

Setup

Table of Contents

| Section | Page | Section | Page |
|---|-------------|---|-------------|
| Introduction | | Switch Control and Team Setup | |
| Qualified Persons | 2 | Switch Control Setup | 10 |
| Read this Instruction Sheet | 2 | Automatic Operation Setup | 27 |
| Retain this Instruction Sheet | 2 | Communication Setup | 32 |
| Proper Application | 2 | IntelliTeam II Automatic Restoration System Setup | 37 |
| Special Warranty Provisions | 2 | Enable Operation and Test the Team | 45 |
| Safety Information | | | |
| Understanding Safety-Alert Messages | 4 | | |
| Following Safety Instructions | 4 | | |
| Replacement Instructions and Labels | 4 | | |
| IntelliLink® Setup Software | | | |
| Applicable Software | 5 | | |
| Hardware and Software Requirements | 6 | | |
| Software Installation | 6 | | |
| Starting IntelliLink Software | 6 | | |
| IntelliLink Software Screens | 8 | | |
| IntelliLink Software Menu Tree | 9 | | |



Introduction

Qualified Persons

WARNING

The equipment covered by this publication must be installed, operated, and maintained by qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead electric power distribution equipment along with the associated hazards. A qualified person is one who is trained and competent in:

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

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

Read this Instruction Sheet

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating S&C 5800 Series Automatic Switch Controls. Familiarize yourself with the Safety Information page 3. 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 your 5800 Series Automatic Switch Control. Designate a location where you can easily retrieve and refer to this publication.

Proper Application

WARNING

The equipment in this publication must be selected for a specific application. The application must be within the ratings furnished for the selected equipment.

Special Warranty Provisions

The standard warranty contained in S&C's standard conditions of sale, as set forth in Price Sheets 150 and 181, applies to the S&C 6800 Series Automatic Switch Control, except that the first paragraph of the said warranty is replaced by the following:

(1) General: The seller warrants to the immediate purchaser or end user for a period of 10 years from the date of shipment that the equipment delivered will be of the kind and quality specified in the contract description and will be free of defects of workmanship and material. Should any failure to conform to this warranty appear under proper and normal use within 10 years after the date of shipment, the seller agrees, upon prompt notification thereof and confirmation that the equipment has been stored, installed, operated, inspected, and maintained in accordance with the recommendations of the seller and standard industry practice, to correct the nonconformity either by repairing any damaged or defective parts of the equipment or (at the seller's option) by shipment of necessary replacement parts. The seller's warranty does not apply to any equipment that has been disassembled, repaired, or altered by anyone other than the seller. This limited warranty is granted only to the immediate purchaser or, if the equipment is purchased by a third party for installation in third-party equipment, the end user of the equipment. The seller's duty to perform under any warranty may be delayed, at the seller's sole option, until the seller has been paid in full for all goods purchased by the immediate purchaser. No such delay shall extend the warranty period.

Replacement parts provided by the seller or repairs performed by the seller under the warranty for the original equipment will be covered by the above special warranty provision for its duration. Replacement parts purchased separately will be covered by the above special warranty provision.

For equipment/services packages, the seller warrants for a period of one year after commissioning that the 6800 Series Automatic Switch Control will provide automatic fault isolation and system reconfiguration per agreed-upon service levels. The remedy shall be additional system analysis and reconfiguration of the IntelliTeam II Automatic Restoration System until the desired result is achieved.

Warranty of the S&C 6800 Series Automatic Switch Control is contingent upon the installation, configuration, and use of the control or software in accordance with S&C's applicable instruction sheets.

This warranty does not apply to major components not of S&C manufacture, such as batteries and communication devices. However, S&C will assign to the immediate purchaser or end user all manufacturer's warranties that apply to such major components.

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

Safety Information

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the 5800 Series Automatic Switch Control. Familiarize yourself with these types of messages and the importance of these various signal words:

DANGER

“DANGER” identifies the most serious and immediate hazards that *will 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 you do not understand any portion of this instruction sheet and need assistance, contact your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C’s website sandc.com, or call S&C Headquarters at (773) 338-1000; in Canada, call S&C Electric Canada Ltd. at (416) 249-9171.

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating your S&C 5800 Series Automatic Switch Control.



Replacement Instructions and Labels

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

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

Applicable Software

This instruction sheet was prepared for use with 5800 Series IntelliTeam II Automatic Restoration System software available January 2011:

SNCD2B1X Rev. 2.45, SNCD2B6D Rev. 2.43, PADD2B1X Rev. 2.43, VISD2B1X Rev. 2.43, and USBD2B1X Rev. 2.43.

The revision number is located on the *Setup>General>Revisions* screen. For questions regarding the applicability of information in this chapter to future software releases, please contact S&C Electric Company.

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.

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

The S&C 5800 Series Automatic Switch Control is connected to switchgear operating at primary voltage levels. High voltage may be present in the wiring to the switch control or the switch control itself during certain failures of the switchgear wiring or grounding system, or due to a failure of the switch itself. For this reason, access to the switch control should be treated with the same caution applied when accessing other high-voltage lines and equipment. Follow all locally-approved safety procedures when working on or around this switch control.

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 II system. This prevents any unexpected operation of a team member.

You can disable the IntelliTeam II system by pressing the automatic operation ENABLE/DISABLE faceplate button to **Disable** mode on the faceplate of any active 5800 Series team member of the team you want to disable.

WARNING

All switch controls in an IntelliTeam II system must use the same software revision.

Revision 2.39 should be installed only in 5800 Series Switch Controls manufactured after January 1, 2005, or in older controls that have had the four-layer processor board (006-001053-01 or 006-001053-02) retrofitted. Using Revision 2.39 with the earlier two-layer boards may result in memory corruption. If you need assistance, or your equipment requires the upgrade, please contact S&C Electric Company.

Hardware and Software Requirements

The following hardware and support software are required for IntelliLink software:

- Portable computer—The computer must be transportable to the switch control installation site and must have:
 - Microsoft Windows® 7 or later operating system
 - A serial or USB port
 - Access to the S&C Automation Customer Support Portal, located at this link: sandc.com/en/support/sc-customer-portal/
- RS232 serial cable—The straight-through (not a null-modem) cable must have a DB9 connector for the port on the switch control faceplate and a connector for the computer port. The cable should be long enough to reach from the switch control at the site to the computer.
- IntelliLink software installer—S&C provides several software-controlled products. Make sure the correct software is installed for this switch control. The latest versions are posted at the S&C Automation Customer Support Portal.
- IntelliLink.CFG file (optional)—Use a .CFG file to quickly enter the same setup configuration into all team members. For more information, see the “Saving and loading a Setup Configuration” section in Instruction Sheet 042-540, “S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Operation.*” Make sure the correct .CFG file is available on the computer.

Software Installation

Follow these steps to install IntelliLink software on the computer:

- STEP 1.** Download the latest IntelliLink software installer from the S&C Automation Customer Support Portal, and save it on the desktop.
- STEP 2.** On the Windows **Start** menu, click on the **Run as administrator** option. The Run dialog box opens.
- STEP 3.** The installer automatically completes the software installation process.
- STEP 4.** When installation is done, shut down the computer or go to the next section.

Starting IntelliLink Software

Start IntelliLink software to access setpoint configuration and data stored in the control. To edit a snapshot (virtual memory file) or simply view the software without data, see the “Using Snapshots” section in Instruction Sheet 1042-540, “S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Operation.*”

IntelliLink software can be started from the setup manager software to easily move back and forth between IntelliLink software and RadioShop software.

NOTICE

Damage to the serial port on the computer may occur when using a two-wire, ungrounded extension cord to power either the computer or the switch control while they are connected. ALWAYS use a grounded, three-wire extension cord, or run the computer on battery power.

Follow these steps to start the IntelliLink software:

- STEP 1.** Connect the computer to the switch control.
 - Plug the communication cable into the serial port on the computer and into the LOCAL COMMUNICATION port on the switch control faceplate.
- STEP 2.** Open the Windows **Start** menu and select the Start>Programs>EnergyLine>IntelliLink program to start the software.
- STEP 3.** Wait while IntelliLink software attempts to open communication with the switch control.

When the software establishes communication with the switch control, the *Operation* screen opens. See Figure 1. Control setpoints can be configured, live data can be viewed and saved, settings can be loaded into the control, and maintenance and troubleshooting procedures can be run from this screen.

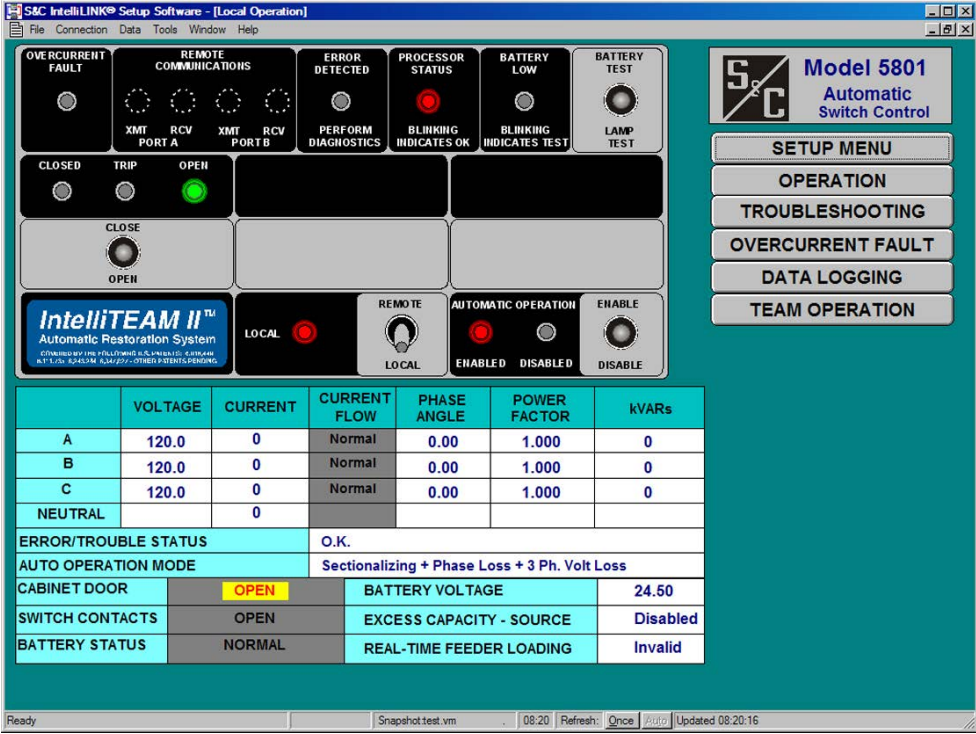


Figure 1. The *Operation* screen for a 5801 Switch Control.

Note: If the IntelliLink software does not establish communication with a functioning switch control, it displays the dialog box shown in Figure 2. When this dialog box appears, or if the *Operation* screen opens but the software does not operate properly, see the “Software Troubleshooting and Error Messages” section in Instruction Sheet 1042-550, “S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Troubleshooting.*”



Figure 2. The dialog box displayed when IntelliLink software does not establish communication.

IntelliLink Software Screens

IntelliLink software includes a series of screens and dialog boxes that enable switch control configuration and have the capability to view and manage team activity.

Changing Data Values on the Screens

Follow these steps to add or change a screen value (for example, refer to the *Setup>Miscellaneous* screen shown in Figure 5 on page 11):

- STEP 1.** Move the mouse cursor over the value to be changed. When the cursor changes to a double arrow, click the left mouse button to open the Change Value dialog box.
- STEP 2.** If the dialog box accepts typed input, enter the new value with the keyboard. If the dialog box does not accept typed input, click on the Up or Down arrow to change the value, or click on the **Radio** button to select the correct value.
- STEP 3.** Click on the **OK** button to record the new value, or click on the **Cancel** button to exit the dialog box without changing the value.
- STEP 4.** Repeat this process for each value to be added or changed.
- STEP 5.** To view Help text for all fields on the screen, press the <F1> key.

Opening a New Screen

Click on the corresponding button in any IntelliLink screen to move to a new screen. See Figure 3.

Note: The exact appearance and content of an IntelliLink screen depends on which version of software is installed. The screen arrangements on the next page apply to all IntelliLink versions for 5800 Series Switch Controls with IntelliTeam II software.

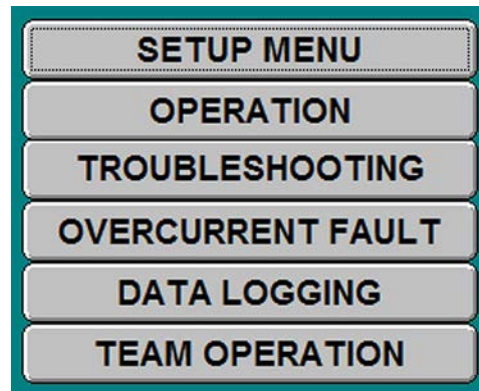


Figure 3. The screen-selection buttons shown on every IntelliLink screen.

**IntelliLink Software
Menu Tree****Menu Tree for 5800 Series Controls with IntelliTeam II Software****SETUP MENU screen**

- *Setup>Miscellaneous* screen
- *Setup>Sensor Configuration* screen
- *Setup>Site-Related* screen
- *Setup>Fault Detection* screen
- *Setup>Automatic Operation* screen
- *Setup>Communications* screen [3 pages]
- *Setup>Team Menu* screen
 - *Setup>Team 1 - Team 8* screens
- *Setup>External Source Loading* screen

OPERATION screen

- *Operation* screen [the program opens at this screen]
- *Team Operation* screen
 - *Team Operation>Team 1 to Team 8* [2 pages each]
- *Misc Operation* screen
 - *Misc Operation>Member Tasks* screen
 - *Misc Operation>Contract Status* screen
 - *Misc Operation>Prohibit Restoration* screen
 - *Misc Operation>Action Path* screen

TROUBLESHOOTING MENU screen

- *Troubleshooting>Event Status* screen [3 pages]
- *Troubleshooting>Chronological Log* screen [3 pages]
- *Troubleshooting>Team Event Log* screen [8 pages]
- *Troubleshooting>Coach Activity* screen (page 9 on Team Event Log)
- *Troubleshooting>Control & Switch Information* screen
- *Troubleshooting>Switch Operations* screen
- *Troubleshooting>Battery System* screen
- *Troubleshooting>Communications* screen
- *Troubleshooting>Various Counters* screen [2 pages]

OVERCURRENT FAULT MENU screen

- *Overcurrent Fault>Fault Events* screen [4 pages]
- *Overcurrent Fault>Fault Magnitudes* screen
- *Overcurrent Fault>Ac Power Outages* screen

DATA LOGGING MENU screen

- *Data Logging>Daily Highs and Lows for Today* screen
- *Data Logging>Daily Highs and Lows - Most Recent Week* screen [7 pages]

Switch Control and Team Setup

Switch Control Setup

When configuring a switch control and team for normal operation, carry out the series of steps outlined in the team setup procedure flowcharts in Instruction Sheet 1042-511, “S&C 5800 Series Automatic Switch Control with IntelliTeam® II Automatic Restoration System: *Installation*.”

Note: Refer to these flowcharts while the automatic restoration system is being configured.

Follow these steps to configure the switch control. The values entered on each setup screen depend on the electrical distribution system and details specific to each individual switch.

STEP 1. Start IntelliLink software and establish communication with the switch control.

For details, see the “Starting IntelliLink Software” section on page 6. If the software is already running, skip this step.

STEP 2. At any IntelliLink software screen, click on the **Setup Menu** button to display the *Setup Menu* screen. See Figure 4.

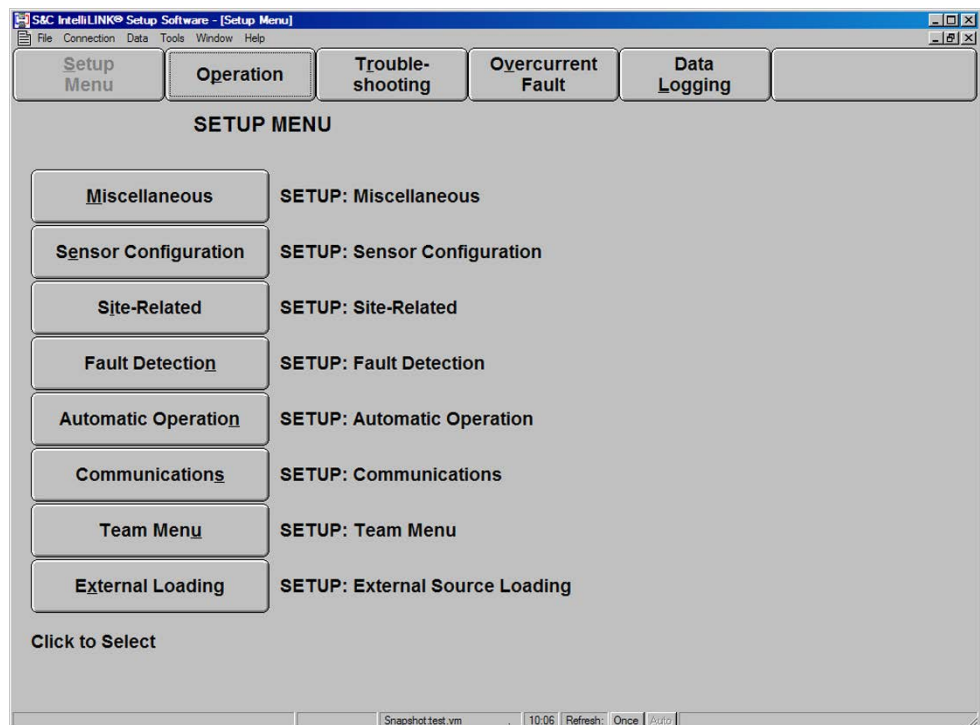


Figure 4. The *Setup Menu* screen.

STEP 3. At the *Setup Menu* screen, click on the **Miscellaneous** button to open the *Setup>Miscellaneous* screen. See Figure 5 on page 11. Enter the correct values for the switch control on this screen.

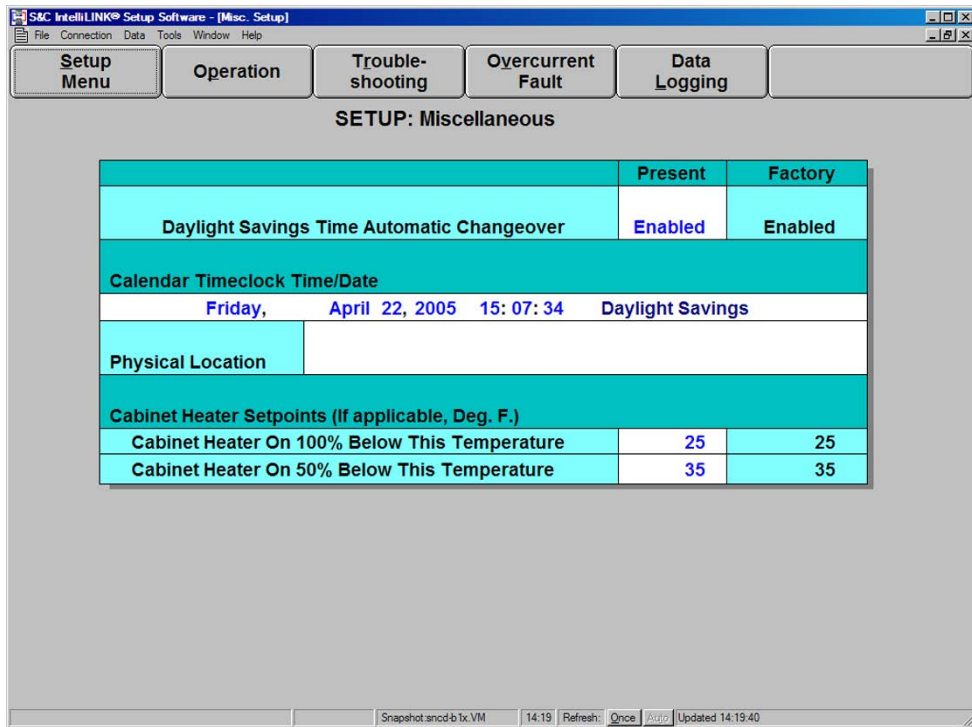


Figure 5. The Setup>Miscellaneous screen.

This screen configures the miscellaneous setup information and includes the following fields:

Daylight Savings Time Automatic Changeover

When this setpoint is enabled, the switch control automatically adjusts the clock for the start and end date of daylight savings time. Check with the SCADA vendor to see whether the SCADA master corrects for daylight savings time. If it does, disable this setpoint or the correction will be incorrectly duplicated.

Calendar Timeclock Time/Date

The control time and date are factory set to Pacific Standard Time (GMT-8:00). Reset this value when the control is installed in a different time zone.

When the **Daylight Savings Time Automatic Changeover** setpoint is enabled, the time/date statement includes the present daylight savings time status, for example: “Thursday, May 30, 2002 3:25:08 Daylight Savings.” The control uses this information for logging data and event recording.

When the time and date are reset, wait at least six minutes. Then, check the calendar and clock settings. When a date change causes the transition into or out of daylight savings time, the one-hour automatic adjustment made by the control may need correction.

Physical Location

Enter the company standard location identification information. For example, “Switch # 429, 73 Main St., Centerville.” This information identifies the switch to the SCADA master station operator and appears on all reports generated from the switch control.

Cabinet Heater On 100% Below This Temperature

When the control has a cabinet heater and is powered by an external ac source, the heater stays on continuously while the interior temperature is below this setpoint. Leave this setpoint at the factory-default value.

The enclosure temperature is checked every 10 minutes. The temperature at the thermistor on the power supply/control I/O module is typically 10-15° F (5.6-8.3° C) above the outdoor air temperature.

Cabinet Heater On 50% Below This Temperature

When the control has a cabinet heater and is powered by an external ac source, the heater stays on 50% of the time whenever the interior temperature is below this setpoint but above the **Cabinet Heater on 100% Below This Temperature** setpoint. Leave this setpoint at the factory-default value.

STEP 4. At the *Setup Menu* screen, click on the **Sensor Configuration** button to display the *Setup>Sensor Configuration* screen. See Figure 6. Enter the correct values for this switch control.

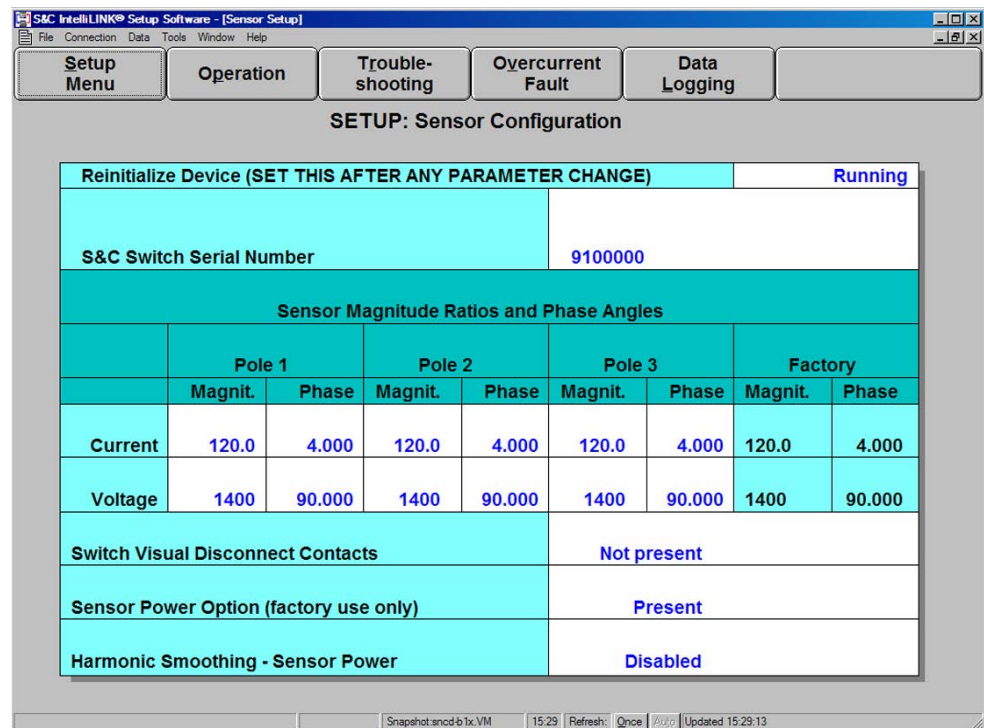


Figure 6. The *Setup>Sensor Configuration* screen for a 5801 control.

This screen configures calibration data (correction factors) for S&C Scada-Mate® Switching Systems, PME or PMH switchgear, or Vista® Underground Distribution Switchgear sensors. The control uses correction factors to produce voltage and current accuracy within specification for the S&C sensors.

This screen includes the following fields:

Reinitialize Device

Any *Setup* screen that has the word “Running” in the upper right corner must be reinitialized before the control will use newly entered data. The control reinitializes automatically about 10 minutes after it detects a data-entry change. To use the new configuration immediately, click on the word “Running” and then select the **Reinitialize** option. The word “Running” will change to “Reinitialize” and back to “Running.” The control has then updated all setpoints on this screen.

S&C Switch Serial Number

This information is listed on the switch or on the switch-information card. Use the serial number of the line switch, not the switch control. The serial number is useful to resolve a sensor-conditioning or calibration problem.

Padmount Configuration (Padmount software only)

This is the type of pad-mounted switch installed at this location. The software is compatible with several pad-mounted switch configurations. When switch configuration is selected, the screen displays the appropriate sensor setup values for that configuration.

Current (Magnitude/Phase) & Voltage (Magnitude/Phase) on Poles 1, 2, and 3

S&C sensors are factory-calibrated. The sensor ratios are provided on the information card shipped with the switch and stamped on each sensor.

The number of sensors must be selected before calibration factors are entered. Ratios must be entered on this screen to obtain accurate voltage and current measurement. Each field has an approximate default entry, so fewer keystrokes are needed to enter data. The switch control ignores the entry for any pole not specified in the **Voltage Sensors Present** setpoint on the *Setup>Site-Related* screen.

After entering the ratios, store the calibration data sheet in the control door pocket for future reference.

NOTICE

Ratios must be entered for Phase B, even when only Phase A or Phase C are measured. The ratios for Phase B are used to adjust all voltage scales for 15-kV, 25-kV, or 35-kV systems.

Switch Visual Disconnect Contacts

Scada-Mate Switches equipped with an R2 switch operator have visual-disconnect contacts. Visual-disconnect contacts are optional for the R1 switch operator. When the switch has visual-disconnect contacts, set this to the **Present** state. When the visual-disconnect contacts are open, the ERROR DETECTED LED on the faceplate is lit, and the *Troubleshooting>Event Status* screen indicates a **Not Ready** condition, and **Disconnect Active** status. The condition is cleared when the visual-disconnect status contacts are manually closed. Automated Omni-Rupter Switches do not have visual-disconnect contacts.

Sensor Power Option

This is set when the switch control has the **Sensor Power** option. 5800 Series controls with the **Sensor Power** option have a cable connecting J8 on the PS/IO board to J6 on the SPA board. This setpoint is configured at the factory and may need to be changed when a replacement processor board without the **Sensor Power** option is installed.

Low Pressure Indication Option (Vista software)

When Vista switchgear includes low pressure indication, set this value to the **Present** state. When the switchgear indicates low pressure, the ERROR DETECTED LED on the faceplate is lit, and the *Troubleshooting>Event Status* screen indicates the **Switch Not Xfer Ready** and **Low Pressure** conditions.

Fault Interrupter Option (Vista software)

When the Vista switchgear includes **Fault Interrupting** positions, set this value to the **Present** state. When the fault interrupter trips open, the OVERCURRENT FAULT LED begins to flash, the LCD displays a message, and the switch control makes an entry in the Overcurrent Fault-Fault Events log. The condition is cleared when the fault interrupter is closed.

Harmonic Smoothing for Sensor-Powered Controls

Customers have reported excessive fluctuation of voltage and phase-angle values when the sensor **Control Power** feature is used on a feeder with harmonic content in excess of the IEEE 519 Guidelines. The **Harmonic Smoothing** algorithm mitigates these fluctuations for display and DNP reporting purposes. The algorithm is enabled on the *Setup>Sensor Configuration* screen. The factory default is disabled. The algorithm can take up to 20 minutes to stabilize the voltage and phase-angle values, depending on the harmonic content and magnitude of the power-line harmonics. Excessive voltage and phase-angle fluctuations are not an issue when using 120-Vac control power.

After Completing Data Entry on This Screen

Any *Setup* screen that has the word “Running” in the upper right corner must be reinitialized before the control will use newly entered data. The control reinitializes automatically about 10 minutes after it detects a data-entry change. To use the new configuration immediately, click on the word “Running” and then select the **Reinitialize** option. The word “Running” will change to “Reinitialize” and back to “Running.” The control has then updated all setpoints on this screen.

STEP 5. At the *Setup Menu* screen, click on the **Site-Related** button to open the *Setup>Site-Related* screen. See Figure 7. Enter the correct values for this switch control.

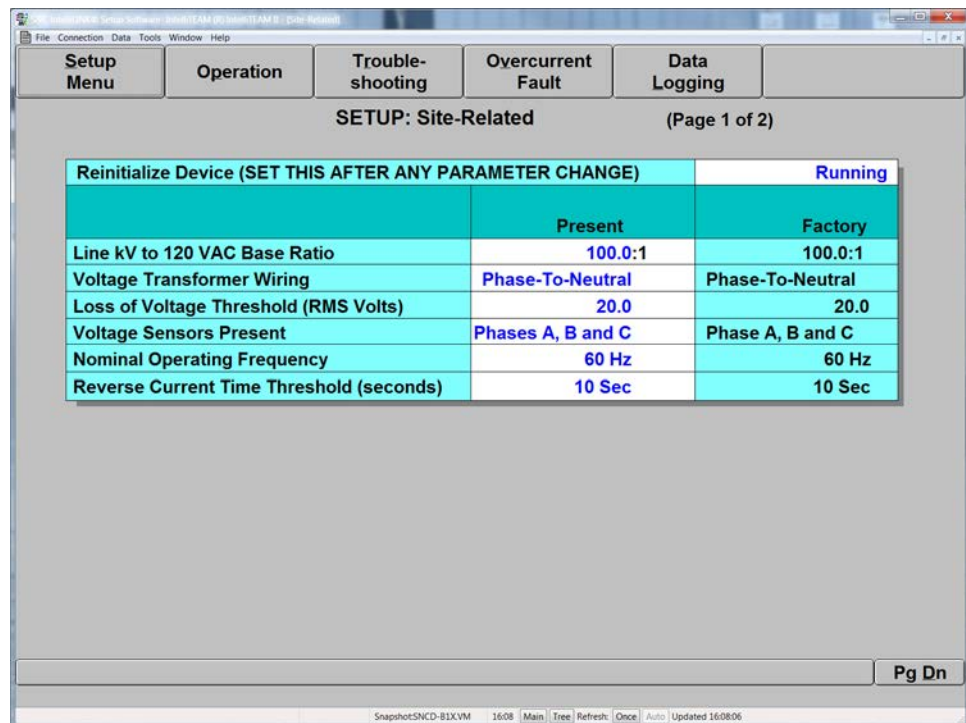


Figure 7. The *Setup>Site-Related* screen page 1, for a 5801 control.

Enter the installation-dependent parameters associated with ac-waveform analysis in the upper screen section. The lower section displays real-time ac-waveform analysis data.

For S&C 5802/5803 switch controls, the phase-angle offset setpoints are on page 2 of the *Setup>Site-Related* screen, and the real-time information is on page 3. To view page 2 and page 3, click the **PgDn** button.

The switch control supports reporting voltage as either phase to phase (delta) or phase to neutral (wye), based on the connection of the single-phase transformers, and always displays voltage on a nominal 120-Vac or 240-Vac base. This is useful for comparison of the measured voltages with those seen on a customer load.

Delta Voltage Reporting

The control sensor-conditioning module measures primary phase-to-phase voltage. The control scales this voltage using the specified **Line kV to 120-Vac Base Ratio** setpoint to yield a nominal 120-Vac value.

For delta-voltage reporting, be sure the delta jumper is installed on the sensor-conditioning module and specify the **Phase To Phase** value for the **Voltage Transformer Wiring** setpoint.

Wye Voltage Reporting

The control sensor-conditioning module measures primary phase-to-neutral voltage. The control scales this voltage using the specified **Line kV to 120-Vac Base Ratio** setpoint to yield a nominal 120-Vac value.

For wye voltage reporting, be sure the wye jumper is installed on the sensor-conditioning module, and specify the **Phase To Neutral** value for the **Voltage Transformer Wiring** setpoint.

For more information about how the control processes sensor data, see Instruction Sheet 1042-541, “S&C 5800 Series Automatic Switch Controls With IntelliTeam® II Automatic Restoration System: *Operation.*”

The *Setup>Site-Related* screen includes the following fields:

Reinitialize Device

Any *Setup* screen that has the word “Running” in the upper right corner must be reinitialized before the control will use newly entered data. The control reinitializes automatically about 10 minutes after it detects a data-entry change. To use the new configuration immediately, click on the word “Running” and then select the **Reinitialize** option. The word “Running” will change to “Reinitialize” and back to “Running.” The control has then updated all setpoints on this screen.

Line kV to 120-Vac Base Ratio

This is the voltage step-down ratio of the customer-load transformers on the feeder. The switch control records, displays, and manipulates voltages normalized on a 120- or 240-Volt base. This parameter provides the conversion ratio from line voltage to base voltage.

Enter the ratio for transformers wired the same way (phase to phase or phase to neutral) as the **Voltage Transformer Wiring** setpoint. See the following examples.

Example #1: For a four-wire, wye, multi-grounded, 24.9-kV phase-to-phase primary distribution system with phase-to-neutral connected single-phase customer transformers rated 14,400/120 Volts, enter the ratio 120:1. Then, specify the **Phase To Neutral** setting for the **Voltage Transformer Wiring** setpoint.

Example #2: For a three-wire, wye, 12-kV phase-to-phase primary distribution system with phase-to-phase connected customer transformers rated 12,000/120 Volts, enter the ratio 100:1. Then, specify the **Phase To Phase** setting for the **Voltage Transformer Wiring** setpoint.

Voltage Transformer Wiring

This configures the control for customer voltage reporting. The control uses this information when calculating kvars. For delta voltage reporting, select **Phase To Phase** for this setpoint. For wye voltage reporting, select **Phase To Neutral** for this setpoint.

Loss of Voltage Threshold (RMS Volts)

When the voltage level drops below this value on a 120 Volt base, the control decides power is no longer being supplied to the monitored phase.

Use the factory default value of 20.0 Volts.

Loss of voltage is detected by the control's true RMS transducer circuits, which have some response latency. Figure 8 on page 16 shows the time between when the source-side protective device (breaker, recloser, etc.) opens and when the switch control can reliably detect the loss of voltage.

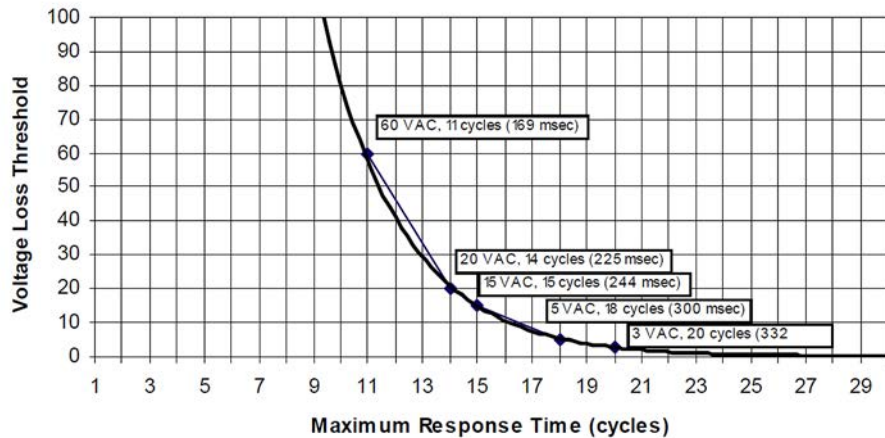


Figure 8. The Voltage Loss Threshold and Maximum Response Time curve.

CAUTION

Times listed in Figure 8 do not include the output-relay or switch-operation times. For proper coordination with a fast-reclosing source-side protective device, make sure the reclosing-interval time for the device is long enough for the switch control to detect the outage and for the sectionalizing switch to fully open.

Backfeed from customer loads affects the speed of voltage-loss detection. Enter a threshold value high enough to detect the loss of voltage before service is resumed and low enough to ensure loss of voltage is not falsely detected because of system overload or persistent backfeed. See Figure 8.

Voltage Sensors Present

This is the number of sensors installed on the line switch.

For PME/PMH pad-mounted switches, the software automatically sets the correct value based on the **Pad-mounted Configuration** setpoint on the *Setup>Sensor Configuration* screen. Correct values are also set automatically for Vista switchgear.

Nominal Operating Frequency

This is the operating frequency in Hertz for the distribution system.

Reverse Current Time Threshold (seconds)

This is the minimum-qualification time a change in current direction must persist after detection before being displayed or reported. The default value is 10 seconds. Reporting a current-direction change can be disabled by selecting the **Disabled** mode. Then, no reverse-current condition is displayed or reported, and indication of a reverse-current condition will be cleared.

The qualification time can be configured from 10 seconds to 60 seconds in one-second increments, from 1 minute to 60 minutes in one-minute increments, from 1 hour to 12 hours in one-hour increments, or it can be disabled.

Installation Voltage-Current Phase Angle Offsets (degrees)

These setpoints (one for each voltage and current phase) allow installation-dependent phase-angle correction. These corrections determine the normal and reverse current-flow direction. These corrections and the sensor-conditioning corrections on the *Setup>Sensor Configuration* screen calculate power factor and kvars. See Figure 9 on page 17.

Sensors should face the substation end of the feeder when the team is in the normal configuration. Team members closest to substations must have their sensors facing the substation.

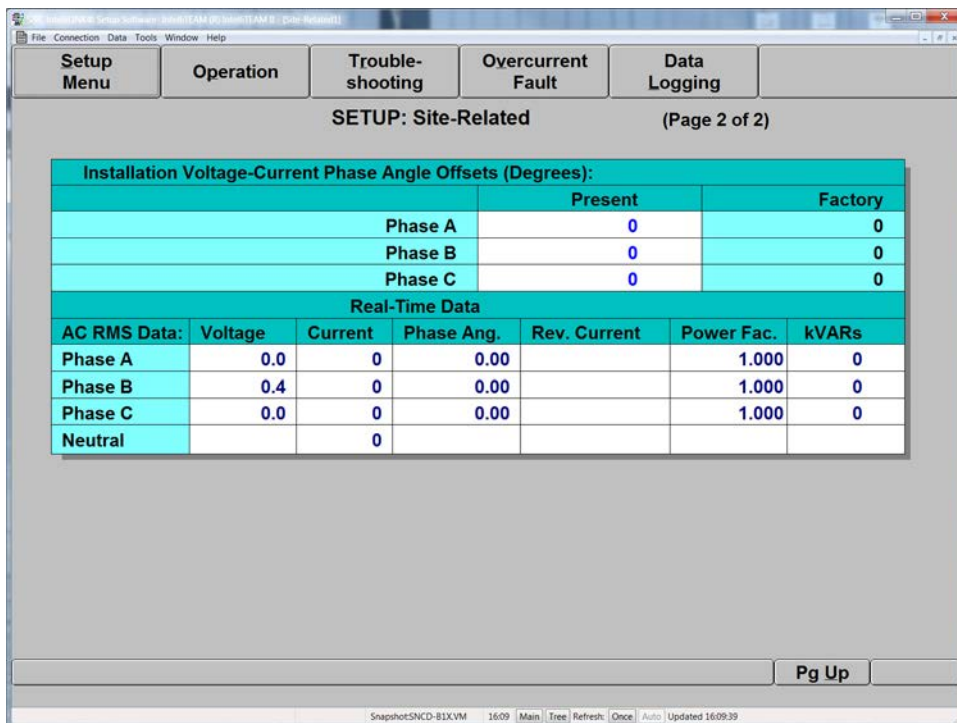


Figure 9. The Setup>Site-Related screen, Page 2 for a 5801 control.

The screen shown in Figure 9 configures the phase-angle offset (correction) values for various system types. When making adjustments, keep in mind that:

- Phase-angle detection and display require a minimum current of 0.75% of full scale (6 amperes at 800 amperes full scale). Current magnitudes continue to be detected and displayed below this level.
- To see the effect of any changed offset values on real-time data, the switch control must be reinitialized.

Phase-To-Neutral Connected Customer Transformers

Set the **Three-Phase Angle Offsets** setpoint to 0 degrees. If the **Rev. Current** fields for all three phases display a “Reverse” message when the offsets are set to 0 and current is flowing through the switch, power is being fed from the opposite direction. To remove the “Reverse” messages, set the **Three-Phase Angle Offsets** setpoint to 180 degrees.

The correct setting should result in reasonable real-time corrected phase angles in the **Phase Ang.** fields and no “Reverse” messages in the **Rev. Current** fields.

Pad-mount and Vista switchgear controls assume the outgoing current flow is positive. Therefore, the incoming bay always must be shifted by 180 degrees.

Switches with Three or Six Voltage Sensors and Phase-To-Phase Connected Customer Transformers

Set all **Three-Phase Angle Offset** setpoints to either 30 or 330 degrees. If neither of these setting combinations removes all the “Reverse” messages in the **Rev. Current** fields, the power flow direction is reversed. In this case, set all **Three-Phase Angle Offset** setpoints to either 210 or 150 degrees.

One of these settings should eliminate all “Reverse” messages in the **Rev. Current** field and result in reasonable **Real-time Corrected Phase-Angle** values in the **Phase Ang.** fields and **Power Factor** values in the **Power Fac.** fields.

Real-Time Data

The switch control displays real-time data values for Phases A, B, C, and Neutral. It generates these values from raw sensor data and the setpoints configured on the setup screens.

After this screen is reinitialized, real-time data can be used to check the effect of any change made to the site-related setpoints. The control reinitializes automatically about 10 minutes after it detects a data-entry change. To use the new configuration immediately, click on the word “Running” and then select the **Reinitialize** option. The word “Running” will change to “Reinitialize” and back to “Running.” The control has then updated all setpoints on this screen.

For the 5802/5803 controls, as real-time information is reviewed, keep in mind that:

- To ensure the information on the screen is associated with the correct switch, make sure the connectors from the low-voltage cabinet to the control are attached properly: Compartment 1 to Switch 1 and Compartment 2 to Switch 2.
- The switch control can only measure phase angles, kvars, and faults on two circuits (switches). The third set of RMS current sensors is optional. When using the third set of current sensors, only a single set of voltage sensors can be used.
- When using a single set of voltage sensors, the Switch 2 voltage displays “N/A.” However, because voltage is measured on the bus, the Switch 1 voltage is the same for both switches.

Voltage

This value is the distribution-line voltage, transformed to a nominal 120-Vac base and scaled according to the calibration factors entered on the *Setup>Sensor Configuration* screen. The control uses this as the input-sensed value when calculating primary voltage.

Current

This value is the current, measured by the current sensor and scaled according to the calibration factors entered on the *Setup>Sensor Configuration* screen.

Phase Ang.

This value is the calibrated phase angle, the offset of the current waveform referenced to the voltage after all setup calibration factors have been applied. When the control is properly configured, these corrected phase angles will all be 0 ± 89.9 degrees.

Lagging phase angles are represented as values between 0 and 90 degrees. Leading phase angles are represented as values between 0 and -90 degrees.

Rev. Current

When the control is properly configured and power is flowing in the normal direction, these three fields are all blank. When unusual circuit-switching conditions cause the direction of current flow to reverse, all three fields change to **Reverse** values.

Power Fac.

This value is the power factor calculated as the cosine of the value in the **Phase Ang.** field. Leading power factors are represented by negative numbers.

kvars

The control uses the line-to-neutral voltage, the current, and the sine of the phase angle to calculate the kvar (kilovolts-amperes, reactive) value.

After Completing Data Entry on This Screen

The control reinitializes automatically about 10 minutes after it detects a data-entry change. To use the new configuration immediately, click on the word “Running” and then select the **Reinitialize** option. The word “Running” will change to “Reinitialize” and back to “Running.” The control has then updated all setpoints on this screen.

STEP 6. At the *Setup Menu* screen, click on the **Fault Detection** button to display the *Setup>Fault Detection* screen. See Figure 10. Enter the correct values for this switch control.

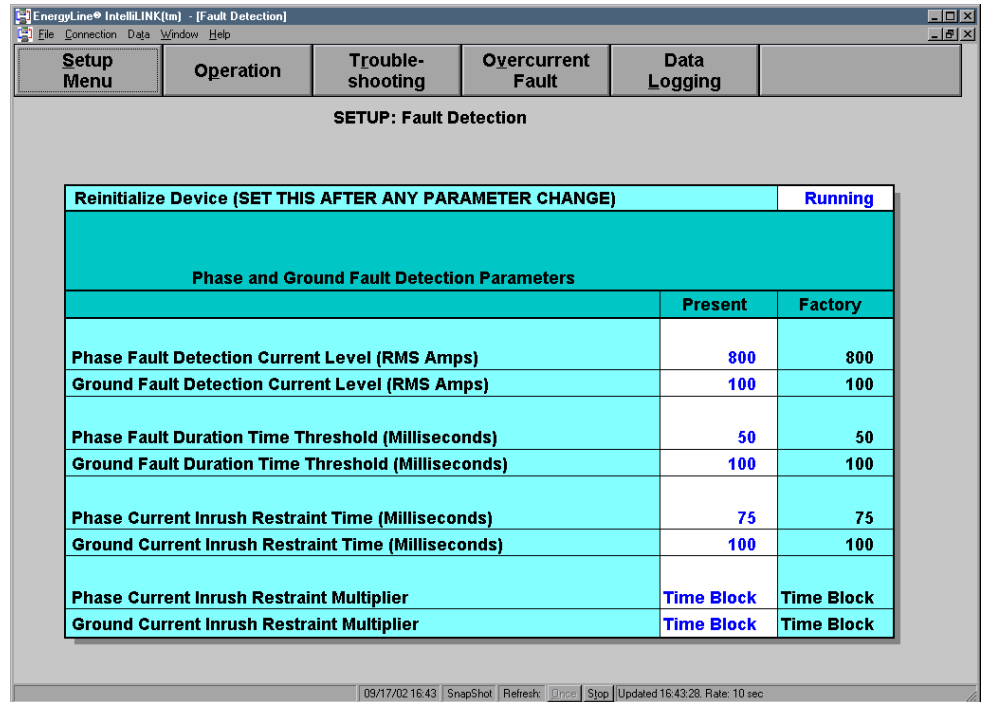


Figure 10. The *Setup>Fault Detection* screen.

The screen shown in Figure 10 configures the setpoint values the control uses to detect phase and ground faults. It includes the following fields:

Reinitialize Device

Any *Setup* screen that has the word “Running” in the upper right corner must be reinitialized before the control will use newly entered data. The control reinitializes automatically about 10 minutes after it detects a data-entry change. To use the new configuration immediately, click on the word “Running” and then select the **Reinitialize** option. The word “Running” will change to “Reinitialize” and back to “Running.” The control has then updated all setpoints on this screen.

Phase and Ground Overcurrent Detection

Phase-fault current is measured by a high-speed detecting circuit that has a full scale of approximately 4200 amperes RMS and samples every 6.25 ms. Phase faults greater than full scale are recorded at the full-scale value. The phase-fault detection characteristics are controlled by the **Phase-Fault Detection-Current Level** and **Phase-Fault Duration-Time Threshold** setpoints. Currents on all three phases are monitored and compared with these setpoint values. When an overcurrent condition is registered, the **Phase-Fault Duration-Time Threshold** timer starts. If the overcurrent condition is present for the duration of the timer, the control records a phase-overcurrent fault. If the current drops below the **Phase-Fault Detection-Current Level** setpoint before the timer expires, the control ignores the overcurrent condition and resets the timer.

Ground-fault current is measured separately by a true-RMS-detecting circuit as the vector sum of the three individually sensed phase currents. The detecting circuit has a full scale of approximately 800 amperes and is slower and more accurate than the phase-detecting circuit. The analog signal is continuously integrated over several cycles and sampled every 50 ms. Because the circuit continuously integrates the current signal, faults

of a shorter duration than the sampling rate will be detected. The net response of this circuit is similar to the Time Current Characteristic (TCC) curves of a protective relay. See Figure 11. The curves show that, with a **Ground-Fault Detection-Current Level** setting of 150 amperes, the control detects a 600-ampere fault in 34 ms. With a **Ground-Fault Detection-Current Level** setting of 231 amperes, the control detects an 800-ampere fault in 42 ms. See page 24 for guidance in generating additional ground curves by interpolation. The ground-fault detection characteristics are controlled by the **Ground-Fault Detection-Current Level** and **Ground-Fault Duration-Time Threshold** setpoints.

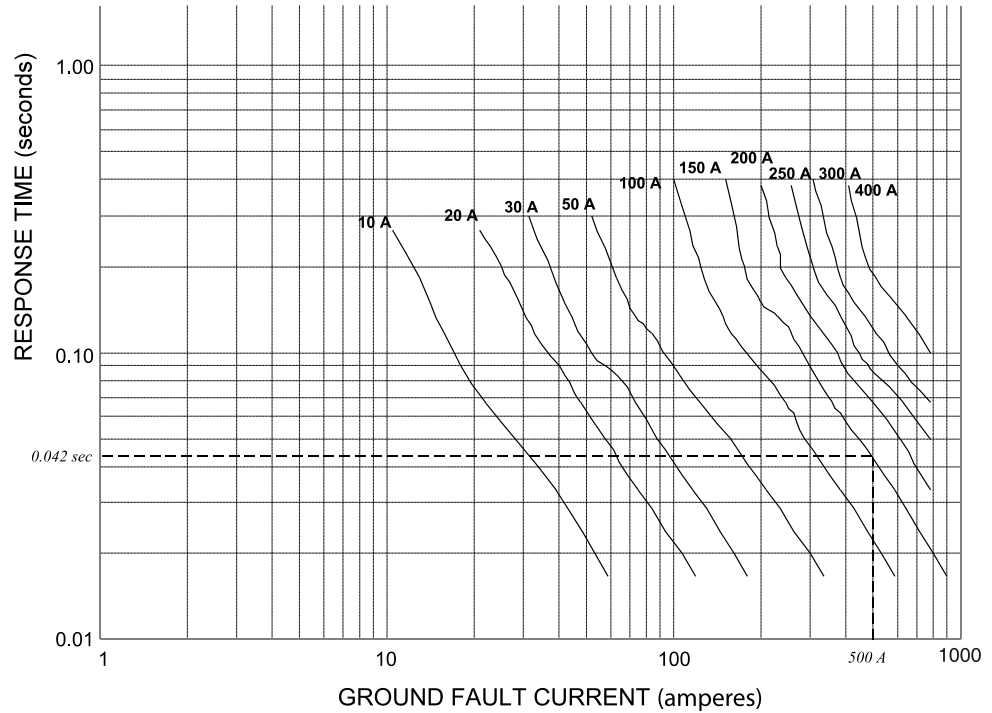


Figure 11. The Time-Current Characteristic curve for ground-fault detection.

Phase-Overcurrent Detection Setup Procedure

To determine the proper settings, review the source-side protective-device Time Current Characteristic (TCC) curves for a range of fault duty, up to the maximum-available phase-fault current at the sectionalizing switch. In general, set the **Phase-Fault Detection-Current Level** setpoint slightly lower than the source-side protective device's minimum pickup/trip and the **Phase-Fault Duration-Time Threshold** setpoint slightly faster than the fastest time the source-side protective device will trip. See Coordination Sheet #1 for an example, Figure 12 on page 21.

Phase-Fault Detection-Current Level (RMS amperes)

Set the **Phase-Fault Detection-Current Level** setpoint to a value equal to 90% of the minimum pickup/trip of the source-side protective device. The setpoint may be increased to 95% or higher in situations where the available inrush-restraint multiplier is too small to mask expected inrush currents but the next-higher multiplier is too large and may mask fault currents.

Phase-Fault Duration-Time Threshold (milliseconds)

Set the **Phase-Fault Duration-Time Threshold** setpoint to a value equal to or less than the breaker total-clearing time minus the **Time-Block Inrush-Restraint** setpoint, if any, and minus 19 ms, where 19 ms is the approximate time required for the control to confirm a fault. The inrush-restraint time can be ignored in situations where numerical multipliers are used (time block is not used) and the elevated overcurrent level (numerical multiplier times the **Phase-Fault Detection-Current Level** setpoint) is less than the expected minimum phase-fault current levels. In situations where the elevated overcurrent level exceeds the estimated **Minimum Phase-Fault Current** levels, select the lowest inrush multiplier that will protect

against inrush. **Minimum Phase-Fault Current** levels may be estimated as 60% of end-of-line maximum fault-current levels, where the end-of-line is defined as the worst-case end of line after load has been transferred to the alternate feed.

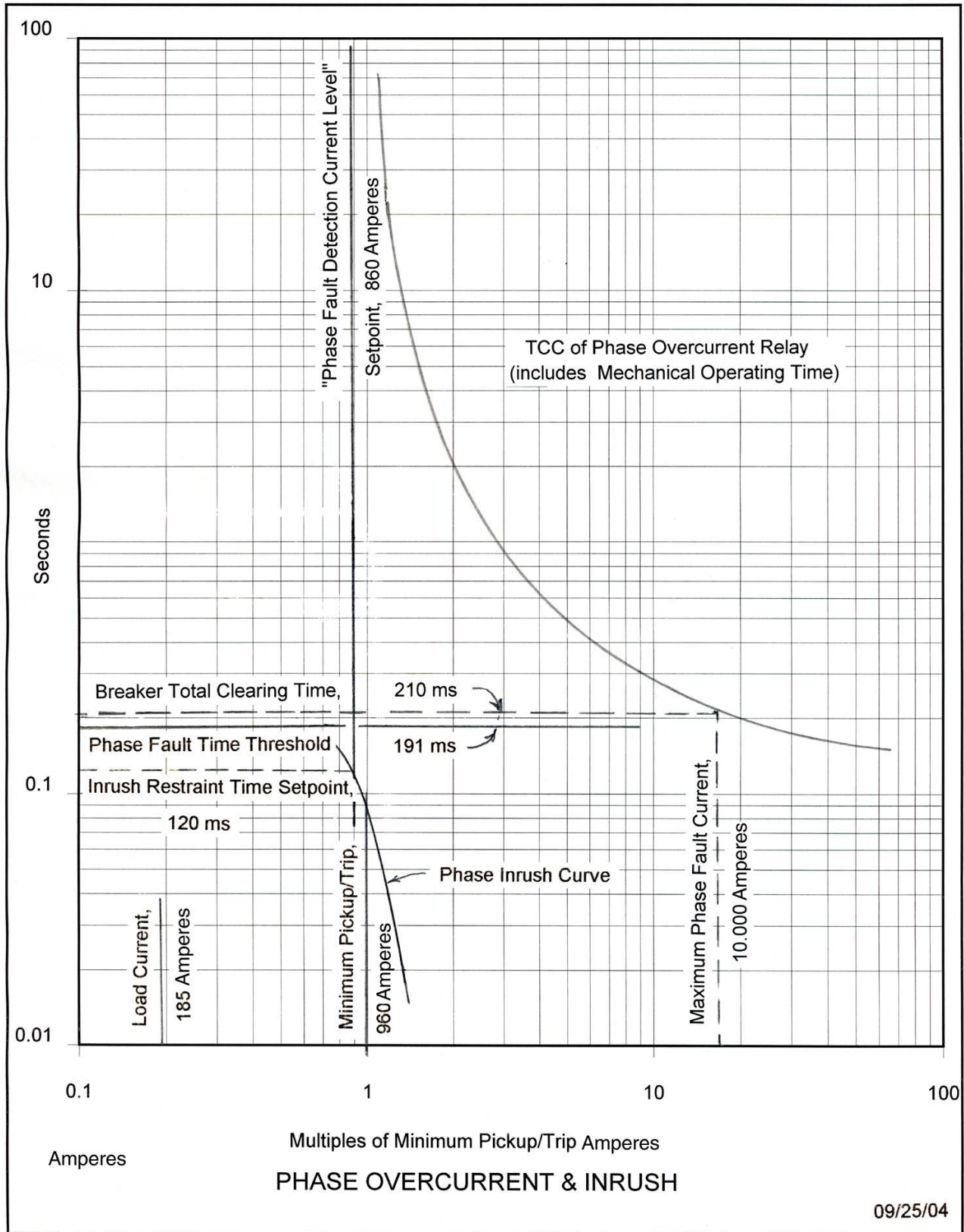


Figure 12. Coordination sheet for phase overcurrent and inrush.

Ground-Overcurrent Detection Setup Procedure

To determine the proper setting, review the source-side protective device's ground TCC curves for a range of fault duty, up to the maximum available ground-fault current at the sectionalizing switch. The control must be able to detect the fault prior to the source-side protective device tripping. See Figure 13 on page 24.

Ground-Fault Detection Current Level (RMS amperes)

This is the RMS level of neutral or ground current required to indicate the presence of a possible ground-overcurrent (fault) condition. Follow these steps to set the level:

- (a) Set the **Ground-Fault Detection-Current Level** setpoint to a value equal to ground minimum pickup/trip current of the source-side protective device.
- (b) Find the control time-current coordination curve in Figure 11 on page 20 for that minimum ground-trip current.
- (c) Compare the TCC curves shown in Figure 11 to the TCC curve for the protective device. The curve for the protective device should include the mechanical-operating time. See Figure 13 on page 24. The switch control response time should be set less than 75% of the source-side protective device's total clearing time for fault-current values up to the maximum line-to-ground fault current at the control. To compare times, select several fault-current values between the **Ground-Fault Detection-Current Level** setpoint and maximum-available faults at the control. For each fault-current value selected, determine the response and clearing times from the TCC curves. In each case, the control-response time should be less than 75% of the source-side protective-device clearing time.
- (d) If necessary, reduce the **Ground-Fault Detection-Current Level** value until the control-response time is short enough.

When the **Ground-Fault Current-Detection Level** value is not found on an existing curve, estimate the points and plot them on the coordination sheet (Figure 11) with the source-side protective-device TCC curve. When more accuracy is needed, interpolate the points between the nearest pair of curves. For example, to interpolate a 231-ampere point, the detection times for the 200- and 250-ampere curves at the specific fault-current level are needed. The 231-ampere point is the 200-ampere detection time plus the difference between the 200- and 250-ampere detection times multiplied by $(231-200)/(250-200)$.

When the load current exceeds the **Ground-Fault Detection-Current Level** setpoint and the circuit is four-wire grounded wye, source-side line-to-ground faults on a four-wire grounded-wye distribution system, the event can reduce load current on faulted phase(s) and result in an imbalance up to the magnitude of the phase-load current. When the unbalanced current exceeds the **Ground-Fault Detection-Current Level** setpoint for a period equal to the **Ground-Fault Duration-Time Threshold** setpoint, the control records a ground fault. When the event is followed by loss of voltage, the control will count. During stand-alone sectionalizing, the control may go to a full count and trip. For IntelliTeam systems, registering a false fault may prematurely shut down both reconfiguration and service restoration processes, and customers will experience an unnecessary outage. This can be prevented by setting the **Ground-Fault Detection-Current Level** setpoint to a value greater than the load current. A disadvantage is the control will ignore any low-level ground faults below the setpoint. However, in most cases the fault-current levels will be high enough to be detected by the high-speed phase-fault detection system. This is especially true with underground construction, where the faults are usually low impedance, high current, and persistent.

Ground-Fault Duration-Time Threshold (Milliseconds)

This configures the time a detected ground-overcurrent condition must be continuously present before the switch control registers a ground-overcurrent fault.

Set the **Ground-Fault Duration-Time Threshold** setpoint to a value less than the source-side protective-device total clearing time minus the **Time-Block Inrush-Restraint** setpoint (if any) minus the time required to detect a ground fault. See the ground-fault current curves, Figure 11 on page 20, for the time required to detect a ground fault.

The resolution of this value is 50 milliseconds (3 cycles). This setpoint value should be rounded down to the nearest multiple of 50 milliseconds. Values of 0 or 50 milliseconds for this setpoint will yield the same effective time threshold of 50 milliseconds.

When using an **Inrush-Restraint Numerical-Multiplier** setpoint (of 2x, 4x, etc.) and the elevated **Ground-Fault Detection-Current Level** setpoint exceeds the maximum available ground short-circuit current level, adjust the **Ground-Fault Duration-Time Threshold** and **Ground-Fault Current-Inrush Restraint-Time** setpoints to ensure the control has enough time after the restraint time to detect a ground fault. The sum of both timers plus the ground-fault detection time must be less than the breaker total-clear time.

If the multiplier elevates the fault-current detection to greater than the maximum fault current available at the switch location, this has the same effect as setting a time block.

Switch Control and Team Setup

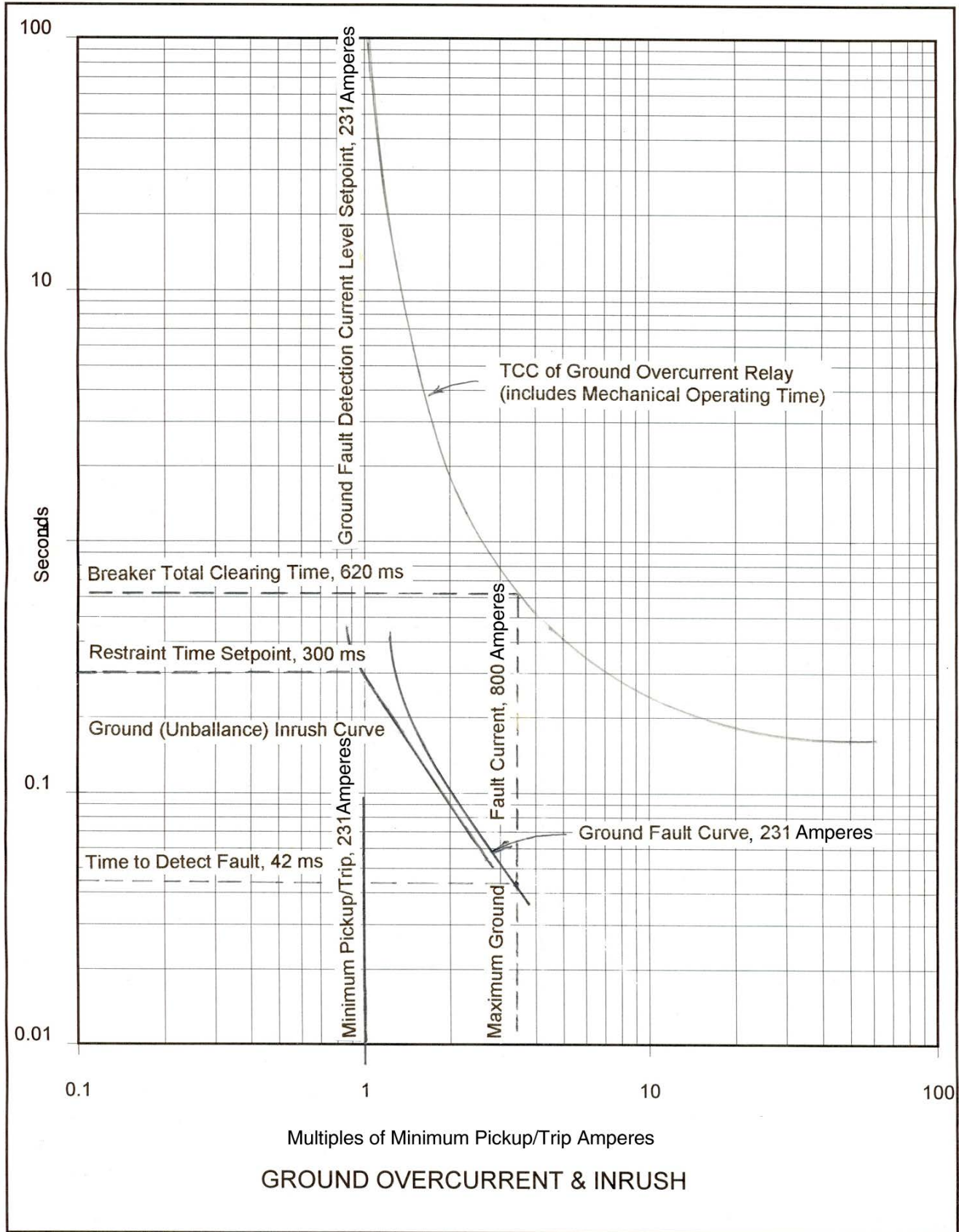


Figure 13. Coordination Sheet for ground overcurrent and inrush.

Inrush and Load-Pickup Restraint

Inrush and load-pickup currents occur when voltage is restored to a distribution circuit that has connected load. These are examples of the type of current involved.

- **Magnetizing inrush**—The magnetizing-inrush current has a short duration, and the magnitude depends primarily on the connected transformer capacity, residual magnetism in the transformers, and system impedance. Generally accepted inrush for a single distribution transformer is up to 25 x full load kVA for 0.01 second.
- **Hot-load pickup**—The hot-load pickup current occurs when the source breaker trips and recloses. The magnitude depends on magnetizing inrush and the type of connected load. For example, a momentary power interruption may cause motor controllers to disconnect their motors, while resistive loads may remain online. See Figure 14.
- **Cold-load pickup**—The cold-load pickup current is caused by connected load after an extended outage. The magnitude depends on the magnetizing inrush, the type and amount of connected load, and the duration of the outage. For example, thermostatically controlled loads (such as refrigeration, air conditioning, and heating) increase because of the loss of diversity. Generally accepted inrush for cold-load pickup is 6 x full load for 1 second, 3 x full load for 10 seconds, and 2 x full load for 100 to 300 seconds.

The 5800 Series Switch Control invokes inrush restraint whenever three-phase voltage is lost and one or more phases return. The **Current Inrush Restraint Time** setpoint is the amount of time, in milliseconds, that must elapse after restoration of voltage before the switch control responds normally to an **Overcurrent Fault** condition. During this time period, the response of the switch control is determined by the **Phase or Ground Current Inrush Restraint Multiplier** setpoint.

When using a fast reclose on the source-side breaker, it must remain open long enough for the control to detect the outage or inrush restraint will not be applied. The time required for the control to detect a loss of voltage is variable depending on the selection of the **Loss-of-Voltage Threshold** setpoint. For example, the control can detect a loss of voltage in approximately 11 cycles with a threshold of 60 volts, or 14 cycles with a threshold of 20 volts. See Figure 8 on page 16 for voltage-response times.

The software has two types of inrush-/load-pickup restraint, **Time Block** mode and a numerical multiplier. When the **Inrush Restraint Multiplier** setpoint is in **Time Block** mode, the switch control ignores all overcurrent conditions during the restraint time. When it is a numerical multiplier value (2x, 4x, 8x, or 16x), the corresponding phase- or ground-fault detection current level is temporarily raised by the multiplier value.

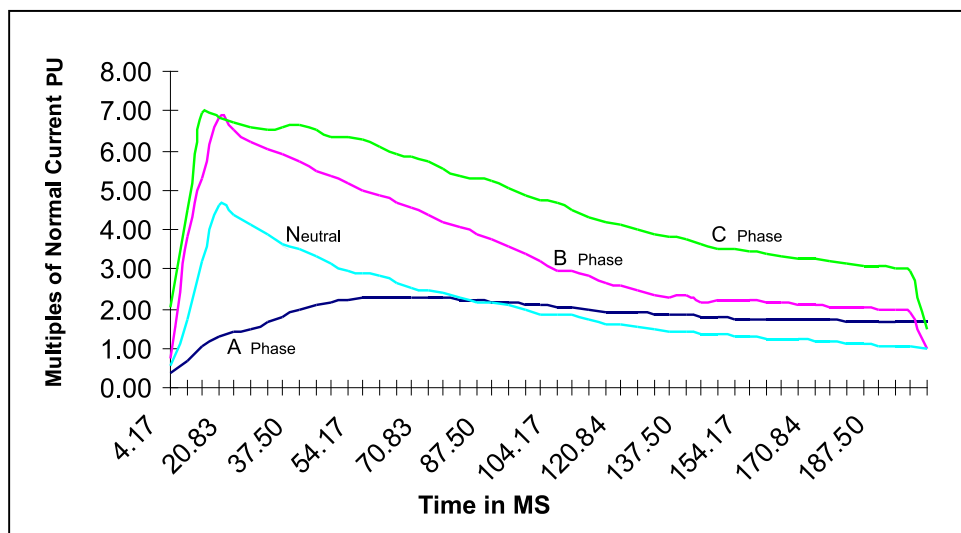


Figure 14. Example of hot load pickup inrush currents for a commercial area.

Setup Procedures

Evaluate the magnitude and type of load beyond the switch control, and estimate the magnitude and duration of the inrush-/load-pickup current. See Figure 14 on page 25 for examples.

Phase Current Inrush Restraint Time

Set this to a value long enough to allow the inrush-/load-pickup current to drop below the **Phase Fault Detection Current Level** setpoint before the timer expires.

Phase Current Inrush Restraint Multiplier

Select either **Time Block** mode or a multiplier value. Either setting is used only for the duration of the **Phase Current Inrush Restraint Timer** setpoint.

- **Time Block**—All phase currents are ignored until the restraint timer expires. If an overcurrent condition is present at the end of the **Time Block** mode, the control starts the **Phase Fault Duration Time Threshold** timer. Adjust the **Phase Fault Duration Time Threshold** and **Phase Current Inrush Restraint Time** setpoints to ensure the control has enough time after the time block to detect a phase fault.
- **Multiplier Value**—The **Phase Fault Detection Current Level** setpoint is temporarily raised by the selected multiplier value: 2x, 4x, 8x, or 16x. If the switch control detects current magnitudes greater than the elevated level, it starts the **Phase Fault Duration Time Threshold** timer. If the current remains above fault levels and the timer expires, the switch control records a fault.

Where possible, set the multiplier to raise the **Phase Fault Current Detection Level** setpoint above the expected inrush-/load-pickup levels, but below end-of-line (EOL) minimum phase-fault current levels. The end-of-line minimum phase-fault levels may be estimated as 60% of end-of-line maximum fault-current levels, where the end of line is defined as the worst case end of line after load has been transferred to the alternate feeder. When the inrush multiplier raises the elevated fault-detection current level to a value that exceeds actual fault current, the result is the same as **Time Block** mode.

Make sure there is enough time after the **Phase Inrush Restraint** timer expires to detect a fault. Check for fault-current values up to the **Maximum Phase Fault Current Level** setting.

For example, if the **Phase Fault Detection Current Level** setpoint is 860 and the **Phase Current Inrush Restraint Multiplier** setpoint is 4x, during the **Phase Current Inrush Restraint Time** setting the switch control ignores all phase-fault conditions of less than 3440 RMS amperes. When the **Inrush-Restraint** timer expires, the switch control responds to all faults of at least 860 amperes.

Ground Current Inrush Restraint Time

Estimate the maximum imbalance inrush-/load-pickup current and its duration at the switch control. Set this to a value long enough to allow the inrush-/load-pickup current to drop below the **Ground Fault Detection Current Level** setpoint before the timer expires.

Ground Current Inrush Restraint Multiplier

Select either **Time Block** mode or a multiplier value. Either setting is used only for the duration of the **Ground Current Inrush Restraint Timer** setting.

- **Time Block**—All ground (unbalanced) currents are ignored until the restraint timer expires. If an overcurrent condition is present at the end of the time block, the switch control starts the **Ground Fault Duration Time Threshold** timer. Adjust the **Ground Fault Duration Time Threshold** and **Ground Current Inrush Restraint Time** setpoints to ensure the switch control has enough time after the time block to detect a ground fault.
- **Multiplier Value**—The **Ground Fault Detection Current Level** setpoint is temporarily raised by the selected multiplier value: 2x, 4x, 8x, or 16x. If the switch control detects currents whose magnitudes are greater than the elevated level, it starts the **Ground Fault Duration Time Threshold** timer. When the currents remain above fault levels and the timer expires, the switch control records a fault.

Where possible, set the multiplier to raise the ground-fault current-detection level above the expected inrush-/load-pickup levels. Don't set the multiplier higher than necessary or it may mask a low-level ground fault. When the inrush multiplier raises the elevated fault-detection current level to a value that exceeds full scale, the result is the same as **Time Block** mode. Full scale for ground faults is 800 amperes.

Suggested Information for Each Switch Location:

- Phase and ground TCC curves for the source-side protective device
- Phase and ground source-side protective device minimum pickup/trip amperes
- Source-side protective device mechanical-operation time
- Maximum available phase- and ground-fault current at each sectionalizing switch from each source
- Peak normal-load current at each sectionalizing switch
- End-of-line phase- and ground-fault current for each source

Automatic Operation Setup

STEP 7. At the *Setup Menu* screen, click on the **Automatic Operation** button to display the *Setup>Automatic Operation* screen. See Figure 15. Enter the correct values for the parameters for this switch control.

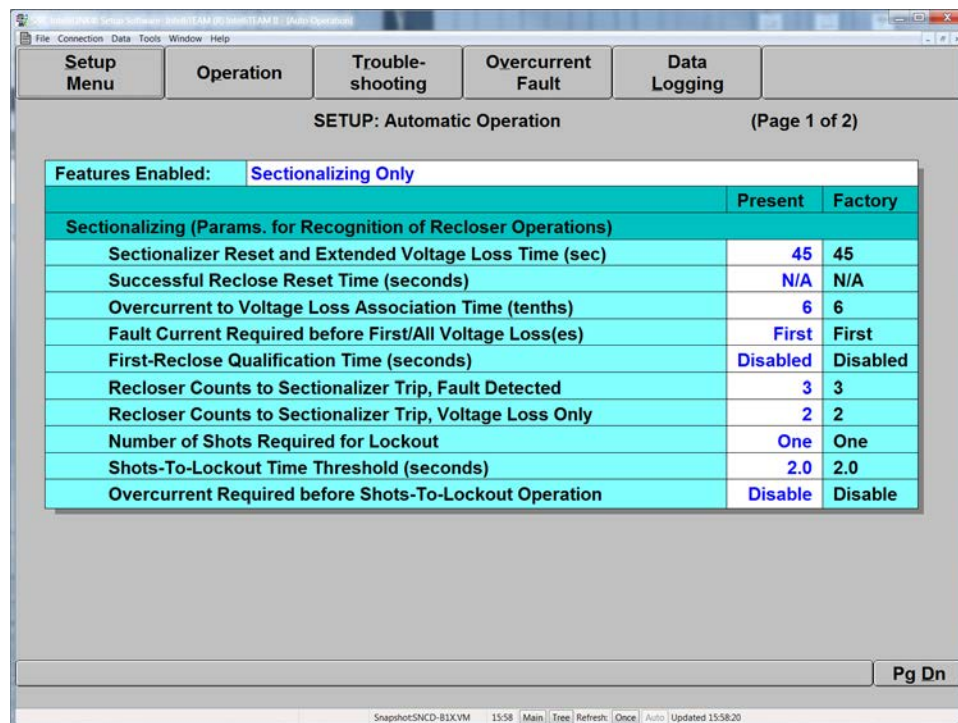


Figure 15. The *Setup>Automatic Operation* screen, Page 1 for a 5801 control.

The *Setup>Automatic Operation* screen configures various automatic switch control operations and allows entry of the setpoints for these operations. For the S&C 5802/5803 controls, separate values can be selected for Switch 1 and Switch 2 for most of the setpoints.

The control opens the line switch for these four conditions:

- **Fault current counts**—The control measures fault current and observes the source-side protective device trip and reclose. A fault-current count is defined as fault current followed by a three-phase voltage loss. When the control fault-current counts equal the **Recloser Counts to Sectionalizer Trip—Fault Detected** setting, the control opens the line switch.
- **Single-phasing**—The control measures voltage on one or two phases staying below the **Phase Loss Protection Voltage Loss Threshold** setpoint for a period equal to the **Phase Loss Protection Time Threshold** setpoint.
- **Voltage-loss counts**—The control observes the source-side protective device trip and reclose. A voltage-loss count is defined as normal voltage followed by a three-phase voltage loss. When the control voltage-loss counts equal the **Recloser Counts to Sectionalizer Trip—Voltage Loss Only** setting, the control opens the line switch. This feature applies only when the IntelliTeam II system is enabled and in the **Ready for Transfer** state.
- **Extended loss of voltage**—The control measures the three-phase voltage going below the **Loss of Voltage Threshold** setpoint and staying there longer than the **Sectionalizer Reset and Extended Voltage Loss Time** setpoint. This feature applies only when the IntelliTeam II system is enabled and in the **Ready to Transfer** state.

Features Enabled [Switches 1 and 2, if applicable]

The switch control can carry out the following automatic operations:

- **None** (all automatic-operation features are disabled)
- **Sectionalizing Only**
- **Phase-Loss Protection Only**
- **Sectionalizing + Phase-Loss Protection**

Sectionalizing—Team members monitor conditions associated with breaker and recloser operations and sectionalize the line based on an overcurrent condition and/or loss of voltage.

Phase-Loss Protection—Team members open the switch based on loss of voltage on one or two individual phases.

NOTICE

When one of the automatic operation options is selected, on either switch if applicable, the faceplate Automatic Operation ENABLE/DISABLE switch or a SCADA command can be used to disable **Automatic Operation** mode. If the **None** mode (on both switches, if applicable) is selected, the control software puts the team member in Automatic Operation **Disabled** mode and ignores all commands from the faceplate Automatic Operation ENABLE/DISABLE switch. Also, **Automatic Operation** mode cannot be enabled from the SCADA master station.

NOTICE

IMPORTANT: Total loss of power to the switch control caused by complete battery discharge and no ac power will cancel all automatic operations in progress.

Sectionalizing

When **Sectionalizing** mode is enabled and the control recognizes a three-phase voltage loss, it starts the **Sectionalizer Reset and Extended Voltage Loss Time** timer and begins to count trip operations. If three-phase voltage returns with no faults detected, the **Sectionalizer Reset and Extended Voltage Loss Timer** resets and the **Successful Reclose Reset Timer** is started. If the source-side protection device continues to trip and the trip count equals the **Recloser Counts to Sectionalizer Trip** setpoint, the control opens the line switch.

If the **Sectionalizer Reset and Extended Voltage Loss Timer** expires before the **Recloser Counts to Sectionalizer Trip** setpoint is reached, the control resets the timer and the counter to zero.

If three-phase voltage remains out for the duration of the **Sectionalizer Reset and Extended Voltage Loss Time** setpoint, an extended voltage-loss condition exists and the control opens the line switch.

Sectionalizer Reset and Extended Voltage Loss Time

This timer opens the line switch when all three phases are continuously below the **Loss of Voltage Threshold** setpoint on the *Site Related* screen for the duration of this setpoint.

Set this value to a time 5 seconds longer than the maximum lockout time for the normal source-side protective device. This ensures the loss of voltage is not a temporary condition and the normal source-side protective device has reached its **Lockout** state.

Successful Reclose Reset Time (seconds)

When three-phase voltage is continuously present without a fault event for this amount of time (in seconds), the switch control considers the source-side protective device to have had a successful reclose. When this timer expires, the control resets the sectionalizing timers and counters to zero.

Use this setpoint when the **Successful Reclose Reset Time** setpoint has been implemented in the source-side protective device. Set the value to the same value as the source-side protective device. When the source-side protective device does not use this reset scheme, set it to the **N/A** value; the switch control uses the **Sectionalizer Reset and Extended Voltage Loss Time** setpoint to reset the count.

Overcurrent to Voltage Loss Association Time (tenths)

This setpoint defines the time interval between the end of a detected overcurrent event and the start of a detected three-phase voltage loss for the purpose of associating the two events to count breaker operations.

Under normal circuit conditions, leave this set to the factory default of six-tenths. If line voltage will be supported for an abnormal period of time following the breaker operation, adjust this setpoint to account for it.

Fault Current Required Before First/All Voltage Loss(es)

For the control to trip open the switch because of a fault, it must detect and count fault-current and voltage-loss events. When this is set to **All** mode, the switch control only increments counts when it detects a fault current before every voltage loss. Any voltage loss without an associated fault current disarms the sectionalizer. When set to **First** mode, the control must detect fault current before the first voltage loss only. After that, the recloser operation count increments with each voltage loss. When the count is reset, the next voltage loss must be preceded by fault current for the switch control to start counting again.

The default value is **First** mode because the current transformers are load-metering CTs (not fault-current CTs). After the first fault, they may not register subsequent faults correctly.

First-Reclose Qualification Time (seconds)

In some recloser configurations that implement an initial instantaneous reclose strategy, the three-phase voltage loss cannot be reliably detected or missed by sectionalizing logic that counts recloser operations. The **First-Reclose Qualification Time** mode requires a detected three-phase loss of voltage to persist longer than this setpoint for it to register as the first sectionalizing count. This allows the control to ignore an initial instantaneous reclose, should it be detected. After the first qualified sectionalizing count in a series has been recorded, subsequent voltage losses are not qualified by this setpoint time before being counted for purposes of sectionalizer operation. All detected voltage losses are entered in the events log, whether qualified for sectionalizing count or otherwise, and a voltage loss disqualified by this criterion is logged as an instantaneous reclose and is not counted for sectionalizing purposes.

Note: This time represents an additional qualification period, after the detection of the voltage loss, during which the control determines whether or not to count it for sectionalizing purposes. It is distinct from the **Loss of Voltage Threshold Maximum Response Time** setpoint, which varies based on the **Loss of Voltage Threshold** setpoint configured on the *Setup>Site-*

Related screen. The detection threshold applies to all voltage losses. The **First-Reclose Qualification Time** setpoint allows the control to disqualify any potentially detected voltage loss, such as those caused by initial instantaneous reclose operations, and disregard them only for purposes of sectionalizing. It is applied to detected voltage losses only until the first qualified recloser operation in a series has been recorded.

When this feature is used, the memory time from first recloser operation to reset will be counted from the first qualified breaker operation count in the series recorded by the control, and not from the disqualified instantaneous first-reclose operation, if it is detected.

Note: When the **First-Reclose Qualification Time** mode is enabled and the breaker uses an instantaneous first reclose, the number of breaker shots-to-lockout counts must be increased by one because the switch control will ignore the first instantaneous breaker operation should it be detected and disqualified.

The next breaker operation after the instant reclose must be longer than the time chosen for the **First Reclose Qualification Time** setpoint to allow the subsequent operation to qualify as the first recloser operation count.

The qualification time can be configured from 0.1 second to 6.0 seconds in 0.1-second increments.

Recloser Counts to Sectionalizer Trip, Fault Detected

This is the number of three-phase voltage losses associated with fault current that will cause the control to open the line switch.

The switch control trips open the line switch when all of the following are true:

- The switch control detects a number of three-phase voltage losses equal to the **Recloser Counts to Sectionalizer Trip, Fault Detected** setpoint.
- **Sectionalizing** mode is enabled.
- An overcurrent fault preceded the number of voltage losses set by the **Fault Current Required before First/All Voltage Loss(es)** setpoint.

For example, if the configured setpoint value is 3, the switch control trips open the line switch on the third qualifying voltage outage.

Recloser Counts to Sectionalizer Trip, Voltage Loss Only

When **Sectionalizing** mode is enabled and the switch control detects this number of three-phase voltage losses with no fault current, the control opens the line switch. This feature applies only when the IntelliTeam II system is enabled and in the **Ready to Transfer** state.

For example, if the configured setpoint value is 3, the switch control trips open the line switch on the third qualifying voltage outage.

Number of Shots Required for Lockout

Should a source-side breaker or switch inadvertently close into a fault, this is the number of three-phase voltage losses that the switch control must detect during the **Shots-To-Lockout Time Threshold** period before it trips open the switch. The switch control can lock out after either one or two voltage losses. Normally, this value is set to 1 unless the coordinating breaker uses the instantaneous reclose feature.

Shots-To-Lockout Time Threshold (seconds)

This is the number of seconds the **Shots-to-Lockout** timer runs. If the applicable number of three-phase voltage losses occurs during this time period, the control trips open the switch. To enable the **Shots-to-Lockout** feature, set this time to a value greater than zero.

During circuit reconfiguration the **Shots-to-Lockout** timer is always used when enabled. When the IntelliTeam II system closes a switch to restore load, it waits the **Shots-to-Lockout Time Threshold** period before progressing to the next switch. This delay ensures each switch will remain closed as the circuit reconfiguration continues.

Overcurrent Required Before Shots-To-Lockout Operation

When this setpoint is enabled, the **Shots-to-Lockout** mode reopens the switch only when the three-phase voltage loss is preceded by overcurrent. The **Shots-to-Lockout** mode normally uses only voltage loss to detect a breaker trip. This prevents a misoperation because of an incorrect fault-detection or inrush-restraint setting. Enabling this setpoint is recommended when the system circuit breakers trip on inrush current.

When the **Number of Shots Required for Lockout** setpoint is 2, the relationship between the detection of overcurrent and voltage losses follows the **Fault Current Required before First/All Voltage Loss(es)** setpoint.

The screenshot shows a software interface with a menu bar (File, Connection, Data, Tools, Window, Help) and a main menu (Setup Menu, Operation, Troubleshooting, Overcurrent Fault, Data Logging). The title is "SETUP: Automatic Operation (Page 2 of 2)". A table lists "Features Enabled: Sectionalizing Only".

| | Present | Factory |
|--|---------|---------|
| Phase Loss Protection | | |
| Phase Loss Protection Voltage Loss Threshold (RMS Volts) | N/A | N/A |
| Phase Loss Protection Time Threshold (seconds) | 30 | 30 |
| Phase Loss Protection Current Threshold (amps) | 600 | 600 |
| Automatic Reclose (In Conjunction with Phase Loss Protection) | | |
| Automatic Reclose Time Threshold (seconds) | 30 | 30 |

At the bottom, there is a "Pg Up" button and a status bar with "Snapshot5NCD-B1XVM 15:56 | Main | Tree | Refresh | Once | Auto | Updated 15:54:59".

Figure 16. The Setup>Automatic Operation screen, Page 2 for a 5801 control.

About Phase Loss Protection

When **Phase Loss Protection** mode is enabled and the switch control detects a loss of voltage on one or two phases, it starts the **Phase Loss Protection Time Threshold** timer. When the voltage loss persists and true RMS voltage remains below the setpoint until the timer expires, the control trips open the line switch. If voltage returns on one phase but is then lost on another phase, the switch control restarts the timer.

In a wye system, if a phase loses voltage, the voltage reading is 0 (zero) for that phase, so a phase imbalance can be detected easily.

In a delta system, the loss of one phase results in sensor readings with magnitudes slightly more than 1/2 of normal phase-to-phase voltage. Simultaneous loss of two phases is not detectable as a phase imbalance condition.

Phase Loss Protection Voltage Loss Threshold (RMS Volts)

When voltage on one or two phases drops below this value, the switch control starts the **Phase Loss Protection Time Threshold** timer. When voltage stays continuously below this setpoint until the timer expires, the control opens the line switch. When this is set to the **N/A** value, the switch control uses the **Loss of Voltage Threshold** setpoint (on the Setup>Site-Related screen) for both three-phase voltage loss and for phase-loss protection. A higher value for this setpoint lets the switch control detect phase loss conditions, where there are delta-connected transformers, and still provide accurate sensing of true three-phase outages. A threshold of approximately 75% of the normal phase voltage is recommended, essentially 90 Volts on a 120-Volt base. See Figure 16.

When set to other than the **N/A** value, this setpoint is also used as the **Return of Voltage** threshold value.

Phase Loss Protection Time Threshold (seconds)

This is the number of seconds the switch control waits after it detects a phase-voltage loss before it trips open the switch. When the timer expires, if the voltage on one or two phases has remained below the **Phase Loss Protection Voltage Loss Threshold** setpoint, and the current has remained continuously below the **Phase Loss Protection Current Threshold** setpoint, the control trips open the line switch.

At a minimum, this time should exceed the reaction time of any single-phase source-side protective device.

Phase Loss Protection Current Threshold (amperes)

When minimizing loss-of-phase conditions, the control must switch the remaining live phases. To ensure these live phases have safe current levels for the switch rating, set this to the load-break rating of the line switch.

Automatic Reclose Time Threshold (seconds)

The **Automatic Reclose Time Threshold** setpoint is not used by this IntelliTeam II software revision.

Communication Setup

STEP 8. At the *Setup Menu* screen, click on the **Communications** button to display Page 1 of the *Setup>Communications* screen. See Figure 17. Enter the correct values for this switch control.

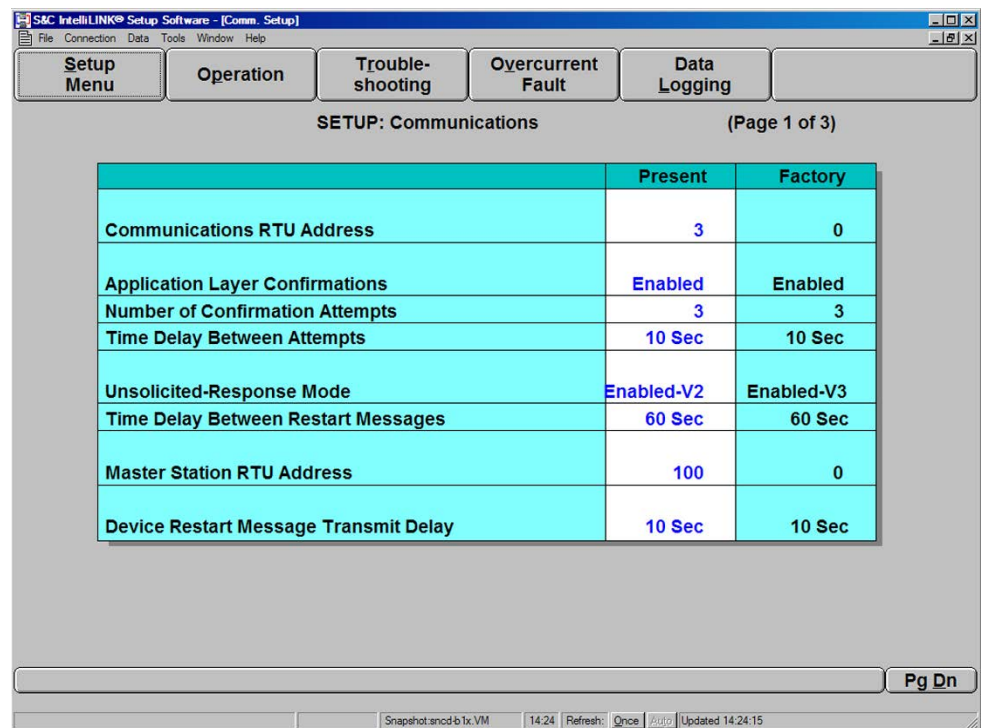


Figure 17. The *Setup>Communications* screen, page 1.

This screen configures setpoints related to IntelliTeam II and SCADA (if applicable) communications. This screen includes the following fields:

Communications RTU Address

Enter the network address for this control. It must be the same as the **DNP/RTU Address** setpoint (on the *Setup>Team* screen) for this team member. Be sure to enter an address even when this switch control is not accessed via SCADA.

WARNING

When a configured switch control is moved to a new location, be sure to enter the new address into the control. When the old address is not changed, the control may respond to instructions meant for a different switch control location.

NOTICE

IntelliLink® Remote Setup Software Users: Changing the RTU address or other communication parameters can stop this device from communicating with IntelliLink Remote Software and the other team members. The IntelliTeam system stops working when it can't reach a team member. When communication with a control is lost, **the operator must go to the site**, connect directly to that control, and reset the RTU address or other changed communication parameters.

Application Layer Confirmations

When this is enabled, the control requests a confirmation from the SCADA master station for each message sent. That includes change-event data, whether through an unsolicited report by exception or polled requests. If the control does not receive a confirmation within the **Time Delay Between Attempts** setpoint, it retransmits the response with a request for another confirmation.

Number of Confirmation Attempts

This is the number of times the control asks for a confirmation when the **Application Layer Confirmations** setpoint is enabled. This number includes the initial response transmission.

Time Delay Between Attempts

When the control does not receive a confirmation within this time period, it retransmits the response with a request for another confirmation unless the **Number of Confirmation Attempts** setpoint has been reached.

Unsolicited-Response Mode

When this setpoint is enabled, the control sends a message to the SCADA master station every time a status point changes state. For more information, see the applicable DNP Points List and Implementation Instruction Sheet. When this feature is enabled, the master station RTU address must also be entered on this screen.

The **Enabled-V3** mode conforms to the latest DNP Level-2 requirements. For example, at power-up, null unsolicited responses are sent until the master station confirms them. The data-filled responses are sent only when the master station issues an **EnaUns** command (application function code 14x). The **Enabled-V2** mode conforms to the past approach.

Time Delay Between Restart Messages

NOTICE

Enabling this feature may add significant communication traffic to the communication network and reduce network efficiency.

When the **Unsolicited-Response Mode** setpoint is Enabled-V3, at restart the control sends unsolicited device-restart messages at this frequency, after the **Device Restart Message Transmit Delay** timer expires. These messages will continue until the control receives a confirmation from the master station.

Master Station RTU Address

This is the master station RTU address to which the control sends all unsolicited responses. Leaving this address at zero prevents the control from generating any unsolicited responses, regardless of whether the **Unsolicited Responses to Master Station** setpoint is enabled.

Device Restart Message Transmit Delay

This is the delay between the restart of the control and the transmission of the unsolicited device-restart message. When the communication system needs time for acquisition following a restart, adjust this value to match the requirements.

STEP 9. At Page 1 of the *Setup>Communications* screen, click on the **PgDn** button to display Page 2. See Figure 18. Enter the correct values for this switch control.

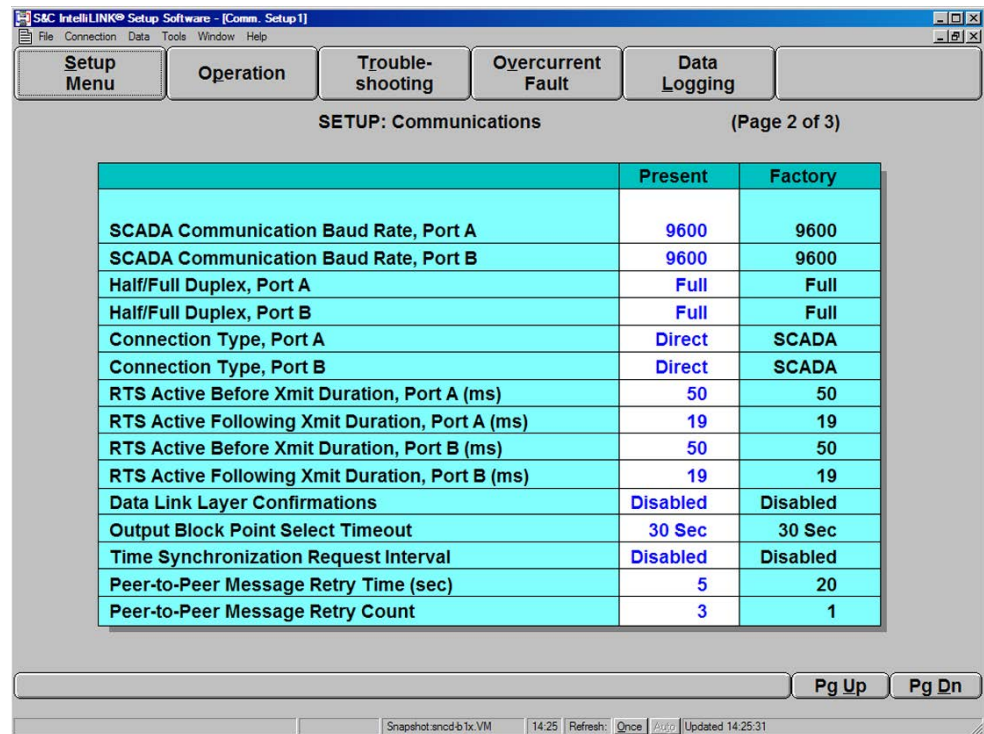


Figure 18. The *Setup>Communications* screen, Page 2.

This screen includes the following fields:

SCADA Communication Baud Rate, Port A and Port B

This is the baud rate between the switch control and the directly connected communication device (radio, modem, etc.). The baud rate must be identical to the baud rate for the device.

Half/Full Duplex, Port A and Port B

Set this value to match the value selected for the directly connected device at this port (modem, radio, master station, another team member, etc.). For example, select **Full Duplex** mode when this port is connected to another member in the team or other full-duplex device.

Connection Type, Port A and Port B

The connection type set for this port defines how the control handles communication.

- None** There is no connection to the port.
- Non-Relay** Messages received on the port are not intended for the entire team. This setting also prevents the control from recording errors when this port receives a message not addressed to the local control.
- SCADA** The port is connected to a SCADA master station. The port will not relay SCADA polls to other team controls.
- Direct** The port is connected to another team member or SCADA. The port will relay messages to other team controls.

RTS Active Before Xmit Duration, Port A and Port B

This is the amount of time (in milliseconds) a request to send (RTS) message is active for this port before a transmission takes place. Leave this at the factory-default value.

RTS Active Following Xmit Duration, Port A and Port B

This is the amount of time (in milliseconds) RTS is active after a transmission takes place. Leave this at the factory-default value.

Data Link Layer Confirmations

When this setpoint is enabled, a data-link layer function of DNP suppresses duplicate messages to another team member receiving requests. This function only affects messages originating from a team member, not responses. Disable this setpoint to reduce communication between team members.

Output Block Point Select Timeout

This is the timeout duration of the **Select** function on control points. For information about analog output points, see the applicable DNP Points List Instruction Sheet. When the timeout duration is too short between the **Select** and the **Operate** functions during a **Select-Before-Operate** sequence, the control disables the point and reports a transmission failure to the master station, if applicable.

Time Synchronization Request Interval

The switch control maintains the time and date in an accurate battery-backed clock chip. When this setpoint is enabled, the control requests a time-synchronization message from the DNP master station. The control requests the time on startup and again at every configured interval. For example, if the set interval is 2 Hrs and the control starts at 1:30, a time request will occur at 1:30 and again at 3:00, 5:00, 7:00, and so on.

Peer-to-Peer Message Retry Time (seconds)

The control waits this amount of time (in seconds) to receive a response from another team member. When it does not receive the response within this time period, it re-sends the message to the team member. It continues sending the message until it receives a response or reaches the **Peer-to-Peer Message Retry Count** setpoint.

Peer-to-Peer Message Retry Count

This is the number of times the control re-sends a message to a team member that does not respond within the **Peer-to-Peer Message Retry Time** period.

Decreasing the **Peer-to-Peer Message Retry Time** setpoint, or increasing the **Peer-to-Peer Message Retry Count** setpoint, may have a negative effect on some communication systems because of increased traffic. Take this into account when changing these setpoints.

STEP 10. At Page 2 of the *Setup>Communications* screen, click on the **PgDn** button to display Page 3. See Figure 19. Enter the correct values for this switch control.

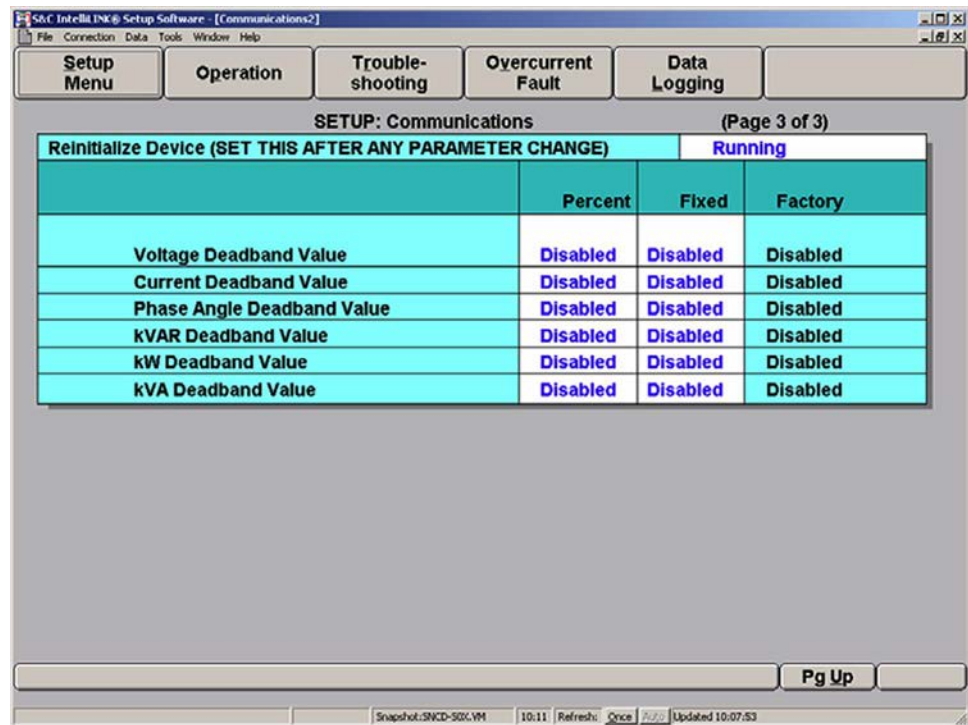


Figure 19. The *Setup>Communications* screen, Page 3 for a 5801 control with DNP.

Deadband values can be applied to voltage, current, phase-angle, kvars, kW, and kVA monitoring. When enabled, the deadband setpoint defines the variance threshold from a previously stored reference value. When the measured value deviates more than this amount from the reference value, the control reports the analog event and updates the reference value to equal the new measurement.

Deadband values are set by either a fixed value or a percentage of the minimum variance appropriate for the specific parameter. When a threshold value is changed and reinitialized, for either the **Percent** setpoint or the **Fixed** setpoint, the other value is automatically set to the **N/A** value. If both the **Percent** and **Fixed** setpoints are changed and reinitialized, the **Fixed** value takes precedence and the **Percent** value is automatically set to the **N/A** state. When the **Disabled** state is selected for both the **Percent** and **Fixed** setpoints, deadband event reporting is disabled for that parameter.

Deadband event sensing can be disabled on a per-parameter basis by configuring a setting above the maximum value. The field will display “Disabled.”

For 5801 Switch Controls, the deadband value entered for **kvars**, **kW**, and **kVA** setpoints applies to each reported phase and the total value. For 5802/5803 controls, the deadband value entered for Total kvars, Total kW and Total kVA apply to the sum of the three phases only.

The deadband baseline is set or changed for the following conditions:

- On power-up or restart, after a short delay for the system to stabilize, the baseline for each deadbanded analog is set to the present analog value.
- After a switch operation, deadband events are generated for enabled current and/or voltage analog deadbanded quantities, and each baseline is set to the returned analog value.
- When an analog value changes by an amount exceeding its deadband value, an analog event is generated, timestamped, and the baseline is set to the new analog value.

IntelliTeam II Automatic Restoration System Setup

This section describes switch-control configuration for using the IntelliTeam II Automatic Restoration System software.

STEP 11. At the *Setup Menu* screen, click on the **Team Menu** button to display the *Team Setup Menu* screen. See Figure 20.

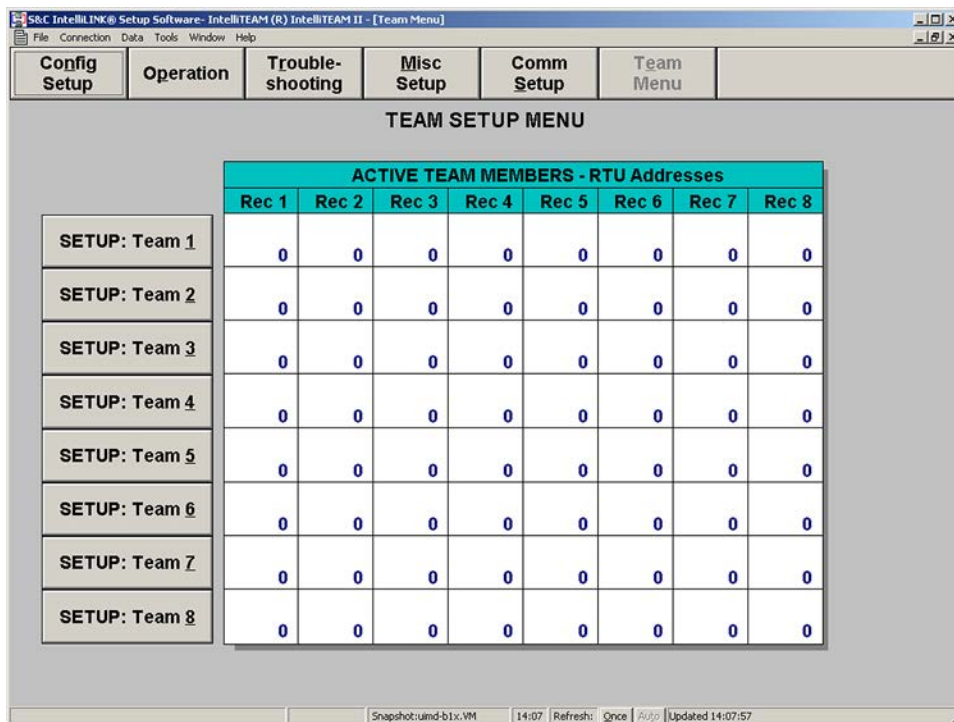


Figure 20. The *Team Setup Menu* screen.

This screen shows the DNP/RTU address summary for the teams in which this switch control is a member.

STEP 12. If available, load the .CFG file for each team where this switch control is a member. Otherwise, go to Step 13.

Use the .CFG file(s) for the team(s) where this switch control is a member to load the setpoints:

- (a) In the **File** menu, click on the **Load Setpoints** option.
- (b) In the Load Setpoints dialog box, select the name of the .CFG file for the first team where this switch control is a member. Click on the **OK** button. The IntelliLink software indicates when installation is complete. Click on the **OK** button. The updated address information is available in the summary table.
- (c) Do one of the following:
 - When this switch control is part of another team and the corresponding .CFG file is available, repeat Steps (a) and (b). Then, go to Step 16.
 - When this switch control is part of another team and a corresponding .CFG file is not available, go to Step 13.
 - When this switch control is not part of another team, go to Step 16.

Switch Control and Team Setup

STEP 13. At the *Team Setup Menu* screen, click on the **Team Setup** button for the team to be accessed. The IntelliLink software displays the corresponding *Setup>Team* screen. See Figure 21. Enter the correct values for this switch control.

The screenshot shows the 'Setup: Team' screen for Team 1. The window title is 'S&C IntelliLINK Setup Software - [Setup_Team1]'. The screen has a menu bar with 'File', 'Connection', 'Data', 'Tools', 'Window', and 'Help'. Below the menu bar are six buttons: 'Setup Menu', 'Operation', 'Troubleshooting', 'Overcurrent Fault', 'Data Logging', and 'Team Menu'. The main area is titled 'SETUP: Team' and 'Team 1'. It contains several sections:

- Team ID:** (empty field)
- Team Logic:** Disabled
- Team Setup:** Stopped
- Alternate Source Sequence:**
 - 1st Alt Src: ----
 - 2nd Alt Src: ----
 - 3rd Alt Src: ----
 - 4th Alt Src: ----
- General Team Parameters:**
 - Reserved: (empty)
 - Line Seg. Limit: N/A
 - Contract Required: No
 - RTN Time (minutes): 5
 - PR Time (minutes): Disabled
- Individual Team Member Parameters:**

| | Rec 1 | Rec 2 | Rec 3 | Rec 4 | Rec 5 | Rec 6 | Rec 7 | Rec 8 |
|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| DNP/RTU Address | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sw/Pos Number | Sw1 | Sw1 | Sw1 | Sw1 | Sw1 | Sw1 | Sw1 | Sw1 |
| Normal Open/Close | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Normal Sw Func | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Rtn to Norm Mode | None | None | None | None | None | None | None | None |
| Maximum Capacity | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |

At the bottom, there is a status bar with 'Snapshot:PADD-B1X.VM', '16:45', 'Refresh: Once', and 'Updated 16:43:42'.

Figure 21. The *Setup>Team* screen for a specific team.

The *Setup>Team* screens configure the team-related parameters for each of the teams in which this switch control is a member. This control can also connect to other teams on the SCADA network.

NOTICE

For any one team, the values on the associated *Setup>Team* screen must be identical for every team member.

This screen includes the following fields:

Team ID

Enter the name for this team with a maximum of 16 characters. The name identifies the team to the SCADA master station operator and appears on all reports generated from the team members. When a team configuration is saved, this name is included. The name also appears on the LCD screen.

Team Logic

This setpoint enables or disables **IntelliTeam II** operation mode for this team.

Team Setup

This setpoint changes operational status for the team defined on this screen. It automatically changes to the **Stopped** mode when team logic detects a change to any of the parameters on this screen.

NOTICE

When this value is set to **Stopped** mode and back to **Running** mode, the IntelliTeam II software uses the setpoint values on this screen as the presently valid team parameters. Until all team members have identical values on this screen, the team will not be in the **Ready to Transfer** state.

Alternate Source Sequence

This configures the sequence in which team members are used to restore the line segment. When the team cannot use the source switch to restore the line segment, the team tries the members listed here. See the “Normal Sw Func” section on page 40.

These setpoints are optional. When values for these setpoints are not entered or the selected team members cannot be used to restore the line segment, the team tries the tie switch(es) to find an alternate source. If this is not successful, the team tries the load/tie switch(es).

General Team Parameters

These setpoints apply to all members of the team shown on this *Setup>Team* screen page.

Reserved

This feature is not presently implemented.

Line Segment Limit

Set this to the maximum number of line segments this team can pick up. For example, the **Add 1** setting inhibits any other line segments from being restored through a team member after it restores its first line segment. To allow the team to pick up as many line segments as capacity allows, set this to the **N/A** value.

Setting this setpoint to anything other than the **N/A** value automatically changes the **Contract Required** setpoint to the **Yes** state.

Contract Required

When a line segment cannot handle any overloading at all, set this to the **Yes** state. When team members encounter a line segment in the restoration path requiring a contract, they communicate with all subsequent line segments in the direction of the alternate source to ensure that the alternate source or a line segment will not be overloaded.

Note: Requiring a contract slows the reconfiguration process.

RTN Time (minutes)

Power must be restored to the faulted line segment for this amount of time (in minutes) before the **Return to Normal** process starts.

PR Time (minutes—Prohibit Restoration)

Configure the desired time period this team will be allowed to attempt to restore service after the start of the event. If this timer expires prior to restoration of service, the team enters the **Prohibit Restoration** state. This stops any restoration by this team until the **Prohibit Restoration** state is cleared by a SCADA command or a command on the *Miscellaneous Operation>Prohibit Restoration* screen.

Individual Team Member Parameters

These setpoints apply to the individual members of this team. The “Rec” entry is the record for each team member. The “Rec” entry is used rather than a DNP/RTU address because two team members may be switches in the same pad-mounted gear and then both will have the same DNP/RTU address.

DNP/RTU Address

This row shows the DNP/RTU address for each team member. One of the addresses entered here must be the DNP/RTU address entered on the *Setup>Communications* screen.

Sw/Pos Number

This row shows the switch/position number associated with the team member, for example, Sw1 is a single overhead switch.

Normal Open/Close

This row shows the state of each line switch when the circuit is configured normally. The team uses this information during transfer operations.

Normal Sw Func

There are six types of functionality for team members:

| Functionality | Description |
|---------------|-------------|
|---------------|-------------|

Normally Closed Switches, Breakers, or Reclosers

| | |
|-------------------|--|
| Source/Sub | Use this value when the source switch is the first team member after the substation/source or is an S&C IntelliNode® Interface Module on the source breaker relay. |
|-------------------|--|

| | |
|---------------|---|
| Source | Use this value for the one closed switch in the team through which the line segment receives power when the circuit is in its normal configuration. |
|---------------|---|

| | |
|-----------------|--|
| Load/Tie | A team may have zero, one, or multiple closed switches through which loads on other line segments receive power. Use this value when the switch could be involved when restoring power to the line segment because line segments on the other side of the switch have alternate sources. |
|-----------------|--|

| | |
|-------------|---|
| Load | A team may have zero, one, or multiple closed switches through which loads on other line segments receive power. Use this value when the switch could not be involved when restoring power to the line segment because line segments on the other side of the switch have no alternate sources. |
|-------------|---|

Normally Open Switches, Breakers or Reclosers

| | |
|----------------|--|
| Tie/Sub | Use this value when the tie switch is the first team member after the substation/source. |
|----------------|--|

| | |
|------------|--|
| Tie | Use this value for zero, one, or multiple open switches in the team that restores power to the line segment directly from an alternate source when closed. |
|------------|--|

NOTICE

Every switch or recloser should be installed with its sensors facing the normal source of the team.

Rtn to Norm Mode

The team members can return the circuit to its normal configuration either automatically once a stable three-phase voltage has been restored to the faulted line segment or on command. For teams with one or more tie switches, choose **Open Transition** mode (the tie switch/es open before the other team members return the circuit to its normal configuration) or **Closed Transition** mode (the team members close all of the switches and then the tie switch/es open). The **Return to Normal** process starts at the line segments closest to the normal source and works outward.

Maximum Capacity

This configures the loading capacity allowed beyond each line switch in the direction of the team being configured. Be sure to take into account cable/wire size and any other circuit restrictions in the configuration. When a team switch is also the first switch on the circuit,

consideration must be given for any loading and cable/wire size restrictions that exist between this switch and the substation. These restrictions may cause a further reduction in the maximum capacity at this first switch.

Note: The real capacity of a team is propagated to each load-side team during normal operation, ensuring the sourceside restriction is honored throughout the remainder of the circuit.

STEP 14. Make the screen values the valid team parameters.

Set the **Team Setup** mode to the **Stopped** state, if not set there already. Click on the **OK** button. Then, set it back to the **Running** state and click on the **OK** button. This directs the IntelliLink software to check the settings of subsequent team members against values on this screen.

STEP 15. Do one of the following:

- When this switch control is part of more than one team, click on the **Team Menu** button. Then, click on the Team Name to display its *Setup>Team* screen. Repeat Steps 13 and Step 14. When the correct setpoint values are entered for each team, go to Step 16.
- If this switch control is not part of more than one team, go to Step 16.

STEP 16. If necessary, create a team .CFG file for each team where this switch control is a member.

Save the values on the *Setup>Team* screen for each team where this switch control is a member. Load this file into subsequent members of this team to ensure all team members use the same setup parameters.

- (a) On the **File** menu, click on the **Save Setpoints** entry. Select the desired **Setpoint Profile** entry. Then, click on the **OK** button.
- (b) In the Save Setpoints dialog box, choose a name and location for the file. For example, "team1234567." The extension .CFG is added automatically.
- (c) When this switch control is part of another team, repeat Steps A and B.

For more information, see the "Saving and Loading a Setup Configuration" section in Instruction Sheet 1042-541, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® II Automatic Restoration System: *Operation*."

STEP 17. At the *Setup Menu* screen, click on the **External Loading** button to display the *Setup>External Source Loading* screen. See Figure 22. Enter the correct values for this switch control.

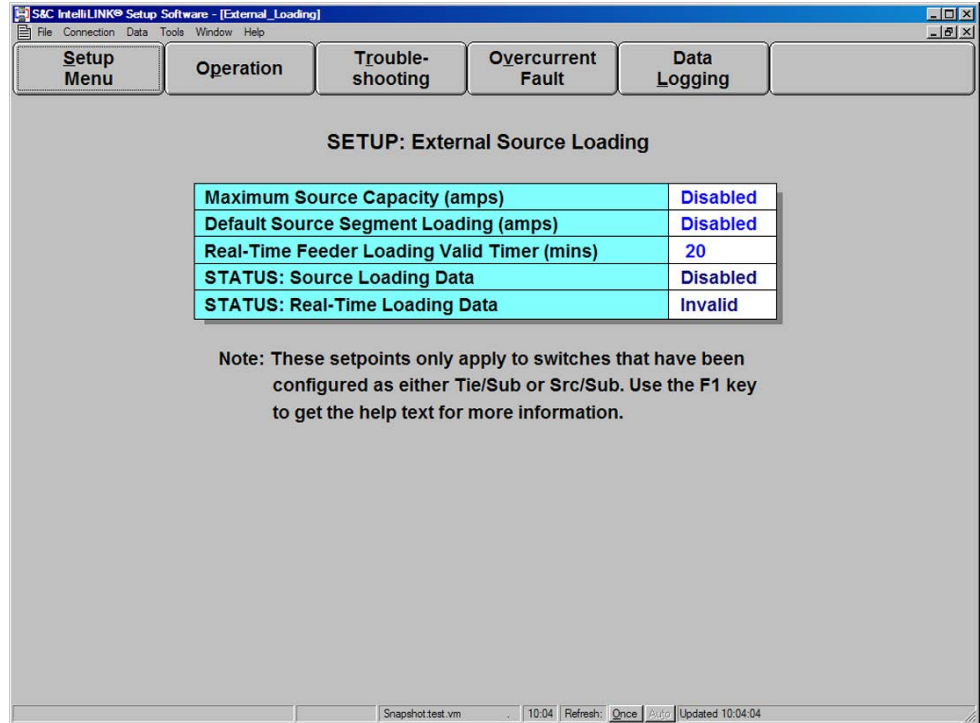


Figure 22. The *Setup>External Source Loading* screen.

External source-loading information (real-time feeder loading) allows the DNP master station monitoring feeder loading measured at a breaker to transmit loading data to the first team member switch on the feeder outside the substation. Loading information is used in conjunction with the following setpoints to calculate the **Real-Time Excess Capacity** value used when transfers occur.

Both the **Maximum Source Capacity** and **Default Source Segment Loading** setpoints must be enabled to use this feature. The **External Source Loading** feature should only be used at the team control closest to the substation.

Maximum Source Capacity (amperes)

This setpoint configures the maximum feeder capacity viewed from the substation. Enter the maximum three-phase load in amperes the feeder can carry at any time (10 amps per count).

Default Source Segment Loading (amperes)

This setpoint configures the estimated maximum load of the line segment between the substation feeder breaker and the first team switch. Enter the peak three-phase load in amperes that estimates the maximum expected load when loading information is not available or valid (10 amps per count).

Real-Time Feeder Loading Valid Timer (minutes)

This timer starts counting when real-time feeder information is received from SCADA. If real-time feeder-loading information is not updated before this timer expires, the load calculation defaults to the **Default Source Segment Loading** setpoint.

STATUS: Source Loading Data

When both the **Maximum Source Capacity** and **Default Source Segment Loading** setpoints are not configured, the real-time loading feature is inactive. This field shows “Disabled,” even when the control is receiving feeder-loading information. The **Maximum Source Capacity** setpoint value is used in calculations.

STATUS: Real-Time Loading Data

This field displays “Invalid” when any of the following are true:

- The **Real-Time Feeder Loading** feature is disabled.
- The received value is zero.
- The received value is less than the local real-time load.
- The received value is greater or equal to the **Maximum Source Capacity** setpoint.
- The **Real Time Feeder Loading Valid** timer has expired.

When **Real-Time Loading Data** is invalid, the **Default Source Segment Loading** setpoint is used.

Local Operations Screen: Excess Capacity—Source

The **Excess Capacity—Source** value is calculated by subtracting the **Real-Time Feeder Loading** value (received through DNP) from the **Maximum Source Capacity** setpoint. With **Real-Time Feeder Loading** information, the real capacity at the configured source switch is computed as the lesser of either Local Capacity or Excess Capacity—Source. If the real-time information is invalid, the **Excess Capacity** value is then calculated as: **Maximum Source Capacity** value minus the **Default Source Segment Load** value minus the **Extended Load** value seen at the switch.

Local Operations Screen: Real-Time Feeder Loading

The **Real-Time Feeder Loading** value is the averaged three-phase total load of the feeder in amperes received through DNP. The data field displays “Invalid” when any of the following are true:

- The **Real-Time Feeder Loading** value is disabled.
- The received value is zero.
- The received value is less than the local real-time load.
- The received value is greater or equal to the **Maximum Source Capacity** setpoint.
- The **Real Time Feeder Loading Valid** timer has expired.

STEP 18. If necessary, reinitialize the control.

Go to the *Setup Menu* screen, click on the **Sensor Configuration** button, and click on the **Reinitialize** entry.

STEP 19. Do one of the following:

- When this switch control is not the last member of this team, go to Step 20.
- When this switch control is the last member of this team, go to the next section: “Enable Operation and Test the Team” on page 45.

STEP 20. Save a snapshot or generate a report.

Save a snapshot or generate a report when a record of the team settings is needed or help is required from S&C. See the “Using Snapshots or Generating Reports” section in Instruction Sheet 1042-541, “S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Operation*.”

Switch Control and Team Setup

STEP 21. Exit IntelliLink software.

Select the menu entry **File** and click on the **Exit** option. Then, click on the **OK** button to exit the software.

STEP 22. Shut down the computer and disconnect it from the switch control.

STEP 23. On the switch control faceplate, set the Automatic Operation ENABLE/DISABLE switch to the preferred state.

It is safest to leave the faceplate switch set to the **Disable** state to avoid unexpected operation of the switch while the rest of the team is being configured.

Note: Team setup cannot be completed until this switch is operated at the site to select the **Enable** state.

STEP 24. Go to the next switch-control site.

Install the switch control hardware. See Instruction Sheet 1042-511, "S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Installation*," and configure the software as described in this instruction sheet.

When all team members are configured, check the team(s) for normal operation.

STEP 1. On the switch control faceplate, set the REMOTE/LOCAL switch to **Remote** mode and the Automatic Operation ENABLE/DISABLE switch to **Enable** mode.

STEP 2. Review the status of the local switch control and the team(s).

- (a) Click on the **Operation** button to display the *Operation Menu* screen.
- (b) Do either of the following:
 - For information about the local switch control, click on the **Local Operation** button.
 - For information about the team(s), click on the **Team Operation** button. Confirm that “READY” is displayed in the **Ready Status** field for all teams. This indicates the team is ready to take action, even if a transfer event has already taken place and there are no errors, faults, battery problems, or team communication problems present. For more information about a particular team, click on its **Oper** button.

For a detailed explanation of the *Local Operation* and *Team Operation* screens, see the “View the Local Operation Screen” and “View the Team Operation Screens” sections in Instruction Sheet 1042-551, “S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Troubleshooting*.”

STEP 3. Check the status of the other teams this switch control communicates with via DNP.

- (a) Connect the DNP cable (with a 6-pin IDC connector and a DB9 connector) to the computer serial port, and the open comm port on the control, normally Port A.
- (b) In the IntelliLink menu, select **Tools** and click on the **Options** entry.
- (c) In **Communications** options, select the **DNP** option as the protocol. Then, enter the DNP/RTU address for a switch control in the team in the Dest. Address box. Enter the DNP/RTU address for this control in the Our Address box. Be sure the connection is set for the **Serial** option and the port settings are correct. If necessary, set a timeout appropriate for the type of communication equipment in use. Click on the **Connect** entry. When it connects, the IntelliLink screens can be used as though connected directly to that switch control.
- (d) Repeat to review the status of all other team controls.

STEP 4. Save a snapshot or generate a report when a record of the team settings is needed or there is a problem requiring help from S&C Electric Company. For more information, see the “Using Snapshots” or “Generating Reports” sections in Instruction Sheet 1042-541, “S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Operation*.” Unless high-speed communication links are used, save a snapshot or generate a report only from a locally-connected switch control.

STEP 5. Exit the IntelliLink software and disconnect the computer.

Select the menu **File** entry and click on the **Exit** option. Then, click on the **OK** button in the dialog box to exit IntelliLink software.

This completes switch control setup.