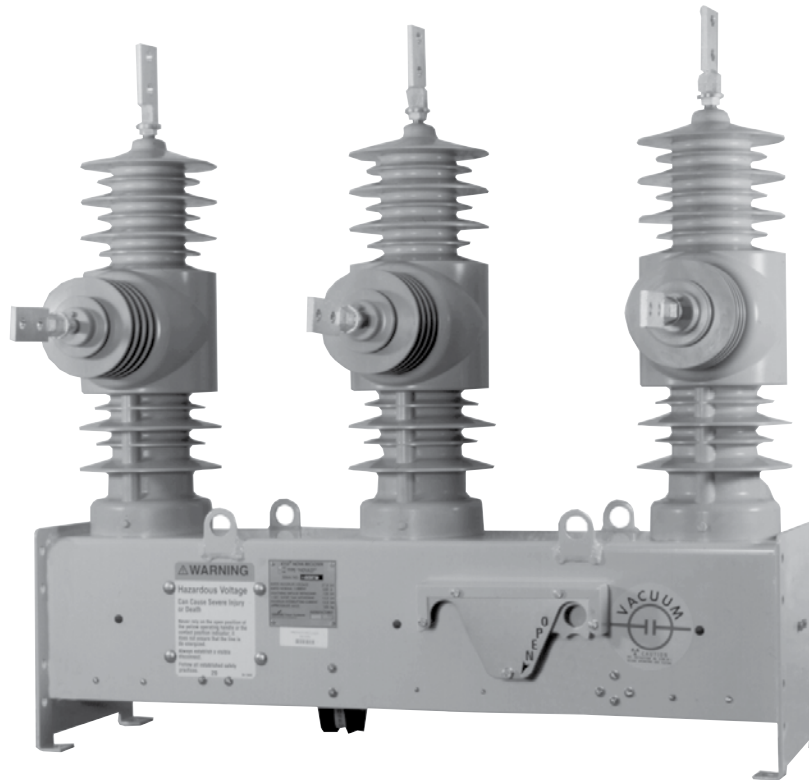


Types NOVA 15, NOVA 27, and NOVA 38; Three-Phase Microprocessor-Controlled; Installation and Operation Instructions

NOVA 15 for Serial Number CP571297544 and above

NOVA 27 for Serial Number CP571300976 and above

NOVA 38 for Serial Number CP571298286 and above



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Powering Business Worldwide

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Safety for life



Eaton meets or exceeds all applicable industry standards relating to product safety in its Cooper Power™ series products. 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 Eaton 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 arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, 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.

NOTICE

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 and transmission 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 and transmission equipment can result in death, severe personal injury, and equipment damage.

G122.2

WARNING

Overlapping zones of protection are required. Upstream protection device settings must provide adequate over-current protection in the event of a system or product failure. Failure to properly select appropriate upstream coordination protection can result in death, severe personal injury, and equipment damage.

G172.0

Product Information

Introduction

MN280092EN provides installation, operation, and service instructions for Eaton's Cooper Power series NOVA™ three-phase, microprocessor-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. This recloser is used in conjunction with Eaton's Cooper Power series microprocessor-based recloser control.

- If used with a Form 4C control, refer to Service Information S280-77-1.
- If used with a Form 4D Pole Mount control, refer to Service Information MN280049EN
- If used with a Form 5 control, refer to Service Information S280-79-10.
- If used with a Form 6 Rack Mount control, refer to Service Information MN280075EN
- If used with a Form 6 Yard Mount control, refer to Service Information MN280076EN
- If used with a Form 6 Pole Mount control, refer to Service Information MN280077EN
- If used with an FXB control, refer to Service Information S280-78-1.
- The NOVA recloser with Type A mechanism/control-powered interface is not compatible with the FXB control.
- The NOVA recloser is not compatible with the Form 2, Form 3, nor Form 3A controls.

Additional Information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton's Cooper Power series product 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. Refer to the Moving the Recloser and Lifting the Recloser sections. If the recloser is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Eaton recommends transporting Cooper Power series NOVA reclosers in the closed position to maximize the operational performance of the unit.

Standards

The Type NOVA reclosers are designed and tested in accordance with:

IEEE Standard C37.60-2003™

IEEE Standard C37.61-1973™

ANSI C37.85 - 2002

Quality Standards

ISO 9001 Certified Quality Management System

Description of Operation

The Type NOVA recloser is a three-phase, vacuum-interrupting recloser designed for electrical distribution systems through 34.5 kV. The NOVA recloser is designed and tested to be compatible with Eaton's Cooper Power series control types. The Type NOVA recloser is available with two configuration options: control-powered interface and auxiliary-powered interface.

The solid polymer insulation system does not rely on a gaseous, liquid, or foam dielectric. The NOVA recloser is highly resistant to ozone, oxygen, moisture, contamination, and ultraviolet light. The NOVA recloser has three solid-polymer interrupter modules, an embedded current transformer, and a standard aluminum mechanism housing. It is suitable for operation through a temperature range of -40°C to +55°C.

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, 3, and 4 list the ratings and specifications for the Type NOVA recloser. Table 5 lists the auxiliary-powered interface power requirements.

Table 1. Voltage Ratings

Description	15 kV	15 kV	27 kV	27 kV	38 kV
Maximum Voltage	15.5 kV	15.5 kV	27.0 kV	27.0 kV	38.0 kV
Rated Basic Impulse Level	110.0 kV	125.0 kV	125.0 kV	150.0 kV	170.0 kV*
Radio Noise Limit (μ v)	100 @ 9.4 kV	100 @ 9.4 kV	100 @ 16.4 kV	100 @ 16.4 kV	100 @ 23.0 kV
Power Frequency Withstand, Dry	50 kV	50 kV	60 kV	60 kV	70 kV
Power Frequency Withstand, Wet	45 kV	45 kV	50 kV	50 kV	60 kV

*170 kV beginning with S/N CP571192790; S/N 1000 through S/N CP571192789 are rated 150 kV BIL or less — as indicated on the nameplate.

Table 2. Current Ratings (Amperes)

Description	15 kV	15 kV	27 kV	27 kV	38 kV
Rated Continuous Current	630 A*	630 A*	630 A*	630 A*	630 A*
Short Circuit Current, Symmetrical	12.5 kA**	12.5 kA**	12.5 kA**	12.5 kA**	12.5 kA
Making Current, Asymmetrical Peak	32.0 kA	32.0 kA	32.0 kA	32.0 kA	32.0 kA
Cable Charging Current	10 A	10 A	25 A	25 A	40A

*800 amp accessory is also available.

**16.0 kA option is also available. (Making Current is 41.0 kA Asymmetrical Peak.)

Table 3. Mechanical Ratings

Description	15 kV	15 kV	27 kV	27 kV	38 kV
Min. Mechanical/Electrical Operations Without Maintenance (C-0)	10,000	10,000	10,000	10,000	10,000
Mass (Weight) - kg (lbs)	86 (190)	91 (200)	91 (200)	101 (223)	101 (223)

Table 4. Duty Cycle

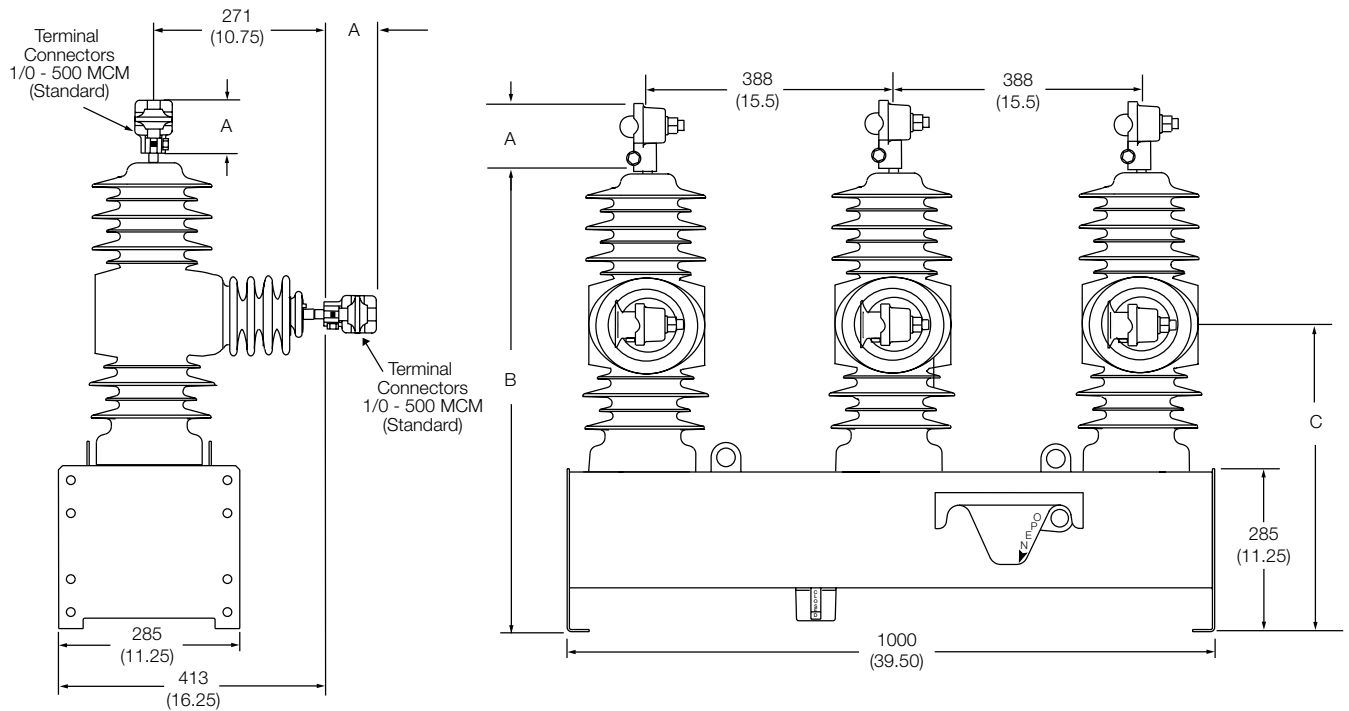
Type	Percentage of Interrupting Rating	Number of Unit Operations	Minimum Circuit X/R Value
NOVA	15-20	88	4
	45-55	112	8
	100	32	17*
		Total 232	

*Value shown for 60 Hz.

Table 5. Auxiliary-Powered Interface Power Requirements

Voltage	Normal Current	Operating Current	Duration	Recommended Power
120 VAC	0.2 A	1.0 A	3 sec	150 VA
240 VAC	0.1 A	0.5 A	3 sec	150 VA
48 VDC	0.4 A	2.0 A	3 sec	150 VA
125 VDC	0.2 A	1.0 A	3 sec	150 VA
250 VDC	0.1 A	.5 A	3 sec	150 VA

Dimensions



Note: All dimensions are mm (inches). Dimensions shown are approximate.

Terminal Options	A	B	C
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	80 (3.25)	NOVA 15 110 kV BIL 791 (31.25)	508 (20)
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	108 (4.25)	NOVA 15 125 kV BIL 847 (33.25)	564 (22.25)
Flat Pad, 2-hole (630 A maximum)	114 (4.5)	NOVA 27 125 kV BIL 847 (33.25)	564 (22.25)
Flat Pad, 4-hole (800 A maximum)	121 (4.75)	NOVA 27 150 kV BIL 946 (37.25)	663 (26.0)
Stud Type, 1.125 - 12 threads (800 A maximum)	82 (3.25)	NOVA 38 170 kV BIL 946 (37.25)	663 (26.0)

Creepage Distances

Description	15 kV 110 kV BIL	15 kV 125 kV BIL	27 kV 125 kV BIL	27 kV 150 kV BIL	38 kV 170 kV BIL
Terminal to terminal	1040 (40.9)	1040 (40.9)	1040 (40.9)	1040 (40.9)	1040 (40.9)
Lower terminal to ground/earth	673 (26.5)	772 (30.5)	772 (30.5)	950 (37.5)	950 (37.5)

Figure 1. Type NOVA recloser dimensions, NOVA 27 shown.

NOVA Mechanism Interface Options

Control-Powered Interface

The Type NOVA recloser mechanism with the control-powered interface is fully operational with Eaton's Cooper Power series Form 4C, Form 5, and Form 6 microprocessor-based controls equipped with the required DC-to-DC converter, interface circuit, and a fully shielded 19-pin cable. It is not compatible with the Types F3A nor FXB controls. The control-powered interface includes a 19-pin receptacle on the recloser and internal heaters (for humidity control) powered from the control input power supply (AC or DC).

Control-powered NOVA reclosers manufactured after September 2004 require a Voltage Trip/Close (VTC) interface and a VTC-ready control for tripping and closing. This VTC requirement applies to three-phase, control-powered NOVA reclosers with serial numbers 100,000 and above or beginning with the characters CP57; refer to Table 6. Control-powered NOVA reclosers with serial numbers below 100,000 do not require a VTC-ready control. Refer to the recloser nameplate for the serial number.

Table 6. Serial Number Break for Control-Powered NOVA Reclosers with VTC

Control-Powered NOVA Recloser	Serial No.
NOVA 15	100,000 or CP57#####
NOVA 27	100,000 or CP57#####
NOVA 38	100,000 or CP57#####

The DC-to-DC converter board converts the control's 24 VDC battery supply to 53 VDC to charge the trip/close capacitors in the NOVA mechanism. The DC-to-DC converter board also houses voltage monitoring and conditioning circuits that protect the battery from failure and provide trip/close operations without AC power. In the absence of AC power to the electronic control, the control battery will provide the trip and close operations. A complete four-trip sequence with minimal reclose intervals as configured for each control is obtainable without AC power. The recloser and control system is capable of exceeding over one thousand operations on battery power only.

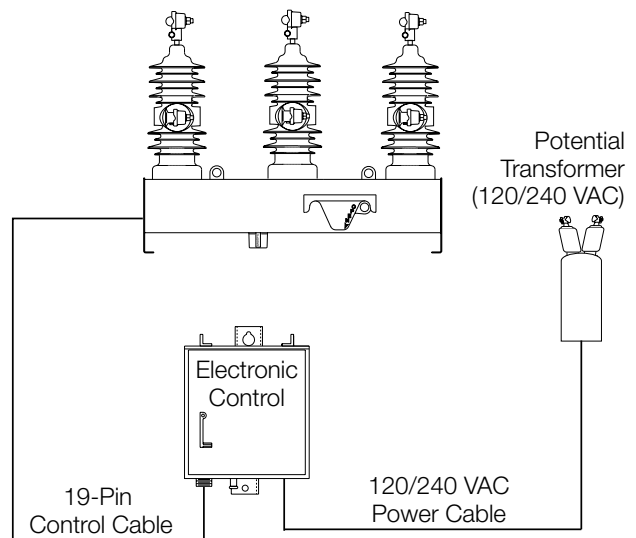


Figure 2. Control-powered NOVA recloser configuration with potential transformer input power.

Auxiliary-Powered Interface

The Type NOVA recloser mechanism with the auxiliary-powered interface is fully operational with standard Cooper Power series FXB, Form 4C, Form 4D, Form 5, and Form 6 microprocessor-based controls and standard 14-pin control cables. It is not compatible with the Type F3A control. The auxiliary-powered interface includes both a 2-pin and a 14-pin receptacle on the recloser. Internal heaters (for humidity control) are also included.

The Type NOVA recloser mechanism with the auxiliary-powered interface is compatible with 120 VAC, 240 VAC, 125 VDC, or 250 VDC as configured at the time of order. The auxiliary input power supply (AC or DC) is connected to a 2-pin male receptacle located next to the 14-pin female control receptacle. This provides power to the trip-and-close capacitors and the heaters in the recloser.

DC Auxiliary Input

The trip-and-close capacitors are maintained from the DC source. Upon loss of the DC power, the trip-and-close capacitors will maintain trip and close power for several minutes. If the trip-and-close capacitors are discharged, the recloser is inoperative until DC power is resumed.

AC Auxiliary Input

The trip-and-close capacitors are charged through both the AC auxiliary input power and the recloser control. This applies to recloser controls with an internal battery but is not applicable for the Form 6 rack or yard mount controls that use an external substation supply. Upon loss of AC power, the capacitors will be continuously charged from the control battery to allow tripping and will also be trickle-charged to allow for backup closing.

The charge on the capacitors will be maintained for the duration of the control battery power. Allow one minute between backup close operations to recharge the capacitors. However, the NOVA recloser is ready to trip immediately after performing a backup closing. Should the battery power discharge to the disconnect level, backup closing is disabled until AC auxiliary power is resumed. Apply AC auxiliary input power to the NOVA recloser to recharge the capacitors.

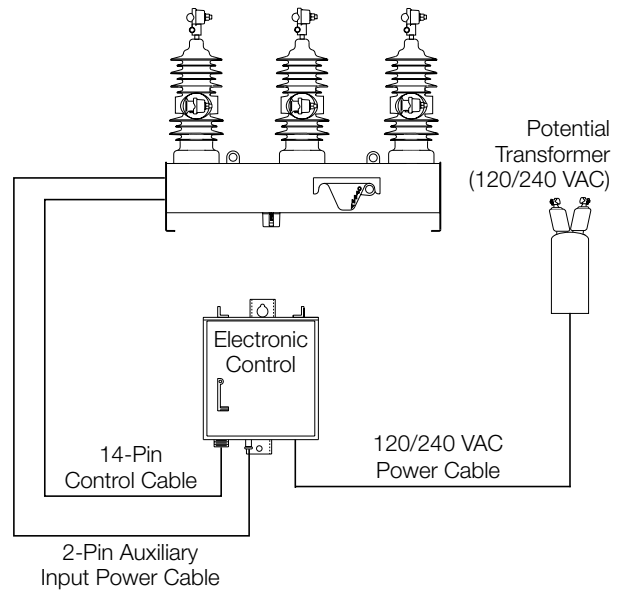


Figure 4. Auxiliary-powered NOVA recloser mechanism configuration with potential transformer input power.

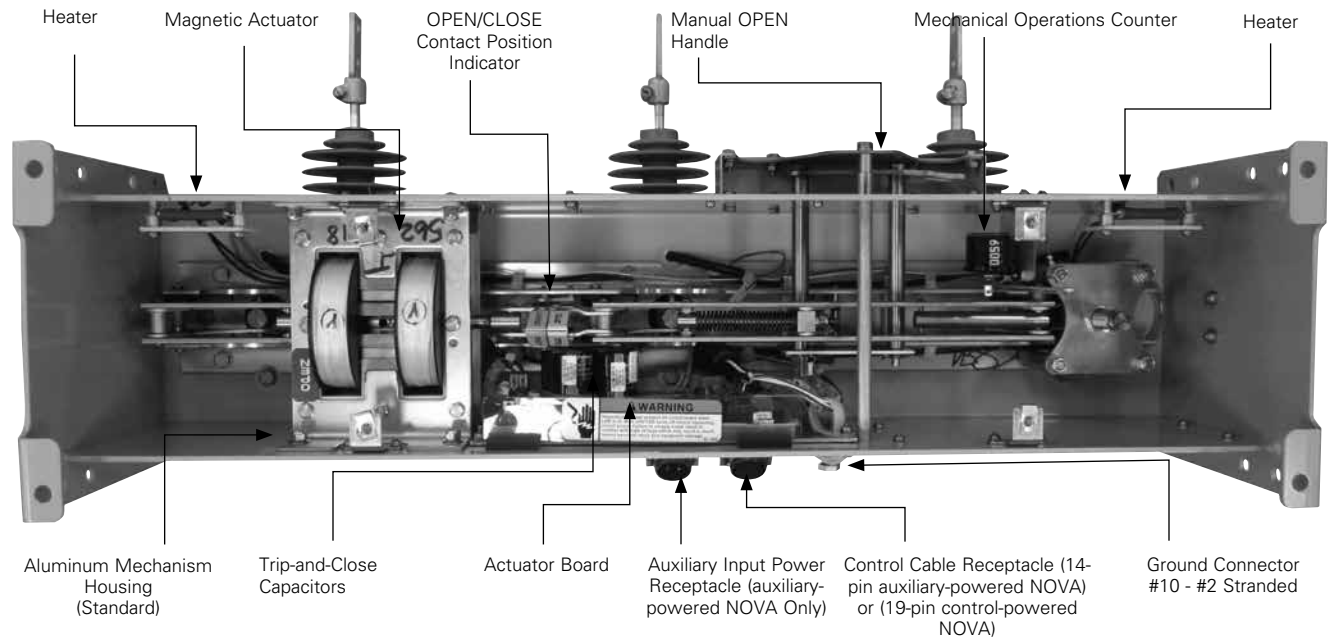


Figure 3. Type NOVA recloser mechanism (view from bottom of recloser with bottom cover and actuator board safety shield removed).

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

⚠ CAUTION

Personal injury. Sheds on epoxy encapsulation have sharp edges. Wear protective gloves when handling the unit. Failure to do so can result in cuts and abrasions.

T258.1

When installing the recloser, refer to the applicable recloser-mounting frame instructions. Installation instructions are included with the mounting frame.

1. Check the data plate ratings. Make sure the ratings, settings, and interface options on the recloser data plate (Table 7 and Figure 13) are correct for the planned installation.

Table 7. Nameplate Stamping

Serial number format: CP57#####Y

Option	Stamping
	Y
Auxiliary-Powered Interface	
48 VDC Interface Input / 48 VDC Heater	A
125 VDC Interface Input / 125 VDC Heater	D
250 VDC Interface Input / 250 VDC Heater	E
120 VAC Interface Input / 120 VAC Heater	H
240 VAC Interface Input / 240 VAC Heater	J
Control-Powered Interface	
120 VAC Heater	B
240 VAC Heater	C

2. Perform high-potential withstand tests. Prior to installing the NOVA recloser, perform high-potential withstand tests. Refer to the Service Information section for high-potential withstand test procedures.
3. Install the recloser. Install the recloser in the appropriate Cooper Power series pole- or substation-mounting frame. Refer to Figure 5 for moving and lifting instructions.
 - Before hanging the recloser on the pole, manually open the unit by lowering the yellow handle.

⚠ WARNING

Falling equipment. Use the lifting lugs provided and follow all locally approved safety practices when lifting and mounting the equipment. Lift the unit smoothly and do not allow the unit to shift. Improper lifting can result in severe personal injury, death, and/or equipment damage.

G106.3

Moving the Recloser

NOVA Type NOVA reclosers are shipped palletized (bolted onto a pallet). When moving with a fork truck/lift, the recloser must remain bolted to the pallet to avoid damage to the OPEN/CLOSE contact position indicator.

Eaton recommends transporting Cooper Power series NOVA reclosers in the closed position to maximize the operational performance of the unit.

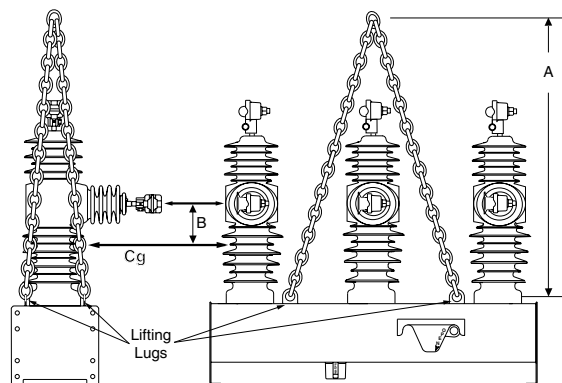
⚠ CAUTION

Tip-over Hazard. High center of gravity. Use a 4-point hitch to prevent switchgear from overturning during lifting operations. Improper lifting can result in personal injury or equipment damage.

T297.0

Lifting the Recloser

Follow all approved safety practices when making hitches and lifting the equipment. Lift the unit smoothly and do not allow the unit to shift.



A: Sling height for 15 kV and 27 kV with 125 BIL units: 914 mm (36 in)
Sling height for 27 kV with 150 BIL and 38 kV units: 1067 mm (42 in)

B: Center of gravity (Cg) is approximately 100 mm (4 in) below plane of lower terminals.

Figure 5. Moving and lifting the Type NOVA recloser.

⚠ WARNING

Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

T223.2

4. Ground the recloser. Make the ground connection to the ground connector. The ground connector is located on the back of the mechanism housing.
 - Refer to Figure 3 for ground connector location. The ground clamp accepts #10 to #2 stranded cables.
 - Refer to Figures 10, 11, and 12 for recommended grounding for the Type NOVA recloser.
5. Install the control. Refer to the control installation manual and install the control. Make sure the control cable is connected between the control and the recloser, the control is properly programmed for the planned installation, and the control is grounded.

To ensure proper installation of this cable, securely fasten the aluminum cable coupler ring (Figure 6).



Figure 6. Cable with aluminum cable coupler ring.

⚠ CAUTION

Equipment misoperation. The control-powered NOVA reclosers that require a VTC interface must be used with VTC-ready controls. Failure to use a VTC-ready control will result in failure to trip or close.

G144.0

Control-powered NOVA reclosers manufactured after September 2004 require a Voltage Trip/Close (VTC) interface and a VTC-ready control for tripping and closing. This VTC requirement applies to three-phase, control-powered NOVA reclosers with a Type A or Type D mechanism with serial numbers 100,000 and above or beginning with the characters CP57. They can be identified by labels prominently displayed on the bottom of the recloser tank and on the side near the 19-pin receptacle, as shown in Figure 7. Control-powered NOVA reclosers with serial numbers below 100,000 do not require a VTC-ready control. Refer to the recloser nameplate for the serial number.

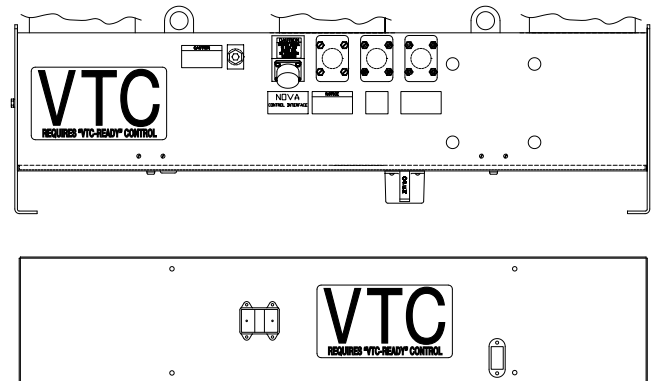


Figure 7. Control-powered NOVA recloser VTC labels.

6. Make high-voltage line connections (refer to Figures 8 and 9).

Note: Disconnect switches and bypass switches are not required, but are highly recommended as they facilitate switching and isolation.

CAUTION

Equipment Damage. Do not adjust or rotate bushing terminals without first removing power line leads and loosening pinch bolt to release clamp tension. Failure to remove tension between the clamp and the interrupter stud prior to rotating the terminal will damage the encapsulated interrupter assembly resulting in equipment damage.

T347.0

CAUTION

Equipment damage may occur if torque values are exceeded.

T370.0

A. Connect high-voltage lines to recloser bushing terminals.

The recommended torque value for bushing terminal-to-line connection is 45-50 ft•lbs. This is applicable to soft-drawn and hard-drawn copper as well as applicable wire sizes, solid wire, and stranded wire.

Note: Equipment damage may occur when

- line tension is not removed prior to making or disconnecting wires to the recloser terminals
- if the recommended torque is exceeded

Refer to Figure 9 for terminal identification of the NOVA recloser.

Terminal connection to copper conductors only are recommended.

To rotate a flat-pad or eyebolt bushing terminal prior to connecting power line leads, loosen the pinch bolt on the terminals.

After rotating the terminal, retighten the pinch bolt as follows:

- torque 3/8-16 pinch bolts to 15-17 ft•lbs
- torque 1/2-13 pinch bolts to 29-31 ft•lbs

IMPORTANT

The default connections use the horizontal bushing as the source side and the vertical bushing as the load side. Also, the horizontal bushing may be used as the load side and the vertical bushing as the source side. Note that reversing the source and load bushings has no effect on overcurrent protection but may require setting or wiring changes to the control for correct metering. If equipped with internal voltage sensors, the horizontal bushings (1, 3, 5) must be connected to the source. The internal voltage sensors cannot monitor source-side voltage when the NOVA recloser is in the OPEN position if the horizontal bushings are connected to the load.

B. Provide surge arrester protection. Surge arrester protection should be provided on both sides; refer to Figure 8.

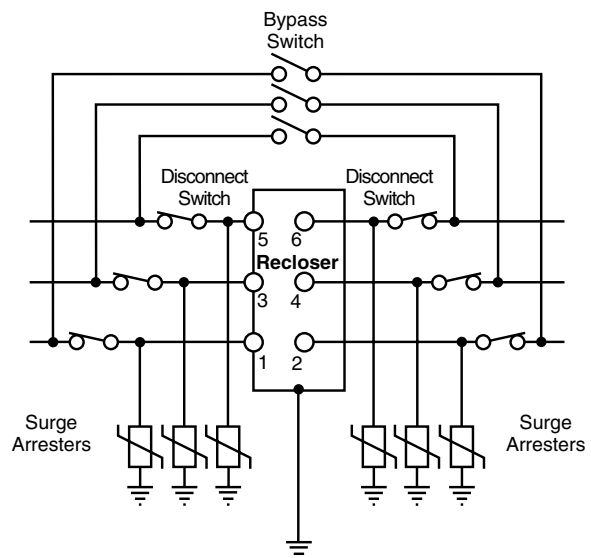


Figure 8. Connection diagram shows complete surge protection and illustrates bypass and disconnect switches.

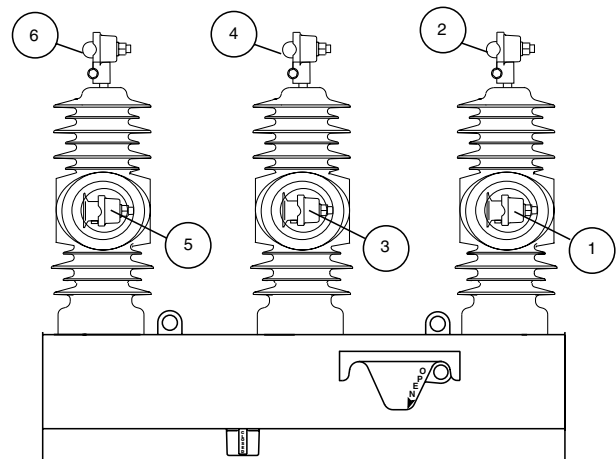


Figure 9. Terminal identification of Type NOVA recloser.

Remove Recloser from Service

1. Block ground tripping via the control panel. Refer to the instructions for the control connected to the recloser.
2. Close all three bypass switches.
3. Pull down the yellow operating handle with a hotstick. The yellow operating handle is located under the recloser sleet hood.

The control will sense that the recloser is open and provide OPEN/LOCKOUT indication on the front panel.
4. Open the source and load disconnect switches.
5. Disconnect the control battery.

CAUTION

Equipment misoperation. Disconnect all control power sources prior to disconnecting or reconnecting the control cable from the control. Failure to comply can result in recloser misoperation at the time of disconnection or reconnection of the control cable to the control.

T311.1

IMPORTANT

Disconnect switches for AC sensing and power connections are necessary to isolate the control for testing and servicing.

6. Remove the control AC sensing and power connections from the control using a separate disconnect switch.

CAUTION

Hazardous voltage. Open CT secondaries can generate high voltages. Contact with CT pins of the disconnected cable can cause electric shock and may result in personal injury. Open recloser contacts and open disconnect switches before disconnecting control cable.

T204.3

CAUTION

Hazardous voltage. Cable conductors attached to controls will remain at 53 VDC and 120/240 VAC potential while connected to the control. Contact with any pins at the end of the cable directly or indirectly connected to a control can result in personal injury or equipment damage. Disconnect battery and external power sources in the control then remove control cable at control end before disconnecting from recloser end.

T312.3

7. Disconnect the control cable from the recloser.
8. Follow standard utility procedures regarding removal of recloser from service.
 - Eaton recommends transporting NOVA reclosers in the closed position to maximize the operational performance of the unit.

Grounding the NOVA Recloser

IMPORTANT

In pole-mounted applications, a ground connection must be made between the recloser, transformer, recloser control, and SCADA equipment for proper protection of the equipment. The pole ground must be sized per local utility practices to minimize the impedance between the recloser and the control.

IMPORTANT

All external inputs to the control must be routed within 8 inches of their corresponding ground. During a surge, a potential of approximately 1.5 kV per foot can develop in the conductors. Differences between conductor and ground path lengths can add additional stress to the control components in the event of a power surge.

IMPORTANT

Any external voltage sensor installed with the NOVA recloser must have its ground referenced to the recloser ground.

3-Wire Ungrounded and Impedance Grounded Systems

The use of a grounding mat may be required depending upon the local safety regulations defining the permissible step and touch potential levels. Consult local regulations for proper grounding procedures.

Grounding with a Local Supply Voltage Transformer: 4-Wire Multi-Grounded, 3-Wire Ungrounded, or Impedance- Grounded

Installation with a local supply voltage transformer must include the following (refer to Figure 10):

- Protection of the recloser bushings and the supplying transformer with lightning arresters.
- Grounding of the recloser head and tank.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

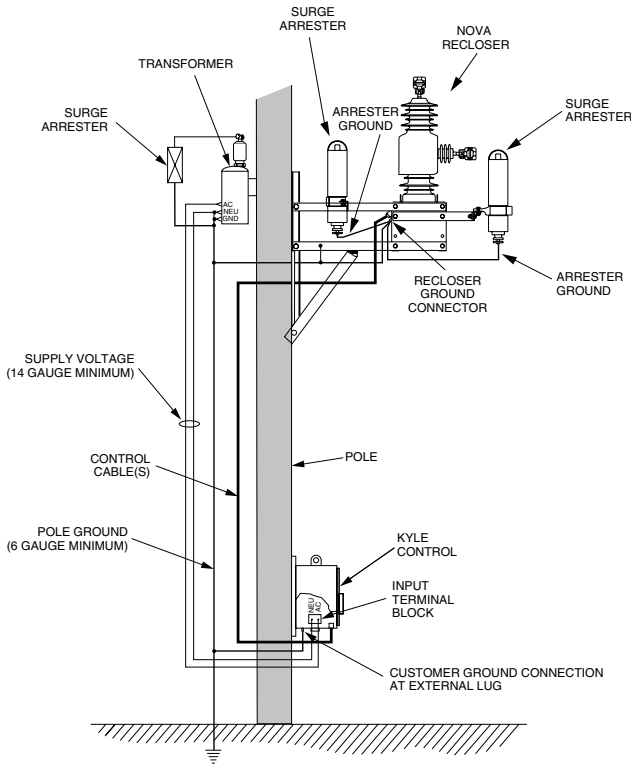


Figure 10. Recommended grounding method for NOVA recloser with Eaton's Cooper Power series microprocessor-based control and local supply voltage transformer.

Grounding with a Remote Supply Voltage Transformer: 4-Wire Multi-Grounded, 3-Wire Ungrounded, or Impedance- Grounded

Installation with a remote supply voltage transformer must include the following (refer to Figure 11):

- Protection of the recloser bushings and the supplying transformer with lightning arresters.
- Grounding of the recloser head and tank.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

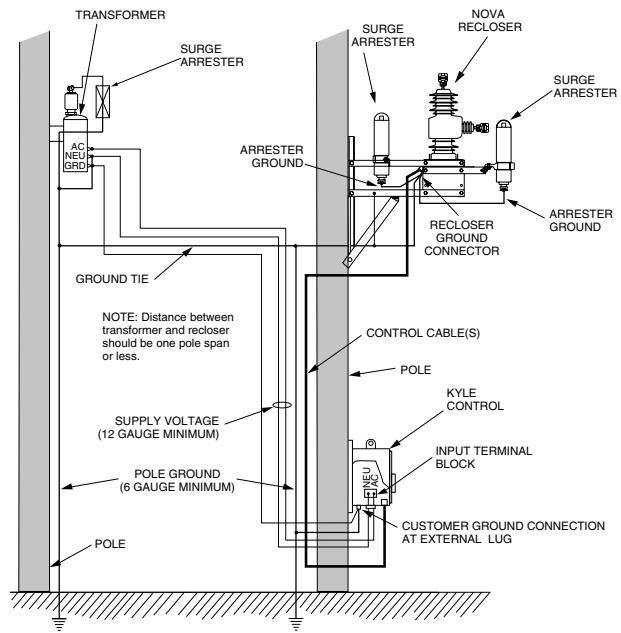


Figure 11. Recommended grounding method for NOVA reclosers with Eaton's Cooper Power series microprocessor-based control and remote supply voltage transformer.

Grounding on a 3-Wire Uni-Grounded System

Installation on a 3-wire uni-grounded system must include the following (refer to Figure 12):

- Protection of the recloser bushings and the supplying transformer with lightning arresters.
- Grounding of the recloser head and tank.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

WARNING

Hazardous Voltage. Use locally approved operator safety procedures for proper insulation when maintaining this equipment. High voltage step and touch potential is characteristic in uni-ground systems. Failure to comply can cause death or severe personal injury.

T262.0

CAUTION

Exported Potential. Do not make direct electrical connections to remote devices. All SCADA equipment must be mounted locally or connected using the fiber-optic or radio communication accessory. Direct connections to remote devices can produce exported potential causing equipment damage or personal injury.

T263.0

CAUTION

Hazardous Voltage. Do not use a shared low-voltage network to power the recloser control unless the network is specifically designed to withstand maximum ground potential rise. Ground faults on a high-voltage network can create a rise in ground potential.

T264.0

IMPORTANT

In pole-mounted applications, a ground connection must be made between the recloser, transformer, recloser control, and SCADA equipment for proper protection of the equipment. The pole ground must be sized per local utility practices to minimize the impedance between the recloser and the control.

IMPORTANT

All external inputs to the control must be routed within 8 inches of their corresponding ground. During a surge, a potential of approximately 1.5 kV per foot can develop in the conductors. Differences between conductor and ground path lengths can add additional stress to the control components in the event of a power surge.

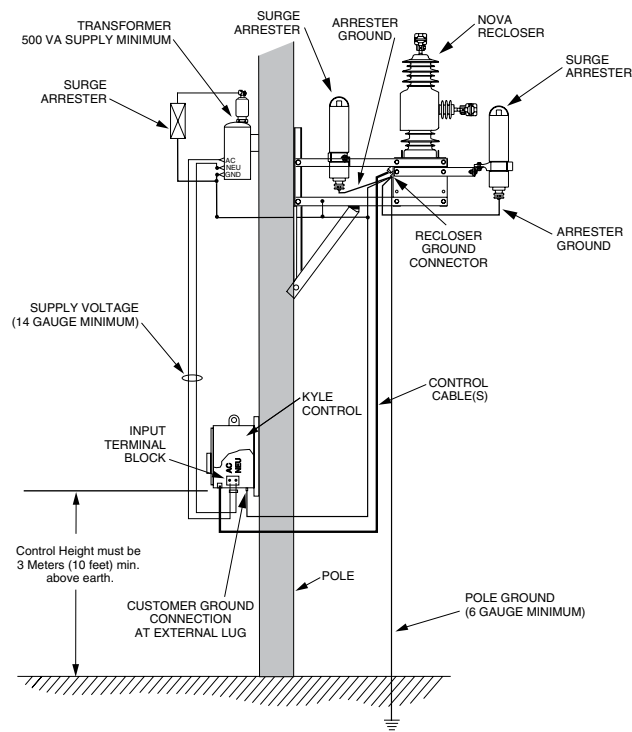


Figure 12. Recommended grounding method for NOVA reclosers with Eaton's Cooper Power series microprocessor-based control on a 3-wire uni-grounded system.

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

Electrical Operation

The Type NOVA recloser utilizes an interface circuit located in the mechanism housing. The electronic interface circuit controls the opening and closing signals to the magnetic actuator. Both control-powered and auxiliary-powered interface options are available. Refer to Figures 25 and 26 for wiring diagrams.

OPEN/CLOSE Contact Position Indicator

WARNING

Hazardous voltage. Never rely on the open position of the operating handle or the contact position indicator; it does not ensure that the line is de-energized. Follow all locally approved safety practices. Failure to comply can result in contact with high voltage, which will cause death or severe personal injury.

G123.1

The OPEN/CLOSE contact position indicator consists of a red CLOSED and a green OPEN indicator located on the bottom of the mechanism housing (Figure 13).

Hotstick Operation (Manual Open, Electrical Close)

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 recloser may be opened manually by using a hotstick to pull down the yellow manual OPEN handle, located on the front of the recloser (Figure 13). To close the recloser after a manual opening, first, push the yellow manual open handle up. Then, using the microprocessor control, close the recloser.

IMPORTANT

If the yellow manual open handle remains in the down position, the recloser cannot be closed electrically.

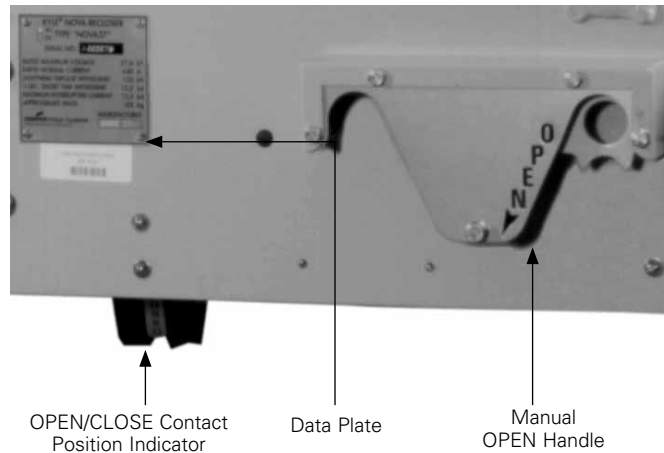


Figure 13. Type NOVA recloser OPEN/CLOSE contact position indicator, data plate, and manual OPEN handle.

Internal Voltage Sensing Option

Installation

⚠ 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

⚠ WARNING

Hazardous voltage. Solidly ground all equipment. Failure to comply can result in death, severe personal injury, and equipment damage. T223.2

IMPORTANT

Disconnect switches for AC control power are necessary to isolate the control for testing and servicing.

⚠ WARNING

Hazardous voltage. If terminal connections are reversed, the internal voltage sensing option may indicate zero voltage with the contacts open. Do not rely on internal voltage sensing to ensure that the voltage is zero and the line has been de-energized. Always follow proper safety practices and use a separate detection method to verify a de-energized condition. Failure to do so can result in contact with high voltage, which will cause death or severe personal injury. T365.0

⚠ CAUTION

Equipment damage may occur if torque values are exceeded. T370.0

The internal voltage sensors use a resistive voltage divider to provide a low-voltage input to the NOVA recloser control.

Refer to the Installation section of this manual for information on the NOVA recloser installation procedure.

- Refer to MN280049EN for further information on installing the Form 4D control.
- Refer to S280-79-10 for further information on installing the Form 5 control.
- Refer to MN280077EN for further information on installing the Form 6 Pole-Mount control.

Make voltage-sensing-option connections when installing the control as indicated in these Service Information manuals.

Verify correct grounding of the NOVA recloser and control prior to making any high-voltage connections and before high-potential testing. A proper ground connection consists of a good electrical ground connection to the surge ground connector located on the mechanism housing. Provide a good electrical ground connection to the control cabinet ground.

Note: Painted surfaces of the mechanism housing may prevent a ground connection to the recloser housing. Always provide a good electrical connection to the mechanism surge ground connector. Poor grounding of the mechanism housing may result in the presence of high voltage on the mechanism housing associated with the high-voltage resistor connections used with internal voltage sensing.

To ensure proper installation of this cable, securely fasten the aluminum cable coupler ring.

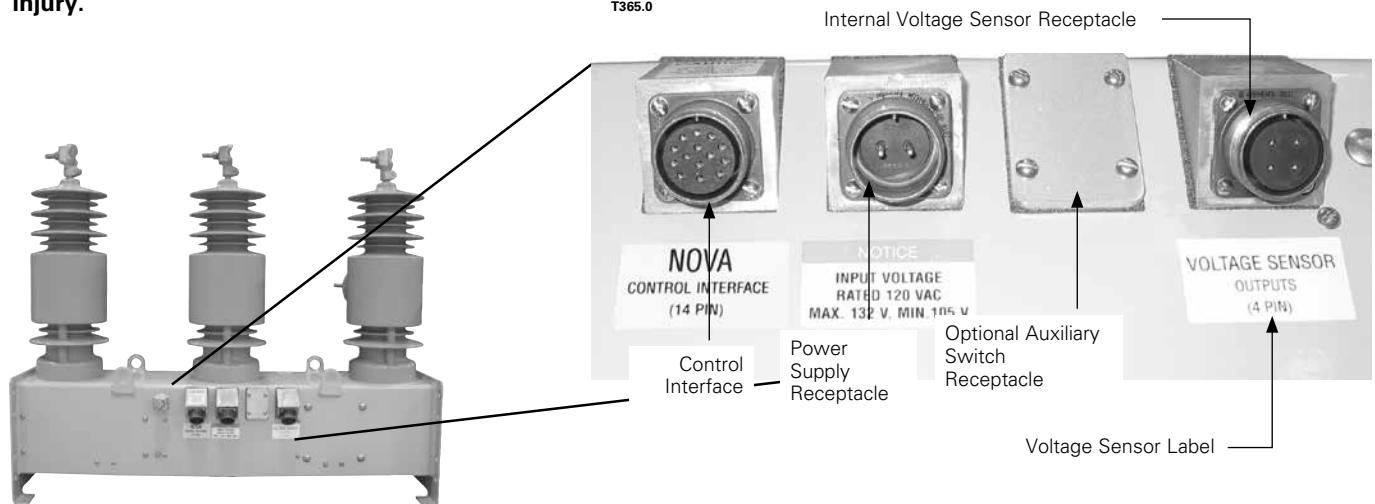


Figure 14. Type NOVA recloser cable receptacles with internal voltage sensing option. (Type NOVA recloser with 14-pin control interface shown.)

⚠ CAUTION

Hazardous voltage. Do not touch the receptacle connections of the control/voltage-sensing cable. If the recloser is energized and the control/ voltage-sensing cable is disconnected from the recloser or the control, a voltage clamped at 250 VAC will be present at the receptacle. Contact with this voltage can result in personal injury.

T346.1

The recloser is equipped with a 4-pin female receptacle (Figure 14) that connects to the control with a shielded, 4-conductor cable. The control accessory includes a 4-pin male receptacle on the control and appropriate circuitry; refer to Figures 15, 16, and 17.

⚠ CAUTION

Equipment misoperation. Verify all connector pins and both mating interface surfaces are clean and dry before connecting cables. Voltage sensing errors can result from contamination. Failure to comply can result in control and recloser misoperation.

G142.0

The electrical connectors of the recloser, control, and cable must be clean and dry. Contaminated surfaces may be cleaned with denatured alcohol and wet connector surfaces may be dried with a heat gun. Dry surfaces are particularly important for the internal voltage sensor cable connections. The accuracy of the sensors can be influenced by moisture contamination.

⚠ 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

Connect control cables, power cables, and sensor cables to the control. Verify that the proper cable/receptacle connections are made. Improper cable connections can result in damage to the recloser and/or control.

Complete the control programming before making the high-voltage line connections. Refer to the Operation section of this manual. Verify the correct voltage rating of the equipment. Verify the correct control programming for ratio and phase angle correction for the voltage rating of the equipment.

Make appropriate electrical connections to the terminals of the recloser. Verify the correct load-side (vertical bushings) and source-side (horizontal bushings) terminal connections. This is required for correct operation of the internal voltage sensor. Energize recloser and confirm the voltage outputs in the control.

When the recloser is energized, the voltage sensing output signal to the control is approximately 6 V (depending on

the primary voltage). If the sensor cable is disconnected at either the control or the recloser, the voltage sensing output signal is 250 VAC. The receptacles on both the NOVA recloser and the voltage sensing cable (control end) are 4-pin female connectors to minimize accidental contact with the voltage sensor outputs. The recloser control input impedance to the voltage sensors lowers the voltage to 6 V during normal operation.



Figure 15. Form 4D control Voltage Sensor receptacle.

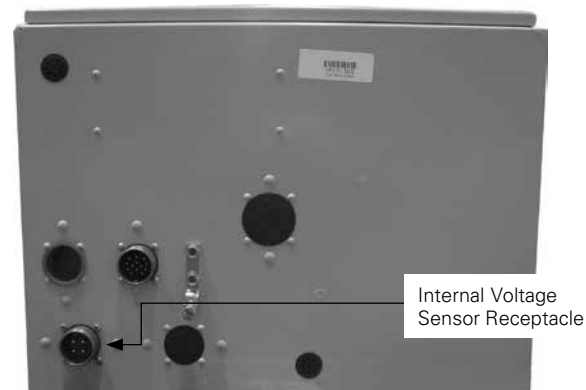


Figure 16. Form 5 control Voltage Sensor receptacle.

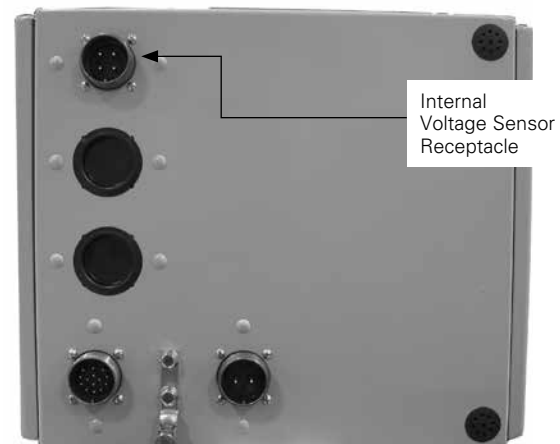


Figure 17. Form 6 control Voltage Sensor receptacle.

Operation

Form 5 Control Settings

The Form 5 control must be programmed with an adjusted voltage sensor ratio and a phase angle correction; refer to Tables 8 and 9. These are entered in the Form 5, Voltage Sensor Parameters screen (Figure 18).

The Form 5 control Recloser Interface (RIF) module must be set to 12 V for the source side bushings. (The load side bushings are not configured to work with the internal voltage sensing option and are set as described in the Form 5 Programming Guide.) Also, the Phantom Phase feature can not be enabled on the Form 5 control when using the voltage sensing option.

- Refer to Service Information S280-79-10 for installation and operation information of the Form 5 control.
- Refer to Service Information S280-79-2 for more information on programming the Form 5 control.

RIF Input Voltage Setting	Adjusted Voltage Sensor Ratio	Phase Angle Correction (DEG)
Bushing 1: 12	140.84	-3.3
Bushing 2: 120	120	0
Bushing 3: 12	140.84	-3.3
Bushing 4: 120	120	0
Bushing 5: 12	140.84	-3.3
Bushing 6: 120	120	0

Figure 18. Form 5 control Voltage Sensor Parameters screen.

Table 8. Adjusted Voltage Sensor Ratio/PT Ratio

Recloser	Recloser Control		
	Form 4D PT Ratio	Form 5 Adj. Voltage Sensor Ratio	Form 6 PT Ratio
NOVA 15	1175:1	140.84:1	1100:1
NOVA 27	2360:1	281.69:1	2200:1
NOVA 38	2360:1	281.69:1	2200:1

Table 9. Phase Angle Adjustment

Voltage Sensor Cable Length*	Phase Shift, NOVA 15		
	Form 4D	Form 5	Form 6
3.05 m (10 ft.)	-2.9°	-3.3°	-177.8°
6.10 m (20 ft.)	-3.5°	-4.1°	-177.0°
9.15 m (30 ft.)	-4.1°	-4.9°	-176.2°
12.2 m (40 ft.)	-4.7°	-5.7°	-175.4°
15.25 m (50 ft.)	-5.3°	-6.5°	-174.6°

Phase Shift, NOVA 27 and NOVA 15 with extended BIL

Cable Length	Phase Shift, NOVA 27 and NOVA 15 with extended BIL		
	Form 4D	Form 5	Form 6
3.05 m (10 ft.)	-3.3°	-4.0°	-176.0°
6.10 m (20 ft.)	-3.9°	-4.8°	-175.2°
9.15 m (30 ft.)	-4.5°	-5.6°	-174.4°
12.2 m (40 ft.)	-5.0°	-6.4°	-173.6°
15.25 m (50 ft.)	-5.6°	-7.2°	-172.8°

Phase Shift, NOVA 38 and NOVA 27 with extended BIL

Cable Length	Phase Shift, NOVA 38 and NOVA 27 with extended BIL		
	Form 4D	Form 5	Form 6
3.05 m (10 ft.)	-5.9°	-6.6°	-174.2°
6.10 m (20 ft.)	-6.5°	-7.4°	-173.4°
9.15 m (30 ft.)	-7.1°	-8.2°	-172.6°
12.2 m (40 ft.)	-7.7°	-9.0°	-171.8°
15.25 m (50 ft.)	-8.3°	-9.8°	-171.0°

Note: For Form 4D controls, the phase shift is adjusted -0.6° for each additional 3.05 m (10 ft.) of cable.

For Form 5 controls, the phase shift is adjusted -0.8° for each additional 3.05 m (10 ft.) of cable.

For Form 6 controls, the phase shift is adjusted +0.8° for each additional 3.05 m (10 ft.) of cable.

Note: Form 4D controls running firmware version 1.2.0 or newer use the Phase Angle Adjustment(s) listed in Table 9. Form 4D controls running previous versions of firmware will require adding 180 degrees of phase shift to the listed values in table 9.

*Maximum cable length is 15.25 m (50 ft.).

Form 4D and Form 6 Control Settings

The Form 4D and Form 6 controls must be programmed with a PT ratio and a phase angle adjustment; refer to Tables 8 and 9. These are entered in the System Configuration screen (Figures 19 and 20).

When programming either control, the PT connection must

be set for a Wye connection. Also, the Phantom Phase feature must be disabled.

- Refer to Service Information S280-104-2 for more information on programming the Form 4D control.
- Refer to Service Information S280-70-4 for more information on programming the Form 6 control.

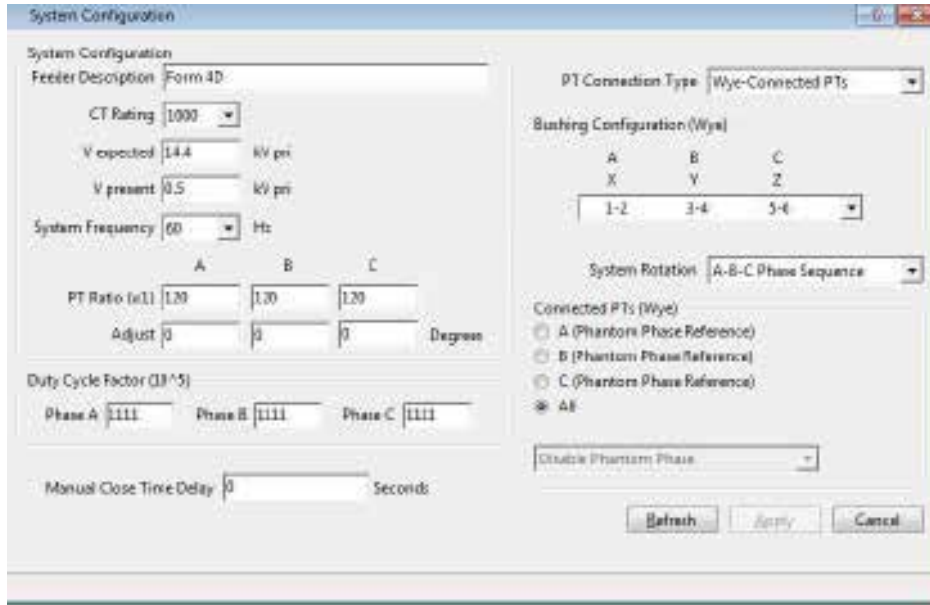


Figure 19. Form 4D control System Configuration screen.

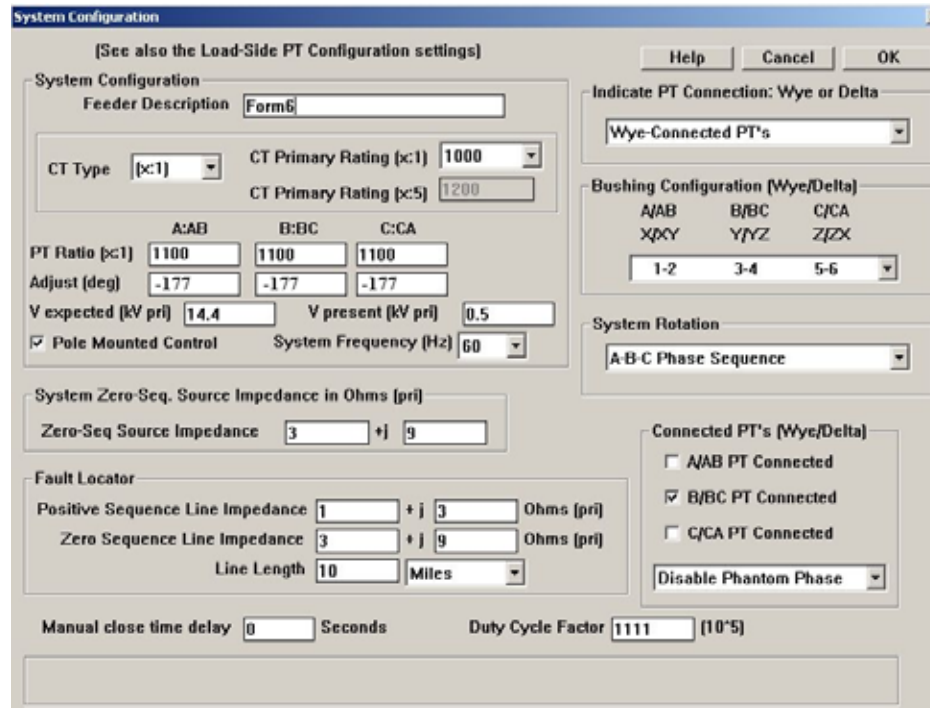


Figure 20. Form 6 control System Configuration screen.

Accessories

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” (follow state of recloser contacts) and “b” (opposite recloser contacts) positions. The switch contacts are insulated for 600 V and have a continuous current rating of 10 A. Their interrupting ratings are shown in Table 10.

Table 10. Auxiliary Switch Interrupting Ratings

Volts	Inductive ac (A)	Non- Inductive ac (A)	Inductive dc (A)	Non- Inductive dc (A)
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

Terminals

The standard terminal is an eyebolt, 1/0—500 mcm (630 A). Eyebolt, 4/0—1000 mcm (800 A), 2-hole and 4-hole flat-pad terminals, and stud-type terminals are available as an accessory (Figure 21).

The eyebolt, flat-pad, and stud terminals are made of copper alloys. Eaton recommends terminal connection to copper wires to optimize the electrical connection. Aluminum cables may produce aluminum oxide sufficient to compromise the electrical connections.

Anti-oxide coatings for temporary protection of wire-brushed, aluminum cable connections to flat-pad or stud terminals must be maintained at intervals determined by the customer based on load current, climate, and other installation conditions.

Eyebolt terminals are recommended for copper conductors only.

Pole-Mounting Hanger

A pole-mounting hanger (Figure 21), which bolts directly to the recloser frame, is available for pole-mounting installation.

Note: All dimensions are mm (inches).
Dimensions shown are approximate.

Terminal Options	A
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	80 (3.25)
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	108 (4.25)
Flat Pad, 2-hole (630 A maximum)	114 (4.5)
Flat Pad, 4-hole (800 A maximum)	121 (4.75)
Stud Type, 1.125 - 12 threads (800 A maximum)	82 (3.25)

Dimension B	
NOVA 15 110 kV BIL	791 (31.25)
NOVA 15 125 kV BIL	847 (33.25)
NOVA 27 125 kV BIL	847 (33.25)
NOVA 27 150 kV BIL	946 (37.25)
NOVA 38 170 kV BIL	946 (37.25)

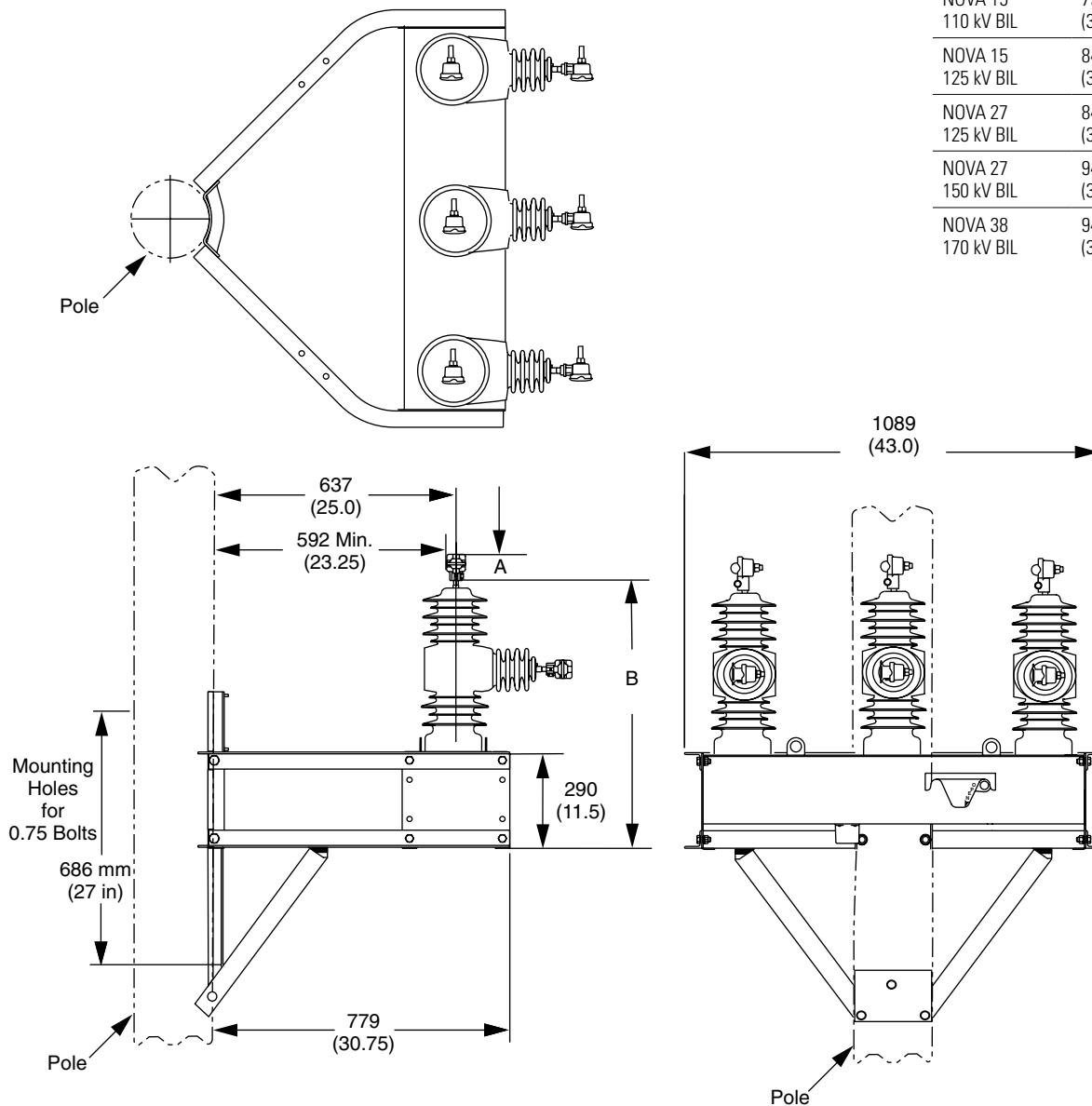


Figure 21. Dimensions of Type NOVA recloser with pole-mounting hanger accessory.

Arrester-Mounting Brackets

The arrester-mounting bracket accessory (Figure 22) can be bolted to the recloser frame and pole-mounting hanger for the addition of inboard and outboard arresters. The arresters are not included with the brackets.

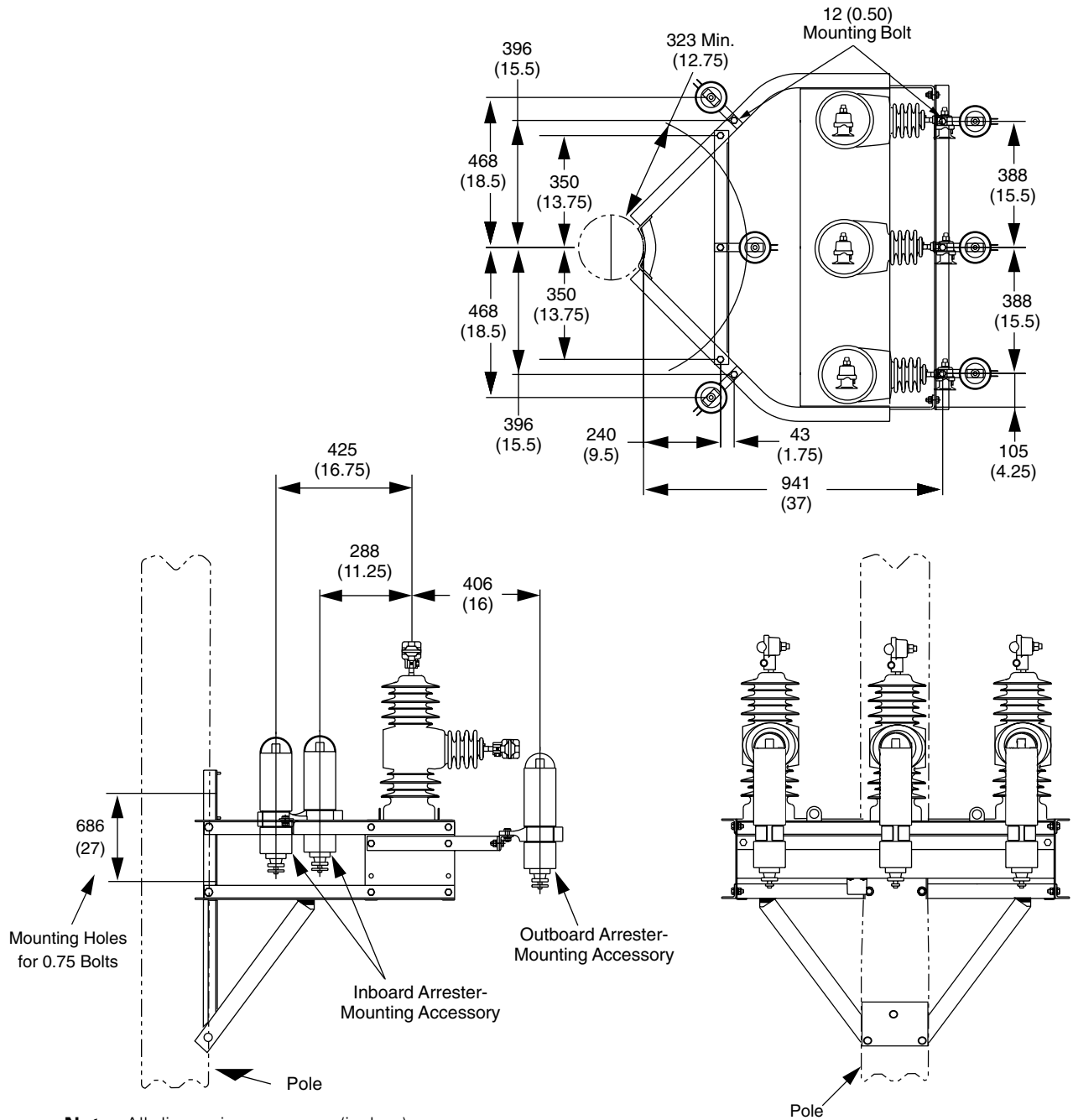
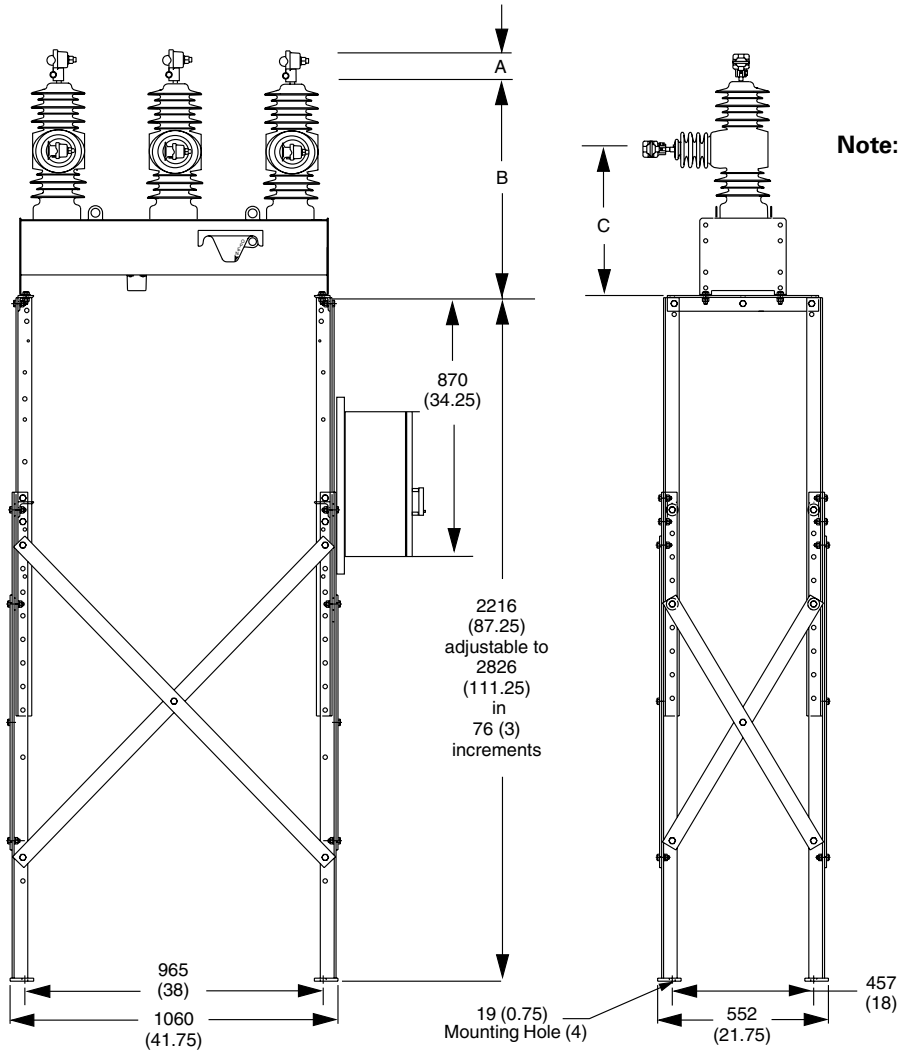


Figure 22. Dimensions of Type NOVA recloser with pole-mounting hanger and arrester-mounting bracket accessories.

Substation-Mounting Frame

A substation-mounting frame accessory (Figure 23) is available for substation-mounting applications.



Note: All dimensions are mm (inches). Dimensions shown are approximate.

Terminal Options	A
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	80 (3.25)
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	108 (4.25)
Flat Pad, 2-hole (630 A maximum)	114 (4.5)
Flat Pad, 4-hole (800 A maximum)	121 (4.75)
Stud Type, 1.125 - 12 threads (800 A maximum)	82 (3.25)

	B	C
NOVA 15 110 kV BIL	791 (31.25)	508 (20)
NOVA 15 125 kV BIL	847 (33.25)	564 (22.25)
NOVA 27 125 kV BIL	847 (33.25)	564 (22.25)
NOVA 27 150 kV BIL	946 (37.25)	663 (26.0)
NOVA 38 170 kV BIL	946 (37.25)	663 (26.0)

Figure 23. Dimensions of Type NOVA recloser with substation-mounting frame accessory.

Service Information

Service Requirements

The Type NOVA recloser has been designed with a minimum mechanical life of 10,000 operations. The NOVA recloser should be inspected every ten years to check for physical damage and verify proper operation.

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, solid-insulated, vacuum-interrupting reclosers should be inspected every ten years.

Testing Operation

This recloser is used with Eaton's Cooper Power series microprocessor-based recloser controls. Refer to the control operation manual.

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

1. Check the data plate ratings. Make sure the ratings, settings, and interface options on the recloser data plate (Figure 13 and Table 7) are correct for the planned testing.

2. Test electrical open and close operation. Close and open the recloser contacts using the microprocessor control. Confirm that the contacts have closed and opened by:
 - A. The OPEN/CLOSE contact position indicator, or
 - B. By a continuity check between the recloser terminals.
3. Test manual open. Pull the yellow manual open handle (Figure 13) down to open the recloser contacts. Confirm that the contacts have opened by:
 - A. The OPEN/CLOSE contact position indicatorOR
 - B. By a continuity check between the recloser terminals.
4. To close the recloser contacts:
 - A. First, push the yellow manual open handle up.
 - B. Close the recloser using the microprocessor-based control.

Note: When manual close and open operations are being performed from the control front panel, it is recommended to wait 60 seconds after every fourth close/open operation. This recommendation also applies if conducting four operations with fault current applied to the unit.

High-Potential Withstand Testing

The following equipment is required for this test:

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.

Note: Test results for NOVA reclosers equipped with the internal voltage sensing option will be influenced by the source-to-ground connected sensing resistor, especially if DC high-potential testing is performed.

⚠ WARNING

Hazardous voltage. The switchgear (apparatus and control) and high-voltage transformer must be in a test cage or similar protected area 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.

T221.5

⚠ 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 MN280062EN, Vacuum Interrupter Withstand Test Voltage Ratings Information for further information.

G109.3

Use the following procedures to perform high-potential withstand tests at 75% of the rated low-frequency withstand voltage for 60 seconds. Refer to Table 11 for test voltages and Figure 24 for test connection diagrams.

Test results for NOVA reclosers equipped with the internal voltage sensing option will be influenced by the source-to-ground connected sensing resistor.

Table 11. Type NOVA Recloser Withstand Test Voltage Ratings Information

75% of Rated Low-Frequency Withstand Voltage (1 minute dry) (kV rms)

Description	AC	DC
NOVA-15	37.5	53.0*
NOVA-27	45.0	63.6†
NOVA-38	52.5	74.2**

* Approximately 0.53 mA additional leakage current per phase with internal voltage sensors.

† Approximately 0.32 mA additional leakage current per phase with internal voltage sensors.

** Approximately 0.37 mA additional leakage current per phase with internal voltage sensors.

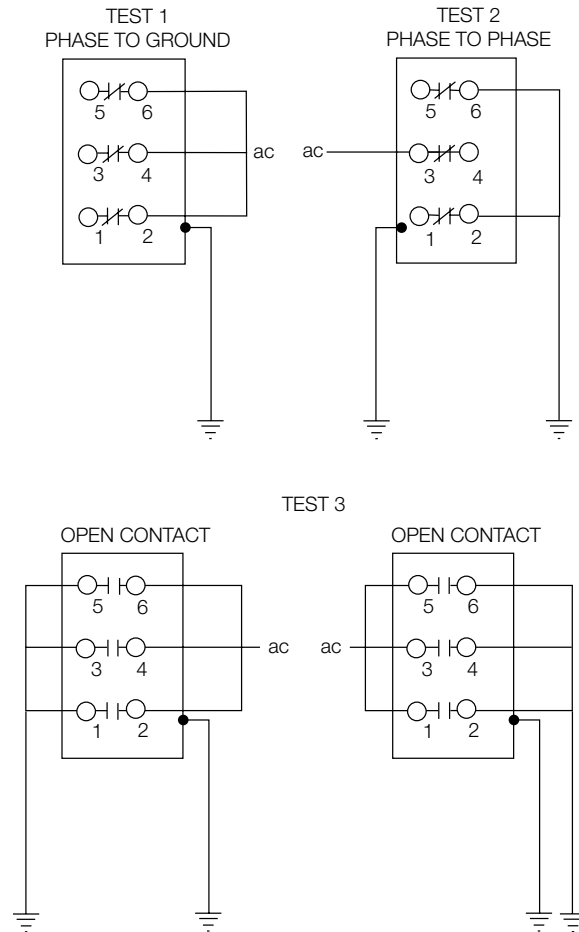


Figure 24. Connection diagrams for high-potential withstand testing.

Test 1

1. Close the recloser contacts.
2. Ground the recloser.
3. Connect terminals 2, 4, and 6 (see Figure 9) together.
4. Apply proper test voltage (see Table 11) to terminals 2, 4, and 6.
5. The recloser should withstand the test voltage for 60 seconds.

Test 2

1. Close the recloser contacts.
2. Ground the recloser.
3. Ground terminal 2 and terminal 6.
4. Apply proper test voltage to terminal 3.
5. The recloser should withstand the test voltage for 60 seconds.

Test 3

1. Open the recloser contacts.
2. Ground the recloser.
3. Connect and ground terminals 1, 3, and 5 (see Figure 9).
4. Connect terminals 2, 4, and 6.
5. Apply proper test voltage to terminals 2, 4, and 6.
6. The recloser should withstand the test voltage for 60 seconds.
7. Reverse the connections: ground terminals 2, 4, and 6.
8. Apply test voltage to terminals 1, 3, and 5 for 60 seconds.
9. 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 interrupters.

If the recloser passes the closed-contacts tests (Tests 1 and 2), but fails the open-contacts test (Test 3), the cause is likely to be in the interrupter assembly. Retest each phase individually to determine the failed phase or phases.

If a 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 Tests 1, 2, or 3, contact an authorized service center or your Eaton's Cooper Power series product representative.

Note: Test results for NOVA reclosers equipped with the internal voltage sensing option will be influenced by the source-to-ground connected sensing resistor, especially if DC high-potential testing is performed.

Module Flashover Service

If a NOVA recloser module was exposed to an external flashover, an inspection process is recommended to assure proper operation of the recloser. Should the NOVA recloser exhibit external flashover attributes (carbon tracking or discoloration), the following procedure is recommended:

1. Bypass and remove the recloser from service as described in this manual.
2. Confirm the dielectric strength of the recloser by performing high-potential withstand test. Refer to the High-Potential Withstand Testing section of this manual.
3. Inspect the housing and lifting lugs for damage that may affect electrical and/or mechanical performance. If there is damage to either the housing or lifting lugs they must be replaced or repaired.

4. Inspect module for damage to the terminals. Remove any damaged terminals and replace.
5. Inspect module for damage to the module conductor rods (0.63" diameter threaded rods on top and side of module for affixing terminals). If there is damage to the module rods, the module must be replaced. Contact an authorized service center or your Eaton's Cooper Power series product representative.
6. Inspect the operating rod for damage. If there is damage to the operating rod, the module must be replaced. Contact an authorized service center or your Eaton's Cooper Power series product representative.
7. If no damage is found, clean the module with isopropyl alcohol and a scratch-free, nylon scouring pad to remove any carbon deposit.
8. Before returning to service confirm electrical operation by opening and closing the recloser with a control. Confirm the dielectric strength of the recloser by performing a high-potential withstand test. Refer to the High-Potential Withstand Testing section of this manual.

TROUBLESHOOTING

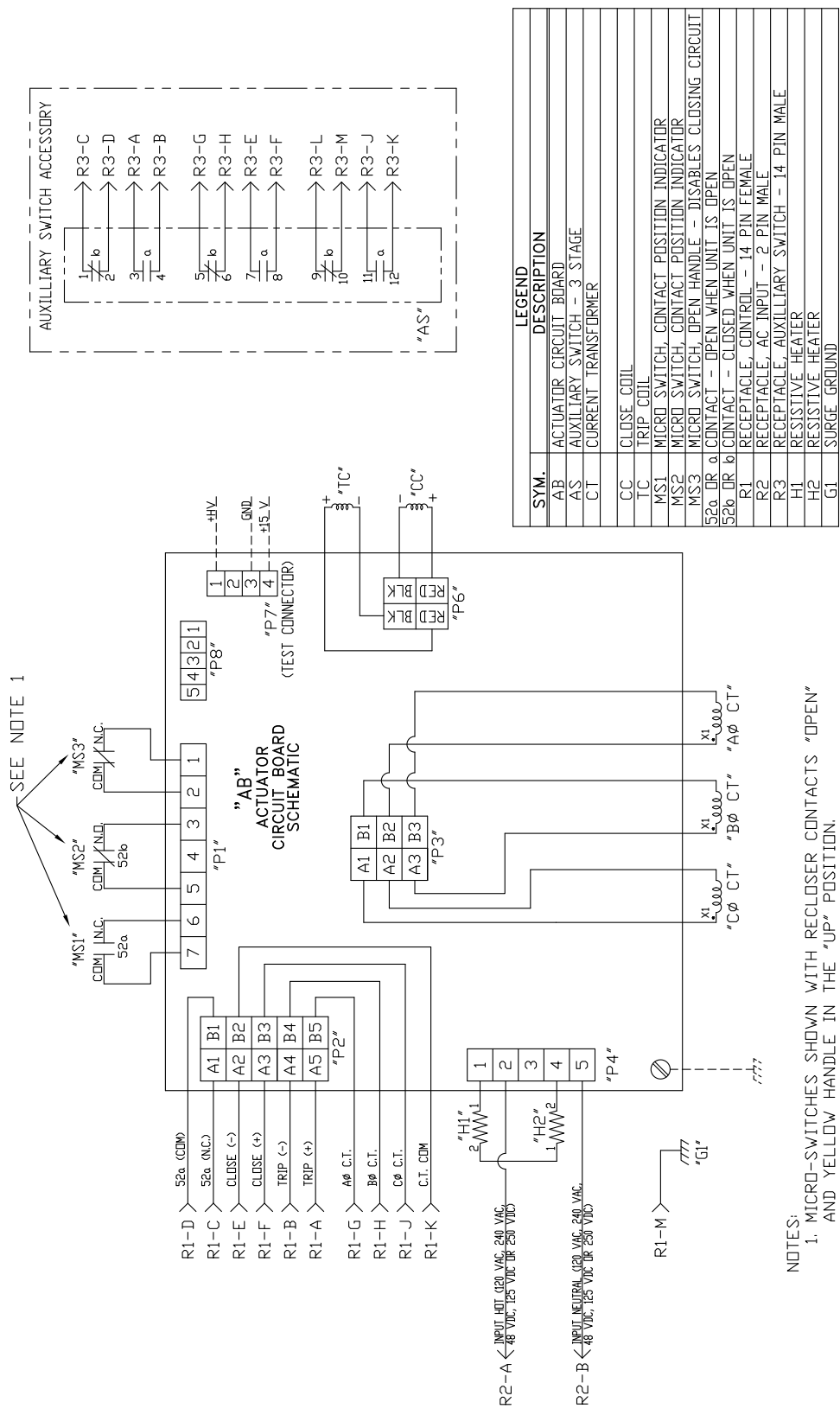
If the Type NOVA recloser does not perform as described in the OPERATION section of this manual, the following information may assist in troubleshooting:

Unit Will Not Close

- Make sure the yellow manual open handle is completely up.
- Check all cables for proper connection.
- Verify that the control has power.
- Upon loss of AC power, check recloser control battery level.
- For NOVA reclosers with the auxiliary-powered interface, verify that auxiliary power is present at recloser.
- For NOVA reclosers with the control-powered interface, check the fusing on the DC-to-DC converter board located in the control cabinet.

Unit Will Not Open Electrically

- Check all cables for proper connection.
- Verify that the control has power.
- For NOVA reclosers with the auxiliary-powered interface, verify that auxiliary power is present at recloser.
- For NOVA reclosers with the control-powered interface, check the fusing on the DC-to-DC converter board located in the control cabinet.



NOTES:
 1. MICRO-SWITCHES SHOWN WITH RECLOSER CONTACTS "OPEN" AND YELLOW HANDLE IN THE "UP" POSITION.

Figure 25. Wiring diagram for NOVA recloser mechanism with auxiliary-powered interface.

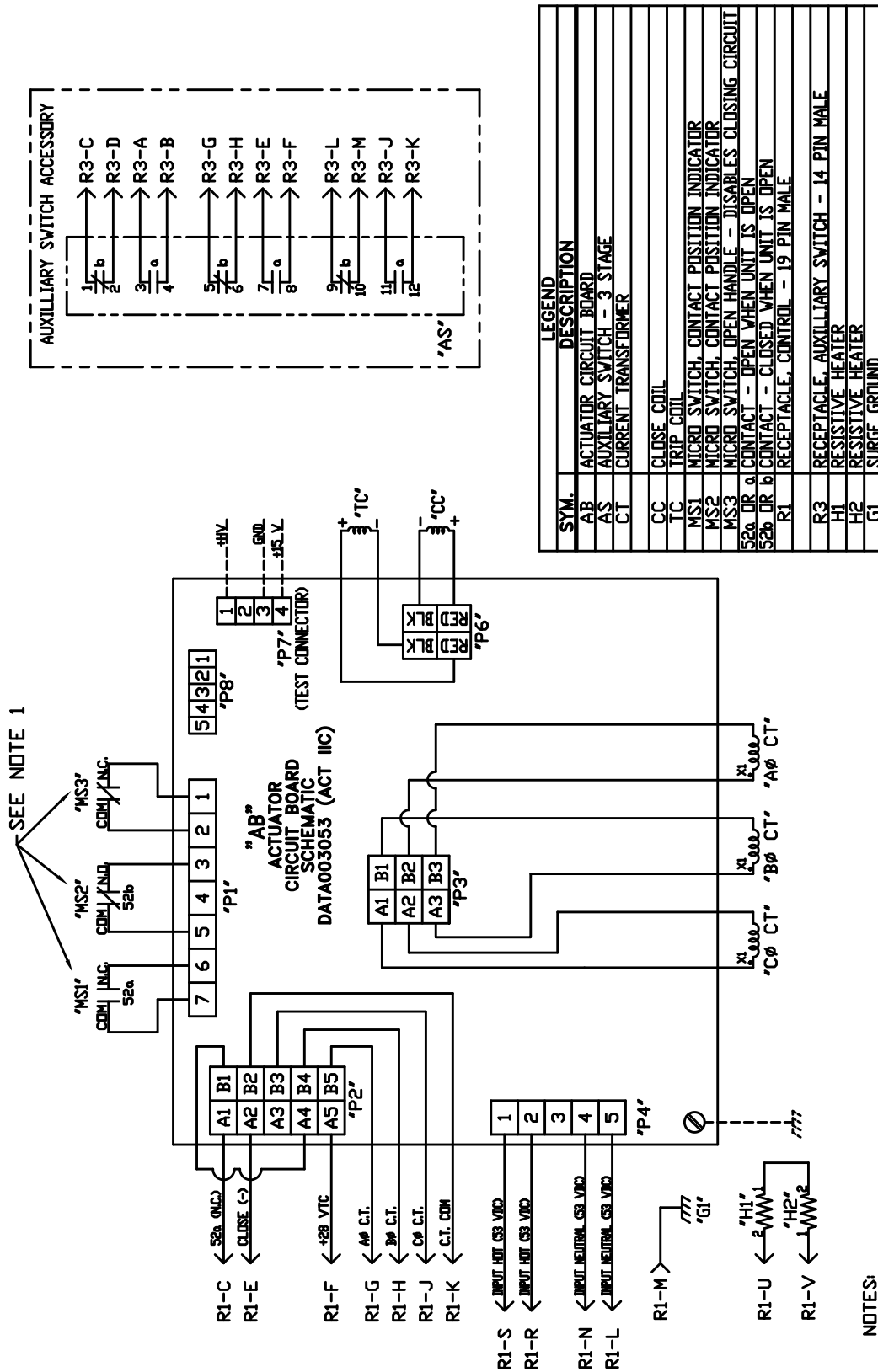


Figure 26. Wiring diagram for NOVA recloser mechanism with control-powered interface.

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