Setup

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Qualified Persons

⚠ WARNING

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

A qualified person is one who is trained and competent in:

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

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

Read this Instruction Sheet

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating the S&C IntelliCap Plus Automatic Capacitor Control. Familiarize yourself with the Safety Information on page 4 and Safety Precautions on page 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 your S&C IntelliCap Plus Automatic Capacitor Control. Designate a location where you can easily retrieve and refer to this publication.

Proper Application

⚠ WARNING

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

Special Warranty Provisions

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

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels attached to the S&C IntelliCap Plus 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 your nearest S&C Sales Office or S&C Authorized Distributor. Their telephone numbers are listed on S&C's website **sandc.com**, or call S&C Headquarters at (773) 338-1000; in Canada, call S&C Electric Canada Ltd. at (416) 249-9171.

NOTICE

Read this instruction sheet thoroughly and carefully before installing or operating your S&C IntelliCap Plus Automatic Capacitor Control.

Replacement Instructions and Labels

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

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

⚠ DANGER

The S&C IntelliCap Plus 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 the IntelliCap Plus Automatic Capacitor Control must be restricted only to Qualified Persons.

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 AND TAGS. Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "*NOTICE*" labels and tags. 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 Plus software: **PCSD126S** and **PCVD126S**.

Software identification is on the IntelliLink® Setup Software *Product Information* screen. For questions regarding the applicability of information in this instruction sheet to future product releases, please contact S&C Electric Company.

⚠ WARNING

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.

⚠ 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.

The S&C IntelliCap Plus Automatic Capacitor Control is connected to switchgear operating at primary voltage levels. High voltage may be present in the wiring to the switch control or the switch control itself during certain failures of the switchgear wiring or grounding system, or because of a failure of the switch itself. For this reason, access to the switch 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 switch control.

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

Using the LCD Screen for Setup

The IntelliCap Plus control includes a two-line LCD screen that shows information about the control and the capacitor bank. When the control is operating normally and no alarms are active, the top line reads ***UNIT OK***; the bottom line scrolls through real-time data and setpoint values for the present season. When an alarm is active, the top line reads ***ACTIVE ALARMS***; scroll through information on the bottom line to find the active alarm(s). See the "Faceplate LCD" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*," for more information.

Table 1 on page 7 summarizes the functions of the faceplate keypad buttons. If any of the buttons are pressed when the LCD reads ***UNIT OK*** or ***ACTIVE ALARMS***, the top line displays ***MENU***. Scroll through and select any of these menu options on the bottom line:

- ***DATA***—Use this entry to scroll through real-time data and present setpoint values.
- ***SETUP***—Use this entry to change the control's setpoint values. Password protection can be enabled to limit access to faceplate setup. See the "Faceplate Setpoint Adjustment" section on page 39.
- ***ALARMS***—Use this entry to scroll through the alarm list to determine whether any alarms are active.

Table 1. Faceplate Keypad Button Functions

Button	Function
NEXT	Scrolls forward through data, menu, and setpoint choices
PREV	Scrolls backward through data, menu, and setpoint choices
ENTER	Selects menu choice or setpoint value, and accepts value change
ESC	Cancels a setpoint change or returns the LCD to the previous menu level
+	Increases a blinking setpoint value
–	Decreases a blinking setpoint value

To enter **Setup** mode, press the ENTER button while the LCD screen displays ***SETUP***. The LCD display then shows ***Season 1***. Press the NEXT button to scroll through the setup choices: ***Season 1***, ***Season 2***, ***Season 3***, ***Season 4***, ***General***, ***Site-Related***, ***Neutral Sensor***, and ***SCADA Override***. Press the ENTER button to display the first setpoint for that selection.

To change a setpoint value, press the ENTER button again; the value will blink. Use the **+** or **–** button to increase or decrease the value. Press the ENTER button to accept the new value or the ESC button to cancel the change. To display the next setpoint, press the NEXT button. Repeat the process for each setpoint value that should be changed.

If ***Season 1***, ***Season 2***, ***Season 3***, or ***Season 4*** is selected, the first setpoint shown on the LCD screen is ***Start Month***. If a season has not been set up already, setting the ***Start Month***, ***Start Day***, and ***Auto*** (automatic control strategy) is required before changing any other setpoints for the season. The control automatically calculates the **End Month** and **End Day** values. There is no need to enter all season setpoints before changing ***General***, ***Site-Related***, ***Neutral Sensor***, or ***SCADA Override*** setpoint values.

IntelliLink® Setup Software

This section provides an introduction to the IntelliLink software and how to install and use it on a computer.

The following equipment is required for using IntelliLink software to set up the capacitor control:

Note: Although it is possible use the faceplate buttons and LCD screen for the initial setup of the control, using the IntelliLink software makes the process faster. Use the faceplate buttons later to make adjustments without a computer.

- **Laptop Computer—**The computer must be transportable to the control installation site and must include:
  - Microsoft Windows 7 or later operating system
  - Microsoft Internet Explorer, version 5.0 or higher
  - 32 MB of RAM
  - A serial communications port
- **Serial Communications Cable—**This cable is used to connect the serial port on the computer to a communications port on the control. The cable should be long enough to reach comfortably from the control to the computer after the control is installed at the site. It must be a straight-through cable, not a null-modem cable.

For the faceplate LOCAL COMM PORT, use an RS232 serial cable with a DB9-pin plug connector at one end (to plug into the port on the control) and a connector at the other end that fits the serial port on the computer.

- **Setup Software—**Software for the computer is available at the S&C Automation Customer Support Portal. If assistance is required, call (888) 762-1100, which accesses the S&C Global Monitoring Support Center.

  Note: Make sure to have the correct software for this capacitor control. When IntelliLink software is installed on a computer, a dialog box will appear if the correct software is not installed. Connecting to a control without the proper software installed on a computer will not harm the control or the computer.

Installing IntelliLink Software

Follow these steps to install the IntelliLink software on a computer:

STEP 1. Go to the S&C Automation Customer Support Portal. Obtain a password by contacting S&C Electric Company. The Portal is located at this link: **sandc.com/en/support/sc-customer-portal/**.

STEP 2. Open the "IntelliCap Plus DNP" workspace and download the software installer. The latest version is highlighted in yellow.

STEP 3. Move the software installer from the download folder and save it on the desktop.

STEP 4. Right click and select "Run as administrator." Administrative privileges are required to install S&C Software on a computer.

STEP 5. Follow the installation instructions. The Installer guides the user through the software-installation process.

Starting IntelliLink Software

These steps show how to start the IntelliLink software when working with the setpoints or stored data in the IntelliCap Plus control. To edit a snapshot (virtual memory file) or simply view the software without data, see the "Using Snapshots (VM Files)" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Controls: *Operation*."

NOTICE

If using a two-wire, ungrounded extension cord to power either the computer or the capacitor control while they are connected, the serial port on the computer may be damaged. Always use a grounded, three-wire extension cord or battery power.

STEP 1. Connect the computer to the control. Plug one end of the communications cable into the serial port on the computer. Then, attach the other end to the local communications port on the capacitor control.

STEP 2. Double-click the **IntelliLink** icon in the open EnergyLine folder on the Windows desktop. If the EnergyLine folder is not open, open the **Windows Start** menu, the click Start>Programs>EnergyLine>IntelliLink to start the software.

STEP 3. Wait while the EnergyLine logo appears and the IntelliLink software attempts to open communications with the capacitor control.

When the IntelliLink software establishes communications with the control, the *Operation* screen opens. See Figure 1 on page 9. The control software can now be set up. Users also can view and save the live data in the control, load settings into the control, and perform maintenance and troubleshooting.

Note: If the IntelliLink software does not establish communications with a functioning capacitor control, it displays the dialog box shown in Figure 2 on page 9.

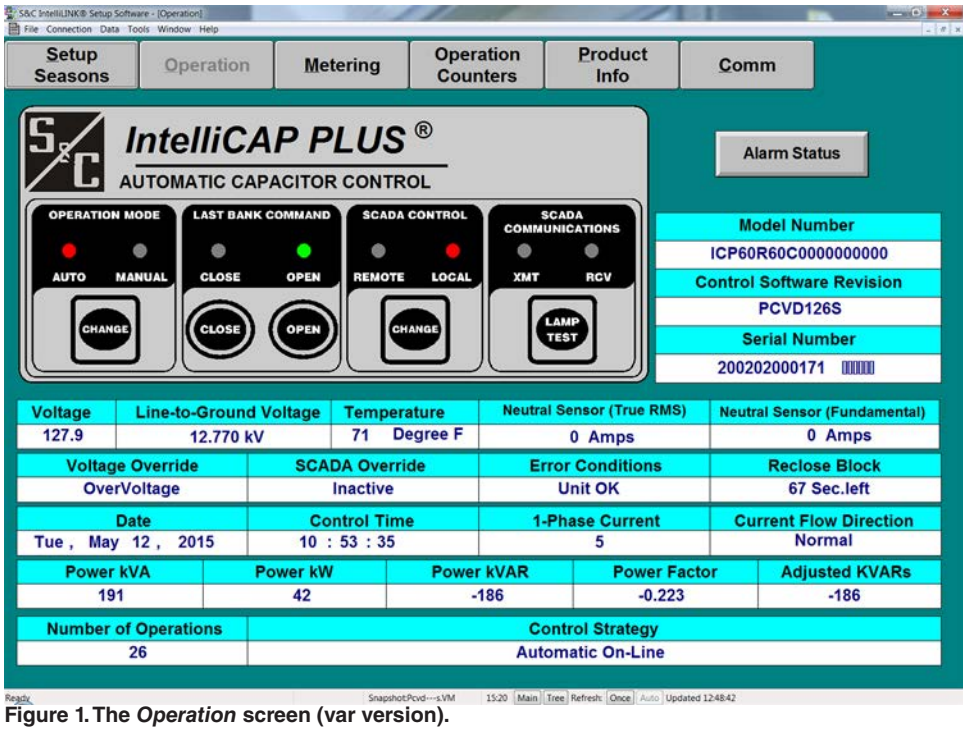


Figure 1. The *Operation* screen (var version).

If this dialog box is displayed, or if the *Operation* screen opens but the software does not operate properly, see the "Software Troubleshooting and Error Messages" section in Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Controls: *Troubleshooting*."

Figure 2. This dialog box indicates the computer could not connect to control.

IntelliLink Screens

IntelliLink software includes screens and dialog boxes that enable setting up the control for proper operation, viewing data, and troubleshooting control problems.

To access the top level screens, click the corresponding button in any IntelliLink screen.

Follow these instructions to jump to any screen directly:

STEP 1. In the menu bar, click on the **Window** entry and then click on the **Show Tree** entry.

STEP 2. Double click on the name of the screen to be viewed. If necessary, first click on the "**+**" to reveal the names of lower level screens.

Note: The exact appearance and content of the IntelliLink screens depend on which version of the software is installed. The screen arrangements shown in this document apply to all IntelliLink versions for the IntelliCap Plus capacitor controls, except where noted.

Follow these steps to change data values on an IntelliLink screen:

STEP 1. Move the mouse cursor onto the value field to be changed. When the cursor changes to a double-arrow, click on the left mouse button to open the Change Value dialog box.

STEP 2. If the dialog box accepts typed input, use the keyboard to enter the new value. If the dialog box does not accept typed input, click the Up or Down arrow to move through the value range, or click on the radio button for the desired value.

STEP 3. Click on the **OK** button to record the new value, or click on the **Cancel** button to exit the dialog box without changing the original value.

STEP 4. Repeat this process for each value to be added or changed.

STEP 5. To view help text for all the fields on a screen, press the <F1> key.

Menu Tree for Standard Controls

This is the menu of screens for non-var IntelliCap controls:

OPERATION

- Alarm Status

SETUP SEASONS

- Temperature Strategy
- Time-Biased Temperature Strategy
- Timeclock Strategy
- Timeclock with Temperature Override Strategy
- Voltage Only Strategy
- Time-Biased Voltage Strategy
- SETUP: General [4 pages]
- SETUP: Neutral Sensor
- SETUP: SCADA Override

METERING

OPERATION COUNTERS

PRODUCT INFO

COMMUNICATIONS

- Communication Setup [2 pages]
- Communication Troubleshooting [DNP Version]

Menu Tree for Var Controls

This is the menu of screens for IntelliCap with Var controls:

OPERATION

- Alarm Status

SETUP SEASONS

- Temperature Strategy
- Time-Biased Temperature Strategy
- Timeclock Strategy
- Timeclock with Temperature Override Strategy
- Voltage Only Strategy
- Time-Biased Voltage Strategy
- Current Strategy
- Current with Temperature Override Strategy
- VAR Strategy
- VAR with Temperature Override Strategy

- SETUP: General [4 pages]
- SETUP: Neutral Sensor
- SETUP: SCADA Override

METERING

OPERATION COUNTERS

PRODUCT INFO

COMMUNICATIONS

- Communication Setup [2 pages]
- Communication Troubleshooting [DNP Version]

Setup for Normal Operation

Follow these steps to set up the capacitor control for normal operations:

STEP 1. Connect the computer to the control and start the IntelliLink software as described in the "Starting IntelliLink Software" section on page 8.

STEP 2. Enter the setup parameters for this particular control starting at the "Seasons Setup" section below.

STEP 3. Disconnect the computer from the control.

STEP 4. Use the faceplate buttons to set the desired operating mode, as described in the "Enabling Normal Operation" section on page 62.

The values entered on the setup screens depend on the electrical distribution system and details specific to each individual capacitor bank.

When communication is established between the IntelliLink software and the capacitor control, the *Operation* screen opens. Enter the setup information for this control. There are two ways to do this:

- Follow the steps in this section to enter all the required values for this control.
- Load the contents of a CFG file, which was saved from a snapshot or another control, into this control. Then, make any adjustments needed for this control. For details, see the "Load a Saved Configuration into a capacitor Control" section in Instruction Sheet 1023-540, "S&C IntelliCap Plus Automatic Capacitor Control: *Operation*."

Seasons Setup

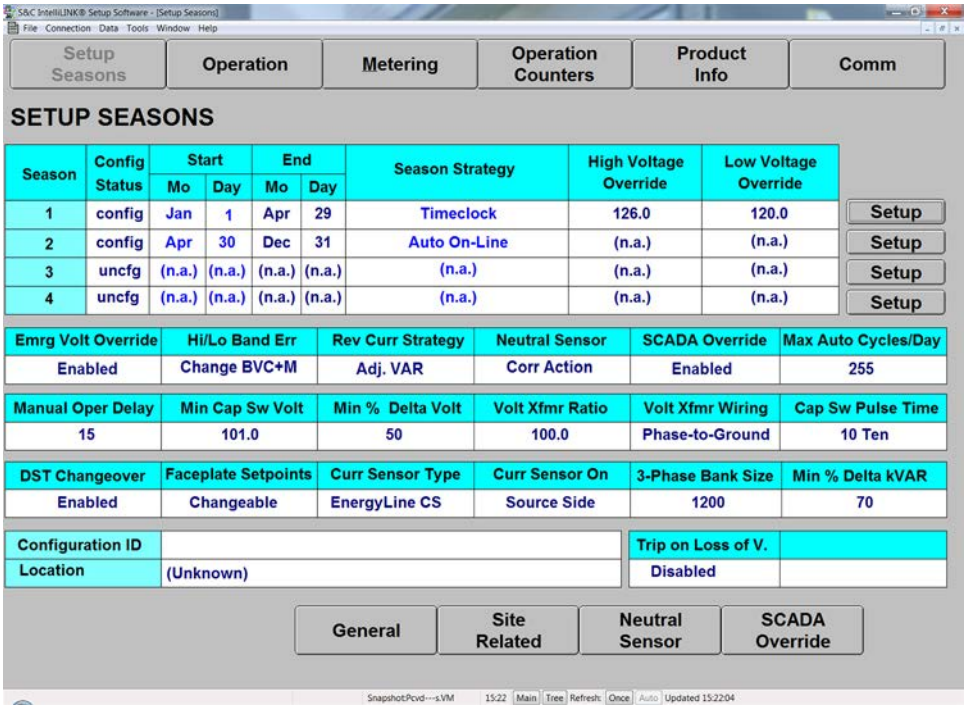


Figure 3. The *Setup Seasons* screen for var control with neutral current sensor.

At the *Operation* screen, click on the **Setup Seasons** button. The upper part of the *Setup Seasons* screen accommodates setting the control strategy and dates for each season. See Figure 3.

Season

This column shows the number for each season. If this control uses the same control strategy all year, enter the values in Season 1.

Config Status

This column shows whether the setpoints for the season (Start Mo, Start Day, and Season Strategy) have been configured.

Start (month and day)
End (month and day)

These columns show the start and end dates for the season. When a start date is entered, the control automatically calculates the end date based on start dates for other seasons. Select a control strategy to complete the auto-calculation process. Selecting the **Reset** button changes Season 1 to the default values and clears the other seasons. For correct operation, the seasons must not overlap.

Season Strategy

This column enables selection of the the control strategy used for the season when the capacitor control is in **Automatic** mode. After selecting a strategy, click on the **Setup** button at the end of the row to make any adjustments to the default setpoint values for that season.

Possible control strategies are:

- **Temperature—**The bank is switched in or out based on the ambient temperature. See the "Temperature Strategy" section on page 15.
- **Time-Biased Temperature—**The bank is switched in or out based on **High-** and **Low-Temperature** setpoints during timeclock-scheduled periods. During unscheduled periods, the bank is switched to the **Out** state. See the "Time-Biased Temperature Strategy" section on page 17.
- **Timeclock—**The bank is switched in or out based on a time schedule. See the "Timeclock Strategy" section on page 19.
- **Timeclock with Temperature Override—**The bank is switched in or out based on a time schedule, and changes to switching based on temperature during **High-** and/or **Low-Temperature** conditions. See the "Timeclock with Temperature Override Strategy" section on page 20.
- **Voltage Only—**The bank is switched in or out based on the **High-** and **Low-Voltage Override** setpoints and the preferred capacitor bank position. See the "Voltage Only Strategy" section on page 22.
- **Time-Biased Voltage—**The bank is switched in or out based on **High-** and **Low-Voltage** setpoints for two different timeclock schedules. See the "Time-Biased Voltage Strategy" section on page 24.
- **Automatic Offline—**The bank is always switched to the **Out** state when the control is in **Automatic** mode. The control does not even switch the bank for a **Low-Voltage** condition. If the bank is switched to the **Online** state in **Manual** mode, the control switches it back to the **Offline** state when it returns to **Automatic** mode, after the 60-second safety delay.
- **Automatic Online—**The bank is always switched to the **Online** state when the control is in **Automatic** mode. The control does not even switch the bank for a **High-Voltage** condition. If the bank is switched to the **Offline** state in **Manual** mode, the control switches it back to the **Online** mode when it returns to **Automatic** mode, after the reclose block.

For var capacitor controls, four additional control strategies are available:

- **Current—**The bank is switched in or out based on measured single-phase current flow. See the "Current Strategy (var controls only)" section on page 25.
- **Current with Temperature Override—**The bank is switched in or out based on measured single-phase current flow and changes to switching based on temperature during **High-** and/or **Low-Temperature** conditions. See the "Current with Temperature-Override Strategy (var controls only)" section on page 27.
- **Var—**The bank is switched in or out based on three-phase kvars, kilovolt-amperes reactive calculated as 3 times the single-phase kvars. See the "Var Strategy (var controls only)" section on page 29.
- **Var with Temperature Override—**The bank is switched in or out based on three-phase kvars, kilovolt-amperes reactive calculated as 3 times the single-phase kvars, and changes to switching based on temperature during **High-** and/or **Low-Temperature** conditions. See the "Var with Temperature-Override Strategy (var controls only)" section on page 31.

High Voltage Override
Low Voltage Override

These columns show the value of the **High-Voltage Override** and the **Low-Voltage Override** setpoints for the season. These setpoints are entered on the *Setup* screen for the selected control strategy.

Setup Button

This button opens the screen for this season's strategy, where changes can be made to the setpoint values, if needed.

The lower part of the screen displays key setpoints from other *Setup* screens. For a full explanation, see the description for the screen listed. Any differences in meaning for the summary field are noted here.

From Page 1 of the *Setup: General* screen (page 33)

- **Emrg Volt Override—**This field shows "Enabled" when the value for one or both of the **Emergency Voltage Override Time** setpoints is greater than zero.
- **Hi-/Lo-Band Err—**This field shows which strategy the control will use (**Change BVC+M** or **Control Lockout** strategy) if the **High-/Low-Voltage Band Error** condition becomes active.
- **Rev Curr Option—**This field is for var controls only.

From Page 2 of the *Setup>General* screen

- **Max Auto Cycles/Day**
- **Manual Oper Delay**
- **Min Cap Sw Volt**
- **Min% Delta Volt**
- **Cap Sw Pulse Time**
- **Faceplate Setpoints**
- **Min% Delta kVAR—**This field is for var controls only.
- **Data Log Interval—**This field is for non-var controls only.
- **Location**

From Page 3 of the *Setup>General* screen

- **DST Changeover**
- **Configuration ID**

From the *Setup>Site-Related* screen – var controls only (page 42)

- **Volt Xfmr Ratio**
- **Volt Xfmr Wiring**
- **Curr Sensor Type**
- **Curr Sensor On**
- **3-Phase Bank Size**

From the *Setup>Neutral Sensor* screen (page 47)

- **Neutral Sensor—**This field shows whether the control will attempt "Corrective Action" and/or "Retry" following a Neutral Current or Neutral Voltage alarm. "Retry" indicates either 1 or 2 retries.

From the *Setup>SCADA Override* screen (page 52)

- **SCADA Override**

Set-up information is only required for the control strategy(ies) selected. Follow these steps to set up the seasons:

STEP 1. Click on the **Setup** button for Season 1.

STEP 2. Enter all required configuration information.

STEP 3. Click on the **Setup Seasons** button to return to the *Setup>Seasons* screen.

STEP 4. Repeat Steps 1-3 for the other configured seasons.

- For the **Temperature Strategy**, see page 15.
- For the **Time-Biased Temperature Strategy**, see page 17.
- For the **Timeclock Strategy**, see page 19.
- For the **Timeclock with Temperature Override Strategy**, see page 20.
- For the **Voltage Only Strategy**, see page 22.
- For the **Time-Biased Voltage Strategy**, see page 24.
- For the **Current Strategy**, see page 25.
- For the **Current with Temperature-Override Strategy**, see page 27.
- For the **Var Strategy**, see page 29.
- For the **Var with Temperature-Override Strategy**, see page 31.

Note: No further setup is required for the **Automatic Offline** or **Automatic Online** strategy.

Temperature Strategy

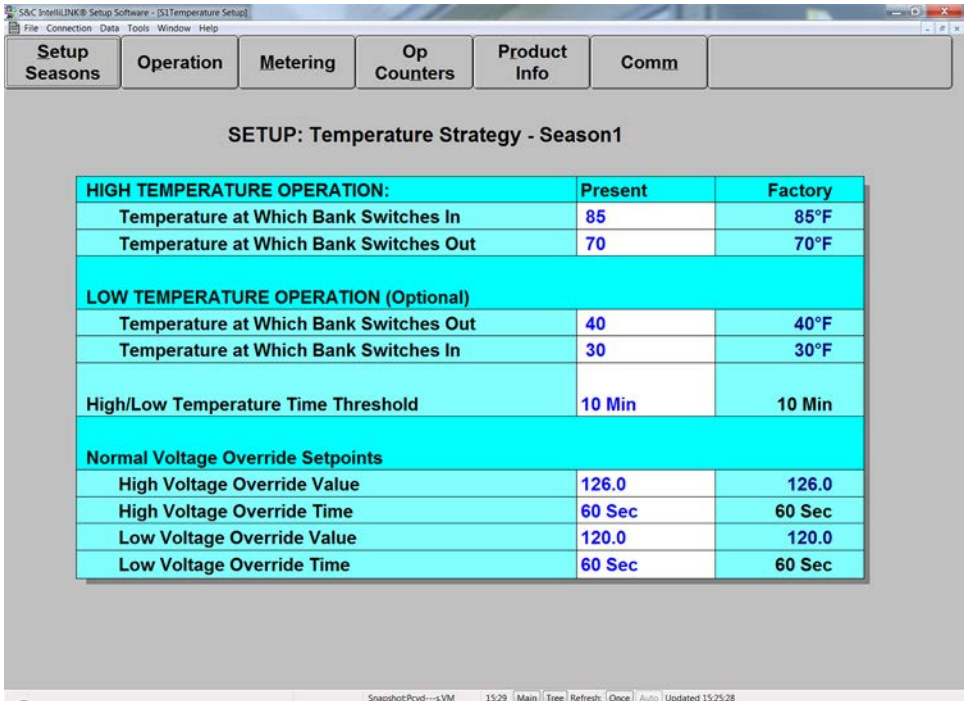


Figure 4. The *Setup: Temperature Strategy* screen.

To open the *Setup: Temperature Strategy* screen: on the *Operation* screen, click on the **Setup Seasons** button, and select Temperature strategy for Season 1. Click on the **Setup** button at the right of Season 1. This screen contains the setpoints used in **Temperature Control** mode. See Figure 4. The difference between the **Switch-In** and **Switch-Out Temperature** setpoints should be at least 8° F (5° C). To disable **High-/Low-Temperature** mode, set the **Switch-In** and **Switch-Out** setpoints to the **N/A** state. For more details, see the "Temperature Control Strategy" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Temperature Strategy - Season 1* screen includes the following fields:

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during high-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch in.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during high-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during low-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during low-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch in.

High-/Low-Temperature Time Threshold

This is the amount of time the temperature must be continuously outside the normal temperature range before a switching operation occurs.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Change + Margin Operation" section on page 35.

High-Voltage Override Value

This is the maximum voltage level before the capacitor control overrides **Automatic** mode and switches the bank out to avoid a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High Voltage Override Time** setpoint.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setting before the bank switches out.

Low-Voltage Override Value

This is the minimum voltage level before the capacitor control overrides **Automatic** mode and switches the bank in to avoid a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint described on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setting before the bank switches in.

Time-Biased Temperature Strategy

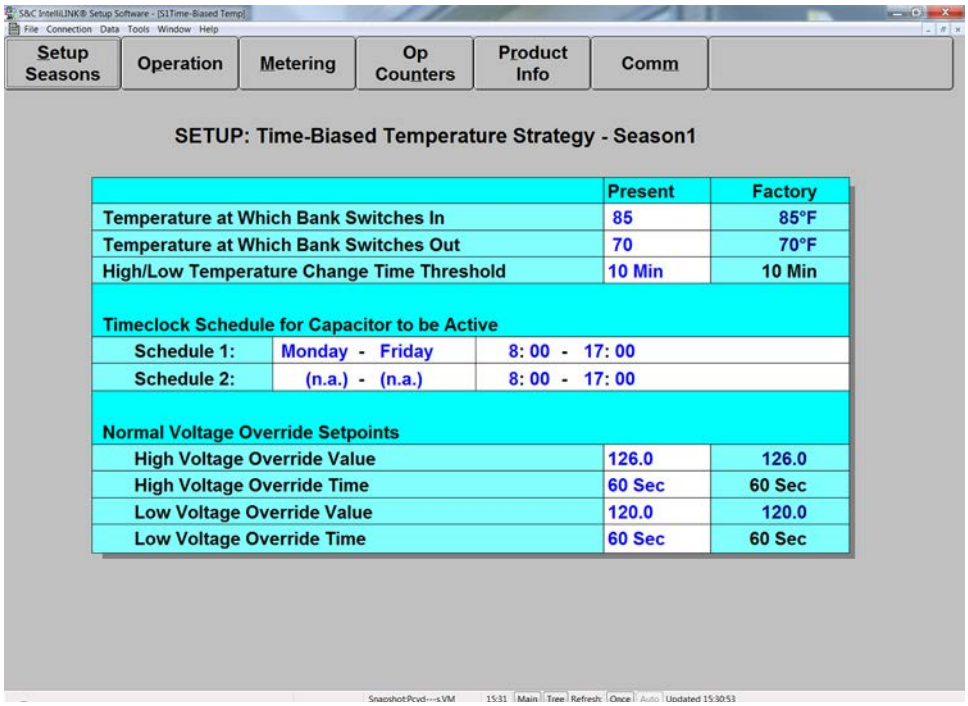


Figure 5. The *Setup: Time-Biased Temperature Strategy* screen.

To open the *Setup: Time-Biased Temperature Strategy* screen: at the top of any screen, click on the **Setup Seasons** button, and select the Time-Biased Temperature Strategy for Season 1. Then, click on the **Setup** button at the right of Season 1. See Figure 5. When the control is in **Time-Biased Temperature** mode, it switches the bank according to the schedule and temperature setpoints on this screen. The bank is offline during unscheduled periods. For more details, see the "Time-Biased Temperature Control Strategy" section in Instruction Sheet 1023-540, S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Time-Biased Temperature Strategy - Season 1* screen includes the following fields:

Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during scheduled periods. The temperature must stay above this value for the period of time specified by the **Temperature-Change Time Threshold** setting before the bank will switch in.

Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during scheduled periods. The temperature must be below this value for the period of time specified by the **Temperature-Change Time Threshold** setting before the bank will switch out.

Temperature Change Time Threshold

This is the amount of time the temperature must be continuously outside the normal temperature range before a switching operation occurs.

Timeclock Schedules

These schedules are used in the Time-Biased Temperature strategy to determine when the bank is to be active. Each schedule is specified as a day range and hour range. The day range must be specified as a starting day followed by an ending day. Sunday is the first day of the week.

For example, if a schedule is active on all 7 days of the week, enter it as Sunday– Saturday, not as Saturday–Sunday.

The time is specified as a range between a starting and ending time on the same day. As with the day range, the chronologically first time must come first. The time is entered in military format (i.e., 5:00 p.m. is entered as 17:00).

Up to two schedules may be specified. The bank will be active if the present time falls within either of the schedules.

Normal-Voltage Override Setpoints

For details on voltage-override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Change + Margin Operation" section on page 35.

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 a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setting.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setting before the bank switches out.

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 a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setting.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint described on Page 2 of the *Setup: General* screen.

Low Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setting before the bank switches in.

Timeclock Strategy

Figure 6. The *Setup: Timeclock Strategy* screen.

To open the *Setup: Timeclock Strategy* screen: on any screen, click on the **Setup Seasons** button, and select Timeclock Strategy for Season 1. Then, click on the **Setup** button at the right of Season 1. When the control is operating in **Timeclock** mode, the setpoints on this screen determine which days of the year and which hours of the day the bank is active. See Figure 6. For more details, see the "Timeclock Control Strategy" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Timeclock Strategy - Season 1* screen includes the following fields:

Timeclock Schedules

These schedules are used in the Timeclock strategy to determine when the bank is active. Each schedule is specified as a day range and hour range. The day range must be specified as a starting day followed by an ending day. Sunday is the first day of the week.

For example, if a schedule is to be active on all 7 days of the week, enter it as Sunday–Saturday, not as Saturday–Sunday.

The time is specified as a range between a starting and ending time on the same day. As with the day range, the chronologically first time must come first. The time is entered in military format (i.e., 5:00 p.m. is entered as 17:00).

Up to two schedules may be specified. The bank will be active if the present time falls within either of the schedules.

Normal-Voltage Override Setpoints

For details on voltage-override operation, see the "Voltage Override Operation" section on page 33, and the "Bank Voltage Change + Margin Operation" section on page 35.

High-Voltage Override Value

This is the maximum voltage level before the control overrides the **Automatic** mode and switches the bank out to avoid a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setpoint.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setpoint before the bank switches out.

Low-Voltage Override Value

This is the minimum voltage level before the control overrides the **Automatic** mode and switches the bank in to avoid a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank does not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint described on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setting before the bank switches in.

Timeclock with Temperature-Override Strategy

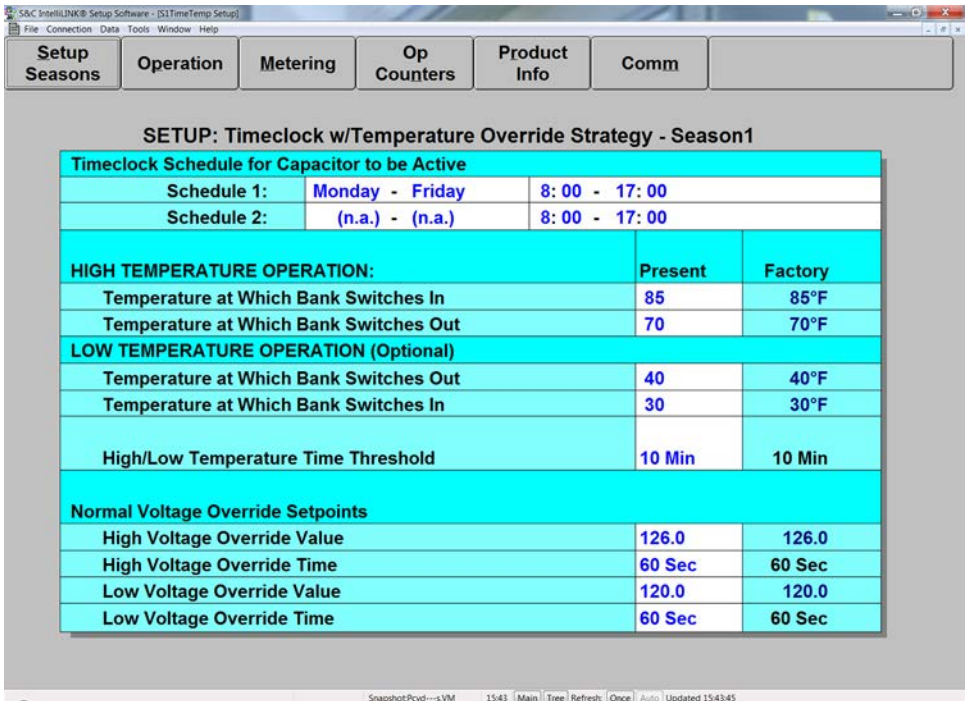


Figure 7. The *Setup: Timeclock with Temperature Override Strategy* screen.

To open the *Setup: Timeclock with Temperature Override Strategy* screen: on any screen, click on the **Setup Seasons** button, and select the Timeclock with Temperature Override strategy for Season 1. Then, click on the **Setup** button at the right of Season 1. If the control is operating in **Timeclock with Temperature Override** mode, the setpoints on this screen determine which days of the year and which hours of the day the bank is active. See Figure 7.

The control changes to switching based on temperature when the ambient temperature exceeds the **High-Temperature Operation: Temperature at Which Bank Switches In** setpoint or drops below the **Low-Temperature Operation: Temperature at Which Bank Switches In** setpoint. This strategy remains active until the temperature is in the range specified for the bank to switch out.

For more details, see the "Timeclock with Temperature Override Control Strategy" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Timeclock with Temperature-Override Strategy* screen includes the following fields:

Timeclock Schedules

These schedules are used in the Timeclock with Temperature Override strategy to determine when the bank is active. Each schedule is specified as a day range and hour range. The day range must be specified as a starting day followed by an ending day. Sunday is the first day of the week.

For example, if a schedule is to be active on all 7 days of the week, enter it as Sunday–Saturday, not as Saturday–Sunday.

The time is specified as a range between a starting and ending time on the same day. As with the day range, the chronologically-first time must come first. The time is entered in military format (i.e., 5:00 p.m. is entered as 17:00).

Up to two schedules may be specified. The bank will be active if the present time falls within either of the schedules.

Temperature Override Setpoints

The difference between the switch-in and switch-out temperatures should be at least 8° F (5° C). To disable the **High- or Low-Temperature** mode, set the switch-in and switch-out setpoints to the **N/A** setting.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during high-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch in.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during high-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during low-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during low-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch in.

High-/Low-Temperature Change Time Threshold

This is the amount of time the temperature must be continuously outside the normal temperature range before a switching operation occurs.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33, and the "Bank Voltage Change + Margin Operation" section on page 35.

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 a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setting.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setting before the bank switches out.

Low-Voltage Override Value

This is the minimum voltage level before the control overrides the **Automatic** mode and switches the bank in to avoid a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint described on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setting before the bank switches in.

Voltage-Only Strategy

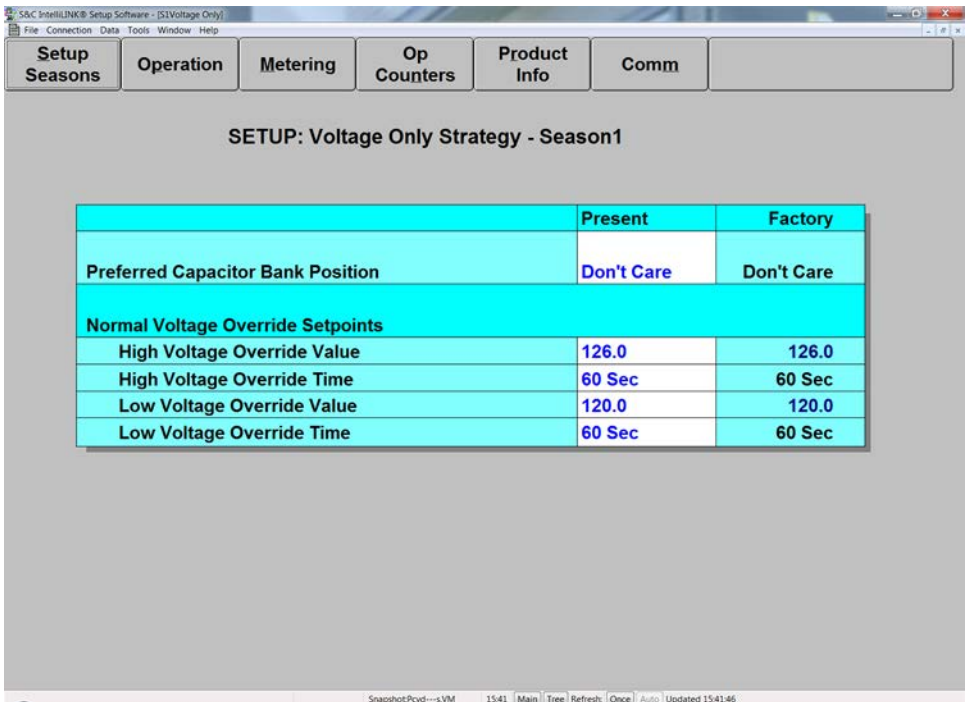


Figure 8. The *Setup: Voltage Only Strategy* screen.

To open the *Setup: Voltage Only Strategy* screen: on any screen, click on the **Setup Seasons** button, and select Voltage Only Strategy for Season 1. Then, click on the **Setup** button at the right of Season 1. In **Voltage-Only** mode, the control switches the capacitor bank based solely on voltage levels. See Figure 8 on page 22. The preferred capacitor bank position can also be selected. For more details, see the "Voltage Only Control Strategy" section in Instruction Sheet 1023-540, "IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Voltage Only Strategy* screen includes the following fields:

Preferred Capacitor Bank Position

When the voltage remains within the normal range, the capacitor control switches the bank according to the chosen **Preferred Capacitor Bank Position** setpoint. No action takes place if the **Don't Care** setting is selected or if switching the bank would cause a **Voltage-Override** condition.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Change + Margin Operation" section on page 35.

High-Voltage Override Value

This is the maximum voltage level before the control overrides the **Automatic** mode and switches the bank out to avoid a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setpoint.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setpoint before the bank switches out.

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 a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setpoint before the bank switches in.

Time-Biased Voltage Strategy

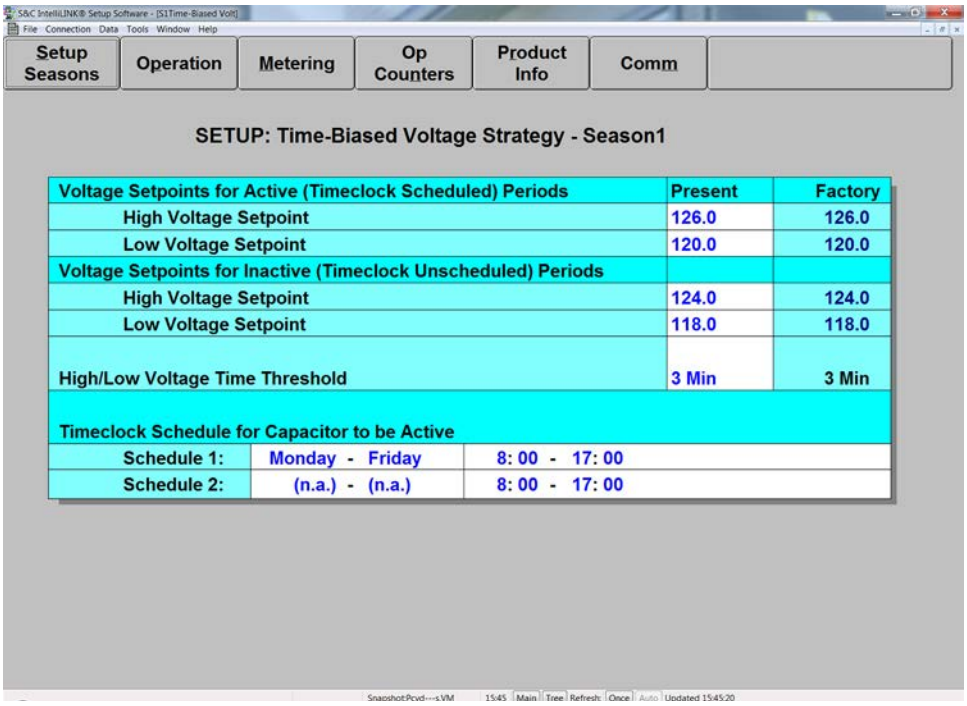


Figure 9. The *Setup: Time-Biased Voltage Strategy* screen.

When the capacitor control is in **Time-Biased Voltage** mode, it switches the capacitor bank according to the schedule on this screen and uses two sets of voltage-override setpoints. See Figure 9. For more details, see the "Time-Biased Voltage Control Strategy" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Time-Biased Voltage Strategy* screen includes the following fields:

Active (Timeclock Scheduled) Periods: High-Voltage Setpoint

This is the voltage level above which the bank is switched out if the time is within a scheduled on period. The voltage must be above this value for the period of time specified by the **High-/Low-Voltage Change Time Threshold** setpoint before the bank will switch out.

Active (Timeclock Scheduled) Periods: Low-Voltage Setpoint

This is the voltage level below which the bank is switched in if the time is within a scheduled on period. The voltage must be below this value for the period of time specified by the **High-/Low-Voltage Change Time Threshold** setpoint before the bank will switch in.

Inactive (Timeclock Unscheduled) Periods: High-Voltage Setpoint

As above, but this setpoint applies during unscheduled periods.

Inactive (Timeclock Unscheduled) Periods: Low-Voltage Setpoint

As above, but this setpoint applies during unscheduled periods.

High-/Low-Voltage Change Time Threshold

This is the amount of time the voltage must be continuously outside the normal voltage range before a switching operation occurs.

Timeclock Schedules

These schedules are used in Time-Biased Voltage strategy to determine when the bank is active. Each schedule is specified as a day range and hour range. The day range must be specified as a starting day followed by an ending day. Sunday is the first day of the week.

For example, if a schedule is to be active on all 7 days of the week, enter it as Sunday–Saturday, not as Saturday–Sunday.

The time is specified as a range between a starting and ending time on the same day. As with the day range, the chronologically first time must come first. The time is entered in military format (i.e., 5:00 p.m. is entered as 17:00).

Up to two schedules may be specified. The bank will be active if the present time falls within either of the schedules.

Current Strategy (var controls only)

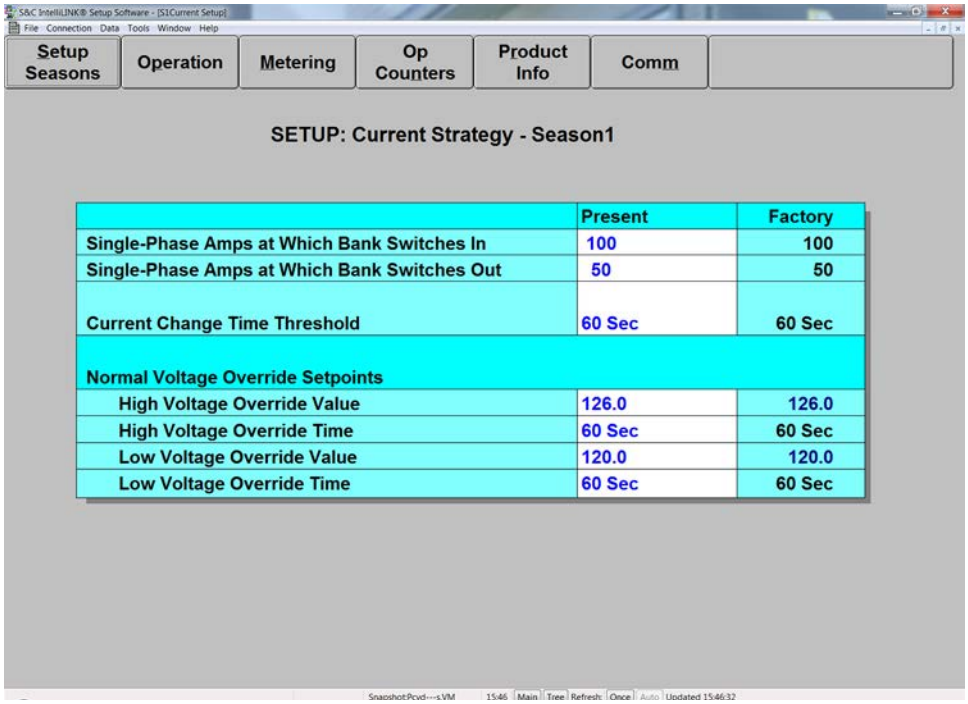


Figure 10. The *Setup: Current Strategy* screen.

In **Current** mode, the control uses the setpoints on the *Setup: Current Strategy* screen to switch the bank based on single-phase current levels. See Figure 10.

When the current sensor is on the source side of the capacitor bank, the line current changes due to a change in the power factor when the capacitor bank switches in or out. The difference between the switch-in and switch-out current setpoints should be larger than the effect of the bank. This prevents the control from continuously attempting to switch the bank in and out.

When the current sensor is on the load side of the capacitor bank, no change in current levels or power factor is sensed when the bank switches in or out.

Note: The number of automatic switching cycles can be limited by using the **Maximum Automatic Switching Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

For more details, see the "Current Control Strategy (var controls only)" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Controls: *Operation*."

The *Setup: Current Strategy* screen includes the following fields:

Single-Phase Amps at Which Bank Switches In

This is the current level (in amps) at which the bank switches in. The current must be above this value for the period of time specified by the **Current-Change Time Threshold** setpoint before the bank will switch in.

Single-Phase Amps at Which Bank Switches Out

This is the current level (in amps) at which the bank switches out. The current must be below this value for the period of time specified by the **Current-Change Time Threshold** setpoint before the bank will switch out.

Current-Change Time Threshold

This is the amount of time the current must be continuously outside the normal range before a switching operation occurs.

Capacitor controls can be easily coordinated by changing this setpoint. Give source-side controls a longer time delay when capacitor banks at the end of the line should switch first.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Charge + Margin Operation" section on page 35.

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 a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setpoint.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setting before the bank switches out.

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 a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank does not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint, on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setpoint before the bank switches in.

Current with Temperature-Override Strategy (var controls only)

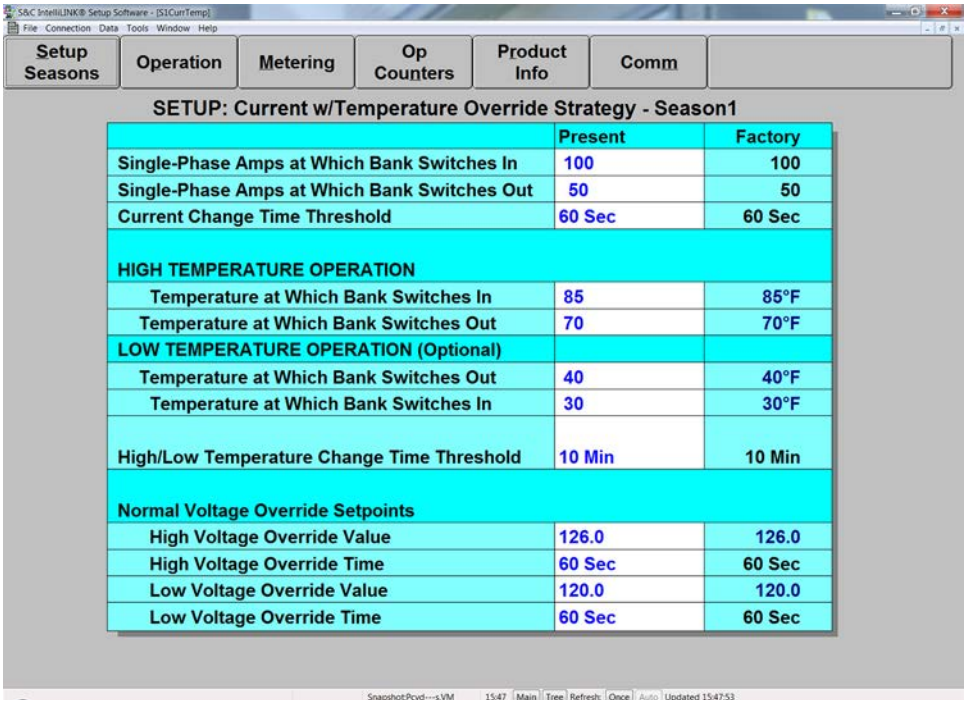


Figure 11. The *Setup: Current with Temperature Override Strategy* screen.

In **Current with Temperature Override** mode, the capacitor control uses the setpoints on the *Setup: Current with Temperature Override Strategy* screen to switch the bank based on single-phase current levels. See Figure 11.

When the current sensor is on the source side of the capacitor bank, the line current changes due to a change in the power factor when the capacitor bank switches in or out. The difference between the **Switch-In** and **Switch-Out Current** setpoints should be larger than the effect of the bank. This prevents the control from continuously attempting to switch the bank in and out.

When the current sensor is on the load side of the capacitor bank, no change in current levels or power factor is sensed when the bank switches in or out.

Note: The number of automatic switching cycles can be limited by using the **Maximum Automatic Switching Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

The control changes to switching based on temperature if the ambient temperature exceeds the **High-Temperature Operation: Temperature at Which Bank Switches In** setpoint or drops below the **Low-Temperature Operation: Temperature at Which Bank Switches In** setpoint. This strategy remains active until the ambient temperature is in the range specified for the bank to switch out.

For more details, see the "Current with Temperature Override Strategy (var controls only)" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Current with Temperature Override Strategy* screen includes the following fields:

Single-Phase Amps at Which Bank Switches In

This is the current level (in amps) at which the bank switches in. The current must be above this value for the period of time specified by the **Current-Change Time Threshold** setpoint before the bank will switch in.

Single-Phase Amps at Which Bank Switches Out

This is the current level (in amps) at which the bank switches out. The current must be below this value for the period of time specified by the **Current-Change Time Threshold** setpoint before the bank will switch out.

Current-Change Time Threshold

This is the amount of time the current must be continuously outside the normal range before a switching operation occurs.

Capacitor controls can be easily coordinated by changing this setpoint. Give source-side controls a longer time delay if capacitor banks at the end of the line should switch first.

Temperature-Override Setpoints

The difference between the switch-in and switch-out temperatures should be at least 8° F (5° C). To disable **High-** or **Low-Temperature** mode, set the switch-in and switch-out setpoints to the **N/A** value.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during high-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch in.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during high-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during low-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during low-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setpoint before the bank will switch in.

High-/Low-Temperature Change Time Threshold

This is the amount of time that the temperature must be continuously outside the normal temperature range before a switching operation occurs.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Change + Margin Operation" section on page 35.

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 a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setpoint.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setpoint before the bank switches out.

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 a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setpoint before the bank switches in.

Var Strategy (var controls only)

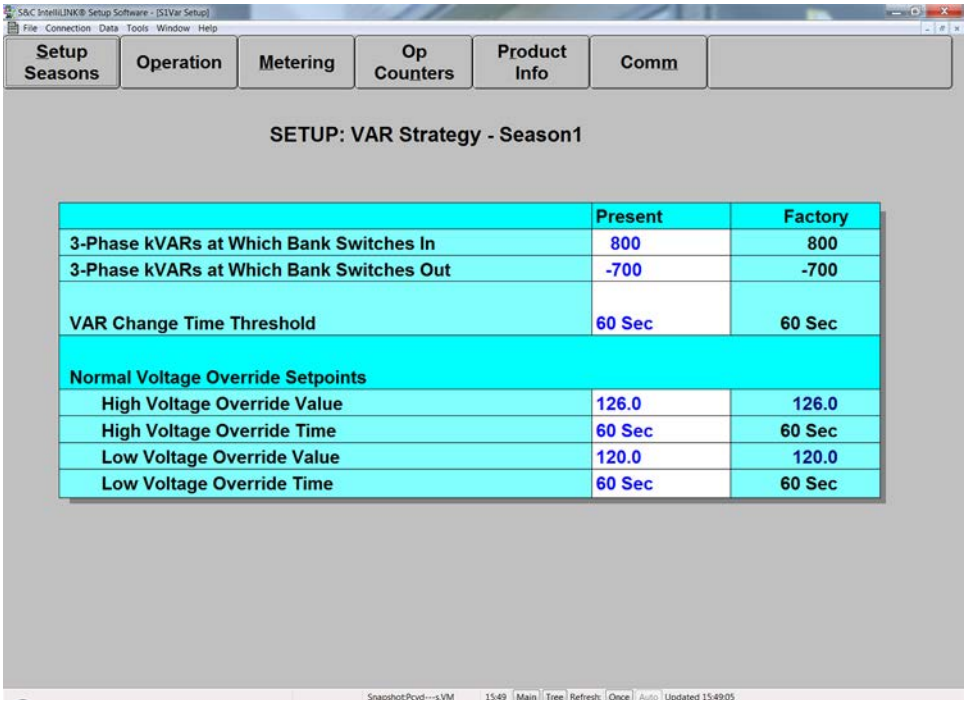


Figure 12. The *Setup: Var Strategy* screen.

In **Var** mode, the capacitor control uses the setpoints on the *Setup: Var Strategy* screen to switch the bank based on three-phase kvar levels. See Figure 12. The difference between the switch-in and switch-out kvar setpoints should be about 20% to 25% above the nameplate rating of the capacitor bank. The kvar contribution of the bank may exceed the nameplate rating due to higher system voltages and manufacturing tolerances. If the kvar contribution of the bank is greater than the difference between the setpoint levels, the capacitor control will continuously attempt to switch the bank in and out.

Note: The number of automatic switching cycles can be limited by using the **Maximum Automatic Switching Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

For more details, see the "Var Control Strategy (var controls only)" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

The *Setup: Var Strategy* screen includes the following fields:

3-Phase kvars at Which Bank Switches In

This is the var level (in kvars) at which the bank switches in. The var level must be above this value for the period of time specified by the **Var-Change Time Threshold** setpoint before the bank will switch in.

3-Phase kvars at Which Bank Switches Out

This is the var level (in kvars) at which the bank switches out. The var level must be below this value for the period of time specified by the **Var-Change Time Threshold** setting before the bank will switch out.

Var-Change Time Threshold

This is the amount of time the var level must be continuously outside the normal range before a switching operation occurs.

Capacitor controls can be easily coordinated by changing this setpoint. Give source-side controls a longer time delay if capacitor banks at the end of the line should switch first.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Change + Margin Operation" section on page 35.

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 a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setpoint.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setpoint before the bank switches out.

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 a **Low-Voltage** condition. The bank will switch in if both of the following are true:

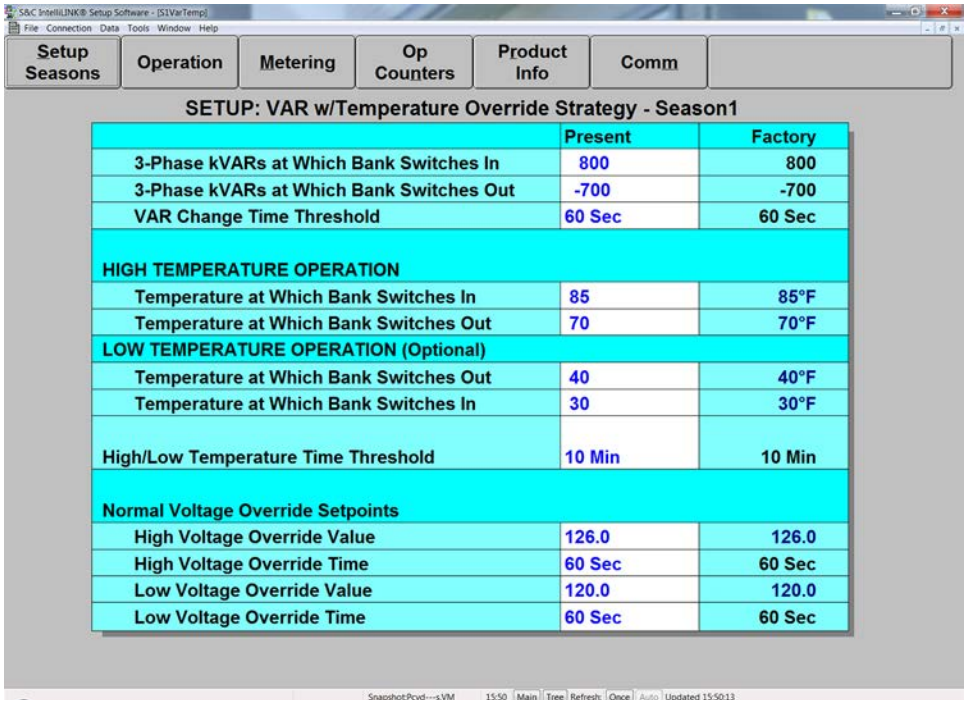
- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setpoint.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setpoint before the bank switches in.

Var with Temperature-Override Strategy (var controls only)



	Present	Factory
3-Phase kVARs at Which Bank Switches In	800	800
3-Phase kVARs at Which Bank Switches Out	-700	-700
VAR Change Time Threshold	60 Sec	60 Sec
HIGH TEMPERATURE OPERATION		
Temperature at Which Bank Switches In	85	85°F
Temperature at Which Bank Switches Out	70	70°F
LOW TEMPERATURE OPERATION (Optional)		
Temperature at Which Bank Switches Out	40	40°F
Temperature at Which Bank Switches In	30	30°F
High/Low Temperature Time Threshold	10 Min	10 Min
Normal Voltage Override Setpoints		
High Voltage Override Value	126.0	126.0
High Voltage Override Time	60 Sec	60 Sec
Low Voltage Override Value	120.0	120.0
Low Voltage Override Time	60 Sec	60 Sec

Figure 13. The *Setup: Var with Temperature Override Strategy* screen.

In **Var with Temperature-Override** mode, the capacitor control uses the setpoints on the *Setup: Var with Temperature Override Strategy* screen to switch the bank based on three-phase var levels. See Figure 13. The difference between the **3-Phase kvars at Which Bank Switches In** and the **3-Phase kvars at Which Bank Switches Out** setpoints should be about 20% to 25% above the nameplate rating of the capacitor bank. The kvar contribution of the bank may exceed the nameplate rating due to higher system voltages and manufacturing tolerances. If the kvar contribution of the bank is greater than the difference between the setpoint levels, the capacitor control will continuously attempt to switch the bank in and out.

Note: The number of automatic switching cycles can be limited using the **Maximum Automatic Switching Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

The control changes to switching based on temperature if the ambient temperature exceeds the **High-Temperature Operation: Temperature at Which Bank Switches In** setpoint or drops below the **Low-Temperature Operation: Temperature at Which Bank Switches In** setpoint. This strategy remains active until the ambient temperature is in the range specified for the bank to switch out.

For more details, see the "Var with Temperature Override Control Strategy (var controls only)" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Contorls: *Operation*."

The *Setup: Var with Temperature Override Strategy* screen includes the following fields:

3-Phase kvars at Which Bank Switches In

This is the var level (in kvars) at which the bank switches in. The var level must be above this value for the period of time specified by the **Var-Change Time Threshold** setpoint before the bank will switch in.

3-Phase kvars at Which Bank Switches Out

This is the var level (in kvars) at which the bank switches out. The var level must be below this value for the period of time specified by the **Var-Change Time Threshold** setpoint before the bank will switch out.

Var-Change Time Threshold

This is the amount of time that the var level must be continuously outside the normal range before a switching operation occurs.

Capacitor controls can be easily coordinated by changing this setpoint. Give source-side controls a longer time delay if capacitor banks at the end of the line should switch first.

Temperature Override Setpoints

The difference between the switch-in and switch-out temperatures should be at least 8° F (5° C). To disable **High-** or **Low-Temperature** mode, set the **Switch-In** and **Switch-Out** setpoints to the **N/A** value.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during high-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setting before the bank will switch in.

HIGH-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during high-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setting before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches Out

This is the temperature at which the bank switches out during low-temperature operation. The temperature must be above this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setting before the bank will switch out.

LOW-TEMPERATURE OPERATION: Temperature at Which Bank Switches In

This is the temperature at which the bank switches in during low-temperature operation. The temperature must be below this value for the period of time specified by the **High-/Low-Temperature Change Time Threshold** setting before the bank will switch in.

High-/Low-Temperature Change Time Threshold

This is the amount of time the temperature must be continuously outside the normal temperature range before a switching operation occurs.

Normal-Voltage Override Setpoints

For details on voltage override operation, see the "Voltage Override Operation" section on page 33 and the "Bank Voltage Change + Margin Operation" section on page 35.

High-Voltage Override Value

This is the maximum voltage level before the control overrides the **Automatic** mode and switches the bank out to avoid a **High-Voltage** condition. The bank will switch out if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays above this level for the period of time specified by the **High-Voltage Override Time** setting.

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

High-Voltage Override Time

This is the amount of time the voltage must be continuously above the **High-Voltage Override Value** setting before the bank switches out.

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 a **Low-Voltage** condition. The bank will switch in if both of the following are true:

- The control is in **Automatic** mode.
- The voltage stays below this level for the period of time specified by the **Low-Voltage Override Time** setting.

To avoid excess cycling, the bank will not switch in if the daily number of automatic switching cycles would exceed the **Maximum Automatic Control Cycles Per Day** setpoint, configured on Page 2 of the *Setup: General* screen.

Low-Voltage Override Time

This is the amount of time the voltage must be continuously below the **Low-Voltage Override Value** setting before the bank switches in.

General Setup

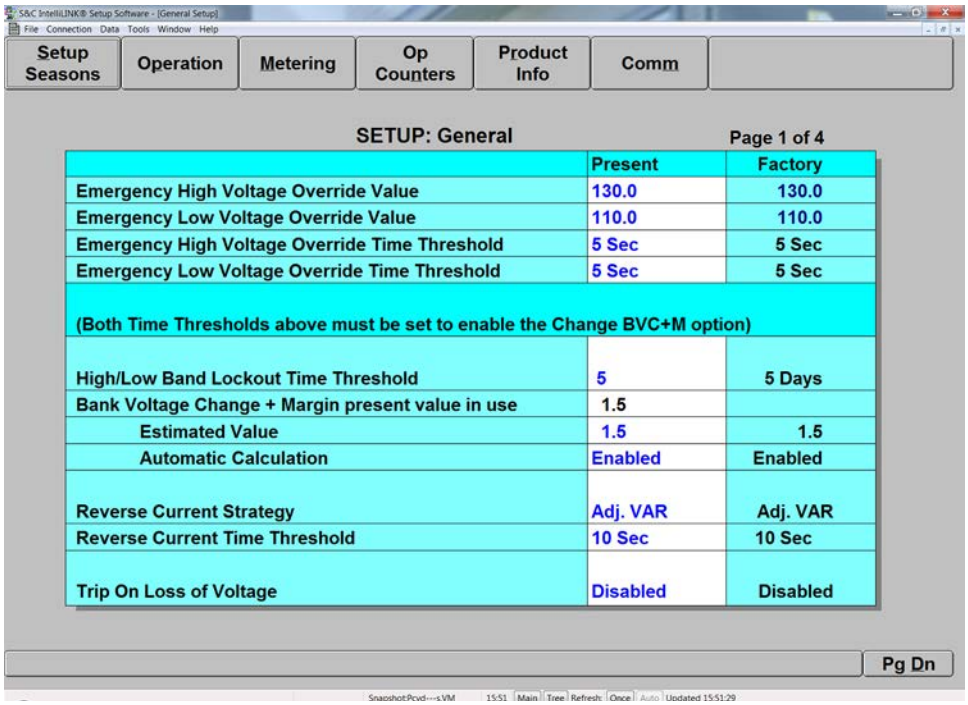


Figure 14. Page 1 of the *Setup: General* screen.

Click on the **Setup Seasons** button to return to the *Setup Seasons* screen. Click on the **General** button to display page 1 of the *Setup: General* screen. See Figure 14. This screen contains the basic setup parameters for the capacitor control. All of these parameters must be reviewed during installation of the control to insure correct operation. The values are only adjusted during installation, reinstallation, or maintenance.

Voltage-Override Operation

In **Automatic** mode, the capacitor control will override the selected control strategy (Temperature, Timeclock, etc.) if a **High-Voltage** or **Low-Voltage** condition (or an **Emergency High-** or **Emergency Low-Voltage** condition) is present. See Figure 15 on page 34. 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-** 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.

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

For more details, see the descriptions on the control strategy setup screens.

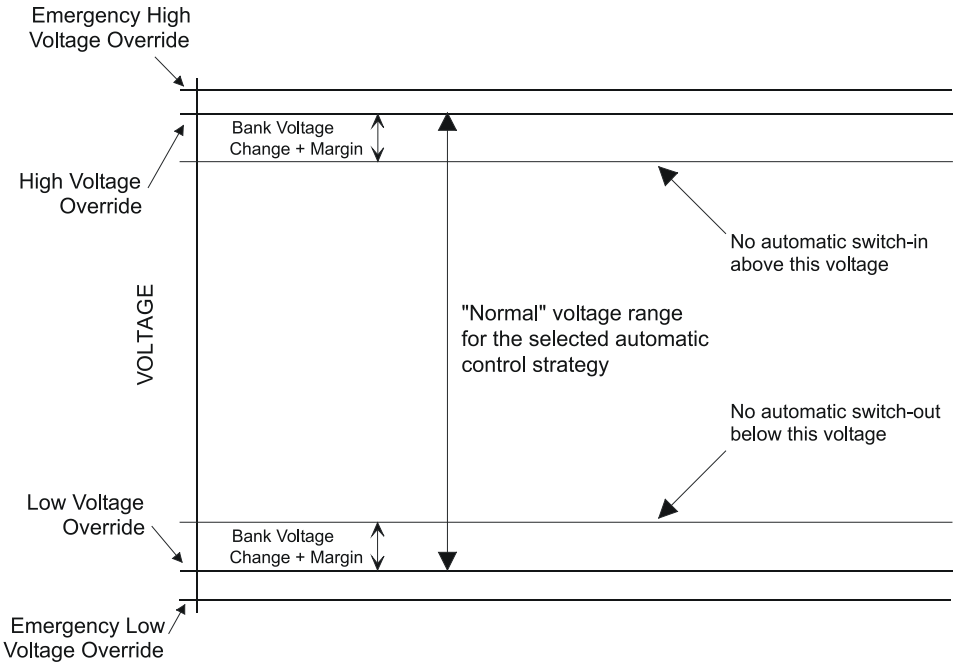


Figure 15. Voltage levels for Voltage Override operation.

When a **High-Voltage** condition ends, the control returns to normal operation when the voltage stays below a value equal to the present season's **High-Voltage Override Value** setpoint minus the **Bank Voltage Change + Margin** setpoint for the duration of the present season's **High-Voltage Override Time** setting. When a **Low-Voltage** condition ends, the control returns to normal operation when the voltage stays above a value equal to the **Low-Voltage Override Value** setpoint plus the **Bank Voltage Change + Margin** setpoint for the duration of the present season's **Low-Voltage Override Time** setpoint.

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

The *Setup: General* screen includes the following fields:

Emergency High-Voltage Override Value

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

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

Set the **Emergency High-Voltage Override Value** setpoint to a value higher than the **High-Voltage Override Value** setpoint on the setup screens for the selected control strategies.

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 control overrides the **Automatic** mode and switches the bank in to avoid an extreme **Low-Voltage** condition. The bank will switch in if both of the following are true:

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

Set the **Emergency Low-Voltage Override Value** setpoint to a value lower than the **Low-Voltage Override Value** setpoint on the setup screens for the selected control strategies.

Emergency High-Voltage Override Time Threshold

This is the amount of time the voltage must be continuously above the **Emergency High-Voltage Override Value** setpoint before the bank switches out. Set this value to a time shorter than the **High-Voltage Override Time** setpoint on the setup screens for the selected control strategies.

When the control is re-energized after a power outage, it will take approximately one minute to re-initialize, and will then start the **High-Voltage Override Timer** if the configured **High-Voltage** setpoint is exceeded.

Emergency Low-Voltage Override Time Threshold

This is the amount of time the voltage must be continuously below the **Emergency Low-Voltage Override Value** setpoint before the bank switches in. Set this value to a time shorter than the **Low-Voltage Override Time** setpoint on the setup screens for the selected control strategies.

When the control is re-energized after a power outage, it will take approximately one minute to re-initialize and will then start the **Low-Voltage Override Timer** if the configured **Low-Voltage** setpoint is exceeded.

Bank Voltage Change + Margin Operation

If the **Bank Voltage Change + Margin** setpoint is greater than the difference between the **High-Voltage Override Value** setpoint and the **Low-Voltage Override Value** setpoint for the present season, the control sets the **High-/Low-Voltage Band** error alarm. For more on the Bank Voltage Change + Margin and voltage override, see the "Voltage Override Operation" section on page 33.

When either of the emergency voltage override times is disabled, the control then 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 times are enabled, the control then uses the **Emergency Voltage-Override** values to define **Voltage-Override** conditions and to 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** value is less than the difference between the **High-Voltage Override Value** setpoint and the **Low-Voltage Override Value** setpoint for the present season. However, if it becomes greater than the difference between the emergency **Voltage-Override** values, the control blocks further automatic operation of the bank, except to open a closed bank during a **High-Voltage** condition.

For more details, see Instruction Sheet 1023-540. "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

High-/Low-Band Lockout Time Threshold

This is the number of days the control is allowed to operate before locking out the bank after a High-/Low-Voltage Band Error occurs. When the control should reset the **Bank Voltage Change + Margin** value to the estimated value at midnight following a High-/Low-Voltage Band Error, set this setpoint to the **Rst at Midnight** value.

Bank Voltage Change + Margin: Present Value In Use

This field shows the **Bank Voltage Change + Margin** value that the control is presently using, whether estimated or calculated, see the following setpoint descriptions.

Note: When the control is installed, it uses the **Bank Voltage Change + Margin: Estimated Value** setpoint until four **Open/Close** operations have taken place. Whenever the estimated value is changed, the control uses that value until another four switching operations have taken place. Therefore, make sure the correct **Bank Voltage Change + Margin: Estimated Value** setpoint is configured even when the **Automatic Calculation** mode is enabled.

Bank Voltage Change + Margin: Estimated Value

This is the estimated average of the voltage change associated with the bank switching in or out, plus a small margin. This should be set to the average measured voltage change at the bank, plus 0.5 volts or 25% (whichever is larger) for an operating margin. The capacitor control uses the **Bank Voltage Change + Margin** setpoint and the **Voltage-Override** setpoints for the present season to inhibit bank switching if the voltage is close enough to an override limit that switching the bank would cause a **Voltage-Override** condition.

Bank Voltage Change + Margin: Automatic Calculation

When this setpoint is enabled, the control automatically calculates the voltage change and margin. The control uses the average change in voltage from the last four switching operations for the voltage change and 25% of the average for the margin. The minimum value for the margin is 0.5 volts.

With this feature enabled, the capacitor control can account for any future feeder configuration changes that affect the voltage change.

Reverse Current Strategy (var controls only)

This sets 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** setpoint. When current flow returns to its normal direction, bank switching is based on the presently active control strategy.

Possible options are:

- **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** setpoint 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 value.
- **Trip & Inh.—**The control switches the bank offline during a **Reverse-Current** condition, and inhibits further switching until the condition clears.
- **Volt Only—**During a **Reverse-Current** condition, the control switches the bank based only on the presently active normal- and emergency-voltage overrides. If any neutral-sensor strategies are enabled, they remain in effect.

If 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, **Temperature-Override** mode 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.

If 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. For more about the reverse-current direction, see the *Setup: Site-Related* screen.

Trip on Loss of Voltage

When invoked, this feature causes the control to open the bank switches whenever power is restored after a loss-of-voltage event. The minimum operation time is about 60 seconds.

Operation of this feature results in opening the bank switches. The control will then initiate a 300-second reclose block to prevent a reclose operation until the capacitors discharge. When the reclose block expires, the control will re-evaluate the line conditions and strategy as well as possible contingency conditions and operate the bank according to its configured settings.

No higher precedence operation or contingency condition exists to countermand operation of this feature. The three configuration settings for this feature are:

Disabled—This is the default setting. When power returns after a loss-of-voltage event, the bank switch is presumed to be in the same state it was in before the power loss, and no action is taken on power restoration unless indicated by a strategy, another operation, or a contingency.

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

1. A **Voltage Below Minimum Configured Bank-Operation Voltage** condition
2. A **SCADA Override, Inhibit Automatic** operation
3. A Neutral-Alarm Corrective Action or Automatic-Operation Lockout
4. Maximum Number of Daily Automatic Operations Reached or Exceeded

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

1. A **Voltage-Override Operation or Voltage-Inhibit** condition.
2. A **SCADA Override or Bank-Operation** command.
3. An **Automatic Season-Strategy** operation.

Unconditional—This setting is used when the control is working with a bank-switching device equipped with an automatic mechanism to trip open the bank switch on loss of voltage. When power is restored 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 device. 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.

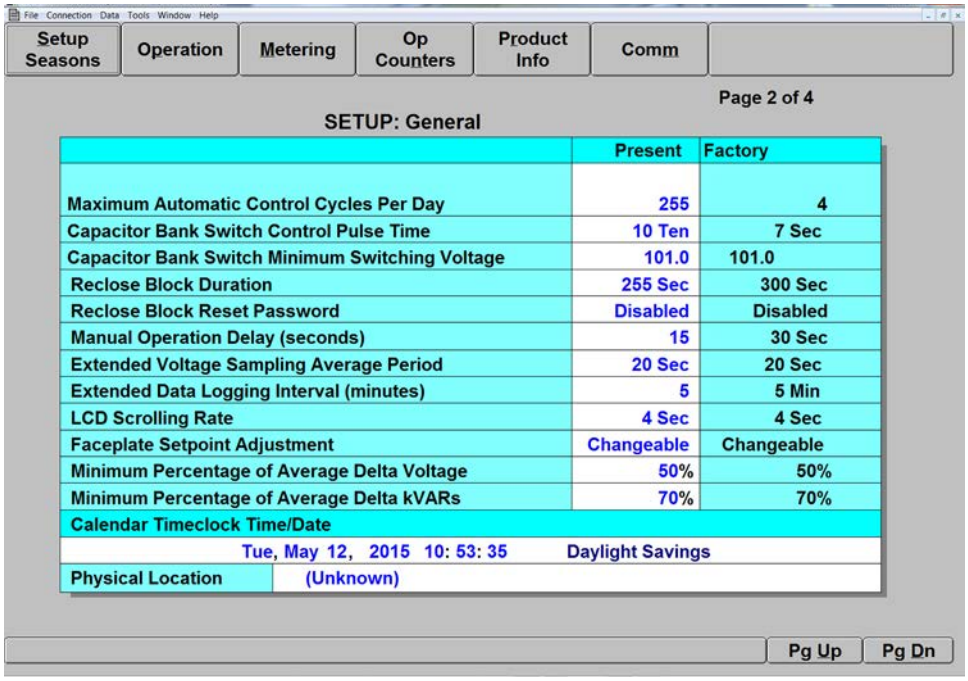


Figure 16. Page 2 of the *Setup: General* screen.

On page 1 of the *Setup: General* screen, click on the **PgDn** button to display Page 2. See Figure 16. Page 2 of the *Setup: General* screen includes the following fields:

Maximum Automatic Control Cycles Per Day

If the bank switches out this number of times during any calendar day while in **Automatic** mode, further switching in **Automatic** mode is inhibited until the next calendar day.

Capacitor Bank Switch Control Pulse Time

This is the amount of time the control output is energized whenever the bank is switched in **Automatic** mode or by a software manual command. Set the pulse time equal to or longer than the switch manufacturer's recommendation. For motor-driven oil switches, 7 seconds is the typical setting. For vacuum-type switches, 2 seconds may be configured, but the default value of 7 seconds can also be configured. For latching relays, click and hold the Up arrow until the value reads Latched. This continually energizes the control output.

When the **Latched** value is selected and the control is re-energized after a power outage, the Open and Close outputs will be de-energized. When the bank is next switched by an **Automatic** or software **Manual** command, the control output will be energized continuously.

Capacitor Bank Switch Minimum Switching Voltage

The control will not operate the bank switch below this voltage. For motor-controlled switches, set this value as low as 100.0 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 damage to the switch during brownout conditions).

Reclose-Block Duration

This is the time duration for the Reclose-Block feature. After opening the bank, the reclose block inhibits closing the bank for the time configured, which may range from 255 seconds to 510 seconds (4 min, 15 sec to 8 min, 30 sec).

Reclose-Block Reset Password

When enabled, this password lets the user override the **Reclose-Block Duration** setpoint and set the timer to zero if the reclose block is presently active. Only one Close operation is allowed each time the timer is reset.

When the control is in **Manual** mode, the reclose block is active and a password has been selected. Press the faceplate LAST BANK COMMAND CLOSE button to initiate the reset procedure. Press the faceplate + or – buttons to scroll through the password list. Then, press the ENTER button when the LCD screen shows the correct password. This resets the timer to zero. To end the procedure without resetting the timer, press the faceplate ESC button.

Manual Operation Delay

This is the amount of time, in seconds, **Close** and **Open** operations from the faceplate are delayed to allow the operator to step away from the bank. Disable the delay or choose a delay from 1 to 255 seconds.

After the LAST BANK COMMAND CLOSE or OPEN button is pressed, the LCD screen reads ***Close in ## secs*** or ***Open in ## secs*** and starts counting down the seconds. Cancel the delay and the requested operation at any time before the output relays are energized by pressing the OPERATION MODE CHANGE button to enter **Automatic** mode.

Note: Make sure to return to **Manual** mode to prevent the bank from switching automatically.

Extended Voltage-Sampling Average Period

The user can configure an extended voltage sampling period over which the control will compute the average of the RMS voltage samples collected. The period is configurable from one to 300 seconds. The default time is 20 seconds. The value is displayed on the *Metering* screen in a report file or as a SCADA analog input point.

Voltage is sampled approximately every 0.3 seconds. Four of these raw samples are averaged and scaled every 1.2 seconds to produce the RMS voltage reading. These averaged and scaled RMS voltages are accumulated and averaged over the new extended-sampling period. The number of samples collected will be based on the configured number of seconds plus one, multiplied by 5/6, rounded down. The default setting results in 17 samples collected and averaged over approximately 20.4 seconds.

Extended Data-Logging Interval (minutes)

This is the interval in minutes used for logging voltage and temperature data, as well as var, current, and neutral-current/neutral-voltage data when applicable. Logged data values are averaged over this interval. The selectable intervals are 1, 5, 10, 15, 30, and 60 minutes.

Note: When the data-logging interval is changed, previously stored data will be overwritten. To save older data, generate a report before changing the interval. See Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*," for details.

LCD Display Scrolling Rate

This is the rate at which the setpoints and real-time data are displayed on the LCD screen. Select a scrolling rate between 1 second and 60 seconds.

Faceplate Setpoint Adjustment

When this is set to the **Changeable** state, faceplate entries will adjust the setpoints. When set to the **Protected** state, pressing the faceplate ENTER button when the LCD screen shows *****SETUP***** has no effect.

Minimum Percentage of Average Delta Voltage

The control uses this setpoint to compare the most recent change in voltage (ΔV) with the average **ΔV** value for the previous 4 switching operations. If the most recent **ΔV** value is below this percentage of the average level, a bank switch malfunction may have occurred. The control logs the condition on the *Chronological Log* screen. See Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Control: *Troubleshooting*," for more information.

Decrease the value when greater deviation in the **ΔV** value is expected, or increase it if the **ΔV** value will be very stable.

Minimum Percentage of Average Delta kvars (var controls only)

The control uses this setpoint to compare the most recent change in kvars (Δkvars) with the average **Δkvars** values for the previous 4 switching operations. If the most recent **Δkvars** value is below this percentage of the average level, a bank switch malfunction may have occurred. The control logs the condition on the *Chronological Log* screen. See Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Control: *Troubleshooting*", for more details.

Decrease the value when greater deviation in the Δkvars is expected, or increase it if the **Δkvar** value will be very stable.

When current direction prevents measurement of var delta change, then a **Low-Delta** condition would be considered an undefined state and DNP Status Point 23 will not be active.

Calendar Timeclock Time/Date

The time and date are set to Pacific Standard time at the factory before shipment. If the capacitor control is installed in a different time zone, reset the time.

If the **Daylight Savings Time Automatic Changeover** feature is enabled, the time/date statement includes the current daylight savings time status, for example:

Friday, March 30, 2001 10:22:48 Standard Time

The control uses this information for switching the capacitor bank, data logging, and event recording.

Physical Location

Enter your company's standard location identification information, for example, "Bank # 1043, 437 Main St., Centerville". This information will identify the capacitor bank to the SCADA master station operator and appears on all reports generated from the control. Enter up to 50 characters.

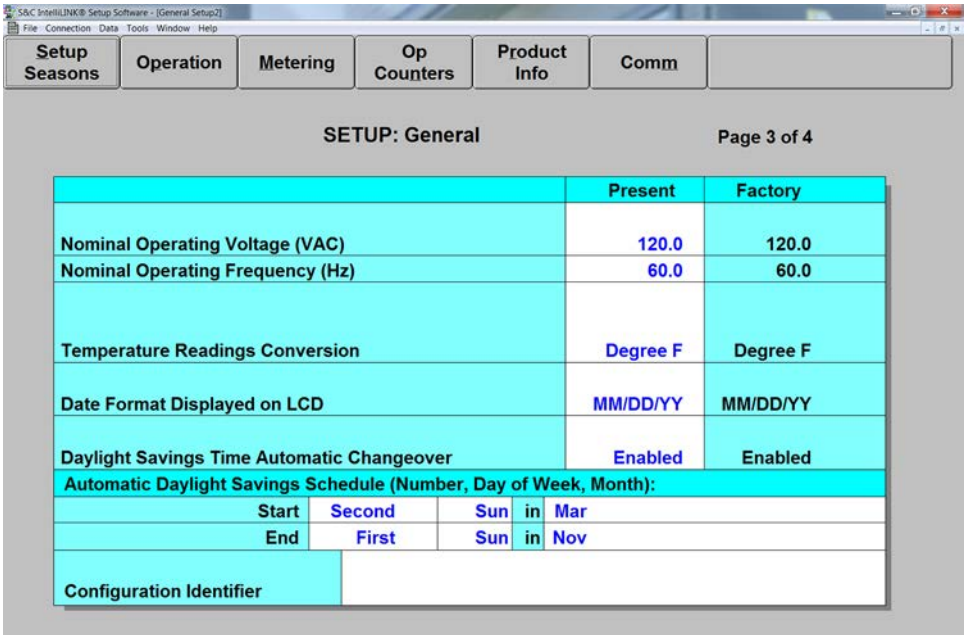


Figure 17. Page 3 of the *Setup: General* screen.

At page 2 of the *Setup: General* screen, click on the **PgDn** button to display page 3. See Figure 17. Page 3 of the *Setup: General* screen includes the following fields:

Nominal Operating Voltage (Vac)

This is the nominal operating voltage, in Vac, for the distribution system. When this value is selected, the IntelliLink software automatically scales all voltage setpoints to the proper operating range. The voltage settings available are 110.0, 115.0, 120.0, 127.0, 220.0, 230.0, and 240.0 volts.

Nominal Operating Frequency (Hz)

This is the nominal operating frequency of the distribution system: 50.0 Hz or 60.0 Hz.

Temperature Reading Conversion

This is the unit of temperature that the control operates on and displays. Select Degrees F or Degrees C.

Date Format Shown on LCD Display

Use this setpoint to change the format of the date shown 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.

Daylight Savings Time Automatic Changeover

When this setpoint is enabled, the control automatically adjusts the clock for the start and end of daylight savings time. When this option is not required, set it to the **Disabled** state.

Automatic Daylight Savings Schedule

When the **Enabled** state for the **Daylight Savings Time Automatic Changeover** setting is selected, the dates when the automatic daylight savings time changeover occurs may be selected. The dates are in the format [First, Second, Third, Fourth, Last] [day of week] in [month], for example, Last Sunday in October. The default values are for the US dates established by Congress in 2007.

Configuration Identifier

Enter up to 12 characters to identify the particular setpoint configuration used by this control. This is helpful when saving and loading different setpoint configurations in several controls. For more information, see the "Load a Saved Configuration into a capacitor Control and Using Snapshots (VM Files)" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

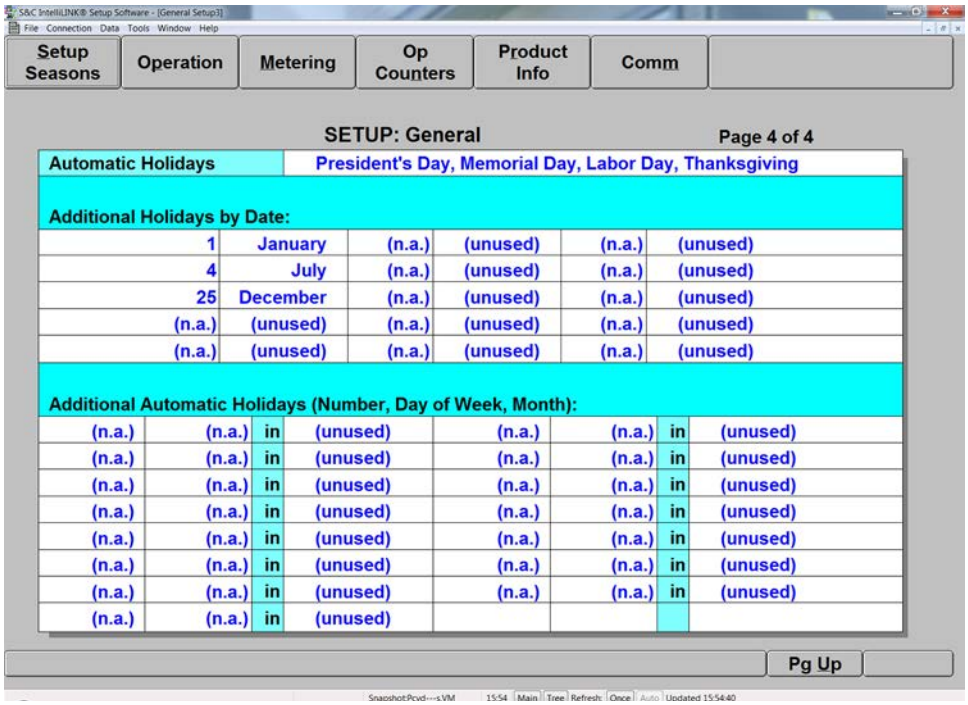


Figure 18. Page 4 of the *Setup: General* screen.

At page 3 of the *Setup: General* screen, click on the **PgDn** button to display page 4. See Figure 18. Page 4 of the *Setup: General* screen includes the following fields:

Automatic Holidays (President's Day, Memorial Day, Labor Day, Thanksgiving)

This option allows the control to automatically recognize certain days of the year as holidays, (days when the bank should be switched off, except during a **Low-Voltage** condition). The actual dates are determined by the control for the following specific holidays: President's Day, Memorial Day, Labor Day, and Thanksgiving. Enable any combination of these automatic holidays. The default is all four holidays enabled.

Additional Holidays by Date

These dates are specific days of the year to be treated as holidays. On these specified days, the bank will be switched off, except during a **Low-Voltage** condition. If the day falls on a Saturday, the previous Friday will also be treated as a holiday. If the day falls on a Sunday, the following Monday will also be treated as a holiday. The defaults are January 1, July 4, and December 25.

Additional Automatic Holidays

This schedule represents holidays that fall on the same day of the week in a specific month each year. They are entered in the format [First, Second, Third, Fourth, Last] [day of week] in [month], for example, Second Saturday in August. When using this method to specify a holiday, the control software calculates the correct date each year. On these calculated dates, the bank will be switched off, except during a **Low-Voltage** condition. If the day is a Saturday, the previous Friday will also be treated as a holiday. If the day is a Sunday, the following Monday will also be treated as a holiday.

- If the software version includes var sensing, go to page 42.
- If it includes neutral current or neutral voltage sensing (but not var), go to page 47.
- If it includes neither var or neutral-current/neutral-voltage sensing, go to page 52.

Site-Related Setup (var controls only)

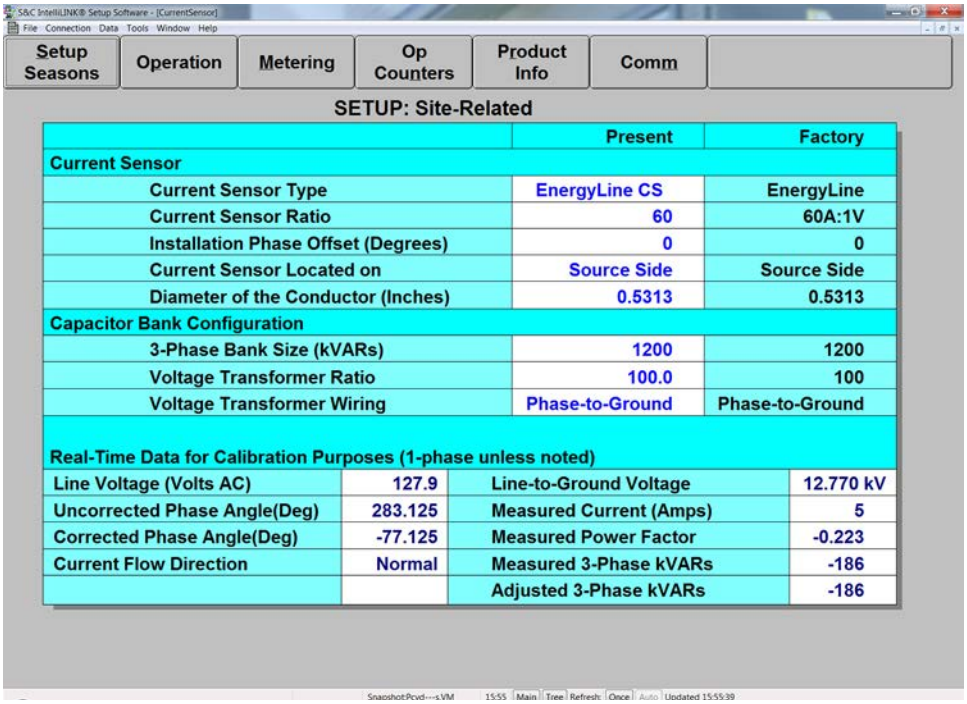


Figure 19. The *Setup: Site-Related* screen (current sensor version).

At the *Setup Seasons* screen, click on the **Site-Related** button to display the *Setup: Site-Related* screen. See Figure 19. The upper part of this screen is for entering the installation-dependent parameters associated with the type of current sensor, and the location of the voltage transformer and current sensor with respect to the capacitor bank. The lower part of the screen displays real-time data, which is dependent on the location of the voltage transformer and current sensor.

The voltage transformer powering the capacitor control can be connected phase to neutral or phase to phase. The control scales the nominal voltage, using the specified **Voltage Transformer Ratio** setting and **Voltage Transformer Wiring** setting to yield the **Line-to-Ground Voltage** value and to calculate the kvars value.

For more information about how the capacitor control processes sensor data, see Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

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

Current Sensor Type (controls with current sensors)

This is the type of sensor used with this capacitor control. The control works with the following sensor types:

- EnergyLine CS Current Sensor
- Lindsey CVMI-C (choke-equipped)
- Fisher Pierce low-accuracy sensors (1301-11A for 15-kV systems, 1301-21A for 35-kV systems, 1301-41A for 25-kV systems)
- Fisher Pierce high-accuracy sensors (1301-17A for 15-kV systems, 1301-27A for 35-kV systems, 1301-47A for 25-kV systems)
- Piedmont Electric current sensors

NOTICE

Var controls must be installed with a current sensor. If an IntelliCap Plus var control is installed without a current and/or neutral sensor, then the control must be returned to S&C Electric Company for removal of the internal component options and installation of standard (non-var) software.

Current-Sensor Ratio (controls with current sensors)

This is the ratio of sensed current, as specified by the manufacturer, that produces a 1-volt RMS output. The control uses this ratio to calculate the actual current flow.

Current-Transformer Ratio (controls with current transformers)

This is the ratio of the full-scale current on the primary to 1 amp (full scale) or 5 amps (full scale) on the secondary.

Installation Phase Offset (Degrees)

This setpoint enters installation-dependent phase-angle corrections. Before adjusting this value, enter the correct values for the rest of the setpoints on this screen. To determine the correct value for this setpoint, after entering those values, follow the instructions under the "Calculating the Installation Phase Offset (Degrees)" section on page 44.

Current Sensor Located on/Current Transformer Located on

This is the location of the current sensor or current transformer. When the sensor/transformer is on the normal source side of the bank, enter Source Side. When the sensor/transformer is on the normal load side of the bank, enter Load Side.

For var strategy, the sensor/transformer should be installed on the normal source side of the bank whenever possible.

For Current strategy, control setup is simplified when the sensor/transformer is installed on the load side of the bank.

Diameter of the Conductor (Inches)

For controls with Fisher Pierce sensors: this is the diameter in inches of the monitored conductor. Correction factors are based on Fisher Pierce's published data; see Fisher Pierce's data sheets for more information.

3-Phase Bank Size (kvars)

This is the size of the capacitor bank, in kvars, that the control switches. Enter the correct value because this value is used to calculate the **Adjusted Total kvars** value.

Voltage-Transformer Ratio

This is the step-down ratio of the voltage transformer, for example, primary to 120 Volts. The control records, displays, and manipulates voltages normalized on the nominal-voltage base. This setpoint is the conversion ratio from the nominal-voltage base to the line-to-ground voltage.

Enter the ratio for transformers which are wired the same way, phase to neutral or phase to phase, as the value entered for the **Voltage-Transformer Wiring** setpoint described below.

Voltage-Transformer Wiring

This indicates how the voltage transformer which powers the control is connected, phase to ground or phase to phase.

Real-Time Data

The lower part of this screen displays real-time data values. The control software creates these values from raw sensor data and the information entered on the setup screens.

Use real-time data to immediately check the effect of any change made in the upper section of the screen. Use this data when setting the **Installation Phase-Offset** setpoint.

Note: Data are not updated while the Change Value dialog box is open. Updates resume as soon as the dialog box is closed.

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 kvar values.

Uncorrected Phase Angle (Deg.)

This phase angle is the offset of the current waveform referenced to the voltage before setup correction factors are applied.

Corrected Phase Angle (Deg.)

This is the corrected phase angle, the offset of the current waveform referenced to the voltage after setup correction factors are applied. When the capacitor control is properly set up, these corrected phase angles will all be 0 ± 89.9 degrees. Lagging phase angles are represented as values between 0 and 90 degrees. Leading phase angles are represented as values between 0 and -90 degrees.

Current Flow Direction

When the capacitor control is properly configured 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.

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

Line-to-Ground Voltage (kV)

This is the present, calculated distribution line voltage, based on the measured line voltage and the specified **Voltage Transformer Ratio** and **Voltage Transformer Wiring** setpoints.

Measured Current (Amps)

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

Measured Power Factor

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

Measured 3-Phase kvars

This is the total kvar level measured at the location of the current sensor, calculated as 3 times the single-phase kvar value. This assumes a balanced three-phase system.

Adjusted 3-Phase kvars

This is the kvar level that the control uses when operating in **Var** mode. This value is different from the **Measured 3-Phase kvars** value if 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 capacitor control accounts for these conditions by adding the **3-Phase Bank Size** setpoint to the **Measured 3-Phase kvars** value.

Calculating the Installation Phase Offset (Degrees)

The **Installation Phase Offset (Degrees)** setpoint allows entry of installation-dependent phase-angle corrections. The control software uses these corrections and other site-related parameters to calculate power factor and kvar value and to determine the Normal and Reverse directions of current flow. Enter a value which is a multiples of 30°.

The information below, and the example on page 47, explain how to adjust the **Phase-Angle Offset** (correction) setpoint for various system types.

As adjustments are made, keep in mind that phase-angle detection and display require a minimum current of 0.5% of full-scale values. Current magnitudes continue to be detected and displayed below the 0.5% threshold.

These instructions assume normal power flow at the time of installation, with the capacitor bank offline.

Note: Correct values must be entered for the other setpoints on this screen before entering the **Installation Phase Offset** setpoint value.

Capacitor Banks with a Phase-to-Neutral Connected Voltage Transformer (Connected to Phase Common with the Current Sensor)

Set the **Phase-Angle Offset** setpoint to 0 degrees. If the **Current-Flow Direction** field displays a Reverse message, set the offset to 180 degrees. The correct setting should eliminate any Reverse messages and result in a reasonable real-time corrected phase angle (in the **Corrected Phase Angle** field) and power factor (in the **Measured Power Factor** field). For information about circuit power factors, see Table 2.

Capacitor Banks with a Phase-to-Neutral Connected Voltage Transformer (Connected to Phases Not Common with the Current Sensor)

Follow the instructions in the "Using the tables to estimate the phase angle offset" section below and use Table 2 and Table 3 on page 46.

Capacitor Banks with a Phase-to-Phase Connected Voltage Transformer (Connected to Phases Not Common with the Current Sensor)

Set the **Phase-Angle Offset** setpoint to 90 degrees. If the **Current Flow Direction** field displays a Reverse message, set the offset to 270 degrees. The correct setting should eliminate any Reverse messages and result in a reasonable real-time corrected phase angle, in the **Corrected Phase Angle** field, and power factor, in the **Measured Power Factor** field. For information about circuit power factors, see Table 2.

Capacitor Banks with a Phase-to-Phase Connected Voltage Transformer (Connected to Phase Common with the Current Sensor)

Follow the instructions under "Using the tables to estimate the phase-angle offset" below, and use Table 2, and Tables 3 and 4 on page 46.

Using the tables to estimate the phase-angle offset

To determine the correct phase-angle offset from the tables, do the following:

STEP 1. Estimate the circuit power-factor range. Use Table 2 to find the Range # for the power-factor range of the load current that is flowing through the current sensor.

Note: In general, circuit base power factors (power factors of load without power factor correction) vary from approximately 0.75 to 0.9 (lag). Adding capacitors usually does not result in power factors more leading than -0.966. In most cases, Range #2 is correct. Range #3 is the second most likely.

Table 2. Distribution ranges for circuit power factors.

Range #	Power-Factor Range	Description of Loads
#1	0 to 0.707 (More lag than 0.707)	Abnormally lagging circuit power factor due to heavy inductive reactive loading
#2	0.707 to -0.966 (lag to lead)	Normal circuit loading, with or without connected capacitors
#3	-0.966 to -0.5 (lead)	Circuit loading with excessive capacitors
#4	-0.5 to 0 (More lead than -0.5)	Abnormally leading power factor due to predominantly capacitive loading

STEP 2. Read the **Uncorrected Phase Angle** value from the real-time data in the lower part of the *Setup: Site-Related* screen.

STEP 3. Using the Range # of the estimated power factor (from Step 1) and the **Uncorrected Phase Angle** value (from Step 2), determine the **Installation Phase Offset** setpoint from Table 3 (for phase-to-neutral connected voltage transformers) or from Table 4 (for phase-to-phase connected voltage transformers).

Table 3. Installation phase offset values for phase-to-neutral connected potential transformers.

Uncorrected Phase Angle				Installation Phase Offset
Range #1	Range #2	Range #3	Range #4	
45° to 90°	345° to 45°	300° to 345°	270° to 300°	0
105° to 150°	45° to 105°	0° to 45°	330° to 0°	300
165° to 210°	105° to 165°	60° to 105°	30° to 60°	240
225° to 270°	165° to 225°	120° to 165°	90° to 120°	180
285° to 330°	225° to 285°	180° to 225°	150° to 180°	120
345° to 30°	285° to 345°	240° to 285°	210° to 240°	60

Table 4. Installation phase offset values for phase-to-phase connected potential transformers.

Uncorrected Phase Angle				Installation Phase Offset
Range #1	Range #2	Range #3	Range #4	
75° to 120°	15° to 75°	330° to 15°	300° to 330°	330
135° to 180°	75° to 135°	30° to 75°	0° to 30°	270
195° to 240°	135° to 195°	90° to 135°	60° to 90°	210
255° to 300°	195° to 255°	150° to 195°	120° to 150°	150
315° to 0°	255° to 315°	210° to 255°	180° to 210°	90
15° to 60°	315° to 15°	270° to 315°	240° to 270°	30

STEP 4. To confirm the correct offset is selected, check that the **Measured Power Factor** value is within the range estimated in Step 2 and that the **Current Flow Direction** field shows Normal. Also, the Uncorrected Phase Angle value should stay within the range used in Table 3 or Table 4.

If any of these checks fails, make sure the values for the other setpoints on the *Setup: Site-Related* screen are correct. If necessary, estimate the power factor again, repeat Step 2, and recheck the **Measured Power Factor** value.

When the Uncorrected Phase Angle is borderline

If the **Uncorrected Phase Angle** value is on the border between ranges shown in the tables, do one of the following to change the **Uncorrected Phase Angle** value to a non-borderline value:

- Change the status of any capacitor bank on the load side of the sensor. If the bank is online, switch it out. If the bank is offline, switch it in.
- Wait a few minutes for the phase angle to change from a borderline value. The circuit phase angle changes as industrial loads change in the morning (start-up), midday (lunch break), and afternoon (shutdown).

  Then, begin again at Step 1 to determine the correct **Installation Phase Offset** setpoint.

Example

The potential transformer (PT) is connected line to neutral (A phase), the current sensor is connected to B phase, and current is flowing in the normal direction.

1. Based on the above facts, start at the instructions for Capacitor Banks with a Phase-to-Neutral Connected Voltage Transformer (Connected to Phases Not Common with the Current Sensor) on page 45.
2. Based on those instructions, Table 2 on page 45 and Table 3 on page 46 must be used to determine the correct value for the **Installation Phase Offset** setpoint.
3. With Table 2 on page 45, estimate the power factor range to be Range #2 (0.707 to -0.966) because an excessive number of capacitors are not presently online on the load side of the sensor.
4. At the *Setup: Site-Related* screen, determine that the **Uncorrected Phase Angle** value is presently 157 degrees.
5. With Table 3 on page 46, look down the Range #2 column until the line that includes 157 degrees is found. Then, look to the right and see that the **Installation Phase Offset** value for that line is 240.
6. At the *Setup: Site-Related* screen, enter 240 for the **Installation Phase Offset** setpoint, then check how this change affects other values on the screen.
7. Because the correct phase-offset value was selected, the **Measured Power Factor** value is reasonable and within the estimated range (Range #2 in Table 2 on page 45) and the **Current Flow Direction** field is now Normal.

Neutral Sensor Setup

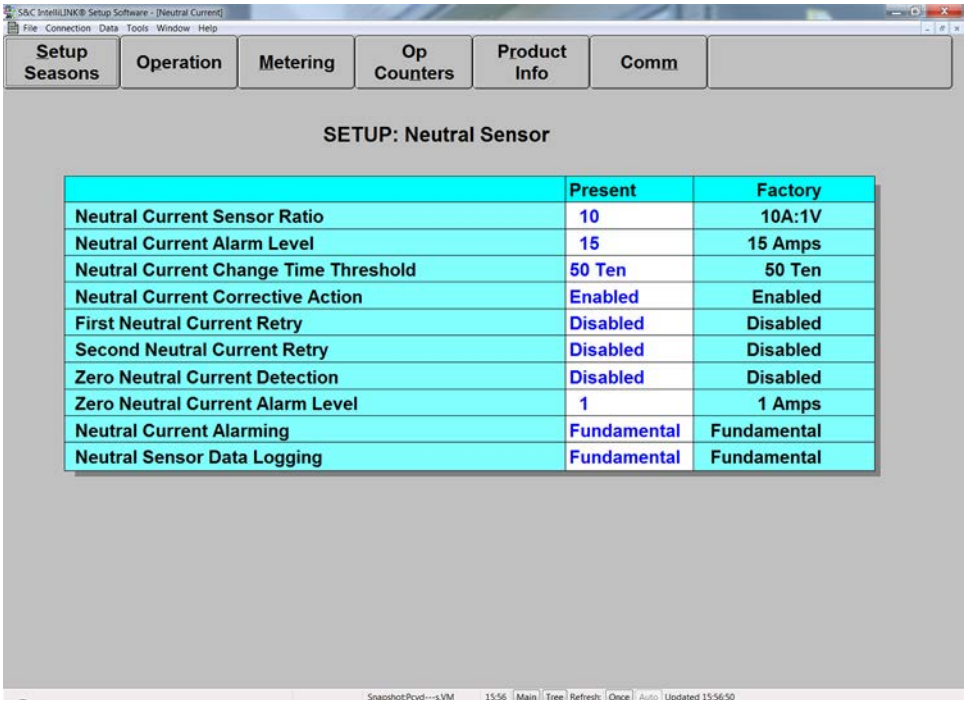


Figure 20. The *Setup: Neutral Sensor* screen (neutral current capacitor control).

At the *Setup: Seasons* screen, click on the **Neutral Sensor** button to display the *Setup: Neutral Sensor* screen. See Figure 20. These setpoints are used for neutral-current or neutral-voltage sensing, depending on the type of control that is connected. See Figure 21 on page 50 for a Neutral-Voltage Sensing control. Neutral-Current Sensing capacitor controls have the following setpoints:

Neutral-Current Sensor Ratio

This is the neutral current sensor ratio specified by the manufacturer. It corresponds to a 1-Volt RMS neutral-current sensor output and is used to calculate the actual neutral-current level. Default is 10 amperes = 1-Volt ac output, the S&C Neutral Current Sensor ratio.

Neutral-Current Alarm Level

The capacitor control triggers the **Neutral-Sensor** alarm on the *Alarm Status* screen when neutral current is above this value for the period of time specified by the **Neutral-Current Change Time Threshold** setpoint. See Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Control: *Troubleshooting*," for more details.

To detect blown fuses and defective capacitor switches, set the **Neutral Current Alarm Level** setpoint to approximately 50% of the normal capacitor bank line current and enable the **Fundamental Neutral Current Alarming** feature.

For example, for a wye-grounded, 24.9-kV phase-to-phase distribution circuit with a 900-kvar three-phase capacitor bank, the line current is 900/(24.9 x √3) = 21 amps. Set the **Neutral Current Alarm Level** setpoint to 10 amps.

To detect the partial failure of individual capacitor units, set the **Neutral Current Alarm Level** setpoint to a lower level.

Neutral Current Change Time Threshold

When neutral current exceeding the **Neutral Current Alarm Level** setpoint persists for the duration of the **Neutral Current Change Time Threshold** setpoint, the **Neutral Sensor** alarm will be set.

This setpoint is also used by another timer to define recent switching activity for the **Neutral Current Corrective Action** feature. If the control switches the bank and then detects neutral current exceeding the **Neutral Current Alarm Level** setpoint within a time period starting at the switching event equal to the **Neutral Current Change Time Threshold** setpoint, this is considered recent switching activity if the excess neutral current persists and becomes a **Neutral Sensor** alarm. See Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Contorl: *Operation*," for more details.

Neutral Current Corrective Action

When the **Neutral Current Corrective Action** feature is enabled and a **Neutral Sensor** alarm is triggered by neutral current that was detected close enough to the switch operation to be considered recent switching activity, the control attempts to reverse the last switching operation. The control also takes corrective action if the bank is closed and a **Neutral Sensor** alarm becomes active but is not reporting recent switching activity. In this case, the control assumes a fuse operation and opens the bank. If the bank is open and a **Neutral Sensor** alarm becomes active, the control assumes a condition that cannot be handled by closing the bank, such as a shorted switch, has occurred and locks out further automatic operation. If a switch sticks when the bank opens, corrective action is taken after the **Reclose Block Delay** timer expires. During a reclose block, line 1 of the LCD screen shows ****Retry Pending****, and Line 2 does not indicate the reclose block time remaining. During the **Reclose Block Delay** state, the OPEN LED display blinks. When the **Neutral Current Corrective Action** feature is disabled, the capacitor control locks out automatic operation, and takes no corrective action or retries.

Neutral Current Retry

If the **First Neutral Current Retry** feature is enabled, the control waits for the setpoint time to expire and operates the bank. If the **Second Neutral Current Retry** feature is also enabled, the control waits for that setpoint time to expire and operates the bank a second time. If the neutral current level becomes normal after either retry, the alarms clear and the control returns to normal operation. Otherwise, the control returns the bank to the **Corrective Action** state and, if this was the second retry or if the second retry is disabled, blocks further automatic operation of the bank. If the **First Neutral Current Retry** feature is disabled, the control blocks any automatic operation of the bank after the corrective action.

The **Neutral Current Corrective Action** feature setpoint values are Disabled (default) and Enabled. Values for the **First Neutral Current Retry** and **Second Neutral Current Retry** setpoints are Disabled (default), 5 min, 10 min, 20 min, 60 min, and 1 hour through 48 hours in one hour increments. When the **Neutral Current Corrective Action** feature is enabled, Line 1 of the LCD display shows ****Retry Pending**** when a retry is pending. Line 2 displays the time remaining before the retry will occur. The LCD display Real-Time Data menu **NeutRmsAmps** and the *Operation* screen **Neutral Sensor** fields display the real-time neutral current value during the retry time delay. If a **Neutral Current Retry** operation is pending, the LCD display shows ****Alarms Active**** and the Neutral Sensor alarm is also active. The **Neutral Current First Retry** and **Neutral Current Second Retry** setpoints are not programmable from the LCD screen.

The **Neutral Sensor** alarm clears automatically if the condition is corrected before any retries are performed. Placing the control in **Manual** mode will cancel any pending retries.

To manually clear the **Neutral Sensor** trouble condition during a retry time delay:

STEP 1. Place the control in **Manual** mode.

STEP 2. Wait for the **Neutral Sensing** trouble condition to clear.

STEP 3. Switch to **Automatic** mode.

The control will return to local strategy and return the bank to the correct bank state for the present strategy after the **Reclose Bank Delay** timer expires, if active. The LCD display shows ****Retry Pending**** and a countdown of the time remaining during a retry.

If the **Corrective Action** feature is enabled, an **Emergency Voltage** condition will override a **Neutral Sensor Lockout** state. When the voltage returns to its configured normal range, the **Neutral Sensor Lockout** state will be reapplied.

Zero Neutral Current Detection and Zero Neutral Current Alarm Level

When the control detects zero total RMS neutral current that is less than the configured **Zero Neutral Current Alarm Level** setpoint for a period of time specified by this setpoint (if enabled), the control sets the **Zero Neutral Current** alarm. The control does not try any corrective action or lock out the bank. The alarm clears when the **Zero Neutral Current** condition clears when a **Clear All Alarms** command is executed or when a **Neutral Sensor Lockout Reset** procedure is performed.

Neutral Current Alarming

This sets the **Fundamental** or **RMS** value of the neutral current the control measures and compares to the **Neutral Current Alarm Level** setpoint to trigger the **Neutral Sensor** alarm. When the **Fundamental** setpoint value is chosen, the control uses only the 60-Hz component.

Neutral Sensor Data Logging

This setpoint value allows data logging of either the neutral current fundamental or RMS that is used by the control to trigger the **Neutral Sensor** alarm.

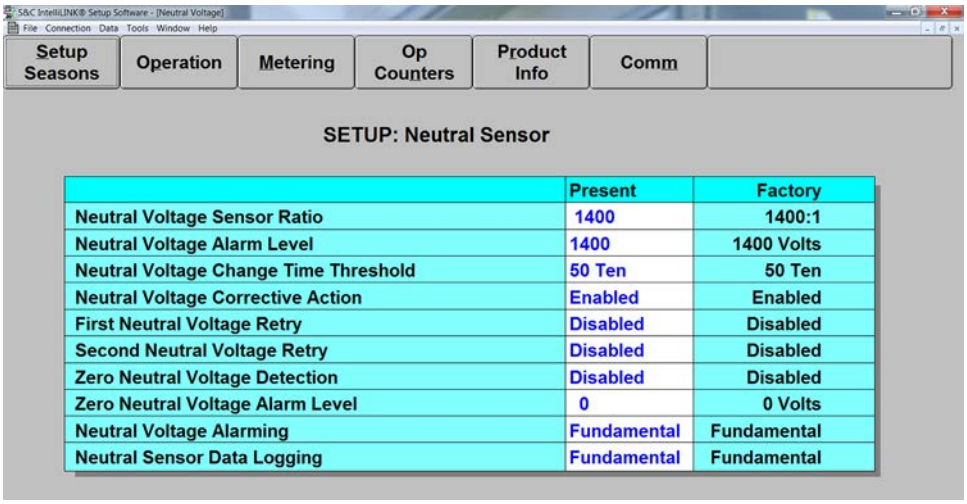


Figure 21. The *Setup: Neutral Sensor* screen (neutral voltage capacitor control).

For capacitor controls with neutral voltage sensing, refer to Figure 21. This screen includes the following fields:

Neutral Voltage Sensor Ratio

This is the neutral voltage sensor ratio specified by the manufacturer. The capacitor control uses this ratio to calculate the level of actual neutral voltage.

The control is configured to accept a neutral voltage sensor with a secondary output of either 0-5 Vac or 0-150 Vac. The eighth digit of the control's model number, shown on the *Operation* screen, identifies the type of neutral voltage sensor to be used:

V—The capacitor control accepts a sensor with a 0-5 Vac output. Enter the ratio for the neutral voltage sensor, as specified by the manufacturer (for example, "1400" for a sensor with a voltage divider ratio of 1400:1).

P—The capacitor control accepts a voltage transformer with an output in the 0-150 Vac range. Enter the step-down ratio of the voltage transformer (for example, "100" for a 12000/120 V distribution transformer).

S—The capacitor control accepts an S&C voltage sensor with an output in the 0-150 Vac range. Enter the step-down ratio of the S&C voltage sensor (for example, "130" for an S&C Catalog #81602R2-B with a ratio of 130:1).

Neutral Voltage Alarm Level

The capacitor control triggers the **Neutral Sensor** alarm on the *Alarm Status* screen when neutral voltage is above this value for the period of time specified by the **Neutral Voltage Change Time Threshold** setpoint. See Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Control: *Troubleshooting*," for more information.

Note: Neutral voltage monitoring begins 5 minutes after opening the capacitor bank to allow stored energy to discharge.

Neutral Voltage Change Time Threshold

If neutral voltage exceeding the **Neutral Voltage Alarm Level** setpoint persists for the time set on the **Neutral Voltage Change Time Threshold** setpoint, the **Neutral Sensor** alarm will be set. Neutral Voltage monitoring begins 5 minutes after opening the capacitor bank.

This setpoint is also used by another timer to define Recent Switching Activity for Neutral Voltage Corrective Action. If the control switches the bank and then detects neutral voltage exceeding the **Neutral Voltage Alarm Level** setpoint within a time period starting at the switching event equal to the **Neutral Voltage Change Time Threshold** setpoint, this is considered Recent Switching Activity if the excess neural current persists and becomes a **Neutral Sensor** alarm. See Instruction Sheet 1023-540, "S&C IntelliCap® Automatic Capacitor Control: *Operation*," for more information.

Neutral Voltage Corrective Action

When the **Neutral Voltage Corrective Action** feature is enabled and a **Neutral Sensor** alarm is triggered by neutral voltage that was detected close enough to the switch operation to be considered Recent Switching Activity, the control attempts to reverse the last switching operation. The control also takes corrective action if the bank is closed and a **Neutral Sensor** alarm becomes active but is not Recent Switching Activity. In this case, the control assumes a fuse operation and opens the bank. If the bank is open and a **Neutral Sensor** alarm becomes active, the control assumes a condition that cannot be handled by closing the bank, such as a shorted switch, has occurred and locks out further automatic operation. If a switch sticks when the bank opens, corrective action is taken after the **Reclose Block Delay** timer expires. During a reclose block, line 1 of the LCD display shows ****Retry Pending**** and Line 2 does not indicate the reclose block time remaining. During the **Reclose Block Delay** event, the OPEN LED display blinks. When the **Neutral Voltage Corrective Action** feature is disabled, the capacitor control locks out automatic operation, and takes no corrective action or retries.

Neutral Voltage Retry

If the **First Neutral Voltage Retry** setpoint is enabled, the control waits for the setpoint time to expire and operates the bank. If the **Second Neutral Voltage Retry** setpoint is also enabled, the control waits for that setpoint time to expire and operates the bank a second time. If the neutral voltage level becomes normal after either retry, the alarms clear and the control returns to normal operation. Otherwise, the control returns the bank to the **Corrective Action** state and, if this was the second retry or if the second retry is disabled, blocks further automatic operation of the bank. If the **First Neutral Voltage Retry** setpoint is disabled, the control blocks any automatic operation of the bank after the corrective action.

Setpoint values for the **Neutral Voltage Corrective Action** feature are **Disabled** (default) and **Enabled**. Values for the **First Neutral Voltage Retry** and **Second Neutral Voltage Retry** setpoints are **Disabled** (default), **5 min**, **10 min**, **20 min**, **60 min**, and **1 hour through 48 hours** in one hour increments. When the **Neutral Voltage Corrective Action** feature is enabled, Line 1 of the LCD display shows ****Retry Pending**** when a retry is pending. Line 2 displays the time remaining before the retry will occur. The LCD screen Real-Time Data menu **NeutRmsAmps** and the *Operation* screen **Neutral Sensor** fields display the real-time **Neutral Voltage** value during the retry time delay. If a **Neutral Voltage Retry** event is pending, the LCD screen shows ****Alarms Active****, and the **Neutral Sensor** alarm is also active. The **Neutral Voltage First Retry** and **Neutral Voltage Second Retry** setpoints are not programmable from the LCD display.

The **Neutral Sensor** alarm clears automatically if the condition is corrected before any retries are performed. Placing the control in **Manual** mode will cancel any pending retries.

To manually clear the **Neutral Sensor** trouble condition during a retry time delay:

STEP 1. Place the control in **Manual** mode.

STEP 2. Wait for the Neutral Sensing trouble condition to clear.

STEP 3. Switch to **Automatic** mode.

The control will return to local strategy and return the bank to the correct bank state for the present strategy after the **Reclose Bank Delay** timer expires, if active. The LCD screen shows ****Retry Pending**** and a countdown of the time remaining during a retry.

When the **Corrective Action** feature is enabled, an **Emergency Voltage** condition will override a **Neutral Sensor Lockout** event. When the voltage returns to its configured normal range, the **Neutral Sensor Lockout** event will be reapplied.

Zero Neutral Voltage Detection and Zero Neutral Voltage Alarm Level

When the control detects a total RMS neutral voltage that is less than the configured **Zero Neutral Voltage Alarm Level** for a period of time specified by this setpoint (if enabled), the control sets the **Zero Neutral Voltage** alarm. The control does not try any corrective action or lock out the bank. The alarm clears when the **Zero Neutral Voltage** condition clears, when a **Clear All Alarms** command is executed, or when a **Neutral Sensor Lockout Reset** procedure is performed.

Neutral Voltage Alarming

This sets Fundamental or RMS reporting for the neutral voltage the control measures and compares to the **Neutral Voltage Alarm Level** setpoint to trigger the **Neutral Sensor** alarm. If the fundamental setpoint value is chosen, the control uses only the 60-Hz component.

Neutral Sensor Data Logging

This setpoint value allows data logging of either the neutral voltage fundamental or RMS reporting used by the control to trigger the **Neutral Sensor** alarm.

SCADA Override Setup

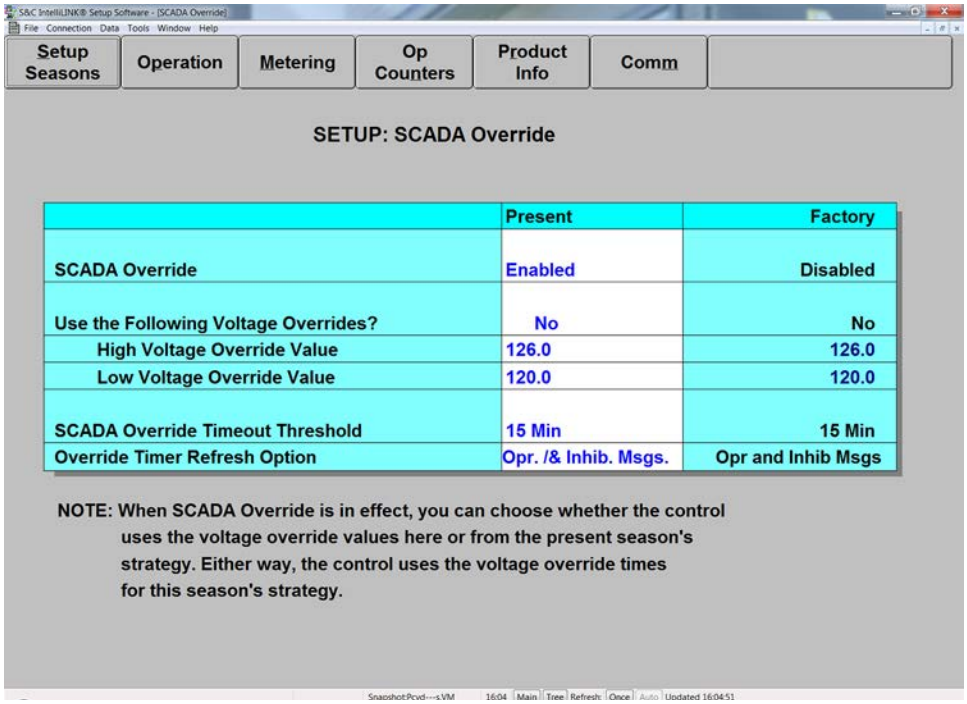


Figure 22. The *Setup: SCADA Override* screen.

When the control has communications equipment installed as part of a SCADA system, at the *Setup: Seasons* screen, click on the **SCADA Override** button to display the *Setup: SCADA Override* screen. See Figure 22.

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

The master station sends these parameters to the capacitor control over DNP. As long as the sensed voltage at the capacitor bank remains within the voltage range and the timer is active, the bank remains in **SCADA Override** mode. When the voltage falls outside of the specified range, the regular voltage override logic controls the bank.

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

SCADA Override

This setpoint enables or disables **SCADA Override** mode. The master station can also enable/disable it by sending a **Latch On/Off** request to the control point for this setpoint. **SCADA Override** mode only becomes active when the master station sends a **Close** or **Open** request.

Use the Following Voltage Overrides?

When this setpoint is set to the **Yes** state, the control uses the **Voltage-Override** values on this screen. The SCADA master station can then adjust these values to find the best results for the feeder.

When this setpoint is set to the **No** state, the control uses the **Voltage-Override** values associated with the present season's control strategy.

High Voltage Override Value

This is the maximum voltage level before the control overrides the **SCADA Override** bank state to avoid a **High-Voltage** condition. If the voltage exceeds this level for the duration of the **High Voltage Override Time** setpoint on the screen for this season's control strategy, the bank switches out.

Low Voltage Override Value

This is the minimum voltage level before the control overrides the **SCADA Override** bank state to avoid a **Low-Voltage** condition. If the voltage is below this level for the duration of the **Low Voltage Override Time** setpoint on the screen for this season's control strategy, the bank switches in.

SCADA Override Timeout Threshold

This is the length of time **SCADA Override** mode will be active after the control receives an override-initiating **Close**, **Open**, or **Operation Inhibit** command from the master station. If during this period the control does not receive a subsequent SCADA message, whose type(s) are determined by the **SCADA Override Timer Refresh Option** setting, the **SCADA Override** mode ends and the control returns to its regular automatic control strategy. To "latch" the bank in or out command (with voltage overrides possible) or the **Automatic Operation Inhibit** command, click and hold the up arrow until the value of this setpoint reads **Latched**. The **SCADA Override** mode will then persist until specifically cancelled by a command from the SCADA master.

Override Timer Refresh Option

When the **SCADA Override Timer** is active and the control receives a message to set the time for the **SCADA Override Timeout Threshold** setpoint, the control will reset the timer to the time configured. The control will also reset this timer when it is already active in response to receiving new SCADA commands and messages, as follows: if this setting is configured to **Operate and Inhibit Messages**, then any new SCADA bank operation command or the **Automatic Operation Inhibit** command received while the timer is active will also cause the active SCADA Override Timeout to be reset to its maximum value. If this setting is configured to **Every Message Received**, then the control will reset the **SCADA Override Timeout** timer to its configured value in response to any message received from the SCADA master station while the timer is active.

Communications Setup

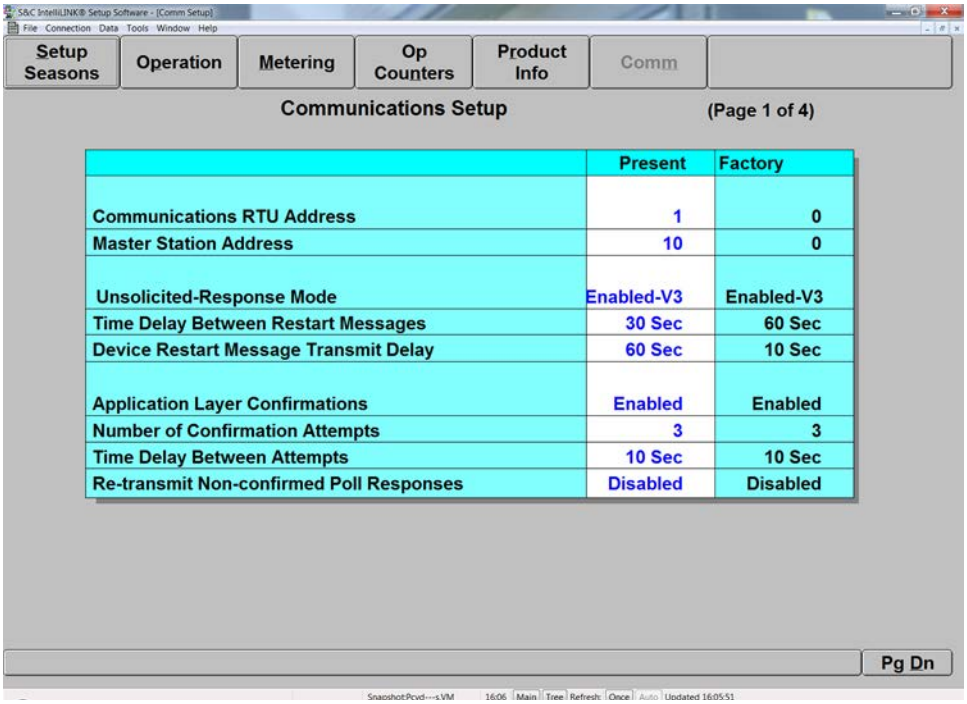


Figure 23. Page 1 of the *Communications Setup* screen (DNP version).

Click on the **Comm** button to display page 1 of the *Communications Setup* screen. See Figure 23.

This screen includes the following fields:

Communications RTU Address

When this control will be accessed via SCADA communications, enter the network address for this control installation.

NOTICE

When an already-configured capacitor control is moved to a new location, be sure to enter the new address into the control. If the old address is left in the control, it may respond to instructions meant for a different location.

NOTICE

IntelliLink Remote Users: Changing the RTU address or other communication parameters can stop this device from communicating with the IntelliLink Remote Setup Software. When communication with a control is lost, the user must go to the site, connect directly to that control, and reset the RTU address or other changed communication parameter.

Master Station Address

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

Unsolicited Response Mode

This setpoint determines how the control behaves with respect to event messages. There are three settings: Disabled, Enabled-V2, and Enabled-V3.

When this setpoint is in the **Disabled** state, the control behavior will conform to the latest DNP level-2 specification for disabling the transmission of unsolicited event messages. No event messages of any kind will be transmitted to the SCADA master station. This includes null unsolicited response (restart) messages when the control restarts. If an Enable Unsolicited DNP message (application function code 0x14) is sent to the control, the control responds by setting the Second IIN Octet, bit 0: Bad Function Code. Configuring this setpoint to the **Disabled** state renders the setpoints non-applicable and irrelevant to the behavior of the control.

When this setpoint is configured to any **Enabled** state setting, the capacitor control sends an event to the SCADA master station every time a status point changes state or an analog event is generated. When this feature is enabled, the master station address must also be entered on this screen. See the "Master Station Address" section on page 54.

When this setpoint is configured to the **Enabled-V2** state, the control re-transmits any unconfirmed event message, including null unsolicited response (restart) messages, until the count of the number of transmission attempts is equal to the number given by the **Number of Confirmation Attempts** setpoint. Furthermore, the control will not wait to receive an **Enable Unsolicited DNP message** command (application function code 0x14) before transmitting event-containing unsolicited response messages to the SCADA master station. The behavior given by the **Enabled-V2** state setting is not DNP level-2 specification compliant. It is included to support previous communication functionality. Using this setting may significantly reduce the amount of network traffic because the number of restart messages is limited when the SCADA master cannot or does not confirm. Conversely, use of this setting may increase traffic after a power loss and device restart because the devices do not wait for the **Enable Unsolicited DNP message** command (application function code 0x14) to be received before starting to transmit unsolicited response messages to the master station.

When this setpoint is configured to the **Enabled-V3** state, the control behavior conforms to the present DNP Level-2 requirements regarding event messages, unless this behavior is overridden by setting the **Application Layer Confirmations** setpoint to the **Disabled** state setting. This means that at power up null unsolicited responses are sent until a master station confirmation is received. Also, the control will not transmit any data-filled unsolicited response until it has received an **Enable Unsolicited DNP message** command (application function code 0x14).

Note: Enabling this feature may add significant communication traffic to the communication network.

Application Layer Confirmations

When this setpoint is configured to the **Enabled** state, the capacitor control requests an application layer confirmation from the SCADA master station every time an event message is transmitted. This includes null unsolicited response (restart) messages. If the control does not receive a confirmation within a specified time period given by the **Time Delay Between Attempts** setpoint, it retransmits the response. When this setpoint is configured to the **Disabled** state, the control will not request confirmation for event messages. Any event messages, including the null unsolicited response (restart) message, will be transmitted one time only regardless of whether the **Unsolicited-Response Mode** is configured for the **Enabled-V2** or **Enabled-V3** state.

Note: Disabling this feature is not compliant with the DNP level-2 specification, but enabling this feature may add significant communication traffic to the communication network.

Number of Confirmation Attempts

If the **Application Layer Confirmations** setpoint is set to the **Enabled** state, the **Number of Confirmation Attempts** setpoint establishes the maximum number of times the control will transmit the unsolicited response when the control does not receive an application layer confirmation from the SCADA master station in response to a transmitted event message. This maximum number also applies to the null unsolicited response (restart) message transmitted upon device restart if the **Unsolicited Response Mode** is configured to the **Enabled-V2** state. Conversely, this setpoint does not apply in the special case of such restart messages if the **Unsolicited-Response** mode is configured to the **Enabled-V3** state. In the case where

Unsolicited Response mode is configured to the **Enabled-V3** state, the start-up message is retransmitted indefinitely until it is confirmed. If the **Application Layer Confirmations** setpoint is configured to the **Disabled** state, then all event messages, whether data-filled or not, are sent one time only regardless of the setting value of the **Unsolicited-Response Mode** setpoint. Each time the same unsolicited response message is retransmitted to the master station, a count of the number of attempts is incremented and compared with the maximum number of attempts, given by this setpoint. Whenever a new, unique, unsolicited response message is constructed and transmitted the count of the number of attempts is reset to one.

Time Delay Between Attempts

When the **Application Layer Confirmations** setpoint is set to the **Enabled** state and the capacitor control does not receive a confirmation within the time period defined by this setpoint, it retransmits the response, unless the message transmission is subject to limitation by the **Number of Confirmation Attempts** setpoint, defined above, and this limit has been reached. If a new event occurs while the control is waiting for a previous unsolicited response message to be confirmed, the control will wait until one of two conditions is true before acting on the new event. If the previous message is confirmed before this time delay expires, the control will clear from the event queue all of the events contained in the previous message, now confirmed. It will then immediately build a new unsolicited response message containing the new event(s) and transmit it. If the time defined by this setpoint expires before a confirmation of the previous message is received, the control will build a new message containing all of the events presently in the queue and transmit it to the master.

Time Delay Between Restart Messages

When the **Application Layer Confirmations** setpoint is set to the **Enabled** state, this setpoint gives the unsolicited-retry time interval for null unsolicited response (restart) messages. If the capacitor control did not receive a confirmation following a null unsolicited response (restart) message within this time period, it retransmits this unsolicited response. If the **Unsolicited-Response Mode** setpoint is configured to the **Enabled-V2** state, an unconfirmed restart message will be retransmitted until the **Number of Confirmation Attempts** setpoint has been reached. If the **Unsolicited-Response Mode** setpoint is configured to the **Enabled-V3** state, a restart message will be retransmitted at this time interval indefinitely until it is confirmed.

Device Restart Message Transmit Delay

When the **Unsolicited-Response Mode** setpoint is configured in the **Enabled-V2** or **Enabled-V3** state, this setpoint establishes the delay between the restart of the control and the transmission of the **Device Restart** unsolicited message. If the communication system needs time for acquisition following a restart, adjust this value to match the requirements.

Retransmit Non-confirmed Poll Responses

When this setpoint is configured to the **Enabled** state, the capacitor control will treat DNP poll response messages containing event data in the same way as it treats unsolicited event messages. That is, it will retransmit an unconfirmed poll-response message up to the number of times given by the **Number of Confirmation Attempts** setpoint. If a poll response containing event data is not confirmed after the number of attempts have been exhausted, the events will still be retained in the event queue as they are when this feature is not enabled and the poll response message is not confirmed. This retransmitting of event data-containing poll responses behavior is not DNP level-2 specification compliant and is included for compatibility with prior versions of the control software.

Note: Enabling this feature may add significant communication traffic to the communication network.

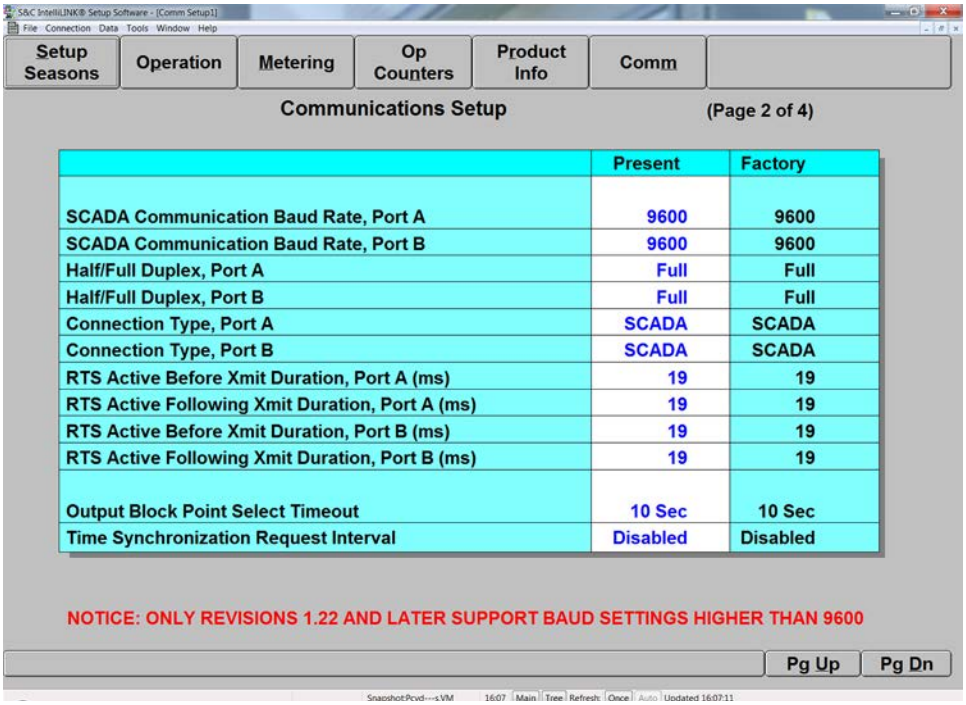


Figure 24. Page 2 of the *Communications Setup* screen (DNP version).

At page 1 of the *Communications Setup* screen, click on the **PgDn** button to display page 2 of the *Communications Setup* screen. See Figure 24.

This screen includes the following fields:

SCADA Communication Baud Rate, Port A
SCADA Communication Baud Rate, Port B

This is the baud rate between the control and the directly connected communications device (radio, modem, etc.). This baud rate must be identical to the baud rate for the device. Only software revisions 1.22 and later support baud settings higher than 9600.

Half/Full Duplex, Port A
Half/Full Duplex, Port B

Set this value to match the value selected for the device (modem, radio, etc.) that is directly connected to this port.

Connection Type, Port A
Connection Type, Port B

This is the type of connection for this port which defines how the control handles communications.

- **None—**There is no connection to this port
- **Non-Relay—**Messages received on this port are not intended for other controls (This setting also prevents the control from recording errors if this port receives a message not addressed to the local control.)
- **SCADA—**This port is connected to a SCADA master station
- **Direct—**This port is connected directly to another control and is intended to relay messages to it

RTS Active Before Xmit Duration, Port A
RTS Active Before Xmit Duration, Port B

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

RTS Active Following Xmit Duration, Port A
RTS Active Following Xmit Duration, Port B

This is the amount of time, in milliseconds, RTS (request to send) is active after a transmission has taken place. Leave this at the factory default value.

Output Block Point Select Timeout

This is the timeout duration of the **Select** function on control points. If the timeout duration is too short between the **Select** and the **Operate** functions during a **Select-Before-Operate** sequence, the control disables the point and reports a failure to the master station.

Time Synchronization Request Interval

The control time and date are maintained in a highly accurate battery-backed clock chip, but the control can be forced to request a time-synchronization message by setting an interval in this setpoint. If an interval has been set, the control will request time upon startup and then again every subsequent interval. For example, if the interval is configured for 2 hours and the control starts up at 1:30, a request for time will be made at 1:30 and then again at 3:00, 5:00, 7:00, etc.

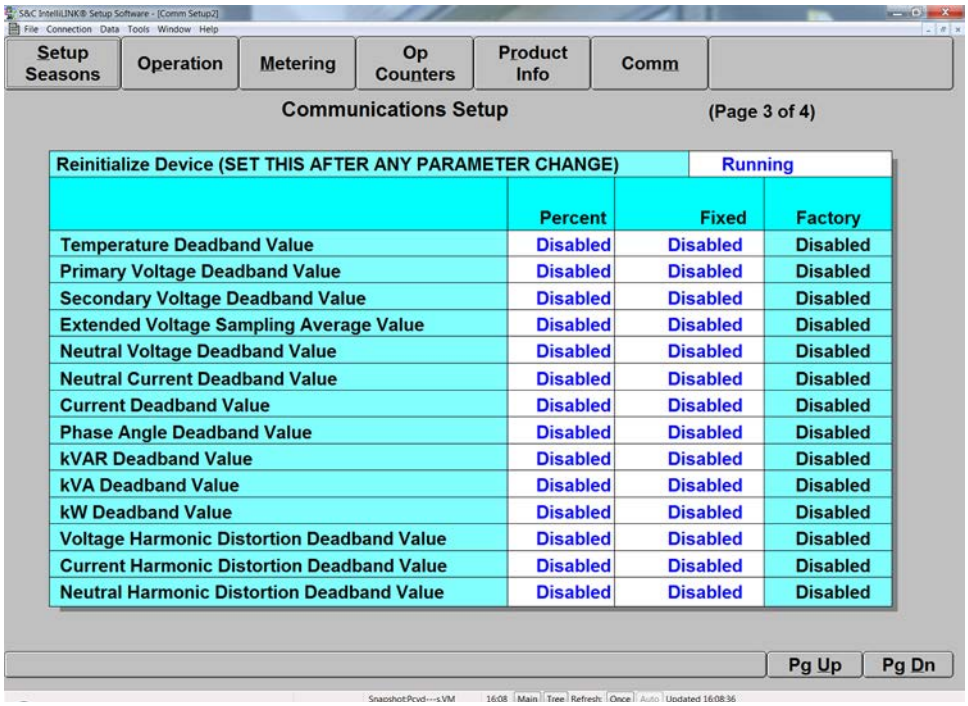


Figure 25. Page 3 of the *Communications Setup* screen (DNP version).

At page 2 of the *Communications Setup* screen, click on the **PgDn** button to display page 3 of the *Communications Setup* screen. See Figure 25.

Deadband Values

This is a variance value that, if exceeded, captures the amount by which a measured parameter (voltage, current, kvars etc.) deviated from a previously stored reference value. The amount of variance is then stored as a 1 Analog Event (Object 32), and the reference is updated to reflect the new measurement. The event threshold is selectable by percent or by a fixed value (fixed values have precedence) to a maximum appropriate to the individual parameter. Reference values are initialized to reflect sensor values after a brief stabilization period after system start up. Deadband-event sensing can be disabled on a per parameter type basis by incrementing the value past maximum. The word **Disabled** will be displayed.

Each deadband value may vary from one to 100 percent, if a percentage deadband is selected for that value. The fixed deadband ranges are dependent upon the value in question, as follows:

Temperature—The temperature deadband may vary from one to 40 degrees.

Primary Voltage—The primary voltage deadband may vary from one to 300 Volts (var controls only).

Secondary Voltage—The secondary voltage deadband may vary from one to 50 Volts.

Extended Voltage Sampling Average—The extended voltage sampling average deadband may vary from one to 50 Volts.

Neutral Voltage—The neutral voltage deadband (if applicable) may vary from one to 50 Volts (neutral sensing controls only).

Neutral Current—The neutral current deadband (if applicable) may vary from one to 200 amps (neutral sensing controls only).

Phase Current—The phase current deadband may vary from one to 200 amps (var controls only).

Phase Angle—The phase angle deadband may vary from one to 720 degrees (var controls only).

kvar, kVA, and kW—The kvar, kVA, and kW deadband values may each vary from one to 6000 kvars, kVA, or kW respectively (var controls only).

Voltage, Current, and Neutral Total Harmonic Distortion—The voltage, current, and neutral total harmonic distortion may each vary from 0.1 to 100.0 percent. This is a fixed percentage range and not to be confused with a percentage change in value. Current distortion is for var controls only; neutral distortion is for neutral-sensing controls only.

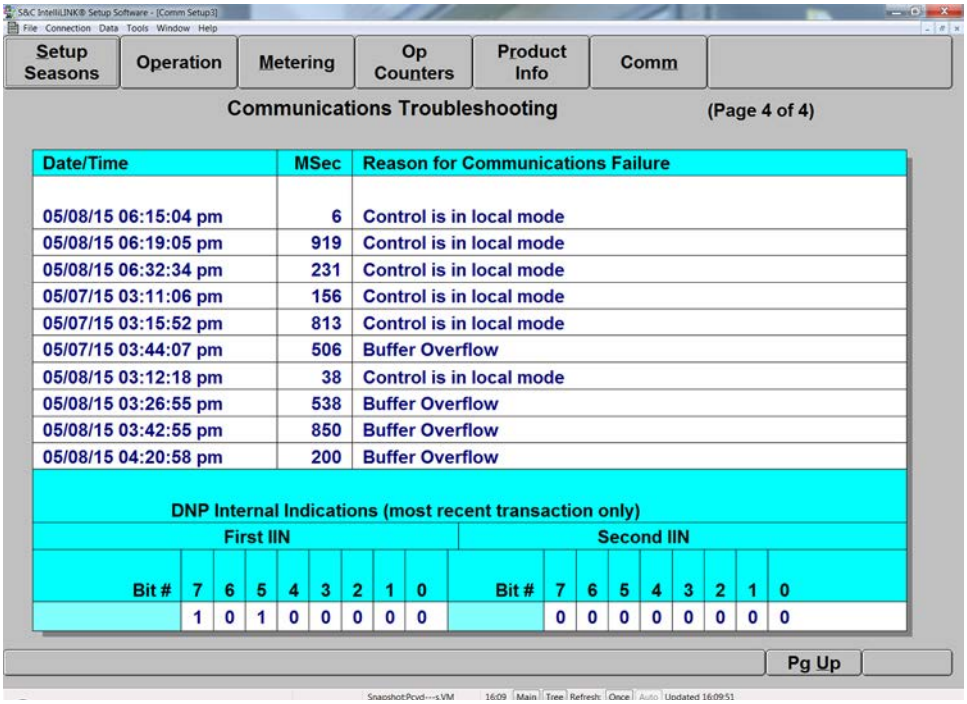


Figure 26. Page 4 of the *Communications Troubleshooting* screen (DNP version).

At page 3 of the *Communications Setup* screen, click on the **PgDn** button to display page 4 of the *Communications Setup* screen. See Figure 26.

This screen provides information regarding the DNPv3.00 communication process. It includes a circular buffer that holds the most recent 10 events and the status of the IIN bits for the most recent transaction.

Information regarding the data Link layer of DNPv3.00 may be available within the circular buffer. If events occur that cause a message to fail at the data link layer, one of the following messages may appear:

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

Information regarding the application layer of DNPv3.00 may also be available within the circular buffer section. If events occur that cause a message to fail at the data link layer, one of the following message may appear:

- Invalid function code received
- Invalid object variation received
- Invalid object type received
- Invalid index size received
- Invalid qualifier code received
- Invalid object range received
- Invalid object header parameters
- Control is in local mode
- Message received with broadcast address

In addition to the circular buffer, application layer information may also be found in the DNPv3.00 Internal Indication (IIN) bits status box. The status of each bit is indicated by either an Up Arrow or a Down Arrow. The Up Arrow indicates the described state is active. The status of the bits is valid for the most recent transaction only.

First IIN

Bit 0 Broadcast message received

Bit 1 Class 1 data available

Bit 2 Class 2 data available

Bit 3 Class 3 data available

Bit 4 Time-synchronization required from the master

Bit 5 Control is in Local state

Bit 6 Device trouble

Bit 7 Device restart

Second IIN

Bit 0 Function code not implemented

Bit 1 Requested object unknown

Bit 2 Parameters in the qualifier, range, or data fields are not valid or out of range

Bit 3 Event or application buffers have overflowed

Bit 4 Requested operation is already executing

Bit 5 Configuration corrupt

Bit 6 Reserved

Bit 7 Reserved

Metering Setup

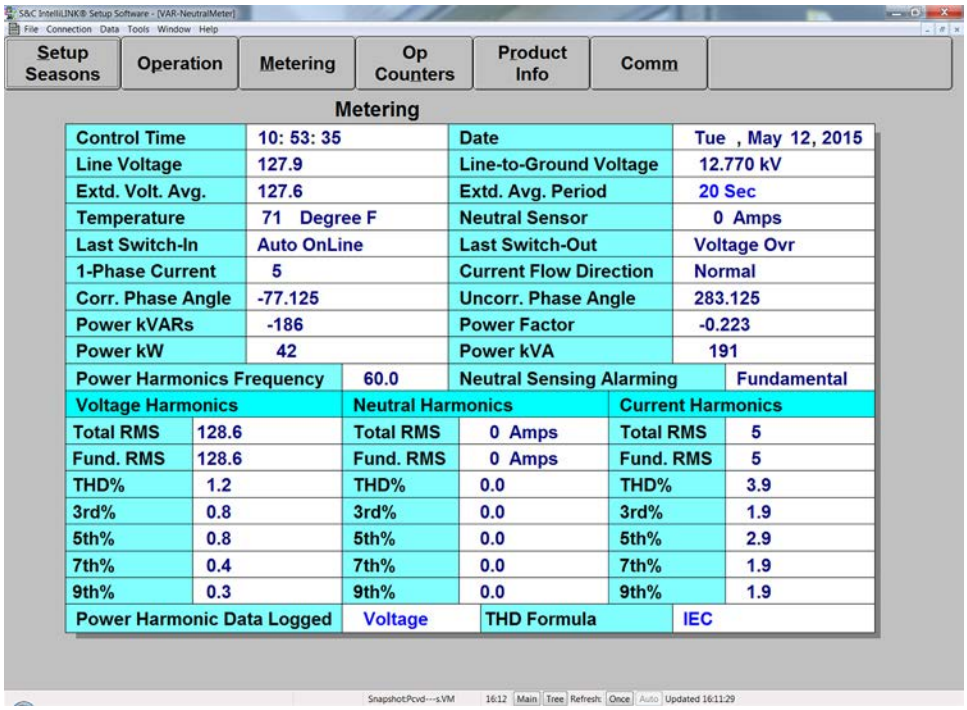


Figure 27. The *Metering* screen for a var control.

Click on the **Metering** button to display the *Metering* screen. See Figure 27.

The upper part of this screen displays real-time data values. For more information about these fields, see "View the Metering Screen" in Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Control: *Troubleshooting*."

The lower part of this screen displays power harmonics data. The capacitor control calculates the 1st (fundamental), 3rd, 5th, and 7th harmonics, as well as the total harmonic distortion, THD, every 15 minutes. The Total RMS is a 24-hour total of all RMS harmonics. Once the log is full, each new value overwrites the oldest value in the log.

Harmonics are expressed as a percentage of the fundamental. Total harmonic distortion is calculated as the ratio of the total RMS harmonic content to the RMS level of the fundamental.

The *Metering* screen includes the following fields:

Frequency

This is the nominal operating frequency in use. For more details, see Page 3 of the *Setup: General* screen.

Neutral Sensing Alarming

This is the component or components of the neutral sensing used to trigger the **Neutral Sensing** alarm.

Voltage Harmonics

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

Neutral Harmonics

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

Current Harmonics (var controls only)

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

Power Harmonics Data Logged

This setpoint chooses what type of harmonic data the control records in the Selected Sensor Harmonics Analysis log: voltage, current, or neutral voltage/neutral current, as applicable. Harmonic data are logged and time stamped every 15 minutes for a 24 hour period. At the end of 24 hours, the oldest data are over-written with new data.

THD Formula

This setpoint chooses how the THD and individual harmonic percentages are calculated. The IEEE formula relates the THD and all harmonics to the Fundamental, the IEC formula 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.

Enabling Normal Operation

Follow these steps to enable normal operation:

STEP 1. If desired, review the present status of the capacitor control on the *Operation* screen.

To display the *Operation* screen, click the **Operation** button at any other screen. For a detailed explanation of the *Operation* screen, see the "View the Operations Information" section in Instruction Sheet 1023-550, "S&C IntelliCap® Plus Automatic Capacitor Control: *Troubleshooting*."

STEP 2. If desired, generate a report.

Generate a report when a printed record of the capacitor control settings is needed or a problem exists that requires help from S&C Electric company. For details, see the "Generating Reports" section in Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."

STEP 3. Exit the IntelliLink software.

In the **File** menu at any IntelliLink screen, select the **Exit** button. Then, click on the **OK** button.

STEP 4. Turn off the computer, and disconnect it from the capacitor control.

STEP 5. On the capacitor control faceplate, set the **Operation Mode (Auto/Manual)** and **SCADA Control (Remote/Local)** settings for desired operation.

This completes IntelliCap Plus control setup.

Continue with Instruction Sheet 1023-540, "S&C IntelliCap® Plus Automatic Capacitor Control: *Operation*."