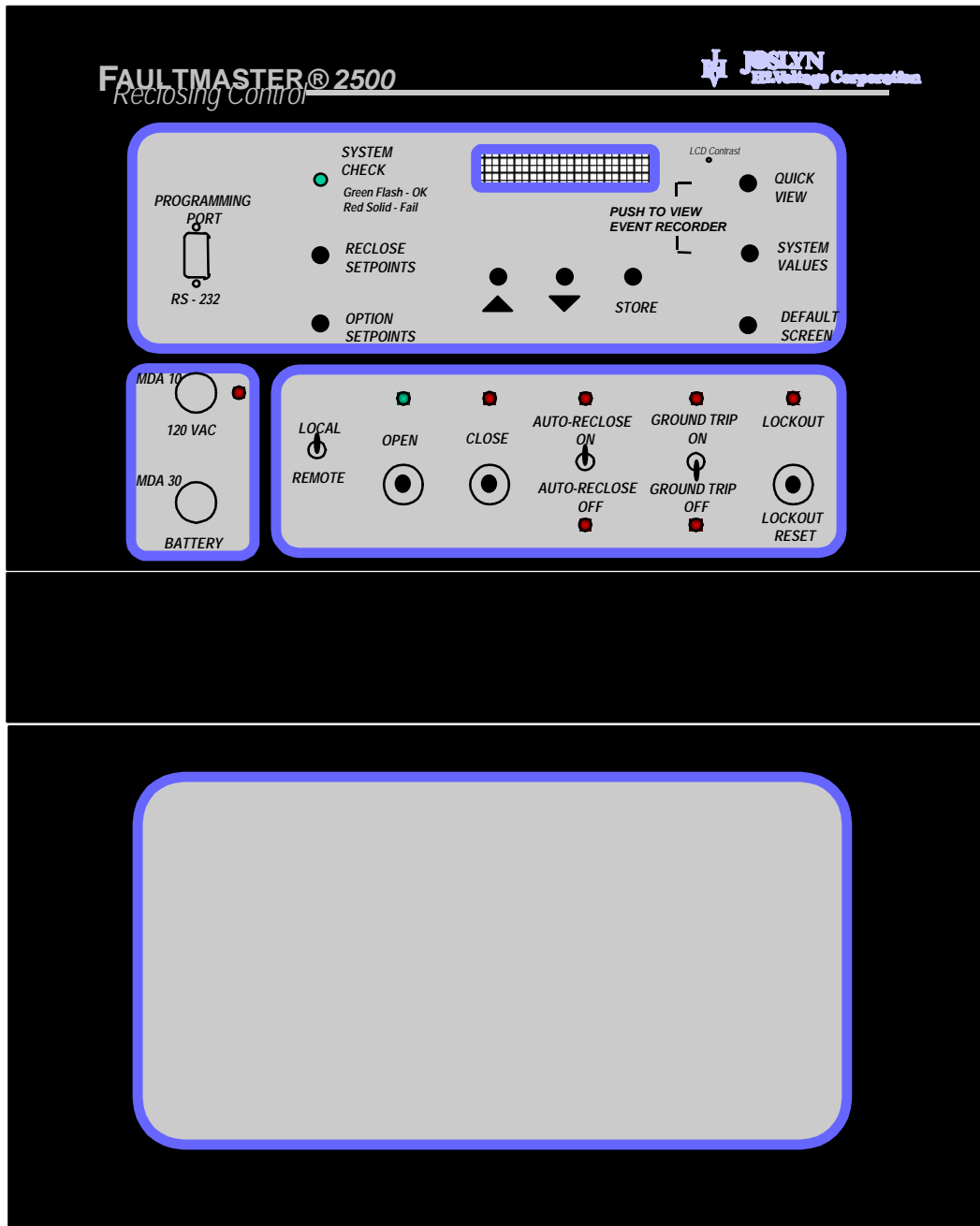


Faultmaster[®] 2500



Instruction Manual

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1.0 Unpacking and Acceptance

Each Faultmaster® 2500 is completely tested and calibrated at the factory and in good condition when accepted by the carrier for shipment.

Upon receipt, inspect the shipping container for signs of damage. Unpack the control and inspect for damage that may have occurred during shipment. If any damage is discovered, file a claim with the carrier immediately.

2.0 Storage

The control should be stored in a clean, dry area. If storage is in a humid atmosphere the control circuitry should be energized with 120Vac. The 120Vac terminal block is located on the I/O board in the bottom of the control cabinet behind the swing out panel (Figure 3).

3.0 Control Battery Storage

The control contains three 12Vdc sealed lead acid batteries (Figure 2). These batteries are capable of being stored for at least six months without losing their ability to be recharged. When the control is stored, the battery switch on the I/O board must be placed in the OFF position (Figure 3).

The batteries can be kept charged for extended storage periods by applying 120Vac to terminal block which is located on the I/O board in the bottom of the control cabinet behind the swing out panel.

NOTE: Refer to interconnection diagram for controls purchased to operate at 220 VAC.

4.0 Description of Operation

The microprocessor-based Faultmaster® 2500 control provides overcurrent protection with multishot reclosing in conjunction with the Joslyn TriMod Vacuum Recloser. Line current flowing through the TriMod is sensed by three externally mounted current transformers. When the phase or ground current exceeds the programmed minimum pickup level, the control initiates tripping and reclosing operations as selected by the user.

If the fault is temporary, resulting in a successful reclosure, the control will reset to the start of its operating sequence after a preset time delay

expires. If the fault is permanent, the control will go to lockout after completing its programmed tripping and reclosing operations. Once in lockout, the control must be reset either locally or remotely.

5.0 Description of Control

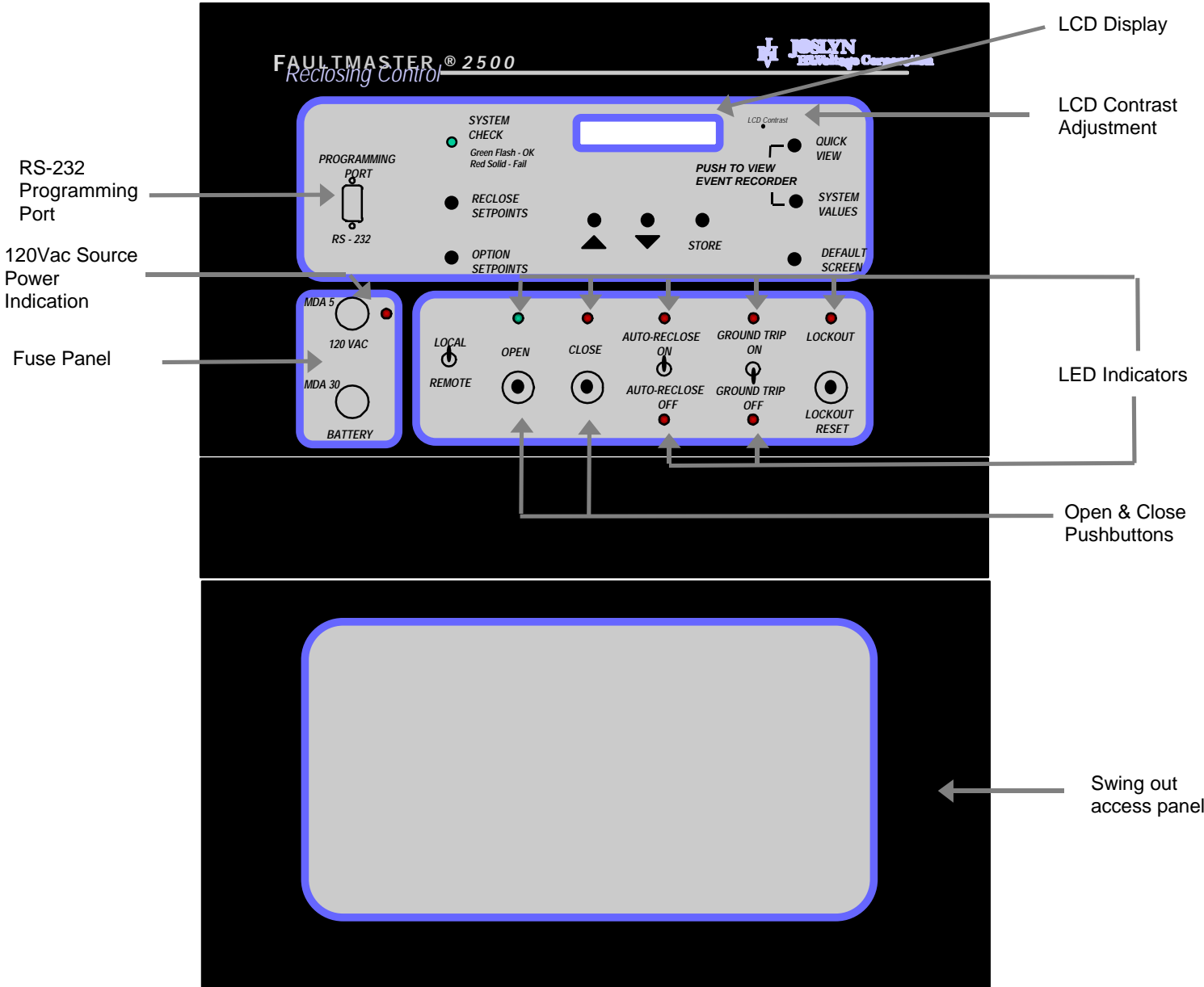


Figure 1: Front Panel

5.1 LCD Display

The Backlit Display is used for determining status of the control and programming and retrieving data. The display is always on when 120Vac or battery power is available. The contrast of the LCD display can be adjusted by turning the *LCD Contrast* adjustment screw recessed on the front panel (Figure1).

5.2 System Check LED

The system check LED will flash green if the system is normal. If a problem occurs, the LED will turn solid red.

5.3 Programming Port

The RS-232 programming port is used for connecting to a computer to upload or download settings and to retrieve system value information such as the event recorder. This port has priority over the port that is located on the I/O board which is behind the swing out access panel.



5.4 RECLOSE SETPOINTS Pushbutton

This pushbutton is used to access the standard reclosing settings. Pushing the button allows scrolling through the settings. To change a setting, use the up or down pushbuttons to select a new value and then push the store pushbutton. If the setpoint access switch is in the enabled position, the message "NEW SETPOINT STORED" will appear on the display. If the setpoint access switch is in the disabled position, the message "ILLEGAL ACCESS" will appear on the display and the change will not be stored. (see section 8.0 for a list of these settings)

5.5 OPTION SETPOINTS Pushbutton

This pushbutton is used to access the option settings. Pushing the button allows scrolling through the settings. To change a setting, use the up or down pushbuttons to select a new value and then push the store pushbutton. If the setpoint access switch is in the enabled position, the message "NEW SETPOINT STORED" will appear on the display. If the setpoint access switch is in the disabled position, the message "ILLEGAL ACCESS" will appear on the display and the change will not be stored (see section 8.0 for a list of these settings).

5.6 QUICK VIEW Pushbutton

This pushbutton is used to access the Quick View menu. Any System Value parameter can be stored and then viewed in this menu. To store a System Value in this menu, first view the desired System Value and then press the Store button. Any System Value stored in this menu can be removed by pressing the  and  buttons simultaneously.

5.7 SYSTEMS VALUES Pushbutton

This pushbutton is used to access System Values.



5.8 DEFAULT SCREEN Pushbutton

This pushbutton is used to return to the Default Screen which displays the instantaneous phase currents and the operations counter.

When an overcurrent occurs and the recloser trips, the default screen will change to either “INSTANT CURRENT TRIP” if the trip was due to an instantaneous setting, or “TIMED CURRENT TRIP” if the trip was due to a timed overcurrent curve setting. If the control goes to lockout, these screens will remain on the display until the control is reset.

The display will read “SEQ COORD ACTIVE” if the reclose sequence started due to the sequence coordination feature.

5.9 PUSH TO VIEW EVENT RECORDER Pushbuttons

The Event Recorder can be accessed by pressing and holding the QUICK VIEW and SYSTEM VALUES pushbuttons at the same time, as indicated on the front panel of the control. Once in the Event Recorder, the most recent 100 events can be viewed by using the  or  pushbuttons.

5.10 LED Indicators

The LED indicators are used for determining position status of the TriMod switch, lockout status of the control, auto-reclosing status, ground-trip status and control power status.

5.11 LOCAL/REMOTE Switch

When in the LOCAL position, all remote commands are disabled. When in the REMOTE position all local commands are disabled, except the OPEN and CLOSE pushbuttons.

5.12 OPEN and CLOSE Command Pushbuttons

The OPEN pushbutton is used to issue a trip command to the TriMod recloser. The CLOSE pushbutton is used to issue a close command to the TriMod recloser.

5.13 LOCKOUT RESET Pushbutton

The LOCKOUT RESET pushbutton resets the control to the start of the control operating sequence.

5.14 AUTO-RECLOSE ON/OFF Switch

When in the ON position, the control will follow the preprogrammed tripping and reclosing sequence. The corresponding red LED will be illuminated, verifying that auto-reclosing is ON. When in the OFF position, the control will be set for one trip operation to lockout and the corresponding LED will be illuminated.

5.15 GROUND TRIP ON/OFF Switch

When in the ON position, ground protection will be active and the corresponding red LED will be illuminated. When in the OFF position, all ground tripping will be blocked and the corresponding red LED will be illuminated.

5.16 Setpoint Access Switch

The Setpoint Access switch must be in the enable position for any setpoint programming to take place. To prevent unauthorized setpoint access, place the switch in the disable position thus preventing programming of new setpoints. Setpoints can always be viewed regardless of the Setpoint Access switch position. If attempting to store a new setpoint value and the following message appears on the display, "ILLEGAL ACCESS," the setpoint access switch is in the disable position. This switch is located on the input/output board (Figure 3).

5.17 Battery ON/OFF Switch

The battery ON/OFF switch is used to connect or disconnect the batteries from the control circuitry. When the control is placed in service this switch must be in the ON position. When not in service, and programming and testing of the control is desired, the switch should be in the ON position and 120Vac should be connected to the control. Be sure that the battery ON/OFF switch is in the OFF position before shipping or storing the control. This switch is located on the input/output board.

5.18 Control Batteries

The control contains three 12Vdc, 7A-Hr. sealed lead acid batteries. The life of the batteries is approximately five years. The batteries are capable of being stored for at least six months without losing their ability to be recharged. When the control is stored, the battery switch must be placed in the OFF position.

The batteries can be kept charged for extended storage periods by applying 120Vac to terminal block which is located on the I/O board in the bottom of the control cabinet behind the swing out panel.

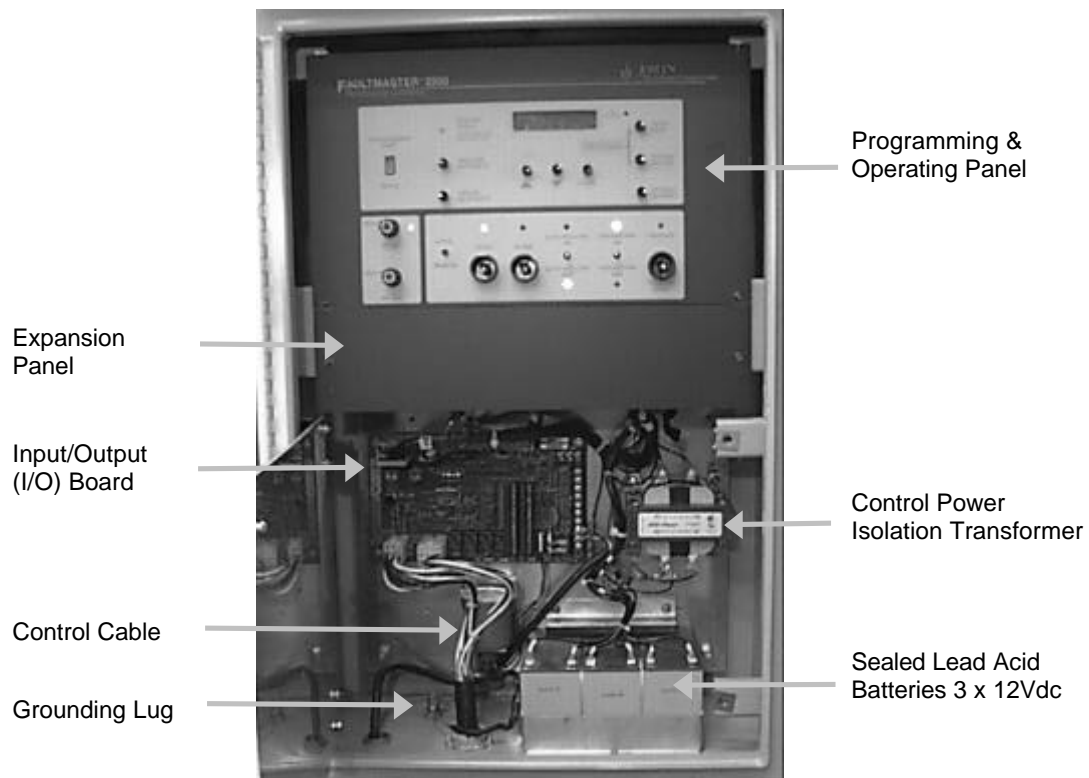
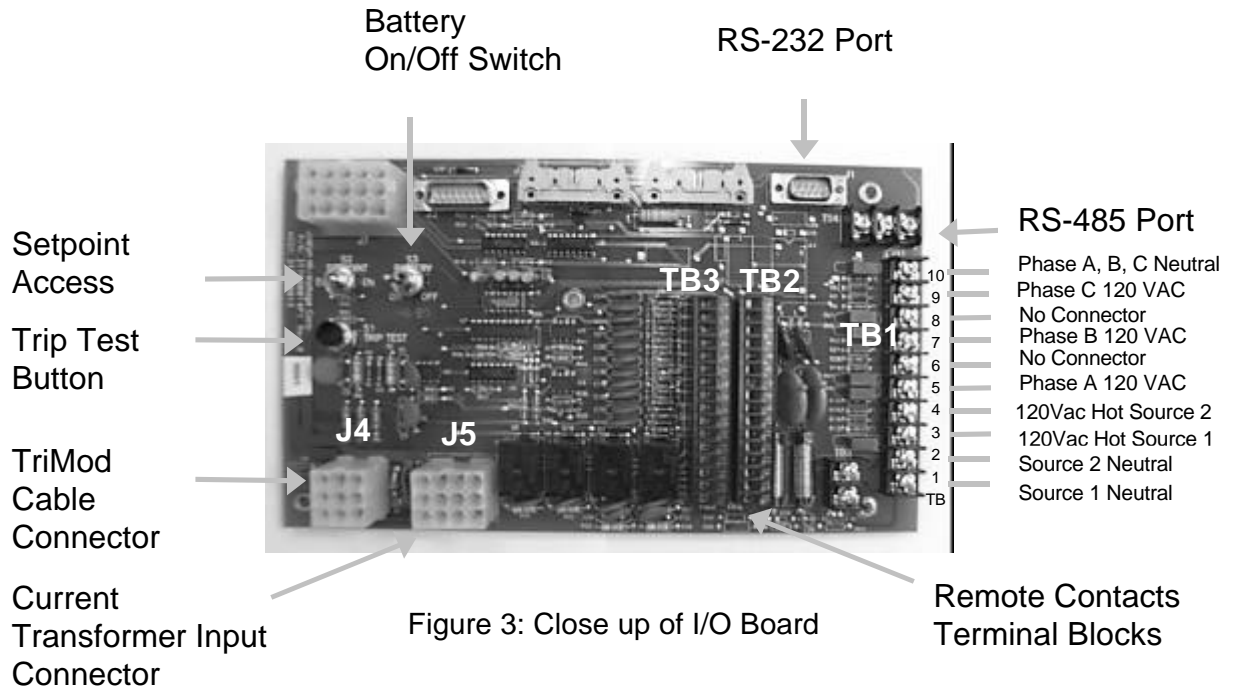


Figure 2: View of Control with Swing Out Panel Open

5.19 TRIP TEST Pushbutton

Caution: Activation of the Trip Test pushbutton will cause the control to open the TriMod Recloser.

The trip test pushbutton, located on the input/output board (Figure 3) will inject approximately 1.7A into the control simulating a 1000A three-phase fault. The control will then follow its preprogrammed tripping and reclosing sequence. The pushbutton must be held in to allow the control to go through its full preprogrammed sequence.



5.20 Voltage Input Terminal Block

Terminal block TB1 contains the inputs for up to two control power sources and three sensing sources. The control will automatically transfer between the two control power sources if one of the sources is lost. All inputs are rated at 120Vac. Refer to the interconnection diagram supplied with each control for specific input locations.

Controls ordered with 220 VAC control power will have a dedicated terminal block for this connection. Refer to the supplied interconnection diagram for the specific designation and location.

5.21 TriMod Cable Connectors

There are three connectors labeled J4, J5 and J6. Connectors J4, J5 and J6 correspond to P4, P5 and P6 of the control cable. Connector J4 contains all of the wiring for the Trimod close solenoids and one side of the open solenoids. Connector J5 contains all the wiring for the three current transformers mounted on the TriMod recloser. Connector J6 contains the mechanical limit switch (Form C contact) from the Trimod and the other side of the open solenoids.

NOTE: FM2500 controls that interface with a JVR recloser will only have connectors P4 and P5.

5.22 Communication Ports

There is a RS-232 and RS-485 port located on the remote input/output board. Either port can be used for communication; however, both cannot be used at the same time.

6.0 Control Power

6.1 120Vac Source

One external 120Vac source is required to provide power to the control. The control will not function properly without this power source. It is used to charge the tripping and closing capacitors, power the control circuitry and charge the batteries.

220Vac Source

Controls can be ordered to power from a single 220 Vac source.

6.2 Power Source No. 1 (Standard)

The standard control has one power source labeled Source #1. A second power source may be ordered as an option. Only one source is required for proper operation.

6.3 Power Source No. 1 and No. 2

The control may be ordered with inputs for two power sources labeled Source #1 and Source #2 (Figure 4). The control will use Source #1 when available and transfer to Source #2 if Source #1 is lost. If both source inputs are lost, the control will be powered by the batteries for a minimum of 24 hours. Opening and closing of the recloser is available during this period locally or remotely and protection is still in place. The control power inputs are located on the terminal strip TB1 on the I/O board.

At least one 120Vac source must be supplied from the source side of the recloser.

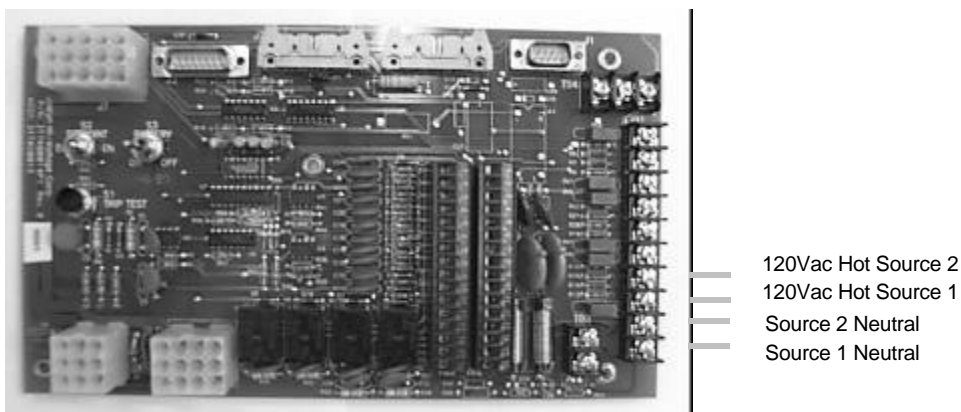


Figure 4: I/O Board with Source Connections Shown

7.0 Programming Setpoints

There are two programming menus: RECLOSE SETPOINTS and OPTION SETPOINTS. To enter either menu, push the corresponding setpoint pushbutton located on the front panel (Figure 1). When the pushbutton is pushed, the first line of that particular setpoint menu will be displayed. Continue to push the pushbutton to scroll through the settings. To change a displayed setpoint value, use the Increase and Decrease pushbuttons on the front panel until the desired value appears and then push the STORE pushbutton.

SETTING NOTE: For controls purchased before Jan. 2000 and not upgraded, the changing of the curve must be validated by pressing the “Store” key for the Time Dial setting. If this is not performed, the revised curve will be activated after the next trip operation.

If the setpoint access switch is in the enabled position, the message “NEW SETPOINT STORED” will appear on the display. If the setpoint access switch is in the disabled position, the message “ILLEGAL ACCESS” will appear on the display and the change will not be stored. (see section 8.0 for a list of settings with ranges.)

Reclose Setpoints

7.1 Phase Pick-up - *Phase Pick-up Level*

The Phase Pick-up setting determines the minimum phase current that will cause the control to initiate the programmed sequence of tripping and reclosing operations. The range is 50 to 1600A in 1A steps.

7.2 Phase Fast Curve - *1st Phase Overcurrent Curve*

The Phase Fast Curve setting determines the shape of the first time-overcurrent curve that is used when the phase Pick-up level is exceeded. The available selections are Normal Inverse, Moderately Inverse, Very Inverse, Extremely Inverse or Custom. The Custom Curve will only be available if it was previously downloaded to the control using the communication software program.

7.3 Phase Fast Time Dial - *Time Dial for Phase Fast Curve*

The Phase Fast Time Dial setting determines the exact time-overcurrent curve for the chosen shape in the first phase curve selection. There are 32 time dials available.

7.4 Phase Fast Def Time - *Definite Time Adder for Fast Phase Curve*

The Phase Fast Def Time setting determines the amount of time that is added to the first phase curve selection. The range is from 0 to 1 second with 0.01667 second steps.

- 7.5 Phase Slow Curve - *2nd Phase Overcurrent Curve*
The Phase Slow Curve setting determines the shape of the second time-overcurrent curve that is used when the phase Pick-up level is exceeded. The available selections are Normal Inverse, Moderately Inverse, Very Inverse, Extremely Inverse or Custom. The Custom Curve will only be available if it was previously downloaded to the control using the communication software program.
- 7.6 Phase Slow Time Dial - *Time Dial for Phase Slow Curve*
The Phase Slow Time Dial setting determines the exact time-overcurrent curve for the chosen shape in the second phase curve selection. There are 32 time dials available.
- 7.7 Phase Slow Def Time - *Definite Time Adder for Phase Slow Curve*
The Phase Slow Def Time setting determines the amount of time that is added to the second phase curve selection. The range is from 0 to 1 second with 0.01667 second steps.
- 7.8 Phase Alt Pick-up - *Phase Alternate Pick-up Level*
The Phase Alt Pick-up setting determines an alternate phase Pick-up level that can be utilized when desired by turning this feature on in the option setpoints menu. The range is 50 to 1600A in 1A steps.
- 7.9 Phase Inst Pick-up - *Phase Instantaneous Pick-up Level*
The Phase Instantaneous Pick-up level determines the minimum phase current that will cause the control to initiate a trip command with no intentional time delay. The available range is 50 amps to 12,000 amps.
- 7.10 Phase Inst Delay - *Phase Instantaneous Delay*
The Phase Instantaneous Delay is used to set an intentional time delay of 0 to 1 second with 0.01667 second steps for the phase instantaneous trip command.
- 7.11 Phase Inst Block - *Phase Instantaneous Blocking*
Phase instantaneous tripping can be blocked after a specified point in the auto-reclose sequence. The blocking can be activated after reclose 1, 2 or 3. If set to Off, no blocking will occur.
- 7.12 Phase Inst Lockout - *Phase Instantaneous Lockout*
If ON and a phase instantaneous trip occurs, the control will go to lockout mode and no reclosing will take place.

7.13 Ground Protection - *Ground Protection On or Off*

If the Ground Protection is set to OFF, no ground protection setpoints will be displayed, nor will any ground protection or alarms occur. If this feature is ON **and** the GROUND TRIP toggle switch on the front panel is ON, ground protection will be active.

7.14 Ground Pick-up - *Ground Pick-up Level*

The Ground Pick-up setting determines the minimum ground current that will cause the control to initiate the programmed sequence of tripping and reclosing operations. The range is 5 to 800A in 1A steps.

7.15 Ground Fast Curve - *1st Ground Overcurrent Curve*

The Ground Fast Curve setting determines the shape of the first time-overcurrent curve that is used when the ground Pick-up level is exceeded.

The available selections are Normal Inverse, Moderately Inverse, Very Inverse, Extremely Inverse or Custom. The Custom Curve will only be available if it was previously downloaded to the control using the communication software program.

7.16 Gnd Fast Time Dial - *Time Dial for Ground Fast Curve*

The Ground Fast Time Dial setting determines the exact time-overcurrent curve for the chosen shape in the first ground curve selection. There are 32 time dials available.

7.17 Ground Fast Def Time - *Definite Time Adder for Fast Ground Curve*

The Ground Fast Def Time setting determines the amount of time that is added to the first ground curve selection. The range is from 0 to 1 second with 0.01667 second steps.

7.18 Ground Slow Curve - *2nd Ground Overcurrent Curve*

The Ground Slow Curve setting determines the shape of the second time-overcurrent curve that is used when the ground Pick-up level is exceeded. The available selections are Normal Inverse, Moderately Inverse, Very Inverse, Extremely Inverse or Custom. The Custom Curve will only be available if it was previously downloaded to the control using the communication software program.

7.19 Gnd Slow Time Dial - *Time Dial for Ground Slow Curve*

The Ground Slow Time Dial setting determines the exact time-overcurrent curve for the chosen shape in the second ground curve selection. There are 32 time dials available.

- 7.20 Ground Slow Def Time - *Definite Time Adder for Ground Slow Curve*
The Ground Slow Def Time setting determines the amount of time that is added to the second ground curve selection. The range is from 0 to 1 second with 0.01667 second steps.
- 7.21 Ground Alt Pick-up - *Ground Alternate Pick-up Level*
The Ground Alt Pick-up setting determines an alternate ground Pick-up level that can be utilized when desired by turning this feature on in the option setpoints menu. The range is 5 to 800A in 1A steps.
- 7.22 Ground Inst Pick-up - *Ground Instantaneous Pick-up Level*
The Ground Instantaneous Pick-up level determines the minimum ground current that will cause the control to initiate a trip command with no intentional time delay. The available range is 0 amps to 3,000 amps in 25 amp steps.
- 7.23 Ground Inst Delay - *Ground Instantaneous Delay*
The Ground Instantaneous Delay is used to set an intentional time delay of 0 to 1 second with 0.01667 second steps for the ground instantaneous trip command.
- 7.24 Ground Inst Block - *Ground Instantaneous Blocking*
Ground instantaneous tripping can be blocked after a specified point in the auto-reclose sequence. The blocking can be activated after reclose 1, 2 or 3. If set to Off, no blocking will occur.
- 7.25 Ground Inst Lockout - *Ground Instantaneous Lockout*
If ON and a ground instantaneous trip occurs, the control will go to lockout mode and no reclosing will take place.
- 7.26 TriMod Interrupting Rating - *TriMod Recloser Interrupting Rating*
Caution: If the interrupting rating value is changed, the duty monitor will be cleared! The interrupting rating should be set to the same value as the interrupting rating of the TriMod recloser connected to the control. The TriMod recloser interrupting rating value is used in the calculation of the accumulated duty monitor.
- 7.27 SEF Protection - *Sensitive Earth Fault Protection On or Off*
If the SEF Protection is set to OFF, no SEF protection setpoints will be displayed nor will any SEF protection or alarms occur.



- 7.28 SEF Pick-up - *Sensitive Earth Fault Pick-up Level*
The SEF Pick-up setting determines the minimum ground current that will cause the control to initiate the programmed sequence of tripping and reclosing operations. The range is 3 to 80A in 1A steps.
- 7.29 SEF Delay - *Sensitive Earth Fault Delay Time*
This sets the time delay that must expire once the Pick-up Level is exceeded before a trip command will be given. The range is 0.5 to 20 seconds with 0.5 second steps.
- 7.30 SEF Trips to Lockout - *Sensitive Earth Fault Trips to Lockout*
This setting determines the number of SEF trips that will take place during an auto-reclosing sequence. When the maximum number of trips has been reached without the auto-reclose scheme timer resetting, the control will be locked out. The available selections are 1, 2, 3 or 4. This selection is independent of the standard trips to lockout.
- 7.31 Trips to Lockout - *Number of Trips before Lockout*
This setting determines the number of automatic recloses that will take place during an auto-reclosing sequence. When the maximum number of auto-recloses has been reached without the auto-reclose scheme timer resetting, the control will be locked out. The available selections are 1, 2, 3 or 4.
- 7.32 Dead Time 1 - *Dead Time After 1st Reclose*
This sets the timing of the first interval after a trip command is issued and before automatic reclosing takes place. The range is 0.5 to 60 seconds in 0.5 second steps.
- 7.33 Dead Time 2 - *Dead Time After 2nd Reclose*
This sets the timing of the second interval after a trip command is issued and before automatic reclosing takes place. The range is 1 to 60 seconds in 1 second steps.
- 7.34 Dead Time 3 - *Dead Time After 3^d Reclose*
This sets the timing of the third interval after a trip command is issued and before automatic reclosing takes place. The range is 1 to 60 seconds in 1 second steps.
- 7.35 Reclose Reset Time - *Auto-Reclose Scheme Reset Time*
The auto-reclose scheme will reset to its initial condition if, after any auto-reclose the TriMod closes and the currents in all phases and ground are less than the overcurrent Pick-up setpoints for a time greater than this setting. The range is 3 to 180 seconds in 1 second steps.

- 7.36 Number of Fast Trips - *Number of Trips that use the Fast Protection Curve*
This sets the number of trips that will occur using the Fast Protection Curve. The range is 1 to 4 in 1 trip steps.
- 7.37 Alternate Pick-up - *Alternate Pick-up On or Off*
If the Alternate Pick-up is set to ON, the alternate Pick-up level will be used instead of the normal Pick-up level.
- 7.38 Sequence Coord - *Sequence Coordination On or Off*
When set to ON, the auto-reclose sequence will advance one step if the phase current exceeds the phase Pick-up level setting for at least 1 cycle and then drops below the Pick-up level before a trip command is issued to the TriMod recloser. The auto-reclose sequence will advance until the Slow Curve is reached. The setting for the number of Fast Trips must be set less than the setting for the number of Trips to Lockout in order for sequence coordination to be used.

Option Setpoints

- 7.39 Clear Event Recorder - *Clears Event Recorder*
This is used for clearing all events from the Event Recorder. Change the setting to YES and press the STORE pushbutton. "Press Store to Clear Events" will appear on the screen, press the STORE pushbutton again to confirm this action.
- 7.40 Clear Peak Demand - *Clears Peak Demand Values*
This is used for clearing Peak Demand Values for each phase. Change the setting to YES and press the STORE pushbutton. "Press Store to Clear Demands" will appear on the screen, press the STORE pushbutton again to confirm this action.
- 7.41 Inrush Delay - *Inrush Delay Time Setting*
For the time period selected, the ground and phase instantaneous protection is disabled and the ground and phase time delayed protection is switched to the Slow Curve. The range is 0 to 20 seconds with 1 second steps.

- 7.42 Lockout Close Block - *Lockout Close Block Setting*
If set to ON and the control is in the lockout mode, the LOCKOUT RESET pushbutton must be pushed to reset the control before a close command can be given. If set to OFF, the CLOSE pushbutton will reset the control and close the TriMod recloser.
- 7.43 Close Into Fault - *Close Into Fault Setting*
This programs a time period where auto-reclosing is blocked after a manual close command is issued (local or remote). The range is 0 to 20 seconds with 1 second steps.
- 7.44 Minimum Trip Time - *Minimum Trip Time Setting*
If an overcurrent condition occurs, a trip command will not be issued until the selected time period expires. If the overcurrent condition ceases before the time period has elapsed, no trip command will be issued and the timer will be reset. The range is 0 to 1.002 seconds with .01667 seconds steps.
- 7.45 Voltage Protection - *Voltage Protection On or Off*
If Voltage Protection is set to OFF, no voltage protection setpoints will be displayed nor will any voltage protection or alarms occur.
- 7.46 Primary Voltage - *Rating of the Primary Voltage*
If voltage protection is ON, the rating of the primary voltage must be entered so that the control can calculate the overvoltage and undervoltage thresholds. This is a line-to-line rating.
- 7.47 Undervoltage Pick-up - *Undervoltage Pick-up Threshold*
This sets the phase-to-phase voltage level under which a trip command will be issued. If an undervoltage trip does occur, the control will go to lockout and no reclosing will take place. The range is 0 to 100% in 1% steps.
- 7.48 Undervoltage Delay - *Undervoltage Delay*
This sets the time delay that must expire once the voltage drops below the undervoltage Pick-up level before a trip command will be given. The range is 0 to 30 seconds with 1 second steps.
- 7.49 Overvoltage Pick-up - *Overvoltage Pick-up Threshold*
This sets the phase-to-phase voltage level under which a trip command will be issued. If an overvoltage trip does occur, the control will go to lockout and no reclosing will take place. The range is 100 to 150% in 1% steps.

- 7.50 Overvoltage Delay - Overvoltage Delay
This sets the time delay that must expire once the voltage goes above the overvoltage Pick-up level before a trip command will be given. The range is 0 to 30 seconds with 1 second steps.
- 7.51 Single/Multi-Phase - Single or Multi-Phase Voltage Protection
The number of phases that must be outside the voltage threshold level settings before a trip command will be given. The choices are: Any Phase or Phases, 1 or 2 Phases Only, and 3-Phases Only.
- 7.52 User Analog Input - User Analog Input ON or OFF
This feature allows the user to input a 0 to 1ma analog signal to the control and set parameters in which certain events will occur. If User Analog Input is set to OFF, no user analog input setpoints will be displayed nor will any events or alarms occur with regards to this feature.
- 7.53 User Analog Text - User Analog Text
This is a seven character name for the units that the user selects for the analog input. The character set includes all alpha-numeric characters and several others. The text is selected one character at a time. Use the  or  pushbuttons to select a character and STORE to save the character and select the next character.
- 7.54 User Value at 0mA In - User Analog Input Value at 0mA
This sets the low end (0mA) unit value of the user input signal for scaling to the user specified value. The range is 0 to 999.9 in 0.1 steps.
- 7.55 User Value at 1mA In - User Analog Input Value at 1mA
This sets the high end (1mA) unit value of the user input signal for scaling to the user specified value. The range is 0 to 999.9 in 0.1 steps.
- 7.56 User Min Value Trip - User Minimum Value Trip
This sets the lower threshold level, in a percentage of the full range, that will result in a trip and lockout command being issued if the input falls below it. The range is 0 to 100% in 1% steps.
- 7.57 User Max Value Trip - User Maximum Value Trip
This sets the upper threshold level, in a percentage of the full range, that will result in a trip and lockout command being issued if the input goes above it. The range is 0 to 100% in 1% steps.

- 7.58 User Min Value Alarm - *User Minimum Value Alarm*
This sets the lower threshold level, in a percentage of the full range, that will result in an alarm being issued if the input falls below this lower level. The range is 0 to 100% in 1% steps.
- 7.59 User Max Value Alarm - *User Maximum Value Alarm*
This sets the upper threshold level, in a percentage of the full range, that will result in an alarm being issued if the input goes above this upper level. The range is 0 to 100% in 1% steps.
- 7.60 User Event Delay - *User Event Delay Time Period*
This sets the time delay that must expire before an alarm or trip is issued for the user input after the signal falls outside of the minimum or maximum percentages. If the signal returns to the acceptable range before the time delay expires, no trip or alarm will be issued and the timer is reset. The range is 0 to 600 seconds with 1 second steps.
- 7.61 User Event Assign - *User Event Assignment*
This determines what happens when a user event occurs. The available options are: Alarm, Trip or Alarm and Trip.
- 7.62 Daylight Savings - *Daylight Savings Time ON or OFF*
When set to ON, the control will adjust its time for daylight savings time.
- 7.63 Date Set Year - *Sets the Current Year*
- 7.64 Date Set Day - *Sets the Current Day*
- 7.65 Date Set Month - *Sets the Current Month*
- 7.66 Time Set Second - *Sets the Current Second*
- 7.67 Time Set Minute - *Sets the Current Minute*
- 7.68 Time Set Hour - *Sets the Current Hour*
- 7.69 Set Day of Week - *Sets the Current Day of the Week*
- 7.70 Com Station Address - *Communication Station Address*
This sets the Modbus slave address for the control

8.0 Setpoint Defaults and Ranges

8.1 Recloser Setpoints

Table 1 – Recloser Setpoints

<i>Recloser Setpoints</i>	<i>Default</i>	<i>Range</i>	<i>Step</i>	<i>Units</i>
PHASE PICK-UP	300	50 - 1600	1	AMPS
PHASE FAST CURVE	MODERATE INVERSE	N/A	MODERATE, NORMAL, VERY, EXTREMELY , CUSTOM	N/A
PHASE FAST TIME DIAL	1	1-32	1	N/A
PHASE FAST DEF TIME	0	0-1.002	0.01667	SECONDS
PHASE SLOW CURVE	MODERATE INVERSE	N/A	MODERATE, NORMAL, VERY, EXTREMELY , CUSTOM	N/A
PHASE SLOW TIME DIAL	1	1-32	1	N/A
PHASE SLOW DEF TIME	0	0-1.002	0.01667	SECONDS
PHASE ALT PICK-UP	300	50 - 1600	1	AMPS
PHASE INST PICK-UP	6000	OFF - 12,000	50	AMPS
PHASE INST DELAY	0	0-1.002	0.01667	SECONDS
PHASE INST BLOCK	OFF	OFF - 3	1	RECLOSE NUMBER
PHASE INST LOCKOUT	OFF	ON, OFF	N/A	N/A
GROUND PROTECTION	OFF	ON,OFF	N/A	N/A

8.1 Recloser Setpoints Table (continued)

Recloser Setpoints	Default	Range	Step	Units
GROUND PICK-UP	150	5-800	1	AMPS
GROUND FAST CURVE	MODERATE INVERSE	N/A	MODERATE, NORMAL, VERY, EXTREMELY , CUSTOM	N/A
GND FAST TIME DIAL	1	1-32	1	N/A
GROUND FAST DEF TIME	0	0-1.002	0.01667	SECONDS
GROUND SLOW CURVE	MODERATE INVERSE	N/A	MODERATE, NORMAL, VERY, EXTREMELY , CUSTOM	N/A
GND SLOW TIME DIAL	0	0-1.002	0.01667	SECONDS
GROUND SLOW DEF TIME	0	0-1.002	0.01667	SECONDS
GROUND ALT PICK-UP	150	5-800	1	AMPS
GROUND INST PICK-UP	3000	0 - 3000	25	AMPS
GROUND INST DELAY	0	0-1.002	0.01667	SECONDS
GROUND INST BLOCK	OFF	OFF - 3	1	RECLOSE NUMBER
GROUND INST LOCKOUT	OFF	ON, OFF	N/A	N/A
INTERRUPT RATING	12,000	6000, 10000, 12000	N/A	AMPS
SEF PROTECTION	OFF	ON,OFF	N/A	N/A
SEF PICK-UP	10	3 - 80	1	AMPS
SEF DELAY	20	0.5 - 20	0.5	SECONDS

8.1 Recloser Setpoints Table (continued)

Recloser Setpoints	Default	Range	Step	Units
SEF TRIPS TO LOCKOUT	4	1 - 4	1	TRIPS
TRIPS TO LOCKOUT	4	1 - 4	1	TRIPS
DEAD TIME 1	0.5	0.5 - 60	0.5	SECONDS
SEF PICK-UP	10	3 - 80	1	AMPS
SEF DELAY	20	0.5 - 20	0.5	SECONDS
DEAD TIME 2	2	1 - 60	1	SECONDS
DEAD TIME 3	5	1 - 60	1	SECONDS
RECLOSE RESET TIME	30	3 - 180	1	SECONDS
NUMBER OF FAST TRIPS	2	1 - 4	1	TRIPS
ALTERNATE PICK-UP	OFF	ON,OFF	N/A	N/A
SEQUENCE COORDINATION	OFF	ON,OFF	N/A	N/A
CLEAR EVENT RECORDER	NO	YES, NO	N/A	N/A
CLEAR PEAK DEMAND	NO	YES, NO	N/A	N/A
INRUSH DELAY	1	1 - 20	1	SECONDS
LOCKOUT CLOSE BLOCK	OFF	ON,OFF	N/A	N/A
CLEAR EVENT RECORDER	NO	YES, NO	N/A	N/A
CLEAR PEAK DEMAND	NO	YES, NO	N/A	N/A
INRUSH DELAY	1	1 - 20	1	SECONDS
LOCKOUT CLOSE BLOCK	OFF	ON,OFF	N/A	N/A
CLOSE INTO FAULT	OFF	ON,OFF	N/A	N/A

8.2 Recloser Setpoints

Table 2 – Option Setpoints

Option Setpoints	Default	Range	Step	Units
VOLTAGE PROTECTION	OFF	ON, OFF	N/A	N/A
PRIMARY VOLTAGE				
UNDERVOLTAGE PICK-UP	70	0 - 100	1	PERCENT
UNDERVOLTAGE DELAY	30	0 -30	1	SECONDS
OVERVOLTAGE PICK-UP	135	100 - 150	1	PERCENT
OVERVOLTAGE DELAY	30	0 - 30	1	SECONDS
SINGLE/MULTI - PHASE	ANY PHASE	ANY PHASE, 1 OR 2 PHASES, 3-PHASES ONLY	N/A	N/A
USER ANALOG INPUT	OFF	ON,OFF	N/A	N/A
USER ANALOG TEXT	*Refer to Section 7.53			
USER ANALOG VALUE AT 0 mA IN	0	0 to 999.9	0.1	N/A
USER ANALOG VALUE AT 1 mA IN	0	0 to 999.9	0.1	N/A
USER MIN VALUE TRIP	0	0 - 100	1	PERCENT
USER MAX VALUE TRIP	0	0 - 100	1	PERCENT
USER MIN VALUE ALARM	0	0 - 100	1	PERCENT
USER MAX VALUE ALARM	0	0 - 100	1	PERCENT
USER EVENT DELAY	0	0 - 60	0.1	SECONDS
USER EVENT ASSIGN	ALARM	ALARM,TRIP ,ALARM & TRIP	N/A	N/A

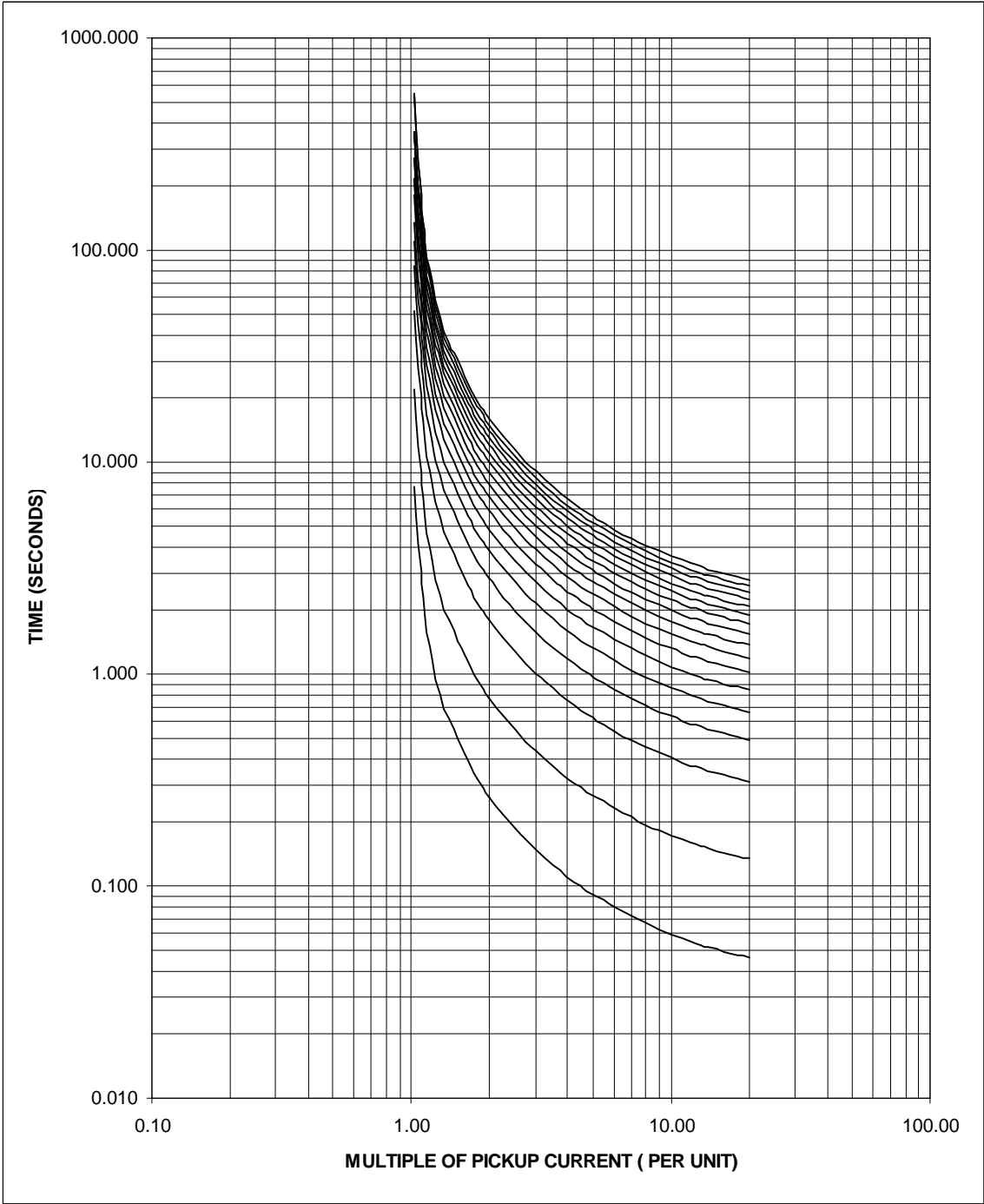
8.2 Option Setpoints Table (continued)

USER EVENT ASSIGN	ALARM	ALARM, TRIP, ALARM & TRIP	N/A	N/A
DAYLIGHT SAVINGS	OFF	ON,OFF	N/A	N/A
DATE SET YEAR	CURRENT	0 -99	1	YEAR
DATE SET DAY	CURRENT	1 - 31	1	DAY
DATE SET MONTH	CURRENT	JAN - DEC	1	MONTH
TIME SET SECOND	CURRENT	0 - 59	1	SECOND
TIME SET MINUTE	CURRENT	0 - 59	1	MINUTE
TIME SET HOUR	CURRENT	0 - 23	1	HOUR
SET DAY OF WEEK	CURRENT	SUN - SAT	1	DAY
COM STATION ADDRESS	1	1 - 247	1	N/A
DAYLIGHT SAVINGS	OFF	ON,OFF	N/A	N/A
DATE SET YEAR	CURRENT	0 -99	1	YEAR

9.0 **Time-Overcurrent Curves**

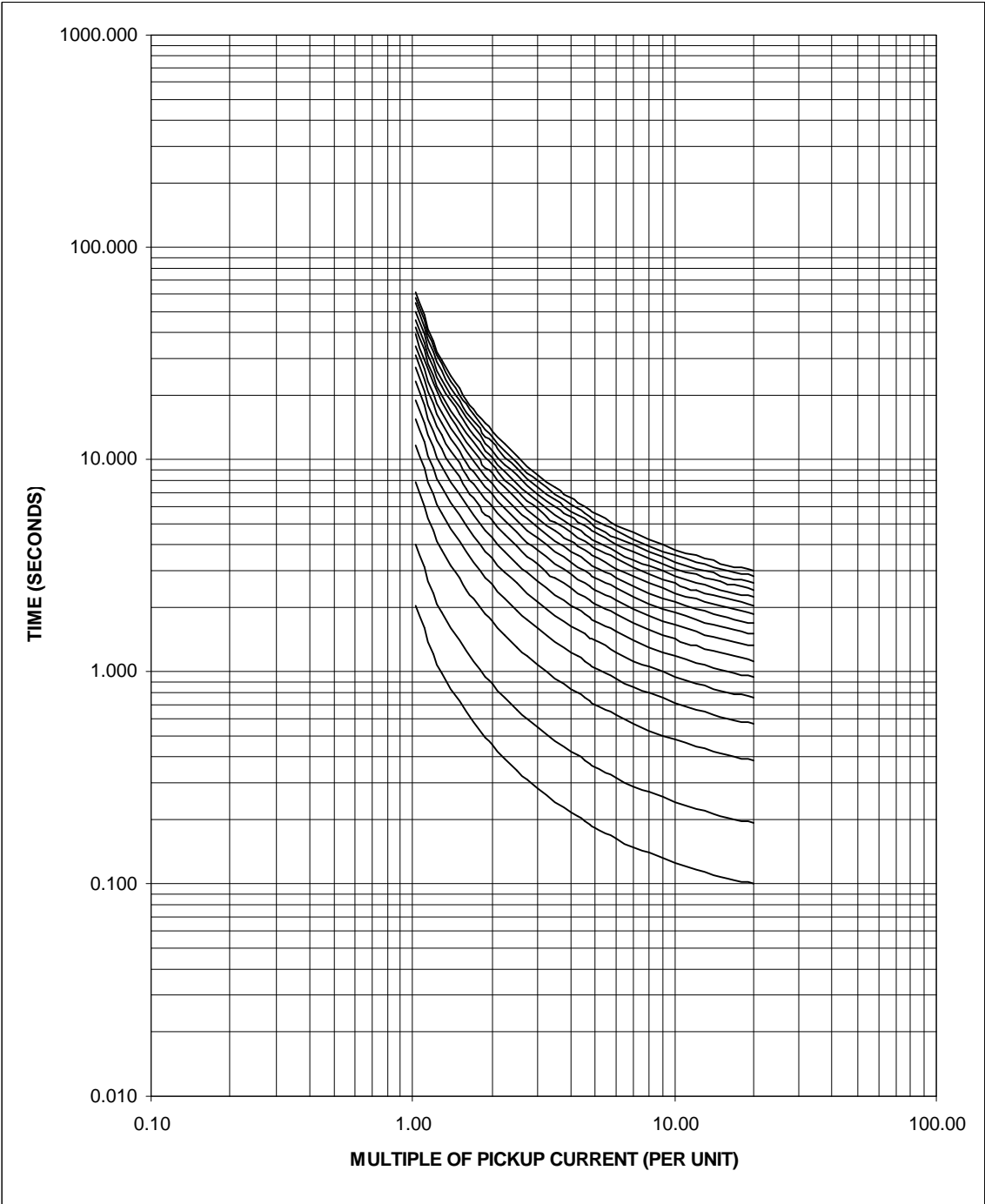
- 9.1 Normally Inverse
- 9.2 Moderately Inverse
- 9.3 Very Inverse
- 9.4 Extremely Inverse

9.1 NORMALLY INVERSE



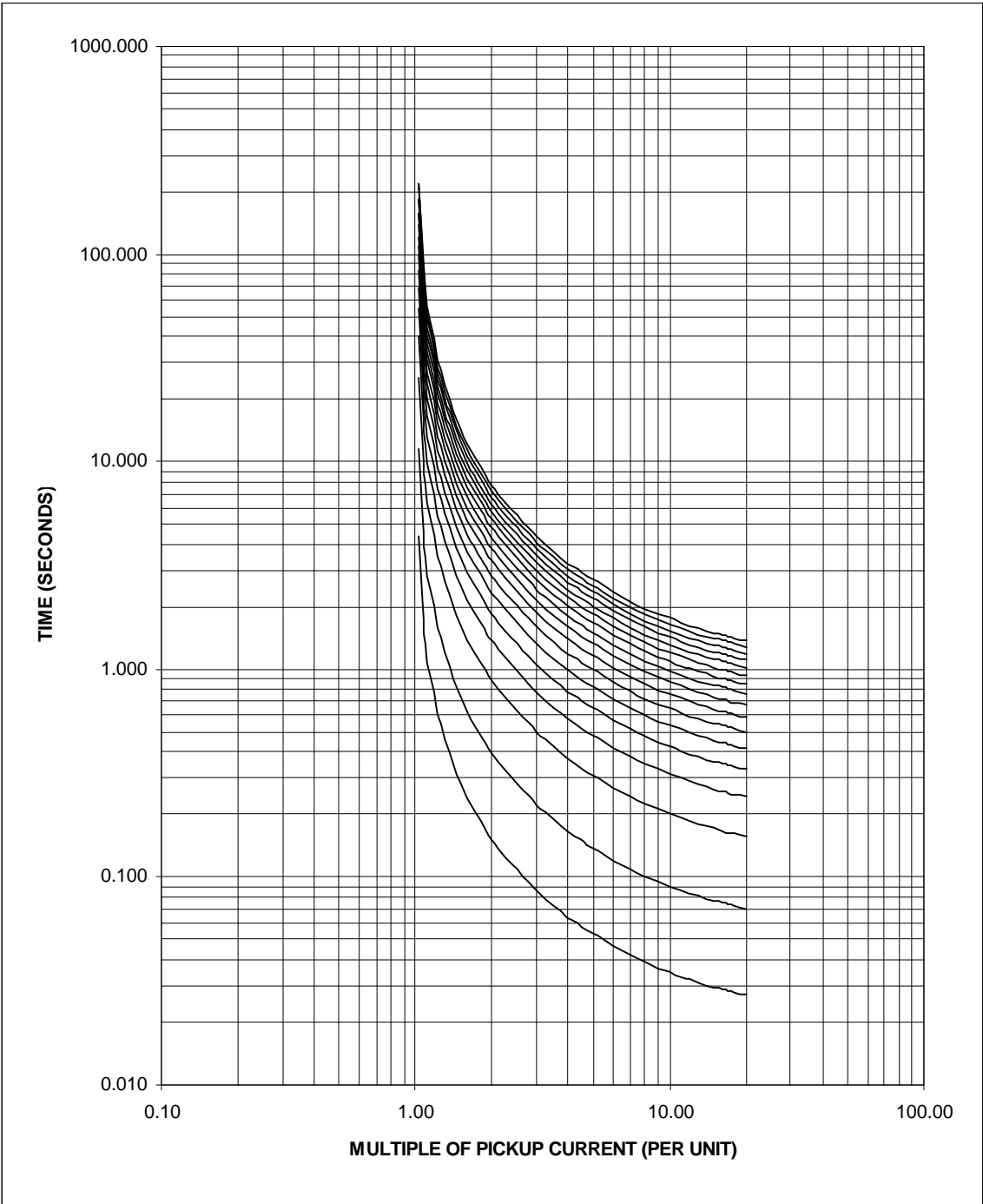
Time current curves list control response times.
Add 28 ms for JVR recloser clearing time.

9.2 MODERATELY INVERSE



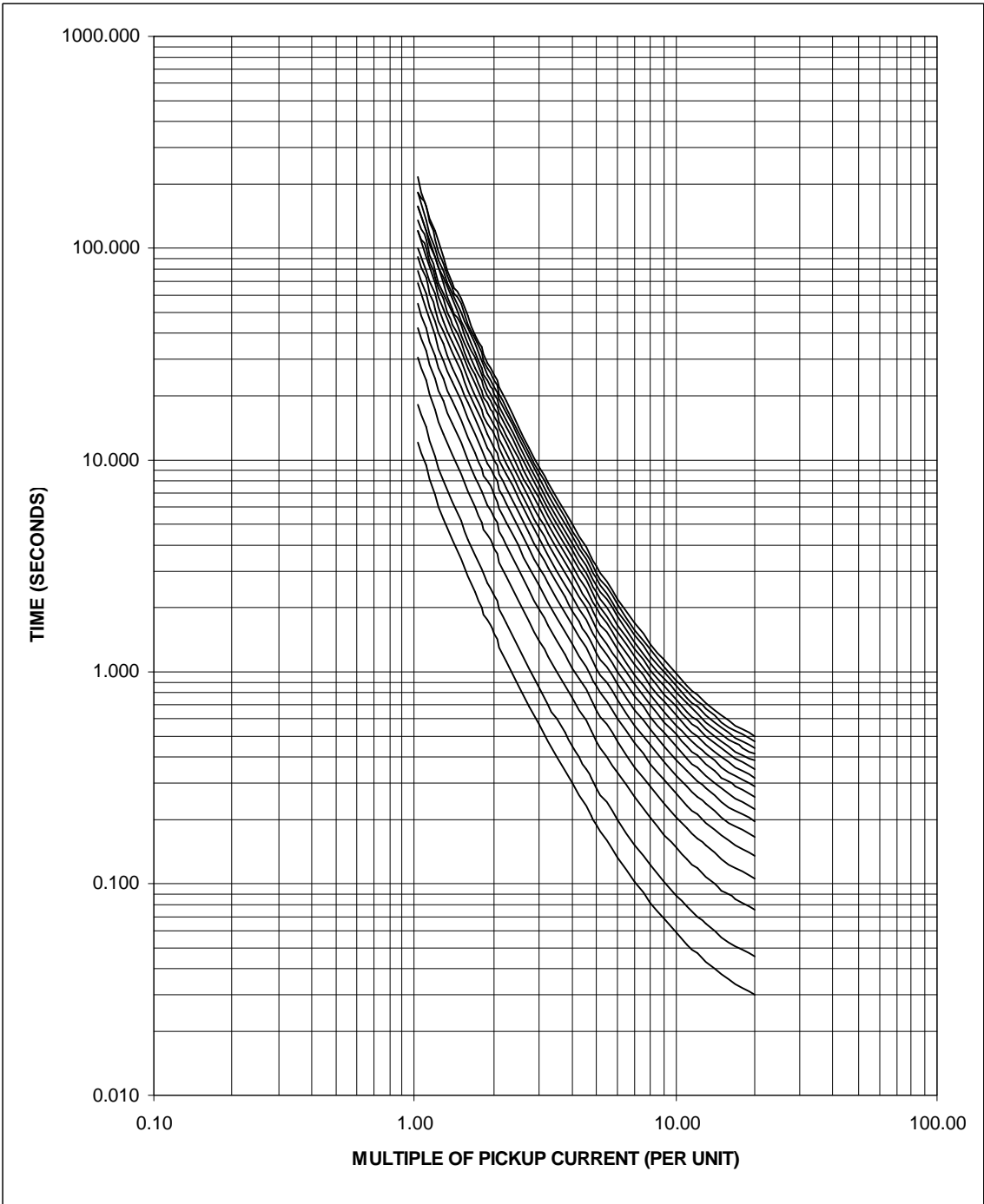
Time current curves list control response times.
Add 28 ms for JVR recloser clearing time.

9.3 VERY INVERSE



Time current curves list control response times.
Add 28 ms for TriMod recloser clearing time.

9.4 EXTREMELY INVERSE



Time current curves list control response times.
Add 28 ms for TriMod recloser clearing time.

10.0 System Values

10.1 SYSTEM VALUES Pushbutton

The SYSTEM VALUES are available by pressing the SYSTEM VALUES pushbutton. System values appear in the order listed.

PHASE A CURRENT <i>(in amperes)</i>	- Phase A instantaneous current displayed in amperes
PHASE B CURRENT <i>(in amperes)</i>	- Phase B instantaneous current displayed in amperes
PHASE C CURRENT <i>(in amperes)</i>	- Phase C instantaneous current displayed in amperes
GROUND CURRENT <i>(in amperes)</i>	- Ground instantaneous current displayed in amperes
PHASE A VOLTAGE <i>(in Kilovolts)</i>	- Phase A instantaneous voltage displayed in Kilovolts (voltages will not appear if voltage option is disabled).
PHASE B VOLTAGE <i>(in Kilovolts)</i>	- Phase B instantaneous voltage displayed in Kilovolts.
PHASE C VOLTAGE <i>(In Kilovolts)</i>	- Phase C instantaneous voltage displayed in Kilovolts.
USER ANALOG <i>(Option Setpoint)</i>	- User analog value in units as specified in Option Setpoints (user analog will not appear if option is disabled).
CAUSE OF LAST TRIP <i>(See Section 10.2)</i>	- The reason that the recloser was issued a trip command. A full listing of possible causes is listed in Section 10.2.
DATE OF LAST TRIP <i>(Date)</i>	- Date of the most recent tripping operation.
TIME OF LAST TRIP <i>(Time)</i>	- Time of the most recent tripping

operation.

PHASE A LAST TRIP (<i>Current in amperes</i>)	- Phase A current immediately before the tripping operation occurred.
PHASE B LAST TRIP (<i>Current in amperes</i>)	- Phase B current immediately before the tripping operation occurred.
PHASE C LAST TRIP (<i>Current in amperes</i>)	- Phase C current immediately before the tripping operation occurred.
GROUND LAST TRIP (<i>Current in amperes</i>)	- Ground current immediately before the last tripping operation occurred.
NUMBER OF TRIPS (<i>Accumulated number of tripping operations</i>)	- Accumulated number of tripping operations.
CONTACT DUTY PHASE A (<i>Percentage Value</i>)	- Displays the accumulated duty that phase A has interrupted in a percentage value. If 30% was displayed, then the vacuum contacts will have 70% of their life remaining. (Refer to Section 13.0 for details on the contact duty Monitor.
CONTACT DUTY PHASE B (<i>Percentage Value</i>)	- Displays the accumulated duty that phase B has interrupted in a percentage value.
CONTACT DUTY PHASE C (<i>Percentage Value</i>)	- Displays the accumulated duty that phase C has interrupted in a percentage value.
PEAK DEMAND PHASE A (<i>in amperes</i>)	- Displays the peak current demand of phase A since the last clearing.
PEAK DEMAND PHASE B (<i>in amperes</i>)	- Displays the peak current demand of phase B since the last clearing.

PEAK DEMAND PHASE C <i>(in amperes)</i>	- Displays the peak current demand of phase C since the last clearing.
REVISION <i>(Revision Number)</i>	- Displays the accumulated duty that phase C has interrupted in a percentage value.
SERIAL ID NUMBER <i>(ID Number of Control)</i>	- Displays the serial ID number of the control.

The displayed phase currents are the actual currents flowing through the switch and sensed by the individual phase current transformers incorporated in the TriMod switch. The ground current is either the sum of the phase currents, or the ground current sensed by a separate ground current transformer as determined by the customer's requirement.

The displayed phase voltages are the actual line voltages. The side of the TriMod switch that the voltages are read from is determined by the customer. The potential transformer secondary is required to be 120V at the rated voltage of the customer's line. The potential transformer primary voltage should match the rated line voltage. The PRIMARY VOLTAGE setpoint must be set to the potential transformer primary for the voltage reading to be accurate.

Care should be used in setting the over and under voltage pick-up setpoints since these setpoints are based on a percentage of the transformer primary voltage (e.g. the potential transformer primary is 13.8kV and the line voltage is 12.5kV, the line is then more than 11% below the transformer primary).

The user analog value is the actual scaled value of the user signal. The USER VALUE AT 0MA IN and USER VALUE AT 1MA IN setpoints must be set correctly so the signal scaling is accurate.

10.1 SYSTEM VALUES Pushbutton (Continued)

The following trip information is captured at every trip: Cause of last trip, Date of last trip, Time of last trip, Phase A last trip, Phase B last trip, Phase C last trip, and Ground at last trip. If there has been no trip, the cause of the last trip reads “NO PROTECTION TRIPS” and all data (as well as the time and date) will read zero.

The total number of trips is the number of times that the TriMod has been opened by the FM2500.

The phase contact duties are the total percentage of contact life used up by high or fault current interruptions. In order for the duty to be an accurate representation of contact wear, the TriMod INTERRUPT RATING setpoint must match the TriMod nameplate.

The peak demand of each phase is the highest 15 minute average current flow through the respective phase. The demands can be cleared as follows:

- (1) Access the CLEAR PEAK DEMAND from option setpoints.
- (2) Press STORE, and “PUSH STORE TO CLEAR DEMAND” appears on the display.
- (3) Press STORE again, and “DEMAND DATA ERASED” appears on the display; and about one second later, the screen returns to CLEAR PEAK DEMAND.

The revision entry is the revision level of the software that the microprocessors have been installed with. The revision consists of two or three digits and reads as follows: “12 is revision 1.2.”

10.2 Control Recorded Trip Causes

The following is a list of all possible trip causes that the control will record:



- | | |
|----------------------|--|
| INSTANT CURRENT TRIP | - If a trip occurs as a result of an instantaneous phase or ground setting. |
| TIMED CURRENT TRIP | - If a trip occurs as a result of a timed overcurrent phase or ground setting. |
| OVERVOLTAGE TRIP | - If a trip occurs as a result of an overvoltage setting. |

UNDERVOLTAGE TRIP	- If a trip occurs as a result of an undervoltage setting.
SENSITIVE EARTH TRIP	- If a trip occurs as a result of a sensitive earth fault setting.
USER LOW LIMIT TRIP	- If a trip occurs as a result of a user low limit setting.
USER HIGH LIMIT TRIP	-If a trip occurs as a result of a user high limit setting.
TEST TRIP	-If a trip occurs as a result of the trip test button being pushed.
NO PROTECTION TRIPS	-This message will be displayed for the "cause of the last trip" only if no trips have occurred as a result of the protection settings. Once a protection trip occurs, this message will not be displayed again.

11.0 Quick View

11.1 Quick View Menu

The Quick View feature is provided for the convenience of the operator and essentially provides a method of creating an abbreviated list of system values. Any item in System Values can be stored in the Quick View list by displaying the desired System Value item and pressing STORE. The action is confirmed by the "QUICK VIEW ITEM STORED" message.

If the System Value has already been saved to Quick View the "QUICK VIEW ALREADY STORED" message is displayed. To remove a Quick View item, display the Quick View item to be removed and press the  and  pushbuttons simultaneously. This action is confirmed by the "QUICK VIEW ITEM REMOVED MESSAGE." The items are stored in the order that they are entered in the Quick View List.

Note: Option items entered in the Quick View List that are later disabled, will stay in the quick view list and will not be updated to the actual values, but will remain at the value recorded at the time the option was disabled. Either remove the items from Quick View, or enable the options to restore actual value updates.

The following example will step through the procedure of how to store particular screens of the System Values menu in the Quick View menu:

A: 125 A B: 143 A
C: 133 A Trips: 234

- Default Screen

PHASE A CURRENT
125 A

- Push SYSTEM VALUES
Pushbutton once and the first item
will be displayed.

●
●
●
●

- Push SYSTEM VALUES pushbutton
to get to the desired screen. In this
case eight times.

CAUSE OF LAST TRIP
TIMED OVERCURRENT

- In this example, this is our desired
screen. Push the STORE
pushbutton and this System Value
will be stored in the Quick View
Menu.

QUICK VIEW ITEM STORED

- This message will appear
momentarily to confirm that the
message was stored in the Quick
View Menu

CAUSE OF LAST TRIP
TIMED OVERCURRENT

- Then the System Value screen will
be displayed again. At this stage
continue scrolling through the
System Values Menu to store
additional items in the Quick View
Menu, or push the DEFAULT
SCREEN pushbutton.

12.0 Event Recorder

12.1 Event Recorder Access

The Event Recorder records up to one-hundred events. Events in excess one - hundred events over-write the oldest previous events. The event recorder is accessed by pressing and holding the QUICK VIEW and SYSTEM VALUES pushbuttons at the same time until the Event Recorder message is displayed, or if there are no entries in the event recorder, the “NO EVENTS RECORDED” message is displayed. The first event displayed is the most recent.

Press the Down pushbutton to scroll back to the next most recent event. If there is a need to go back further in time, to view previously recorded events, continue to press the Down pushbutton. Press the Up pushbutton to move forward in time. In either direction the display will scroll past the most recent event to the oldest event, or will scroll past the oldest event to the most recent event.

If an event has data associated with it the data can be displayed as follows: Scroll to the event of interest and push the STORE pushbutton. The data associated with that specific event will be displayed.

The Event Recorder can be cleared as follows: Access CLEAR EVENT RECORDER from option setpoints. Press the Up pushbutton to change to YES, then press STORE. The “PUSH TO CLEAR EVENT DATA” message appears, press STORE again, and the “EVENTS ERASED” message is displayed. About a second later the display returns to “CLEAR EVENT RECORDER.”

12.2 Events Data

Table 3 – Events Data

The following table lists all events that are logged with the time and date. The events that have data associated with them are noted.

Event	Explanation	Data Logged
Instant Current Trip	If a trip occurs as a result of an instantaneous phase or ground setting	Phase & Ground Currents
Timed Current Trip	If a trip occurs as a result of a timed overcurrent phase or ground setting	Phase & Ground Currents

12.2 Events Data Table (continued)

Event	Explanation	Data Logged
Overvoltage Trip	If a trip occurs as a result of an overvoltage setting	Phase-Voltages
Undervoltage Trip	If a trip occurs as a result of an undervoltage setting	Phase-Voltages
Sensitive Earth Trip	If a trip occurs as a result of a sensitive earth fault setting	Phase & Ground Currents
User Low Limit Trip	If a trip occurs as a result of a user low limit setting	User Scaled Input Signal
User High Limit Trip	If a trip occurs as a result of a user high limit setting	User Scaled Input Signal
User Low Limit Alarm	If an alarm occurs as a result of a user low limit setting	User Scaled Input Signal
User High Limit Alarm	If an alarm occurs as a result of a user high limit setting	User Scaled Input Signal
System Checksum Fail	If either processor finds a memory checksum error	Solved and stored Checksum Values
Discrepancy CLS	If a discrepancy occurs during or after a closing operation.	N/A
Discrepancy Open	If a discrepancy occurs during or after an opening operation.	N/A
System Battery Fail	If a battery voltage drops below 10.5V	N/A
Low Close Cap Energy	If the closing capacitor voltage drops below the normal level	N/A

12.2 Events Data Table (continued)

Low Open Cap Energy	If the opening capacitor voltage drops below the normal level	N/A
Manual Close	If a local or remote close command was issued	N/A
Manual Open	If a local or remote open command was issued	N/A
Test Trip	If a trip occurred as a result of the trip test button being pushed	Phase and Ground Currents
Auto Reclose ON	If automatic reclosing was turned ON	N/A
Auto Reclose Off	If automatic reclosing was turned OFF	N/A
Ground-Trip ON	If ground tripping was turned ON	N/A
Ground-Trip OFF	If ground tripping was turned OFF	N/A
Lockout Reset	If lockout was reset locally or remotely	N/A
Processor Com Fail	If communications with the protection processor fails.	N/A
Solenoid Fail	If continuity is lost through a switch solenoid	
Lockout Issued	If control issues a lockout	N/A
SEF Trips Enabled	If Sensitive Earth Fault trips are enabled	N/A
SEF Trips Disabled	If Sensitive Earth Fault trips are disabled	N/A

13.0 **Contact Duty Monitor**

Each phase has a duty percent listing in SYSTEM VALUES. A new TriMod switch should start at 0.0% and be replaced when the displayed duty is equal to or exceeds 100.0%.

The rate of accumulated duty is dependent on the selected interrupt rating in the TriMod INTERRUPT RATING setpoint. The only method of clearing duties is to

change the selected TriMod interrupt rating . For the duty to accumulate properly the selected interrupt rating should match the interrupt rating as listed on the TriMod nameplate.

All TriMod interrupt ratings will accumulate approximately 1% at an interrupted current equal to the TriMod interrupt rating. For example, if a fault of 2000A is interrupted by the recloser, the control will calculate a value of 4 which is $(2000A * 2000A)/1 \times 10^6$. This value will then recorded as a percentage of the Maximum Duty Life.

The following are the minimum interrupted currents that will accumulate for each TriMod interrupt rating: 1.3kA for the 12kA TriMod, 915A for the 10kA TriMod, and 650A for the 6kA TriMod (less than 1% is not accumulated).

Vacuum Interrupter Maximum Duty Life

TriMod Interrupting Rating	Maximum Duty Life kA ²
6000A	4289
10,000 A	11915
12,000A	17158

13.1 Clearing Duty Monitor Data

It is recommended that the duty monitor be cleared only when replacing the TriMod switch.

To clear the duty monitor data, access the setpoint menu and go to the TriMod INTERRUPT RATING entry, change the switch interrupt rating, and press the STORE pushbutton. The “PUSH STORE TO CLEAR KA DUTY DATA” message appears on the screen. At this time press the STORE button again, and the screen returns to the interrupt rating entry. Reset the interrupt rating to match the switch rating, and store the information.

The duty data is only recalculated after a trip due to an overcurrent has occurred, so press the TEST TRIP button to trip the switch. After the switch trips, each phase duty will reset to 0.00%.

14.0 Remote Operation

Status and commands are available for remote operation and access. There are both RS232 and RS485 connections for serial communications and dry contact inputs and outputs for hardware application.

14.1 Serial Communications (RS 232 and RS 485)

There are two RS232 connectors. The connector on the operator display panel is intended for temporary programming and the connector on the I/O board is intended for permanent communication cable installation. These two RS232 connections require a null modem, or the wiring may be done as follows:

Note: Only the necessary pins are shown

<u>RS232 Standard Pin and Designation</u>	<u>FM2500 Connector Pin</u>
2 RD -----	3
3 TD-----	2
5 SG -----	5
7 RTS	+ --- 7
8 CTS	+ --- 8

Wires to pins 2 and 3 must be reversed and pins 7 and 8 must be connected together at the FM 2500 connector end of the cable. The cable can be standard RS232 cable, but the FM2500 end must be modified as described above or use a null modem adapter.

Also, there is a RS485 terminal block on the I/O board. Terminal 1 is the '+' or 'B' line and terminal 2 is the '-' or 'A' line for the RS485 connection.

The communications priority at these connections is set in the following (highest first): RS232 I/O Port, followed by RS485 I/O Terminal Block. Connecting to a higher priority port excludes communications at lower priority connections.

14.2 Dry Contacts

TB-2 Connections

- TB2 - 1 Spare
- TB2 - 2 Lockout Status
- TB2 - 3 Lockout Status } Open When Locked Out
- TB2 - 4 Ground Trip Status
- TB2 - 5 Ground Trip Status } Closed When Ground Trip Protection is Disabled
- TB2 - 6 Reclose Status
- TB2 - 7 Reclose Status } Closed When Auto-Reclose is Disabled
- TB2 - 8 Spare
- TB2 - 9 Spare
- TB2 - 10 System Failure
- TB2 - 11 System Failure } Normally Open Contact, Closes for System Failure
- TBA -12 Battery Alarm
- TB2 - 13 Battery Alarm } Opens for Battery Alarm or When Control is Powered Down

TB-2 Connections (Continued)

- TB2 - 14 Switch Position Common For TB2-15 and TB2-16
- TB2 - 15 Switch position “b” Contact
- TB2 - 16 Switch Position “a” Contact

TB-3 Connections

- TB3 - 1 Initiate Battery Test
- TB3 - 2 Spare
- TB3 - 3 Analog Input (0 -1 ma)
- TB3 - 4 Command Input Common: See Note*
- TB3 - 5 Reset: See Note*
- TB3 - 6 Disable Ground Tripping: See Note*
- TB3 - 7 Enable Ground Tripping: See Note*
- TB3 - 8 Disable Reclose Input: See Note*
- TB3 - 9 Enable Reclose Input: See Note*
- TB3 - 10 Close Command Input: See Note*
- TB3 - 11 Open Command Input: See Note*
- TB3 - 12 Local/Remote Status } Closed in Remote Mode
- TB3 - 13 Local/Remote Status }
- TB3 - 14 Alternate Pickup Status - Common
- TB3 - 15 Alternate Pickup Status - Closed for Normal Curve
- TB3 - 16 Alternate Pickup Status - Open for Normal Curve

* Note: Commands are initiated by connecting a momentary dry contact between TB3-4 and the terminal point for the command. The command should be maintained for 0.2 to 1 second.

15.0 Installation**15.1 Mounting the Control**

Mount the Faultmaster® 2500 control (Figure 5) at a convenient location near or remote to the TriMod recloser. Consult the factory for limitations on control cable length.

15.2 Grounding the Control

The control cabinet must be solidly grounded using the grounding lug provided on the underside of the cabinet.

15.3 Connecting the Control Cable

A control cable hole is provided on the bottom of the cabinet. Remove the locking nut from the control cable end and place the cable into the hole. Then, install the locking nut on the cable to secure the nut to the control cabinet. The two connectors, J4 and J5 from the control cable must be connected to J4 and J5 on the I/O board (PCB3). The other end of the control cable is connected to the TriMod recloser and current transformers.

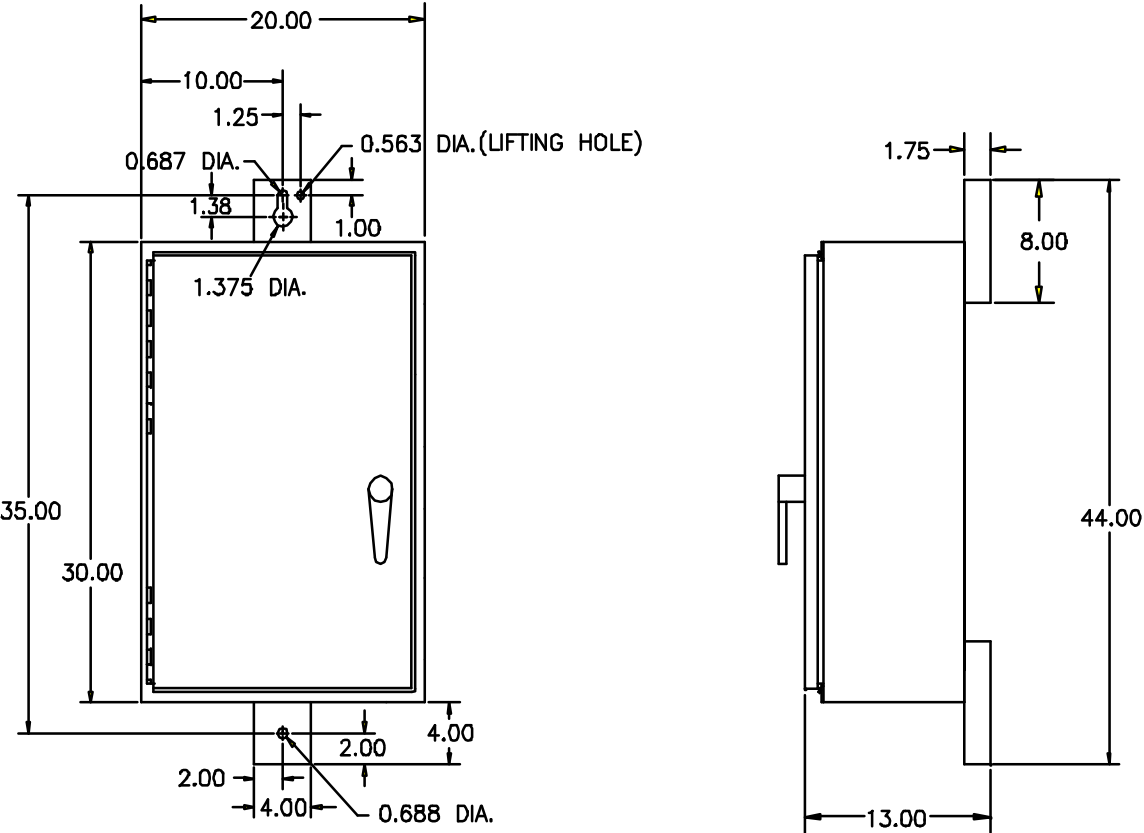


Figure 5: Standard Cabinet Mounting Dimensions

15.4 Connecting 120Vac Control Power

When connecting the 120Vac external control power source to the I/O Board (PCB3), the “hot lead” must be wired to TB1-3 and the neutral to TB1-1. If a second 120Vac source is provided, the connections are TB1-4 and TB1-2. Refer to Figure 3. The 120Vac control power continuous load is less than 0.5kVA, but must be capable of supplying 45A of inrush current for 2 cycles during capacitor charging.


15.5 Connecting 220Vac Control Power (Optional)


When a control is ordered with a 220 Vac control power source, the input wires are connected to a dedicated terminal block (refer to supplied interconnection diagram). The 220 Vac control power continuous load is less than 0.25kVA, but most supply 22.5 Amp inrush for 2 cycles during capacitor charging.

16.0 Testing

The TriMod 300 series recloser and Faultmaster 2500 are completely adjusted and tested at the factory and ready for installation prior to shipment. No pre-installation testing is required, however if desired, the following characteristics can be checked:

Electrical Operation
 Mechanical Operation
 Vacuum Bottle Integrity
 Minimum Trip Current
 Operating Sequence
 Block Reclosing

 **WARNING:** Follow all locally approved procedures and safety practices when testing or operating this equipment. Failure to comply may result in death, severe personal injury, and/or equipment damage.

 **DANGER:** Contact with energized recloser terminals or test equipment may cause electric shock that can result in injury or death.

16.1 Electrical Operation

Connect the control power as described in the *Control Power Section*. Then use the Open and Close buttons to electrically operate the TriMod recloser. Confirm that the open and close LED indicators on the control panel are in agreement with the open and close position indicator on the bottom of the TriMod. **NOTE:** The Trip handle will not change positions during electrical operations.

16.2 Mechanical Operation

With control power still connected to the control, pull down on the TriMod yellow operating handle to open the high voltage contacts. Confirm that the open and close LED indicators on the control panel are in

agreement with the open and close position indicator on the bottom of the TriMod. The operating handle will return to the normal position after it is released.


16.3 Vacuum Bottle Integrity

A. AC High Potential Test

High potential withstand tests provide information on the dielectric strength of the vacuum bottle contained in the recloser. Loss of vacuum results in complete breakdown across and open vacuum contact at voltages below 30kV RMS. Only AC high potential testing meaningful, DC testing cannot be used.

1. Ground the recloser frame and control.
2. Connect the control power as described in the *Control Power Section*
3. Place the recloser in the open position.
4. Apply 30kV AC RMS across the high voltage terminals for 15 seconds.

During high potential testing, self-extinguishing, momentary breakdowns lasting only a few seconds may occur. These breakdowns are not significant, but can result in false indication of vacuum loss if the test set utilizes a high-speed overload relay or breaker.

 **CAUTION:** To avoid possible generation of x-rays, do not apply more than 30kV RMS.

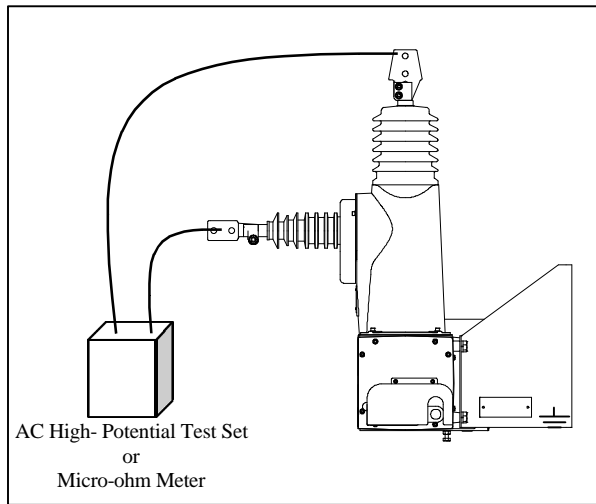


Figure 6: Vacuum Integrity Test Setup

B. Contact Resistance Test

With the recloser in the closed position, measure the resistance across the terminals. Resistance values should be less than 200 micro-ohms. If higher resistance values are measured, contact the local Joslyn Hi-Voltage Representative.

16.4 Minimum Trip Test Current

A. Primary Current Injection

The minimum trip current can be checked by injecting current through the recloser while it is in the closed position. Assemble the test setup as shown below:

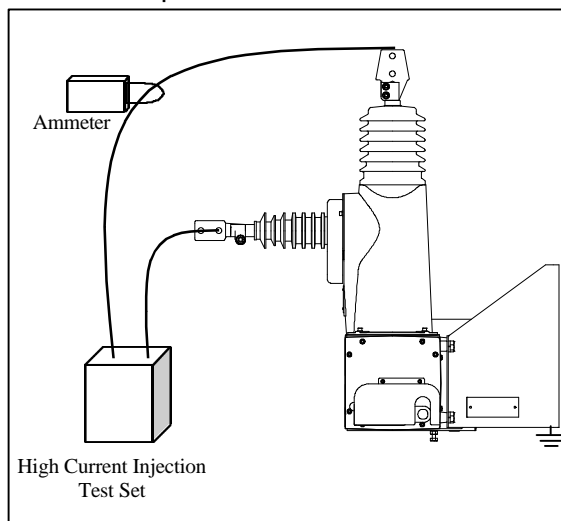


Figure 7: Primary Trip Test Current Setup

1. Ground the recloser frame and control.

2. Connect the control power as described in the *Control Power Section*
3. Place the recloser in the closed position.
4. Slowly increase the current until the recloser trips. Note the ammeter reading and compare it to the pick-up level setting in the Faultmaster 2500 control.

B. Secondary Current Injection

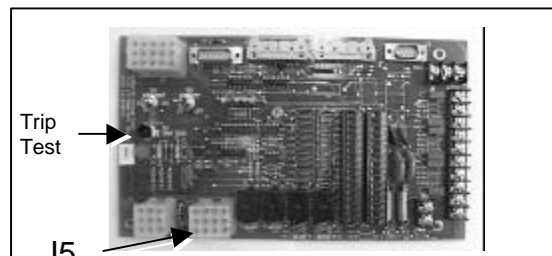
If no high current test set is available, Minimum Trip Current Testing can also be done by using secondary current injection or by using the Trip Test button on the I/O Board. The Trip Test button simulates a 1000A per phase and the control will go through its preprogrammed sequence.

Secondary injection can be done through the connector on the I/O board or via the secondary of the current transfer.

NOTE: The TriMod typically utilizes current transformers with 600:1A ratio. Therefore, injecting 1A into the secondary wiring will equate to 600A as read by the control.

C. Secondary Current Injection through the I/O Board

The connector J5 on the I/O board is the input location for the secondary of the current transformers.



The pin designations are listed below.

12	11	10	9
8	7	6	5
4	3	2	1

Pin 1 = Phase A CT

Pin 2 = Phase A CT Polarity
Pin 3 = Phase B CT
Pin 4 = Phase B CT Polarity
Pin 5 = Phase C CT
Pin 6 = Phase C CT Polarity
Pin 7 = Ground CT
Pin 8 = Ground CT Polarity

Figure 8: Secondary Trip Test Current
Setup Through I/O

D. Secondary Current Injection through the CT Connector

This entails disconnecting the current transformer on the TriMod recloser and injecting current into the current transformer connector.

1. Remove the CT cover
2. Disconnect and remove the CT using the 2-pin insulated connector.

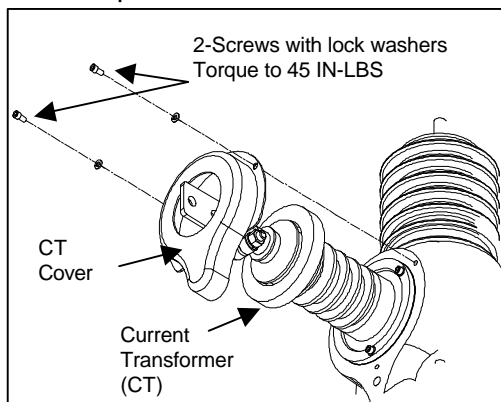


Figure 9: Removal of Current Transformer

3. Ground the recloser frame and control.
4. Connect the control power as described in the *Control Power Section*
5. Place the recloser in the closed position.
6. Connect the secondary current injection test set to the CT connector. One Connector and two pins are required: Molex connector 2-pin Cat. # 19-09-1029 (or equivalent), Molex pins-female Cat. # 02-09-1104 (or equivalent) .

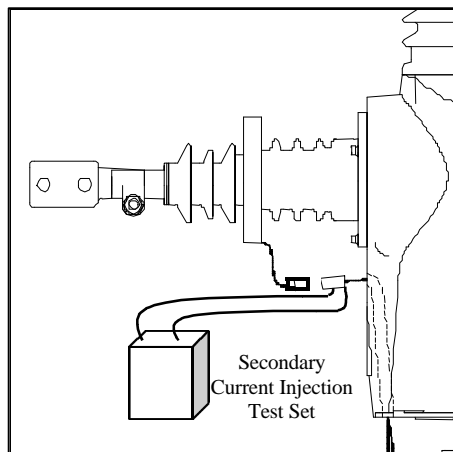


Figure 10: Secondary Trip Test Current Setup Through CTs

7. Slowly increase the secondary current until the recloser trips. Note the ammeter reading and compare it to the pick-up level setting in the Faultmaster 2500 control.
8. When testing is complete, reconnect the CT and replace the CT cover.

16.5 Operating Sequence

A. Complete Sequence to Lockout

The operating sequence can be checked by using the same setup as described in the Minimum Trip Current Test.

1. Ground the recloser frame and control.
2. Connect the control power as described in the *Control Power Section*
3. Place the recloser in the closed position.
4. Slowly increase the current until the recloser trips.

The recloser will initiate the reclose sequence. Compare the number of operations to lockout and the number tripping operations on Curve 1 and Curve 2, as well as the dead times between each reclose s to the programmed values in the Faultmaster 2500 control.

B. Reclose Disabled

To check the block reclose functionality, disable reclosing by either using the Reclose Disable button on the control panel or the block reclose handle on the TriMod.

Next follow the above sequence. There should be no automatic reclosing operations after the first tripping operation and the control will go to lockout.

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JOSLYN **Hi-Voltage Corporation**

