Proton Power Technology Inc.

AUTO-RECLOSER & SECTIONALIZER

SDV Series Outdoor Vacuum

upto 36 KV

OUR COMPANY

Proton Power Technology Inc. is an ISO 9001:2015 certified; one of the modern and leading quality manufacturers of various Electrical equipment's up to 33kV under the brand name of Proton Power Technology Inc. Vadodra, Gujarat, India

Driven by Technology and Innovation, Proton Power Technology Inc. is a well-established Manufacturer, Exporter and Supplier of World Class range of Electrical Products. Since its inception in 1984, the Company has grown manifold and secured a strong foothold in the Industry. Under the direction of able Management, we have successfully acquired a widespread customer base and it continues to expand further. Our Customers prefer us due to our Ethical Business Practices, Customer-Centric Business Approach, Unmatched Product Quality and an Efficient Delivery System.

We believe in offering Quality-Assured range of Products which completely fulfills the essential needs of our valued Clients. We are involved in Manufacturing, and Supplying of different types of products. We strictly adhere to all the quality guidelines that assist us in providing assurance to the customers that all the dispatched products meet with the International Quality Standards. Some points in reference to this are:

- **Ability to suffice in large number**
- **Quality Processed Product Range**
- **Modest Transactional Gateway**
- **Prompt Shipment Facility**
- **Customization**
- **Strict Quality Control**

Vision: Delighting the Customers by exceeding their logical expectations by providing Quality Products with highest level of system control and best standards of manufacturing with on-time delivery at the most competitive price. During the process, we will be the Doyen in Quality and Services for our Customers and create value for all Stake-Holders.

Mission: Having excelled in International and Domestic markets in a small way with our Product Portfolio and winning customers' confidence in all cases proven by repeat orders from them; Proton Power Tech. now proposes to take big leap forward by exploring African, Asean and other developed Countries and achieving a turn-over of INR 1000 Millions in 3 years.

Along the process we will become the most Customer Caring Company.

AUTO-RECLOSER & SECTIONALIZER

The demand for Smart Auto-Recloser & Sectionalizers in modern smart grids has never been higher. Current reclosers have several limitations: they are often too heavy and challenging to upgrade. As a result, the necessary features must be carefully planned in advance, especially if they are needed years down the line. Additionally, if the recloser you choose lacks advanced technical features that ensure zero maintenance, it could be more detrimental than not having a recloser at all.

Auto-Recloser & Sectionalizers are solid-insulated devices that use proven Vacuum Interrupters, encased in Hydrophobic Cycloaliphatic Epoxy. These vacuum circuit breakers come with a maintenance-free magnetic actuator mechanism and reliable current and voltage sensors, making them ideal for harsh, outdoor, unmanned power distribution networks. Their primary goal is to enhance system reliability, reduce downtime, and lower ownership costs.

These SCADA-Compatible units include a control cabinet equipped with a breaker control unit, a microprocessor-based relay, a battery, a battery charger, and provisions for an FRTU.

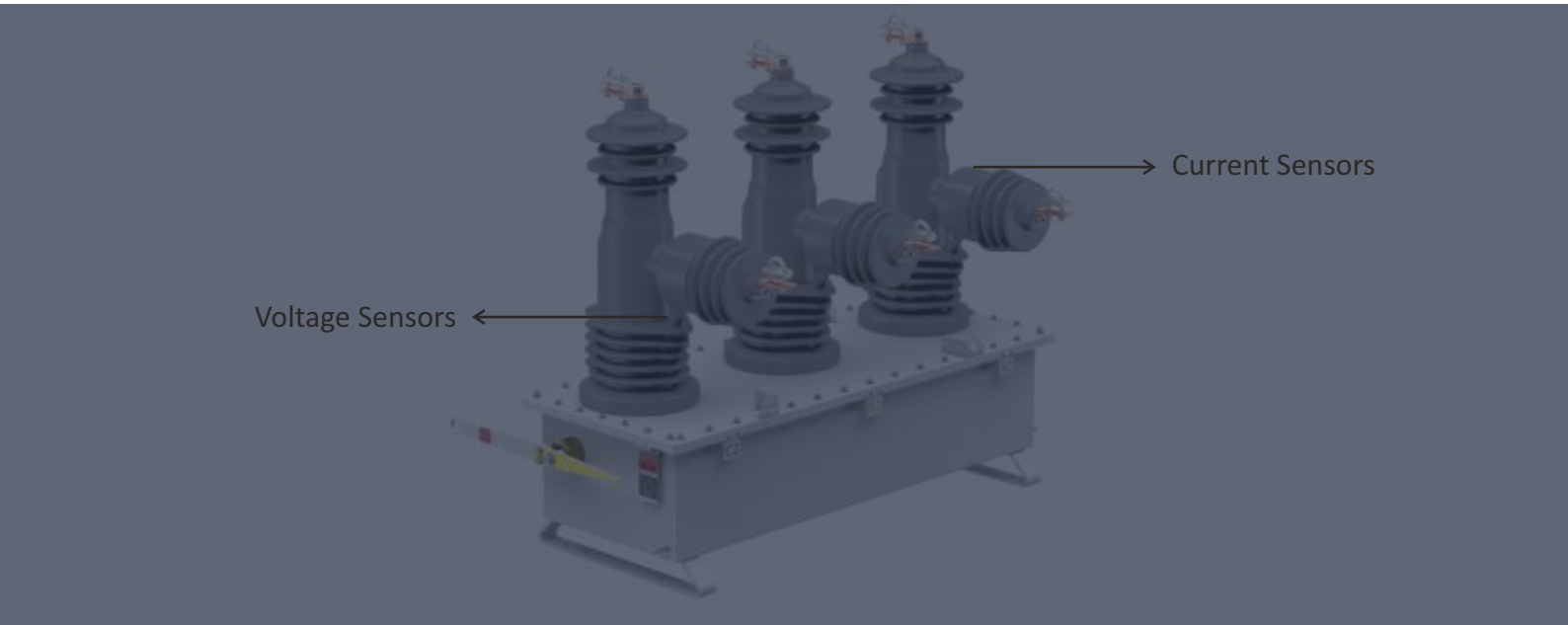
STANDARDS

Auto-Recloser & Sectionalizers provides safety and protection for a wide range of applications ranging from power utilities, industries and infrastructure by complying with the latest IEC standards:

- IEC 62271-100 Alternating Current Circuit Breakers.
- IEC 62271-111 Pole Mounted Outdoor Recloser.
- IEC 60255- Measuring Relays and Protective Equipment.
- IEC 60044-7-8 Electronic Current and Voltage Sensors.

Voltage Sensors:
Voltage sensors replace conventional potential transformers. They operate based on a proven capacitive voltage divider principle, ensuring linear performance across a wide range of values.

Current Sensors:
Current sensors serve as direct replacements for traditional current transformers. They offer a broad current range within a single design, eliminating the need for multiple specifications. These linear devices are highly reliable, as they lack an iron core and do not saturate, even at 40 times the primary current. Each sensor is designed for both metering (class 0.2) and protection (5P40) applications.



MAGNETIC ACTUATORS

The Auto Recloser is equipped with advanced, highly reliable magnetic actuators that utilize magnetic forces to operate the circuit breaker. This cutting-edge technology offers unmatched benefits, making the actuators completely maintenance-free.

- 100,000 Mechanical Operations without any Maintenance.
- Fewer Moving Parts.
- No links and latches; lubrication and periodic maintenance is avoided.
- Faster Close/Open Time.
- Low Power Consumption.
- Light Weight.

VACUUM INTERRUPTION

ESPL offers proven vacuum technology for arc interruption. Each pole is equipped with a vacuum interrupter, utilizing a proprietary casting technique that significantly enhances the dielectric strength of the product. This vacuum technology is highly effective in switching capacitive components of current, making the SDV an ideal solution for overhead line and cable protection.

HYDROPHOBIC INSULATION

The SDV embedded poles are made from high-quality hydrophobic materials, specifically HCEP (Hydrophobic Cycloaliphatic Epoxy). Each pole houses separate current and voltage sensors. This material is proven to perform exceptionally well under humid conditions.

BASIC DESIGN

The Auto Recloser operates electrically by energizing a magnetic actuator system housed in a fully sealed enclosure. Each pole is equipped with a vacuum interrupter, enclosed in solid dielectric insulation for both mechanical strength and high dielectric performance. Compact and lightweight current and voltage sensors are integrated into the Auto Recloser unit.

Accurate

Embedded current and voltage sensors

Metering

Failure Free

Safe

Protection

Light Weight

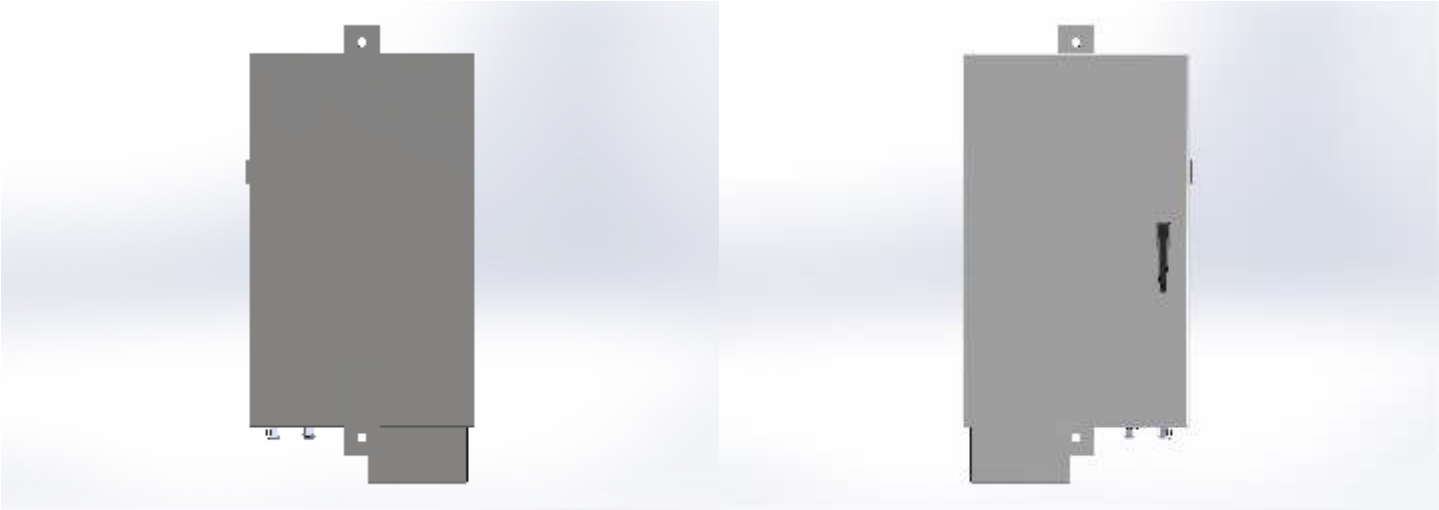
100,000 operations

Consumes less energy

Maintainence free

CONTROL CABINETS

The Control Cabinet houses the Advanced Relay, Battery, Battery Charger, Breaker Control Unit, and provisions for an FRTU, along with all necessary connector options. Designed for outdoor applications, the cabinet can be mounted on a pole for secondary distribution or on a pedestal for substation installation. It is tested to meet IP65 standards. The cabinet includes a 24V battery charger with both 12V and 24V outputs. It eliminates the need for costly rewiring of I/O signals by accepting existing connector plugs for power, control, voltages, and currents with the same pin sequence. Additionally, it supports existing communication connections for Serial TIA-232, TIA-485, Fiber Optic, and IRIG-B. Upgrading communications is simplified with the optional true embedded Ethernet ports in the M-7679 R-PAC, allowing for multi-user, multi-protocol access to advanced metering, power quality (PQ), and disturbance fault recorder (DFR) data collected by the control system.



PROTECTION FUNCTIONS

The SDV offers a comprehensive range of protection functions, all of which are multi-stage. The Auto Recloser (ACR) can accommodate up to 8 different protection groups. Additionally, these protection functions can be individually programmed to either operate the switch, raise an alarm, or trigger other actions. For instance, in a 50Hz power generating station, the operator can program the first stage to trigger an alarm at the Control Room SCADA when the frequency exceeds 51Hz, and on the second stage, tripping can be programmed if the frequency exceeds 52Hz.

Over Current and Earth Fault Protection
Over Current and Earth Fault protection are essential to almost every part of the protection system, safeguarding against overloads and short circuits. This protection can include a follower or standard DTL added to inverse time or instantaneous protection, with:

- 4-stage operation
- IEC Curves: Normal Inverse, Very Inverse, Extremely Inverse
- IEEE Curves: Moderately Inverse, Very Inverse, Extremely Inverse
- User-programmable non-standard curves

Sensitive Earth Fault
Sensitive Earth Fault (SEF) protection is used in systems with high-resistance grounding, such as alternators and generators. High resistance limits the fault current to a very low magnitude, which may go undetected by standard Earth Fault protection. This feature ensures that faults are detected before they cause a short circuit in another phase.

Fault Locator
The Fault Locator function uses proprietary impedance logic to calculate the distance to a fault. This is particularly useful for restoring long distribution lines, especially in distributed generating stations with long feeder lines. The advantage of distance protection is its independence from source impedance variations.

Under/Over Voltage Protection
Over-voltage or voltage surges are common causes of protection failures. This function protects against these issues by working within a defend threshold above and below the specified voltage, with the nominal phase-to-ground system operating voltage set by the user.

Negative Phase Sequence Overcurrent and Over-voltage
Negative, positive, and zero-phase sequence currents and voltages can be monitored and logged. Negative-phase sequence current protection is used to detect low-level phase-to-phase faults in high-level, three-phase loads. Protection can be set to inverse time, definite time, or instantaneous operation.

Broken Conductor/Phase Unbalance
The ACR detects unbalanced conditions in the three-phase currents, typically caused by a broken line conductor, poor grounding, or floating conditions.

Under-Current Protection
Each element has settings for pickup level and Definite Time Lag (DTL) delays. This protection activates if the current falls below the setting for the specified delay duration.

Thermal Overload Protection
The thermal algorithm calculates thermal states based on measured currents, applicable to lines, cables, and transformers. It provides outputs for both thermal overload and thermal capacity.

Neutral Overvoltage
This function detects if the neutral voltage exceeds the set threshold for the duration of the delay. It is useful for identifying earth faults in high-impedance earthed or isolated systems.

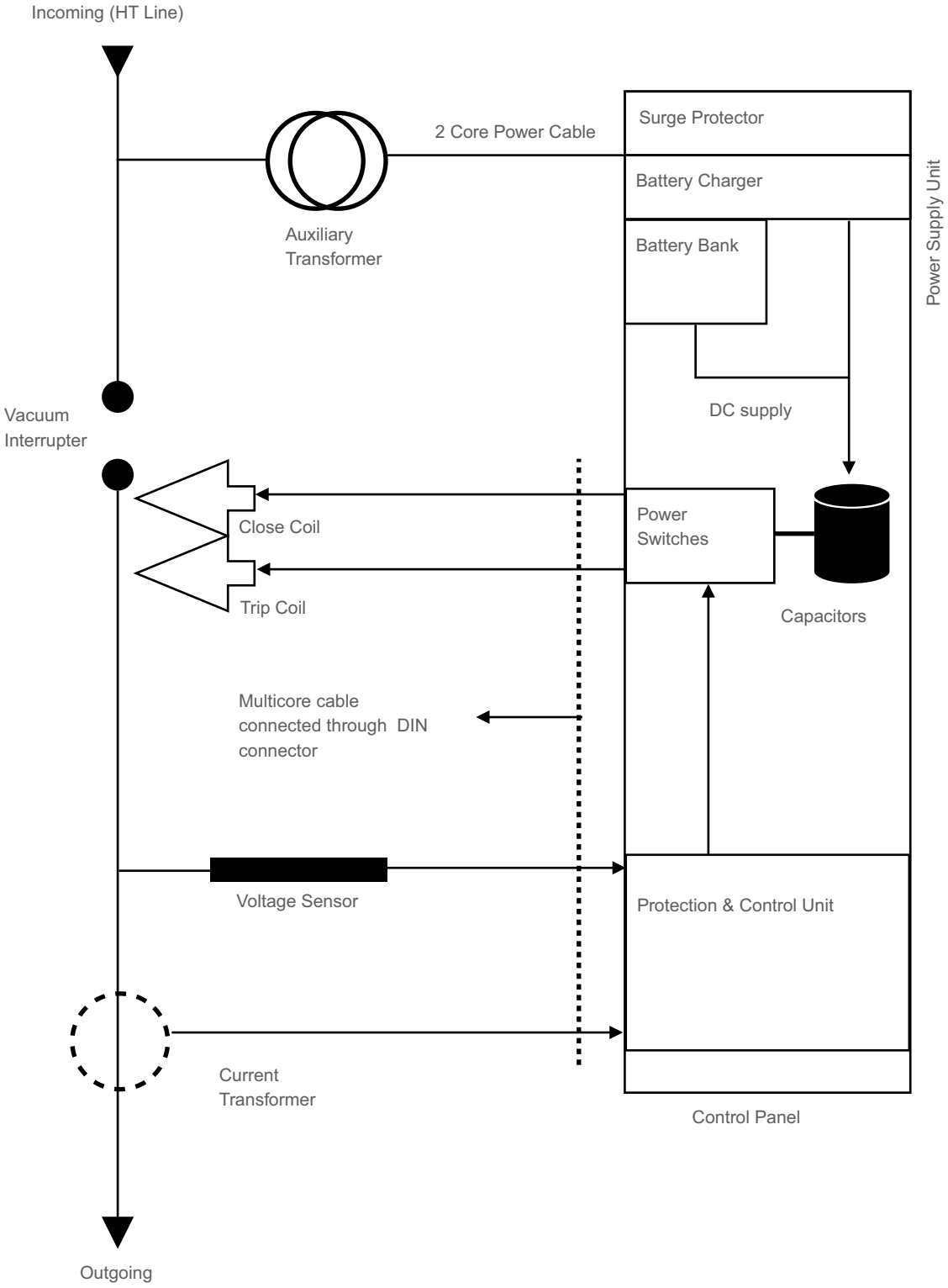
Under/Over Frequency Protection
This function causes the ACR to trip if the system frequency exceeds the specified under or over-frequency trip threshold values.

Auto Reclose
The SDV provides independent phase-fault and earth fault/sensitive earth fault sequences, with up to 5 trips, meaning 4 reclose attempts before lockout. The auto-reclose sequence can be initiated by internal protection operations or through a binary input from external protection. Each trip in the sequence can be set as either instantaneous (fast) or delayed. The user can also configure the reclose (dead) time and reclaim time for each trip.

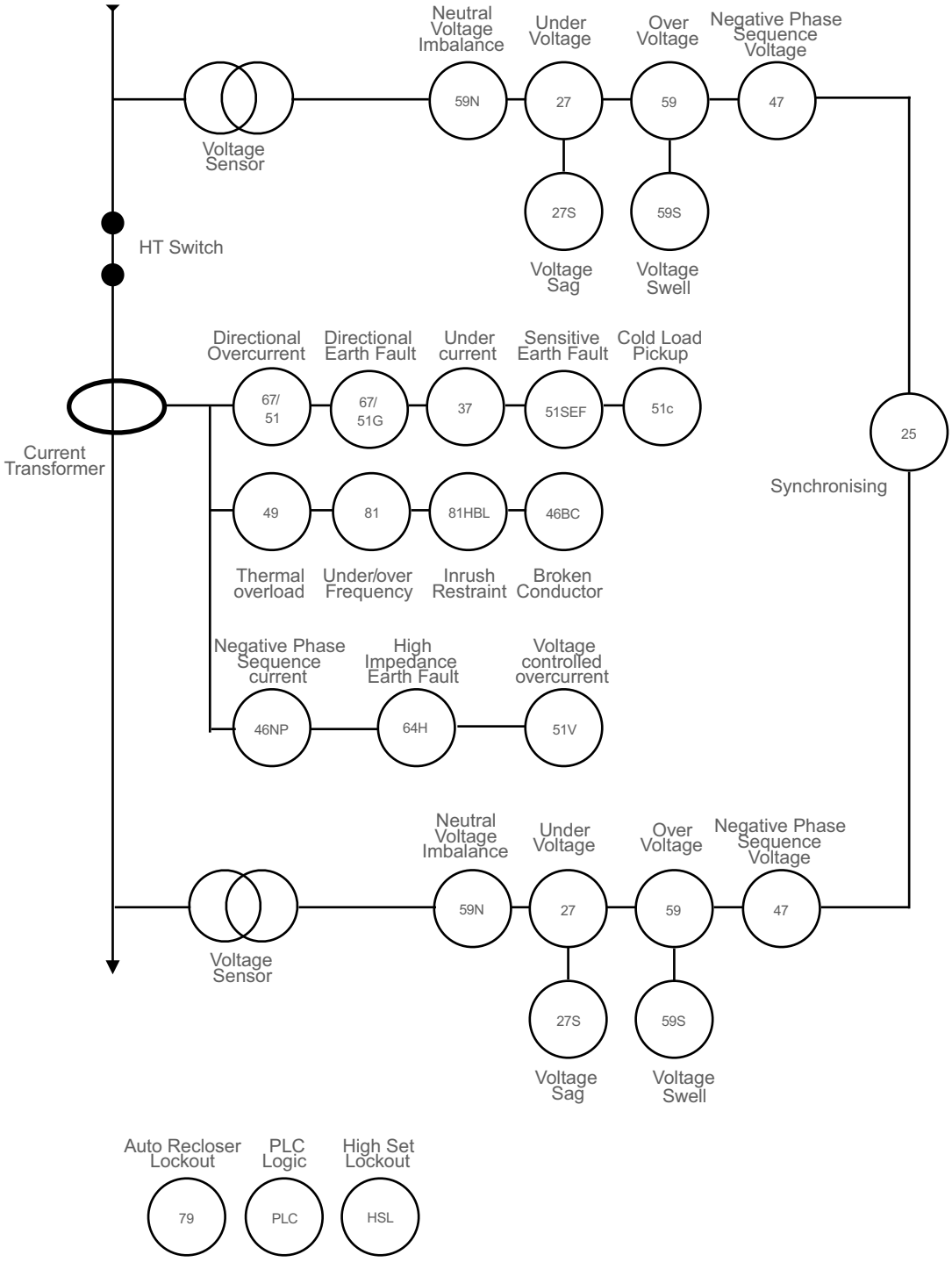
COMMUNICATION

- Universal Serial Bus Port can be used to connect to a Laptop/PC
- Rear End RS-485 Port
- Ethernet Port
- Communication Protocols: IEC 60870-5-103,104, MODBUS and IEC 61850

FUNCTIONAL DIAGRAM OF STANDARD SDV



ANSI PROTECTION DIAGRAM



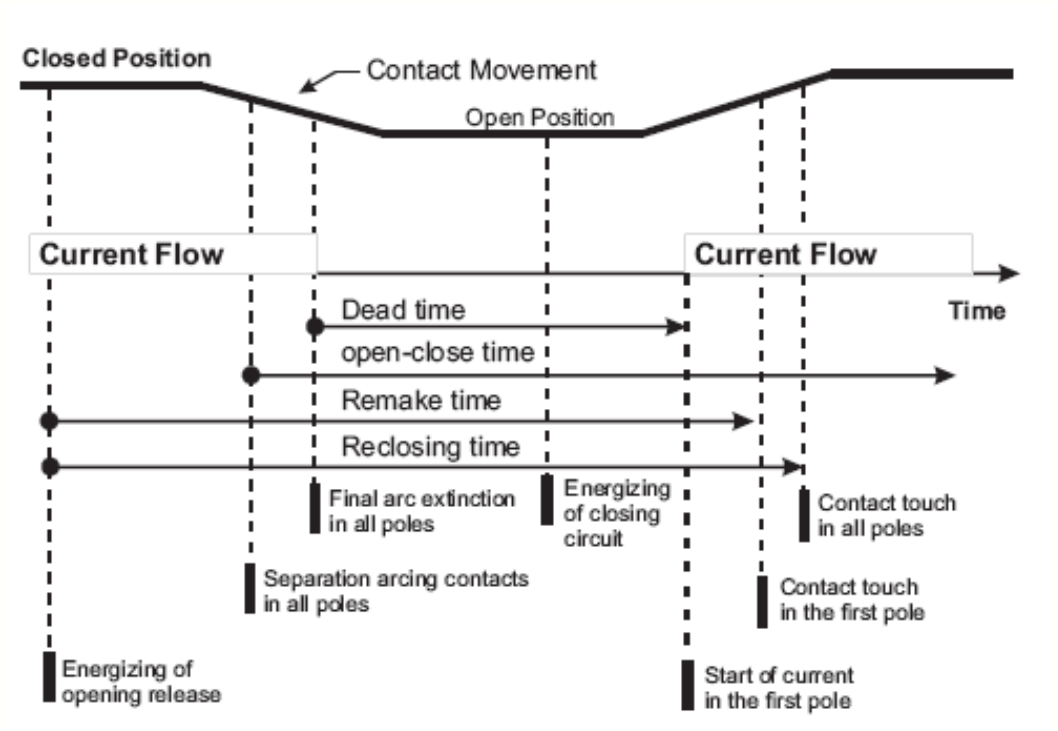
PRINCIPLE OF OPERATION - AUTO RECLOSER

It is well understood that 80-90% of faults on overhead lines are transient in nature. These temporary faults can cause significant delays in restoration if addressed manually. The primary objective of an Auto Recloser is to reduce outage times on distribution lines by quickly restoring power. This is achieved by automatically closing the line after a pre-determined delay. Typically, transient faults are cleared within the first or second dead time. However, if the fault is permanent, the recloser will enter a lockout state after the final closure attempt. Once in lockout, the breaker remains open until it is manually reset by an operator.

The Auto Recloser duty cycle is defined as O-DT1-CO-DT2-CO-DT3-CO-DT4-CO, which represents the sequence of events that occur before the device enters lockout mode at the end of the cycle.

- **O** - Open/Trip operation
- **C** - Close operation
- **DT1...4** - Dead time 1...4

A diagram illustrating the line restoration process and associated steps in power line operation using the Auto Recloser principle is shown below.



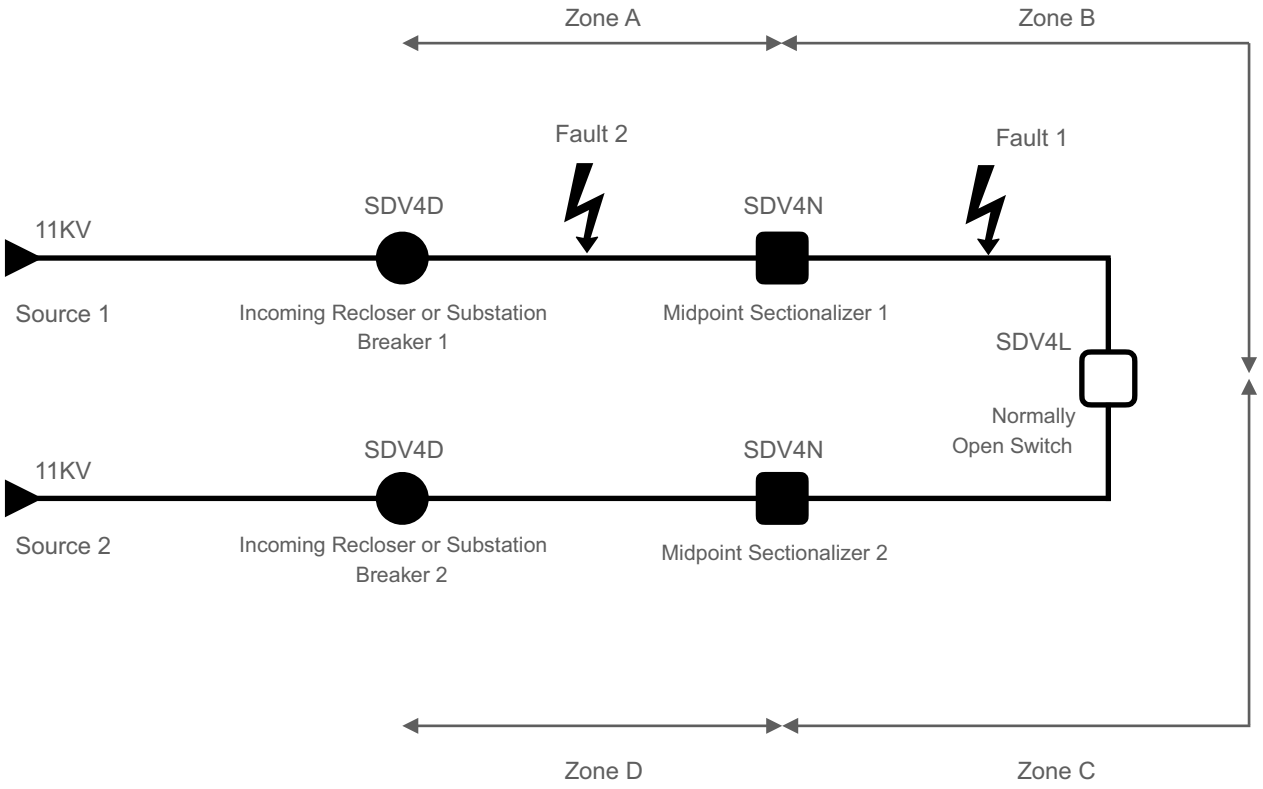
Reclosers also play a critical role in self-healing grids, a key component of modern smart grids. Additionally, features such as cybersecurity, real-time monitoring and control, interoperability, and demand response management can be achieved with the SDV Auto-Recloser.

PRINCIPLE OF OPERATION - SECTIONALIZER

A Sectionalizer is a load break switch installed downstream of a recloser or breaker on a feeder. Unlike traditional protection coordination, it operates based on a counting principle.

When a fault occurs, the counter logic is activated. It tracks the number of reclosing attempts made by the upstream device, recording each count in its memory. After a specified number of attempts (set as part of the Sectionalizer settings), the Sectionalizer opens to isolate the faulted section of the line, provided the backup device is also in the open condition. The main objective of the Sectionalizer is to isolate the faulty section.

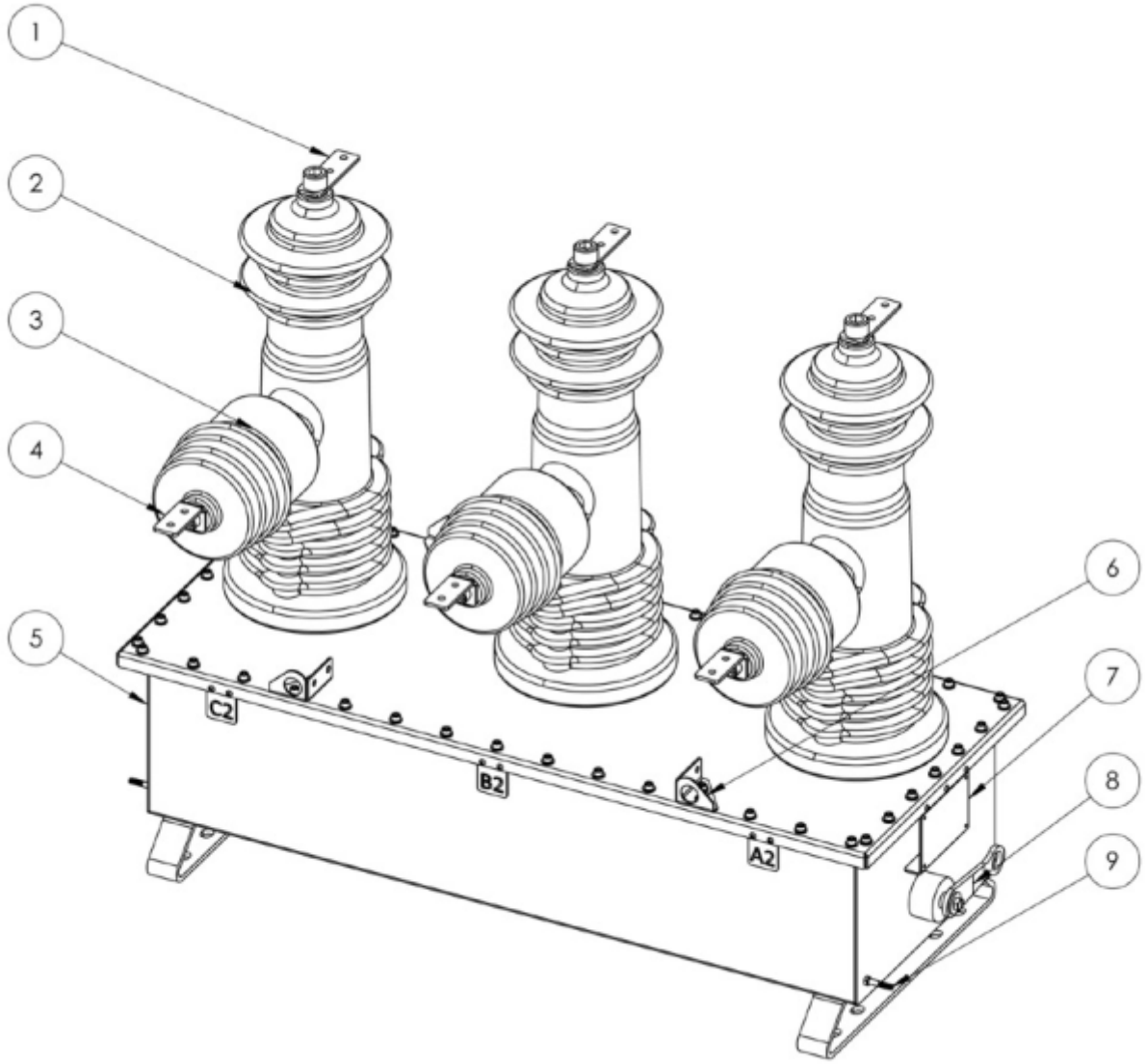
ESPL Sectionalizers are programmed to sense current and voltage to detect a fault. The upstream protective device's operation (i.e., its opening) is identified by the zero current flow through it, triggering the Sectionalizer to open. After the Sectionalizer opens, the backup device automatically recloses to restore service to the portion of the line up to the Sectionalizer's location.



A practical application of the Sectionalizer is illustrated in the diagram above. Two feeders (Feeder 1 and Feeder 2) are connected through a Sectionalizer, which is typically in the open condition, with voltage sensing on both the incoming and outgoing sides. Reclosers handle fault interruption, while the Sectionalizer is positioned at a midpoint for fault isolation. Two case scenarios are described below for clarity:

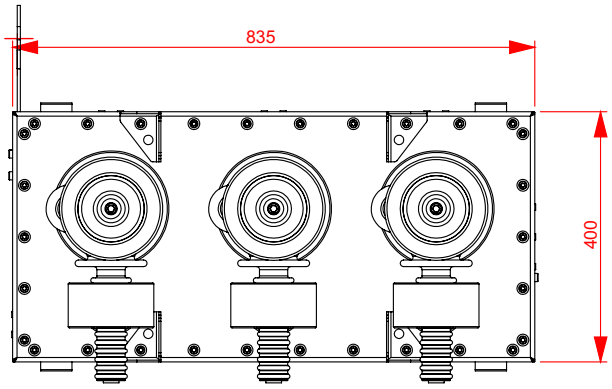
1. Permanent Fault 1 in Zone B: The Sectionalizer 1 will open after the preset number of retries from Recloser 1. As a result, Zone B will be isolated automatically, while Zones A, C, and D will continue receiving power.
2. Permanent Fault 2 in Zone A: In this case, only Recloser 1 will open and lock out after completing its duty cycle. When this happens, Sectionalizer 3 will sense the voltage outage on one of its sides and automatically close, restoring power to Zone B. Ultimately, Zone A will be isolated automatically, while Zones B, C, and D will remain powered.

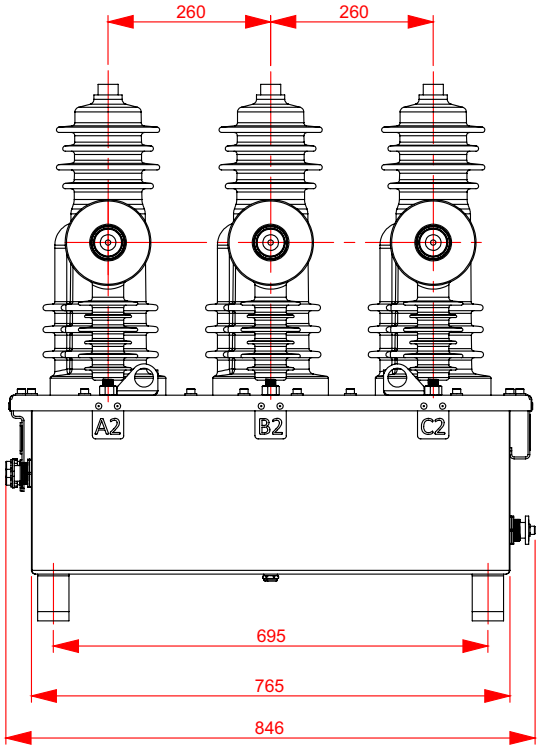
AUTO-RECLOSER & SECTIONALIZER ARRANGEMENT

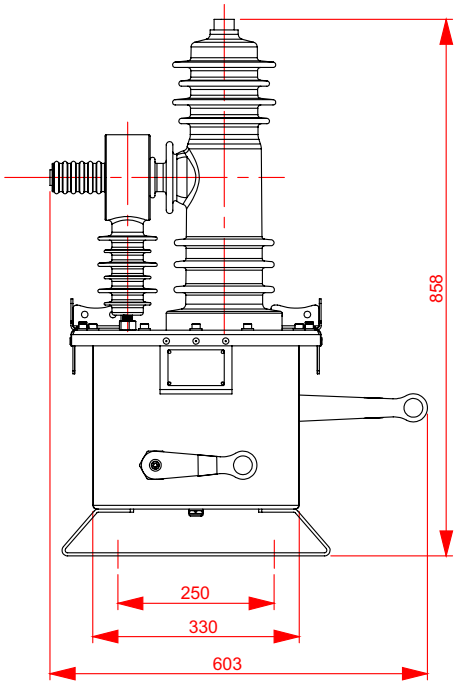


S. No.	Description	Qty.
1	Incoming Terminal Clamp	3
2	Embedded Pole Assy.	3
3	Current Transformer Housing	3
4	Outgoing Terminal Clamp	3
5	Base Tank	1
6	Lifting Hook	4
7	Name Plate	1
8	Trip Lever	1
9	Earthing Terminal	2

DIMENSIONS 11 KV AUTO-RECLOSER & SECTIONALIZER

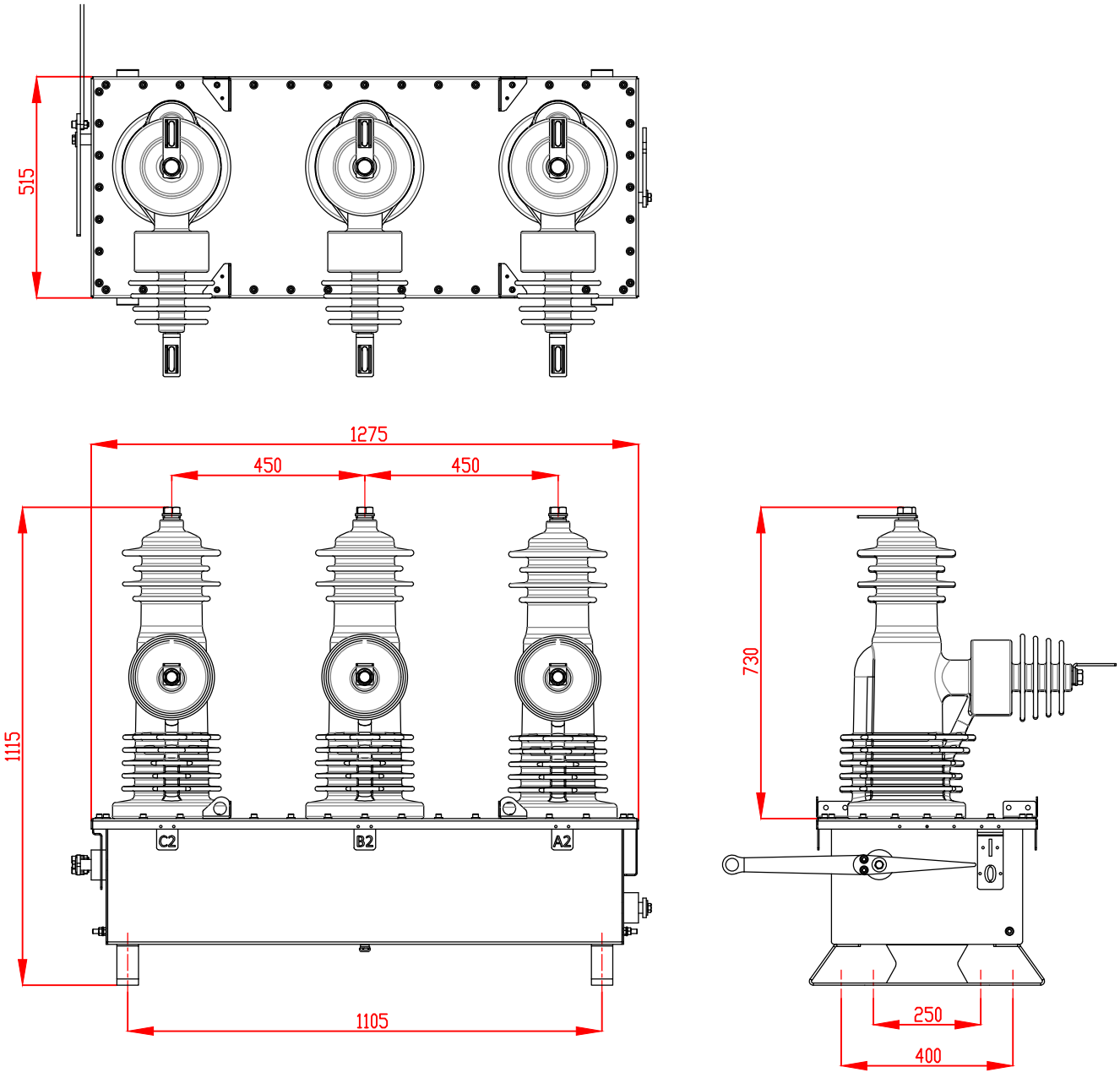






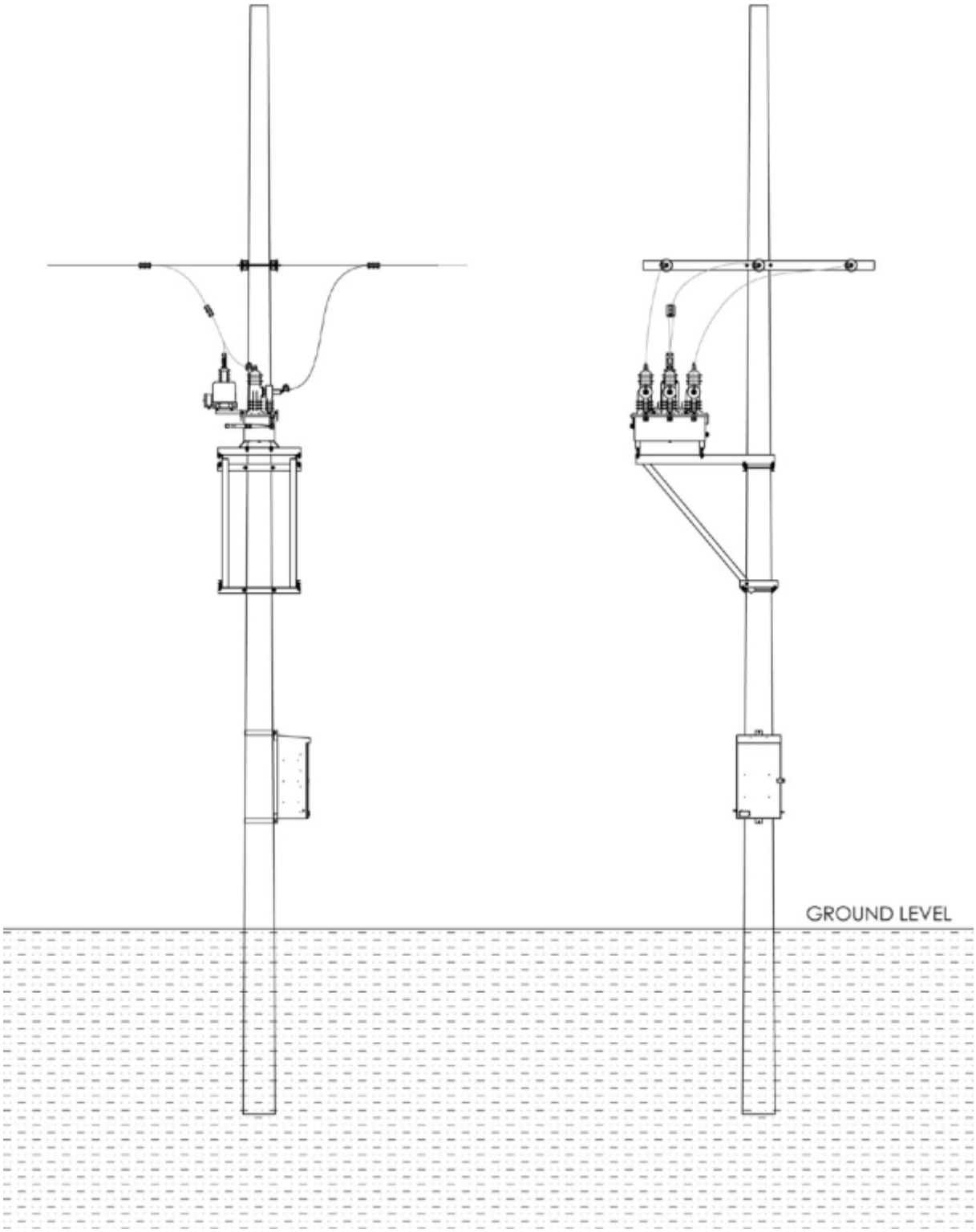
All dimensions are in mm

DIMENSIONS 33 KV AUTO-RECLOSER & SECTIONALIZER

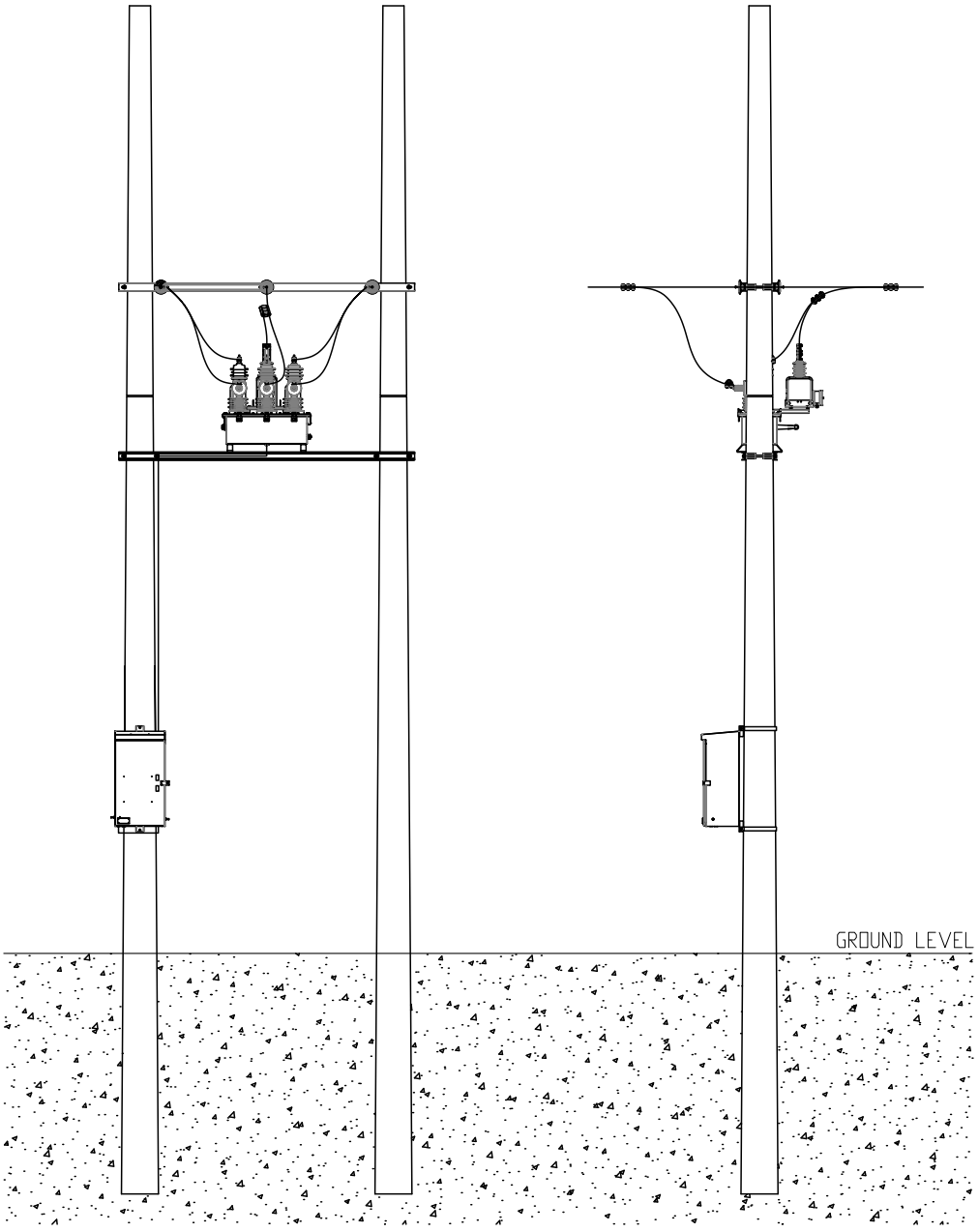


All dimensions are in mm

INSTALLATION - SINGLE POLE



INSTALLATION - DOUBLE POLE



STANDARD TECHNICAL SPECIFICATIONS

Specification	SDV12	SDV27	SDV36
Rated Maximum Voltage	12KV	27kV	36kV
Power frequency withstand (Dry & Wet) for 60s	32kV rms	60kv rms	70kv rms [1]
Lightning Impulse withstand	85kVp	150kVp	170kVp[1]
Rated continuous current	800A	800A	800A
Short Circuit withstand (3s)	12.5kA	16.0kA	16.0kA
Fault breaking capacity	12.5kA	16.0kA	16.0kA
Fault making capacity	31.25 kA	40.0 kA	40.0 kA
Mechanical Endurance	10,000 [1]	10,000 [1]	10,000 [1]
Rated full load operations	10,000	10,000	10,000
Creepage Distance	>31.5mm/kV	>31.5mm/kV	>31.5mm/kV
Interrupting Medium	Vacuum	Vacuum	Vacuum
Insulation Medium	Solid Dielectric	Solid Dielectric	Solid Dielectric
Rated frequency	50 Hz	50 Hz	50 Hz
Ambient temperature	-10°c to +55 °c[1]	-10°c to +55 °c[1]	-10°c to +55 °c[1]
Humidity	0 to 100%	0 to 100%	0 to 100%
Altitude	2200 meter	2200 meter	2200 meter
Weight (Circuit Breaker)	120 KG	230 KG	230 KG
Line charging current	2	5	5
Cable Charging current	10	40	40

1. Higher rating available on request
2. For altitude correction above 1000 meter, IEC 62271-111 shall be applied

ORDERING INFORMATION

Description	Rating	Digit No						
		1	2	3	4	5	6	7
Solid Dielectric Insulated		S	D	V				
Rated Voltage	12kV				12			
	36kV				36			
Protection Type	Non-Directional Protection					N		
	Directional protection					D		
	Loop Automation					L		
Communication	IEC 103, MODBUS, DNP 3.0						S	
	Above + IEC 101/104						R	
	Above + IEC 61850						T	
Mounting Bracket	None							0
	Standard							1
	Custom							2

OPTIONAL ACCESSORIES

Auxiliary Supply Transformer
A pole-mounted transformer can be provided when the ACR is installed in remote or isolated locations, ensuring it has a reliable power supply.

4G Modem

This modem is ideal for areas with poor internet connectivity. It enables remote control of the ACR, allowing the user to manage it from a distance.

Line Isolator

A visual isolation feature is provided on the outgoing side of the ACR to enhance safety during maintenance or fault isolation.

Surge Arrestors

Surge arrestors can be installed on either the incoming or outgoing side of the ACR to protect against voltage spikes and surges.

Incoming Voltage Sensors

The ACR can monitor voltage on both the incoming and outgoing sides. This feature is particularly useful in tie-point conditions where two different voltage sources are involved.

FRTU

Used as a programmable controller for telecontrol and automation applications, the FRTU allows for efficient remote management and control