

# Reclosers

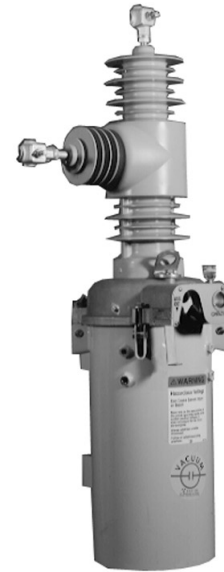
## Types NOVA<sup>1</sup>-15 and NOVA<sup>1</sup>-27 Single-Phase, Electronically Controlled Recloser Installation and Operation Instructions

Service Information  
**S280-17-1**

Applicable to serial numbers above 9999 or beginning with CP57 for NOVA<sup>1</sup>-15.

Applicable to serial numbers above 225 or beginning with CP57 for NOVA<sup>1</sup>-27.

Applicable to serial numbers above 600 or beginning with CP57 for NOVA<sup>1</sup> Control.



020085KM  
000003KM

**Figure 1.**  
Kyle<sup>®</sup> NOVA<sup>1</sup> single-phase, electronically controlled recloser and 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.

### 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.

### 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 properly 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 power distribution equipment can result in death, severe personal injury, and equipment damage. G122.2



## PRODUCT INFORMATION

### Introduction

*Service Information S280-17-1* provides installation, operation, and service instructions for the Kyle Type NOVA<sup>1</sup> single-phase, electronically controlled recloser. Before installing and operating this recloser, 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 or operating this equipment.

### Additional Information

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

### Acceptance and Initial Inspection

Each recloser is completely assembled, tested, and inspected at the factory. It is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the recloser and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

### Handling and Storage

Be careful during handling and storage of the recloser to minimize the possibility of damage. If the recloser is to be stored for any length of time prior to installation, provide a clean, dry storage area.

During storage, the batteries must be disconnected from the control circuit board. If the storage area temperature exceeds 100° F, remove the batteries and store in a cool, dry area.

### Standards

Kyle Type NOVA<sup>1</sup> single-phase, electronically controlled reclosers are designed and tested in accordance with

**ANSI C37.85–1989**

**IEEE C37.60–1981™**

**IEEE C37.61–1973™**

**IEEE C37.90–1978™**

### Quality Standards

ISO 9001:2000 Certified Quality Management System

### Description

The Type NOVA<sup>1</sup> recloser is a self-contained, single-phase, current-interrupting device. No external power is required for proper operation. A complete Type NOVA<sup>1</sup> single-phase recloser assembly consists of a solid-polymer interrupter module NOVA<sup>1</sup> recloser with an embedded current transformer and a separate NOVA<sup>1</sup> control, which is connected to the recloser with a control cable. The control cabinet may be mounted to a pole or other mounting structure. The control cable is attached to the control and recloser with threaded, separable, weatherproof connectors.

## RATINGS AND SPECIFICATIONS

### Check Recloser Ratings Prior to Installation

The recloser must be applied within its specified ratings. Check data plate ratings and compare with the system characteristics at the point of application prior to installation. Tables 1, 2, and 3 list the ratings and specifications for the Type NOVA<sup>1</sup> single-phase recloser.

**TABLE 1**  
**Voltage and Current Ratings**

Rating	NOVA <sup>1</sup> -15	NOVA <sup>1</sup> -15	NOVA <sup>1</sup> -27	NOVA <sup>1</sup> -27
Maximum Design Voltage (kV)	15.5	15.5	29.2	29.2
Nominal Operating Voltage (kV)	14.4	14.4	24.9	24.9
Basic Insulation Level (BIL) (kV)	110	110	125	125
60 Hertz Withstand Voltage (kV)				
Dry, one minute	50	50	60	60
Wet, ten seconds	45	45	50	50
Max RIV at 1.0 MHz				
9.4 kV (μV)	100	100		
16.4 kV (μV)			100	100
Continuous Current Ratings (A)	400	800	400	800
Symmetric Interrupting Current (A)	8,000	12,500	8,000	12,500
Overload Capability				
125% - 8 Hours (A)	500	No overload rating	500	No overload rating
150% - 4 Hours (A)	600	—	600	—
Cable Charging Current (A)	10	10	25	25
Magnetizing Current	14	28	14	28
Three-Second Current, Symmetric (A)	8,000	12,500	8,000	12,500

**TABLE 2**  
**Mechanical Life**

Minimum Operations . . . . .	2,500
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**TABLE 3**  
**Mass (Weight)**

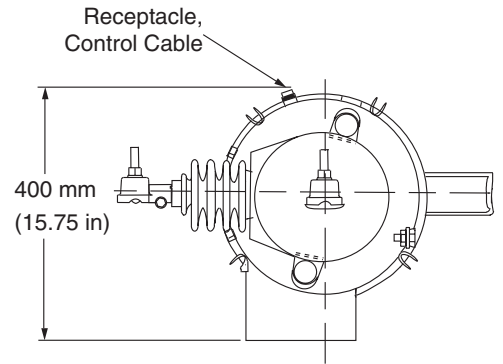
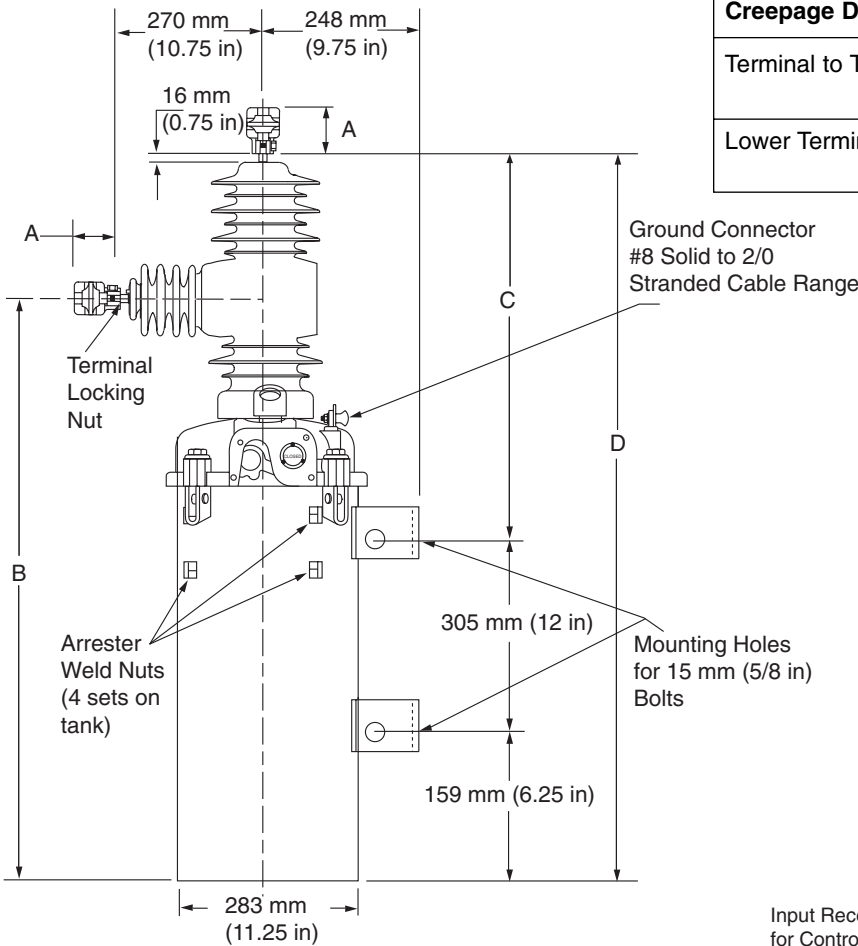
	NOVA <sup>1</sup> -15	NOVA <sup>1</sup> -27
NOVA <sup>1</sup> Recloser kg (pounds)	48 (105)	50 (110)
NOVA <sup>1</sup> Control kg (pounds)	16 (35)	16 (35)

**TABLE 4**  
**Duty Cycle**

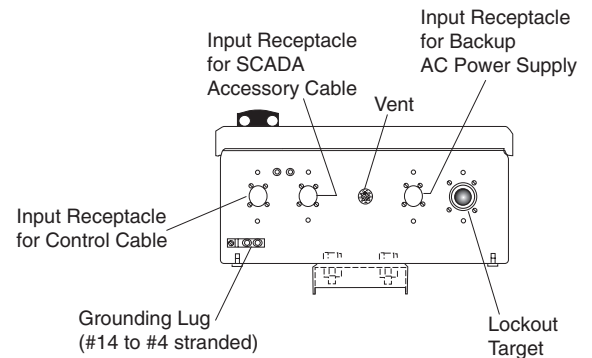
Percent of Maximum Circuit Interrupting Rating	Minimum X/R Ratio	Number of Unit Operations
15-20	4	88
45-55	8	112
90-100	15	32
		<b>Total 232</b>

# DIMENSIONS

Creepage Distances	NOVA <sup>1</sup> -15	NOVA <sup>1</sup> -27
Terminal to Terminal	1052 mm 41.5 in	1052 mm 41.5 in
Lower Terminal to Ground	673 mm 26.5 in	772 mm 30.5 in

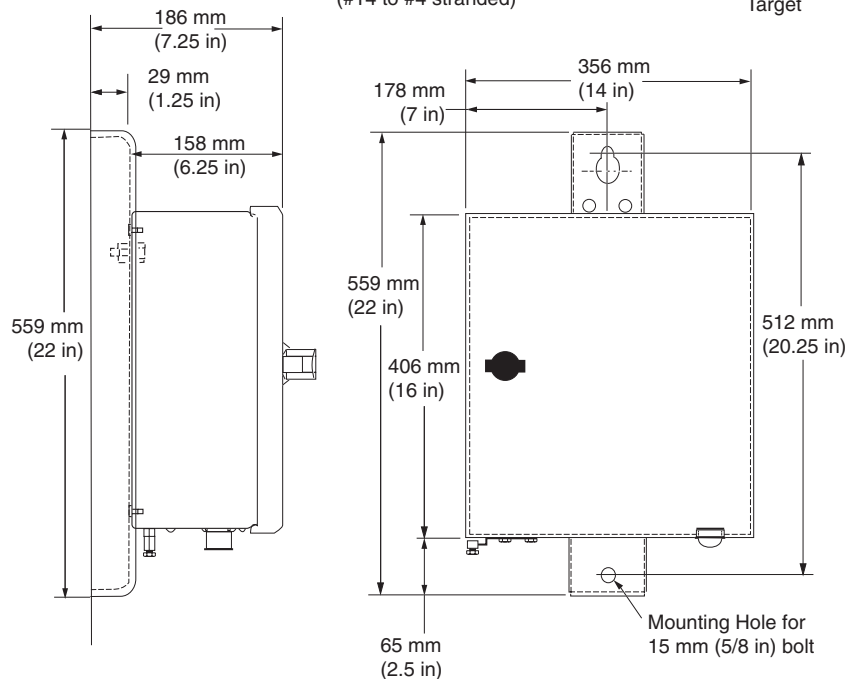


**NOTE:** All dimensions are approximate. Dimensions shown in mm (in).



Terminal Option Type	Dimension A
Eyebolt - (400 A) 1/0 to 500 MCM Cable Range	80 mm / 3.25 in
Eyebolt - (800 A) 4/0 to 1000 MCM Cable Range	108 mm / 4.25 in
Flat Pad - 2 Hole (630 A max)	114 mm / 4.5 in
Flat Pad - 4 Hole (800 A max)	121 mm / 4.75 in
Stud Type - (800 A max) 1.125 - 12 threads	82 mm / 3.25 in

NOVA <sup>1</sup> Dimensions			
	B	C	D
NOVA <sup>1</sup> - 15 kV	878 mm 34.5 in	696 mm 27.5 in	1160 mm 45.75 in
NOVA <sup>1</sup> - 27 kV	939 mm 37.0 in	757 mm 29.75 in	1221 mm 48.25 in



**Figure 2.**  
**Kyle NOVA<sup>1</sup> single-phase recloser and control dimensions.**

## INSTALLATION PROCEDURE

**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:** Hazardous Voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury. G108.1

All reclosers are carefully tested and adjusted at the factory to operate according to published data. Well-equipped test facilities, detailed testing procedures, and thoroughly trained personnel assure accurately calibrated equipment. Each recloser leaves the factory ready for installation.

- 1. Check the data plate ratings.** Make sure the ratings and settings on the recloser data plate are correct for the planned installation. See Figure 3.



**Figure 3.** Kyle NOVA<sup>1</sup> single-phase recloser data plates are located on the sleet hood. 99020KM

- 2. Check manual operation.** Connect control and recloser using the control cable. Connect the control battery. Connect the primary battery. Raise and lower yellow operating handle and confirm recloser operation via position indicator. The four-digit operations counter should count one operation. Lowering the yellow operating handle should change the control lock-out target from black to orange. Raising the yellow operating handle should change the control lock-out target from orange to black.
- 3. Perform high-potential withstand tests.** Prior to installing the NOVA<sup>1</sup> recloser, perform high-potential withstand tests. Refer to the **Testing** section of this manual for high-potential withstand test procedures. This test will help discover any shipping damage affecting the dielectric condition of the recloser or the vacuum integrity of the interrupter.

**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

- 4. Program the control.** All NOVA<sup>1</sup> electronic controls are carefully tested at the factory and shipped with plug-in TCC cards connected and ready for operation. Inspect the control and make sure that all TCC components are correct for the planned installation. Connect the 9 V control battery to the battery plug as shown in Figure 10. Connect the 60 V lithium primary battery as shown in Figure 10.

**Note:** The unit should not be stored or shipped with the batteries connected. Even if the recloser is not in service, connected batteries will still expend energy. Disconnect the batteries when the recloser is not in service.

Make sure that all DIP switch settings are set correctly and that the control cable is connected between the recloser and control.

**CAUTION:** Personal Injury. Bushings have sharp edges. Wear protective gloves when handling the unit. Failure to do so can result in cuts and abrasions. T258.0

**CAUTION:** Follow all locally approved safety practices when lifting and mounting the equipment. Use the lifting lugs provided. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in equipment damage. G106.2

- 5. Mount the recloser.** Use the lifting lugs located on the head casting and follow approved procedures.

For some applications, the head may be rotated in 90° increments to allow for various mounting arrangements. See Figures 4 and 5.

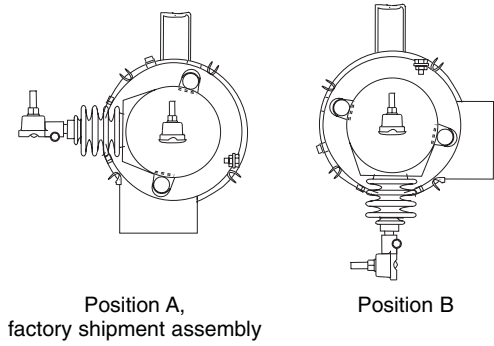
**Position A:** The recloser is shipped assembled in this position. **Position A can be used for all mounting applications.** See Figures 4 and 5.

**Position B:** The recloser head may be rotated to this position for mounting requirements. See Figures 4 and 5.

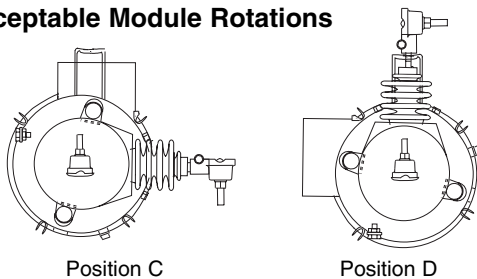
**Position B** can not be used for the middle position of the tri-mount, pole-mount hanger accessory. This location has arbor clearance limitations based upon the distance between the mounting pole and the arbor emplacement.

Follow all locally approved practices when determining the position of the recloser head.

**Acceptable Module Rotations**



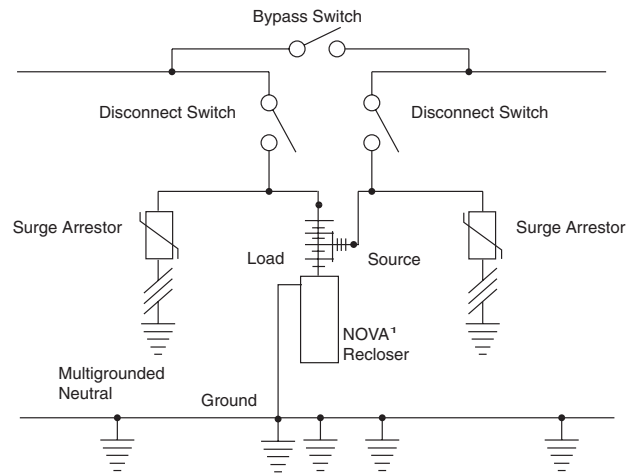
**Unacceptable Module Rotations**



**Figure 4.**  
Module rotations.

**WARNING:** Hazardous Voltage. Recloser and control must be solidly grounded. Follow all locally approved procedures and safety practices when grounding this equipment. Improper grounding can result in contact with high voltage, which will cause death or severe personal injury. G115.1

**6. Ground the recloser and the control.** Refer to Figure 7. Make ground connections to the recloser head ground connector. It will accommodate #10 to #2 stranded conductors. Ground the control using the ground connector provided at the bottom of the electronic control cabinet for connecting #8 to #2 stranded grounding cable to a suitable ground. Make ground connections in accordance with approved utility standards.



Recloser and control function is independent of the source and load connection.

**Figure 6.**  
Connection diagram shows complete surge protection and illustrates bypass and disconnect switches.

**7. Make the high-voltage line connections.** See Figure 6.

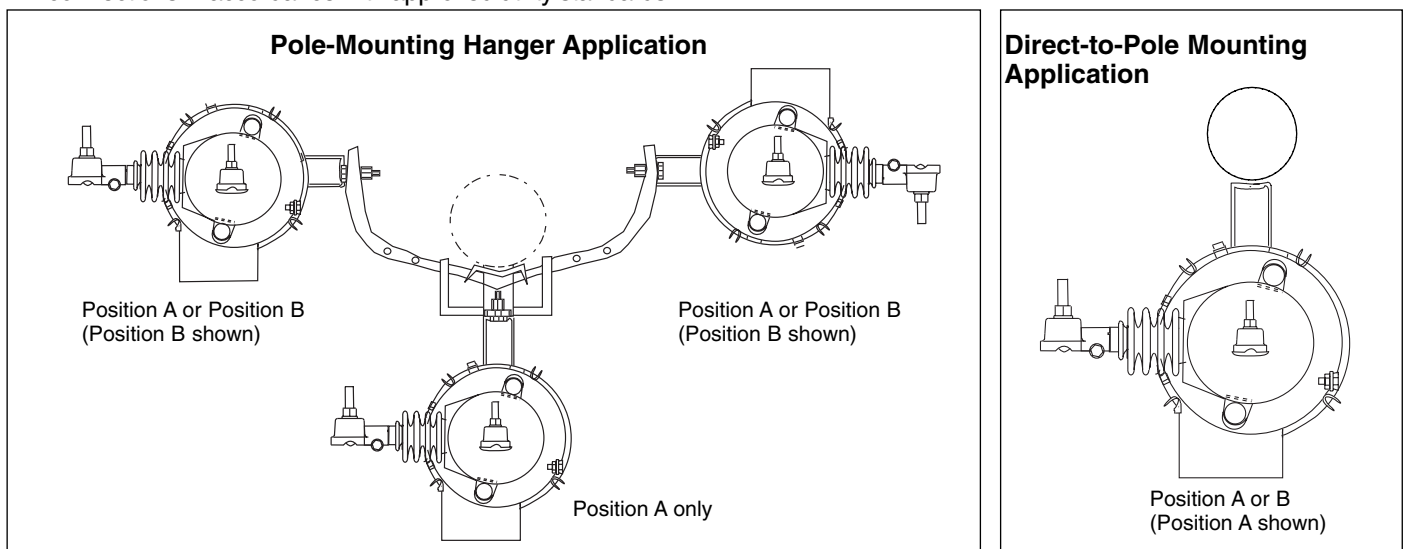
**Note:** Disconnect switches and bypass switches are recommended to facilitate switching and isolation.

**A.** Provide surge protection to both sides of the recloser.

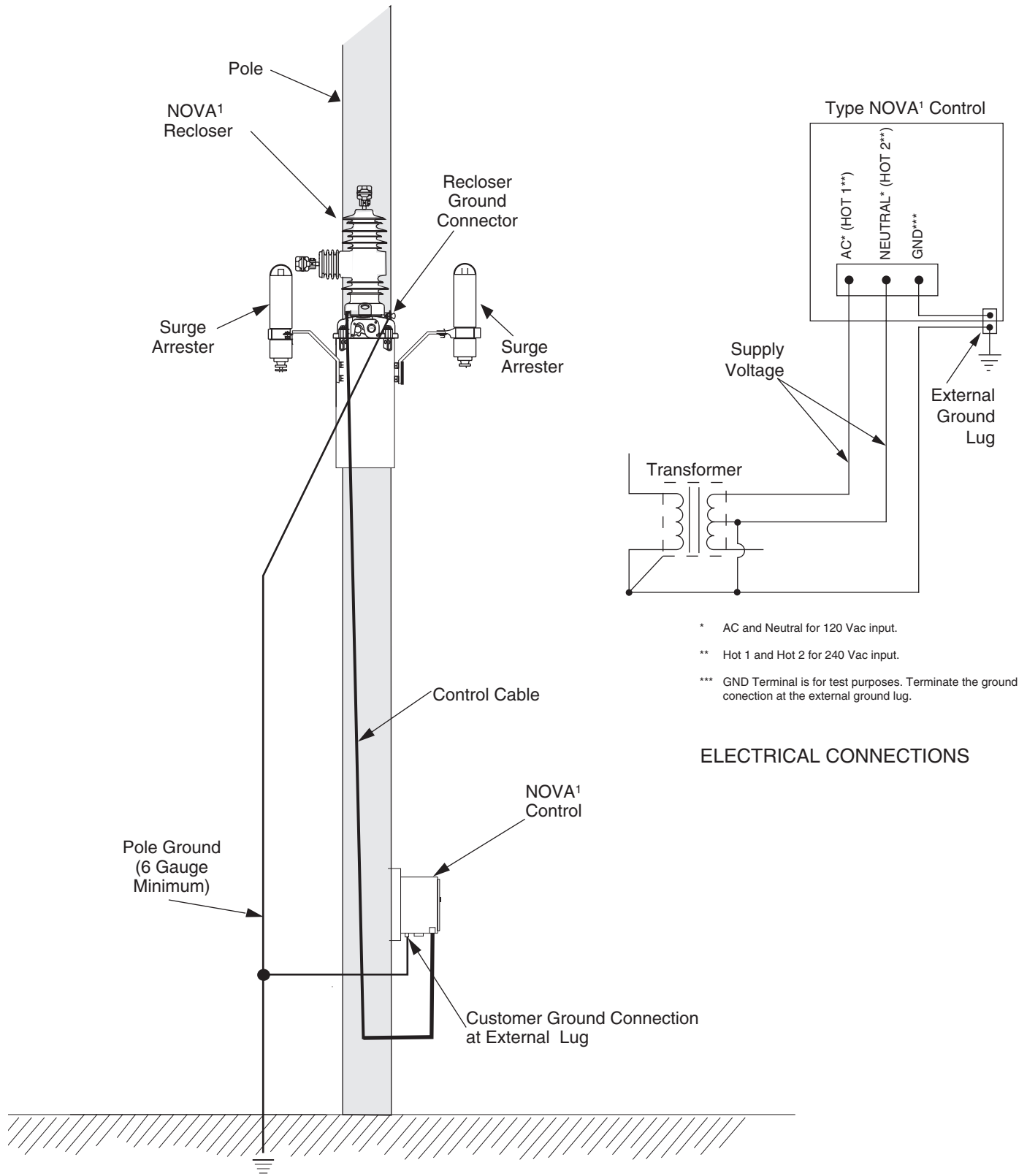
**CAUTION:** Equipment Damage. Do not adjust or rotate bushing terminals. The bushing terminals are factory-calibrated to meet the continuous current requirement of the switchgear. Adjusting or rotating the bushing terminals can damage the encapsulated interrupter resulting in equipment damage or personal injury. T270.0

**B.** Connect high-voltage lines to recloser bushing terminals.

Refer to the **Place the Recloser in Service** section of this manual for instructions on placing the recloser in service.



**Figure 5.**  
Rotation of Kyle Type NOVA<sup>1</sup> recloser head to comply with 90° mounting requirements.



**Figure 7.** Recommended grounding method for NOVA<sup>1</sup> single-phase, electronically controlled reclosers.



## Place the Recloser in Service

**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

Always follow locally approved procedures and safety practices when placing the recloser in service. Be sure that both the 9 V control backup battery and nominal 60 V primary battery are properly connected. When the control is connected, the recloser can be placed in service. Refer to the connection diagram in Figure 6.

**WARNING:** Hazardous Voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury.

G108.1

**IMPORTANT:** The recloser and control must be synchronized before placing the control into service. Failure to do so could result in the lockout target and/or the SCADA lockout status indicator being in the wrong state.

1. Move the yellow manual operating handle under the sleet hood to the OPEN (down) position.
2. Close the source and load disconnect switches.
3. Move the yellow manual operating handle under the sleet hood to the CLOSE (up) position.

This resets the control and synchronizes the control to the recloser. The recloser should immediately close. The recloser contact indicator should read CLOSED and the control target indicator should be black.

4. Open the bypass switch. The recloser is now in service.

## Input Receptacle for Backup Power Supply Accessory

The factory-installed backup power supply accessory may be ordered with a three-pin receptacle accessory for connecting ac power to the NOVA<sup>1</sup> control, see Figure 10. The power supply input voltage selector switch (120 Vac or 240 Vac) must be in the correct position, see Figure 17.

The three-pin receptacle accessory simplifies installation and removal of the control. The ac power is supplied between Pin A (Hot 1) and Pin B (Neutral or Hot 2). For field installations, the PT ground connection to the control must be made only at the external ground lug. (Pin C connects to chassis ground for bench testing only.) See Figure 7.

When the Backup Power Supply accessory operates to trip the recloser with a weak battery, the target indicator of the control will be black while the recloser contact indicator reads OPEN. This indicates that the 60 V primary battery has lost sufficient charge to trip the recloser and should be tested. Refer to the **Backup Power Supply Accessory Battery Test** section of this manual.

## Remove the Recloser from Service

**WARNING:** Hazardous Voltage. Do not rely on the open position of the yellow operating handle or the contact position indicator; it does not ensure that the line has been de-energized. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury.

G114.1

**WARNING:** Hazardous Voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury.

G108.1

1. Close the bypass switch.
2. Pull down the yellow operating handle with a hotstick. The yellow operating handle is located under the recloser sleet hood.
3. The control will sense that the recloser is open and provide lockout indication.
4. Open the source and load disconnect switches.
5. Remove high-voltage connections from recloser.

**WARNING:** Hazardous Voltage. If the recloser is energized while the control cable is disconnected, the CT secondaries can generate high voltages. Contact with high voltage can cause severe personal injury or death.

T204.2

6. Remove control cables, power cables, and ground leads from recloser.
 

**Note:** Disconnecting the control cable on an energized recloser will not damage the internal CTs.
7. Follow standard utility procedures regarding removal of recloser from service.

## Remove the Control from Service

1. Disconnect the batteries in the control box.
2. For controls with the Backup Power Supply Accessory, remove the ac power connections.

**IMPORTANT:** Remove ac power connection to isolate the NOVA<sup>1</sup> Control for testing and servicing.

**WARNING:** Hazardous Voltage. If the recloser is energized while the control cable is disconnected, the CT secondaries can generate high voltages. Contact with high voltage can cause severe personal injury or death.

T204.2

3. Disconnect control cable from control.
  4. Disconnect the ground from the control.
- Note:** The unit should not be stored or shipped with the batteries connected. Even if the recloser is not in service, connected batteries will still expend energy. Disconnect the batteries when the recloser is not in service.

## RECLOSER OPERATION

**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:** Hazardous voltage. Do not rely on the open position of the yellow operating handle or the contact position indicator; it does not ensure that the line has been de-energized. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury.

G114.1

The NOVA<sup>1</sup> recloser senses line current and automatically interrupts the phase of the distribution circuit to which it is connected when line current exceeds the minimum trip level. Next, it automatically recloses to restore service and monitors the line to determine if the fault has been cleared. If the fault is permanent, the recloser sequences to lockout after one, two, three, or four preset trip operations. Once the recloser sequences to lockout, the recloser must be manually reset to restore service.

**Note:** The recloser can be reset remotely if equipped with the SCADA Input/Output accessory board, via the remote close feature.

Should the fault clear before lockout, the recloser will reset automatically for another sequence of operations. The recloser can also be set for non-reclosing operation (lock out after the first trip operation) with a manually operated, external non-reclosing lever. The recloser can be remotely set for non-reclosing operation if equipped with the SCADA Input/Output accessory board, via the remote non-reclosing feature. The trip operations of the recloser can be all fast, all delayed, or any combination of fast operations and delayed operations up to a maximum total of four. Fast operations clear temporary faults before branch line fuses are weakened. Delayed operations allow time for fuses or other downline protective devices to clear to limit permanent faults to the smallest section of line.

The NOVA<sup>1</sup> recloser control uses solid-state electronics to provide accurate, reliable, and flexible overcurrent sensing and trip timing. The electronic circuits are housed in a separate weatherproof cabinet and connected to the recloser with a control cable.

### Vacuum Interrupter

Arc interruption takes place within the sealed vacuum interrupter. Kyle vacuum interrupters employ axial-magnetic field contacts. Slots are machined into the contact support structure producing a magnetic field along the axis of the interrupter. This axial-magnetic field keeps the arc in an easier-to-interrupt diffuse mode, resulting in less power in the arc that needs to be dissipated, resulting in extended operating duty.

### Mechanism Tripping and Closing

A magnetic actuator provides fast, efficient latching. Two rare-earth neodymium magnets provide latching forces in excess of 136 kilograms (300 pounds), eliminating the need for mechanical latches.

While in the closed position, the magnetic fields established by the two magnets are coupled in the iron yoke assembly to provide latching forces for the movable plunger. The magnetic forces are concentrated at the yoke-plunger interface and provide the latching force required to keep the mechanism closed. The yoke also houses the trip and closing coils that provide the energy to operate the mechanism.

To open the main contacts, the trip coil is pulsed with electrical current that produces a magnetic field. The magnetic field, concentrated in the center of the coil, moves the plunger assembly toward the open position. As the plunger moves, the magnetic field strength increases as the air gap decreases, due to the difference in the relative permeability of free space and the ferrous yoke. Once in the open position, the permanent magnets re-establish the magnetic field to latch the unit open.

The control cabinet includes an 8.5 Ah (ampere-hour), nominal 60 V lithium battery required for tripping and closing of the recloser mechanism. A factory-installed backup power supply accessory will allow one trip operation with dead batteries.

### Electronic Control

**CAUTION:** Equipment misoperation. Do not energize this equipment until all control settings have been properly programmed and verified. Refer to the *Control Programming and Operation* section of this manual for programming procedures. Failure to comply can result in misoperation (unintended operation), equipment damage, and personal injury.

G118.1

The electronic circuits for programming operating sequence, minimum trip levels, time-current characteristics, and other parameters are located in a separate pad-lockable cabinet that can be mounted at any convenient accessible location, near or remote from the recloser.

## Current Sensing

Type NOVA<sup>1</sup> reclosers have a 1000:1-ratio current-sensing transformer. The CT is connected to the electronic control cabinet through the control cable. A solid-state CT protector circuit, inside the recloser tank, ahead of the cable disconnect, is connected to the current transformer.

## Control Power

No external power source is required to operate the electronics. Control power for the electronic circuitry is supplied by the sensing CT located in the recloser when a minimum of 5 A of line current is flowing through the recloser.

**CAUTION:** Fire. Explosion. Leakage. Severe burn hazard. Do not recharge or disassemble battery. Battery should not be exposed to temperatures about 175°F. Do not incinerate or expose the battery contents to water. Failure to comply can result in equipment damage and serious personal injury. T251.1

A minimum of 5 A of primary current flow is sufficient to power the electronics. If line current drops below 5 A or the control locks the recloser in the open position, a 9 V, 1.2 Ah (ampere-hour) lithium battery ensures proper control operation.

The 9 V, 1.2 Ah lithium Type NOVA<sup>1</sup> control battery is also required to close the recloser after a trip operation during a normal trip sequence.

A nominal 60 V, 8.5 Ah lithium battery is provided in the control cabinet to supply tripping and closing energy for the recloser mechanism.

Both the control and primary batteries use lithium technology. Refer to the **Frequency of Inspection** section of this manual for battery replacement recommendation. Refer to the **Battery Testing** section for proper battery level testing procedures.

Electronic control circuitry is centralized on a single printed circuit board. Simple DIP switch programmable control parameters, along with easily interchangeable TCC cards, increase application flexibility. Refer to the **Control Programming and Operation** section of this manual for further information.

The Type NOVA<sup>1</sup> control can be equipped with a SCADA input/output board accessory to provide remote operation and status functions for SCADA applications. A factory-installed backup power supply accessory will allow a trip operation with dead batteries. Refer to the **Accessories** section of this manual for additional information.

## Manual Operation of Energized Recloser

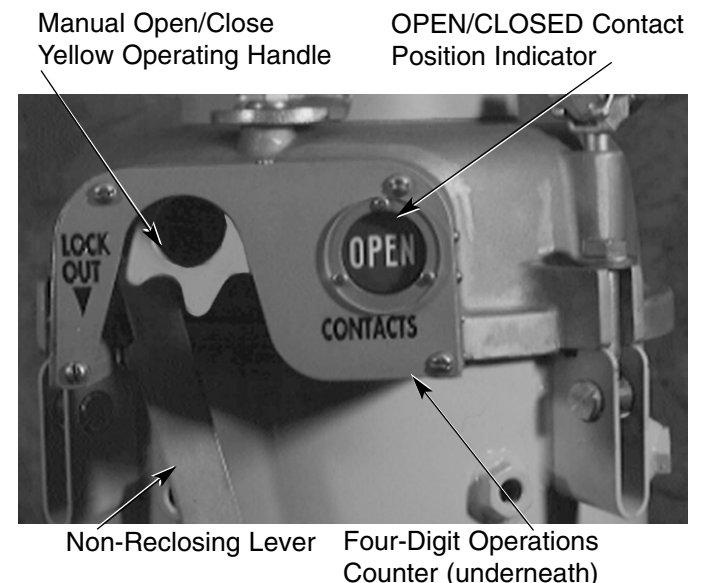
**WARNING:** Hazardous voltage. Do not rely on the open position of the yellow operating handle; it does not ensure that the line has been de-energized. Always establish a visible disconnect. Failure to follow proper safety practices can result in contact with high voltage, which will cause death or severe personal injury. G116.0

**WARNING:** Hazardous Voltage. Always use a hotstick when working with this equipment. Failure to do so could result in contact with high voltage, which will cause death or severe personal injury. G108.1

The manual operating handle is designed to be operated with a hotstick. See Figure 8. Pulling down the yellow handle trips and locks open the main contacts of the recloser. Contact position is indicated by the OPEN flag in the contact position indicator. The operating handle will remain in the down position (OPEN). *The yellow operating handle is never to be used as a substitute for establishing a visible disconnect during line work.*

**Note:** When the recloser electronically operates to lockout, the yellow manual operating handle will not drop down from under the sleet hood. The yellow operating handle remains in the down position only after a manual opening is performed.

When the NOVA<sup>1</sup> recloser is locked out, the unit is manually closed by pulling the yellow manual operating handle down and then returning the operating handle to its up (CLOSED) position. See Figure 8. If the NOVA<sup>1</sup> control is equipped with the SCADA input/output accessory board, the recloser can be remotely closed from lockout.



**Figure 8.** Kyle NOVA<sup>1</sup> single-phase, electronically controlled recloser operating levers and indicators. 99021KM

## Non-Reclosing Operation

When the non-reclosing lever has been manually pulled down into the non-reclosing position, any current over the minimum trip rating will cause the control to automatically lock open the recloser on the first trip operation instead of cycling through the normal operating sequence. The non-reclosing lever does not interfere with manual recloser operation or operation via a SCADA trip or close signal. The recloser can be opened or closed manually regardless of the position of the non-reclosing lever. See Figure 8.

## Contact Position Indicator

Located on the outboard side of the sleet hood, this indicator displays the word OPEN (Green) when the recloser contacts are open and CLOSED (Red) when the recloser contacts are closed. See Figure 8.

## Operations Counter

A four-digit mechanical counter, located under the sleet hood, records the recloser trip operations. See Figure 8.

## Trip and Close Capacitors

**WARNING:** Personal Injury. The trip and close capacitors retain an electrical charge. Always discharge the trip and close capacitors prior to performing any service on the mechanism. Contact with charged capacitors can result in a skin burn or electrical shock. T266.0

Trip and close capacitors, located within the mechanism, store the necessary energy for operating the recloser. While only the close capacitor energy is used for closing, both capacitors are used for opening, providing extra reserve capacity to trip the recloser. See Figure 9.

## Actuator Board

The actuator board, located within the mechanism, drives the mechanism based upon signals sent from the control. The actuator board manages the high-power path by providing precharge and discharge capabilities and provides the proper current pulses and timing to the mechanism. It also prevents closing when there is insufficient energy stored in the trip and close capacitors. See Figure 9.

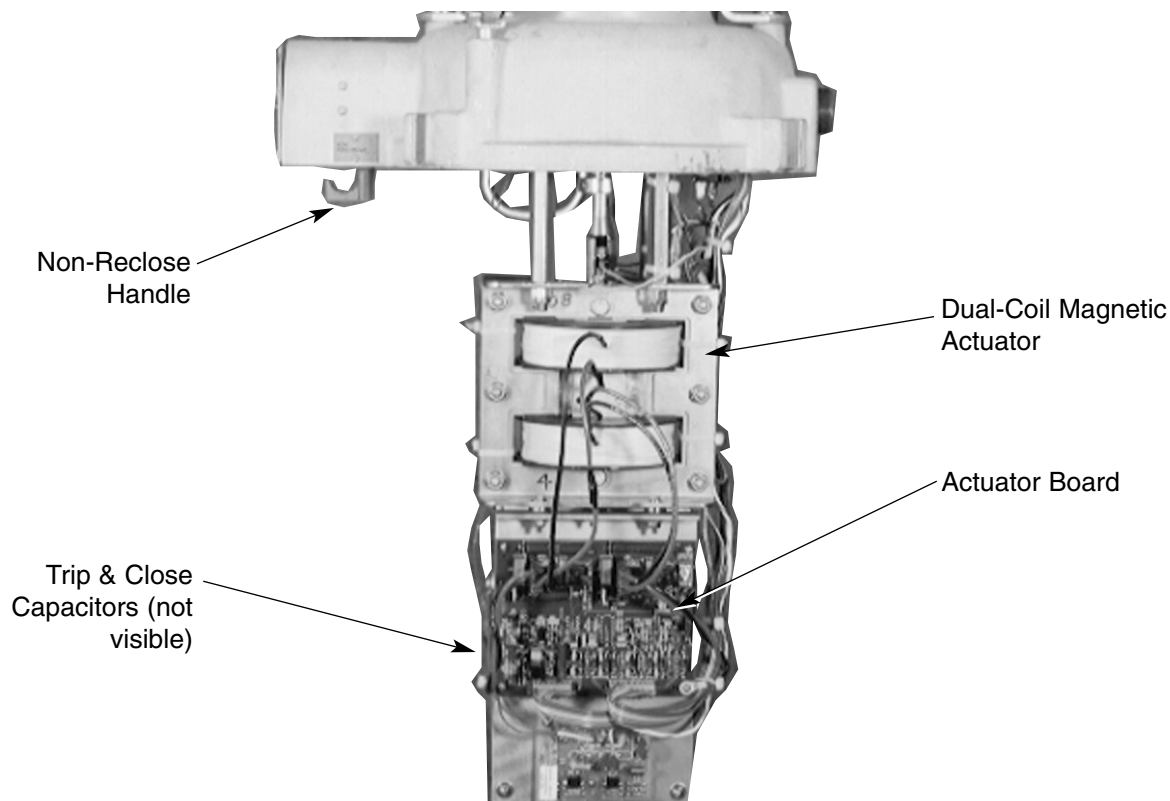
## Lockout Indication

Lockout is indicated by the lockout indicator located at the bottom of the control cabinet. A circular orange target is displayed when the control is in lockout. When the control is not in lockout, the target is black. See Figure 10.

**Note:** When the recloser is locked out via the control or SCADA, the yellow manual operating handle will not drop down from under the sleet hood.

## Automatic Operation

The NOVA<sup>1</sup> recloser, in the CLOSED position, operates automatically per the control-programmed settings.



99022KM

**Figure 9.** Kyle NOVA<sup>1</sup> single-phase, electronically controlled recloser mechanism view (untanked).

## CONTROL PROGRAMMING AND OPERATION

The Type NOVA<sup>1</sup> electronic control utilizes solid-state circuitry and provides the intelligence for current sensing, trip timing, and all other control functions. The control electronics and electronic accessories are located in an external weatherproof cabinet connected to the recloser with a control cable. Available in 5 ft. increments, the maximum control cable length is 80 ft.

### Programming the Control Settings

**CAUTION:** Equipment misoperation. Do not energize this equipment until all control settings have been properly programmed and verified. Refer to the *Control Programming and Operation* section of this manual for programming procedures. Failure to comply can result in misoperation (unintended operation), equipment damage, and personal injury. G118.1

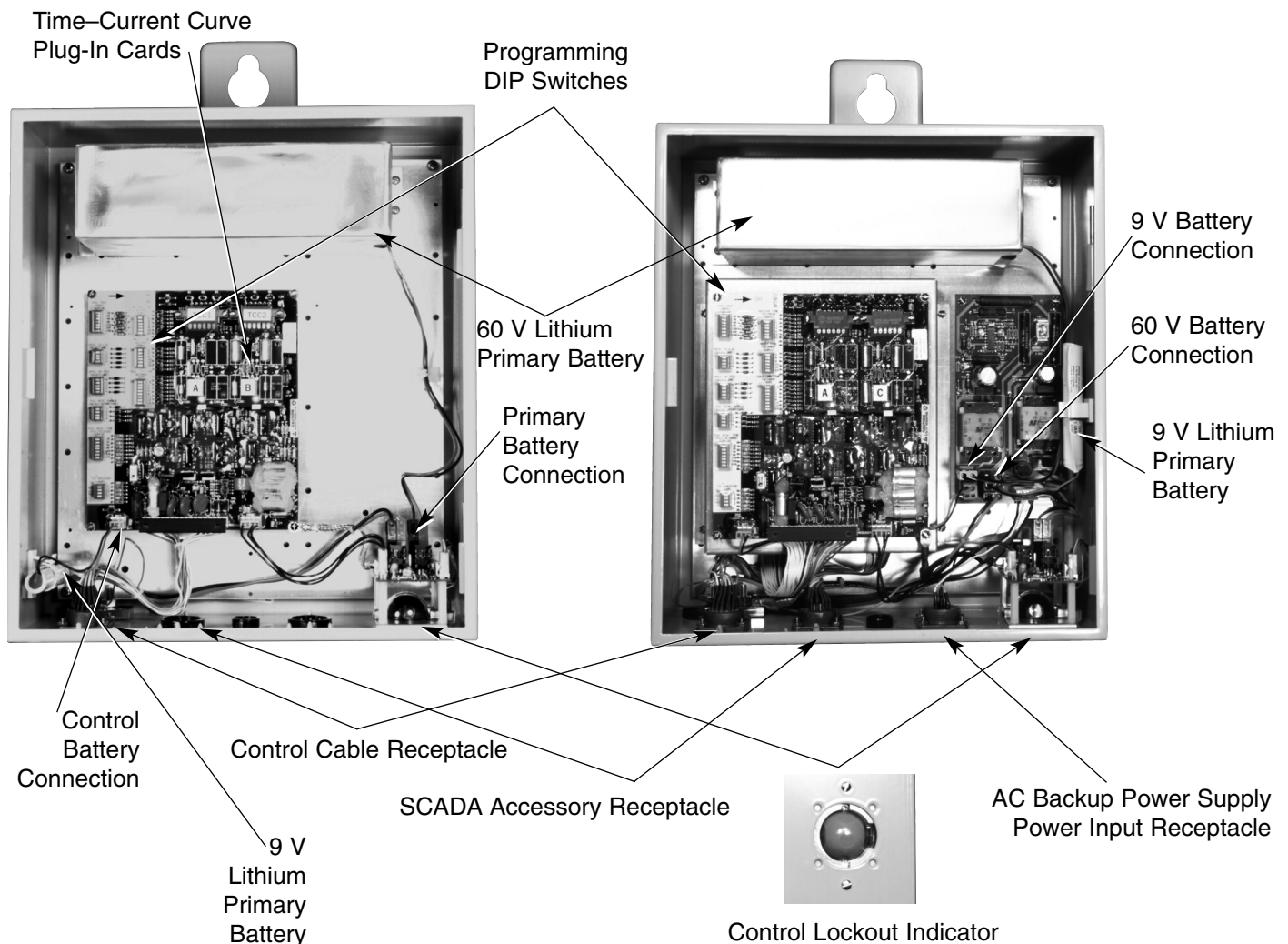
The control must be programmed with all necessary operating settings prior to operation with an energized recloser.

Changes in the control operating parameters should only be made by a qualified technician or engineer.

The DIP switches for programming the control are located on the left side of the control cabinet as shown in Figure 10.

### Sequence Coordination

Sequence coordination is always active in the NOVA<sup>1</sup> control. This feature prevents unnecessary operation of the backup recloser for a fault beyond a downline recloser. This is accomplished by advancing the control sequence one step when line current exceeds the programmed minimum trip value for a time duration shorter than the programmed control response time. This maintains trip coordination with a downline recloser while protecting fuses from temporary faults.



**Figure 10.** Kyle NOVA<sup>1</sup> single-phase recloser electronic controls, backup power supply accessory shown in control on right.

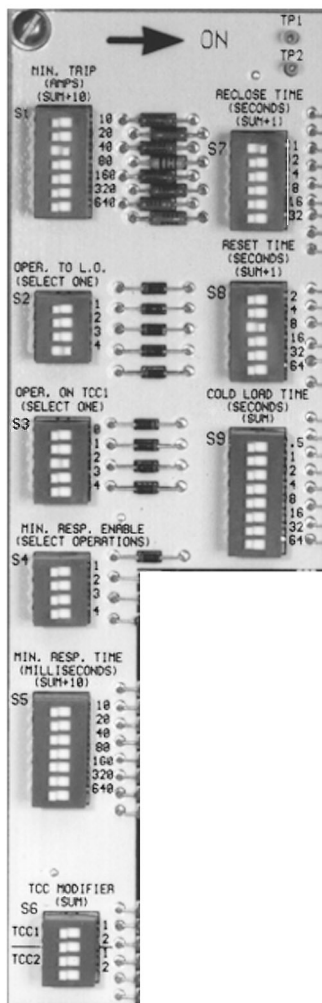
020095KM, 020085KM, 020086KM

## Minimum Trip Value

The minimum trip current rating for phase overcurrent is established by positioning DIP switches (labeled S1) in the control. See Figure 11. The minimum trip setting of the recloser can be changed by merely changing the DIP switch setting.

Minimum trip level can be programmed from 10 through 1280 A in 10 A increments. The programmed value equals the sum of the values of the switches in the ON position plus 10 A.

**Note:** To avoid inadvertent tripping of the recloser when changing minimum trip settings on an energized recloser, all the S1 switches must first be set to the ON position. Turn off the necessary switches to obtain the desired minimum trip value.



991119KM-2

**Figure 11.**  
Kyle NOVA<sup>1</sup> single-phase electronic control DIP switches.

## Operations to Lockout

The control can be set to provide 1, 2, 3, or 4 operations to lockout by positioning one of the DIP switches labeled S2 to the ON position. See Figure 11.

**Note:** If more than one switch is selected, only the lowest switch value will be enabled. If none are selected, the control defaults to 4 operations.

## Operations on TCC Number 1

The control can be set to provide 0, 1, 2, 3, or 4 operations on TCC1 by positioning one of the DIP switches labeled S3 to the ON position. See Figure 11. If none are selected, the control defaults to zero operations. If more than one switch is selected, all operations will be on TCC1.

## Minimum Response Time Enable

To achieve coordination of fault-interrupting devices, where fault levels would cause simultaneous tripping, the minimum response time function will inhibit tripping until a programmed time has elapsed. The minimum response time function can be enabled on operation 1, 2, 3, and/or 4 by selecting any of the desired DIP switches labeled S4. See Figure 11.

## Minimum Response Time Setting

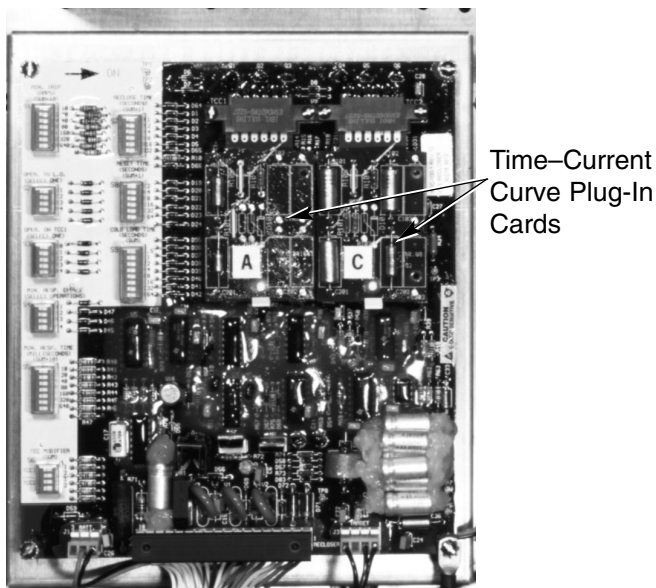
The minimum response time setting is established by positioning the DIP switches labeled S5. See Figure 11. Minimum response time can be programmed from 10 through 1280 milliseconds in 10 millisecond increments. The programmed time setting equals the sum of the values of the switches in the ON position plus 10 milliseconds. Minimum response settings are often used with sequence coordination to obtain trip coordination.

## Time–Current Curve Characteristics

The NOVA<sup>1</sup> time–current characteristic (TCC) curves are established by individual circuit cards that plug into the circuit board of the control. See Figure 12. Two TCC plug-in cards are required for proper operation.

The available plug-in, time–current characteristic curves and the TCC modifiers available for the electronic control enable the NOVA<sup>1</sup> to meet a wide variety of application requirements and simplify coordination with other protective devices in the distribution system. See *Reference Bulletin R280-91-16* for published time–current curve characteristics.

All timing starts at initiation of a fault or when closing into a fault. TCC circuit cards are interchangeable between sockets TCC1 and TCC2. However, fast curves are normally used in TCC1, and delayed response curves are normally used in TCC2.



**Figure 12.**  
Time–Current curve cards.

020085KM

## Time–Current Curve Modifiers

The DIP switches labeled S6 (see Figure 11) are used to modify the shape of the time–current curve produced by the TCC plug-in card for TCC1 and/or TCC2. Each TCC plug-in card can produce 4 curves (Unmodified, Mod 1, Mod 2, or Mod 3).

The TCC modifier is the sum of the values of the DIP switches. For example, TCC1 is unmodified when both DIP switches are in the OFF position. To modify TCC1 to obtain the Mod 3 modification, move TCC1 DIP switches 1 and 2 to the ON position.

## Reclose Time

The reclose time setting is established by positioning the DIP switches labeled S7. See Figure 11. Reclose time can be programmed from 1 through 64 seconds in 1 second increments. Programmed reclose time is the sum of the value of all DIP switches in the ON position plus 1 second. All reclose intervals use the identical reclose time.

## Reset Time

The reset time after successful reclose is established by positioning the DIP switches labeled S8. See Figure 11. Reset time can be programmed from 1 through 128 seconds in 1 second increments. Programmed reset time is the sum of the value of all DIP switches in the ON position plus 1 second.

## Cold-Load Pickup

After the recloser has been closed from lockout, either manually or remotely through SCADA, cold-load pickup will be active for the programmed time interval. During this interval, the control will be in the one-operation-to-lockout-mode, and overcurrent timing will be on time–current curve number 2. If no overcurrent is present during the programmed time interval, the control will be reset and the lockout indicator will flip from orange to black.

The cold-load pickup time setting is established by positioning the DIP switches labeled S9. See Figure 11. The cold-load pickup time can be programmed from 0 to 127.5 seconds in 0.5 second increments. Programmed cold-load pickup time is the sum of the value of all DIP switches in the ON position.

The circular control lockout indicator target will not reset until cold-load pickup program time has expired.

## Control Lockout Indicator

Control lockout is indicated by a lockout indicator located at the bottom of the control cabinet. A circular, orange target (shown in Figure 10) is displayed when the control is in lockout. When the control is not in lockout, the display is black.

**Note:** The control lockout indicator will not change status if cold-load pickup is active until the cold-load pickup time interval elapses.

The circular target is orange when the unit is in cold-load pickup.

## ACCESSORIES

### Backup Power Supply Accessory

The factory-installed 120/240 Vac input power supply accessory allows one trip operation with dead batteries (9 Vdc and 60 Vdc). The power supply is sufficient to charge the Trip/Close capacitors in the recloser to support one trip operation independent of battery health. It cannot support multiple recloser operations.

Supplying ac power removes the requirement to maintain a minimum of 5 A of line current to prevent the 9 V battery from discharging. This maximizes the battery life and allows the NOVA<sup>1</sup> recloser to be applied on lightly loaded feeders.

The Backup Power Supply accessory is a separate circuit board mounted in the control cabinet and is specified at the time of order for 120 Vac or 240 Vac. A 3-pin male receptacle can be specified for the control cabinet for user connections. A 2-wire cable with a 3-pin plug, with female pins, is available for transformer connection. A 2 m (6 ft) test cable for 120 Vac connections is also available for bench testing.

Included on the circuit board is surge suppression and incoming fuse(s) Type 181 rated 8 A at 240 Vac. The 8 A fuse is sized to prevent misoperation and can be used, along with removal of the batteries, to de-energize the control.

The power supply input voltage range is 80—160 Vac or 160—320 Vac, 50/60 Hz, depending on the position of the Input Voltage Selector Switch. See Figure 17. The required input current is less than 1 A, for either voltage range. Input power connects to J1-1 (Hot 1) and J1-2 (Hot 2/Neutral). A power system ground must connect to the external control cabinet ground. An amber AC Power LED indicator on the backup power supply circuit board will illuminate when ac is present, independent of the battery health.

The backup power supply accessory does not eliminate the need for the batteries; it only allows one trip operation with dead batteries. Batteries still must be replaced every six years. See the **Frequency of Inspection** section of this manual.

The time required to charge fully discharged trip and close capacitors without the 60 V battery is 10 minutes. A trip operation is always immediately available following any closing operation.

The Backup Power Supply accessory also provides battery testing of both the 60 V and 9 V batteries. Each battery has a battery test LED to verify the battery performance. The batteries may be tested with or without ac voltage applied, as the ac voltage will not affect the results. When the Backup Power Supply accessory operates to trip the recloser, the target indicator of the control can be black while the recloser contact indicator reads OPEN. This indicates that the 60 V battery has lost sufficient charge to trip the recloser and should be tested. Refer to the **Backup Power Supply Accessory Battery Test** section of this manual.

**TABLE 5**  
Auxiliary Switch Interrupting Ratings

Volts	Inductive ac (Amps)	Non-Inductive ac (Amps)	Inductive dc (Amps)	Non-Inductive dc (Amps)
24	—	—	15.0	20.0
48	—	—	7.5	10.0
120	60	80	—	—
125	—	—	1.5	2.0
240	30	60	—	—
250	—	—	0.45	0.5

**TABLE 6**  
Auxiliary Switch Pin Contacts and Wire Colors

Pin	Color	Contact Type
A B	black white	a
C D	red green	b
E F	orange blue	a
G H	white/black red/black	b
J K	green/black orange/black	a
L M	blue/black black/white	b
N, P	unused	

### Auxiliary Switch

A three-stage auxiliary switch can be provided as an accessory. Each stage has two independent contacts that permit any desired combination of a and b contacts.

The switch contacts are insulated for 600 V and have a continuous current rating of 10 A. The interrupting ratings are shown in Table 5, and the cable wire colors and switch pin contacts are listed in Table 6.

### Bushing Terminal Options

NOVA<sup>1</sup> reclosers can be specified with eyebolt terminals (400 and 800 A), two-hole (630 A) and four-hole (800 A) flat-pad terminals, and stud-type terminals (800 A).

### Mounting Hangers

A pole-mounting hanger is available for pole-mounting installation of the NOVA<sup>1</sup> reclosers. A crossarm-mounting hanger is available for crossarm installation.

### Cable-Locking Sleeve

To prevent detachment of the control cable from the NOVA<sup>1</sup> control cabinet by unauthorized personnel, a cable-locking sleeve is available to enclose the cable plug. The plug is passed through the sleeve, and the sleeve is then fastened from inside the control cabinet. There is no access to the cable receptacle without opening the locked cabinet door and detaching the sleeve.



## SCADA Input/Output Board

A factory-installed SCADA input/output circuit board accessory is available for the NOVA<sup>1</sup> control to provide remote operation capabilities. The SCADA I/O board also includes dry contacts to provide remote status information.

All remote features are accessed through a 19-pin receptacle (Type MS 22-14 female) mounted on the bottom of the control cabinet. See Figure 10. Remote operation capabilities are described below.

### Remote Lockout

Remote lockout provides the ability to trip and lock out the recloser from a remote signal. Operation requires a momentary contact closure of 0.1 second between pins D and B.

### Remote Close with Cold-Load Pickup

The remote close with cold-load pickup feature provides the control with the capability of being remotely closed from lockout by momentary contact closure (0.1 second) between pins E and B.

Cold-load pickup is active for a programmable time as set on the DIP switch labeled S9, during which the control will be in the one-operation-to-lockout mode and overcurrent time will be on TCC2. If no overcurrent is present during this interval, the control will reset to the programmed operating sequence.

### Remote Non-Reclose

Remote non-reclose provides the ability to remotely place the control in the non-reclose mode by momentary contact closure (0.1 second) between pins F and B.

### Recloser Open/Close Status Indicator

The recloser status indicator provides a dry contact (SPDT rated 1 A at 28 Vdc) to indicate open or closed status of the recloser contacts. Contact closure occurs between pins H and K when the recloser is closed.

### Remote Lockout Status

The remote lockout status feature provides an open contact between pins L and K when the control is not locked out and a closed contact between pins M and K when the control is locked out. Contacts are rated 1 A at 30 Vdc.

### Remote Non-Reclose Status

The remote non-reclose status indicator provides a closed contact (rated 1 A at 28 Vdc) to indicate when the recloser is in the normal reclosing mode. Contact closure occurs between pins J and K when the recloser is in the reclose mode.

### Remote Analog Current Monitor

The remote analog current monitor provides a 0 to 0.5 mA dc signal corresponding to 0 to 500 A of line current between pins C (+) and B (-). The factory calibration point is set at 35 A with a 2.5 k $\Omega$  resistor across the output with accuracy of  $\pm 10\%$  from 15 to 400 A.

## TESTING

### Testing Recloser Operation

Type NOVA<sup>1</sup> reclosers are carefully tested and adjusted at the factory to operate according to the published data. Well-equipped test facilities, a detailed testing procedure, and trained personnel assure accurate calibration. As a result, each recloser leaves the factory ready for installation. However, should verification of recloser operation be desired, the following characteristics can be checked:

- Dielectric integrity of the recloser
- Minimum trip current
- Operations sequence of the recloser and control

The test results should agree with the settings programmed in the control. The recloser can be test-tripped with a low-voltage ac source.

### Test Equipment Required

The following equipment is required for these tests:

- Variable autotransformer – 120 V, 10 A.
- 600:5 BCT – Slip-on type bushing current transformer, set on the 600:5 tap.
- Ammeter – Must have a rating based on the level of the test current. Since the control responds to peak current, it is recommended that metering responsive to peak current be used when wave distortion is a problem.
- High-voltage test set – Must be capable of supplying suitable voltages for determining the dielectric withstand capability of the recloser. Sensitive circuit breakers should be included to prevent damage in the event of a flashover.

## High-Potential Withstand Tests

**WARNING:** Hazardous Voltage. The switchgear and high voltage transformer must be in a test cage or similar protective device to prevent accidental contact with the high voltage parts. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T221.3

**CAUTION:** Radiation. At voltages up to the specified test voltages, the radiation emitted by the vacuum interrupter is negligible. However, above these voltages, radiation injurious to personnel can be emitted. See *Service Information S280-90-1, Vacuum Interrupter Withstand Test Voltage Ratings Information* for further information. G109.2

Use the following procedures to perform high-potential withstand tests at 75% of the rated low-frequency withstand voltage for 60 seconds. See Table 7 for test voltages and Figure 13 for test connection diagrams.

**TABLE 7**  
Type NOVA<sup>1</sup> Single-Phase Recloser Withstand Test Voltage Ratings Information

75% of Rated Low-Frequency Withstand Voltage (1 minute dry) (kV rms)		
Description	ac	dc
NOVA <sup>1</sup> -15	37.5	53.0
NOVA <sup>1</sup> -27	45.0	63.6

### Closed-Contacts High-Potential Test

1. Close the recloser contacts.
2. Ground the recloser using the grounding lug on the head casting.
3. Apply the proper test voltage to one of the bushing terminals.
4. The recloser should withstand the test voltage for 60 seconds.

### Open-Contacts High-Potential Test

1. Open the recloser contacts.
2. Ground the recloser using the grounding lug on the head casting.
3. Ground the bushing terminal on one side of the recloser.
4. Apply the proper test voltage to the ungrounded bushing terminal.

5. The recloser should withstand the test voltage for 60 seconds.
6. Reverse the test and ground connections on the bushing terminals.
7. Apply the proper test voltage to the ungrounded bushing terminal.
8. The recloser should withstand the test voltage for 60 seconds.

### Withstand Test Results

The high-potential withstand tests provide information on the dielectric condition of the recloser and the vacuum integrity of the interrupter.

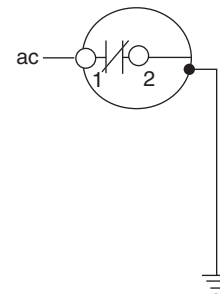
If the recloser passes the closed-contacts test and fails the open-contacts test, the cause is likely to be in the interrupter assembly.

If the recloser fails the closed-contacts test, the cause is likely to be a diminished electrical clearance or failed insulation.

If the recloser does not pass either the Open or Closed Contacts High-Potential Test, contact an authorized service center or your Cooper Power Systems Representative.

Closed Contacts High-Potential Insulation Level Withstand Test

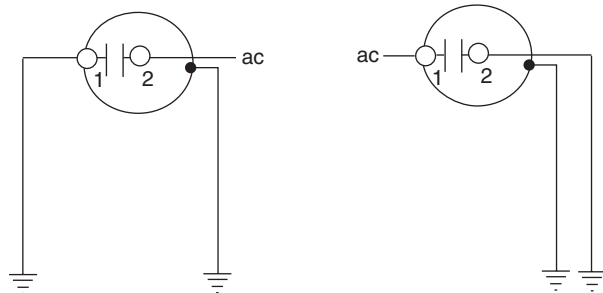
Phase to Ground



Open Contacts High-Potential Insulation Level Withstand Test

Open Contact

Open Contact

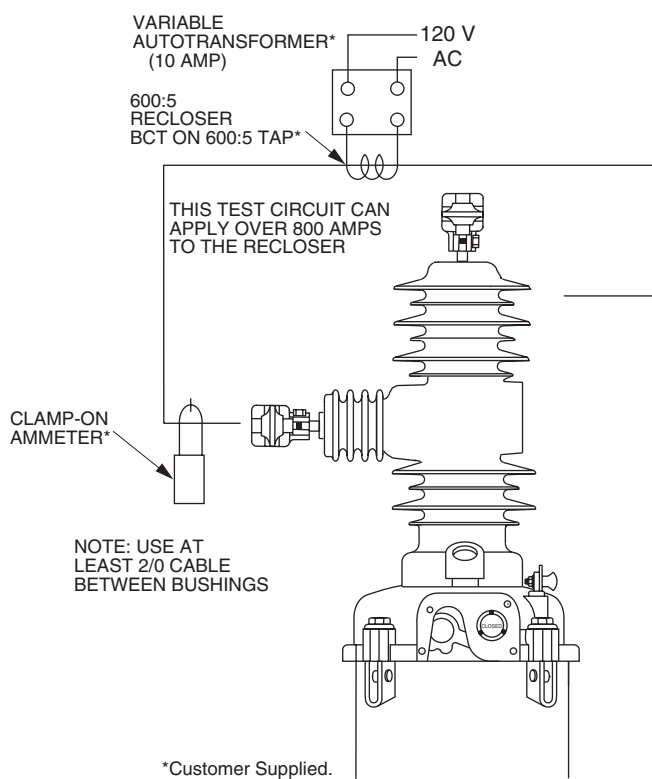


**Figure 13.**  
Connection diagrams for high-potential withstand testing.

## Minimum Trip Current Level Test

The minimum trip current can be checked by closing the recloser while it is de-energized and then tripping the recloser with the low-voltage ac source. Assemble and connect the low-voltage test portion of the setup shown in Figure 14 and proceed as follows:

1. Close the recloser contacts.
2. Connect the low-voltage test leads to the recloser bushings as shown in Figure 14.
3. Slowly increase the variable autotransformer voltage from zero, note the ammeter reading when the recloser trips, and compare to the programmed minimum trip value of the NOVA<sup>1</sup>.



**Figure 14.**  
Suggested test diagram for minimum trip testing.

## Sequence of Operation Test

The operating sequence can be checked by closing the recloser while it is de-energized and then tripping the recloser with the low-voltage ac source.

1. Check the number of programmed fast and delayed operations by observing the NOVA<sup>1</sup> control DIP switch setting for Operations to Lockout (labeled S2) and the number of TCC1 fast operations programmed on DIP switches labeled S3.
2. Assemble and connect the low-voltage test portion of the setup shown in Figure 14 and proceed as follows:
  - A. Close the recloser contacts.
  - B. Connect the low-voltage test leads to the recloser bushing terminals as shown in Figure 14.
  - C. Using the customer supplied variable autotransformer, apply a test current above the minimum trip level to trip the recloser.
3. Repeat Step 2 until the recloser locks out, which is indicated by the orange control lockout indicator target on the bottom of the control cabinet.

## Test Results

Note the number of fast and delayed operations to lockout and compare these numbers to the programmed values.

## Control

Refer to the **Remove Control from Service** section of this manual when removing the control from service for testing.

Control power for the electronic circuitry is supplied by the sensing CT located in the recloser when a minimum of 5 A of line current is flowing through the recloser. A green LED on the control circuit board illuminates when the control is powered off line current, not the battery. Refer to Figure 17.

## Backup Power Supply Accessory

The ac power is supplied between Pin A (Hot 1) and Pin B (Neutral or Hot 2). Pin C connects to chassis ground, used only during bench testing. See the **Backup Power Supply Accessory Battery Test** section of this manual.

## SERVICE INFORMATION

### Service Requirements

The Kyle Type NOVA<sup>1</sup> recloser has been designed with a minimum mechanical life of 2500 operations. The NOVA<sup>1</sup> recloser requires minimal routine inspection to check for physical damage and verify proper operation.

It should not be necessary to access the mechanism of the NOVA<sup>1</sup> recloser. If entry is required, the trip and close capacitors must be discharged prior to any contact with the mechanism. The capacitors retain an electrical charge even with the control cable disconnected.

**WARNING:** Personal Injury. The trip and close capacitors retain an electrical charge. Always discharge the trip and close capacitors prior to performing any service on the mechanism. Contact with charged capacitors can result in skin burn or electrical shock.

T266.0

### Discharge Trip and Close Capacitors

To discharge the trip and close capacitors:

1. Remove the recloser from service. Refer to the **To Remove the Recloser from Service** section of this manual.

**CAUTION:** Equipment damage. Always unplug the control cable from the control prior to discharging the capacitors. Failure to do so can result in resistor damage.

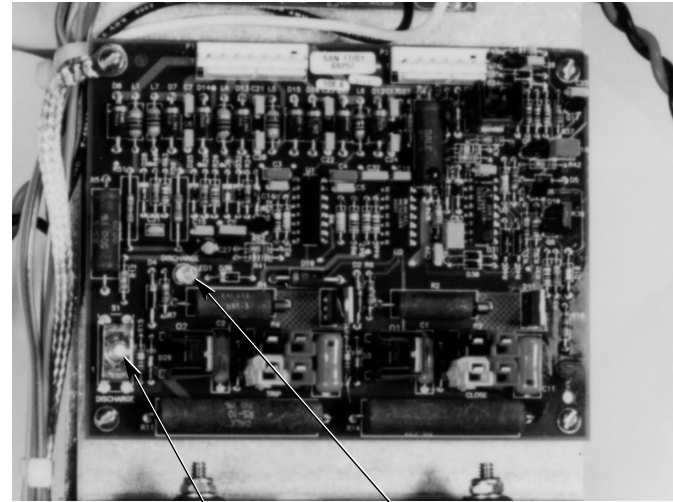
T267.0

2. Unplug the control cable from the control.

**CAUTION:** Follow all locally approved safety practices when lifting and mounting the equipment. Use the lifting lugs provided. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in equipment damage.

G106.2

3. Loosen bolts that secure head casting and remove mechanism from tank.
4. Locate the white Discharge button on the actuator board. See Figure 15.



Discharge LED Discharge Button

020050KM

**Figure 15.**  
Location of white discharge button on actuator board.

5. Push and hold in the discharge button. The discharge LED will light up and gradually dim as capacitor energy is discharged. This will take approximately 45 to 60 seconds.
6. When the light completely dims, release the button.
7. The capacitors are now discharged.

**Note:** After approximately twenty minutes, the discharged capacitors may have recharged up to 7 V. If this occurs, the discharge LED will light up if the discharge button is pushed.


### Frequency of Inspection

Because these reclosers are applied under widely varying operating and climatic conditions, service intervals are best determined by the user based on actual operating experience. However, NOVA<sup>1</sup> reclosers should be visually inspected every six years.

**IMPORTANT:** Both the 9 V and 60 V lithium batteries must be replaced every six years, regardless of the results of the battery test.

- When the 9 V battery is depleted, the control will still issue a trip signal to clear the fault, but the control will not issue a reclose signal to the recloser mechanism.
- When the 60 V battery is depleted, the control will still issue a signal to the recloser mechanism, but the mechanism will not respond to the signal.

## Battery Replacement

 **CAUTION:** Fire. Explosion. Leakage. Severe burn hazard. Do not recharge or disassemble battery. Battery should not be exposed to temperatures above 175°F. Do not incinerate or expose the battery contents to water. Failure to comply can result in equipment damage and serious personal injury. T251.1

It is recommended that both the 9 V and 60 V batteries be replaced every six years.

The 9 V battery should also be replaced if total accumulated time without line current reaches 100 days (50 days with SCADA). This limitation is negated with the backup power supply accessory.

The lithium technology provides consistent operating power throughout a wide range of temperatures and does not require external charging circuits. The battery maintains consistent voltage throughout its recommended usage.

*The recommended procedure is to base battery replacement on a time interval (six years), rather than on regular battery testing.*

Battery testing can still be performed if desired. See the **Battery Testing** section of this manual.

**IMPORTANT:** Disconnect switches and bypass switches are recommended to facilitate switching and isolation during battery maintenance. Follow standard utility procedures regarding replacement of batteries.

Refer to the **Remove Control from Service** section of this manual before performing battery maintenance.

## Battery Testing (standard unit)

Battery testing is only recommended during the following conditions:

1. If the batteries are less than six years old and the recloser will not open or close.
2. If the batteries were inadvertently left connected while the recloser was not in service.

**Note:** Should battery testing be utilized, each test will further drain the battery.

**IMPORTANT:** Both the 9 V and 60 V lithium batteries must be replaced at least every six years, regardless of the results of the battery test.

- When the 9 V battery is depleted, the control will still issue a trip signal to clear the fault, but the control will not issue a reclose signal to the recloser mechanism.
- When the 60 V battery is depleted, the control will still issue a signal to the recloser mechanism, but the mechanism will not respond to the signal.

## Battery Test Equipment Required

The following equipment is required for this test:

Voltmeter – Must be capable of measuring up to 100 Vdc.

Resistor - The wattage rating for each *Battery Testing Procedure* is as follows:

- 60 V Primary Battery - 25 W minimum rating
- 9 V Control Battery - 0.25 W minimum rating

## Battery Testing Procedure for the 60 V Primary Battery

1. Disconnect the battery at the primary battery connector.
2. Connect clip leads to voltmeter across resistor. See Figure 16.
3. Turn voltmeter on.
4. Set voltmeter to a 100 V scale.

**IMPORTANT:** To prevent resistor overheating and damage

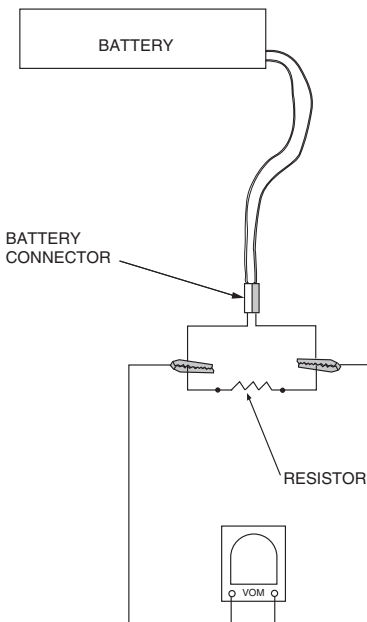
- Do not energize resistor for more than three seconds.
- A resistor with a minimum 25 W rating must be used for the primary battery test.

**CAUTION:** Excessive Heat. Do not leave the resistor connected to the battery connector for more than three seconds. Resistor can generate excessive heat when energized for more than three seconds. Contact with the energized resistor can result in skin burns.

T268.1

**5. Step 5 should be performed for no more than three seconds.** Carefully connect resistor across battery connection. Do not allow ends to touch. Verify that the voltage does not drop below 45.0 Vdc with a 300  $\Omega$ , 25 W load applied across battery connection. See Figure 16. Disconnect resistor from battery connection.

6. Record voltage.
7. Turn voltmeter off.
8. If the battery voltage drops below 45.0 Vdc during the test, replace the battery.



**Figure 16.**  
Suggested test diagram for battery testing.

## Battery Testing Procedure for the 9 V Control Backup Battery

1. Disconnect the battery from the circuit board.
2. Connect clip leads to voltmeter across resistor. See Figure 16.
3. Turn voltmeter on.
4. Set voltmeter to a 100 V scale.
5. Carefully connect resistor across battery connection. Do not allow ends to touch. See Figure 16.
6. Measure and verify at least 7.8 Vdc (see note) across the battery with a 600  $\Omega$ , 0.25 W load applied across the battery for **one second**.

**Note:** Acceptable battery voltage levels are dependent on the temperature.

If the battery is at room temperature, the voltage should be at least 7.8 Vdc.

For temperatures above 20°C, add 0.016 V for each degree above 20°C.

For temperatures below 20°C, subtract 0.016 V for each degree below 20°C.

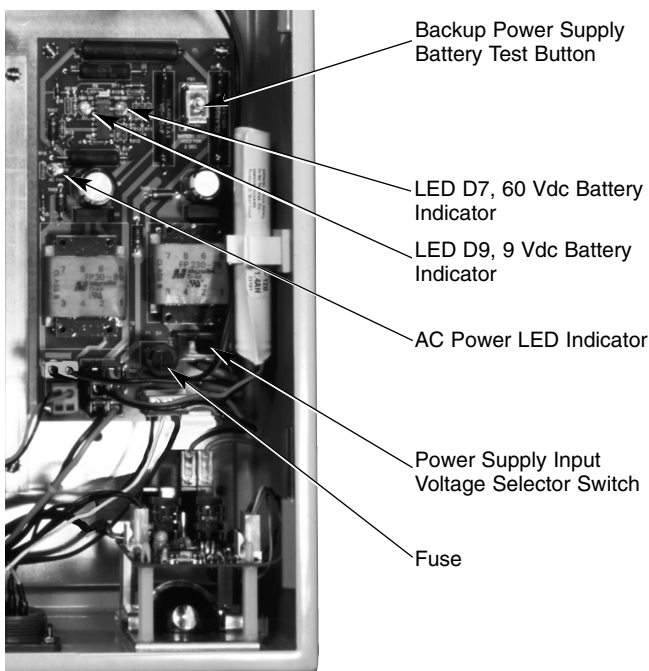
7. Disconnect resistor.
8. Record voltage.
9. Turn voltmeter off.
10. If the battery voltage is not within the specified range, replace the battery.

## Backup Power Supply Accessory Battery Test

The factory-installed Backup Power Supply accessory allows a battery test function to test the 60 Vdc and the 9 Vdc batteries. See Figure 17.

A power system ground must connect to the external control cabinet ground. A 2 m (6 ft) test cable for 120 Vac connections is available. An amber AC Power LED indicator on the backup power supply circuit board will illuminate when ac is present, independent of the battery health. An 8 A fuse, sized to prevent misoperation, can be used, along with removal of the batteries, to de-energize the control.

To test the batteries, press the battery-test button, on the backup power supply circuit board, for 3 seconds. A resistive load will be placed across the batteries and the battery voltage will be checked. Each battery has a corresponding green LED that will light if the battery is good: LED D7 for the 60 V battery and LED D9 for the 9 V battery. The batteries can be connected and tested independently of each other and the ac source.



**Figure 17.**  
Backup Power Supply Battery Test

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## Inspection of NOVA<sup>1</sup> Module

If the NOVA<sup>1</sup> module was exposed to an external flashover, an inspection process is recommended to assure proper operation of the switch. Should the NOVA<sup>1</sup> exhibit external flashover attributes (carbon tracking or discoloration), the following procedure is recommended to restore the encapsulation back to its original condition:

1. Remove device from service.
2. Inspect module for damage to the terminals. Remove any damaged terminals and replace.
3. Inspect module for damage to the module rods. If there is damage to the module rods, the module must be replaced.
4. Verify through careful inspection that there is no damage to the tank or head casting that could inhibit proper operation.
5. Clean the damaged module with isopropyl alcohol and a scratch-free, nylon scouring pad to remove any carbon deposit.
6. With a clean rag, apply a thin coat of dielectric silicone grease to the cleaned areas.
7. Confirm the dielectric strength of the module by performing high-potential withstand testing. Confirm both phase-to-ground and phase-to-phase conditions. See the **High-Potential Withstand Testing** section of this manual.

## Troubleshooting

If the Type NOVA<sup>1</sup> recloser does not perform as described in the **Recloser Operation** section of this manual, the following information may assist in troubleshooting:

### Unit Will Not Close

- Make sure the yellow manual operating handle is completely up.
- Check all cables for proper connection.
- Check battery levels. Refer to the **Battery Testing** section of this manual for proper battery level testing procedures.

### Unit Will Not Open

- Check all cables for proper connection.
- Verify that the control has both batteries connected and has the correct minimum trip setting.
- Check battery levels. Refer to the **Battery Testing** section of this manual for proper battery level testing procedures.



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