

NOJA POWER[®]

GMK

GROUND MOUNT KIOSK PRODUCT GUIDE

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



INTRODUCTION

The Ground Mount Kiosk (GMK) is designed for the connection and protection of underground cables for voltage classes up to 38kV.

The kiosk houses an OSM automatic circuit recloser, an RC controller, equipment mounting compartment and cable connection compartment.

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

The RC controller provides all the protection, data logging and communications functions. An operator panel is used to operate the device locally.

A manual trip ring mechanism is located in the front compartment above the mounting plate and is used to manually open the OSM. The open and closed position of the device is indicated by a green 'O' to indicate the device is open and a red 'I' to indicate the device is closed, this can be viewed through the window next to the trip ring.

Underground cables enter the kiosk through a metal plate provided in the base of the cable

connection compartment. The Dead break elbows connects the cables onto the Load and Source side of the OSM automatic circuit recloser. An earth bar is also located in this compartment for earth bond connections.



CABLE ENTRY, MAIN EARTH BAR & HIGH VOLTAGE TERMINATIONS



GMK GROUND MOUNT KIOSK RC10



GMK GROUND MOUNT KIOSK EQUIPMENT MOUNTING PLATE, TRIP RING, OPEN/CLOSE INDICATOR

OVERVIEW

The OSM automatic circuit reclosers incorporate vacuum interrupters inside a solid dielectric polymer housing enclosed inside an arc vented 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 using capacitively coupled screens. Current is measured on all three (3) phases using current transformers.

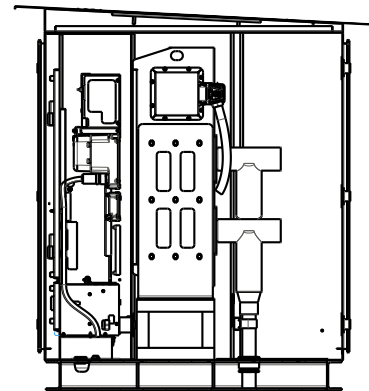
The recloser mechanism is operated by three (3) separate magnetic actuators, one per phase. These magnetic actuators are mechanically interlocked to guarantee correct three (3) phase operation. The device is latched in the closed position by magnetic latching. Each magnetic actuator uses a single coil.

The status of the recloser is also reflected by a microswitch 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 polymer and have a silicone rubber bushing boot to provide the required creepage distance.

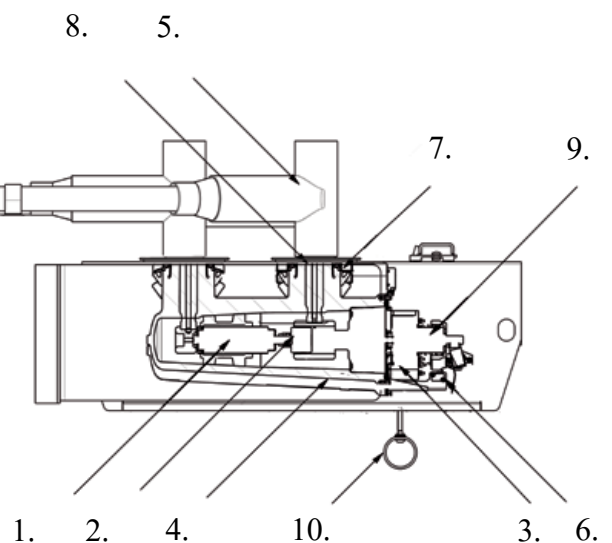
The magnetic actuators are operated from stored energy charged capacitors located in the RC control cubicle. There is a rating plate located in the base of the tank that provides tank rating details in accordance with the requirements of ANSI C37.60.

The cross sectional diagram below details the OSM tank configuration and main components.



GMK GROUND MOUNT KIOSK

1. Vacuum Interrupter
2. Insulated Drive Rod
3. Magnetic Actuator
4. Aromatic Epoxy Resin Housing
5. Dead Break Elbow (not included)
6. Auxiliary Switches
7. Current Transformer (position varies with model)
8. Capacitively Coupled Voltage Sensor
9. Opening spring
10. Mechanical Trip Ring



RC10 CONTROL & COMMUNICATIONS CUBICLE

The RC10 control and communications cubicle is a microprocessor based controller that 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 local control functions.

The control cubicle has three (3) main modules:

- The operator panel module which provides the man machine interface.
- 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 main microprocessor and Digital Signal Processing (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.

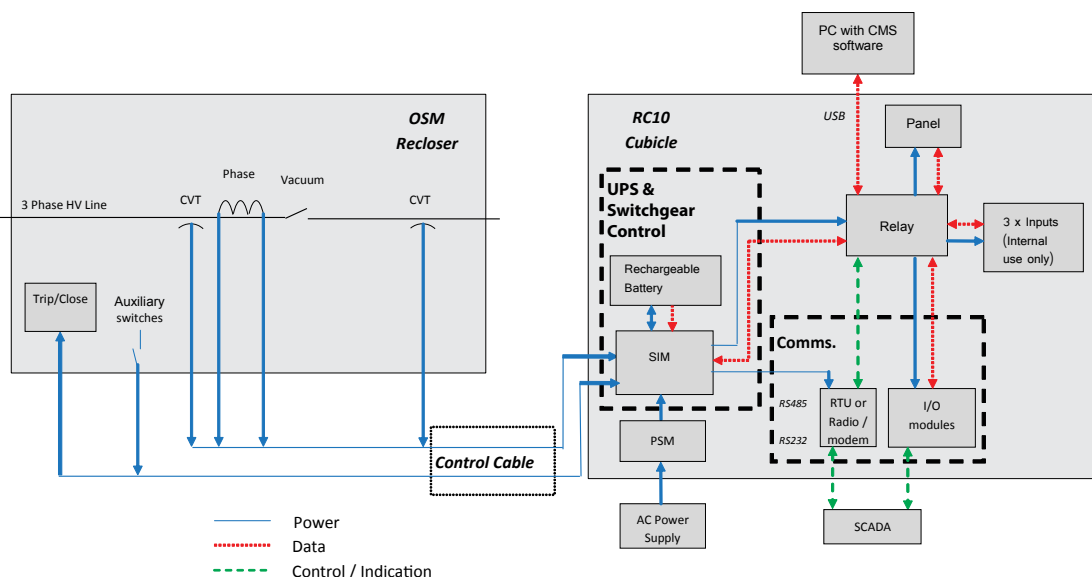


CONTROL AND COMMUNICATIONS CUBICLE

The equipment has been designed for the RC10 control cubicle to operate over a temperature range of -40 to $+55^{\circ}\text{C}$ inside the IP65 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

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.

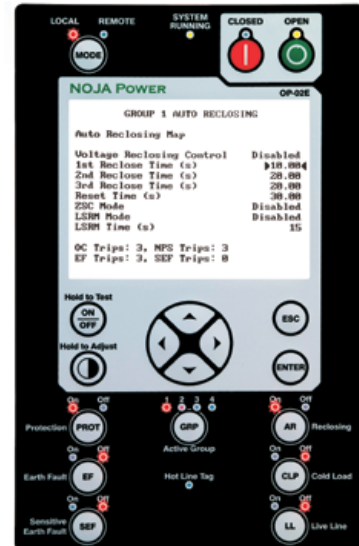
The recloser can also be configured as a fault passage indicator by placing it in Alarm Mode.

The ACR can be used as a traditional Sectionaliser. In this instance the fault is detected and counted but the fault is interrupted by an upstream device.

NOJA 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
 - 1-80A option available
 - Setting Resolution 0.5A



LOCAL CONTROL PANEL

- Definite Time 0-120 seconds
- Time Resolution 0.01 seconds
- Voltage Protection Element
 - Phase undervoltage balanced element (UV1)
 - Line-to-Line Undervoltage Element (UV2)
 - Loss of Supply (UV3)
 - Voltage Sag Protection (UV4 Sag)
 - Phase (OV1) & Line-to-Line (OV2) Over Voltage
- Frequency Protection Element
- Voltage reclose control with automatic back feed restoration provides loop automation functionality.
- Zone Sequence Co-ordination
- 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
- Redosing Times
- 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
- Harmonic Protection
- Advanced Automation
- Advance 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 $\pm 1\%$ or $\pm 0.1\text{kV}$

Phase to Phase Voltage: Range 0.5 – 38.0kV, Accuracy $\pm 2\%$ or $\pm 0.1\text{kV}$

Phase Current: Range 0 – 800A, Accuracy $\pm 1\%$ or $\pm 4\text{A}$

Residual Current: Range 0 – 100A, Accuracy $\pm 5\%$ or $\pm 0.5\text{A}$

Active, Reactive and Total Power: Range 10 – 800A, 4.5 – 38kV, Accuracy $\pm 2\%$

Active, Reactive and Energy: Range 10 – 800A, 4.5 – 38kV, Accuracy $\pm 2\%$

Frequency: Range 46–55Hz, 55–65Hz
Accuracy at $dF/dT < 0.2\text{Hz/s}$: $\pm 0.025\text{Hz}$

Range 46–55Hz, 55–65Hz
Accuracy at $dF/dT < 0.5\text{Hz/s}$: $\pm 0.05\text{Hz}$

Power Factor: Range 0–1, Accuracy ± 0.02

REMOTE CONTROL & AUTOMATION

The Control and Management Software (CMS) is a software package that runs on a PC and is used to configure and interrogate the RC-10 control cubicle both locally and remotely.

A USB front panel interface is provided on the RC10 for local engineering access. Remote control systems such as CMS 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 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 RC10 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 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. 32 logic channels and variables are available.

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

CMS allows both local and remote download of settings to a device including communication and protection settings and switchgear coefficients.

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 0.0001 sec resolution.

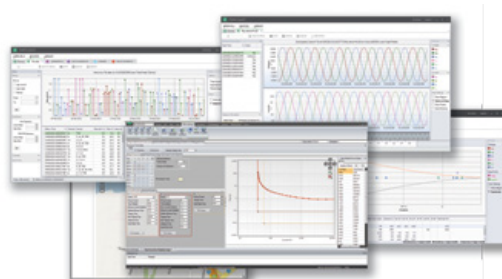
CMS provides additional information such as a full log of all operational history including setting changes, operations and fault history. The fault history logs include 50 cycles of pre-trip history to allow analysis of the fault propagation.

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.

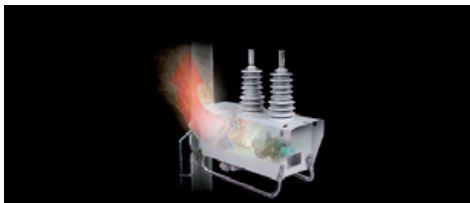
NOJA Power's Patent Arc fault contained and vented design is in accordance with the requirements of IEC62271-2011 Clause 6.106 and Annex AA; the efficacy of this important safety feature has been verified as part of full type testing by independent test laboratories such as KEMA in the Netherlands.

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.

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.



ARC FAULT CONTAINMENT TESTING



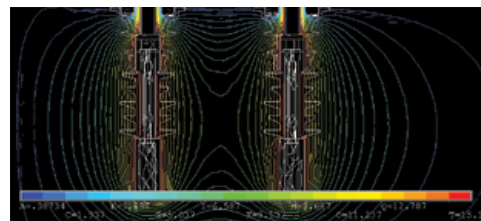
ARC FAULT CONTAINMENT DESIGN



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'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

The RC10 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 and Ethernet links.

The Relay module in the RC10 includes of 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, WiFi, GSM and GPRS modems.

NOJA Power can supply accessories which are designed and tested to work within the RC10 specified temperature range of -40°C to $+55^{\circ}\text{C}$.

The RC10 controller functionality can be extended by using internal logic expressions, local inputs on the Relay module and up to two optional Input/ Output Modules.

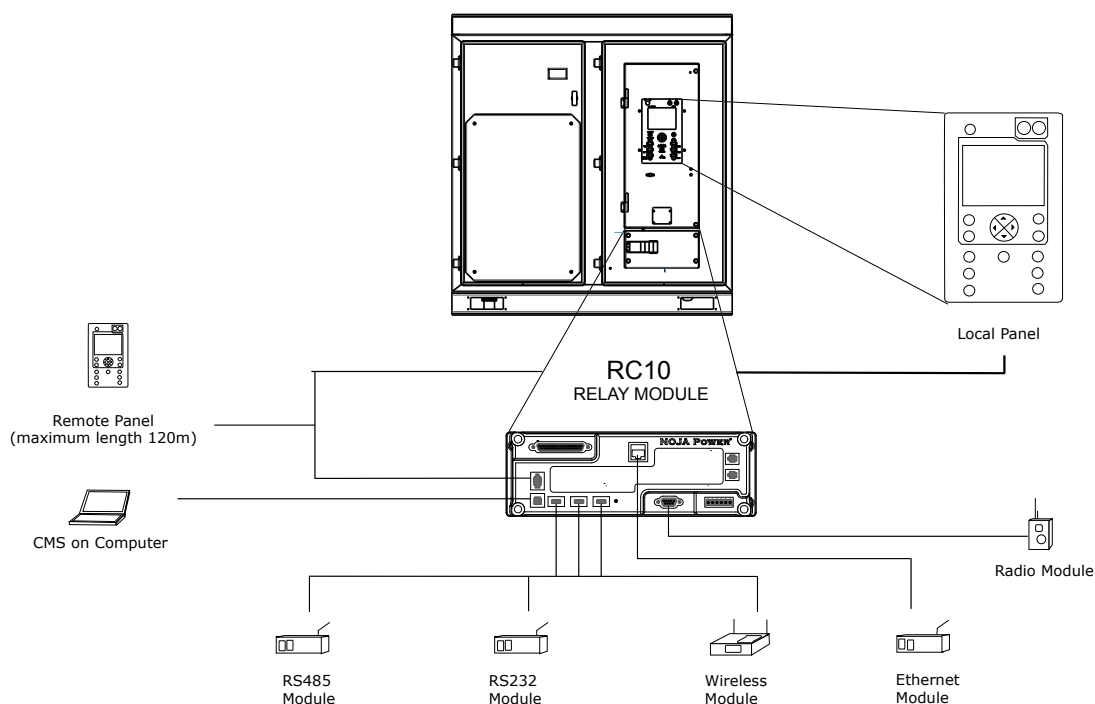
Each I/O module has eight opto-coupled inputs and eight voltage free contact outputs with normally open and normally closed contacts. The modules can be used to control or monitor external equipment, implement custom automation



2 X IO MODULE

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 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.



NOJA POWER RECLOSER REMOTE APP

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.



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 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

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

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.

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 ComtradeAdvance Programmable Logic binary.

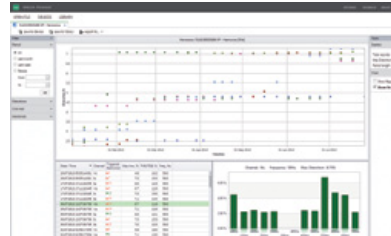
Harmonics

The RC-10 measures Total Harmonic Distortion (THD), Total Demand Distortion (TDD) and Harmonics Voltages and Currents up to the 15th Harmonic (800A).

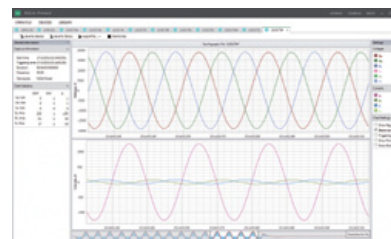
Harmonic data is averaged over 64 cycles and is made available every 32 cycles.

Long and Short Duration Interruption

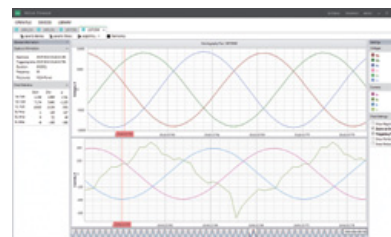
The RC-10 stores information relating to long and



PQS HARMONIC LOG



PQS OVER CURRENT GRAPH



PQS HARMONIC CURRENT GRAPH

short 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).

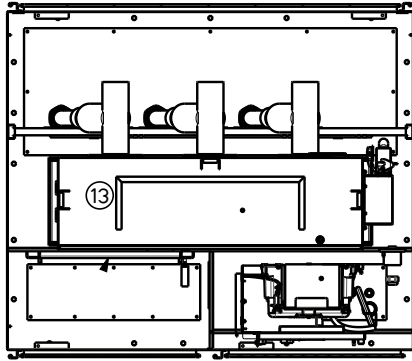
Collects long and short interruption information for calculating SAIDI, SAIFI and MAIFI.

Sag and Swell

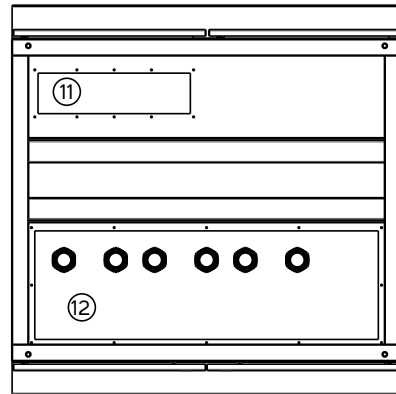
The RC-10 records voltage variations (sags & swells) occurring outside a user set period of time. Sags & Swell voltages are based on the phase to earth voltages.

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

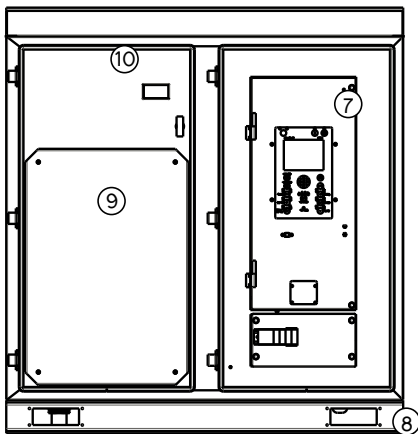
The PQS is available to all NOJA Power OSM range ACR customers, free of charge.



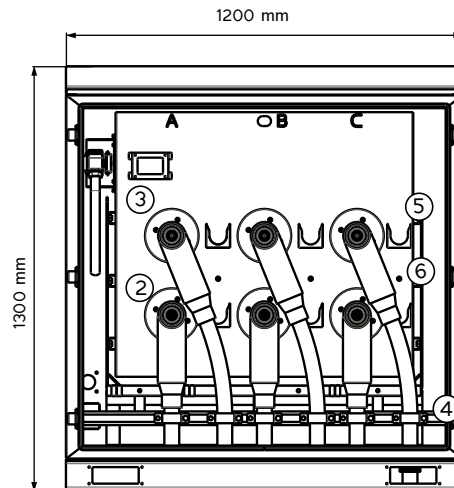
TOP VIEW
(ROOF REMOVED)



BOTTOM VIEW



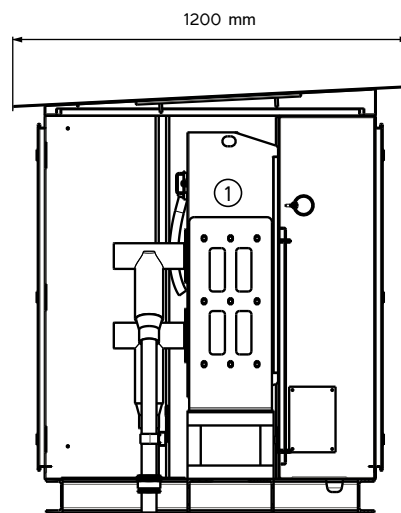
FRONT VIEW
(DOORS REMOVED)



BACK VIEW
(DOORS REMOVED)

COMPONENTS

1. Automatic Circuite Recloser
2. Load Side Bushings
3. Source Side Bushings
4. Earth Bar
5. Parking Saddles
6. Earthing Points
7. RC10 Control Communication Cubicle
8. Fork Lift Entry
9. Optional Communications Equipment Mounting Plate
10. Recloser Status Viewing Window
11. Low Voltage Cable Entry
12. HV Cable Entry
13. Arc fault ventilation



SIDE VIEW

NOJA POWER®

Part Number	GMK15-16-800-310	GMK27-12-800-310	GMK38-12-800-300
Current Sensing	3 x Current Transformers	3 x Current Transformers	3 x Current Transformers
Voltage Sensing	6 x Voltage Screens	6 x Voltage Screens	6 x Voltage Screens
Control Type	RC10	RC10	RC10
Rated Maximum Voltage	15.5kV	27kV	38kV
Rated Continuous Current	800A	800A	800A
Fault Make Capacity RMS	16kA	12.5kA	12.5kA
Fault Make Capacity Peak	40kA	31.5kA	31.5kA
Fault Break Capacity	16kA	12.5kA	12.5kA
Mechanical / Full Load Operations	30,000	30,000	30,000
Fault Break Capacity Operations	70	70	70
Short Time Current Withstand	16kA/3 secs	16kA/3 secs	12.5kA/3 secs
Mainly Active Breaking Capacity	800A	800A	800A
Cable Charging Current	25A	25A	40A
Line Charging Current	5A	5A	5A
Impulse Withstand Phase to Earth & Phase to Phase	110kV	150kV	195kV
Impulse Across the Interrupter	110kV	150kV	170kV
Power Frequency Withstand Phase to Earth (Dry)	50kV	60kV	70kV
Power Frequency Across the Interrupter	50kV	60kV	70kV
Ambient Temperature	-40°C to +55°C	-40°C to +55°C	-40°C to +55°C
Humidity	0-100%	0-100%	0-100%
Altitude ¹	3000M	3000M	3000M
Weight of the Kiosk	480kg	480kg	511kg

¹ Altitudes above 1000m should be corrected in accordance with ANSI C37.60-2012

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