COOPER POWER SERIES

Reclosers

Types NOVAi
Three-phase Microprocessor-Controlled
Installation and Operation Instructions

S280-63-2

Figure1.
NOVAi three-phase, microprocessor-controlled recloser, with two-hole flat-pad terminals accessory.

CONTENTS

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Safety for Life

Eaton's 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 Eaton's 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 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, could result in minor or moderate injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, could 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.

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.

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.

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.

Product Information

Introduction

Service Information S280-63-2 provides installation, operation, and maintenance instructions for the Type NOVAi three-phase, microprocessor-controlled recloser. Before installing and operating this recloser, carefully read and understand the contents of this manual.

Reading the 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 a Cooper Power Systems microprocessor-based recloser control.

- If used with a FXD Pole Mount control, refer to Service Information S280-63-2

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. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Eaton's Cooper Power Systems representative.

Acceptance and initial inspection

Each recloser and control 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 control 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.

Standards

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

IEEE Std C37.100.1-2018
IEEE Std C37.60™-2019
IEC standard 62271-1: 2017
IEC standard 62271-111: 2019

Quality standards

ISO 9001 Certified Quality Management System.

Description of Operation

The Type NOVAi Recloser is a three-phase, microprocessor-controlled, vacuum interrupting recloser designed for electrical distribution systems through 38kV. The NOVAi recloser is designed and tested to be compatible with Cooper Power Systems' FXD control.

The solid polymer insulation system does not rely on gaseous or liquid dielectric. The NOVAi recloser is highly resistant to ozone, oxygen, moisture, contamination, and ultraviolet light. The NOVAi recloser has three solid-insulated interrupting bushings, embedded 3 current transformers and 6 internal voltage sensors, and is suitable for operation through a temperature range of -40°C to +65°C.

The NOVAi recloser is equipped with permanent magnetic actuator that provides electrical closing and opening operations. The NOVAi recloser is also equipped with manual closing and opening mechanism convenient for maintenance or emergency operations. More importantly, the electrical and manual closing operations can be locked by pulling the open handle down.

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 through 4 list the ratings and specifications for the NOVAi recloser.

Table 1. Frequency

Description	27kV	38kV
Rated Frequency	50Hz & 60Hz	50Hz & 60Hz

Table 2. Voltage Ratings

Description	27kV	38kV
Rated Basic Impulse Level (BIL)	150 kV	170kV
Power Frequency Withstand, Dry/Wet	60 kV	70kV
Max. Partial Discharge level	20pC*@17.2kV	20pC*@24.2kV

* For a phase tested alone

Table 3. Current Ratings

Description	27kV	38kV
Rated Continuous Current	630/800* A	630/800* A
Rated Short circuit Current, Symmetrical	16 kA	16 kA
Making Current, Asymmetrical Peak	41.6 kA	41.6 kA
Cable Charging Current Break	25A	40A

* Available optional ratings

Table 4. Mechanical Ratings

Description	27kV	38kV
Min. Mechanical/Electrical Operations without Maintenance	10000	10000
Mass (Weight) -kg(lbs.)	170(375)	180(397)

Table 5. Duty Cycle (50/60 Hz) *

Type	Percentage of Interrupting Rating	Number of Unit Operations	Minimum Circuit X/R Value
NOVAi	15-20	44	4
	45-55	56	8
	100	16	17
		Total 116	

Dimensions

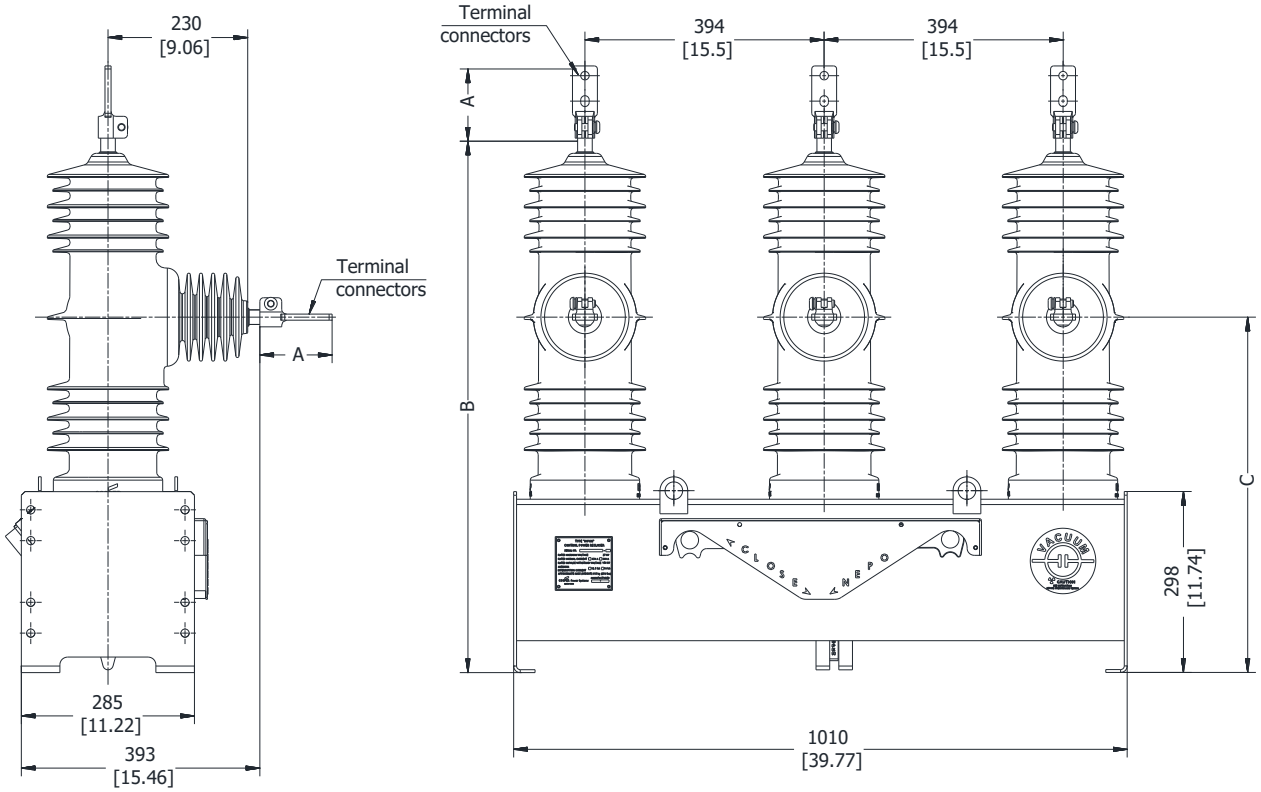


Figure 2.

NOVAi-27kV recloser Dimensions.

Terminal opinions	A	B	C
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	89	876 [34.48]	585.5 [23.05]
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	111	876 [34.48]	585.5 [23.05]
Flat pad, 2 holes 800A maximum	119	876 [34.48]	585.5 [23.05]

	Description	Creepage distance (mm)	Creep (mm/kV)
NOVAi-27kV	Terminal to terminal	916	33.9
	Lower terminal to ground/earth	854	31.6

Notes:

For non-standard requirements, please contact us.

Dimensions

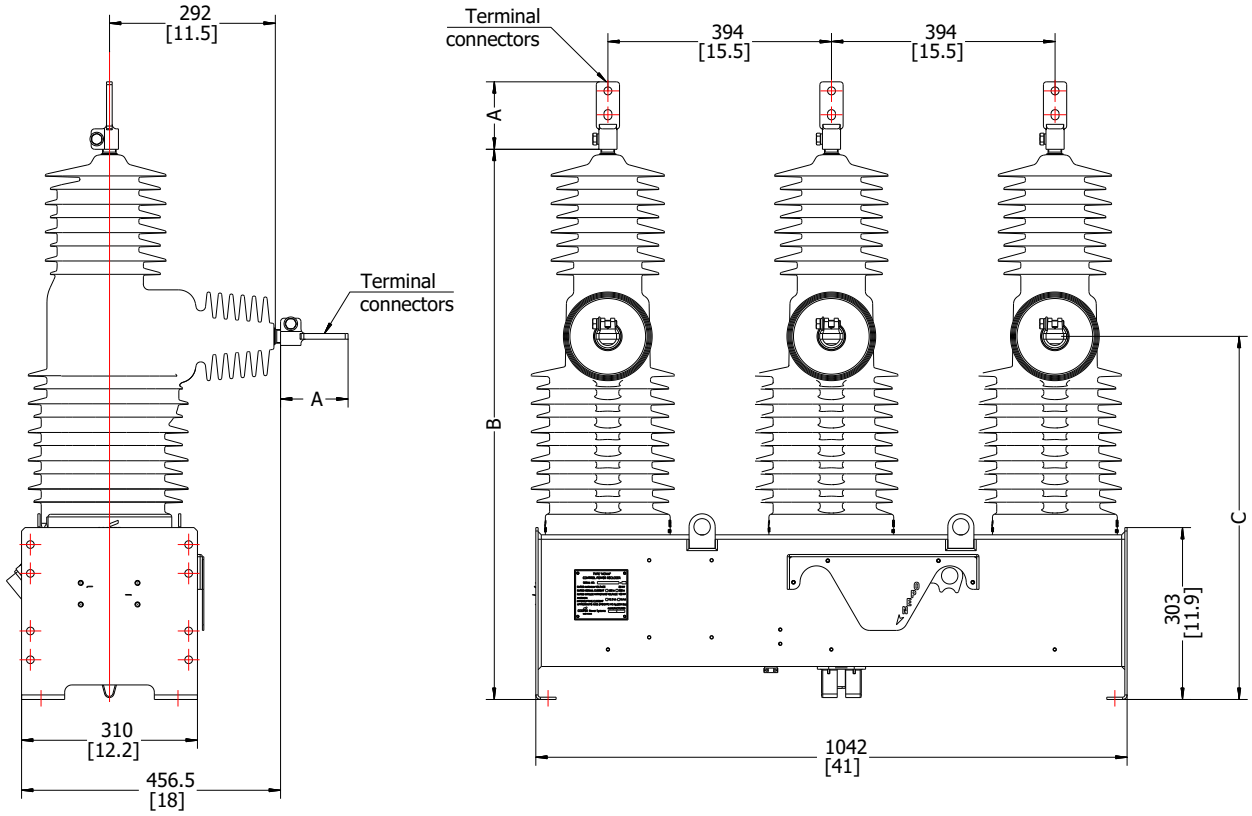


Figure 3.

NOVAi-38kV recloser Dimensions.

Terminal opinions	A	B	C
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	89	970.5 [38.21]	640.5 [25.22]
Eyebolt, 4/0 - 1000 mcm Cable Range (800 A maximum)	111	970.5 [38.21]	640.5 [25.22]
Flat pad, 2 holes 800A maximum	119	970.5 [38.21]	640.5 [25.22]

	Description	Creepage distance (mm)	Creep (mm/kV)
NOVAi-38kV	Terminal to terminal	1530	40.3
	Lower terminal to ground/earth	1335	35.1

Notes:

For non-standard requirements, please contact us.

NOVAi Mechanism interface options

The NOVAi recloser mechanism (see Figures 4 and 5) with the control-powered interface is fully operational with a FXD microprocessor-based control equipped with the required converter, interface circuit, and a fully shielded 37-pin cable. The control-powered interface includes a 37-pin receptacle on the recloser, and an internal heater (for humidity control) powered from the control input power supply.

The controller supply to 110V dc to perform the trip/close operations. 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 exceedingly over fifty operations on for-example 18Ah battery power only.

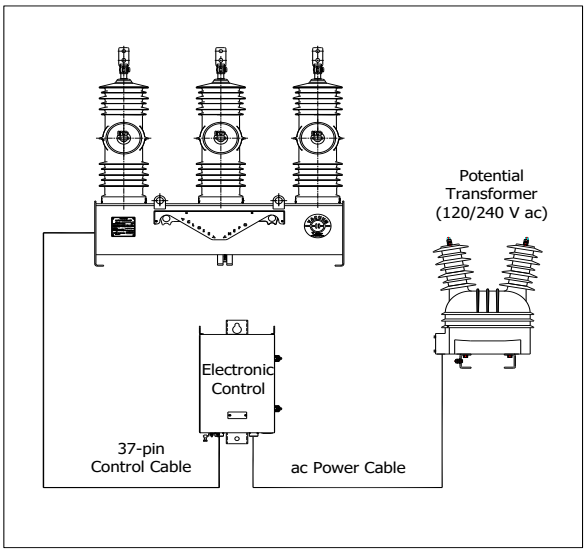


Figure 4.

Control-powered NOVAi recloser configuration with potential transformer input power.

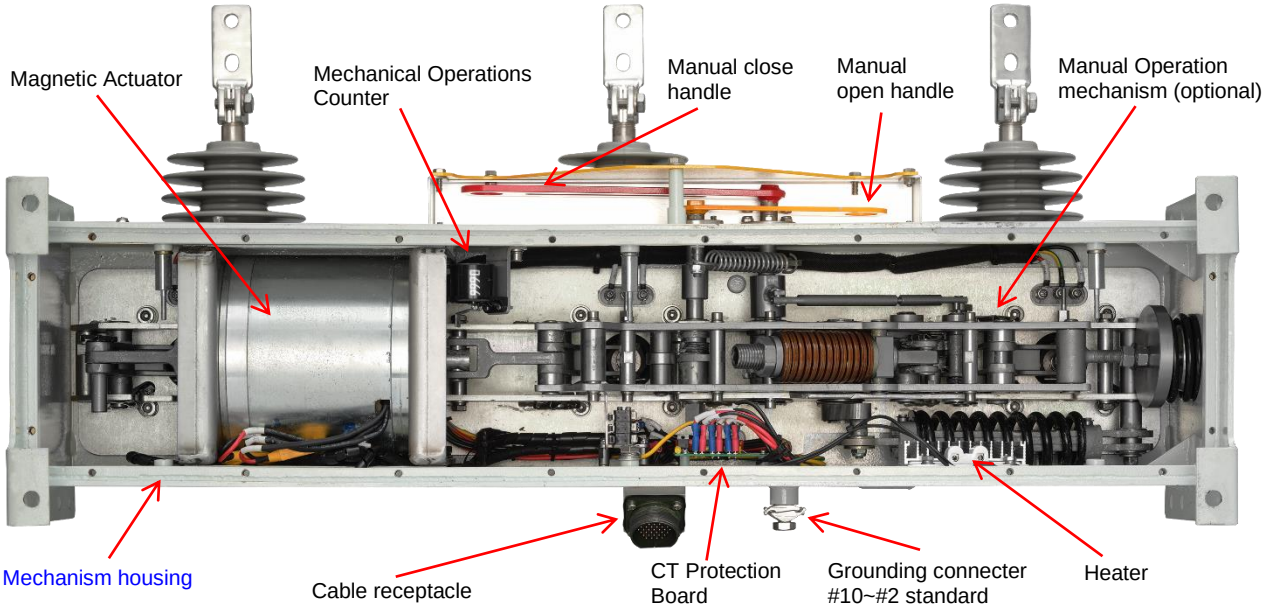


Figure 5.

NOVAi recloser mechanism with control-powered interface (view from bottom of recloser with bottom cover removed).

Product Acceptance Inspection

Each NOVAi recloser has passed careful inspection and stringent routine testing before shipping, to ensure the integrity and quality of the product.

Visual Checking

After receiving the product, users shall visually check the product free from any damages from the outside, especially on the epoxy casting components; check whether there are any loosened bolts during transport and tighten the bolts if loosened and ensure that the nameplate is correct for the product ordered.

Storage

In the case of storage for some time before mounting, NOVAi recloser should be placed in a dry and clean environment. During storage, proper protective measures shall be taken to decrease possible mechanical damages, especially neither lean nor place the device upside down. Do not place sundries on top of boxes, to protect the epoxy casting pole.

Insulation Testing

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.

WARNING

Before testing, NOVAi recloser should be connected with FXD control or the secondary terminals of CTs should be short-circuited, and FXD control should be really grounded.

All recloser products from EATON's Cooper Power systems pass IEC 62271-1 or IEEE Std C37.100.1 standards for power frequency and partial discharge tests before shipment from the manufacturer.

Power frequency testing prior to installation is recommended to ensure that no damage has happened during shipment. 80% of rated power frequency withstand voltage should be applied to check insulation according to related testing standard. See table 6 for test voltages.

Table 6. NOVAi Recloser Vacuum Interrupter Withstand Test

Description	80% of Rated Low-Frequency Withstand Voltage (1 min. dry) (kV rms)
NOVAi-27kV	48
NOVAi-38kV	56

Circuit Resistance Measurement

NOVAi recloser should have a circuit resistance less than 50 μΩ excluding terminals.

Testing operation

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

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.

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.

1. **Check the nameplate ratings.**

   Make sure the ratings and settings on the recloser nameplate are correct for the planned installation. See Tables 1-4.

2. **Test electrical open and close operation.**

   Close and open the recloser contacts using the FXD control. Confirm that the contacts have closed and opened by:

   - The OPEN/CLOSE position indicator, or
   - By a continuity check between the recloser terminals.

3. **Test manual open and close operation.**

   Using a hotstick, pull the ***YELLOW*** manual OPEN handle down to open the recloser contacts. Confirm that the contacts are open as follows:

   - By the OPEN/CLOSE position indicator, or
   - By a continuity check between the recloser terminals.

   To close the recloser contacts:

   A. Raise the ***YELLOW*** OPEN handle.
   B. Using a hotstick, pull down and push up the ***RED*** manual CLOSE handle many times, until completing the closing operation.

4. **Verify that the *YELLOW* open handle inhibits an electrical close.**

   Using a hotstick, pull the ***YELLOW*** manual OPEN handle down and keep the status.

   Attempt to close the recloser using the FXD control. Confirm that the recloser remain open by:

   - The OPEN/CLOSE position indicator, or
   - A continuity check between the recloser terminals.

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.

⚠ 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. Improper lifting can result in severe personal injury, death, and/or equipment damage.

⚠ CAUTION

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

1. **Check the name plate ratings.** Make sure the ratings and settings on the recloser name plate are correct for the planned installation. See Tables 1-4.

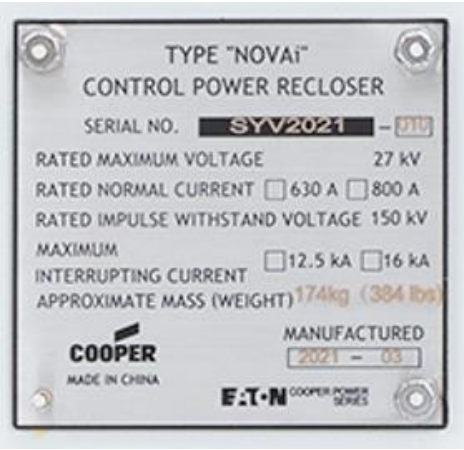


Figure 6.
Nameplate

2. **Perform high potential withstand tests.** Prior to installing the NOVAi recloser, perform high-potential withstand tests. Refer to the Service information section for high-potential withstand test procedures.

⚠ CAUTION

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

3. **Install the recloser.** Mounting frames from Eaton's Cooper Power Systems should always be used. See Figure 6 for moving and lifting instructions.

Moving the recloser

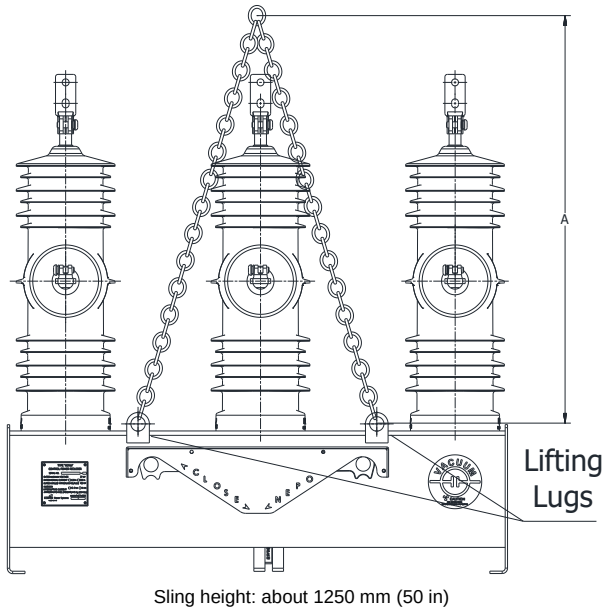
NOVAi reclosers are shipped palletized (bolted onto a pallet). When moving with a fork truck/lift, the recloser must remain bolted to the pallet to avoid damage to the OPEN/CLOSE contact position indicator.

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.

⚠ CAUTION

Tip-over Hazard. High center of gravity. Use a 4-point hitch to prevent switchgear from overturning during lifting operations.



Sling height: about 1250 mm (50 in)

Figure 7:
Moving and lifting instructions for NOVAi recloser

⚠ WARNING

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

4. **Ground the recloser.** Make the ground connection to the ground connector. The ground connector is located on the back of the mechanism housing. The ground connection needs plate terminal capable of matching ISO M12 screws and accepts #10 to #2 stranded cables.

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.

6. **Make high-voltage line connections** (Figure 8).

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 terminals. Failure to remove power line terminals prior to rotating the terminal will damage the encapsulated interrupter assembly resulting in equipment damage.

⚠ CAUTION

Equipment damage may occur if torque values are exceeded.

A. Connect high-voltage lines terminals to recloser bushing terminals. The recommended torque value for bushing terminal to line terminal connection is 60-70N•m (45-50lbs•ft).

   Refer to Figure 9 for terminal identification of the NOVAI recloser. Terminal connections to copper conductors only are recommended.

⚠ 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 only equipped with internal voltage sensors at source sides, the horizontal bushings (1, 3, 5) must be connected to the source. The internal voltage sensors cannot monitor source-side voltage when the 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 figure 8.

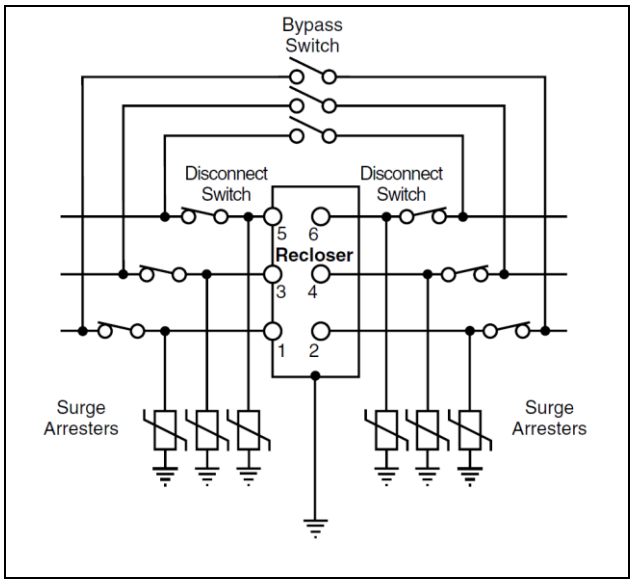


Figure 8.
Connection diagram shows complete surge protection and illustrates Bypass and Disconnect recloser to facilitate maintenance.

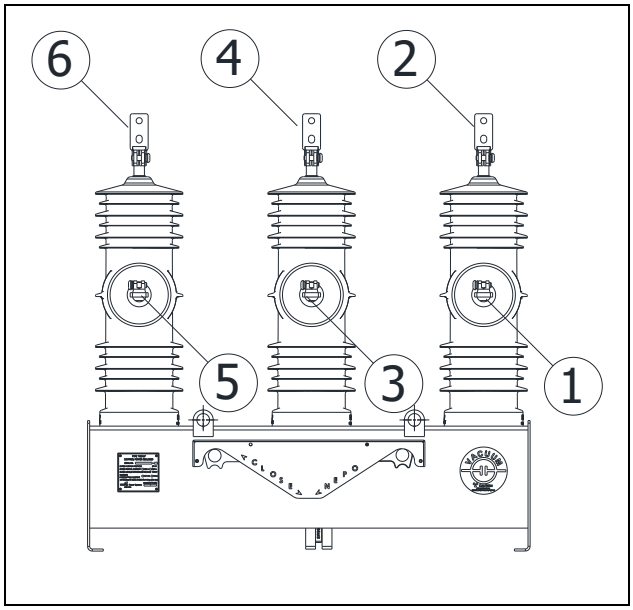


Figure 9.
Terminal identification of NOVAi recloser.

Remove recloser from service

1. Block ground tripping via the control panel. Refer to the instructions for the control connected to 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.
6. Remove the control ac sensing and power connections from the control using a separate disconnect switch.

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.

IMPORTANT

Disconnect reclosers for ac sensing and power connections are necessary to isolate the control for testing and servicing.

7. Disconnect the control cable from the recloser.

CAUTION

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

CAUTION

Hazardous voltage. Cable conductors attached to controls will remain at 24 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 NOVAi recloser end.

8. Follow standard utility procedures regarding removal of recloser from service.

   Eaton's Cooper Power Systems recommends transporting NOVAi reclosers in the closed position to maximize the operational performance of the unit.

Grounding

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 NOVAi 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 tough 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 housing.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

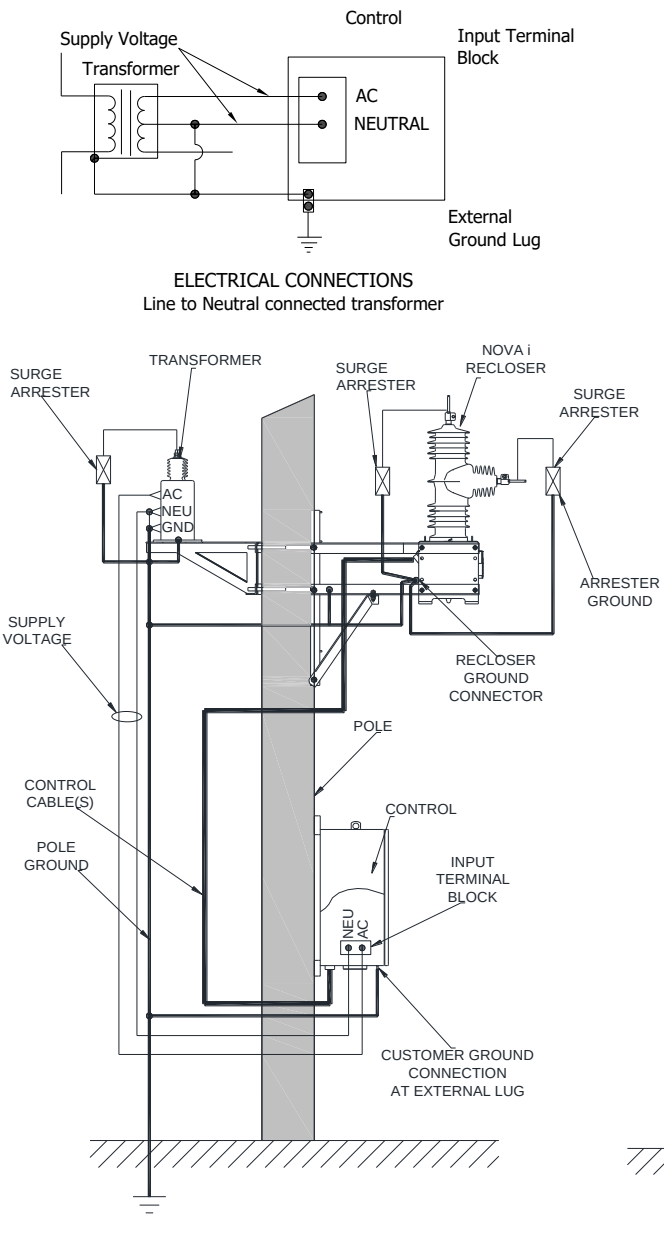


Figure 10.
Recommended grounding method for the NOVAi recloser with FXD control installed with local supply voltage transformer

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 housing.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

Figure 11.
Recommended grounding method for the NOVAi recloser with FXD control installed with remote supply voltage transformer.

Grounding on a 3-wire uni-grounded system

Installation with a 3-wire uni-ground 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 housing.
- Grounding of the transformer tank.
- Grounding of the control cabinet.
- Grounding of the SCADA equipment.

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.

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.

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.

IMPORTANT

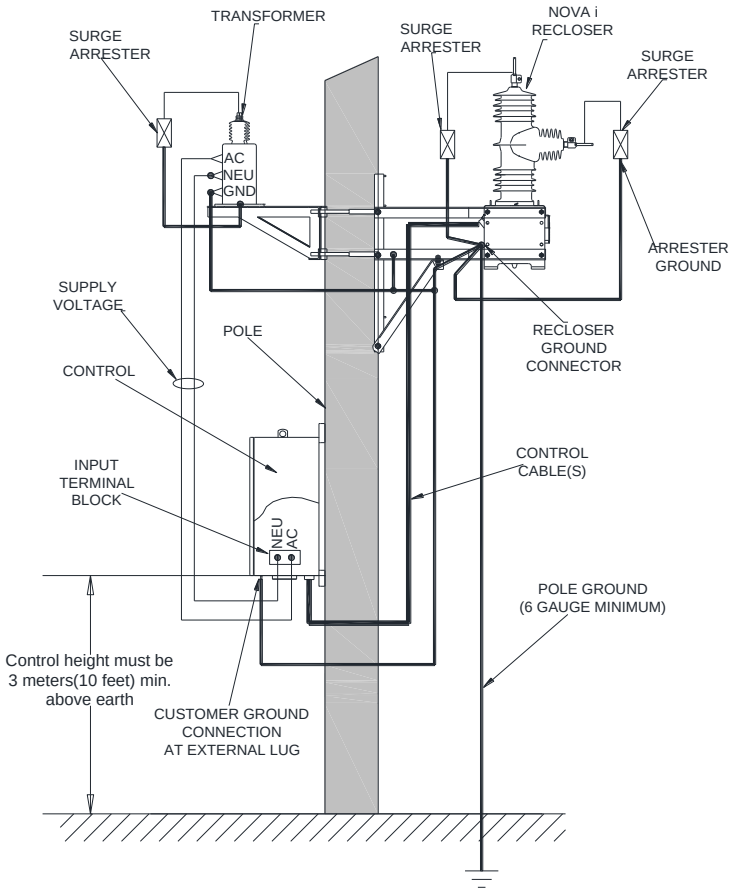
In pole-mounted applications, a ground connection must be made between the recloser, transformer, recloser control, and SCADA equipment for proper protection of the equipment. The pole ground must be sized per local utility practices to minimize the impedance between the recloser and the control.

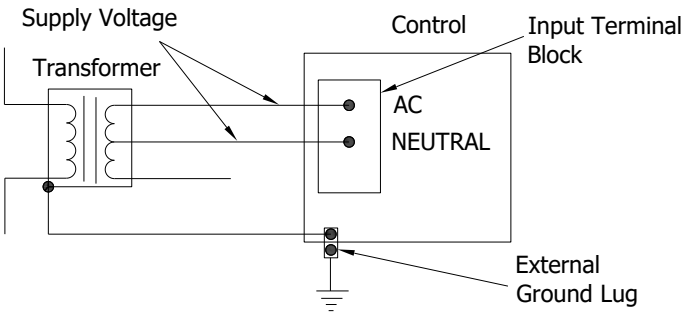
IMPORTANT

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 DAS recloser must have its ground referenced to the





ELECTRICAL CONNECTIONS
Line to Neutral connected transformer

Figure 12.

Recommended grounding method for NOVAi recloser with FXD recloser control installed on a 3-wire uni-grounded system

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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.

WARNING

Hazardous voltage. Do not rely on the open position of the green 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.

Electrical Operation

The Type NOVAi recloser utilizes an interface circuit located in the mechanism housing. The electronic interface circuit controls the opening and closing signals to the magnetic actuator.

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.

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

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Hotstick Operation (Manual Open/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.

IMPORTANT

If the Yellow manual OPEN handle remains in the down position, the recloser cannot be closed electrically.

The recloser may be opened manually by using a hotstick to pull down the YELLOW manual OPEN handle, located on the side of the recloser (see Figure 12). To close the recloser, first, push the YELLOW manual open handle up. Then, pull down the RED manual CLOSE handle, located on the side of the recloser (see Figure 13).

Note repeated pulling-down operations are needed to complete manual close operation by checking *Open/Close Contact Position Indicator*.

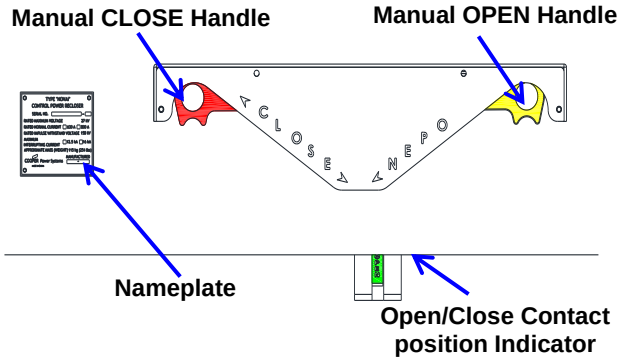


Figure 13.
NOVAi recloser Open/Close contact position indicator, nameplate, and manual open and close handles.

INTERNAL VOLTAGE SENSING OPTION

The internal voltage sensors use a resistive voltage divider to provide a low-voltage input to the recloser control for metering and/or protective function.

The sensing option, cable and control support a magnitude accuracy of 2% or better, and a phase angle accuracy of 1.5° throughout the temperature range of -40℃ to + 65℃.

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.

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.

WARNING

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

IMPORTANT

Disconnect reclosers 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.

CAUTION

Equipment damage may occur if torque values are exceeded.

Refer to the **Installation Procedure** section of this manual for information on the NOVAi recloser installation procedure.

Refer to Service Information S280-63-2 for further information on install the FXD Pole-mount control.

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

Verify correct grounding of the NOVAi 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.

CAUTION

Hazardous voltage. Do not touch the receptacle connections of the control cable. If the recloser is energized and the control 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.

The recloser is equipped with a 37-pin male receptacle that connects to the control with a shielded, 37-conductor cable. The control accessory includes a 37-pin female receptacle on the control and appropriate circuitry. Refer to Figures 14 and 15.

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.

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 the control. Failure to comply can result in control and recloser misoperation, equipment damage, and personal injury.

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. See the **FXD control settings** 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 NOVAi recloser and the voltage sensing cable (control end) are 37-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.

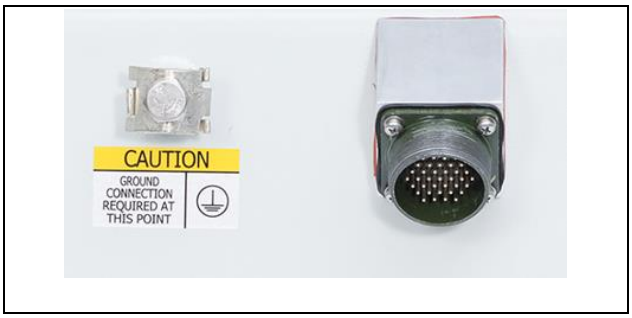


Figure 13.
NOVAi recloser cable receptables with internal voltage sensing option.

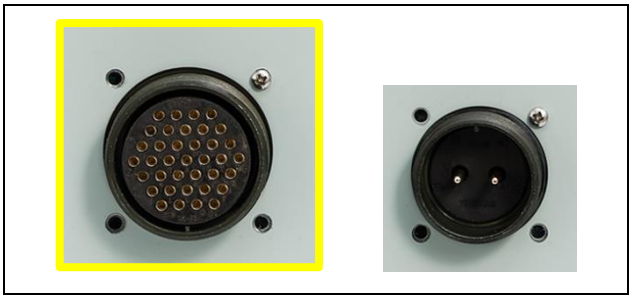


Figure 14.
FXD cable receptables with internal voltage sensing option.

FXD Control Settings

The FXD control must be programmed with a PT ratio and a phase angle adjustment; refer to Tables 7 and 8. These are entered in the System Configuration screen; see Figure 16.

When programming the FXD, the PT connection must be set for a Wye connection. Also, the Phantom Phase feature must be disabled. Refer to Service Information S280-63-2 for more information on programming the FXD control.

Table 8.
FXD Phase Angle Adjustment

Voltage Sensor Cable Length	Phase shift, NOVAi
20FT / 6.1m	N/A
33FT / 10m	N/A
42FT / 12.8m	N/A

Table 7.
FXD Adjusted PT Ratio

Description	PT ratio
NOVAi-27kV	15.6kV:1.45V
NOVAi-38kV	21.94kV:4.75v

Parameter Name	IED Value	PC Value	Unit	Min	Max
Voltage (6U, Sensor)					
Primary phase voltage		**15.600**	kV	1.000	38.000
Volt rated sec		**1.450**	V	1.000	100.000
A mag correct		**0.0**	%	-50.0	50.0
B mag correct		**0.0**	%	-50.0	50.0
C mag correct		**0.0**	%	-50.0	50.0
X mag correct		**0.0**	%	-50.0	50.0
Y mag correct		**0.0**	%	-50.0	50.0
Z mag correct		**0.0**	%	-50.0	50.0

Parameter Name	IED Value	PC Value	Unit	Min	Max
Voltage (6U, Sensor)					
Primary phase voltage		**21.940**	kV	1.000	38.000
Volt rated sec		**4.750**	V	1.000	100.000
A mag correct		**0.0**	%	-50.0	50.0
B mag correct		**0.0**	%	-50.0	50.0
C mag correct		**0.0**	%	-50.0	50.0
X mag correct		**0.0**	%	-50.0	50.0
Y mag correct		**0.0**	%	-50.0	50.0
Z mag correct		**0.0**	%	-50.0	50.0

Figure 16.
FXD control system configuration screen.

Recloser Accessories

Auxiliary switch

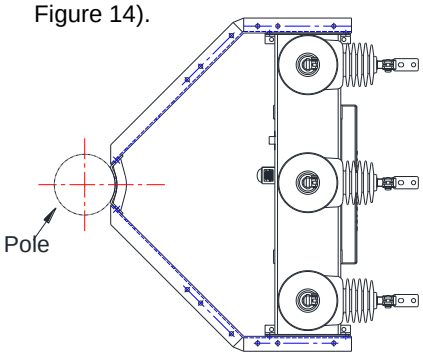
A three-stage auxiliary switch can be provided as an accessory. Each stage has two independent contacts that permit any desired combination of “a” (follow state of recloser contacts) and “b” (opposite recloser contacts) positions. The switch contacts are insulated for 600 V and have a continuous current rating of 10 A. Their interrupting ratings are shown in Table 9.

Table 9
Auxiliary switch interrupting ratings

Volts	Inductive ac (A)	Non-Inductive ac (A)	Inductive dc (A)	Non-Inductive dc (A)
24	-	-	15	20
48	-	-	7.5	10
120	60	80	-	-
125	-	-	1.5	2
240	30	60	-	-
250	-	-	0.45	0.5

Terminals

The standard terminal is a 2-hole flat-pad terminal rated 800 A. An eyebolt, 1/0–500 mcm (630 A), eyebolt 4/0–1000 mcm (800 A), are available as an accessory (see Figure 14).



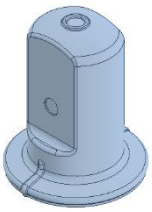
The eyebolt and fixed-pad terminals are made of copper alloys. Cooper Power Systems recommends terminal connection to copper wires to optimize the electrical connection.
Anti-oxide coatings for temporary protection of wire-brushed aluminum cable connections to flat-pad terminals must be maintained at intervals determined by the customer based on load current, climate, and other installation conditions.
Eyebolt terminals are recommended for copper conductors only.

Bird Guard

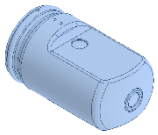
WARNING

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.

The series of Bird-Guard covers are made in outdoor silicon rubber and used to cover the conducting terminals of the circuit-breaker to protect the birds from touching high-voltage conductor directly.



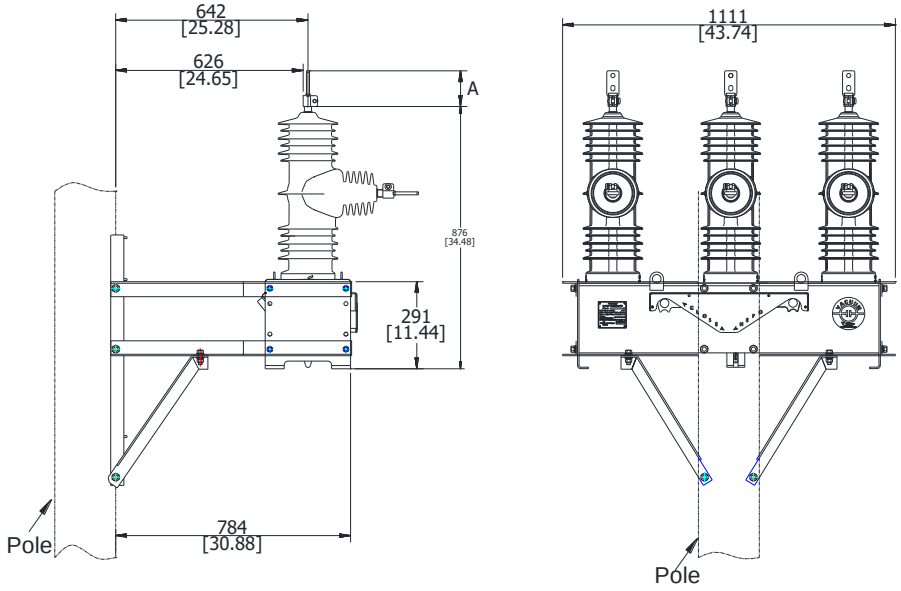
Bird-Guard for top terminals



Bird-Guard for side terminals

Pole-mounting hanger

A pole-mounting hanger (see Figure 17), which bolts directly to the recloser frame, is available for pole mounting installation.



Terminal options	A
Eyebolt, 1/0 - 500 mcm Cable range (630A Max.)	89
Eyebolt, 4/0 - 1000 mcm Cable range (800A Max.)	111
Flat Pad, 2-hole (800A Max.)	119

Figure 17.
Dimensions of NOVAi recloser with pole-mounting hanger accessory

Arrester Mounting Brackets

The arrester mounting bracket accessory (see Figure 18) can be bolted to the recloser frame and pole-mounted hanger for the addition of inboard and outboard arresters. The arresters are not included with the brackets.

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

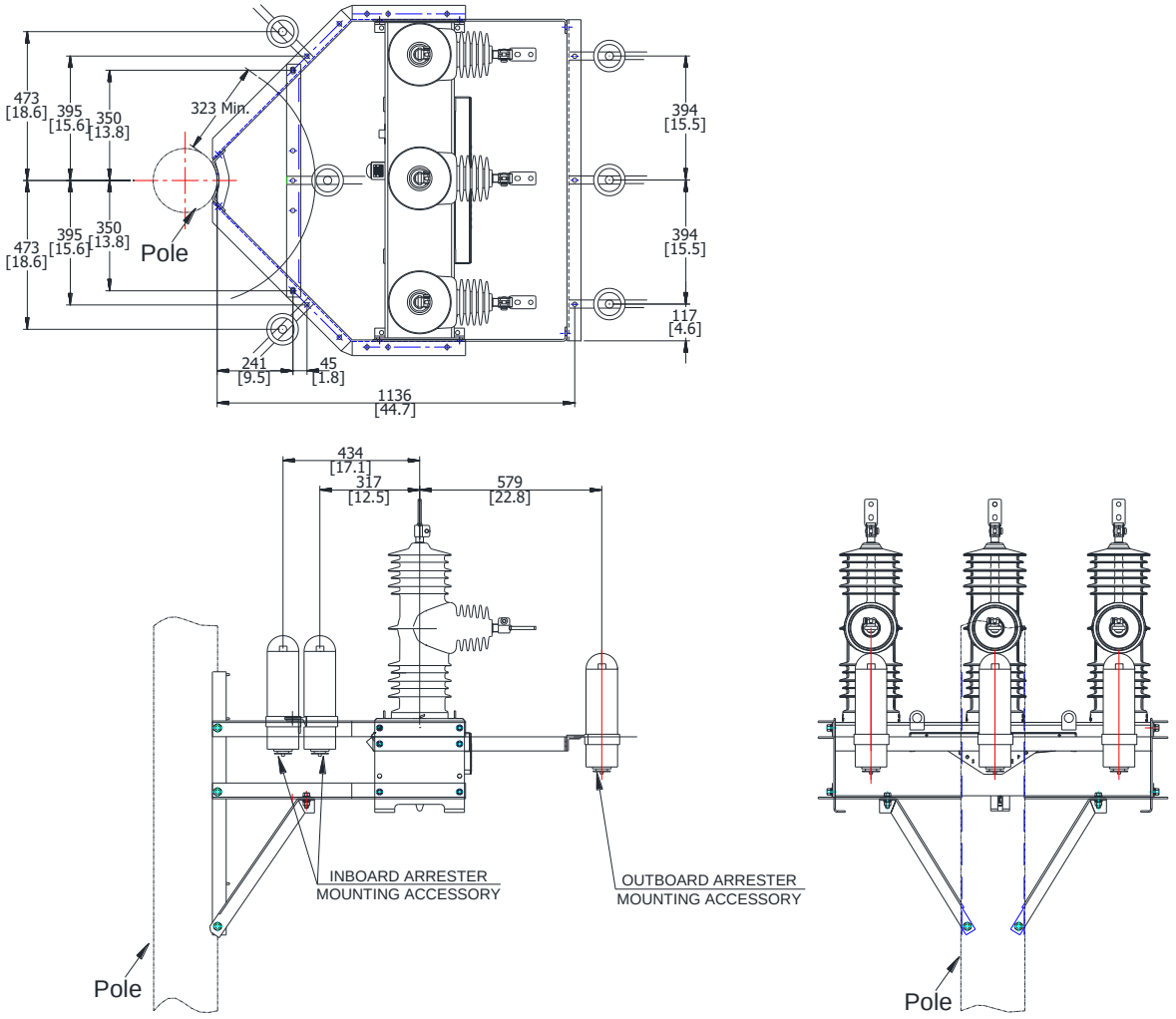
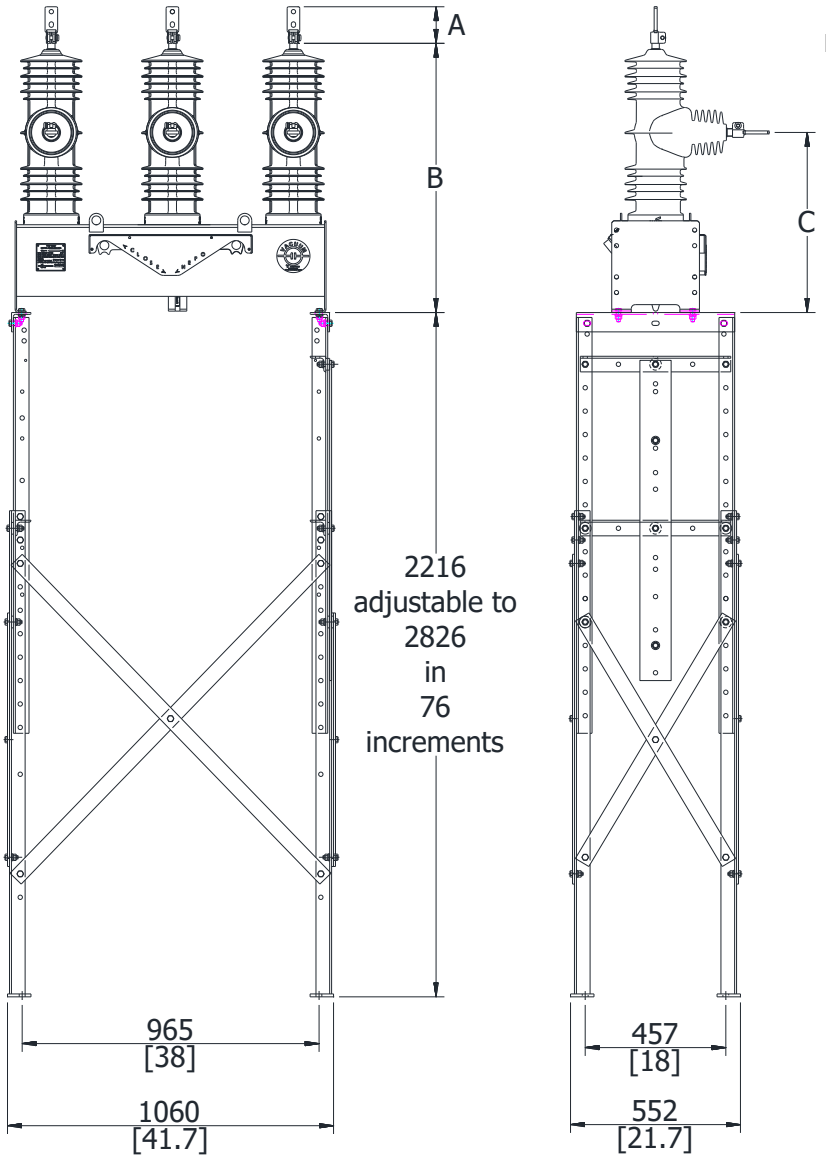


Figure 18.

Dimensions of NOVAi recloser with pole-mounting hanger and arrester mounting bracket accessories.

Substation mounting frame

A substation mounting frame accessory (se Figure 19) is available for substation mounting applications.



Note: All dimensions are mm (inches).

Dimensions shown are approximate.

Terminal opinions	A
Eyebolt, 1/0 - 500 mcm Cable Range (630 A maximum)	89
Eyebolt, 4/0 - 1000 mcm Cable Range (630 A maximum)	111
Flat pad, 2 holes 800 A maximum	119

	B	C
NOVAi-27kV	876 [34.48]	585.5 [23.05]
NOVAi-38kV	970.5 [38.21]	640.5 [25.22]

Figure 19.

Dimensions of NOVAi recloser with substation mounting frame accessory

SERVICE INFORMATION

Service Requirements

The NOVAi recloser has been designed with a minimum mechanical life of 10,000 operations. The NOVAi recloser requires routine inspection 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 the FXD/Form 6 microprocessor-based recloser controls. Refer to the control operation manual.

WARNING

The 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.

1. **Check the Nameplate Ratings**. Make sure the ratings, settings,and interface options on the recloser nameplate (see Figure 5) are correct for the planned testing.

2. **Test Electrical Open/Close Operation**. Close and open the recloser contacts using the microprocessor control. Confirm thatthe 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/Close**. Pull the yellow manual open handle (see Figure 12) down to open the recloser contacts. Confirm that the contacts have opened by:

   A. The OPEN/CLOSE contact position indicator, or

   B. By a continuity check between the recloser terminals.

4. **Test Manual Open/Close**. Push the YELLOW manual open handle up. Pull down the RED manual CLOSE handle, located on the side of the recloser (see Figure 12). Confirm that thecontacts have closed by:

   A. The OPEN/CLOSE contact position indicator, or

   B. By a continuity check between the recloser terminals.

5. **To Close the Recloser Contacts:**

   A. First, push the yellow manual open handle up.

   B. Close the recloser by 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

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.

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.

Use the following procedures to perform high-potential withstand tests at 80% of the rated power-frequency withstand voltage for 60 seconds. See Table 10 for test voltages and Figure 20 for test connection diagrams.

Test results for NOVAi 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.

Table 10.

NOVAi Recloser Vacuum Interrupter Withstand Test

	80% of Rated Low-Frequency Withstand Voltage (1 min. dry) (kV rms)
Description	**ac**
NOVAi-27kV	48
NOVAi-38kV	56

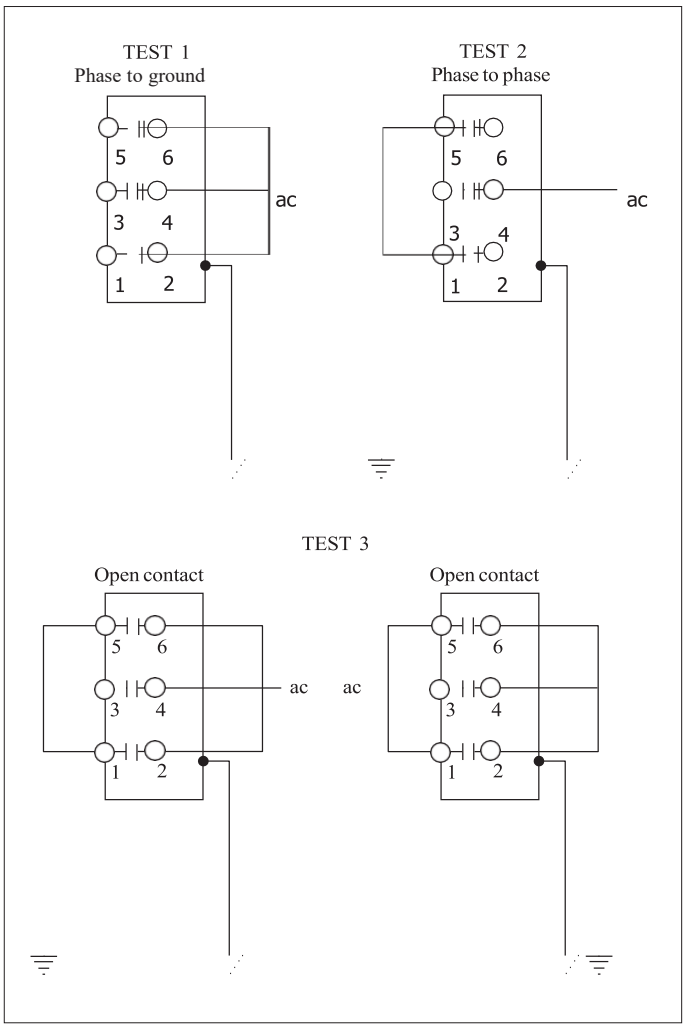


Figure 20.
Connection diagrams for high-potential withstand testing

Test 1

1. Close the recloser contacts.
2. Ground the recloser.
3. Connect terminals 2, 4, and 6 (see Figure 20) together.
4. Apply proper test voltage (see Table 10) 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 Phase A (terminal 2) and Phase C (terminal 6).
4. Apply proper test voltage to Phase B (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 20).
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 tests (Tests 1 or 2), the cause is likely to be a diminished electrical clearance or failed insulation. Retest each phase individually to determine the failed phase or phases.

If the recloser does not pass Tests 1, 2, or 3, contact an authorized service center or your Cooper Power Systems representative.

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

Module flashover service

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

1. Bypass and remove the recloser from service as described in the 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. If there is a damage to the module rods, the module must be replaced. Contact an authorized service center or your Cooper Power Systems representative.
6. Clean the damaged module with isopropyl alcohol and a scratch-free, nylon scouring pad to remove any carbon deposit.
7. With a clean rag, apply a thin coat of dielectric silicone grease to the cleaned areas.
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 high-potential withstand test. Refer to the **High-Potential Withstand Testing** section of this manual.

Troubleshooting

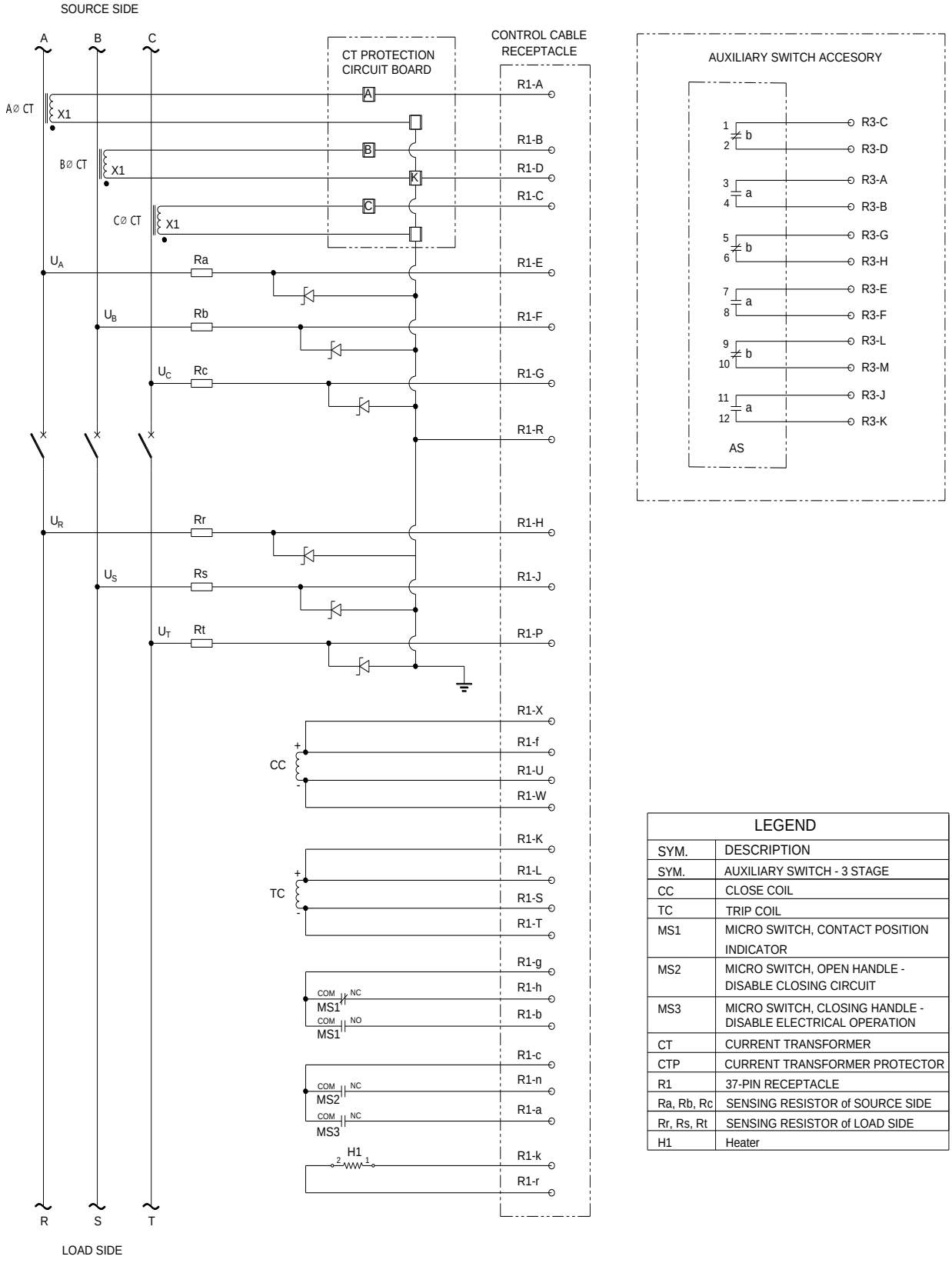
If the NOVAi recloser does not perform as described in the **OPERATION** section of this manual, the following information may assist in troubleshooting:

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
- 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
- Check the fusing on the dc-to-dc converter board located in the control cabinet.



LEGEND	
SYM.	DESCRIPTION
SYM.	AUXILIARY SWITCH - 3 STAGE
CC	CLOSE COIL
TC	TRIP COIL
MS1	MICRO SWITCH, CONTACT POSITION INDICATOR
MS2	MICRO SWITCH, OPEN HANDLE - DISABLE CLOSING CIRCUIT
MS3	MICRO SWITCH, CLOSING HANDLE - DISABLE ELECTRICAL OPERATION
CT	CURRENT TRANSFORMER
CTP	CURRENT TRANSFORMER PROTECTOR
R1	37-PIN RECEPTACLE
Ra, Rb, Rc	SENSING RESISTOR of SOURCE SIDE
Rr, Rs, Rt	SENSING RESISTOR of LOAD SIDE
H1	Heater

Figure 21.

Wiring diagram for standard NOVAI recloser with control-powered interforce (37-pin receptacle)

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