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 dielectric insulated recloser to provide controlled arc fault venting and the independent testing provides verification of this important safety feature.

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.
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 RC10 control cubicle. There is a rating plate located in the base 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. Ceramic Breather
13. Mechanical Trip Ring

OSM Cross Sectional Diagram
RC10 CONTROL & COMMUNICATIONS CUBICLE

The RC10 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 Switchgear Interface Module (SIM) which provides the power supply battery charger and incorporates the capacitors that provide the tripping and closing energy to the OSM tank.
- The Relay module which provides the microprocessor and DSP functionality.

Temperature compensated float charging is provided to the sealed lead acid batteries located in the RC10 control cubicle.

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

The equipment has been designed for the RC10 control cubicle to operate over a temperature range of -40° to +55°C inside the IP66 sealed enclosure.

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.
PROTECTION

■ 4 Independent Protection Groups
  (Each group contains independent protection settings for each direction)

■ Directional over current and earth fault protection
  • Current Setting Range 3-1280A
  • Setting Resolution 1A

■ 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
  • 1-80A option available
  • Setting Resolution 0.5A
  • Definite Time 0-120 seconds
  • Time Resolution 0.01 seconds

■ Voltage Protection Element
  • Phase undervoltage balanced element (UV1)
    • 3 phase load shedding
    • Multiplier setting range: 0.6-1 of system voltage
    • Multiplier setting resolution: 0.01
    • Trip time range: 0-180 sec
    • Trip time setting resolution: 0.01 sec
  • Phase-to-Phase Undervoltage Element (UV2)
    • Multiplier setting range: 0.6-1 of system voltage
    • Multiplier setting resolution: 0.01
    • Trip time range: 0-180 sec
    • Trip time setting resolution: 0.01 sec
  • Loss of Supply (UV3)
    • Trip time range: 0-180 sec
    • Trip time setting resolution: 0.01 sec
    • Reclose time: 1-180 sec
    • Reclose time resolution: 0.01 sec
  • Voltage Sag Protection (UV4 Sag)
    • Trip time range: 1-180 sec
    • Min Multiplier: 0.01 - 0.8
    • Max Multiplier: 0.5 - 1.0
    • Mid Multiplier: 0.5-1.0
    • Phase (OV1) & Line-to-Line (OV2) Over Voltage
      • Trip time range: 0-180 sec
      • Multiplier Setting Range: 1.00 -1.20

■ Frequency Protection Element
  • Under Frequency (UF) Pickup Range: 46-50Hz (50Hz system), 55-60Hz (60Hz system)
  • Over Frequency (OF) Pickup Range: 50-55Hz (50Hz system), 60-65Hz (60Hz system)
  • Frequency settings resolution: 0.01Hz
  • Trip time range: 0.05-120 sec
  • Trip time setting resolution: 0.01 sec

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■ Voltage reclose control with automatic back feed restoration provides loop automation functionality.

■ Zone Sequence Co-ordination

■ Cold Load Pickup
  • Cold load time ramp up: 1-400 min
  • Cold load time ramp down: 0-60 min
  • Cold load time resolution: 1 min
  • Cold load multiplier: 1-5 times pickup current
  • Cold load multiplier resolution: 0.1

■ Inrush Restraint
  • Inrush time: 0.01-10 sec
  • Inrush time resolution: 0.01 sec
  • Inrush multiplier: 1-20
  • Inrush multiplier resolution: 0.1

■ 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
  • 0-0.1sec-CO-1sec-CO-1sec-CO-60sec recovery time

■ Redclosing Times
  • 1st redclosing time range 0.1 - 180 seconds
  • 2nd redclosing time range 1 - 180 seconds
  • 3rd redclosing time range 1 - 180 seconds
  • Setting resolution 0.01 seconds

■ Auto Reclose
  • User configurable 1-4 trips to lockout, independently settable for overcurrent earth fault, sensitive earth fault and voltage protection.

■ Live Line Function & Hot Line Tag Function

■ Negative Phase Sequence

■ Harmonic Protection

■ Advanced Automation

■ Programmable Logic
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 40 – 800A, 4.5 – 38kV, Accuracy ± 2%
Active, Reactive and Energy:
Range 40 – 800A, 4.5 – 38kV, Accuracy ± 2%
Frequency:
Range 46-55Hz, 55-65Hz
Accuracy at dF/dT < 0.2Hz/s: ± 0.025Hz
Range 46-55Hz, 55-65Hz
Accuracy at dF/dT < 0.5Hz/s: ± 0.05Hz
Power Factor:
Range 0-1, Accuracy ± 0.02

POWER QUALITY

Oscillography
Multiple channel wave capture of voltage and current. 1600 samples per second. Event triggered data memory storage.

Harmonics
15th Harmonic (750Hz) capable. Current measurement up to 800A. Harmonic data is averaged over 64 cycles and is made available every 32 cycles.

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

Sag and Swell
Sag and Swell Information of voltage outside user configured range and set time period.

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

EVENT LOG

The RC10 control provides two methods to access the event logs which time and date stamped to a 0.001 sec resolution.

The first method is from the RC LCD display, it provides critical operation data for the linesman and includes close/open operations, fault types, phase and peak level of fault current.

The second method is by PC upload using CMS. It provides 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.

REMOTE CONTROL

A USB front panel interface is provided for a PC to connect directly to the RC10 to provide engineering access. In addition remote control systems can connect to the RC10 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.

NOJA Power application 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 RC10 control and communication cubicle.

DNP3, IEC60870-5-101, 2179 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 on average over a rolling 60 seconds window. I/O modules with eight (8) user configurable inputs and eight (8) user configurable outputs can be ordered as options in the RC10 control. Up to two I/O modules can be fitted extending this to sixteen inputs and sixteen outputs.

User Constructed Logic Expressions provide custom user functions. 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.

Three (3) user configurable relay digital inputs are included as standard.

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.
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 RC10 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.
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 patented arc fault contained and vented design is in accordance with the requirements of IEC62271-200 Clause 6.106 and Annex A.

The NOJA Power OSM range of reclosers offers solid dielectric installation have been designed and type tested to provide this important safety feature.

The NOJA Power OSM range of reclosers have successfully passed the arc fault containment type test and have complied with the specifications. 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

NOJA Power is unique among comparable companies in attaining AS/NZS ISO 14001 and AS/NZS 4801 accreditation. 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 consultants DNV KEMA. The OSM38 recloser, for example, was tested for electrical performance including interruption duty cycle at 12.5 kA, load switching at 800A, cable charging, line charging, dielectric withstand capability including 170 kV BIL across the open gap and 195 kV BIL phase-to-phase and phase-to-earth, wet and dry power frequency, temperature rise and mechanical operations testing.
FIELD SAFETY

NOJA Power Automatic recloser comes with a free software app which enhances electrical utility field engineer’s 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 communicates via a Wi-Fi link with the Automatic Circuit Recloser 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 RC10 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-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.
INTEROPERABLE

NOJA Power’s RC10 Control Cubicle provides flexible communication options. The OSM recloser is supplied with an RC10 Control Cubicle. The Relay module inside the RC10 has three USB ports, one ethernet port and one RS232 port available for communication connections.

The USB ports can be used with NOJA Power approved communication accessories. The accessories can be used to provide a wide range of port interfaces such as RS485, RS232, Ethernet, WiFi, GSM and GPRS modems.

The USB communications accessories can also be used to remotely connect the CMS configuration software for engineering access across serial, modem and Ethernet links.

The accessories provide a wide range of options for SCADA and engineering access to the RC10 control cubicle. All approved USB accessories are designed to work within the RC10 specified temperature range of -40°C to +55°C.

Up to two General Purpose Input Output (GPIO) modules can be supplied with the RC cubicle as an option. 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 program the modules. Any available control signal can be programmed for each input and any combination of available indications can be programmed for each output.
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 RC10 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-10 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.

Harmonics
Harmonics are waves which have frequency multiples of the fundamental frequency. The RC-10 measures Total Harmonic Distortion (THD), Total Demand Distortion (TDD) and Harmonics Voltages and Currents up to the 15th Harmonic.

15th Harmonic (750Hz) capable. Current measurement up to 800A. Harmonic data is averaged over 64 cycles and is made available every 32 cycles.

Long and Short Duration Interruption
The RC-10 stores information relating to long and short duration interruptions. This information is used to calculate SAIDI (System Average 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-10 records voltage variations (sags & swells) occurring outside a user set period of time. Sags & Swell voltages are based on the phase to earth voltages.

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 binary.

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.
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<td>70</td>
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1. Altitudes above 1000m should be corrected in accordance with ANSI C37.60-2012
2. OSM15-12-800-312 (Two Phase Autorecloser)
3. OSM38-12-800-301 (Single Phase Autorecloser)