Medium Voltage Distribution

N-Series Three-Phase Recloser with ADVC Controller

Make the most of your energy℠
Applications

Smart Grid Ready

With the increasing push for advanced monitoring, reduction of outages, and the need to facilitate two-way communications between supply and the distribution network, the N-Series Automatic Circuit Recloser is ready to be integrated into your smart grid solution.

Loop Automation

Restoring power to your customers in the shortest possible time is the focus of Recloser Solutions' Loop Automation Scheme.

The Loop Automation Scheme reconfigures protection settings, sectionalizes faults, minimizes affected areas, and restores network supply without the need for communications or operator intervention, using standard recloser features.

Automatic Changeover (ACO)

The Automatic Changeover (ACO) System uses primary and alternative supplies, master and slave reclosers, and fast communications to ensure that supply is always available for a critical load in the event of a power failure.

Using a number of different setups, including break-before-make and make-before-break, allows the system to be configured to the exact specifications required for the critical load. The system can even be set up for one-way or two-way switching to ensure power is always available to your critical systems.

Operation as a Sectionalizer

Reclosers and sectionalizers work together to further improve feeder reliability. Using a separate RL-Series LBS/Sectionalizer, as part of a feeder automation network, detects fault passage and automatically isolates faulty sections of a network in conjunction with upstream recloser operation. To accomplish this it senses the three-phase current and voltage to count the number of recloser trip operations. When the preprogrammed number of recloser operations is reached, the controller opens the sectionalizer during the recloser dead time to isolate the downstream fault.
The N-Series Automatic Circuit Recloser (ACR) represents the commitment of Schneider Electric™ to improve products and invest in ongoing product development. Providing the features of a traditional recloser, plus the benefits of up-to-date design optimized for automation, remote control, and monitoring, now or in the future, the N-Series ACR is a complete scalable solution.

The N-Series development was driven by customer demand for improved return on capital investment in the distribution network. After careful evaluation of customer needs, the N-Series was developed to achieve optimum performance and reliability, making use of the latest available technology in vacuum interruption and microelectronics.

In the past, distribution equipment such as reclosers have been purchased only to support load growth. Today, your customers, the electricity consumers, are demanding reduced outages and lower prices. At Schneider Electric, we are continually working to provide the advanced equipment needed for tomorrow’s competitive electricity distribution system.

By using our technologically advanced equipment, operating costs will be reduced and capital works can be deferred through better management of the existing plant. There will be a reduction in the outage area; reductions can cause lost revenue.

In addition to ACRs, the Schneider Electric family of switchgear includes remotely controlled and monitored pole-mounted load break switches and sectionalizers, as well as remote control and monitoring software.

The Schneider Electric Switchgear and Controller product ranges create a complete solution for distribution system automation (DSA).

**Reduced Purchase Cost**
- Fully integrated: No requirement for additional Remote Terminal Units (RTU), power supplies, batteries, or enclosures. The RTU and a range of communication ports are included in the standard equipment.
- A 630 A cable connection kit is provided as part of the standard package. Optional 250 A, 400 A, and 800 A cable kits are also available.

**Reduced Installation Costs**
- Simple Commissioning: Configuration of the unit is from the WSOS Software or the operator interface.
- All key components required for installation are included.
- Lightning arrester mounting, cable tail kit, and pole-mounting brackets are provided in the standard package. An optional voltage transformer (VT) for auxiliary supply is available.
- Schneider Electric ACRs are ideally suited as low-cost feeder circuit breakers in outdoor primary substations. In this application, connection into the substation control system is simple and low cost.

**Reduced Operating Costs**
- Reduce equipment damage through the integral protection relay, which provides fast isolation of faults.
- The recloser constantly monitors line current and voltage without the need for additional measurement devices. This data can then be used for forward planning and optimization of existing feeders.
- Reliable lifetime, low maintenance equipment reduces operational costs.

**DSA/SCADA Compatibility**
When used with a compatible DSA or SCADA system, Schneider Electric ACRs support remote control and monitoring to provide the following advantages:
- Reduced travel time for line crews: information on fault current and recloser status values transmitted to system control allows fast location of the faulted line section.
- This same information allows informed remote switching, reducing the affected area and quickly restoring supply.
- ACRs can be configured and settings managed from system control without technicians having to visit each individual recloser in the field, with a consequent reduction in travelling time and improved system integrity.

**Increased Customer Satisfaction**
- Reduced Customer Minutes Lost: Supply can be quickly restored to fault-free areas.

**Deferred Capital Expenditures**
- Remotely controlled and monitored reclosers give an improved knowledge of a system and provide better system control. Feeder and substation load can then be remotely managed, improving utilization of your existing plant. Purchase of new plant can then most likely be deferred for a considerable period of time.
ACR Overview

The N-Series ACR is designed around vacuum interrupters contained in a fully welded and sealed 316 marine-grade stainless steel enclosure. The enclosure is filled with sulphur hexafluoride (SF₆) gas or dry air ('N-green' option), which both have excellent electrical insulating properties, resulting in a compact and low-maintenance device.

The N-Series circuit breaker is controlled and monitored by either the COMPACT™ or ULTRA ADVC Controller (ADVC).

Enclosed in a 304 (COMPACT™) or 316 (ULTRA) grade stainless steel enclosure, the ADVC provides an electronic controller with operator interface that monitors the circuit breaker and provides protection, measurement, control, and communication functions. Connected via a control cable, the Switchgear and ADVC can form a remotely controlled and monitored ACR.

The circuit breaker is operated by sending a controlled pulse of current from a storage capacitor in the ADVC through a solenoid. This attracts the mechanism plate, which in turn closes the contacts in the vacuum interrupter. The contacts are held in the closed position by latch tongues resting on the trip bar.

Opening of the contacts is achieved by releasing a controlled pulse of current from a capacitor through the trip coil. This attracts the trip bar armature, turning the trip bar and releasing the latch. The opening spring and the contact pressure springs accelerate the contacts open. A flexible connection is provided to allow movement of the contacts to occur.

Epoxy bushings insulate the main circuit conductors from the tank and provide a double O-ring seal. They also provide the necessary insulation and support for the embedded capacitive voltage transformers (CVT) and for the current transformers (CT). The bushings are DIN 47 636 (threaded option) and allow the connection of alternative cable connection elbows if desired. Lightning arrester mounting is provided for installation convenience.

A standard kit for field fitting is supplied with the circuit breaker. It contains silicone bushing boots and 9.85 ft. (3 m) lengths of .372 in.² (240 mm²) aluminium insulated water-tight cable tails rated at 630 A. This arrangement results in a recloser suitable for connection into an insulated conductor system, or a bare conductor system, as appropriate. The fully insulated system provides freedom from faults caused by birds and other wildlife.

An auxiliary voltage supply of 110, 220, or 240 volts AC is required to power the unit and, if necessary, a VT can be provided as a purchase option. The ADVC is connected by a control cable to the bottom of the circuit breaker through a rubber covered plug/socket arrangement.

A clearly visible external pointer shows the contact position. The recloser can be tripped from the ground by a hookstick. It can then be locked out by opening the isolating switches located on the operator control panel. These switches are physically connected in series with both the trip and close solenoids.

The ADVC interfaces to the recloser via the control cable and connects to the switch cable entry module (SCEM) in the base of the tank. The SCEM uses nonvolatile memory to store all relevant calibration data, ratings, and number of operations. The SCEM also provides the first stage of electrical isolation and shorting electronics to short the CTs and CVTs in the event the control cable is disconnected while current is flowing through the recloser.
**ADVC Controller Series**

Advanced protection, data logging, and communications capabilities are made possible by the technology housed in the ADVC Controller.

It has been designed especially for outdoor pole-mounted operation and is typically mounted low on the pole for ease of access by operation personnel.

With a cubicle designed to minimize temperature rise from solar heating, the 304 (COMPACT) or 316 (ULTRA) grade stainless steel enclosure is used to mount the control and protection enclosure (CAPE), power supply unit (PSU), customer accessories, and operator interface.

The ADVC Controller Series incorporates a multifunction protection relay, a circuit breaker controller, a metering unit, and an RTU.

Batteries are carefully located underneath these modules to help avoid overheating so that a battery life of up to 5 years\(^1\) can be achieved. A tamper-resistant, lockable stainless steel door sealed with a rubber gasket provides access to the operator interface. Vents are screened against vermin entry and all electronic parts are enclosed in a sealed die-cast enclosure, which protects them from entry of moisture and condensation ensuring a long lifetime.

The **COMPACT** Cubicle is suitable for temperatures from -14 °F (-10 °C) to 122 °F (50 °C), while the option of a battery heater in the **ULTRA** Cubicle extends its operating temperature range from -40 °F (-40 °C) to 122 °F (50 °C).

A built-in microprocessor controlled power supply provides uninterrupted operation of not only the circuit breaker and controller, but also the communications radio or modem. These accessories are connected to a built-in user-programmable radio power supply. Therefore no other power supplies are required for connection into your SCADA or distribution automation system.

Due to careful design, the efficiency of all parts is extremely high, allowing a battery hold-up time of up to 44 hours.\(^2\) The architecture used has the advantage that the circuit breaker operation is independent of the high-voltage supply, relying on a set of capacitors charged by the auxiliary supply.

Due to sophisticated power-supply-management techniques, a circuit breaker operation is always guaranteed when attempted and alarms are raised over the telemetry when auxiliary power is lost.

Communications equipment can be mounted within the ADVC Controller cubicle. A V23 FSK modem, RS232, RS485, and Ethernet TCP/IP are provided as standard to support all of your communications needs.

The ADVC Controller Series is available in two models:

- **ULTRA**
- **COMPACT**

The table below outlines some of the differences between the two models.

<table>
<thead>
<tr>
<th>Feature</th>
<th>ULTRA</th>
<th>COMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>316 stainless steel</td>
<td>304 stainless steel</td>
</tr>
<tr>
<td>Door locking</td>
<td>Three-point</td>
<td>Two-point</td>
</tr>
<tr>
<td>Customer accessory tray</td>
<td>Side tray</td>
<td>Side tray only</td>
</tr>
<tr>
<td></td>
<td>Upper tray</td>
<td></td>
</tr>
<tr>
<td>Input/Output modules</td>
<td>8 inputs, 8 outputs</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Battery heater</td>
<td>Optional</td>
<td>N/A</td>
</tr>
<tr>
<td>Battery</td>
<td>7 Ah or 12 Ah</td>
<td>7 Ah</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 °F (-40 °C) to 122 °F (50 °C)</td>
<td>-14 °F (-10 °C) to 122 °F (50 °C)</td>
</tr>
<tr>
<td>(with battery heater option)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary power supply</td>
<td>120/240 VAC</td>
<td>120/240 VAC</td>
</tr>
<tr>
<td>Dual AC power supply</td>
<td>Optional</td>
<td>N/A</td>
</tr>
<tr>
<td>VT supply via switchgear</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>DC power supply</td>
<td>Optional</td>
<td>N/A</td>
</tr>
</tbody>
</table>

\(^1\) Battery replacement interval is influenced by environmental temperature.

\(^2\) With optional 12 Ah Battery, panel off, and without communications devices operating.
Schneider Electric ACRs provide many outstanding advantages to the user.

New and innovative features have been made possible by the way the pole-mounted circuit breaker and control cubicle work closely together. The block diagram on this page shows how the two items are interfaced.

Special extended range CTs provide a range from 1 A to 16,000 A for measurement and protection. Embedded voltage screens accurately image the primary voltage value and phase relationship at the analogue front end, allowing measurement of voltage, current, power factor, and frequency in the electronic module.
Each recloser is provided with an operator interface. From here a user can access and program the many measurement and protection features available. The two following operator interfaces are available:

> **setVUE Operator Interface**
  - Based on the field-proven operator panels in the previous controllers, this menu-driven interface with large LCD display offers a familiar look and feel.

> **flexVUE Operator Interface**
  - 20 Status Lights provide a quick snapshot of the protection and controller status.
  - 12 Quick Action Keys are available to execute frequently used actions such as «Remote control» ON/OFF, «Reclose» ON/OFF, etc. Each key has its own status light to indicate the ON/OFF state.
  - All Status Lights and Quick Action Keys are customizable.
  - It is possible to access event and measurement data and change settings.

---

**Telemetry Interface**

The Schneider Electric ACR can be interfaced to your SCADA system either through its built-in V23 modem and a radio, or its RS232 ports and a modem of your choice. RS485 and Ethernet TCP/IP are also available. A variable-voltage uninterruptible power supply is included for the radio or modem, which can be mounted inside the communications cubicle. Many telemetry protocols can be supported such as DNP3 and IEC 60870-5-101.

**Computer Interface**

WSOS is an advanced personal-computer-based software package to allow offline and online programming, monitoring, and control of a recloser via a USB port, RS232 port, or Ethernet.

**Remote Control**

The ADVC offers an impressive list of communication ports for use in remote control applications:

- 4 x RS232
- 1 x RS485
- 1 x Ethernet
- 1 x V23
Customizing the operator interface to suit your unique applications has never been easier.

The flexVUE operator interface uses light-emitting diodes (LEDs) and an LCD display to communicate the system status to a local operator. Operator actions that are performed on a regular basis can be mapped to 12 dedicated buttons on the interface. Each of these buttons also has a light to indicate the ON/OFF state of each action. Together with the 20 Status Lights the panel provides no less than 32 three-color LEDs that display the state of the controller and overhead system. On the interface, the action buttons are grouped together and referred to as Quick Action Keys. The status LEDs are also grouped together and referred to as Status Lights.

Every controller is programmed with a standard configuration of Status Lights and Quick Action Keys — text labels are used to mark the function of each. These labels are inserted into special pockets within the flexVUE operator interface and can be changed in the field if required.

A graphical panel configuration tool is provided as part of the WSOS 5 software package that will allow full customization of the flexVUE operator interface, if required. With the tool you can create your own logic functions driving the Status Lights, as well as change the actions linked to each Quick Action Key. New labels can be printed from the WSOS template using standard office paper, cut to size, and inserted into the controller.

WSOS Version 5 integrates the Schneider Electric field-proven, Windows®-based switchgear operating system and its powerful features and tools, developed over many years, into a modern desktop. The desktop includes the Switchgear Explorer to organize your switchgear the way you like it and the Launch Pad for handy links to online help, getting started, updates, and much more. Controlling, configuring, and accessing valuable switchgear data from local or remote locations is now even easier than before.

**Local and Remote Control**

- Switchgear operation
- Protection group selection
- Protection group copy
- NPS on/off/alarm control
- Auto reclose, ground protection, and SGF on/off control
- Hot line tag, low gas, and dead lockout on/off control
- Configurable input/output expander (IOEX)
- Configurable quick keys
- Configurable delay for local *open* and *close* operations (*hit and run*)
- Configurable SCADA protocols (e.g., DNP3, 101/104, modbus, MITS)
Windows Switchgear Operating System

WSOS is the Schneider Electric Switchgear Operating System software. It provides easy access to all switchgear functions from opening/closing, through configuring protection and communication parameters to accessing measurement and analytical data.

By using a PC, engineers can manage a large number of reclosers, either remotely via a communications link or locally via USB, serial port, or Ethernet connection.

Communication Options
- Local USB port (for connection to WSOS only)
- Local RS232 port connection
- Radio modem
- GSM/PSTN modem
- DNP3 virtual terminal object
- TCP/IP
- Communications output capture

Measurement Screens
- Three-phase, ground, and sequence current
- Phase voltages:
  - Phase to phase
  - Phase to ground
  - Sequence voltages
- Phase live/dead indication
- Apparent, reactive, and real power:
  - Total
  - Per phase
- Power factor
- Signed or unsigned power
- Frequency
- Power quality toolkit:
  - Waveform capture
  - Harmonics

Interface Configuration
- Status Lights:
  - Logic function to indicate, separate true/false state color configuration
- Quick Action Keys:
  - Customize actions assigned to each key
  - Custom logic functions for light indication
  - Separate true/false color configuration
- Print labels to insert into operator interface
Operating Sequence

Reclose times are individually selectable. The operating sequence is defined by:

\[ O - 1st \ rt - CO - 2nd \ rt - CO - 3rd \ rt - CO \]

where \( rt \) = reclose time
where \( O \) = open
where \( C \) = close

Reclose Times

> First reclose time range: 0.5 – 180 sec.
> Second reclose time range: 2.0 – 180 sec.
> Third reclose time range: 2.0 – 180 sec.
> Timing resolution: 0.1 sec.

Sequence Reset Time

> Sequence reset time: 3 – 180 sec.
> Timing resolution: 1 sec.

Trips to Lockout

Overcurrent and fault trips to lockout are selectable between 1 and 4. A separate setting is available for sensitive ground fault and negative phase sequence.

Inverse Time Protection Curves

The ADVC offers a total of 48 user-selectable inverse time protection curves. These are:

> Three IEC60255 curves: Inverse
  Very inverse
  Extremely inverse
> Three IEEE C37.112 inverse time curves: Moderately inverse
  Very inverse
  Extremely inverse
> 42 nonstandard inverse time curves: Refer to the Operating Manual for a full listing

Instantaneous Protection

Instantaneous protection works by tripping the recloser if the line current exceeds the Instantaneous Multiplier \( x \) Setting Current.

> Multiplier range: 1 – 30
> Resolution of setting: 0.1
> Max effective setting: 16 kA

Definite Time Protection

Definite time protection is an alternative to inverse time protection. It works by tripping the recloser at a fixed time after pick-up.

> Setting current range: 10 – 1,260 A
> Definite time resolution: 0.1 sec.
> Definite time range: 0.01 – 100 sec.
> Setting current resolution: 1 A

Sensitive Ground Fault (SGF)

SGF causes the recloser to trip when the ground current rises above a set level for longer than the set time.

> SGF trip current range: 4 – 20 A
> SGF operating time range: 0.1 – 999 sec.
> SGF trip current setting resolution: 1 A
> SGF operating time resolution: 0.1 sec.
General Protection Features (continued)

Inrush Restraint

Inrush restraint raises the phase and ground threshold currents for a short period of time to allow for short duration inrush currents when closing onto a load.

- Multiplier range: 1 – 30
- Multiplier resolution: 0.1
- Time range: 0.05 – 30 sec.
- Time resolution: 0.05 sec.

Cold Load Pick-Up

Cold load pick-up allows for a loss of diversity when a load has been without supply for a period of time.

- Multiplier range: 1 – 5
- Multiplier resolution: 0.1
- Time constant range: 1 – 480 min.
- Time constant resolution: 1 min.

Multiple Protection Groups

The ADVC supports up to 10 protection groups, each of which can be configured with completely separate protection characteristics with different inverse time curves and setting currents. The number of protection groups available to the operator can be configured using WSOS, thereby restricting or enabling access to protection settings as required.

Automatic Protection Group Selection

Automatic protection group selection (APGS) is used to change the protection group depending on the direction of power flow. This allows the recloser to be correctly graded with devices downstream regardless of the power flow direction.

Loss of Phase

Loss of phase protection trips the recloser if phase-ground voltage on one or two phases falls below a set voltage threshold for a set length of time.

- Threshold voltage range: 2 – 15 kV
- Voltage resolution: 1 V
- Time range: 0.1 – 100 sec.
- Time resolution: 0.1 sec.

Live Load Blocking

Live load blocking prevents a recloser from closing if any of the load side terminals are live.

- Live load threshold voltage range: 2 – 15 kV

Dead Lockout

Dead lockout prevents a reclose unless one or more of the source side or load side terminals are live. If all terminals are dead then the controller goes to lockout.
Advanced Protection Features

Directional Blocking

Directional blocking is a protection feature that restricts tripping on faults to a designated side of the recloser. It prevents nuisance tripping if particular network conditions are causing “false” ground faults. In radial systems, directional blocking prevents nuisance tripping by blocking faults in the source direction and only responding to faults in the load direction.

Directional Protection

Directional protection is distinct protection for faults in the forward and reverse direction. A forward fault may use a different time-current curve and settings to a reverse fault (i.e., these are individually selectable). Both the forward protection and reverse protection are operating at the same time. This is an additional protection feature.

Sequence Components

Negative-, positive-, and zero-phase sequence currents and voltages can be monitored and logged.

In addition, the negative-phase sequence current protection can be used for detection of low-level phase-to-phase faults in the presence of high-level, three-phase loads. Inverse time, definite time, and instantaneous operation is available.

- Setting current range: 10 – 1,260 A

Sequence Coordination

Sequence coordination allows a recloser to coordinate its trip sequence with another recloser downstream.

Under/Over-Frequency Protection

Under/over-frequency protection trips the recloser when the system frequency exceeds the under- and over-frequency trip threshold values; frequency tripping range: 45 – 65 Hz

- Frequency calculation: Once per cycle over a two-cycle period
- Number of under/over-frequency cycles before tripping: 2 – 1,000
- Accuracy: ±0.05 Hz

Under/Overvoltage Protection

When selected, and a nominal phase-to-ground system operating voltage is set, the under/overvoltage protection works within a defined threshold above and below the specified voltage.

- Undervoltage lower threshold range: 50% – 88%
- Overvoltage upper threshold range: 112% – 150%
- Trip range (after x sec.): 0 – 300 sec.
- Phase logic:
  - AND: when ALL phases deviate beyond thresholds
  - OR: when ANY phase voltage deviates beyond the thresholds
  - AVERAGE: when the numerical AVERAGE of all phase voltages deviates beyond the threshold
### Measurement Features

#### RMS Voltage and Current

True root mean square (RMS) voltage is measured on all six terminals. A user-configured threshold indicates a live terminal (accuracy ±2.5%). RMS current is measured on three phases (reading 2 – 800 A).

#### Real Power (Signed or Unsigned)

Real power is determined by multiplying the line voltage and line current in real time and averaging over 2 seconds (accuracy ±5% of reading, within limits of V and I above).

#### Power and Power Factor

The ADVC Controller measures kW, kVA, kVar, and power factor on a per-phase basis. The power factor of the line is determined from the line voltage and the line-current phase relationship and the previously calculated real power (accuracy ±5% of reading, within limits of V and I above).

#### Default Historical Measurements

Power flow is integrated over 5-, 15-, 30-, or 60-minute intervals (kWh) and recorded for two months at the default setting. This can be viewed on the operator control panel, computer, or compatible SCADA system. Additionally, data can be uploaded into a portable computer or a compatible SCADA system.

#### Configurable Historical Measurements

Average demand profiles may be configured using WSOS. Customized configuration enables the user to specify only the parameters that are required, negating unnecessary information capture. Parameters such as line voltages and currents, power, kWh, battery voltage, and cubicle temperature can be recorded in intervals selectable between 1 and 1,440 min.

#### Event History

- Maximum number of typical events stored in the event history: 30,000 events

#### Gas Pressure Measurement (SF₆ or Dry Air “N-green” Option)

- Gas pressure display resolution: .725 psi (5 kPa)
- Gas pressure display accuracy: ±1.45 psi (±10 kPa)
- Gas low alarm setting: 9.427 psi gauge @ 68 °F (65 kPa gauge @ 20 °C)
- Gas low alarm/interlock accuracy: ±1.45 psi (±10 kPa)

#### Power Quality Toolkit

- **Supply Outage Measurement**
  - The supply outage measurement feature utilizes built-in recloser features to record the number and duration of outages. These statistics are recorded in the controller and are available to the utility to help calculate system outage customer minutes.

- **The Controller Records:**
  - Cumulative total number of outages
  - Cumulative total outage duration
  - The time and duration of each outage event in the event log
  - These records are accessible to the user and can be retrieved using the operator control panel, WSOS, or a SCADA system

- **Harmonic Analysis**
  - Harmonics 2 to 16 and the total harmonic distortion (THD) are calculated over an 80-ms period for four currents, six line-line voltages and six line-ground voltages — these harmonics are available via WSOS

- **Waveform Capture:**
  - Based on a user-defined trigger, the ADVC captures and stores in nonvolatile memory, scaled raw data (10 x 3,200 samples per second) of the six line-ground voltages, and four currents for a predefined time window either side of a user-defined trigger
  - The user can configure a pre- and post-trigger time ratio for data to be stored — this defaults to 50% pre-trigger and 50% post-trigger
  - The captured data can be uploaded at anytime in COMTRADE (IEEE Std C37.111-1999) format via WSOS
N-Series Recloser Pole Mounting Details

Customer supplied:
- Insulated connectors
- Connecting cables
- Lightning arresters

Schneider Electric supplied:
- 9.85 ft. (3 m), 630 A cable tail standard
- 250 A, 400 A, or 800 A by request
- Silicone bushing boots (see detail below)

Notes
(1) Details given in this illustration are subject to change without notice. For full details see the Installation Manual.
(2) Grounding connections are not shown and are to be in accordance with the Installation Manual.
(3) Recloser can be mounted closer to pole if lightning arresters are pole-mounted.
(4) Optional substation mounting frame available on request.

<table>
<thead>
<tr>
<th>N-Series Model</th>
<th>Rated Voltage</th>
<th>A (in./mm)</th>
<th>B (in./mm)</th>
<th>C (in./mm)</th>
<th>D (in./mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N15</td>
<td>15.5 kV</td>
<td>54.9/1,370</td>
<td>35.3/898</td>
<td>22.1/525</td>
<td>33.6/880</td>
</tr>
<tr>
<td>N27</td>
<td>27 kV</td>
<td>54.9/1,370</td>
<td>35.3/898</td>
<td>22.1/525</td>
<td>33.6/880</td>
</tr>
<tr>
<td>N38</td>
<td>38 kV</td>
<td>55.5/1,410</td>
<td>35.3/898</td>
<td>22.1/525</td>
<td>37.5/955</td>
</tr>
<tr>
<td>N38 (“N-green”)</td>
<td>38 kV</td>
<td>55.5/1,410</td>
<td>35.3/898</td>
<td>22.1/525</td>
<td>37.5/955</td>
</tr>
</tbody>
</table>
## N-Series Recloser Specifications

<table>
<thead>
<tr>
<th>Ratings</th>
<th>N-Series</th>
<th>“N-green” option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 kV</td>
<td>27 kV</td>
</tr>
<tr>
<td></td>
<td>12.5 kA</td>
<td>12.5 kA</td>
</tr>
<tr>
<td>Rated Maximum Voltage</td>
<td>15.5 kV</td>
<td>27 kV</td>
</tr>
<tr>
<td>Rated Nominal Voltage (Phase to Ground)</td>
<td>800 A</td>
<td>800 A</td>
</tr>
<tr>
<td>Rated Continuous Current</td>
<td>850 A</td>
<td>850 A</td>
</tr>
<tr>
<td>Emergency Current (8 Hours)</td>
<td>12.5 kA</td>
<td>12.5 kA</td>
</tr>
<tr>
<td>Fault Make Capacity (RMS)</td>
<td>31.5 kA</td>
<td>31.5 kA</td>
</tr>
<tr>
<td>Power Operating Time (Close/Open)</td>
<td>0.1/0.05 s</td>
<td>0.1/0.05 s</td>
</tr>
<tr>
<td>Mechanical Operations</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Rated Full Load Operations</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Short Time Current</td>
<td>12.5 kA</td>
<td>12.5 kA</td>
</tr>
</tbody>
</table>

### Breaking Capacity

| Mainly Active (0.7pf) | 800 A | 800 A | 800 A | 800 A | 800 A |
| Fault Break Capacity | 12.5 kA | 12.5 kA | 16 kA |
| Cable Charging | 25 A | 40 A | 40 A | 40 A | 40 A |
| Line Charging | 22 A | 22 A | 22 A | 22 A | 22 A |
| Transformer Magnetizing | 250 A |  

### Lightning Impulse Withstand Level

| Phase to Phase | 110 kV | 150 kV | 170 kV |
| Phase to Ground | 110 kV | 150 kV | 170 kV |
| Across Interrupter | 60 kV | 70 kV | 70 kV | 70 kV | 70 kV |

### Power Frequency Withstand Voltage

| Phase to Ground | 50 kV | 60 kV | 70 kV | 70 kV | 70 kV |
| Across Interrupter | 50 kV | 60 kV | 70 kV | 70 kV | 70 kV |

### Service Conditions

| Ambient Temperature* (°F) | -40 to 122 | -40 to 122 | -40 to 122 | -40 to 122 | -40 to 122 |
| Ambient Temperature* (°C) | -40 to 50 | -40 to 50 | -40 to 50 | -40 to 50 | -40 to 50 |
| Radiation (Max.) | 1.1 kW/m² | 1.1 kW/m² | 1.1 kW/m² | 1.1 kW/m² | 1.1 kW/m² |
| Humidity | 0 to 100% | 0 to 100% | 0 to 100% | 0 to 100% | 0 to 100% |
| Altitude Feet (Max.) | 9,840 | 9,840 | 9,840 | 9,840 | 9,840 |
| Altitude Meters (Max.) | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |

### Net Weights

- Circuit Breaker with Pole-Mount Bracket (lb./kg) | 549/249 | 549/249 | 549/249 | 549/249 | 549/249 |
- Control Cubicle with Control Cable (lb./kg) | 90/41 | 90/41 | 90/41 | 90/41 | 90/41 |
- Gross Weight of Crate (lb./kg) | 891/404 | 891/404 | 891/404 | 891/404 | 891/404 |
- External VT (lb./kg) | 132/60 | 132/60 | 132/60 | 132/60 | 132/60 |

### Crate Dimensions

| Width (in./mm) | 45.7/1,160 | 45.7/1,160 | 45.7/1,160 | 45.7/1,160 | 45.7/1,160 |
| Depth (in./mm) | 28.7/730 | 28.7/730 | 28.7/730 | 28.7/730 | 28.7/730 |
| Height (in./mm) | 64.6/1,640 | 64.6/1,640 | 64.6/1,640 | 64.6/1,640 | 64.6/1,640 |

---

1. Option when cubicle battery heater is fitted (-14 °F to 122 °F (-10 °C to 50 °C) without heater)
2. For altitudes above 1,000 m (3,280 feet), derate in accordance with ANSI C37.60 for reclosers (ANSI C37.63 for LBS)
For More Information ...
Scan the QR code to email one of our subject matter experts about our reclosers or visit us at http://goo.gl/XVwg1T.