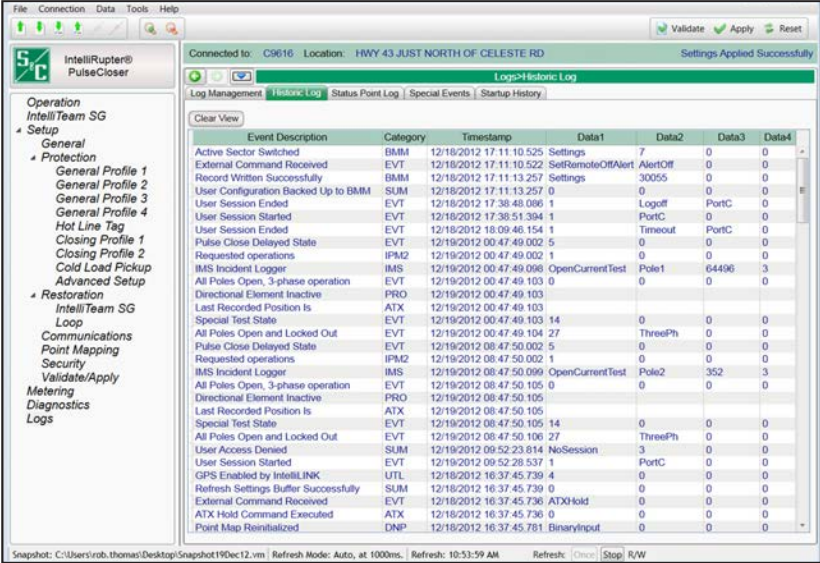
Historic Log

Figure 36. The *Logs>Historic Log* screen.

The screen shown in Figure 36 displays the Historic log, a subset of the Historic Event log. It is a chronological listing of events filtered based on the criteria specified on the *Logs>Log Management* screen. In **Real-Time View** mode, when the log is full each new event overwrites the oldest event in the log.

The Historic log does not show the entire Historic log, which is stored in flash memory. Flash memory files can be downloaded by opening the **Tools** option on the menu bar and clicking on the **Compact Flash Access…** option. Select and save any files needed. The following parameters are shown:

Clear View

This button empties the Historic log. In **Real Time View** mode, the next qualifying event will be placed at the top of the log. In **Static View** mode, the log will remain empty until it is refilled.

Event Description

This field provides the description for each event.

Category

Each historic event is assigned to a category to simplify filtering and sorting.

Time Stamp

The date and time of the event occurrence based on the **Time Source Synchronization** setting on the *Setup>General>Time* screen.

Data 1, Data 2, Data 3, Data 4

Each event message, in conjunction with the Data 1 through Data 4 code, describes the event and action(s) taken. S&C Electric Company uses any value(s) in the other data columns for diagnostic purposes if an event message refers only to Data 1.
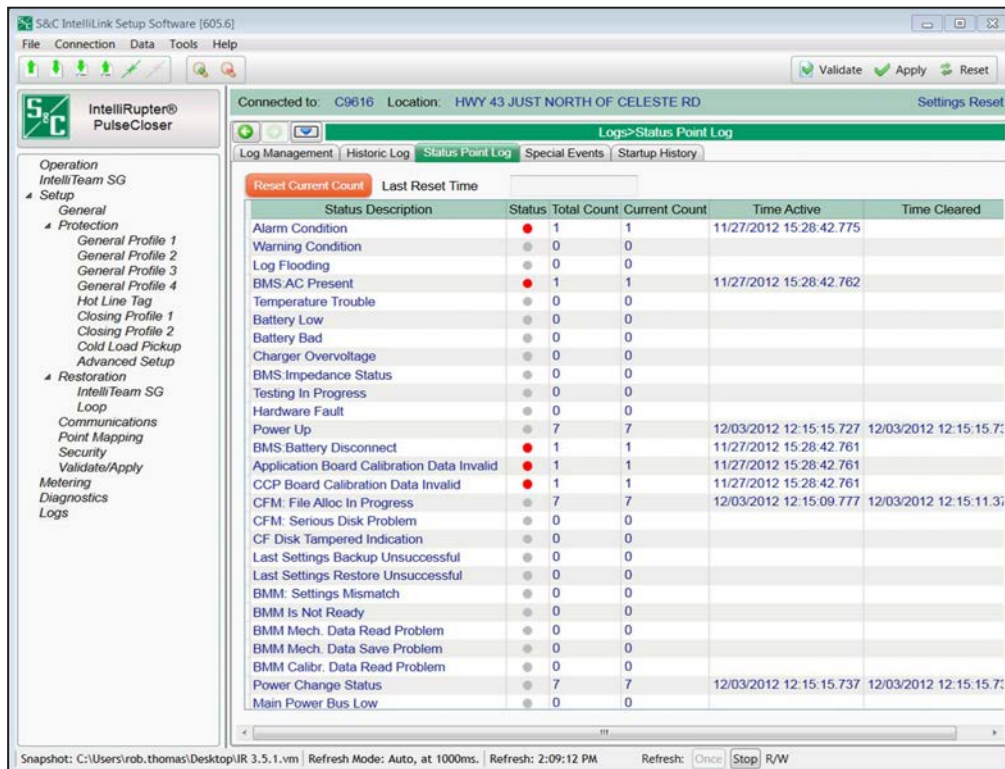
Status Point Log

Figure 37. The *Logs>Status Point Log* screen.

The screen shown in Figure 37 indicates whether a status point is active or inactive, how many times it has been active, when it last became active, and when it last became inactive. Two Historic events are associated with each status point in the Historic log—when the status point became active and when it became inactive.

For example, if a status point has been active 100 times and is active now, 199 related events are included in the Historic log—100 for the status point becoming active, and 99 for the status point becoming inactive. The *Logs>Status Point Log* screen is a convenience; this information is also available in the Historic log.

Reset Current Count

This button resets the current count column of the table displayed on the screen.

Last Reset Time

This is the date and time the current count total was reset.

Status Description

The definition of each status point is available in S&C Instruction Sheet 766-560, "IntelliRupter® PulseCloser® Fault Interrupter: *DNP Points List and Implementation*."

Status

This shows the state of the status point: a red dot indicates active, and a gray dot indicates inactive.

Total Count

This is the total number of times the status point has been active.

Current Count

This is the number of times the status point has been active after a **Reset Current Count** button command.

Time Active

This is the date and time the status point last became active after a **Reset Current Count** button command.

Time Cleared

This is the date and time the status point last became inactive because the status point counters were reset.
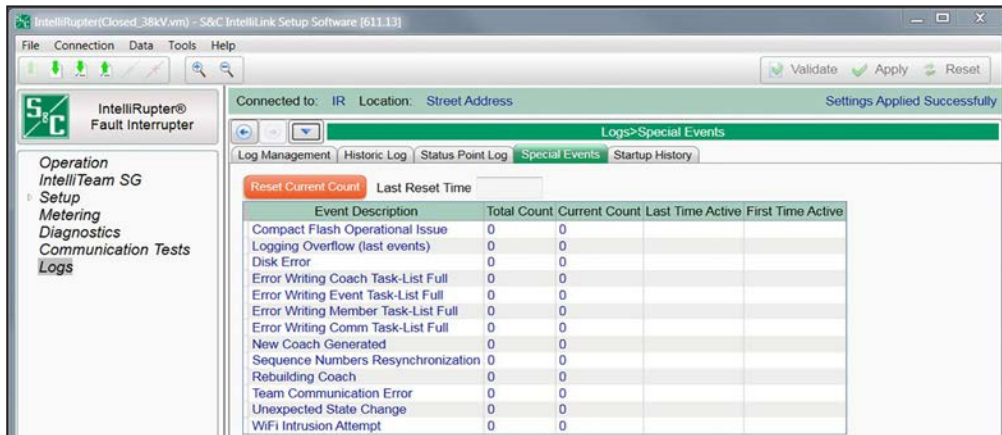
Special Events

Figure 38. The *Logs>Special Events* screen.

The screen shown in Figure 38 shows Special events. Some Historic events are Special events, such as when a flash memory failure will adversely impact operation. This screen indicates how many times each special event has occurred, the last time it occurred, and the last time it cleared. The following parameters are shown:

Reset Current Count

This button resets the current count column of the table displayed on the screen.

Last Reset Time

Date and time the current count totals were reset.

Event Description

See S&C Instruction Sheet 766-561, "IntelliRupter® PulseCloser® Fault Interrupter: *Data Log Messages*" for the definition of each event.

Total Count

This is the total number of times the special event has occurred.

Current Count

This is the number of times the special event has occurred since the last reset using the **Reset Current Count** button on this screen.

Last Time Active

This is the date and time the special event last became active since the current count was reset.

First Time Active

This is the date and time the special event first became active since the current count was reset.
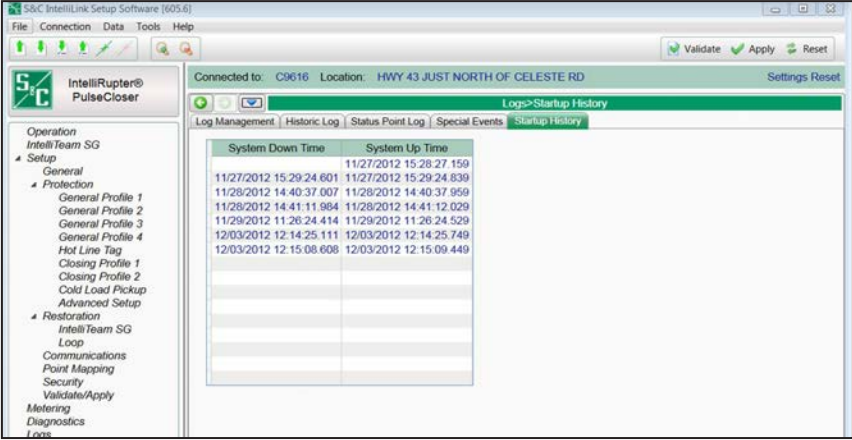
Startup History

Figure 39. The *Logs>Startup History* screen.

The screen shown in Figure 39 displays system start and stop time stamps, in ascending order. The following parameters are shown:

System Down Time

This is the date and time power to the control was lost.

System Up Time

This is the date and time power to the control was restored.

Compact Flash Log

When **Compact Flash Logging** mode is enabled (from the *Logs>Log Management* screen), every historic event generated by the IntelliRupter fault interrupter is written to flash memory, even if historic event logging has been stopped for the Historic log or the event does not satisfy logging criteria.

Only the IntelliNode™ Interface Module has a removable compact flash memory card. The 6800 Series Automatic Switch Controls, the 6801M Automatic Switch Operators, and the IntelliRupter PulseCloser Fault Interrupters use flash memory that cannot be removed. However, the screens and descriptions refer to the permanent flash memory as "compact flash" memory.

The IntelliRupter fault interrupter uses 100 pre-allocated fixed-size files to store historic event data in the compact flash memory and stores over 1,000,000 events. The files are named LOG00.VM, LOG01.VM…LOG98.VM, LOG99.VM, and are all a very similar size. Files are continuously reused. When data logging fills all 100 files, LOG00.VM will be opened again, and new events written, starting at the beginning of the file and replacing the oldest events. This means that after all 100 files have been used, at any given moment, one of the files is circular, without a fixed beginning.

Note: The number of event entries in a full file is about 10,000, but this is not a precise count and varies slightly for each file. This means that a reused file is likely to contain a small amount of very old data at the end. The older events are identified by their time stamp. Sometimes data being stored to a file are interrupted, usually by a power loss or Compact Flash card removal. In this case, data logging assumes that the file is corrupted, saves it under a unique name such as "AABBCCDD.err", and creates a new file for future use. A corrupted file like this can still be useful because usually only a small amount of data has been corrupted.

Viewing Compact Flash Data

The Compact Flash Memory logs cannot be viewed using IntelliLink software; they must be downloaded to a computer. See Figure 40.
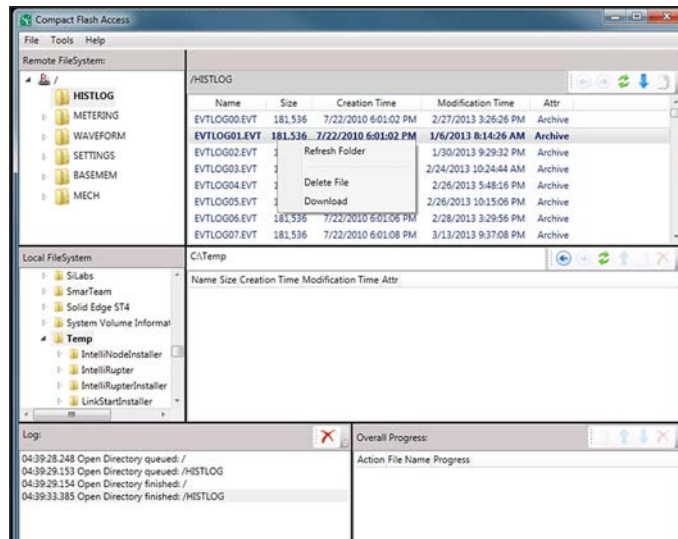

Figure 40. The Compact Flash Access dialog box.

Follow these steps to download the log files:

STEP 1. In the **Tools** pull-down menu, select the **Compact Flash Access…** option to open the Compact Flash Access dialog box.

STEP 2. In the "Local File System" section of the screen, select the target directory for the file download.

STEP 3. In the "Remote File System" section of the screen, select the HISTLOG folder.

STEP 4. Select the file to download.

STEP 5. Right click the selected file and select the **Download** option.

The download progress will display in the lower right corner of the Compact Flash Explorer dialog box. Wait until the download has completed and navigate to the downloaded file to view it. An .xml and an .html version of the file will be created in the target directory.

NOTICE
To view waveform capture files, first install WaveWin software on the computer. See S&C Instruction Sheet 766-571, "IntelliRupter® PulseCloser® Fault Interrupter: *Software Installation*," for software-installation instructions.

When troubleshooting events, first download Waveform Capture files and Historic log files. Click on the modification time header to have the files sort according to the modification date, and select the files in the date range of the event to be analyzed.

Always save a Snapshot file for the **Main IntelliLink File** menu and download the Waveform Capture and Historic Log files related to an event when contacting S&C. If there is a mechanism issue, also include the MECH files beginning from the time the issue began.

Connection Problems

This section provides guidance for troubleshooting connection problems after installing LinkStart Version 3 Wi-Fi interfacing software for IntelliRupter fault interrupters. The troubleshooting steps can also be used as an installation checklist for identifying potential problems, or conflicting software, on the user's computer.

These instructions are generally applicable to other S&C automation controls with Wi-Fi capability.

Connection problems fall into the following general categories:

- The software fails to connect with the desired unit, and no signal strength is shown in the *LinkStart Connection* screen.

- The signal strength is shown temporarily, but the connection process does not complete.

- The connection process completes, but the connection cannot be maintained reliably, or cannot be maintained at all.

- The Wi-Fi connection is reliable, but IntelliLink Setup Software or DU.exe will not successfully connect.

- The Wi-Fi connection is successful, but the connection is lost after a control firmware download.

Unfortunately, there are numerous problems that can manifest themselves in different symptom categories, so diagnosis of any problem should consist of following the complete checklist from beginning to end. It is strongly advised going through the entire checklist before contacting S&C Electric Company.

This document focuses almost entirely on the software environment of a computer intended to access an IntelliRupter fault interrupter. This is not a troubleshooting guide for IntelliRupter fault interrupter firmware.

Installation of software and drivers requires administrative privileges on the computer. It is very advantageous to have access to the Internet so replacements for obsolete drivers or other software can be obtained if necessary.

NOTICE
Confirm that the S&C device is energized. The STATUS lamp on the IntelliRupter fault interrupter will blink once every 30 seconds when it is energized and operational.

Contacting S&C

If troubleshooting does not resolve the problem, generate a Microsoft System Information report on the computer and contact the S&C Global Support and Monitoring Center by following this procedure:

STEP 1. Run the program: C:\Program Files\Common Files\Microsoft Shared\MSInfo\msinfo32.exe.

STEP 2. On the **File** menu, click on the "Save" entry.

STEP 3. Zip the output file and email it to: **GSMC@sandc.com**.

STEP 4. Call the S&C Global Support and Monitoring Center at (888) 762-1100.

Wi-Fi Troubleshooting Procedure

If a conflict is discovered between the settings specifications, software/driver versions, or other requirements listed in this guide and the target computer, the conflict should be resolved and the computer rebooted before continuing the troubleshooting procedure.

The following steps are used for Wi-Fi connection problems:

STEP 1. Go to the **Add/Remove Programs** menu entry, and check whether LinkStart v2 or v3 is installed. Version v2 and/or v3 must be uninstalled before installing LinkStart v4. If version v2, or versions v2 and v3, are installed, remove both and reinstall LinkStart version v4 only.

STEP 2. Make sure the driver for the Wi-Fi interface on the computer is up to date. Be particularly sensitive to Intel 3945 and 4935 Wi-Fi interfaces because older versions of the drivers for these interfaces have known problems.

Check the computer manufacturer's website for up-to-date drivers. If the updates are not there, contact the manufacturer of the hardware interface.

The Intel AC 8260 Wi-Fi Adapter and the Intel Dual Band Wireless-AC 7260 require the latest driver. If issues are observed with these adapters, update to the latest driver.

STEP 3. Any Wi-Fi-specific PC software such as connection managers, with the exception of the Windows Zero Configuration Service (WZC), will likely cause problems with LinkStart connection establishment and reliability. Disabling these managers is usually enough to resolve any problems, but sometimes it is necessary to uninstall them.

Note also any computer software that is Wi-Fi sensitive or specific in any way will likely cause a potential conflict. The typical conflicts that occur are with:

(a) Intel PROSet—If it is active, open its *Interface* screen and disable it by selecting the **Let WZC manage the connection** option.

(b) AT&T Cellular Interface—Configure it so it does not attempt to manage the Wi-Fi connection.

(c) AT&T Airport Connection Software Boingo Wireless

(d) Cisco AnyConnect VPN Client

STEP 4. Check both firewall and antivirus software. Make sure both the firewall and antivirus software have either been configured to allow LinkStart and the related S&C applications to operate (see the "Symantec Endpoint Protection" section on page 109 for the list of exclusions to configure), or disable both the antivirus and firewall software, at least for testing purposes.

Certain programs such as "Symantec Endpoint Protection" will automatically re-enable certain features after a brief time. To be sure these features are disabled during testing, first enable the software and then immediately disable it.

STEP 5. Make Wi-Fi operational on the computer.

(a) Set the Wi-Fi adapter power setting to the **Maximum Performance** setting.

(b) Turn off **Airplane** mode.

(c) Turn on the manual Wi-Fi switch, if present. Many wireless-equipped laptop computers have a slide switch to enable Wi-Fi operation, while others use a combination of key strokes to enable/disable the Wi-Fi adapter. Because the Wi-Fi device driver may not know the state of the on-off control, make sure to know how to turn on Wi-Fi operation.

STEP 6. Start the LinkStart software. Verify the LinkStart software is using the correct Wi-Fi adapter, and attempt to connect to the desired IntelliRupter fault interrupter.

STEP 7. Verify the IntelliRupter fault interrupter being connect to has power and the correct IntelliRupter fault interrupter serial number displays in the serial number field on the *LinkStart* screen.

STEP 8. When unable to connect, attempt a connection using the Universal Serial Number 00-0000000.

STEP 9. If the laptop will not connect even to the Universal Serial Number, confirm the Wi-Fi antenna is connected internally. Remove the large, outer bolts from the panel holding the Wi-Fi antenna in place and confirm the antenna lead remains connected to the external antenna.

STEP 10. If the lead is connected and Wi-Fi is still not functional, replace the communication module with known good module.

STEP 11. If Wi-Fi is restored, issue an RMA for the original communication module.

STEP 12. If a signal strength indication can't be seen, verify the Wi-Fi adapter is turned on. See Step 5 on page 105.

STEP 13. If there is signal strength and the connection process has completed, select Intel-liLink software. If the IntelliLink software does not connect (no *Logon* screen appears), verify both virtual LEDs on the LinkStart software screen are green.

If they are not (right side LED is red) but there is still a connection, swap or reinsert first the communication module and then the control module to isolate the problem.

STEP 14. If both LEDs are green, then there should be a logon prompt that enables a log in. If not, then there is probably a problem with conflicting Wi-Fi management or with antivirus or firewall software on the computer. Contact the S&C Global Support and Monitoring Center for help with Wi-Fi connection troubleshooting.

STEP 15. LinkStart cannot connect to an IntelliRupter fault interrupter docking station.

(a) Confirm the Wi-Fi jumper has been installed on the docking station.

(b) If the Omicron Test Set is being used with the control module, remove the Omicron Test Set, reinstall the control module, and start the LinkStart software again.

Note: LinkStart software generates logs to aid with troubleshooting. They can be found at: C:\Users\Public\Documents\S&C Electric\LinkStart. Be sure to include the latest logs when contacting the S&C Global Support and Monitoring Center for support.

IP Addresses

Wi-Fi Module

The Wi-Fi module has a fixed IP address of 192.168.101.1.

LinkStart

LinkStart acquires a random IP address on the 192.168.101.0/24 subnet in the range 192.168.101.2 to 192.168.101.254 on the 802.11 network adapter.

For some operations it binds to the local host loopback IP address of 127.0.0.1.

Note: Windows 10 may not provide a usable IP address. The command "ipconfig" can be run from the command prompt to determine whether an appropriate IP address was obtained. If not, troubleshooting tips can be found at this link: **www.sysprobs.com/fixed-windows-10-limited connectivity-not-getting-ip-from dhcp**.

LinkStart Port Use

Tables 6 and 7 show the ports used by LinkStart software but do not include dynamically assigned ports (IPPORT_ANY) assigned by the system when LinkStart connects to well-known ports on the Wi-Fi module.

Table 6. LinkStart Port Use on the 802.11 Adapter interface (192.168.101.2 to 192.168.101.254)

Port	Protocol	Comment
1006	UDP/In	V3 Message Protocol. Receive Wi-Fi module responses to messages initiated by the LinkStart software
1007	UDP/In	V3 Message Protocol. Receive messages initiated by the Wi-Fi module
1008	UDP/In	V3 Detailed Logging
1021	UDP/In	Receive KeepAlive from the Wi-Fi module

Table 7. LinkStart Port Use on the Local Host Loopback IP Interface (for R0 communication modules, use 127.0.0.1; for R3 communication modules, use 192.168.101.1)

Port	Protocol	Comment
20000	UDP	UDP COM Bridge: LinkStart software to IntelliRupter fault interrupter
20001	UDP	UDP COM Bridge: IntelliRupter software to LinkStart
9797	UDP	SDA-4554R3-xxx (R3) communication module

Wi-Fi Module Port Use

Table 8 shows the ports used by the Wi-Fi module:

Table 8. SDA-4540-xxx Wi-Fi Module Port Use

Port	Protocol	Comment
116	TCP	V3 file upload
1002	UDP	UDP COM Bridge, LinkStart to Wi-Fi module
1006	UDP	V3 message protocol. Messages initiated by LinkStart
1007	UDP	V3 message protocol. Messages initiated by Wi-Fi module
1008	TCP	V3 file download
1020	UDP	KeepAlive
8828	TCP	VCOM router (e.g., RadioShop…)
8888	TCP	RSA authentication

Table 9 shows the default ports used by the SDA-4540R3-xxx communication module Wi-Fi module (These are user-configurable with a range of 1024 to 65535.):

Table 9. SDA-4540R3-xxx Wi-Fi Module Port Use

Port	Protocol	Comment
9797	UDP	(R3) IntelliLink UDP port
8828	TCP	(R3) VCOM TCP port
8829	UDP	(R3) Comm Module Keep-alive port

Firewall Settings

Figure 41 shows a typical firewall configuration:

Figure 41. This is a representation of the allowances the firewall could make.

Note: In LinkStart V4, the TCP/IP Ports are configurable. S&C recommends using the default settings in Table 9 and shown in Figure 42.
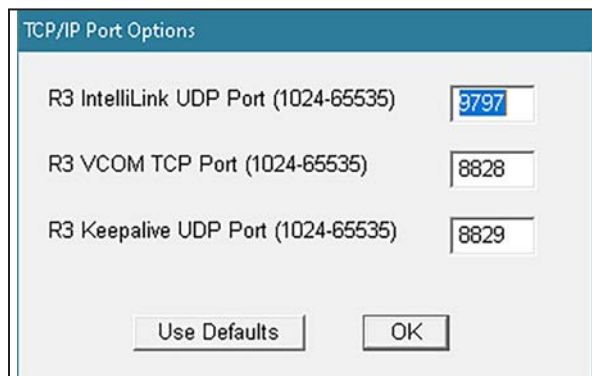

Figure 42. The TCP/IP Port Options dialog box accessed through the Tools>TCP/IP Port Options menu.

Symantec Endpoint Protection

Symantec Endpoint Protection (SEP) clients have been configured to accommodate the LinkStart software. Tables 10 and 11 show execution policy settings:

Exclusion Policy

Table 10. Directories being Excluded from SEP Scanning

Directory	Comment
%[PROGRAM_FILES]%S&C Electric	Security Risk Folder—Ignore
c:\Documents and Settings\All Users\ Application Data\S&C Electric	Security Risk Folder—Ignore
c:\Documents and Settings\All Users\ Documents\S&C Electric	Security Risk Folder—Ignore
%[PROGRAM_FILES]%S&C Electric	Tamper Protection File—Ignore
c:\Documents and Settings\All Users\ Application Data\S&C Electric	Tamper Protection File—Ignore
c:\Documents and Settings\All Users\Documents\S&C Electric	Tamper Protection File—Ignore

Table 11. Another Way of Specifying the Exclusion Policy Paths

Directory	Comment
%[PROGRAM_FILES]%S&C Electric	Security Risk Folder—Ignore
%[ALLUSERSPROFILE]%Application Data\S&C Electric	Security Risk Folder—Ignore
%[ALLUSERSPROFILE]%Documents\ S&C Electric	Security Risk Folder—Ignore
%[PROGRAM_FILES]%S&C Electric	Tamper Protection File—Ignore
%[ALLUSERSPROFILE]%Application Data\S&C Electric	Tamper Protection File—Ignore
%[ALLUSERSPROFILE]%Documents\ S&C Electric	Tamper Protection File—Ignore

Firewall Policy

The firewall policy has been modified to allow LinkStart communication. This applies only to laptop computers; desktop computers do not have an SEP Firewall installed. The firewall modifications noted in Table 12 and Tables 13 through 15 on page 110 are required for LinkStart communication:

Table 12. IP Range:192.168.101.1 to 192.168.101.254 for Any Application (could be limited to LinkStart.exe)

Port	Protocol	Action
1006	UDP/In	Allow
1007	UDP/In	Allow
1008	UDP/In	Allow
1021	UDP/In	Allow

Table 13. SDA-4540-xxx IP 127.0.0.1 for Any Application

Port	Protocol	Action
20000	UDP	Allow
20001	UDP	Allow

Table 14 shows the default ports. (These are user-configurable with a range of 1024 to 65535. If the defaults are changed, the configured ports must be allowed.)

Table 14. SDA-4540R3-xxx IP 192.168.101.1 for Any Application

Port	Protocol	Action
9797	UDP	Allow
8828	TCP	Allow
8829	UDP	Allow

Table 15. Ports that Must also be Allowed for Other Applications and Any IP Address

Port	Protocol
116	TCP
1002	UDP
1006	UDP
1007	UDP
1008	TCP
1020	UDP
8828	TCP
8888	TCP
8829	UDP

Verify these exceptions have been pushed to the clients.

Check the registry under this registry path:

HKEY_LOCAL_MACHINE>SOFTWARE>Symantec>Symantec Endpoint Protection>AV>-Exclusions>ScanningEngines\

Several keys in this registry show exceptions pushed to clients.

Windows Defender Antivirus

Windows Defender antivirus users must add the Linkstart and IntelliLink software programs to the Allowed Apps list. Follow these steps to add the programs:

STEP 1. In the Windows search window, type "fire." See Figure 43. Click on "Firewall & network protection."

Figure 43. The Windows search dialog box.

STEP 2.   Select "Allow an app through firewall." Administrative privilege is required. See Figure 44.
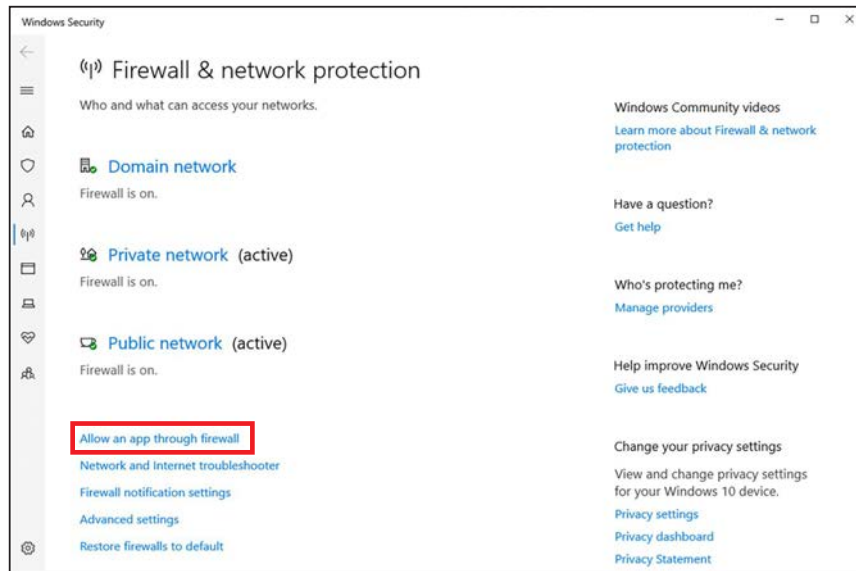

Figure 44. The *Firewall & network protection* screen.

STEP 3.   Scroll through the "Allowed apps and features:" list and check the applications in the public profile. See Figure 45 on page113 and Figure 46 on page 113. Table 16 lists the applications that must be allowed and their file locations.

Table 16. Applications That Must Be Allowed

Application	File Location
Ilink6	C:\Program Files (x86)\S&C Electric\IntelliLink6\iLink6.exe
S&C Communication Server Console	C:\Program Files (x86)\S&C Electric\IntelliLink6\CpsServer.exe, C:\Program Files (x86)\S&C Electric\IntelliLink6\CpsConsole.exe
LinkStart.exe	C:\Program Files (x86)\S&C Electric\LinkStartV4\LinkStart.exe
SandCVCo Application	C:\Program Files (x86)\S&C Electric\LinkStartV4\SandCVCom\SandCVComCfg.exe
S&C Network Service	C:\Program Files (x86)\S&C Electric\LinkStartV4\ SandCNetSvc.exe

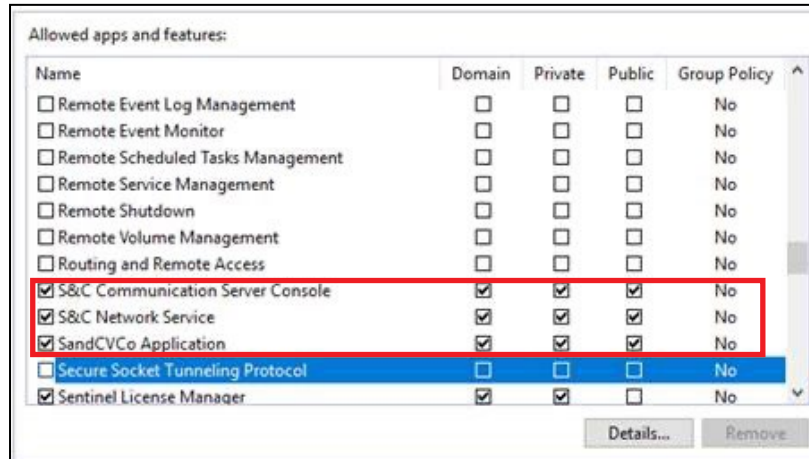**STEP 4.**   Click on the **Change Settings** button.

Figure 45. The Allow apps to communicate through Windows Defender Firewall dialog box.
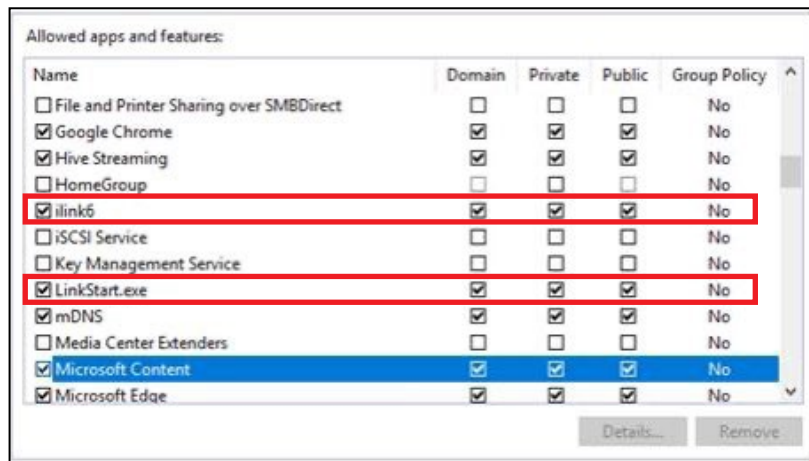

Figure 46. The Allow apps to communicate through Windows Defender Firewall dialog box continued.