

Innovative Power Engineering at its best!

HUGHES
POWER SYSTEM

INDOOR VACUUM CIRCUIT BREAKER

FOR SUBSTATIONS, CABLE LINES



VX4 SUBSTATION VACUUM CIRCUIT BREAKER
SERIES FOR DIFFERENT VOLTAGE CLASSES:

- VX4-12 series for 6/12kV;
- VX4-24 series for 22/24kV;

ABOUT US

Hughes Power System is a Swedish manufacturer of environmentally friendly equipment for electrification and automation of mass transport and electrical distribution systems. Very high quality standards together with innovative approach result in an advanced range of products, aiming to improve network quality by minimizing the number and duration of faults.

Our product portfolio includes:

- High and medium voltage solid insulated vacuum circuit breakers
- Reclosers
- Disconnectors
- Motor operating drives for disconnectors
- Voltage transformers
- D/C power supplies

With its more than 30 years expertise in research, development, manufacturing, marketing and sales the company operates in many countries though cooperation with local partners. As we move towards our goal of being a world class advanced technological company in electrical utility products, we guarantee our commitment to the well known Swedish standards of reliability, safety and quality.

The majority of Hughes Power System's products are designed and built in Sweden.



GENERAL DESCRIPTION



OPTIONAL CXB CONTROL UNIT

- The **CXB-1** (1) control unit is intended for a simple remote control of a VX4 switch.
- The cabinet contains all necessary components for local and remote control of the device.
- The CXB unit has a parallel remote control Interface to a RTU.



WHAT IS A VACUUM CIRCUIT BREAKER

Hughes VX4 substation vacuum circuit breaker series is designed and manufactured in Sweden. It is built for use on underground distribution lines, in distribution substation applications and as an advanced Smart Grid building block. The products are built to remain in operation for more than 30 years without major maintenance due to the highest quality materials used in its construction.

VX4 can be equipped with Hughes control unit for a simple remote control or with Hughes recloser control unit to form a recloser/sectionalizer.

OPTIONAL FTU RECLOSER CONTROL

- The **FTU** (2) recloser control cabinet together with the VX4 switch forms a recloser or a sectionalizer.
- FTU handles the network protection and the RTU functionality.
- The protective relay senses the faults, assists the vacuum circuit breaker module in a recloser to clear the fault on the line.



OPERATION PRINCIPLE

- The VX4 series of vacuum circuit breakers can be operated manually for remote control.
- The solenoid release mechanism has the operation springs charged all the time. It is released by an electric solenoid (ca 25 ms delay) or by a manual operation mechanism. This mechanism has stored spring energy for 3 operations before it needs to be automatically charged.



VX4 SERIES OF VACUUM CIRCUIT BREAKER MODEL RANGE

- For 6/12kV **VX4-12** model of vacuum circuit breaker equipped with 12kV bushings;
- For 22/24kV **VX4-24** model of vacuum circuit breaker switch equipped with 24kV bushings;

GENERAL DESCRIPTION

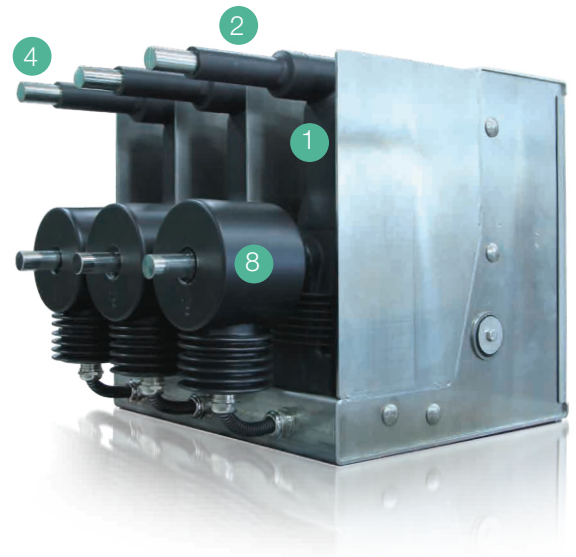
VX4 INDOOR VACUUM CIRCUIT BREAKER COMPONENTS AND ADVANTAGES

Hughes **VX4** series of vacuum circuit breaker has the following components and advantages:

- **Low maintenance.** Hughes reclosers are built to remain in operation for more than 30 years without major maintenance due to the highest quality materials used in its construction;
- **Live tank construction** (1) completely eliminates the occurrence of internal arc faults and the risk of explosion or destruction inside the recloser switch tank. That makes it repairable in case one of the poles is damaged. It provides improved cooling of the vacuum interrupters due to unhindered air circulation. It has the increased creepage distance that allows the use of reclosers in an environment with a 4th degree of atmospheric pollution and cleaning of insulation without dismantling;
- **Long operational life time.** Up to 20,000 interruptions (one of the longest operating life on today's market) of the well proven VX4 vacuum circuit breaker;
- **Solid epoxy insulation** of bushings (2) and insulators is environmentally friendly, does not contain harmful SF6 gas or oil;
- **Highest quality stainless steel** (3) is used for most of the parts to minimize electrochemical corrosion. The use of stainless steel in accordance with DIN50049 / 3.1B, thanks to its non-magnetic properties, completely eliminates the occurrence of any kind of corrosion, including electrochemical corrosion over the entire life of the recloser;
- **Electrical circuit** (4) made of high-grade copper;



VX4-24 indoor vacuum circuit breaker, front view



VX4-12 indoor vacuum circuit breaker, back view

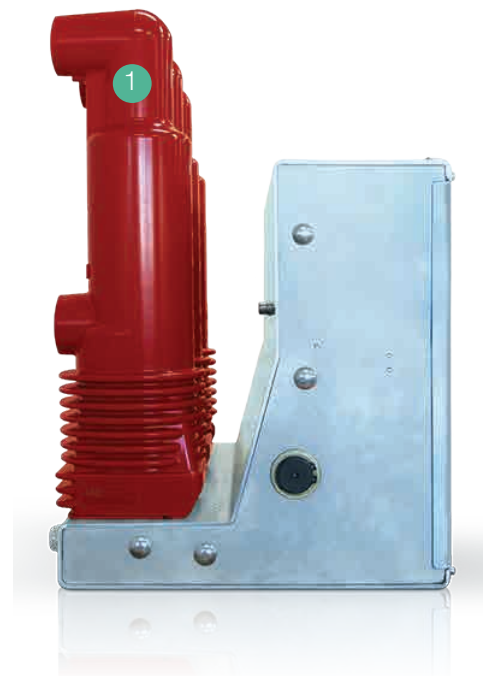
- **Vacuum interrupter bottles** (1) can handle 25kA faults for 3s guarantee long term problem free operation in networks with many high current faults;
- **Spring stored energy operating mechanism** provides turning On and Off the switch module even in the complete absence of power supply (voltage transformer malfunction, full battery discharge);
- **Manual charging** (5) of the spring mechanism as well as switch operation On and Off are possible with the help of maneuvering arms located on a switch body. The spring capacity is enough for the full reclosing cycle (Off - On - Off);
- **Padlock facility** (6) for mechanical blocking of operation;
- **Advanced protection relay** with functions of directional fault detection, low earth fault detection, intermittent earth fault detection, automatic reverse power flow setting change;
- Same footprint as **ABB NAL** load break switch and **ABB VD4** circuit breaker;
- **Truck mount** (7) for simple maintenance (optional);
- **Simple connection to the bus bar** or cable (several custom options);
- **Simple installation** in existing switch bays and kiosks;

OPTIONAL COMPONENTS

- **Phase current transformers** (8). The VX4 can be fitted with phase current transformers with different winding ratio and with multiple tapings;



VX4-12 vacuum circuit breaker on truck mount, front view



VX4-24 vacuum circuit breaker, side view

GENERAL DESCRIPTION

OPTIONAL CXB-1 CONTROL CABINET AND FTU RECLOSER CONTROL ADVANTAGES

Hughes CXB and FTU control units for VX4 vacuum circuit breaker have the following advantages:

- **Complete solution** from a pole to SCADA system;
- **Easy installation** and compatible with most disconnectors;
- **Compact design**;
- **External cabinet** (1) of highest quality stainless steel. The use of stainless steel in accordance with DIN50049 / 3.1B, thanks to its non-magnetic properties, completely eliminates the occurrence of any kind of corrosion, including electrochemical corrosion over the entire life of the cabinet;
- **Special double roof** (2) prevents the accumulation of the water / snow on the cabinet and protects from overheating of the internal cabinet in hot climates;
- **Padlock facility** (3) handle protects from unauthorized access;
- **Protection lips** (4) from rain water;
- **Connector** (5) for antenna remote control;
- Rugged pole **mounting brackets** (6) for different pole types;
- **Door alarm switch** (7) activates when the door is opened and sends the signal to the SCADA system. This feature notifies about access to the cabinet;
- **Inventive climate system** (8) for long term reliability. The lower louvers have a combination of a polymeric fine filter and a PTC thermoelement, which creates a moving air stream to the upper louvers. This air stream always evens out the day and night effect. The bottom of the cabinet has 5 drainage holes with micro filter preventing water gathering in case of any condensation;
- **Inventive protection system** from water ingress via the outgoing drive shaft;
- **Communication** to the control centre can be done via SMS, MODBUS, DNP3 and IEC 60870-5-101/104 serial and IP communication via radio-GSM;



CXB control unit



FTU recloser control cabinet

Hughes FTU recloser control cabinet has the following components:

- **FTUR200** (1) protection relay;
- **Standard lead acid AGM type battery** (2) 2 x 12 V 20 AH;
- **Temperature compensated battery charger** (UPS) (3);
- **Disconnectable terminal blocks** (4) for easy test of functions;
- **Internal ventilation system** (5) with special filter;
- **Heating system** (6) to prevent condensation and to give the electronics a long life and a good working environment;



OPTIONAL COMPONENTS:

- **Lightning protection** for the antenna gland;
- **Li-Ion batteries** for high temperature climate zones, 2 x 12.8 V 20 AH;
- **Input power** (110 or 230V) surge arresters;
- **Communication unit option A:** GIO-100
GSM/4G/LAN Router with IEC60870-5-104 signaling protocol and IPSec encryption and IP filtering;
- **Communication unit option B:** GIO-200
GSM/4G/LAN Router with IEC60870-5-104 signaling protocol and IPSec and Open VPN encryption and IP filtering;



GIO-100



Li-Ion battery

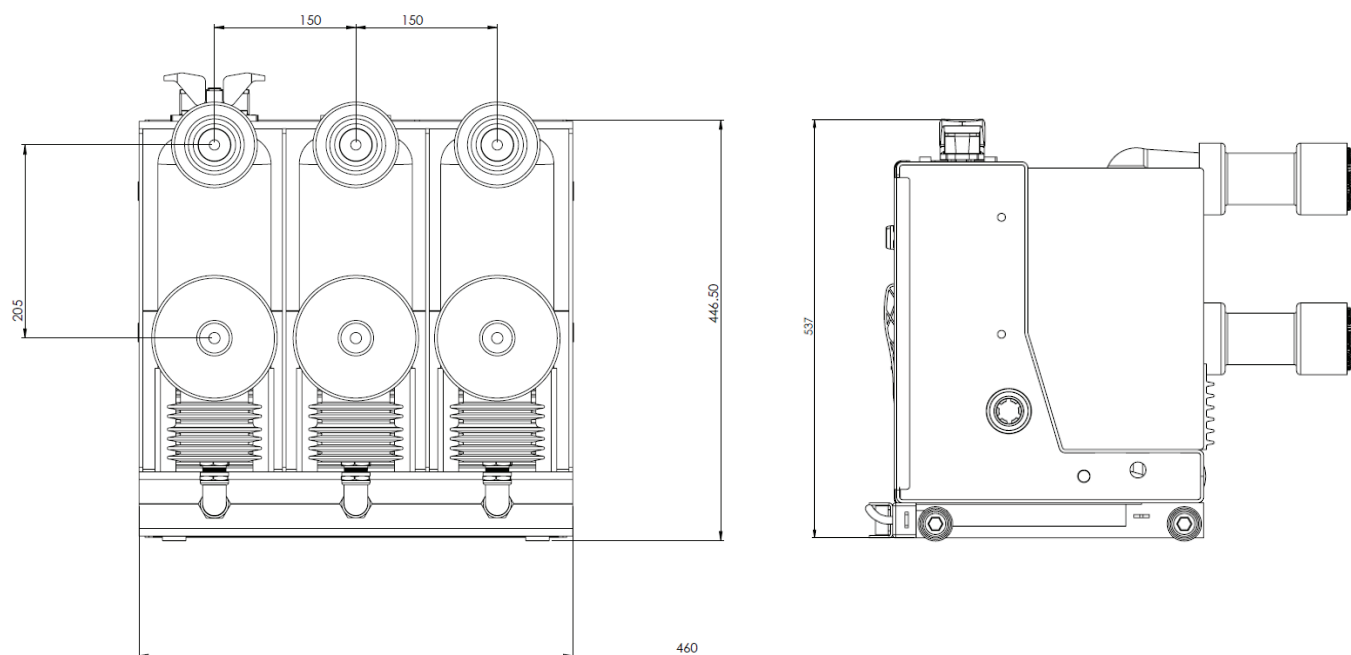


Lightning protection for antenna

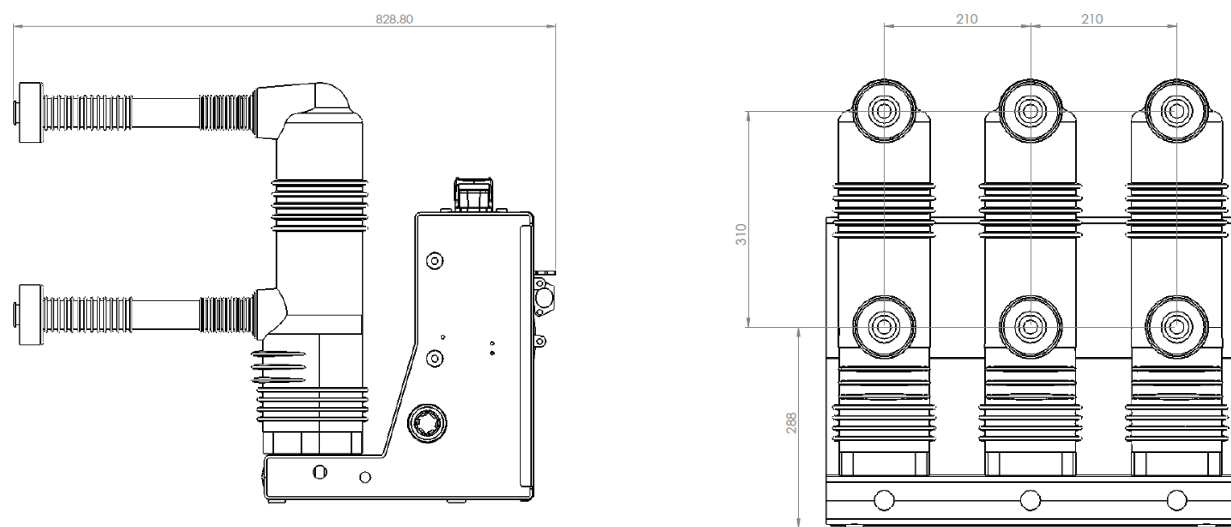
VX4 VACUUM CIRCUIT BREAKER

DRAWINGS

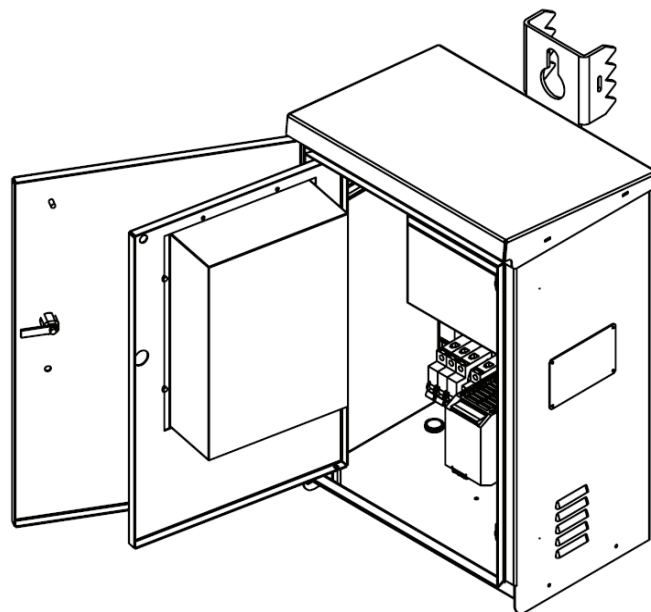
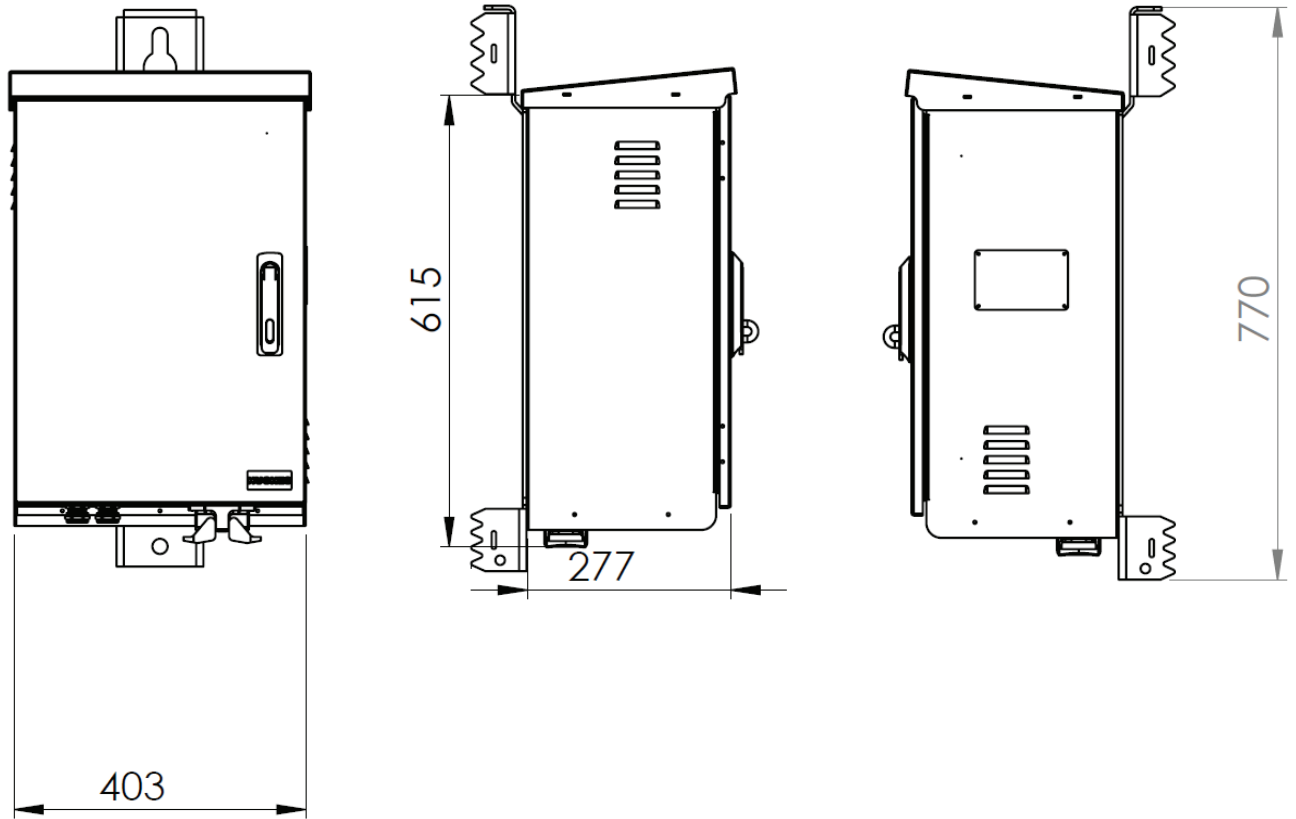
VX4-12



VX4-24

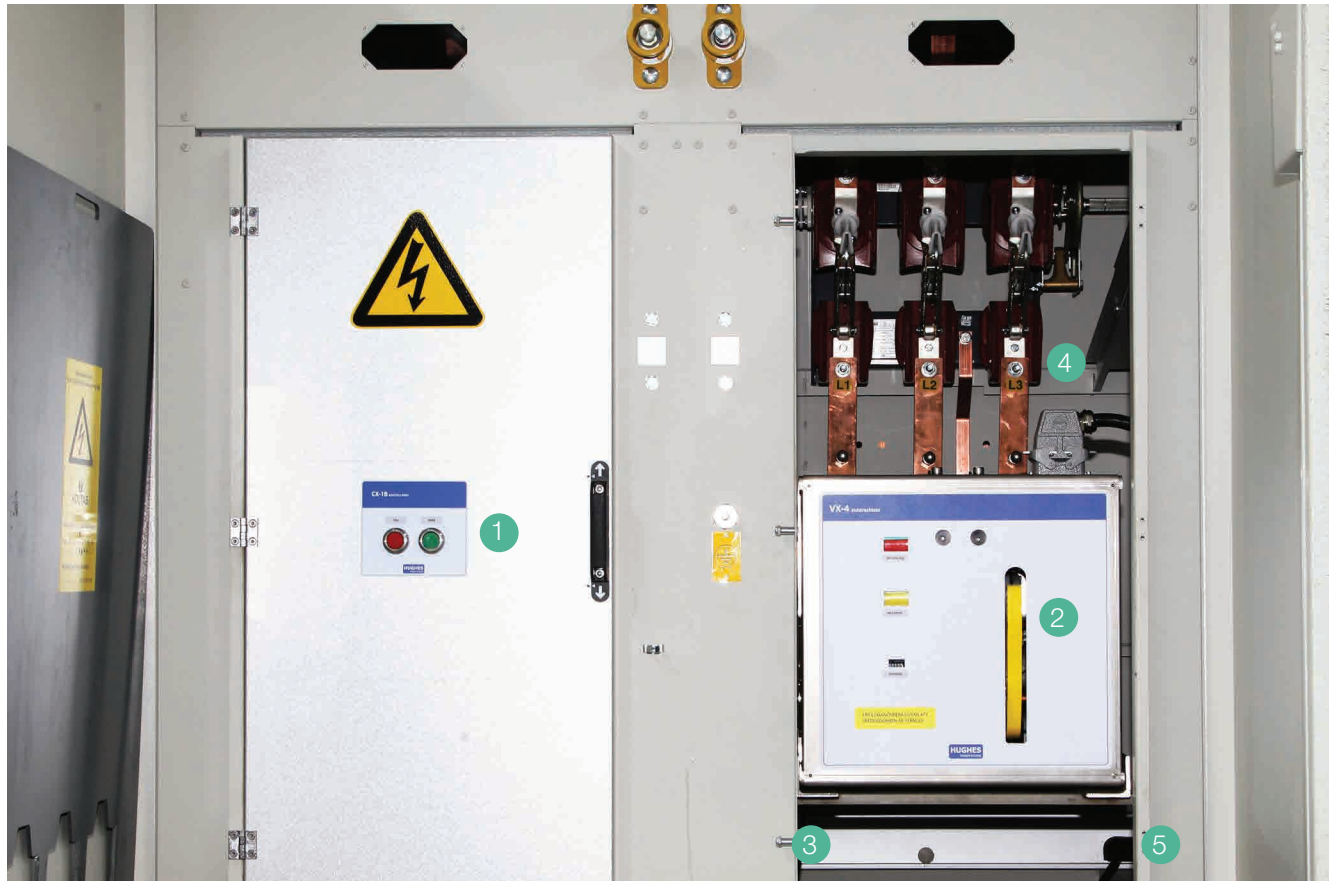


FTU



INSTALLATIONS

VX4-12 / 24



VX4 installation in a substation breaker bay.

- Left door: inner protection door closed. Circuit breaker operation buttons (1) extender is mounted on the door;
- Right door: VX4 (2) installed in a mounting frame (3). Upper side connected to a disconnector (4) with visual open points. Lower side connected to an outgoing cable (5);

FTU



Installation of protection relays and circuit breaker operating panels in a small pre-manufactured substation.

- 4 protection relays (2, 3, 5, 6) for 4 outgoing lines;
- 2 circuit breaker operating panels (7, 8) for 2 incoming cables;
- 1 operating panel (4) for bus bar interconnection circuit breaker;

EXTERNAL ACCESSORIES

NEW! FOR CXB-1 CONTROL CABINET AND FTU RECLOSER CONTROL GROUNDING SYSTEM CABLE THEFT ALARM

Grounding system cable theft alarm is an optional accessory that notifies SCADA system if the grounding system is missing or damaged.

It is installed inside a control cabinet and is suitable for all Hughes pole mounted products, such as:

- motor drives;
- overhead line and kiosk reclosers' protection relay cabinets;
- control cabinets for sectionalizers;
- control cabinets for vacuum circuit breakers or load break switches.

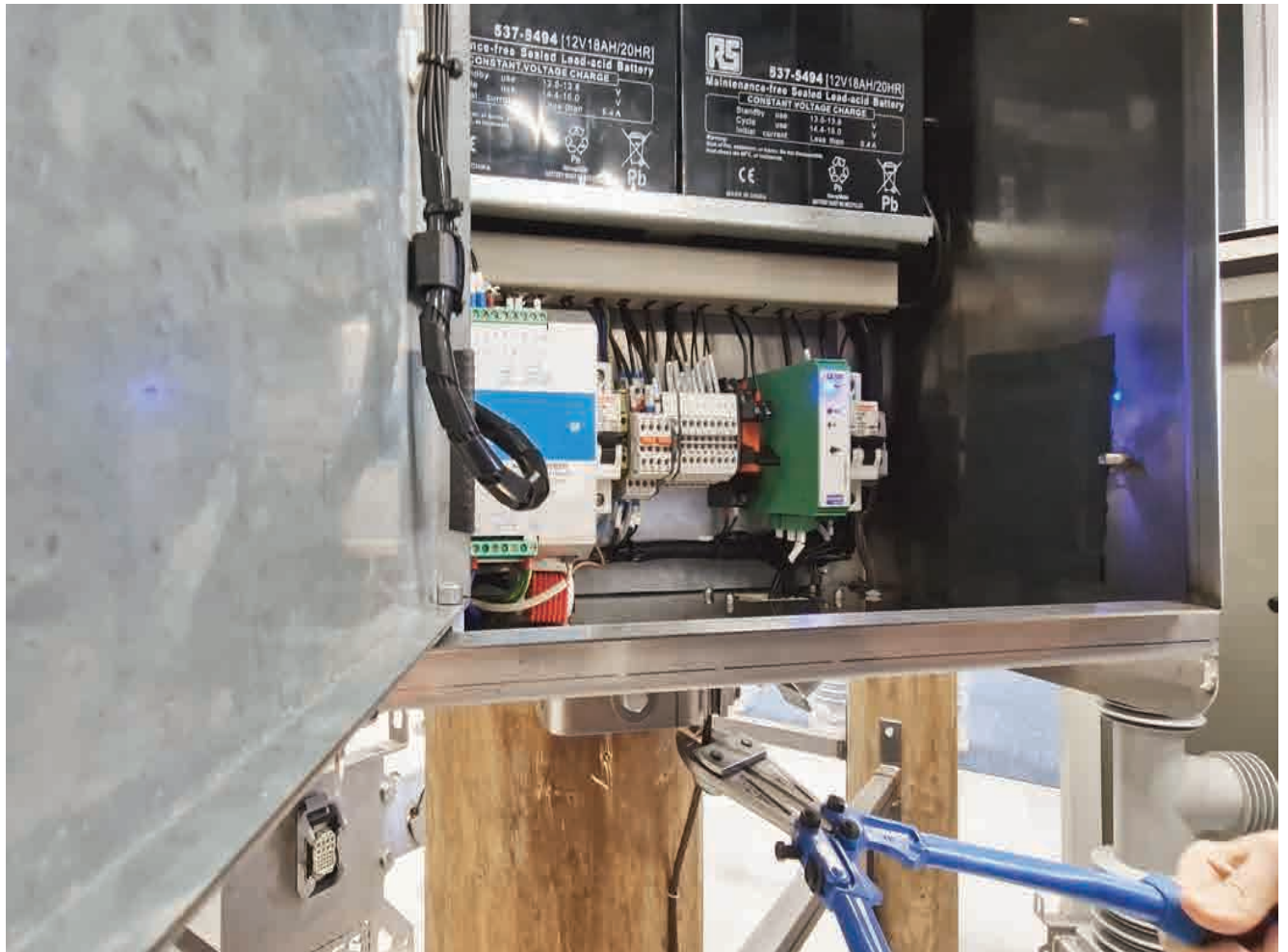


Installation in the motor drive cabinet

INDICATORS AND BUTTONS

When a ground wire of a control cabinet is cut, the red LED button is activated, and an immediate notification is sent to a SCADA system.

- The accessory has 3 indicators and one test button:
- POWER - on with a constant blue LED indicator;
- OK - with green LED displaying that ground system is normal;
- ALARM - with red LED displaying that the ground wire is cut;
- Test button - for testing the operation of the device;



PURPOSES

The alarm is in high demand in regions with a big number of copper cable thefts.

The theft alarm purposes are:

- to receive immediate notification that the grounding system is missing;
- to help to prevent big electrical hazardous risks for the operator or public;
- to avoid receiving false measuring information from the remote device;
- to make it possible to repair the grounding system in the shortest time;

VX4 VACUUM CIRCUIT BREAKER

EXTERNAL ACCESSORIES

FOR FTU RECLOSER CONTROL CABINET AND VX4 VACUUM CIRCUIT BREAKER



Multicore interconnection cable for
VX4 and FTU recloser control



Clip-on current transformer,
winding: 150/1;



Core balance transformer, winding: 20/1;



Hand crank operated truck mount
with interlock function;



Voltage transformer 1-phase connection
12 or 24/110 kV class1, 50 VA;



Modem – Router G100



Modem – Router G200



Antenna for GSM/4G



Pole mounted bracket for antenna



Surge arresters for antenna
N-N connectors



Antenna cable (3) 8M RG-213 N-N
professional connectors;



Standard lead acid AGM type battery 12 V 20 AH;



Li-Ion batteries for hot climate
with LiFePO₄ chemical system 12.8V 20 AH

VX4 VACUUM CIRCUIT BREAKER

TECHNICAL DATA

CHARACTERISTICS	FTU recloser control cabinet
Dimensions (LxWxH), mm	403 x 293 x 630
Weight, kg	45 (including batteries)
Operating temperature, °C	-50 ... +60 Optional -10...+80
Enclosure	IP55-65, non-magnetic stainless steel, optional painted in RAL or ANSI colour
Climate system	35 W PTC element
Thermostat, °C	on at 5°C off at 15°C
Operation voltage	90– 250VAC 240 W, temperature compensation;
Batteries	2 x 12 V 22 Ah AGM Lead cell
Battery optional	2 x 12.8 V, 22 AH Li-Ion
Control interface	Parallel - Modbus
Signalling protocols, serial	IEC 60870-5-101, DNP3, Modbus RTU
Signalling protocols, IP	IEC 60870-5-104, DNP3, Modbus
Signaling protocols, optional	IEC 61850
GPS timing protocol	IRIG-B
Communication interface	1 x RS-232/485, 1 x RS-232, 1 x 10/100Mbit TP(Ethernet), GSM/4G
Sensor input	2 x 4-20 mA
Optional communication board	2 x 100Mbit TCP or 2 x Fibre
Optional communication system	HSR and PRP Redundancy protocols
Tests	• EN 60068-2-1 • EN 60068-2-2 • EN 60068-2-30 • EN 60068-2-52 • EN 60068-2-78 • EN 62271-102 6.103 • EN 62271-102 6.104 • EN 62271-102 6.105 • EN 60265
Control panel	• RS-232 or USB B type • Provided LCD • Self-Diagnosis LED • RS232/485/Ethernet (communication port) • SCADA communication status LED • Battery voltage low LED • Fault Indication LED • Local/Remote operation mode selection button • Reclosing enable/disable button • Protection enable/disable button • Close/open operation button • Hotline tag button • Phase/Ground fault • SEF • Under/Over voltage • Under /Over frequency

CHARACTERISTICS	FTU recloser control cabinet
Protection	• Phase/Earth/Negative Over Current • Harmonic Restraint Trip & Reclosing • Sensitive Earth Fault (SEF) • Intermittent Earth Fault(IEF) • Broken Conductor • Open Line Detection • Directional Tripping/Blocking • Under Voltage • Over Voltage/Ground Over Voltage • Under Frequency, Over Frequency • Synchronism Check • Loop Automation Scheme, • Fault Location • Sectionalizer • 4 Setting Groups with automatic change due to power flow
Time Current Curve	62 types curve including ANSI, IEC and user-customized curve
SCADA Communication port	• USB or RS232C(Maintenance Port) • RS232C(Modem Control Supports) • RS232C/485, Ethernet Port 10/100 Base-T • Fiber Optic* • PRP/HSR scheme (Parallel Redundancy Protocol)/(High Availability Seamless Redundancy)
Event recording	Event recording with 1ms time-stamp: • I/O changed events (1023) • Functional operating events (20,000)* • System related events (255) • Communication events (255) • Fault current (1,023) • PQM events (255) • Demand profile: current, voltage and power (6,143) • Daily maximum current, voltage and power (1,023) • Energy & Peak Demand Profile (63) • Current, Voltage, Power, Power Factor, Frequency, Energy, Harmonics, Demand, Internal Temperature.
Measurement	• Current • Voltage • Power • Power Factor • Frequency • Energy • Harmonics • Demand • Internal Temperature • Battery voltage

VX4 VACUUM CIRCUIT BREAKER

TECHNICAL DATA

CHARACTERISTICS	VX4-12 for 6/12kV	VX4-24 for 22/24kV
Dimensions LxWxH, mm	460x447x537	587x829x643
Weight, kg	75	95
Operating temperature, °C	-45 - +70	-45 - +70
Humidity	100% at 25C	100% at 25C
Enclosure	IP55-65, non-magnetic stainless steel, optional painted in RAL or ANSI colour	IP55-65, non-magnetic stainless steel, optional painted in RAL or ANSI colour
Bushing type	Epoxy core	Epoxy core
Phase to phase distance, mm	150	210
Max installation altitude at rated BIL, m	3000	3000
Rated operation voltage, VDC	24-48-110	24-48-110
Rated maximum voltage, kV	12	24
Rated basic impulse level, kV	95	125
Rated continuous current, A	630 / 1250	630 / 1250
Rated fault making current, kA	63	63
Rated fault breaking current, kA	25	25
Cable charging current, A	20	40
Line charging current, A	5	10
Rated fault duration time, s	3	3
Contact resistance, VCB, $\mu\Omega$	< 35	< 35
Network frequency, Hz	50/60	50/60
Design min mechanical/electrical	20.000	20.000
Rated power, W	40	40
Design specification	IEC 62271-100	IEC 62271-100
Marking specification	IEEE std C37.60	IEEE std C37.60
Operation sequence, no charge	25ms trip - 50ms close - 25ms trip	25ms trip - 50ms close - 25ms trip



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