

Troubleshooting

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Introduction

Qualified Persons

WARNING

Only qualified persons who are knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone 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 special precautionary techniques, personal protective equipment, insulated and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

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

Read this Instruction Sheet

NOTICE

Thoroughly and carefully read this instruction sheet and all materials included in the product's instruction handbook before installing or operating an IntelliCap 2000 Automatic Capacitor Control. Familiarize yourself with the Safety Information and Safety Precautions on pages 4 through 5. The latest version of this publication is available online in PDF format at sandc.com/en/support/product-literature/.

Retain this Instruction Sheet

This instruction sheet is a permanent part of the IntelliCap 2000 Automatic Capacitor Control. Designate a location where users can easily retrieve and refer to this publication.

Proper Application

WARNING

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

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 IntelliCap 2000 Automatic Capacitor 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.

Warranty of the IntelliCap 2000 Automatic Capacitor 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 communication devices. However, S&C will assign to the immediate purchaser or end user all manufacturer's warranties that apply to such major components.

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

Warranty Qualifications

Warranty of IntelliCap 2000 Automatic Capacitor Controls 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, communication devices, and remote terminal units. However, S&C will assign to the immediate purchaser or end user all manufacturers' warranties that apply to such major components.

Safety Information

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the IntelliCap 2000 Automatic Capacitor 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 the nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C’s website sandc.com, or call the S&C Global Support and Monitoring Center at 1-888-762-1100.

NOTICE	
Read this instruction sheet thoroughly and carefully before installing an IntelliCap 2000 Automatic Capacitor Control.	

Replacement Instructions and Labels

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

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

⚠ DANGER



The IntelliCap 2000 Automatic Capacitor Control line voltage input range is 93 to 276 Vac. Failure to observe the precautions below will result in serious personal injury or death. Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS.** Access to an IntelliCap 2000 Automatic Capacitor Control must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules. Always maintain proper clearance from energized components.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, arc-flash clothing, and fall protection, in accordance with safe operating procedures and rules.
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels. Remove tags ONLY if instructed to do so.
5. **MAINTAINING PROPER CLEARANCE.** Always maintain proper clearance from energized components.

Applicable Software

This instruction sheet was prepared for use with IntelliCap 2000 software version IC2000 Installer-2.1.x or higher.

Software identification is located on the IntelliLink Setup Software *Setup>General>Software Versions* 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.

This control is connected to capacitors operating at primary voltage levels. High voltage may be present in the wiring to the control or the control itself during certain failures of the capacitor bank wiring or grounding systems or when there is a failure of the capacitor bank itself. For this reason, access to the control 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 control or any other part of the installation). These warning signs include such things as smoke, fire, open fuses, crackling noises, loud buzzing, etc. If a malfunction is suspected, treat all components of the installation, including the control and associated mounting hardware, as if they were elevated to primary (high) voltage.

LCD Screen

The faceplate LCD screen provides information about the present state of the control. For an explanation of the faceplate and LCD screen, see the “Faceplate” section in S&C Instruction Sheet 1024-540, “IntelliCap® 2000 Automatic Capacitor Control: *Operation*.”

IntelliLink® Setup Software

IntelliLink Setup Software *Operation, Diagnostics>Alarms, Metering, and Setup>General>Software Versions* screens display information about the IntelliCap 2000 control, operating data, and sensor data.

To view these screens, you need a Windows 7 or later computer, Microsoft Edge, a USB 2.0 A to B cable, and IntelliLink Setup Software for the IntelliCap 2000 control. For more information about the required equipment and how to use IntelliLink Setup Software, see S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*.”

Electrical Diagrams

The electrical interconnect diagrams at the back of S&C Instruction Sheet 1024-510, “IntelliCap® 2000 Automatic Capacitor Control: *Installation*,” show IntelliCap 2000 control wiring layouts.

Tools Required

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

- Multimeter
- 4-inch long #2 Phillips screwdriver
- 4-inch long ¼-inch blade screwdriver

NOTICE

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

Basic Troubleshooting

A properly functioning IntelliCap 2000 control has ****UNIT OK**** on the first line of the LCD screen. If trouble is suspected and the LCD screen is normal, there are two options: continue to follow these troubleshooting instructions, or save a snapshot of the control and contact S&C Electric Company. See the “Using A Snapshot” section in S&C Instruction Sheet 1024-540, “IntelliCap® 2000 Automatic Capacitor Control: *Operation*.”

When the LCD screen does not display ****UNIT OK****, check the LCD error messages in Table 1 on page 13. To eliminate the possibility of software malfunction, reload the operating software into the control. Always save a snapshot before reloading the operating software.

NOTICE

With firmware version 2.3.x and later, the default passwords for all user accounts, including the admin account, must be changed before IntelliLink software can connect to and configure a control. See S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for more information.

Follow these steps to troubleshoot a specific control:

STEP 1. Install the contents of the new software installer on the computer.

For details, see the “Start IntelliLink Software” section in S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*.”

STEP 2. Connect the computer to the USB port on the control faceplate.

STEP 3. Select the **IntelliLink** option from the *Start>All Programs>S&C Electric screen*. See Figure 1 on page 8.

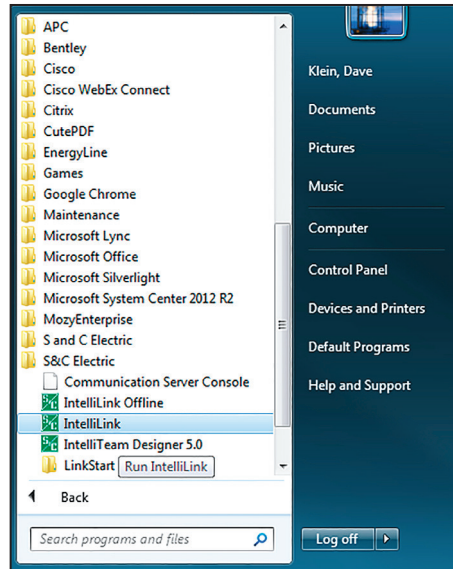


Figure 1. Start button program selection screen.

STEP 4. Click on the **Local Connection** button. See Figure 2.

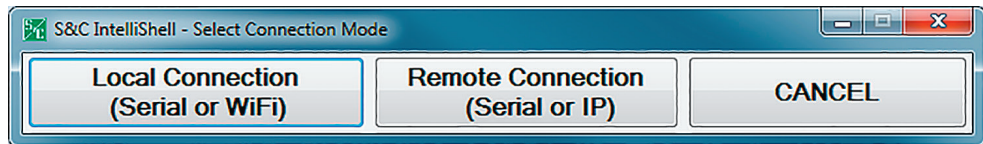


Figure 2. IntelliShell—Select Connection Mode dialog box.

STEP 5. Select the **IntelliCap 2000** option from the **Select S&C Product Family** drop-down menu, and click on either the **Serial** or the **Wi-Fi** button. See Figure 3 on page 9.

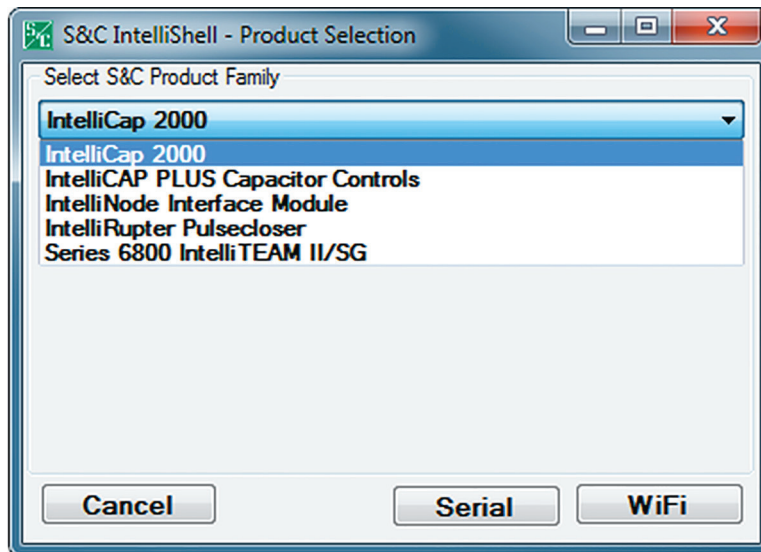


Figure 3. IntelliShell—Product Family selection dialog box.

STEP 6. Select the Comm Port used to connect to the control, and click on the **Update Firmware** button. See Figure 4.

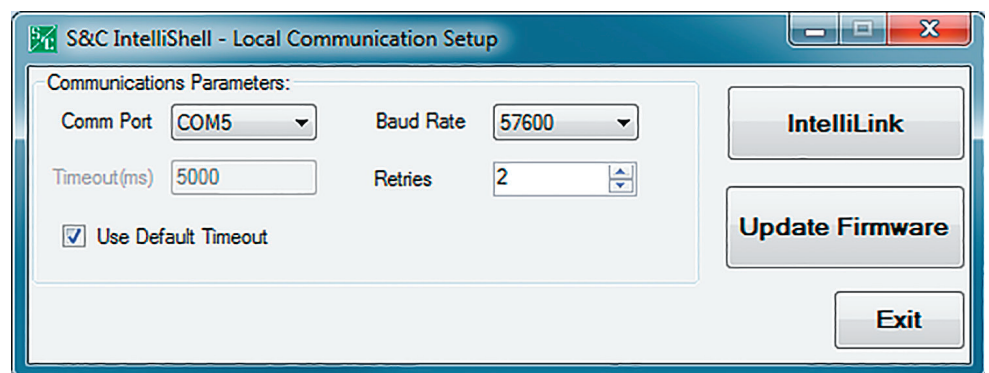


Figure 4. IntelliShell—Local Communication Setup dialog box.

STEP 7. Log in to the control and follow the dialog instructions. See Figure 5. Do not skip any of the software components unless instructed to do so by S&C Electric Company. Contact S&C Electric Company for the default username and password.

NOTICE

With firmware version 2.3.x and later, the default passwords for all user accounts, including the admin account, must be changed before IntelliLink software can connect to and configure a control. If the default password does not work and no prompt appears to change it, the control is using a new password. If the new password is not known, call the S&C Global Support and Monitoring Center at 1-888-762-1100 for help. Please see S&C Instruction Sheet 1024-530, "IntelliCap® 2000 Automatic Capacitor Control: *Setup*," for more information.

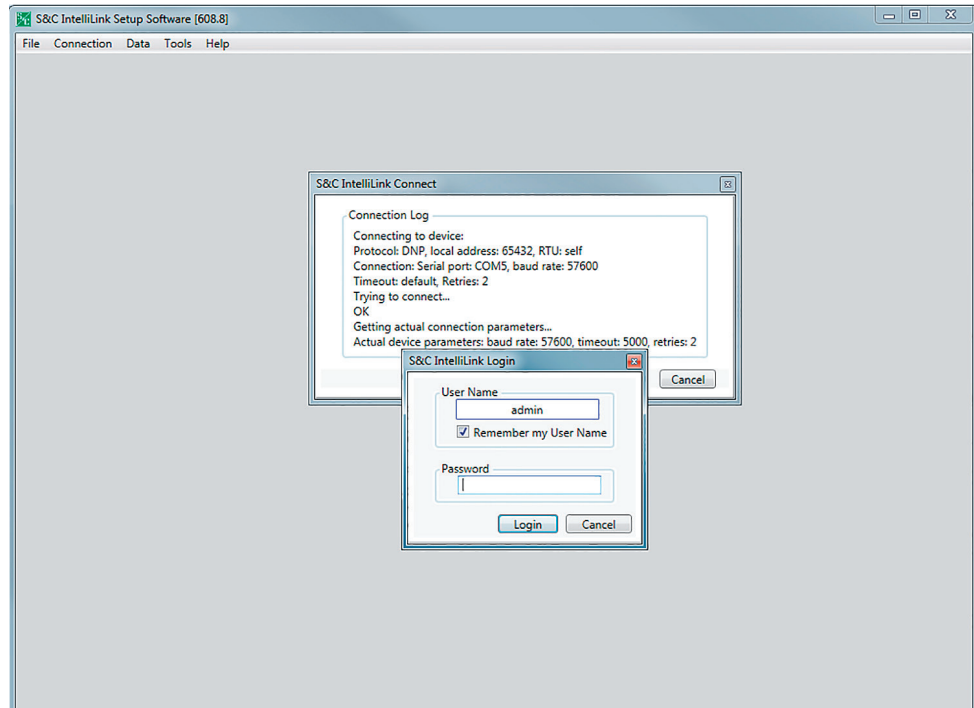


Figure 5. IntelliLink Setup Software Login dialog box.

- STEP 8.** The operating system will be reloaded into the IntelliCap 2000 control, and the LCD screen should show ****UNIT OK**** on the first line.
- STEP 9.** If the trouble remains, continue to follow the troubleshooting instructions or contact S&C Electric Company.

Load Fuse Is Blown

When the load fuse is blown, the control displays approximately zero voltage.

NOTICE

Before changing the blown load fuse, set the **Operation** mode to the **Manual** state. This will prevent any automatic operation.

Change the **Operation** mode to the **Manual** state. Remove the fuse holder from the faceplate and replace the fuse. See Figure 6. Switch the bank in and out. If the new fuse blows, check the wiring, peripheral equipment, and the line switches.

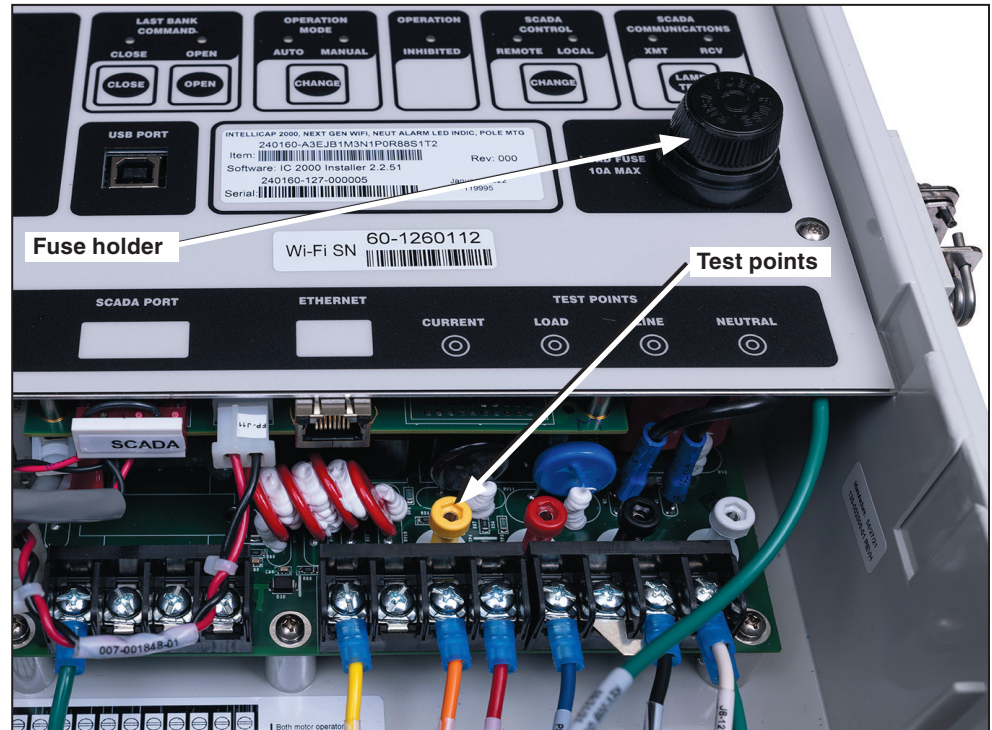


Figure 6. 10 ampere load fuse and location of the test points.

Test Points

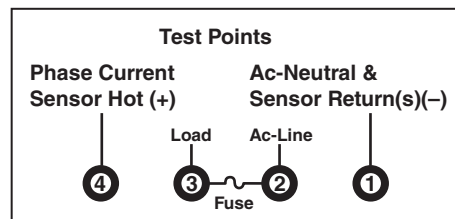


Figure 7. The test point connections.

The test points are located below the faceplate and provide convenient access for troubleshooting or measuring voltage and signal inputs to the control. See Figures 6 and 7 on page 11.

Use test points for troubleshooting by measuring the two listed test points with a multimeter:

- 1 to 2:** Reads 120 Vac when control power is present
Reads 0 Vac when control power is not available
- 1 to 3:** Reads 120 Vac when 10-A load fuse is installed and not blown
Reads 0 Vac when 10-A load fuse is not installed or blown
- 1 to 4:** Reads some Vac when phase current sensor has current flowing through it
Reads 0 Vac when phase current sensor is not installed or no current is flowing
- 2 to 3:** Reads 0 Vac when the 10-A load fuse is installed and working properly
Reads 120 Vac when the 10-A load fuse is not installed or blown

LCD Screen Problems

LCD screen is blank

Follow these steps to investigate a blank LCD screen:

STEP 1. Check for ac power to the control. Check for ac voltage between test points 2 (ac line) and 3 (neutral return) below the faceplate if there is no voltage.

For controls with a meter base, make sure the ac line and ac neutral wires are connected to the proper terminals in the meter base socket.

For controls with a bracket mount, make sure the cable wiring is correct. There is a label inside the enclosure that shows correct wiring.

STEP 2. Check whether there is an equipment problem. There may be a problem with the PC board, the LCD screen, or the operating system. Call S&C Electric Company.

LCD screen does not display **UNIT OK**** or the data line is not scrolling**

Follow these steps to investigate error messages:

STEP 1. Check the LCD screen error messages. Table 1 shows possible messages.

STEP 2. Check for IntelliLink software troubleshooting messages. Connect the computer to the capacitor control, and start the IntelliLink software. Check for active messages on the *Alarm Status* screen. Follow the troubleshooting suggestions for those messages. See Table 1.

Table 1. LCD Screen Error Messages

Message	Meaning
TempSensorErr	The temperature sensor is reading outside of its range or may be faulty
VoltageDeltaErr	A Low Switching Voltage Delta message appears when the actual change in voltage level during switching is below the minimum percentage of the expected change
VoltBandErr	Var controls only—The control has locked out the bank because of the High/Low Voltage Band error message
VarDeltaErr	Var controls only—a Low Switching kVARs Delta message appears when the actual change in kvar levels during switching is below the minimum percentage of the expected change
VoltageSensorErr	The voltage sensor is reading outside of its range or may be faulty
LoadFuseErr	Blown load fuse
VoltRangeErr	An Incorrect Voltage Range message appears when the voltage is not within +/-15% of the nominal voltage
MaxAutoCyclesErr	The control reached the Maximum Automatic Control Cycles Per Day limit; further automatic switching is inhibited until the next calendar day
NeutralSensorErr	Neutral sensing controls only—this message is displayed before the control locks out the bank following a Neutral Current or Neutral Voltage alarm
NeutLockourErr	Neutral sensing controls only—the level of neutral current or neutral voltage has caused the control to lock out the bank; see S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: <i>Setup</i> ,” for more details
NeutralZeroErr	Neutral sensing controls only—the control detected zero neutral current or neutral voltage for the length of the Zero Neutral Detection setpoint; see S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: <i>Setup</i> ,” for more details [load fuse alarm]

LED Problems

Close and Open LEDs on the faceplate are OFF

Follow these steps to investigate the LED problem:

- STEP 1.** Check the LCD screen. If it is not operating normally, review the “LCD Screen Problems” section on page 13.
- STEP 2.** Run the Lamp Test procedure. Press the faceplate LAMP TEST button. If the CLOSE or OPEN LED does not light up but other LEDs do, the LED is probably bad. If none of the LEDs light up, review the “LCD Screen Problems” section on page 13.
- STEP 3.** Manually switch the bank to the **In** or **Out** state. Press the faceplate OPERATION MODE CHANGE button so the MANUAL LED is lit. Following utility-approved work procedures and safety practices, switch the bank using the faceplate CLOSE or OPEN button. If you are powering up the capacitor control for the first time or if the control software has been reloaded (not updated), the LEDs do not indicate the bank state until a switching operation has been performed.

Error Messages

Incompatible Ident

When an incompatible ident occurs, make sure to use the correct screenset. IntelliLink software uses a different screenset (.wmn file) for each type of control, and it automatically selects the screenset. This message appears when a screenset is selected (displayed) and connected to a snapshot (.vm file) that requires a different screenset.

To close the open screenset, in the **File** drop-down menu click on the **Close Screenset** option. Then, in the **File** drop-down menu click on the **Open Snapshot** option. In the Open Controller Data File dialog box, select the snapshot to be viewed. Then, click on the **OK** button to open both the snapshot and the correct screenset.

IntelliLink setup incorrect or incomplete

When this problem occurs, reinstall the IntelliLink software for the IntelliCap 2000 control on the computer. There may be a problem with one of the files. See the “To Install the IntelliLink Software” section in S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for details.

Opening port COM1... Trying 9600 BAUD... Connection Failed

These messages appear in the Connect dialog box when the IntelliLink software cannot establish communication with the capacitor control. Follow these steps to establish communication:

- STEP 1.** Check that the capacitor control has power. If the LCD screen is blank, the capacitor control has no power and cannot communicate with the computer. See the “LCD Screen Problems” section on page 13.
- STEP 2.** Try another communications port. The COM1 port on the computer may be assigned to a different device. In the **Tools** drop-down menu, select the **Options...** entry to open the S&C IntelliLink Options dialog box. See Figure 8. Select the **Connection** tab and select a new comm port.
- STEP 3.** Use a different USB cable.

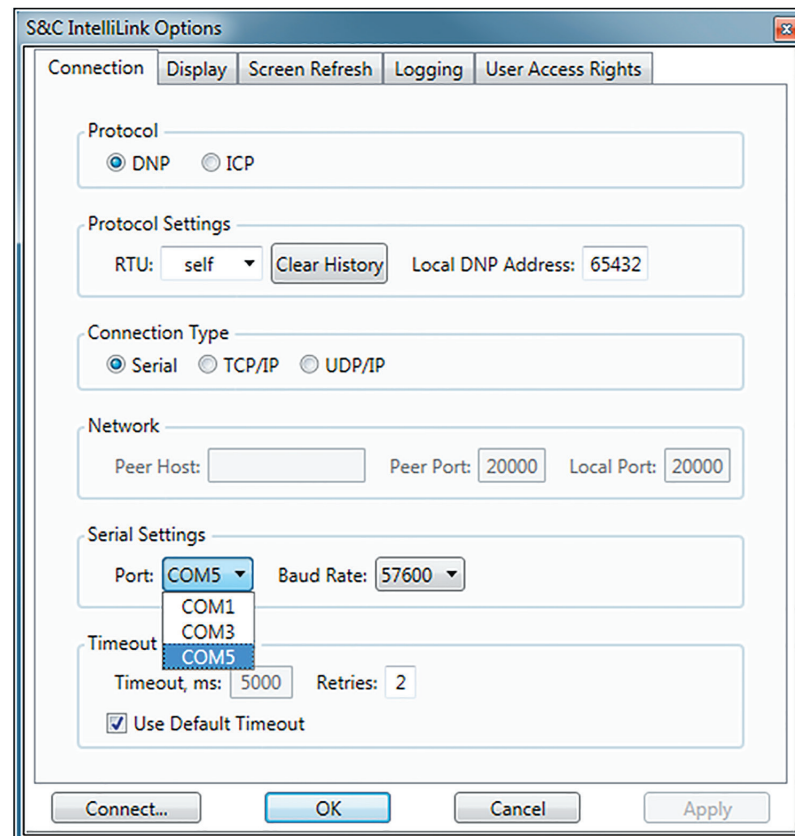


Figure 8. IntelliLink Options, Connection tab dialog box.

STEP 4. Check the USB port on the computer. If a two-wire, ungrounded extension cord is used to power the computer or the capacitor control during lab testing, the USB port on the computer may be damaged. Test the USB port by trying to communicate with a different USB device.

STEP 5. Check that the OPERATION INHIBITED LED is not illuminated. If it is, check the *Diagnostics>Alarms*, *Diagnostics>Warnings*, and *Diagnostics>Errors* screens.

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

When this occurs, reinstall the IntelliLink software for the IntelliCap 2000 control on the computer. Make sure to install the software for this type of capacitor control. See the “To Install the IntelliLink Software” section in S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for details.

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

When this occurs, use the correct screenset. IntelliLink software uses a different screenset (.wmn file) for each type of control, and automatically selects the screenset. This message appears when a screenset is selected (displayed) and a snapshot (.vm file) is connected that requires a different screenset.

To close the open screenset, in the **File** drop-down menu select the **Close Screenset** entry. Then, in the **File** drop-down menu select the **Open Screenset** entry and choose the correct screenset for the control. When the screenset opens (the *Operation* screen is displayed), click on the **Connection** entry and select the **Connect to Device** option.

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

When this occurs, reinstall the IntelliLink software for the IntelliCap 2000 control on the computer. There may be a problem with one of the files. See the “To Install the IntelliLink Software” section in S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for details.

Incorrect Real-Time Data

Sensed current is zero on the Operation screen

When this occurs, follow these steps:

STEP 1. Check the sensor cable. Check that the cable is securely connected to the sensors and to the capacitor control. Check that the cable is not damaged. See S&C Instruction Sheet 1024-510, “IntelliCap® 2000 Automatic Capacitor Control: *Installation*,” for details.

STEP 2. Check the power line. Following utility-approved work procedures and safety practices, verify current is flowing through the sensor and the sensor is installed properly.

Real-time kvar values are wrong

When this occurs, follow these steps:

STEP 1. Check the **System Transformer Ratio** and **System Wiring** setpoints on the *Setup>General>Sensor Configuration* screen. The **System Wiring** setpoint should reflect how the transformer powering the capacitor control is wired (phase to ground or phase to phase). The **System Transformer Ratio** setpoint should be the ratio of the transformer's primary rated voltage to 120 Volts. For example, a 12000/120-240 Volt transformer has a ratio of 12000/120, or 100:1.

STEP 2. Check the current level. Because of sensor accuracy limitations at low current levels, phase-angle detection and display require a minimum current of 0.5% of full-scale values. Below this threshold, the measured power factor reads "1.000" and the kvar values read "0." Current magnitudes continue to be detected and displayed below the 0.5% threshold.

For example, for a capacitor control with a 600-ampere Lindsey sensor, phase-angle detection shuts down at approximately 3 amperes. Below 3 amperes, the power factor shows "1.000," and the kvars show "0."

STEP 3. Check the phase-angle offset. Check the **Phase Offset** setpoint on the *Setup>General>Sensor Configuration* screen.

Miscellaneous Problems

SCADA commands are ignored by the capacitor control

When this occurs, follow these steps:

- STEP 1.** Check the SCADA CONTROL LED. To operate the bank remotely, the faceplate REMOTE LED must be lit. If it is not, press the SCADA CONTROL CHANGE button.
- STEP 2.** Check for control power. See the “LCD Screen Problems” section on page 13.
- STEP 3.** Check the RTU address. On the *Setup>Communications>DNP* screen, check the address used by this capacitor control. Make sure the SCADA master station is sending commands for this control to the correct address.
- STEP 4.** For serial communications, check the baud rate. On the *Setup>Communications>Serial Ports* screen, check that the baud rate is correct for the communications equipment. For modems, the baud rate should match the baud rate used by the SCADA master station.

For Ethernet communications, check the IP address. On the *Setup>Communications>Ethernet* screen, verify all of the addresses are configured appropriately.

- STEP 5.** Check your communication hardware.

Capacitor bank switch does not operate

When this occurs, follow these steps:

- STEP 1.** Make sure the faceplate LOCAL and MANUAL LEDs are both lit. If the LOCAL LED is off, press the SCADA CONTROL CHANGE button. If the MANUAL LED is off, press the OPERATION MODE CHANGE button. Then, press the CLOSE or OPEN button.
- STEP 2.** Check the faceplate CLOSE/OPEN LEDs. If the OPEN LED is blinking slowly, the **Reclose Block** timer is running. Wait until it stops blinking, and then try switching the bank again. If both LEDs are off, see the “Incompatible Ident” section on page 15.
- STEP 3.** Check the line-voltage level. Make sure the line voltage is not below the minimum required to switch the capacitor bank.

Check the capacitor bank switch control pulse time. Connect the computer to the capacitor control, and then start the IntelliLink software. Check that the **Capacitor Bank Switch Control Pulse Time** setting is long enough. See S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for details.

- STEP 4.** Check the wiring. The wiring between the capacitor control and the bank switch may be damaged or defective.
- STEP 5.** Check the capacitor bank primary switch(es). They may be malfunctioning.

Some (but not all) capacitor bank switches do not operate

When this occurs, follow these steps:

- STEP 1.** Check the line-voltage level. Make sure the line voltage is not below the minimum required to switch the capacitor bank.

Check the capacitor bank switch control pulse time. Connect the computer to the capacitor control, and then start the IntelliLink software. Check that the **Capacitor Bank Switch Control Pulse Time** setting is long enough. See S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for details.

- STEP 2.** Check the wiring. The wiring between the capacitor control and the bank switch may be damaged or defective.
- STEP 3.** Check the capacitor bank primary switch(es). The capacitor bank switch(es) may be malfunctioning.

Capacitor control is not switching the bank automatically

When this occurs, follow these steps:

- STEP 1.** Make sure the faceplate AUTO LED is lit. If the AUTO LED is off, press the OPERATION MODE CHANGE button.

Note: If the capacitor control has been in **Manual** mode and is returned to **Automatic** mode, it waits 60 seconds before switching the bank.

- STEP 2.** Check the **Reclose Block** field. If a number appears in this field on the *Operation* screen, the **Reclose Block** timer is running. After the timer runs out, automatic switching should resume.
- STEP 3.** Check for a **Voltage Override** condition. On the *Operation* screen, check for a voltage-override message. If a **Voltage Override** condition is in effect, make sure the **Voltage Override** setpoints are appropriate for this capacitor bank installation.

Check for a possible **Voltage Override** condition. Check the present line voltage (on the *Operation* screen), the **Voltage Override** setpoints presently in effect, and the **Bank Voltage Rise + Margin** value. The capacitor control does not switch the bank if doing so would cause a **Voltage Override** condition. See S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*,” for more details.

- STEP 4.** Check the number of automatic switching cycles. On the *Logs>Operation Counters* screen, look at the number of automatic switching cycles (switch in and switch out) for the day. If the number is equal to (or greater than) the **Maximum Automatic Control Cycles Per Day** setpoint, further switching is inhibited in **Automatic** mode until the next calendar day.
- STEP 5.** Check whether the bank is scheduled to be active. Check whether today is configured as a holiday. If the capacitor control is in **Timeclock**, **Time-Biased Voltage**, or **Time-Biased Temperature** mode, check the schedules.
- STEP 6.** Check for IntelliLink software diagnostics messages. Check for active messages on the *Diagnostics>Alarms*, *Diagnostics>Warnings*, and *Diagnostics>Errors* screens. Follow the troubleshooting suggestions for those messages.
- STEP 7.** Check manual bank operation. Put the control in **Manual** mode (the faceplate MANUALLED is lit). Following company procedures, use the faceplate CLOSE or OPEN button to operate the capacitor bank. If the bank does not switch, see the “Capacitor bank switch does not operate” section on page 18.

- STEP 8.** Check that the OPERATION INHIBITED LED is not lit. If it is, check the *Diagnostics>Alarms*, *Diagnostics>Warnings*, and *Diagnostics>Errors* screens. If the INHIBITED LED display is lit, it can also be an indication an **Inhibit Automatic Operation** command was received when in the **SCADA Override Enabled** mode.
- STEP 9.** Check the user input or digital switch position inputs. Both the **User Defined Digital Input** and the **Digital Switch Position Input** setpoints have user-selectable options that can block automatic operation. Check the *Diagnostics>Warnings* and *Diagnostics>Errors* screens to see whether there is an active indication for the **User Defined Input** or an **Inconsistent Bank Position** or **Contradictory Bank Position** indication for the digital switch position inputs.

Operation Screen

The IntelliLink software *Operation*, *Metering*, and *Diagnostics* screens can help you check capacitor control status and locate the causes for several types of problems.

The *Operation* screen displays the present status of the capacitor control and capacitor bank, along with real-time data from the feeder. See Figure 9. The menu tree at the left provides access to other screens and to perform certain capacitor control operations.

To display the Operation screen:

Connect the computer to the capacitor control. Then, double-click on the **IntelliLink** icon to start the IntelliLink software. For more information, see the “Start the IntelliLink Software” section in S&C Instruction Sheet 1024-530, “IntelliCap® 2000 Automatic Capacitor Control: *Setup*.”

If the IntelliLink software is already running on the computer, click on the **Operation** entry in the left menu tree on any screen.

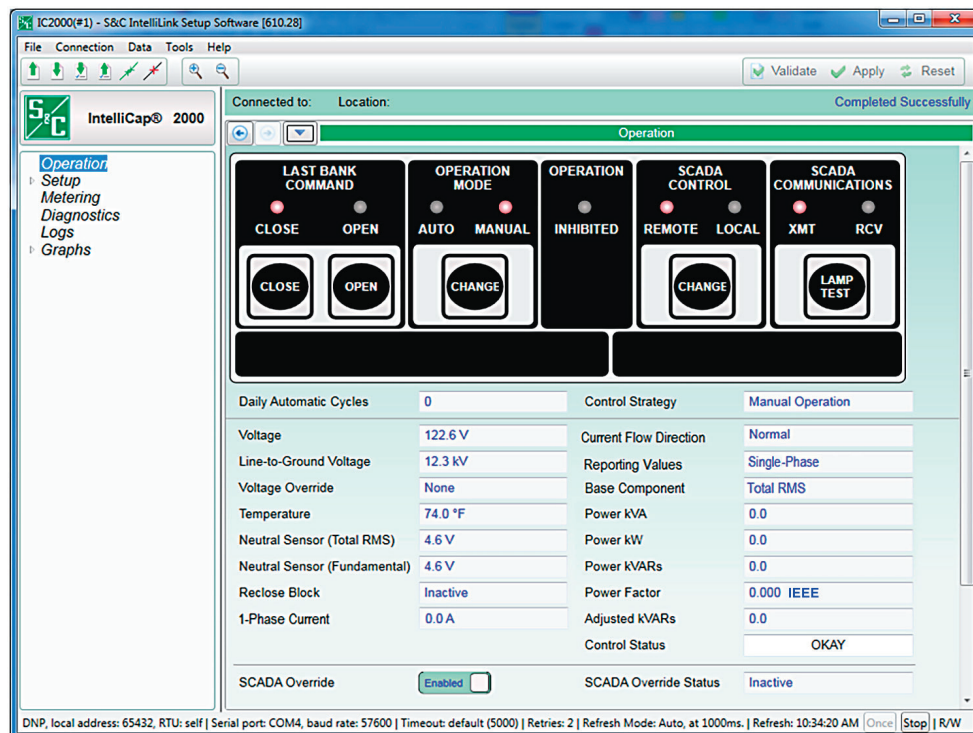


Figure 9. The Operation screen for the var capacitor control.

The *Operation* screen represents the IntelliCap 2000 control indicators and user controls found on the front panel of the device and several key variables that would be viewed through the LCD screen on the front panel.

Last Bank Command: Close/Open

These indicators show the present position of the capacitor bank, unless a problem prevented bank operation. To initiate a **Close** or **Open** command, make sure the **SCADA Control Local** LED is lit and the **Operation Mode Manual** indicator is lit. Then, click on the **Close** or **Open** button and click on the **OK** button.

Operation Mode: Auto/Manual

These indicators show whether operation of the capacitor control is in the **Auto** or **Manual** mode. To change the mode, make sure the **SCADA Control Local** indicator is lit. Then, click on the **Change** button and click on the **OK** button.

Operation Inhibited

When this display is lit, automatic operation is presently blocked. Go to the *Diagnostics* screens to determine why operation is inhibited.

SCADA Control: Remote/Local

These indicators show whether SCADA control is allowed (**Remote** operation) or only **Local** operation is allowed. Click on the **Change** button to change the state and click on the **OK** button.

SCADA Communications: XMT/RCV

These indicators blink to show transmission activity generated by SCADA communications and IntelliLink software activity. The blink pattern is not identical to the LED indicators on the faceplate.

Switch Position Inputs: OPEN/CLOSED

When the digital switch-position inputs are enabled and the physical inputs are connected to a dry position contact on the capacitor switch, these indicators show the state of the closed and open digital input terminals 3 and 4 on the input terminal block. Terminal 1 is the return contact. The switch-position inputs are configured on the *Setup>General>Site-Related* screen.

Daily Automatic Cycle

This field shows the total number of automatic switching cycles completed today. The count includes SCADA commands but excludes manual operations. The control increments the counter when it switches the bank out. When the control software is reloaded and settings are preserved, the count is retained. When the control software is reloaded and the settings are not preserved, this counter resets to zero.

Control Strategy

This is the control strategy for the present season.

Voltage

This is the present voltage at the control (in Volts) on the nominal voltage base (for example, 120 Vac). The control software uses this value for calculating the kvars for var controls.

1-Phase Current (var controls only)

This is the current (in amperes), measured by the current sensor and scaled using the **Single-Phase Full-Scale Current** setpoint.

Line-to-Ground Voltage (var controls only)

This is the present value of the distribution line voltage (in kV), calculated based on the **Voltage Sensor Ratio** and **System Wiring** setpoints on the *Setup>General>Sensor Configuration>Voltage and Current* screen.

Current Flow Direction (var controls only)

When the control is properly set up and power is flowing through the circuit in the normal direction, this field displays “Normal.” If unusual circuit-switching conditions cause the direction of power flow to reverse, the value changes to “Reverse.” When the phase angle is outside the +/- 90 degree range, the control displays “Reverse” in the **Current Flow Direction** field and subtracts 180 degrees from the phase angle.

Reporting Values

This setting determines whether the power kVA, power kV, power kvars, and adjusted kvars are reported as **Single-Phase** or **Three-Phase** values. This setpoint affects both IntelliLink screens and DNP points. When reported as a **Three-Phase** value, the reported value is three times the measured or calculated **Single-Phase** value.

Base Component

This is the component or components the control measures and compares. For the **Fundamental RMS** setpoint, the control uses only the 60-Hz (or 50-Hz) component. Options are Fundamental RMS and Total RMS (Default: Fundamental RMS).

Voltage Override

This shows whether a **Voltage Override** condition is presently active.

Power kVA (var controls only)

This is the present kVA level measured at the current sensor.

Temperature

This is the present air temperature displayed in degrees Fahrenheit. The temperature sensor is located on the bottom of the control enclosure.

Power kW (var controls only)

This is the present kW level measured at the current sensor.

Neutral Sensor (True RMS)

When the control does not have neutral sensing installed, this field displays “n/a.” The **Neutral Sensing** alarm is based on the **Total RMS** value when the **Neutral Sensing Alarming** setpoint on the *Setup>General>Sensor Configuration>Neutral* screen is set to **Total RMS** mode.

Power kvars (var controls only)

This is the total kvar level measured at the current sensor, calculated as three times the single-phase kvars. This assumes a balanced three-phase system.

Neutral Sensor (Fundamental)

This is the fundamental (60-Hz) component of the neutral sensing value. Neutral sensing alarms on the **Fundamental** value when the **Neutral Sensing Alarming (Current or Voltage)** setpoint on the *Setup>General>Sensor Configuration>Neutral* screen is set to the **Fundamental** mode.

Power Factor (var controls only)

This is the power factor calculated as the cosine of the value in the **Corrected Phase Angle** field on the *Metering* screen. Lagging phase angles are represented as values between 0 and 90 degrees. Leading phase angles are represented as values between 0 and -90 degrees.

Reclose Block

After opening, the capacitor bank will not reclose for 5 minutes to allow the capacitors to discharge. When the reclose block is in effect, this field shows the time remaining before the bank can be switched in. The **Reclose Block** timer can be reset from the control's LCD screen when the **Reclose Block Reset** feature is set to the **Enabled** mode. See the *Setup>General>Site-Related>Operations* screen for more details.

Adjusted kvars (var controls only)

This is the three-phase kvar level (assuming a balanced three-phase system) used by the control when operating in **var** mode. This value is different from the measured three-phase kvars level when the bank is switched in and one of the following is true:

- The current sensor is on the source side of the bank and current flow is "Reversed."
- The current sensor is on the load side of the bank and current flow is "Normal."
- The control accounts for these conditions by subtracting the **3-Phase Bank Size** setpoint from the **Measured Three-Phase kvars** value.

Control Status

The **Control Status** field shows one of the following indications:

OKAY, when the control is functioning normally

ALARM, when an **Alarm** indicator on the *Diagnostics>Alarm* screen is active

WARNING, when a **Warning** indicator on the *Diagnostics>Warning* screen is active

ERROR, when an **Error** indicator on the *Diagnostics>Error* screen is active

MAINT MODE, when the IntelliCap 2000 control cannot function properly and an application program needs to be reloaded

SCADA Override: Enabled/Disabled

When the **SCADA Override** mode is in the **Enabled** state, the SCADA master station chooses the capacitor bank state and the voltage range in which the **SCADA Override** mode is active.

The master station communicates these parameters to the capacitor control. As long as the sensed voltage at the capacitor bank remains within the voltage range and the **SCADA Override** timer is active, the bank remains in the **SCADA Override** mode. When voltage goes outside of the specified range, the **Regular Voltage Override** mode controls the bank.

Note: The capacitor bank may not enter **SCADA Override** mode, even though the master station sends a **SCADA Override** command. This occurs when the control is already in **Voltage Override** mode or if switching would put the control into **Voltage Override** mode. If the voltage later returns to a level where switching is allowed and the **SCADA Override** mode is still active, the control remembers the **SCADA Override** command and switches the bank.

Related settings are located on the *Setup>Communications>SCADA Override* screen.

Software Versions

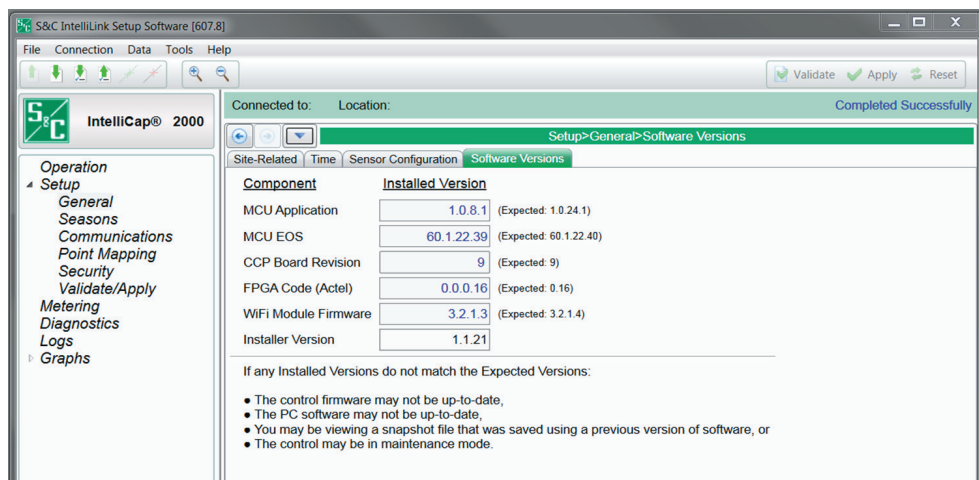


Figure 10. The Software Versions screen.

The *Software Versions* screen is updated whenever a software change occurs. The **Expected Value** field is stored in the IntelliLink software, and the **Revision Value** field is loaded from the connected IntelliCap 2000 Automatic Capacitor Control. See Figure 10.

The latest IntelliCap 2000 software revisions are available at the S&C Automation Customer Support Portal, which requires an assigned user name and password. Go to this link: <https://www.sandc.com/en/support/sc-customer-portal/>.

To obtain a password, S&C contact information is posted on the S&C Automation Customer Support Portal login page.

Site-Related Device Information

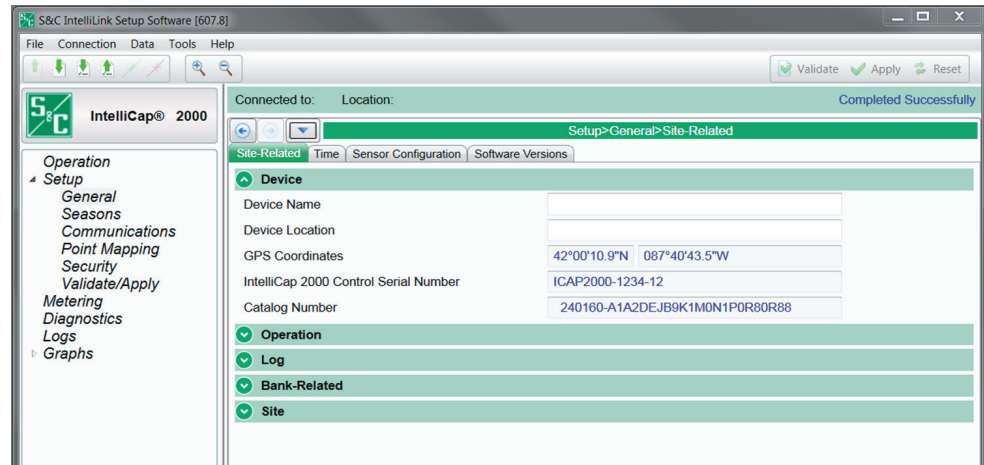


Figure 11. The *Site-Related Device* screen.

Device Section

Device Name

Enter a name for the IntelliCap 2000 control, up to 12 characters. This name is displayed at the top of the screen as “Connected to:”. See Figure 11.

Device Location

Enter a location for the IntelliCap 2000 control, up to 64 characters. This location is displayed at the top of the screen as “Location:”.

GPS Coordinates

The integrated global positioning system automatically displays location data.

IntelliCap 2000 Control Serial Number

The serial number is automatically displayed.

Catalog Number

The catalog number is automatically displayed.

Operation Section

Maximum Automatic Control Cycles Per Day

In **Automatic** mode, the bank can switch out this number of times during a calendar day; further switching is inhibited until the next calendar day. (Range: 0-255; Step: 1; Default: 4)

Capacitor Bank Switch Control Pulse Time

This is the amount of time the control output is energized whenever the bank is switched by the control in **Automatic** mode or by a software manual command. The pulse time is generally set to be equal to, or longer than, the switch manufacturer’s recommendation.

For motor-driven oil switches, a value of 7 seconds is typical. For vacuum-type switches, S&C recommends a value of 1 second (though the default value of 7 seconds will also work). For latching relays, select the **Latched** button to energize the control output continuously. (Range: 0.1-60.0; Step: 0.1; Default: 7.0)

Manual Operation Delay

This is the amount of time (in seconds) **Close** and **Open** operations from the faceplate are delayed. This allows the operator to step away from the bank. The operator can choose a delay from 1 to 300 seconds or disable the delay by clicking on the **Disabled** button. (Range: 1-300; Step: 1; Default: 30)

Reverse Current Strategy (var controls only)

This setpoint configures how the control responds to a detected reverse-current condition. A reverse-current condition exists if the current remains continuously in the reverse direction for longer than the **Reverse Current Time Threshold** setting. Once current flow returns to its normal direction, bank switching is based on the presently active control strategy. (Default: Adj, Var)

Possible options are:

Close & Inhibit—The control switches the bank online during a **Reverse Current** condition and inhibits further switching until the condition clears.

Adj. Var—During a **Reverse Current** condition, if the current sensor is on the normal source side, the control calculates the **Adjusted 3-Phase kvars** value by subtracting the **3-Phase Bank Size** setting from the **Measured 3-Phase kvars** value. See the *Setup>Site-Related* screen. If the current sensor is on the normal load side, the control uses the measured kvars.

Trip & Inhibit—The control switches the bank offline during a **Reverse Current** condition and inhibits further switching until the condition clears.

Voltage Only—During a **Reverse Current** condition, the control switches the bank based only on the presently active **Normal Voltage Override** setting and the **Emergency Voltage Override** setting. If any **Neutral Sensor** strategies are enabled, they remain in effect.

When the control is in one of the **Current** or **Var** control modes when the current reverses, the **Volt Only** logic takes precedence over the **High/Low Voltage Band Error** logic; if applicable, the **Temperature Override** strategy is also discontinued. When current flow returns to normal, the control returns to switching the bank based on its regular control strategy and the present conditions.

When the control is not in one of the **Current** or **Var** control modes when the current reverses, it uses the **High/Low Voltage Band Error** logic in effect.

Reverse Current Time Threshold (var controls only)

This is the amount of time the current must be continuously in the reverse direction for a **Reverse Current** condition to exist. For the condition to clear, the current must be continuously in the normal direction for this amount of time. (Range: 0-60; Step: 1; Default: 10)

Reverse Current Detection Level (var controls only)

This is the amount of current flow in the reverse direction required for the control to detect the **Reverse Current** condition. The current must persist at or above this level continuously for the **Reverse Current Time Threshold** setting before the control applies the **Reverse Current Strategy** mode. (Range: 1-10 Amps; Step: 1; Default : 6)

Nominal Operating Voltage

This is the nominal operating voltage (in Vac) for the distribution system. The IntelliLink software automatically scales all voltage setpoints to the proper operating range. The voltages available are 110, 115, 120, 127, 220, 230, and 240 Volts. The **System Transformer Ratio** setting on the *Setup>General>Sensor Configuration>Voltage and Current* screen represents the ratio of the line-to-ground primary nominal voltage to the **Nominal Operating Voltage** setting. (Default: 120)

Nominal Operating Frequency

This is the nominal operating frequency (in Hertz) for the distribution system. (Default: 60)

Temperature Readings Conversion

Configure this setting for the unit of temperature the control operates on and displays as °F or °C. (Default: °F)

Date Format Displayed on LCD

This setpoint changes the format of the date displayed on the LCD screen at the start of each scrolling sequence. The three options are MM/DD/YY, DD/MM/YY, and YY/MM/DD. (Default: MM/DD/YY)

Trip on Loss of Voltage

When invoked, this feature causes the control to trip the bank switches to the **Open** position whenever power is restored after a loss-of-voltage event. The minimum operation time is about 60 seconds. The feature has three settings: **Disabled** (default), **Trip Only**, and **Unconditional**. This feature is only active if the control is in the **Automatic** operation mode and no higher-precedence operation or contingency condition exists to countermand its operation.

Operation of this feature results in the signal being sent to trip open the bank switches. The control will then initiate a 300-second **Reclose Block** function to prevent reclose operations until the capacitors discharge. After the **Reclose Block** function expires, the control will re-evaluate line conditions, strategy, and possible contingency conditions. It will operate the bank according to the configured settings. (Default: Disabled)

Three configuration settings are available for this feature:

Disabled—This is the default setting. When the feature is disabled, upon power recovery after a loss-of-voltage event, the bank switch state is presumed to be in the same state it was in before the power loss. No action is taken upon power restoration unless indicated by strategy or other operation or contingency.

Trip Only—When the **Trip on Loss of Voltage** feature is configured to this setting, the control will automatically open the bank as soon as power is restored after a detected loss-of-voltage event. This operation will be superseded, inhibited, or countermanded by the following higher-precedence contingencies and operations, in order from highest to lowest:

- Voltage below the **Minimum Configured Bank Operation Voltage** condition
- SCADA Override, **Inhibit Automatic Operation** mode
- **Neutral Alarm Corrective Action** or **Automatic Operation Lockout** operations
- **Maximum Number of Daily Automatic Operations Reached or Exceeded** setting

The **Trip Only** operation will override the following lower-precedence operations or conditions, in order from highest to lowest:

- **Voltage Override** operation or **Voltage Inhibit** condition
- **SCADA Override, Bank Operation** command
- **Automatic Season Strategy** operation

Unconditional—This setting is used when the bank switching device is equipped with an automatic mechanism to trip open the bank switch on loss of voltage. When power is recovered after a detected loss-of-voltage event and this setting is configured, the control will unconditionally issue the signal to trip open the bank switch to keep the bank state, as presumed by the control, consistent with the state of the physical switches. The only exception to this rule is the overriding condition where the control is operating at a voltage below the **Minimum Configured Voltage for Automatic Operation** setting.

Reclose Block Reset

Opening the capacitor bank switch activates the **Reclose Block** function; the capacitor bank switch will not be allowed to reclose for the configured **Reclose Delay** setting (Range: 240 – 480 seconds; default: 300). This allows the capacitors to discharge. If the **Reclose Block** feature is in effect and the **Reclose Block Reset** function is set to **Enabled** mode, the **Reclose Delay** function can be reset through the LCD screen using front panel keys. (Default: Disabled)

When the **Reclose Block Reset** setting is set to **Enabled** mode, the LCD screen will display:

Reclose Blk: nnn

ENTER to Cancel

Note: nnn = time remaining

To cancel the **Reclose Delay** function, press the <Enter> key and use the +/- keys to change the number displayed to match the configured **Reclose Passcode** setting.

Reclose Passcode

This setting defines numeric code that will allow the **Reclose Block** function to be reset from the front panel. (Range: 0-9; Step: 1; Default: 5)

Reclose Delay

This setting determines the duration a reclose will be blocked after the bank has been opened. (Range: 240-480; Step: 1; Default: 300)

Reporting Values

This setting determines whether the **Power kVA**, **Power kV**, **Power kvars**, and **Adjusted kvars** values are reported as single-phase or three-phase measurements. This affects both IntelliLink screens and DNP points. When reported as three-phase measurements, the reported value is three times the measured or calculated **Single-Phase** value.

Log Section

Logging Level

The logging level selected determines the type of data log messages captured in the base memory module and displayed on the *Logs>Historic Events* screen. Every data log message is assigned a specific log level, as follows:

Normal:	User information (default)
Extended:	User information and internal status
All:	User information, internal status, and internal trace/debugging information

Duplicate Event Margin (milliseconds)

The storage of identical events in a short time period can flood the internal memory and does not yield useful diagnostic information. For events to be considered duplicates, every element of their event records must match. This setpoint selects the data that will be stored in the internal memory and displayed on the *Logs>Historic Logs* screen. It determines the time between logging duplicate events. It has no effect on an alternating sequence of events.

For example, the setpoint can be set to 10 ms. for a sequence of events ABABAB (where A and B are different), assuming the next event occurs 1 ms after the previous one. Though identical events occur within 2 ms—well within the value of the setpoint—all events will be logged. (Range: 0-30, Step: 1, Default: 10)

Time Average for Metering

This is the interval (in minutes) over which a reported parameter will be averaged and stored in the control and in compact flash memory. A smaller interval will result in more log entries. (Range: 0-120, Step: 1, Default: 15)

Bank-Related Section

Voltage Override Operation

In **Automatic** mode, the control will override the selected control strategy (**Temperature**, **Timeclock**, etc.) when a **High-Voltage or Low-Voltage** condition (or an **Emergency High-Voltage** condition or **Emergency Low-Voltage** condition) is present. A **High-Voltage** or **Low-Voltage** condition is present if the voltage level remains outside the

normal range for the user-specified period of time. Setpoints associated with each season's control strategy determine the range and period of time. The **Emergency High-Voltage** and **Emergency Low-Voltage** settings allow the bank to be switched more quickly during periods when the voltage is at a critical high or low level. For more information, see the *Setup>Seasons* screens and S&C Instruction Sheet 1024-530, "IntelliCap® 2000 Automatic Capacitor Control: *Setup*."

Note: This logic does not apply when either the **Automatic Offline** or **Automatic Online** control strategy is in effect.

After a **High-Voltage** condition, the control will return to **Normal** operation when the voltage stays below a value equal to the present season's **High-Voltage Override Value** setting minus the **Bank Voltage Change + Margin** setting for the duration of the present season's configured **High-Voltage Override Time** value. After a **Low-Voltage** condition, the control will return to normal operation when the voltage stays above a value equal to the present season's **Low-Voltage Override Value** setting plus the **Bank Voltage Change + Margin** setting (BVC+M) for the duration of the present season's configured **Low-Voltage Override Time** value.

The capacitor control also uses these override setpoints and the configured **Bank Voltage Change + Margin** setting to inhibit bank switching if it would cause a **Voltage Override** condition.

Emergency High-Voltage Override Value

This is the maximum voltage level before the capacitor control overrides the **Automatic** mode and switches the bank out to avoid an extreme high-voltage condition. The bank will be switched out if both of the following are true:

- The capacitor control is in any **Automatic** mode other than either the **Automatic Offline** or **Automatic Online** strategy
- The voltage stays above this level for the period of time specified by the configured **Emergency High-Voltage Override Time Threshold** setting

Configure the **Emergency High-Voltage Override** setting to a value higher than the **High-Voltage Override Value** setting on the *Setup>Seasons* screens for the selected control strategies. (Range: 0.0-400.0; Step: 0.1; Default: 130.0)

Note: The control counts a switching cycle when the bank switches out.

Emergency Low-Voltage Override Value

This is the minimum voltage level before the capacitor control overrides the **Automatic** mode and switches the bank in to avoid an extreme low-voltage condition. The bank will be switched in if both of the following are true:

- The capacitor control is in any **Automatic** mode other than either the **Automatic Offline** or **Automatic Online** strategy
- The voltage stays below this level for the period of time specified by the configured **Emergency Low Voltage Override Time Threshold** setting

Configure the **Emergency Low-Voltage Override** setting to a value less than the **Low-Voltage Override Value** setting on the *Setup>Seasons* screens for the selected control strategies. (Range: 0.0-400.0; Step: 0.1; Default: 110.0)

Emergency High-Voltage Override Time Threshold

This is the amount of time the voltage must be continuously above the **Emergency High-Voltage Override** setting before the bank switches out. Set this value to a time shorter than the **High Voltage Override Time** setting on the *Setup>Seasons* screens for the selected control strategies. (Range: 0.1-30.0; Step: 0.1; Default: 5.0)

Emergency Low-Voltage Override Time Threshold

This is the amount of time the voltage must be continuously below the **Emergency Low-Voltage Override** setpoint before the bank switches in. Set this value to a time shorter than the **Low Voltage Override Time** setting on the *Setup>Seasons* screens for the selected control strategies. (Range: 0.1-30.0; Step: 0.1; Default: 5.0)

High-/Low-Band Lockout Time Threshold

This is the number of days the control is allowed to operate before lockout after a **High-/Low-Voltage Band Error** state occurs. To reset the **Bank Voltage Change + Margin (BVC+M)** setting to the default value at midnight, set the value to reset at midnight: **Rst at Midnight**. (Range: 1-30; Step: 1; Default: 5)

High-/Low-Voltage Band Lockout Reset (Lockout Override)

The **High-/Low-Voltage Band Error** condition is set when the Bank Voltage Change + Margin (BVC+M) voltage exceeds the voltage difference of the season strategy **High-/Low-Voltage Override** settings. The **Control Status** field on the *Operation* screen shows an **Error** state. This error is reported on the *Diagnostics>Error* screen and the *Logs>Status Point Log* screen. The **Emergency High-/Low-Voltage Override** settings are used instead of the season overrides while the **High-/Low-Voltage Band Error** condition is active. When the condition persists continuously for the duration of the **High-/Low-Band Lockout Time Threshold** timer, the **Voltage Band Lockout Error** condition is set.

When the **High-/Low-Voltage Band Lockout** condition is set, automatic operation of the bank switch is inhibited, except to allow the bank switch to open for a high-voltage condition. This error is reported on the *Diagnostics>Error* screen and the *Logs>Status Point Log* screen. The **High-/Low-Voltage Band Lockout** condition is also set when either the **Emergency Voltage Override Time Threshold** setting is in the **Disabled** state or the **BVC+M** value is greater than the difference of the **Emergency High-/Low-Voltage Override** setpoints during a **High-/Low-Voltage Band Error** condition.

The **High-/Low-Voltage Band Error** condition will automatically clear if the **BVC+M** value is being automatically calculated and subsequent switch operations result in the calculated **BVC+M** value becoming less than the difference of the season strategy **High-/Low-Voltage Override** settings. The **High-/Low-Voltage Band Lockout** condition cannot be automatically cleared.

The season **High-/Low-Voltage Override** difference used is based on one of the following, depending on present settings:

- **Season High-/Low-Voltage Override** settings
- **SCADA Override High-/Low-Voltage Override** settings
- **Time-Biased Voltage Season Strategy, Timeclock Active, High-/Low-Voltage Override** settings
- **Time-Biased Voltage Season Strategy, Timeclock Inactive, High-/Low-Voltage Override** settings

High-/Low-Voltage Band Lockout Reset Delay Time

This setting allows reset of the **BVC+M** value in use to the estimated value and resets the Automatic Calculation buffer so normal operation resumes control of the bank after a High/Low Voltage Band Lockout occurred. When set to the **None** mode, the **BVC+M** value and the Automatic Calculation buffer will not be reset by this feature. (Range: None, 1-96; Step: 1; Default: None)

High/Low Voltage Band Lockout Reset Delay Time Units

This setting configures the time value. (Range: Minutes, Hours; Default: Hours)

Bank Voltage Change + Margin Operation

When the **Bank Voltage Change + Margin** setting is greater than the difference between the configured **High Voltage Override Value** setting and the configured **Low Voltage Override Value** setting for the present season, the control sets the **High/Low Voltage Band** error alarm. For more about configuring the **Bank Voltage Change + Margin** setting and the **Voltage Override** setting, see the “Voltage Override Operation” section on page 30.

When either of the **Emergency Voltage Override Time Threshold** settings is disabled, the control blocks further automatic operation of the capacitor bank except to open a closed bank during a **High Voltage** condition.

When both of the **Emergency Voltage Override Time** thresholds are enabled, the control uses the **Emergency Voltage Override** setpoints to define **Voltage Override** conditions and inhibit bank switching. The strategy for the present season remains in effect. The control returns to the **Normal Voltage Override** setpoints when the calculated Bank Voltage Change + Margin result is less than the difference between the **High-Voltage Override Value** setting and the **Low-Voltage Override Value** setting for the present season. However, if it becomes greater than the difference between the **Emergency Voltage Override** setpoints, the control blocks further automatic operation of the bank, except to open a closed bank during a **High-Voltage** condition.

For more information, see S&C Instruction Sheet 1024-540, “IntelliCap® 2000 Automatic Capacitor Control: *Operation*.”

Bank Voltage Change + Margin: Present Value In Use

This field shows the **Bank Voltage Change + Margin** value the control is using, whether estimated or calculated.

Note: When the control is installed, it uses the **Bank Voltage Change + Margin: Estimated Value** setting until four **Open/Close** operations have taken place. Any time you change the estimated value, the control uses that value until another four **Open/Close** operations have taken place. Therefore, make sure the correct **Bank Voltage Change + Margin: Estimated Value** setpoint is configured when the **Automatic Calculation** setting is used.

Bank Voltage Change + Margin: Estimated Value

This is an estimated average of the voltage change associated with the bank switching in or out, plus a small margin. Set this value to the average measured voltage change at the bank, plus 0.5 Volts or 25% (whichever is larger) for an operating margin. The control uses the **Bank Voltage Change + Margin** and the **Voltage Override** setpoints for the present season to inhibit bank switching if the voltage is close enough to a configured **Override Limit** setting that switching the bank would cause a **Voltage Override** condition. (Range: 0.5-25.4; Step: 0.1; Default: 1.5)

Bank Voltage Change + Margin: Automatic Calculation

When enabled, the control automatically calculates the **Voltage Change** and **Margin** values. The control uses the average change in voltage from the last four switching operations for the **Voltage Change** value and 25% of the average for the **Margin** value. The minimum for the **Margin** value is 0.5 Volts. (Default: Enabled)

When this feature is enabled, the control can account for any future feeder configuration changes that affect the **Voltage Change** value.

Capacitor Bank Switch Minimum Switching Voltage

The control will not operate the capacitor bank switch below this voltage. For motor-controlled switches, set this value as low as 100 Volts, on a 120-Vac base. For vacuum switches, do not set this value below 110 Volts, on a 120-Vac base, or the minimum value specified by the switch manufacturer to prevent switch damage during a brownout condition. (Range: 0.0-400.0; Step: 0.1; Default: 101.0)

Minimum Percentage of Average Delta Voltage

This setpoint compares the most recent change in voltage (Delta V) with the average Delta V for the previous four switching operations. When the most recent **Delta V** value is below this percentage of the average Delta V level, a bank switch malfunction may have occurred. This condition is logged on the *Logs>Historic Log* screen. See S&C Instruction Sheet 1024-540, "IntelliCap® 2000 Automatic Capacitor Control: *Operation*." (Range: 0-99; Step: 1; Default: 50)

This value may be decreased to allow a greater deviation in the **Delta V** value, or it may be increased when the **Delta V** value is very stable.

Minimum Percentage of Average Delta kvars (var controls only)

This setpoint compares the most recent change in kvars (Delta kvars) with the average Delta kvars for the previous four switching operations. When the most recent **Delta kvars** value is below this percentage of the average level, a bank switch malfunction may have occurred. This condition is logged on the *Logs>Historic Log* screen. See S&C Instruction Sheet 1024-540, “IntelliCap® 2000 Automatic Capacitor Control: *Operation*.” (Range: 0-99; Step: 1; Default: 70)

This value may be decreased to allow a greater deviation in the Delta kvars, or it may be increased when the **Delta kvars** value is very stable.

3-Phase Bank Size (kvars) (var controls only)

This is the size of the capacitor bank (in kvars) the control switches. Be sure to enter the correct value because this number may be used to calculate the **Adjusted Total kvars** value. (Range: 0-12,750; Step: 1; Default: 1,200)

Site Section

User Defined Input: Enable/Disable

The IntelliCap 2000 control has one **User Defined Input** setting. When enabled, the state of this input is displayed on the *Operation* screen, and the **Automatic** operation will respond to the active state of the input as determined by the **User Defined Input Response** setting. (Default: Disabled)

Digital Input 3 is connected to Input Terminal 2, and Terminal 1 is the return.

User Defined Input Label

The label for the **User Defined Input** setting may be any combination of up to 20 alphanumeric characters and dash “-” and underline “_” special characters. (Default: User Input)

User Defined Input Response

The **User Defined Input** setting can provide an alarm indication or it can affect control operation. The control will respond as follows to the selected response setting:

Do nothing—(default) When this response is selected, only the DNP status point and the indication on the *Operation* screen will respond to the input state. The input state is on when connected to a closed contact; otherwise, it's off. This is the default setting. This selection will also result in the **User Defined** status on the *Diagnostics>Warnings* screen becoming active.

Disable operation—When this response is selected, the DNP status point and the indication on the *Operation* screen will respond to the input state. The input state is on when connected to a closed contact; otherwise, it's off. When the input state is on, the bank will remain in whatever state—**Switched In** or **Switched Out**—it was in when the point became active. The control will enter an **Error** state that ceases all automatic/manual operations until the point becomes inactive. Issuing a **Clear Error** command on the *Diagnostics>Errors* screen or the **DNP Clear Errors** control point will not suspend this error. This selection will also result in the **User Defined** status on the *Diagnostics>Errors* screen becoming active.

Issue open and disable operation—When the **Operation Mode** setting is set to **Auto** mode, the DNP status point and the indication on the *Operation* screen will respond to the input state. The input state is on when connected to a closed contact; otherwise, it's off. When the input is on, the control will issue an **Open** command and will enter an **Error** state that ceases all automatic/manual operations until the point becomes inactive. Issuing a **Clear Error** command on the *Diagnostics>Errors* screen or from the **DNP Clear Errors** control point will not suspend this error. This selection will also result in the **User Defined** status on the *Diagnostics>Errors* screen becoming active.

When the **Operation Mode** setting is set to **Manual** mode, if this response is selected, the DNP status point and the indication on the *Operation* screen will respond to the input state. The input state is on when connected to a closed contact; otherwise, it's off. When the input is on, the control will not issue an **Open** command and will only enter an **Error** state that ceases all automatic/manual operations until the point becomes inactive. When the **User Defined Input** indicator goes off, the error will automatically clear and automatic/manual operation will be allowed to resume. Issuing a **Clear Error** command on the *Diagnostics>Errors* screen or from the **DNP Clear Errors** control point will not suspend this error. This selection will also result in the **User Defined** status on the *Diagnostics>Errors* screen becoming active.

Issue close and disable operation—When the **Operation Mode** setting is set to **Auto** mode, if this response is selected, the DNP status point and the indication on the *Operation* screen will respond to the input state. The input state is on when connected to a closed contact; otherwise, it's off. When the input is on, the control will issue a **Close** command, and the control will enter an **Error** state that ceases all automatic/manual operations until the point becomes inactive. Issuing a **Clear Error** command on the *Diagnostics>Errors* screen or from the **DNP Clear Errors** control point will not suspend this error. This selection will also result in the **User Defined** status on the *Diagnostics>Errors* screen becoming active.

When the **Operation Mode** setting is set to **Manual** mode, if this response is selected, the DNP status point and the indication on the *Operation* screen will respond to the input state. The input state is on when connected to a closed contact; otherwise, it's off. When the input is on, the control will not issue a **Close** command and the control will only enter an **Error** state that ceases all automatic/manual operations until the point becomes inactive. When the **User Defined Input** status goes off, the error will automatically clear and automatic/manual operation will be allowed to resume. Issuing a **Clear Error** command on the *Diagnostics>Errors* screen or from the **DNP Clear Errors** control point will not suspend this error. This selection will also result in the **User Defined** status on the *Diagnostics>Errors* screen becoming active.

Manual Override of User Input Response

When set to **Disabled manual** mode, the IntelliLink software and SCADA commands will be blocked whenever automatic operation has been set to the **Disabled** state by the **User Defined Input** status. When set to **Enabled Manual** mode, the IntelliLink software and SCADA commands will be allowed, with no modification to operational criteria, when automatic operation has been set to the **Disabled** mode by the **User Defined Input** status. (Default: Enabled)

Door Position Sensor

When the control has an optional door position sensor, set this to **Installed** mode. (Default: Not Installed)

Digital Switch Position Inputs

When the capacitor switch provides position indication, set this to **Enabled** mode. (Default: Disabled)

Digital Switch Inconsistent Position Inconsistent

When the switch position indicators report both a **Closed** status and an **Open** status or they report neither **Closed** nor **Open** status—which can occur in the case of a damaged switch or incorrect input wiring—one of these automatic responses can be configured to determine the action of the control:

Disable All Automatic Operations—When this response is selected and an inconsistent position is detected, the bank will remain in whatever state—**Switched In** or **Switched Out**—that it was in. The control will enter an **Error** state that ceases all automatic operations until the condition is corrected and the error is cleared. The **Inconsistent Position** status on the *Diagnostics>Errors* screen also becomes active.

Issue Open and Disable All Automatic Operations—When this response is selected and an inconsistent position is detected, the control will issue an **Open** command and will enter an **Error** state that ceases all automatic operations until the condition is corrected and the error is cleared. The **Inconsistent Position** status on the *Diagnostics>Errors* screen also becomes active. This condition does not block manual operation from the front panel, IntelliLink software commands, or SCADA commands.

Issue Close and Disable All Automatic Operations—When this response is selected and an inconsistent position is detected, the control will issue a **Close** command and will enter an **Error** state that ceases all automatic operations until the condition is corrected and the error is cleared. The **Inconsistent Position** status on the *Diagnostics>Errors* screen also becomes active. This condition does not block manual operation from the front panel, IntelliLink software commands, or SCADA commands.

Default to Last Bank Command—(default) When this response is selected, the control will disregard the position response and show the **Last Bank Command** status as the bank position. Automatic operation will remain unchanged. The **Inconsistent Position** status on the *Diagnostics>Errors* screen also becomes active.

Digital Switch Contradictory Position Response

A contradictory position response occurs when the **Switch Position** status does not agree with the **Last Bank Command** status. This can occur after a power cycle or when the capacitor bank can be manually operated independently of the control. One of the following automatic responses can be configured to determine the action of the control:

Do Nothing—(default) When this response is selected, the control operates based on the **Last Bank Command** status. The **Contradictory Position** status on the *Diagnostics>Warnings* screen becomes active when a contradictory position is detected and resets when the condition is corrected.

Disable All Automatic Operations—When this response is selected, the bank will remain in whatever state—**Switched In** or **Switched Out**—it is in when the problem occurs. The control will enter an **Error** state that ceases all automatic operations until the condition is corrected and the error is cleared. Issuing a **Clear Error** command from the *Diagnostics>Errors* screen or from the **DNP Clear Errors** control point will suspend this error until the next bank operation. When the **Last Bank Command** status and the digital switch positions do not agree, the **Error** state is issued and the **Contradictory Position** status on the *Diagnostics>Errors* screen becomes active. This condition does not block manual operation from the front panel by an IntelliLink software command or SCADA command.

Issue Command to Input State—When selected, the control automatically issues a command to the input state. If a **Close** command is required, the control starts the **Reclose Block Timer** function and delays the command until the timer expires. If there is an active **Emergency Override** condition, the control automatically meets the override requirements. After issuing the command, the control resumes **Automatic** operation and follows the active strategies or overrides. The **Contradictory Position** status on the *Diagnostics>Warnings* screen also becomes active when a contradictory position is detected and automatically resets when the condition is corrected.

Diagnostics Alarms

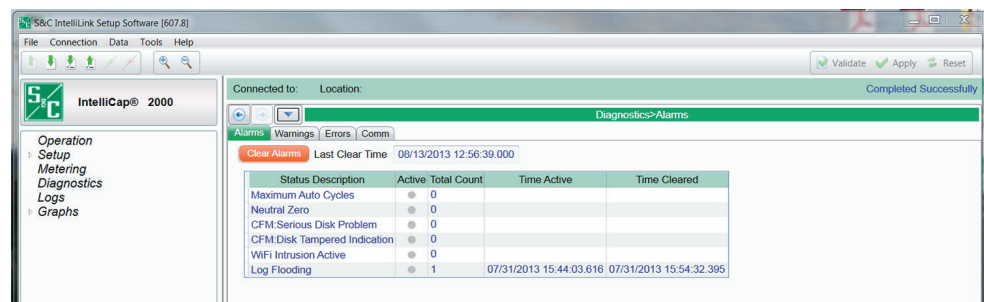


Figure 12. The *Diagnostics>Alarms* screen.

This screen shows the status of a number of alarms. See Figure 12 and Table 2 on page 39.

Clear Alarms

Clicking on the **Clear Alarms** button will attempt to clear all the **Alarm** conditions. When the condition persists, the alarm will reappear.

Last Clear Time

The timestamp indicates the last time the **Clear Alarms** command was performed. If counters have not been recently cleared, they may not accurately represent present performance.

Table 2. Alarm Messages

Status Description	Active When	Clear When	Impact
Log Flooding	One or more events have stopped being recorded because they were flooding the log by generating 1,000 or more entries in a 2-second time period	No events have stopped being recorded because they were flooding the log	No impact
Maximum Auto Cycle ^①	The control reached the Maximum Automatic Control Cycles Per Day setpoint (Further automatic switching is inhibited until the next calendar day.)	The next calendar day occurs	Prevents lower precedence operations
Neutral Zero	For controls with neutral current sensing, the Neutral Zero alarm indicates the control detected zero neutral current for the duration of the Zero Neutral Current Detection setpoint For controls with neutral voltage sensing, the Neutral Zero alarm indicates the control detected zero neutral voltage for the length of the Zero Neutral Voltage Detection setpoint	Neutral current is no longer zero	No impact
CFM: Serious Disk Problem	Problem with compact flash memory	No problem with compact flash memory.	No impact
CFM Disk Tampered Indication ^②	Compact flash directory contents corruption was detected on startup	Compact flash directory contents corruption was not detected on startup	No impact
Wi-Fi Intrusion Active	An attempted access by an unauthorized user activated the Wi-Fi Intrusion alarm	The Wi-Fi intrusion is cleared	No impact

① If the control reaches this limit frequently, make sure the setpoints are set appropriately for this capacitor bank.

② Restarting the control may correct this condition.

Diagnostics Warnings

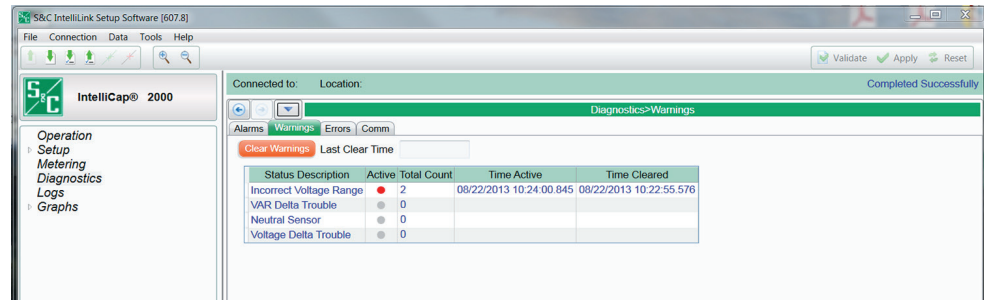


Figure 13. The *Diagnostics>Warnings* screen.

This screen shows the status of a number of warnings. See Figure 13 and Table 3 on page 41.

Clear Warnings

Clicking on the **Clear Warnings** button will attempt to clear all the **Warning** conditions. When the condition persists, the alarm will reappear.

Last Clear Time

The timestamp indicates the last time the **Clear Warnings** command was performed. If counters have not been recently cleared, they may not accurately represent present performance.

Note: Warnings do not prevent bank operation.

Table 3. Warning Messages

Status Description	Active When	Clear When	Impact
Voltage Delta Trouble Low Switching Voltage ^①	The actual change in voltage levels during switching is below the minimum percentage of the expected change	Voltage levels during switching are above the minimum percentage of the expected change	No impact
Incorrect Voltage Range ^②	The voltage is not within +/-15% of the nominal voltage	The voltage is within +/-15% of the nominal voltage	No impact
VAR Delta Trouble Low Switching kvars Delta ^③	The actual change in kvar levels during switching is below the minimum percentage of the expected change	The kvar levels during switching are above the minimum percentage of the expected change	No impact
Neutral Sensor	The neutral current/voltage remains above the Neutral Current/Voltage Alarm Level setpoint for a period of time specified by the Neutral Current/Voltage Change Time Threshold setpoint	The neutral current/voltage falls below the Neutral Current/Voltage Alarm Level setpoint after retries (if retries have been enabled)	No impact
User Defined Input	The User Defined Input Response setting is set to the Do Nothing state and the User Defined Input is connected to a closed contact	Otherwise, Off	No impact
Inconsistent Bank Position	This warning is active when the response for the Digital Switch Position Inconsistent setpoint is set to the Default to Last Bank Command state and an inconsistent position response occurs (See the "Digital Switch Inconsistent Position Response" section in the <i>Setup>General>Site-Related</i> help text page for more details.)	Otherwise, Off	No impact
Contradictory Bank Position	The Response Contradicts Last Bank Command setpoint is set to the Do Nothing or Issue Command to Input State setting and a contradictory position response occurs (See the "Digital Switch Contradictory Position Response" section in the <i>Setup>General>Site-Related</i> help text page for more details.)	Otherwise, Off	No impact

^① The **Minimum Percentage of Average Delta Voltage** setpoint is on the *Setup>General>Site-Related>Bank-Related* screen.

^② Make sure the **Nominal Operating Voltage** setpoint on the *Setup>General>Site-Related>Operation* screen is set correctly.

^③ The **Minimum Percentage of Average Delta kvars** setpoint is on the *Setup>General>Site-Related>Bank-Related* screen.

Diagnostics Errors

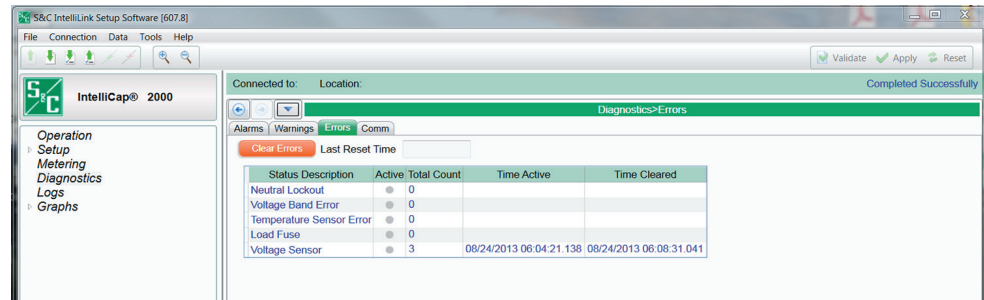


Figure 14. The *Diagnostics>Errors* screen.

This screen shows the status of a number of errors. See Figure 14 and Table 4 on page 43.

Clear Errors

This button clears error statistics and enters a timestamp in the **Last Reset Time** and **Time Cleared** fields. When the condition persists, the error reappears.

Last Reset Time

The timestamp indicates the last time the **Clear Errors** command was performed. If counters have not been recently cleared, they may not accurately represent present performance.

Table 4. Error Messages

Status Description	Active When	Clear When	Impact
Temperature Sensor	The sensor or sensor readings are outside the valid operating range (-40° F to 150° F or -45° C to 66° C)	The sensor is operating within the valid operating range	Temperature strategies are changed to the Voltage Only setting
Load Fuse ^①	The fuse mounted on the faceplate is blown	The fuse is normal	Operation prevented
Neutral Lockout ^②	There is a Neutral Current or Neutral Voltage alarm that the control could not clear	All neutral voltage alarms are cleared	Prevents lower precedence operations
Voltage Band Error ^③	The Bank Voltage Change + Margin average value is greater than the difference between the High-Voltage Override Value setting and the Low-Voltage Override Value setting for the present season	The average value is within the difference	Prevents lower precedence operations
User Defined Input	The User Defined Input Response setting is set to the Disable Operation, Issue Open and Disable Operation or Issue Close and Disable Operation mode and the User Defined Input is connected to a closed contact	Otherwise, Off	Prevents lower precedence operations
Inconsistent Bank Position	The Response for Digital Switch Position Inconsistent setting is set to the Disable All Automatic Operation, Issue Open and Disable All Automatic Operation , or Issue Close and Disable All Automatic Operation mode and an inconsistent position response occurs (See the "Digital Switch Inconsistent Position Response" section on the <i>Setup > General > Site-Related</i> screen for more details.)	Otherwise, Off	Prevents lower precedence operations
Contradictory Bank Position	The Response Contradicts Last Bank Command setting is set to the Disable All Automatic Operation mode and a contradictory position response occurs (See the "Digital Switch Contradictory Position Response" section on the <i>Setup > General > Site-Related</i> screen for more details.)	Otherwise, Off	Prevents lower precedence operations
Voltage Sensor	The sensor or sensor readings are outside the valid operating range (45 to 300 Volts)	The sensor is operating within its valid operating range	No impact

① This means there is a problem with the wiring to the capacitor switches or with the capacitor switches themselves.

② The bank remains in the **Locked Out** state until the alarm is reset.

③ The **Bank Voltage Change + Margin** settings are on the *Setup > General > Site-Related > Bank-Related* screen.

Automatic Operation Order of Precedence

Reasons for determining the **Automatic Operation** state are listed in order of precedence, from highest to lowest:

1. Load fuse blown error●
2. Voltage below minimum configured **Bank Operation Voltage** condition●
3. Trip on loss of voltage (**Trip Unconditional** option)■
4. Emergency high-voltage override■
5. User defined error▲
6. Inconsistent bank position error▲
7. Contradictory bank position error▲
8. SCADA override, **Inhibit Automatic** operation●
9. Neutral alarm corrective action or automatic operation lockout■
10. Maximum number of daily automatic operations reached or exceeded●
11. Trip on loss of voltage (**Trip Only** option)
12. Voltage band lockout error●
13. Voltage override operation■ or **Voltage Inhibit** condition●
14. SCADA override, **Bank Operation** command■
15. Automatic **Season Strategy** operation■

● Bank operation is prevented.

■ Bank will change state.

▲ Depending on the user configuration, bank will change state.

Diagnostics Comm



List	Count
Transport Function Receive List	1
Transport Function Transmit List	0
Application Layer Message List	2
Peer Device List	1
Special Function List	42
URBE Function List	0
Binary Input Point List	216
Analog Input Point List	126
Counter Input Point List	16
Control Input Point List	56
Analog Output Point List	16
Binary Event List	0
Analog Event List	0
Counter Event List	0
Route Table List	0

Figure 15. The *Diagnostics > Comm* screen.

DNP Counts

This screen section shows diagnostic information about DNP communications-related buffers. See Figure 15.

Transport Function Receive List

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

Transport Function Transmit List

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

Application Layer Message List

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

Peer Device List

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

Special Function List

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

URBE Function List

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

Binary Input Point List

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

Analog Input Point List

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

Counter Input Point List

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

Control Output Point List

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

Analog Output Point List

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

Binary Event List

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

Analog Event List

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

Counter Event List

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

Route Table List

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

Metering

Connected to: Location: Completed Successfully

Primary Metering Data

Measurement Base Component	Fundamental RMS	1-Phase Current	0.0 A
Line Voltage	0.0 V	Corr. Phase Angle	90.00 Degree
Line-To-Ground Voltage	0.0 kV	Reporting Values	Three-Phase
Temperature	77.0 °F	Power kVARs	0.0
Last Switch-In	N/A	Power kW	0.0
Last Switch-Out	N/A	Uncorr. Phase Angle	0.00 Degree
Current Flow Direction	Normal	Power Factor	0.000 IEEE
Neutral Sensor	0.0 A	Power kVA	0.0
Neutral Sensing Alarm	Fundamental RMS	Power Harmonics Frequency	60

Harmonics Data

	Voltage Harmonics	Neutral Harmonics	Current Harmonics
Total RMS	0.0 V	0.0 A	0.0 A
Fund. RMS	0.0 V	0.0 A	0.0 A
THD%	0.0 %	0.0 %	0.0 %
3rd%	0.0 %	0.0 %	0.0 %
5th%	0.0 %	0.0 %	0.0 %
7th%	0.0 %	0.0 %	0.0 %
9th%	0.0 %	0.0 %	0.0 %
11th%	0.0 %	0.0 %	0.0 %
13th%	0.0 %	0.0 %	0.0 %
15th%	0.0 %	0.0 %	0.0 %
17th%	0.0 %	0.0 %	0.0 %
19th%	0.0 %	0.0 %	0.0 %

DNP, local address: 65432, RTU: self | Serial port: COM4, baud rate: 57600 | Timeout: 5000(default) | Retries: 2 | Refresh Mode: Auto, at 1000ms. | 10:47:09 AM [Once] [Stop] [R/W]

Figure 16. The Metering screen.

Primary Metering Data

All values are time-averaged and reported locally and via SCADA on a one-second interval. See Figure 16.

Measurement Base Component

This is the component or components of the voltage and current waveforms the control measures and compares. When the **Fundamental** setpoint value is used, the control uses only the 60-Hz (or 50-Hz) component.

Line Voltage (Volts Ac)

This is the present, measured voltage at the capacitor control on the nominal voltage base (for example, 120 Vac). The control software uses this value in calculating kvars.

Line-to-Ground Voltage (kV)

This is the present, calculated distribution line voltage based on the measured **Line Voltage** setting and the specified **Voltage Transformer Ratio** and **Voltage Transformer Wiring** settings. The control uses this value in making all power calculations.

Temperature

This is the present air temperature displayed as degrees Fahrenheit. The temperature sensor is located on the bottom of the control enclosure.

Last Switch-In Last Switch-Out

These fields show the reason for the last **Switch-In** and **Switch-Out** operation, for example, “Timeclock” or “Hardware Manual.”

Current Flow Direction (var controls only)

When the control is properly set up and power is flowing through the circuit in the normal direction, this field displays “Normal.” When unusual circuit-switching conditions cause the direction of power flow to reverse, the value changes to “Reverse.”

Neutral Sensor

Both current and voltage-neutral sensing options are available. Check the “-N” option suffix in the control catalog number with the Neutral Sensing Input Options table found in S&C Specification Bulletin 1024-31: “IntelliCap® 2000 Automatic Capacitor Control: *Specifications.*”

Neutral Sensor (Current)

For controls with neutral current sensing, this is the present level of neutral current (in RMS amperes) measured by the neutral current sensor.

Neutral Sensor (Voltage)

For controls with neutral voltage sensing, this is the present level of neutral voltage (in RMS Volts) measured by the neutral voltage sensor.

Neutral Sensing Alarm

Both current and voltage neutral sensing options are available. Check the “-N” option suffix in the control catalog number with the Neutral Sensing Input Options table found in S&C Specification Bulletin 1024-31: “IntelliCap® 2000 Automatic Capacitor Control: *Specifications.*”

Neutral Sensing Alarm (Current)

This indicates whether the control is alarming on the “Fundamental RMS” or the “Total RMS” component.

Neutral Sensing Alarm (Voltage)

This field indicates whether the control is alarming on the “Fundamental RMS” or the “Total RMS” component.

1-Phase Current (Amps) (var controls only)

This is the current, measured by the current sensor and scaled using **Single-Phase Current Sensor Ratio** setting.

To compensate for a permanent change in the power-flow direction, add 180 degrees to the **Installation Phase Offset** setpoint. This will eliminate a **Reverse** condition indication.

Corrected Phase Angle (Deg.) (var controls only)

This is the corrected phase angle. The raw, uncorrected phase angle as measured by the control is modified by the configured **Voltage Sensor Phase Shift Correction** and **Phase Angle Offset** setpoints. This value represents the single-phase phase shift of the current waveform referenced to the voltage. The angle is represented as a positive or negative displacement from zero, in eighths of a degree increments, with reference to the geometric unit circle. (Range: -180 to +180 degrees; Step: one-eighth degree)

When active power is being delivered, a lagging current will be represented as a positive phase angle between 0 and 90 degrees. Leading current is represented as a negative phase angle value between 0 and -90 degrees.

When active power is being received, a leading current is represented as a positive phase angle between 90 and 180 degrees. A lagging current is represented as a negative phase angle value between -90 and -180 degrees. See Figure 17.

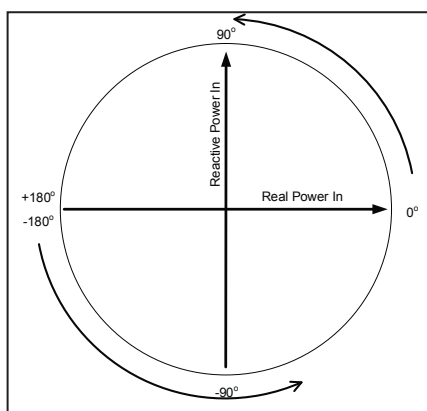


Figure 17. The Corrected Phase Angle with reference to the geometric unit circle.

Power kvars (var controls only)

This is the reactive power, expressed in kvar, calculated from the measured voltage, current, and phase angle at the location of the current sensor. This value will be reported either as the calculated single-phase reactive power or reported as the extrapolated three-phase value, three times the single-phase kvars, presuming a balanced three-phase system, depending on the user-configured setting: **Report Power Calculation Values as**.

Power kW (var controls only)

This is the active power, expressed in kW, calculated from the measured voltage, current, and phase angle at the location of the current sensor. This value will be reported either as the calculated single-phase active power or reported as the extrapolated three-phase value, three times the single-phase kvars, presuming a balanced three-phase system, depending on the user-configured setting: **Report Power Calculation Values as**.

Uncorrected Phase Angle (Degrees) (var controls only)

This is the phase angle, the offset of the current waveform referenced to the voltage, as measured by the control, before any configured setup correction factors have been applied. The angle is represented as a positive displacement from zero, in eighths of a degree increments, with reference to the geometric unit circle, ranging from 0 to 360 degrees. See Figure 18.

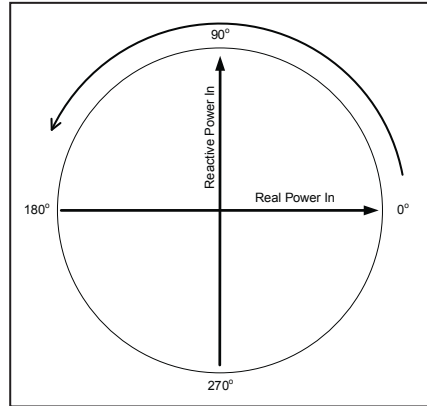


Figure 18. The Uncorrected Phase Angle with reference to the geometric unit circle.

Power Factor (var controls only)

This is the power factor, a dimensionless value, calculated as the ratio of active power to apparent power and reported according to the configured Power Factor Sign Convention, either the IEC or IEEE, which is displayed following the value. The calculation is based on the cosine of the value in the **Corrected Phase Angle** field.

Power kVA (var controls only)

This is the present kVA level measured at the location of the current sensor.

Power Harmonics Frequency (var controls only)

This is the normal frequency in use.

Harmonics Data Section

The capacitor control continually calculates the first (fundamental) and all odd harmonics from the first to the 31st, as well as total harmonic distortion (THD). THD and individual harmonic percentages can be calculated using one of two methods. See the **THD Formula** setpoint.

The user-configured logging interval can be set from one minute to 120 minutes. The last 96 records are preserved in flash memory, and the total time represented by these records is a function of the logging interval. For voltage, neutral current or voltage, and phase current, all present harmonics from first through 31st are displayed on the *Metering* screen. The harmonic data are logged as follows:

Voltage:	Odd harmonics first through 23rd harmonic
Neutral Current/Voltage:	Odd harmonics first through 9th harmonic
Phase Current:	Odd harmonics first through 19th harmonic

Voltage Harmonics

This is the most recently calculated harmonics for the single-phase voltage powering the control.

Neutral Harmonics (Controls with Neutral Sensing only)

This is the most recently calculated harmonics for the neutral current or neutral voltage where the neutral sensor is installed.

Current Harmonics (var controls only)

This is the most recently calculated harmonics for the single-phase current where the current sensor is installed.

THD Formula

Choose how THD and individual harmonic percentages are calculated with this setpoint. The **IEEE** setting relates THD and all harmonics to the **Fundamental** value; the **IEC** setting uses the **Total RMS** value.

Note: Using the IEEE method may result in large percentages or “****” (which indicates a number greater than the numeric range of the control) being recorded in the neutral sensor harmonics data logging. This indicates the fundamental component of the neutral sensor value is small compared to its harmonic components.

Historic Log

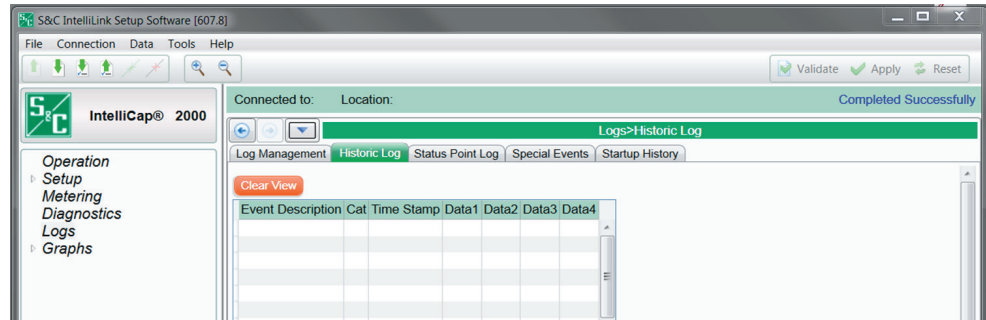


Figure 19. The **Logs>Historic Log** screen.

This screen displays the Historic log, a subset of the Historic Event log. This is a chronological event list, filtered based on the criteria specified on the *Logs>Log Management* screen. In **Real-Time View** mode, when the log is full, each new event overwrites the oldest event in the log. The Historic log does not show the entire Historic Event log, which is stored in flash memory. Flash memory files can be downloaded by opening the **Tools** drop-down menu and then clicking on the **Compact Flash Access** entry. See Figure 19.

Clear View

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

Event Description

Refer to S&C Instruction Sheet 1024-561, “IntelliCap® 2000 Automatic Capacitor Control: *Data Log Messages*,” for the definition of each event description.

Category

To simplify filtering and sorting, each historic event is assigned to a category. Refer to S&C Instruction Sheet 1024-561, “IntelliCap® 2000 Automatic Capacitor Control: *Data Log Messages*,” for a complete list of categories.

Timestamp

This is the date and time of the event occurrence, based on the active time-source setting on the *Setup>General>Time* screen.

Data 1, Data 2, Data 3, Data 4

Each event message, in conjunction with the **Data 1** through **Data 4** code, describes the event and action(s) taken. If an event message refers only to Data 1, any value(s) in the other data columns are for diagnostic use by S&C Electric Company.

Status Point Log

Connected to: Location: Completed Successfully

Log Management | Historic Log | **Status Point Log** | Special Events | Startup History

Reset Current Count Last Reset Time

Status Description	Status	Total Count	Current Count	Time Active	Time Cleared
Alarm Condition	●	1	1	07/31/2013 15:44:03.616	07/31/2013 15:54:32.395
Warning Condition	●	2	2	08/22/2013 10:24:00.846	08/22/2013 10:22:55.577
Log Flooding	●	1	1	07/31/2013 15:44:03.616	07/31/2013 15:54:32.381
Voltage Delta Trouble	●	0	0		
VAR Delta Trouble	●	0	0		
Switch Open	●	2	2	07/31/2013 11:43:13.870	08/27/2013 08:08:28.975
Switch Closed	●	2	2	08/27/2013 08:08:29.676	07/31/2013 11:43:13.169
Voltage Band Lockout	●	0	0		
Voltage Band Error	●	0	0		
Voltage Sensor	●	3	3	08/24/2013 06:04:21.114	08/24/2013 06:08:31.036
Maximum Auto Cycles	●	0	0		
Neutral Sensor	●	0	0		
Neutral Lockout	●	0	0		
Neutral Zero	●	0	0		
Reclose Delay	●	2	2	07/31/2013 11:43:13.169	07/31/2013 11:48:17.629
Auto Mode	●	8	8	08/28/2013 14:59:10.549	08/20/2013 15:04:50.700
Load Fuse	●	0	0		
Incorrect Voltage Range	●	2	2	08/22/2013 10:24:00.812	08/22/2013 10:22:55.527
Temperature Sensor Error	●	0	0		
Reverse Current	●	0	0		
Scada override enable	●	4	4	08/13/2013 08:39:12.757	08/13/2013 12:57:23.463
Over Voltage	●	4	4	08/13/2013 16:21:53.109	08/14/2013 02:24:05.784
Under Voltage	●	2	2	08/22/2013 10:24:05.225	08/22/2013 10:23:56.089
Emergency Voltage	●	2	2	08/22/2013 10:24:05.124	08/22/2013 10:22:54.833
Temperature System	●	0	0		
Neutral sensor option	●	0	0		
Neutral sensor config	●	1	1	07/30/2013 10:35:32.642	07/30/2013 11:13:14.113

Snapshot: C:\VM\IC 2000 V1.12.vvm Refresh Mode: Auto, at 1000ms Refresh: 2:18:39 PM Refresh: R/W

Figure 20. The Status Point Log screen.

This screen indicates whether a status point is presently active or inactive, how many times it has been active, when it last became active, and when it last became inactive. See Figure 20.

Two historic events are associated with each status point in the Historic Event log—when the status point became active and when it became inactive. For example, if a status point has been active 100 times and is active now, 199 related events are included in the Historic Event log—100 for the status point becoming active, and 99 for the status point becoming inactive.

The *Logs>Status Point Log* screen is a convenience; this information is also available in the Historic Event log.

Reset Current Count

This resets the Current Count total.

Last Reset Time

This is the date and time the Current Count total was reset.

Status Description

Refer to S&C Instruction Sheet 1024-560, "IntelliCap® 2000 Automatic Capacitor Control: *DNP Points List and Implementation*," for the definition of each status point.

Status

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

Total Count

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

Current Count

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

Time Active

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

Time Cleared

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

Special Events Log

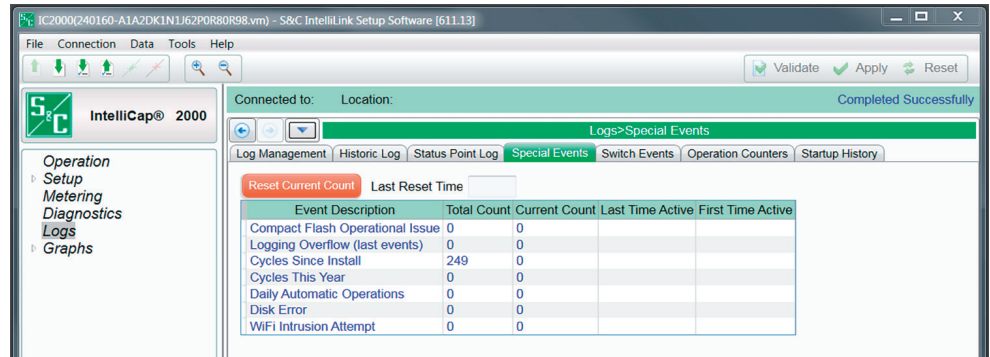


Figure 21. The Special Events screen.

Some historic events are special events, such as when a flash memory failure will adversely affect operation. This screen indicates how many times each special event has occurred, the last time it occurred, and the last time it cleared. See Figure 21.

Reset Current Count

Resets the Current Count totals.

Last Reset Time

This is the date and time the Current Count totals were reset.

Event Description

Refer to S&C Instruction Sheet 1024-561, “IntelliCap® 2000 Automatic Capacitor Control: Data Log Messages,” for the definition of each event description.

Total Count

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

Current Count

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

Last Time Active

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

First Time Active

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

Startup History Log

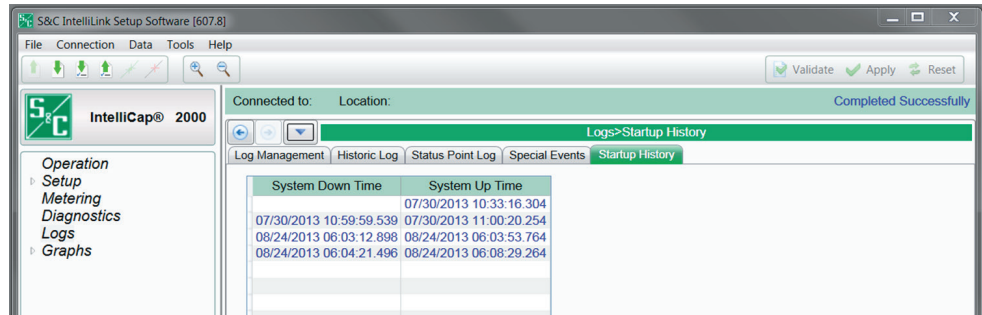


Figure 22. The Startup History screen.

This screen tracks the dates and times the system started and stopped, in ascending chronological order. See Figure 22.

System Down Time

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

System Up Time

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