Troubleshooting

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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 Provisions

The standard warranty contained in S&C's standard conditions of sale, as set forth in Price Sheets 150 and 181, applies to the S&C 5800 Series 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.

This instruction sheet was 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 due to a problem with the switch control itself. For this reason, access to switch controls should be treated with the same safety precautions that would be applied when accessing other high-voltage lines and equipment. Follow all locally approved safety procedures when working on or around this control.

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

Whenever you manually reconfigure the circuit (for example, during repairs), follow your company's operating procedures to disable automatic operation of the switch control. This will prevent any unexpected operation.

The following tools and switch control features are used to diagnose and correct problems.

LCD Screen

The LCD screen on the switch control faceplate provides information about the present state of the team and the control. For an explanation of the faceplate and the LCD screen, see "The Faceplate" section in Instruction Sheet 1042-540, "S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Operation*."

LEDs

The LEDs on the switch control modules and the faceplate provide information about the present state of the control. See Figure 1 on page 7.

IntelliLink® Setup Software

The *Operation* and *Troubleshooting* screens display information about the switch control, switch control operations, and switch sensor data. For an explanation of these screens, see the "Software Troubleshooting and Error Messages" section on page 11.

To view these screens, a computer, serial cable, and the IntelliLink software version for this 5800 Series switch control are required. See the "Hardware and Software Requirements" section on page 6 in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Setup*."

Electrical Interconnect Diagrams

The electrical interconnect diagrams show the switch control wiring layout. See Instruction Sheet 1042-510, "S&C 5800 Series Automatic Switch Control with IntelliTeam® Automatic Restoration System: *Installation*."

Test Points

Most of the wiring in the control enclosure is terminated in insulation displacement connectors. To test a pin, gently slide the black plastic cap sideways on the connector until the pin is exposed. Test the pin, and then replace the cap (to protect the wiring from dust and to prevent shorts). Avoid inserting the test probe into the connector receptacle as this may damage the connector.

Tools Required

To correct a problem, you may need one or more of the following tools:

- Multimeter and probes
- 4-inch long, #2 Phillips screwdriver
- 4-inch long, ¼-inch flat-blade screwdriver

NOTICE

If the suggested troubleshooting steps do not resolve the problem, call S&C Electric Company at (888) 762-1100.

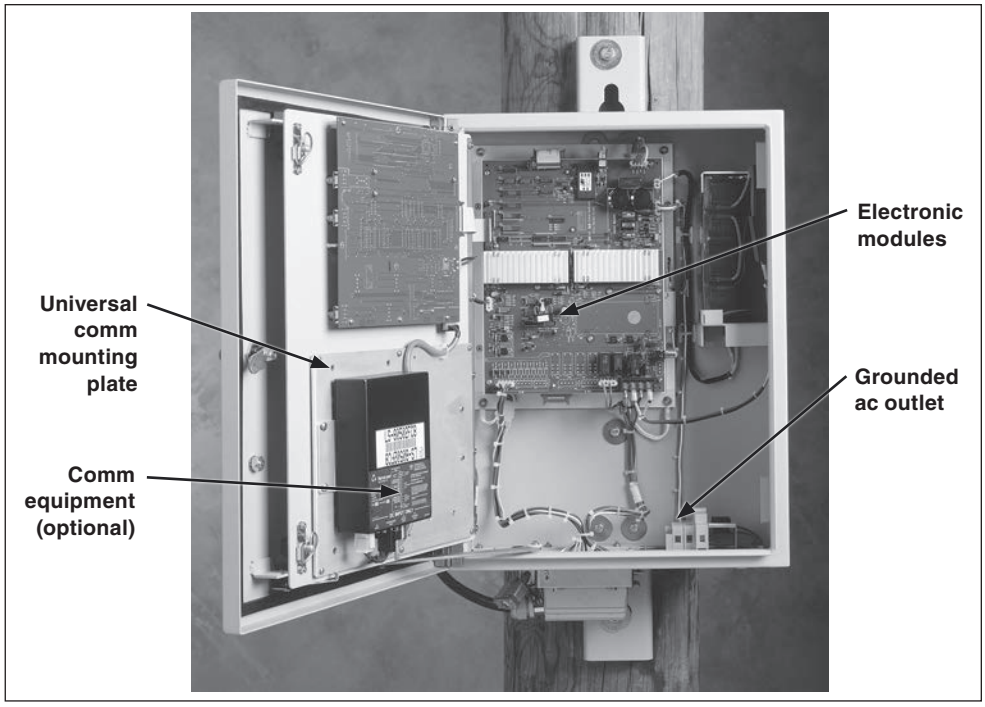

Figure 1. Model 5801 Switch Control with the faceplate open.

Power Problems

Ac line fuse is blown

Replace the fuse. Swing the fuse holder open, replace the fuse, and push the fuse holder back into place.

Battery does not supply power when ac power is off

See the "BAT ON LED (on the PS/IO board) is off" section on page 9.

Power supply/control I/O module is not providing power

See the "BAT ON LED (on the PS/IO board) is off" section on page 9.

LCD Screen Problems

LCD screen is blank or data does not scroll

Follow these steps to check the condition:

STEP 1. Check the LEDs. If all the control LEDs (including those on the PS/IO board) are off, the control is not receiving power. See the "AC ON LED (on the PS/IO board) is off" section on page 8 and the "BAT ON LED (on the PS/IO board) is off" section on page 9.

STEP 2. Check the faceplate connections. Check connectors J4, J1, and DSC. If one of the connectors is loose, push it into place, and then cycle power to the switch control. To cycle power to the control, remove the ac line fuse, and then disconnect the red and black battery leads. Reconnect the battery, and then reinsert the ac line fuse. If the LCD screen still does not work, the LCD module may need to be replaced.

Backlighting on the LCD screen does not light

Perform a lamp test. Hold the faceplate BATTERY TEST/LAMP TEST switch in the LAMP **Test** position. If the LCD screen backlight does not illuminate, but the LEDs blink, the toggle switch or the LCD module may need to be replaced. If none of the LEDs blink, see the "All LEDs on the faceplate are off" section on page 8.

Ready state is not displayed on the control LCD screen

Follow these steps to check the condition:

STEP 1. Find out which team member has a problem. On the LCD single-line team diagram, look for the blinking switch symbol. If the blinking symbol is for a team member other than this switch control, go to that site.

STEP 2. Connect the computer to the team member with the problem. Then, start the IntelliLink software. For more information, see the "Starting IntelliLink Software" section on page 6 in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration System: *Setup*."

STEP 3. Check for active messages on Page 2 of the *Troubleshooting>Event Status* screen. Follow the troubleshooting suggestions for those messages; this will usually correct the problem. See Figure 10 on page 30.

STEP 4. Follow this procedure to reset the team member control.

(a) If the team member control has a faceplate REMOTE/LOCAL switch, set the switch to **Local** mode.

(b) Toggle the Automatic Operation ENABLE/DISABLE switch to the **Disable** state.

(c) Make sure the line switch is in its **Normally Open/Closed** state, unless special system conditions require otherwise.

(d) Toggle the Automatic Operation ENABLE/DISABLE switch back to the **Enable** state.

(e) If the team member has a REMOTE/LOCAL switch, return the switch to its normal state.

Note: To clear a **Stop Transfer** condition, all line switches in the team must be in their **Normally Open/Closed** states. Other switches may have to be operated before the condition clears.

Problems Displayed with LEDs

All LEDs on the faceplate are off

Follow these steps to check the condition:

STEP 1. Check the LCD screen for data. If the screen has information and can be scrolled, the processor is powered and functioning. The problem is with the tamper switch for the door. Make sure the magnet is present on the top inside of the enclosure door (S&C 5801 control) or on the compartment door (S&C 5802/5803 control). Make sure the wiring to the magnet is connected.

When the display is blank or data cannot be scrolled, open the faceplate and check the red CPU RESET LED. The LED is found behind the BATTERY TEST switch on the faceplate circuit board. If it is lit, the faceplate circuit board is bad; contact S&C Electric Company.

STEP 2. Check switch control power (+12 Vdc). Check the AC ON and BAT ON LEDs. If neither is lit, the battery may be discharged. Press the BAT ON switch (on the left side of the PS/IO board, near the AC ON LED) to test this condition. Power will be restored for about one minute if the battery is low and ac power (or sensor power, if applicable) is off. When ac power (or sensor power, if applicable) is on, the battery will begin to recharge.

AC ON LED (on PS/IO board) is Off

Follow these steps to check the condition:

STEP 1. Check for ac control power. Check for ac voltage between the incoming-side test point of the ac line fuse holder and the ac-neutral contact. See Figure 2 on page 9.

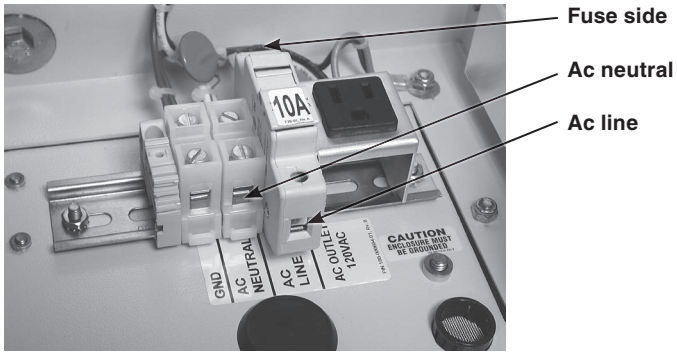

Figure 2. Test points for ac line and ac neutral measurements.

STEP 2. For externally powered controls, check the power line. Following utility-approved work procedures and safety practices, and verify there is 120-Vac control power.

STEP 3. Check the ac line and ac neutral wiring connections. Make sure the ac line wire is securely connected to the bottom of the ac line fuse holder. See Figure 2. Make sure the neutral wire is securely connected to the ac neutral terminal.

STEP 4. Check the ac line fuse by one of the following:

(a) Swing the fuse holder open and check the fuse for continuity with a multimeter; replace a bad fuse, and close the fuse holder.

(b) If 120 Vac is present at the ac line test point, check for voltage at the fuse-side test point. See Figure 2.

STEP 5. Disconnect ac power and the battery. For sensor-powered controls, also disconnect the external signal cable(s). Remove the ac line fuse. Tighten the two screws that are normally hidden behind the fuse. Reinstall the fuse, and then reconnect all power sources.

STEP 6. Check that the ac power connector is plugged into the PS/IO board at the J17 connector.

STEP 7. For sensor-powered controls, check the voltage supplied by the switch sensors.

⚠ CAUTION

This is a high-voltage area of the PS/IO board. When checking voltage, make sure the 10-A ac line fuse and the 10-A dc wetting fuse have been removed and the ac power line is de-energized. For switch controls powered by sensors, the switch interface cable(s) on the bottom of the enclosure must be disconnected.

Check the dc voltage across the PS/IO board J8 connector, pins 1 (positive) and pin 3 (negative). The voltage should measure between 280 and 340 Vdc.

Note: Do not unplug the PS/IO board J8 connector.

ANALOG PWR LED (on PS/IO board) is off or blinking

Call S&C Electric Company. The PS/IO board is malfunctioning.

BATTERY LOW LED is lit

See the "'Battery Low" on the *Troubleshooting>Event Status* screen" section on page 12.

BAT ON LED (on PS/IO board) is off

Follow these steps to check the condition:

STEP 1. Check the BATTERY LOW LED on the faceplate. When the BATTERY LOW LED is blinking, a battery test is in progress. The BAT ON LED normally turns off and on several times during a battery test.

STEP 2. Check the battery leads, and make sure they are connected.

STEP 3. Disconnect all power sources and check the wiring from the battery. Disconnect the battery leads and the ac power line. For sensor-powered controls, also disconnect the external signal cable(s).

STEP 4. On the PS/IO board, check that the cables are connected at the Bat A1+, Bat A2-, +24VOUT or +35VOUT, and BATCOM connectors. Tighten the screws that hold these wires.

STEP 5. Replace the battery.

CHG ON LED (on PS/IO board) is off

Follow these steps to check the condition:

STEP 1. Make sure the battery is present and connected to the control. The CHG ON LED is always off when the battery is disconnected.

STEP 2. Check the BATTERY LOW LED on the faceplate. If the BATTERY LOW LED is blinking, a battery test is in progress. The CHG ON LED is always off during a battery test.

STEP 3. Check for ac control power to the switch control. See the "AC ON LED (on PS/IO board) is off" section on page 8 for details. The CHG ON LED is always off when ac power is off. For sensor-powered controls, check the PS/IO board J8 connector. See Step 7 on page 9 for voltage information.

STEP 4. Check the battery voltage. Disconnect the battery. With a voltmeter, see whether the voltage is greater than 23 volts (for a 24-Vdc battery) or 35 volts (for a 36-Vdc battery). If not, replace the battery.

STEP 5. Check the battery connections. Are the battery leads connected to the battery and the PS/IO board. Are the connections OK?

STEP 6. The PS/IO board is probably bad. Call S&C Electric Company to discuss replacing the PS/IO board.

ERROR DETECTED LED (on the faceplate) is lit

Follow these steps to check the condition:

STEP 1. Determine which team switch control has a problem. The ERROR DETECTED LED is lit at each switch control when one or more team members has problems.

STEP 2. On the LCD screen, look for the switch symbol that is blinking. When the blinking symbol is for a different switch, go to that control site.

STEP 3. Connect the portable computer to the control and start the IntelliLink software. Check for active messages on Page 2 of the *Troubleshooting>Event Status* screen. To correct problems, follow the troubleshooting suggestions for those messages. When the only active message is "Stop Transfer," go directly to Step 7.

STEP 4. Make sure the faceplate REMOTE/LOCAL switch is in the **Local** state. Toggle the Automatic Operation ENABLE/DISABLE switch to the **Disable** state.

STEP 5. Make sure the switch is in its **Normally Open/Closed** state, unless special system conditions require otherwise.

STEP 6. Toggle the Automatic Operation ENABLE/DISABLE switch back to the **Enable** state. Return the REMOTE/LOCAL switch to the normal state for this control.

STEP 7. For a **Stop Transfer** condition to clear, all line switches in the team must be in their **Normally Open/Closed** state. Other switch controls may have to be operated before the **Stop Transfer** condition will clear.

PROCESSOR STATUS LED (on faceplate) does not blink

Perform a lamp test. Hold the faceplate BATTERY TEST/LAMP TEST switch in the **Lamp Test** position. If none of the LEDs blink, see the "All LEDs on the faceplate are off" section on page 8.

IntelliLink software may display an error message when trying to establish communication with a switch control or a snapshot (VM file). If an error message appears, follow the corrective action given for that message.

IntelliLink software won't start

Follow these steps to correct the condition:

STEP 1. Close other software programs. Some software applications (such as HotSync® technology for Palm™ handhelds) may interfere with IntelliLink software access to the computer serial port. Exit any program that might take control of a serial port while IntelliLink software is in use.

STEP 2. Reinstall IntelliLink software on the computer. There may be a problem with one of the files. See the "Starting IntelliLink Software" section on page 6 in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration System: *Setup*," for more information.

"Could not connect to control on COM1"

See the "Opening port COM1... Trying 38400 BAUD... Connection Failed" section below.

"Incompatible Ident"

IntelliLink Setup Software uses a different screenset (.WMN file) for each type of control and automatically selects the screenset. This message appears when a screenset is displayed and connection is attempted to a snapshot (.VM file) that requires a different screenset.

Follow these instructions to open the correct screenset:

STEP 1. To close an open screenset, click on the **File** menu and on the **Close Screenset** entry.

STEP 2. In the **Connection** menu, click on the **Connect to VM File** entry.

STEP 3. In the Open Controller Data File dialog box, select the snapshot (.VM file) to be viewed and click on the **OK** button to open both the snapshot and the correct screenset.

IntelliLink setup incorrect or incomplete

Reinstall IntelliLink Setup Software on the computer. There may be a problem with one of the files. See the "Starting IntelliLink Software" section on page 6 in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration System: *Setup*," for more information.

"Opening port COM1... Trying 38400 BAUD... Connection Failed"

These messages appear in the Connect dialog box when the IntelliLink software in the computer cannot establish communication with the software in the switch control.

Follow these steps to correct the condition:

STEP 1. Check that the control has power. If the LCD screen is blank or data does not scroll, the control may have no power and cannot communicate with the computer. See the "LCD screen is blank or data does not scroll" section on page 7.

STEP 2. Check the serial cable connection. Confirm the serial cable is plugged in to the LOCAL port on the switch control faceplate. Confirm the cable goes to the correct port on the computer, usually the COM1 port.

STEP 3. Try another communication port. The COM1 port on the computer may be broken or assigned to a different device. Connect the cable to a different comm port. In the Connect dialog box, click the **Change Setup** button. From the pull-down list, select the name of the port where the cable is connected. Click on the **Connect** button.

STEP 4. Use a different serial cable. The old serial cable may have a broken wire or pin. The cable may be wired for use with a different type of computer, or it may be a null-modem cable.

STEP 5. Check the serial port on the computer. Test the serial port by trying to communicate with a modem or other serial device.

Note: If a two-wire, ungrounded extension cord was used to power the computer (or the switch control during lab testing), the serial port on the computer may have been damaged.

Program in the control: XXXX... not configured for this program

Reinstall IntelliLink Setup Software on the computer. Make sure the IntelliLink software matches the switch control software version.

Software in control incompatible with open screenset... cannot be established

IntelliLink Setup Software uses a different screenset (.WMN file) for each type of control and selects the screenset automatically. This message appears when a screenset is displayed and the connected switch control requires a different screenset.

Follow these instructions to open the correct screenset:

STEP 1. To close an open screenset, click on the **File** menu and on the **Close Screenset** entry.

STEP 2. In the **File** menu, click on the **Open Screenset** entry.

STEP 3. Select the correct screenset for the control.

STEP 4. When the screenset opens, in the **Connection** menu click on the **Connect to Device** entry.

Software in control is XXXX... not properly configured for this product

Reinstall IntelliLink software on the computer. There may be a problem with one of the files. See the "Starting IntelliLink Software" section on page 6 in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration System: *Setup*," for more information.

Times New Roman font is not on your system. The project requires it.

Click on the **OK** button to close the dialog box. When the program cannot find the desired font, it shows a warning and uses a different font.

"Cabinet Door" on the *Operation* screen shows wrong door status

Check the door magnet. Make sure the magnet is present on the top inside of the enclosure door (S&C 5801 control) or on the compartment door (S&C 5802/5803 control). Make sure the wiring to the magnet is connected.

"Battery Low" on the *Troubleshooting>Event Status* screen

Follow these instructions to correct the problem:

STEP 1. Test the battery. Briefly hold the BATTERY TEST/LAMP TEST switch in the **Battery Test** position to start a battery test. If the BATTERY LOW LED remains lit after it stops blinking (when the battery test is finished), replace the battery. When the battery has been replaced, run the test again to update battery status.

STEP 2. Restart the switch control. If the "Battery Low" message is active or the BATTERY LOW LED is lit after replacing the battery, remove the ac line fuse and disconnect the battery cable. For sensor-powered controls, also disconnect the external signal cable(s). Reconnect the battery cable and replace the ac line fuse and signal cable(s) from the switch to the control.

"Battery Charger Bad" on *Troubleshooting>Event Status* screen

Call S&C Electric Company. The battery is being charged at an abnormally high voltage. The PS/IO board may need replacement.

"Open/Close Contacts Bad" on *Troubleshooting>Event Status* screen

Follow these instructions to correct the problem:

STEP 1. Check the cable from the control to the switch. The control must be connected to a switch to remove this active message. Check that the cable is securely connected to the switch interface connector(s) on the bottom of the switch control. Check that the line switch and cable(s) are correctly connected and are not damaged.

STEP 2. Check dc wetting voltage. Check the voltage between terminals #1 and #4 on J4 on the PS/IO board. The voltage should be the same as the battery voltage on terminals #2 and #3. If the voltage is 0 and the BAT ON LED is off, see the "BAT ON LED (on PS/IO board) is off" section on page 9.

STEP 3. Check the red 10-A dc wetting fuse on the PS/IO board. With the fuse installed, check the dc wetting fuse using the test points and a voltmeter. Replace the fuse if it is bad.

Real-time data is all zero on the *Site-Related* or *Operation* screen

Follow these instructions to correct the problem:

STEP 1. Check the control to line-switch cable. Make sure the cable is securely connected to the line switch and to the connector(s) on the bottom of the switch control. Make sure the cable is not damaged.

STEP 2. Check the sensor-conditioning module connections. Carefully check that all connections to the module are secure. Make sure the 3-pin dc power connector (at the top center of the sensor conditioning module) is securely connected.

STEP 3. For an externally powered control, check the distribution power line. Following utility-approved work procedures and safety practices, verify the distribution circuit is energized and load current is flowing through the switch. Verify ac power is connected to the control.

STEP 4. For sensor-powered controls, measure the voltage from the switch sensors.

⚠ CAUTION

This is a high-voltage area of the PS/IO board. When checking voltage, make sure the 10-A ac line fuse and the 10-A dc wetting fuse have been removed and the ac power line is de-energized. For switch controls powered by sensors, the switch interface cable(s) on the bottom of the enclosure must be disconnected.

Check the dc voltage across the PS/IO board J8 connector, pins 1 (positive) and pin 3 (negative). The voltage should measure between 280 and 340 Vdc.

Note: Do not unplug the PS/IO board J8 connector.

Real-time voltage or current or kvar values are wrong

Follow these instructions to correct the problem:

STEP 1. Reinitialize the switch control. At the *Setup>Site-Related* screen, click on the **Reinitialize Device** entry. Setup parameter values only take effect when the control is reinitialized.

STEP 2. If applicable, check values on the *Setup>Sensor Configuration* screen. Confirm the switch serial number(s) on the sensor-calibration card(s) and on the installed switch(es) are identical. The sensor calibration card is shipped with the switch and is usually stored in the door pocket of the switch control or low voltage cabinet. Then, confirm the values on the *Setup>Sensor Configuration* screen exactly match the values on the card. If any values are changed, reinitialize the control.

STEP 3. Check the values on the *Setup>Site-Related* screen. Confirm the **Line kV to 120 Vac Base Ratio**, **Voltage Transformer Wiring**, and **Voltage Sensors Present** setpoints are correct for this switch and distribution system. If any setting is changed, reinitialize the control. See Table 1.

Table 1. Setpoints On the *Setup>Site-Related* Screen

Distribution System	Line kV to 120 Vac Base Ratio	Voltage Transformer Wiring
Delta voltage reporting	Phase-to-Phase voltage / 120 volts*	Phase to Phase
Wye voltage reporting	Phase-to-Neutral voltage / 120 volts*	Phase to Neutral

* For example: 12000-Volt distribution-line voltage / 120 Volts = 100 / 1 ratio.

STEP 4. Check the sensor conditioning module jumper. Make sure the correct jumper (wye or delta) is installed for this distribution line. Make sure the side of the jumper with more wire loops (2 loops for wye, 3 loops for delta) is toward the bottom of the enclosure. See Table 2.

Table 2. Sensor Conditioning Module Jumpers

Wires & Grounding Type	Sensors	Use
Uni-grounded Wye 3-Wire System	3 Voltage Sensors 6 Voltage Sensors	Delta jumper Delta jumpers
Uni-grounded Wye (Primary Neutral) 4-Wire System	3 Voltage Sensors 6 Voltage Sensors	Delta jumper Delta jumpers
Multi-grounded Wye 4-Wire System	3 Voltage Sensors 6 Voltage Sensors	Wye jumper Wye jumpers
Delta System	Phase-to-ground connected sensors should not be used with ungrounded delta systems.	

Team does not communicate

Follow these steps to carry out the following general procedure at each member of the team, starting at the team member most likely the source of the problem.

STEP 1. Check the link between the control and the team communication device. Make sure all cables are firmly connected and the communication device has power.

STEP 2. Check the UtiliNet radio. Connect the computer to the control and start the IntelliLink Setup Software. On the *Setup>Communications* screen, set the **Control-to-Radio Local Comm Link Test** setpoint to the **Initiate Test** state and verify the link is operating. Make sure the radio is properly set up and the DCW is installed. See UtiliNet documentation.

STEP 3. Check other communication ports in use. When the control is directly connected to another team member or has a radio or cable connection to a SCADA master station, check the cable connections. Test communication between the control and the other device.

STEP 4. Check the *Setup>Team Configuration* screen settings. Make sure the **DNP/RTU Address** and **UtiliNet WAN Address** (if applicable) setpoints are correct for each team member (and master station, if applicable). Initiate a team configuration to ensure all team members have the same global setpoint values. For more information, see the "Initiate a Team Configuration at the Last Team Member" section in Instruction Sheet 1042-530, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration System: *Setup*."

STEP 5. Check the *Setup>Communications* screen settings. Make sure the baud rates and duplex settings are correct for the installed communication hardware.

STEP 6. When this control uses a radio, check the radio antenna. Check the radio antenna and that the antenna cable is attached at both ends.

STEP 7. Check radio connectivity. Using RadioShop software, check that the radio at this location can see all the other radios it should see.

Team does not reconfigure the circuit

Follow these instructions to correct the problem:

STEP 1. Check the **Features Enabled** setpoint. Connect the computer to the control and start IntelliLink Setup Software. On the *Setup>Automatic Operation* screen, check the **Features Enabled** setpoint(s). The selection must include **Auto Transfer** mode for the team to reconfigure the circuit.

STEP 2. Check the *Setup>Team Configuration* screen settings. Make sure the **DNP/RTU Address** and **UtiliNet WAN Address** (if applicable) setpoints are correct for each team member (and master station, if applicable). Also, check the normal switch position in the **Normally Open/Close** field is correct for each switch in the team. The team should not include more than one normally open switch.

STEP 3. Check values on the **Team Operation** screen. Make sure the operation feature is in the **Team** mode for all active team members. If it is in the **Manual**, **Man**, **Non-Team**, or **N/T** mode for an active team member, team reconfiguration will not occur.

When the **One-minute averaged three-phase load** setpoint is in the **N/A** state, the control does not presently have a value for the average load and team reconfiguration will not occur.

STEP 4. Check team communications. See the "Team does not communicate" section above.

STEP 5. Check the loading settings. On Page 2 of the *Setup>Automatic Operation* screen, make sure the loading settings are appropriate for circuit conditions for this season.

STEP 6. Check the circuit configuration. Make sure the circuit has not been temporarily reconfigured due to construction or maintenance.

STEP 7. Check the *Overcurrent Fault>Fault Events* screen to see whether the switch control detected and took action for an event.

STEP 8. Check the sectionalizing parameters. Check the *Setup>Automatic Operation* screen and the *Setup>Fault Detection* screen, make sure the parameters necessary for proper sectionalizing to occur have been configured.

Team does not return the circuit to normal

Follow these instructions to correct the problem:

STEP 1. Check the **Features Enabled** setpoint(s). Connect the computer to the control and start IntelliLink software. On the *Setup>Automatic Operation* screen, check the **Features Enabled** setpoints(s). The selection must include **Auto Transfer** and **Return to Normal** (open or closed) modes for the team to return the circuit to its normal configuration.

STEP 2. Check the operation mode for each team member. On Page 2 of the *Team Operation* screen, make sure that the operation "Mode" column reads **Team** mode for all active team members. If it reads **Manual**, **Man**, **Non-Team**, or **N/T** mode for an active team member, team reconfiguration will not occur.

STEP 3. Check team communication. See the "Team does not communicate" section on page 16.

STEP 4. Be sure **Automatic Operation** mode was not disabled. If **Automatic Operation** mode was disabled at any team member while the circuit was in its reconfigured state, the **Return to Normal** process is canceled.

OVERCURRENT FAULT LED failed to show a load-side fault

Follow these instructions to correct the problem:

STEP 1. Check the *Overcurrent Fault>Fault Events* screen to see whether the switch control detected and took action on the fault. Go to Step 2 if it logged the fault. If not, go to Step 3.

STEP 2. Check the *Overcurrent Fault>Fault Events* screen to see whether the fault was cleared. For a normally closed switch, the faceplate OVERCURRENT FAULT LED is off when all of the following are true:

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

The LED also turns off when the switch is closed and the faceplate REMOTE/LOCAL switch is toggled or the LED is cleared by a SCADA command.

For a normally open switch, the LED turns off when one of the following occurs:

- The REMOTE/LOCAL switch is toggled or the LED is cleared by a SCADA command. (The line switch can be open or closed.)
- Close the switch from the faceplate or with a SCADA command.

Note: The LED cannot be cleared with a SCADA command if the REMOTE/LOCAL switch is in the **Local** state.

STEP 3. Check the *Setup>Fault Detection* screen settings. If no fault was recorded, check the values for the **...Fault Detection Current Level** and the **...Fault Duration Time Threshold** setpoints on the *Setup>Fault Detection* screen.

SCADA commands are ignored by the switch control

Follow these instructions to correct the problem:

STEP 1. Check ac control power. See the "AC ON LED (on PS/IO board) is off" section on page 8 and the "BAT ON LED (on PS/IO board) is off" section on page 9 for details.

STEP 2. Check the faceplate REMOTE/LOCAL switch. Toggle the faceplate REMOTE/LOCAL switch to the **Remote** state.

STEP 3. Check the RTU address. At the *Setup>Communications* screen, check the **Communications RTU Address** setting used by this control. Make sure the SCADA master station is sending commands for this control to the correct address.

STEP 4. Check the communication hardware.

"Cannot open file 'nodes'. Create it? (y/n)" message in RadioShop software

The RadioShop software could not find a nodes table. Make a new table before proceeding. For details, see the "Nodes Table" section on page 5 in Instruction Sheet 1042-520, "S&C 5800 Series Automatic Switch Controls With IntellTeam® Automatic Restoration System.

Local Radio did not match Nodes List

Either the radio name in the table does not match the radio name or the information for this radio is missing from the table. Add the correct information for this radio to the nodes table.

Operation Screen

The *Operation*, *Team Operation*, and *Troubleshooting* screens can check the present status of:

- This switch control
- Other team members
- The sideline devices
- Team operations

In addition, these screens can locate the cause for various types of team and team member problems. For more information about events that can cause problems, see the "Fault Events Log" section on page 29 in Instruction Sheet 1042-540, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration system: *Operation*."

The *Operation* screen shows the present status of various switch control settings, any existing fault and error conditions, the battery, and the power line. See Figure 3.

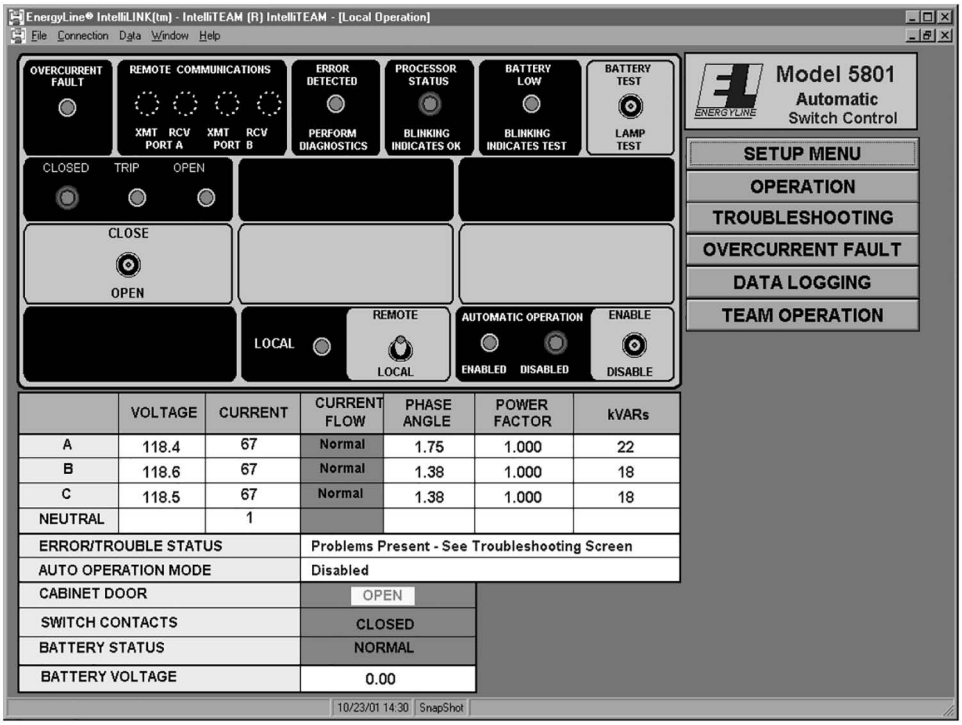

Figure 3. The *Operation* screen for a 5801 control.

This screen opens when IntelliLink Setup Software starts. To access this screen from any other screen, click on the **Operation** button, and then click on the **Local Operation** button.

The upper part of the screen shows the status of the LEDs on the faceplate. For a full description of these LEDs and their meanings, see Instruction Sheet 1042-540, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration system: *Operation*."

This screen also includes the following fields:

AC RMS Data (Voltage, Current, Phase Ang., Rev. Current, Power Fac., kvars)

These are the true RMS amplitude measurements for the three phases on each feeder. When applicable, only RMS current values are logged for Switch 3. The control takes a measurement every 0.2 seconds. Then, it averages eight measurements and displays the 1.6-second averaged value.

The control measures the phase angles between the voltage and current waveforms. The angle is displayed as a value between +90 degrees and -90 degrees. A negative value indicates a leading power factor.

When the phase angle is outside the ±90 degree range, the switch control displays a "Reverse Current" message and subtracts 180 degrees from the phase angle.

For a more detailed explanation of these fields, see Instruction Sheet 1042-540, "S&C 5800 Series Automatic Switch Controls With IntelliTeam® Automatic Restoration system: *Operation*."

Error/Trouble Status

When the switch control detects an error or trouble condition, this field displays the message "Problems Present - See Troubleshooting Screen." When this message is present, see the "Software Troubleshooting and Error Messages" section on page 11 and the "Event Status" section on page 29 for more information.

Auto Operation Mode [Switches 1 and 2, if applicable]

This field shows which automatic-operation features are presently enabled (for example, **Sectionalizing + Automatic Transfer** mode). These features are enabled and disabled on the *Setup>Automatic Operation* screen.

Cabinet Door

When the switch control enclosure door is open and the faceplate is receiving power, this field displays the message "Door Open." For switch control malfunctions that can also cause this message, see the "'Cabinet Door' on *Operation* screen shows wrong door status" section on page 12.

Switch Contacts

This is the present position of the switch contacts for each line switch:

"Open"	The switch is in a normal, fully open position.
"Closed"	The switch is in a normal, fully closed position.
"Bad"	The switch contacts are not mutually exclusive. For possible causes, see the "Open/Close Contacts Bad status on the *Troubleshooting>Event Status* screen" section on page 13.

Battery Status

This is the overall status of the battery system:

"Normal"	Enough charge is present to operate the line switch.
"Low"	The battery is in a marginal condition and line switch operation may or may not be possible.
"Bad"	The battery charge is too low to operate the line switch.

Battery Voltage

This is the battery voltage under normal operating loads, with the charger disconnected. When ac power is present, the control updates this voltage only during battery testing. When ac power is not present, this is the real-time measurement of battery voltage.

Team Operation Screens

The *Team Operation* screens show the present status of various team-related parameters for all members of the team.

To display Page 1 of the *Team Operation* screen, click on the **Operation** button at any IntelliLink screen, and then click on the **Team Operation** button. See Figure 4 on page 21.

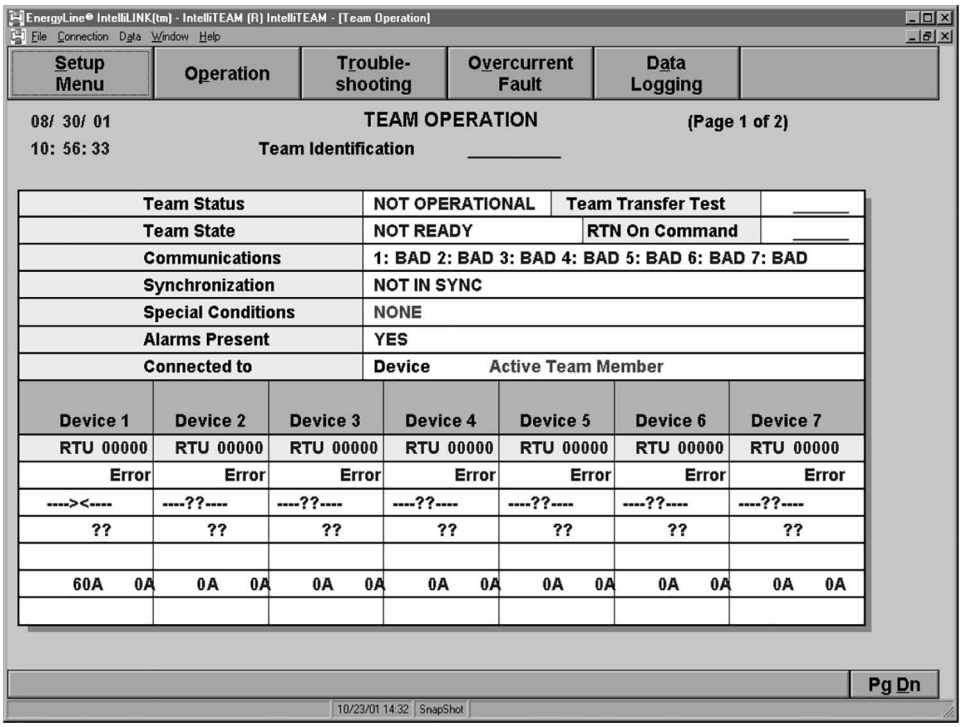

Figure 4. Page 1 of the *Team Operation* screen.

Page 1 of the *Team Operation* screen shows the present status of various team-related parameters and information for each team member.

XX/XX/XX(date)
XX:XX:XX(time)

These numbers near the top left corner of the screen are the date and time read directly from the switch control.

Team Identification

This is the name entered at the **Team Identification** setpoint on Page 1 of the *Setup>Team Configuration* screen.

Team Status

This is the operational status of the system. When team members can perform team operations, this field shows "OPERATIONAL." Otherwise, it shows "NOT OPERATIONAL."

Team Transfer Test

This field initiates a team transfer test that simulates a voltage-loss condition and causes an actual transfer event to take place. This test helps ensure the team is operating properly.

⚠ WARNING

Exercise extreme caution when performing this test. Switches will open and close during the procedure. If they are not properly bypassed, load will be dropped. The tie switch will also close, paralleling the circuits.

Important: When the team includes 2801 switch controls, they must be removed from the team before the test is started.

Follow these steps to perform a team transfer test:

STEP 1. Make sure the switch control is a normally closed device and the team is ready to transfer.

It is usually preferable to be at the first normally closed switch in the team. However, the test cannot be started from a multiple-switch team member that controls a normally open switch.

If the team is not in **Ready to Transfer** state when the test is started, the test will not start. For possible reasons, see the "Team does not reconfigure the circuit" section on page 16.

STEP 2. While holding the Automatic Operation ENABLE/DISABLE faceplate switch in the **Enable** state:

(a) Click on the **Team Transfer Test** field to open the dialog box.

(b) Select the **START** option, and then click on the **OK** button.

(c) Click on the **OK** button to confirm starting the test.

If the Automatic Operation ENABLE/DISABLE switch is not held in the **Enable** state, the field displays "OFF" and the test is not performed.

STEP 3. If necessary, return the switches to their normal position manually.

If the transfer is successful, and **Return-to-Normal** mode is enabled (on Page 1 of the *Setup>Automatic Operation* screen), the team returns the circuit to its normal configuration when the **Global Return to Normal Delay Time** elapses. If the **Return-to-Normal** mode is not enabled, manually return the switches to their normal position.

Team State

This is the state of team operations. Possible values are:

"INITIALIZING"	The team is in startup mode.
"READY TO TRANSFER"	The team is ready for team operation.
"TRANSFERRING"	A fault has occurred and a transfer is in process.
"WAITING TO RETURN"	The team is waiting to return to its normal circuit configuration.
"RETURNING"	The team is in the process of returning to its normal circuit configuration.
"NOT READY"	The team is not ready for operation.
"SINGLE MEMBER MODE"	The local multiple-switch team member will operate as a single-member team for simple source transfers (while the other team members display a "NOT READY" message).

RTN On Command

When the **Team State** is "WAITING TO RETURN," this field can be used to force the team to begin the **Return-to-Normal** process.

This may be necessary when the return of voltage cannot be detected because of the arrangement of the team or the placement of the sensors, if the **Global Return to Normal Delay Time** setpoint is in the **On Command Only** mode, or to bypass the remaining **Global Return to Normal Delay Time** period.

⚠ WARNING

Before forcing the **Return-to-Normal** process to start, be sure all necessary repairs have been made and all standard safety precautions are followed.

Follow these steps to start the **Return-to-Normal** process:

STEP 1. Click on the **RTN on Command** field to open the dialog box.

STEP 2. Select the **RETURN** entry, and then click on the **OK** button.

STEP 3. Click on the **OK** button to carry out this command.

Note: Starting the **Return-to-Normal** process when the team state is not "WAITING TO RETURN," the field becomes blank again and nothing happens.

Communications 1:OK 2:OK 3:OK ...

This is the state of team communications from this switch control to other team members. Possible values are:

"OK"	Communications to the team devices are operational.
"BAD"	Communications to the team have failed.
"N/A"	The record is not in use.

Synchronization

This is the state of the team synchronization. Possible values are:

"OK"	The team is synchronized.
"NOT IN SYNC"	The team is not synchronized.

Special Conditions

This field shows any special conditions present for team operation.

Alarms Present

When this field displays "YES," an alarm condition is present for team operations. Otherwise, the field shows "NONE."

Connected to

This field sets whether the local switch control is active in, or deactivated from, the team. When **Deactivated from Team** mode is selected, the local control disables **Automatic Operation** mode, changes its record to indicate it is not in use, and sends its local record to the other team members. The remaining team members continue to operate as a team to isolate faults and reconfigure the circuit. When the switch control is returned to active status, **Automatic Operation** mode must also be selected.

For Example: When the switch control battery is bad, thus making the switch operation unreliable, the switch is manually closed, and this field is set to **Deactivated from Team** mode so the other teams will ignore this switch. When the battery is replaced, reset this field to **Team** mode and enable **Automatic Operation** mode.

Device 1, Device 2, etc. (Device Status Information)

The lower part of the screen is a table with seven columns and eight lines. Each column includes information about one team member:

Line 1—The team member device number in the team.

Line 2—The team member RTU address.

Line 3—The operation state for each switch controlled by the team member.

Possible values are:

Manual (or **Man**)—Automatic operation is disabled.

Non-Team (or **N/T**)—Automatic operation is enabled, but IntelliTeam system operation is not enabled.

Team Automatic—IntelliTeam system operation is enabled.

Line 4—The present position of each switch controlled by this team member:

][or "O" = open

>< or "C" = closed

?? = unknown

Line 5—The normal switch position of each switch controlled by this team member:

"NO" or "O" = Normally Open

"NC" or "C" = Normally Closed

Line 6—The 1-minute averaged measured three-phase load (in amps) on each line that is monitored by the team member. If there is only one value, it is shown in the left field.

Note: If the team member does not presently have a value for the average load, this field shows "N/A" and no transfer events can occur.

Line 7—The fault and voltage loss status on each line that is monitored by the team member. When no fault or voltage loss is detected, this field is blank. For a multiple-switch team member, if a fault or voltage loss is detected on one circuit but not the other, the field for the unaffected circuit shows "None." Possible values are:

"FAULT" or "FLT"	The team member detected a fault, but no voltage loss.
"VOLT LOSS" or "VL"	The team member detected a voltage loss, but no fault.
"FLT/V LOSS" or "F/VL"	The team member detected a fault and a voltage loss.

Line 8—The alarm status for the team member. If an alarm is active, this field reads "ALARMS." Otherwise, the field is blank.

To display Page 2 of the *Team Operation* screen:

Click on the **PgDn** button at Page 1 of the screen. See Figure 5.

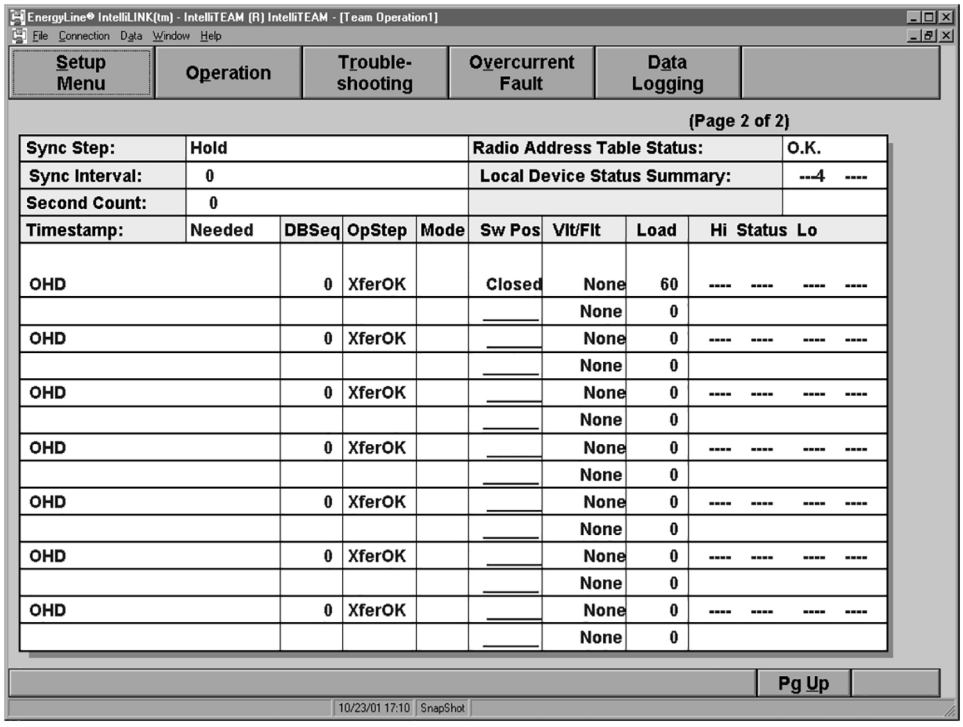

Figure 5. Page 2 of the *Team Operation* screen.

Page 2 of the *Team Operation* screen provides a detailed view of the switch control internal team database. The screen includes synchronization data as well as the status of each team control.

When a team configuration is initiated, use the information on this screen to confirm all members of the team are communicating successfully. For details, see the "Confirming Successful Team Communications (Checking the Sync Activity)" section on page 28.

The upper part of the screen displays the same information for all members of the team (for example, the **Sync Interval** setpoint) and information for this team member only (for example, the **Local Device Status Summary** setpoint).

Sync Step

This is the sync interval step presently active within this switch control. Possible values are:

"Sync"	The team is presently exchanging synchronization information.
"Rest"	The information exchange is complete; the switch control is waiting for the test phase.
"Test"	The database information is being tested for synchronization integrity.
"Diag"	System diagnostics are testing the integrity of the team.
"Xfer"	A transfer process is presently in effect.
"RTN"	A **Return to Normal** process is presently in effect.
"Hold"	Activity stopped to wait for a new synchronization interval to begin.

Sync Interval

This is the length of a single synchronization interval (in seconds). The sync interval is the time allotted for the team members to update their databases and to check record and team integrity. The team members dynamically calculate the length of the interval, based on the number of database records in use.

Second Count

This is the number of seconds that have elapsed in the sync interval.

Radio Address Table Status

This is the status of the radio's address table, if applicable. Possible values are:

"O.K."	The address table was successfully delivered to the radio.
"Update"	The address table needs to be sent to the radio.
"Sent"	The address table has been sent to the radio.

Local Device Status Summary

This field has information about the status of the local switch control.

When the control is operating normally, only dashes are shown in this field. When there is a problem, a number is shown that identifies the problem. For example, the "4" in Figure 6 means no local record was found and the "0" means a **Stop Transfer** operation occurred.

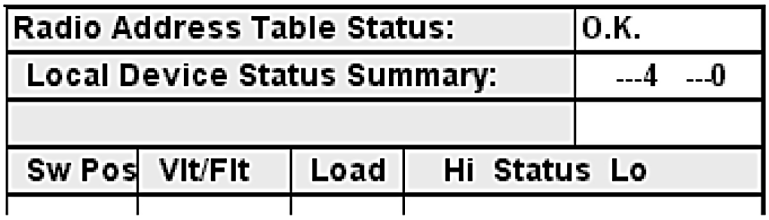

Figure 6. Two problems identified in the Local Device Status Summary field.

The possible problems include:

0 Stop transfer process

1 Stop transfer and communication

2 Bad address table

3 Team configuration process active

4 No local record found

5 Return to Normal mode mismatch

6 (Reserved for future use)

7 (Reserved for future use)

Timestamp

This is the state of the timestamp in the local record. Possible states are:

"O.K."	The timestamp is good.
"Needed"	A new timestamp is needed.
"Request"	The switch control requested a timestamp.
"Received"	The switch control received a timestamp.
"N/A"	No timestamp is available from the source.

The lower part of the screen contains a table of information (database record) about all members of the team. The table contains 14 lines, two lines for each team member. If a team member controls two line switches, its information is displayed on both of the two lines; otherwise, the information is displayed on only one line. Values in these fields cannot be changed on this screen.

Record State and Timestamp

No title for this column. The far left column shows the basic state of the database record and the most recent timestamp for each team member.

Possible database record values are:

"NIU"	The record is not in use.
"OHD"	The record contains information about an active, overhead, single-switch team member.
"TST"	The record is in **Transfer Test** mode.
"PAD"	The record contains information about a multiple-switch, pad-mounted team member.
"SMM"	The record contains information about a multiple-switch team member that is operating in **Single Member** mode.

The timestamp is the time and date recorded by each team member at the start of the sync interval. The timestamps should be no more than 1 second apart. If a timestamp is off by more than 1 second, the switch control issues a timestamp request. If a timestamp is off by more than 5 seconds, a **Stop Transfer** condition is set until the timestamp is corrected.

DBSeq

This is the database sequence number as reported by each team member. At the end of the sync interval, all team members must have the same number. Otherwise, a **Stop Transfer** condition is set. The value ranges from 0 to 255.

OpStep

This field shows the present state of the control logic in this team member. Possible values are:

"XferOK"	The team member is ready for transfer activity.
"Step 1" to "Step 5"	The team member is executing a step in the transfer or reconfiguration process. Each step is associated with a particular point of execution.
"RTN OK"	The team member is ready for **Return-to-Normal** activity.
"Step 33" to "Step 37"	The team member is executing a step in the **Return-to-Normal** process. Each step is associated with a particular point of execution.
"Finish"	The team member has successfully finished a transfer.
"Hold"	The team member is not presently ready for reconfiguration or **Return-to-Normal** activity. This occurs when a team member senses a condition that causes a **Stop Transfer** condition to be set.

For a team member to start a **Transfer** process, this field must contain "XferOK" or one of the "Step 1" to "Step 5" messages for all team members listed in the table.

For a team member to start a **Return-to-Normal** process, this field must contain "RTN OK" or one of the "Step 33" to "Step 37" messages for all team members listed in the table.

Mode

This is the operation mode for each team member. Possible values are:

"Man"	**Automatic Operation** mode is disabled.
"Othr"	**Automatic Operation** mode is enabled, but **Automatic IntelliTeam Operation** is not enabled.
"Team"	**Automatic IntelliTeam Operation** is enabled.

All team members must be in **Team** mode for reconfiguration or **Return-to-Normal** activity to occur.

Sw Pos

This is the present position of each switch in the team:

"Open"	The switch is open.
"Closed"	The switch is closed.
"Unknown"	The switch state is unknown or the device number is not in use. This is the initial state of all switches and is considered an error condition during normal operation.

Vlt/Flt

This field shows the **Voltage Loss** and **Fault** status at each switch control:

"None"	The team member does not detect a voltage loss or fault.
"V Loss"	The team member detected a voltage loss, but no fault.
"Fault"	The team member detected a fault but no voltage loss.
"VL/Flt"	The team member detected a voltage loss and a fault.

Load

This is the average three-phase load reported by each team member. This value is used during reconfiguration to determine whether the load on the adjacent line section is within the **Allowed Transfer Limit** setpoint on the *Setup>Automatic Operation* screen. After a **Transfer** and **Return-to-Normal** process, this field reads "N/A" to indicate that load information is not yet available. New load information will be provided after the next full averaging period.

Hi Status Lo

This column provides information about the status of each team member.

When all team members are operating normally, only groups of dashes are shown in this column. If a problem occurs, a number appears that identifies the problem.

Numbers in the left-half of the column are "Hi-Bit" numbers, which are explained in the "Hi-Bit Problems" section on page 28. Numbers in the right-half of the column are "Lo- Bit" numbers, which are explained in the "Lo-Bit Problems" section on page 28.

For example, Figure 7 shows a team member with one "Hi-Bit" problem (3) and two "Lo-Bit" problems (6 and 1).

Timestamp:	O.K.	DBSeq	OpStep	Mode	Sw Pos	Vlt/Flt	Load	Hi Status Lo
NIU		0	XferOK			None	0	---- ---- ---- ----
						None	0	
OHD	04/28/00 01:05:59 pm	68	Hold	Othr	Closed	V Loss	N/A	---- 3... .6.. ..1.
				Othr	Open	V Loss	N/A	

Figure 7. A team member with one "Hi-Bit" and two "Low-Bit" problems.

Hi-Bit Problems

Hi-Bit problems include the following:

0 Stop transfer and communication
1 Bad address table
2 Team configuration process active
3 No local record found
4 (Reserved for future use)
5 (Reserved for future use)
6 (Reserved for future use)
7 (Reserved for future use)

Lo-Bit Problems

Lo-Bit problems include the following:

0 Clearing error conditions disabled
1 Stop transfer process
2 Other internal error
3 **Return to Normal** mode mismatch
4 Timestamp mismatch
5 Database sequence number mismatch
6 Communication failure
7 Sideline Error

Confirming Successful Team Communications (Checking the Sync Activity)

When a team configuration is initiated, confirm all members of the team can communicate with each other. To do this, check the "sync activity" on this page of the *Team Operation* screen. Check for the following, as shown in Figure 8:

- All dates are the same.
- All the times are within 1 second of each other.
- All the "DBSeq" values are the same (when one changes, they all change).

Timestamp:	O.K.	DBSeq
OHD	04/28/00 01:05:59 pm	68
OHD	04/28/00 01:05:59 pm	68
PAD	04/28/00 01:06:00 pm	68

Figure 8. Team members with correct sync activity.

Event Status

The *Troubleshooting>Event Status* screens show the present status (active or inactive) of several troubleshooting-related events. See Figure 9 and Figure 10 on page 30.

The fields on these screens are grouped into five categories: Normal Events, Team Events, Trouble Conditions, Team-Related Conditions, and Switch Not Ready Conditions.

To display Page 1 of the *Troubleshooting>Event Status* screen, click on the **Troubleshooting** button at any IntelliLink screen, and then click on the **Event Status** button.

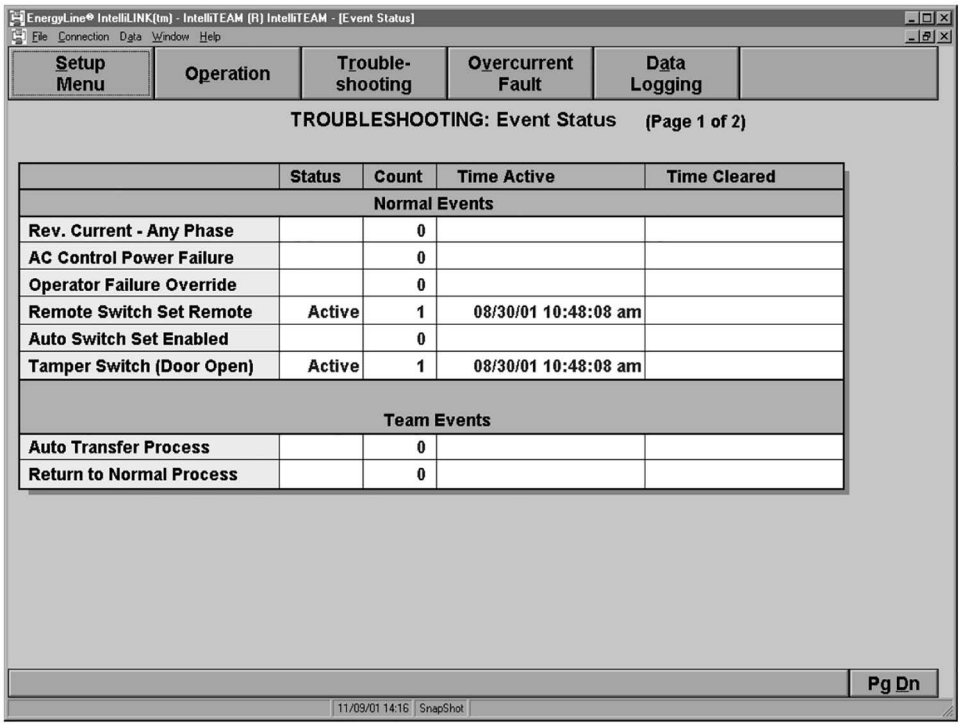

Figure 9. Page 1 of the *Troubleshooting>Event Status* screen.

This screen has 5 columns:

(no title)	The name of the event.
Status	If the status of an event is active, it means the condition presently exists.
Count	The number of times this event or condition has occurred since the last time the switch control was reset. When the control software is reloaded, not updated, the counts are reset to zero.
Time Active	The most recent time that the event status became active.
Time Cleared	The most recent time that the event status became inactive.

Normal Events

The events named in the first column are conditions that may occur routinely during normal operations but which may also indicate a problem.

Rev. Current - Any Phase

This field displays an active message when reverse current flow is detected on any single phase.

Ac Control Power Failure

This field displays an active message when ac power is not present at the power supply/control I/O module. For corrective actions, see the "All LEDs on the faceplate are off" section on page 8.

Operator Failure Override

This field displays an active message when the SCADA operator sends a **Failure Override** command to the control. This command enables the line switch to be opened and closed by the operator even with a **Battery Low** condition.

Remote Switch Set Remote

This field displays an active message when the faceplate REMOTE/LOCAL switch is in the **Remote** state.

Auto Switch Set Enabled

This field displays an active message when the faceplate Automatic Operation ENABLE/DISABLE switch is in the **Enable** state. A **Stop Transfer** condition will exist when **Automatic Operation** mode is disabled.

Tamper Switch (Door Open)

This field displays an active message when the control enclosure door (S&C 5801 control) or low-voltage cabinet door (S&C 5802/5803 control) is open.

Team Events

These are team-related conditions that may occur routinely during normal operation but which may also indicate a problem.

Auto Transfer Process

This field displays an active message while the team is in the process of reconfiguring the circuit and transferring load.

Return to Normal Process

This field displays an active message while the team is returning the circuit to its normal configuration.

To display Page 2 of the *Troubleshooting>Event Status* screen, click on the **PgDn** button on Page 1 of the screen. See Figure 10.

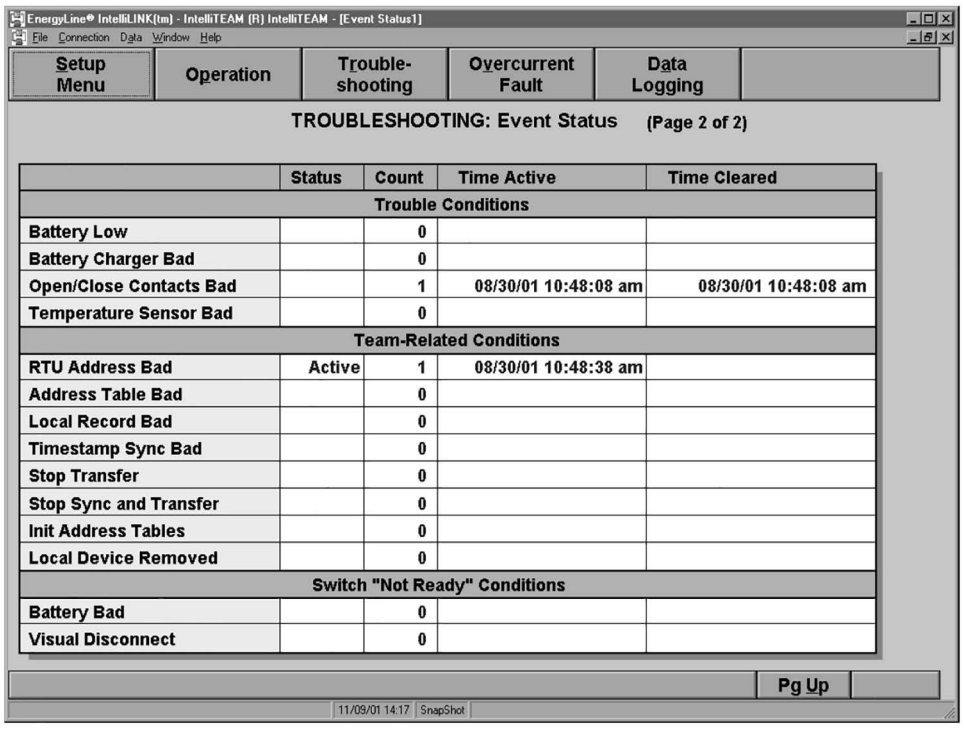

Figure 10. Page 2 of the *Troubleshooting>Event Status* screen for a 5801 control.

For an explanation of the columns on the screen shown in Figure 10, see the "Event Status" section on page 29.

Trouble Conditions

These conditions clearly indicate a problem but may not prevent line switch operation.

Battery Low

This field displays an active message when the predicted battery voltage under load is below the **Battery Low** setpoint.

Battery Charger Bad

This field displays an active message when the battery is being charged at an abnormally high voltage.

Open/Close Contacts Bad [Switches 1, 2, and 3, if applicable]

This field displays an active message when the open and close contacts on the line switch are not mutually exclusive (and the switch is not in motion).

Temperature Sensor Bad

This field displays an active message when the switch control temperature sensor reports temperature outside the valid range.

Team-Related Conditions

These team-related conditions clearly indicate a problem and will prevent team operation.

RTU Address Bad

This field displays an active message when the **Communications RTU Address** setpoint on the *Setup>Communication* screen is set to the invalid address of 0. Enter the correct address to correct the problem.

Address Table Bad

This field displays an active message when a change has been made to the configuration table on the *Setup>Team Configuration* screen but the switch control has not distributed the new information to the other team members. Initiate a team configuration to correct the problem.

Local Record Bad

This field displays an active message when the **DNP/RTU Address** on the *Setup>Team Configuration* screen does not match the **Communications RTU Address** on the *Setup>Communications* screen. Initiate a team configuration to correct the problem.

Timestamp Sync Bad

This field displays an active message when there is more than a 5-second difference between the timestamp in the local switch control and any of the timestamps reported by the other team members. To correct the problem, correct the time source or wait for the team to exchange information and synchronize the clocks.

Stop Transfer

This field displays an active message when a **Stop Transfer** condition is in effect. When other problems have been corrected, this problem usually corrects itself.

Stop Sync and Transfer

This field displays an active message when both transfer activity and communication activity are stopped. When other problems have been corrected, this problem usually corrects itself.

Init Address Tables

This field displays an active message when an **Initiate Configuration** process is in progress.

Local Device Removed

This field displays an active message when the local switch control is temporarily removed from active team participation. For more details, see the "Device 1, Device 2, etc. (Device Status Information)" section on page 23.

Switch Not Ready Conditions

These conditions prevent operation of the line switch.

Note: For S&C 5802/5803 controls, the **Switch Not Ready** conditions are on Page 3 of the *Troubleshooting>Event Status* screen. To display these fields, click on the **PgDn** button on Page 2 of the screen.

Battery Bad

This field displays an active message when the predicted battery voltage under load drops below the **Battery Bad** setpoint.

Visual Disconnect (S&C 5801)

This field displays an active message when visual-disconnect contacts (if applicable) are open on the line switch. The condition clears when the contacts are closed manually.

Low Pressure (if appl.) (Vista switches)

If applicable, this field displays an active message when the switch control detects low pressure inside a switch equipped with low pressure sensing.

Switch 1 in Local Mode (PME and PMH switches)
Switch 2 in Local Mode (PME and PMH switches)
Switch 3 in Local Mode (PME and PMH switches)

This field displays an active message when the external REMOTE/LOCAL switch on this pad-mounted switch (located in the PM Operator compartment) is set to **Local** mode.

Switchgear in Local Mode (Vista switches)

This field displays an active message when the external REMOTE/LOCAL switch on this switchgear is set to **Local** mode.

Position 1 Grounded (Vista switches)
Position 2 Grounded (Vista switches)

This field displays an active message when this switch has been opened and put in the grounded position.

Chronological Log

The *Troubleshooting>Chronological Log* screen shows a chronological list of troubleshooting-related events. Each time an active message is added or removed on the *Troubleshooting>Event Status* screen, the control enters a message in this log.

To display the *Troubleshooting>Chronological Log* screen, click on the **Troubleshooting** button on any IntelliLink screen, and then click on the **Chronological Log** button. See Figure 11.

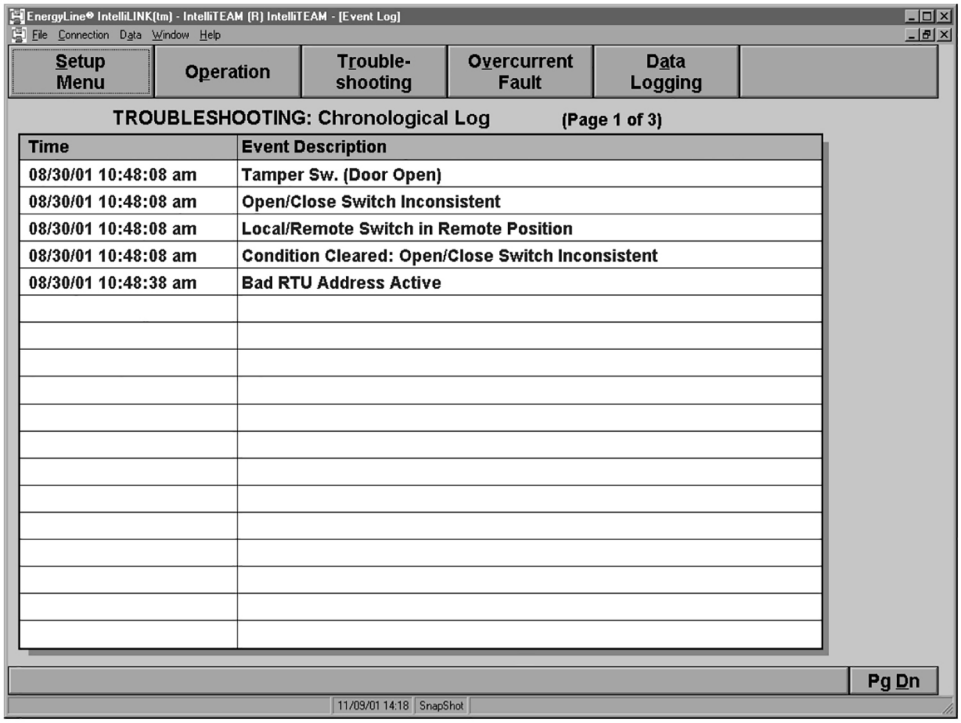

Figure 11. The *Troubleshooting>Chronological Log* screen.

The log holds three pages of information. 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.

Control and Switch Information

The *Troubleshooting>Control & Switch Information* screen shows miscellaneous hardware and software information, the present operations count, and the power-failure log.

To display the *Troubleshooting>Control & Switch Information* screen, click on the **Troubleshooting** button on any IntelliLink screen, and then click on the **Control & Switch Info** button. See Figure 12.

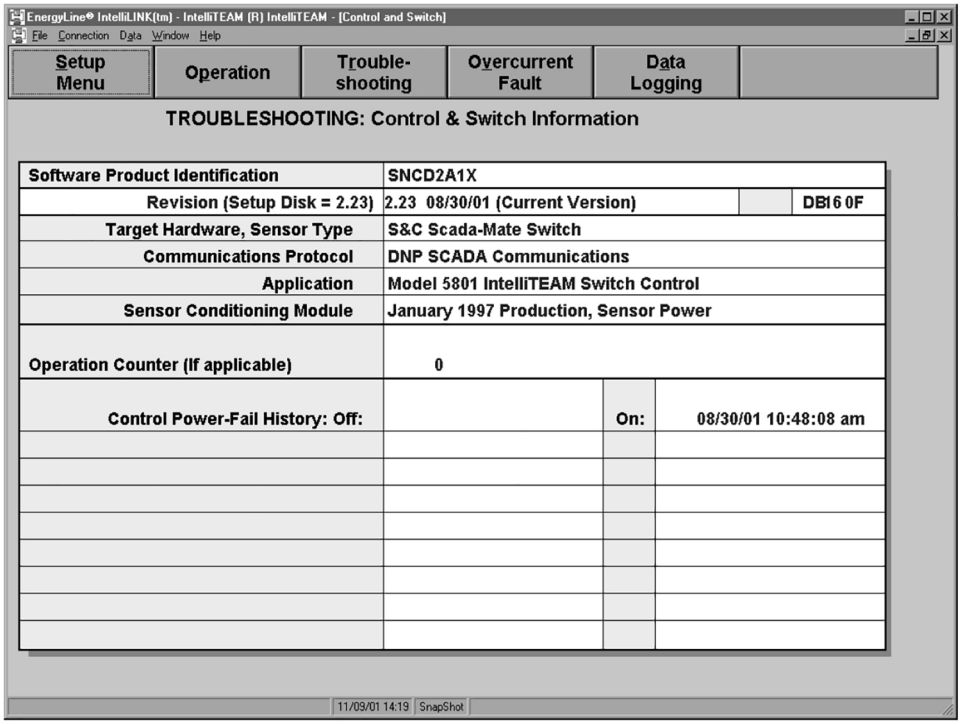

Figure 12. The *Troubleshooting>Control & Switch Information* screen.

This screen includes the following fields:

Software Product Identification

This is a two-line field:

- The first line is the S&C name for the control software version present in this switch control (for example, SNCD2A1X).
- The left side of the second line is the revision number for the IntelliLink version presently loaded into the computer.
- The right side of the second line is the revision number and date for the control software in the switch control.

When the IntelliLink software version is older than the control software, this field includes the message "Unrecognized/superseded." When the IntelliLink software version is newer than the control software, this field includes the message "Not Current Release."

When the IntelliLink software is started for a different S&C product (for example, an S&C 2801 Control) while the computer is connected to the 5800 Series Switch Control, the IntelliLink software terminates during startup and displays an error message.

Enc.

This is a six-digit hexadecimal encoding of the name and version information for the software in the switch control. This code is used by S&C staff during software troubleshooting. Please have this code available when S&C is called about a problem.

Target Hardware, Sensor Type

This is the type of switch hardware and sensors this control was designed for.

Communications Protocol

When the control is connected to a SCADA communication system, this is the communication protocol used by the control. If no communication protocol is present, this field displays "None."

Application

When the control is programmed for any active control functions or application-specific features, such as event-driven data logging or custom features, the features are listed in this field.

Sensor Conditioning Module

This is the version of the sensor conditioning module presently installed in the control. This information helps S&C staff troubleshoot control problems.

Operation Counter (If applicable)

This is the number of completed close operations performed on the line switch. The control only counts operations that begin with a SCADA or faceplate **Close** command, while the switch is in a valid open position, and end with a closed signal from the switch status circuit. The switch control filters out excess control signals or intermittent digital-input state changes.

Control Power-Fail History: …Off: …On:

This is a chronological list of control power failures, when both ac and battery power are lost. The log holds information about nine power losses and nine power returns. When the log is full, each new event overwrites the oldest event in the log. To find the most recent power-on or power-off event, look for the message with a timestamp older than the time for the message above it.

Switch Operation

The *Troubleshooting>Switch Operations* screen shows a chronological list of switch actions. Every time the line switch opens or closes, a message is entered in this log.

To display the *Troubleshooting>Switch Operations* screen, click on the **Troubleshooting** button on any IntelliLink screen, and then click on the **Switch Operations** button. See Figure 13.

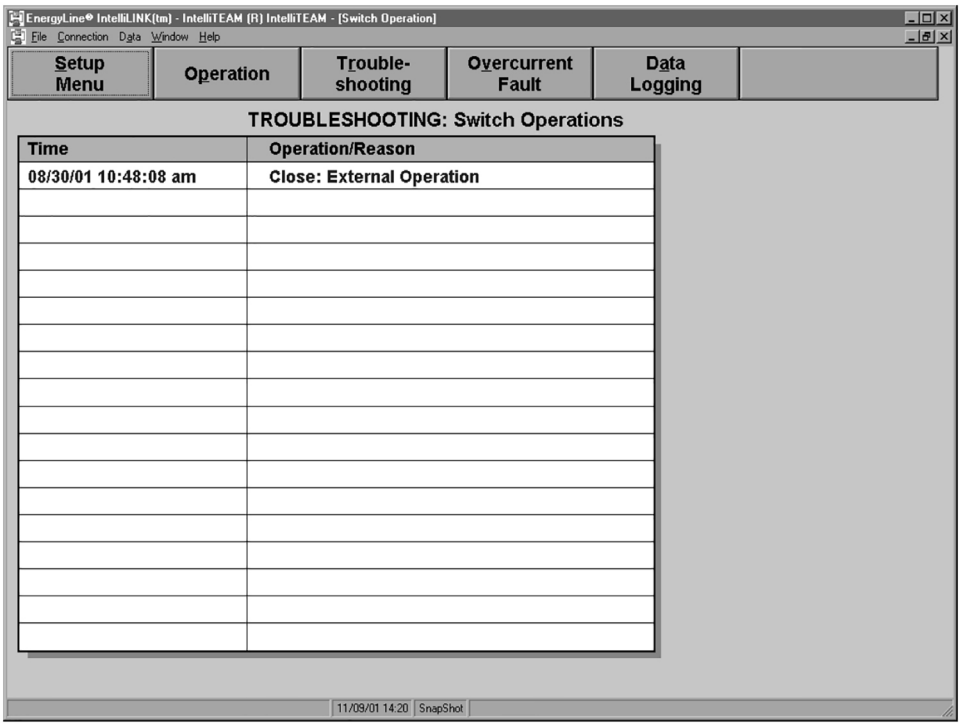

Figure 13. The *Troubleshooting>Switch Operations* screen.

The log holds 18 entries. 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 timestamp older than the time for the message above it.

This screen includes the following fields:

Time

This is the date and time the event occurred.

Operation/Reason

This is the line switch operation that occurred and the source of the command to change the switch position:

"Open"	The switch opened.
"Close"	The switch closed.
"Faceplate Operation"	The command came from the switch control faceplate.
"SCADA Communication Operation"	The command came from a SCADA master station.
"Automatic Operation"	The switch control carried out an automatic operation. For example: **Automatic Sectionalizing**, **Phase Loss Protection**, or **Reclose After Restoration of Voltage** operation. For details, see the *Overcurrent Fault>Fault Events* screen.
"Operation Failed"	A request for switch operation was issued but could not be completed. For example: the switch contacts did not indicate the switch was closed after a **Close Operation** command.

Battery System

The *Troubleshooting>Battery System* screen shows status of the battery system.

To display the *Troubleshooting>Battery System* screen, click on the **Troubleshooting** button on any IntelliLink screen, and then click on the **Battery System** button. See Figure 14.

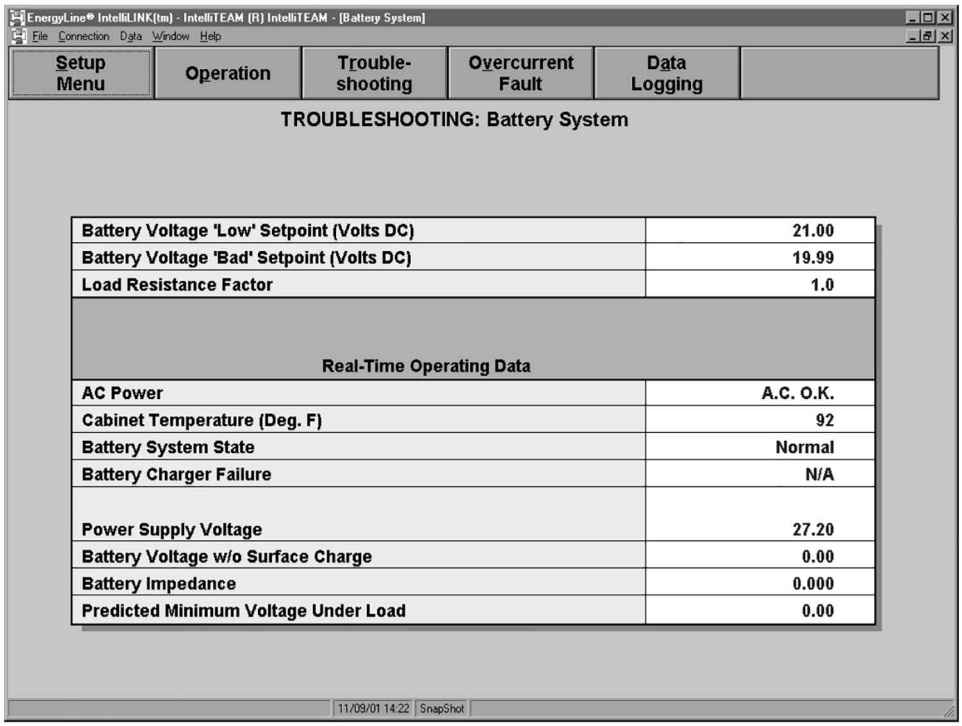

Figure 14. The *Troubleshooting>Battery System* screen.

The upper part of this screen shows the factory-defined values for this switch installation. The lower part of the screen displays real-time battery information.

This screen includes the following fields:

Battery Voltage "Low" Setpoint (Volts DC)

When the battery voltage is between this value and the **Battery Bad** setpoint, switch operation is still possible but only for a limited time. When the **Calculated Voltage Under Load** value drops below this value, the switch control displays a **Battery Low** state.

Battery Voltage "Bad" Setpoint (Volts DC)

The switch will not reliably operate at voltages below this value. When the **Calculated Voltage Under Load** value drops below this value, the switch control displays a **Battery Bad** state.

Load Resistance Factor

This is the correction factor the control applies to the calculation of battery voltage under load. This value is entered at the factory.

Ac Power

This field shows whether the switch control is presently running on ac power (or sensor power, if applicable) or battery power.

Cabinet Temperature (Deg. F)

This is the present temperature inside the switch control enclosure measured by the thermistor on the front of the power supply/control I/O board. The control uses this value to make corrections to the clock and ac waveform conditioning electronics.

Battery System State

This field shows if the battery presently contains enough charge to operate the switch. Three states are possible:

"Normal"	Enough charge is present to operate the switch.
"Low"	The battery is in a marginal condition; it will soon be depleted and unable to operate the switch. No damage should occur to the switch if it is operated.
"Bad"	The battery charge is too low to operate the switch.

Battery Charger Failure

This field indicates the type of charger failure. The field is set or cleared during a battery test. Three states are possible:

"N/A"	Not applicable; no alarms are present.
"Overvoltage"	A high voltage was applied to battery system by the charging system. The battery charger is shut down on this alarm condition.
"Low Impedance"	The calculated battery impedance is too low to be valid.
"Over Volt/Low Imped"	Both overvoltage and low impedance conditions are present.

Power Supply Voltage

This field shows the actual voltage presently being supplied to the 24-volt or 36-volt power system. If ac power (or sensor power, if applicable) is present, this voltage is supplied from the power supply/control I/O board. If ac power (and sensor power, if applicable) is off, this is the actual battery voltage. During a battery test, this voltage varies as the switch control applies test loads to the battery system.

Battery Voltage w/o Surface Charge

This is the battery voltage under normal operating load. If ac power is present, this value is only updated during battery testing. If ac power and sensor power are absent, this is the real-time measurement of battery voltage.

Battery Impedance

The switch control calculates this value during battery testing. This is a measure of battery health. A fully charged battery in good condition typically has an impedance of 0.125-0.150 ohms.

Predicted Minimum Voltage Under Load

This is the voltage that the switch control estimates will be present at the battery terminals when the switch is operated.

The switch control calculates this value from the **Battery Voltage w/o Surface Charge**, the **Load Resistance Factor**, and the **Battery Impedance** values.

Communication

The *Troubleshooting>Communications* screen shows a chronological list of DNP communication problems.

To display the *Troubleshooting>Battery System* screen, click on the **Troubleshooting** button on any IntelliLink screen, and then click on the **Communications** button. See Figure 15.

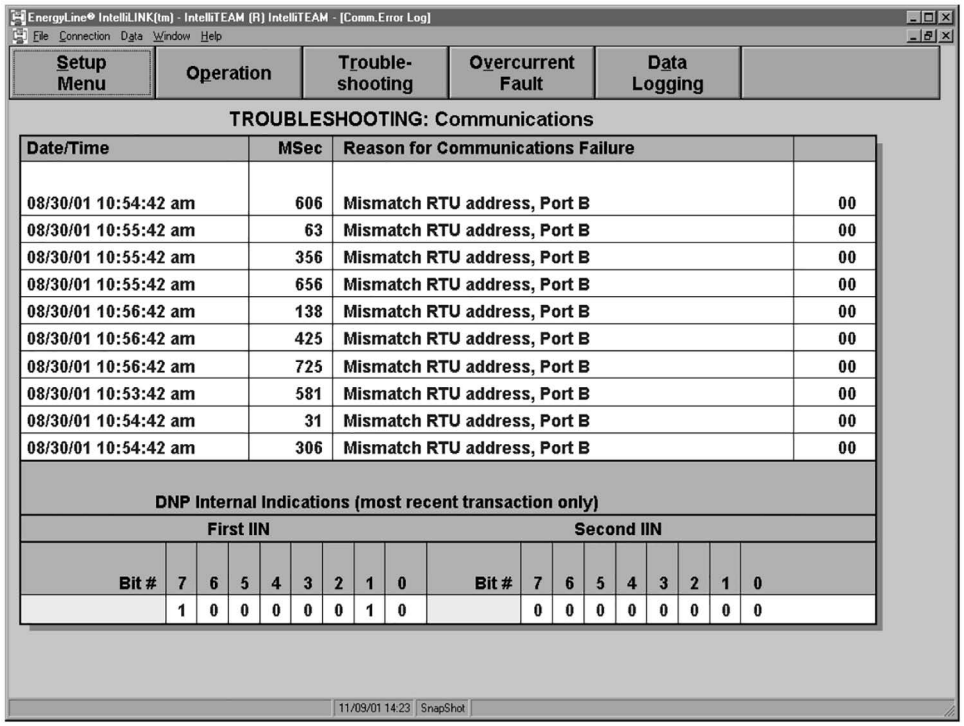

Figure 15. The *Troubleshooting>Communications* screen.

The log holds 10 entries. 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 timestamp older than the time for the message above it.

This screen includes the following fields:

Date/Time...MSec

This is the time (to the nearest 6.25 milliseconds) when the event occurred.

Reason for Communication Failure

This is the reason communication failed. If a message fails at the DNP data link layer, one of the following messages appears (including the port if applicable):

- Simultaneous transmit and receive interrupts
- Character received with bad framing
- Mismatched RTU address
- Bad packet preamble
- Bad packet length
- Bad CRC in received packet
- Receive channel in use
- Transmit channel in use

One of the following messages appears for DNP application layer events:

- Invalid function variation received
- Invalid object variation received
- Invalid object type received
- Invalid index size received
- Invalid qualifier code received
- Invalid object range received
- Invalid object header parameters
- Control is in local mode
- Message received with broadcast address
- Timer synchronization required
- DNP packet sequence number mismatch
- FIR or FIN bits not set in ac byte
- Communication failed to device x (where x ranges from 1 to 7)

DNP Internal Indications (most recent transaction only)

The **DNP IIN** bits status fields contain diagnostic information about the application layer. A “1” (or up arrow) indicates an active state, and a “0” (or down arrow) indicates an inactive state. For example, the “1” in Figure 16 means the configuration is corrupt.

DNP Internal Indications (most recent transaction only)																
First IIN									Second IIN							
Bit #	7	6	5	4	3	2	1	0	Bit #	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0		0	0	1	0	0	0	0	0

Figure 16. The application layer information in DNP IIN fields.

The status of the bits is valid for the most recent transaction only. For an explanation of the bit codes, see Table 1 on page 40.

Table 1. DNP Internal Indication Bits Status Field Codes

Bit #	First IIN Byte Definition	Second IIN Byte Definition
0	Broadcast message received	Function code not implemented
1	Class 1 data available	Requested object unknown
2	Class 2 data available	Parameters in the qualifier, range, or data fields are not valid or out of range
3	Class 3 data available	Event or application buffers have overflowed
4	Time synchronization required from the master	Requested operation is already executing
5	Control is in local mode	Configuration corrupt
6	Device trouble	Reserved
7	Device restart	Reserved

Various Counters

The *Troubleshooting>Various Counters* screens contain counters and statistics associated with DNP communication and the IntelliTeam system.

To display the *Troubleshooting>Various Counters* screen, click on the **Troubleshooting** button on any IntelliLink screen, and then click on the **Various Counters** button. See Figure 17.

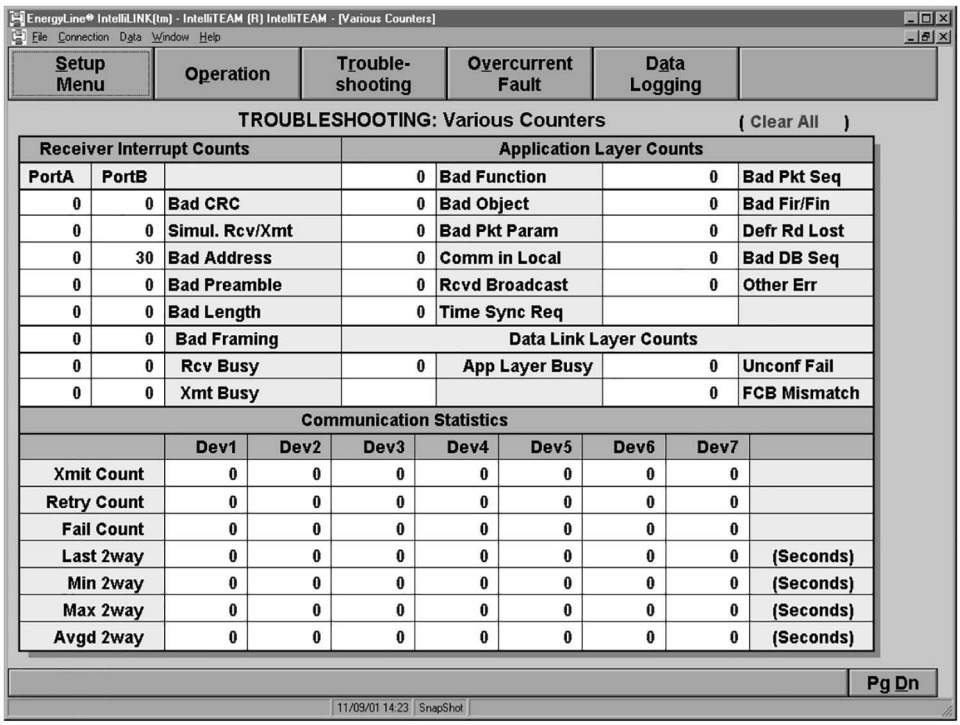

Figure 17. The *Troubleshooting>Various Counters* screen.

This screen shows counter information for each team member and for the whole team.

The switch control counts and records errors and events associated with the interrupt service routine, the data link layer, and the application layer. The counts are stored in non-volatile memory and may be cleared when necessary.

Follow these steps to clear counts in both pages of this screen:

STEP 1. Generate a report to save the count information on the screen.

Note: When the counts and statistics have been cleared, data cannot be recovered.

STEP 2. Click on the (Clear All) text in the upper right corner of the screen.

This causes all counters and statistics to return to 0, except the Min 2way statistic, which clears to the maximum value of 255.

The fields on these screens are grouped into four categories: Receiver Interrupt Counts, Application Layer Counts, Data Link Layer Counts, and Communication Statistics.

Receive Interrupt Counts

These are errors associated with the communications interrupt routine. If applicable, the information for each port is shown separately.

Bad CRC

This field shows the number of failed CRC calculations on incoming packets.

Simul. Rcv/Xmt

This field shows the number of times the receiver and transmitter were enabled simultaneously.

Bad Address

This field shows the number of packets received with a destination address that does not match the RTU address of the local team member.

Bad Preamble

This field shows the number of packets received without the required two-byte DNP packet preamble of 0564 hex.

Bad Length

This field displays the number of packets received with an invalid length. Invalid packet lengths are values less than 5.

Bad Framing

This field shows the number of times an improperly framed byte was received.

Rcv Busy

This field shows the number of times a packet was unable to be received due to a busy receive channel.

Xmt Busy

This field shows the number of times a packet was unable to be transmitted due to a busy transmit channel.

Application Layer Counts

These are errors associated with DNP application layer communications.

Bad Function

This field shows the number of times an invalid or unsupported function code was received.

Bad Object

This field shows the number of times an invalid or unsupported object code was received.

Bad Pkt Param

This field shows the number of times an invalid or unsupported packet parameter was received. Packet parameters include the variation, qualifier, and indexing associated with the object.

Comm in Local

This field shows the number of times that **Remote** mode was changed to **Local** mode during communications.

Rcvd Broadcast

This field shows the number of times a packet containing the broadcast destination address was received.

Time Sync Req

This field shows the number of requests made for timestamps by toggling on the associated **IIN** bit.

Bad Pkt Seq

This field shows the number of mismatched application layer sequence numbers received in the packets.

Bad Fir/Fin

This field shows the number of packets received with the **Fir** and **Fin** bits set improperly.

Xmit Delay

This field shows the number of times the transmission of a packet was delayed because of interrupt or data-link layer activity. A large number in this field does not indicate a problem, although a problem may exist if the number is continuously incrementing.

Bad DB Seq

This field shows the number of times a team database sequence number was found that did not match other records in the database.

Other Err

This field shows the number of unidentified errors encountered.

Data-Link Layer Counts

These are errors associated with the data-link layer of DNP communications.

App Layer Busy

This field shows the number of times a confirmed user data packet was received into the data-link layer but could not be delivered to the application layer because of existing application layer activity. Confirmed packets that cannot reach the application layer cause a nack confirmation to be sent to the packet sender.

Unconf Fail

This field shows the number of times an unconfirmed user data packet was received into the data link layer but could not be delivered to the application layer because of existing application layer activity. These unconfirmed packets are dropped without notifying the sender.

FCB Mismatch

This field shows mismatch occurrences of the Frame Control Bit (FCB) in the data link layer.

Communication Statistics

This is information tracked for each team member (Dev1 through Dev7).

Xmit Count

This field shows the number of original packets transmitted to a single team member.

Retry Count

This field shows the number of packets transmitted to a single team member because of an original packet retry.

Fail Count

This field shows the number of communications failures with a single team member. A failure is counted if neither a response nor a request was received from that team member during the previous sync interval.

Last 2way

This field shows the latency (in seconds) associated with the last request sent to a single team member.

Min 2way
This field shows the minimum latency (in seconds) recorded for a request sent to a single team member.

Max 2way
This field shows the maximum latency (in seconds) recorded for a request sent to a single team member.

Avgd 2way
This field shows the average latency (in seconds) recorded for requests sent to a single team member.

To display Page 2 of the *Troubleshooting>Various Counters* screen: click on the **PgDn** button on Page 1 of the screen. See Figure 18.

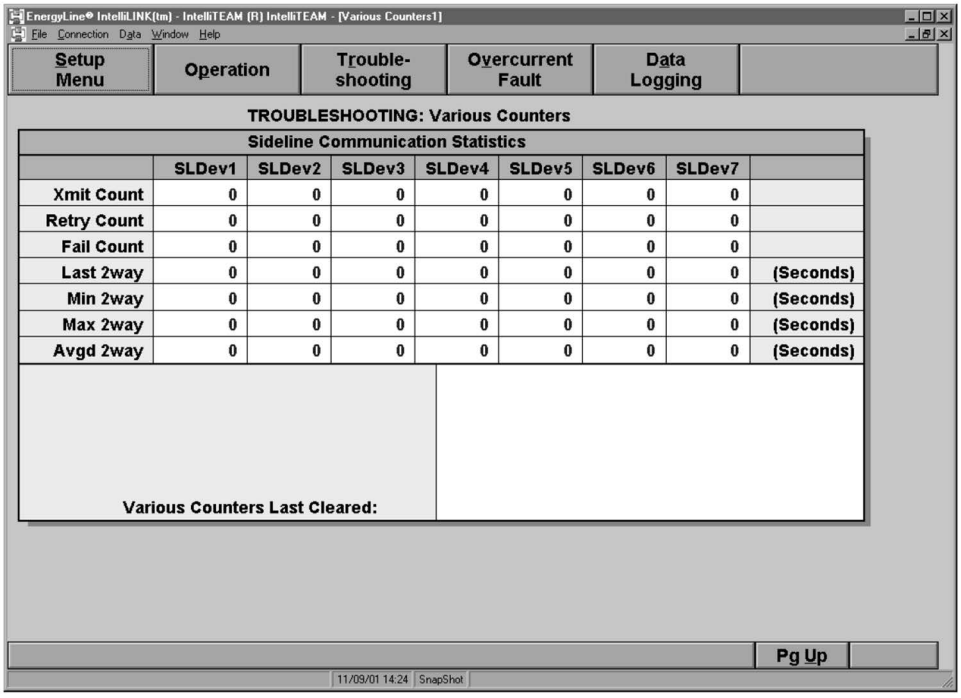

Figure 18. Page 2 of the *Troubleshooting>Various Counters* screen.

This screen page displays Sideline Communications Statistics for any sideline devices (SLDev1 through SLDev7) that are part of the team. For an explanation of the fields in this window, see the "Communication Statistics" section on page 42.

This information is specifically for UtiliNet Internal WANGate Radios (IWRs) used by an IntelliTeam system. Some of this information also applies to other radios.

General Routing Information

Each UtiliNet IWR radio is capable of independently routing network traffic. The address of a radio represents its geographic location. By knowing the addresses of its neighbors, a radio can forward packets to radios closer to the final destination of the packet.

Connectivity

Connectivity is how well a radio can see the other radios around it. A radio has good connectivity when it can see its neighbors well and poor connectivity if it cannot. If all the radios in a network have good connectivity, the network is said to be well-connected.

If a radio has connectivity to radios closer to the final destination of a packet, it has forward connectivity. The packet can be routed forward only when a radio has forward connectivity.

Limits of Standard Routing

In a well-connected network, standard routing is sufficient. However, most networks will not be completely well-connected, and routing problems occur when a radio does not have good or forward connectivity. In these cases, a packet will have difficulty using standard routing to reach its destination. Because the IntelliTeam system uses aggressive communication, optimized for speed, good routing is essential.

Radios with poor connectivity do not make good routers. Packets that arrive at those radios may have trouble moving forward or may be unable to move forward at all if the radio does not have forward connectivity.

Localized regions of radios may have connectivity among themselves, but not to radios outside the area. Packets arriving in such a region have trouble getting back out. Areas of limited connectivity are undesirable routing choices for packets not destined for that area.

Transit time (latency) varies depending on which radios a packet routes through; some radios are better routers than others. For example, in areas where some radios see short distances and some see longer distances, a packet takes longer if it routes through the radios that see short distances because it will have to hop through more radios.

Customizing Routing

When standard routing is inefficient, routing can be customized to improve connectivity. The simplest way is to add more radios to serve as routers. However, if the new radios do not have good connectivity, they may only improve routing for some radios.

Use the RadioShop software to identify weak links in connectivity. See the “Identifying Routing Problems” section on page 45. Connectivity problems can also be the result of poor or inadequate installation and this is not a routing issue.

When team members are set up, select whether each radio can route packets to other destinations. When a team member radio should not be used for routing, configure it as a non-routing radio.

Routing problems are not always apparent if the system can only be observed from the application level. However, excessive delays or lost packets can be observed that are the result of routing problems. Delays are indicated by unusually long times in the **Last 2way** and **Avgd 2way** fields on the *Troubleshooting>Various Counters* screen. Lost packets information is located in the RadioShop *WAN Nodes Query* screen.

Excessive Delays

Routing problems cause a packet to take longer than necessary to route through a network. When specific radios or areas of radios are slower to respond than others, this could result from routing problems.

Lost Packets

Packets that do not reach their destination before running out of "time-to-live" or "luck" (hops) are "killed." A packet experiencing sufficient routing difficulty can be lost this way. When packets do not always seem to reach certain radios or areas of radios, they may be timing out or running out of hops due to routing problems.

Identifying Routing Problems

Follow these steps to identify routing problems. Radio connectivity and routing scan lists can be examined in the RadioShop software. Start at the most likely trouble source and then repeat the process at each team member until the problem is found.

STEP 1. Find or create a copy of:

(a) The IntelliTeam team information sheet for this team.

(b) The nodes table that contains the radios for this team.

STEP 2. At the team member most likely the source of the problem, connect your computer to the radio.

Connect a RS232 serial cable to the serial port on your computer and to the LAN PACKET PORT on the radio.

STEP 3. Start the RadioShop software

(a) Start the computer.

(b) On the **Start** menu, click on the **Programs>EnergyLine>Setup Manager** entries.

(c) On the **UtiliNet Setup** tab, click on the **RadioShop** button.

STEP 4. Perform a WAN Nodes query.

(a) At the RadioShop *Main Menu* screen, press the <S> key to select the **Select Radio** option.

(b) Press on the <Enter> key to select the **Local Radio** option.

Note: If the message "Local Radio did not match Nodes List" appears, this radio is not included in the RadioShop nodes table in the computer. Add the radio to the table, and then start this step again.

(c) Check that the on-screen radio name is the name you expected for this radio.

If necessary, edit the radio information to correct errors.

(d) Press the <Q> key to select the **Query Radio** option and then press the <Enter> key.

(e) Press the <Enter> key to select the **Connectivity and Routing Reports** option.

(f) Press the <W> key to select the **WAN Nodes** option.

The software queries the radio and displays the information it finds there, See Figure 19 on page 46.

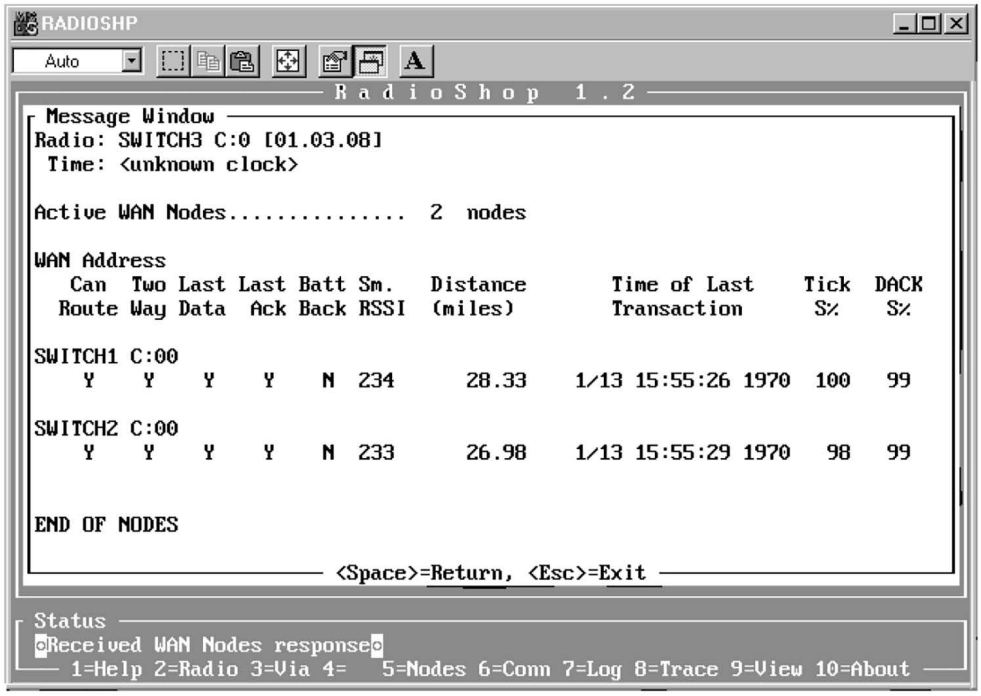

Figure 19. The RadioShop *WAN Nodes Query* screen.

(g) Compare the on-screen radio list and the nodes table printout. If one or more radios are missing from the list, there may be a radio configuration problem or a system design problem.

- When the local radio is missing, confirm the WAN address and setup values in the radio are the same as those in the printout. If necessary, either edit the nodes table to match the radio or configure the radio to match the nodes table.

  Then repeat the WAN Nodes query to confirm the problem has been corrected.

- When the local radio is present but one or more of the other radios are missing, note which one(s) are missing. Then, go directly to Step 5.
- When the list of radio names is complete but communication problems still occurs; contact S&C Electric Company.

STEP 5. When local radio configuration has been completed, exit all programs and then disconnect the computer from the radio.

STEP 6. Repeat Step 2 through Step 5 at the next radio on the routing path.

STEP 7. When all radios have the correct information, update the team.

Use the Setup Manager software to transfer the radio information from your computer to one of the team members, and then initiate a new team configuration.

If all the radios have been checked and the source of the problem was not found, contact S&C Electric Company.

These questions are about the IntelliTeam Automatic Restoration System.

Automatic operation DISABLED mode

Q. What happens to the other team members when one member is placed in **Automatic Operation Disabled** state? Will **Automatic Reconfiguration** mode still operate?

A. For automatic reconfiguration to take place, all team members must be in the **Automatic Operation Enabled** state, and the **Features Enabled** field (on the *Setup>Automatic Operation* screen) must include the **Automatic Transfer Enabled** mode. If any team member is placed in the **Automatic Operation Disabled** state, it affects the entire team. To prevent automatic transfer activity within the team, change the **Automatic Operation** mode at one team member to the **Disabled** state. The other team controls continue to operate as stand-alone automatic switch controls.

Note: When the team includes a multiple-switch switch control at the normally open point in the system (a control with one normally closed line switch and one normally open line switch), disable **Automatic Operation** mode at that control do disable all automatic team operation. Otherwise, that control will enter **Single Member** mode and operate as a two-switch team.

Manual circuit reconfiguration

Q. Suppose I need to do some switching on my circuit. How does the team react to manual circuit reconfiguration?

A. Depending on the changes made, the team unintentionally may be caused to reconfigure the circuit automatically. Later, the team may not behave as expected because the team members have already responded to the manual switching. To make sure the team does not operate unintentionally when the circuit has been manually reconfigured, it is very important to disable **Automatic Team Operation** mode before making changes. See the previous question.

Reclose operations

Q. How do I work with a restricted number of reclose operations?

A. For circuits where a recloser control may perform few (or no) tests to clear a fault (such as in underground systems where cable damage is an issue or in areas with a high degree of fire hazard), the team can still restore load to as many customers as possible. Set the **Recloser Counts to Trip** setpoint to a level that insures the sectionalizers open quickly. For example, they may open on the first loss of voltage detected. Then, the team members will begin to restore service from the adjacent circuit, up to the faulted section. Various levels of coordination between the recloser control and IntelliTeam members are possible, depending on the number of recloser operations available and the number of members in the team.

Maximum/minimum reclose counts

Q. Why does the *Setup>Automatic Operation* screen for the 5801 control have both **Maximum Recloser Counts to Trip, Fault Current Detected** and **Minimum Recloser Counts to Trip, Fault Current Detected** fields?

A. These two setpoints let team controls dynamically coordinate sectionalizing activity. When the controls use standard sectionalizing logic, they only need to coordinate with the recloser control in one preset pattern around the circuit tie point. With the IntelliTeam system, the circuit configuration changes during fault events. A single preset coordination pattern may not be ideal. When the circuit is reconfigured, the open tie switch may be in a different location, and the coordination needs to change appropriately.

This feature can be overridden by setting the maximum and minimum counts to the same value. This forces the preset pattern of coordination, regardless of the present circuit configuration.

System errors

Q. How does the team respond when an error occurs?

A. When any single team member detects an error that affects automatic transfer, the information is quickly shared among all the team members. This causes further automatic transfer operations to stop throughout the entire team until the error is cleared. While the error is active, all team members revert to standard sectionalizing and/or phase-loss protection logic to isolate faults as well as possible. When the team includes a multiple-switch team member at the normally open point (with one normally closed line switch and one normally open line switch that are both part of the team), and the team was in the **Ready-to-Transfer** state before the error, this switch control will enter **Single Member** mode.

Radio placement

Q. When the team uses UtiliNet radios, what do I do if there is no direct line of sight between the radios in the team? How far apart can they be?

A. UtiliNet radios route data from the source to the destination using sophisticated routing algorithms. Every UtiliNet radio has this routing capability, whether it is a stand-alone relay radio or one integrated into a switch control. Typically, the distance between radios is no more than 5 miles. If team members cannot communicate with each other, a dedicated relay radio can be installed between the team members at a location with line-of-sight communication to both team members. When placed appropriately, a relay radio can serve as a link for any number of radios.

Multiple feeders

Q. What if I have more than two feeders?

A. The IntelliTeam system is designed to reconfigure two feeders in a substation-to-substation configuration. If other circuits connect to the team, they can be automated as well and their operation coordinated. In a three-circuit configuration, the controls on the third circuit can be a second team, with one end connected to Team 1. The member of Team 2 closest to Team 1 becomes the normally open switch/recloser. This allows Team 1 to act as a source for Team 2.

IntelliTeam status information

Q. What information about the team can I get from the faceplate?

A. The faceplate LCD screen displays status information about the team and all analog, status, and event data logged for the local team member. The IntelliTeam information includes:

- A single-line diagram of the team, with the present open/close status of each switch
- The RTU addresses of each member of the team
- The team identification associated with the local team member
- The present status of voltage-loss and fault conditions at each team member
- The present average load seen at each team member
- The mode of operation for each team member
- The operational status of the team as seen by each team member

If the team is in the **Ready for Automatic Load Transfer** mode, the LCD screen also displays "[RDY]."

Q. Can I get IntelliTeam status information through my existing SCADA system?

A. The IntelliTeam system was designed not only as a standalone solution for specific distribution system reliability problems, but also with the ability to interface with SCADA systems. The IntelliTeam system uses true DNP V3.0 Subset Level 2 protocol. The members of a team easily interface with a DNP master station. If the existing SCADA system is not DNP protocol, one team member can act as a gateway into the team. With this gateway and the existing communication system, access is available to all status information for each member of the team, and the switches can be controlled by SCADA commands.

Reconfiguration time

Q. How quickly does the IntelliTeam system reconfigure the switches after a fault?

A. The speed of reconfiguration depends on the communication equipment. Under normal conditions using radio communication, the tie switch closes within 10 seconds following successful sectionalizing. After it closes, the tie switch waits for the **Shots-To-Lockout Time Threshold** timer to elapse to ensure a good operation, and then communicates to the next open switch. That switch then operates within 10 seconds. Each switch operates in turn within 10 seconds plus the **Shots-To-Lockout Time Threshold** setpoint. Radio communication time accounts for the majority of the 10 second delay. The delay may be as short as 1 second.

With other communication equipment (for example, fiber optics), delays will generally be as short as 1 second.

Load transfer levels

Q. How do I account for load transfers when I don't know which way the circuit is reconfiguring?

A. The IntelliTeam system has setpoints to account for load transfers. Different **Load Transfer Limit** setpoints for the two feeders can be configured on Page 2 of the *Setup>Automatic Operation* screen.

Q. How does the team use all of the **Load Transfer** setpoints on Page 2 of the *Setup>Automatic Operation* screen?

A. During circuit reconfiguration, each switch can transfer load either to the left side or to the right side on a single-line diagram. The values entered on Page 2 of the *Setup>Automatic Operation* screen correspond to the additional capacity available on the left feed and the right feed. Each feed has **Summer-Loading** and **Non-Summer-Loading** setpoints.

The **Maximum Capacity for Transfer** and **Maximum Rated Feeder Capacity** setpoints are used when real-time feeder loading information is available to the team member. They determine the load the team member can transfer, based on present conditions. The **Capacity for Transfer (total feeder load n/a)** setpoint is used when real-time information is not available.

Shots-to-lockout

Q. My normal substation breaker setting is four shots to lockout, and I configured my team to coordinate with this. If I need to perform work on the circuit and temporarily reset the breaker to one shot, will the team still reconfigure the circuit for a fault during this period?

A. Yes. The substation breaker will lock out after the first trip. The number of source-side reclosing operations will not reach the count normally required, but the team can still reconfigure the circuit based on the **Extended Voltage Loss** setpoint.

⚠ WARNING

Exercise extreme caution when performing this test. Switches will open and close during the procedure. When they are not properly bypassed, load will be dropped. The tie switch will also close, paralleling the circuits.

Q. My substation breaker uses an **Instantaneous-Reclose** feature. Is that a problem for the IntelliTeam system?

A. No. As a safety feature, the IntelliTeam system uses shots-to-lockout whenever it closes a switch to pick up load during transfer events. For breakers with instantaneous reclose, set the **Number of Shots Required for Lockout** septoing to two. This feature delays the trip action until there is enough dead time to open the line switch.

Pager notification

Q. I don't have a SCADA system. Is there an easy way for me to find out when the team has operated?

A. Yes. Order the IntelliTeam configuration that includes the PASS option (Pager Alert and Supervisory System). PASS works like a mobile SCADA monitoring station. During an IntelliTeam system event, a Pager Gateway team member dials in to and logs on to the paging company's host computer. Then, it forms an appropriate message and sends it to your pager. The message includes the name of the team, a single-line representation of the team, voltage loss and fault conditions, and the action taking place. Pages are issued for transfer events, return-to-normal events, and changes in team readiness status.

Return to Normal and an additional fault

Q. How does the return to normal closed transition work if an additional fault occurs on the alternate feeder?

A. If a second fault occurs on the feeder while the team is waiting to return to normal, the team members will sectionalize the second fault. However, this stops the automatic **Return to Normal** mode. A crew must fix both faults and return all team members to their normally open or closed position either manually or via SCADA.

Communication statistics on the *Troubleshooting>Various Counters* screen

Q. My team has been communicating well for a long time. Why does the *Troubleshooting>Various Counters* screen show over 15,000 time sync requests?

A. A time sync request occurs once every 30 minutes, even when everything is fine. Time sync requests also occur every time the timestamp difference between two team members is greater than 1 second. This could occur frequently, even under normal conditions, and does not necessarily indicate a problem.

Although these may not account for all the requests, they probably cover many of them. For a better idea of what is happening with the team, check how many time syncs are requested on a daily or weekly basis.

Q. What is the significance of the **Bad Pkt Seq** value?

A. The **Bad Pkt Seq** count (bad packet sequence) indicates the DNP application layer received a response from another team member whose DNP sequence number does not match the sequence number of the present DNP request. As long as it doesn't happen constantly, this is a normal occurrence. One example is when a team member sends a high-priority request before receiving a response for a lower-priority request. When the lower-priority response is received, it will be considered old and the **Bad Pkt Seq** count will be incremented.

Q. Tell me more about the **FCB Mismatch** value.

A. The **FCB Mismatch** value (FCB = Frame Control Bit) is another DNP specific item. It's like a DNP sequence number for the DNP data link layer. In this case, the sequence number is either 0 or 1. As with the Bad Pkt Seq, the FCB Mismatch can happen under normal conditions; as long as it doesn't occur constantly, it's probably not a problem.

Q. What about the **Bad DB Seq** value?

A. The **Bad DB Seq** count (bad database sequence) indicates the database sequence number of the local control did not match the database sequence number of one of the other team members. This is a little more troubling, but a bad DB sequence number can happen from time to time, as long as it does not occur twice in a row. At twice in a row, the team goes into a **Stop Transfer** condition, and the team must be resynchronized. A **Bad DB Seq** event can be a sign of poor communication, but it depends on frequency of occurrence.

Q. Do these events cause a **Stop Transfer** condition?

A. Under severe conditions, each of these can cause **Stop Transfer** conditions. If this happens, other error conditions will probably be observed, such as failed communication. To diagnose a problem, look at all of the information from a known time interval. Contact S&C Electric Company if you need further assistance.