

99024KM  
98001KM

**Figure 1.**  
Form 5 Microprocessor-Based Recloser Control.

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## SAFETY FOR LIFE



Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Cooper Power Systems employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment and support our “Safety For Life” mission.

## SAFETY INFORMATION

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians who are familiar with this equipment should install, operate, and service it.


*A competent technician has these qualifications:*


- *Is thoroughly familiar with these instructions.*
- *Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.*
- *Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.*
- *Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, hotstick, etc.*


Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.


### Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

 **DANGER:** Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high and low voltage lines and equipment. G103.3


 **WARNING:** Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage. G101.0


 **WARNING:** This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage. G102.1


 **WARNING:** Power distribution equipment must be selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain this equipment can result in death, severe personal injury, and equipment damage. G122.2

### Hazard Statement Definitions

This manual may contain four types of hazard statements:

 **DANGER:** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.



## PRODUCT INFORMATION

### Introduction

*Service Information S280-79-2* provides programming instructions for the Form 5 microprocessor-based recloser control. Before installing, programming, or operating this control, carefully read and understand the contents of this manual.

### Read This Manual First

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing, programming, or operating this equipment.

### Additional Information

These instructions cannot cover all details or variations in the equipment, procedures, or process described, nor to provide directions for meeting every possible contingency during installation, programming, operation, or maintenance. For additional information, please contact your Cooper Power Systems representative.

### ANSI Standards

Kyle reclosers are designed and tested in accordance with ANSI standards C37.60 and C37.85 and ANSI guideline C37.61.

### Quality Standards

The Quality System at the Cooper Power Systems, Kyle Distribution Switchgear plant is certified to the following standards:

- ISO 9001
- CAN/CSA ISO 9001
- BS EN ISO 9001
- ANSI/ASQC Q9001

### Description

The Form 5 software is used to program the operating parameters of the Form 5 Control, to download data, and to test the Form 5 Control.

Designed with a Graphical User Interface, the Form 5 software is run from an IBM compatible personal computer (PC) with a Windows<sup>®</sup> operating system.

The Form 5 Control must be programmed with all necessary operating settings and parameters prior to operation with an energized recloser.

Initial programming of the control is the responsibility of a qualified technician or engineer familiar with the control functions and programming parameters required for the specific recloser installation.

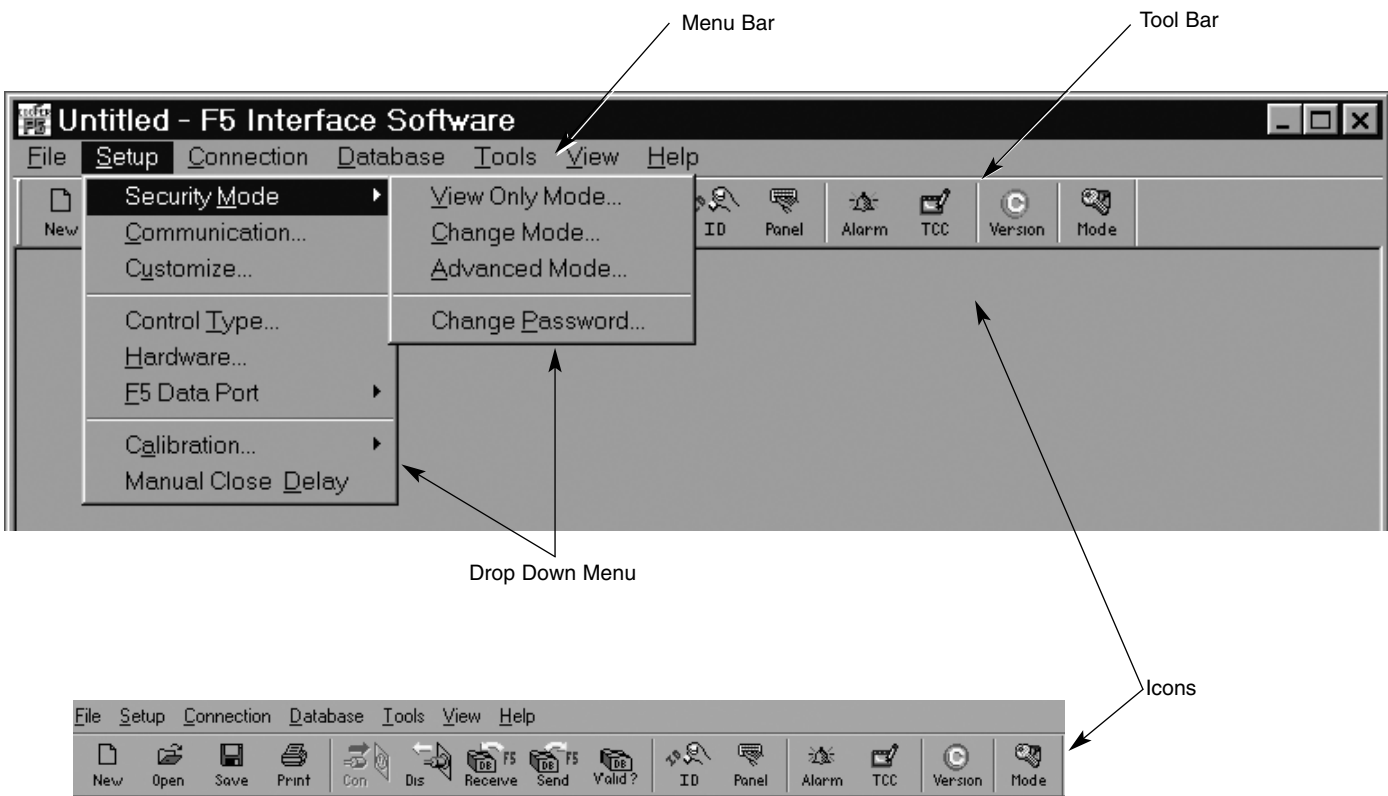
The Form 5 can be ordered with Cooper 2179, DNP 3.0, and/or customer specific protocols for PC communication. A 9-pin RS232 serial port is located on the front panel as a standard feature. Fiber-optic and 9- and 25-pin RS232 communications are available with accessory communication boards.

# FORM 5 INTERFACE SOFTWARE

## Software Directions

This manual includes directions on how to navigate the Form 5 Interface Software.

Place the cursor over specified objects on the screen and click to reach specific screens. Click on headings in the menu bar. Click on icons in the tool bar. See Figure 2. Menu bar directions for the example are written **Setup > Security Mode >**. Within a screen, click on buttons to reach a nested screen. See Figure 3.



**Figure 2.**  
**Menu Bar and Icon Bar.**

There are various methods for entering and selecting options and information in screens. See Figure 3.

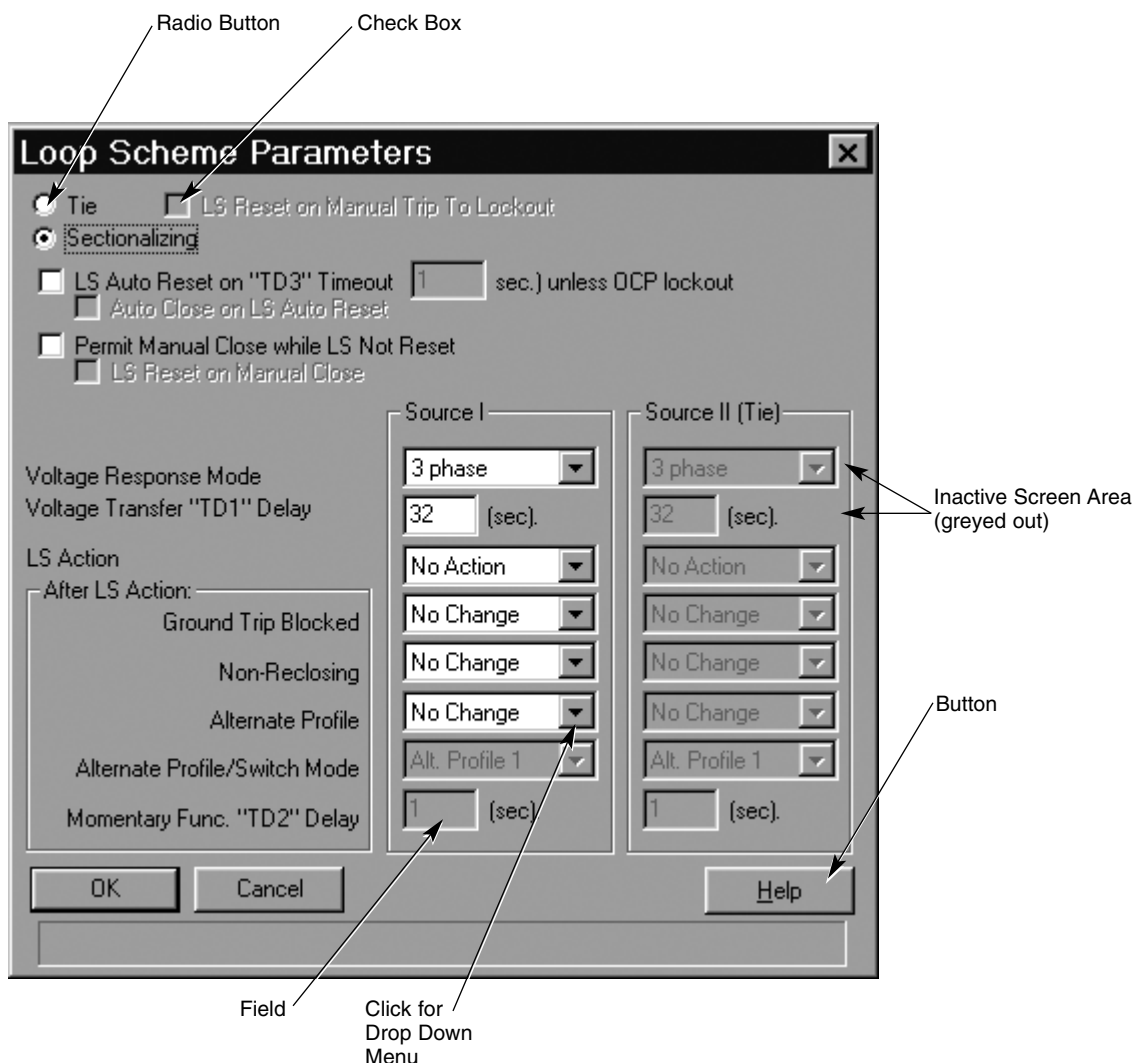
Click in a radio button or a check-box to select the item and click again to deselect. Click on the triangle to drop down a menu, click the desired option to highlight, and that option will be selected. Click in a field and use the keyboard for manual entry of a selection or information. Navigation routes and icon and button names are printed in bold. Some items are not applicable until certain options are selected. They will be greyed out in these situations.

Some data display screens have Refresh buttons. Click the **Refresh** button to update the display with data collected after the screen was opened. Click **Help** in any screen to reach the Help menu.

## Form 5 Software Installation

The Form 5 software is provided on two floppy disks or on one CD. The disks, marked Disk 1 and Disk 2, or the CD are included with first orders of the Form 5 control. To load the software, insert the CD or Disk 1 into the appropriate PC drive. Click **Start > Run > (Drive) > Disk 1 > Setup.exe** and the installation wizard will lead you through the installation. The software will not be fully installed until you restart the computer.

The same database structure is used for the Form 5 control settings and for the Form 5 event recorders and print-outs. Separate the control programming files by using different file directories. The installation wizard provides two different directories for this.



**Figure 3.**  
**Screen Usage.**

# COMMUNICATION CONNECTIONS

## Communication Protocols

The standard, UDP, Loop Scheme, and Triple-Single Form 5 can be configured with 2179, DNP3.0, and customer specified protocols. This allows multiple protocols to be configured into a Form 5 control, with one protocol configured on any one port. The communication protocols are configured in the factory; they can not be changed in the field.

## Data Communication Ports

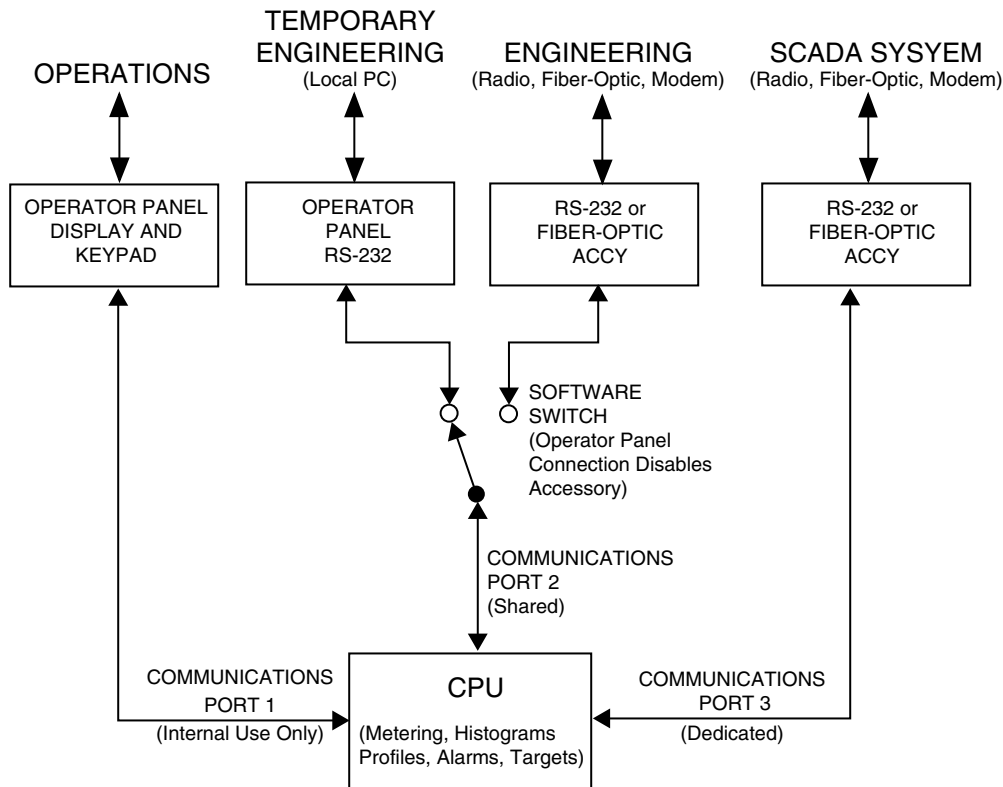
The Form 5 control is equipped with one data communication port as a standard feature (Port 2). It is a 9-pin RS232 serial port located on the operator panel for temporary PC access. Port 2 can also provide a dual communication interface to a communication accessory board. Local connection to the operator panel will temporarily disable the accessory board connection when the accessory board is programmed as Port 2. They can not be used simultaneously. See Figure 4.

Port 3 provides uninterrupted communication through a communication accessory board and is not affected by any other port. This port should be used for SCADA communications. An accessory board must be used for SCADA communication with the control.

The Form 5 controls with serial numbers 3000 to 39,000 use KME5-74-1 for RS232 communications and KME5-75-2 for fiber-optic communications. Refer to *Service Information S280-79-4* for proper configuration of the DIP switches on the Communications Interface Module.

The Form 5 controls with serial numbers below 3000 and above 40,000 and the Form 5LS/UDP controls use the KME5-65-1 or KME5-65-2 accessory board. Each board has one 25-pin RS232 plug and one set of fiber-optic connections. With the KME5-65-1, one accessory board can connect to two ports (Port 2 and 3) and the setting for Port 3 is dominant. For example, when Port 3 communicates through fiber optics, then Port 2 defaults to RS232. Switching Port 3 on the Communications Interface Module to RS232 will cause Port 2 to default to fiber-optic. Refer to *Service Information S280-79-3* to properly set the function switches on the Communications Interface Module.

The front panel RS232 port is wired as a Data Communication Equipment (DCE) port to allow for direct connection to a PC. The RS232 accessory is wired as a Data Terminal Equipment (DTE) port to allow for direct connections to communication equipment. Use a direct RS232 cable to connect the PC to the 9-pin RS232 on the operation panel. Use the cable supplied with the RS232 accessories and a NULL modem to connect the PC to the 25-pin RS232 on the accessory board. To communicate through fiber optics to a PC, use the KME4-163 fiber optic to RS232 converter.



**Figure 4.**  
**Data Communication Ports.**

# INITIAL PROGRAMMING

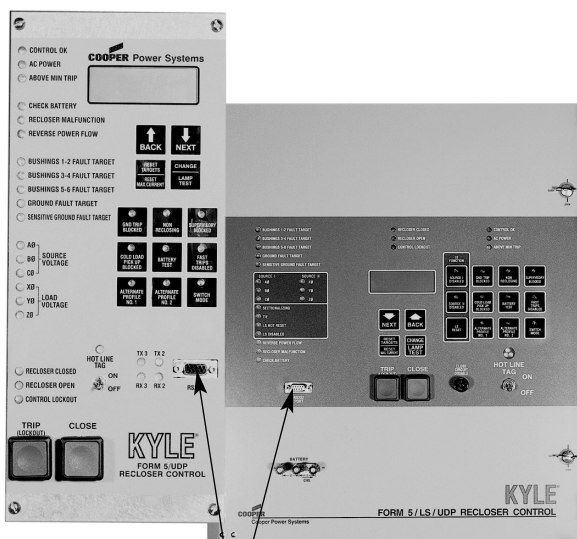
## Connecting to the Form 5 Recloser Control

**CAUTION:** Equipment misoperation. Do not connect this control to an energized recloser until all control settings have been properly programmed and verified. Refer to the programming information for this control. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury. G110.3

The initial programming will synchronize the interface software to the functionality of the control used.

**Note:** Connecting to the control will modify any database that is open.

1. Open the Form 5 software. Click **Start > Programs > Cooper > Form 5**, OR double click on the **F5** icon in the toolbar, OR double click on the F5prgrmr.exe file in the program file.



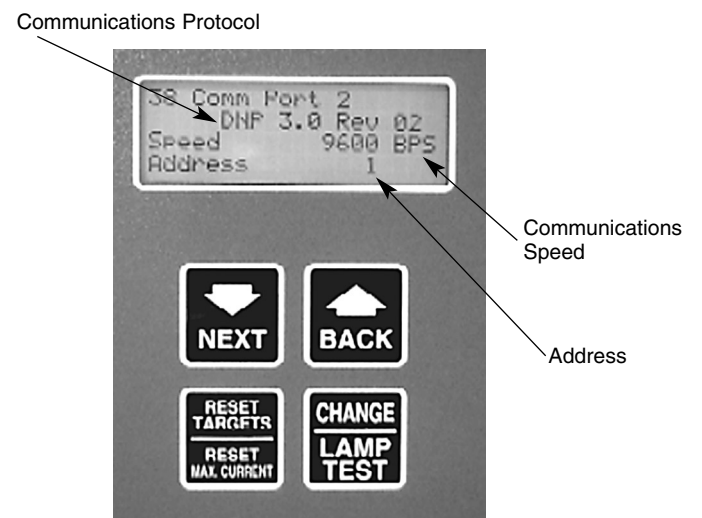
**Figure 5.**  
Form 5 Front Panel Ports.

Every time the Form 5 software is opened, a default database, “untitled”, is opened. This should be the only database that is ever open when communication with a control is initiated. When communication is established, the Form 5 sends and overwrites the hardware settings in the open database. This automatically modifies the software options to conform to the features of that control. This modified database is the basis of the file created for a specific control.

2. Apply power to the control.
3. Physically connect the PC to Port 2 on the front panel of the Form 5. See Figure 5.
4. The screen on the front panel is now operating. Scroll to the Port 2 screen page. It is typically the next to last page. You can scroll backwards or forwards by pushing the next or back key. To scroll faster, press and hold a scroll key down. See Figure 6.

The Port 2 screen page lists the communications protocol, the communications speed, and the address.

5. In the interface software, select the protocol, communications speed, and the Control Port address to provide proper communications. See Figure 7. The protocol and address entered into the PC screen need to match those in the Form 5 front panel screen to connect to the control. The speed can be changed once communications are established.



**Figure 6.**  
Form 5 Screen.

5. On the PC, click **Setup > Communication** to reach the PC Port Configuration screen. See Figure 7.

**Note:** The serial port referred to in this screen is the PC's communication port.

6. Click on the Protocol drop down menu and select the correct protocol to match the Form 5 data port.

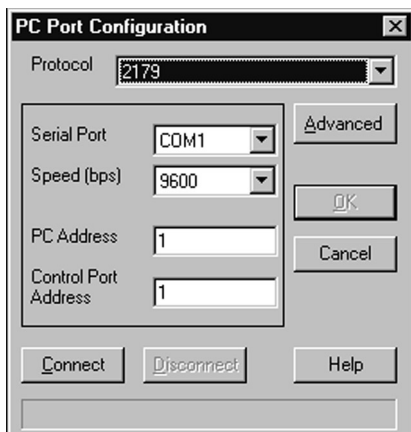
7. Click on the Speed (bps) drop down menu and set the speed to auto or to the speed indicated on the Form 5 control. Setting the actual speed, rather than using auto, will decrease the connection time.

8. Click in the Control Port Address box and enter the address shown on the control screen.

9. Leave the PC Address on the default setting.

10. Click **Connect** OR click **OK** and click the **CON** icon.

The title bar will change from Untitled to Untitled-Modified and the status message will change from Offline to Online when communication has been successfully established.



**Figure 7.**  
**PC Port Configuration Screen.**

## Setup

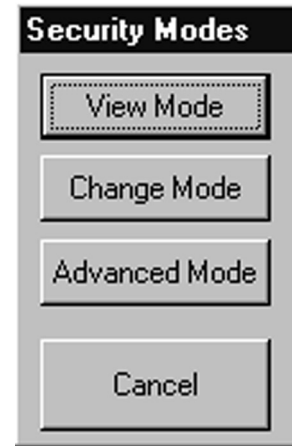
### Security Mode

**Note:** The advanced mode allows access to the calibration screens. Do not enter the calibration screens: accuracy can be affected up to 10%. Contact the Cooper Power Systems Service Department for calibrations.

1. Click the **Mode** icon OR click **Setup > Security Mode > Change Mode** to reach the Security Mode selection screen. See Figure 8.

The Change Mode is recommended for all normal uses.

2. Click **Change Mode**.



**Figure 8.**  
**Security Modes Screen.**

### Password

The Password screen is also accessed through the Security Modes screen. However, the Mode must be set to Change Mode or Advanced Mode. The Password screen is not accessible while in View Only Mode.

**Note:** The Change Password screen can be accessed only through the menu toolbar. It can not be accessed through the Mode Icon.

1. Click **Setup > Security Mode > Change Password** to reach the Password screen. See Figure 9.
2. Enter a password in the first field. The password must have 5 -16 characters. Reenter the password in the second field.
3. Click **OK**.

To disable the password protection, reenter the Password screen. Do not enter the password. Click on **Cancel**. Another screen will appear to verify disabling Password Protection. Click **OK**.



**Figure 9.**  
**Password Screen.**

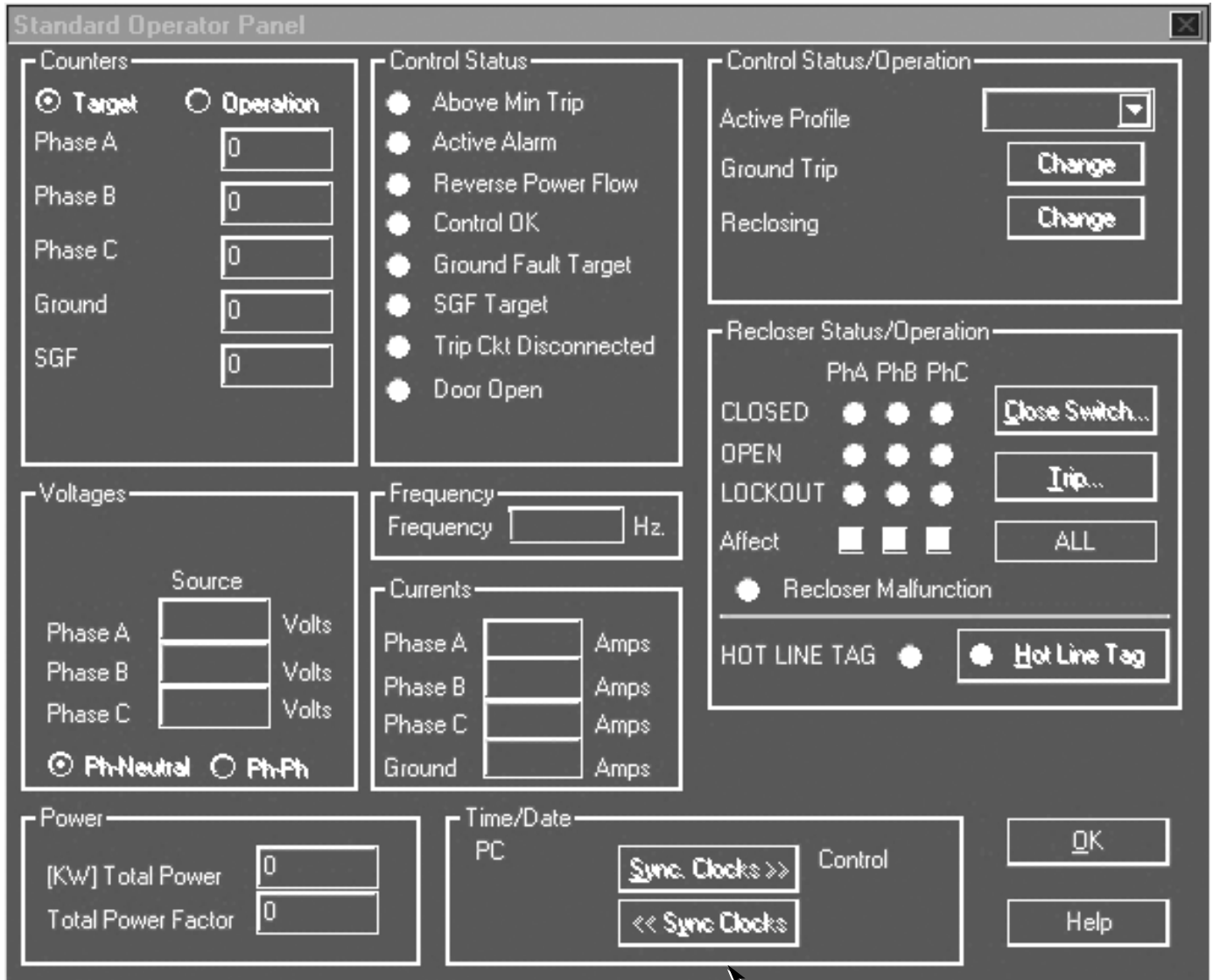


### Standard Operator Panel

The Standard Operator Panel screen allows remote input of commands performed via the Form 5 display panel.

The clock on the Standard Operator Panel screen must be set for historical data recordings to be accurate. The clock must be reset every time the control is completely de-energized.

1. Click the **Panel** icon OR **Tools > Operator Panel > Standard** to reach the Standard Operating panel screen. See Figure 10.
2. Click **Sync. Clocks >>** to set the Form 5 control's clock to match the PC's clock.
3. Click **OK**.



**Figure 10.**  
Standard Operator Panel Screen.

### Preset Counters

The Form 5 default database counters are preset to zero. Presetting the counters allows the Form 5 to be installed with an existing recloser, such as when replacing a Form 3 control with a Form 5.

1. Click **Database > Counters** to reach the Counters Screen. See Figure 11.

The current value of the counters will appear. For Software versions 3.7.5a and below, the Preset capability for the counters is only available online.

2. Preset the counters now if the Form 5 is to be installed in an existing location. Click **Preset** to reach the Preset Counters screen. See Figure 12.

3. Click **OK**.

Reset the counters after all test procedures are completed, or enter the counter values, number of operations, and the duty cycle accumulator (% depleted) of the recloser at the existing location.

### Disconnect

It is recommended that all the database programming be done offline (not connected to the control).

Disconnect by clicking **Connection > Disconnect** OR the **DIS** icon.

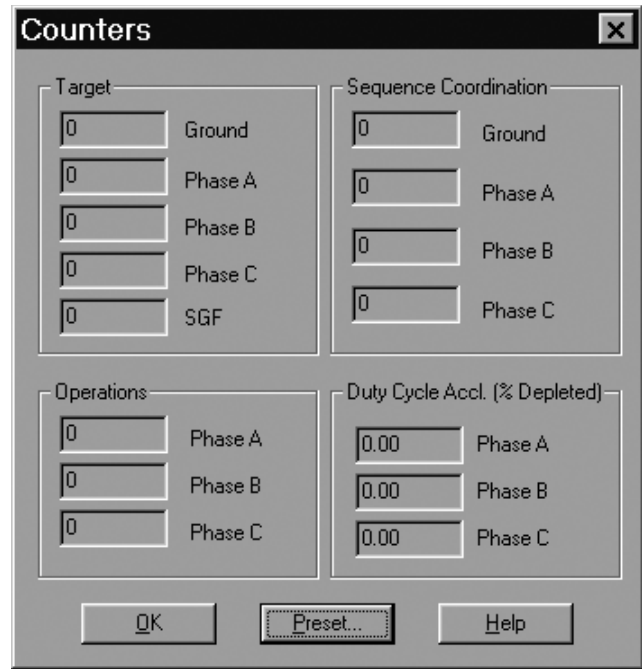


Figure 11. Counter Screen.

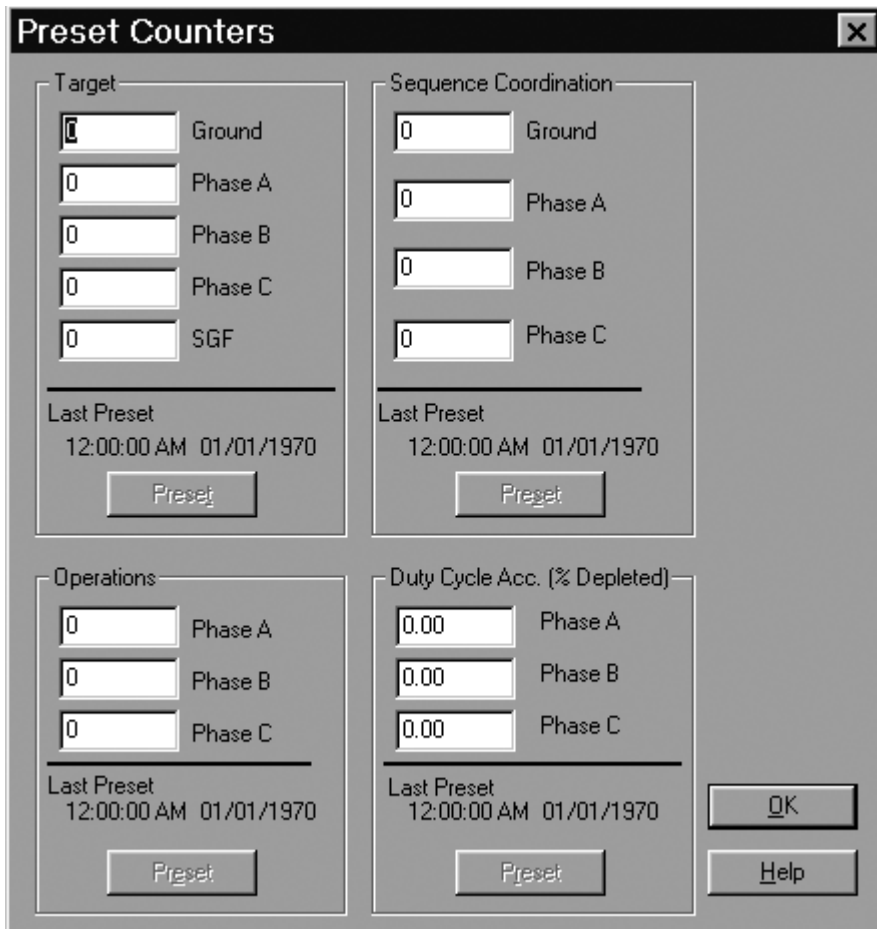


Figure 12. Preset Counters Screen.

## CREATING THE BASIC DATABASE

Complete the steps in the Preliminary Programming section of this manual before attempting to create a database.

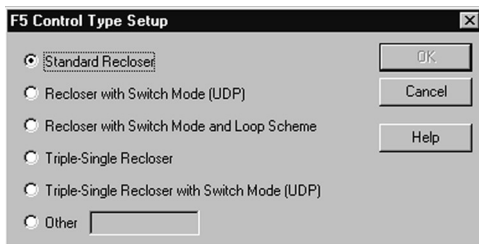
The following steps can be used to create a basic Form 5 database. This is the minimum programming needed to provide complete overcurrent protection. The Advanced Functions section describes optional programming.

### Identification

#### Control Type

The control type is automatically identified when communication is established with the control and the file name will read Untitled-Modified. To begin programming an unmodified database, before connecting to the control, select the control type.

1. Click **Setup > Control Type** to reach the F5 Control Type Setup screen. See Figure 13.
2. Click the radio button next to the type of recloser control.
3. Click **OK**.

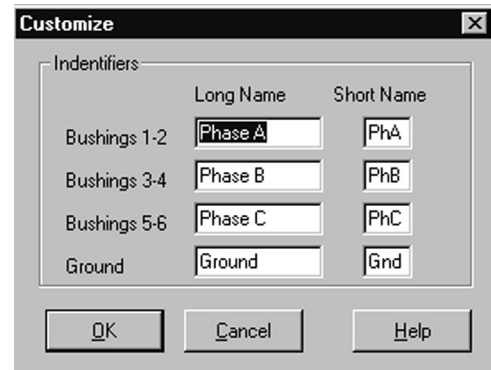


**Figure 13.**  
F5 Control Type Setup Screen.

#### Customized Identifiers

The Customize screen allows unique labeling of all phases within the software screens. This labeling does not transfer to the control: it resides only in the PC that created the customized labels. The customized identifiers are independent of the file being used. They will stay customized for all files used in that PC.

1. Click **Setup > Customize** to reach the Customize screen. See Figure 14.
2. Enter custom names in the Long Name box (up to 7 characters) and the Short Name box (up to 3 characters).
3. Click **OK**.



**Figure 14.**  
Customize Screen.

## Hardware

Specifications on external measurement devices used to provide data to the Form 5 are entered via the hardware screen. Click **Setup > Hardware** to reach the Hardware screen. See Figure 15.

### Frequency

Select 50 Hz or 60 Hz from the drop down menu. Unless otherwise specified by the customer, all controls are shipped with a 60 Hz database. Changing to a 50 Hz database requires 50 Hz TCC's to be loaded through installing the TCC Editor.

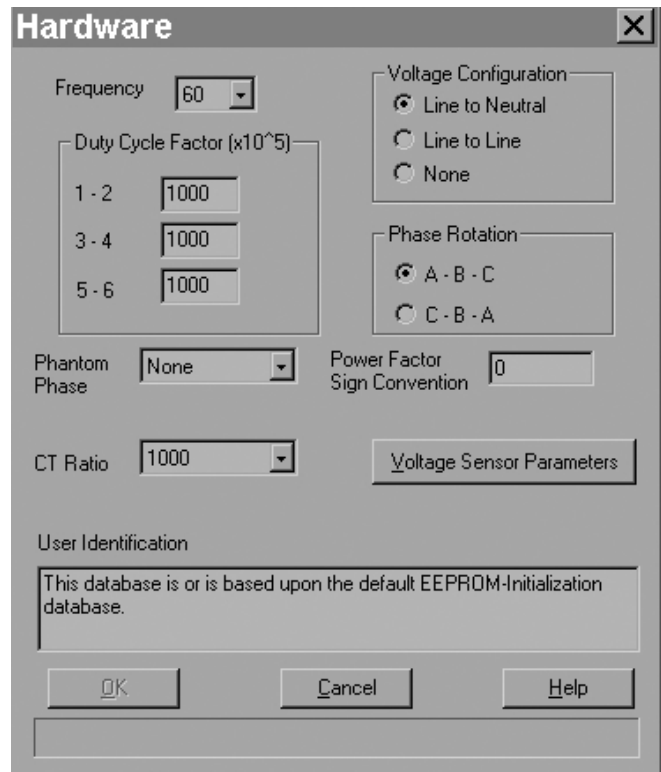
### Duty Cycle Factor

Enter the Duty Cycle Factor for contacts 1-2, 3-4, and 5-6.

The Duty Cycle Factor is used to calculate the percent of the rated duty cycle used. When the Duty Cycle Factor equals 100%, the recloser contacts are at the end of their useful life and need to be serviced. (The Duty Cycle Factor does not measure the dielectric purity of an interrupting medium.) See Table 1.

### Voltage Configuration

Click the radio button next to the type of potential transformer used to provide voltage to the control: line-to-line or line-to-neutral, or select None when voltage metering is not being used. See Figure 15.



**Figure 15.**  
**Hardware Screen with Voltage Sensor Parameters.**

**TABLE 1**  
**100% Duty Cycle Factor**

Recloser Type	Interrupting Rating, (rms. sym Amps)	100% Duty Cycle Factor
RXE, RVE	6000 A	97
WE	12000 A @ 4.8 kV	257
WE	12000 A	196
VWE	12000 A	1045
VWVE27	12000 A	1045
VWVE38X	12000 A	1045
WVE27	8000 A	140
WVE38X	8000 A	140
VSA12	12000 A	1045
VSA16	16000 A	1608
VSA20	20000 A	2248
VSA20A	20000 A	2248
VSA20B	20000 A	2248
VSO12	12000 A	1045
VSO16	16000 A	1608
NOVA, NOVA-TS 800 A	12500 A	1111
NOVA-TS 400 A	8000 A	569
KFME	6000 A	369
KFME	8000 A	569

### Phase Rotation

Click the radio button next to A-B-C or C-B-A to select the phase rotation. See Figure 16.

The phase rotation must be correct for the metering functions to work correctly. If the phase rotation is incorrect, the reverse power flow light on the front panel of the Form 5 may be on.

### Phantom Phase

The Phantom Phase feature is used when only one potential transformer (PT) is available to power the control and to provide voltage metering for all three phases. The Phantom Phase feature creates two virtual voltages rotated 120 degrees, in a clockwise direction with A-B-C rotation and counterclockwise with C-B-A rotation, with respect to the real PT phasor. The virtual voltages are exactly equal in magnitude to the original and are used in all power calculations.

For controls having serial numbers below 300, only B phase may be used as the Phantom Phase. See Figure 16.

Controls having serial 300 and above may designate any phase as the Phantom Phase. However, if a phase other than B is chosen, the wiring from the PT must be routed to the corresponding phase input on the Recloser Interface Module. Also, the power supply is wired to the B phase at the factory and will need to be rerouted if a different phase is chosen. Refer to the *S280-79-1, S280-79-10, or S280-79-12 Installation and Operation Instructions* of the Form 5 for wiring connections.

Select the corresponding Phantom Phase from the drop down menu. See Figure 16.

### CT Ratio

Enter the CT ratio or choose it from the drop down menu. See Figure 16.

### Power Factor Sign Convention

Enter 0 for the historically defined convention (power factor sign follows power flow) or enter 1 for the definition cosine of angle between current and voltage. See Figure 16.

### PT Ratio or Voltage Sensor Correction

PT Ratio - Controls with a CPU version lower than 2.9 require a PT ratio setting. Select the PT ratio from the drop down menu. See Figure 16.

Voltage Sensor Correction - Controls with a CPU version 2.9 and higher have the Voltage Sensor Correction or Voltage Sensor Parameters feature. See the Voltage Sensor Parameters/Voltage Sensors Correction section of this manual.

### User Identification

This field allows the user up to 80 characters for unique control identification. Typical uses are substation name, feeder number, and/or the file name the control's database is saved under.

When all fields in the Hardware screen are set, click **OK**. See Figure 16.

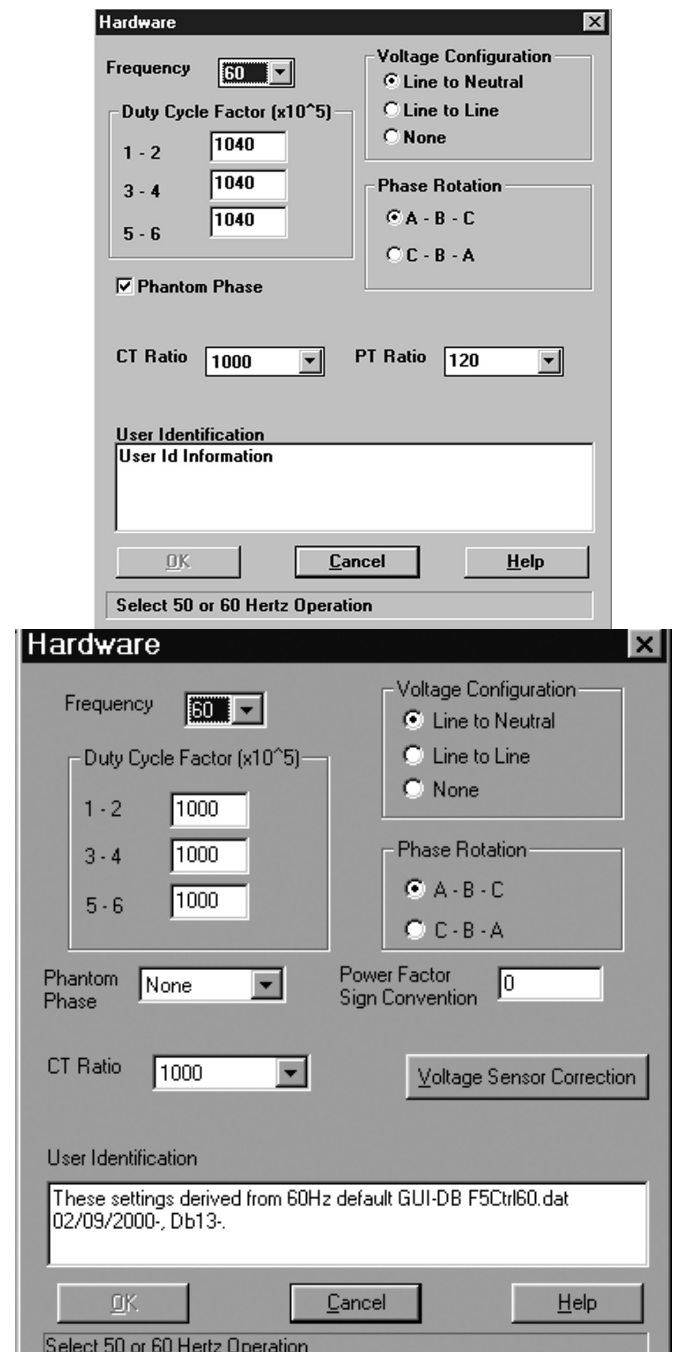
### Voltage Sensor Parameters or Voltage Sensor Correction

Controls with a CPU version 2.9 and higher and a software version lower than 3.11.8d have the Voltage Sensor Correction feature.

Click **Voltage Sensor Correction** to reach the Voltage Sensor Correction screen. See Figure 16.

Controls with a software version 3.11.8d and higher use the Voltage Sensor Parameters feature.

Click **Voltage Sensor Parameters** to reach the Voltage Sensor Parameters screen. See Figure 15.



**Figure 16.** Hardware Screen with PT Ratio (upper) and with Voltage Sensor Correction (lower).

These controls correct for the phase angle shift that occurs from the primary voltage and the voltage sensing device's secondary output. This phase angle correction increases the metering accuracy. The amount of the phase angle shift should be provided in the PT manufacturer's specification data sheet. See Figure 17.

1. For software versions 3.11.8d and higher, enter a value that is 80% of the Primary Voltage in the Voltage Present Threshold/Primary Volts field.
2. The RIF (Recloser Interface Module) Input Voltage Setting must be set to the secondary voltage of the voltage sensing device being used for accurate metering. See the RIF module overlay; unmarked RIF's are 120 Vac. Select the RIF Input Voltage Setting from the drop down menu or enter manually.
3. The Adjusted Voltage Sensor Ratio is the PT ratio based on a 120 Vac input. Common adjusted Voltage Sensor Ratios are included in Table 2. All voltages are displayed as primary voltages. The Adjusted Voltage Sensor Ratio can be determined as follows:

$$\text{Adjusted Voltage Sensor Ratio} = \frac{(\text{Sensor Ratio}) \times (\text{RIF Input Voltage Setting})}{120}$$

Select a value from the drop down menu or enter a value in the field.

4. The Phase Angle Correction should be set equal to the degree of phase shift caused by the PT.

**Reverse Power Flow**

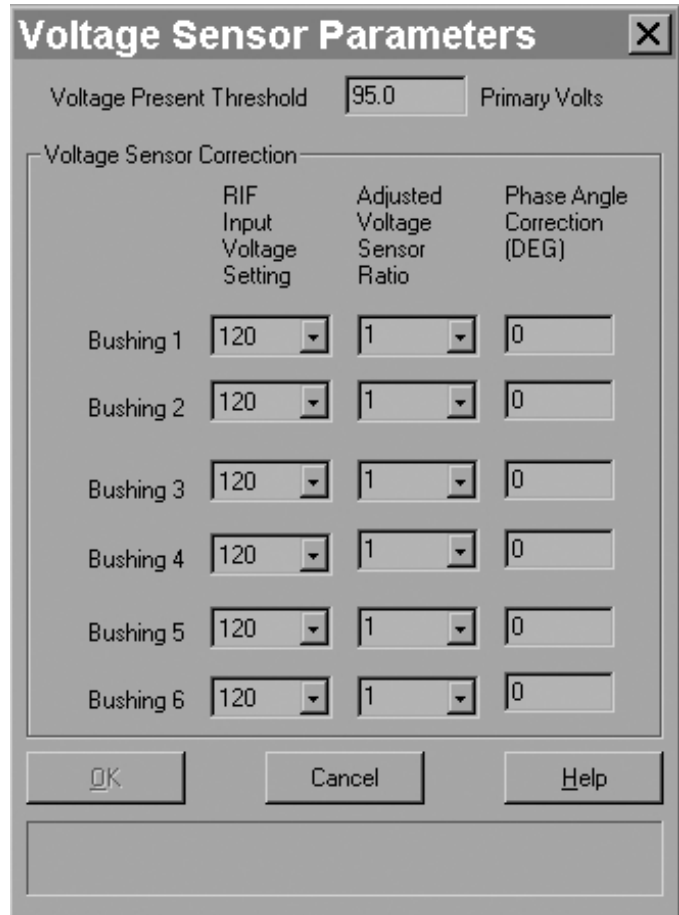
The RPF indication is only relevant with three-phase voltage (phantom phase provides this with a single voltage source) and three-phase current.

The Reverse Power Flow (RPF) indication light can represent a symptom of improper installation. The RPF LED will indicate when the Hardware screen settings are for A-B-C rotation and the actual line rotation is different. In this case, choose C-B-A rotation in the Hardware screen if C phase is connected to bushing 1-2, B to 3-4, and A to 5-6.

The capability to use phantom phase and perform a phase rotation within the software is available for all controls with a CPU version 2.9 and higher.

**TABLE 2  
Adjusted Voltage Sensor Ratio**

Ratio	Voltage Reading with 120 Vac Input	Voltage Present Threshold
1	120 Vac	96 Vac
20	2.4 kV	1.9 kV
60	7.2 kV	5.7 kV
120	14.4 kV	11.5 kV
208	24.9 kV	19.9 kV



**Figure 17.  
Voltage Sensor Parameters Screen.**

## Protection Profiles

**IMPORTANT:** All profiles must be programmed for the control to function correctly.

A profile consists of all the basic and advanced operating parameters used to provide overcurrent protection. The Form 5 has four basic profiles. Program all profiles, including those that are not needed, for the control to function correctly.

For controls equipped with the Universal Protection Device (UDP) option, there are three basic profiles and a Switch Mode Profile. The Switch Mode profile is programmed similarly to other profiles, but will not issue a trip signal to the recloser. This mode is used where the application requires switch functionality for tight coordination scenarios.

1.
  - A. Click **Database > Protection Profiles > Normal** to reach the Normal - Operation Parameters screen. See Figure 18.
  - B. Click **Database > Protection Profiles > Alternate (1, 2, or 3) OR Switch Mode** to edit the other profiles.

Phase and ground parameters can have different values and so are programmed separately.

2. Enter values for the phase and ground minimum trip settings.

These values are the primary current levels at which the Form 5 will issue a trip signal for phase and ground.

3. Select the number of trips to lockout (1, 2, 3, or 4) from the Operations to Lockout drop down menus for Phase and Ground.

This is the number of trip operations the control is required to operate before locking the recloser out in the open position.

Screens for programming other functions are accessed via buttons on this screen. The selection of buttons is determined by the software and firmware versions.

See the Triple-Single Accessory section of this manual on use of the TS button.

Phase		Ground	
Minimum Trip	100 Amps	50 Amps	
Operations to Lockout	4	4	
TCC's			
TCC 1	Kyle_104	Kyle_106	
TCC 2	Kyle_104	Kyle_106	
TCC 3	Kyle_117	Kyle_135	
TCC 4	Kyle_117	Kyle_135	
Fast Trips Disabled	Kyle_117	Kyle_135	
Reclose Intervals			
1st Interval	2 Sec.	2 Sec.	
2nd Interval	2 Sec.	2 Sec.	
3rd Interval	5 Sec.	5 Sec.	
Reset time	30 Sec.	Fast Trips Disabled Shots to Lockout	2
<input checked="" type="checkbox"/> Sequence Coordination	Maximum Sequence Coordination Operation Number		2
<input type="checkbox"/> Ground Trip Precedence		<input type="checkbox"/> Disc Reset Time Delay	0 Sec.
<input checked="" type="checkbox"/> Reset Targets on Close			

**Figure 18.**  
**Normal - Operation Parameters Screen.**

## Time–Current Curves

Each operation to lockout, Hot Line Tag, and Fast Trips Disabled for each of the four Protection Profiles must be set with a Time–Current Curve (TCC).

1. Select TCC's from the drop down menus.

The TCC options in the drop down menus of the Operations Parameters screen are set in the TCC Configuration screen.

2. Click **TCC's** (see Figure 18) to reach the TCC Configuration screen. See Figure 19.

The available TCC's are listed on the left of the screen. Use the scroll bar to view over 40 available TCC's.

The Selected TCC's listed on the right are the active TCC's. A TCC must be listed in this field to appear in a drop down menu used to set a TCC parameter. A maximum of 20 TCC's can be selected at one time.

3. To replace a TCC, highlight the TCC in the Available list that you want to activate, then highlight the TCC in the Selected list that you want to replace with the newly activated TCC. Then click **Replace**.

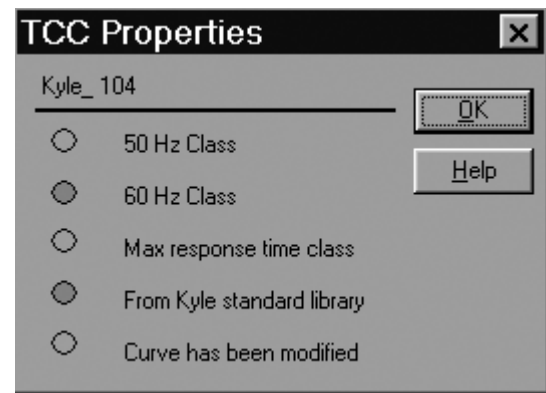
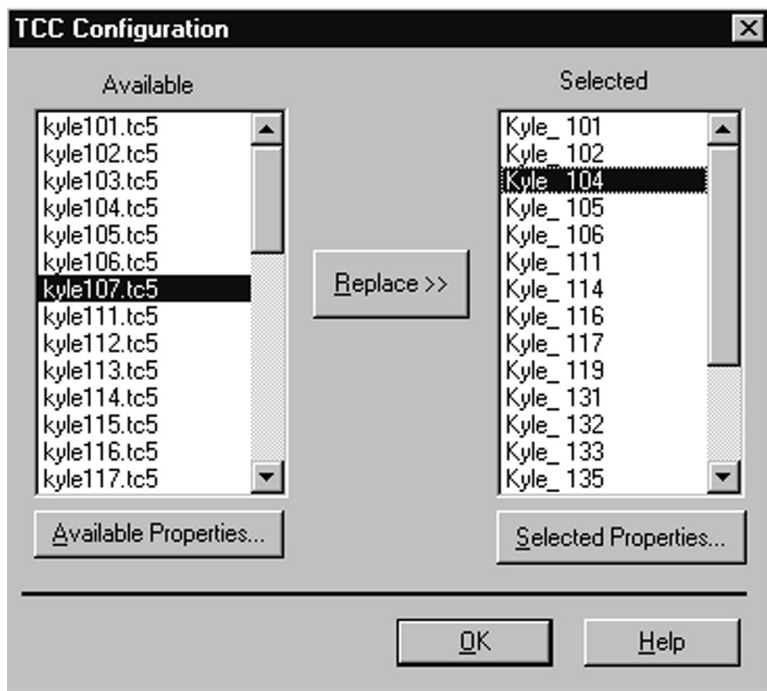
This will deactivate the highlighted TCC in the Selected list and replace it with the highlighted TCC from the Available list. If the TCC that is being deactivated is used in any profile, a warning will appear stating that replacing this TCC will effect all profiles.

4. Click **OK** when all the TCC's are chosen.

### Time–Current Curve Properties

The TCC Properties of Available or Selected TCC's can be viewed in the TCC Properties screen. See Figure 20.

1. Highlight a TCC.
2. Click Available Properties or Selected Properties.
3. Click **OK** after reviewing the screen information.



**Figure 20.**  
TCC Properties Screen.

**Figure 19.**  
TCC Configuration Screen.



## Hot Line Tag

The Hot Line Tag, different from the Non-Reclose Mode, is a standard feature. The control can not close when the Hot Line Tag is active, either locally or through SCADA. It can be disabled only in the same manner and through the same communication port from which it was activated. For example, if the Hot Line Tag is activated locally, it can not be turned off through SCADA and must be deactivated locally.

For software versions lower than 3.11.8d, the Hot Line Tag TCC for phase and ground is set with the drop down menu in the TCC's section of the Operation Parameters screen. See Figure 22.

For software version 3.11.8d and higher and firmware database version 16 and higher, click **HLT** on the Operations Parameters screen to reach the Hot Line Tag Screen. See Figure 21. The default setting is Automatic Minimum Trip (the Automatic Minimum Trip Selection box is checked). These are the Minimum Trip settings for Phase and Ground in the Operation Parameters screen.

Specific minimum trip settings can be selected for Phase, Ground, and SGF. TCC's are then selected for Phase and Ground. These can be specified in each Profile.

1. Click in the Automatic Minimum Trip Selection box to disable this feature (the box is no longer checked).
2. Enter minimum trip values for Phase, Ground, and SGF.
3. Select the Hot Line Tag TCC for Phase and Ground from the drop down menu.
4. Click **OK**.

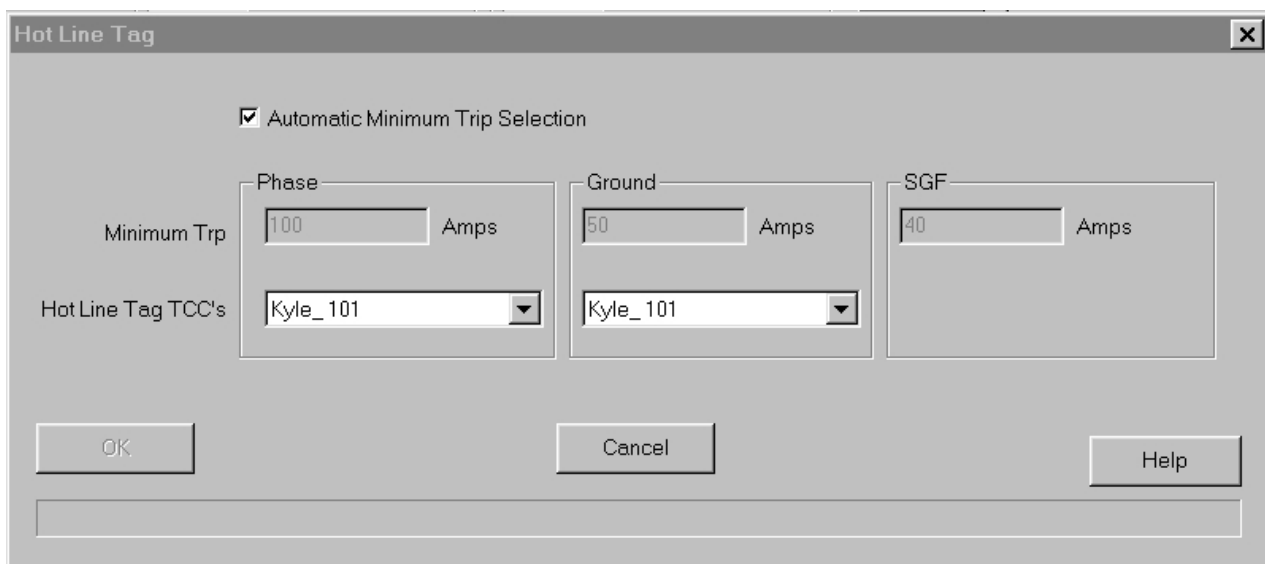
## Fast Trips Disabled

Fast Trips Disabled is primarily activated via the front panel to select a new curve and sequence independent of the active profile. The Fast Trip Disabled function's primary application is a fast and direct method to minimize temporary faults by only operating on delayed curves. When activated, the control will operate following the settings for Fast Trips Disabled Shots to Lockout and the Fast Trips Disabled TCC.

Select the TCC curve and set the number of Fast Trips Disabled Shots to Lockout. See Figure 22.

## Reclose Interval

This is the amount of time the recloser is open between trip operations. Set the first interval between 0.3 and 1000 seconds. Set the second and third intervals between 2.0 and 1000 seconds. See Figure 22.



**Figure 21.**  
Hot Line Tag Screen.

## Reset Time

This is the amount of time the control waits before resetting the number of operations remaining after a fault occurs and is cleared without lockout. Enter the Reset Time. See Figure 22.

## Sequence Coordination

This feature is used to coordinate multiple reclosers in series. It allows the control to recognize a temporary fault cleared by a down line recloser and advances the control to the next programmed operation without issuing a trip signal. Sequence coordination requires a time-current curve coordination study to verify performance. This reduces the number of customers effected by the fault. See Figure 22.

1. Click the Sequence Coordination box to enable this feature. A check mark appears when enabled.
2. Choose a Maximum Sequence Coordination Operation Number, to set the number of times the feature will advance the control, from the drop down menu. The actual sequence coordination operations value will never exceed one less than the programmed number of operations to lockout value.

## Ground Trip Precedence

With Ground Trip Precedence enabled, for all faults above the programmed ground minimum trip level, the number of operations to lockout equals the programmed number of ground operations to lockout.

Without Ground Trip Precedence enabled, for all faults between the programmed ground minimum trip level and the programmed phase minimum trip level, the number of operations to lockout equals the programmed number of ground operations to lockout. For all faults above the programmed phase minimum trip level, the number of operations to lockout equals the programmed number of phase operations to lockout. Click the Ground Fault Precedence box to enable this feature. A check mark appears when enabled. See Figure 22.

## Reset Targets on Close

This feature resets the front panel target indicators upon a reclose action between operations or when the close button is depressed. See Figure 22.

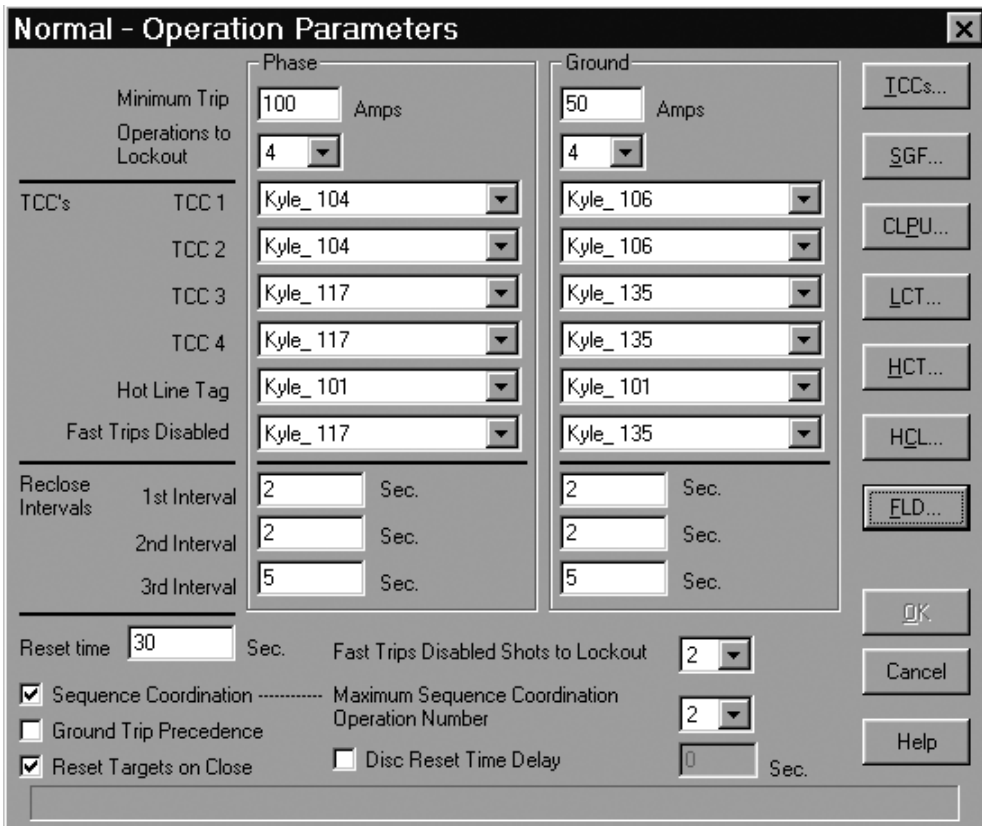
Click the Reset Targets on Close box to enable this feature. A check mark appears when enabled.

The time delayed Target Reset is now available for the Switch Mode Profile for software 3.11.8d and higher and firmware database version 16 and higher. The time delay range is 3-1800 seconds.

## Disc Reset Time Delay

This feature allows coordination with existing line equipment using a reset time delay disc. See Figure 22.

1. Click the Disc Reset Time Delay box to enable this feature. A check mark appears when enabled.
2. Enter the time delay for the Disc Reset Time Delay feature.



**Figure 22.**  
Normal - Operation Parameters Screen.

### Sensitive Ground Fault Option

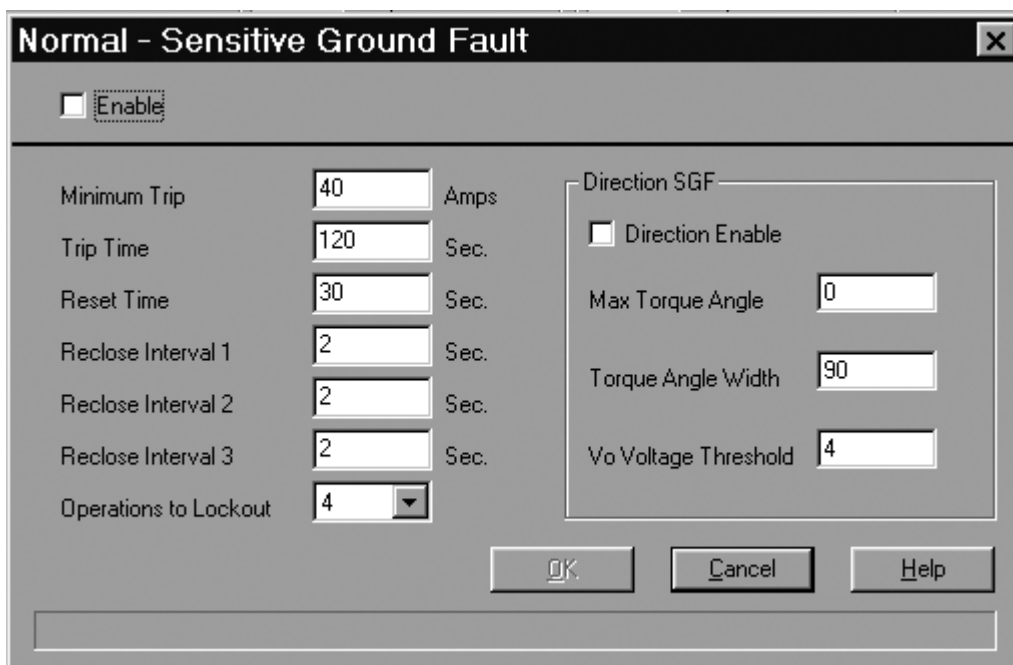
This is an optional feature based upon order configuration. The SGF/SEF option will include a front panel activation key pad.

The Sensitive Ground (Earth) Fault (SGF) (SEF) feature is set in the Sensitive Ground Fault screen for each profile. On the Operation Parameters screen, click **SGF** to reach this screen. See Figure 23.

1. Click the enable box to allow activation of the SGF feature. A check mark appears when enabled. This does not activate the SGF feature, but only indicates that this function may be activated or deactivated. If the SGF/SEF is not enabled, it can not be activated from the front panel, from the PC, or from SCADA.

2. Enter the Minimum Trip value.
3. Enter the Trip and Reset Times.
4. Enter the Reclose Interval Times.
5. Enter the number of Operations to Lockout.
6. Click **OK**.

Activate this feature via the front panel, via SCADA, or via the PC through the Advanced Control and Status Points screen (click Tools > Operator Panel > Advanced Control & Status).



**Figure 23.**  
Normal - Sensitive Ground Fault Screen.

### Cold Load Pick Up Option

The Normal - Cold Load Pickup (CLPU) feature is enabled in the Cold Load Pickup screen for each profile. On the Operation Parameters screen, click **CLPU** to reach this screen. See Figure 24.

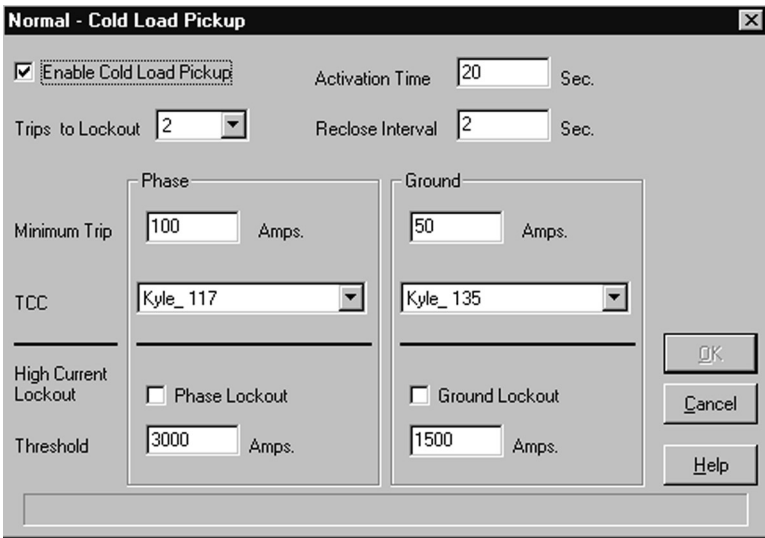
1. Click the Enable Cold Load Pickup box to allow activation of the Cold Load Pickup feature. A check mark appears when enabled. This does not activate the Cold Load Pick Up feature, but only indicates that this function may be activated or deactivated. If the Cold Load Pick Up feature is not enabled, it can not be activated from the front panel, from the PC, or from SCADA.
2. Enter the amount of time CLPU is active after a close command is issued in the Activation Time box.
3. Enter the time delay between operations in the Reclose Interval box.
4. Enter the number of operations to lockout when CLPU is active in the Trips to Lockout box.

5. Enter the Minimum Trip level for both Phase and Ground for CLPU.
6. Choose the active TCC's for Phase and for Ground during CLPU.

This High Current Lockout feature is for setting high current lockout parameters during CLPU timing only.

7. Click the Phase Lockout box to enable. A check mark appears when enabled. Set the minimum trip level for high current lockout for Phase lockout during CLPU.
8. Click the Ground Lockout box to enable. A check mark appears when enabled. Set the minimum trip level for high current lockout for Ground lockout during CLPU.
9. Click **OK**.

Activate the Cold Load Pick Up feature via the front panel, via SCADA, or via the PC through the Advanced Control and Status Points screen (click Tools > Operator Panel > Advanced Control & Status).



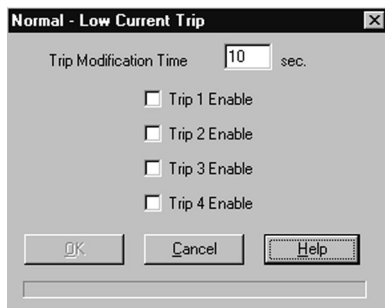
**Figure 24.**  
Normal - Cold Load Pickup Screen.

## Low Current Trip

The Low Current Trip (LCT) feature is set in the Low Current Trip screen for any profile. On the Operation Parameters screen, click **LCT** to reach this screen. See Figure 25.

This feature will cause a trip at the selected time if current is above minimum trip and the normal TCC time is longer than this time. The value of the trip modification time must be between 1 and 10 seconds with 1 second intervals.

1. Enter the Trip Modification Time.
2. Click Trip Enable box(es) to enable this feature for each trip operation. A check mark appears when enabled.
3. Click **OK**.



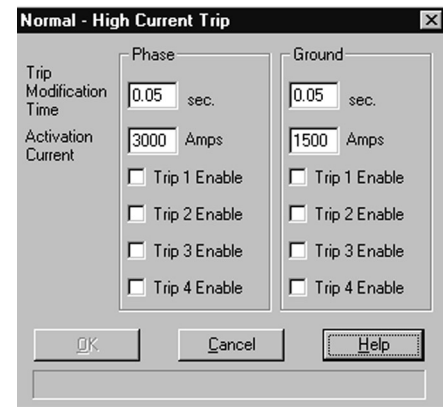
**Figure 25.**  
Normal - Low Current Trip Screen.

## High Current Trip

The High Current Trip (HCT) feature is set in the High Current Trip screen. This function is also known as instantaneous trip or high set. On the Operation Parameters screen, click **HCT** to reach this screen. See Figure 26.

High Current Trip can be enabled for some or all of the operations. The activation range is based on the minimum trip for ground and phase. If the minimum trip is changed and the high current trip falls out of range, it will default to the applicable high or low value. The activation current value ranges from equal to the minimum trip setting up to thirty times the minimum trip setting.

1. Click in the boxes labeled 1st, 2nd, and 3rd to enable this feature for each trip operation. A check mark appears when enabled.
2. Enter the Activation Current range for each enabled operation.
3. Click **OK**.

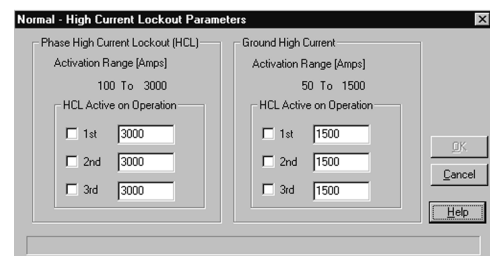


**Figure 26.**  
Normal - High Current Trip Screen.

## High Current Lockout

High Current Lockout can be enabled for some or all of the operations. On the Operation Parameters screen, click **HCL** to reach this screen. The activation range is based on the minimum trip for ground and phase. If the minimum trip is changed and the high current lockout falls out of range, it will default to the applicable high or low value. The range of the activation current is from equal to the minimum trip setting to up to thirty times the minimum trip setting. See Figure 27.

1. Select the phase and ground operations for this feature to be active on by clicking in the appropriate box.
2. Click **OK**.



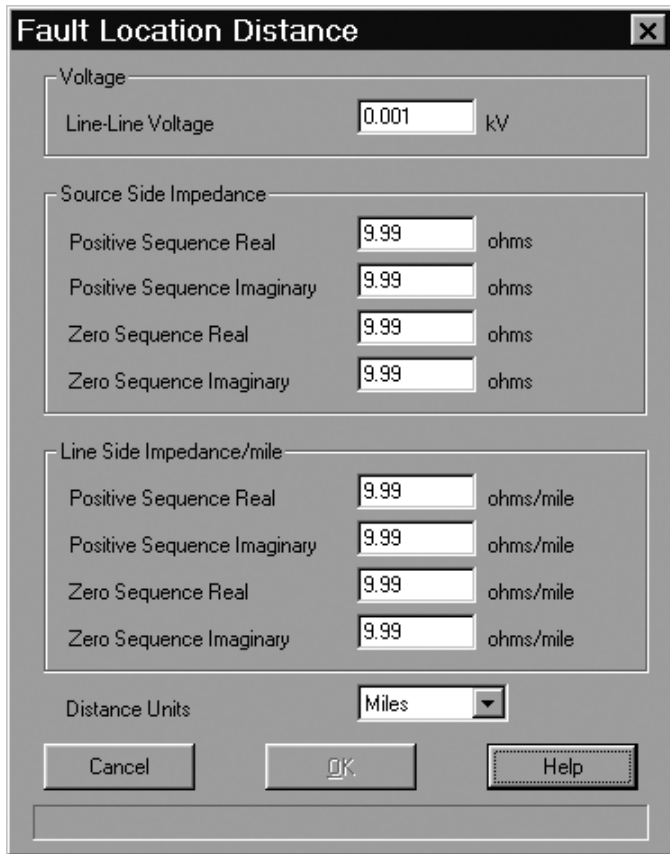
**Figure 27.**  
Normal - High Current Lockout Parameters Screen.

### Fault Location Distance

The Fault Location Distance (FLD) feature, available in controls with a CPU version 3.22 and above, is set in the Fault Location Distance screen. On the Operation Parameters screen, click **FLD** to reach this screen. See Figure 28.

This feature provides the lineman with the distance from the Form 5 control to the fault. The Form 5 calculates the distance by using the programmed impedance values of the line and the magnitude level of the fault. The distance can be given in miles or kilometers. The distance is displayed on the front panel of the control and stored in the event recorder.

1. Enter the Line-Line Voltage, Source Side, and Line Side Impedance values.
2. Choose miles or kilometers from the Distance Units drop down menu.
3. Click **OK**.

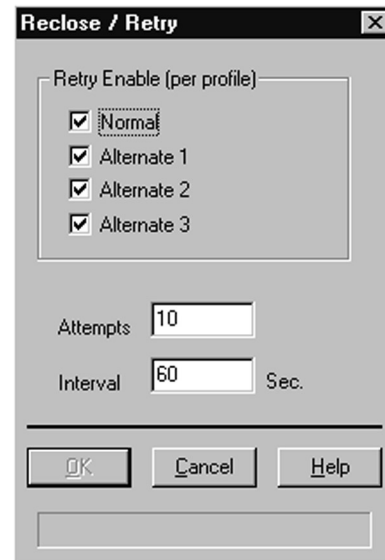


**Figure 28.**  
**Fault Location Distance Screen.**

### Reclose/Retry

The Form 5 will enter the Reclose/Retry mode when a recloser fails to close when a reclose command is issued between fault operations. The Open, Lockout, and Close LED indicators on the front panel will not be lit when the control is in the Reclose/Retry mode.

1. Click **Database > Reclose/Retry** to reach the Reclose/Retry screen. See Figure 29.
2. Click a profile box to enable that profile. A check mark appears when enabled.
3. Enter the number of retry Attempts the Form 5 will perform before locking out.
4. Enter the amount of time between retry attempts in the Interval box.
5. Click **OK**.



**Figure 29.**  
**Reclose/Retry Screen.**

## Metering

The Form 5 has four different metering parameters: instantaneous, demand, histogram, and data profiler. The histogram and data profiler features are explained in the Advanced Functions section of this manual.

The Instantaneous-Voltage, Current, and Power and Demand-Voltage, Current, and Power screens display the voltage, current, power, and total harmonic distortion measurements for each phase and ground, including total power metering. To toggle between the two screens, click **Demand** or **Instantaneous**. See Figure 30. In the Instantaneous screen, the Demand button is enabled. In the Demand screen, the Instantaneous button is enabled.

These screens also provide access to the Configure, Energy, Symmetrical, and Harmonics screens.

1. Click **Database > Metering > Demand** to reach the Demand - Voltage, Current and Power screen.

2. Click **Configure** to reach the Demand Configure screen. The Demand Configure screen is only available through the Demand screen. See Figure 31.
3. Enter the Integration Intervals for Fundamental Current/Voltage, Power, Harmonic, and Sequence Component.
4. Click **OK**.

The Integration Interval is the amount of time needed to measure 90% of a change of a measured value.

Four integration intervals must elapse to obtain a 100% demand metering reading.

See Figure 30. With these settings, a reading of 90% of the load (90 A) is obtained after one hour. A reading of 100 A is obtained only after the load current is consistently 100 A for four hours.

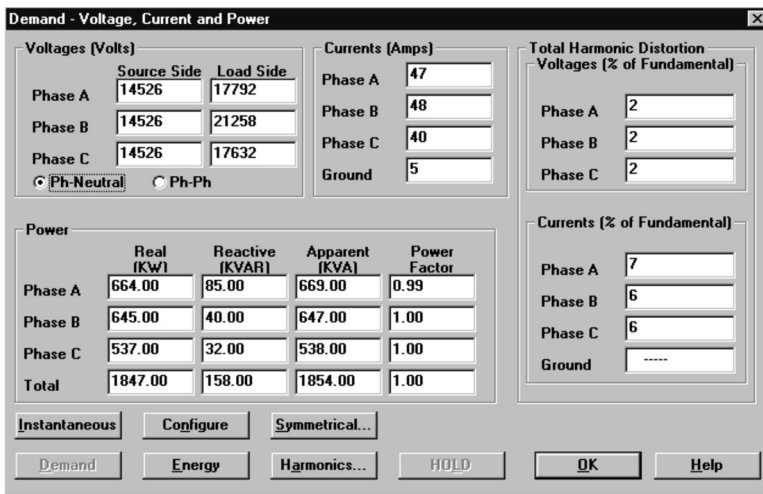


Figure 30. Demand - Voltage, Current and Power Screen.

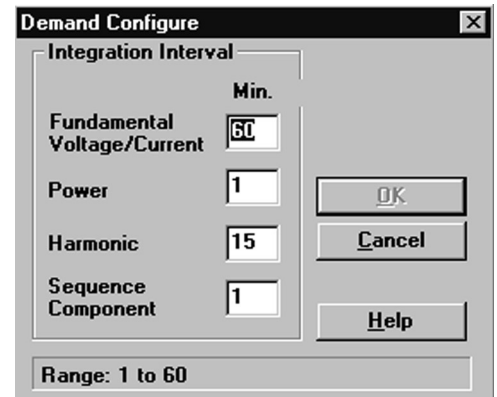


Figure 31. Demand Configure Screen.

## Energy

The Energy screen is reached from the Instantaneous-Voltage, Current, and Power and Demand-Voltage, Current, and Power screens. Click **Energy** to view the Energy - Demand screen.

This screen displays the kilowatt-hours measured for each phase and the total kilowatt-hours measured. The readings can only be reset while online. Click **OK**. See Figure 32.

Energy (KWH)	
Phase A	-0.000
Phase B	-0.000
Phase C	-0.000
Total	-0.000

Buttons: OK, Reset, Help

**Figure 32.**  
Energy - Demand Screen.

## Symmetrical Components

The Demand-Symmetrical Components screen is reached from the Demand-Voltage, Current, and Power screen. The Instantaneous-Symmetrical Components screen is reached from the Instantaneous-Voltage, Current, and Power screen. Click **Symmetrical** in either screen. See Figure 30.

During non-fault operation, symmetrical component quantities reflect the degree of unbalance that exists on a power system. See Figure 33.

Under normal operation on a three-phase system, with equal magnitude voltage and/or current on the three phases, and assuming 120 degree phase displacement and phase rotation A-B-C, only positive sequence is present. The magnitude of the negative and zero sequence quantities will be zero if the system is perfectly balanced. As unbalance is introduced, negative and zero sequence components of voltage and/or current will appear.

The symmetrical component quantities are most useful in diagnosing the operation of protective devices during fault events. The interconnection of sequence networks for different types of system faults allow power system protection engineers to calculate expected fault magnitudes for a variety of unbalanced fault events on the distribution system.

Voltage		
	Magnitude	Angle (Deg)
Positive	14516	-119
Negative	0	90

Current		
	Magnitude	Angle (Deg)
Positive	43	-125
Negative	4	174
Zero	2	-95

Buttons: OK, Help

**Figure 33.**  
Instantaneous - Symmetrical Components Screen.



## Harmonics

1. Click **Harmonics** in the Instantaneous-Voltage, Current, and Power or the Demand-Voltage, Current, and Power screen to view the Harmonics (% of Fundamental) screen. See Figure 34.
2. Click the header of a column or row, then click **Graph** to display the values as a bar graph. See Figure 35.

Line harmonics measurements are used in analyzing power quality. The Form 5 automatically measures harmonics up to the 15th harmonic. See the Downloading a Database section of this manual for details on different graphing options.

3. Click **OK**.

Harmonic	Phase A - Neutral Voltage	Phase B - Neutral Voltage	Phase C - Neutral Voltage	Phase A Current	Phase B Current	Phase C Current	Ground Current
THD	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0

Select a row, or column to display graph

OK

Graph

Help

Figure 34. Harmonics (% of Fundamental) Screen.

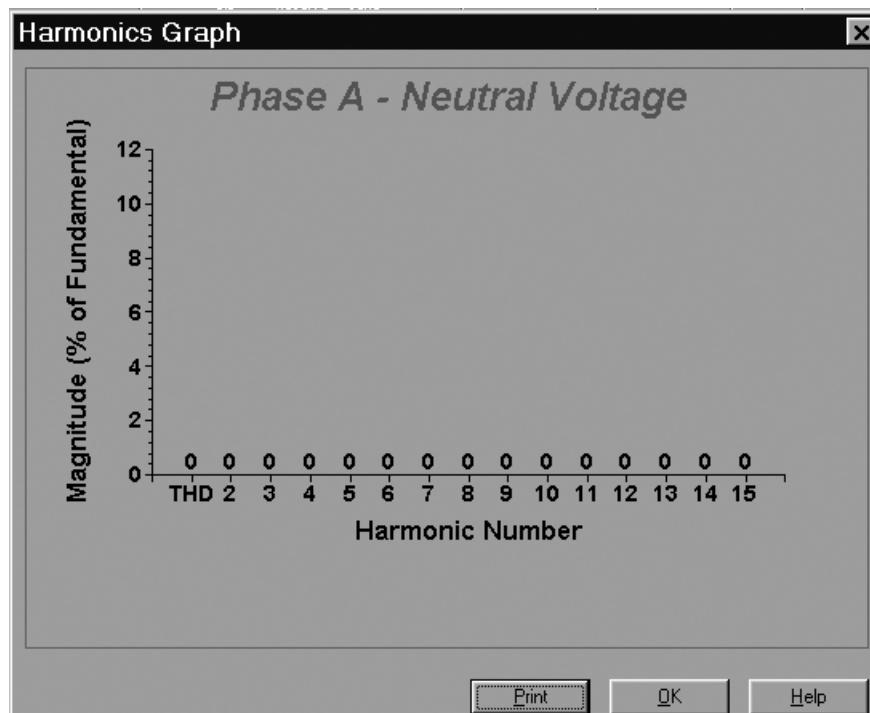


Figure 35. Harmonics Graph Screen.

## Database Management

### Saving the Database

**Note:** The database can be saved with the basic functions programmed as explained in the preceding sections. However, any advanced functions that will be used need to be programmed before saving. Refer to the Advanced Functions section of this manual for additional programming functions.

It is recommended that the database files used to program a control be placed in a separate folder than the files that contain the live data. The file name that is used for the database is not saved internally in the database. When a file is downloaded to the control, the control will not retain the file name. The file name can be entered in the User Identification box in the Hardware screen. See the Hardware section of this manual.

Click **File > Save As**, OR **File > Save**, OR the **Save** icon. Rename the file and save the database files in a separate folder from the live data.

### Downloading a Database

1. Click the **New** icon OR click **File > Close** to close the database that you have modified and saved. If you have not saved the database, a message will appear and offer to save the database.
2. Click the **Con** icon to initiate communication with the control.
3. Click the **Open** icon.
4. Choose and open the file to download to the control by double clicking on the file name OR by highlighting the file name then clicking on **OK**.

A message will appear and offer to save the modified untitled database. This will save the default database, which opens every time communication with the control is initiated. It is the same default database used as the basis for the programming database file created for the control.

5. Click **No** in the message window.

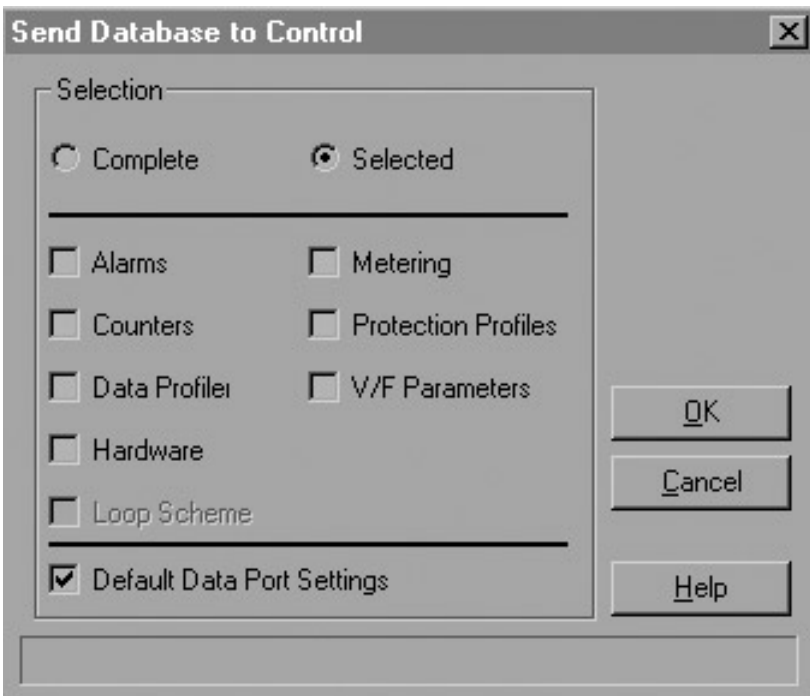
**Note:** The name of the file that contains the database to be sent to the control should now appear in the blue title bar, replacing “untitled”. The file name should not have the suffix “-modified”. If the file does have the “-modified” suffix, close the file. Do not save the changes. Then reopen the file. Do not review any parameters while online prior to download or the control will modify the programming database file.

6. Click the **Send** icon. This will open the Send Database to Control screen. See Figure 36.

- A. Click the Complete radio button to send the complete database.
- B. Click the Selected radio button when part of the database is changed. Click in appropriate boxes for the sections of the database changed. A check mark appears when selected.

**Note:** Software versions 3.11.8d and higher also support a Data Ports feature. By clicking in the Data Ports check box, the values entered in the F5 Data Port screen for 2179 and DNP 3.0 Protocols and the screens accessed by clicking **Advanced** in the F5 Data Port screen for the DNP 3.0 Protocol are sent to controls with **firmware database version 15 and higher**. Click the **ID** icon to determine the Firmware Database Version.

7. Click **OK**.



**Figure 36.**  
**Send Database to Control Screen.**

## Verifying the Programming

1. Click the **New** icon.

This will close any open file. It eliminates any possibility of mixing databases and ensures all parameters are actually what is programmed into the Form 5.

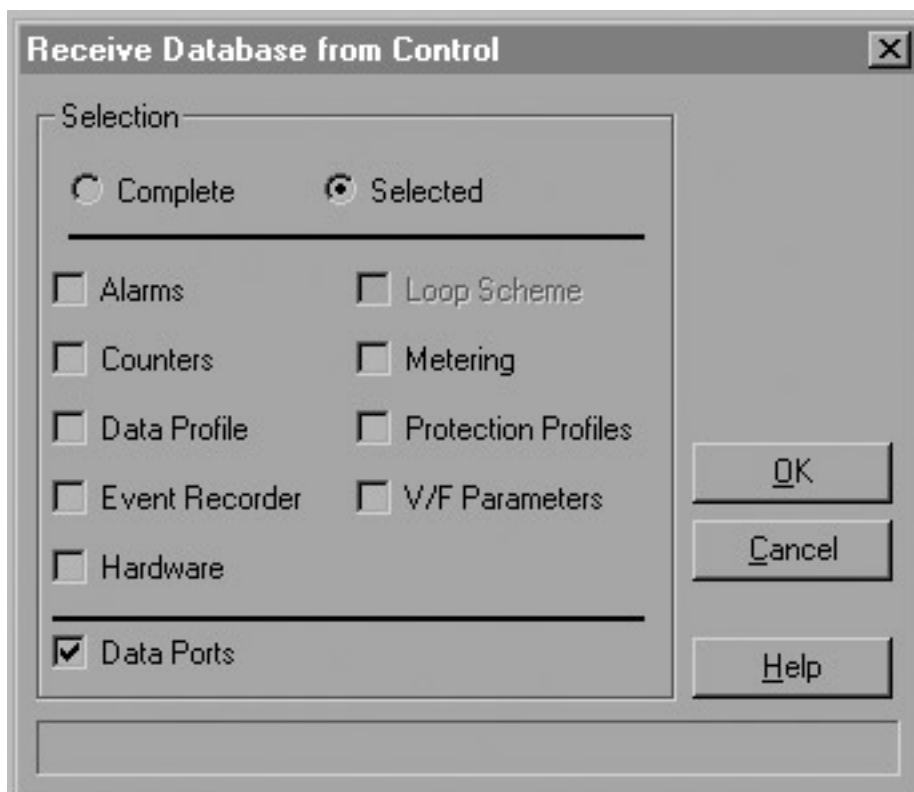
2. Click the **Receive** icon to reach the Receive Database from Control screen. See Figure 37.
3. Select to receive all or part of the database.
  - A. Click the Complete radio button to receive the complete database.
  - B. Click the Selected radio button when only portions of the database need to be viewed and not saved.

**Note:** Software versions 3.11.8d and higher also support a Data Ports feature. By clicking in the Data Ports check box, the values entered in the F5 Data Port screen for 2179 and DNP 3.0 Protocols and the screens accessed by clicking **Advanced** in the F5 Data Port screen for the DNP 3.0 Protocol are sent from controls with **firmware database version 15 and higher**. Click the **ID** icon to determine the Firmware Database Version.

**Note:** Viewing any parameters while online will initiate a selected receive of those parameters. For example, if the normal profile is selected while online, the Form 5 will send all profile information, but will display only the normal profile.

4. Click the **Dis** icon.
5. Physically disconnect the PC from the Form 5 port.

This allows faster viewing of all parameters. Review all parameters for accuracy. Any viewing of profiles, counters, etc., while online, after receiving a complete database, will reinitiate a selected receive of the chosen parameter(s) and slow down the viewing process.



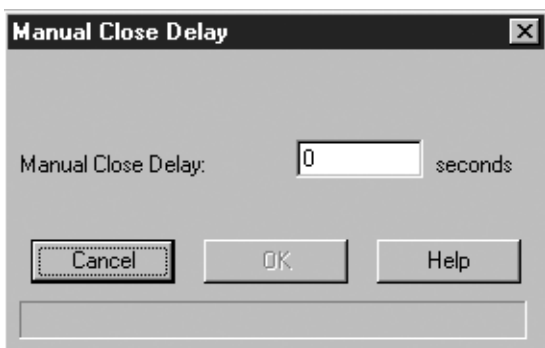
**Figure 37.**  
Receive Database from Control Screen.

## ADVANCED FUNCTIONS

### Manual Close Delay

The manual close delay allows a delay of 0 to 60 seconds to the close signal issued from the control when the manual close switch is activated from the front panel. When this function is providing a delay, the recloser closed LED status indicator on the front panel of the control will flash until the close signal is issued.

1. Click **Setup > Manual Close Delay** to reach the Manual close Delay Screen. See Figure 38.
2. Enter the delay time from 0 to 60 seconds.
3. Click **OK**.



**Figure 38.**  
Manual Close Delay Screen.

### Histograms

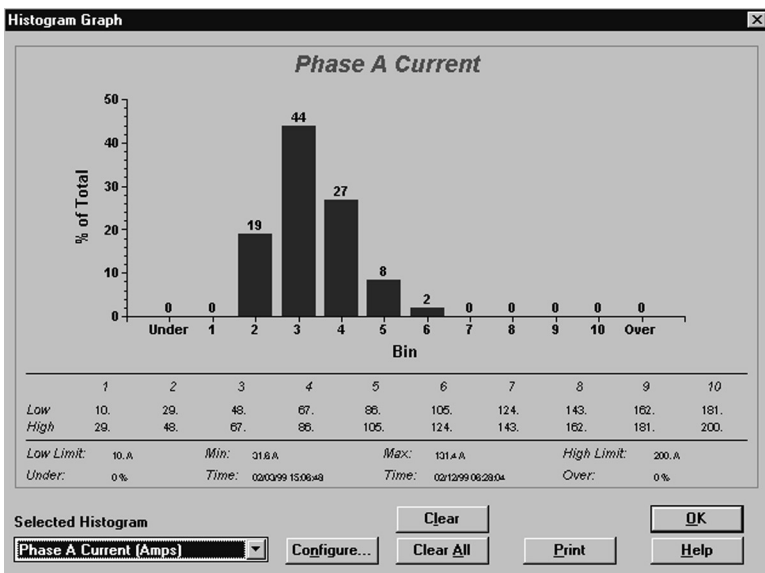
Histograms in the Form 5 are bar graph representations of the Form 5's demand metering. A histogram is available for each of the demand metering parameters.

The Form 5 control automatically collects the data used for the histograms from the moment it is powered up. The histogram data accumulation time can not be programmed, but the histogram data can be reset. A histogram will represent the demand metering data on the power system from the time of power-up or the last reset until the histogram is requested.

Each histogram samples the demand metering values once a minute. The bar graphs display the percentage of time since the last reset that the metered demand values have been within the range of a bin.

The histogram has 10 bins per configurable range plus an under range bin and an over range bin. Each bin represents 1/10th of the range. The range of each histogram is set with defaults and is also user configurable.

1. Click **Database > Metering > Histogram** to reach the Histogram Graph screen. See Figure 39.
2. Select a Histogram from the drop down menu.
3. Click **Configure** to reach the Histogram Configuration screen.



**Figure 39.**  
Histogram Graph Screen.

## Histogram Configuration

See Figure 40. In this example, the histogram for Phase A Current is configured for a range of 10 to 200 A (this is the default range). Therefore, all recordings of Phase A current that is below 10 A will be stored in the under bin and any current above 200 A will be stored in the over bin. All other levels of current measured for Phase A will be recorded in one of the remaining 10 bins.

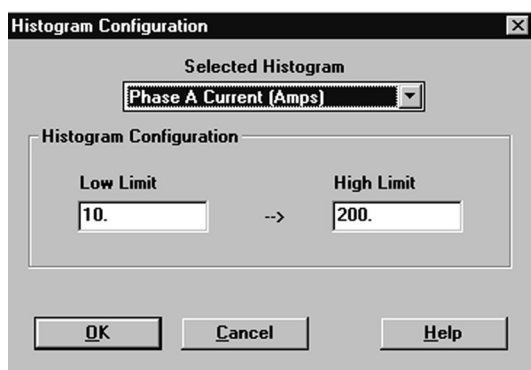
Figure 39 is the histogram graph for this example. The graph shows that in bin 2 the demand current was between 29 and 48 A 19% of the time (from when the histograms were last reset).

Histograms reflect demand values, not instantaneous values. The demand metering uses an Integration Interval that is user configured. The range is 1 to 60 minutes.

For example, if the Integration Interval is set to 10 minutes and a 100 A step in current occurs after 10 minutes, the demand curve will increase by 90 A (90% in one time constant or integration interval). The demand Integration Interval is not the time over which the histogram data is taken. Setting the Integration Intervals to 1 minute will make demand metering more responsive.

The histograms also contain the true maximum and minimum demand readings and the time and day those readings were acquired.

1. Select a Histogram from the drop down menu. See Figure 40.
2. Enter the Low Limit and High Limit values.
3. Click **OK**.



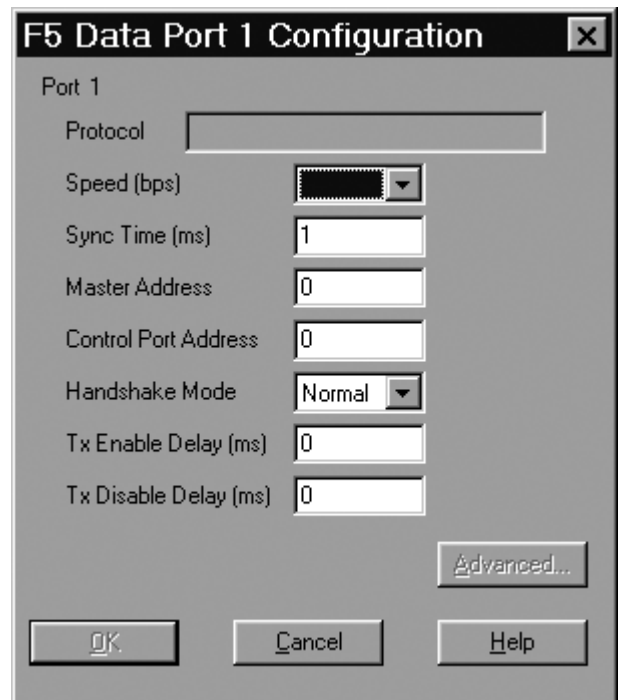
**Figure 40.**  
Histogram Configuration Screen.

## Communications Configuration

### Data Port Configuration

Cooper Power Systems offers two standard protocols: 2179 and DNP 3.0. Separate documentation is available for either protocol. Use these directions to connect to port 2 or to port 3.

1. After communications are established, click **Setup > F5 Data Port > Port (2 or 3)** to reach the F5 Data Port (2 or 3) Configuration screen. See Figure 41.
2. Select the baud rate of the communication port in the Speed (bps) drop down menu.
3. Enter the Control Port Address.
4. Select a Handshake Mode from the drop down menu.
5. Enter the Tx (transmit) Enable Delay value.
6. Enter the Tx (transmit) Disable Delay value.
7. For DNP 3.0 Protocol only, click **Advanced** to reach the DNP 3.0 Protocol Parameters screen.



**Figure 41.**  
F5 Data Port Configuration Screen.

## DNP Protocol Parameters

### Data link Confirm

1. Select the Data link Confirm Mode from the drop down window. The mode choices are Never, Always, and Sometimes. In the Never Mode, Retries and Timeout will be greyed out. See Figure 42.
2. Enter the number of Retries.
3. Enter the Timeout value.
4. Enter the Application Confirm Timeout value.

### Unsolicited Responses

1. Click the Enabled box. A check mark will appear when enabled.
2. Enter the Delay value.
3. Enter the Minimums for Class 1, Class 2, and Class 3.

### Direct Operate Allowed

1. Click the Direct Operate Allow box. A check mark will appear when allowed.
2. Enter the Select Arm Timeout value.
3. Select the Default Analog Variation setting from the drop down menu.
4. Select the Default Counter Variation setting from the drop down menu.
5. Enter the Write Time Request Interval.

## Deadbands

The Deadbands values are set to default levels so that they do not report until reset to a realistic value. In the example (see Figure 42), when the voltage changes by 40000 V, the control will report through SCADA that a voltage change has occurred.

## Collision Avoidance

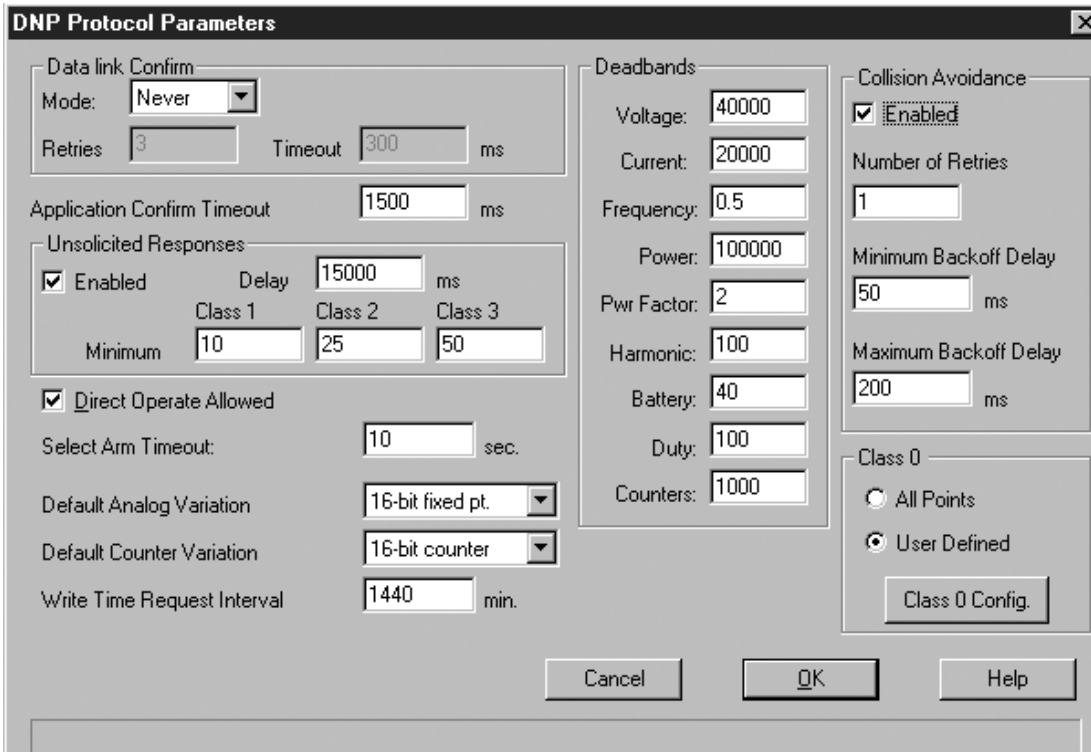
Collision Avoidance is used in conjunction with unsolicited report by exception. The unsolicited report by exception feature allows the control to initiate a communication link with SCADA without waiting for a poll for data. This allows the control to report immediately if a change occurs. With collision avoidance, the control resends the unsolicited report if the SCADA did not acknowledge the unsolicited report.

1. Click the Enabled box. A check mark will appear when enabled.
2. Enter the Number of Retries.
3. Enter the Minimum Backoff Delay.
4. Enter the Maximum Backoff Delay.

## Class 0

The Class 0 (zero) Configuration option allows the user to choose which data points the control will send to the SCADA system.

1. Click in a radio button to select All Points or User Defined points.
2. Click **Class 0 Config.** to reach the DNP Class 0 Configuration screen.

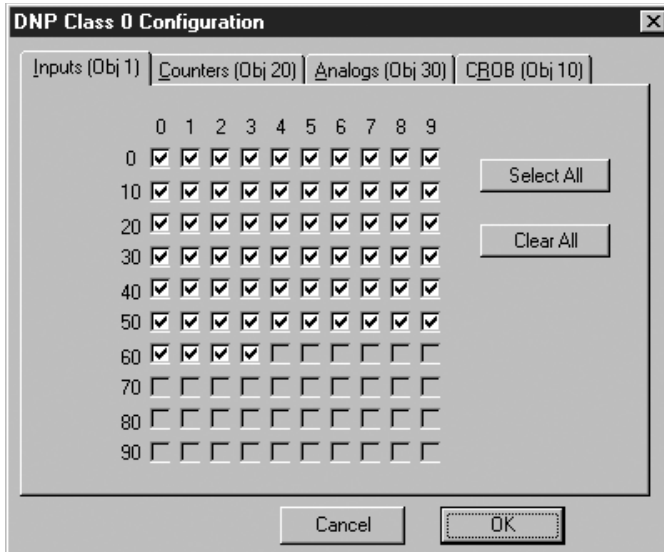


**Figure 42.**  
**DNP Protocol Parameters Screen.**

### DNP Class 0 Configuration

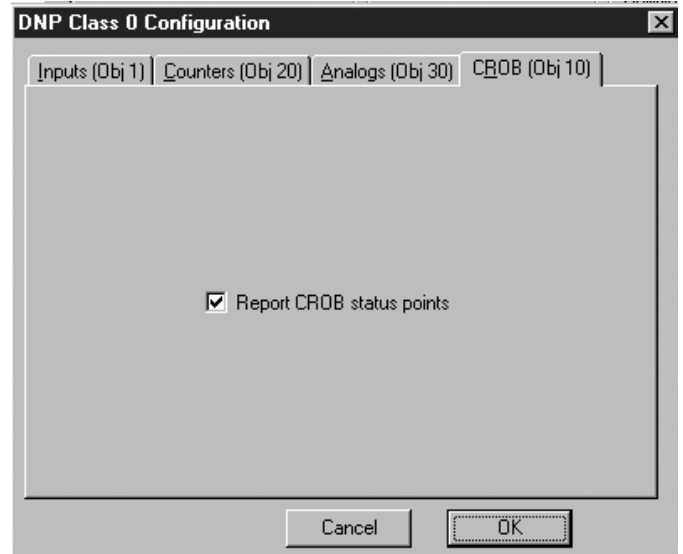
The Form 5, by default, sends most data points back through SCADA. Unwanted data points are removed from the SCADA report by removing (clicking) the check mark in the data point map. Refer to *R280-90-14* for data point definitions. Currently, all of the CROB objects or none of the CROB objects may be chosen. The default is all. See Figures 43 and 44.

Click **OK**.



**Figure 43.**  
DNP Class 0 Configuration Screen.

For firmware database version 15 and higher, a single index point for trip/close adapts legacy RTU's (Remote Terminal Units) to this function. This point is in addition to the separate trip and separate close points. These points will still operate the control, as will the new point.



**Figure 44.**  
DNP Class 0 Configuration Screen.

## Data Profiler

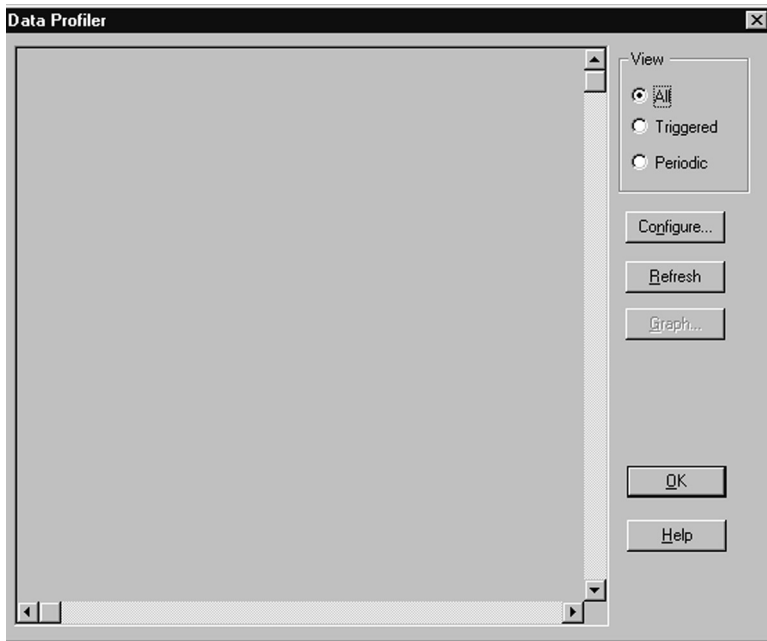
The Data Profiler is used for acquiring demand-metering data for a specific period of time. The Profiler is not automatic; it must be manually configured. The Profiler is capable of retaining metering data for each phase. The number of data samples that can be retained is dependent upon the number of metering forms used and the sample rate interval.

The Profiler can be a very useful troubleshooting tool. By selecting the fewest and most appropriate metering forms at a high sample rate, a large amount of demand metering data can be acquired to determine the cause of many line and power quality issues.

1. Click **Database > Data Profiler** to reach the Data Profiler screen. See Figure 45.

Much of the screen is greyed-out. The screen will display a chart after the Profiler is configured and has acquired readings.

2. Click **Configure** to reach the Profiler Configuration screen.



**Figure 45.**  
**Data Profiler Screen.**



## Profiler Configuration Screen

This screen operates similar to the TCC Configuration screen. The phase and unit of metering options are listed on the left of the screen. Use the scroll bar to view all of the options. See Figure 46.

The Selected metering options listed on the right are the active options. A metering option must be listed in this field to be enabled.

**1. Available and Selected metering options.**

**A.** To select a metering option, click the desired metering option in the Available list, then click **ADD >>** OR double click the metering option in the Available list.

**B.** To remove a metering option from the selected list, click on the metering option, then click **<< REMOVE**.

**2. Click the Enable Periodic Programming box. A check mark appears when enabled. The greyed area of the screen will then become active.**

**3. Set the date the recordings are to start or set to the current date. The time must be changed from the default of 1/1/70 for the graph to be useful.**

**4. The Continuous and Duration settings act like toggle switches: when one is enabled, the other is disabled.**

A Trend Time will be given in days, hours, and minutes when the Continuous feature is enabled. If 0 Hrs. 0 Mins. is displayed, the start/stop times are set before the current date.

Trend Time is the total amount of time the Data Profiler can record. This time will vary and is dependent on the sample rate and the number of metering options selected. It is recommended to enable the Continuous feature and check the Trend Time available.

**A.** Click the Continuous box if the recordings are not to be stopped. A check mark appears when enabled.

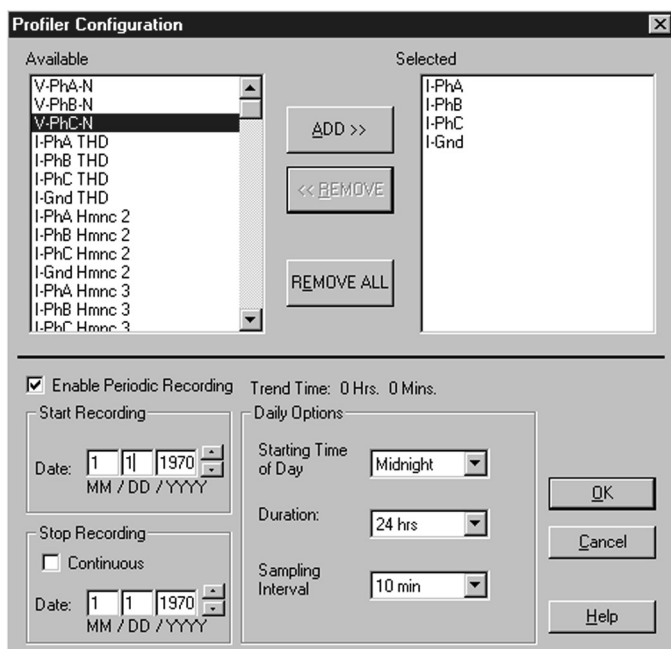
**B.** Set the stop date if Continuous is not enabled. Be sure there is enough Trend Time available.

**5. Set the Starting Time of Day the recordings are to begin from the drop down menu.**

**6. Set the Duration of time the Profiler is to run each day, beginning at the Starting Time of Day, from the drop down menu.**

**7. Set the Sampling Interval from the drop down menu. Frequent sampling rates decrease the amount of Trend Time available.**

**8. Click OK to return to the Data Profiler screen.**



**Figure 46.**  
**Profiler Configuration Screen.**

The Data Profiler will display data only after the first sampling interval. See Figure 47.

9. Select a profile view by clicking in a radio button. The Triggered view displays data initiated by an alarm(s). The Periodic view displays data from periodic sampling. The All view displays both the triggered and periodic data.

### Profiler Graph

1. Click the header of the column to be displayed as a line graph. The column will be highlighted and the Graph button will enable.

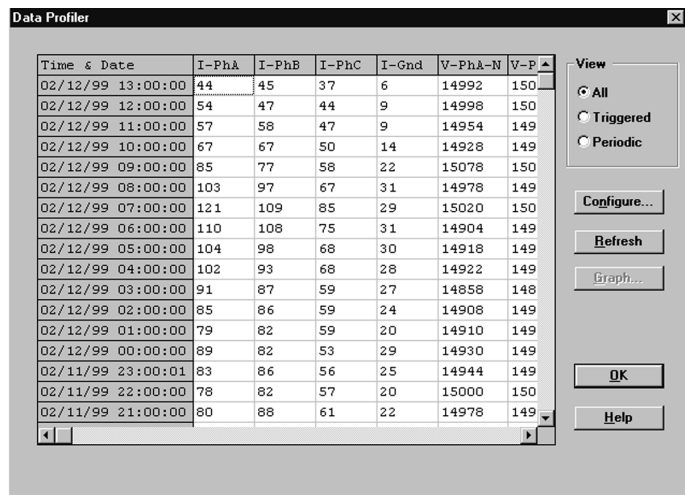


Figure 47  
Data Profiler Screen.

2. Click **Graph**. See Figure 47.

Multiple columns can be graphed simultaneously if they are in the same form of metering. Hold down the shift key while clicking column headers to select multiple columns. For example, all four current recordings (A phase, B phase, C phase, and ground) can be plotted in the same graph. A phase current and A phase voltage recordings can not be plotted in the same graph. This is possible only through the Export feature. See the Exporting Data section of this manual.

3. Click **Filter** to apply a new start date to the graph. See Figure 48.

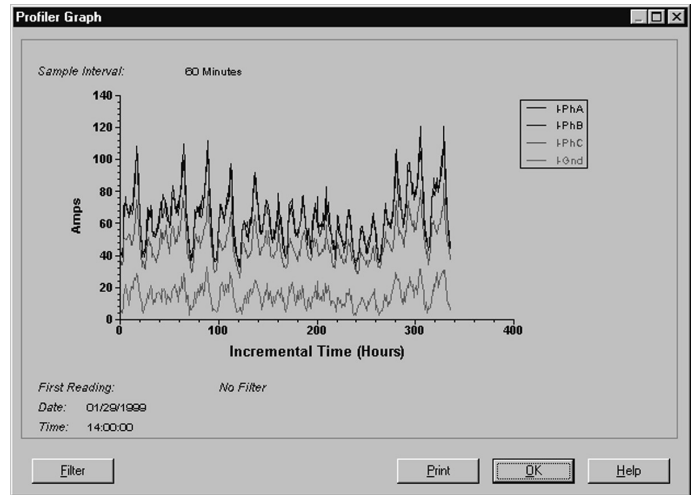


Figure 48.  
Profiler Graph Screen.

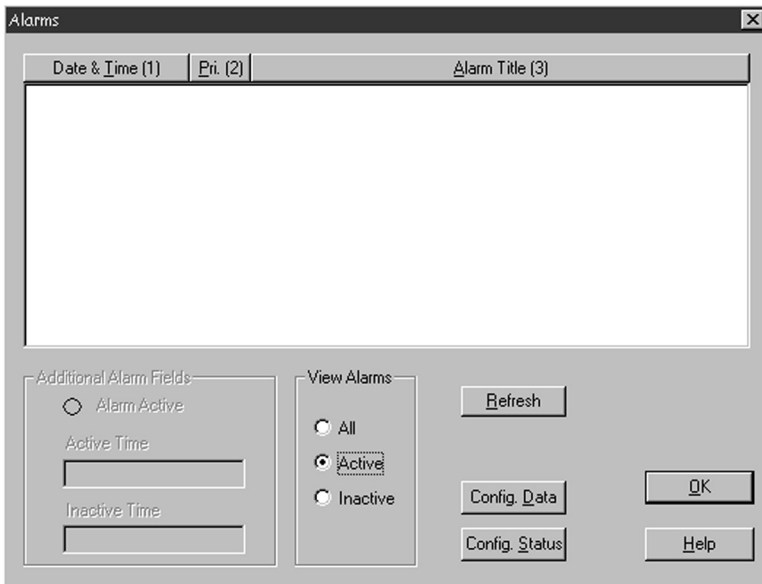
## Alarms

1. Click **Database > Alarms** OR click the **Alarm** icon to reach the Alarm screen. See Figure 49.

Any alarm that is active will appear on this screen when it is opened.

2. Change the View Alarms view by clicking the radio button for All Alarms or Inactive Alarms.

3. Click **Refresh** to refresh the alarm screen when online.
4. Click **Config. Data** to reach the Data Alarm Configuration screen.



**Figure 49.**  
**Alarms Screen.**

## Data Alarm Configuration

This screen operates similar to the TCC Configuration screen. The Available alarms are listed on the left of the screen. Use the scroll bar to view all of the options. See Figure 50. The Selected alarms listed on the right are the active options. An alarm must be listed in this field to be enabled.

**1. Available and Selected alarms.**

- A.** To select an alarm, click the desired alarm in the Available list, then click **ADD >>** OR double click the alarm in the Available list.
- B.** To remove an alarm from the selected list, click on the alarm, then click the **<< REMOVE**.

A maximum of 20 Data alarms can be selected. The criteria of each Selected alarm is also set in this screen.

**2. Highlight a Selected alarm to set its criteria.**

The Trigger Settings and Options will now be available. The Trigger Settings are used to customize the manner in which all alarms react.

**3. Enter the Priority level from 0 to 127.**

**4. Set the Alarm Delay from the drop down menu.**

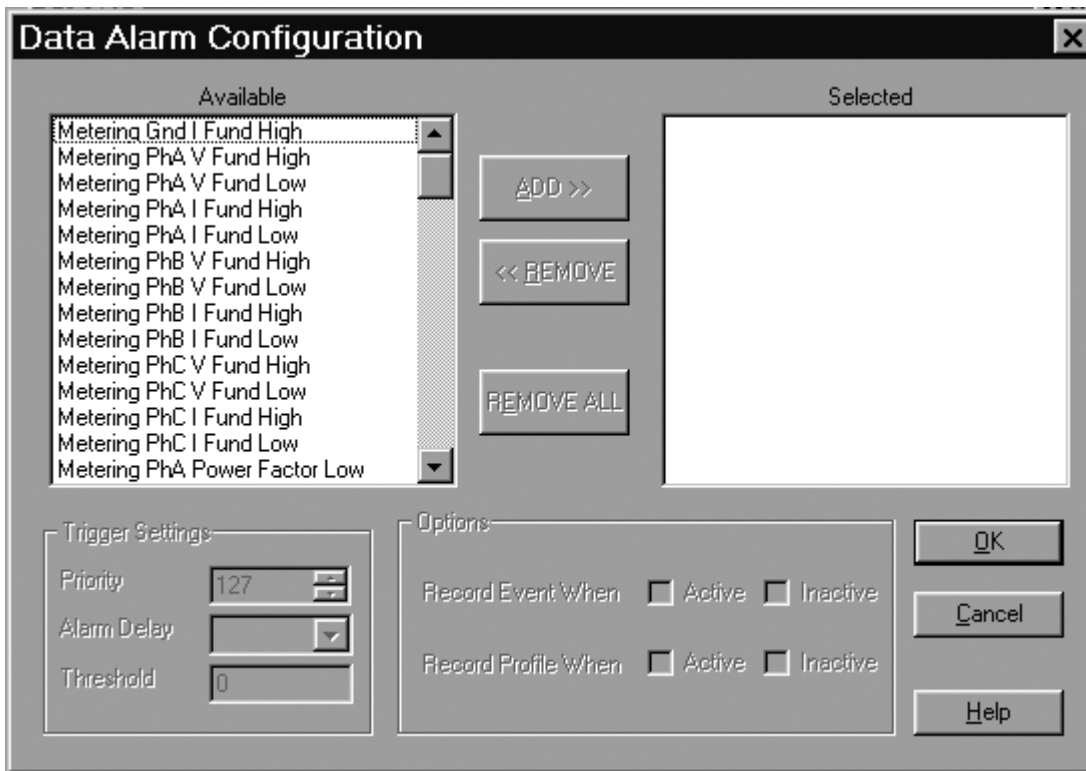
This is the amount of time after the threshold is crossed until the alarm indicator is activated. The Alarm Delay must be set to eliminate irrelevant alarms. The default time is zero seconds (instantaneous). The available delay range is from zero seconds to 60 minutes at pre-determined intervals.

**5. Enter the Threshold level at which the alarm is to be activated. This value must be the primary measurement.**

Threshold level measurement units are automatically set. For example, if the Metering PHA I Fund Low alarm is highlighted, the threshold value is measured in amperage.

For all Fund High alarms, set the threshold level to trigger at an above normal condition. For all Fund Low alarms, set the threshold to trigger at a below normal condition.

The threshold value for voltage metering alarms is based on the primary voltage. Also, the V/F: Frequency alarms are not over-excitation alarms. The V/F is a shorthand label that specifies these two alarms to be load shedding alarms that are triggered by the line frequency crossing the specified frequency threshold defined within the parameters of this alarm.



**Figure 50.**  
**Data Alarm Configuration Screen.**

6. The Record Event When - Active/Inactive options are used to record the alarm indications into the event recorder.

- A. Click the Active box for the alarm and its measurements to be recorded to the event recorder when the alarm is actuated.
- B. Click the Inactive box for the alarm and its measurements to be recorded to the event recorder when the threshold level is crossed as the alarm becomes deactivated.

The alarms will only record when the threshold value has been crossed, the function being measured maintains above (or below) threshold level, and the time delay has expired. The alarm events will be designated as an ALM event instead of an OPR event. The alarm event recording will capture the instantaneous value for that data alarm in the event recorder. This is the only method of storing metered values in a non-volatile memory location.

7. The Record Profile When - Active/Inactive options are used to initiate a data profile reading.

- A. Click the Active box to initiate the data profiler recording when the alarm is actuated.
- B. Click the Inactive box to initiate the data profile recording when the threshold level is crossed as the alarm becomes deactivated.

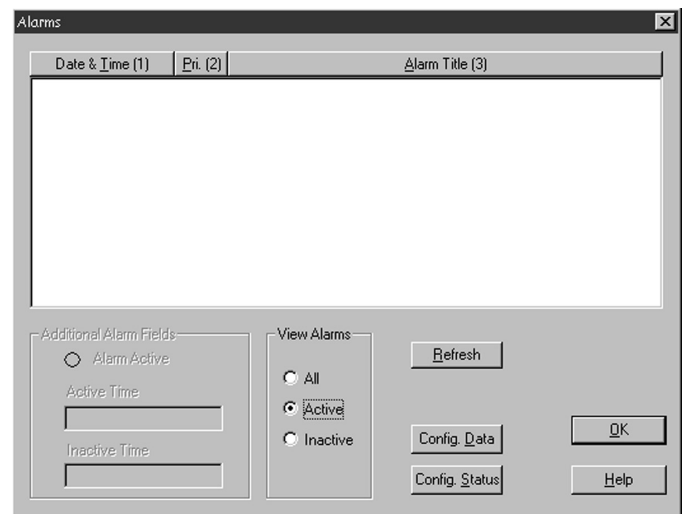
## Status Alarm Configuration

The Status alarms are activated based upon the status of various functions of the control. The Status alarms are recorded on or off for each function. The Alarm on High or Low options determine this logic. The High and Low terms can also be thought of as True or False. Set the alarm to activate when the alarm description in the alarm list is true or when it is false.

For example, the Battery Trouble status alarm indicates if the LED on the front panel is on or off (High or Low).

The power save mode of the front panel does not affect the on/off states of the status indicators.

1. Click **Database > Alarms** OR click the **Alarm** icon to reach the Alarm screen. See Figure 51.
2. Click **Config Status** to reach the Status Alarm Configuration screen.



**Figure 51.**  
**Alarms Screen.**

The Status Alarm Configuration screen (see Figure 52) operates similar to the TCC Configuration screen. The Available alarms are listed on the left of the screen. Use the scroll bar to view all of the options.

The Selected alarms listed on the right are the enabled alarms. An alarm must be listed in this field to be activated.

**1. Available and Selected alarms.**

**A.** To select an alarm, click the desired alarm in the Available list, then click **ADD >>** OR double click the alarm in the Available list.

**B.** To remove an alarm from the selected list, click on the alarm, then click **<< Remove**.

A maximum of 20 Status alarms can be selected. The criteria of each Selected alarm is also set in this screen.

**2. Highlight a Selected alarm to set its criteria.**

The Trigger Settings and Options will now be available. The Trigger Settings are used to customize the manner in which all alarms react.

**3.** Enter the Priority level from 0 to 127. The default is 127.

**4.** Set the Alarm Delay from the drop down menu.

The default time is zero seconds (instantaneous). The available delay range is from zero seconds to 60 minutes at predetermined intervals.

**5.** Set the Alarm On option High or Low (True or False) by clicking the High or Low radio button.

**6.** The Record Event When - Active/Inactive options are used to record the alarm indications into the event recorder.

**A.** Click the Active box for the alarm, the date and time it became active, and its status to be recorded to the event recorder when the alarm is actuated.

**B.** Click the Inactive box and the alarm's change in status, with the time and date it became inactive, will be recorded to the event recorder.

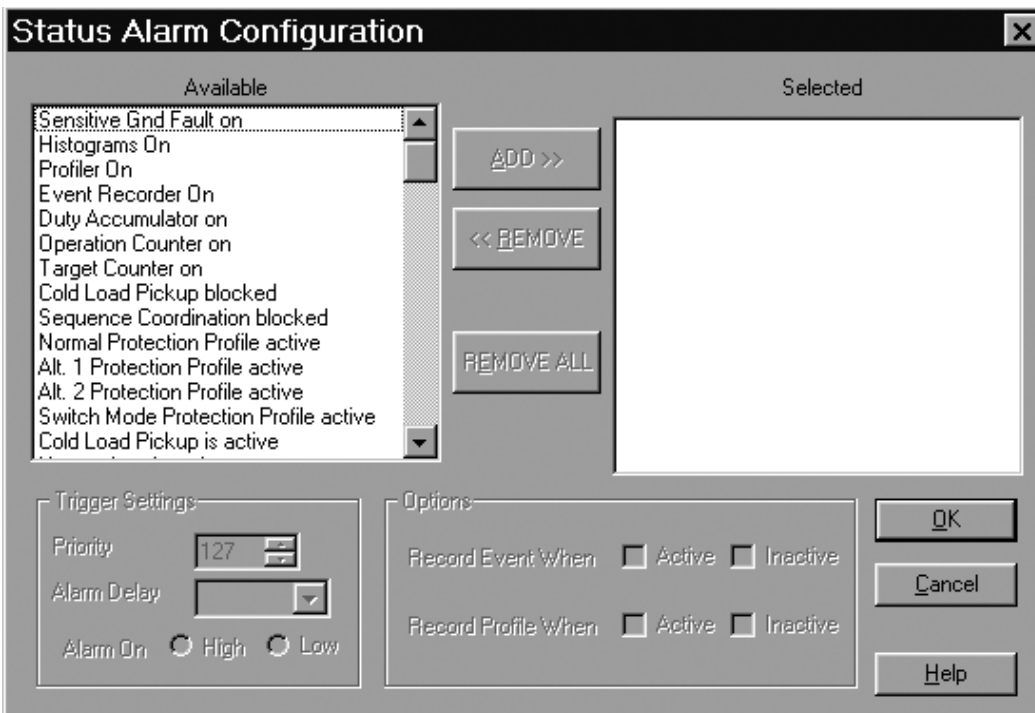
The alarms will only record when the time delay has expired. The alarm events will be designated as an ALM event instead of an OPR event. The status alarms are stored in the non-volatile event recorder location.

**7.** The Record Profile When - Active/Inactive options are used to initiate a data profile with alarm events.

**A.** Click the Active box to initiate a data profiler recording when the alarm is actuated.

**B.** Click the Inactive box to initiate a data profile recording when the alarm becomes inactive.

For example, highlight the Control AC power on status alarm in the Selected list to select it. Enter a Priority of 127 and an Alarm Delay of 2 minutes. The alarm delay time should exceed the programmed trip and reclose times of the recloser to avoid any irrelevant alarms. When Alarm On - Low is selected, the alarm will activate when Control AC power is not present. When the Record Event when Active and Inactive options are checked, the event recorder will record when the AC Power is lost (Control AC power on is false, low selected) and when the AC Power returns and the alarm becomes inactive (Control AC power on now true).



**Figure 52.**  
**Status Alarm Configuration Screen.**

## Load Shedding

Load shedding is the method of tripping a recloser open when either or both of the configured voltage parameters and the configured frequency parameters are breached. It is sensed by voltage connected to B phase. There must be a voltage sensing connection to Block TB1-2 in the control. The Load Shedding feature is off by default. To enable the Load Shedding feature, the parameters must be set.

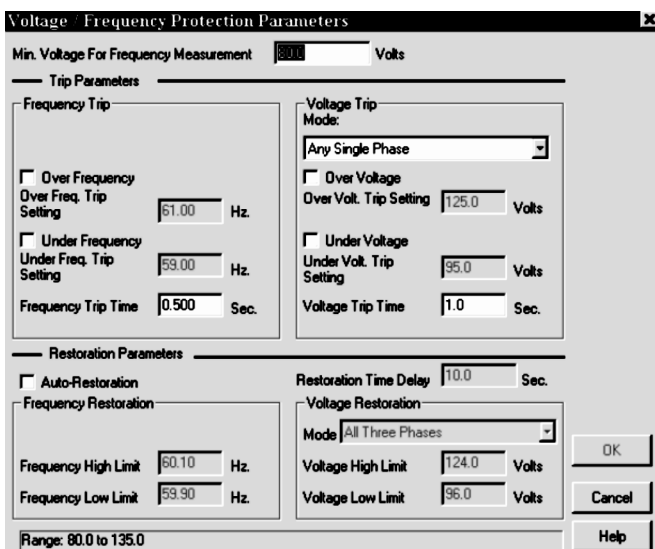
**Note:** If the Phantom Phase feature is used, the load shedding single phase mode will only operate correctly on the phase that is being used to create the other two phantom phases.

1. Click **Database > Voltage/Frequency** to reach the Voltage/Frequency Protection Parameters screen. See Figure 53.
2. Determine the lowest voltage level at which the control will monitor frequency for load shedding purposes (no less than 80 Vac). Enter that value in the Min. Voltage For Frequency Measurement box.

## Frequency Trip

1. Check the Over Frequency box to enable. A check mark will appear when enabled.
2. Enter the frequency for over frequency trip.
3. Check the Under Frequency box to enable. A check mark will appear when enabled.
4. Enter the frequency for under frequency trip.
5. Enter the Frequency Trip Time delay time.

The frequency must be outside of this range for the defined amount of time delay for trip.



**Figure 53.**  
**Voltage/Frequency Protection Parameters Screen.**

## Voltage Trip

1. Select the Mode from the drop down menu. The mode options are Any Single Phase, All Three Phases, or Any Single Phase, Three Phase Inhibit.

To trip only on an overage or underage of any phase of source voltage, but not on an overage or underage of all three phases of source voltage, choose Any Single Phase, Three Phase Inhibit.

2. Check the Over Voltage box to enable. A check mark will appear when enabled.
3. Enter the voltage for the Over Volt. Trip Setting.
4. Check the Under Voltage box to enable. A check mark will appear when enabled.
5. Enter the voltage for the Under Volt. Trip Setting.
6. Enter the Voltage Trip Time delay time.

The voltage must be outside of this range for the defined amount of time delay for trip.

## Restoration Parameters

1. Click the Auto-Restoration box to enable the Auto-Restoration feature. A check mark will appear when the feature is enabled.
2. Enter a Restoration Delay time.

After both the frequency and voltage are within the selected values, the restoration time delay begins timing. The voltage and frequency values must remain in the selected ranges for the duration of the restoration time delay for the auto-restoration to occur. If a value changes prior to completion of the restoration time delay, the time is instantaneously reset.

3. Enter a Frequency High Limit and a Frequency Low Limit.

This is the range the frequency must remain within to allow auto restoration.

4. Select a Mode.

To restore on any one phase of source voltage, choose Any Single Phase. To restore when all three phases of source voltage are within limits, choose All Three Phases.

5. Enter a Voltage High Limit and the Voltage Low Limit.

This is the range the voltage must remain within to allow auto-restoration.

6. Click **OK**.

**Note:** Do not choose both single phase loss of voltage load shedding and single phase auto restoration without careful consideration of the application. It should not be used when all three phases are brought to the control. This combination of settings may cause the recloser to open and close every time the time delay expires, until one of the parameters is no longer being met. The setting may be appropriate with only one PT input to the control.

## Form 5 Loop Scheme Control Accessory

The Form 5 LS Control improves distribution system continuity through load-transfer and loop-sectionalizing schemes. The Form 5 can change the protection scheme upon an LS action. Each protection profile can be configured differently, so programming an LS scheme can be easily accomplished for sectionalizing or tie applications.

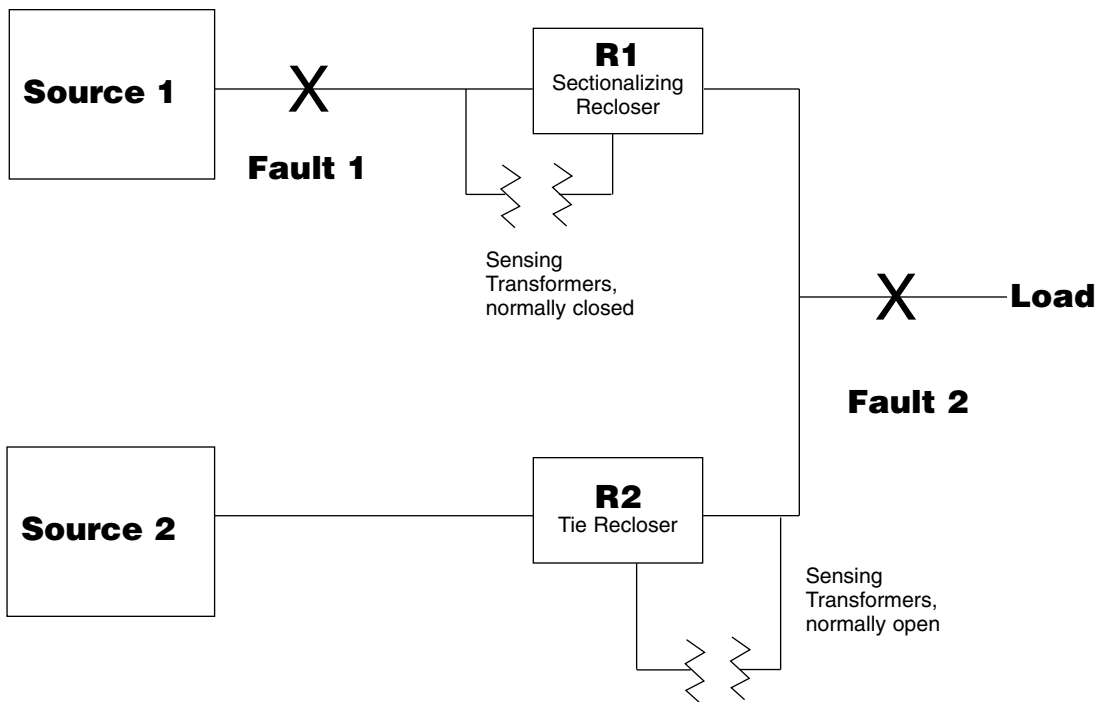
The Form 5 LS Control senses the loss of source- and load-side voltage with customer supplied potential transformers. The control will perform its programmed LS functions after a programmable time delay when loss of voltage occurs.

The control can be in either the sectionalizing or the tie mode of operation. The sectionalizing mode senses voltage on the source-side of a normally closed recloser and is activated upon loss of source-side voltage. The ability to change the profile in this application enhances the loop scheme's capabilities. The tie mode senses voltage on both sides of a normally open recloser and is activated upon loss of voltage on either side.

## Load Transfer/ Manual Return-to-Preferred Service

A simple load-transfer scheme using two electronic reclosers with LS sectionalizing controls is diagrammed in Figure 54. The normally closed R1 senses the source-side voltage. When S1 voltage is lost (for example, when a fault occurs at Fault 1), the LS application begins timing. R1 will open before R2 closes to restore service from the alternate Source 2. To return to preferred source S1, the controls can be operated manually or through SCADA.

In the event of fault at Fault 2, R1 sequences to lockout. Upon loss of load side voltage, R2 closes and would normally sequence to lockout. However, this can be reduced to one trip operation to lockout by using a momentary non-reclose LS action option to prevent reclosing if a fault operation occurs within a preset time of closing. The momentary on time of the LS action options is programmable from 1 to 1000 seconds.



**Figure 54.**  
**Load Transfer Application.**



### Typical Loop Scheme, 3 Reclosers

Figure 55 is a diagram of a typical three recloser loop-sectionalizing scheme. Reclosers R1 and R2 are located at the approximate midpoint of the load on two feeders. The ends of the feeders are joined by a normally open recloser (TIE), R3. Reclosers R1 and R2 are programmed to perform the sectionalizing LS function. R3 is programmed with the LS TIE functionality. As an example, R1 and R2 are set for a 560 A phase minimum trip and are programmed to change profiles, which provides the appropriate minimum trip (280 A in this example), or, depending on system requirements, can be set to lockout. Recloser R3 is set for a 400 A minimum trip.

Upon loss of source side voltage for 25 seconds (programmable value), the profile of R1 is changed and the LS is now programmed for one trip operation to lockout and its minimum trip setting is reduced to 280 A. Recloser R3 closes 30 seconds (programmable value) after the loss of voltage. In the event of a fault at Fault 1, R1 would operate one trip operation to lockout.

Again, under normal conditions (S1 energized), a fault at Fault 2 would cause R1 to sequence to lockout. After 30 seconds, R3 would close in on the fault and lock out on its one operation.

In all cases, the fault is isolated to the smallest section.

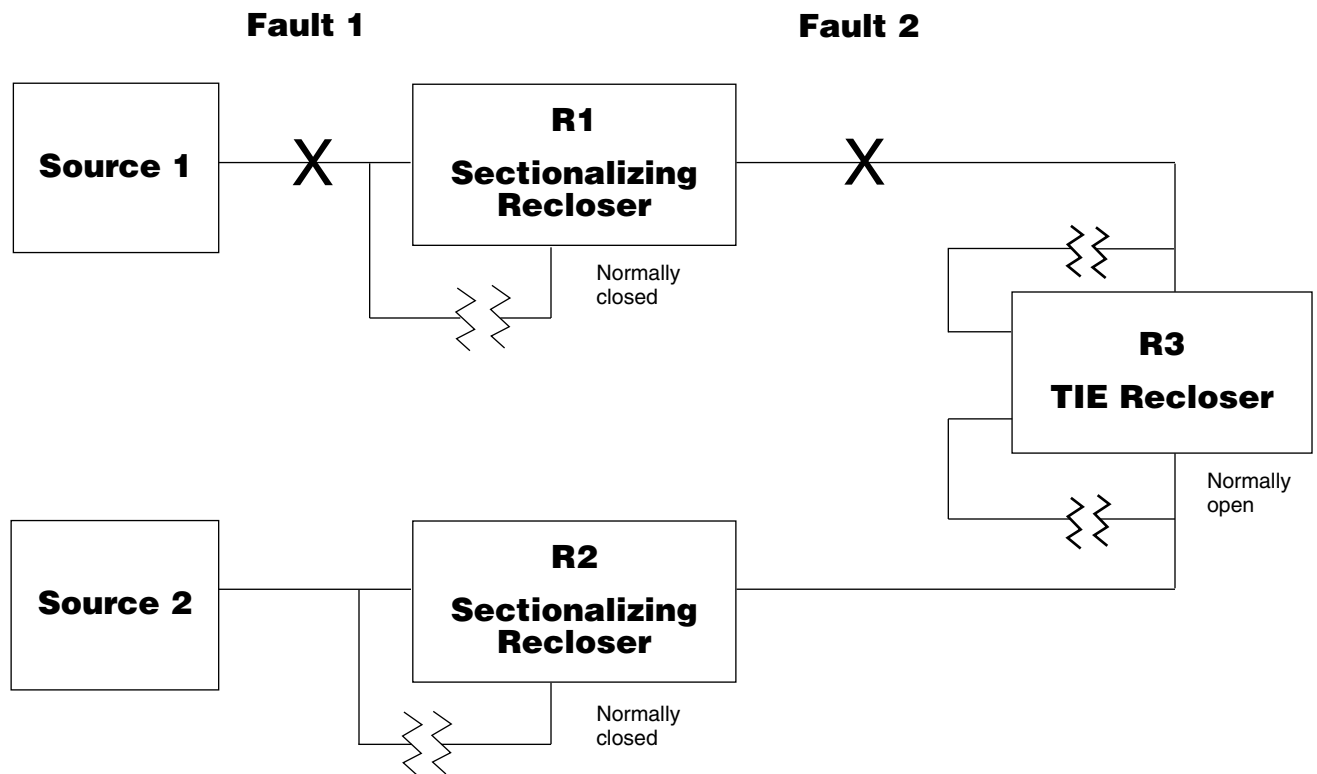


Figure 55. Loop-Sectionalizing Scheme with Three Reclosers.

### Loop-Sectionalizing Scheme with Five Reclosers

A loop-sectionalizing scheme involving five reclosers confines a permanent fault to smaller portions of the distribution circuit while maintaining service to the remaining unfaulted sections. In this scheme, each distribution circuit is divided into three sections of equal load with normally closed reclosers R1 - R3 and R2 - R4. The two circuits are connected at the tie point with a normally open recloser, R5.

The Form 5 LS controls for R1 and R2 are programmed with LS sectionalizing capabilities, which will lock out the reclosers upon loss of source voltage after a programmable time delay. The Form 5 LS controls for R3 and R4 are also programmed with sectionalizing capabilities which, upon loss of source voltage and after a programmable time delay (longer than R1 and R2), change the profile to provide a different minimum trip value and the number of operations to lockout. The control for R5 is programmed as an LS tie, which will close the recloser upon loss of voltage on either side after a programmed time delay longer than that of R3 or R4.

As an example (see Figure 56), upon loss of S1 voltage, reclosers R1, R3, and R5 sense the voltage loss and start timing. R1 times out first and opens. Next, the active profile of R3 is changed and its minimum trip value becomes 280 A to coordinate with the tie recloser. The non-reclose feature is also momentarily enabled (an LS Action option). Finally, the tie recloser closes. The major portion of the loop, up to R1, is now fed from S2. After restoration of S1, the return to normal system operation is accomplished manually or through SCADA commands.

If a permanent fault occurs a Fault 1, R1 operates to lockout normally. R3 and R5 sense the loss of voltage and start timing. R3 times out and changes its active profile to provide a new minimum trip of 280 A and its operating sequence is momentarily modified by the LS Action, non-reclosing. Next, R5 times out, closes in the fault, and R3 will lock out. The fault is isolated between R3 and R5. Service is maintained to the remaining major portion of the loop. If a permanent fault occurs of Fault 2, R3 operates to lockout normally, R5 senses the loss of voltage after its programmed time delay, R5 closes into the fault and operates to lockout. The fault is isolated between R3 and R5. Service is maintained to the remaining major portion of the loop.

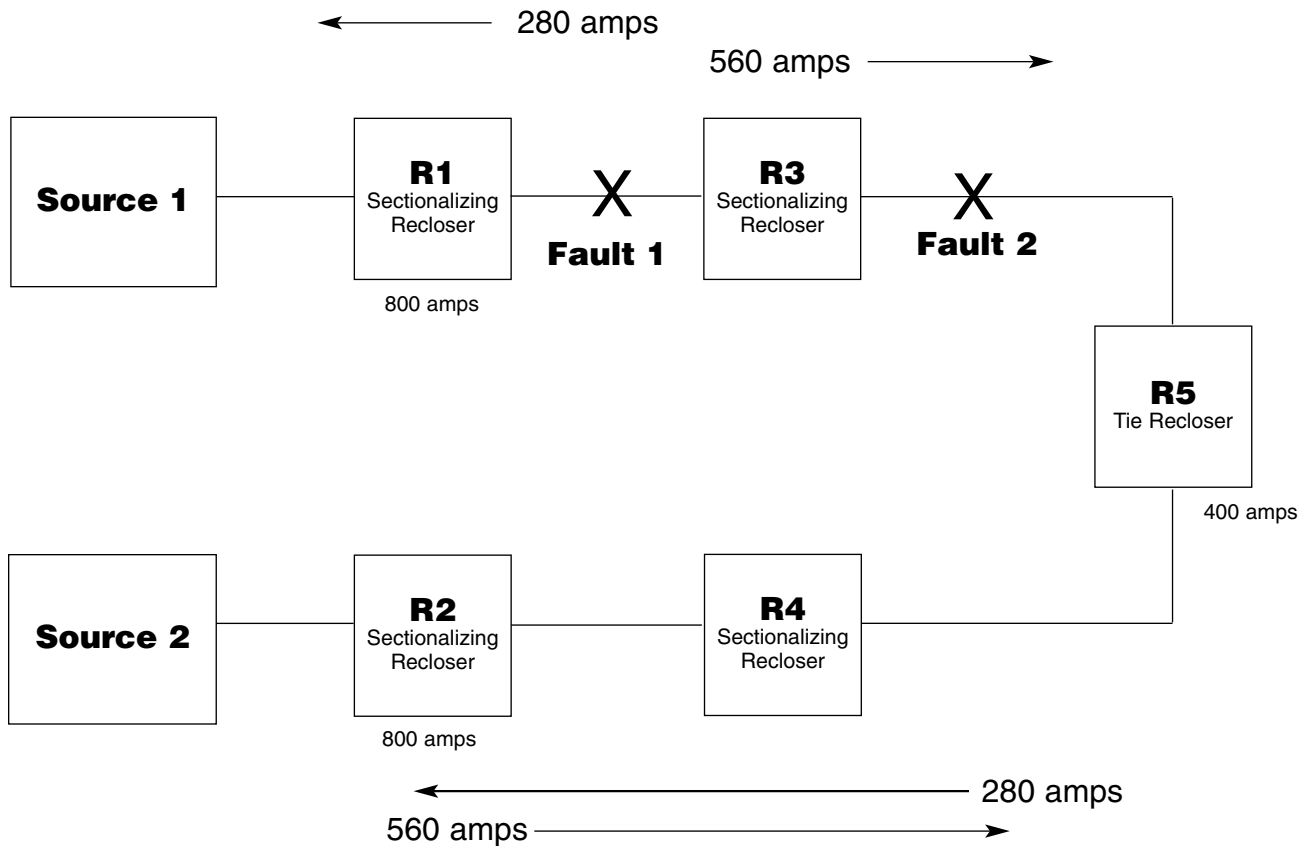


Figure 56. Loop-Sectionalizing Scheme with Five Reclosers.

## Programming the Loop Scheme

1. Click **Database > Loop Scheme** to reach the Loop Scheme Parameters screen. See Figure 57.
2. Select an LS method by clicking the Tie or Sectionalizing radio buttons.
3. Select Reset functionality and the time delay for auto-restoration.
4. Select the Close functionality.
5. Select the Voltage Response Mode from the drop down menu. LS action can be enacted after any single-phase trip or after a three-phase trip.
6. Set the Voltage Transfer "TD1" Delay time. This is the amount of time the voltage response mode condition must be met before initiating the LS action.
7. Select the LS Action from the drop down menu. This is the type of action required after the voltage transfer delay expires.

### After LS Action

The Form 5 LS can change profiles when an LS action occurs.

1. Select the parameters for the LS Loops scheme. Set Ground Trip Blocked, Non-Reclosing, and Alternate Profile to Momentary On or Latched On from the drop down menus.
2. Select the Alternate Profile/Switch Mode from the drop down menu. This is greyed out unless Latched On or Momentary On is selected in Step 1.
3. Set the Momentary Func. "TD2" Delay when Momentary On is selected in Step 1. It is greyed out unless Momentary On is selected.

### LS Auto Reset on TD3 Timeout

An LS sectionalizer control may be in the closed position and trip and lock out on loss of voltage for Source 1. With LS Auto Reset on TD3 Timeout selected, the LS will reset after the Source 1 voltage returns and the programmed TD3 time has expired. Additionally, the LS will also CLOSE back in when Auto Close on LS Auto Reset is selected.

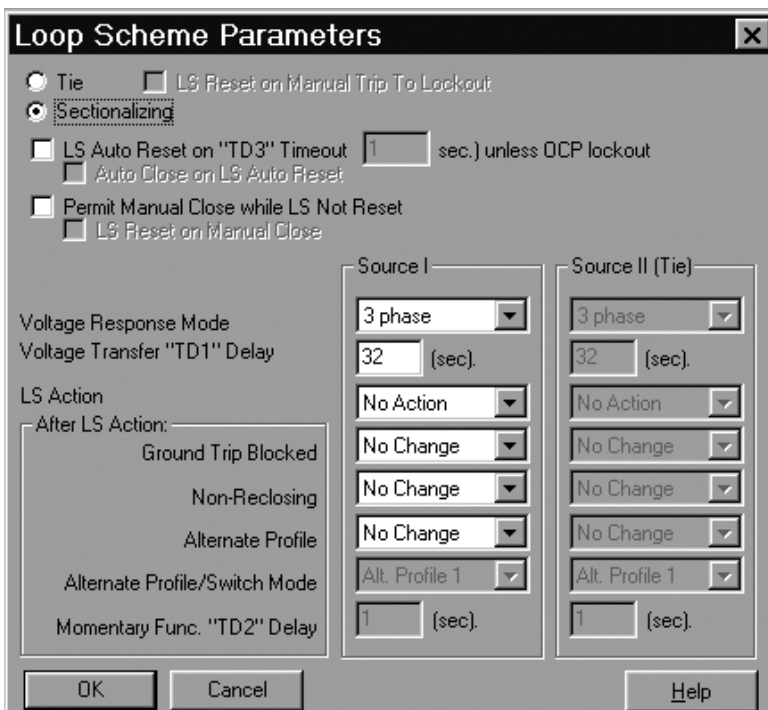
1. Click the LS Auto Reset on "TD3" Timeout box to select this feature. A check mark appears when enabled. See Figure 57.
2. Enter a value for the number of seconds for the TD3 timeout.
3. Click the Auto Close on LS Auto Reset box to select this feature. A check mark appears when enabled. This feature is greyed out unless the LS Auto Reset on "TD3" Timeout feature is selected.

Note: The LS Auto Reset will not reset and close if the loss of voltage was preceded by fault current.

### Permit Manual Close While LS Not Reset

An LS sectionalizing control may be closed without first resetting the LS by activating the Permit Manual Close While LS Not Reset feature. Normally, the LS Reset on Manual Close will also be used to reset the LS when a manual close function is performed, eliminating the extra step of resetting the LS.

1. Click the Permit Manual Close while LS not Reset box to select this feature. A check mark appears when enabled.
2. Click the LS Reset on Manual Close box to select this feature. A check mark appears when enabled. This feature is greyed out unless the Permit Manual Close while LS not Reset feature is selected.



**Figure 57.**  
**Loop Scheme Parameters Screen.**

## Triple-Single Recloser Accessory

Controls built with this feature can only be used with the triple-single reclosers. It allows the control to trip a single phase independent from the other two phases when equipped with Triple-Single reclosers. This feature allows one phase to trip independently to lockout or single phase tripping with three phase lock out.

1. Choose the instruction for the applicable software version to access the Triple-Single screen.

- For software versions 3.11.8d and higher, click **TS** in the Operations Parameters screen to reach the Triple-Single screen. See Figure 58. This allows different settings for each profile.

- For software versions lower than 3.11.8d, click **Database > Triple/Single** to reach the Triple-Single screen. See Figure 58.

2. Select the recloser mode by clicking in a radio button.

The Ganged Three Phase mode operates as three-phase-to-trip, three-phase-to-lockout. The Single Phase with Three Phase Lockout mode operates as single-phase-to-trip, three-phase-to-lockout. The Single Phase with Single Phase Lockout operates as single-phase-to-trip, single-phase-to-lockout.

3. Click in the Dynamic Phase Tripping box to enable. A check mark will appear in the box.

The Dynamic Phase Tripping feature will only operate if the control is in the Single Phase with Single Phase Lockout mode. When enabled, this feature will cause the control to lock out all phases if one phase locks out after a fault where two or more phases had current above pickup.

## Advanced Control and Status Points

1. Click **Tools > Operator Panel > Advanced Control & Status** to reach the Advanced Control and Status Points screen (must be online). See Figure 59.

The Input Control, left panel, lists the features available.

The Output Status, right panel, lists the status of the features.

2. Double-click on a feature in the Input Control panel to change the status of that feature. The feature must be enabled in that feature’s screen before it can become active.

3. Click **OK**.

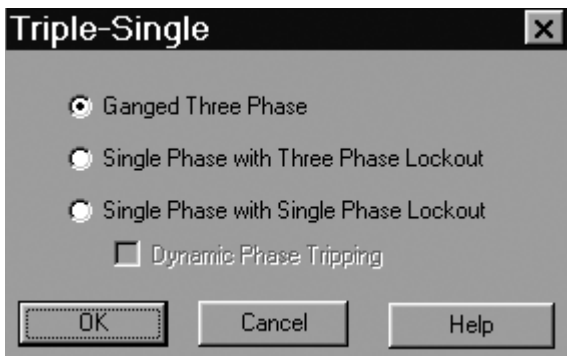


Figure 58. Triple-Single Screen.

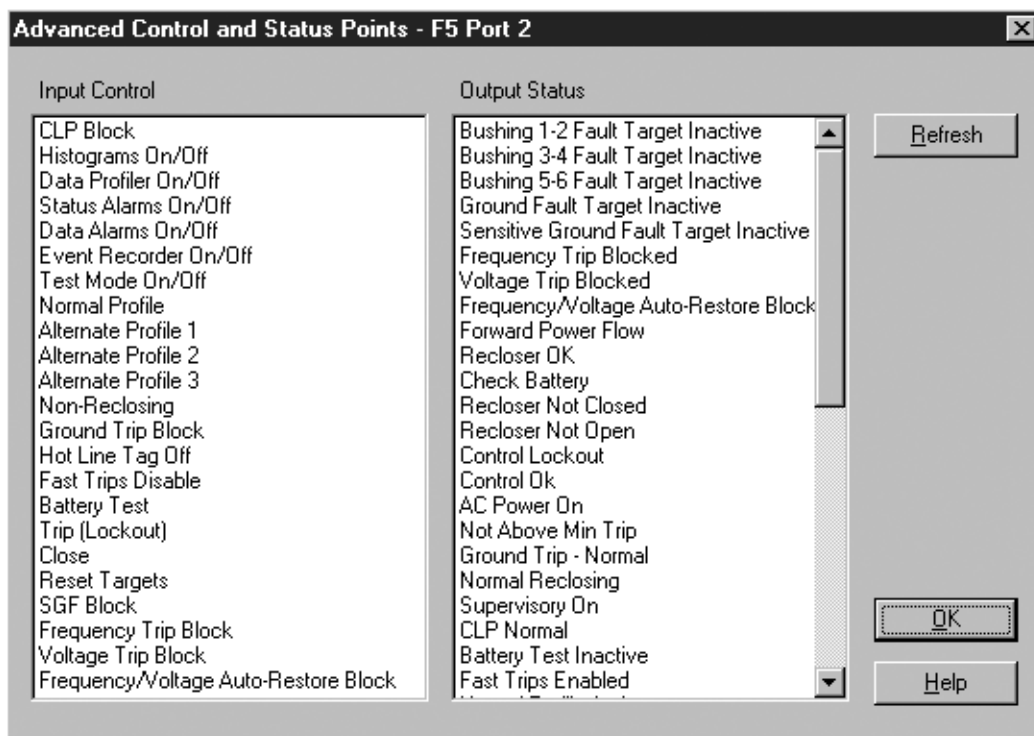
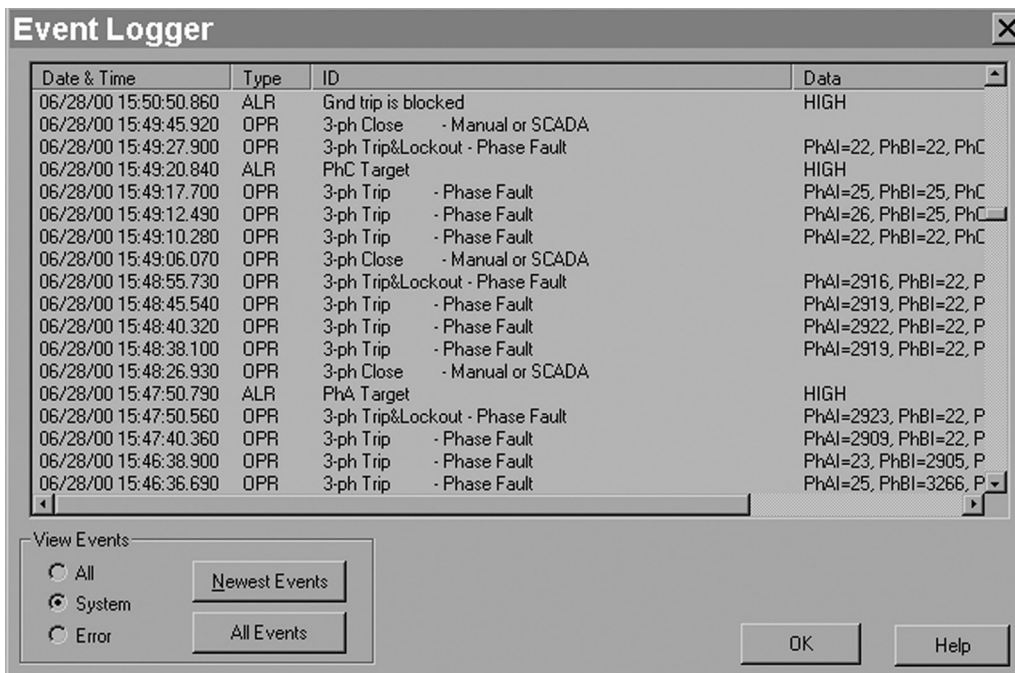


Figure 59. Advanced Control and Status Points Screen.

## ACQUIRING DATA

### Event Recorder

1. Click **Database > Event Recorder** to reach the Event Logger screen. See Figure 60.
2. Select which events to view.
  - A. Click the **System** radio button to view events generated by the programming.
  - B. Click the **Error** radio button to view events generated by the watch dog circuitry.
  - C. Click the **All** radio button to view events generated by both.
3. Click **OK**.



**Figure 60.**  
**Event Logger Screen.**

## Receive Database from Form 5 Control

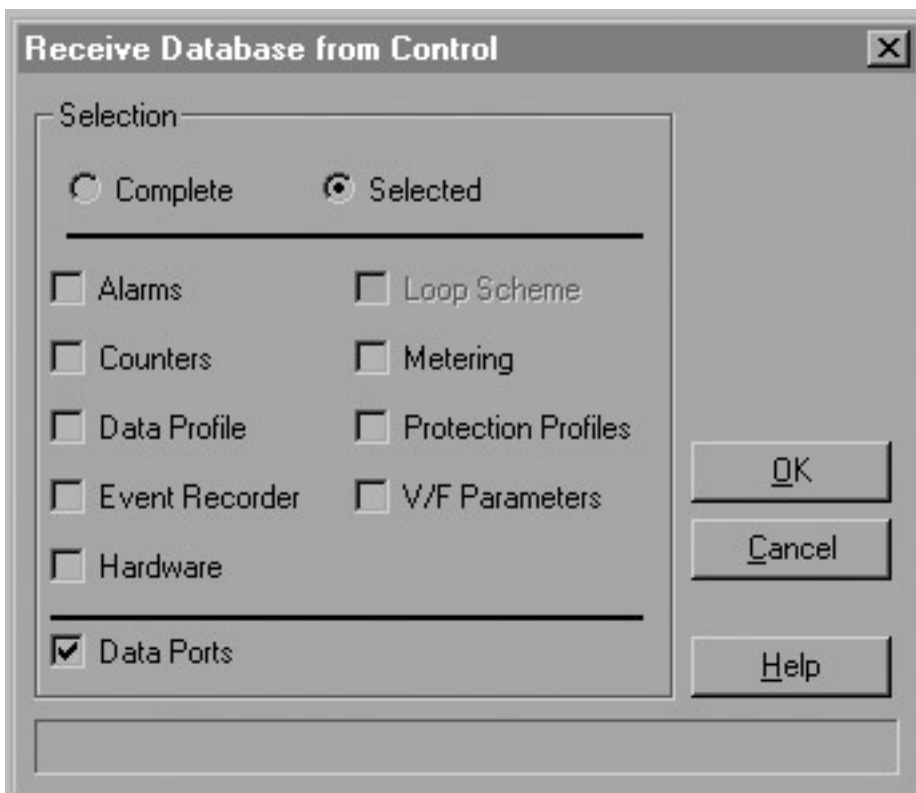
It is recommended that the Form 5 be in View mode when acquiring data from the control. This will prevent unintended changes to the database.

1. Click **Setup > Security Mode > View Only Mode**.
2. Click the **Receive** icon to reach the Receive Database from Control screen. See Figure 61.
3. Select to receive all or part of the database.
  - A. Click the Complete radio button to receive the complete database.
  - B. Click the Selected radio button when only portions of the database need to be retrieved.

**Note:** Software versions 3.11.8d and higher also support a Data Ports feature. By clicking in the Data Ports check box, the values entered in the F5 Data Port screen for 2179 and DNP 3.0 Protocols and the screens accessed by clicking **Advanced** in the F5 Data Port screen for the DNP 3.0 Protocol are received from controls with Firmware Database Version 15 or higher. Click the **ID** icon to determine the Firmware Database Version.

Viewing any parameters while online will initiate a selected receive of those parameters. For example, if the normal profile is selected while online, the Form 5 will send all profile information, but will display only the normal profile.

4. Click **OK**.
  5. Click the **Dis** icon.
  6. Physically disconnect the PC from the Form 5 port.
- The lower right corner of the PC screen now displays Offline and View Only. The software will not allow the database to be saved in the view mode.
7. Click **Setup > Security Mode > Change**.
  8. Click **File > Save As, OR File > Save, OR the Save** icon. Rename the file and save the live data files in a separate folder from the programming database.



**Figure 61.**  
**Receive Database from Control Screen.**

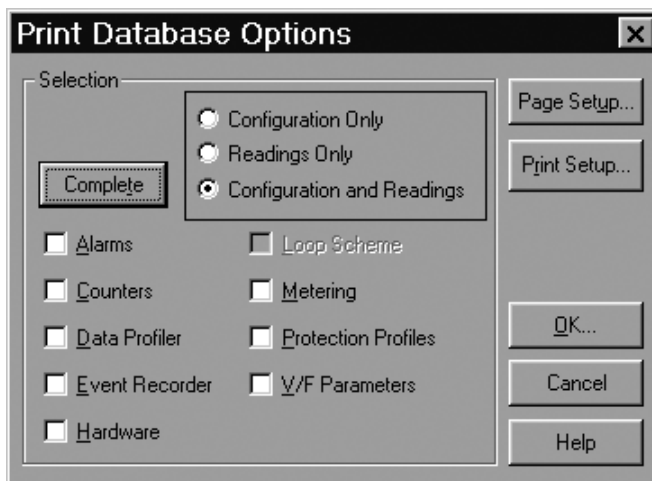
## Printing Data

A database download must be performed prior to printing live data.

1. Click the **Print** icon to reach the Print Database Options screen. See Figure 62.
2. Click a radio button to select Configuration Only, Readings Only, or Configuration and Readings.
3. Select to print all or part of the database.
  - A. Click **Complete** to print the complete database.
  - B. Click the radio buttons to select portions of the database for printing.

Selecting to print the event recorder will create large output.

4. Click **Page Setup** to print the page header.
5. Click **Print Setup** to set the printer options.
6. Click **OK** to reach the Print Preview screen.
7. Click **Print**. Clicking close will close the Print Preview screen and the Database Options screen.

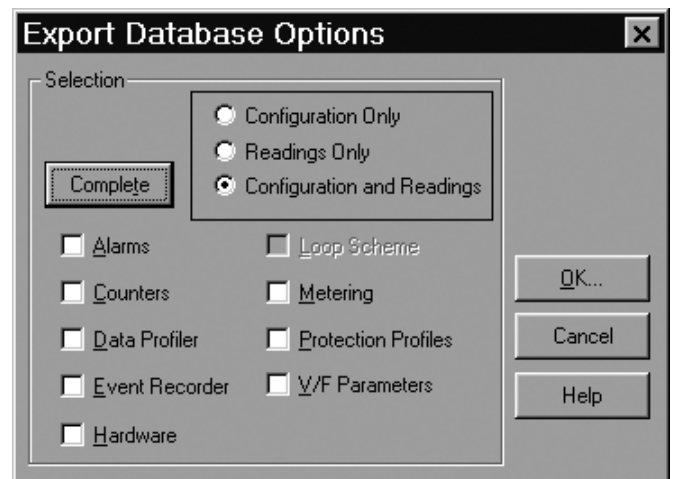


**Figure 62.**  
Print Database Options Screen.

## Exporting Data

Exporting data can facilitate analysis and is used when graphing data of different measurements. The data is exported into a comma separated variable (.csv) file. This type of file is used in spreadsheet programs. A database download must be performed prior to exporting live data.

1. Click **File > Export** to reach the Export Database Options screen. See Figure 63.
2. Click a radio button to select Configuration Only, Readings Only, or Configuration and Readings.
3. Select to export all or part of the database.
  - A. Click **Complete** to export the complete database.
  - B. Click the radio buttons to select portions of the database for exporting.
4. Click **OK**.



**Figure 63.**  
Export Database Options Screen.



# TESTING THE FORM 5 RECLOSER CONTROL

## Form 5 Default Test Procedure

**CAUTION:** Equipment misoperation. Do not connect this control to an energized recloser until all control settings have been properly programmed and verified. Refer to the programming information for this control. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury.

G110.3

**IMPORTANT:** The Form 5 recloser control can be taken out of service for testing and placed back into service without de-energizing its recloser and interrupting the system. However, during the time the control is out of service, the recloser is inoperative.

**IMPORTANT:** The Form 5 NOVA CP and the DC NOVA controls can not be tested with the standard Kyle MET Tester. A junction box accessory for the MET tester is available for testing the Form 5 NOVA CP or the DC NOVA controls.

Use this procedure to test the Form 5 control with factory default control settings. Follow all cautions and warnings in the applicable Form 5 Recloser Control service instructions.

- S280-79-1 Form 5 Installation and Operation Instructions
- S280-79-10 Form 5 Installation and Operation Instructions
- S280-79-12 Form 5 LS Installation and Operation Instructions
- S280-42-3 Form 5/Triple-Single Installation and Operation Instructions

Before installation on an active feeder, the Form 5 control's final control settings must be fully tested using an appropriate test procedure. The F5 Control Default Test Sheet follows these instructions. The F5 Control Default Test Sheet Optimal Values gives the optimal values for the test results.

The Form 5 Interface software TEST MODE feature may be used, while on-line, to shut off the Counters (Duty Cycle Accumulator, Operations Counter, and Target Counters) during control or recloser servicing and testing.

1. Click **Setup > Security Mode > Change Mode**.
2. Click **Tools > Operator Panel > Advanced Control Status**.
3. Double-click **Test Mode On/Off** in the Advanced Control and Status Points screen to turn the counters on or off. See Figure 59.

**Note:** Turn the counters on after testing is complete.

In performing these tests, change the Form 5 panel settings by first pressing the Change button, then the button of the function to be changed.

### Initial Settings

1. Apply 120 (240) Vac to the control phase B and neutral for standard controls.
2. Plug in battery.
3. Verify control is programmed for all default settings.
  - Phase Minimum Trip is set to 100 A.
  - Ground Minimum Trip is set to 50 A.

4. Disable Sequence Coordination in normal profile using personal computer (PC).
5. Activate COLD LOAD PICKUP BLOCKED (LED is on) on Form 5 display panel.
6. Activate GROUND TRIP BLOCK (LED is on) on Form 5 display panel.

### Test Battery Circuitry

**IMPORTANT:** The Battery Test procedure requires large current drain. Overuse of this procedure will drain the battery.

1. Press BACK button on display panel until battery test screen appears.
2. Record values for all settings.
3. Press CHANGE button on the display panel.
4. Press BATTERY TEST button on display panel.
5. Record values for all readings.

### Test Phase Minimum Trip Values

1. Verify Ground Trip Block LED is on.
2. Set KMET Phase Selector S5 to A.
3. Set KMET switch S4 to 300 milliamperere range.
4. Set KMET Variac TR1 to zero.
5. Set KMET switch S2 to test fault current position.
6. Press the TRIP button on the display panel.
7. Press the CLOSE button on the display panel.
8. Slowly raise TR1 until Above Minimum Trip LED is on, on display panel. Control should trip out quickly for load currents above 105 milliamperes. Record value.
9. Repeat steps 4 - 8 for phases B and C (move KMET S5 to B, then C).
10. Change Form 5 control from Normal Profile to Alternate Profile 1.
11. Verify Cold Load Pickup Blocked (LED is on) on the display panel.
12. Repeat steps 2 - 9 for Form 5 Alternate Profiles 1, 2, and 3. The control is programmed to trip out at 200 milliamperes on the Alternate 1, 2, and 3 Profiles.

**Note:** If Cold Load Pickup LED is off, the control will trip on a time delayed Time Current Curve with two trips to lock-out for 30 seconds after closing in the control, per the default Cold Load Pickup control settings.

**Note:** If Alternate Profiles 1, 2, and 3 have the sequence coordination function enabled while testing the Form 5 control minimum trip values, it may result in the control skipping past the fast TCC curves during the test for minimum trip. The control will then lock out on the delayed TCC curves.

**Note:** If the Form 5 control has Switch Mode rather than Profile 3, the control will indicate current Above Minimum Trip, but will not trip out.



## Test Ground Minimum Trip Values

1. Change the Form 5 control from an Alternate Profile to the Normal Profile (all three Profile LED's are off). Disable the Ground Trip Block (LED off).
2. Set KMET switch S4 to 100 milliampere range.
3. Set KMET Variac TR1 to zero.
4. Set KMET switch S2 to test fault position.
5. Verify the Form 5 phase minimum trip values are higher than the ground trip values.
6. Set KMET Phase Selector S5 to A.
7. Press the TRIP button on the display panel.
8. Press the CLOSE button on the display panel.
9. Slowly raise TR1 until Above Minimum Trip shows on Form 5 control. Control should trip out for load currents above 50 milliamperes. Record values.
10. Repeat steps 3 - 9 for the Form 5 Alternate Profiles 1, 2, and 3. The control is programmed to trip out at 100 milliamperes on the Alternate 1, 2, and 3 Profiles.

**Note:** If Cold Load Pickup is activated (LED off), the control will trip on a time delayed TCC with two trips to lockout for 30 seconds after closing in the control, per the default Cold Load Pickup control settings.

## Test Phase Timing

1. Set the Form 5 control to Normal profile (all Alternate Profile LED's off).
2. Activate GROUND TRIP BLOCK (LED on). Ground Trip is Blocked.
3. Set KMET Phase Selector S5 to phase A.
4. Set KMET switch S4 to 300 milliampere range.
5. Press the Form 5 trip switch once to lock out the Form 5 control.
6. Set KMET phase selector S3 to Control Response.
7. While holding the KMET Test Fault Current Switch S2 in the Calibrate position, adjust the fault current to 200 percent fault (100 X 2 or 200 milliamperes).

**Note:** On newer controls, applying fault current while the control is locked out will set the Recloser Malfunction LED. This will not affect testing. To clear, press the Reset Targets button after all tests are complete.

8. Press the TRIP button on the display panel.
9. Press the CLOSE button on the display panel.
10. Set KMET Fault Switch S2 to test fault current position. Record timing readings from the KMET time clock for all trips on the A 2X \_\_\_ test sheet location.
11. Set KMET Test Set switch S4 to the 1A position.
12. Set KMET Phase Selector S5 to phase B.
13. Calibrate KMET fault current to 500 percent (100 X 5 or 500 milliamperes) using the KMET 1A range.
14. Press the TRIP button on the display panel.
15. Press the CLOSE button on the display panel.

16. Set KMET test set Fault Current Switch S2 to test fault current position. Record timings from the KMET test set for all trips on the B 5X \_\_\_ locations on the test sheet.
17. Set KMET Phase Selector S5 to phase C.
18. Calibrate KMET Phase Selector S5 to 1000% of fault (1000 milliamperes).
19. Press the TRIP button on the display panel.
20. Press the CLOSE button on the display panel.
21. Set KMET test set Fault Current Switch S2 to test fault current position. Record timings from the KMET test set for all trips on the C 10X \_\_\_ locations on the test sheet.
22. Repeat steps 2 - 21 for Alternate Profiles 1, 2, and 3. Note that the Phase minimum trip for the Alternate Profiles is 200 amps. The 200% fault will then be 400 milliamperes or .4 amp, the 500% fault will then be 1000 milliamperes or 1 amp, and the 1000% fault will then be 2000 milliamperes or 2 amps.

## Test Ground Timing

1. Verify control is programmed for all default settings.
    - Phase Minimum Trip is set to 100 A.
    - Ground Minimum Trip is set to 50 A.
  2. Disable GROUND TRIP BLOCK (LED off). Ground Trip is Active.
  3. Activate the Normal Profile (Alternate Profile LED's off).
- Note:** When testing the ground trip timing circuit, the KMET test set applies a phase to ground fault to the Form 5 control. If the applied fault current exceeds the phase minimum trip value, the control may time out on the phase time current curve, which may be shorter than the proper ground time current curve. For this reason, the Form 5 phase minimum trip value should be increased to a higher value while testing Form 5 ground trip time current curves.
4. Increase the Form 5 phase minimum trip value to 1600 amperes.
  5. Set KMET Test Set switch S4 to the 300 milliampere position.
  6. While holding the Fault Current Switch S2 in the Calibrate position, adjust the fault current to 200 percent fault (50 X 5 or 250 milliamperes).
  7. Press the TRIP button on the display panel.
  8. Press the CLOSE button on the display panel.
  9. Set KMET test set Fault Current switch S2 in the test fault current position. Record timings from the KMET test set for all trips on the G 2X \_\_\_ locations on the test sheet.
  10. Calibrate KMET fault current to 500 percent, (50 X 5 or 250 milliamperes).
  11. Press the TRIP button on the display panel.
  12. Press the CLOSE button on the display panel.

13. Set KMET test set Fault Current switch S2 in the test fault current position. Record timings from the KMET test set for all trips on the G 5X \_\_\_\_ locations on the test sheet.
14. Set KMET Test Set switch S4 to the 1A position.
15. Calibrate KMET fault current to 1000 percent, (50 X 10 or 500 milliamperes).
16. Press the TRIP button on the display panel.
17. Press the CLOSE button on the display panel.
18. Set KMET test set Fault Current switch S2 in the test fault current position. Record timings from the KMET test set for all trips on the G 10X \_\_\_\_ locations on the test sheet.
19. Repeat steps 3 - 18 for Alternate Profiles 1, 2, and 3. Note that the ground minimum trip for the Alternate Profiles is 100 amps. The 200% fault will then be 200 milliamperes, the 500% fault will then be 500 milliamperes, and the 1000% fault will then be 1000 milliamperes or 1 amps.
20. Return the Normal Profile Phase Minimum Trip Value to the pretest value, 100 amps.

### **Test Non-Reclose**

1. Activate Non-Reclosing (LED on).
2. Activate GROUND TRIP BLOCK (LED on).
3. Set KMET Phase Selector switch S5 to phase A.
4. Set Form 5 control to Normal Profile (all Alternate Profile LED's off).
5. Adjust fault current to 200 percent or 200 milliamperes.
6. Press the TRIP button on the display panel.
7. Press the CLOSE button on the display panel.
8. Set KMET test set Fault Current Switch S2 to fault position.
9. Control should trip once, then indicate open and lockout. Record time value.
10. Disable NON-RECLOSE (LED off).
11. Repeat steps 5 - 8, to lockout. Record time value.

### **Test Cold Load Pickup Blocked**

1. Disable COLD LOAD PICKUP BLOCKED (LED off).
2. CLOSE the Form 5 control.
3. Adjust fault current to 200 percent or 200 milliamperes.
4. Within 30 seconds of Step 3, set KMET test set Fault Current Switch S2 to fault position.
5. Control should trip twice on slow TCC curve, then indicate open and lockout. Record timing value.
6. Activate COLD LOAD PICKUP (LED on).
7. Repeat steps 2 - 4. Record value.

### **Test Fast Trips Disabled**

1. Activate FAST TRIPS DISABLED (LED on).
2. CLOSE the Form 5 control.
3. Adjust fault current to 200 percent or 200 milliamperes.
4. Set KMET test set Fault Current Switch S2 to fault position.
5. Control should trip two times to lockout, on all slow TCC's, then indicate open and lockout. Record value.
6. Deactivate Fast Trips Disabled (LED off).
7. Repeat steps 2 -4. Control should trip on two fast, two slow TCC's. Record values.

### **Test Hot Line Tag**

1. CLOSE the Form 5 control.
2. Activate HOT LINE TAG (LED on).
3. Adjust fault current to 200 percent or 200 milliamperes.
4. Set KMET test set Fault Current Switch S2 to fault position.
5. Control should trip out once on the 101 TCC curve, then indicate open and lockout. Record value.
6. Verify that it is not possible to close the Form 5 control.
7. Deactivate HOT LINE TAG (LED off).
8. Verify that you can CLOSE the Form 5 control.

### **Test Reclose**

1. Set KMET selector switch S3 to Control Reclose Reset.
2. Reset the KMET Time Clock if required.
3. Adjust fault current to 200 percent or 200 milliamperes.
4. Set KMET test set Fault Current Switch S2 to fault position.
5. After trip, turn fault switch S2 off.
6. Record reclose time.
7. Repeat steps 2 - 6 until control locks out.

## Test Close Circuit Disable Fuse

Applicable to swing-panel units only, S/N below 3000.

1. Set KMET Fault Switch S2 to off.
2. CLOSE the Form 5 control.
3. Remove Close Circuit Disable fuse.
4. Adjust fault current to 200 percent or 200 milliamperes.
5. Set KMET test set Fault Current Switch S2 to fault position. The control will trip once.
6. Verify that it is not possible to close the Form 5 control.
7. Replace Close Circuit Disable fuse.
8. Verify it is now possible to CLOSE the Form 5 control.

## Verify Instantaneous Metering

1. Enable GROUND TRIP BLOCK (LED on).
2. Set KMET switch S2 to off.
3. Set KMET Phase Selector S5 to A.
4. Set KMET Variac to zero.
5. Set KMET switch S4 to the 100 milliamperere range.
6. CLOSE Form 5 control.
7. Set KMET switch S2 to on.
8. Set KMET Variac to read 80 millamperes.
9. Scroll the Form 5 LCD screen to screen 1.
10. Verify Instantaneous metering on Phase A and Ground reads 80 millamperes.
11. Set KMET Phase Selector S5 to B.
12. Verify Instantaneous metering on Phase B and Ground reads 80 millamperes.
13. Set KMET Phase Selector S5 to C.
14. Verify Instantaneous metering on Phase C and Ground reads 80 millamperes.

## Battery Test

The Form 5 control will monitor and report the state of the backup battery automatically every 12 hours. Monitored data includes battery terminal voltage and battery current (charging and/or load). The Unloaded Battery Voltage is the battery voltage after the test. With the control connected to ac power, this is a charge voltage; with the ac disconnected, this is a discharge voltage. The Unloaded Battery Current is the battery current measured in milliamperes. Battery current measurements are blanked out for the duration of the test.

The test disables the battery charger and connects a 5  $\Omega$  load. After 0.5 seconds, the test checks and records the battery voltage. If the voltage has dropped to less than 22 V, the battery is open or missing, or the cables are broken.

The test continues for 5 seconds. At the end of this time, the battery voltage is again checked. If the voltage at this point has dropped more than 2 V from the previous reading, the battery has failed the battery test. The final voltage is recorded as the Loaded Battery Voltage, the 5  $\Omega$  load is removed, and the charger is turned back on.

**IMPORTANT:** The Battery Test procedure requires large current drain. Overuse of this procedure will drain the battery.

**IMPORTANT:** Selecting Battery Alarm to be active during a battery test may cause a false battery trouble alarm to be set. Set an Alarm Delay of at least 10 seconds in the Battery Trouble alarm to prevent this condition.

1. Click **Tools > Battery Test** to perform an unscheduled battery test. See Figure 63.
2. Click **Test**.
3. Click **OK**.

The battery test can also be performed via the front panel or via supervisory control.

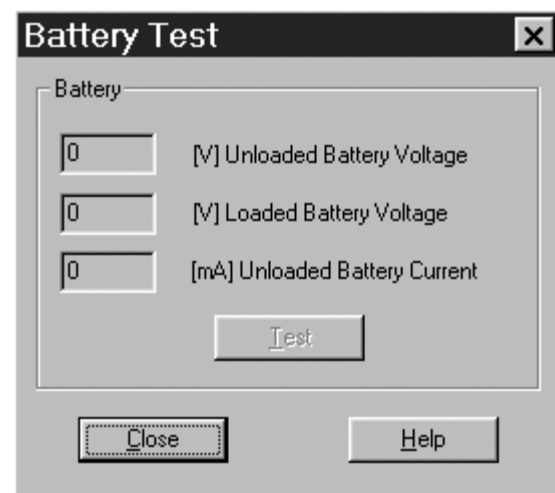
1. Scroll to the Battery Monitor screen.
2. Record the NORMAL VOLTS and NORMAL CURRENT readings from the screen.

**NOTE:** Normal voltage should be between 25 and 31 Vdc, with higher readings at colder temperatures. Under normal conditions, with ac connected and the battery trickle-charging, the current should read less than 20 mA. With ac connected and in bulk-charging mode, current will range from 12 to 600 mA. With ac disconnected and the battery supplying the load, current will read from -180 mA to -600 mA, depending on accessories connected.

3. Press the CHANGE/LAMP TEST key.
4. Press the BATTERY TEST key.

**NOTE:** Ac power can be either connected or disconnected for Steps 3 and 4.

5. Record the TEST VOLTS reading from the LCD and the status of the CHECK BATTERY LED. Service the battery if the CHECK BATTERY LED is illuminated. Also, the Advanced Control and Status Points screen lists the status of the the battery. See the **Advanced Control and Status Points** section of this manual. (If the battery test is initiated from the Advanced Control and Status Points screen, wait 10 seconds, then click Refresh to view battery status.)



**Figure 63.**  
**Battery Test Screen.**

## F5 Control Default Test Optimal Values

2. Battery Circuitry	Volts	<i>28.0</i>		<i>28.0</i>		
	MA	<i>35</i>		<i>550</i>		
	Volts	<i>27.0</i>		<i>24.2</i>		
3.  Phase Minimum Trip	Normal Profile	Phase A Amps	Phase B Amps	Phase C Amps		
		<i>100.5</i>	<i>100.3</i>	<i>100.7</i>		
	Profile #1	Phase A Amps	Phase B Amps	Phase C Amps		
		<i>200.9</i>	<i>200.2</i>	<i>200.5</i>		
	Profile #2	Phase A Amps	Phase B Amps	Phase C Amps		
		<i>200.9</i>	<i>200.2</i>	<i>200.5</i>		
	Profile #3	Phase A Amps	Phase B Amps	Phase C Amps		
	<i>200.9</i>	<i>200.2</i>	<i>200.5</i>			
4.  Ground Minimum Trip	Normal	Ground Amps	<i>50.1</i>			
	Profile #1	Ground Amps	<i>100.3</i>			
	Profile #2	Ground Amps	<i>100.3</i>			
	Profile #3	Ground Amps	<i>100.3</i>			
5.  Phase Timing	Trip to Lockout Sequence		1st	2nd	3rd	4th
	Normal	Phase A 2X	<i>0.161</i>	<i>0.164</i>	<i>1.416</i>	<i>1.421</i>
		Phase B 5X	<i>0.018</i>	<i>0.017</i>	<i>0.278</i>	<i>0.280</i>
		Phase C 10X	<i>0.016</i>	<i>0.014</i>	<i>0.088</i>	<i>0.086</i>
	Profile #1	Phase A 2X	<i>0.153</i>	<i>0.154</i>	<i>1.443</i>	<i>1.441</i>
		Phase B 5X	<i>0.015</i>	<i>0.014</i>	<i>0.273</i>	<i>0.275</i>
		Phase C 10X	<i>0.011</i>	<i>0.009</i>	<i>0.087</i>	<i>0.087</i>
	Profile #2	Phase A 2X	<i>0.153</i>	<i>0.154</i>	<i>1.443</i>	<i>1.441</i>
		Phase B 5X	<i>0.015</i>	<i>0.014</i>	<i>0.273</i>	<i>0.275</i>
		Phase C 10X	<i>0.011</i>	<i>0.009</i>	<i>0.087</i>	<i>0.087</i>
	Profile #3	Phase A 2X	<i>0.153</i>	<i>0.154</i>	<i>1.443</i>	<i>1.441</i>
		Phase B 5X	<i>0.015</i>	<i>0.014</i>	<i>0.273</i>	<i>0.275</i>
		Phase C 10X	<i>0.011</i>	<i>0.009</i>	<i>0.087</i>	<i>0.087</i>



### F5 Control Default Test Optimal Values

6. Ground Timing	Trip Sequence		1st	2nd	3rd	4th	
	Normal	Ground 2X	0.214	0.212	3.894	3.896	
		Ground 5X	0.012	0.016	1.097	1.099	
		Ground 10X	0.008	0.014	0.652	0.653	
	Profile #1	Ground 2X	0.214	0.212	3.894	3.896	
		Ground 5X	0.012	0.016	0.952*	0.954*	
		Ground 10X	0.008	0.014	0.280*	0.276*	
	Profile #2	Ground 2X	0.214	0.212	3.984	3.896	
		Ground 5X	0.012	0.016	0.952*	0.954*	
		Ground 10X	0.008	0.014	0.280*	0.276*	
	Profile #3	Ground 2X	0.214	0.212	3.894	3.896	
		Ground 5X	0.012	0.016	0.952*	0.954*	
		Ground 10X	0.008	0.014	0.280*	0.276*	
	7. Non-Reclose	Enabled	Phase 2X	0.153	lockout	lockout	lockout
		Disabled	Phase 2X	0.152	0.153	1.420	1.433
8. Cold Load PickUp Blocked	Block Off	Phase 2X	1.420	1.433	lockout	lockout	
	Block On	Phase 2X	0.158	0.154	1.420	1.433	
9. Fast Trips	Enabled	Phase 2X	1.419	1.422	lockout	lockout	
	Disabled	Phase 2X	0.155	0.156	1.418	1.424	
10. Hot Line Tag	No Reclose	Phase 2X	0.014	lockout	lockout	lockout	
	Enabled	Phase 2X	0.155	0.156	1.148	1.424	
11. Test Reclose	Reclose Sequence		1st	2nd	3rd	4th	
	Reclose Times		1.975	1.974	4.968	lockout	
12. Close Circuit Disable Fuse (N/A Fixed Panel)	Fuse Out	Can't Close?	Yes	No			
				XXX			
	Fuse In	Can Close?	Yes	No			
			XXX				
13. Instantaneous Metering	Phase A	Phase B		Phase C			
	Amps 80	Amps 81		Amps 80			

\*Refer to the Test Ground Timing section of this manual.

### F5 Control Default Test Sheet

**Date:**

**Serial No:**

2. Battery Circuitry	Volts					
	MA					
	Volts					
3.  Phase Minimum Trip	Normal Profile	Phase A Amps	Phase B Amps	Phase C Amps		
	Profile #1	Phase A Amps	Phase B Amps	Phase C Amps		
	Profile #2	Phase A Amps	Phase B Amps	Phase C Amps		
	Profile #3	Phase A Amps	Phase B Amps	Phase C Amps		
4.  Ground Minimum Trip	Normal	Ground Amps				
	Profile #1	Ground Amps				
	Profile #2	Ground Amps				
	Profile #3	Ground Amps				
5.  Phase Timing	Trip to Lockout Sequence		1st	2nd	3rd	4th
	Normal	Phase A 2X				
		Phase B 5X				
		Phase C 10X				
	Profile #1	Phase A 2X				
		Phase B 5X				
		Phase C 10X				
	Profile #2	Phase A 2X				
		Phase B 5X				
		Phase C 10X				
	Profile #3	Phase A 2X				
		Phase B 5X				
		Phase C 10X				



### F5 Control Default Test Sheet

6. Ground Timing	Trip Sequence		1st	2nd	3rd	4th
	Normal	Ground 2X				
		Ground 5X				
		Ground 10X				
	Profile #1	Ground 2X				
		Ground 5X				
		Ground 10X				
	Profile #2	Ground 2X				
		Ground 5X				
		Ground 10X				
	Profile #3	Ground 2X				
		Ground 5X				
		Ground 10X				
7. Non-Reclose	Enabled	Phase 2X		lockout	lockout	lockout
	Disabled	Phase 2X				
8. Cold Load PickUp Blocked	Block Off	Phase 2X			lockout	lockout
	Block On	Phase 2X				
9. Fast Trips	Enabled	Phase 2X			lockout	lockout
	Disabled	Phase 2X				
10. Hot Line Tag	No Reclose	Phase 2X				
	Enabled	Phase 2X				
11. Test Reclose	Reclose Sequence		1st	2nd	3rd	4th
	Reclose Times					
12. Close Circuit Disable Fuse	Fuse Out	Can't Close?	Yes	No		
	Fuse In	Can Close?	Yes	No		
13. Instantaneous Metering	Phase A	Phase B		Phase C		
	Amps	Amps		Amps		

