

NOJA POWER[®]

OSM

PRODUCT GUIDE

OSM AUTOMATIC
CIRCUIT RECLOSER
15KV, 27KV & 38KV MODELS



INTRODUCTION

The OSM15, OSM27 and OSM38 automatic circuit reclosers are designed for use on overhead distribution lines as well as distribution substation applications for all voltage classes up to 15kV, 27kV and 38kV respectively.

The OSM tanks are manufactured from stainless steel and powder coated a light grey colour.

The product is supplied complete with an RC control and communications cubicle. The RC control cubicle provides all the protection, data logging and communications functions in a single device. The OSM has been designed for use as a stand alone device that is easily integrated into distribution automation and remote control schemes using the in-built communications capability.

The product has been extensively type tested by independent laboratories to ensure long life and reliability under the harshest environmental conditions. The OSM automatic circuit recloser is the only solid di-electric insulated recloser to provide controlled arc fault venting and the independent testing provides verification of this important safety feature.



OSM RECLOSER AND CONTROL AND COMMUNICATIONS CUBICLE

The product uses technology developed and refined over the last decade.

The in-built user configurable distribution automation functionality can be used with or without a communications system and will reduce outage time and increase profitability in your network.



OSM15 THREE PHASE



OSM27 THREE PHASE



OSM38 THREE PHASE



OSM15 TWO PHASE



OSM27 TWO PHASE



OSM38 TWO PHASE



OSM15 SINGLE PHASE



OSM27 SINGLE PHASE



OSM38 SINGLE PHASE

OVERVIEW

The OSM15, OSM27 and OSM38 automatic circuit reclosers incorporate vacuum interrupters inside solid dielectric insulated poles which are housed within the arc fault venting designed, stainless steel tank. This ensures maximum life and reliability with a fully insulated arrangement inside the long life housing.

Voltage is measured on all six (6) bushings for the three phase devices or on four (4) bushings for the two phase device or on two (2) bushings for the single phase device. Current is measured on all three (3) phases or two (2) phase or single phase using current transformers.

Each phase of the recloser mechanism is operated by an individual magnetic actuator. In three phase and two phase operation the magnetic actuators are mechanically interlocked to guarantee correct operation. The device is latched in the closed position by magnetic latching and each magnetic actuator uses a single coil.

The recloser can be mechanically tripped using the yellow mechanical hook stick operated lever in the base of the tank. The device Open/Close indication, also located in the base of the tank, uses a green 'O' to designate contacts are open and a red 'I' to designate contacts closed.

The status of the recloser is also reflected by microswitches connected to the control electronics. The electronic circuit board where the microswitch is fitted has no active elements which dramatically improves impulse immunity.

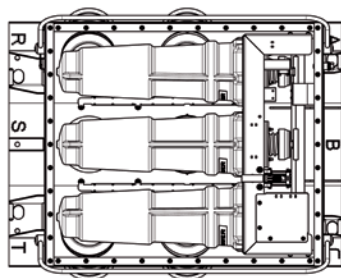
The main circuit bushings are manufactured from UV stable silicone rubber, providing a high creepage distance silicone bushing extension, which is completed with optional termination accessories.

The magnetic actuators are operated from stored energy charged capacitors located in the RC control cubicle. There is a rating plate located on the side of the tank that provides tank rating details in accordance with the requirements of ANSI C37.60. There is an earthing point on the side of the tank.

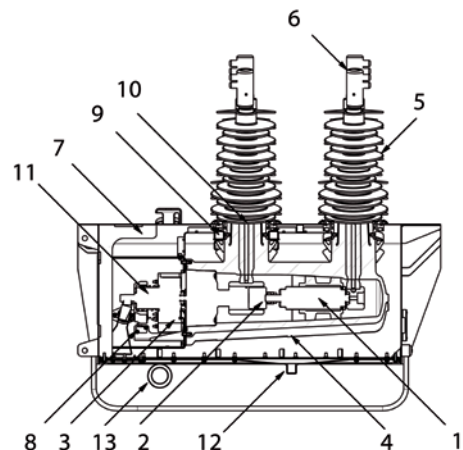
The OSM is supplied with tin plated brass cable connectors on each bushing. The cable connectors can be supplied in the form of tunnel terminals to suit cable up to 260mm² or 2 hole NEMA cable palms.

The cross sectional diagrams below detail the OSM tank configuration and main components.

1. Vacuum Interrupter
2. Insulated Drive Rod
3. Magnetic Actuator
4. Aromatic Epoxy Resin Housing
5. Silicone Rubber Bushing Boot
6. Cable Connector
7. Stainless Steel Tank



8. Auxiliary Switches
9. Current Transformer (position varies with model)
10. Capacitively Coupled Voltage Sensor
11. Opening spring
12. Mechanical Trip Ring



OSM CROSS SECTIONAL DIAGRAM

RC10 / RC15 CONTROL & COMMUNICATIONS CUBICLE

The RC control and communications cubicle provides directional overcurrent, earth fault and sensitive earth fault relay, auto reclosing relay, instantaneous metering, event log, demand logger and remote terminal unit (RTU) for remote control in a single package.

The operator control panel is provided with a large backlit LCD display and keypad to provide fast navigation and local control.

The panel menus are presented in descriptive text which provides ease of use for operators and reduces the learning curve.

The control cubicle has three (3) main modules:

- The operator panel module which provides the Human Machine Interface (HMI).
- The Switch Interface Module (SIM) provides power management, battery charging and incorporates the capacitors that provide the tripping and closing energy to the OSM tank.
- The Relay module includes the main microprocessor and provides DSP functionality.

Temperature compensated float charging is provided to the sealed lead acid batteries located in the RC control cubicle.

There is space provided inside the control cubicle to install any communications equipment to be connected to the in built RTU or I/O module.

The equipment has been designed for the RC control cubicle to operate over a temperature range of -40°C to +55°C inside the IP66 sealed enclosure.



RC CONTROL & COMMUNICATIONS CUBICLE

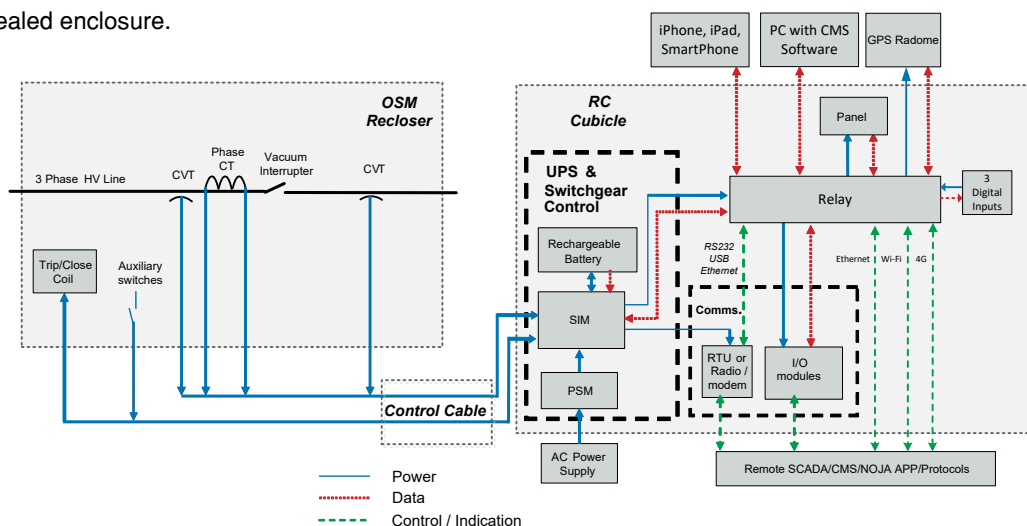
IP66/NEMA 4 VANDAL PROOF CABLE HOUSING



The cubicle is constructed out of powder coated stainless steel for a long maintenance free lifetime. The roof features a ceramic based insulating coating that provides a 16°C reduction in internal temperature when the cubicle is exposed to 1.1kW of solar radiation.

The entry point for the control cable is housed within a vandal-proof enclosure and the cubicle door has a three point handle locking mechanism making it extremely difficult to break into.

The battery provides power while there is loss of auxiliary supply and allows the shutdown of the device in an orderly fashion if there is a prolonged loss of AC. The user can carry out a battery test manually or remotely at a regular configurable time interval.



PROTECTION

The Automatic Circuit Recloser (ACR) is used as a circuit breaker that trips when a fault is detected and has in-built functionality which allows automatic restoration of power based on user configuration.

Protection elements and additional settings such as Temporary Time Addition, Cold Load Pickup and Inrush Restraints allow effective customising of protection to match system characteristics and to suit various network configurations.

The ACR includes Negative Phase Sequence (NPS) protection which allows detection of a broken conductor. Live Load blocking is also available which is useful in preventing backfeed or unsynchronised loads from being connected to the main network.

The recloser can be configured as a fault passage indicator by placing it in Alarm Mode or as a traditional sectionalizer. When the sectionalizer functionality is enabled the fault is detected and counted but the fault is interrupted by an upstream device.

NOJA Power has enhanced this functionality by allowing the recloser to perform a protection trip on the last count to reduce the number of operations of the upstream device.

Protection Features include:

- 4 Independent Protection Groups
 - Each group contains independent protection settings for each direction
- Directional Overcurrent, Negative Phase Sequence and Earth Fault protection
- Inverse Time Protection
 - Independent Curve Selection for Forward & Reverse Direction
 - 4 x IEC255 Curves
 - 8 x ANSI Curves
 - User Defined Curves
 - 42 x Custom Curves
- Definite Time Protection
 - 1-120 seconds
- Time Resolution 0.01 seconds
- High Set Instantaneous Element
- Directional Sensitive Earth Fault Protection
 - Current Setting Range 1-80A
 - Setting Resolution 0.5A
 - Definite Time 0-120 seconds
 - Time Resolution 0.01 seconds



LOCAL CONTROL PANEL

- Admittance Protection & Broken Conductor Protection
- Voltage Protection Element
 - Phase Undervoltage Balanced Element (UV1)
 - Line-to-Line Undervoltage Element (UV2)
 - Loss of Supply (UV3)
 - Voltage Sag Protection (UV4 Sag)
 - Phase Overvoltage (OV1)
 - Line-to-Line Overvoltage (OV2)
 - Neutral Displacement Overvoltage (OV3)
 - Negative Sequence Overvoltage (OV4)
- Frequency Protection Element
- Voltage reclose control with automatic back feed restoration provides loop automation functionality.
- Zone Sequence Co-ordination, Sequence Advance
- Cold Load Pickup
- Inrush Restraint
- Temporary Time Addition
 - Provides a stepped time delay to automatically isolate faulted sections in a feeder or correct grading of devices in series.
- Duty Cycle
- Reclosing Times
- Auto Reclose
 - User configurable 1-4 trips to lockout, independently settable for overcurrent earth fault, sensitive earth fault and voltage protection.
- Synchronisation
- Live Line Function & Hot Line Tag Function
- Harmonic Protection
- Advanced Automation: Automatic Back Feed Restoration, Automatic Change Over, UV3 Autoreclose & Auto-Synchronisation
- Advanced Programmable Logic

REMOTE CONTROL

The Control and Management Software (CMS) is a software package that runs on a PC and is used to configure and interrogate the RC control cubicle both locally and remotely. CMS allows both local and remote download of settings to a device including communication and protection settings.

A USB front panel interface is provided on the RC for local engineering access. Remote control systems such as CMS can connect to the RC using a number of interfaces which include: RS232, USB and Ethernet. Serial connections offer 300-115200bps and both full and half duplex modes. USB ports can be configured for Serial, Wi-fi and LAN. The Ethernet port provides connection to 10/100BaseT networks and can be configured for Wi-Fi. In addition the RC15 cubicle provides an inbuilt Wi-Fi access point.

NOJA Power Recloser Application for mobile devices is available for download from the Android and Apple app store, it will run on Android phones, Android tablets, Apple iPhones and iPads to provide full local and remote control of all products connected to the RC control and communication cubicle.

DNP3, 2179, IEC61850, IEC60870-5-101 and 104 communications protocols are provided in the standard product combined with our ability to engineer new protocols to meet specified customer requests. The control cubicle has space to mount a radio or modem. The onboard radio power supply is rated at 12V 20W. I/O modules with eight (8) user configurable inputs and eight (8) user configurable outputs can be ordered as options in the RC control. Up to two I/O modules can be fitted extending this to sixteen inputs and sixteen outputs.

AUTOMATION

The OSM series ACR's advanced logic enables engineers to implement logic expressions to create their own customised operation of the ACR. Evaluated (true/false) logic expressions initiate actions, activate SCADA points, turn on or off I/O output relays and/or turn on other additional expressions. There are 32 logic channels and variables available.

NOJA's Smart Grid Automation (SGA) PC-based software enables customers to implement and deploy distributed control and automation applications simultaneously across groups of ACRs in accordance with the IEC61499 protocol. SGA software significantly increases the flexibility of the ACRs simplifying the implementation of smart grids.

MEASUREMENT

Voltage is measured on each bushing and current is measured on each phase of the OSM recloser using capacitively coupled voltage sensors and current transformers.

Phase to Earth Voltage: Range 0.3-22.0kV,

Accuracy 1% or 0.1kV

Phase to Phase Voltage: Range 0.5-38.0kV,

Accuracy 2% or 0.1kV

Phase Current: Range 0-800A, Accuracy 1% or 4A

Residual Current: Range 0-100A,

Accuracy 5% or 0.5A

Active, Reactive and Total Power:

Range 10-800A, 4.5 - 38kV, Accuracy 2%

Active, Reactive and Energy: Range 10-800A, 4.5-38kV, Accuracy 2%

Frequency: Range 46-55Hz, 55-65Hz

Accuracy 0.025Hz at $dF/dT < 0.2\text{Hz/s}$

Accuracy 0.05Hz at $dF/dT < 0.5\text{Hz/s}$

Power Factor: Range 0-1, Accuracy 0.02

DATA LOGS

Close Open (CO) and Event Logs are accessible from the LCD display. These include critical operation data such as close open operations, fault types, phase and peak level of fault current. Event logs are time and date stamped to 1 ms resolution which provides additional information such as a full log of all operational history including setting changes, operations and fault history. The fault history logs include 50 cycles of pre-trip history to allow analysis of the fault propagation.

LOAD PROFILE LOG

The Load Profile is logged with a user configured integration period of either 1, 2, 5, 10, 15, 30, 60 and 120 minutes.

Up to 10000 events can be stored in the memory which corresponds to a 417 day, 60 minute, integration period.

CMS can be used to upload and plot the data.



ARC FAULT CONTAINMENT

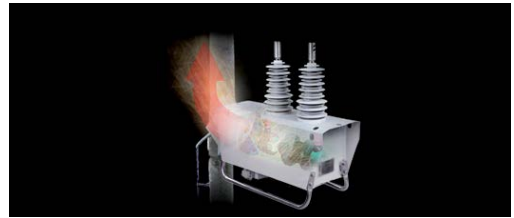
NOJA Power automatic recloser complies with arc fault containment and venting standards. If failure occurs, internal arcing is contained and any gases generated are safely vented.

NOJA Power's patent arc fault contained and vented design is in accordance with the requirements of IEC62271-2011 Clause 6.106 and Annex AA; the efficacy of this important safety feature has been verified as part of full type testing by independent test laboratories such as KEMA in the Netherlands.

NOJA Power OSM range of reclosers use solid dielectric insulation instead of the environmentally unfriendly oil or sulphur hexafluoride (SF6) gas used in older products. The stainless steel enclosure forms the only solid dielectric unit with controlled arc venting on the market.



ARC FAULT CONTAINMENT TESTING



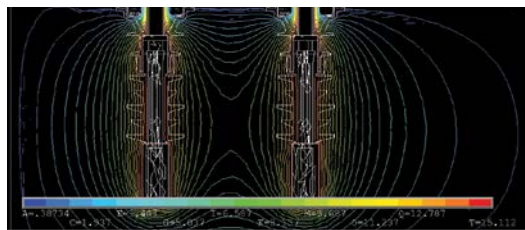
ARC FAULT CONTAINMENT DESIGN



KEMA HIGH CURRENT TEST LABORATORY



KEMA TYPE TEST CERTIFICATE



FINITE ELEMENT ANALYSIS

FINITE ELEMENT ANALYSIS

Finite Element Analysis (FEA) on insulation systems is conducted using ANSYS to optimise and minimise electrical stresses inside solid dielectric material on the surface of insulators in the air.

FEA analysis addresses the following issues:

- Partial discharge
- Impulse withstand
- Longevity due to surface degradation

QUALITY, ENVIRONMENTAL & SAFETY CERTIFICATION

NOJA Power is committed to quality, environmental responsibility and safety in servicing its customers and has been certified to the following standards: AS/NZS ISO 9001, AS/NZS ISO 14001, AS/NZS 4801 and OHSAS 18001.

NOJA Power's SF6-free Automatic Recloser is a key environmental initiative using solid dielectric insulation to reduce environmental footprint. SF6 Load-break switches gas has a potent global warming potential of 23,900 times that of CO₂ so by selecting NOJA Power's SF6-free ACRs, would allow utilities to reduce environmental footprint.

NOJA Power's OSM reclosers have been subjected to full type testing by independent test laboratories such as DNV GL (KEMA) in the Netherlands and have been certified to the latest standards, IEC 62271-111/IEEE C37.60.

INTEROPERABILITY

NOJA Power's control cubicle provides flexible communication options for Supervisory Control and Data Acquisition (SCADA) and to connect the Control and Management Software (CMS) for engineering access across serial, modem, Ethernet, fibre and mobile network links.

There are two control cubicles available, RC10 and RC15. The RC10 relay module includes 3 USB ports, one RS232 port and one LAN/Ethernet port. The ports can be used to provide a wide number of interfaces such as RS485, RS232, Ethernet, GSM and GPRS modems. A Wireless router can also be connected to a USB or LAN port.

The RC15 relay module has additional features which include a Wi-Fi access point for Tablet/Mobile/Notebook connectivity, a 4G cellular modem for mobile network access and GPS synchronisation for accurate time-stamping and location.

NOJA Power can supply accessories which are designed and tested to work within the RC specified temperature range of -40°C to +55°C.

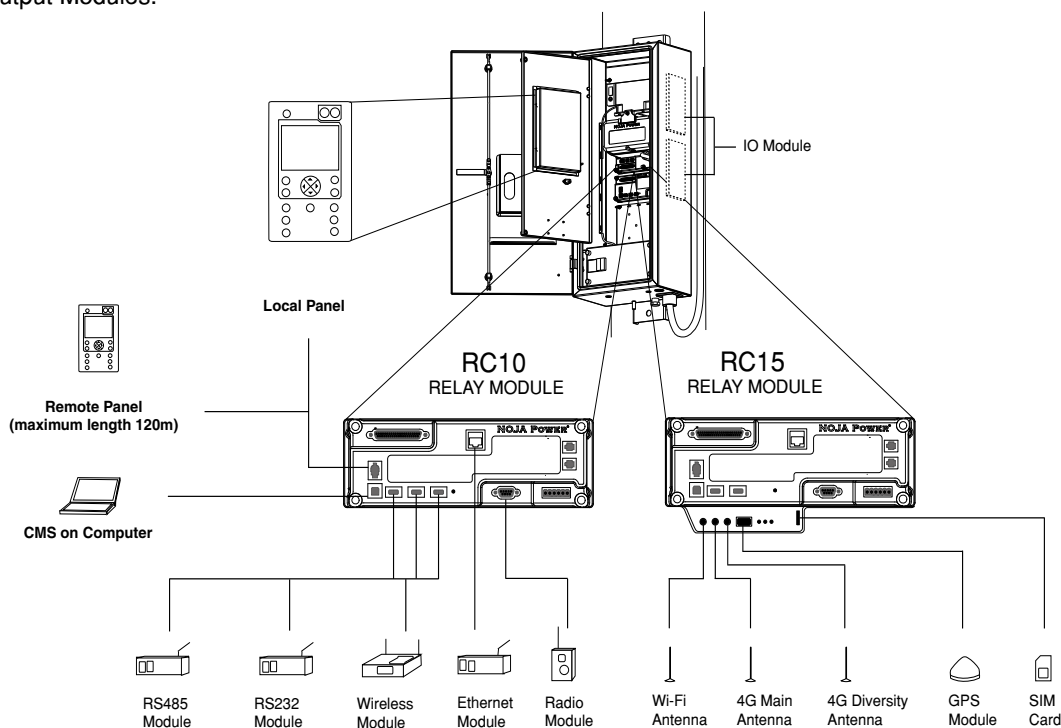
The RC controller functionality can be extended by using internal logic expressions, local inputs on the Relay module and up to two optional Input/Output Modules.



2 X IO MODULE

Each I/O module has eight opto-coupled inputs and eight voltage free contact outputs with normally open and normally closed contacts. The modules can be used to control or monitor external equipment, implement custom automation functionality and provide remote I/O when not using the built in SCADA functionality.

The CMS configuration software is used to create the logic expressions, program the I/O modules and the local inputs using available control and indication signals. CMS is also used to create a subset of data points available for Protocol configuration.



FIELD SAFETY

NOJA Power automatic recloser comes with a free software app which enhances electrical utility field engineers' job safety by enabling wireless remote control.

NOJA Power Recloser App, available free from Android and Apple App Store runs on Android and Apple's handheld devices. It can communicate with the Automatic Circuit Recloser via a Wi-Fi link router (RC10) or Wi-Fi Access Point (RC15) allowing field engineers to control and interrogate the device without having to climb the pole.

Use of the app improves safety because field engineers no longer have to undertake a hazardous climb that is often attempted in poor weather, high off the ground and close to cables that carry tens of thousands of volts.

Running on an Android tablets and phones, Apple iPhone®, iPod touch®, iPad® or iPad mini®, the Recloser App communicates with the NOJA Power RC control and communications cubicle via a TCP/IP connection.

The app is able to configure and retain the fixed IP address and port number for each recloser, which is then stored in a device list that identifies each unit with a name or code. The engineers can then select, configure, control and interrogate any recloser from the list providing connections via a fixed line, GPRS, WiMax or Wi-Fi.

The engineers will be able to read three phase-



NOJA POWER RECLOSER REMOTE APP

current and phase-voltage (voltage on all six bushings), frequency, power, power factor, power flow direction and energy measurements.

In addition, the app also allows the field engineers to control recloser functionality such as Trip/Close, Local/Remote, Active Protection Group, Protection On/Off, Auto Reclose On/Off, Live Line On/Off and Earth Fault On/Off among others.



NOJA POWER RECLOSER REMOTE APP



NOJA POWER RECLOSER REMOTE APP SCREENS

POWER QUALITY SOFTWARE

NOJA Power's Power Quality Software (PQS) automates the analysis of data captured by NOJA Power's OSM range Automatic Circuit Reclosers (ACR) and associated RC controllers allowing engineers to quickly react to problems in the network.

PQS allows Engineers to monitor harmonics caused from:

- Microgeneration systems such as domestic roof-mounted photovoltaic (PV) panels
- Charging of electric vehicles
- Electric motors
- Semiconductor-based consumer products

PQS allows utilities to monitor Power Quality and meet regulation standards avoiding penalties and protects infrastructure in the event of a harmonics exceeding a predetermined threshold. The software is also a valuable tool for companies that want to check that internal operations are not injecting harmonics back into the grid from their spur nor risking damage through harmonics to their own electrical assets.

Oscillography Data

The RC can capture an oscillogram of the waveform when a specific event occurs such as a trip or a close. The amount of waveform captured prior to the trigger can be configured by the user. This ranges from 0 to 80% of the capture prior to the trigger point. The data can be used to analyse power quality fluctuations.

Captured data can be stored on internal flash memory or external USB drive.

The captured Oscillography files are saved in the file system in the IEEE Std C37.111-1999 Comtrade Advance Programmable Logic binary.

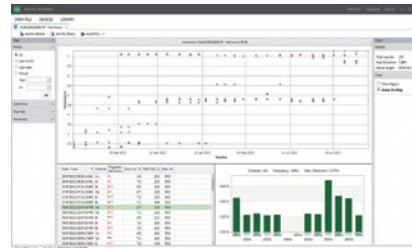
Harmonics

The RC measures Total Harmonic Distortion (THD), Total Demand Distortion (TDD) and Harmonics Voltages and Currents up to the 15th Harmonic (800A).

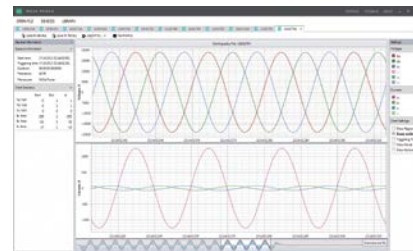
Harmonic data is averaged over 64 cycles and is made available every 32 cycles.

Long and Short Duration Interruption

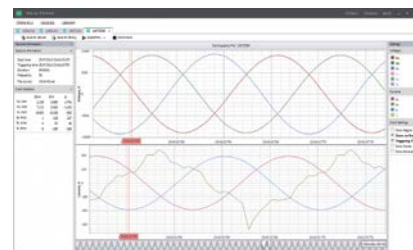
The RC stores information relating to long and short



PQS HARMONIC LOG



PQS OVER CURRENT GRAPH



PQS HARMONIC CURRENT GRAPH

duration interruptions. This information is used to calculate SAIDI (System Average Interruption Duration Index), SAIFI (System Average Interruption Frequency Index) and MAIFI (Momentary Average Interruption Frequency Index). Both long and short interruptions are based on the Loss of Supply Detection (LSD).

Collects long and short interruption information for calculating SAIDI, SAIFI and MAIFI.

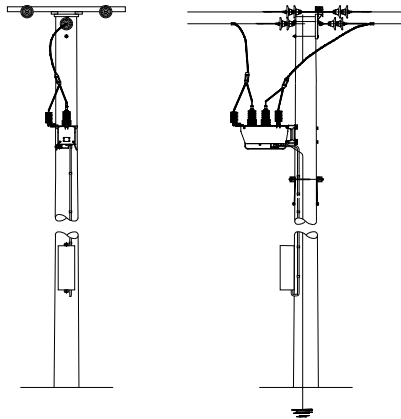
Sag and Swell

The RC records voltage variations (sags & swells) occurring outside a user set period of time. Sags & Swell voltages are based on the phase to earth voltages.

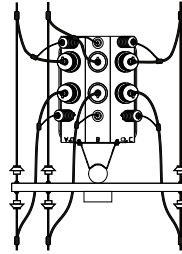
Harmonic data, long and short duration interruptions and sag/swell logs can be transferred to a USB in IEEE P1159.3 PQDIF.

The PQS is available to all NOJA Power OSM range ACR customers, free of charge.

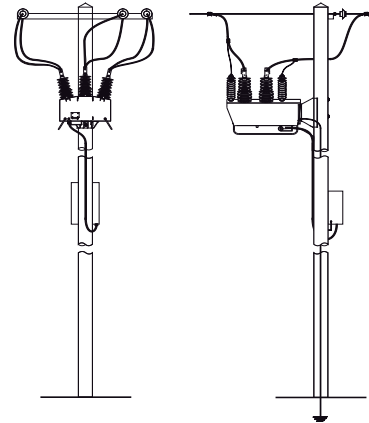
INSTALLATION



SINGLE PHASE POLE MOUNTING
ARRANGEMENT

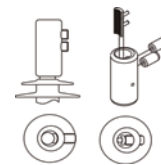


TERMINAL CONNECTORS

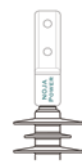


THREE PHASE POLE MOUNTING ARRANGEMENT

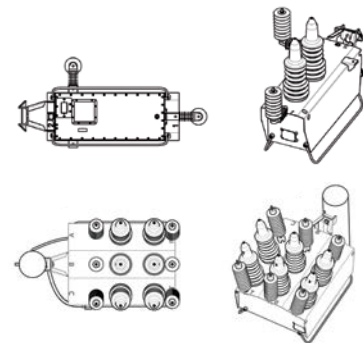
- Earthing should be in accordance with the technical manual. Earthing required is a main earth bond from the tank to earth and a tee-off to the RC control cubicle from this main earth bond. Minimum 35mm² earth cable should be used.
- Each HV terminal on the OSM has a tin-plated brass connector at the end with options for cable connection as follows:
 - A Tunnel terminal arrangement suitable for cable sizes from 40mm² to 260mm². Cables are secured in the connector with two hexagon socket screws.
 - Two hole cable palms with NEMA spacing. The cable palms are supplied with two (2) M12x25mm stainless steel bolts together with flat and spring washers.
- Pole mounting brackets and surge arrester mounting brackets are provided as standard.
- Full installation details are provided in the technical manual, this diagram is provided to show a typical arrangement only.
- Dead-break elbow connectors can be used instead of the bushing boots. The connector must be Interface Type C to DIN EN 50181.



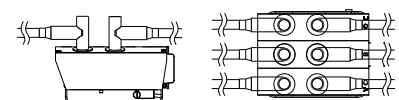
TUNNEL
CONNECTOR



TWO HOLE NEMA
PAD OPTION



OSM38 SINGLE & THREE PHASE
RECLOSER



DEAD-BREAK ELBOW CONNECTORS ON
OSM RECLOSER

NOJA POWER®

Part Number	OSM15-16-800	OSM27-12-800	OSM38-12-800	OSM38-16-800 ⁴
Manufacturing Model	311/312/310 ^{1,2}	311/312/310 ^{1,2}	311/302/300 ^{1,2}	301/302/300 ^{1,2}
Current Sensing	3 x Current Transformers ³	3 x Current Transformers ³	3 x Current Transformers ³	3 x Current Transformers ³
Voltage Sensing	6 x Voltage Screens ³	6 x Voltage Screens ³	6 x Voltage Screens ³	6 x Voltage Screens ³
Rated Maximum Voltage	15.5kV	27kV	38kV	38kV
Rated Continuous Current	800A	800A	800A	800A
Fault Make Capacity RMS	16kA	12.5kA	12.5kA	16kA
Fault Make Capacity Peak	40kA	31.5kA	31.5kA	40kA
Fault Break Capacity	16kA	12.5kA	12.5kA	16kA
Mechanical / Full Load Operations	30,000	30,000	30,000	30,000
Fault Break Capacity Operations	70	140	100	140
Short Time Current Withstand	16kA/3 secs	16kA/3 secs	12.5kA/3 secs	16kA/3 secs
Mainly Active Breaking Capacity	800A	800A	800A	800A
Cable Charging Current	25A	25A	40A	40A
Line Charging Current	5A	5A	5A	5A
Impulse Withstand Phase to Earth & Phase to Phase	110kV	150kV	195kV	200kV
Impulse Across the Interrupter	110kV	150kV	170kV	170kV
Power Frequency Withstand Phase to Earth (Dry)	50kV	60kV	70kV	70kV
Power Frequency Across the Interrupter	50kV	60kV	70kV	70kV
Ambient Temperature	-40°C to +55°C	-40°C to +55°C	-40°C to +55°C	-40°C to +55°C
Humidity	0-100%	0-100%	0-100%	0-100%
Altitude ⁵	3000m	3000m	3000m	3000m
Weight of the Tank (Three Phase)	100kg	109kg	150kg	150kg

1. A Switchgear model with matched CTs to provide 0.2A SEF sensitivity, is available for all 3 phase and 2 phase tanks.

2. OSM15-16-800-311, OSM27-12-800-311, OSM38-12-800-301, OSM38-16-800-301 (Single Phase Autorecloser) 1 x Current Transformers, 2x Voltage Screens
OSM15-16-800-312, OSM27-12-800-312, OSM38-12-800-302, OSM38-16-800-302 (Two Phase Autorecloser) 2 x Current Transformers, 4 x Voltage Screens

3. OSM38-16-800 tested at 40.5kV for interruption

4. Altitudes above 1000m should be corrected in accordance with ANSI C37-60-2012

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