



**SEL**  
MADE IN ITALY

*“Experience and Innovation at Your Service”  
Totally Designed, Developed and Manufactured in Italy*



# F-TPS AIR

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

# GENERAL DESCRIPTION



**EUROPEAN  
GREEN  
DEAL**

## GENERAL DESCRIPTION

In response to the latest requirements of the European Community and as part of continuous innovation to provide effective solutions for environmental preservation, gas emission reduction, and support for the decarbonization process, SEL has developed a new series of modules by eliminating SF6 gas and replacing it with dry air.

## APPLICATIONS

The new series of modules will cover the same requirements met to date with SF6-insulated TPS, which will no longer be present in the new modules as it has been replaced with dry air.

## PATENTED SYSTEM

A patented system manages all operations, coordinating the vacuum circuit breaker and the disconnecter.



# F-TPS AIR CHARACTERISTICS



## FLEXIBILITY

- A wide range of products covering present and future needs.
- Modular compartments suitable for future expansions.
- Possible installation of auxiliary components with the system energized.
- Solutions prepared for remote control.



## COMPACT DIMENSIONS

- Small dimensions and reduced weight for easy handling and installation.
- Reduced costs for civil works.



## REDUCED MAINTENANCE

- F-TPS has a long service life.
- No maintenance required for active parts.
- Mechanical parts require reduced maintenance under normal operating conditions.
- High electrical endurance of disconnecting points.



## EASY OPERATIONS

- Simple operation.
- All switching and control operations are performed from the front using simple tools and equipment.



## EASY INSTALLATION

- Small dimensions and reduced weight make installation easy.
- Designed for easy cable connection.



## SAFETY

- Safety interlocks prevent hazardous situations for the operator and incorrect operations.
- All active parts of this series of modules are contained in an epoxy resin enclosure.



## ECO-SUSTAINABLE

- F-TPS is an eco-sustainable medium voltage switchboard.
- F-TPS is free from environmentally harmful gases, ensuring a cleaner and safer operating environment.
- An efficient solution that places environmental responsibility first without compromising performance and safety.



## SMART CONTROL FUNCTIONS

- Proprietary solutions for monitoring and remote control of environmental conditions and complete status of equipment and installation, including SCADA-ready solutions.



## INTERCHANGEABILITY

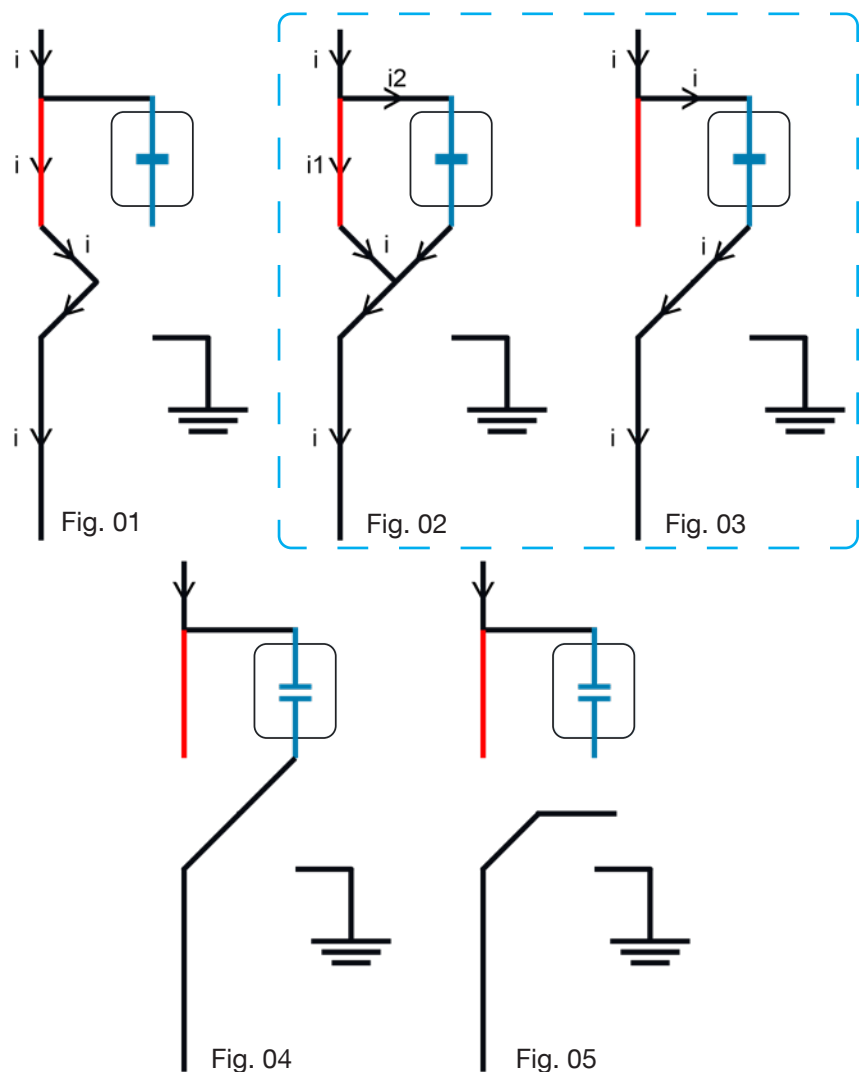
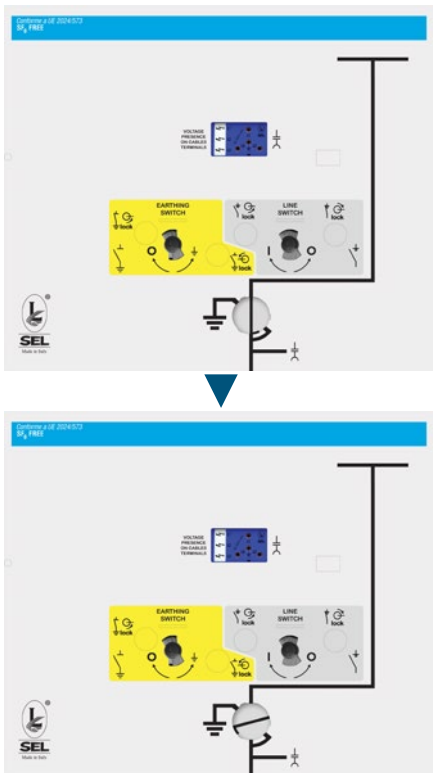
- Having the same dimensions as SF6-insulated TPS, it ensures perfect interchangeability and possible expansion of existing switchboards.

# LOAD BREAK SWITCH-DISCONNECTOR (LBS)

## OPENING

(Fig. 01) Current flows through the main contact (highlighted in red) while the vacuum interrupter contacts remain closed but carry no current. When the main contact moves (red area), it briefly makes connection with the vacuum interrupter contacts (blue area) without interrupting current flow. During this transfer phase, current flows through both the main circuit and the vacuum interrupter (Fig. 02).

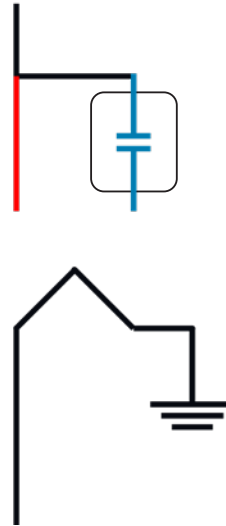
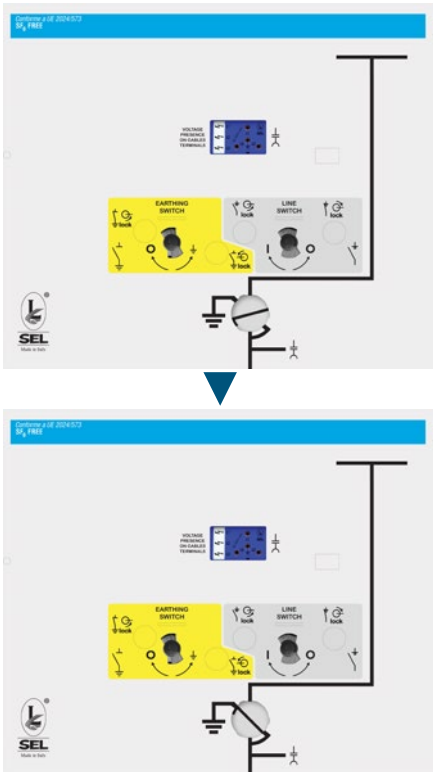
The main circuit is then disconnected and the entire current is carried exclusively by the vacuum interrupter contacts (Fig. 03). The patented mechanical system subsequently initiates the opening of the vacuum interrupter contacts, bringing the circuit to the open position (Fig. 04). Once fully open, the vacuum interrupter contacts remain securely latched in the open position (Fig. 05).



# LOAD BREAK SWITCH-DISCONNECTOR (LBS)

## EARTHING

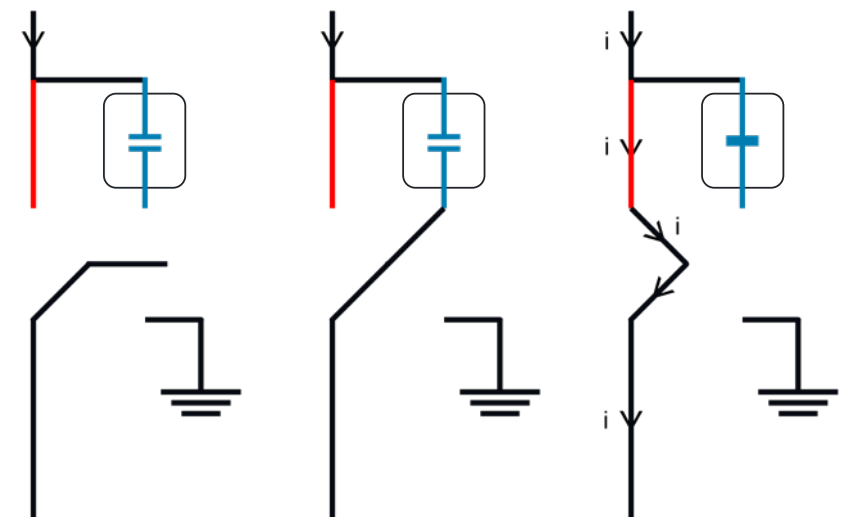
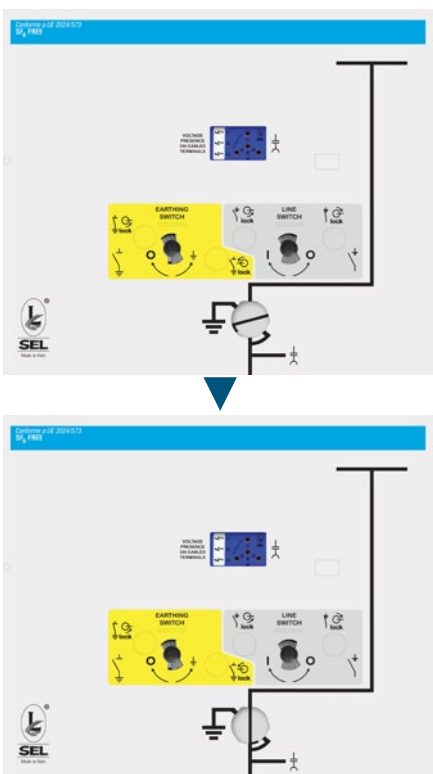
At this stage, earthing can be performed via the dedicated mechanism (see Fig. 06).



## CLOSING

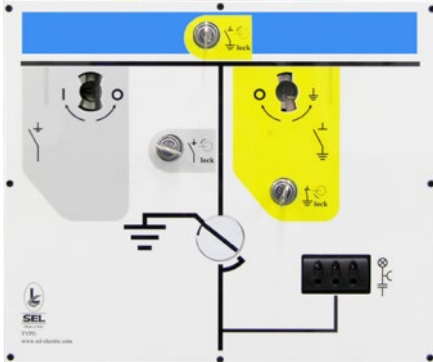
By operating the mechanism, the contacts moves from the earthed position to the open position, enabling the subsequent closing operation.

During closing, the vacuum interrupter performs no active switching function and simply returns to the closed-contact state without taking part in current transfer or circuit closing. At this point, current flows through the main contacts and the circuit is fully energized. The vacuum interrupter contacts are fully closed and ready for the next opening operations (Fig. 07).



# LOAD BREAK SWITCH

It consists of the coupling of an isolating disconnecter with earth closing capability and a load break switch capable of opening and closing the rated current equipped with a vacuum interrupter



## ISOLATING DISCONNECTOR

The active parts that perform the isolation are contained in an epoxy resin enclosure, having a volume of less than 25 liters, filled with dry air.

Any internal overpressures are released through the safety valve located at the rear. The rear of the resin enclosure features a honeycomb structure that allows, in case of internal fault, the exhaust gases to escape toward the back of the switchboard, without any danger to the operator.

## LOAD BREAK SWITCH

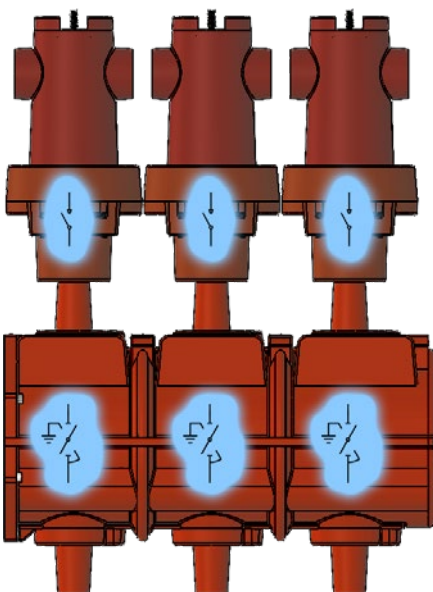
Its "bushing-type pole" design is derived from our TCB circuit breaker. The reliability of this design has now been confirmed by the experience gained over twenty years of manufacturing. Inside the bushing-type pole, a vacuum interrupter is arranged, allowing the closing and opening of the rated current.

The insulation of the epoxy resin molded pole is in free air.

The particular transmission of the control movement of the vacuum interrupter located in each pole, realized with a central shaft passing through the poles themselves, allows us to have no input or output contacts on the sides of the poles, but only at the top and bottom. This design allows us a direct coupling with the isolating disconnecter enclosure.

Special interlocks prevent incorrect operations of the two devices.

The following sketch illustrates the operation of the combined device.



# VACUUM CIRCUIT BREAKER R<sub>IPROVA</sub>V

## DESCRIPTION

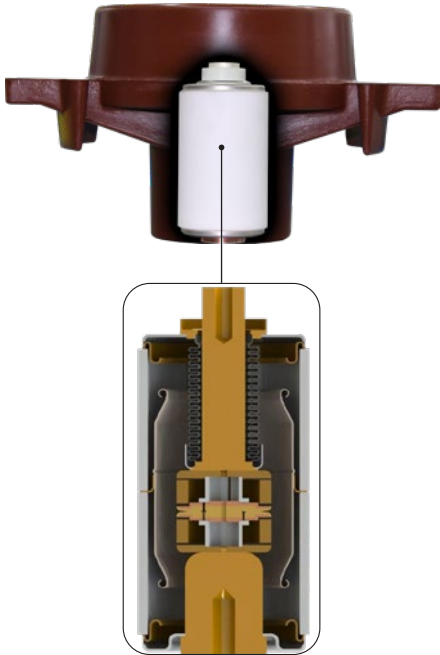
## GENERAL



Our TCB series vacuum circuit breakers are sealed and guaranteed pressure systems (IEC 62271-1 Standards) manufactured with separate poles, each containing a vacuum interrupter which, thanks to a special production process, is encapsulated in resin. This ensures protection of the main element of the circuit breaker from impacts, condensation phenomena, dust accumulation, and guarantees lightning impulse withstand on the external surface of the interrupter.

## VACUUM TECHNOLOGY

It is now evident that the vacuum circuit breaker for medium voltage already represents the dominant technology on the market and that its adoption is growing strongly. In fact, today it is possible to obtain efficient vacuum circuit breakers, with electrical endurance exceeding mechanical endurance, environmentally harmless; but above all with superior performance due to reduced arc energy, insulation recovery after an overvoltage, minimum opening times, and reduced mechanical energy for the operating mechanism.



## VACUUM CIRCUIT BREAKER

Consists of three vacuum interrupters, with closing and interrupting capability under fault conditions.

# TCB VACUUM CIRCUIT BREAKER UNIQUE DESIGN

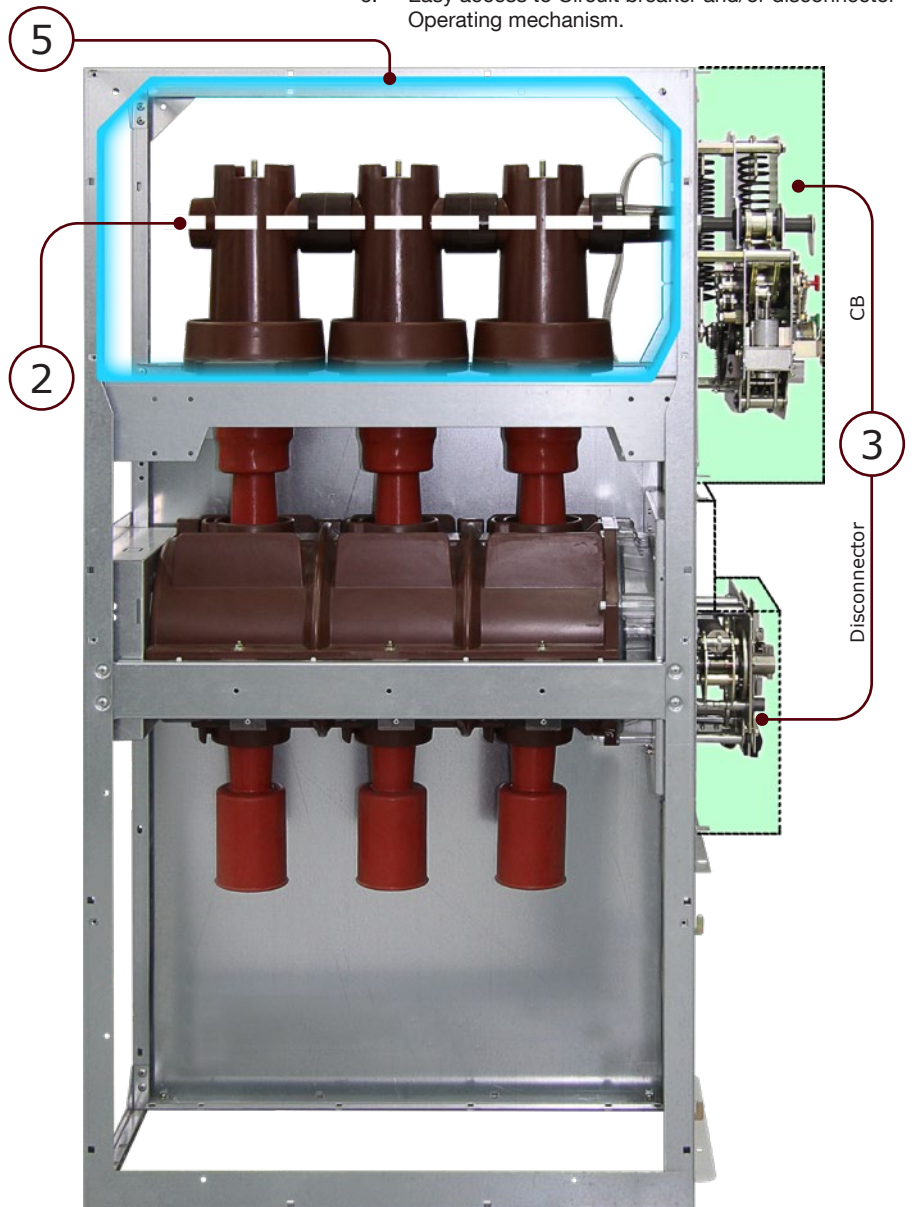
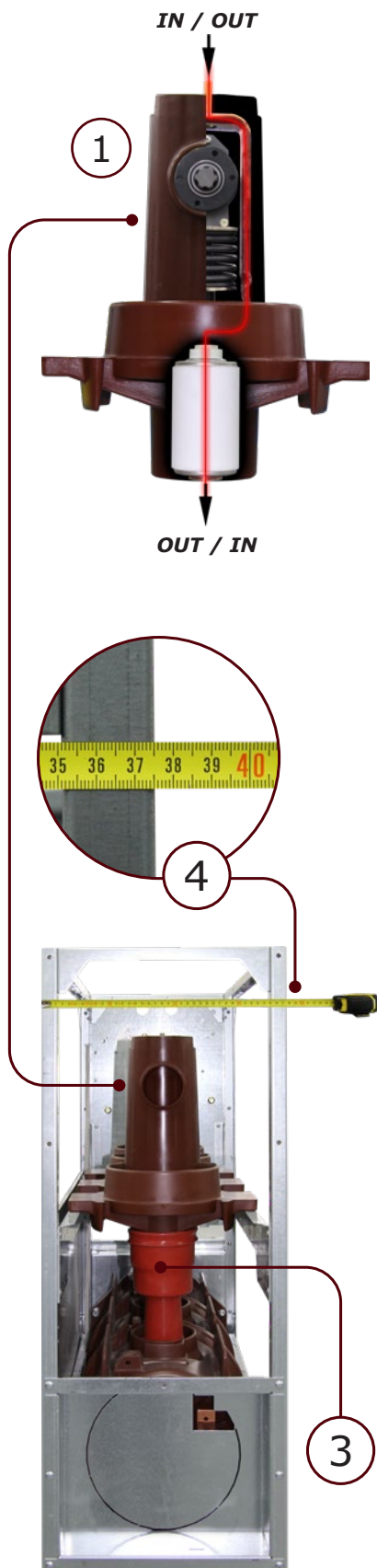
## BUSHING-TYPE POLE CIRCUIT BREAKERIPROVA

The TCB circuit breaker is distinguished by its "Bushing-Type Pole" design.<sup>(1)</sup> Thanks to the particular movement transmission realized by means of a central shaft through the poles<sup>(2)</sup>, it has no input or output contacts on the sides of the poles themselves. Thus, each pole has output/input contacts at the top or bottom, becoming a bushing-type circuit breaker pole.

This characteristic allows for extremely reduced and compact switchboard dimensions and enables solid and easy coupling with the disconnector poles<sup>(3)</sup>, thus creating circuit breaker-disconnector units with modularity in only 375mm width.<sup>(4)</sup>

In this type of unit called FICBV, FILCBV, and FICBVT, besides compactness, the high degree of functionality achieved is appreciated, thanks to the operating mechanism being located completely outside the busbar compartment of the switchboard<sup>(5)</sup>, thus allowing, obviously after performing the logical operations to access it safely, to add or remove accessories and maintain the operating mechanism<sup>(6)</sup> without needing to access the inside of the unit.

1. Bushing-Type Pole design.
2. Transmission by means of a central shaft.
3. Coupling between Circuit Breaker and disconnector.
4. Compact Dimensions in only 375mm.
5. Busbar Compartment.
6. Easy access to Circuit breaker and/or disconnector Operating mechanism.



**IEC Standards**

F-TPS is manufactured and tested in conformity with the latest issues of the following IEC standards.

<b>IEC 62271-1</b>	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear
<b>IEC 62271-200</b>	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
<b>IEC 62271-100</b>	High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers
<b>IEC 62271-103</b>	High-voltage switchgear and controlgear - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV
<b>IEC 62271-102</b>	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches
<b>IEC 62271-213</b>	High-voltage switchgear and controlgear - Part 213: Voltage detecting and indicating system
<b>IEC 62271-304</b>	High-voltage switchgear and controlgear - Part 304: Classification of indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV related to the use in special service conditions with respect to condensation and pollution
<b>IEC 62271-307</b>	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
<b>IEC 60529</b>	Degrees of protection provided by enclosures (IP Code)
<b>IEC 60060-1</b>	High-voltage test techniques - Part 1: General definitions and test requirements
<b>IEC 60255</b>	Measuring relays and protection equipment
<b>IEC 61869-2</b>	Instrument transformers - Part 2: Additional requirements for current transformers
<b>IEC 61869-3</b>	Instrument transformers - Part 3: Additional requirements for inductive voltage transformers
<b>IEC 61869-10</b>	Instrument transformers - Part 10: Additional requirements for low-power passive current transformers
<b>IEC 61869-11</b>	Instrument transformers - Part 11: Additional requirements for low power passive voltage transformers
<b>IEC 60044-8</b>	Instrument transformers - Part 8: Electronic current transformers
<b>IEC 60282-1</b>	High-voltage fuses - Part 1: Current-limiting fuses
<b>DIN 43625</b>	High-voltage fuses; Rated voltage 3,6 to 36 kV; Fuse-Links
<b>CEI 0-16</b>	Reference technical rules for the connection of active and passive consumers to the HV and MV electrical networks of distribution Company

# INTERNAL ARC PROOF UNITS

## ACCORDING WITH IEC STANDARD 62271-200

The F-TPS series switchboards have been tested for internal arc resistance up to 21kA 1s.

F-TPS is now available in several options to install standardized internal arc withstand switchboards.

### IAC: A-FL 12,5 KA 1 sec.

The F-TPS switchboard is positioned against the wall, the operator is safe on the front and lateral sides of the switchboard in case of fault

### IAC: A-FLR 12,5 KA 1 sec.

The F-TPS switchboard can be positioned against the wall or in the center of the room, the operator is safe on all sides of the switchboard.

### IAC: A-FLR 16 KA 1 sec.

The F-TPS switchboard can be positioned against the wall or in the center of the room, the operator is safe on all sides of the switchboard.

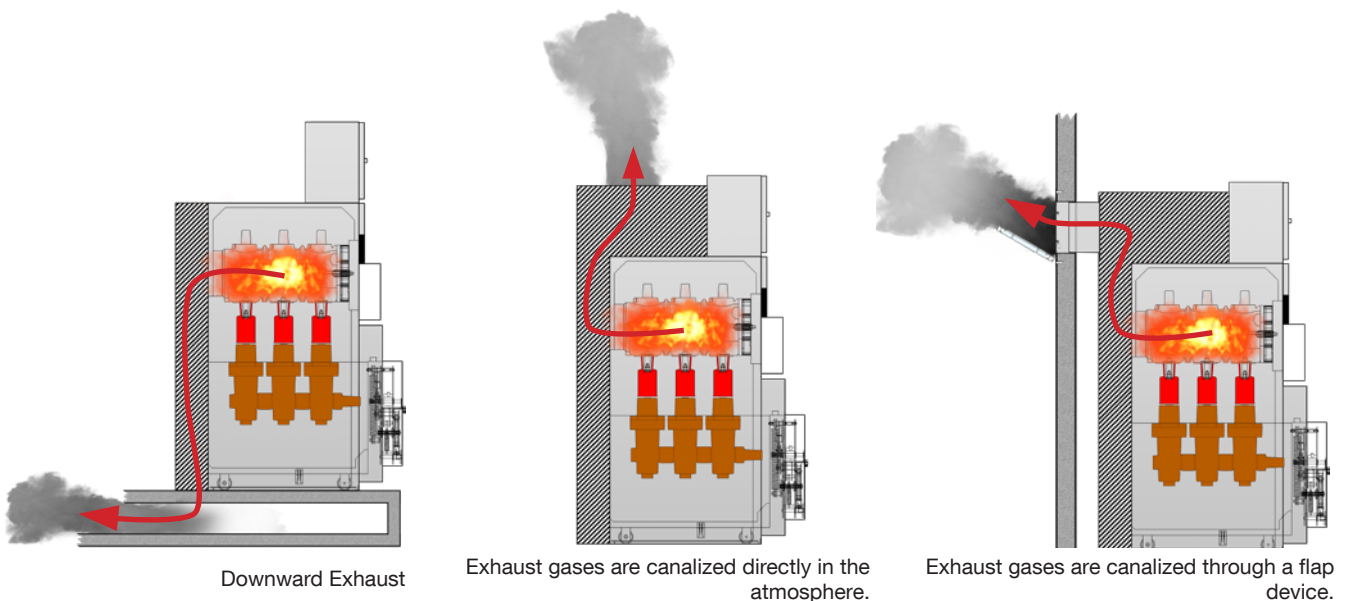
### IAC: A-FLR 21 KA 1 sec.

The F-TPS switchboard can be positioned against the wall or in the center of the room, the operator is safe on all sides of the switchboard.



Type of Exhaust gas evacuation:

- Downward exhaust.
- Upward exhaust.
- Upward exhaust with gas duct.

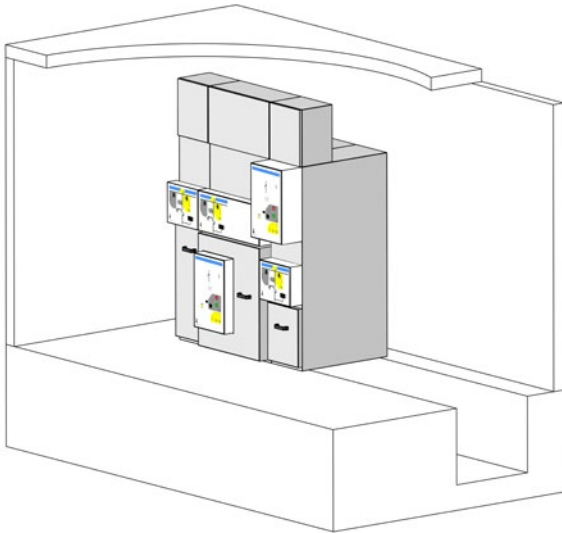


# INTERNAL ARC PROOF UNITS

## IAC: A-FL 12.5kA 1s. REAR EXHAUST

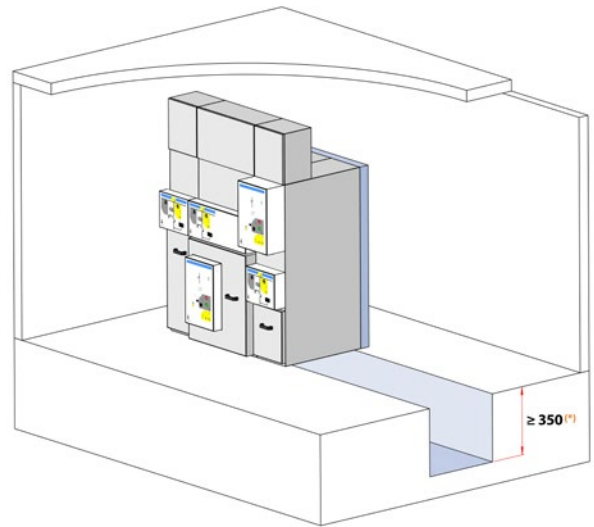
Switchgear safe for the personnel placed in front and lateral of it. No specific arrangements have to be provide for installation. Exhaust gas are directed:

- Towards the rear in case of internal switch enclosure fault
- Towards rear and downward in case of arc in the cable zone
- Towards rear and upward in case of arc in the busbar zone



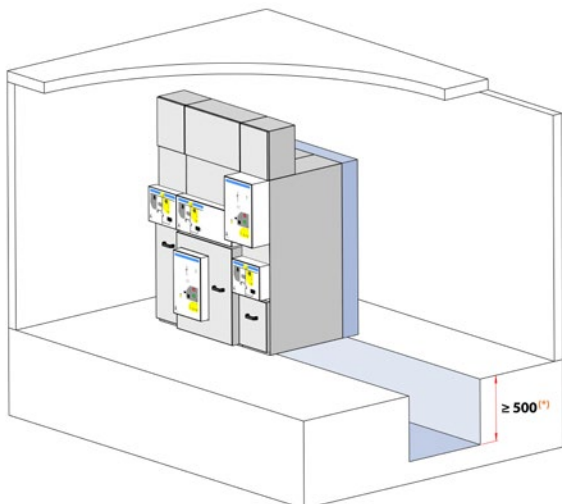
## IAC: A-FLR 12.5kA 1s. DOWNWARD EXHAUST

The switchboard can be installed either wall-mounted or in the center of the room. Personnel are safe in case of fault on all 4 sides of the switchboard. The switchboard is equipped with a 90mm rear duct to channel exhaust gases downward. The duct under the switchboard must have a width of at least 600mm and a height of at least 350mm for 12kA, for higher versions the duct must be at least 870mm wide and 500mm high.



## IAC: A-FLR 16 / 21kA 1s. DOWNWARD EXHAUST

Switchgear safe for the personnel placed in front, lateral and rear side of it. The switchgear is equipped with an additional rear channel (depth 90mm) in order to lead exhaust gas downward in case of arc in all compartments. Trench underneath switchgear has to be 930mm minimum width and 500mm minimum depth.

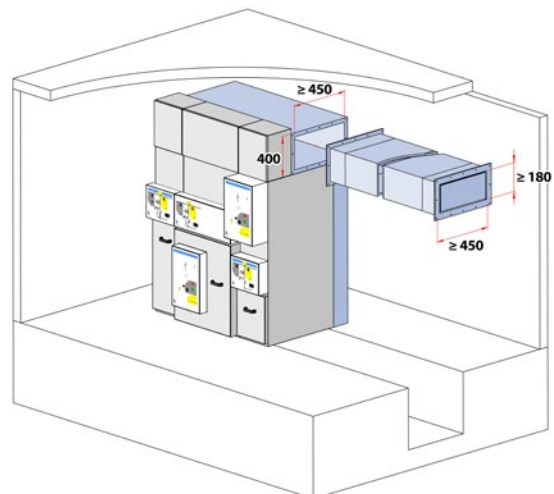


## IAC: A-FLR 12,5 / 16 / 21kA 1s. UPWARD EXHAUST

Switchgear safe for the personnel placed in front and lateral of it. The switchgear is equipped with an additional rear channel (depth 180mm) in order to lead exhaust gas upward in case of arc in all compartments. Moreover in the upper part of the switchgear there is a closed additional metal box (to be mount on site at installer care) 400mm height.

The installer can provide a suitable gas duct in order to lead exhaust gas outside to the room.

At the end of gas duct, outside to the room, has to be also provide a suitable termination in order to prevent the entry of water, dust, moisture, animals, etc. and in such case to prevent icing too.



SWITCHGEARS MAIN CHARACTERISTICS						
		kV	7,2	12	17,5	24
Altitude	IEC 62271-1	m	<1000 (for different value contact SEL)			
Ambient air temperature	IEC 62271-1	°C	-5 ÷ 40			
Relative humidity		%	95			
Insulation Rated Voltage		kV	7,2	12	17,5	24
Rated Voltage		kV	7,2	12	17,5	24
Lightning impulse withstand voltage between phases and towards the ground		kV	60	95	95	125
Lightning impulse withstand voltage across the isolating distance		kV	70	110	110	145
Power frequency withstand voltage between the phases		kV	20	28	38	50
Power frequency withstand voltage across the isolating distance		kV	23	32	45	60
Rated Frequency		Hz	50 - 60			
Rated Current	Switch disconnecter		630			
Rated Current	Vacuum Circuit Breaker		250 - 630			
Rated short time withstand current $I_k$		kA	up to 25			
Rated peak withstand current $I_p$ (making capacity)		kA	50Hz 2,5 x $I_k$ - 60Hz 2,6 $I_k$			
Rated duration of short circuit $t_k$		s	1 - 3			
Degree of protection on front face		IP	3X			
Degree of protection on electrical MV circuits		IP	20			
Internal Arc classification IAC A-F; FL; FLR; including cables box	IEC 62271-200	kA x s	up to 21 1s			

MAIN CHARACTERISTICS SWITCH DISCONNECTOR (WITH VACUUM INTERRUPTER)						
		kV	7,2	12	17,5	24
Mechanical operation	Earthing switch IEC 62271-102		1.000 operations / Class M0			
Electrical operation	Earthing switch IEC 62271-102		making capacity 5 / Class E2			
Mechanical operation	Switch Disconnecter IEC 62271-103 Vacuum Interrupter IEC 62271-100		1.000 operations / Class M1			
Mechanical operation	Switch Disconnecter IEC 62271-103		1.000 operations / Class M1			
Mainly active load breaking current	Switch Disconnecter IEC 62271-103	A	630			
Electrical operation	Switch Disconnecter IEC 62271-103		making capacity 5 / Class E3			
Break Time Vacuum Circuit Breaker	Vacuum Interrupter IEC 62271-100	ms	≤ 70			
Rated operating sequence	Vacuum Interrupter IEC 62271-100		0 - 0,3s - CO - t - CO			
Making Capacity	Vacuum Interrupter IEC 62271-100	kA	54.6			50
Electrical operation	Vacuum Interrupter IEC 62271-100		E1			

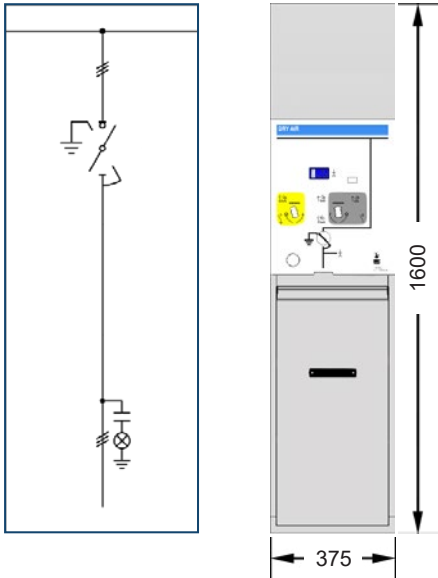
THREE POSITION SWITCH DISCONNECTOR					
RATED VOLTAGE		kV	12	17,5	24
<b>General Switch Function</b>	Rated mainly active load breaking current $I_{load}$	A	630		
	Rated short-circuit making current $I_{ma}$	up to kA	54.6		
	Electrical endurance	Class	E3		
	Number of electrical operating cycles with $I_{load}$	n	100		
	Number of short-circuit making operations with $I_{ma}$	n	5		
	Capacitive switching	Class	C2		
	Mechanical endurance / number of operating cycles	Class/n	M1 / 1000		
	<b>Disconnecter function</b>	Mechanical endurance / number of operating cycles	Class/n	M0 / 1000	
<b>Make-proof earthing switch function</b>	Rated short-circuit making current $I_{ma}$	up to kA	54.6		
	Electrical endurance	Class	E2		
	Number of short-circuit making operations with $I_{ma}$	n	5		
	Mechanical endurance / number of operating cycles	Class/n	M0 / 1000		

VACUUM CIRCUIT-BREAKER WITH THREE POSITION DISCONNECTOR 630A					
RATED VOLTAGE		kV	12	17,5	24
<b>Circuit-breaker</b>	Rated mainly active load breaking current $I_{load}$	A	630		
	Rated operating sequence		0 – 0.3 s – CO – 3 min – CO		
	Rated short-circuit breaking current $I_{sc}$	up to kA	21		20
	Electrical endurance	Class	E1		
	Number of short-circuit making operations with $I_{ma}$	n	10		
	Switching of cable systems	Class	S1		
	Mechanical endurance / number of operating cycles	Class/n	M1 / 2000		
	<b>Disconnecter function</b>	Mechanical endurance / number of operating cycles	Class/n	M0 / 1000	
<b>Make-proof earthing switch function</b>	Rated short-circuit making current $I_{ma}$	up to kA	41.6		
	Electrical endurance	Class	E2		
	Number of short-circuit making operations with $I_{ma}$	n	5		
	Mechanical endurance / number of operating cycles	Class/n	M0 / 1000		

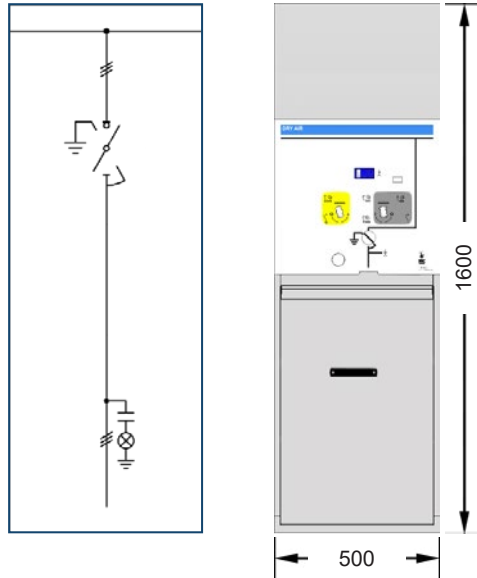
VACUUM CIRCUIT-BREAKER WITH THREE POSITION DISCONNECTOR 200A					
RATED VOLTAGE		kV	12	17,5	24
<b>Circuit-breaker</b>	Rated mainly active load breaking current $I_{load}$	A	200		
	Rated operating sequence		0 – 0.3 s – CO – 3 min – CO		
	Rated short-circuit breaking current $I_{sc}$	up to kA	21		20
	Electrical endurance	Class	E1		
	Number of short-circuit making operations with $I_{ma}$	n	10		
	Switching of cable systems	Class	S1		
	Mechanical endurance / number of operating cycles	Class/n	M1 / 2000		
	<b>Disconnecter function</b>	Mechanical endurance / number of operating cycles	Class/n	M0 / 1000	
<b>Make-proof earthing switch function</b>	Rated short-circuit making current $I_{ma}$	up to kA	41.6		
	Electrical endurance	Class	E2		
	Number of short-circuit making operations with $I_{ma}$	n	5		
	Mechanical endurance / number of operating cycles	Class/n	M0 / 1000		

# SWITCH DISCONNECTOR UNITS

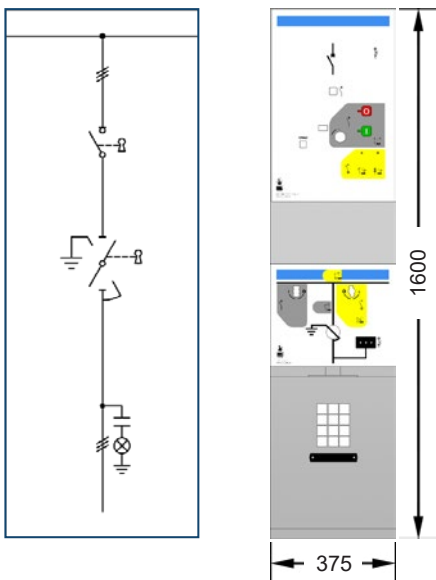
## FSM - SWITCH DISCONNECTOR UNIT



## FSM5 - SWITCH DISCONNECTOR UNIT (500MM)

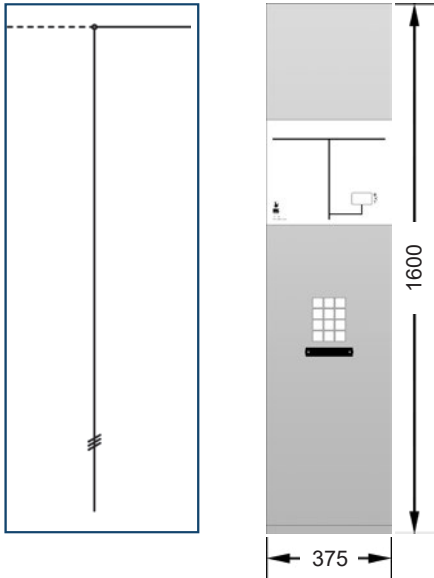


## FSMV - SWITCH DISCONNECTOR UNIT

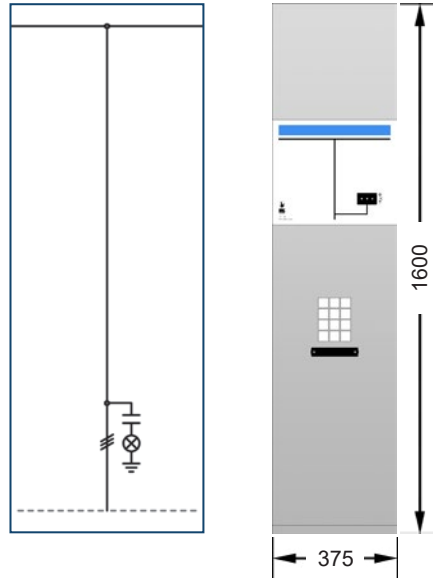


# CABLES AND BUSBARS EARTHING UNITS

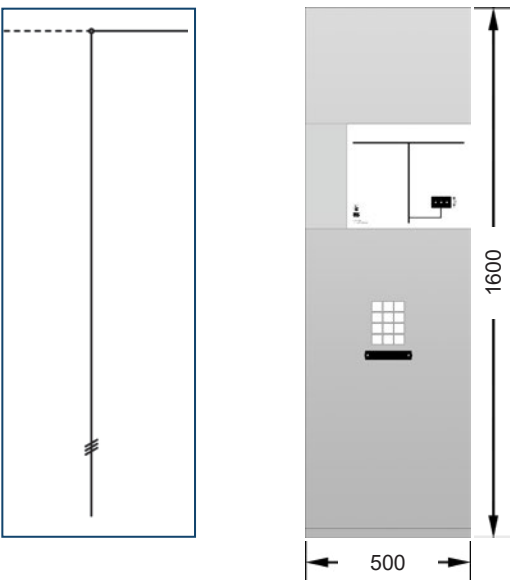
**CM** - CABLE RISER UNIT



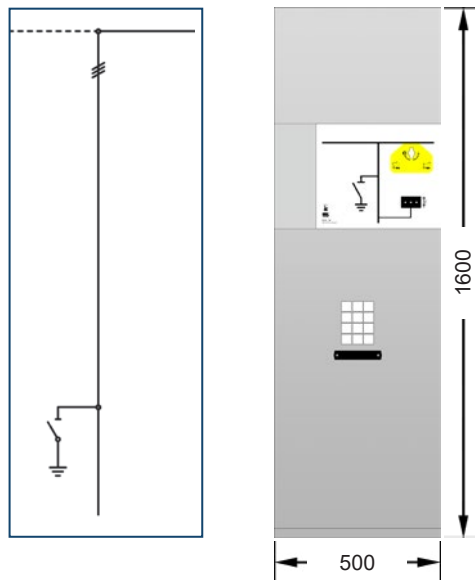
**FIOC** - INCOMING/OUTGOING CABLES OR BUSBAR UNIT



**CM5** - CABLE RISER UNIT

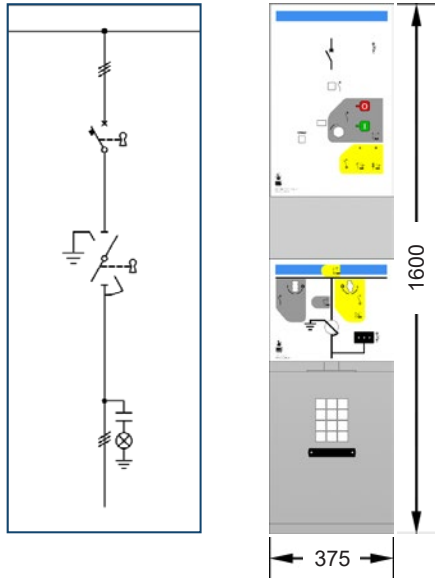


**CME** - CABLE RISER UNIT WITH EARTHING SWITCH

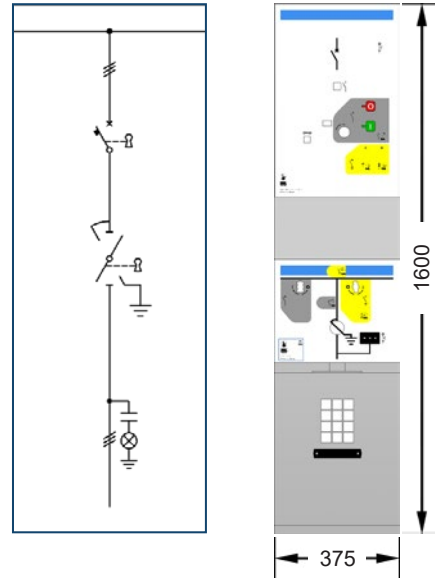


# COMPACT VACUUM CIRCUIT BREAKER UNITS

## **FICBV** - VACUUM CIRCUIT BREAKER UNIT WITH DISCONNECTOR

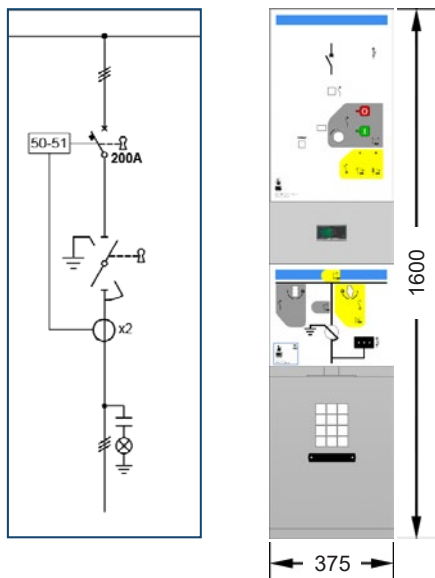


## **FILCBV** - LOWER INCOMING VACUUM CIRCUIT BREAKER UNIT WITH DISCONNECTOR



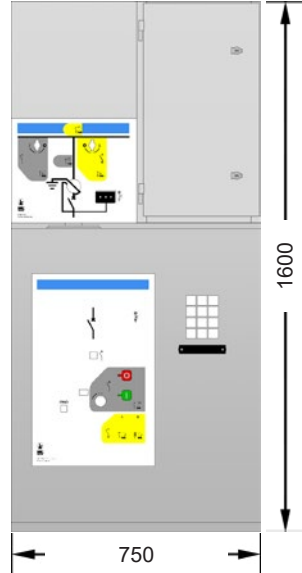
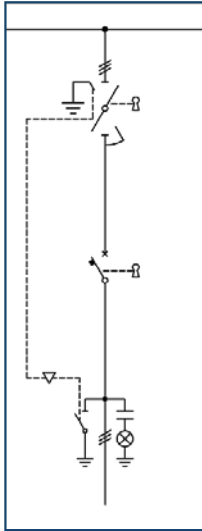
# TRANSFORMER PROTECTION COMPARTMENTS

## **FICBVT** - VACUUM CIRCUIT BREAKER UNIT WITH DISCONNECTOR 200A

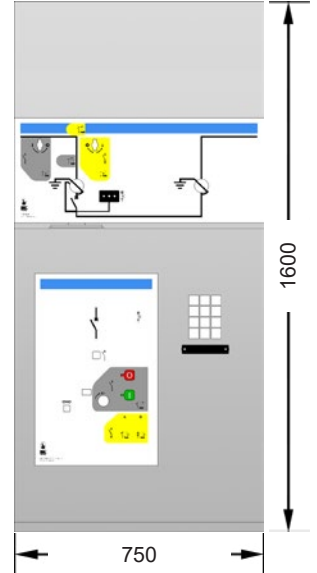
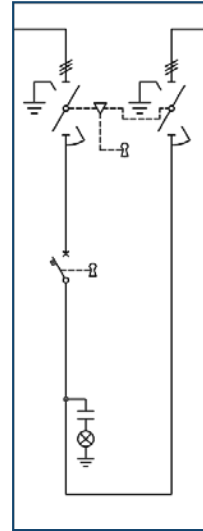


# VACUUM CIRCUIT BREAKER UNITS

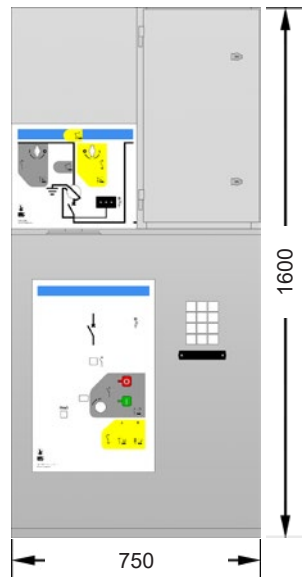
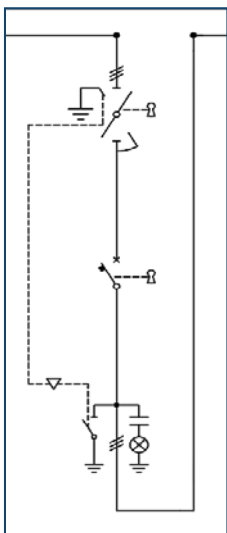
## FICB - VACUUM CIRCUIT BREAKER UNIT WITH DISCONNECTOR



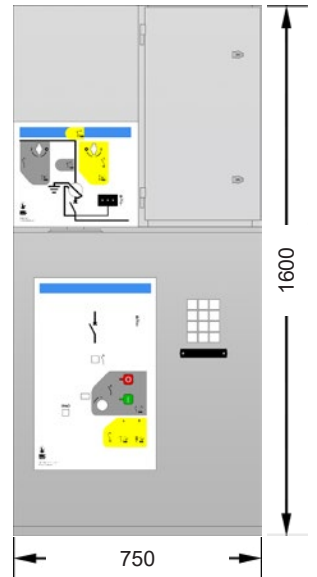
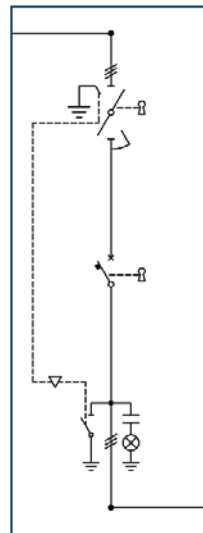
## F2ICB - VACUUM CIRCUIT BREAKER UNIT WITH DOUBLE DISCONNECTOR



## FICBR - VACUUM CIRCUIT BREAKER UNIT WITH DISCONNECTOR AND BUSBAR RISER

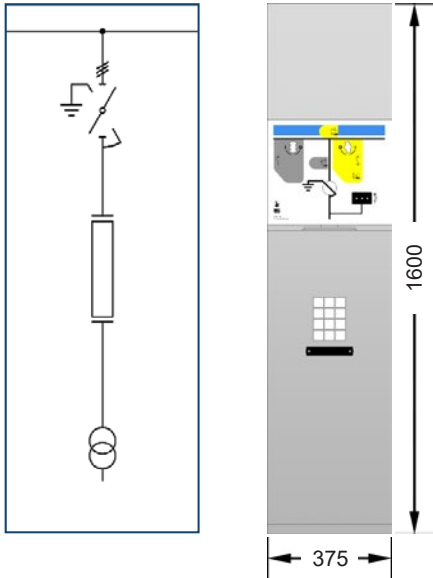


## FICBLT - VACUUM CIRCUIT BREAKER UNIT WITH DISCONNECTOR AND LATERAL OUTGOING BUSBAR

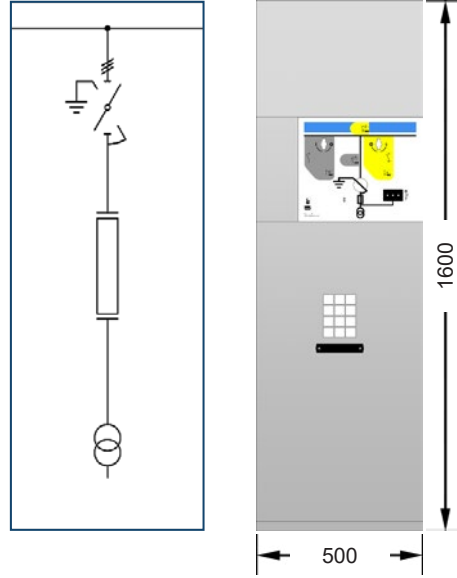


# VT'S - CT'S AND SURGE ARRESTER UNITS

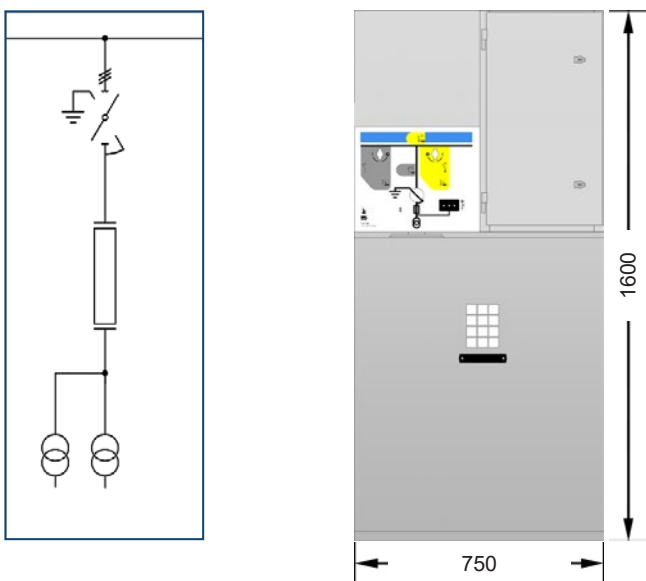
## FFIM - VT UNIT WITH DISCONNECTOR AND FUSES (375MM)



## FFIM5 - VT UNIT WITH DISCONNECTOR AND FUSES (500MM)

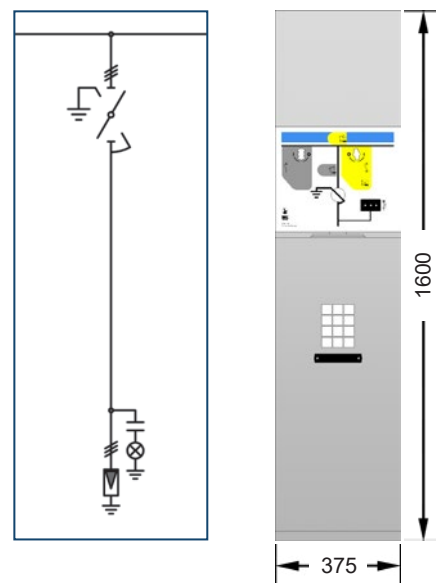


## FFIM7 - VT UNIT WITH DISCONNECTOR AND FUSES (750MM)



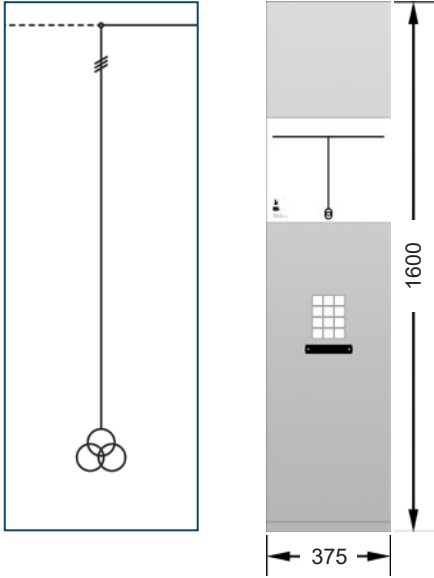
Max 2 VTs Phase-To-Phase + 3 VTs Phase-To-Earth

## FIS - SURGE ARRESTER UNIT WITH DISCONNECTOR

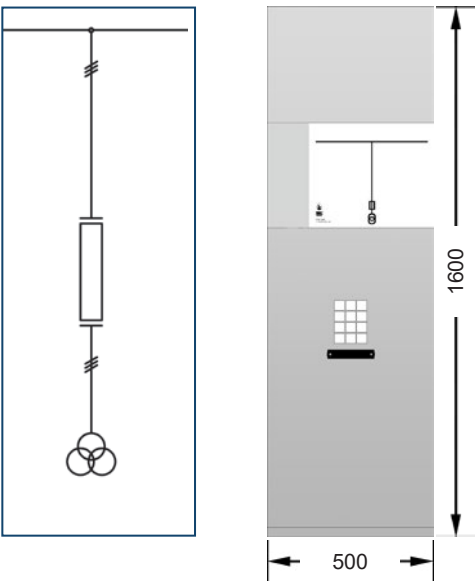


# VT'S AND CT'S UNITS

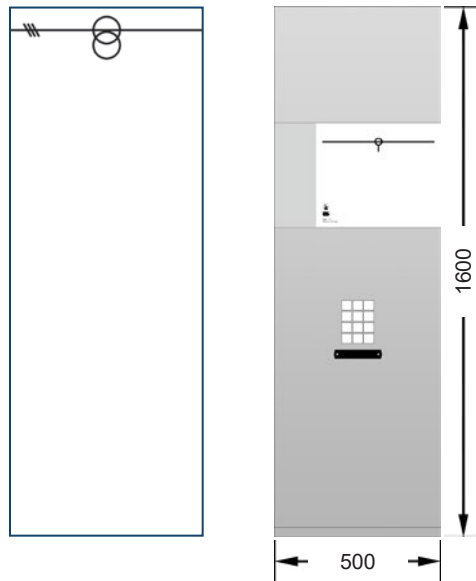
## MTV - VTs COMPARTMENT



## FMM - CT UNIT WITH FUSES

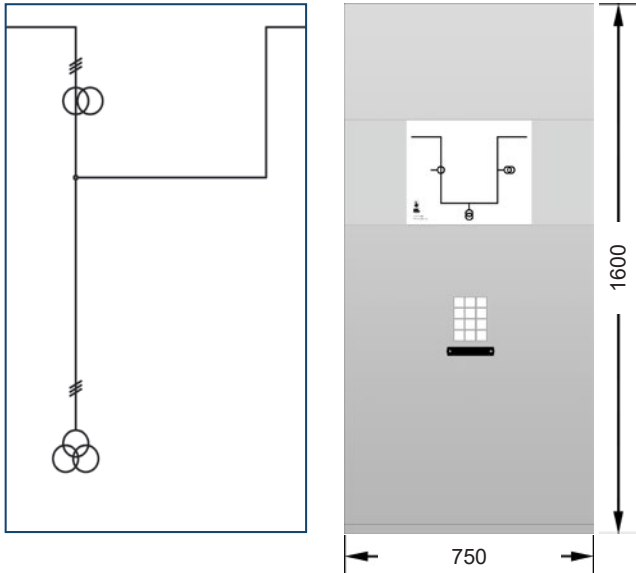


## MTA - CT UNIT



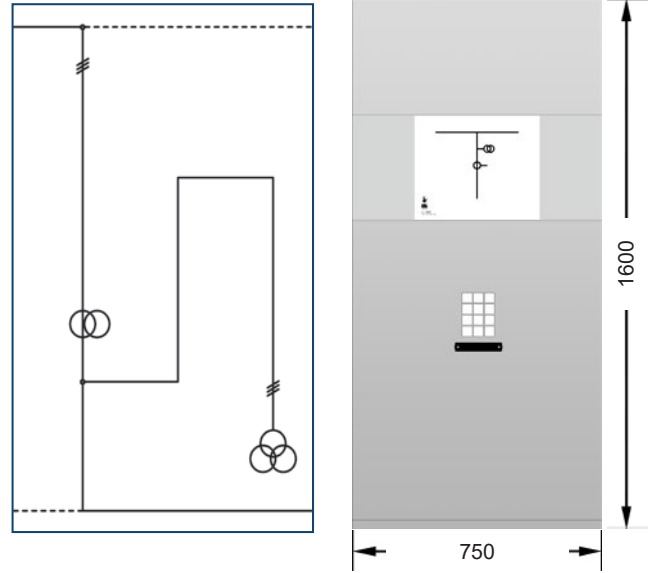
# METERING UNITS

## MBMP - METERING UNIT



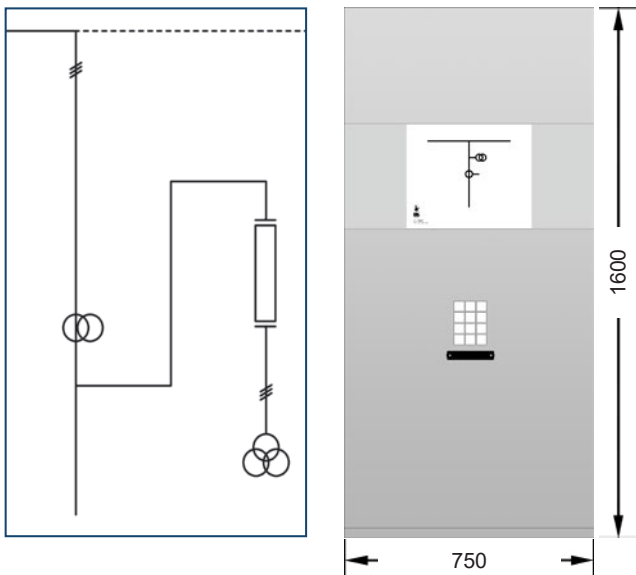
To install fuses in combination with VTs contact SEL.

## MBMR - METERING UNIT WITH RIGHT OR LEFT OUTGOING LINE



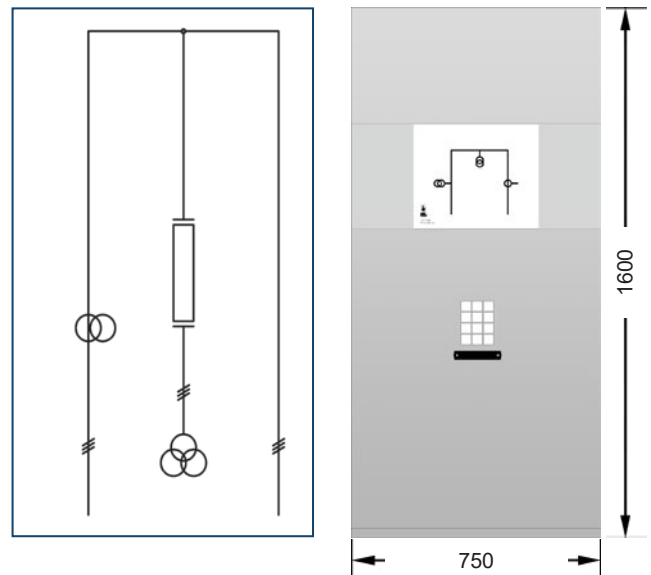
To install fuses in combination with VTs contact SEL.

## MBMC - METERING UNIT WITH LOWER OUTGOING CABLES



To install fuses in combination with VTs contact SEL.

## MCMP - METERING UNIT WITH LOWER INCOMING/OUTGOING CABLES

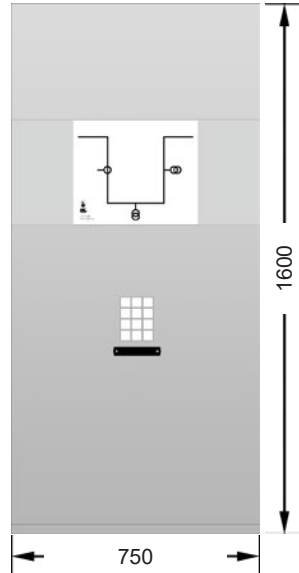
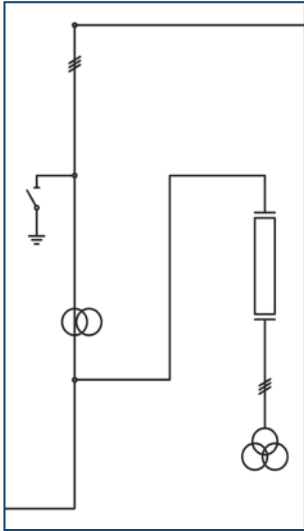


To install fuses in combination with VTs contact SEL.

### CONFIGURATION OF MEASUREMENT TRANSFORMER

CTs	-	-	9	6	3	-	-	3	6	3
VTs PHASE TO EARTH	9	-	-	-	-	6	3	6	3	3
VTs PHASE TO PHASE	-	6	-	2	4	2	4	-	-	3

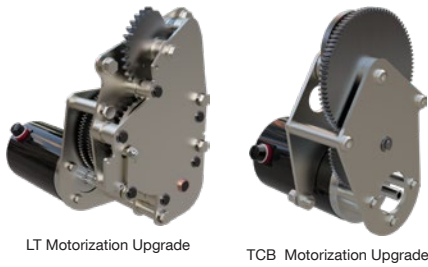
**MBER** - METERING UNIT WITH RIGHT OR LEFT OUTGOING LINE AND EARTHING SWITCH



To install fuses in combination with VTs contact SEL.

CONFIGURATION OF MEASUREMENT TRANSFORMER										
CTs	-	-	9	6	3	-	-	3	6	3
VTs PHASE TO EARTH	9	-	-	-	-	6	3	6	3	3
VTs PHASE TO PHASE	-	6	-	2	4	2	4	-	-	3

# MOTORIZATIONS - VOLTAGE INDICATOR - HVSENSOR



LT Motorization Upgrade

TCB Motorization Upgrade

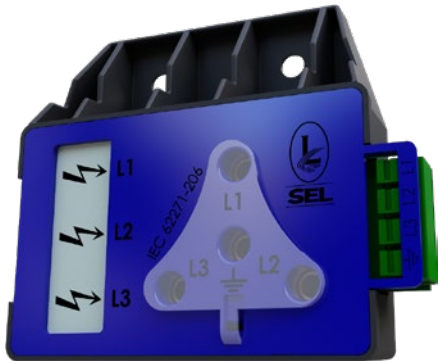
## MOTORIZATION

All our operating mechanisms have the possibility to equip the motorizations upgrade.

## VOLTAGE INDICATOR

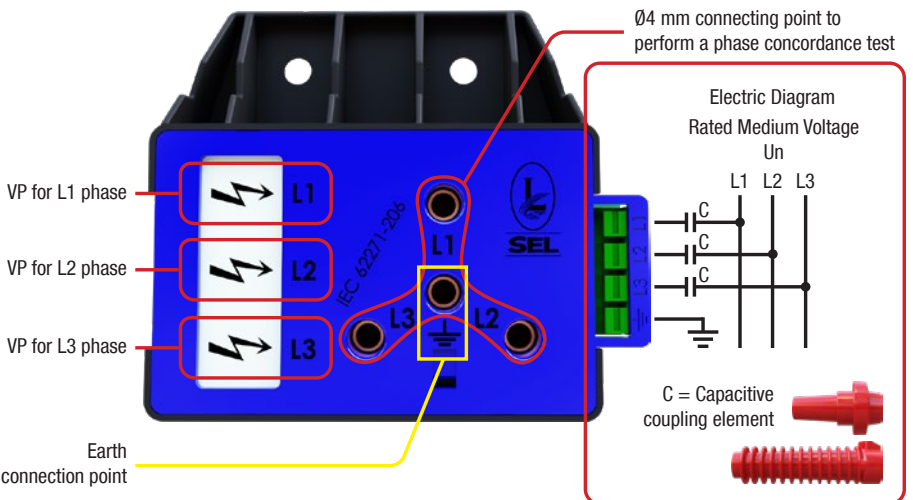
Voltage presence indicating system. Integrated 3-phase test point for phase comparison test.

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.

# PROTECTION RELAYS

## PROTECTION RELAYS

F-TPS 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.

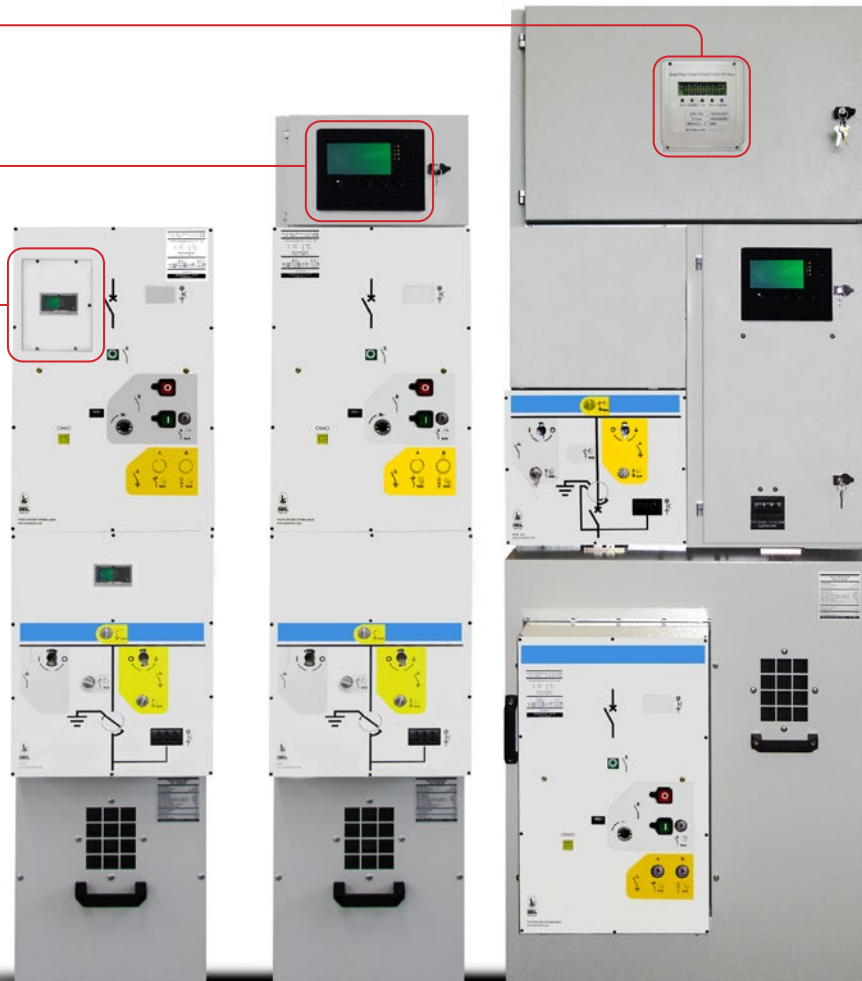
The LV compartment can be installed on the roof or on the front of the unit. The frontal LV compartment can be used in case of very simple and small LV accessories. The LV compartment is necessary for larger and more complex LV accessories

WIDTH	HEIGHT	DEPTH
375	450	300
375	250	240
500	450	300
750	450	300

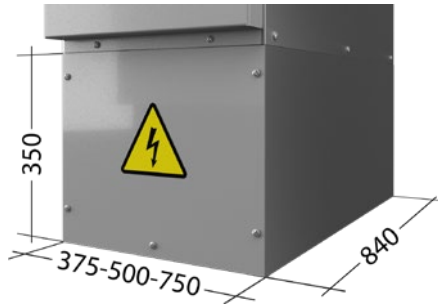
Protection Relay installed in LV Compartment

Protection Relay installed in LV Compartment (FICBV)

Protection Relay installed on frontal panel.



# BASES AND BUSBARS



## BASE

As an option all the units and standard configurations can be equipped with a 350mm high bases. The base is only applicable for standard series "IAC: A-FL 12,5kA 1s".

The use of base simplifies cable connection, helps to keep the correct bending radius of the cables and reduces the trench depth in civil engineering works.

BASE OVERALL DIMENSIONS			
WIDTH		HEIGHT	DEPTH
375		350	840
500		350	840
750		350	840

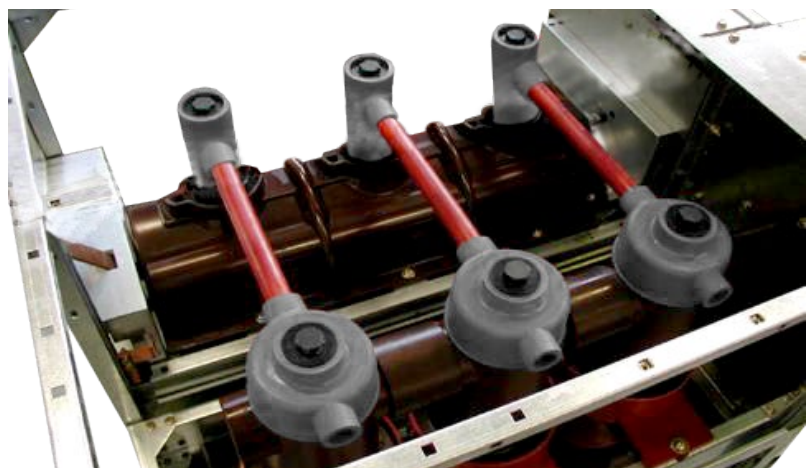
## BUSBARS



Busbars coupling kit switch. 24kV busbars are completely insulated.

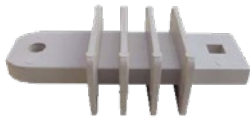


Busbars coupling kit switch circuit breaker. 24kV busbars are completely insulated.



# Surge Arrester and Measuring Instruments

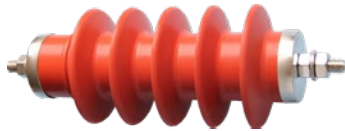
## SURGE ARRESTERS



Insulating base

Insulating base has to be installed in case the automatic disconnector is used to prevent potential earth faults.

Impulse meter counts only the impulses or it can also measure the leakage current. Both kind of solutions can be supplied with auxiliary contact 0,5 A / 250 V for remote control on request. Disconnector Device disconnects overloaded arresters from power supply in case of internal fault or informs about the faulty surge arrester.



Surge Arrester



Disconnector Device



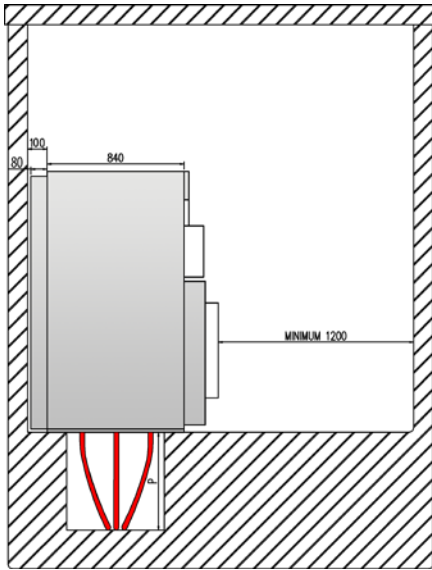
Impulse Counter

### ELECTRICAL CHARACTERISTICS

Discharge rated current	10 kA
Rated voltage	3 ÷ 33 kV
Discharge max. current	100 kA
Discharge current for 2 sec	250 A
Ambient temperature	-40 ÷ +55 °C
Altitude of installation	Up to 1000m

### MEASURING INSTRUMENTS

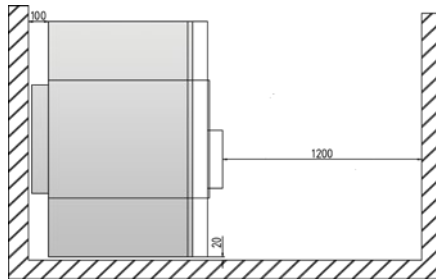
Digital Ammeter
Current switch
Voltmeter (range from 0-90°, cl. 1,5)
Digital Voltmeter
Voltmeter switch
3 Phase measure transducer
Monophase measure transducer
3 Phase active energy counter
Protected terminal for measure control
3 Phase reactive energy counter
Multifunctional meter [V-A-cosØ-W-VAR-Wh-VARh-Hz]
Multifunctional meter [V-A-cosØ-W-VAR-Wh-VARh-Hz] with RS485 output
3 Phase counter Bidirectional active and reactive energy, in according with AEEG
Sealing Kit for measuring unit.
Analogic ammeter (range from 0- 90°, cl. 1,5)



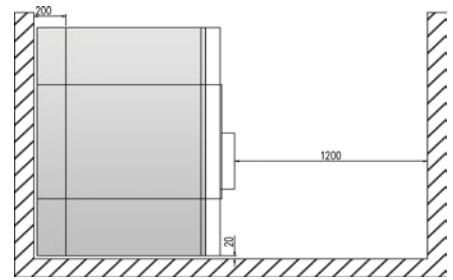
### DISTANCE FROM THE WALLS

For some units an additional depth of 80mm is required for the rear panel. Always provide at least 100mm distance from the rear wall. During the installation respect the minimum distances from the wall.

Leave at least 1.2 m operating space in the front of switchgear.



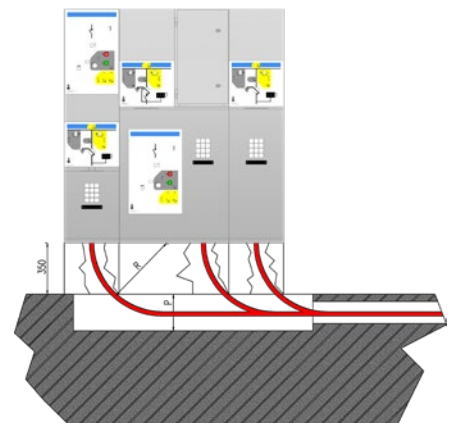
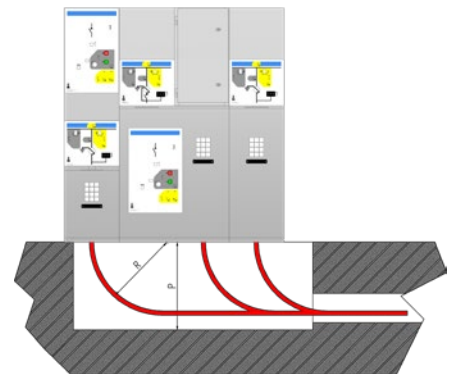
Upper view Standard Version

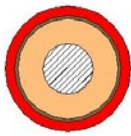
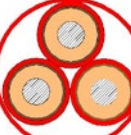
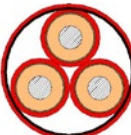


Upper view Internal Arc Proof Version

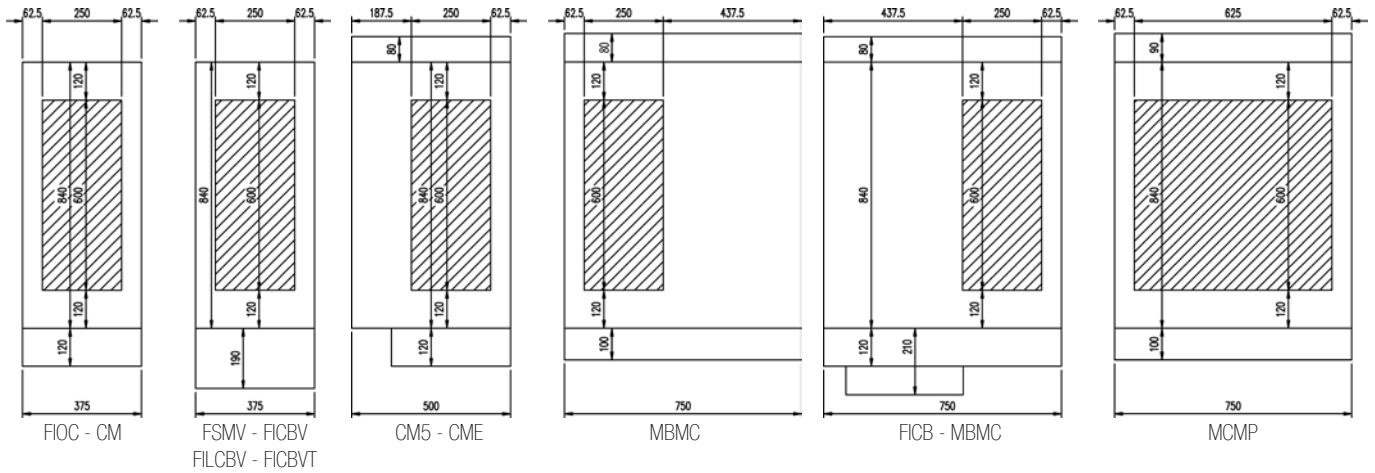
### CABLES TERMINATION

It is very important to maintain the bending radius (R) recommended by the cable manufacturer. As shown in the figures below, the use of raising bases for F-TPS compartments allows compliance with this recommendation, while minimizing the depth (P) of the cable ducts.

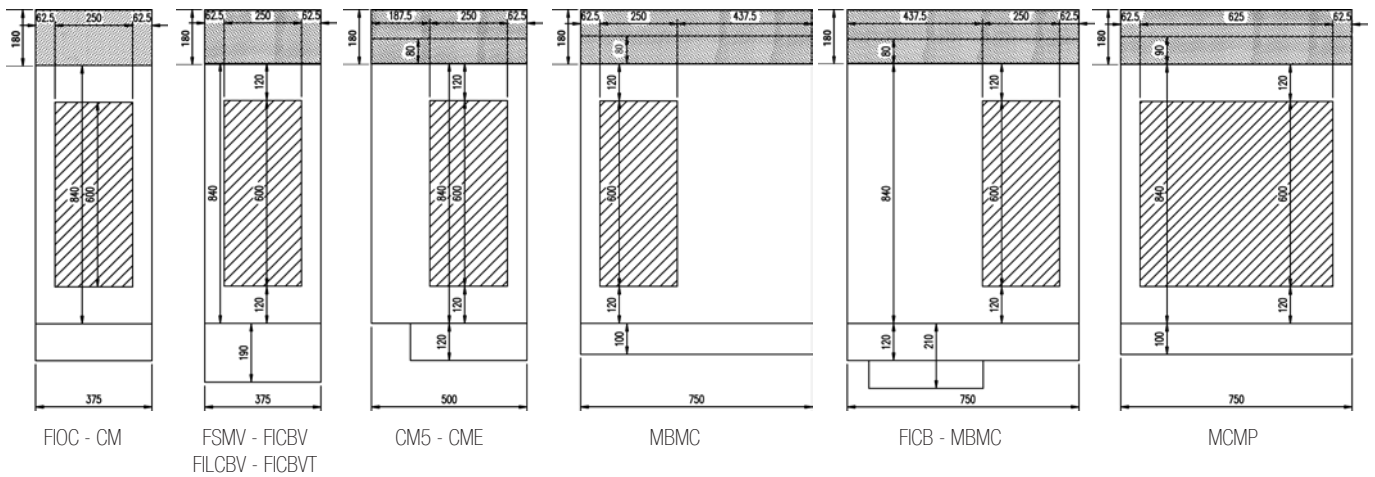



BENDING RADIUS FOR MV CABLES					
CABLE TYPE	CABLE SECTION MM <sup>2</sup>	6/10kV INSULATING DEGREE 17 (MM)	8,7/15kV INSULATING DEGREE 24 (MM)	12/20kV INSULATING DEGREE 32 (MM)	15/20kV INSULATING DEGREE 40 (MM)
 Single core	25	290	320	360	—
	35	300	340	360	390
	50	320	350	380	410
	70	340	380	400	440
	95	370	400	430	460
	120	390	420	450	480
	150	400	440	470	500
	185	430	470	490	520
	240	470	500	530	560
	300	500	530	560	600
 Tri-core	25	550	630	720	—
	35	590	670	740	800
	50	620	710	770	830
	70	680	760	830	890
	95	740	820	880	950
	120	780	860	920	990
	150	820	900	970	1030
	185	880	960	1030	1090
	240	960	1040	1100	1160
	300	1040	1110	—	1250
 Tri-core armoured	25	620	710	800	—
	35	670	750	810	880
	50	700	780	850	920
	70	760	840	910	980
	95	810	900	960	1030
	120	860	940	1010	1080
	150	910	990	1060	1120
	185	960	1040	1110	1180
	240	1040	1120	1200	1260
	300	1120	1210	1270	1330

### IAC A-FL SERIES (STANDARD)



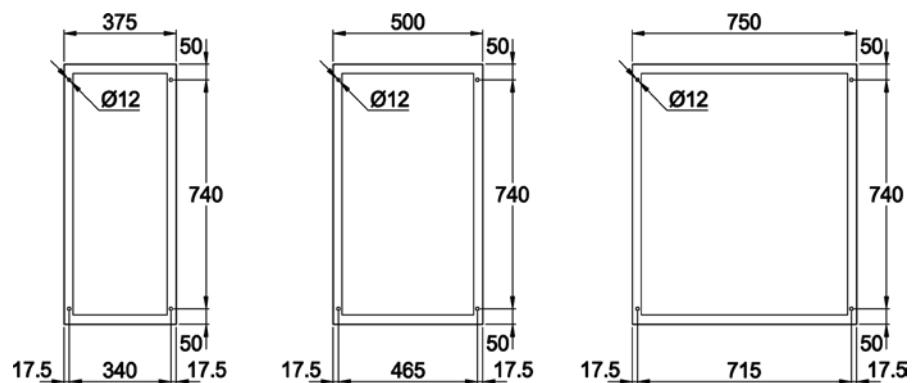
### IAC A-FLR SERIES



 Recommended area for incoming/outgoing cables.

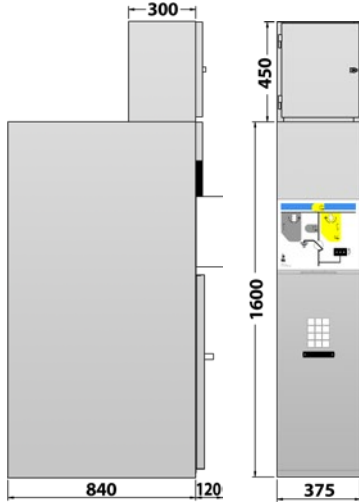
### HOLE POSITIONING FOR FLOOR FIXING

It is possible to fix the units to the floor with wedges, using the holes indicated.

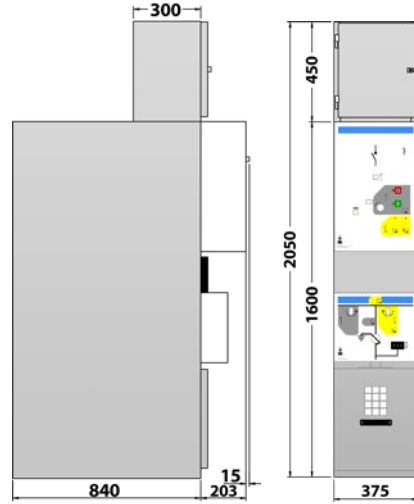


## REAR EXHAUST

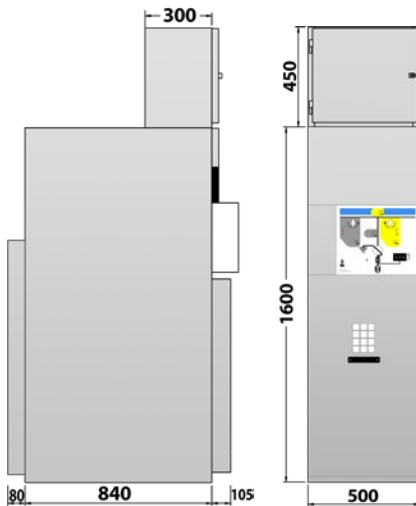
**FIS  
FFIM**



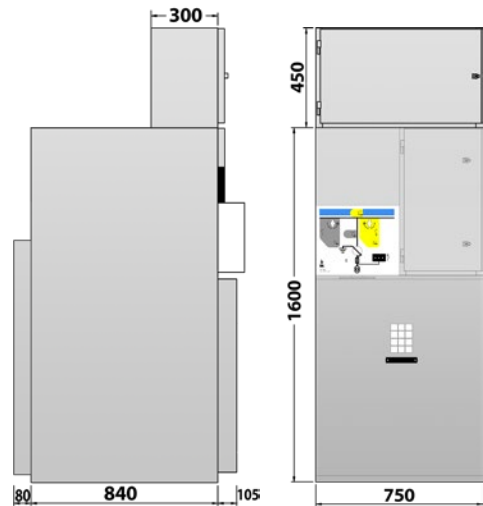
**FSMV  
FICBV  
FILCBV  
FICBVT**



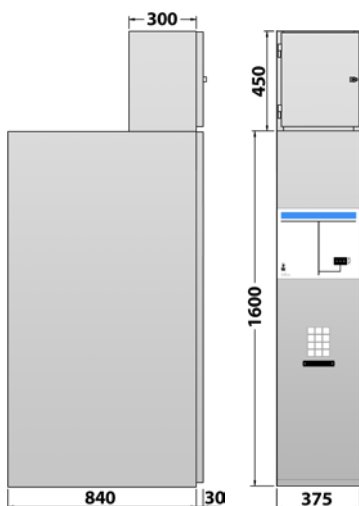
**FFIM5**



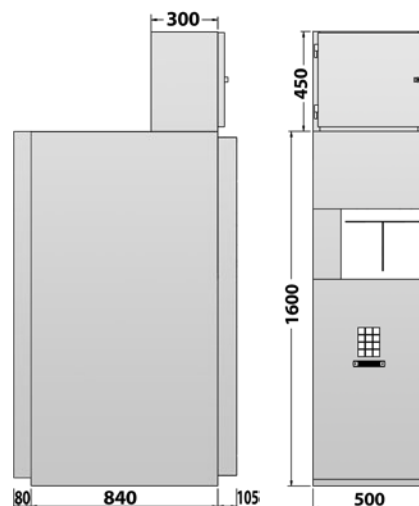
**FFIM7**



**CM  
FIOC  
MTV**

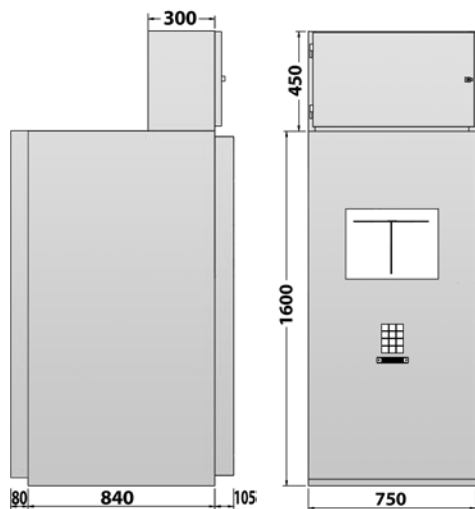


**FMM  
MTA**

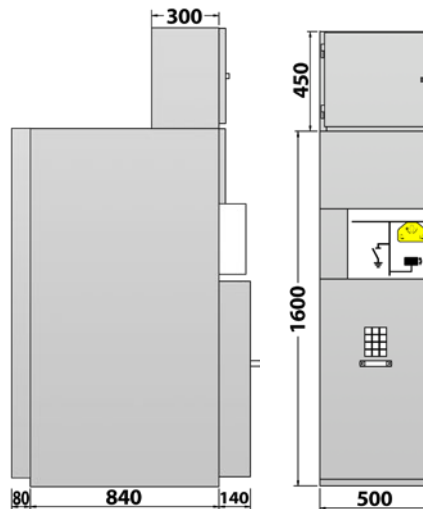


# DIMENSIONAL DATA

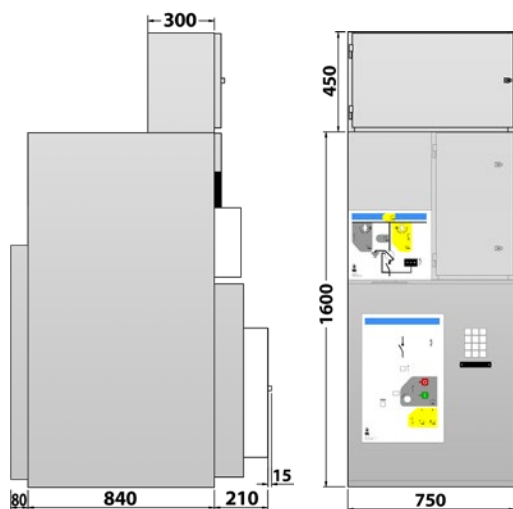
**MBMP  
MBMR  
MBMC  
MCMP**



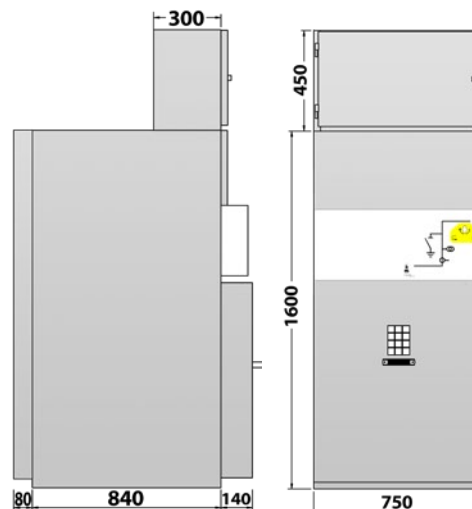
**CM5  
CME**



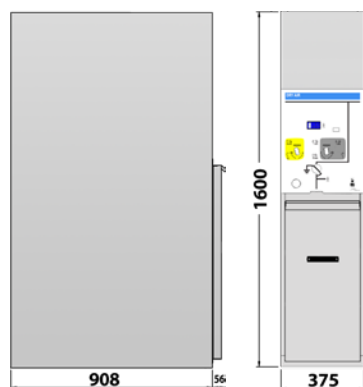
**FICB  
FICBR  
FICBLT  
F2ICB**



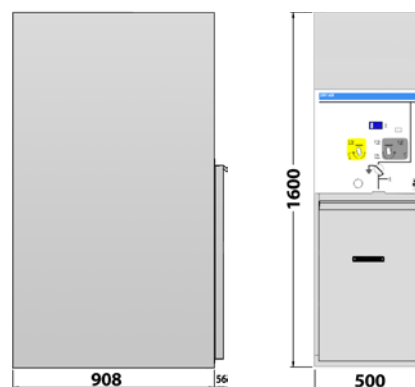
**MBER**



**FSM**

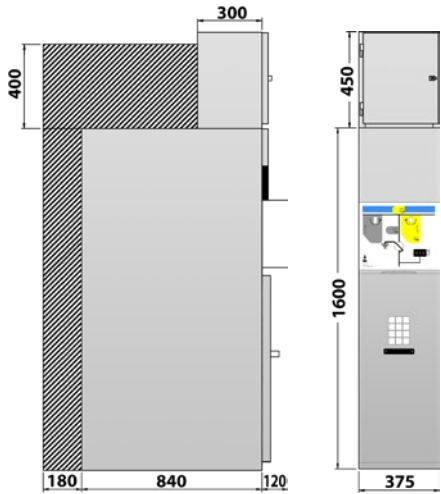


**FSM5**

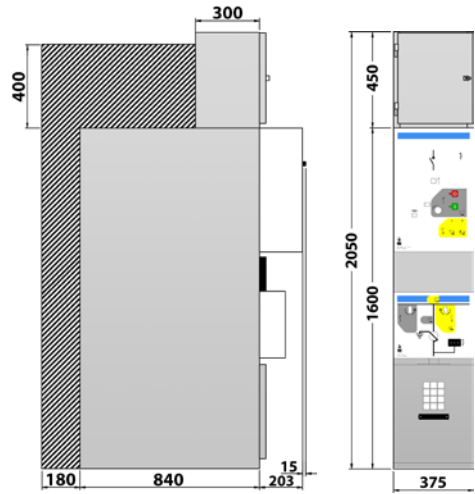


## UPWARD EXHAUST

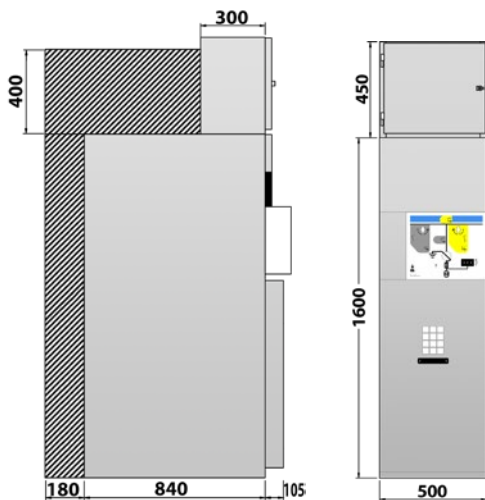
**FFIM  
FIS**



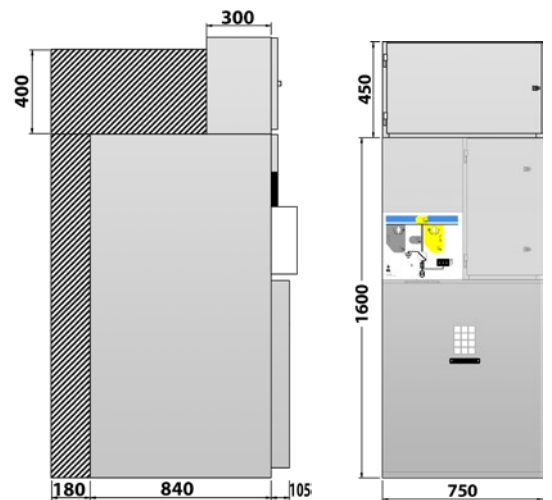
**FSMV  
FICBV  
FILCBV  
FICBVT**



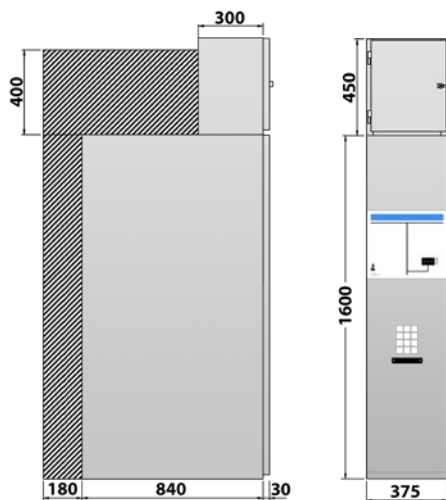
**CM5  
CME  
FFIM5**



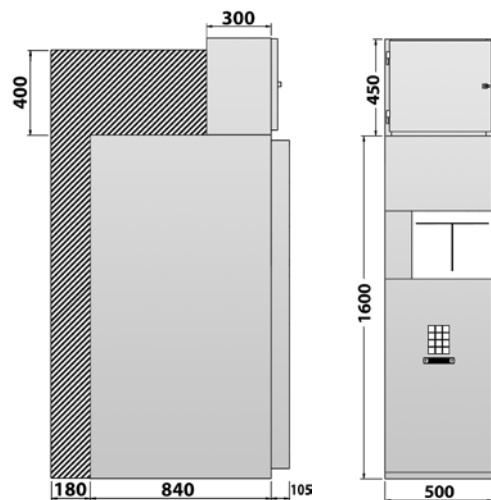
**MBER  
FFIM7**



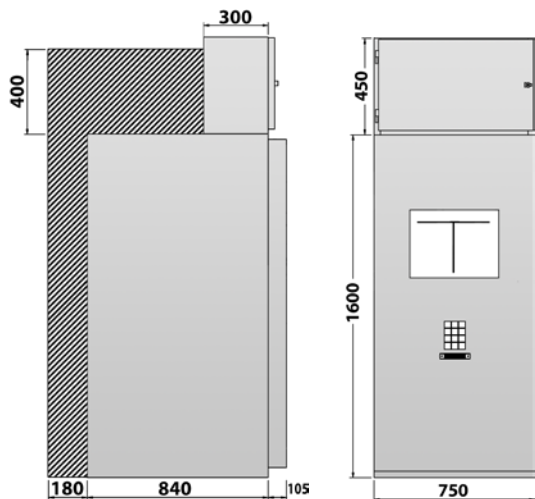
**FIOC  
CM  
MTV**



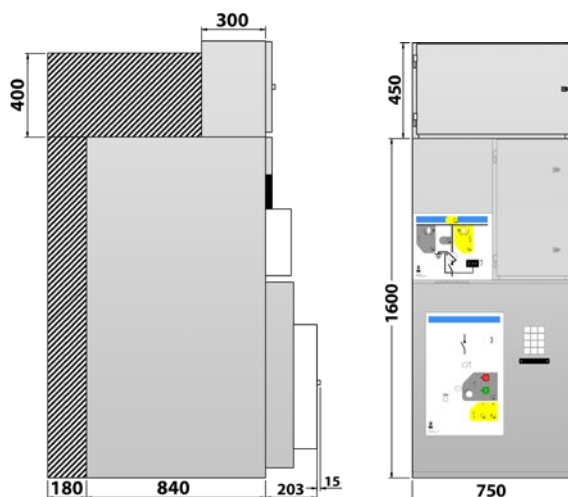
**FMM  
MTA**



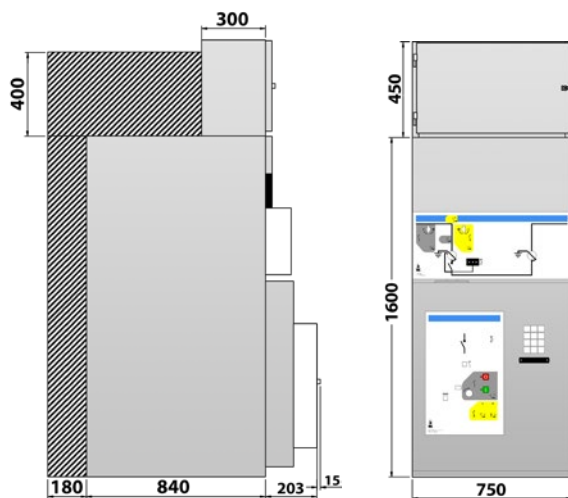
**MBMP  
MBMR  
MBMC  
MCMP**



**FICB  
FICBR  
FICBLT**

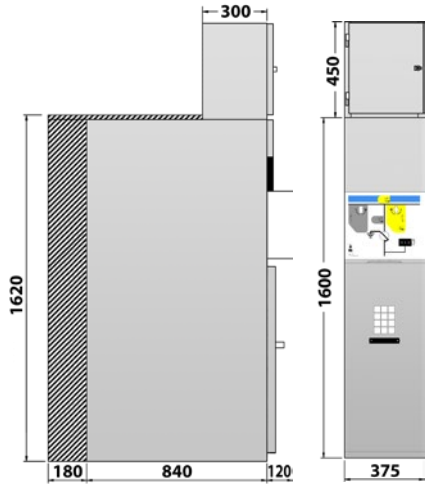


**F2ICB**

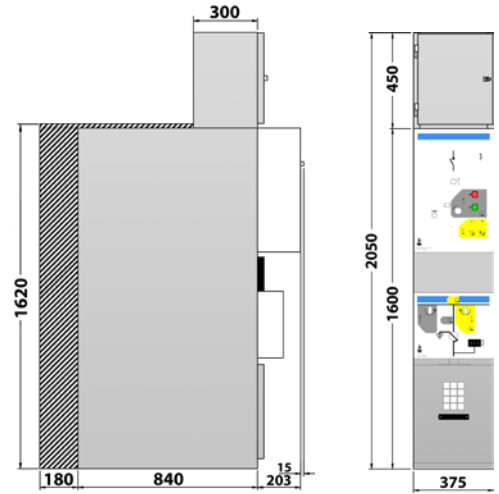


## DOWNWARD EXHAUST

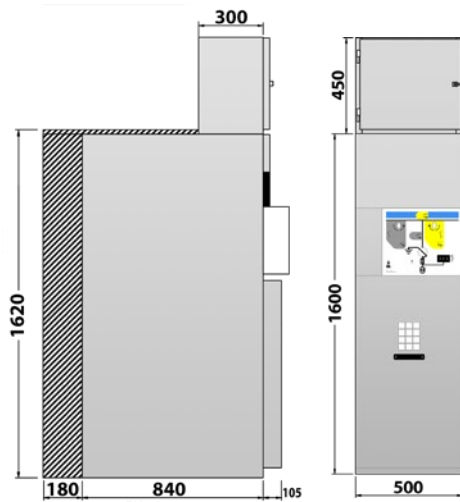
**FFIM  
FIS**



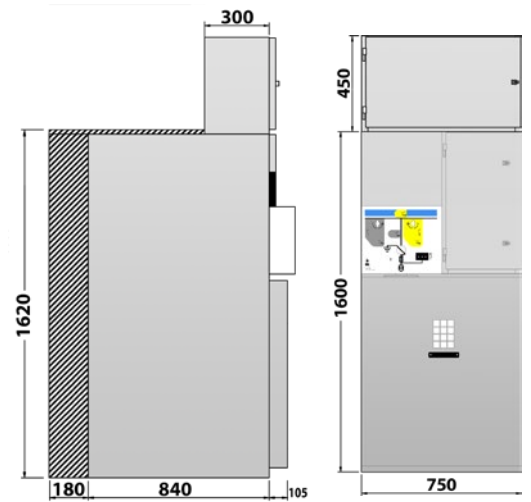
**FSMV  
FICBV  
FILCBV  
FICBVT**



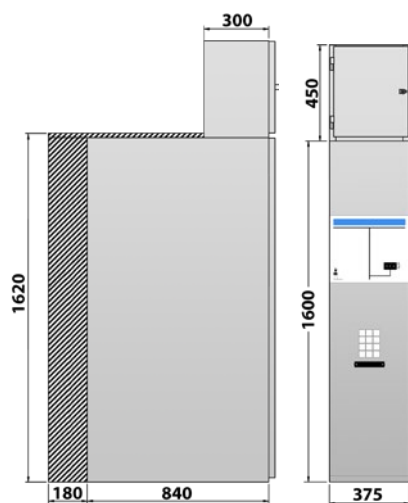
**CM5  
CME  
FFIM5**



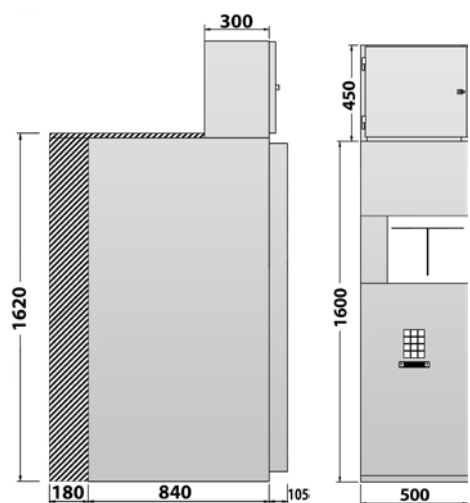
**MBER  
FFIM7**



**FIOC  
CM  
MTV**

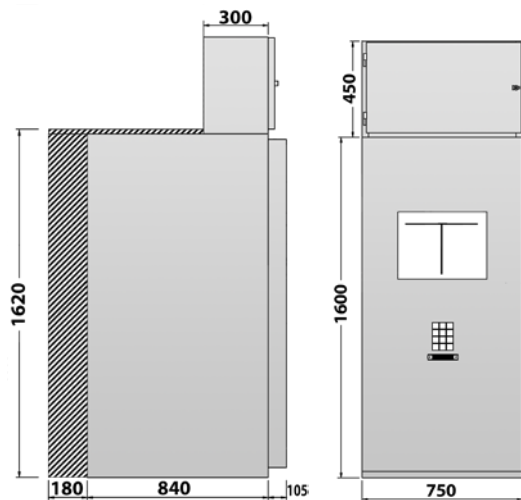


**FMM  
MTA**

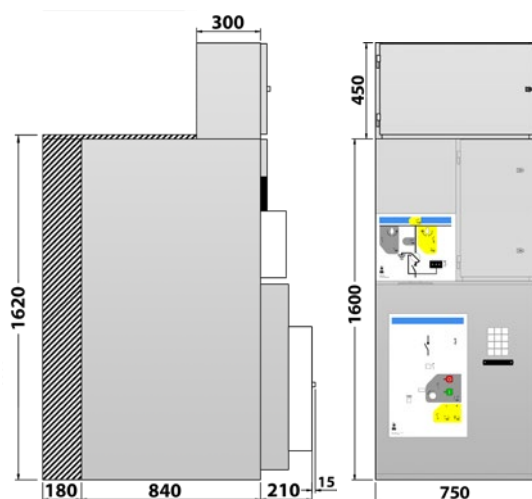


# DIMENSIONAL DATA

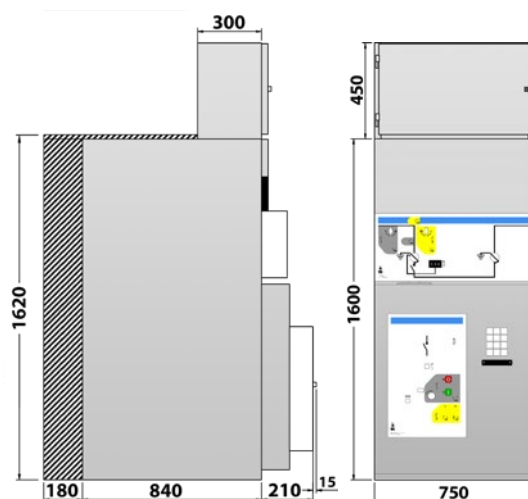
**MBMP  
MBMR  
MBMC  
MCMP**



**FICB  
FICBR  
FICBLT**



**F2ICB**



# CONTROL AND MONITORING SYSTEM

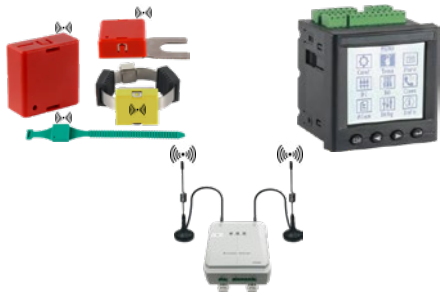
Proprietary solutions for monitoring and remote control of environmental conditions and full status of the switchgear and installation, including SCADA ready solutions.



## REMOTE CONTROL UNIT

Versatile and modular solution for distribution network automation and monitoring. Thanks to its compact dimensions, it is ideal for projects where installation space is limited.

It is now possible to collect up to 2000 signals (together with I/O modules) for direct addressing to SCADA systems via IEC60870-5-101, IEC60870-5-104, DNP3 or Modbus protocol, and it is possible to communicate with the control center through an integrated 2G/3G/4G(LTE) modem. It also features LAN and WiFi interfaces for easier configuration and access.



## TEMPERATURE SENSORS

There are different types of wireless temperature sensors with various mounting methods.

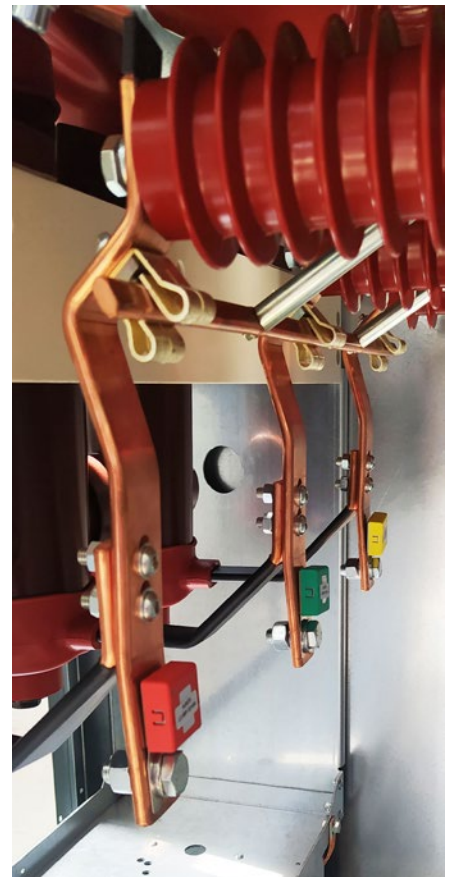
- The bolt-mounted wireless sensor is suitable for use at connections, for example between cable lugs and terminal busbars.
- The strap-fixed type is suitable for use around MV cables.
- The wireless sensor is suitable for installation on equipment surfaces or electrical contacts.
- The mini type is suitable for use on busbar ducts, cables and junctions between busbars and cables. It also operates without a battery, using CT-powered technology. With current >20A it switches on automatically.



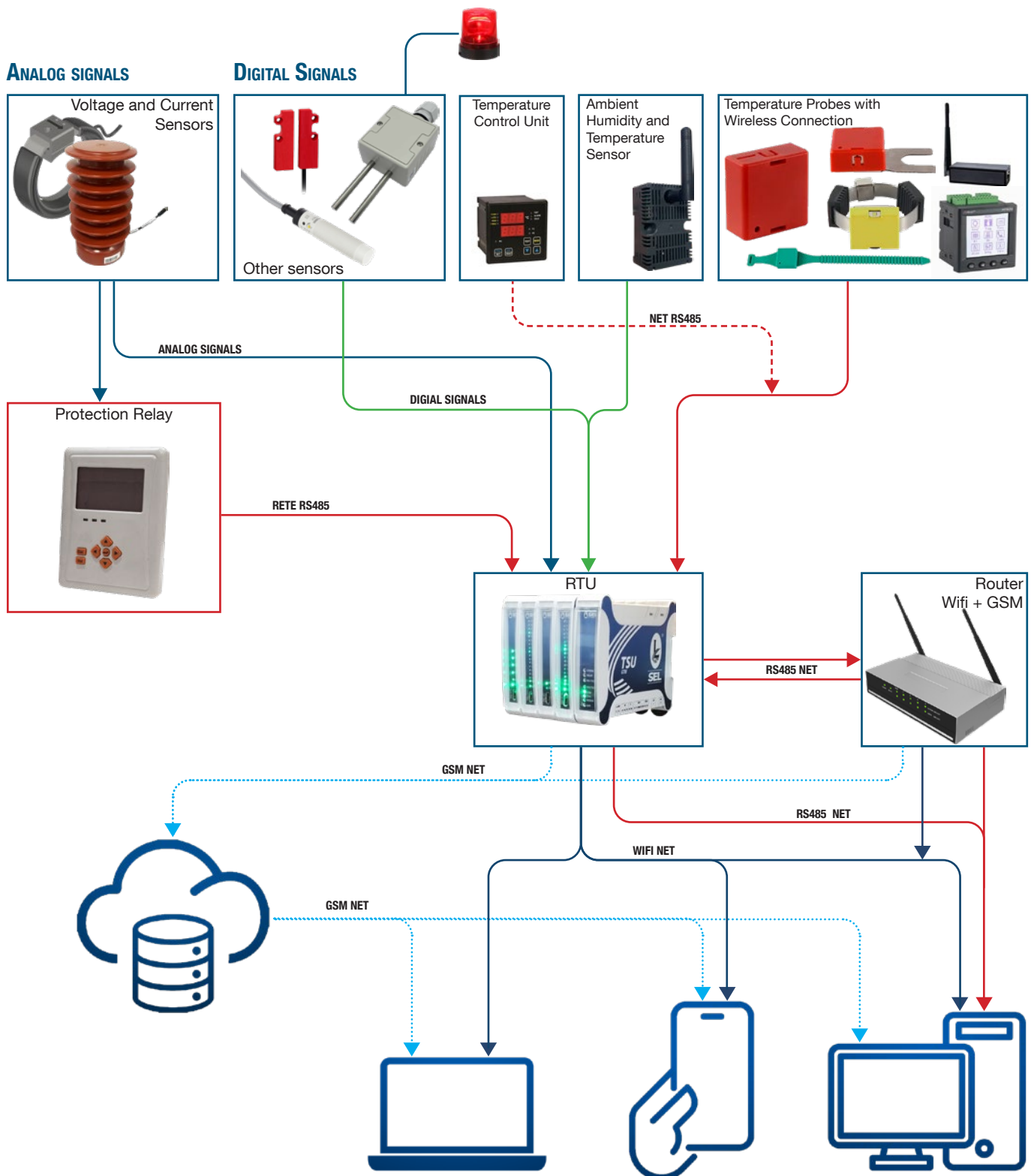
## LOW POWER VOLTAGE TRANSFORMER LOW POWER CURRENT TRANSFORMER

The voltage sensor is suitable for installation on both outgoing feeders and busbar ducts. The current sensor is suitable for cable installation.

Both sensors are suitable for retrofitting existing switchgear.



# CONTROL AND MONITORING SYSTEM - SENSORS





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