Operation

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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 Automatic Switch Controls. Familiarize yourself with the Safety Information page 4. The latest version of this publication is available online in PDF format at **sandc.com/en/support/product-literature/**.

Retain this Instruction Sheet

This instruction sheet is a permanent part of 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 Provision

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 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 5800 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 Automatic Restoration System until the desired result is achieved.

Warranty of the S&C 5800 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 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.

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

These instructions were prepared for use with the IntelliTeam® Automatic Restoration System and 5800 Series Control software Rev. 2.23. S&C Vista® Underground Distribution Switchgear requires 5800 Series Control software Rev. 2.21.

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 because of 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.

Switch Control Modules

The switch control electronics modules are described below and shown in Figure 1.

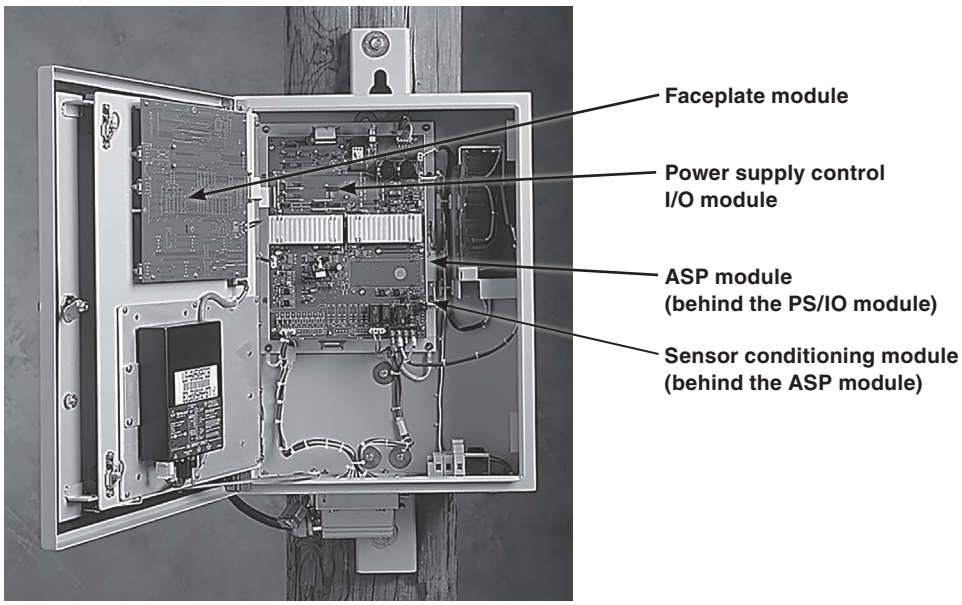


Figure 1. Location of switch control modules.

Faceplate module—The printed circuit board is attached to the back of the faceplate. It includes all the electronics and switches for the faceplate and the 5800 control microprocessor.

Power supply/control I/O module (PS/IO)—This is the source for all low-voltage power used by the switch control and any associated communications equipment. It is also responsible for the digital interfacing. The PS/IO module performs data acquisition, control, and basic communication interface functions. For more about the power management system, see the "Power Supply/Control I/O Module" section on page 13.

ASP module—This is responsible for waveform processing. It is located behind the Power Supply/Control I/O module.

Sensor conditioning module—This conditions ac waveforms to standard low-voltage ac levels and provides analog I/O interfacing. The module is located behind the PS/IO and ASP modules.

Faceplate

The faceplate LCD screen, LEDs, and switches allow monitoring and control of the line switch(es) and the switch control. See Figure 2 on page 7.

To extend battery carryover time, the switch control turns off power to the faceplate LCD screen and LEDs when the enclosure door or low-voltage cabinet door is closed.

Faceplate LEDs

OVERCURRENT FAULT LED

This LED is lit when the switch control detects an overcurrent condition.

For a normally closed switch, the LED is off when all of the following are true:

- Three-phase line voltage has been sensed
- The switch is closed
- Forty-five minutes have elapsed

The LED also goes off when the switch is closed and the faceplate REMOTE/LOCAL switch is toggled between settings or an overcurrent condition is cleared by a SCADA command.

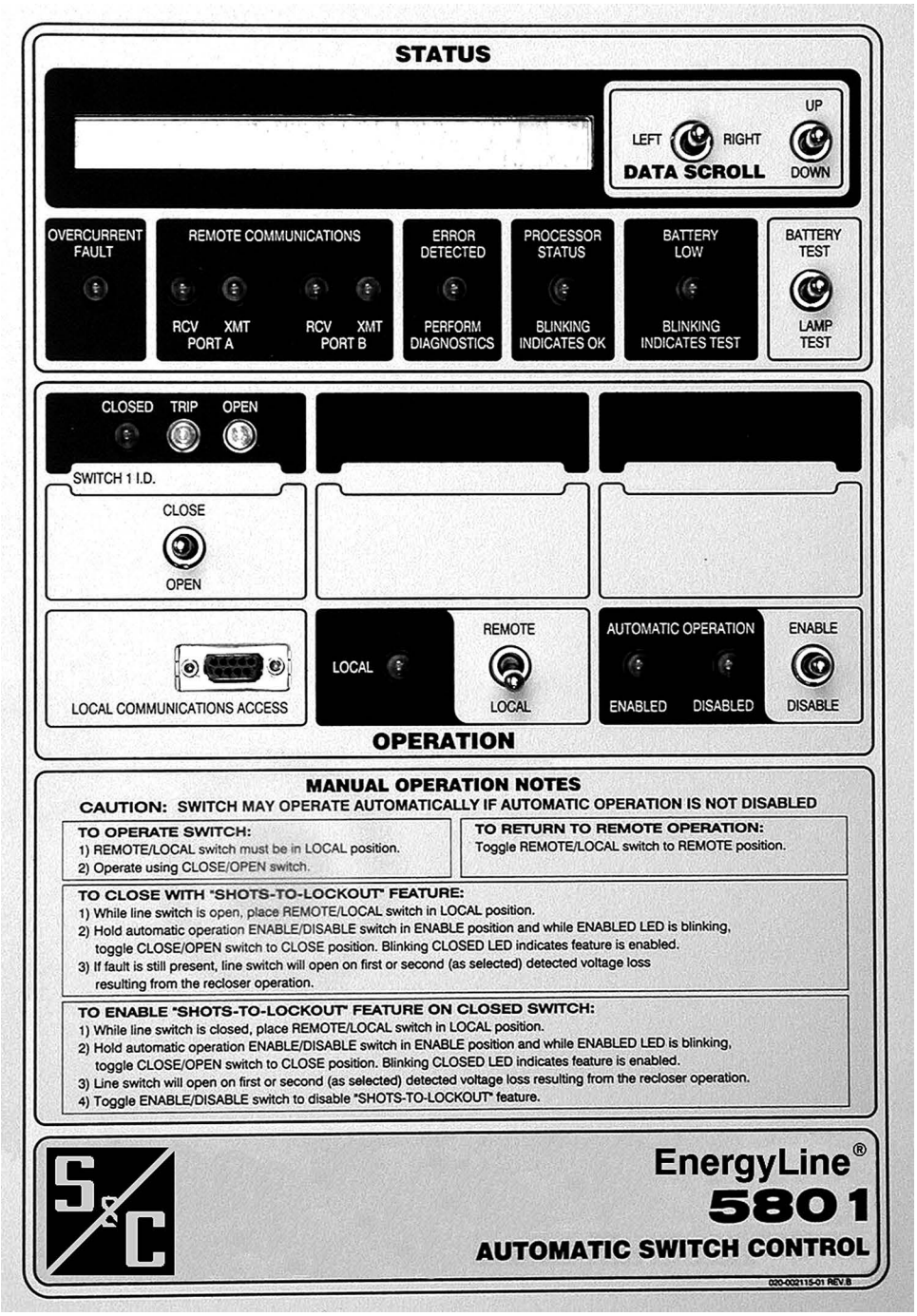


Figure 2. The 5801 Automatic Switch Control faceplate.

For a normally open switch, the LED goes off when:

- The REMOTE/LOCAL switch is toggled between settings or a **Clear** command is sent by SCADA. The line switch can be either open or closed.
- The line switch is closed by a faceplate or SCADA command.

Note: A SCADA command is invalid if the REMOTE/LOCAL switch is in the **Local** position.

Note: When the switch control is reinitialized by IntelliLink® Setup Software, the LED goes off, regardless of whether the conditions above are met.

REMOTE COMMUNICATION RCV/XMT LEDs

These LEDs blink when the switch control sends or receives signals through communication equipment installed in the control enclosure. There are separate LED sets for Port A and Port B.

RCV LED—This LED blinks when the switch control detects an incoming character. Activity occurs only when communication equipment is installed, properly connected, and receiving power.

XMT LED—This LED blinks when the switch control sends one or more characters. The XMT LED blinks any time a transmit is attempted, regardless of whether communication equipment is installed.

ERROR DETECTED LED

This LED is lit when the switch control detects any of the following conditions:

- **Battery charger overvoltage—**If the charger attempts to overcharge the battery, the switch control turns the charger off and turns on the LED.
- **Open/close contacts are not mutually exclusive—**The switch-position contacts are either both open or both closed.
- **Temperature sensor failure—**The temperature sensor (on the PS/IO) reads abnormally high or low, which is generally caused by an open or shorted circuit.
- **Transfer operations blocked—**If the switch control is unable to perform a **Load-Transfer** or a **Return-to-Normal** operation for any reason, or it knows another team member is in this condition, the LED is lit.
- **Switch error (5801) –** There is a switch error, such as open visual-disconnect contacts (Scada-Mate) or low pressure (Joslyn).
- **Switch in Local mode (5802/5803) –** The switch control senses that one of the switches is in **Local** mode (the manual mode for the switch, selected in the low-voltage cabinet).

PROCESSOR STATUS LED

This LED blinks once per second when the switch control has power and control software is running normally.

BATTERY LOW LED

This LED is off when the battery system is working normally and the battery is charged.

The LED is lit when the battery power level drops below the **Battery Voltage Low** setpoint on the *Troubleshooting>Battery System* screen. This LED is normally lit when the control is operating on battery power and the normal battery carryover period is nearly over. If this LED is lit when ac power is on and the battery normally would contain an adequate charge, the battery may be defective.

The LED blinks during any battery test. The control automatically runs a battery test at scheduled intervals. In addition, a SCADA command or the faceplate BATTERY TEST/LAMP TEST switch can be used to start a battery test at any time. See the “BATTERY TEST/LAMP TEST Switch” section on page 9 for more details.

Note: When replacing a defective battery, it is necessary to immediately initiate a battery test to update the battery status.

CLOSED LED

This red LED is lit when the line switch is closed. The LED indicates the sensed position of the line switch based on the state of the closed status input from the switch. It also blinks while the **Shots-to-Lockout** mode is enabled. Each CLOSED LED provides information about one line switch.

TRIP LED

This yellow LED is lit when the control trips open the line switch using automatic logic (sectionalizing, phase-loss protection, etc.). It is off when the switch is closed. For a normally open switch, the LED also goes off when the REMOTE/LOCAL switch is toggled between settings. Each TRIP LED provides information about one line switch.

If the switch tripped because of phase-loss protection and the **Phase Loss Protection with Automatic Reclose** mode is enabled, the LED blinks while waiting to reclose the switch. For the normally open switch, the LED also goes off when the REMOTE/ LOCAL switch is toggled between settings.

Note: If the switch control is reinitialized with IntelliLink software, the LED goes off, regardless of whether the switch is closed.

OPEN LED

This green LED is lit when the line switch is open. The LED indicates the sensed position of the line switch based on the state of the open status input from the switch. Each OPEN LED provides information about one line switch.

LOCAL LED

This LED is lit when remote (SCADA) operation of the switch control is blocked and local operation is allowed. The LED is off when local operation is blocked and remote operation is allowed.

AUTOMATIC OPERATION ENABLED LED

This LED is lit when automatic operation of the switch control is enabled.

⚠ CAUTION

When **Automatic Operation** mode is enabled, the automatic control logic may trip the switch regardless of the state of the REMOTE/LOCAL switch.

AUTOMATIC OPERATION DISABLED LED

This LED is lit when automatic operation of the switch control is disabled.

The Faceplate Switches

The faceplate includes the following switches:

DATA SCROLL Switches

Use these switches to scroll LCD screen data into view. For more information, see the "Faceplate LCD Screen" section on page 10, Table 1 on page 11, and Table 2 on page 12.

BATTERY TEST/LAMP TEST Switch

Toggle this switch up to start a battery test. The test lasts approximately 30 seconds if the control is operating on battery power, or approximately 3 minutes if the control is operating on ac power. The BATTERY LOW LED blinks during the test. See the "Power Supply/Control I/O Module section" on page 13 for more information.

Hold this switch down to test the LEDs on the faceplate; all LEDs should blink.

CLOSE/OPEN Switch

Toggle this switch up to transmit a **Close** command to the line switch. Toggle this switch down to transmit an **Open** command to the switch. It is also used for enabling the **Shots-to-Lockout** feature. See the "Shots-to-Lockout Feature" section on page 23. Each CLOSE/OPEN switch operates one line switch.

Note: If the REMOTE/LOCAL switch is in the **Remote** position, toggling a CLOSE/OPEN switch has no effect.

REMOTE/LOCAL Switch

Toggle this switch up to enable remote (SCADA) control of the line switch(es) and disable commands from the faceplate CLOSE/OPEN switches and the Automatic Operation ENABLE/DISABLE switch.

Toggle this switch down to disable remote (SCADA) operation of the line switch(es) and enable commands from the faceplate CLOSE/OPEN switch(es) and Automatic Operation ENABLE/DISABLE switch. The LOCAL LED is lit when this switch is set to the **Local** state.

Note: To disable **Automatic Operation** mode and have full local control of the switch(es), toggle the faceplate Automatic Operation ENABLE/DISABLE switch to the **Disable** mode. When **Automatic Operation** mode is disabled on the *Setup>Automatic Operation* screen (for both switches, if applicable), toggling the ENABLE/DISABLE switch has no effect.

ENABLE/DISABLE switch

Toggle this switch up to enable **Automatic Operation** mode for the control and the team. Toggle this switch down to disable **Automatic Operation** mode. This switch affects automatic operation of both line switches, if applicable. It is also used to enable the **Shots-to-Lockout** feature. See the "Shots-to-Lockout Feature" section on page 23.

Note: When **Automatic Operation** mode is disabled on the *Setup>Automatic Operation* screen (for both switches, if applicable), toggling this switch has no effect.

Note: Under most conditions, when the ENABLE/DISABLE switch is toggled to the **Disable** state, all IntelliTeam automatic restoration operations are disabled. However, if all of the following are true, a multiple-switch team member (for example, an S&C 5802/5803 control) enters **Single Member** mode (acting alone as a two-switch team) instead of going into the **Disabled** state:

- The team member is not the one from which team operations were disabled.
- Both line switches are active team members.
- One of the line switches is the normally open switch.

Faceplate LCD Screen

The LCD screen allows quick access to key information at the switch control installation site. The LCD displays several categories of information:

Team Status Info—This is the RTU address, team ID, and other status information for each team member shown on a single-line representation of the circuit. This information is also displayed on the *Team Operation* screen.

Real-time Data—This is the total operation count, present phase and ground current levels, line voltage, reverse current conditions, phase angles, and total kvar flows for both feeders if applicable. This information is also displayed on the *Setup>Site-Related* screen.

Auto Operation (Switch 1 and Switch 2, if applicable)—This shows the automatic operation features enabled and the present value of the automatic operation setpoints. These values are also displayed on the *Setup>Automatic Operation* screens.

Fault Events—This is the date, time, event, switch control interpretation, and action for the 62 most recent protection-related fault events. These fault messages are coded versions of the messages displayed on the *Overcurrent Fault>Fault Events* screen. See the "Fault Events Log" section on page 29 for an explanation of each code.

Fault Magnitudes—This is the date, time, phase, peak magnitude, and duration for the 16 (5801) or 32 (5802/5803) most recent overcurrent-fault events. This information is also displayed on the *Overcurrent Fault>Fault Magnitudes* screen.

Maintenance—This shows the software version installed in the switch control, assorted battery-status information, and the present cabinet temperature. The software version is also displayed on the *Troubleshooting>Control & Switch Information* screen. The battery and temperature information are also displayed on the *Troubleshooting>Battery System* screen.

Fault Settings—This is the present value for each of the fault-detection setpoints for Switch 1 and Switch 2 if applicable. These values are also displayed on the *Setup>Fault Detection* screen.

The 2 x 40 character LCD screen always displays one field from a large data page. See Table 1 on page 11 and Table 2 on page 12.

The DATA SCROLL switches are used to scroll each field into view:

- To move left or right across the page (from one category to another category), toggle the LEFT/RIGHT switch.
- To move up or down between fields within a category, toggle the UP/DOWN switch.
- The Fault Events and Fault Magnitude logs are circular buffers. The most recent event is normally displayed on the LCD screen. To see the second-most-recent event, toggle the UP/DOWN switch up.

Table 1. LCD Data Page for S&C 5801 Control with IntelliTeam Functionality

	CATEGORY						
FIELDS	**1. Team Status Information①**	**2. Real-Time Data**	**3. Auto Operation**	**4. Fault Events②**	**5. Fault Magnitude**	**6. Maintenance**	**7. Fault Settings**
	RTU Addresses Team ID Switch 1 Voltage & Fault Status Switch 2 Voltage & Fault Status (where applicable) Switch 1 Average 3-Phase Load Switch 2 Average 3-Phase Load (where applicable) Switch 1 Mode of Operation Switch 2 Mode of Operation (where applicable) Operation Status Codes	Operations Counter Line Current (amps) Ground Current (Amps) Live Voltage (Volts) Phase Angle (Degrees) Reverse Current (Active or None) Line kvars	Automatic Operation Features Enabled Transfer Process Time Limit Return-to-Normal Delay Time Sectionalizer Reset and Extended Voltage Loss Time Successful Reclose Rest Time Fault Current Required before First/ All Voltage Loss(es) Recloser Counts to Trip, w/Fault (Minimum) Recloser Counts to Trip, w/Fault (Maximum) Recloser Counts to Trip, Voltage Loss Only Number of Shots Required for Lockout Shots-To-Lockout Time Threshold (Tenths) Phase Loss Protection Voltage Loss Threshold Phase Loss Protection Time Threshold Phase Loss Protection Current Threshold Automatic Reclose Time Threshold Present Transfer Capacity, Left Feeder Present Transfer Capacity, Right Feeder	Most Recent Oldest 3rd Most Recent 2nd Most Recent	Most Recent Oldest 3rd Most Recent 2nd Most Recent	Software Version Ac Power/ Battery Status Battery Low/ Bad Setpoints Battery Voltage w/o Surface Charge Predicted Voltage Under Load Power Supply Voltage/Battery Impedance Cabinet Temperature	Phase Fault Detected Current Level (Amps) Ground Fault Detected Current Level (Amps) Phase Fault Duration Time Threshold (msec) Ground Fault Duration Time Threshold (msec) Phase Current Inrush Restraint Time (msec) Ground Current Inrush Restraint Time (msec) Phase Current Inrush Restraint Multiplier Ground Current Inrush Restraint Multiplier

① For an explanation of the codes used in the Team Status Information column, see Table 3 on page 13.

② For an explanation of the codes used in the Fault Events column, see the "Fault Events Log" section on page 29.

Table 2. LCD Data Page for S&C 5802/5803 Control with IntelliTeam Functionality

CATEGORY								
FIELDS	1. Team Status Information①	2. Real-Time Data	3. Switch 1 Auto Operation	4. Switch 2 Auto Operation	5. Fault Events②	6. Fault Magnitude	7. Maintenance	8. Fault Settings
	RTU Addresses	Close/Open Status [Sw 1, 2, 3]	Automatic Operation Features Enabled	Automatic Operation Features Enabled	Most Recent	Most Recent	Software Version	Phase Fault Detected Current Level (Amps) [Sw. 1, 2]
	Team ID	Operations Counter [Sw 1, 2, 3]	Transfer Process Time Limit	Transfer Process Time Limit	Oldest	Oldest	Ac Power/ Battery Status	Ground Fault Detected Current Level (Amps) [Sw. 1, 2]
	Switch 1 Voltage + Fault Status	Switch 1 Line Current	Return-to-Normal Delay Time	Return-to-Normal Delay Time			Battery Low/ Bad Setpoints	Phase Fault Duration Time Threshold (msec) [Sw. 1, 2]
	Switch 2 Voltage + Fault Status	Switch 2 Line Current	Sectionalizer Reset + Extended Voltage Loss Time	Sectionalizer Reset + Extended Voltage Loss Time			Battery Voltage w/o Surface Charge	Ground Fault Duration Time Threshold (msec) [Sw. 1, 2]
	Switch 1 Average 3-Phase Load	Switch 3 Line Current	Successful Reclose Rest Time	Successful Reclose Rest Time			Predicted Voltage Under Load	Phase Current Inrush Restraint Time (msec) [Sw. 1, 2]
	Switch 2 Average 3-Phase Load	Ground Current [Sw 1, 2, 3]	Fault Current before First/All Voltage Loss(es)	Fault Current before First/All Voltage Loss(es)			Power Supply Voltage/ Battery Impedance	Ground Current Inrush Restraint Time (msec) [Sw. 1, 2]
	Switch 1 Mode of Operation	Switch 1 Line Voltage	Recloser Counts to Trip, w/Fault	Recloser Counts to Trip, w/Fault			Cabinet Temperature	Phase Current Inrush Restraint Multiplier [Sw. 1, 2]
	Switch 2 Mode of Operation	Switch 2 Line Voltage	Recloser Counts to Trip, Voltage loss Only	Recloser Counts to Trip, Voltage loss Only				Ground Current Inrush Restraint Multiplier [Sw. 1, 2]
	Operation Status Codes	Switch 1 Phase Angle	Number of Shots Required for Lockout	Number of Shots Required for Lockout				
		Switch 2 Phase Angle	Shots-To-Lockout Time Threshold (Tenths)	Shots-To-Lockout Time Threshold (Tenths)				
		Switch 1 Reverse Current (Active or None)	Phase Loss Protection Voltage Loss Threshold	Phase Loss Protection Voltage Loss Threshold				
		Switch 2 Reverse Current (Active or None)	Phase Loss Protection Time Threshold	Phase Loss Protection Time Threshold				
		Switch 1 Line kvars	Phase Loss Protection Current Threshold	Phase Loss Protection Current Threshold				
		Switch 2 Line kvars	Automatic Reclose Time Threshold	Automatic Reclose Time Threshold	3rd Most Recent	3rd Most Recent		
			Present Transfer Capacity, Left Feeder	Present Transfer Capacity, Left Feeder	2nd Most Recent	2nd Most Recent		
			Present Transfer Capacity, Right Feeder	Present Transfer Capacity, Right Feeder				

① For an explanation of the codes used in the Team Status Information column, see Table 3 on page 13.

② For an explanation of the codes used in the Fault Events column, see the “Fault Events Log” section on page 29.

Table 3. Codes Used in the Team Status Information Column

Category	Symbol	Meaning
1. Single-Line Drawing	X	Closed switch
	| |	Open switch
	| ⊓ ; ⊓ |	Combinations of open and closed switches (multiple-switch member)
	?	Unknown switch state
	*	Unexpected value for the switch state (does not match one of the above)
	➔	Points to the local switch location
	RDY	Team is in the **Ready** state for automatic transfer state
	SMM	A multiple-switch team member with the normally open switch is in **Single Member** mode
2. Voltage + Fault Status	OK	Good voltage and no fault condition
	NV	Loss of voltage condition detected
	F	Fault condition detected
	NV+F	Loss of voltage and fault conditions detected
3. Mode of Operation	Team	Switch control is in **Team Automatic Transfer** mode
	Othr	Switch control is in another **Automatic** mode
	Man	Switch control is in **Manual** (non-automatic) mode
4. Operation Status Codes	OK	Switch control is ready for reconfiguration activity
	1	Switch control is not ready; operation step temporarily out of range
	2	Switch control is not ready; **Stop Transfer** condition present
	3	Switch control is not ready; **Stop Transfer** and communication condition present

Power Supply/Control I/O Module

The Power Supply/Control I/O (PS/IO) module is a highly efficient, computer-controlled, uninterrupted power-supply system specifically designed to meet the specialized power requirements of automated electric-power distribution equipment.

The PS/IO module provides steady-state current flow for switch control operation, pulsed current flow for communications equipment, and occasional large current surges for line-switch operation. It also provides 12 Vdc, battery charging (24- or 36-Vdc), and other dc voltages from a single 24 or 36 Vdc source. This design provides superior battery lifetime and carryover compared to systems that "center tap" a 24 or 36 Vdc system to supply their 12-Vdc requirements or that use multiple, non-interchangeable batteries.

The PS/IO module supplies accurate, temperature-compensated charging voltages with current-limiting and other safety mechanisms to maximize battery carryover and minimize the possibility of battery off-gassing or explosion. This system meets or exceeds ANSI surge-withstand and dielectric specifications, including ANSI C62.41 - 1992 6KV3KA surge and C37.90a 2.5kV 125 MHz ring wave and 5-kV Fast Transient waveform specifications.

The power-management system consists of the PS/IO module and a Hawker/Gates 24-Vdc or 36-Vdc battery. When ac power is available, the PS/IO converts the ac power to dc and uses the dc power to run the switch control, charge the battery, and operate the communication equipment. It draws on the battery only for the current needed to operate the switch. When external ac power is not available, the PS/IO uses power from the sensors instead, if applicable. When both external ac power and power from the sensors is not available, the PS/IO draws on the stored battery power for all switch control operations.

The power-management system can be monitored from the switch control faceplate with IntelliLink software or from the SCADA master station.

Power Supply/Control I/O module LEDs

The PS/IO module LEDs provide information about the state of the battery and ac power.

AC ON LED

This LED is lit when the switch control has a power source, either external ac or sensor power. It is located on the middle left of the module.

Note: The ac-line fuse is not intended for field replacement. Replacing a blown fuse may result in further damage.

CHG ON LED

This LED is lit when the battery charger is connected to the battery, the AC ON LED is lit, and the battery charger and battery are within the proper voltage range (20-30.5 volts for 24-Vdc batteries, 30-45.75 volts for 36-Vdc batteries). It is located on the middle left of the module.

BAT ON LED

This LED is lit when the battery is connected to the 24-Vdc or 36-Vdc power-supply bus. It is located on the bottom right of the module.

ANALOG PWR LED

This LED is lit when power is being supplied to the analog processors. It is located on the top middle of the module.

Battery Management

The purpose of the battery-management system is to make sure the switch control can operate the line switch with the available battery capacity and to provide advanced warning of a weak battery. Battery capacity is affected by several variables, including age, temperature, load cycling, and loading.

The switch control continuously monitors the battery voltage. In addition, it tests the battery at regular, scheduled intervals. The interval depends on the power conditions:

- During battery discharge, the test is run hourly.
- After a power outage, the test is run every two hours for 24 hours to monitor the battery status while the battery is recharged.
- After 24 hours of continuous operation on ac power (or power from the sensors, if applicable), the test is run once a day.

Note: The BATTERY TEST/LAMP TEST switch or a SCADA command to manually test the battery can be used at any time.

During the battery test, the switch control applies various loads to the battery to determine how it will perform under load. These tests include:

- **Actual battery voltage—**This determines the true open-circuit battery voltage.
- **Battery impedance—**This determines the internal impedance of the battery.
- **Calculated voltage under load—**This determines the minimum voltage predicted during switch operation. When the switch control is operating on battery power, the control reevaluates the **Calculated Voltage Under Load** value continuously. Otherwise, it evaluates this value only during battery-test cycles.

Based on the results of the above monitoring and tests, the switch control may take the following actions:

- If the battery **Calculated Voltage Under Load** value drops below the **Battery Low** setpoint, the switch control displays a “Battery Low” message and illuminates the faceplate BATTERY LOW LED. At voltages below this value, switch operation is still possible but only for a limited time.
- When the **Calculated Voltage Under Load** value drops below the **Battery Bad** setpoint, the switch control sets the **Battery Bad** status indication for the SCADA operator and displays a “Battery Bad” message on certain IntelliLink screens. The switch will not reliably operate at voltages below this value.

- If the battery steady-state voltage drops below 22.0 volts (for a 24-Vdc battery) or 33.0 volts (for a 36-Vdc battery) while the switch control is operating on battery power, the switch control automatically disconnects all loads to prevent deep discharge. Power is restored to loads when ac power (or sensor power, if applicable) is restored or the battery is replaced.
- If the battery voltage falls outside the proper range (20-30.5 volts for 24-Vdc batteries, 30-45.75 volts for 36-Vdc batteries) while the switch control is operating on ac power (or sensor power, if applicable), the switch control disconnects the battery from the system and turns off the BAT ON LED, on the Power Supply/Control I/O module.

Because the battery supplies the wetting voltage of switch-status contacts, disconnecting the battery will also generate alarms. Based on field experience, a weak battery may fail the battery test in very cold temperatures but pass when the ambient temperature rises. If a **Battery Low** or **Battery Bad** alarm occurs, schedule the battery for replacement. In warmer climates or seasons, if a battery test indicates a **Battery Low** condition, the battery may last 1-2 weeks longer.

About Battery Care and Maintenance

The following suggestions can help with battery maintenance:

- Store batteries at room temperature. To maximize battery life, store all gel-cell batteries at or below room temperature. When in service, the battery will probably be exposed to higher temperatures that will affect its lifetime. However, proper storage can avoid accelerating the process.
- Keep stored batteries charged. Gel-cell batteries are generally designed with a 6-month maximum shelf life. This means they can survive sitting on the shelf without being recharged and without incurring substantial damage for 6 months. When they must be stored for a longer period, periodical recharging is critical. When recharged every month, they can be stored for years without significant damage. To recharge a battery, connect it to the switch control or to an independent battery charger, such as the S&C BC-8-24 battery charging system.

  The best approach is maintaining the smallest inventory possible and rotating the inventory, removing the oldest batteries first.
- Use batteries known to be good. Do not install used batteries in battery-backed equipment unless they have been properly tested. The cost of a service call to replace a bad battery is usually higher than the cost of a new battery. Although a battery might be good enough to provide temporary standby power, the line switch has a brief but large power requirement that may exceed the ability of a weak battery to rapidly deliver necessary current.
- Avoid installing the control enclosure in a sunny location. When possible, install the switch control in a shady area. Because batteries are not efficient in a hot environment, do everything possible to minimize the peak operating temperature.

Switch Control Software

5800 Series switch controls are entirely software-driven. Each control is shipped with control software, IntelliLink software, and the setup manager software.

The Control Software

Control software is installed in the factory. This software manages the minute-by-minute functioning of the team member. It continually monitors:

- Voltage and current on the feeder
- Incoming SCADA commands
- The position of the faceplate switches
- The condition of the battery
- Ambient air temperature inside the control enclosure
- The internal switch control clock/calendar
- The software setpoint values
- Fault and voltage-loss information already stored in the control
- Various other setpoints and data values as needed

Based on this information, the control software decides how to respond to a possible overcurrent fault, a change in voltage, a command from the faceplate or SCADA master station, and other conditions.

The control software, setpoint configurations, and historical data are all stored in non-volatile memory. This memory survives power interruptions, including the complete failure of the battery system. The memory chip has a minimum 10-year shelf life, without power.

IntelliLink Setup Software

IntelliLink Setup Software runs on computers using the Windows® operating system. It communicates with a control connected by cable at the switch control site. IntelliLink software can:

- Enter installation-dependent operating parameters (setpoints), such as the network address, automatic operation features, etc.
- Monitor real-time data, such as the present line voltage and current
- Examine the performance and operating history of an installed switch control
- Transfer all configuration, operating, and historical data from the switch control to a report file on the computer
- Download new control software into the switch control
- Troubleshoot assorted types of switch control installation problems

Setup Manager Software

The setup manager software runs on computers using the Windows operating system. It simplifies the steps required to set up and troubleshoot systems that use UtiliNet radios and the RadioShop software. It allows you to move quickly back and forth between the IntelliLink software and the RadioShop software and easily enter radio information into the switch control.

SCADA Communications Equipment

S&C IntelliTeam Automatic Restoration Software System includes the DNP 3.0 protocol for team communication. A SCADA system using the DNP protocol can remotely monitor, control, and change setpoints. Communication gateways are available for compatibility with other protocols.

The communication hardware (radio, modem, etc.) is mounted inside the switch control enclosure on a universal communication mounting plate at the back of the faceplate. This eliminates clutter and provides a higher level of reliability for the overall installation.

For more information, review the applicable DNP Points List and Implementation instruction sheet.

Operation Overview

This section explains how the switch control components work together to detect and respond to overcurrent faults and voltage outages.

Signal Processing

The switch control includes separate electronic paths to accommodate the different requirements for peak versus normal current measurements. For normal current measurements, full scale is 800 amps RMS. For peak measurements, full scale varies with the switch type. For S&C switches, the value is approximately 4000 amps RMS and depends on the switch model. See Table 4 on page 18.

Peak detection focuses on speed, with several samples taken for each sinusoidal peak and instantaneous analysis of the incoming data. Measurement of normal current is slower and includes a finer degree of accuracy.

The control reports current, voltage, and phase-related data in units of amperes, volts, and kvars. The rated accuracy of these measurements is based on the combined accuracy of all control components (exclusive of the sensor and sensor cable, but inclusive of all sensor conditioning components). The control uses the switch-calibration data and the phase-angle offset values to correct all ac waveform data sampled from the switch sensors.

Using the jumpers included with the control, configure it for wye or delta distribution-line applications. Based on the selected configuration and certain setpoint values, the control normalizes voltages to nominal 120- or 240-Vac values.

RMS AC Waveform Analysis

The control uses RMS detectors, with accuracy to the 100th 60-Hz harmonic, to produce true RMS amplitude data for current, neutral current, and voltage waveforms. This is particularly important when measuring neutral current because the harmonic distortion effects of any single phase are multiplied in the summing of the phases.

Because there is some response latency associated with this circuitry, voltage and current changes that occur within a few tenths of a second are sensed as a single, steady value.

For real-time, steady-state monitoring and data logging, the control collects data at 0.2-second intervals. It averages 8 samples and reports the 1.6-second averaged value. This results in a net response time of 1.6 seconds.

The switch control uses the 1.6-second averaged values for the real-time display, reporting via SCADA communication, and data logging. Daily high and low values are logged for the current day and the preceding seven days.

Waveform Analysis for a Power System with Delta-connected Customer Transformers

The control treats power systems with delta-connected customer transformers as a special case.

When the line switch has three voltage sensors and the sensor conditioning module is configured with a delta jumper, the control reproduces the delta voltage waveform before any transducer functions are performed. This is useful for comparing the measured voltage against that seen by customers served by phase-to-phase connected transformers. For S&C voltage sensors, this configuration is necessary for accurate phase-to-phase voltage measurements because these sensors measure phase-to-neutral voltages even in a delta distribution system.

For switches with one voltage transformer for voltage sensing and control power, and three CVMI current sensors, the sensor-conditioning module must always be configured with the wye jumper. Voltage sensing and reporting are determined by the way the voltage transformer is connected: phase to phase (delta) or phase to neutral (wye).

Voltage Sensing for S&C Switches

The 5800 Series control software supports 15-kV, 25-kV, and 34.5-kV S&C switches.

The nominal voltage-sensor ratios for the line switch(es), with corresponding maximum voltage levels, are shown in the Table 4 on page 18.

Table 4. Maximum Voltage Levels Supported in S&C Switches

S&C Switch Model	S&C Nominal Voltage Sensor Ratio	Maximum Phase-to-Phase Voltage (Delta Jumper)	Maximum Phase-to-Phase Voltage (Wye Jumper)
15 kV	1386:1	20.0 kV	15.0 kV
25 kV	2440:1	27.3 kV	20.4 kV
34.5 kV	3389:1	38.7 kV	29.0 kV

The maximum voltage levels represent the highest voltage measurements supported by the control software. The maximum voltage levels in Table 4 are based on nominal sensor ratios. Actual maximum voltages may vary slightly, based on the S&C sensor-calibration information, supplied with each switch. For the physical information and electrical specifications for each switch, see the applicable S&C literature. When support for higher voltage levels is required, contact S&C Electric Company.

The third column of the table shows the maximum voltage levels supported for installations configured for phase-to-phase (delta) voltage reporting. These installations require a delta-configured sensor conditioning module.

The fourth column of the table shows the maximum voltage levels supported for installations configured for phase-to-ground (wye) voltage reporting. These installations require a wye-configured sensor conditioning module.

Accurate voltage reporting requires proper setpoint configuration. This includes entering the actual sensor ratios supplied by S&C for each sensor. It also includes selection of a voltage-reporting method (phase to phase or phase to neutral) consistent with customer transformers on the feeder and their associated step-down ratios.

Phase Angle Measurements

The switch control uses a highly accurate, proprietary, zero-crossing detection scheme (that is not tricked by multiple zero-crossings of noisy or harmonic-contaminated signals) to measure the phase angles between the voltage and current waveforms on each phase.

The switch control samples the phase-angle reading every 0.2 seconds, then averages eight samples and reports the 1.6-second averaged value. Phase-angle measurements are reported on a 0-360 degree range.

Enter **Phase-Angle Offset** values to compensate for both sensor-dependent and installation-dependent phase-angle characteristics.

Overcurrent Fault & Voltage Loss Detection

Overcurrent faults are measured with a combination of peak-current detection hardware for phase faults and true RMS amplitude-detection hardware for harmonic sensitive, neutral-current faults.

To determine whether an overcurrent fault exists, the control compares sensed current to setpoint values for current level and fault duration. The **Current Level** setpoint can be specified in 10-amp RMS increments for phase faults and 1-amp RMS increments for ground faults.

The **Fault Duration Time Threshold** setpoint can be specified in 6.25-millisecond (approximately 1/3-cycle) increments for phase faults and 50-millisecond increments for ground faults.

This scheme allows the software to measure fault current with a scaling appropriate to the higher amplitude signals encountered with faults and to detect the peaks of narrow spikes caused by CT saturation that trick many digital-sampling schemes.

Phase-Overcurrent Detection

Phase-overcurrent conditions are sensed using a combination of analog and digital techniques. The switch control provides fault detection with a resolution of 1/3 cycle and peak values of approximately 4000 amps RMS. Overcurrent measurements are accurate to 0.5% of full scale excluding sensors. For information about scaling beyond 4000 amps, contact S&C Electric Company.

Note: S&C 5802/5803 controls monitor each feeder independently and respond to changes on that feeder regardless of the condition of the other pad-mounted switch and feeder.

To detect phase overcurrent faults:

A. The switch control monitors the current on all three phases and compares it to the **Phase Fault Detection Current Level** setpoint.

B. When at least one peak overcurrent sample is above the setpoint every 18.75 milliseconds (a window of time slightly longer than one cycle), the control registers an overcurrent condition (a potential or pending fault) on that phase.

C. When the overcurrent condition is registered, the control starts the **Phase Fault Duration Time Threshold** timer.

D. When the overcurrent condition is present continuously for the duration of the timer, the control labels it a **Phase Overcurrent Fault** condition and responds accordingly.

   If, during any 18.75 millisecond window overcurrent is not detected, the control considers the **Phase Overcurrent Fault** condition to be no longer present and takes appropriate action.

E. When a recognized **Phase Overcurrent Fault** condition ends (after the timer expires), the software records the maximum RMS current measured during the fault and the fault duration. Any fault lasting longer than 6.82 minutes is recorded as 6.82 minutes (409.6 seconds).

Ground Overcurrent Detection

The switch control hardware measures ground current as an analog vector sum of the three individually sensed phase currents. This analog signal is measured by a true RMS-detecting circuit, yielding a very accurate, harmonic-independent measure of the true RMS current integrated over several cycles. Because of this multi-cycle integration, there is some delay in the response time through the hardware. This delay is inversely proportional to the magnitude of the change in ground current. The larger the change in ground current, the faster the circuit responds. The net result is very similar to the time-current characteristics of a protective relay.

The software samples the true RMS-detection hardware on 50-millisecond intervals. On each interval, the current is compared to the **Ground Fault Detection Current Level** setpoint. When the current exceeds the setpoint and this condition persists continuously for a period of time specified by the **Ground Fault Duration Time Threshold** setpoint, an **Overcurrent Fault Condition** state is indicated and appropriate action taken.

Because the registration of an overcurrent fault condition is affected by the relationship between the minimum fault-current detection level and the RMS detector rise and fall times, a family of time-current characteristic curves is generated. See the graph in the "Ground Fault Detection Current Level (RMS Amps)" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*." Each of these curves corresponds to a single setting of the **Ground Fault Detection Current Level** setpoint. The points on each curve represent the minimum amount of time the ground current must be present to register a fault. For example, when the **Ground Fault Detection Current Level** setpoint is 150 amps, a 500-amp ground current must be present for approximately 42 milliseconds before the control registers a fault.

The minimum registration time for this example is less than the 50-millisecond software sampling interval. Therefore, short-duration, high-magnitude ground overcurrent faults can be detected by using low-magnitude overcurrent thresholds.

Voltage-Loss Detection

The control checks the voltage on all three phases at 50-millisecond intervals. Any voltage drop below the **Loss of Voltage Threshold** setpoint is considered a voltage outage.

Inrush Restraint

The **Inrush Restraint** feature prevents phase- or ground-overcurrent conditions that can occur during outage restoration (hot- or cold-load pickup) from falsely indicating a fault condition. It also applies when the switch is closed from the faceplate or via SCADA while power is present. The **Current Inrush Restraint Multiplier** feature enables the switch control to differentiate between moderate overcurrents (caused by cold-load pickup) and

large overcurrents (caused by a fault condition) during the inrush restraint period. See the "Setting the Phase & Ground Overcurrent Levels" section in Instruction Sheet 1042-572, "S&C 5800 Series Switch Controls: *Setting Phase and Ground Overcurrent Levels*," for additional information.

Inrush restraint is applied as follows:

A. During a voltage outage, the switch control continuously monitors the switch status, the RMS voltage sensors, and the phase-overcurrent detectors for any indication the outage has ended.

B. When voltage rises above the **Loss of Voltage Threshold** setpoint on any phase or overcurrent is detected on any phase, the switch control checks the switch position.

C. If the switch is closed, the switch control starts the **Phase Current Inrush Restraint** timer and the **Ground Current Inrush Restraint** timer.

D. If both **Current Inrush Restraint Multiplier** setpoints are in **Time Block** mode, the control ignores all overcurrent conditions until the **Inrush Restraint** timers expire.

   If one or both **Current Inrush Restraint Multiplier** setpoints is in something other than **Time Block** mode, the control considers any overcurrent condition that exceeds the specified multiplier value to be an overcurrent fault. See the "Phase Overcurrent Detection" section on page 18 and the "Ground Overcurrent Detection" section on page 19 for details.

E. After the inrush restraint timers expire, the switch control responds to overcurrent conditions in the normal manner.

Note: No inrush restraint occurs when the **Inrush Restraint** setpoints are set to 0.

Switch Control Response to Overcurrent and Voltage Loss Events

The control response to an overcurrent condition or voltage loss depends on the settings in effect when the event occurs. For example, the values selected for the **Fault Detection Current Level** and **Fault Duration Time Threshold** setpoints determine whether the control recognizes an overcurrent event as a fault condition. The **Automatic Operation** features enabled and the position of the faceplate automatic operation ENABLE/DISABLE switch, determine what the control will do when a recognized fault condition occurs.

Overcurrent Data Logging

The control keeps a record of each recognized event, the assumed cause of the event, and any action taken. It logs all events, regardless of the position of the Automatic Operation ENABLE/DISABLE switch and the REMOTE/LOCAL switch.

The control maintains separate chronological logs of event data. Information is stored in these logs in a circular fashion; the newest entry always overwrites the oldest. The control logs each event with millisecond timestamping and 6.25-millisecond resolution.)

The first log is a sequence-of-events buffer. Each record in this log represents one fault event. For example, an overcurrent condition followed by voltage loss and/or a fault-related action taken by the control, "the line switch opened because of a phase-imbalance condition." The information in this log is displayed on the *Overcurrent Fault>Fault Events* screen and the LCD screen.

The second log contains the magnitude and duration information for each fault event. The recorded magnitude is the maximum RMS current amplitude encountered during the fault event. The duration is recorded in units of milliseconds, with 6.25-millisecond resolution and a maximum recordable fault duration of 409 seconds (6 minutes, 49 seconds). The information in this log is displayed on the *Overcurrent Fault>Fault Magnitudes* screen and the LCD screen.

Note: Because of the delayed rise and fall times of the hardware, the logged time for detection of ground-overcurrent faults may be delayed relative to the logged time for phase-overcurrent faults caused by the same event. In addition, the accuracy of recorded duration times for ground-overcurrent events is affected by the 50-millisecond sampling interval and hardware rise and fall times. The peak magnitude of ground overcurrent is also affected by the amount of time the event is present. Accurate magnitude recording requires the condition to be present for approximately 400 milliseconds. See Instruction sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

Automatic Operation

The 5800 Series switch control can perform several automatic operations: line sectionalizing, phase-imbalance protection, phase-imbalance protection with automatic reclose, and one- or two-shot lockout of a faulted circuit.

Note: For any of the automatic operation features to work correctly, an appropriate value for the **Loss of Voltage Threshold** setpoint must be entered. See the "*Setup>Site-Related* Screen" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

Line Sectionalizing

The switch control can sectionalize a distribution circuit based on detected fault current and voltage fluctuations associated with source-side recloser operation.

Note: The S&C 5802/5803 control monitors each feeder independently and responds to changes on specific feeders regardless of the condition of the other pad-mounted switch and feeder.

When **Sectionalizing** mode is enabled, the control uses the following logic to determine when to trip open the switch:

A. The control continuously monitors all sensed voltage phases and compares the voltage to the **Loss of Voltage Threshold** setpoint.

B. When the voltage drops below the setpoint on all sensed phases, the control starts the **Sectionalizer Reset and Extended Voltage Loss Time** timer. In addition, the control sets the counter of recloser operations to "1."

   If a phase- or ground-overcurrent fault was present within 0.6 seconds prior to the detected loss of voltage, the control assumes the voltage loss was caused by a source-side breaker or recloser opening in response to a load-side overcurrent fault.

   If an overcurrent fault was not detected prior to the loss of voltage, the control assumes the voltage loss was caused by a source-side breaker or recloser opening in response to a source-side overcurrent fault.

C. The control continues to monitor voltage levels. It adds one count to the counter for each time the source-side device opens.

D. If the **Successful Reclose Reset Time** setpoint is greater than zero, the **Reset on Successful Reclose** mode is also active. If voltage returns on all sensed phases (above the **Loss of VoltageThreshold** setpoint), current is below the fault-detection threshold, and this condition persists without interruption for longer than the **Successful Reclose Reset Time** timer, the sectionalizing counts and memory timer are reset, and sectionalizing is canceled.

E. If the **Sectionalizer Reset and Extended Voltage Loss Time** timer expires before the counter reaches the appropriate **Recloser Counts to Trip** setpoint, the control resets the counter to zero. Later voltage losses are considered part of a different reclose sequence. However, if three-phase voltage is not present when the timer expires, an **Extended Voltage Loss** condition exists and the control opens the switch.

   When the counter reaches the setpoint value before the timer expires, and the problem was a load-side fault, the control trips open the switch.

   Note: When the **Fault Current Required Before First/All Voltage Loss(es)** setpoint is "All," the switch will not trip open unless all voltage losses were preceded by fault current. However, it may still operate based on the **Recloser Counts to Trip, Voltage Loss Only** setpoint. See Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

   If the counter reaches the setpoint value before the timer expires and the problem was a source-side fault, the control notes the events but does not trip open the switch.

Follow these steps to enable line sectionalizing:

STEP 1. In the **Features Enabled** field on the *Setup>Automatic Operation* screen, select a combination that includes **Sectionalizing** mode.

STEP 2. If desired, at the *Setup>Automatic Operation* screen, set the **Successful Reclose Reset Time** setpoint to coordinate with the reclosers.

STEP 3. Use either the faceplate automatic operation ENABLE/DISABLE switch or a SCADA command to enable **Automatic Operation** mode for the control.

Phase Loss Protection

When the **Phase Loss Protection** mode is enabled, the switch control trips open the switch in response to a persistent phase-imbalance condition to prevent damage to customer equipment. The control uses the following logic to determine when to trip open the switch:

A. When the control detects a loss of voltage on one or two phases, it starts the **Phase Loss Protection Time Threshold** timer.

B. If the voltage loss persists and true RMS current remains below the **Phase Loss Protection Current Threshold** setpoint until the timer expires, the switch control trips open the switch.

If voltage returns before the timer expires, the switch control terminates the timing operation.

If voltage returns on one phase before the timer expires but is then lost on another phase, the switch control restarts the timer.

Follow these steps to enable the **Phase Loss Protection** mode:

STEP 1. In the **Features Enabled** field on the *Setup>Automatic Operation* screen, select a combination that includes the **Phase Loss Protection** mode.

STEP 2. At the *Setup>Automatic Operation* screen, enter values for the **Phase Loss Protection Time Threshold** and the **Phase Loss Protection Current Threshold** setpoints. Also enter the **Phase Loss Protection Voltage Threshold** setpoint; otherwise, the switch control uses the **Loss of Voltage Threshold** setpoint on the *Setup>Site-Related* screen. See the "*Setup>Automatic Operation* Screen section" in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

⚠ CAUTION

Select a conservative value for the **Phase Loss Protection Current Threshold** setpoint, one clearly below the loadbreak rating of the line switch.

STEP 3. Use either the faceplate Automatic Operation ENABLE/DISABLE switch or a SCADA command to enable the **Automatic Operation** mode.

Phase Loss Protection with Automatic Reclose

When **Automatic Reclose** mode is enabled and the switch is tripped open because of a phase imbalance, the control recloses the switch when voltage is again present on all three phases. If **Phase Loss Protection** mode is enabled but **Automatic Reclose** mode is not enabled, the operator must use the faceplate switch or a SCADA command to manually close a tripped switch.

Note: Automatic Reclose mode is not available in conjunction with **Automatic Transfer** mode.

When **Automatic Reclose** mode is enabled, the control uses the following logic to determine when to reclose the switch:

A. The control monitors the line for return of all voltage phases.

B. When the control senses voltage is present on all three phases, it starts the **Automatic Reclose** timer.

C. If voltage remains continuously present for the duration of the timer, the control recloses the tripped switch.

Note: An automatic reclose only occurs when the control tripped the switch open because of phase imbalance. Switches opened for other reasons must be manually closed.

Follow these steps to enable **Automatic Reclose** mode:

STEP 1. In the **Features Enabled** field on the *Setup>Automatic>Operation* screen, select a combination that includes **Phase Loss Protection with Automatic Reclose** mode.

STEP 2. On the *Setup>Automatic Operation* screen, enter values for the **Phase Loss Protection Time Threshold**, the **Phase Loss Protection Current Threshold**, and the **Phase Loss Protection Automatic Reclose Time Threshold** setpoints. Also enter the **Phase Loss Protection Voltage Threshold** setpoint; otherwise, the control uses the **Loss of Voltage Threshold** setpoint on the *Setup>Site-Related* screen. See the "*Setup>Automatic Operation* Screen section" in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

STEP 3. Use either the faceplate Automatic Operation ENABLE/DISABLE switch or a SCADA command to enable the **Automatic Operation** mode for the control.

Shots-to-Lockout Feature

The **Shots-to-Lockout** feature allows the field technician or SCADA operator to test a potentially faulted line. When the circuit is then de-energized by a source-side protective device (recloser, breaker, etc.) and the control sees the transition from voltage present to loss of voltage, the control opens the switch immediately. This allows the faulted line segment to be isolated and prevents the source-side device from reclosing into a fault multiple times.

Note: When the source-side device opens and recloses very quickly, sensors on the load side of the switch may not have enough time to sense both the voltage increase (when the switch closes) and the voltage loss (when the source-side device opens) before the sourceside device recloses. Under these conditions, the control cannot carry out **Shots-to-Lockout** mode, except during a transfer event. For best results, the sensors should always be installed on the source side.

During a transfer event, the IntelliTeam system uses **Shots-to-Lockout** mode every time it automatically closes a switch to restore load. However, depending on the location of voltage sensors, it may not know whether voltage has been restored up to the switch. For this reason, when the IntelliTeam system does not see a transition from voltage present to loss of voltage, it still trips open the switch following the **Shots-to-Lockout Time Threshold** if no voltage is present. Be sure to coordinate this timing with the breaker at the source. For more information about switch control response time, see the "Loss of Voltage Threshold" section in the explanation of the *Setup>Site-Related* screen in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*."

⚠ CAUTION

It is very important to coordinate the end of the **Shots-to-Lockout Timer** and source-breaker operation. Operation of the breaker at the same time the switch opens could result in failure of the switch.

When the line switch is closed, **Shots-to-Lockout** mode can also be enabled. This feature is useful for extending shots-to-lockout functionality to a load-side manual switch. The feature is enabled indefinitely (latched), until disabled by toggling the faceplate REMOTE/LOCAL switch to **Remote** mode.

When **Shots-to-Lockout** mode is enabled:

A. When the line switch is open: If the switch is closed into a fault and the source-side protective device (recloser, circuit breaker, etc.) detects the fault, the source-side device opens and voltage is lost on all phases.

   When the line switch is closed: If a load-side manual switch on the circuit closes into a fault and the source-side protective device (recloser, circuit breaker, etc.) detects the fault, the source-side device opens and voltage is lost on all phases.

B. The control recognizes the source-side device opened. If the **Number of Shots Required for Lockout** sepoint is 1, the control trips open the switch right away. If it is set to 2, the control waits until the source-side device recloses and opens a second time. Then, the control trips open the switch. If the **Overcurrent Required before Shots-to-Lockout Operation** setpoint is also enabled, the control only opens the switch when the three-phase voltage loss was preceded by an overcurrent event.

Setting the **Number of Shots to Lockout** setpoint to "2" prevents the control from trying to open the switch at the same time as the source-side device is performing an instantaneous reclose. When the **Overcurrent Required before Shots-to-Lockout Operation** setpoint is also enabled, the relationship between the detection of overcurrent and voltage losses follows the **Fault Current Required before First/All Voltage Loss(es)** setpoint.

C. The switch remains open until it is closed with a SCADA command or manually from the switch control faceplate.

Local Shots-to-Lockout

To perform the **Shots-to-Lockout** command from the control faceplate:

STEP 1. On Page 1 of the *Setup>Automatic Operation* screen, make sure:

- The **Features Enabled** setpoint is set to an option that includes **Sectionalizing** mode.
- The **Number of Shots Required for Lockout** setpoint is set to the appropriate number for this control.
- The **Shots-To-Lockout Time Threshold** setpoint contains a value larger than zero.
- The **Overcurrent Required Before Shots-to-Lockout Operation** setpoint is set to the appropriate value for this switch control.

STEP 2. Set the faceplate REMOTE/LOCAL switch to **Local** mode.

STEP 3. Hold the faceplate Automatic Operation ENABLE/DISABLE switch in the **Enable** position. This will cause the ENABLED LED to blink while the switch is held.

STEP 4. While holding the ENABLE/DISABLE switch in the **Enable** position, toggle the CLOSE/OPEN faceplate switch (for the tested circuit) to the **Close** position. This will cause the CLOSED LED for the selected switch to blink. If the line switch is open, this action closes the switch.

STEP 5. Release the ENABLE/DISABLE switch.

If the line switch was previously open, the **Lockout** mode remains in effect (and the CLOSED LED continues to blink) for the duration of the **Shots-To-Lockout Time Threshold** timer. If the appropriate number of voltage losses is detected during this time, the control trips open the switch.

If the line switch was already closed, the **Lockout** mode remains in effect (and the CLOSED LED continues to blink) indefinitely. To disable it, toggle the REMOTE/LOCAL switch to **Remote** mode.

Remote Shots-to-Lockout

The **Shots-to-Lockout** command can be issued by a SCADA master station. See the appropriate DNP Implementation instruction sheet for more information. However, **Latched Shots-to-Lockout** mode is not available remotely.

Note: To use **Remote Shots-to-Lockout** mode, the control faceplate REMOTE/LOCAL switch must be set to **Remote** mode and the Automatic Operation ENABLE/DISABLE switch set to **Enable** mode.

Automatic Load Transfer

After completing sectionalizing and/or phase-loss logic, the control can reclose the switch to transfer load to an adjacent distribution circuit or to restore service to load on the source side of the fault. To do this, the switch control uses information it receives from the directly adjacent team members.

There are four key team members during load transfer:

- The tie switch
- The switch on the load side of the fault
- The switch on the source side of the fault

- The switch closest to the source breaker

When **Automatic Load Transfer** mode is enabled, each team member uses the logic associated with its location to determine whether it can close to restore service to that line section. The logic for each key switch location is described in the following:

Note: IntelliTeam logic also applies to team members connected to reclosers.

Tie switch

A. The tie switch does not wait for information from its neighbor on the unaffected circuit. Instead, it assumes only one circuit is faulted when closing to restore load. If both circuits have problems, the tie switch reopens.

B. To determine whether and when to close, the tie switch uses information from the nearest team member in the direction of the event. If the nearest team member detected a fault, the tie switch remains open to isolate the faulted line section.

   If the nearest team member did not detect a fault, it must report to the tie switch it is presently open. If the nearest team member reports it is still closed, the tie switch remains open. The tie switch waits for a report that lets it close until the **Global Transfer Process Time Limit** timer expires.

C. The team member nearest the tie switch must report when its logic sequence reaches the proper step. Otherwise, the tie switch remains open. This ensures that each team member operates properly and in turn. The tie switch waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

D. The tie switch uses load data received from the nearest team member to determine whether the load to be restored is below the applicable **Capacity for Transfer** setpoint. This load information is the most recent 1-minute averaged three-phase current prior to the fault event. If the average is greater than the applicable **Capacity for Transfer** setpoint for the alternate feeder, the tie switch remains open.

E. Before closing, the tie switch verifies no active team members report problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the transfer event.

F. The tie switch closes using **Shots-to-Lockout** logic. This means that if the appropriate number of voltage losses are detected within the **Shots-to-Lockout Delay Time** setpoint (with overcurrent before, as applicable), the tie switch immediately reopens and reports an error condition to the other team members.

Switch on the load side of a fault

A. The control on the load side of a fault obtains information from adjacent team members on both sides. It waits for up to the **Global Transfer Process Time Limit** setpoint to receive the information. If the information is not received within this time, the control indicates an error condition and stops.

B. The control uses information on the state of the nearest team member in the direction away from the fault (the local load side). That team member must report it is closed before the local control can close its switch.

C. The load-side team member nearest to the local switch must report its logic sequence has reached the proper step. Otherwise, the local control cannot close its switch. This ensures the adjacent team member has completed the necessary steps in the transfer process, the state of that switch is correct, and the local switch control is acting in turn.

D. If the team member nearest the local switch on the fault side (on the local source side) detected a fault, the local switch remains open to isolate the faulted line section.

   If it did not detect a fault, the nearest source-side team member must report to the local control it is presently open. If the nearest team member reports it is still closed, the local switch remains open. The local switch waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

E. Both the local control and the nearest source-side team member must have seen voltage loss for the local switch to close. This ensures both team members have detected the event correctly and are operating properly.

F. The source-side team member nearest to the local switch must report that its logic sequence has reached the proper step. Otherwise, the local switch remains open. This ensures each team member operates properly and in turn. The local switch waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

G. The local control uses load data received from the nearest source-side team member to determine whether the load to be restored is below the applicable **Capacity for Transfer** setpoint. This load information is the most recent 1-minute averaged three-phase current prior to the fault event. For the load value, the local control uses the average load the nearest source-side team member reports having detected just prior to the event. When this value is greater than the applicable **Capacity for Transfer** setpoint for the alternate feeder, the local switch remains open.

H. Before closing the switch, the local control verifies that no active team members reported problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the transfer event.

I. The local switch closes using **Shots-to-Lockout** logic. When the appropriate number of voltage losses are detected within the **Shots-to-Lockout Delay Time** setpoint (with overcurrent before loss of voltage, as applicable), the local control immediately opens the switch and reports an error condition to the other team members.

Switch on the source side of a fault

A. A switch control on the source side of a fault obtains information from adjacent team members on both sides. The control waits for up to the **Global Transfer Process Time Limit** setpoint to receive the information. If not received within this time, the control indicates an error condition and stops.

B. The control uses information on the state of the nearest team member in the direction away from the fault (local source side). That team member must report it is closed before the local control can close its switch.

C. The source-side team member nearest the local switch must report ts logic sequence has reached the proper step. Otherwise, the local control cannot close its switch. This ensures the adjacent team member has completed the necessary steps in the transfer process, the state of that team member is correct, and the local switch control is acting in turn.

D. When the team member nearest the local switch on the fault side (local load side) did not detect a fault, the local switch remains open to isolate the faulted line section.

   If it did detect a fault, the nearest load-side team member must report to the local control it is presently open. If the nearest team member reports it is still closed, the local remains open. The local control waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

E. Both the local control and the nearest load-side team member must have observed a fault and voltage loss for the local switch to close. This ensures both team members have detected the event correctly and are operating properly.

F. The load-side team member nearest the local switch must report its logic sequence has reached the proper step. Otherwise, the local switch remains open. This ensures each team member operates properly and in turn. The local switch waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

G. Before closing the switch, the local control verifies that no active team members report problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the transfer event.

H. The local switch closes using **Shots-to-Lockout** logic. If the appropriate number of voltage losses are detected within the shots-to-lockout delay time (with overcurrent before voltage loss, as applicable), the local control immediately reopens the switch and reports an error condition to the other team members.

Switch closest to the source breaker

A. The team switch control nearest the source breaker obtains information only from the nearest team member on its load side. The local control uses the presence of voltage to determine the state of the breaker. The control waits for up to the **Global Transfer Process Time Limit** setpoint to receive the necessary information. If it does not receive it within this time, the control indicates an error condition and stops.

B. The local control must detect source-side voltage before it can close its switch. If the source-side protective device (breaker, recloser, etc.) were to close without voltage the appropriate number of times, the **Shots-to-Lockout** logic would immediately reopen the switch and report an error.

C. If the team member nearest the local switch on the fault side (local load side) did not detect a fault, the local switch remains open to isolate the faulted line section.

If it did detect a fault, the nearest load-side team member must report to the local control that it is presently open. If the nearest team member reports it is still closed, the local switch remains open. The local switch waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

D. Both the local control and the nearest load-side team member must have seen a fault and a voltage loss for the local switch to close. This ensures both team members have detected the event correctly and are operating properly.

E. The load-side team member nearest the local switch must also report that its logic sequence has reached the proper step. Otherwise, the local switch remains open. This ensures each team member operates properly and in turn. The local switch waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

F. Before closing the switch, the local control verifies that no active team members report problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the transfer event.

G. The local switch closes using **Shots-to-Lockout** logic. If the appropriate number of voltage losses are detected within the shots-to-lockout delay time (with overcurrent before loss of voltage as applicable), the local control immediately reopens the switch and reports an error condition to the other team members.

Follow these steps to enable **Automatic Load Transfer** mode:

STEP 1. In the **Features Enabled** field on the *Setup>Automatic Operation* screen, select a combination that includes **Automatic Transfer** mode. See Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

STEP 2. Use either the faceplate Automatic Operation ENABLE/DISABLE switch or a SCADA command to enable **Automatic Operation** mode for the switch control.

Return to Normal

Following a reconfiguration event and subsequent repair and restoration of the faulted line section, the team members can return to their normal states. When the normally closed but presently open switch on the load side of the fault senses voltage has been restored to the faulted section, its control initiates the automatic **Return-to-Normal** process.

During the **Return-to-Normal** process, there are three key locations:

- The normally open but presently closed tie switch
- The switch on the load side of the fault that is normally closed but presently open
- A normally closed but presently open intermediate switch

When the **Return-to-Normal** mode is enabled, each team member uses logic associated with its location to determine whether it can operate its switch. The following are summaries of the logic associated with each key location.

Note: This IntelliTeam logic also applies to team members connected to reclosers.

Normally open but presently closed tie switch

A. The tie switch must receive a report from another team member that a **Return-to-Normal** process has started.

B. For an open transition, the control opens the tie switch if both of the following are true:

- The load seen by the switch control is not above the **Phase Loss Protection Current Threshold** setpoint.
- No active team members report problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the Return-to-Normal event.

For a closed transition, the control waits to receive additional reports indicating all team members are presently closed before opening the tie switch. When the necessary reports have not been received within the **Global Transfer Process Time Limit** setpoint, the control assumes a circuit has been paralleled. As a safety feature, it reopens the tie switch when both of these conditions are true.

Switch on the load side of the fault—normally closed but presently open

A. Following restoration of source-side voltage and expiration of the **Global Return to Normal Delay Time** timer, the control on the load side of the previously faulted line section initiates the **Return-to-Normal** process by informing all other team members of the event.

B. The control waits for a report from the normally open tie switch indicating it received the initial message. The control waits for up to the **Global Transfer Process Time Limit** setpoint to receive this information. If it is not received by this time, the control indicates an error condition and stops.

C. The team member at the normally open tie switch must report its logic sequence has reached the proper step. Otherwise, the local switch will not close. This ensures each team member operates properly and in turn. When the tie switch reports it is not at the proper step, the local switch remains open. It waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

D. Before closing the switch, the local control verifies that no active team members report problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the **Return-to-Normal** event.

E. The local switch closes using **Shots-to-Lockout** logic. If the appropriate number of voltage losses are detected within the shots-to-lockout delay time (with overcurrent before loss of voltage, as applicable), the local control immediately reopens the switch and reports an error condition to the other team members.

Intermediate switch—normally closed but presently open

The normally closed intermediate switch is between the tie switch and the presently open switch that started the **Return-to-Normal** event. The most likely reason it is in an open state during the transfer event is the load it needs to restore is above the allowed limit.

A. The control may reclose the switch when it receives the necessary information from the nearest source-side team member. It waits for up to the **Global Transfer Process Time Limit** setpoint to receive the necessary information. When the information is not received within this time, the control indicates an error condition and stops.

B. The team member on the source side of the local switch must report it is in the normal **Closed** state. This ensures it has successfully closed, restoring service to the source-side line section.

C. The source-side team member nearest the local switch must report its logic sequence has reached the proper step. Otherwise, the local switch will not close. This ensures each team member operates properly and in turn. If the nearest team member reports it is not at the proper step, the local switch remains open. It waits for up to the **Global Transfer Process Time Limit** setpoint for a report that lets it close.

D. Before closing the switch, the local control verifies that no active team members report problems or errors because of operation or synchronization. Any inconsistency within the team prevents further operation of the **Return-to-Normal** event.

E. The local switch closes using **Shots-to-Lockout** logic. If the appropriate number of voltage losses are detected within the shots-to-lockout delay time (with overcurrent before voltage loss, as applicable), the local control immediately reopens the switch and reports an error condition to the other team members.

Follow these steps to enable the **Return-to-Normal** mode:

STEP 1. In the **Features Enabled** field on the *Setup>Automatic Operation* screen, select a combination that includes **Return Open** or **Return Closed** mode. See Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.

STEP 2. Use either the faceplate Automatic Operation ENABLE/DISABLE switch or a SCADA command to enable **Automatic Operation** mode for the switch control.

Fault Events Log

When a line switch has been tripped (opened automatically) by the switch control, the information on the *Overcurrent Fault* screens helps to determine the source and cause of the problem.

Click the **Overcurrent Fault** button on any screen to open the *Overcurrent Fault Menu* screen, and then click the **Fault Events** button. See Figure 3.

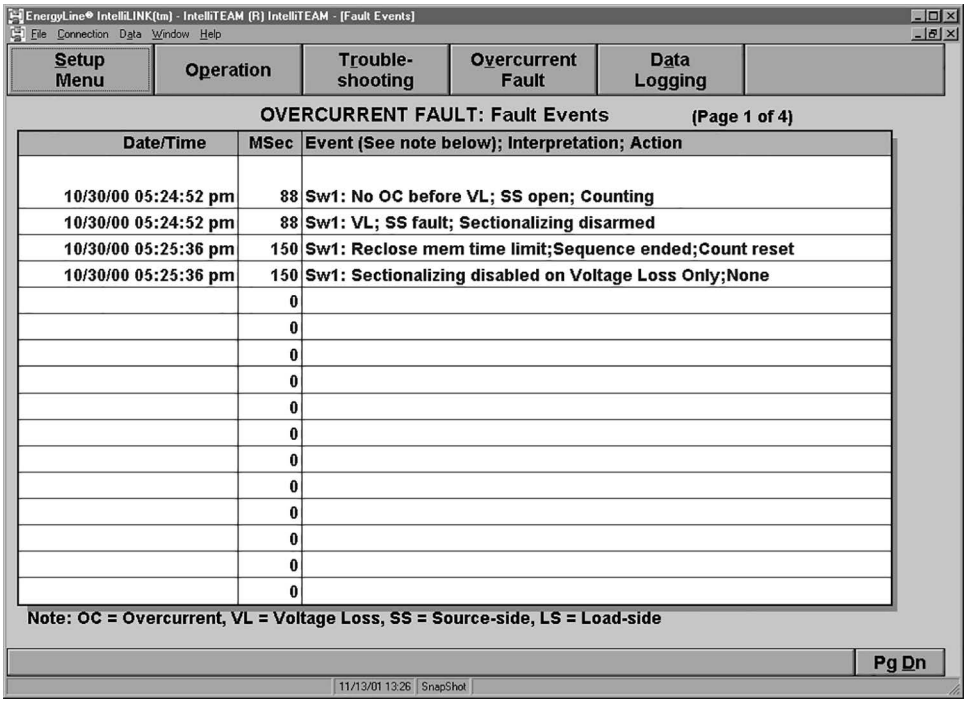


Figure 3. The *Overcurrent Fault>Fault Events* screen.

The *Overcurrent Fault>Fault Events* screen shows a chronological listing of fault-related events for the switch(es). The record for each event includes the time, the switch number (if applicable), the type of event, the switch control's interpretation of the event, and the action taken.

This log includes four pages of data. When the log is full, each new event over-writes the oldest event in the log. To find the most recent event, look for the message with a timestamp that is older than the time for the message above it.

This screen includes two columns:

Date/Time and MSec

This is the time (to the nearest 6.25 milliseconds) when the event was logged. The control logs the event after the fault event and all described actions have been completed.

Event

This is the event message, which describes the event, the assumption the control made about the event, and the action(s) taken. In the following event explanations, the number code appearing on the LCD screen is shown in square brackets (for Switch 1 and Switch 2 respectively, if applicable) on the line below the name that appears on the screen. (Code 0 means that there was no event.)

Note: For the S&C 5802/5803 control, each event message is specific to one switch/circuit and is preceded by either Sw1: (for Switch 1) or Sw2: (for Switch 2). When both circuits are affected, such as by a voltage loss, the message appears twice.

Phase A OC; Fault current sensed & cleared; Noted [1], [2]

The switch control detected an overcurrent fault on Phase A and the overcurrent fault has ended. The control is waiting to see whether voltage will be lost on all three phases. When all voltage is lost, the control begins timing for a possible recloser operation.

Note: The control displays similar messages for **Phase B**, **Phase C**, and **Ground Overcurrent** conditions.

Phase B OC; Fault current sensed & cleared; Noted [3], [4]

See the "Phase A OC; Fault current sensed & cleared; Noted [1], [2]" section.

Phase C OC; Fault current sensed & cleared; Noted [5], [6]

See the "Phase A OC; Fault current sensed & cleared; Noted [1], [2]" section.

Ground OC; Fault current sensed & cleared; Noted [7], [8]

See the "Phase A OC; Fault current sensed & cleared; Noted [1], [2]" section.

OC then voltage o.k.; Load-side protective open; Noted [9], [21]

The control detected an overcurrent fault. This condition was not followed within 0.6 seconds by a loss of voltage on the same phase. The control assumed a load-side fault occurred, but the condition was cleared on the load side (by a fuse, recloser, etc.).

Note: No timer or other action is started for this type of event.

OC then VL; Source-side protective open; Counting [10], [22]

The control detected an overcurrent fault that was followed within 0.6 seconds by a loss of voltage on all phases. The control assumed a loadside fault occurred and the condition was cleared on the source side by a three-phase device (such as a breaker, interrupter, or recloser). The control added one count to the **Recloser Operations** counter.

Reclose memory time limit; Sequence ended; Count reset [11], [23]

The **Sectionalizer Reset** timer expired. The control will consider future events to be part of a different event sequence.

Note: The control always displays this message when the timer expires.

VL; Source-side fault; Sectionalizing disarmed [12], [24]

The control detected a three-phase voltage loss but no overcurrent fault condition. The control assumed a source-side fault occurred and the condition was cleared on the source side by a three-phase device (such as a breaker, interrupter, or recloser). The control started the **Sectionalizer Reset** timer and set the value in the recloser operations counter to "1." Because the fault was on the source side, the control will not trip open the switch because of a **Recloser Counts with Fault Current Detected** count but will open the switch if the **Recloser Counts to Trip, Voltage Loss Only** count is reached.

VL; Load-side fault; Sectionalizing armed [13], [25]

The control previously detected a phase- or ground-overcurrent fault followed within 0.6 seconds by three-phase voltage loss. The control then assumed the present voltage loss was associated with the previous load-side fault and the condition was again cleared on the source side by a three-phase device (such as breaker, interrupter, or recloser). The control incremented the **Recloser Operations** counter.

Full count reached; Source-side fault; Noted [14], [26]

The full count was reached on the **Recloser Operations** counter. Because the first voltage loss in the sequence was not preceded by an overcurrent fault, the control took no sectionalizing action on the count of **Recloser Counts to Trip, Fault Current Detected** counter.

Full count reached; Load-side fault; Noted [15], [27]

The full count was reached on the **Recloser Operations** counter. Because the first voltage loss in the sequence was preceded by an overcurrent fault (as well as all subsequent voltage losses, if the **Fault Current Required Before First/All Voltage Loss(es)** setpoint is set to "All"), the control will take the appropriate sectionalizing action.

Full count reached with sectional. disabled;; Noted [16], [28]

The full count was reached on the **Recloser Operations** counter. Because sectionalizing was disabled, the control did not trip open the switch.

Note: To identify the exact events that led to this action, review the earlier log messages.

Full count reached; Open operation executed [17], [29]

The full count was reached on the **Recloser Operations** counter, so the switch control tripped open the switch.

Note: To identify the exact events that led to this action, review the earlier log messages.

No OC before VL; Source-side open; Counting [18], [30]

The control detected a three-phase voltage outage that was not preceded by an overcurrent fault. The control assumed a source-side fault occurred and the condition was cleared by a source-side device. The control added one count to the **Recloser Operations** counter.

OC then VL; Source-side fuse blown for load-side fault [19], [31]

The control detected a phase- or ground-overcurrent fault. This was followed within 0.6 seconds by a loss of voltage on the same phase, without all other phases losing voltage. The control assumed a load-side fault occurred and the condition was cleared on the source side by a fuse or single-phase recloser.

No OC then VL; Source-side (SS) fuse blown - SS fault [20], [32]

The control detected a loss of voltage on one or two phases that was not preceded by an overcurrent fault. The control assumed a source-side fault occurred and the condition was cleared on the source side by a fuse or a single-phase recloser.

CLOSE operation executed, shots-to-lockout requested [33], [35]

In response to an **Automatic Transfer** command or a SCADA or faceplate **Shots- To-Lockout** command, the control closed the switch and started the **Shots-To- Lockout** timer.

Note: Before the timer expires, when voltage is restored on any phase and then lost on all three phases, the control trips open the switch. When **Overcurrent Required before Shots-To-Lockout Operation** mode is enabled, the control also detected an overcurrent event.

Lockout close complete with event after - OPEN executed [34], [36]

This is an operator-requested **Shots-to-Lockout** operation. The control detected the appropriate number of three-phase voltage losses (within the specified **Shots-to-Lockout Time Interval** setpoint) and tripped open the switch. When the **Overcurrent Required before Shots-To-Lockout Operation** mode is enabled, the control also detected an overcurrent event. When the **Number of Shots Required for Lockout** setpoint is set to "2," the relationship between the detection of overcurrent and voltage losses follows the **Fault Current Required before First/All Voltage Loss(es)** setpoint.

Persistent phase imbalance; OPEN executed [37], [137]

The control detected a loss of voltage on one or two (but not all three) phases. The imbalance continued to the expiration of the **Phase Loss Protection Time Threshold** timer. Because this loss occurred while **Phase Loss Protection** mode and **Automatic Operation** mode were both enabled, the control tripped open the switch.

Phase imbalance w. reclose enabled;; Waiting [38], [138]

The control detected a phase imbalance while **Automatic Reclose** mode was enabled. The control tripped open the line switch and is now waiting for three-phase voltage to return.

Note: When full voltage returns, the control starts the **Automatic Reclose** timer. When voltage is continuously present for the full count of the timer, the control closes the switch.

Switch closed; Operator action; Reclose canceled [39] or [41], [139] or [141]

While the control was waiting for three-phase voltage to return (with **Automatic Reclose** mode enabled), an operator manually closed the line switch (from the faceplate or via a SCADA command). The operator command canceled the pending **Automatic Reclose** operation.

Voltage OK after imbalance; Voltage restored; Waiting [40], [140]

After the control tripped open the switch because of a phase imbalance, three-phase voltage returned. Because **Automatic Reclose** mode was enabled, the control started the **Automatic Reclose** timer and is waiting for the timer to expire.

Note: When the **Automatic Reclose Time…** setpoint value is reached, the control will close the switch.

Imbalance corrected w. reclose enabled; CLOSE executed [42], [142]

After the control tripped open the switch because of a phase imbalance condition, three-phase voltage was restored and remained present for the full count of the **Automatic Reclose** timer. Because **Automatic Reclose** mode was enabled, the control reclosed the switch.

No OC before VL; Voltage Loss Only count reached [43], [143]

The control detected a three-phase voltage outage that was not preceded by an overcurrent fault. **Sectionalizing On Voltage Loss Only** mode is enabled and the **Recloser Counts to Trip, Voltage Loss Only** setpoint has been reached.

Open operation executed on Voltage Loss Only [44], [144]

Sectionalizing On Voltage Loss Only mode is enabled and the **Recloser Counts to Trip, Voltage Loss Only** setpoint has been reached. The control sent the command to open the switch.

Sectionalizing disabled on Voltage Loss Only; None [45], [145]

The necessary criteria for **Sectionalizing On Voltage Loss Only** mode have been reached, but the feature is disabled. A count of voltage losses or an extended voltage loss will not cause an operation.

Reclose memory time limit; Extended Volt Loss; OPEN [46], [146]

The **Reclose Memory Time Limit** timer expired without restoration of voltage on any phase. This constitutes an extended voltage-loss condition. The control opened the switch.

RTN Enabled; Waiting for local voltage restoration [47]

Return-to-Normal mode is enabled and was activated following a transfer event. The **Return-to-Normal** process is now waiting for three-phase voltage to be restored locally before starting the **Return-to-Normal** timer.

Switch closed before RTN; Cancel wait for local volt [48]

The operator manually closed the switch from the faceplate or via a SCADA command. The operator command canceled an enabled **Return-to-Normal** process that was waiting for three-phase voltage to be restored locally after a transfer event.

RTN enabled, Voltage restored, Count started; Waiting [49]

Return-to-Normal mode is enabled and the control sensed three-phase voltage has been restored. The control started the **Return-to-Normal** timer. The control is waiting to ensure the voltage restoration is stable.

RTN enabled, Voltage restored; Timer count complete [50]

Return-to-Normal mode is enabled and the control sensed three-phase voltage has been present to expiration of the **Return-to-Normal** delay timer. The **Return-to-Normal** process can continue.

Return to Normal disabled; Done [51]

A transfer event occurred but **Return-to-Normal** mode is disabled. No further automatic transfer activity will occur.

RTN canceled because of stop transfer condition; Done [52]

A **Stop Transfer** condition canceled the **Return-to-Normal** mode while the control was waiting for voltage restoration and expiration of the **Return-to-Normal** timer. No further **Automatic Transfer** mode or **Return-to-Normal** mode activity will occur.

Return to Normal initiated after voltage restoration; [53]

Following restoration of voltage and expiration of the **Return-to-Normal** delay timer, the local control initiated a **Return-to-Normal** process to return the switch to its normal position.

Return to Normal initiated by peer device; [54]

The local control received a message from a peer device indicating it started a **Return-to-Normal** process. The local control then initiated the **Return-to-Normal** process, too.

Reconfiguration initiated on sectionalizer trip; [55]

The local control initiated a **Reconfiguration** process to transfer load. The process was started as a direct result of the **Sectionalizer** operation.

Reconfiguration initiated after sectionalizer trip; [56]

The local control initiated a **Reconfiguration** process to transfer load. The process was unable to start as a result of the **Sectionalizer** operation but was able to start soon afterward.

RTN canceled; Voltage sensors on load side; Done [57]

After the switch control sensed voltage and started the **Return-to-Normal** timer, it noticed the source-side switch was open. This indicates the local voltage sensors are on the load side. There is no **Stop Transfer** condition but this control cannot initiate a **Return-to-Normal** process.

Reconfiguration initiated by peer device; [58]

A peer device initiated a **Reconfiguration** process in the local switch control.

RTN failed; Break possible parallel; OPEN executed [59]

The control at the normally open tie switch began a **Return-to-Normal** operation but was unable to complete the operation within the **Global Transfer Process Time Limit** setpoint. To ensure a possible parallel condition does not continue, the control opened the tie switch.

Reconfiguration failed after lockout close operation; [60]

Following a command to issue a **Shots-to-Lockout Close** operation, the local control sensed an error in operation. This error caused a **Stop Transfer** condition and prevents any further activity.

Reconfig failed after process timeout, switch open; [61]

The **Reconfiguration and Transfer Process Timer** expired before the local switch could operate. The switch was left open even though it was not isolating a fault.

Reconfig failed after timeout, switch state unknown; [62]

The **Reconfiguration and Transfer** process failed following expiration of the **Reconfiguration and Transfer Process Timer** timer. At the end of the timer, the state of the local switch was unknown.

RTN failed on open; load break limit exceeded; [63], [163]

At the time the normally open tie switch was to reopen during the **Return-to-Normal** process, the load sensed by the control at the tie switch was above the **Phase Loss Protection Current Threshold** setpoint. The switch remains closed and the **Return-to-Normal** process reports an error. No further activity will occur.

Return to Normal failed after return operation; [64]

The switch control attempted to perform a **Return-to-Normal** operation but detected an error in the process. No further return activity will occur.

Return to Normal failed after process timeout; [65]

The **Return-to-Normal** process was not complete when the **Global Transfer Process Time Limit** timer expired. No further return activity will occur.

All reconfig processes stopped because of additional event; [66]

The **Reconfiguration and Transfer** process was interrupted by an additional fault event on the circuit. All automatic team activity is stopped until an operator command is received.

All processes canceled because of stop transfer condition; [67]

The control canceled a **Reconfiguration** or **Return-to-Normal** process because of a **Stop Transfer** condition. No further automatic team activity will occur while the switch controls are in this condition.

Manual mode; Stop Transfer correction enabled; [68]

An operator command cleared a **Stop Transfer** condition by placing the control in Automatic Operation **Disable** mode either from the faceplate or via SCADA.

System diagnostics cleared Stop Transfer condition; [69]

The switch control's system diagnostic logic was able to clear a **Stop Transfer** condition and allow the control to continue transfer operation. System diagnostics can clear **Stop Transfer** conditions no more than once per hour without operator intervention.

System diagnostics disabled Stop Transfer correction; [70]

Following clearing of a **Stop Transfer** condition, the switch control's system diagnostics disabled the further correction of **Stop Transfer** conditions for a full hour or until an operator command puts the control in Automatic Operation **Disable** mode.

Timer expired; Stop Transfer correction enabled; [71]

A full hour has passed since the last **Stop Transfer** condition was cleared by the control's system diagnostics. Correction is enabled again.

Stop Transfer active because of RTN mode mismatch; [72]

Not all team members are in the same **Return-to-Normal** mode. For example, an open-transition mode versus a closed-transition mode. The team is placed in a **Stop Transfer** condition. No further automatic team activity will occur while the team members are in this condition.

Transfer inhibited by excessive feeder loading; [73]

The control stopped the transfer process because there was more load on the affected line section than could be transferred to the alternate feeder.

Reconfiguration TEST initiated by user [74]

A **Team Transfer Test** command was initiated successfully from Page 1 of the *Team Operation* screen.

Reconfiguration TEST failed to initiate [75]

A **Team Transfer Test** command was attempted from Page 1 of the *Team Operation* screen but failed to initiate. See Instruction Sheet 1042-550, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Troubleshooting*," for more information.

Return to Normal (RTN) Enabled; Waiting; [76]

Return-to-Normal mode is enabled and has been activated following a transfer event. The **Return-to-Normal** process is now waiting for an external start for voltage to be restored locally or for the source-side switch to be closed and have three-phase voltage before starting the **Return-to-Normal** timer.

RTN enabled; External start requested; [77]

Return-to-Normal mode is enabled and the team started a **Return-to-Normal** process because of a command received from an external device, master station, or operator.

RTN enabled, SS sw closed, Count started; Waiting; [78]

Return-to-Normal mode is enabled and the control received information the source-side switch was closed and had three-phase voltage restored. The control started the **Return-to-Normal** timer. The control is waiting to ensure the source-side switch is in a stable state.

RTN enabled, SS sw closed; Timer count complete [79]

Return-to-Normal mode is enabled and the control continued to receive information the source-side switch was closed and had three-phase voltage for the entire **Return-to-Normal** delay timer. The **Return-to-Normal** process can continue.

Return to Normal initiated successfully; [80]

The control was able to start the **Return-to-Normal** process following either voltage restoration, source-side switch qualification, or an external command.

RTN enabled, All sw closed; Initiating RTN; [81]

The control at the normally open switch identified a **Closed-Loop** condition (all switches in the team were in a **Closed** state) and initiated the **Return-to-Normal** process to break the parallel condition.

Note: If purposely closing the last open switch to backfeed an additional section of line or for some other reason would like all switches to remain closed, be sure to disable **Automatic Operation** mode at one of the team members before closing the last switch.

Note: The **Global Return-to-Normal Delay Time** setpoint (on Page 1 of the *Setup> Automatic Operation* screen) does not apply if **Return-to-Normal** mode is initiated to break a parallel circuit.

Shots-to-lockout latched on [83]

An operator enabled the **Shots-to-Lockout** operation on a closed switch. The control will open the switch if the detected three-phase voltage count equals the **Number of Shots Required for Lockout** setpoint.

Successful reclose; Sequence ended; Count reset [84]

The **Successful Reclose Reset Time** timer has expired. The control will consider future events to be part of a different event sequence.

Note: The control always displays this message when the timer expires.

Fault Magnitudes

View the Fault Magnitude and Duration Log

Click the **Overcurrent Fault** button on any screen to open the *Overcurrent Fault>Menu* screen. Then, click on the **Fault Magnitudes** button. See Figure 4.

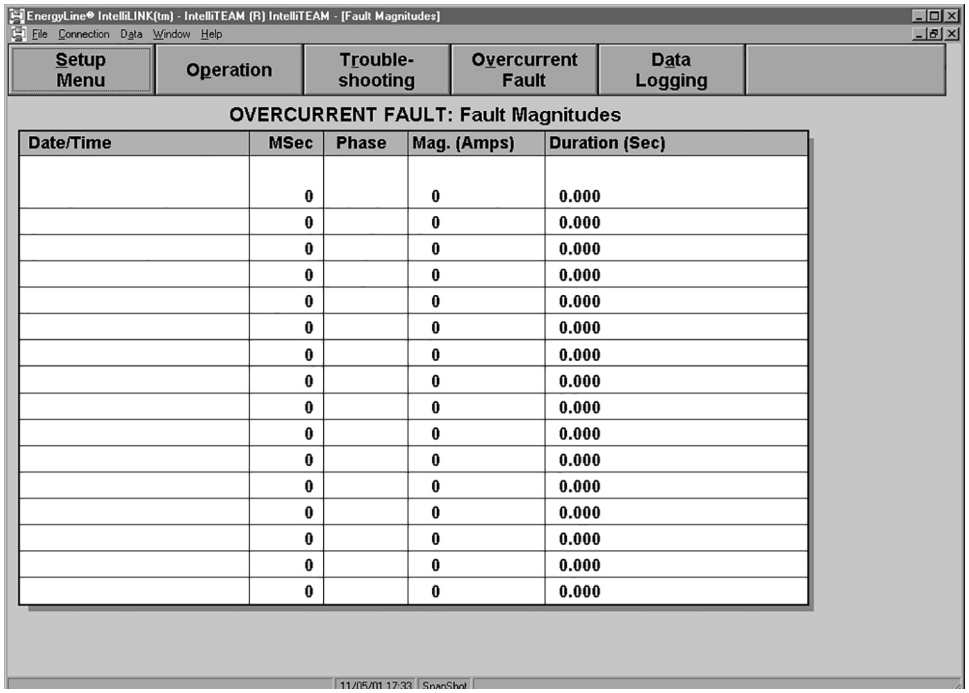


Figure 4. The *Overcurrent Fault>Fault Magnitudes* screen.

The *Overcurrent Fault>Fault Magnitudes* screen shows a chronological list of peak magnitude and duration data for overcurrent fault events. The record for each event includes the date, time, phase, magnitude, and fault duration.

The log can hold information for 16 events. When the log is full, each new event overwrites the oldest event in the log. To find the most recent event, look for the message with a time-stamp older than the time for the message above it.

The screen includes the following fields:

Date/Time and MSec

This is the time (to the nearest 6.25 milliseconds) when the event began. The switch control logs each event when it ends.

Phase

This is the phase and switch, if applicable, on which the overcurrent fault occurred. For example, A2, C1, or G2.

Mag. (Amps)

This is the peak (maximum) overcurrent-fault magnitude during the event. This is displayed as an RMS, asymmetric number.

Duration (Sec)

This is the duration of the overcurrent fault event. The value is displayed in units of seconds, with resolution to the nearest 0.00625 seconds (6.25 milliseconds). The maximum recorded fault duration is 409.6 seconds (6.82 minutes). Any fault that lasts longer than that is recorded as 409.6 seconds.

View the Ac Power Outages Log

Click the **Overcurrent Fault** button on any screen to open the *Overcurrent Fault>Fault Menu* screen. Then, click on the **Power Outages** button.

Ac Power Outages

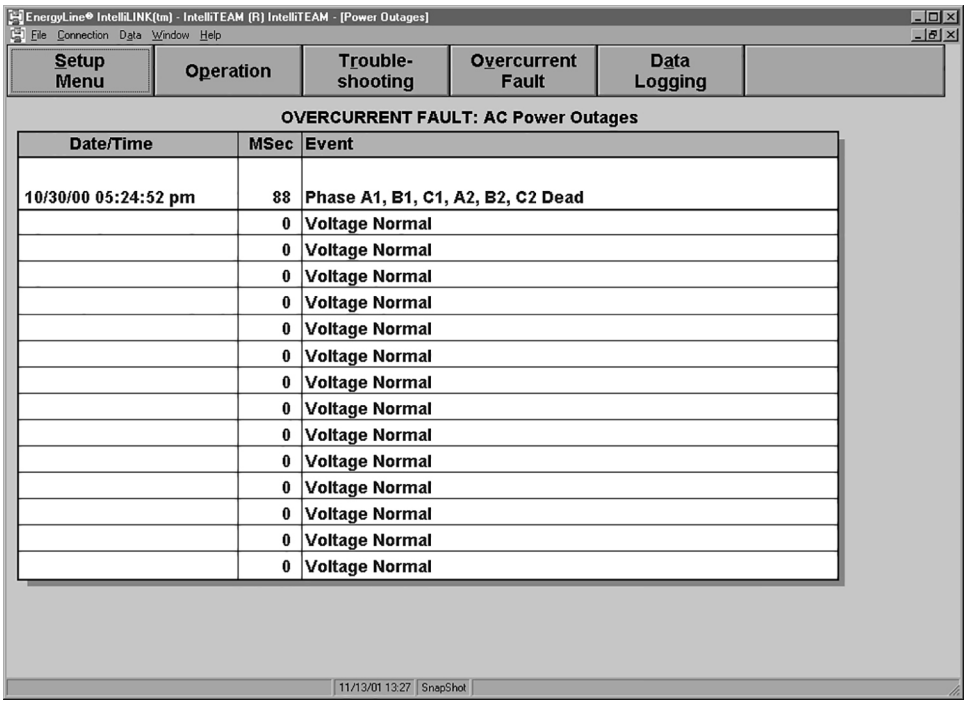


Figure 5. The *Overcurrent Fault>Ac Power Outages* screen.

The *Overcurrent Fault>Ac Power Outages* screen shows a chronological listing of voltage-outage events. The record for each event includes the date, time, and phase status for each event. See Figure 5.

An event is recorded each time:

- Voltage drops below the **Loss of Voltage Threshold** setpoint on any phase. See the "*Setup>Site-Related* Screen" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*," for more information.
- Voltage rises above the **Loss of Voltage Threshold** setpoint.

The log can hold information for 16 events. When the log is full, each new event overwrites the oldest event in the log. To find the most recent event, look for the message with a time-stamp older than the time for the message above it.

This screen includes the following fields:

Date/Time and MSec

This is the time (to the nearest 6.25 milliseconds) when the event began. This time is logged as soon as the event occurs.

Event

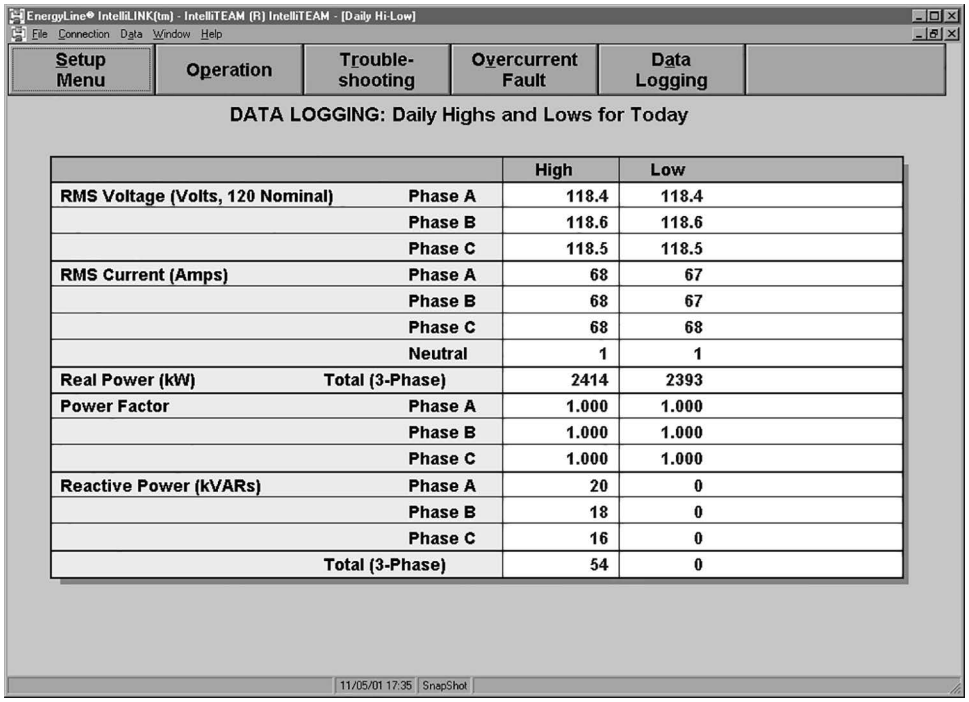
This is the phase and switch, if applicable, on which the voltage-loss event occurred. For example, A2, C1, G2, or control power.

Note: The switch control records a control power voltage-loss event whenever the power supply/control I/O module detects loss of ac power and switches to battery-backup power.

The *Data Logging* screens show high and low values and trend data for voltage and current amplitude, phase, and related parameters. When a customer complains about a service outage or low voltage, the information on the *Data Logging* screens can help determine what happened and why.

View the *Data Logging>Daily Highs and Lows for Today* Screen Data

Click on the **Data Logging** button on any screen to open the *Data Logging>Menu* screen. Then, click the button for the time period that contains the day to review. If necessary, click on the **PgUp** and **PgDn** buttons to move to the correct day.



		High	Low
RMS Voltage (Volts, 120 Nominal)	Phase A	118.4	118.4
	Phase B	118.6	118.6
	Phase C	118.5	118.5
RMS Current (Amps)	Phase A	68	67
	Phase B	68	67
	Phase C	68	68
	Neutral	1	1
Real Power (kW)	Total (3-Phase)	2414	2393
Power Factor	Phase A	1.000	1.000
	Phase B	1.000	1.000
	Phase C	1.000	1.000
Reactive Power (kVARs)	Phase A	20	0
	Phase B	18	0
	Phase C	16	0
	Total (3-Phase)	54	0

Figure 6. The *Data Logging>Daily Highs and Lows for Today* screen for a 5801 control.

Each *Data Logging>Daily Highs and Lows* screen shows the highest and lowest voltage and current, along with associated power factor, kvar, and kW values for each switch for a 24-hour period (12 midnight to 12 midnight). The high/low data can be viewed for today and for each of the preceding 7 days. See Figure 6.

The control records voltage on all three phases when any one phase is higher or lower than the previous high/low recorded on any phase.

The control also records the current on all three phases, based on the average three-phase current. In addition, when a new daily high or low occurs, it records the power factor for each phase, kvars (per phase and total), and total kW at that time.

Each displayed value is the 1.6-second averaged value for that parameter. To obtain a 1.6-second averaged value, the switch control samples the data every 0.2 seconds. Then, it adds together 8 consecutive samples and divides the total by 8.

Follow these steps to use the **Report** option to save the control software settings and stored data to the computer in a .CSV (comma-separated value) file. Keep the report as a permanent record and use the report information in spreadsheets or other programs.

STEP 1. Connect the computer to the control and start the IntelliLink software.

For details, see "Starting IntelliLink Software" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*."

STEP 2. At any IntelliLink screen, click on the **Report Menu** button.

STEP 3. At the *Report Menu* screen, click on the **Full Report** button to generate a report. The full report includes all the information contained in the control.

STEP 4. In the Save Report dialog box, specify a name and location to save this report. Then, click on the **Save** button.

When a location is not specified, the file is saved to the same directory as the program files for this team member. For example, the default location for SNCD-A1X report files is C:\ELine\SNCD-A1X\. The extension .CSV is added automatically.

When the report is complete, the message "Task completed" appears on the status line of the Writing Report dialog box.

STEP 5. Click on the **OK** button.

The software closes the dialog box and displays the *Report Menu* screen.

When two or more team members use a similar setup configuration and the same software version, the configuration from one team member can be saved and loaded into the other(s). Then, the setpoints that are different for each team member can be manually adjusted.

Follow these steps to save a setup configuration:

STEP 1. Determine which team member contains the configuration to be saved.

STEP 2. Connect the computer to the selected team member and start the IntelliLink software.

For more information, see the "Starting IntelliLink Software" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*."

STEP 3. At any IntelliLink screen, click on the **Setup Menu** button.

STEP 4. At the *Setup Menu* screen, click on the **Save Data** button.

STEP 5. In the Save Setpoints dialog box, specify a name and location for this configuration .CFG file. Then, click on the **Save** button.

When a location is not specified, the file is saved to the same directory as the program files for this team member. For example, the default location for SNCD-A1X report files is C:\ELine\SNCD-A1X\. The extension .CFG is added automatically.

Note: This process does not save the **Physical Location** information (on the *Setup>Miscellaneous* screen), the **Communications RTU Address** information (on the *Setup>Communications* screen), or the sensor configuration data (on the *Setup>Sensor Configuration* screen, if applicable).

Follow these steps to load a saved configuration into a team member:

STEP 1. If necessary, connect your computer to the team member where you want to load the saved configuration. Then, start the IntelliLink software.

For details, see the "Starting IntelliLINK Software" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*."

STEP 2. In the **Tools** menu, click on the **Setpoints>Profiles>Load** entry.

STEP 3. In the dialog box, select the .CFG file for the configuration to be loaded. Then, click on the **Open** button.

STEP 4. Enter all setpoint changes required for this team member.

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

Note: Be sure to enter the correct value for the **Physical Location** information (on the *Setup>Miscellaneous* screen), the **Communications RTU Address** information (on the *Setup>Communications* screen), or the sensor configuration data (on the *Setup>Sensor Configuration* screen, if applicable).

Follow these steps to view the IntelliLink screens and help file without connecting to a team member or a snapshot:

STEP 1. Start the IntelliLink software on the computer.

STEP 2. During startup, click on the **Cancel** button to close the Connect dialog box. If the IntelliLink software is already running, click on the **Disconnect** option on the **Connection** menu. Then, click on the **Close Screenset** option on the **File** menu, to clear the present screenset from memory.

STEP 3. On the **File** menu, click on the **Open Screenset** option.

STEP 4. In the Open Screenset dialog box, find and select the .WMN file whose name matches the version name on the software for this switch control.

Operation and data-logging information can be saved in a snapshot (.VM) file. Snapshots are used to view data, generate reports, and save or change setpoint configurations, even when not connected to a switch control. To access the stored information, open the snapshot file instead of connecting to a physical control.

Save Settings and Data to a Snapshot File

Follow these steps to create a snapshot file:

STEP 1. Connect your computer to the switch control from which the information will be saved. Then, start the IntelliLink software.

For details, see the "Starting IntelliLink Software" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*." Skip this step if the computer is already connected to the control.

STEP 2. In the **Tools** menu, click on the **Snapshot>Save** option.

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

When a location is not specified, the file is saved to the same directory as the program files for this team member. For example, the default location for SNCD-A1X report files is C:\ELine\SNCD-A1X\. The extension .VM is added automatically.

View (connect to) a Snapshot File

Follow these steps to view a snapshot file:

STEP 1. Start the IntelliLink software on your computer. During startup, click on the **Cancel** button to close the Connect dialog box.

If the IntelliLink software is already running, click on the **Disconnect** option in the **Connection** menu, and then click on the **Close Screenset** option in the **File** menu to clear the present screenset from memory.

STEP 2. From the **Connection** menu, click on the **Connect to VM File** option.

The Open Controller Data File dialog box opens.

STEP 3. Select the snapshot to view and click on the **Open** button.

STEP 4. When changing the configuration settings in the snapshot, click on the **Yes** button on the Connect to File dialog box. To avoid accidentally changing a setting, click on the **No** button.

The IntelliLink software opens and displays contents of the selected snapshot.

Save New Changes in a Snapshot File

All changes made to configuration settings in the snapshot are automatically saved to the disk immediately. There is no need to save changes in a separate operation.

Generate a Report From a Snapshot

Follow the same procedure as when connected to a switch control. For details, see the "Generating Reports" section on page 39.

Create a Configuration (.CFG) File From a Snapshot

Follow these steps to prepare a setpoint configuration file for team members in the field when there is no access to a comparable device.

STEP 1. Connect to the snapshot file.

For details, see the "View (connect to) a Snapshot File" section on page 42.

STEP 2. Change the configuration settings in the snapshot as needed.

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

STEP 3. At any IntelliLink screen, click on the **Setup Menu** button.

STEP 4. At the *Setup Menu* screen, click on the **Save Data** button.

STEP 5. In the Save Setpoints dialog box, choose a file name and location for saving this configuration, then click on the **Save** button.

If a location is not specified, the file is saved to the same directory as the program files for this team member. For example, the default location for SNCD-A1X report files is C:\ELine\SNCD-A1X\. The extension .CFG is added automatically.

Note: This process does not save the Physical Location information (on the *Setup>Miscellaneous* screen), the Communications RTU Address information (on the *Setup>Communications* screen), or the sensor configuration data (on the *Setup>Sensor Configuration* screen, if applicable).

Occasionally, the control software stored in the switch control must be updated. The Update program, installed with the IntelliLink software, easily replaces the old control software with the new version.

NOTICE

The setpoint values and historical data stored in the switch control may be lost during the update process. Before updating the control software, always generate all reports needed using the earlier IntelliLink and control software versions.

Follow these steps to update the control software:

STEP 1. Install the contents of the new setup disc on the computer.

For details, see the "Starting IntelliLink Software" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls with IntelliTeam® Automatic Restoration System: *Setup*."

STEP 2. Connect the computer to the LOCAL ACCESS port on the switch control.

STEP 3. Start the Update program.

(a) In Windows, select the Start menu>Programs>EnergyLine>Update entry.

The Update Control Software dialog box opens. See Figure 7.

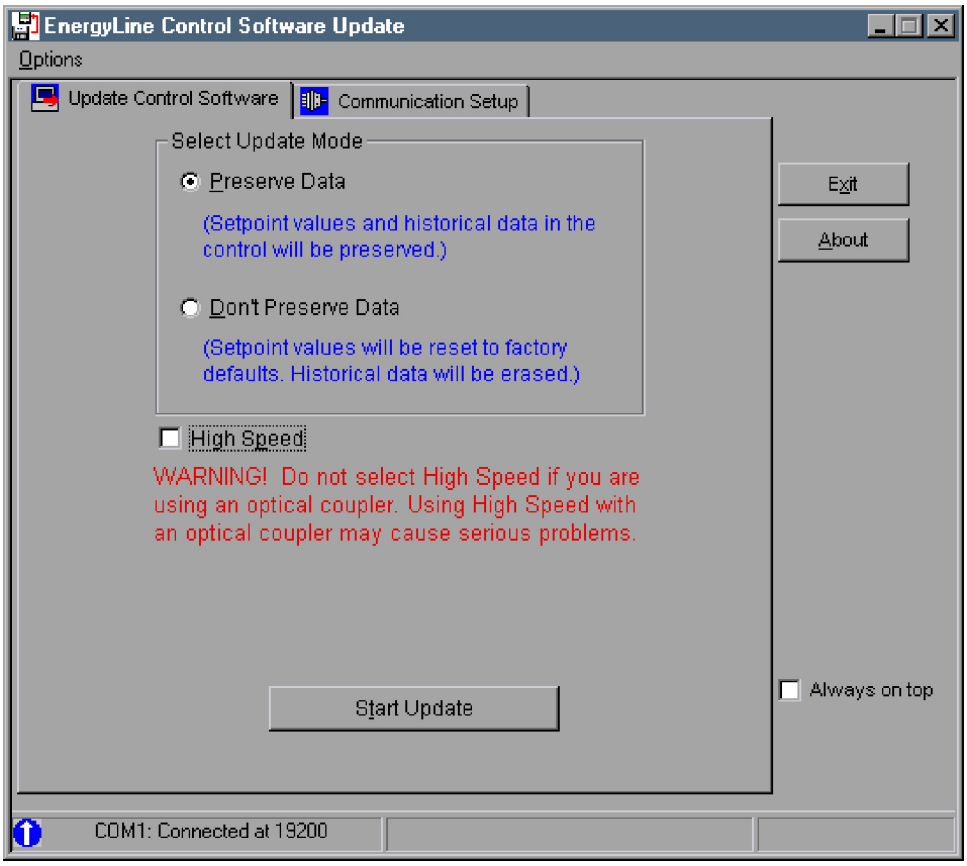


Figure 7. The Update Control Software dialog box.

(b) Select the desired options. Then, click on the **Start Update** button.

Note: When the switch control is not connected to the COM1 port on the computer, click on the **Communication Setup** tab, select the correct comm port, and click on the **Connect** button. Then, return to the **Update Control Software** tab and click on the **Start Update** button.

The update process takes about 15 minutes. The progress can be followed in the lower right corner of the dialog box. The window closes when the update is complete.

NOTICE

When the update process is cancelled after it starts, the software in the control is deactivated. If the process must be cancelled, start it again.

Note: An error message appears when the new downloaded software is not the same type as the software in the switch control. Review the software version in the switch control. Then, press the <Enter> key to abort the update process. When the correct software version has been downloaded, repeat the steps shown on page 44.

Updating the Control Software with Battery Power Only

The switch control should be powered by both battery and ac control power (or battery and sensor power, if applicable) when updating the control software. When the control software must be updated at a location where no ac control power is available, follow these instructions to override the automatic **Shutdown** timer.

Protection System Logic

All control functions are directed by the CPU, including charging and monitoring the battery system. If the CPU program stops or hangs, the control will not function and the battery or circuits might be damaged. To indicate the CPU program is functioning properly, it sets a bit on the PS/IO board every few seconds. When that bit is not set for 60 seconds, the PS/IO board disconnects the battery and shuts down the control to prevent damage to the control circuits and the battery.

During the update process, the CPU is unable to function and cannot set the bit on the PS/IO board. The protection logic will disconnect the battery 60 seconds or less after the update process begins. When ac control power (or sensor power) is present, the control continues to operate without battery power and completes the software update. However, if ac control power (or sensor power) is not present, the control shuts down, terminating the software update. There is no damage to the control, and the update process can be restarted.

Manually Overriding the Battery-Disconnect Command

Control software can be updated using only battery power by manually sending a **Battery On** command to the PS/IO board. Do this by pressing the BAT ON switch every 30 seconds. The white momentary-contact switch is located on the PS/IO board. See Figure 8 on page 46.

Updating the control software takes about 15 minutes. However, maintaining battery power by pushing the BAT ON switch is generally easier than moving the control to a location with ac control power (or sensor power).

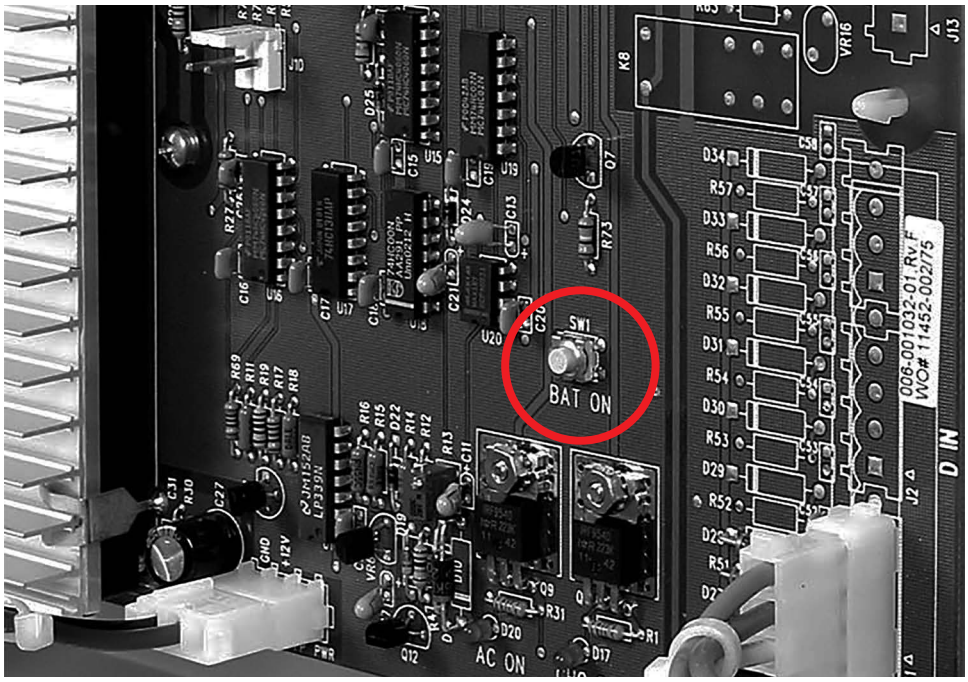


Figure 8. The BAT ON switch on the PS/IO board.