

# Operation

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## Introduction

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### 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 IntelliTeam Network Sectionalizer Switch Control. 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/](http://sandc.com/en/support/product-literature/).

### Retain this Instruction Sheet

This instruction sheet is a permanent part of your 5800 Series IntelliTeam Network Sectionalizer 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 5800 Series IntelliTeam Network Sectionalizer 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 5800 Series IntelliTeam Network Sectionalizer 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® Automatic Restoration System until the desired result is achieved.

Warranty of the S&C 5800 Series IntelliTeam Network Sectionalizer 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 affect 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

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### Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the 5800 Series IntelliTeam Network Sectionalizer 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](http://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 IntelliTeam Network Sectionalizer 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 the IntelliTeam Automatic Restoration System and 5800 Series Control software SNCD2A5V Rev. 2.25.

The software-revision number is on the *Troubleshooting>Control & Switch Information* screen. For questions regarding the applicability of information in this instruction sheet to future product 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.

S&C 5800 Series Controls are connected to switchgear operating at primary voltage levels. High voltage may be present in the wiring to the switch control or in the switch control itself during certain switchgear wiring or grounding system failures, or due to a problem with the switch control itself. For this reason, access to switch controls should be treated with the same safety precautions that would be applied when accessing other high-voltage lines and equipment. Follow all locally approved safety procedures when working on or around this 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 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 you manually reconfigure the circuit (for example, during repairs), follow your company's operating procedures to disable automatic operation of the switch control. This will prevent any unexpected operation.

## Application Description

The network sectionalizer control works with a team of switches on a closed-loop circuit, isolating a fault and restoring load, the same as on a standard open-loop circuit.

The network sectionalizer control uses six voltage sensors, one for each phase on both sides of the switch. The control trips open the switch based on loss-of-voltage events on all six sensors. It can automatically close the switch based on IntelliTeam logic (as it performs circuit reconfiguration) or on network-sectionalizer logic (as it detects synchronized and balanced voltage on both sides of the switch).

When stable three-phase voltage is present, and the configured time delay has elapsed, the network sectionalizer control closes the switch whenever **Automatic Operation** mode is enabled, even when the switch was opened manually or via SCADA command. This can be prevented by disabling **Automatic Operation** mode with the faceplate switch, a SCADA command, or using the IntelliLink® Setup Software screens.

For more information about IntelliTeam system operation, see Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," and Instruction Sheet 1042-540, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Operation*."

## Changing Data Values

IntelliLink software screens and dialog boxes enable configuration of the switch control and team activity.

Follow these steps to change data values on a screen:

- STEP 1.** Move the mouse cursor onto the value field 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.
- STEP 3.** Click on the Up or Down arrow, or use the keyboard arrow keys, to move through the value range. When specific selections are offered, click on the radio button for the desired value.
- STEP 4.** When the settings consist of more than one sub-range, use the <Page Up> and <Page Down> keys to jump to the next or previous sub-range. The arrows or keyboard arrow keys also jump between the sub-ranges.
- STEP 5.** Click on the **OK** button to record the new value or click on the **Cancel** button to exit the dialog box without changing the original value.
- STEP 6.** Repeat this process for each value to be added or changed.
- STEP 7.** To view Help Text for all the fields on a screen, press the <F1> key.

## Opening a Screen

To open a menu screen (for example, the *Setup Menu* or *Troubleshooting Menu* screen), click on the corresponding button that is displayed on every IntelliLink screen. See Figures 1 and 2.

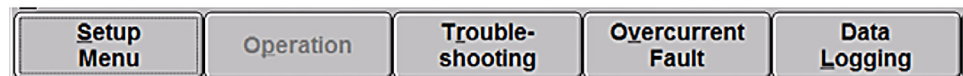


Figure 1. Buttons at the top of the screen to navigate to other screens.



Figure 2. Other screen buttons used for navigating between screens.

**Note:** The exact appearance and content of an IntelliLink screen depends on which software version is installed. The screen menu tree on page 7 applies to all software versions for the 5800 series switch controls with IntelliTeam Automatic Restoration System software.

## Screen Menu Tree

**IntelliLink Screens for 5800 Series Switch Controls with IntelliTeam Network Sectionalizer Software****SETUP MENU screen**

- *Setup>Miscellaneous* screen
- *Setup>Sensor Configuration* screen
- *Setup>Site-Related* screen [3 pages]
- *Setup>Fault Detection* screen
- *Setup>Automatic Operation* screen [2 pages]
- *Setup>Communications* screen [2 pages]
- *Setup>Team Configuration* screen [4 pages]
- *Setup>Save Configuration Data* screen > Save Setpoints dialog box

**OPERATION MENU screen**

- *Local Operation* screen [the program opens at this screen]
- *Team Operation* screen [2 pages]

**TROUBLESHOOTING MENU screen**

- *Troubleshooting>Event Status* screen [3 pages]
- *Troubleshooting>Chronological Log* screen [3 pages]
- *Troubleshooting>Control and 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]

**REPORT MENU**

- *Report>Full* screen > Save Report dialog box

## Screens with Specific Network Sectionalizer Control Parameters

This section shows the setpoints in standard IntelliTeam Setup Software screens that are different for the Network Sectionalizer Switch Control.

For information about screens and setpoints for the regular switch controls, see Instruction Sheet 1042-530, “S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration System: *Setup*.”

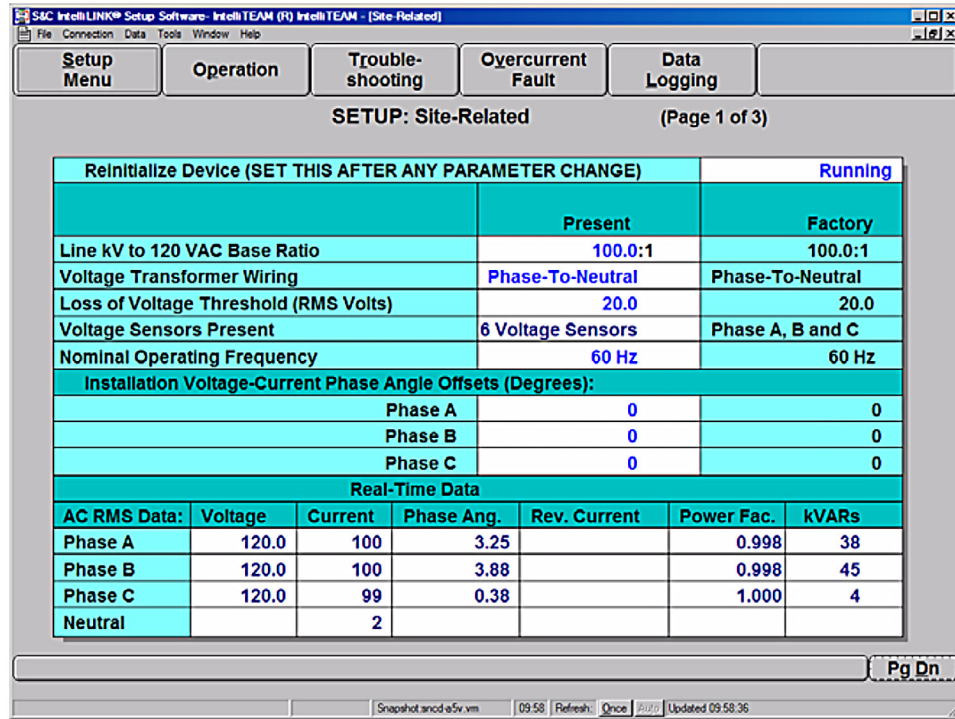


Figure 3. Page 1 of the Setup>Site-Related screen.

### Installation Voltage-Current Phase Angle Offsets

To calculate loading on any line section in a closed-loop circuit, the team must know the direction of current flow. For any team that includes a network sectionalizer control, the convention is normal current flow goes to the right in the single-line diagram. All team members must use the same convention. See Figure 3.

To implement this diagram convention, the **Installation Voltage-Current Phase Angle Offsets** may need to be adjusted by 180° in some switches. When current is flowing to the right in relation to the team single-line diagram, set the phase-angle offsets for a normal open-loop circuit. However, if current is flowing to the left, set the phase-angle offsets 180° from their otherwise expected values. A “Reverse Current” indication will appear in the real-time data section of this screen.



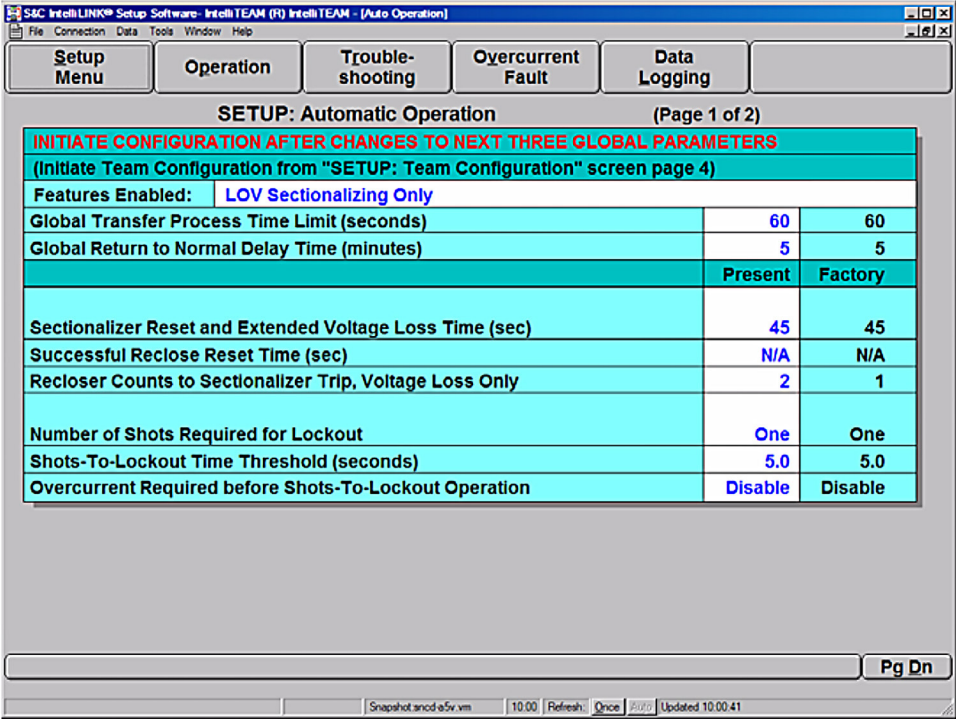


Figure 4. Page 1 of the Setup>Automatic Operation screen.

**Features Enabled [Global]**

Select **Open Transition** mode and the IntelliTeam system will check the voltage balance and synchronization before returning the circuit to its normal state. Otherwise, use the **Closed Transition** mode. See Figure 4.

For teams on closed-loop circuits, **Automatic Transfer** and **Automatic Reclose** modes can be enabled together.

**Minimum Recloser Counts to Trip, Fault Current Detected  
Maximum Recloser Counts to Trip, Fault Current Detected  
Recloser Counts to Sectionalizer Trip, Voltage Loss Only**

The network sectionalizer control must be the first team member to open its switch. For all other team members, set these three setpoints to at least one more than the value set for the network sectionalizer control.

To coordinate sectionalizing of the other team members, set the counts as if the network sectionalizer were the normally open point in the circuit.

**Network Sectionalizer Auto Reclose Time Threshold**

When **Automatic Reclose** mode is enabled, this is the number of seconds the control waits (after three-phase voltage is sensed) before it recloses the switch.

When the voltage status fluctuates, the control delays the reclose operation until the three-phase voltage stabilizes for this length of time, or until an operator manually closes the switch or disarms the pending automatic-close operation.

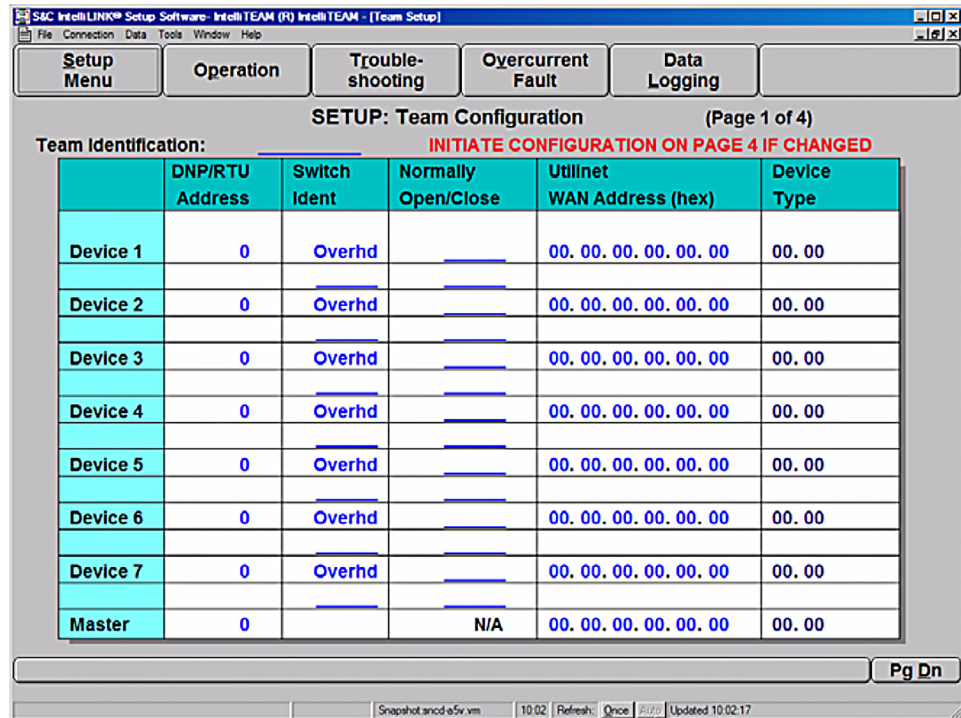


Figure 5. Page 1 of the Setup>Team Configuration screen.

### Normally Open/Close

This field shows the state of each team switch or position when the circuit is configured normally. The IntelliTeam system uses this information during transfer operations. For a team with a network sectionalizer control as one of its members, configure the network sectionalizer control as normally open, even though the switch will be physically closed during normal operation. Each team should have no more than one normally open switch. See Figure 5.

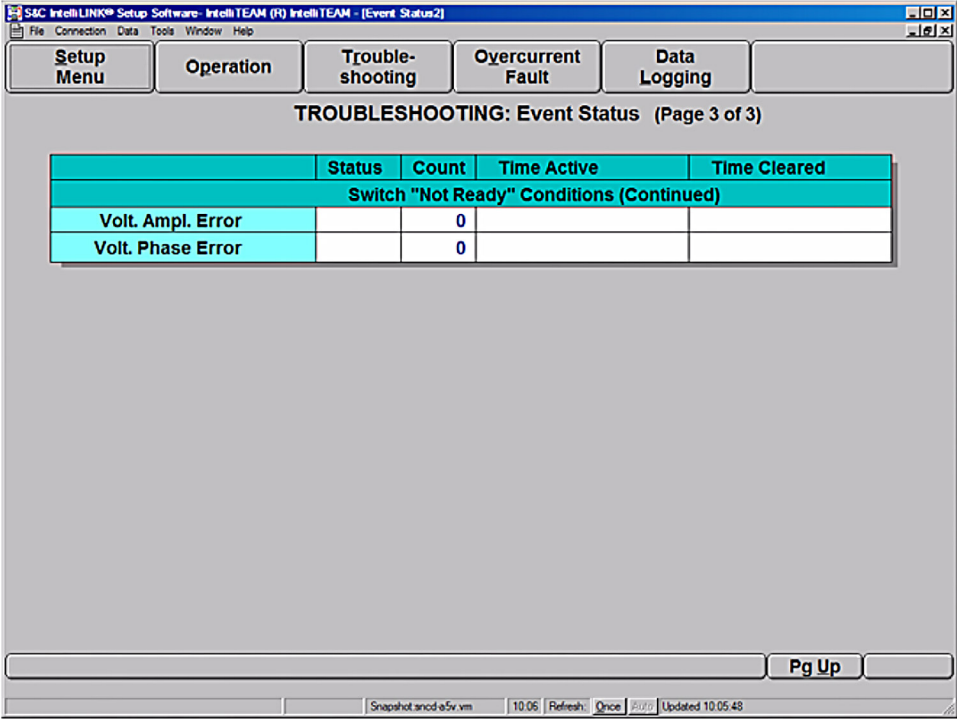


Figure 6. Page 3 of the *Troubleshooting>Event Status* screen.

**Volt. Ampl. Error**

When the switch is closed, the two voltage sensors on the same phase should read the same value. This condition is active when the voltage amplitude measured on the two sensors is inconsistent. See Figure 6.

**Volt. Phase Error**

When the switch is closed, the phase angle between the two voltage signals on the same phase should be zero (within the accuracy of the sensor). This condition is active when the voltage-voltage phase angle indicates a problem.

## Screens to Configure Only the Network Sectionalizer Control

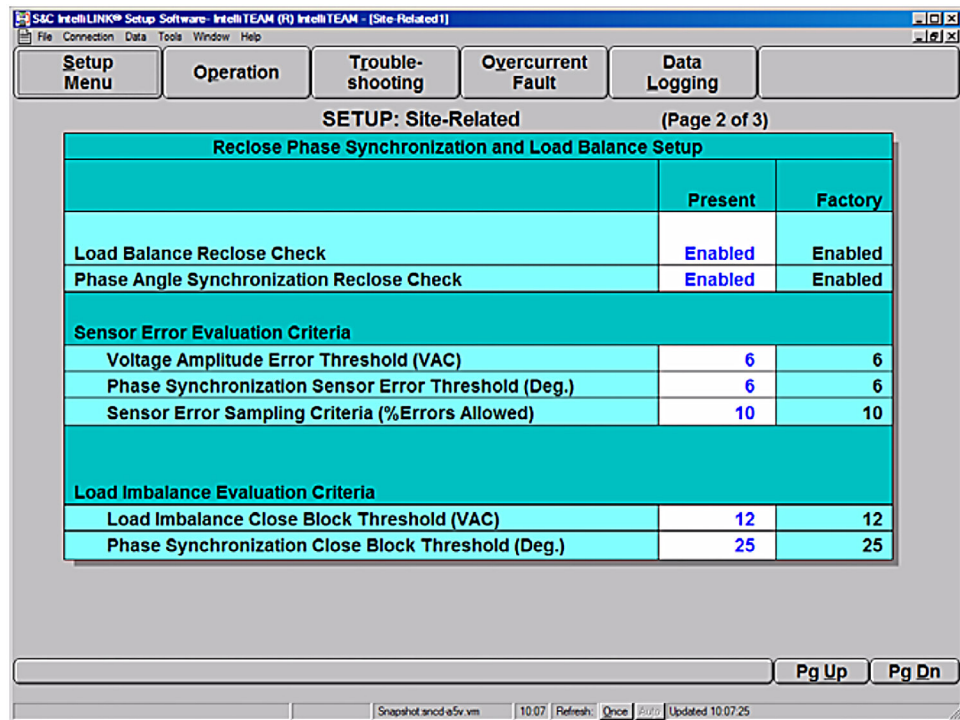


Figure 7. Page 2 of the Setup>Site-Related screen.

This screen configures the reclose phase-synchronization and load-balance setpoints. These parameters are used only with the six-voltage sensor, network sectionalizer application. See Figure 7.

This screen includes the following fields:

### Load Balance Reclose Check

When both **Automatic Reclose** mode and this setpoint are enabled and the switch is open, the control monitors the voltage difference across each phase. For the switch to reclose, all of the following must be true:

- Voltage is present on both sides of every phase.
- The voltage difference on all three phases remains below the **Load Imbalance Close Block Threshold** setpoint (see below) for the duration of the **Network Sectionalizer Auto Reclose Time Threshold** timer (see page 9).
- No **Switch Not Ready** conditions are present.

**Note:** This setpoint also enables/disables the integrity check for voltage-sensor amplitude. See the “Sensor Error Evaluation Criteria” section on page 13 for more information.

### Phase Angle Synchronization Reclose Check

When both **Automatic Reclose** mode and this setpoint are enabled and the switch is open, the control monitors the voltage-to-voltage phase angles across each phase. For the switch to reclose, all of the following must be true:

- Voltage is present on both sides of every phase.
- The voltage-to-voltage phase angles remain within the **Phase Synchronization Close Block Threshold** setpoint for the duration of the **Network Sectionalizer Auto Reclose Time Threshold** period.
- No **Switch Not Ready** conditions are present.

A sensor-powered control takes the voltage-to-voltage phase-angle measurement with the charger temporarily turned off and uses a fixed monitoring time of 10 seconds after voltage restoration. If the criteria are not met, the control resumes monitoring and tries again every 100 seconds.

### Sensor Error Evaluation Criteria

These parameters determine whether voltage sensors are operating properly, based on consistency of measurement across the phases.

#### Voltage Amplitude Error Threshold (VAC)

This is the maximum allowable deviation, in volts ac (true RMS), for a voltage measurement to be considered consistent across a phase. When the switch is closed, both voltage sensors should read within their stated accuracy. If the voltage remains out of this range continuously for more than 10 seconds, the control enters a **Switch Not Ready** condition. The error clears when the voltage difference falls back within the error threshold continuously for 10 seconds.

#### Phase Synchronization Error Threshold (Deg.)

This is the maximum allowable deviation, in degrees, for the voltage-to-voltage phase angles to be considered synchronized when the switch is closed. In sensor-powered units, the control checks the phase angles only once an hour. The **Sensor Error Sampling Criteria** setpoint is also used for determining phase-angle errors.

#### Sensor Error Sampling Criteria (%Errors Allowed)

Because line transients can affect phase-angle measurement, the control rejects this percentage of phase-angle samples without generating sensor errors. The control collects data for 10 seconds, and then applies this setpoint to determine whether a phase-angle sensor error exists.

### Load Imbalance Evaluation Criteria

These setpoints are used to determine whether the load is balanced and the source phase angles are synchronized. These criteria are applied when the switch is open, voltage is present on both sides of all three phases, and the switch is in **Automatic Operation** mode waiting to reclose.

#### Load Imbalance Close Block Threshold (VAC)

If the voltage difference across the switch is outside this threshold, but voltage is present on all phases, the control will not reclose the switch. The voltage difference is probably too large because of a serious load imbalance and reclosing the switch would generate excessive circulating currents.

#### Phase Synchronization Close Block Threshold (Deg.)

This threshold is applied to the voltage-to-voltage phase angles across each phase. When these angles are outside the threshold, the control will not reclose the switch.

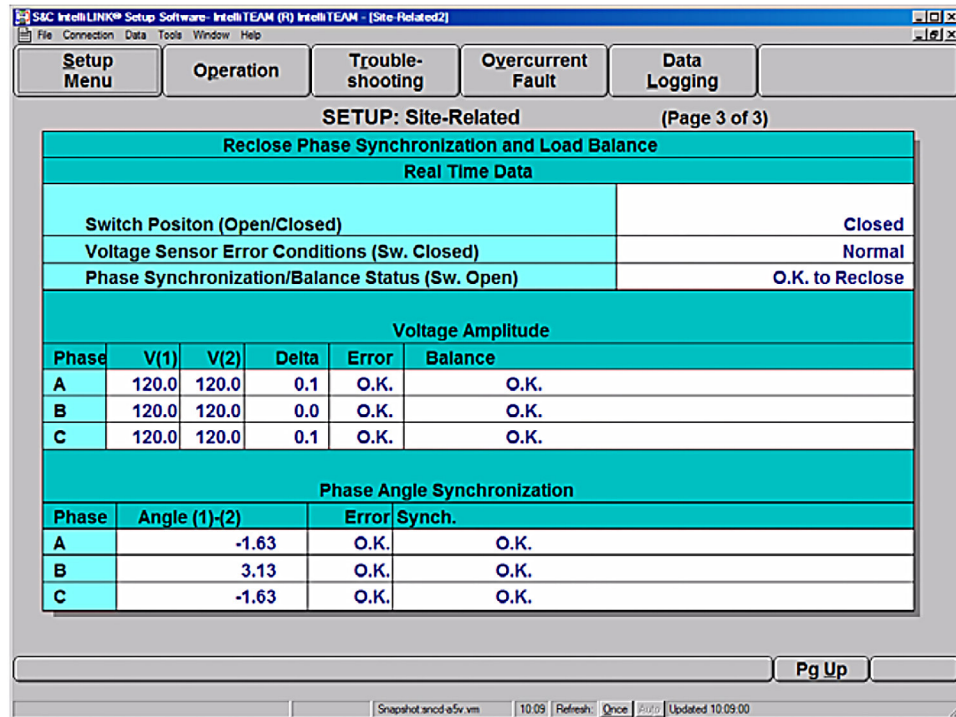


Figure 8. Page 3 of the Setup>Site-Related screen.

This screen monitors the reclose phase synchronization and load-balance real-time data. See Figure 8.

This screen includes the following fields:

**Switch Position**

This is the real-time open/closed position of the switch.

**Voltage Sensor Error Conditions (Sw. Closed)**

These conditions are sensed when the switch is closed and remain active when the switch is open. These can only be cleared when the switch is closed and the problem is resolved or the enabling option is disabled. See Page 2 of the Setup>Site-Related screen for additional information.

- Normal** No voltage-amplitude or phase-angle errors are present.
- Ampl. Error** The voltage sensors on opposite sides of one or more switch poles do not have consistent readings.
- Angle Error** The voltage sensors on opposite sides of one or more switch poles have voltage-to-voltage phase angles outside the error threshold.
- Ampl & Angle Error** Both voltage-amplitude and phase-angle sensor errors are present.
- Unknown Error** Internal error – contact S&C Electric Company.

**Phase Synchronization/Balance Status (Sw. Open)**

These conditions are sensed when the switch is open and voltage is present (above the detection criteria on all phases). The control will only indicate a problem condition when the applicable **Reclose Check** is enabled. See Page 2 of the *Setup>Site-Related* screen for additional information.

<b>O.K. to Reclose</b>	No voltage-amplitude or phase-angle errors are present.
<b>Volt. Imbal.</b>	Voltage is present on both sides of all phases of the switch but is greater than the allowable threshold because of unbalanced-loading or other problems.
<b>Sync. Fail</b>	Voltage is present on both sides of all phases of the switch, but the voltage-to-voltage phase angles across one or more phases are outside the allowable threshold.
<b>Volt. Imbal, Sync. Fail</b>	Both conditions are present.
<b>Unknown Error</b>	Internal error – contact S&C Electric Company.

**Voltage Amplitude**

These fields show information about voltage:

<b>Phase</b>	This column indicates the phase (A, B, or C).
<b>V(1)</b>	This is the voltage amplitude on Side 1 (jaw side) of the switch.
<b>V(2)</b>	This is the voltage amplitude on Side 2 (hinge side) of the switch.
<b>Delta</b>	This is the calculated difference in voltage amplitudes across each phase.
<b>Error</b>	When the switch is closed and the Delta on this phase is outside the allowable sensor-error threshold, this field reads “Fail.” Otherwise, it reads “O.K.”
<b>Balance</b>	When the switch is open and the Delta on this phase is outside the allowable balance threshold, this field reads “Imbalance.” Otherwise, it reads “O.K.”

**Phase Angle Synchronization**

These fields show information about phase-angle synchronization:

<b>Phase</b>	This column indicates the phase (A, B, or C).
<b>Angle (1)-(2)</b>	This is the voltage-to-voltage phase angle across the switch.
<b>Error</b>	When the switch is closed and the Angle (1)-(2) on this phase is outside the allowable sensor-error threshold, this field reads “Fail.” Otherwise, it reads “O.K.”
<b>Synch.</b>	When the switch is open and the Angle (1)-(2) on this phase is outside the allowable reclose-error threshold, this field reads “Out of Sync.” Otherwise, it reads “O.K.”

