Setup

Table of Contents

Section	Page
Introduction	
Qualified Persons	2
Read this Instruction Sheet	2
Retain this Instruction Sheet	2
Proper Application	2
Special Warranty Provisions	2
Safety Information	
Understanding Safety-Alert Messages	4
Following Safety Instructions	4
Replacement Instructions and Labels	4
Safety Precautions	5
Control Setup	
Quick Setup	6
Faceplate Access to Setpoints	7
Computer and Software Requirements	8
IntelliLink® Setup Software	8
IntelliLink Software Screens	10
Model IC-10 Menu Tree	10
Model IC-50 with Var Menu Tree	11
Setup for Normal Operation	12
Setup>General Screen	13
Setup>Site-Related Screen	22
Setup>Miscellaneous Screen	26
Enable Normal Operation	29

March 19, 2018

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 your S&C IntelliCap 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 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 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 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. 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 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 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 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 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.

Quick Setup

This section outlines the basic setup for your IntelliCap control. You can change these setpoints from the faceplate, see the "Faceplate Access to Setpoints" section on page 7 for details. Depending on your system, you may also need to change other setpoints. To review the default values for all setpoints, see the "Setup for Normal Operation" section on page 12.

Quick setup assumes the following:

- The voltage transformer secondary-operating voltage is 120 V at 60 Hz.
- Temperature is displayed as degrees Fahrenheit.

For the IntelliCap with Var control, quick setup assumes the following:

- An EnergyLine CS or Lindsey CVMI current-only sensor is used with a full-scale rating of 600 amps. The sensor is located on the source side of the capacitor bank with the polarity mark "H1" toward the source.
- The voltage transformer is connected phase to neutral and is connected to the same phase as the current sensor.

IntelliLink® Setup Software must be used to change any of these setup parameters.

Follow these steps to configure the control:

STEP 1. Decide on the control strategy necessary for each season (summer and winter). All strategies include a Voltage-Override strategy.

- For the standard IntelliCap control, Timeclock strategy is the default, 8:00 – 17:00, Monday through Friday.
- For the IntelliCap with Var control, Var strategy is the default; switch in at 800 kvars, switch out at -700 kvars. Note that IntelliCap with Var control setup also assumes a bank size of 1200 kvar.

If the default strategy is acceptable for both seasons, control setup is complete.

STEP 2. To use a different control strategy for either season, change the ****Summer**** and/or ****Winter**** setpoints on the LCD screen. Additional setpoints may also need adjustment.

Note: The default summer season is May 15 through September 15. Use the IntelliLink software to change either date.

STEP 3. If required, additional setpoints can be changed from the faceplate. See Table 1 on page 7 for a list of key setpoints and the default values.

STEP 4. To verify the quick setup is correct, check the real-time data from the LCD screen. For the IntelliCap with Var control, the current direction should be normal (****Dir=Nml****) and the power factor should be reasonable. The power factor for a circuit without excessive connected capacitors should be between 0.707 and -0.966. When current direction is reversed (****Dir=Rev****), use IntelliLink software to change the **Offset-Angle** setpoint from 0° to 180°.

Table 1. Key Setpoints on the LCD Screen

Faceplate Abbreviation	Setpoint Name	Default Value (IntelliCap control)	Default Value (IntelliCap with Var control)	Screen Name
***Lo VoltOvr**	Low-Voltage Override	119.9 Vac	119.9 Vac	*Setup>General*
***Hi VoltOvr**	High-Voltage Override	126.1 Vac	126.1 Vac	*Setup>General*
***EstVChg+Mrg**	Bank Voltage Change + Margin: Estimated Value	1.5 Vac	1.5 Vac	*Setup>General*
***Hi VoltTime**	Over-Voltage Override Time Threshold	60 sec	60 sec	*Setup>General*
***Lo VoltTime**	Under-Voltage Override Time Threshold	60 sec	60 sec	*Setup>General*
***Summer**	Summer Control Strategy	Timeclock	Var	*Setup>General*
***Winter**	Winter Control Strategy	Timeclock	Var	*Setup>General*
(various)	You must set the values for the control strategy you choose.			*Setup>Control Strategy*
***3pBankSize**	3-Phase Bank Size	—	1200	*Setup>Site-Related*
***VlfmrRatio**	Voltage-Transformer Ratio	—	100	*Setup>Site-Related*

Faceplate Access to Setpoints

Key setpoint values can be changed from the faceplate. The LCD screen displays the information. See Instruction Sheet 1022-540, "S&C IntelliCap® Capacitor Control: *Operation*" for more information.

Note: Because of value rounding, the IntelliLink and LCD screens may have slightly different values for real-time data and setpoints.

Follow these steps to change setpoint values from the faceplate:

STEP 1. Toggle the AUTO/MANUAL switch to the **Manual** mode.

STEP 2. Toggle the SELECT SETPOINT switch up or down to select the setpoint being changed. To scroll through the setpoints more quickly, hold the switch in the **Up** or **Down** position.

STEP 3. Toggle the CHANGE SETPOINT switch up or down once. The value blinks, indicating it can be changed.

STEP 4. Toggle the CHANGE SETPOINT switch again to change the value. To change the value more quickly, hold the switch in the **Up** or **Down** position.

Note: When the blinking value has been adjusted, the change cannot be cancelled. The setpoint must be reset to change the value.

STEP 5. Toggle the SELECT SETPOINT switch to accept the value. The value will also be automatically accepted after a 60-second delay or when the AUTO/MANUAL switch is set to the **Auto** mode.)

Note: Setpoint values can only be adjusted from the faceplate when the **Faceplate Setpoints Adjustment** setpoint is set to **Changeable** mode on the *Setup: Miscellaneous* screen. This setpoint cannot be reconfigured from the faceplate.

In the "Setup for Normal Operation" section on page 12 and subsequent sections, the faceplate icon  indicates setpoints that can be changed from the faceplate.

Computer and Software Requirements

The following computer and software features are required:

- Portable computer
- Microsoft® Windows® 7 or later operating system
- A serial communications port or a USB port and USB-to-serial cable
- An Internet connection
- DB9 communications cable (The RS232 serial cable is used to connect the computer serial port to the DB9 COMM PORT on the IntelliCap faceplate. The cable must have a DB9-pin male connector at one end and a connector at the other end for the serial port on the computer. It must be a straight-through cable, not a null-modem cable. The cable should be long enough to reach comfortably from the IntelliCap control to the computer while at the site.)
- IntelliLink Setup Software (Download the installer from the S&C Automation Customer Support Portal at this link: **sandc.com/en/support/sc-customer-portal/**.)

IntelliLink® Setup Software

The IntelliLink Setup Software displays real-time data and IntelliCap control settings. Connect the computer to a functioning IntelliCap control before starting the software.

NOTICE

When using a 2-wire, ungrounded extension cord to power either the computer or the IntelliCap control when they are connected, the serial port on the computer may be damaged. ALWAYS use a grounded, three-wire extension cord or battery power.

Follow these steps to use the IntelliLink Setup Software:

STEP 1. Install IntelliLink software on the computer.

(a) Download the software installer from the "IntelliCap Software" workspace on the S&C Automation Customer Support Portal.

(b) Move the installer file from your download folder to the desktop.

(c) Right click on the icon and select "Run as administrator." Administrative privileges are required to install S&C software on a computer.

(d) The installer will provide guidance through the installation process.

STEP 2. Connect the computer to the control. Plug the communication cable into the computer serial port. Attach the other end to the DB9 COMM PORT on the faceplate. To view the IntelliLink screens and online help without real-time data, start the IntelliLink software and connect to a virtual memory (VM) file.

STEP 3. Start the IntelliLink software by double-clicking on the IntelliLink icon in the EnergyLine folder at *Start>Programs>EnergyLine>IntelliLink*. The EnergyLine logo appears, and the software attempts to open communication with the control. The *Operation* screen opens when communication with the control is established. See Figure 1 on page 9. If IntelliLink software does not establish communication with a control, it tries all possible baud rates. Then, it displays the dialog box shown in Figure 2 on page 9.

(a) Click on the **OK** button to close the dialog box and go to the next step.

STEP 4. Locate and correct the connection problem. To troubleshoot a connection problem, see the "Software Troubleshooting and Error Messages" section in Instruction Sheet 1022-550, "S&C IntelliCap® Automatic Capacitor Control: *Troubleshooting*."

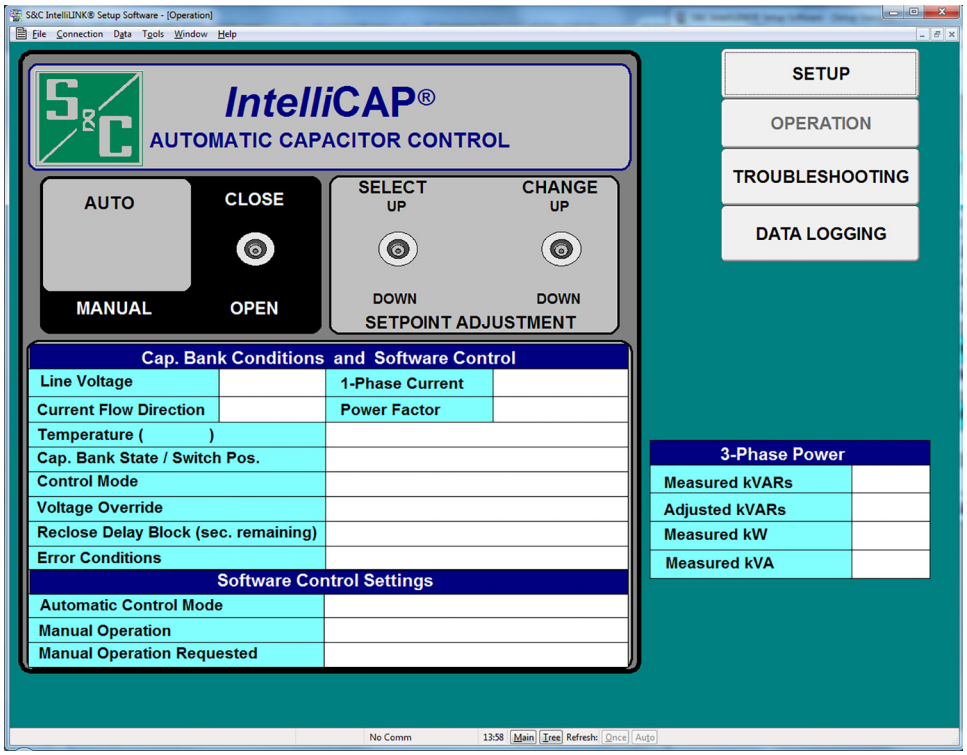

Figure 1. The *Operation* screen (var version).

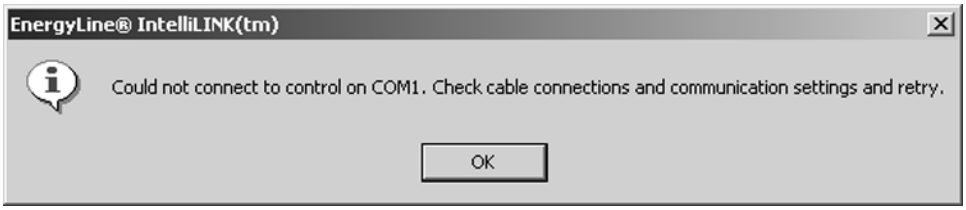

Figure 2. This dialog box indicates the computer could not connect to control.

If communication cannot be established, follow these steps to view the IntelliLink software screens and online help text without viewing real-time data or changing control setpoints:

STEP 1. Click on the **Cancel** button in the Connect dialog box.

STEP 2. To view IntelliLink screens with all fields empty, choose the **Open Screenset** option in the *IntelliLink* screen **File** menu.

STEP 3. In the Open Screenset dialog box, find and select the .WMN file whose name matches the version name of the software for this IntelliCap control.

STEP 4. To view IntelliLink screens with data from a virtual memory (VM) file, choose the **Connect to VM File** option in the *IntelliLink* screen **Connection** menu.

STEP 5. In the Open Controller Data File dialog box, find and select the .VM file to view. A sample VM file is included in the IntelliLink software folder. For more information about VM files, see the "Using Virtual Memory Files" section in Instruction Sheet 1022-540, "S&C IntelliCap® Automatic Capacitor Control: *Operation*."

Note: If an IntelliLink software *Operation* screen does not open or if the software does not operate properly, see Instruction Sheet 1022-550, "S&C IntelliCap® Automatic Capacitor Control: *Troubleshooting*."

IntelliLink Software Screens

IntelliLink Setup Software includes over 50 screens and dialog boxes that are used to enter setpoint values, view data, and troubleshoot control problems. This flexible software is logical and intuitive.

Using IntelliLink software to program the control requires completion of only these three steps:

STEP 1. Use the *General* and *Miscellaneous* screens to adjust all the control setpoints.

STEP 2. Select a summer control strategy and complete all the setpoints for that strategy. Select a winter control strategy and configure the setpoints.

STEP 3. When installing an IntelliCap with Var control, adjust the **Site Related** setpoints.

Each version of the IntelliLink software is tailored to the requirements of a particular control/sensor combination and the expected country of use. All IntelliCap controls use one of the two menu trees shown in the next two sections.

Model IC-10 Menu Tree

Operation

Setup Menu

- Setup>General [page 1 and page 2]
- Setup>Control Strategy Menu
  - Setup>Control Strategy—Timeclock [page 1 and page 2]
  - Setup>Control Strategy—Temperature
  - Setup>Control Strategy—Time-Biased Voltage
  - Setup>Control Strategy—Voltage Only
  - Setup>Control Strategy—Time-Biased Temperature
  - Setup>Miscellaneous [page 1 and page 2]
  - Setup>Communications (If applicable)
  - Save Configuration Data

Troubleshooting

- Control & Switch Information
- Chronological Log
- Faceplate Change Log

Data Logging Menu

- Data Logging>Daily Statistics for Last Month Menu
  - Data Logging>Daily High and Low Hi-Low Voltage and Temperature
  - Data Logging>Daily Switching Cycles
- Data Logging>Sensor Profile Menu
  - Data Logging>Sensor Profile—Voltage
  - Data Logging>Sensor Profile—Temperature
- Data Logging>Switching Data Menu
  - Data Logging>Voltage Levels During Switching
  - Data Logging>Switching Events
- Data Logging>Power Outages

Data Graphing Menu

- Data Graphing>Daily Statistics for Last Month Menu
  - Data Graphing>Daily High and Low Voltage
  - Data Graphing>Daily High and Low Temperature
- Data Graphing>Sensor Profile Menu
  - Data Graphing>Sensor Profile—Voltage
  - Data Graphing>Sensor Profile—Temperature

Report Menu

- Report>Full
- Report>System Setup and Operation
- Report>Troubleshooting Information
- Report>Historical Data

Model IC-50 with Var Menu Tree

- Operation
- Setup Menu
  - Setup>General [page 1 and page 2]
  - Setup>Control Strategy Menu
    - Setup>Control Strategy - Timeclock [page 1 and page 2]
    - Setup>Control Strategy - Temperature
    - Setup>Control Strategy - Time-Biased Voltage
    - Setup>Control Strategy - Voltage Only
    - Setup>Control Strategy - Time-Biased Temperature
    - Setup>Control Strategy - Current
    - Setup>Control Strategy - Var
  - Setup>Site-Related
  - Setup>Miscellaneous [page 1 and page 2]
  - Setup>Communications (If applicable)
  - Save Configuration Data
- Troubleshooting
  - Control & Switch Information
  - Chronological Log
  - Faceplate Change Log
- Data Logging Menu
  - Data Logging>Daily Statistics for Last Month Menu
    - Data Logging>Daily High and Low Voltage and Temperature
    - Data Logging>Daily High and Low Current
    - Data Logging>Daily High and Low Power Factor
    - Data Logging>Daily High and Low kvars
    - Data Logging>Daily High and Low kW
    - Data Logging>Daily Switching Cycles
  - Data Logging>Sensor Profile Menu
    - Data Logging>Sensor Profile - Voltage
    - Data Logging>Sensor Profile - Temperature
    - Data Logging>Sensor Profile - Current
    - Data Logging>Sensor Profile - Power Factor
    - Data Logging>Sensor Profile - kvars
    - Data Logging>Sensor Profile - kW
  - Data Logging>Switching Data Menu
    - Data Logging>Voltage Levels During Switching
    - Data Logging>kvar Levels During Switching
    - Data Logging>Switching Events
  - DATA LOGGING: Power Outages
- Data Graphing Menu
  - Data Graphing>Daily Statistics for Last Month Menu
    - Data Graphing>Daily High and Low Voltage
    - Data Graphing>Daily High and Low Temperature
    - Data Graphing>Daily High and Low Current
    - Data Graphing>Daily High and Low Power Factor
    - Data Graphing>Daily High and Low kvars
    - Data Graphing>Daily High and Low kW
  - Data Graphing>Sensor Profile Menu
    - Data Graphing>Sensor Profile - Voltage
    - Data Graphing>Sensor Profile - Temperature
    - Data Graphing>Sensor Profile - Current
    - Data Graphing>Sensor Profile - Power Factor
    - Data Graphing>Sensor Profile - kVARs
    - Data Graphing>Sensor Profile - kW

CONTINUED ▶

Report Menu
- Report>Full
- Report>System Setup and Operation
- Report>Troubleshooting Information
- Report>Historical Data

Setup for Normal Operation

To configure an IntelliCap control for normal operation, enter the correct setup parameters and set the faceplate switches for the desired **Operating** mode. Key setpoints can be accessed using the faceplate, and all setpoints are configurable in the IntelliLink software. The values entered from the faceplate or in the setup software depend on the electrical distribution system and details specific to the capacitor bank. Most factory-default values should be acceptable.

In this section, a faceplate icon ( ) indicates setpoints changeable from the faceplate. The name that appears on the LCD screen is shown below the name that appears on the IntelliLink screen.

The *Setup Menu* screen opens when the control connects to the computer. See Figure 3. If the correct screen does not open or if the software does not operate properly, see Instruction Sheet 1022-550, "S&C IntelliCap® Automatic Capacitor Control: *Troubleshooting*."

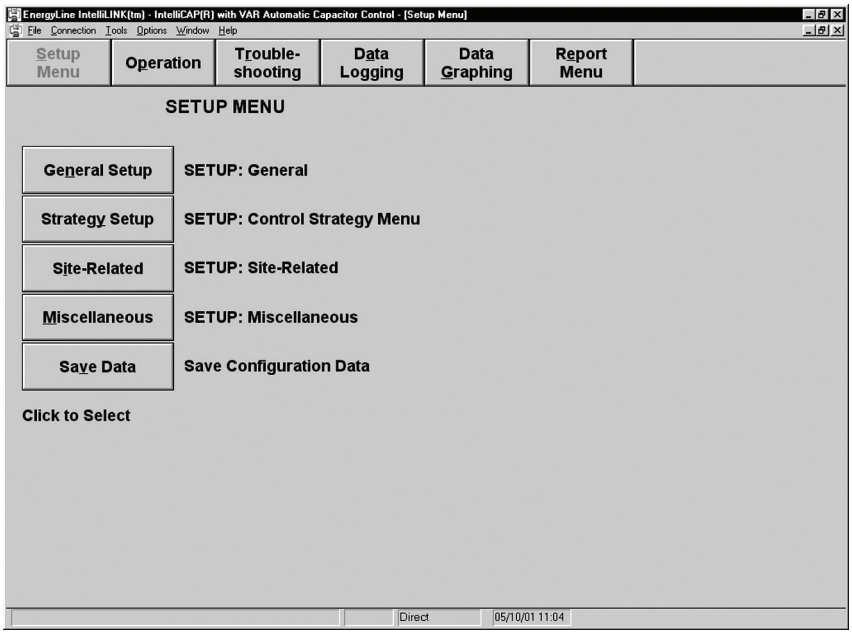

Figure 3. The *Setup Menu* screen for a var control.

The *Setup Menu* screen provides access to other setup screens. Follow these steps to add or change data values on the IntelliLink screens:

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

STEP 2. If the dialog box accepts typed input, use the keyboard to enter the new value. If the dialog box does not accept typed input, click on the up or down arrow to change the value, or click on the **Radio** button to select 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 value.

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

STEP 5. Press the <F1> key to view help text for setpoints in the screen.

Setup>General Screen

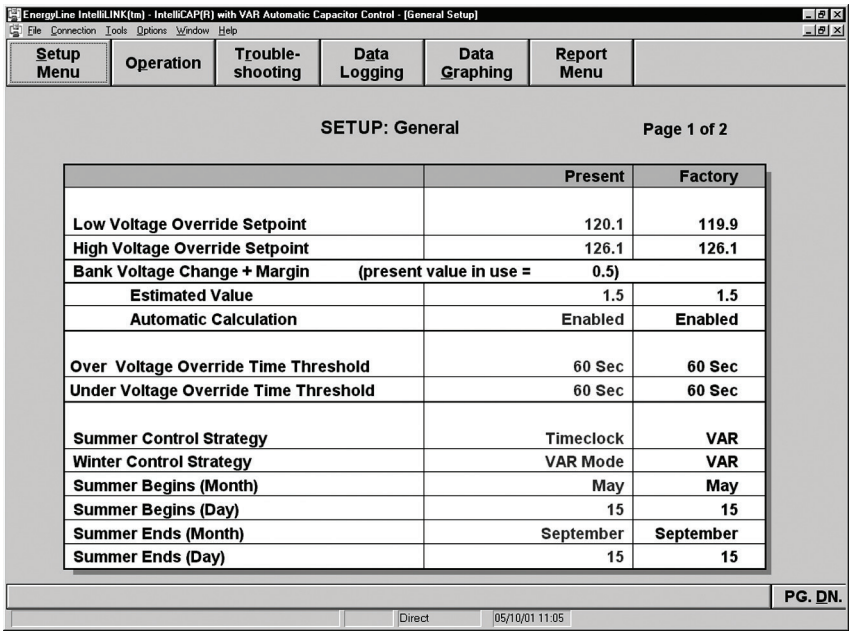

Figure 4. The *Setup>General* screen Page 1, for a var control.

The *Setup>General* screen contains the basic setup parameters. All of these must be reviewed during installation of the control to ensure correct operation. The values are only adjusted for installation, reinstallation, or maintenance.

Note: The control is shipped with a default nominal operating voltage of 120 Vac. The default temperature unit is °F. The default values listed in the setpoint descriptions and shown on the screens are for a 120-Vac base and for °F. When changing the **Nominal Operating Voltage** or the **Temperature Readings Conversion** setpoints (on the *Setup>Miscellaneous* screen), the default values for other voltage and temperature setpoints scale appropriately.

The Voltage Override Operation

In **Automatic** mode, the control overrides the selected control strategy (Temperature, Timeclock, etc.) when an **Over-Voltage** or **Under-Voltage** condition is present. An **Over-Voltage** or **Under-Voltage** condition is present when the voltage level remains outside the normal range for a specified period of time. Setpoints on the *Setup>General* screen determine the range and period of time. For more information, see Figure 5 on page 14 and the following descriptions.

After an **Over-Voltage** condition, the control returns to normal operation when the voltage stays below a value equal to the **High-Voltage Override** setpoint minus the **Bank Voltage Change + Margin** setpoint for the time period specified by the **Over-Voltage Override Time Threshold** setpoint. After an **Under-Voltage** condition, the control returns to normal operation when the voltage stays above a value equal to the **Low-Voltage Override** setpoint plus the **Bank Voltage Change + Margin** setpoint for the time period specified by the **Under-Voltage Override Time Threshold** 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 LCD screen shows ****Evnt=InOvrM**** when automatic switching is inhibited.

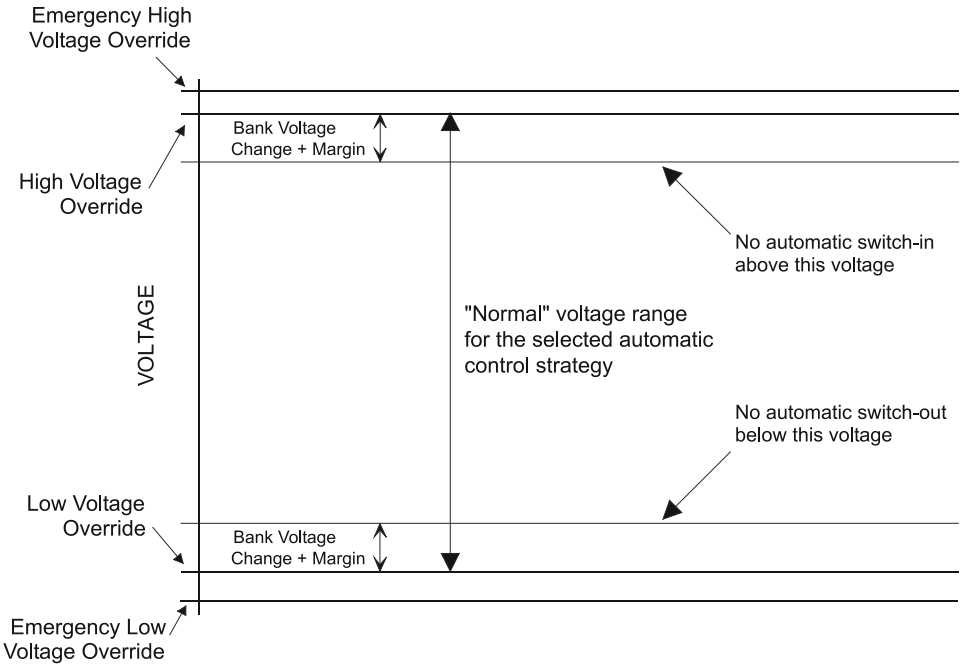

Figure 5. The voltage levels for a Voltage-Override operation.

The *Setup>General* screen Page 1 (see Figure 4 on page 13) includes the following fields:

Low Voltage Override Setpoint
Lo VoltOvr

This is the minimum voltage level before the control overrides **Automatic** mode and switches the bank in to avoid an **Under-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 **Under-Voltage Override Time Threshold** 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 on the *Setup>Miscellaneous* screen.

High Voltage Override Setpoint
Hi VoltOvr

This is the maximum voltage level before the control overrides **Automatic** mode and switches the bank out to avoid an **Over-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 **Over-Voltage Override Time Threshold** setpoint.

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

Bank Voltage Change + Margin: Estimated Value
EstVChg+Mrg

This is an estimated average of the voltage change associated with the bank switching in or out. Set this value to the average measured voltage change at the bank, plus 0.5 volts for an operating margin. The control uses the **Bank Voltage Change + Margin** setpoint and the **Voltage-Override** setpoints to inhibit bank switching if the voltage is close enough to an override limit that switching the bank would cause a voltage override condition.

See the "High-/Low-Voltage Band Error" section in Instruction Sheet 1022-550, "S&C IntelliCap® Automatic Capacitor Control: *Troubleshooting*," for the troubleshooting procedure.

Bank Voltage Change + Margin: Automatic Calculation

When this field is set to the **Enabled** state, 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 control can account for any future feeder configuration adjustments that affect the voltage change. The *Setup* screen displays the present value in use, whether set to **Estimated** or **Calculated** mode.

Note: When the control is installed, it uses the **Bank Voltage Change + Margin: Estimated Value** setpoint until four switching operations have taken place. Any time the estimated value is changed, the control uses that value until another four switching operations have taken place. Therefore, make sure to enter a reasonable **Bank Voltage Change + Margin: Estimated Value** setpoint even if the **Automatic Calculation** feature is enabled.

Over-Voltage Override Time Threshold **Hi VoltTime**

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

Under-Voltage Override Time Threshold **Lo VoltTime**

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

Summer Control Strategy **Summer**

This is the control strategy to be used during the summer operating season, when the control is in **Automatic** mode. The factory default value is Timeclock strategy. See the applicable setpoints below for a definition of the summer months.

Possible control strategies are:

Timeclock—The bank is switched in or out based on a time schedule.

Temperature—The bank is switched in or out based on ambient air temperature.

Time-Biased Voltage—The bank is switched in or out based on **High-** and **Low-Voltage** setpoints for two different Timeclock schedules.

Voltage Only—The bank is switched in or out based on the **High-** and **Low-Voltage Override** setpoints and the preferred capacitor bank position.

Time-Biased Temperature—The bank is switched in or out based on **High-** and **Low-Temperature** setpoints during Timeclock schedule periods. During unscheduled periods, the bank is switched out.

Automatic Online Mode—In **Automatic** mode, the bank is always switched in. The bank remains online regardless of whether an **Over-Voltage** condition is in effect.

Automatic Offline Mode—In **Automatic** mode, bank is always switched out. The bank remains offline regardless of whether an **Under-Voltage** condition is in effect.

For the IntelliCap with Var controls, two additional control strategies are available:

Current—The bank is switched in or out based on measured single-phase current flow.

Vars—The bank is switched in or out based on three-phase kvars (kilovolt-amperes, reactive, calculated as 3 times the single-phase kvars).

Winter Control Strategy
****Winter****

This control strategy is used during the winter season, when the control is in **Automatic** mode. See the applicable setpoints below for a definition of the non-summer months. The possible control strategies are the same as those for the Summer strategy.

Summer Begins (Month)
Summer Begins (Day)

These two fields determine the date on which the summer season begins.

Summer Ends (Month)
Summer Ends (Day)

These two fields determine the date on which the summer season ends. For example, if this date is set to September 15, then the Winter control strategy takes effect one minute after midnight on September 16.

Setup>General screen - Page 2

The second *Setup>General* screen shows the setpoints for the **Emergency Voltage-Override** feature, enabling a decrease in the reaction time of the **Voltage-Override** logic during periods when voltage is at a high or low critical level. This faster response helps reduce the excessive **Over-** or **Under-Voltage** conditions that might damage customer equipment.

This screen includes the following fields:

Emergency Low-Voltage Override Setpoint

This is the minimum voltage level before the control overrides **Automatic** mode to avoid an extreme **Under-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 **Emergency Under- Voltage Override Time Threshold** setpoint.

Set the **Emergency Low-Voltage Override** setpoint to a value lower than the **Low-Voltage Override** setpoint on the *Setup>General* screen Page 1. The default value is 110.0.

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 on the *Setup>Miscellaneous* screen.

Emergency High-Voltage Override Setpoint

This is the maximum voltage level before the control overrides **Automatic** mode to avoid an extreme **Over-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 **Emergency Over- Voltage Override Time Threshold** setpoint.

Set the **Emergency High-Voltage Override** setpoint to a value higher than the **High-Voltage Override** setpoint on the *Setup>General* screen Page 1. The default value is 130.1.

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

Emergency Under-Voltage Override Time Threshold

This is the amount of time the voltage must be continuously below the **Emergency Low-Voltage Override** setpoint before the bank switches in. Set this value to a time much shorter than the **Under-Voltage Override Time Threshold** setpoint on the *Setup>General* screen Page 1.

To enable the **Emergency Under-Voltage Override** feature, enter a time for this setpoint. The default state is **Disabled**.

Emergency Over-Voltage Override Time Threshold

This is the amount of time the voltage must be continuously above the **Emergency High-Voltage Override** setpoint before the bank switches out. Set this value to a time much shorter than the **Over-Voltage Override Time Threshold** setpoint on the *Setup> General* screen Page 1.

To enable the **Emergency Over-Voltage Override** feature, enter a time for this setpoint. The default state is **Disabled**.

Reclose Delay Block Reset On Power-Up

If enabled, the **Reclose Delay Block** timer will reset to 0 after a power-up. This permits quick operational testing in the field by power-cycling the control without waiting the entire 5-minute reclose delay.

To enable the **Reclose Delay Block Reset On Power-Up** feature, set the **Enabled** state for this setpoint. The default state is **Disabled**.

⚠ WARNING

When testing, be sure the high voltage fuse cutouts to the capacitor bank are disconnected so the capacitors cannot be energized. Never attempt to defeat the **Reclose Delay Timer** function to close in a capacitor bank. Failure to allow the reclose delay may cause equipment damage and injury to personnel.

Setup>Control Strategy—Timeclock screen

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 intended to be active.

This screen includes the following fields:

Timeclock Schedules **Sched 1**, **Sched 2**

These schedules are used when in **Timeclock** mode to determine when the bank will be active. These schedules are also used by **Time-Biased Voltage** and **Time-Biased Temperature** modes. 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 seven 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).

Two schedules may be specified. The bank will be active if the present time falls within either of the schedules. The default is Schedule 1 active Monday through Friday, 8:00 - 17:00.

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 or other days when the bank should be switched off, except during an **Under-Voltage** condition. The actual dates are determined by the control for the following specific holidays: President's Day, Memorial Day, Labor Day, and Thanksgiving. Any combination of these automatic holidays can be enabled. The default is all four holidays enabled.

Additional Automatic Holidays

Holidays also may be entered in the format [First, Second, Third, Fourth, Last] [day of week] in [month] (for example: "Second Saturday in August"). Using this method, the exact date of the holidays entered will change dynamically with each year on the *Setup>Control Strategy—Timeclock* screen.

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 an **Under-Voltage** condition). If the day falls on a Saturday, the previous Friday will be treated as the holiday. If the day falls on a Sunday, the following Monday will be treated as the holiday. The defaults are January 1, July 4, and December 25.

Setup>Control Strategy—Temperature screen

This screen contains the setpoints used in the **Temperature** control mode. The difference between the switch-in and switch-out temperatures should be at least 8° F. To disable **High-** or **Low-Temperature** mode, set the switch-in and switch-out setpoints to **N/A** mode.

This screen includes the following fields:

HIGH TEMPERATURE OPERATION: Temperature at Which Bank Switches In
HiTempSwIn

This is the temperature at which the bank switches in during high-temperature operation. The temperature must be above this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch in. The default is 85° F.

HIGH TEMPERATURE OPERATION: Temperature at Which Bank Switches Out
HiTempSwOut

This is the temperature at which the bank switches out during high-temperature operation. The temperature must be below this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch out. The default is 70° F.

LOW TEMPERATURE OPERATION: Temperature at Which Bank Switches Out
LoTempSwOut

This is the temperature at which the bank switches out during low-temperature operation. The temperature must be above this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch out. The default is 40° F.

LOW TEMPERATURE OPERATION: Temperature at Which Bank Switches In
LoTempSwIn

This is the temperature at which the bank switches in during low-temperature operation. The temperature must be below this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch in. The default is 30° F.

TEMPERATURE OVERRIDE OPERATION: Changes Control Strategy to Temperature When Temperature Setpoints Are Exceeded
Enabled

The **Temperature Override** setpoint is in the Timeclock, Current, and Var control strategies. With the **Temperature Override** mode enabled, the control strategy will change to **Temperature** strategy 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. The control strategy will then remain in the **Temperature** strategy until the ambient temperature is in the range specified for the bank to switch out.

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. The default is 10 minutes.

Setup>Control Strategy - Time-Biased Voltage screen

When the control is in the **Time-Biased Voltage** control mode, it switches the capacitor bank according to the schedules on the *Setup>Control Strategy - Timeclock* screen. The control uses the two sets of voltage setpoints entered on this screen instead of the **Voltage-Override** setpoints on the *Setup>General* screen Page 1 (see Figure 4 on page 13). The **Bank Voltage Change + Margin** setpoint is the same.

This screen includes the following fields:

Scheduled Periods: High Voltage Setpoint **Sched VOut**

This is the voltage level above which the bank will be switched out if the time is within a scheduled period for the bank to be on. The voltage must be above this value for a period of time specified by the **Voltage Change Time Threshold** setpoint before the bank will switch out. The default is 126.1.

Scheduled Periods: Low Voltage Setpoint **Sched VIn**

This is the voltage level below which the bank will be switched in if the time is within a scheduled period for the bank to be on. The voltage must be below this value for a period of time specified by the **Voltage Change Time Threshold** setpoint before the bank will switch in. The default is 119.9.

Unscheduled Periods: High Voltage Setpoint **UnSch VOut**

As above, but this setpoint applies during unscheduled periods. The default is 124.0.

Unscheduled Periods: Low Voltage Setpoint **UnSch VIn**

As above, but this setpoint applies during unscheduled periods. The default is 117.9.

Voltage Change Time Threshold **TBiasVTime**

This is the amount of time the voltage must be continuously outside the normal voltage range before a switching operation occurs. The default is 3 minutes.

Setup>Control Strategy—Voltage Only screen

In **Voltage Only** control mode, the control switches the capacitor bank based solely on voltage levels. The **Voltage-Override** setpoints are on the *Setup>General* screen (see Figure 4 on page 13). This also accommodates choosing a preferred capacitor bank position.

Preferred Capacitor Bank Position **Prefer**

When the voltage remains within the normal range (see Figure 5 on page 14), the control switches the bank according to the chosen **Preferred Capacitor Bank Position** setpoint. No action takes place when selecting the **Don't Care** setting or if switching the bank would cause a **Voltage-Override** condition. A different **Preferred Capacitor Bank Position** state for the summer and winter seasons can be assigned. The default is the **All:Don't Care** setting.

Setup>Control Strategy—Time-Biased Temperature screen

When the control is in **Time-Biased Temperature** control mode, it switches the capacitor bank based on the temperature and the schedules on the *Setup>Control Strategy—Timeclock* screen. The **Time-Biased Temperature** control mode uses the same logic as the **Temperature** control mode, except:

- There is only one set of temperature setpoints in use per season.
- The capacitor bank is offline during unscheduled periods.

This screen includes the following fields:

SUMMER OPERATION: Temperature at Which Bank Switches In **Summer SwIn**

This is the temperature at which the bank switches in during scheduled periods in the summer season. The temperature must be above this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch in. The default is 85° F.

SUMMER OPERATION: Temperature at Which Bank Switches Out **Summer SwOut**

This is the temperature at which the bank switches out during scheduled periods in the summer season. The temperature must be below this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch out. The default is 70° F.

WINTER OPERATION: Temperature at Which Bank Switches Out **Winter SwOut**

This is the temperature at which the bank switches out during scheduled periods in the winter season. The temperature must be above this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch out. The default is 40° F.

WINTER OPERATION: Temperature at Which Bank Switches In **Winter SwIn**

This is the temperature at which the bank switches in during scheduled periods in the winter season. The temperature must be below this value for a period of time specified by the **Temperature Change Time Threshold** setpoint before the bank will switch in. The default is 30° F.

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. The default is 10 minutes.

IntelliCap with Var Controls Only:

Setup>Control Strategy—Current screen

In the **Current** control mode, the control uses the setpoints on this screen to switch the bank based on single-phase current levels. When the capacitor bank switches, the line current changes because of a change in the power factor. 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.

Note: The number of automatic switching cycles can be limited using the **Maximum Automatic Switching Cycles Per Day** setpoint on the *Setup>Miscellaneous* screen. See Figure 7 on page 26.

This screen includes the following fields:

Single-Phase Current at Which Bank Switches In **Amps In**

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

Single-Phase Current at Which Bank Switches Out **Amps Out**

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

Current Change Time Threshold **Amps Time**

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

Coordination between IntelliCap controls is most easily done by changing this setpoint. Giving source-side controls longer time delays allows capacitor banks at the end of the line to switch first.

IntelliCap with Var Controls Only:

Setup>Control Strategy—Var screen

In **Var** control mode, the control uses the setpoints on this screen to switch the bank based on 3-phase var levels. 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 because of higher impressed voltages and manufacturing tolerances. If the kvar contribution of the bank is greater than the difference between the setpoint levels, the 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 on the *Setup>Miscellaneous* screen. See Figure 7 on page 26.

This screen includes the following fields:

3-Phase kvars at Which Bank Switches In **kvar In**

This is the var level (in kvars) at which the bank switches in. The vars must be above this value for a 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 **kvar Out**

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

Var Change Time Threshold **kvar Time**

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

IntelliCap controls can be most easily coordinated by changing this setpoint. Giving source-side controls longer time delays allows capacitor banks at the end of the line to switch first.

Note: When finished editing the control strategy setpoints, press the <F10> key to return to the *Setup Menu* screen.

Setup>Site-Related Screen

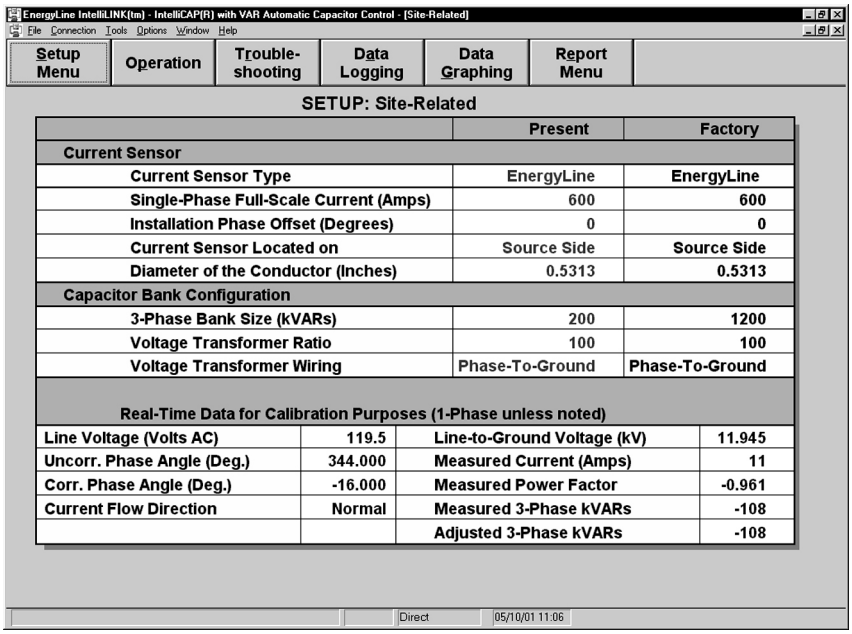

Figure 6. The *Setup>Site-Related* screen, for a var control.

The upper part of the *Setup>Site-Related* screen allows the entering of all the installation-dependent parameters associated with ac waveform analysis. The lower part of the screen displays real-time data produced by the ac waveform analysis.

The voltage transformer powering the control can be connected phase to neutral or phase to phase. The control scales the nominal 120-Vac voltage using the specified **Voltage Transformer Ratio** and **Voltage Transformer Wiring** setpoints to yield the **Line-to-Ground Voltage** value and to calculate kvars.

For more information about how the control processes sensor data, see Instruction Sheet: 1022-540 "S&C IntelliCap® Automatic Capacitor Control: *Operation*."

This screen includes the following fields:

Current Sensor Type

This is the sensor type used with this control. The IntelliCap with Var control software works with the following sensor types:

- EnergyLine CS current sensor
- Lindsey CVMI current-only sensor
- Fisher Pierce low accuracy sensors (1301-11 A for 15 kV systems, 1301-21 A for 35 kV systems, 1301-41 A for 25 kV systems)
- Fisher Pierce high accuracy sensors (1301-17 A for 15 kV systems, 1301-27 A for 35 kV systems, 1301-47 A for 25 kV systems)

NOTICE

A current sensor must be installed when var software is used. If the control will be installed without a current sensor, standard software must be installed in the control.

Single-Phase Full-Scale Current (Amps)

This is the maximum rated current for the current sensor, as specified by the manufacturer. This value corresponds to a full-scale output of 10 Vac from the current sensor. The control uses this number to calculate the level of actual current flow.

Current Sensor Located on

This is the location of the current sensor. If the sensor is on the normal source side of the bank, enter the **Source Side** option. If the sensor is on the normal load side of the bank, enter the **Load Side** option. Installing the sensor on the normal source side of the bank is recommended whenever possible.

Diameter of the Conductor (Inches)

For controls using Fisher Pierce sensors, this is the diameter (in inches) of the monitored conductor. Correction factors are based on Fisher Pierce's published data; refer to that company's data sheets for further information.

3-Phase Bank Size (kvars) **3pBankSize**

This is the size of the capacitor bank (in kvars) the control will be switching. Be sure to enter the correct value because this number is used to calculate the **Adjusted Total kvars** value.

Voltage Transformer Ratio **VXfmrRatio**

This is the stepdown ratio (primary to 120 volts) of the voltage transformer. The control records, displays, and manipulates voltages normalized on a 120-volt base. This parameter provides the conversion ratio from the 120-volt base to the line-to- ground voltage.

Be sure to enter the ratio for transformers wired the same way, phase to neutral or phase to phase, as the value entered for the **Voltage Transformer Wiring** setpoint.

Voltage Transformer Wiring

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

Installation Phase Offset (Degrees)

This field accommodates making installation-dependent phase-angle corrections. The control uses these corrections and other site-related parameters to calculate power factor and kvars and to determine the normal and reverse direction of current flow. Values that are a multiple of 30 degrees can be entered.

The next paragraphs explain how to adjust the phase-angle offset (correction) value for various system types. When making the adjustments, keep in mind that phase-angle detection and display require a minimum current of 1% of full scale values. Current magnitudes continue to be detected and displayed below the 1% threshold.

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

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

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

Located on page 24, Tables 2 and 3, and the "Capacitor Banks with a Phase-To-Phase-Connected Voltage Transformer (Connected to Phase Common with the Current Sensor)" directions show how to set the **Installation Phase-Offset** setpoint.

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

Set the **Phase-Angle Offset** to 0 degrees. If the **Current Flow Direction** field displays a Reverse message (that is, the **Corrected Phase-Angle** value is between 90 degrees and 270 degrees), set the offset to 180 degrees. The correct setting should eliminate any reverse messages in the **Current-Flow Direction** field 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. See Table 2 on page 24.

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 (that is, the **Corrected Phase-Angle** value is between 90 degrees and 270 degrees), set the offset to 270 degrees. The correct setting should eliminate any reverse messages in the **Current-Flow Direction** field 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. See Table 2.

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

Follow these steps to determine this parameter:

STEP 1. Use Table 2 to select a power factor range that includes the power factor of the load current flowing through the current sensor.

Table 2. General Ranges of Distribution 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 caused by 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 caused by predominantly capacitive loading

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 second-most likely.

The control also can be set up using the bank as the only load if the bank is on the load side of the sensor. Use Range #4.

STEP 2. Use the **Uncorrected Phase Angle** value (in the lower part of the screen), the estimated power factor range from Step 1, and the following tables to determine the **Installation Phase Offset** setpoint. Use Table 3 for phase-to-neutral connected voltage transformers and Table 4 for phase-to-phase connected voltage transformers.

Note: After setting the **Installation Phase-Offset** setpoint, be sure to press the <F1> key to resume monitoring.

Table 3. Installation Phase-Offset Values for a Phase-to-Neutral Connected Voltage Transformer.

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 a Phase-to-Phase Connected Voltage Transformer.

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 3. To verify the correct offset, check that the **Measured Power Factor** value is within the range estimated in Step 2 and that the **Current Flow Direction** value indicates Normal. Also, the **Uncorrected Phase Angle** value should stay within the range used in Table 3 on page 24 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.

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

(a) Change the status of any capacitor bank on the load side of the sensor. If a bank is online, switch it out. If a bank is offline, switch it in.

(b) 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).

STEP 4. Start again at Step 1 to determine the correct **Installation Phase Offset** value.

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 you enter on the setup screens.

Use the real-time data to immediately check the effect of any change made in the upper part of the screen (when monitoring is resumed). This data can also be used when setting the **Installation Phase Offset** value.

Line Voltage (Volts Ac)

This is the present value of the voltage seen at the control on a 120 volt base. The control software uses this value in calculating the kvars.

Uncorrected Phase Angle (Deg.)

This is the phase angle (the offset of the current waveform referenced to the voltage) before setup correction factors have been 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 have been applied). When the 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 control is properly set up and power is flowing through the circuit in the normal direction, this field displays “Normal.” If unusual circuit-switching conditions cause the direction of power flow to reverse, the value changes to “Reverse.”

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

Line-to-Ground Voltage (kV)

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

Measured Current (Amps)

This is the current, measured by the current sensor and scaled using the **Single-Phase Full-Scale Current** 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 three times the single-phase kvars. This assumes a balanced three-phase system.

Adjusted 3-Phase kvars

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

Setup>Miscellaneous Screen

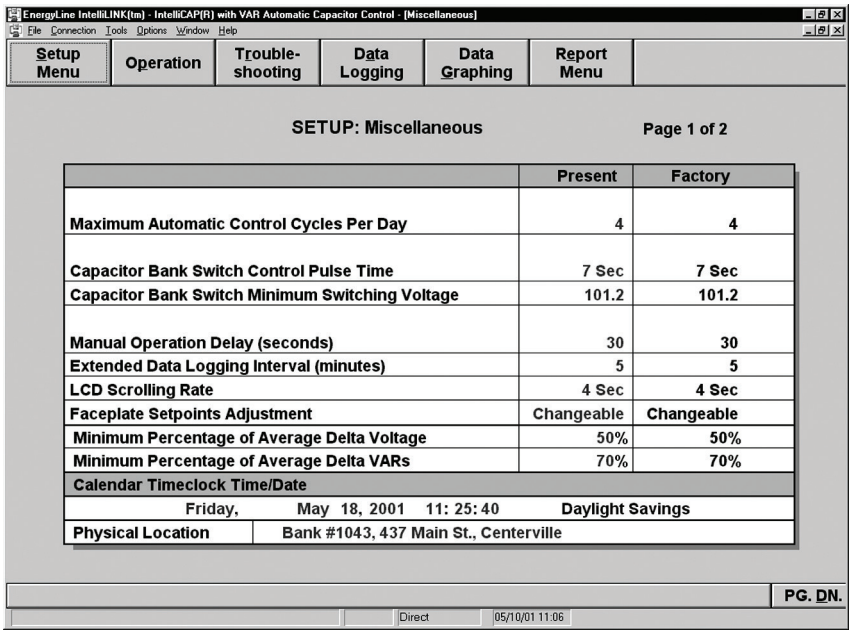

Figure 7. The *Setup>Miscellaneous* screen Page 1, for a var control.

This screen allows entry of general setup information for this IntelliCap control and the installation site.

The 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 by the control in **Automatic** mode or via a software **Manual** command. For motor-driven oil switches, a value of 7 seconds is typical. For latching relays, click on the **<+>** button until the field shows the **Latched** state.

Capacitor Bank Switch Minimum Switching Voltage

This is the voltage below which the control will not operate the capacitor bank switch. For motor-controlled switches, this value usually can be set to as low as 100 volts (on a 120-Vac base). For vacuum switches, do not set this value below 110 volts to prevent damage to the switch during a brownout condition.

Daylight Savings Time Automatic Changeover

The daylight savings time changeover dates are configurable and can be enabled or disabled. Dates are in the format [First, Second, Third, Fourth, Last] [day of week] in [month]. For example: Second Saturday in August. The default values are for the United States. The configuration is set on Page 2 of the *Setup>Miscellaneous* screen.

Manual Operation Delay

This is the amount of time (in seconds) **Close** and **Open** faceplate commands are delayed. This allows the operator to step away from the bank. The delay can be disabled or configured from 0 to 60 seconds. The default is 30 seconds.

After the CLOSE/OPEN switch has been activated, the LCD screen shows ****Close In ## secs**** or ****Open In ## secs**** and starts counting down the seconds. The delay and the requested operation can be canceled at any time before the output relays are energized by toggling the AUTO/MANUAL switch to the **Auto** mode.

Note: Make sure to toggle the AUTO/MANUAL faceplate switch back to the **Manual** mode to prevent the bank from switching automatically.

Extended Data Logging Interval

This is the interval (in minutes) used for logging voltage and temperature data. Logged data is averaged over this interval. The configurable intervals are 1, 5, 10, 15, 30, and 60 minutes.

Note: When the data-logging interval is changed, previously stored data are overwritten. To save older data, generate a report before changing the interval. See Instruction Sheet 1022-540, "S&C IntelliCap® Automatic Capacitor Control: *Operation*," for more information.

LCD Scrolling Rate

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

Faceplate Setpoints Adjustment

When this field is set to the **Changeable** state, setpoints can be adjusted from the faceplate. When it is set to the **Protected** state, toggling the faceplate CHANGE SETPOINT switch 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 for the previous four switching operations. If the most recent ΔV is below this percentage of the average level, a bank switch malfunction may have occurred. The control logs the condition on the *Troubleshooting>Control & Switch Information* screen. See Instruction Sheet 1022-540, "S&C IntelliCap® Automatic Capacitor Control: *Operation*," for more information.

Decrease the value to allow greater deviation in the ΔV, or increase it when the ΔV is expected to be very stable.

Minimum Percentage of Average Delta Vars (IntelliCap with Var only)

The control uses this setpoint to compare the most recent change in vars (Δvars) with the average Δvars for the previous four switching operations. If the most recent Δvars is below this percentage of the average level, a bank switch malfunction may have occurred. Decrease the value to allow greater deviation in the Δvars, or increase it if Δvars is expected to be to be very stable.

Calendar Timeclock Time/Date

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

When the **Daylight Savings Time Automatic Changeover** mode is enabled, the time/date statement includes the present daylight savings time status, for example:

Wednesday, April 29, 1998 10:43:08 Daylight Savings

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 helps identify the capacitor bank and appears on all reports generated from the control.

Setup>Miscellaneous screen Page 2

The *Setup>Miscellaneous* screen Page 2 includes the following fields:

Nominal Operating Voltage

This is the nominal operating voltage (in volts) for the distribution system. When configured, the control software automatically scales all voltage setpoints to the proper operating range. The configurable voltage settings are 110.0, 115.0, 120.0, 127.0, 220.0, 230.0, and 240.0 volts. The default is 120.0.

Nominal Operating Frequency

This is the nominal operating frequency (in Hz) for the distribution system. The default is 60.0.

Temperature Readings Conversion

This is the unit of temperature the control operates on and displays. Select either **Degree F** or **Degree C** mode. The default is **Degree F** mode.

Date Format Displayed on LCD

Dates displayed on the IntelliLink screens and the LCD screen can be set to three different formats and follow the regional settings selected in the screens. The options are: MM/DD/YY (default), DD/MM/YY, and YY/MM/DD.

Daylight Savings Time Automatic Changeover

When enabled, the control clock will adjust to daylight savings time and return to standard time on the selected dates.

Configuration Identifier

Up to 12 characters can be entered to identify the particular setpoint configuration this IntelliCap control uses.

Enable Normal Operation

Follow these steps to set the control to **Normal** operation mode.

STEP 1. Select the *Operation* screen. Review the present status of the control.

STEP 2. Exit the IntelliLink software, turn off the computer, and disconnect it from the IntelliCap control.

STEP 3. On the control faceplate, set the AUTO/MANUAL switch for the desired operation mode.

This completes the IntelliCap control setup configuration.