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SEL
MADE IN ITALY

"Experience and Innovations at Your Service"
Totally Designed, Developed and Manufactured in Italy



TPR AIR

up to 24kV - 21kA 1s - 630A
Medium Voltage Switchgear

Air Insulated Switchgear

General Description



General Description

In response to the latest requests from the European Community and as part of its ongoing innovation to provide effective solutions for environmental preservation, reduce gas emissions, and support the decarbonization process, SEL has developed a new three-position switch disconnector that is SF6-free, utilizing its own expertise and know-how.



New ECO-Friendly device

It is a new eco-friendly device that uses clean air as an insulating medium, free of SF6 gas. It has been designed to extinguish electric arcs using a vacuum interrupter. Through coordination with the movement of the three-position switch, it provides a solution for breaking/ opening, closing and earthing electric circuits in medium voltage networks. This new solution reduces greenhouse gas emissions and does not produce any toxic decomposition products during its operating process.

Patented System

A patented system leads all operations, coordinating the vacuum interrupter and switch disconnector.



Applications

Thanks to this new device a new series of SF6 free Switchgears will be produced and called TPR Air.





TPR AIR FEATURES



FLEXIBILITY

- A wide range of products covering your present and future requirements.
- Modular cubicles adapted to future extensions.
- Possibility to mount auxiliary components under voltage.
- Options to anticipate the telecontrol.



COMPACT DIMENSIONS

- Small dimensions and reduced weights for easier handling and installation.
- Reduced civil works costs.



REDUCED MAINTENANCE

- TPR Air has long service life.
- Maintenance free live parts which are integrated in vacuum or in a sealed tank of stainless steal.
- Control mechanisms are intended to function with reduced maintenance under normal operating conditions.
- High level of electrical endurance when breaking.



EASY OPERATIONS

- Simple operations.
- All the control operations are carried out from the front by means of a simple devices.



EASY INSTALLATION

- Small dimensions and reduced weights facilitate easy installation.
- Solutions adapted to cable connection.



SAFETY

- During the testing cable operation it is not needed to break the earthing busbar system of the switchgear.
- Interlock operated by earthing switch prevents unsafe operations.
- Additional interlocks to prevent incorrect operations.
- All active parts of the TPR Air are contained in a sealed tank of stainless steel making it deal for installation in difficult ambient conditions.



ENVIROMENTAL FRIENDLY

- TPR Air is an eco-friendly medium voltage switchgear designed with sustainability.
- TPR Air is free from environmentally harmful gases, ensuring a cleaner and safer operational environment.
- An efficient solution that prioritizes environmental responsibility without compromising performance and safety.



SMART NETWORKING CONNECTION

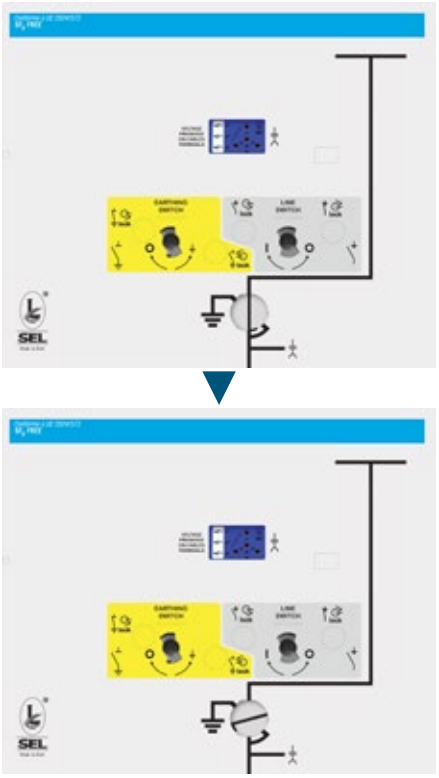
- Proprietary solutions for monitoring and remote control of environmental conditions and full status of the switchgear and installation, including SCADA ready solutions.

DESCRIPTION OF OPERATIONS SEQUENCES

OPENING

(Fig. N.01) The current flows through the main contact (red-colored part) while the vacuum chamber contacts remain closed but do not carry any current. When the main contact moves (red part), it briefly connects with the vacuum chamber contacts (blue part) without interrupting the current flow. During this transition, the current flows through both the main circuit and the vacuum chamber. (Fig. N.02)

The main circuit is then disconnected, and all current flows through the vacuum chamber contacts (Fig. N.03). The patented mechanical system initiates the opening of the vacuum chamber contacts, and the circuit reaches the open state (Fig. N.04). Once the open position is achieved, the vacuum interrupter contacts remain in the open position (Fig. N.05).



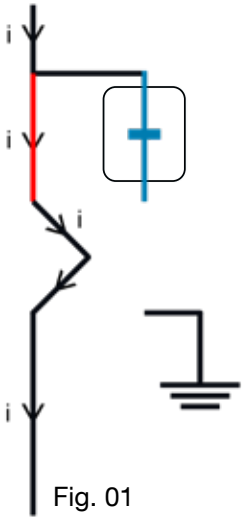


Fig. 01

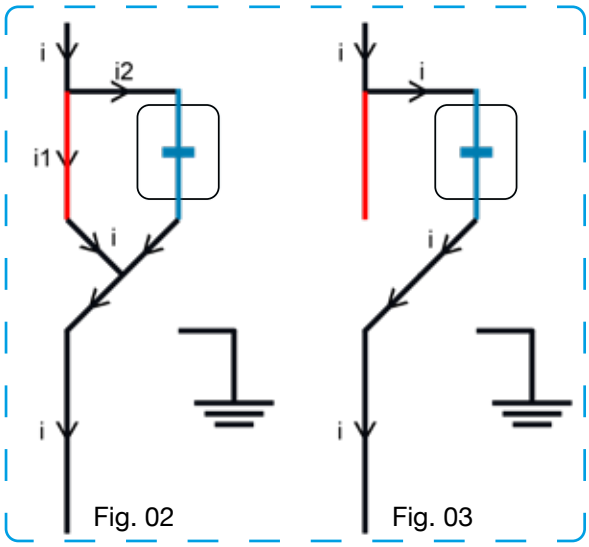


Fig. 02

Fig. 03

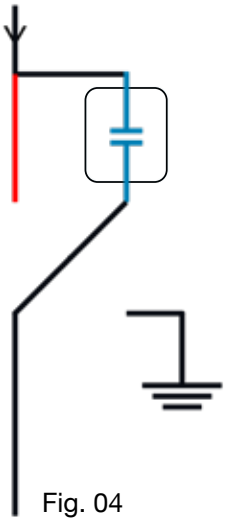


Fig. 04

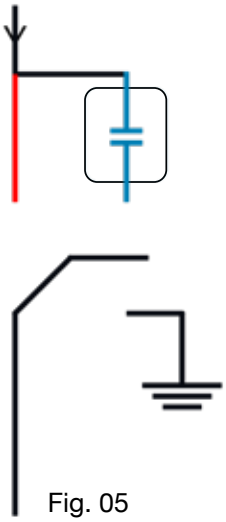
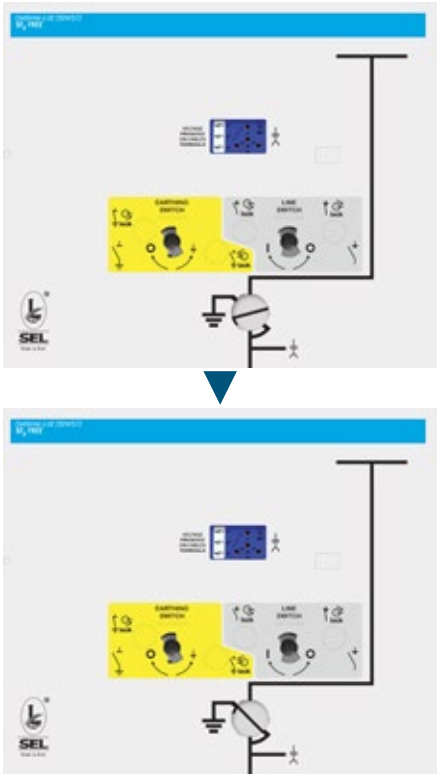


Fig. 05

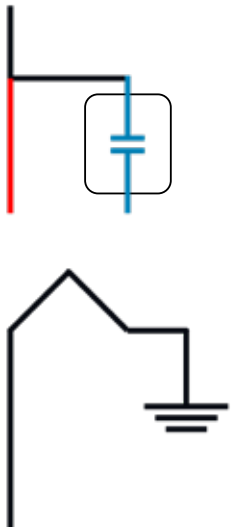
Fig. 06

DESCRIPTION OF OPERATIONS SEQUENCES

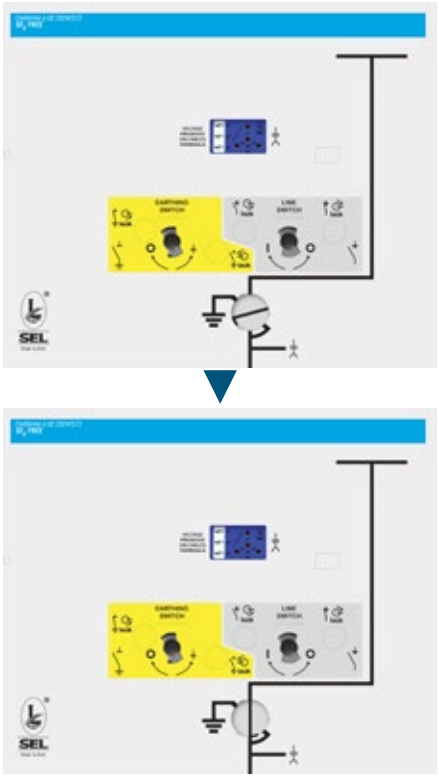
EARTHING



At this stage, it is possible to earth the switch and the linked circuit by operating the mechanism (see Fig. N.06).



CLOSING



By operating the mechanism, the switch moves from the earthing to the open position, allowing the following closing operation.

During the closing operation, the vacuum interrupter does not play any role and returns to a closed-contact status without being involved in current transmission or circuit closure. At this point, the current flows through the main contacts, and the circuit is fully energized. The vacuum interrupter contacts are fully closed and ready for opening operations. (Fig. N.07)

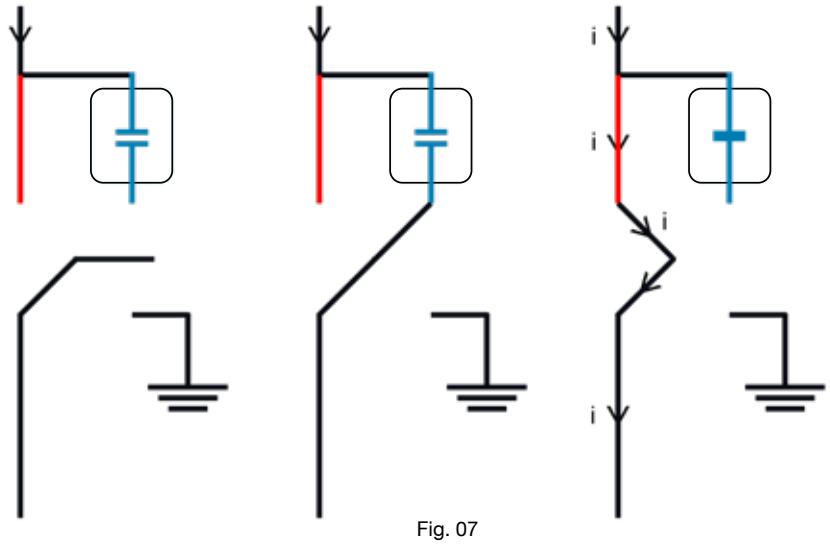


Fig. 07

Circuit Breaker



Vacuum Circuit Breaker

Our circuit breaker introduces the new concept of super-compact Disconnector + Vacuum CB combined device. It comprises of three vacuum interrupters, which have a fault-make, fault-break rating.
Earthing of the outgoing cable is achieved by the use of the circuit breaker in series with the off-load earth disconnector.



Rated current of the RMU is guaranteed with no derating up to 55°C ambient temperature.



The protection against severe weather conditions, rain, humidity and dust is guaranteed by TPR AIR robust design. The protection degree of the switchgear is IP54.

The enclosure is fitted with a front door and padlock. The gas piston facilitates the opening operation and maintains the door lifted in order to allow the normal operations or maintenance.



STANDARDS

IEC Standards
TPR AIR is manufactured and tested in conformity with the latest issues of the following IEC standards.

IEC 62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear
IEC 62271-200	High-voltage switchgear and controlgear - Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
IEC 62271-100	High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers
IEC 62271-103	High-voltage switchgear and controlgear - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV
IEC 62271-102	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches
IEC 62271-213	High-voltage switchgear and controlgear - Part 206: Voltage presence indicating systems for rated voltages above 1 kV and up to and including 52 kV
IEC 62271-304	High-voltage switchgear and controlgear - Part 304: Design classes for indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and includuing 52 kV to be used in severe climatic conditions
IEC 62271-307	High-voltage switchgear and controlgear - Part 307: Guidance for the extension of validity of type tests of AC metal and solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60060-1	High-voltage test techniques - Part 1: General definitions and test requirements
IEC 60255	Measuring relays and protection equipment
IEC 61869-2	Instrument transformers - Part 2: Additional requirements for current transformers
IEC 61869-3	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
IEC 61869-10	Instrument transformers - Part 10: Additional requirements for low-power passive current transformers
IEC 61869-11	Instrument transformers - Part 11: Additional requirements for low power passive voltage transformers
IEC 60044-8	Instrument transformers - Part 8: Electronic current transformers
EN 50181	Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2,50 kA for equipment other than liquid filled transformer
CEI 0-16	Reference technical rules for the connection of active and passive consumers to the HV and MV electrical networks of distribution Company

Technical Data

Three Position Switch Disconnector					
Rated Voltage		kV	**12**	**17,5**	**24**
General Switch function	Rated mainly active load breaking current Iload	A	630		
	Rated short-circuit making current Ima	up to kA	52.5		
	Electrical endurance	Class	E3		
	Number of electrical operating cycles with Iload	n	100		
	Number of short-circuit making operations with Ima	n	5		
	Capacitive switching	Class	C2		
	Mechanical endurance / number of operating cycles	Class / n	M1 / 1000		
Disconnector function	Mechanical endurance / number of operating cycles	Class / n	M0 / 1000		
Make-proof earthing switch function	Rated short-circuit making current Ima	up to kA	52.5		
	Electrical endurance	Class	E2		
	Number of short-circuit making operations with Ima	n	5		
	Mechanical endurance / number of operating cycles	Class / n	M0 / 1000		

Vacuum Circuit-Breaker with Three Position Switch Disconnector "C unit"					
Rated Voltage		kV	**12**	**17,5**	**24**
Circuit-breaker	Rated mainly active load breaking current Iload	A	630		
	Rated operating sequence		O – 0.3 s – CO – 3 min – CO		
	Rated short-circuit breaking current Isc	up to kA	21		
	Electrical endurance	Class	E2		
	Number of short-circuit breaking operations with Isc	n	50		
	Capacitive switching	Class	C1		
	Switching of cable systems	Class	S1		
	Mechanical endurance / number of operating cycles	Class / n	M2 / 10000		
Disconnector function	Mechanical endurance / number of operating cycles	Class / n	M0 / 1000		
Make-proof earthing switch function	Rated short-circuit making current Ima	up to kA	52.5		
	Electrical endurance	Class	E2		
	Number of short-circuit making operations with Ima	n	5		
	Mechanical endurance / number of operating cycles	Class / n	M0 / 1000		

Vacuum Circuit-Breaker with Three Position Disconnector "T unit"					
Rated Voltage		kV	**12**	**17,5**	**24**
Circuit-breaker	Rated mainly active load breaking current Iload	A	200		
	Rated operating sequence		CO – 15 s – CO		
	Rated short-circuit breaking current Isc	up to kA	21		
	Electrical endurance	Class	E2		
	Number of short-circuit breaking operations with Isc	n	50		
	Capacitive switching	Class	C1		
	Switching of cable systems	Class	S1		
	Mechanical endurance / number of operating cycles	Class / n	M2 / 2000		
Disconnector function	Mechanical endurance / number of operating cycles	Class / n	M0 / 1000		
Make-proof earthing switch function	Rated short-circuit making current Ima	up to kA	52.5		
	Electrical endurance	Class	E2		
	Number of short-circuit making operations with Ima	n	5		
	Mechanical endurance / number of operating cycles	Class / n	M0 / 1000		

TECHNICAL DATA

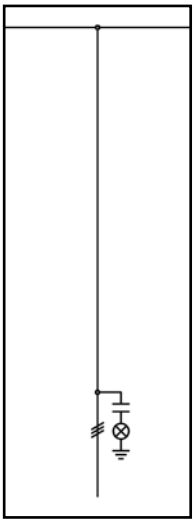
COMMON TECHNICAL DATA				
Rated Voltage	kV	**12**	**17,5**	**24**
Rated short-duration power-frequency withstand voltage Ud	kV	28	38	50
Rated lightning impulse withstand voltage Up	kV	75	95	125
Rated frequency fr	Hz	50		
Rated continuous current Ir – busbar	A	630		
Rated continuous current Ir – feeders	up to A	630		
Rated peak withstand current Ip	up to kA	52.5		
Rated short-time withstand current Ik (up to 3 s)	up to kA	21		
Insulating medium		Dry Air		
GWP (Global Warming Potential)		< 1		
Rated filling level	kPa	210		
Ambient air temperature range Standard	°C	–25 to + 55		
Internal arc classification (option)	up to	IAC A FLR 21 kA 1 s		
Partition class		PM		
Loss of service continuity		LSC 2		
Degree of protection		Primary part IP65		
"Expected service life (under normal service conditions)"		> 40 years		
Classification		IEC 62271-1 / -100 / -102 / -103 / -105 / -200		

UNITS FUNCTIONS

I Air unit



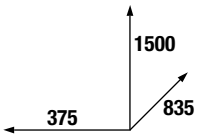
Diagram



Details

Unit Name:
I AIR

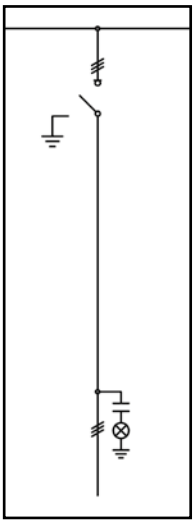
Unit Function:
Cables Connection



L Air unit



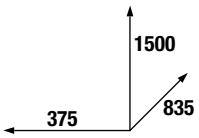
Diagram



Details

Unit Name:
L AIR

Unit Function:
Network Switch Disconnector

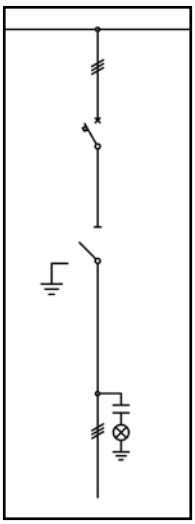


UNITS FUNCTIONS

C Air unit



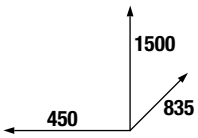
Diagram



Details

Unit Name:
C AIR

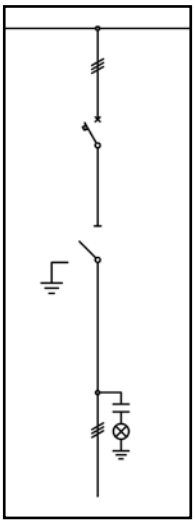
Unit Function:
Circuit Breaker unit with disconnector



T Air unit



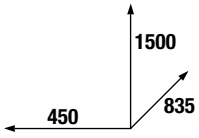
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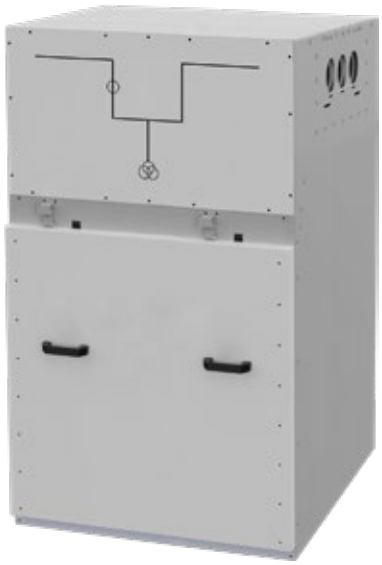
Unit Name:
T AIR

Unit Function:
200A Circuit Breaker unit with disconnector

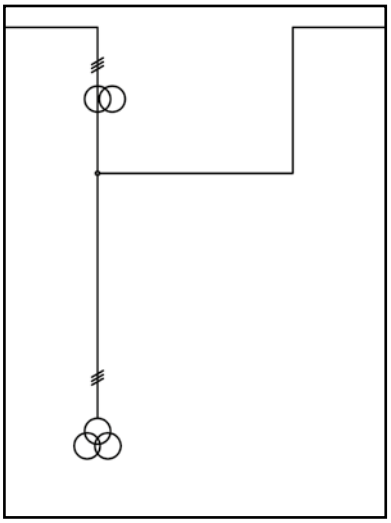


UNITS FUNCTIONS

M Air unit



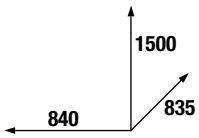
Diagram



Details

Unit Name:
M AIR

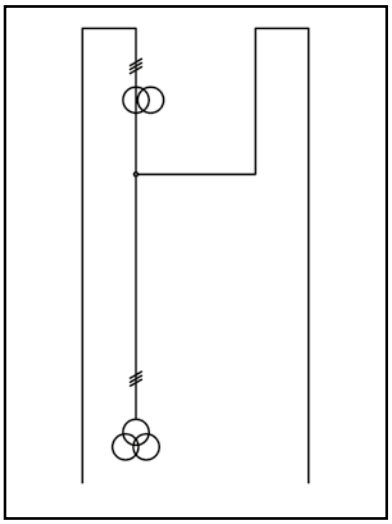
Unit Function:
Metering Unit



M2 Air unit



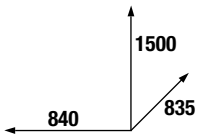
Diagram



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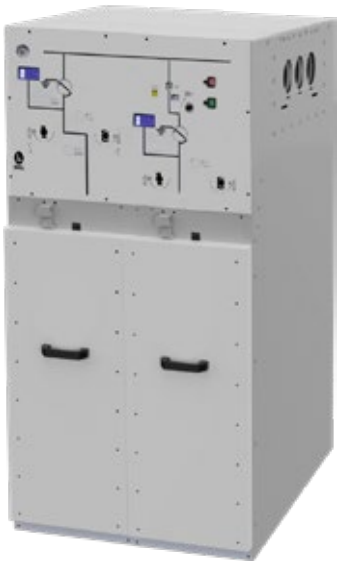
Unit Name:
M2 AIR

Unit Function:
Metering Unit

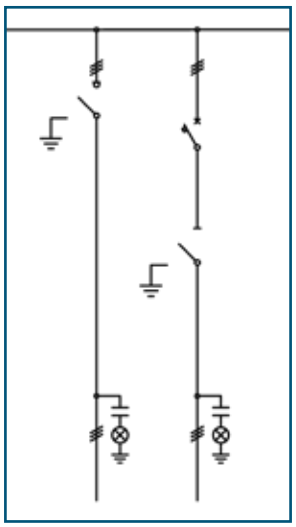


UNITS FUNCTIONS

LC Air unit



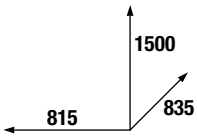
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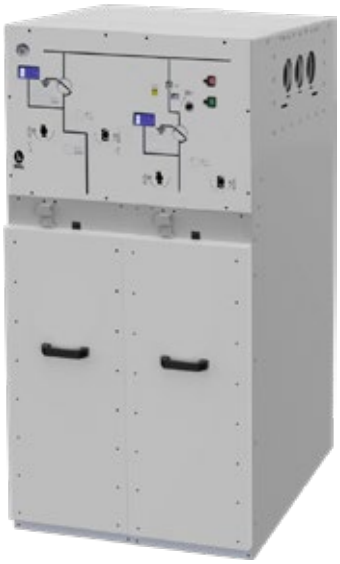
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Unit Name:
LC Air

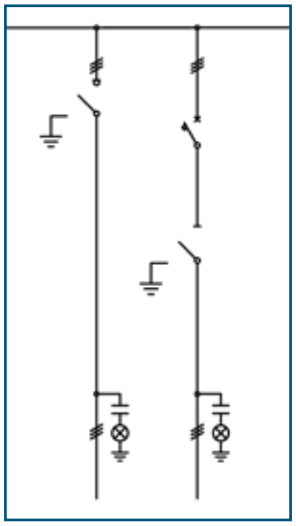
Unit Function:
Switch Disconnector unit +
630A CB with Disconnector unit



LT Air unit



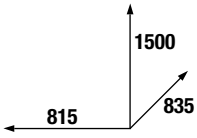
Diagram



Details

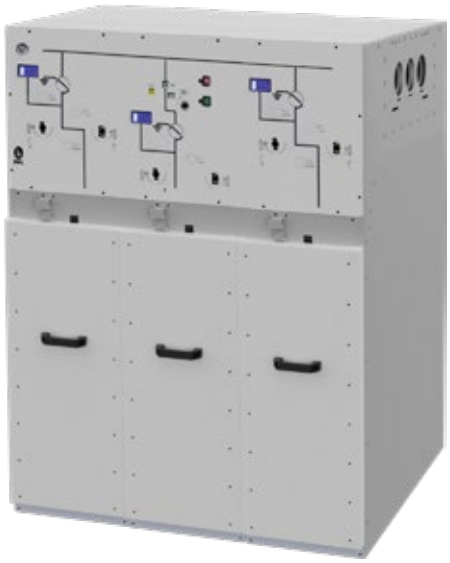
Unit Name:
LT Air

Unit Function:
Switch Disconnector unit +
200A CB with Disconnector unit

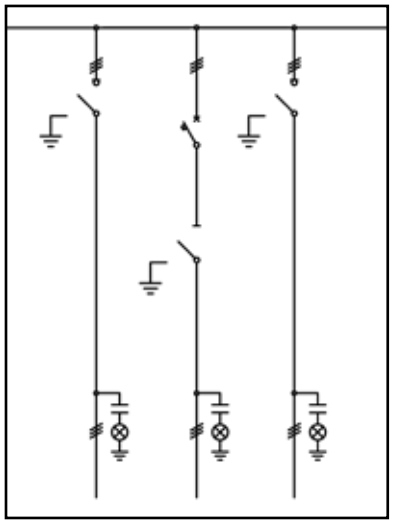


UNITS FUNCTIONS

LCL Air unit



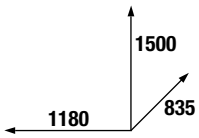
Diagram



Details

Unit Name:
LCL AIR

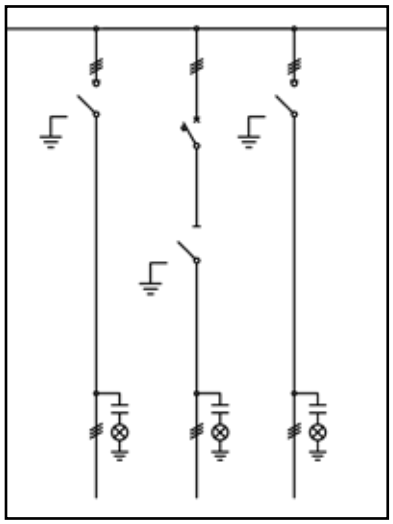
Unit Function:
Switch Disconnector unit +
630A CB with Disconnector unit+
Switch Disconnector unit



LTL Air unit



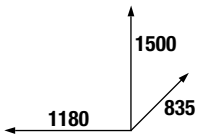
Diagram



Details

Unit Name:
LTL AIR

Unit Function:
Switch Disconnector unit +
200A CB with Disconnector unit+
Switch Disconnector unit

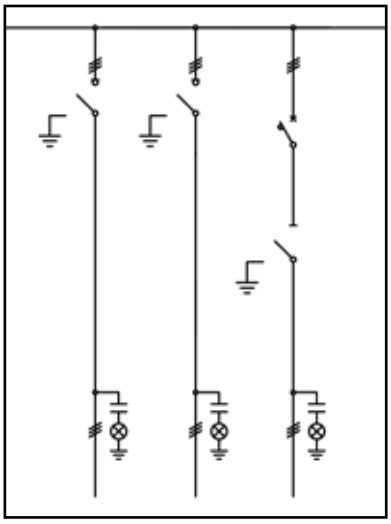


UNITS FUNCTIONS

LLC Air unit



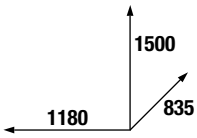
Diagram



Details

Unit Name:
LLC Air

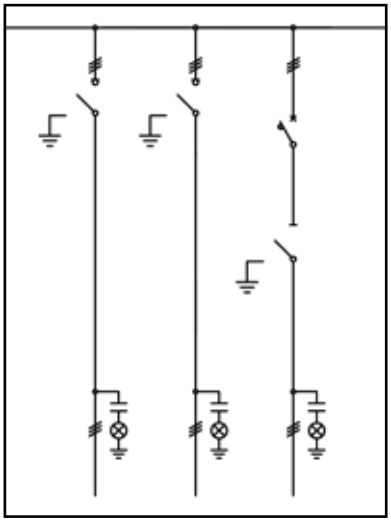
Unit Function:
Switch Disconnector unit +
Switch Disconnector unit +
630A CB with Disconnector unit



LLT Air unit



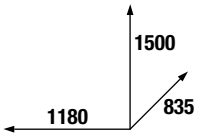
Diagram



Details

Unit Name:
LLT Air

Unit Function:
Switch Disconnector unit +
Switch Disconnector unit +
200A CB with Disconnector unit

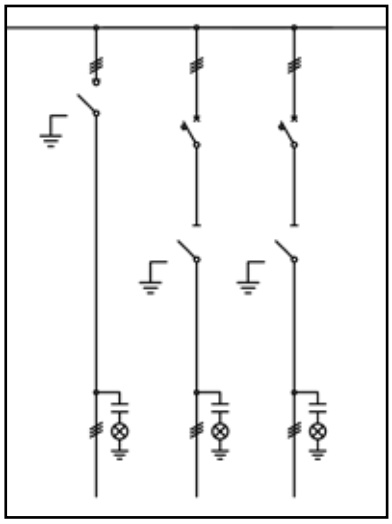


UNITS FUNCTIONS

LCC Air unit



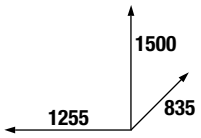
Diagram



Details

Unit Name:
LCC Air

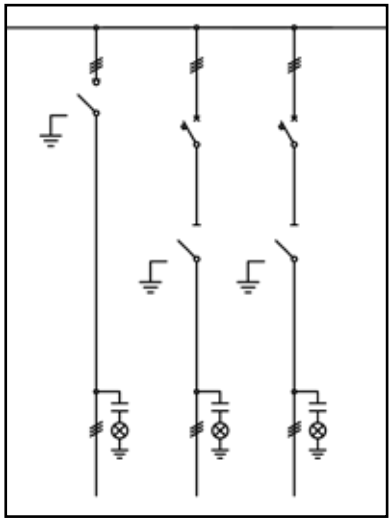
Unit Function:
Switch Disconnector unit +
630A CB with Disconnector unit+
630A CB with Disconnector unit



LTT Air unit



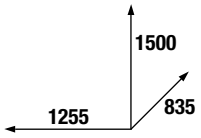
Diagram



Details

Unit Name:
LTT Air

Unit Function:
Switch Disconnector unit +
200A CB with Disconnector unit+
200A CB with Disconnector unit

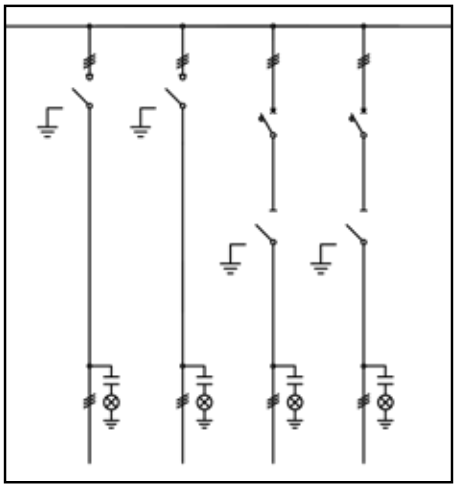


UNITS FUNCTIONS

LLCC Air unit



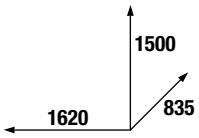
Diagram



Details

Unit Name:
LLCC Air

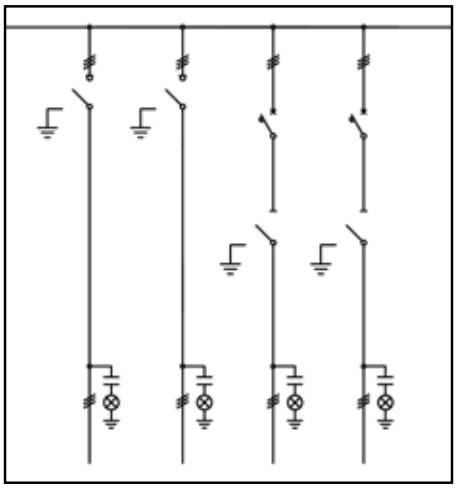
Unit Function:
Switch Disconnector unit +
Switch Disconnector unit +
630A CB with Disconnector unit+
630A CB with Disconnector unit



LLTT Air unit



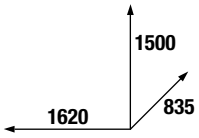
Diagram



Details

Unit Name:
LLTT Air

Unit Function:
Switch Disconnector unit +
Switch Disconnector unit +
200A CB with Disconnector unit+
200A CB with Disconnector unit



INDOOR LATERAL EXTENSIBILITY

EXTENSIBLE VERSION TYPE "+"

Bus-bar coupling system of dry air insulated switchgears (match-makers).



ONE TYPE OF BUSBAR CONNECTION



ONE TYPE OF BUSBAR CONNECTION

Extensible version with only the prearrangement for future extension.

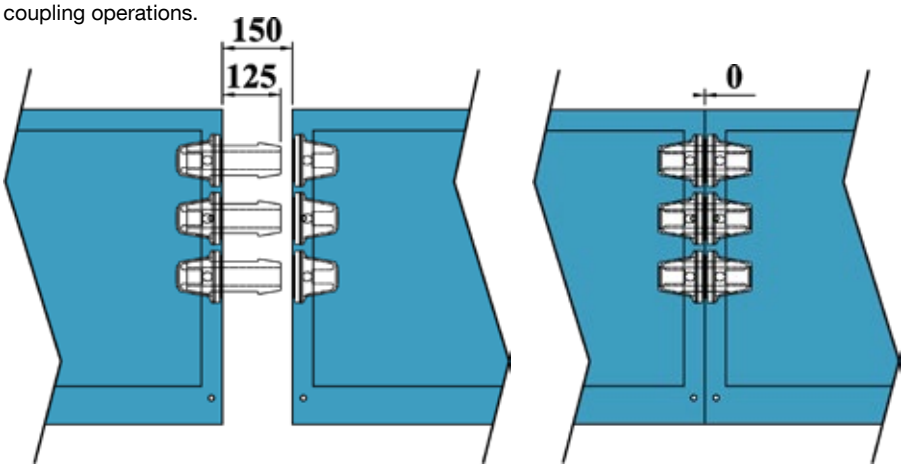






COUPLING SPACE TYPE "+"

In case the switchboard is prearranged for further expansions on the left, on the right or both sides, provide at least 150mm space between the switchboards and a suitable lateral space for coupling operations.



OTHER ACCESSORIES

SWITCH DISCONNECTOR



Shunt opening release (optional)
Shunt closing release (optional)
Only for 3D op. mech.



Auxiliary contacts (optional)
LT max 4 CO Contacts
3D max 5 CO Contacts



Motor gear (optional)

CIRCUIT BREAKER



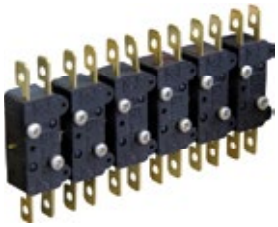
Shunt opening release (standard)



Shunt closing release (optional)



Undervoltage release (optional)



Auxiliary contacts (standard)



Shunt opening release low energy (standard with self powered protection relay)



Spring charging motor (optional)

OTHER ACCESSORIES



Self-regulating heater 50VA 230V (optional)



Voltage indicator (standard)

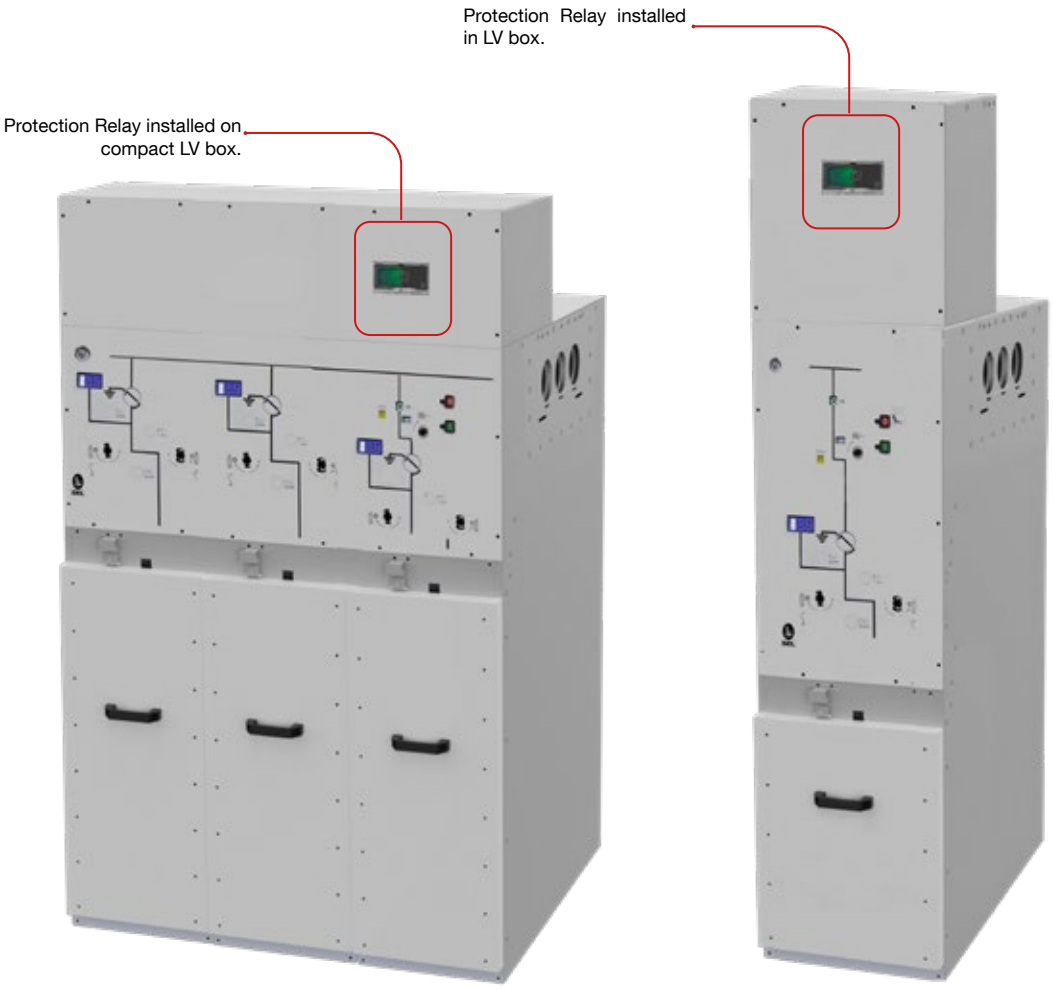


HV sensor (optional)

Protection Relay

Protection Relay

TPR AIR range can be provided with self-powered protection relays with ring core CTs on cables or protection relays with power supply. All the relays used are well-known brands with high level of safety and reliability.
In some cases the protection relay is installed directly on board of the circuit breaker, in other cases when the protection relay dimensions are bigger or when the wiring diagram is more complex, the protection relay is installed in the LV compartment located on the top or in front of the switchgear.
The LV compartment can be installed on the roof or on the front of the unit. The frontal LV compartment can be used in case of very simple and small LV accessories. The LV compartment (height 450mm) is necessary for larger and more complex LV accessories.



MOTORIZATIONS - VOLTAGE INDICATOR - HVSENSOR



LT Motorization Upgrade



TCB Motorization Upgrade

MOTORIZATION

All our operating mechanisms have the possibility to be equipped with motorizations upgrade.

VOLTAGE INDICATOR

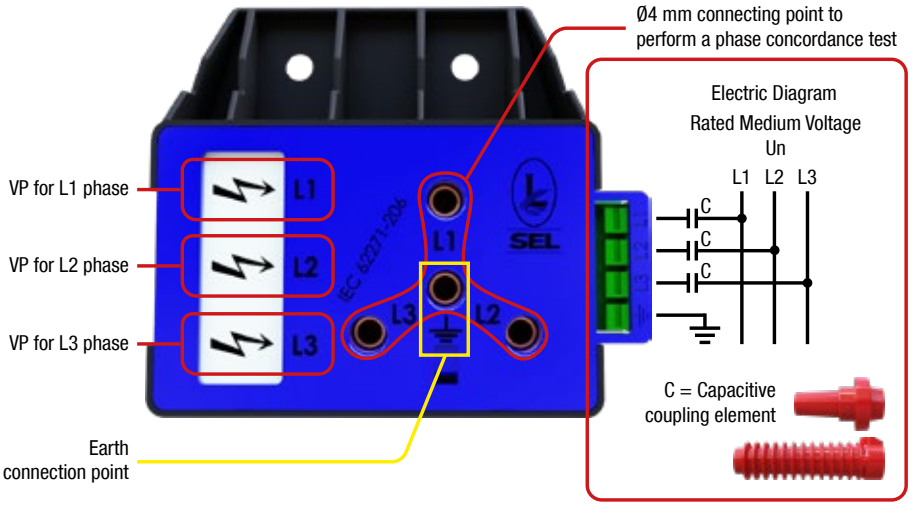


Voltage presence indicating system. Integrated 3-phase test point for phase comparison test.

The Voltage Presence Indicating System (VPIS) SEL
Compliant with the standard IEC 62271-206, allows to display the voltage presence of the three phases by means an LCD, and to do a phase-concordance test between two lines, on all the SEL S.p.A. switchboards indoor and outdoor.

The voltage presence is indicated by the appearance on the display of the symbol

According to the standard IEC 62271-206, the indication will appear for voltages (line-to-earth) greater than 45% of the minimum rated voltage $U_n$min, and will completely disappear for voltages (line-to-earth) less than 10% of the maximum rated voltage $U_n$max. By U_n we mean the line voltage (phase-to-phase) applied to the switchboard.





HVSENSOR VOLTAGE DETECTOR

Voltage detector with relay output. Use in combination with Voltage Indicator.



VOLTAGE DETECTING SYSTEM ACCORDING TO IEC 62271-213

Integrated voltage indicator VOIS+, VOIS R+



PHASE COMPARISON TEST UNIT MAKE

as combined test unit (HR and LRM) for:
– Voltage detection
– Phase comparison
– Interface test
– Integrated self-test
– Indication via LED.

MONITORING CONTROL SYSTEM

Proprietary solutions for monitoring and remote control of environmental conditions and full status of the switchgear and installation, including SCADA ready solutions.



REMOTE TERMINAL UNIT

Versatile and modular solution for automation and monitoring distribution network. Thanks to it's compact dimension is ideal for project where installation space is limited.

Now you can collates up to 2000 signals (together with I/O modules) for direct routing to SCADA systems over IEC60870-5-101, IEC60870-5-104, DNP3 or Modbus protocol and it is possible communicates with the control center through an integrated 2G/3G/4G(LTE) modem. It also has LAN and WiFi interfaces for easier configuration and access.



TEMPERATURE SENSORS

There are several types of wireless temperature sensors and mounting methods correspondingly, i.e. bolted, belt and alloy chip fixing.

- The bolted type wireless sensor is suitable for use at joints, for example between cable and bus bar.
- The strap-secured type called is suitable for use around MV cables.
- The wireless sensor is suitable for electrical nodes or equipment surfaces.
- The mini type called is suitable for using at bus bars, cables and joints between bus bar and cable. It works without any battery, using the CT-powered technology. With current >20A automatically it power on.



LOW POWER VOLTAGE TRANSFORMER / LOW POWER CURRENT TRANSFORMER

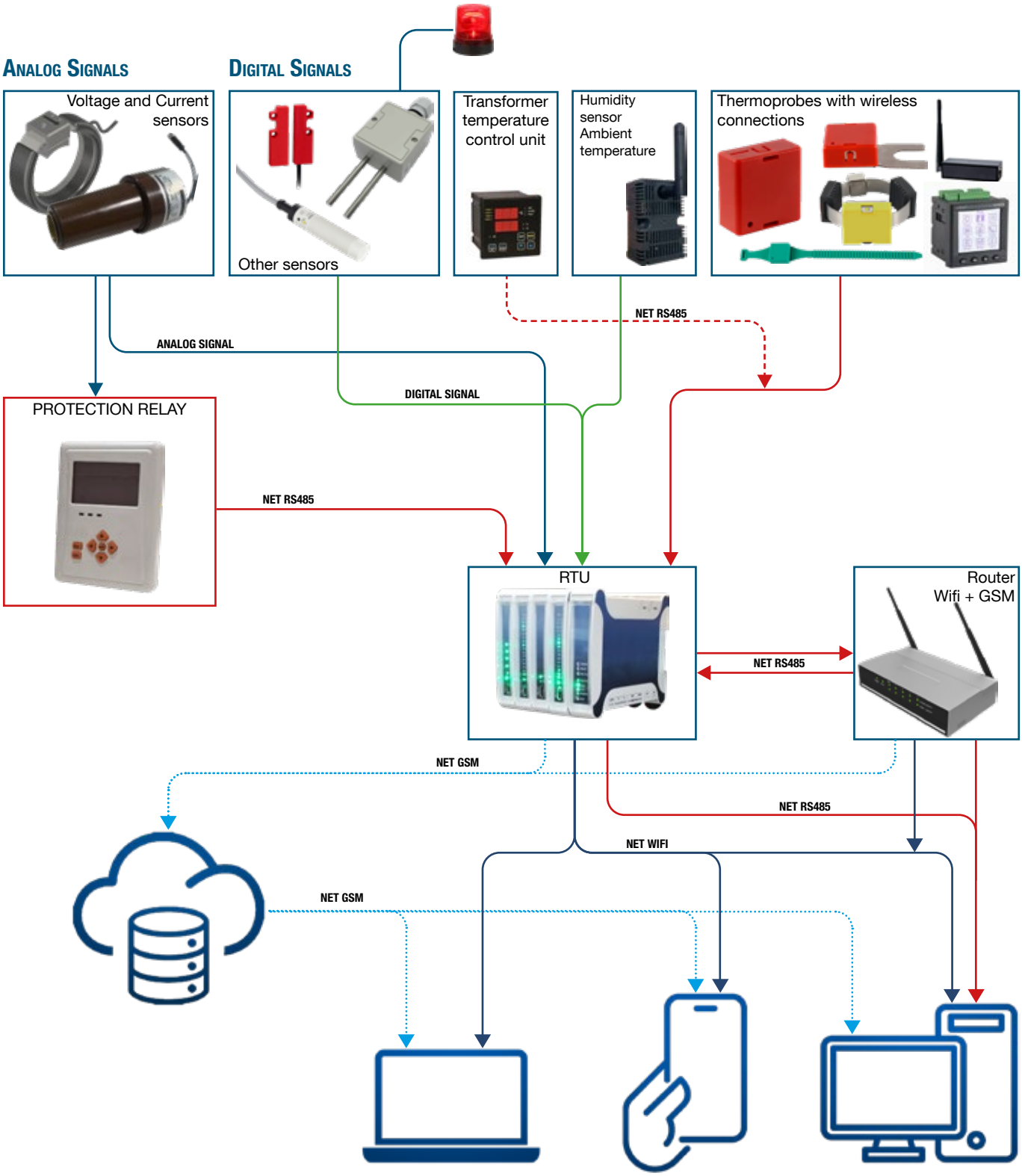
The voltage sensor is installed on the cable outlet at the rear of the T-connector. As a result, the insulating plug is replaced by the voltage sensor. This sensor is suitable for both new equipment and retrofitting, without requiring any modifications to the network station.







MONITORING CONTROL SYSTEM - SENSORS





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E-MAIL: **INFO@SEL-ELECTRIC.COM**

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