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Amendment No 4

1 July 2019

Revision History

This standard replaces amendment no 3 of SDI 213 – NOJA Power Switchgear: 12kV Recloser – OSM 15, 200 series with RC01ES control and 310 series with RC10 control. All changes are highlighted in this document with grey colouring.

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For any enquiries relating to the content of this document please contact the Standards Coordinator on 13 10 81.

Document Control

Documentation content coordinator: Substation Assets Manager

Documentation process coordinator: Standards Process Coordinator

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1 Documentation Scope

This instruction provides information and reference documentation to assist in the safe design, installation, commissioning, operation and decommissioning of the approved OSM 15/OSM 38 11kV/33kV recloser manufactured and supplied by NOJA Power Switchgear (previously known as Tavrida Electric Australia). This instruction is applicable only with the standard units approved for use by Endeavour Energy for use in the distribution network as detailed in 5.1.1.

The scope of this document provides reference to the various lifecycle stages of the switchgear and therefore should be read in conjunction with:

- MCI 0005 – Overhead construction standards manual.
- EDI 100 – Distribution earthing design, construct and commissioning;
- ETS 0074 – 12kV and 24kV reclosers for specification for new equipment;;
- MDI 0031 – Overhead Distribution: Design Standards Manual;
- SDI 120 – Testing and commissioning for distribution systems;
- GNV 1044 – Commissioning Network Electrical Assets
- GAM 0114 – Granting dispensations for engineering documents
- SMI 101 – Minimum requirements for maintenance of distribution equipment; and
- GSU 0012 – Selection and Approval of Disposal Method.

This document should be read in conjunction with the manufacturer's installation instructions:

- NOJA Power OSM – 15 Auto Circuit Breaker DNP3 Protocol Implementation NOJA – 519
- NOJA Power OSM –15 Auto Circuit Recloser Product Guide no. NOJA 502.03
- NOJA Power OSM –15 Auto Circuit Recloser Use Manual no. NOJA 514-02
- NOJA Power OSM – User Manual Automatic Circuit Recloser 15kV, 27kV & 38kV models NOJA-5002-07
- UNIPEDE NORM 13 - Automation and control apparatus for generating stations and substations, Electromagnetic compatibility immunity requirements.

2 References

External Regulations

NSW Work Health and Safety Act 2011

Work Health and Safety Regulation 2017

External Standards

ENA National Electricity Network Safety Code (Doc 01-2008)

IEEE C37.60 - Requirements for overhead pad mount, dry vault and submersible automatic circuit breakers and fault interrupters for AC system

SDI 213 - NOJA Power switchgear: 12kV / 38kV recloser - OSM 15 / 38, 200 series with RC01ES control and 310/300 series with RC10 control

Company Policies and Procedures

Company Policy 9.1.7 – Commissioning Network Electrical Assets

Company Policy 9.2.2 – Network Protection

Company Policy 9.2.5 – Network Asset Design

Company Policy 9.7.1 – Network Asset Construction

Company Policy 9.8.3 – Network Operations

Company Policy 9.9.1 – Network Asset Maintenance

Company Procedure GAM 0114 – Granting Dispensations for Engineering Documents

Company Procedure GSU 0012 – Selection and Approval of a Disposal Method

Division Procedure GNV 1044 – Commissioning network electrical assets

Division Procedure GNV 1061 – Transmission and High Voltage Distribution Network Switching

Company Standards

Earthing Design Instruction EDI 100 – Distribution earthing design, construct and test

Equipment Technical Specification ETS 0074 – 12kV and 24kV reclosers

Mains Construction Instruction MCI 0005 – Overhead Distribution Construction Standards Manual

Mains Design Instruction MDI 0031 – Overhead Distribution: Design Standards Manual

Substation Design Instruction SDI 120 – Testing and commissioning for distribution systems

Substation Maintenance Instruction SMI 101 – Minimum requirements for maintenance of distribution equipment

Drawing no. 332022 - Overhead 11-22kV Const. no. HREC Termination to recloser with any combination of HVABC, bare or CCT

Manufacture's manual

NOJA Power OSM – 15 Auto Circuit Breaker DNP3 Protocol Implementation NOJA – 519

NOJA Power OSM –15 Auto Circuit Recloser Product Guide no. NOJA 502.03

NOJA Power OSM –15 Auto Circuit Recloser Use Manual no. NOJA 514-02

NOJA Power OSM – User Manual Automatic circuit recloser 15kV, 27kV & 38kV models NOJA-5002-07

UNIPED NORM 13 – Automation and Control apparatus for generating stations and substations, Electromagnetic compatibility immunity requirements.

3 Definitions and Abbreviations

Abbreviation	Meaning
ASP	An individual or single entity accredited in accordance with part 3 of the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)
CCT	covered conductor thick
CT	Current transformer
HRC	high rupturing capacity
RTU	remote terminal unit
LCD	liquid crystal display
Rogowski coil	Air-cored toroidal coil placed round the conductor. The alternate magnetic field produced by the current induces a voltage in the coil. This voltage, when used with an electronic integrator, produces a voltage proportional to the current through the conductor.
SCADA	Supervisory control and data acquisition
SF6	sulphur hexafluoride
UV	Ultra violet
VT	voltage transformer
XLPE	cross link polyethylene

4 Actions

4.1 General

4.1.1 Introduction

The NOJA OSM 15 / OSM 38 auto-recloser is distribution switchgear used to improve power supply reliability. The reclosers are designed for use on overhead distribution lines. The recloser can be used (subject to Substation Assets Manager's approval) in an indoor or an outdoor substation as a circuit breaker, provided that the recloser specifications meet the situational requirements.

4.1.2 Product approval and stock codes

The following 12kV reclosers are approved for use in Endeavour Energy's network:

A ref.	Description	Approval no.	Stock code
OSM 15-200	12 kV recloser	340 009	
	Auxiliary supply options :		
	Suitable for 240 V 50 Hz auxiliary supply from an 11kV ph-ph VT		1550292
	Suitable for 230V 1 ph-N 50Hz AC auxiliary power supply		1550284
	Suitable for 110V DC auxiliary power supply		1550300
OSM 15 - 16-800-310	12 kV auto-recloser (complete with RC10 control box, accessories and voltage transformer)	530329	1550292

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OSM 38-16-800-300	33kV auto-recloser ((complete with RC10 control box, accessories and voltage transformer)	530523	1550631
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Reclosers supplied since 2010 have the voltage transformer attached to the recloser. Since January 2013, RC10 control cubicles were supplied with the reclosers. Effective July 2015, the OSM 15- 310 series will be supplied to Endeavour Energy. The OSM 38-300 series recloser can be used in both the 22kV and 33kV network.

4.1.3 Recloser

The NOJA OSM15 -200 recloser construction and main features are:

- tank made from stainless steel grade 304 and powder coated light grey;
- Tavrida vacuum interruption technology;
- solid polycarbonate housing for vacuum interrupters (**no SF₆ gas used**);
- mechanism operated by three separate magnetic actuators (one to each phase);
- Closing operation is possible **only** by using electrically operating magnetic actuators, which are mechanically interlocked to check correct three phase operation;
- can be mechanically tripped using a hook stick operated lever from ground level;
- open and closed position is indicated by green and red coloured indicators respectively;
- status of the switch is also reflected to the control electronics through a micro-switch;
- main bushings are manufactured from UV stable polymer;
- silicon rubber boots used to provide required creepage;
- bare tunnel terminals with drain holes are provided at each bushing end. The tunnel terminal enables easy connection of the bare end of the three meter 180sqmm CCT bonds provided;
- Rogowski coils are used for current measurement.

The NOJA OSM15-310 / OSM 38-300 has the above features with the following exceptions:

- no Rogowski coils but current transformers;
- vacuum interrupters from Siemens, Germany; and
- aromatic epoxy insulation.

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1. Bushing Connector
2. Silicone Rubber Bushing Boot
3. Polymer Bushing
4. Rogowski Coil Current Sensor
5. Capacitively Coupled Voltage Sensor
6. 304 Stainless Steel Tank
7. Magnetic Actuator
8. Opening Spring
9. Auxiliary Switches
10. Insulated Drive Rod
11. Polycarbonate Housing
12. Vacuum Interrupter
13. Ceramic Breather
14. Mechanical Trip Ring

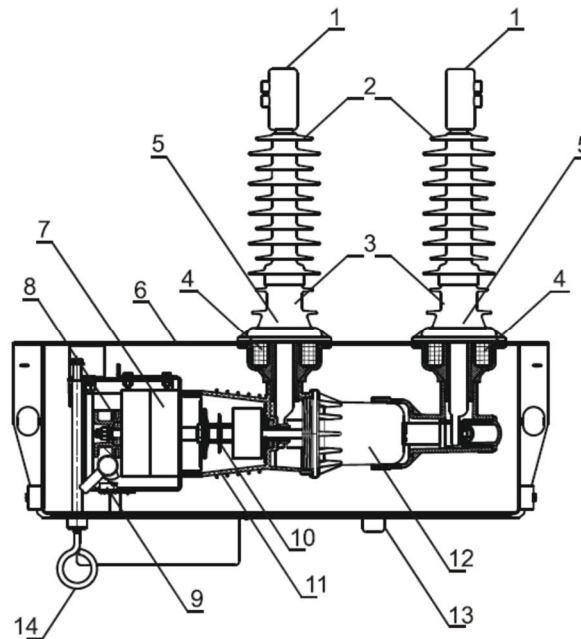


Figure 1: Cross section diagram and photo of an OSM 15-200

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|---------------------------------|---|
| 1. Vacuum Interrupter | 9. Current Transformer (position varies with model) |
| 2. Insulated Drive Rod | 10. Capacitively Coupled Voltage Sensor |
| 3. Magnetic Actuator | 11. Opening spring |
| 4. Aromatic Epoxy Resin Housing | 12. Ceramic Breather |
| 5. Silicone Rubber Bushing Boot | 13. Mechanical Trip Ring |
| 6. Cable Connector | |
| 7. Stainless Steel Tank | |
| 8. Auxiliary Switches | |

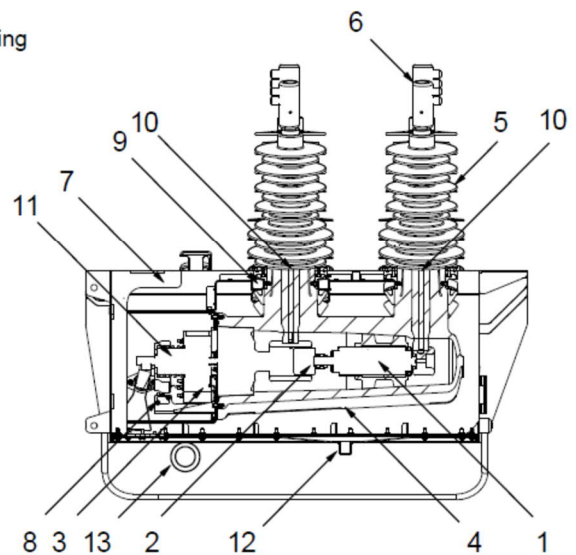
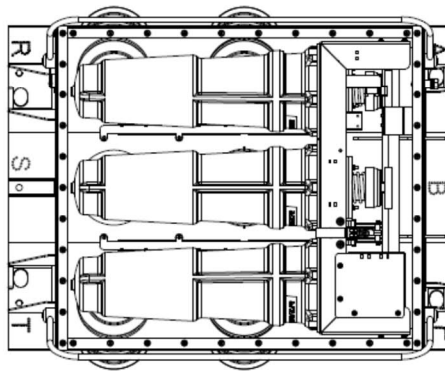


Figure 2: Cross section diagram of an OSM 15-310

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4.1.4 Technical specifications

The specifications of the recloser are:

Description	11kV	33kV
Applicable standards	ANSI C37.60	
Rated maximum voltage	15.5kV	38kV
Rated continuous current	630A (200 series) 800A (310 series)	800A
Fault make capacity RMS	16 kA	
Fault make capacity peak	40 kA	
Fault break capacity	16 kA	
Mechanical operations	30,000	
Full load operations	30,000	
Fault break capacity operations	200	
Short time current withstand	16 kA/4sec (200 series) 16 kA/3sec (310 series)	16 kA/3sec (300 series)
Mainly active breaking capacity	630A	800A
Cable charging current	25A	40A
Line charging current	5A	
Impulse withstand phase to earth	110kV	170kV
Impulse withstand phase to phase	110kV	200kV
Impulse withstand across the interrupter	110kV	170kV
Power frequency withstand phase to earth	50 kV rms	70kV rms
Power frequency withstand across the interrupter	50 kV rms	70kV rms
Closing time	<60ms	<70ms
Opening time	<30ms	
Interrupting time	<50ms	
Current sensing	6 x Rogowski current sensors (200 series) 3 x CTs (310 series)	3 x CTs
Voltage sensing	6 x capacitive voltage dividers (200 series) 6 x voltage sensors (310 series)	6 x voltage sensors
Creepage distance of silicon rubber bushing boots	485mm (200 series)	1284mm

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Description	11kV	33kV
	596mm (310 series)	
Ambient temperature	-40 deg. C to + 55 deg. C	
Humidity	0-100%	
Altitude	< 3000 m	
Weight of the tank	85 kg (200 series) 100kg (310 series)	150kg
Overall dimensions (length x width x height)	760x534x750mm (200 series) 800x668x653mm (310 series)	932 x751x913

4.1.5 Control cabinet

RC01

- Cubicle fabricated from stainless steel grade 306 and powder coated;
- Microprocessor based controller that provides protection, auto reclosing relay, metering, event log, demand logger and remote terminal unit;
- Operator panel is provided with a four line back-lit LCD display;
- Provided with a keypad for local operations;
- A control and communication cubicle with built-in RTU is provided;
- Control cubicle has three main modules - microprocessor, driver, and power supply;
- The power supply module accepts 220V $\pm$ 20% 50Hz AC supply (option for 110V DC);
- Space provided within the cabinet to mount communication equipment;
- Equipment suitable for operation between -40 deg. C and +55 deg. C; and
- For details of protection, metering and communication features, refer to the user manual from NOJA.

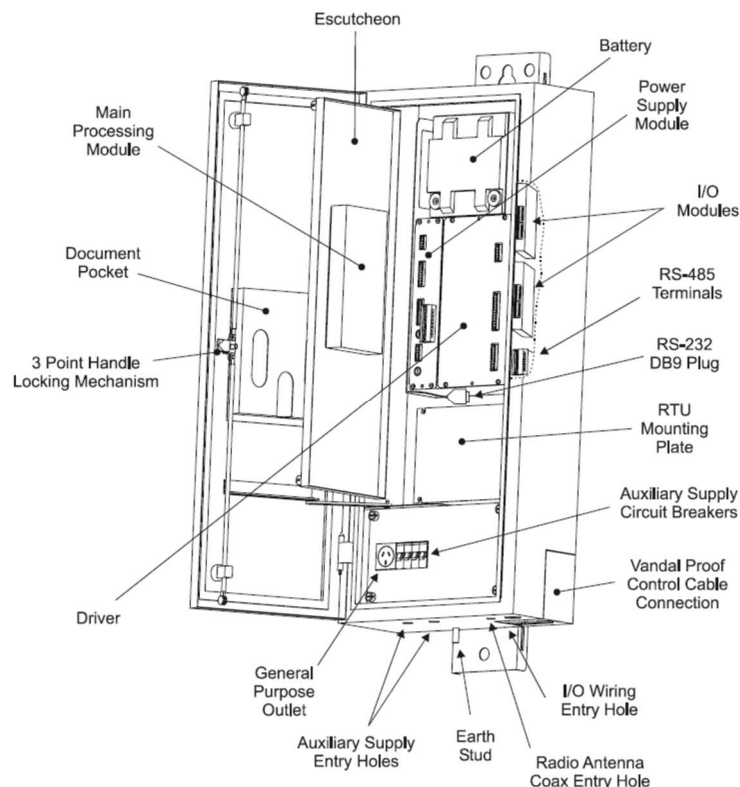


Figure 3: Recloser control cubicle RC 01

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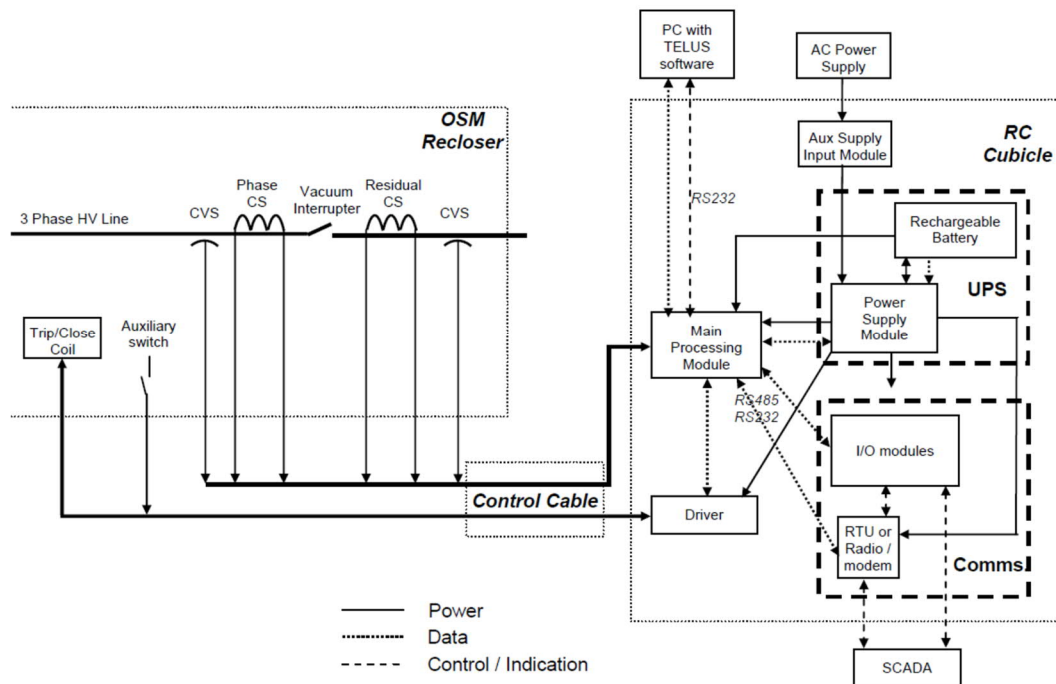


Figure 4: Functional structure of the OSM recloser with RC01 cubicle

RC10

In addition to the above, the RC10 has the following:

- power supply module (PSM) takes the auxiliary AC input and provides DC power supply to the SIM module;
- switchgear interface module (SIM) provides the power management, battery charger and incorporates the capacitors that provide the tripping and closing energy to the OSM tank;
- relay module (REL) contains the main microprocessor control, digital signal processing functionality, RTU, communication ports and standard digital inputs; and
- The communication ports and I/O modules provide external control and indication functions for SCADA or other remote control applications.

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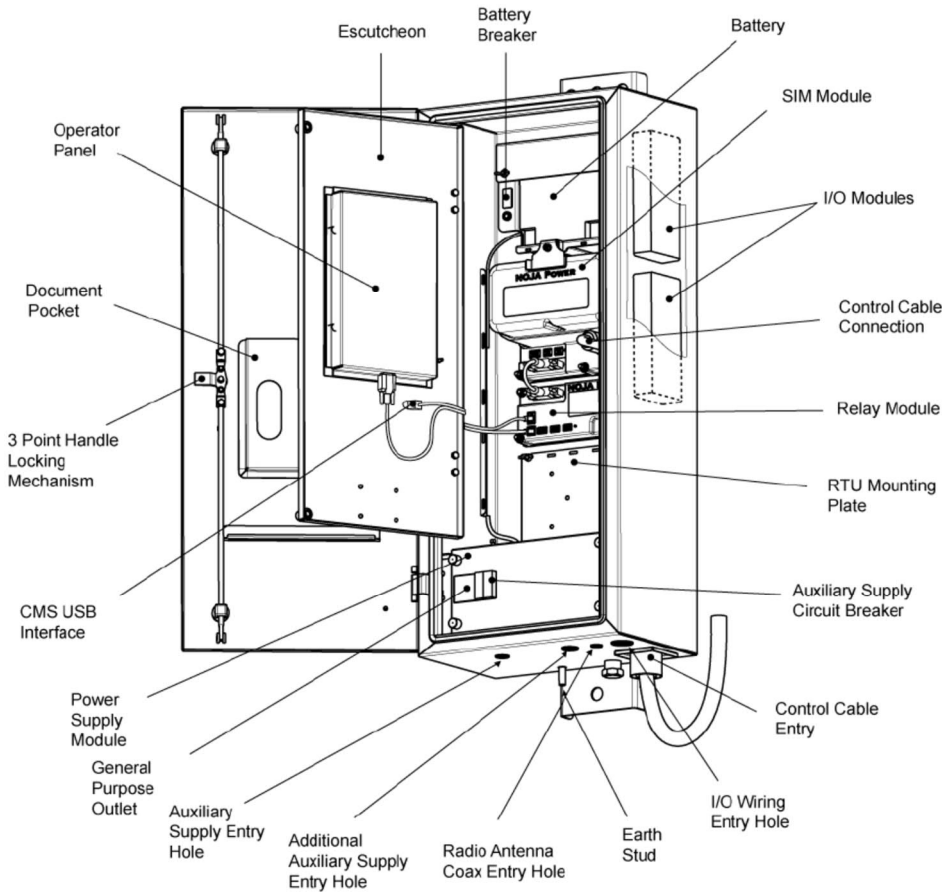


Figure 5: Recloser control cubicle RC 10

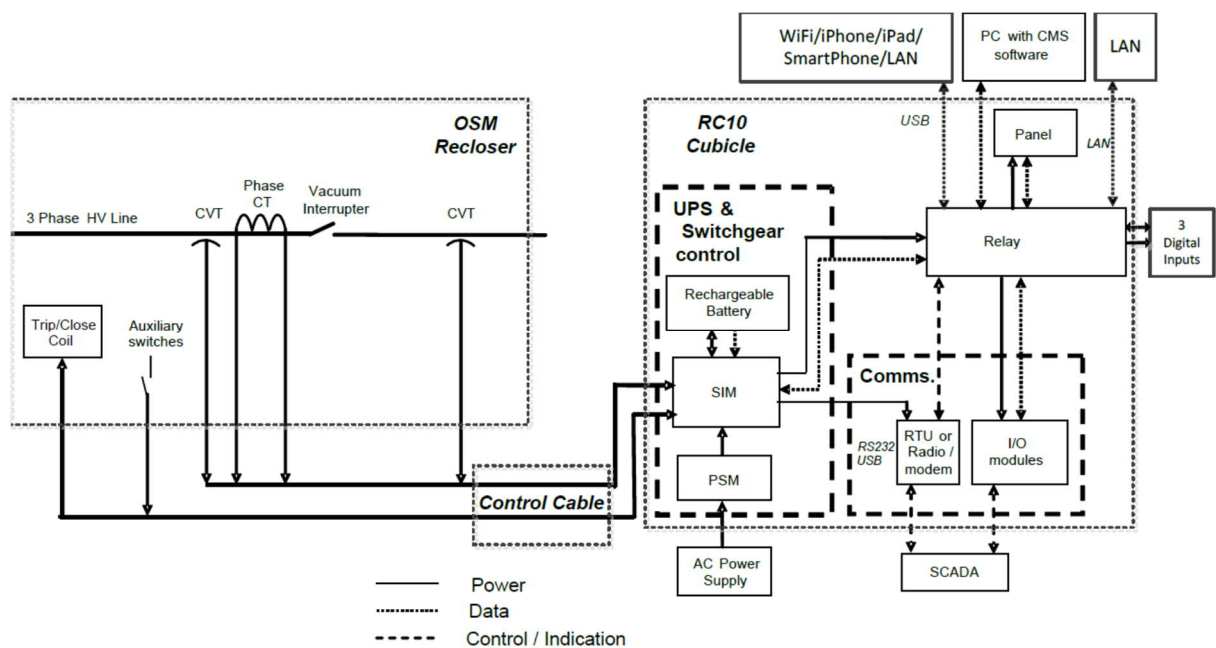


Figure 6: Functional structure of the OSM recloser with RC10 cubicle

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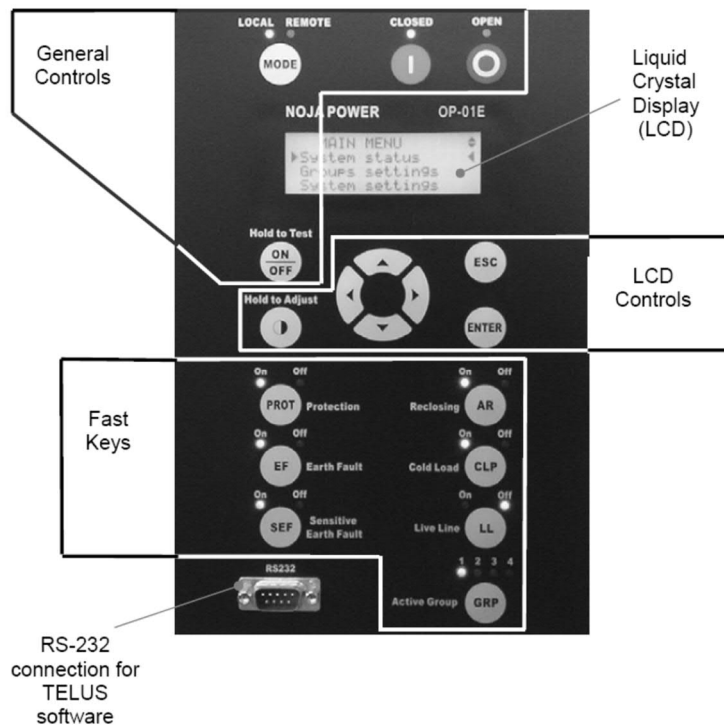


Figure 7: Man machine interface RC 01

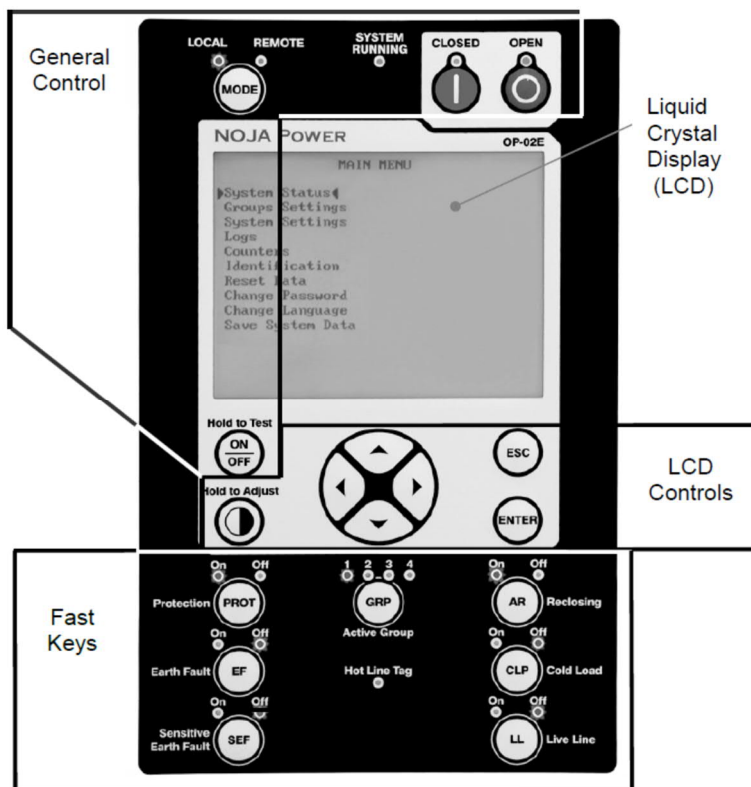


Figure 8: Man machine interface RC 10

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4.1.6 Auxiliary supply VT (optional)

- Epoxy encapsulated design, suitable for outdoor use;
- Suitable for mounting on a pole;
- Phase to phase design;
- VT parameters: ratio 11,000/240V, rated output 100 VA, Class 5M;
- Fitted with an inter-winding screen; and
- Fitted with a 2A HRC fuse.

Further description, operation and maintenance instructions on the recloser are given in manuals, guides and instructions provided by NOJA.

4.1.7 Spares

The following spares can be purchased directly from NOJA:

No.	Item description	Part number	Stock code
1	Silicon Rubber Bird Guard for Tunnel Connectors	BGD-0002	
2	Battery Tray including CB and Wiring Loom	RC10-3020B	
3	RJ45 SIM to Relay Cable	RC10-3037	
4	SIM to Relay Analog Cable	WA30-10	
5	USB Relay to Front Panel Cable	RC10-1071	
6	Operator Panel Human Machine Interface (HMI)	PANS-01E	
7	RJ11 Operator Panel to Relay Cable	RC10-1070	
8	Relay Module REL-02	RELS-02	
9	Switchgear Interface Module (SIM)	SIMS-01	
10	Power Supply Module (PSM)	PSMS-01	
11	Control Cable 7m Length	CC07-11	
12	Pole Mounted External Voltage Transformer	VT15/220-02	
13	Demonstration Unit	DEM-10	
14	Input Output module, 8 inputs, 8 NO/NC outputs	IOMS-11	
15	RC10 controller backward compatible to RC01 controller	RC10-200	1568732

4.2 Installation

4.2.1 General

The NOJA reclosers are designed for pole mounted installation in accordance with Main Construction Instruction MCI 0005 – Overhead Distribution Construction Standards Manual and drawing 332022. The recloser is built in accordance with Equipment Technical Specification ETS 0074 – 12kV and 24kV reclosers for specification for new equipment. Earthing of the recloser shall be performed in accordance with Earthing Design Construction EDI 100 – Distribution earthing design, construct and commissioning

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- and commissioning performed in accordance with Substation Design Instruction SDI 120 – Testing and commissioning for distribution systems.

Installation should be performed safely with all relevant authorisations, training, safe work method statements and all relevant Safe Work and WorkCover codes of practice.



Figure 9: Photo of an installed recloser

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4.2.2 Supplied manufacturer items

The supply from the manufacturer includes the following items:

Description	Qty
OSM 15 / OSM 38 auto-circuit breaker in stainless steel tank with following accessories; - Six (6) silicon rubber bushing boots - manual trip ring - current transformers and capacitive voltage sensors	1
Tunnel cylindrical cable connector	6
Pole mounting bracket for recloser, hot dip galvanised	1
OSM 15 / OSM 38 VT combined bracket	1
RC10 control and communication cubicle complete with the following; - mounting bracket - auxiliary supply input for use with 230 V 50 Hz AC supply - Communication protocol DNP3 and MODBUS - Software (English language) 12V DC 26Ah battery and battery charger	1
Control cable in flexi- conduit, 7 m long	1
BGD-002 bird guards - silicon rubber bushing terminal boots	8
CAB-30 11kV XLP-CCT cable 19/3.5, 180 sq. mm in 3 metre length	6
Three (3) core flex cable 1.5 sq. mm in 10 metre length	1
Outdoor voltage transformer VT11kV/220V, or VT 33kV/220V 100VA, Class 5M (ph-ph connection)	1

The manufacturer does not supply the following items:

- pole mounting hardware for recloser, control box and VT;
- 11kV connectors for connection of recloser to line using 180 sq. mm CCT;
- 11kV connectors for connection of VT to line using 70 sq. mm CCT;
- surge arresters with earth lead disconnect device, including 11kV connections and hardware; and
- earthing conductor from surge arresters to tank and to ground rods.

4.3 Operation

The recloser uses magnetic actuators for open and closed operations. Therefore, under normal circumstances, the recloser can operate with electrical power. However, in an emergency, the recloser can be opened by pulling the manual mechanical trip ring provided on the recloser tank.

A hook stick can be used to pull the manual mechanical trip ring and when pulled down prevents the auto circuit recloser from operating. An *OC Coil Isolated* warning event is generated to provide indication of the locked state. Pushing the mechanical trip ring back into the operating position returns the recloser to normal mode.

For detailed instructions on manual operation of the recloser, refer to the user manual provided by the manufacturer.

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4.3.1 Position indicator

The recloser provides open/close indication, which is linked directly to the operating mechanism. The indication is clearly visible from the ground to provide a clear indication of the position of the recloser. Indicator colour is RED when closed, and GREEN when open.

4.3.2 Remote operation

For a detailed instruction on remote operation of the recloser, refer to the manuals provided by the manufacturer.

4.3.3 Switching operations

Switching operations must be carried out by authorised workers only. Refer to Division Procedure (Network) GNV 1061 - Transmission and High Voltage Distribution Network Switching.

5 Authorities and Responsibilities

Manager Asset Standards & Design has the authority and responsibility for:

- Approving technical standards including any variations.

Substation Assets Manager has the responsibility for:

- Reviewing and endorsing this standard in accordance with Company Policy and Procedures.

Senior Engineer, Distribution Substation Assets has the authority and responsibility for:

- Revising and updating this standard in accordance with company policies and procedures.

Regional Managers have the responsibility for:

- Allocating appropriate resources to enable compliance for designs carried out by regional employees with this standard
- Determining that all designs carried out by Regional employees conform to the requirements of this standard.

Manager Network Connections has the responsibility for:

- Determining that all designs carried out by Level 3 ASPs conform to the requirements of this standard.

Accredited Service Providers have the responsibility for:

- Producing all designs in conformance to the requirements of this standard
- Confirming that the latest issue of any instruction or drawing relevant to or listed in this standard is available and used during the design of any project.

Produced by Asset Standards and Design Branch

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