25 years of protection

FANOX

GENERAL CATALOGUE

Secondary and Primary Distribution Protection

- → Dual & Self Powered Relays
- → Overcurrent & Earth Fault Protection Relays
- → Feeder / Generator / Line / Voltage / Frequency Protection Relays
- → Transformers
- → Redundancy Protocols Gateways

IEC 61850 DLMS

Low Voltage Protection

- → Electronic Protection & Control Relays for Motors, Generators and Pumps
- → Control & Measurement Equipments
- → Earth Leakage Protection Relays
- → Transformers
- → Surge Protection Devices

25 years of protection

FANOX

Fanox designs and manufactures electronic protection relays for Low and Medium Voltage. Since it was founded in 1992, the main focus has been to help our customers to improve power systems reliability and safety at a reduced cost.

With an in-house R+D+I department always searching for the most suitable technical solution, and thanks to our innovative spirit and successfully proven experience with thousand of field installed devices operating in top conditions for years, our **SELF POWERED Protection Relays** have become a reference in the electrical sector.

Quality is a commitment to all of us in Fanox. We have been certified by DQS as an ISO 9001:2008 company.

From our headquarters at Bizkaia Technology Park in the north of Spain, we serve customers and utilities worldwide.

IBERDROLA

الهيئة الاتحادية للكهرباء والماء
Federal Electricity & Water Authority

الشركة السعودية للكهرباء
Saudi Electricity Company
طاقة مثمرة

REPSOL

ORMAZABAL
velatia

Lucy Electric

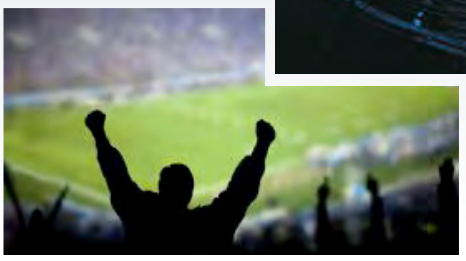
Schneider Electric

SIEMENS

Fanox protects your daily life more than you can imagine ....

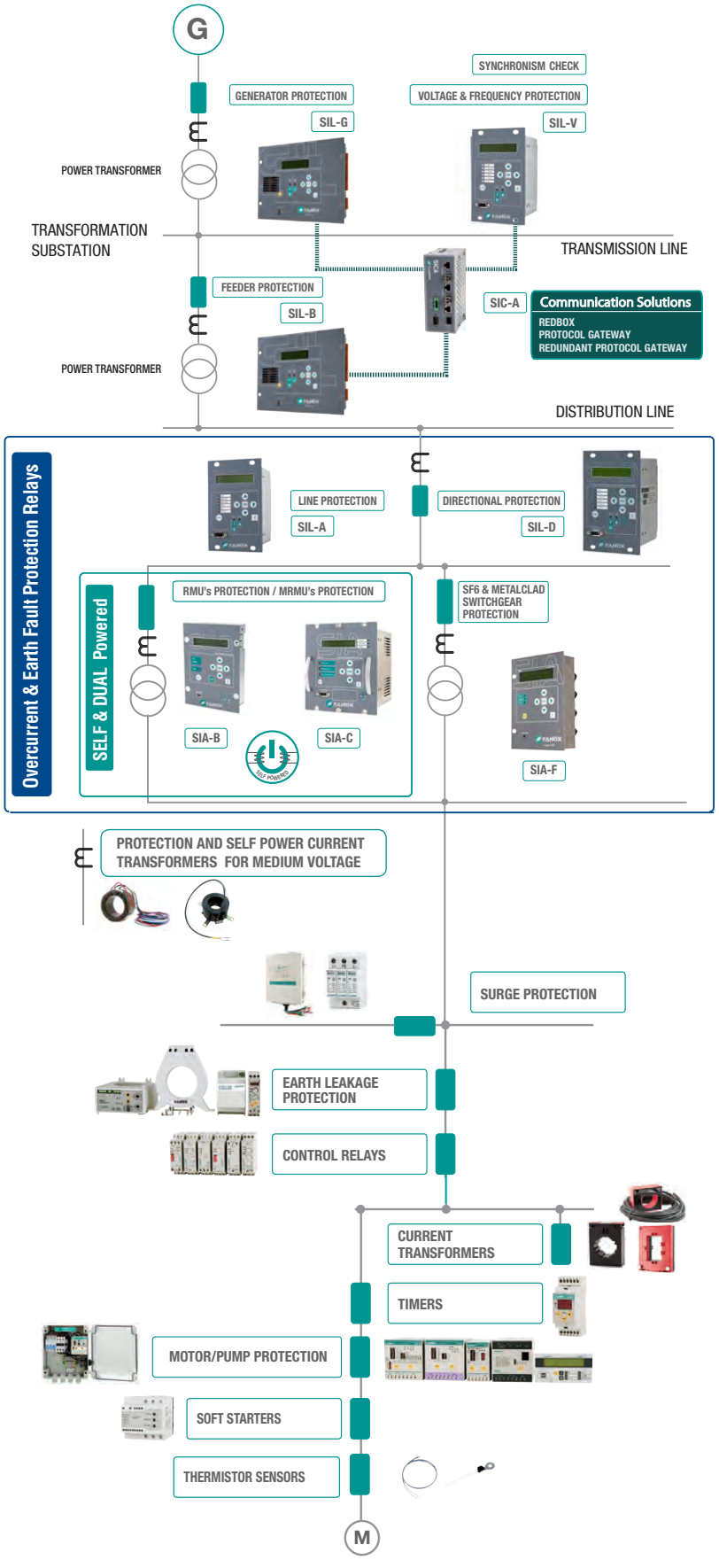
....taking care of systems operability and people safety.






FANOX PRODUCTS



PRIMARY DISTRIBUTION

SECONDARY DISTRIBUTION

LOW VOLTAGE

POWER T & D

PROTECTION & CONTROL

PROTECTION

POWER T&D

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power T&D

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Five year guarantee

FANOX power T&D

What is “self - power”?

The concept “Self-Power” defines the supplying mode of electronic protection relays for Medium Voltage.

It means that there is no need for auxiliary voltage to power the relay and that the **energy is obtained directly from the line that we are protecting.**

How do we obtain power from the line?

The energy is obtained through current transformers installed in the line we want to protect.

There are two options respecting to the transformers:

- Standard transformers /1 or /5
- Specific transformers: in this case the secondary current is not standard and they provide some special feature respect the standard Cts like a higher saturation level, or a wider measurement range.

RMUs based on switches with 3 fuses are being substituted by SF6 Circuit breakers and self powered relays.

Advantages of self-powered relays vs. fuses

Low current faults: Fuses only can break high current faults. Circuit breaker with self powered relays can detect and clear low current faults avoiding the destruction of the MV/LV transformers.

Protection Selectivity: The discrimination with fuse curves becomes difficult. It is possible to choose the right curve in self powered relays to ensure coordination between MV and LV protection.

Inrush current: Transformer energizing produces high transient inrush current. This is a natural phenomena and the protection should not operate. Fuses are not able to distinguish this current and the trip cannot be blocked. Circuit breaker with self powered relay allows greater flexibility to avoid the trip.

Temperature: Fuses are weak into harsh environment and the different temperatures can provoke 2 situation:

- ✔ High temperature: Undesired trips.
- ✔ Low temperature: The trip does not happen instead the fault current is high enough.

Saving Costs: Circuit-breaker with self power reduces costs for 2 reasons:

- ✔ Self powered relays are maintenance free.
- ✔ There is no need to keep large stocks of fuses.

Which opening mechanism will be used with self powered relays?

Self powered relays do power themselves from the primary current and the energy is scarce, so an efficient management of this energy is indispensable.

Due to this situation using coils is not viable because they have a very high electrical consumption. The solution is to use a **striker**.

But what is a striker?

It's a bistable device with a simple action. It consists on an electromagnet that is charged when the breaker is closed (To trip, it required low energy, 100 millijoules approximately) The striker shaft is moved by a spring. And activated by a polarized low power electrical signal, supplied by the relay if a fault occurs.

Could a Self-powered Relay be used if the opening mechanism is a coil instead of a striker?

Yes, it is possible to use a Self-powered Relays if the installed opening mechanism is a coil, but it is necessary to install an external device with the relay.

Fanox offers amongst its products catalogue the TCM adapter. This device is connected to the trip contact of the relay and provides the required energy to trip a coil.

How does TCM work?

TCM is an energy accumulator that can be charged, through its auxiliary supply terminals, before the installation or once the device is installed, if in the installation auxiliary supply is available. The charging time is 10 seconds approximately and once the power supply is lost the TCM has three days of autonomy.

Specialized in Ring Main Unit and Switchgear Protection

Why is Fanox the world's leading manufacturer of SELF POWERED Relays?

Our innovative spirit, the direct care of the market requirements and our extensive experience in the manufacture of protection relays, have made our **Self Powered Relays** a reference worldwide.

The relays include the latest technology: LCD, keyboard, event recording, SCADA communication, PC software ...

Utilities worldwide have relied on our technology for over 25 years.

Main advantages over other brands:

- The relays are **self powered by the current measured by the CTs fitted on the lines. The MAIN ADVANTAGE comparing with other self-powered relays in the market is that Fanox relays do not required internal batteries.** This means that the maintenance of transformation centers is heavily reduced.
- **High electromagnetic compatibility** makes FANOX relays the safest in the market. KEMA certification proves it.
- 5 years **warranty al least.**
- Standard CTs /1A or /5A can be used saving money due to specific CTs are not required.
- **Fanox self-powered relays are able to trip all the strikers in the market**. Thanks to a setting that allows the user to select the required voltage by the striker.
- Possibility of **LOCAL AND REMOTE** communication .
- Very intuitive menu, extremely **easy to set.**
- Our **flexible design** offers solutions for all the applications worldwide: coils, strikers, dual-powered installations...
- No one in the market gives more quality and specifications with so **competitive prices.**

Besides, all models can be powered from an external battery, in order to facilitate the commissioning of the centers (the settings and configuration procedure can be carried out without installing the relay), to manage the incidents that may occur and also to manage the devices in adverse conditions.

Solutions for the Smart Grid and Predictive Maintenance Network

Our relays incorporate new industry trends in remote communication protocols for automatized substations.

In all Fanox relays for Primary distribution (SIL) the protocol IEC 61850 can be included. This protocol is an international standard designed for the integration and communication of the electrical devices in the substations. Besides, it uses new concepts and the most advanced technical solutions to cover the data management and to simplify the applications and devices integration

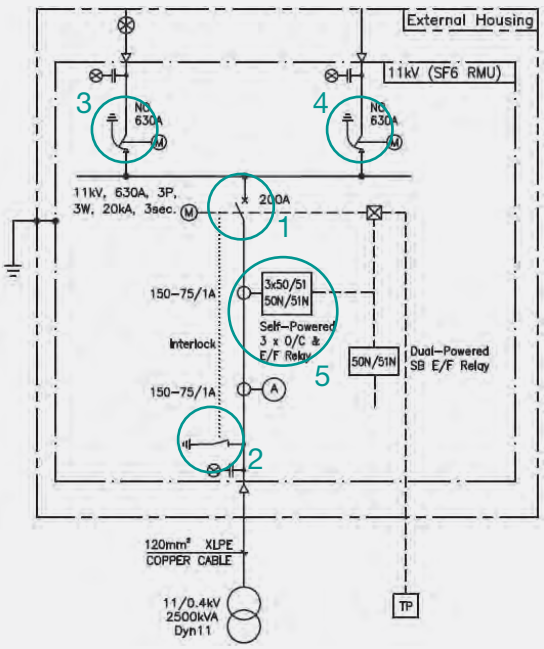
Evolution of RMU's Protection Systems

SIA-C Self and Dual Powered protection relay is the **most effective protection** relay for **SF6 RMUs** for secondary distribution (up to 13.8kV, 17.5kV, 24kV or 34.5kV). Its applications are quite varied.

But first of all...

What is a RMU?

We can define a Ring Main Unit as a standard piece of switchgear in distribution systems comprising of switches for switching power cable rings and of switches in series with fuses or circuit breakers for the protection of distribution transformers.



Breaking components:

1 Vacuum Circuit Breaker

2 Earth switch

3 Ring Switch with remote control

4 Ring Switch with remote control

5 Self Powered relay protection

Changes and developments

RMUs protection systems have experienced in recent years an outstanding development and modernization. Protection, control measurement, communication in addition to the need of simplify the maintenance of the installations are behind the current trend of change.

Switchgears and RMUs need to be **firmly and safely under control** and traditional RMUs based on switches with fuses don't meet the requirements of the market.

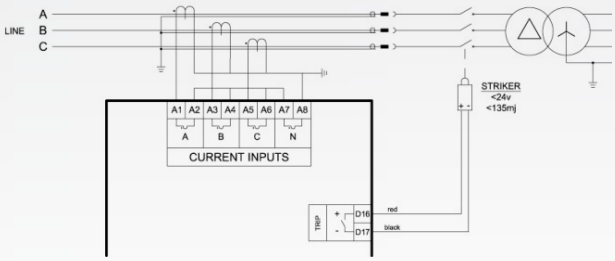
The need for electronic devices **without maintenance** has passed from a desire to a necessity.

RMUs based on switches with 3 fuses are being substituted by SF6 **circuit breakers** and **self powered protection relays**. This way, batteries are removed, events and alarms of the RMU are stored in the relay and the Grid can be remotely motorized thanks to the communications that FANOX's protection relays have.

In most cases there is a lack of access to the installation. Not all facilities are roadside. Some are buried, or in areas of difficult access where replacing a fuse can entail a big problem.

Circuit breaker can be opened by the action of tripping coils or tripping strikers. When self powered relays are installed in the SF6 RMUs, the circuit breaker is opened by the action of a **tripping striker** that is activated by up to a 24V supply that the self powered relay provides.

The striker is an electromagnet that is loaded at the closing of the switchgear, and is required low-energy trigger to release them. Different models and tensions, and in general the selection of it is a compromise between mechanical security and tripping energy, but in general are a reliable and high quality element.



RMUs for primary distribution have a capacity of up to 50kA short circuits, rated currents up to 4000A. They usually use vacuum circuit breakers and air isolation.

RMUs for secondary distribution have a capacity of up to 21kA short circuit, rated currents up to 630A. They usually use vacuum circuit breakers and SF6 isolation.

All these improvements are focused in having the installation under the safest control and in saving cost in terms of material and personnel.

Fanox as a specialist in SELF POWERED relays, is the best ally to adapt your switchgear to what market demands.

Protection functions & Standards

Function 50
Instantaneous phase overcurrent

Function 50N and 50N/G
50N = Instantaneous neutral overcurrent internally calculated ($I_A+I_B+I_C$)
50N/G = Instantaneous neutral overcurrent measured

Function 50/51
Inverse time phase overcurrent

Function 50/51N and 50/51 N/G
50/51N = Inverse time neutral overcurrent internally calculated ($I_A+I_B+I_C$)
50/51 N/G = Inverse time neutral overcurrent measured

Curves IEC 60255-151 and ANSI
Standard curves are used for the protection functions
- 50/51, 50/51N, 46, 67 y 67N:
- Normally inverse
- Very inverse
- Extremely inverse
- Definite time

Function 49
Thermal overload protection.

Function 49T (External Trip)
There is a direct trip input, normally associated with a bimetallic contact that is fitted to the power transformer, which serves as a backup for the current functions. In order for it to be a real backup, this input is not related to the protection processors. This means that the processors do not read the input and trip the striker, but the input acts directly on the striker, remaining operational for as long as the equipment is powered. This input is especially protected against electromagnetic noise.

Function 81U
Underfrequency protection

Function 81O
Overfrequency protection

Function 25
Synchronism check

Function 46
Inverse time negative sequence overcurrent

Function 59
Defined time phase overvoltage

Function 59N
Defined time neutral overvoltage

Function 27
Defined time phase undervoltage

Function 37
Phase undercurrent

Function 32/40
Defined time directional overpower

Function 79, auto-recloser
This function is the responsible of reclosing the breaker when a fault occurs.

Function 67
It uses the voltage between phases as the polarization magnitude and the phase current as the operating variable. If the directional function 67 is not enabled, it behaves as a 51/50 function.

The operative time starts when the following conditions are met simultaneously:
- Polarization voltage higher than setting
- Phase current higher than setting
- Gap between phase current and polarization voltage is such that the phase current is within the area of the intervention.

Function 67N, Neutral directional protection
It uses the residual voltage as the polarization magnitude and the residual current as the operating variable. If the directional function 67N is not enabled, it behaves as a 50/51 N/G Function. The operative time starts when the following conditions are met simultaneously:
- residual voltage higher than setting
- residual current higher than setting
- the gap between the residual current and residual voltage is such that the residual current is within the area of the intervention.

Trip Block for Switch disconnector protection
Many transformation centers have a disconnector as a break element. As line breakers have a limited opening current, with short-circuit events at high currents the responsibility for opening falls on the fuses, because otherwise, opening the line breaker would mean destroying it. In order to deal with these situations, tripping either in phase or neutral is blocked when the measured current exceeds a preset value.

Function 68, Logical Trip bus
Function 68 allows the creation of a coordinated net of equipments installed in different levels of the line which enables the blocking or the tripping and whose objective is clearing the fault in the least damaging place of the application.

Function 86
Function 86 allows to latch (lock out) the contact trip due to programmable logic (PLC).

Function 52
This function allows monitoring of circuit breaker state and makes a preventive maintenance.

Function 50BF
This function allows showing a possible error of the circuit breaker opening.

Function 74TCS, Trip Circuit Supervision
This function allows the supervision of breaker's trip circuit.

Function CLP, Cold Load Pick-up
This unit is used in order to avoid non-desirable operations of overcurrent functions when the line is not energized.

Function 74CT
Current transformer supervision

Function 46BC
Open phase detection

MEASUREMENTS
Phase and neutral are measured with an accuracy of ±2% over a band of ±20% of nominal and ±4% over the rest of the measurement range. The measurement range is from 0.02 until 30 times nominal current.

TIME SYNCHRONIZATION
- IRIG-B: GPS Time Synchronization Protocol
- Communications protocol synchronization.

SETTINGS GROUPS
The relay has up to 4 settings groups for the protections settings.

HMI
The HMI consists of:
- A 20x2 LCD screen with alphanumeric characters that allow the equipment parameters to be set (adjusted) and monitored (measurements, statuses, events).
- A membrane keyboard with six keys that allow you to navigate the menus and access information of interest. A seventh button "RESET", allows you to reset the bistable and led indicators and the events log. For security reasons, an access code is needed to modify the settings.
- LED indicators showing the type of power supply being used at all times. The relay can use more than one power source at one time.
- Bistable magnetic indicators that signal the cause of tripping. These indicators remain in position when the equipment loses power, reducing the time the maintenance service needs to identify the cause of tripping.

EVENTS RECORD
Events are recorded and ordered chronologically (up to 1024), allowing you to analyse what has happened with the installation over time (start-ups, tripping power supplies, etc.). They are recorded chronologically to the nearest millisecond in real time, thanks to the Real Time Clock (RTC). Events can be recorded on a non-volatile FRAM memory.

FAULT REPORT
A fault report is a record of specific events in the period of time when a fault occurs. Having a specific events record for the fault period is a significant help to resolve an incident.

OSCILLOGRAPHY RECORDS
The relay stores up to 5 oscillographic logs and 20 fault reports, with a resolution of 16 samples/cycle. The oscillography can be downloaded by communications through the Modbus protocol. The SICom communications program allows the oscillography to be downloaded and saved in COMTRADE format (IEEE C37.111-1991).

COM PORTS
The relay has up to 3 communication ports in different format: USB, RS232, RS485, FOP, FOC, RJ45 (Ethernet).

COM PROTOCOLS
The relay supports the different protocols: ModBus RTU, Modbus TCP/IP, IEC60870-5-103, IEC60870-5-104, DNP3.0 (TCP/IP), DNP3 Serial, IEC61850.

COMMUNICATIONS
The relays have a communication local port on the front of the equipment and rear ports on the back for remote communication. The SICom software with Windows® W7, W8, W8.1 and W10 uses a graphic user interface to allow you to access all equipment information, modify the settings and save events.
The software can be used locally by using the front port or remotely by using the rear RS485 port when the protocol is ModBus RTU.

TEST MENU
This allows you to use the HMI to verify correct operation of the LEDs, the bistable magnetic indicators, the trip contact and the outputs.
Activating the trip contact from the test menu allows you to verify correct operation of the opening mechanism simply.

SELF-DIAGNOSIS
Diagnostic algorithms to generate the corresponding events are executed on starting up the equipment and all the time the relay is operating.

Protection functions & Standards

• EMC requirements - Emission

Test Name	Relay Test	LEVELS
Radiated emission	IEC 60255-26 EN 55022 EN 55011	Radiated emission limit for Class A (group 1 for EN 55011) on Enclosure port. Frequency range 30MHz - 230MHz (Quasi Peak 40dBµV/m). Frequency range 230MHz - 1000MHz (Quasi Peak 47dBµV/m)
Conducted emission	IEC 60255-26 EN 55022 EN 55011	Conducted emission limit for Class A (group 1 for EN 55011) on Auxiliary power supply port. Frequency range 0.15MHz – 0.5MHz (Quasi Peak 79µV, Avg 66µV). Frequency range 0.5MHz – 30MHz (Quasi Peak 73µV, Avg 60µV)

• EMC requirements - Immunity

Test Name	Relay Test	LEVELS
1MHz damped oscillatory waves	IEC 60255-26 IEC 61000-4-18	Class 3, Repetition frequency 400Hz, Duration of each application 3s. Common mode for all terminals ±2.5kV. Differential mode for all terminals excepts Communication port ±1kV
Electrostatic discharge	IEC 60255-26 IEC 61000-4-2	Level 4, Contact discharge ±8kV. Air discharge ±15kV
Radiated radiofrequency electromagnetic fields	IEC 60255-26 IEC 61000-4-3	Level 3, Test field strenght 10V/m, Frequency 80MHZ - 1000MHz and 1400MHz - 2000MHz, AM Modulation 80% for 1KHz carrier sinusoidal signal
Electrical fast transients	IEC 60255-26 IEC 61000-4-4	Level 4, Power supply to Earth terminals ±4kV, Signal and control terminals ±2kV. Repetition frequency 5KHz, Burst duration 75s.
Surge	IEC 60255-26 IEC 61000-4-5	Level 4, Line to earth for all terminals ±4kV. Line to Line for all terminals excepts Communication port ±2kV
Conducted disturbance induced by radio frequency fields	IEC 60255-26 IEC 61000-4-6	Level 3, Applied voltage 10V, Frequency 0.15MHz - 80 MHz, AM Modulation 80% for 1KHz carrier sinusoidal signal, Dwell time 1s., Test duration >10s.
Voltage dips, short interruptions and voltage variations	IEC 60255-26 IEC 61000-4-11 IEC 61000-4-29	DC Voltage Dips: 40%, 130ms and 70%, 100ms, 3 times every 10s. DC Voltage Interruption: 100ms, 3 times every 10s.
Ripple on DC input power port	IEC 60255-26 IEC 61000-4-17	Level 4, Ripple 15%, 50Hz and 100Hz
Power frequency magnetic field	IEC 60255-26 IEC 61000-4-8	Level 5, Continuous field strenght 100 A/m. Short field strenght for a duration of 3s. 1000 A/m. Frequency 50Hz.
100KHz damped oscillatory waves	IEC 61000-4-18	Class 3, Repetition frequency 40Hz, Duration of each application 3s. Common mode: ±2.5kV. Differential mode: ±1kV
Pulse magnetic fields	IEC 61000-4-9	Field strenght 1000 A/m, Cadence between pulses 40s.
Damped oscillatory magnetic fields	IEC 61000-4-10	Level 5, Field strenght 100 A/m, Frequency 100KHz and 1MHz, Repetition frequency 40 trans./s at 100KHz, 400 trans/s at 1MHz, Duration of each application 3s.
Ring wave immunity test	IEC 61000-4-12	Level 4, Line to earth for all terminals ±4kV. Line to Line for all terminals excepts Communication port ±2kV

• Product safety requirements (including thermal short time rating)

Test Name	Relay Test	LEVELS
Impulse voltage	IEC 60255-27 IEC 60255-5	Each group to earth and with rest of the groups in short-circuit ±5kV. Differential mode for each one of the groups ±1kV
AC or DC dielectric voltage	IEC 60255-27 IEC 60255-5	Each group to earth and with rest of the groups in short-circuit 2kVac, 50Hz, 1 minute
Insulation resistance	IEC 60255-27 IEC 60255-5	500V applied between each group to earth and with rest of the groups in short-circuit
Protective bonding resistance	IEC 60255-27	Test current 2xIn, Test voltage 12Vac during 60s. Resistance shall be less than 0.1 ohm

• Burden

Test Name	Relay Test	LEVELS
AC burden for CT	IEC 60255-1	Declared on manual
AC burden for VT		
AC, DC burden for power supply		
AC, DC burden for binary inputs		

• Contact performance

Test Name	Relay Test	LEVELS
Contact performance	IEC 60255-27	

• Communication requirements

Test Name	Relay Test	LEVELS
Communication requirements	ModBus RTU IEC 61850 IEC 60870-5-103 IEC 60870-5-104 DNP 3.0	

• Climatic environmental requirements

Test Name	Relay Test	LEVELS
Cold	IEC 60068-2-1	Cold Operation Ab, -25ºC, 72h Cold transport & Storage Ad, -40ºC, 72h
Dry heat	IEC 60068-2-2	Dry Heat Operation Bb, +70ºC, 72h Dry Heat transport & Storage Bd, +85ºC, 72h
Change of temperature	IEC 60068-2-14	Change of Temperature Nb, Upper temp +70ºC, Lower temp -25ºC, 5 cycles, Exposure time 3h, Transfer time 2 min.
Damp heat	IEC 60068-2-30	Damp Heat Cyclic Db, Upper temp +40ºC, Humidity 93%, 2 cycles. Relay energized
	IEC 60068-2-78	Damp Heat Steady State Test Cab, Upper temp +40ºC, Humidity 85%, 2 days. Relay not energized

• Mechanical requirements

Test Name	Relay Test	LEVELS
Vibration	IEC 60255-21-1 IEC 60068-2-6	Vibration response, Class 1, 10Hz to 59Hz, 0,035mm and 59Hz to 150Hz, $0.5g_n$ Vibration endurance, Class 1, 10Hz to 150Hz, $1g_n$
Shock	IEC 60255-21-2 IEC 60068-21-2	Shock Response, Class 1, $5g_n$, Shock Withstands, Class 1, $15g_n$
Bump	IEC 60255-21-2 IEC 60068-21-2	Bump, Class 1, $10g_n$
Seismic	IEC 60255-21-3 IEC 60068-21-3	Single Axis Sine Sweep, Class 1, X Axis: 1 to 9Hz, 3.5mm and 9 to 35Hz, $1g_n$; Y Axis: 1 to 9Hz, 1.5mm and 9 to 35Hz, $0.5g_n$

• Electrical environmental requirements

Test Name	Relay Test	LEVELS
CT Input continuous overload	IEC 60255-27	3xIn without damage for continuous operation
CT Input short time overload	IEC 60255-27	70xIn without damage for 1s short time overloading
VT Input continuous overload	IEC 60255-27	Declared on manual, without damage for continuous operation
VT Input short time overload	IEC 60255-27	Declared on manual, without damage for 10s short time overloading

• Enclosure protection

Test Name	Relay Test	LEVELS
Enclosure protection	IEC 60255-27 IEC 60529	IP-54

• Quality Management System

Test Name	Relay Test	LEVELS
Quality Management System	ISO 9001:2008	

Product selection guide

SIA	OC & EF FOR SECONDARY DISTRIBUTION		
	SELF & DUAL POWERED (SELF+AUX)		AUXILIARY POWERED
	SIA-B	SIA-C	SIA-F
Auxiliary Supply	24Vdc 110Vac 230Vac	24Vdc 230Vac 48 Vdc 85-265 Vac/Vdc	24–220 Vdc /48-230 Vac
Self Power Supply	3.2A, 6.4A, 12.8A, 25.6A or 51.2A depending on the CT. (x3)	0,1 In (x3)	
External battery	USB cable/ Power bank	KITCOM	USB cable/ Power bank
Internal battery	✔ (*)	✔ (*)	
Consumption	0,5 W	0,5 W	1,5 – 2,2 W
CT	Specific CT	Standard 2,5VA	Standard 0,5VA
50	1	2	1
50N/G		2	1
50N	1		
50/51	1	1	1
50/51N/G		1	1
50/51N	1		
52			1
50BF			1
49	1		1
49T	1	1	1
CLP			1
Trip Block	1		1
68 (Trip Bus)		1	1
86		✔	✔
Programmable Logic	V3	V3	V3
Counters			✔
Commands			✔
Sett. Group	2	4	3
Inputs	1	1+EXT. TRIP	2
Outputs	- / 2NC - NO	2 NC - NO / 3 NO	1 NO +1 NC - NO
Output for STRIKER	1X (24 Vdc – 135 mJ)	1X (24 Vdc – 135 mJ)	NO
LEDs	2 LEDs +1MAG.FLAG	3 LEDs +3 MAG.FLAGS	3 LEDs configurable
HMI	20X2 LCD + 7 keys	20X2 LCD + 7 keys	20X2 LCD + 7 keys
Event	100	1024	200
Fault Report	4	20	4
Oscillography			1 record x 22 cycles
Current demand		✔	
Local Port (frontal)	USB	RS232	USB
Remote Port (rear)	RS485	RS485	RS485
Communications Protocols	ModBus RTU	ModBus RTU	ModBus RTU / DNP3.0 (Serial)
Size of	Vertical: 120.65 x 167.80 mm Horizontal: 185,80 x 102,7 mm	Vertical Compacto: 177 x 155 mm Vertical Estándar: 177 x 189 mm Horizontal: 177,8 x 290,3 mm	167,80 x 120,65 mm

(*) The internal battery is only an accessory. The relay operates independently of the battery. Its function is to allow the user to set the relay and analyze the information stored in fault reports and in the event menu when the relay is not powered, for example during the commissioning.

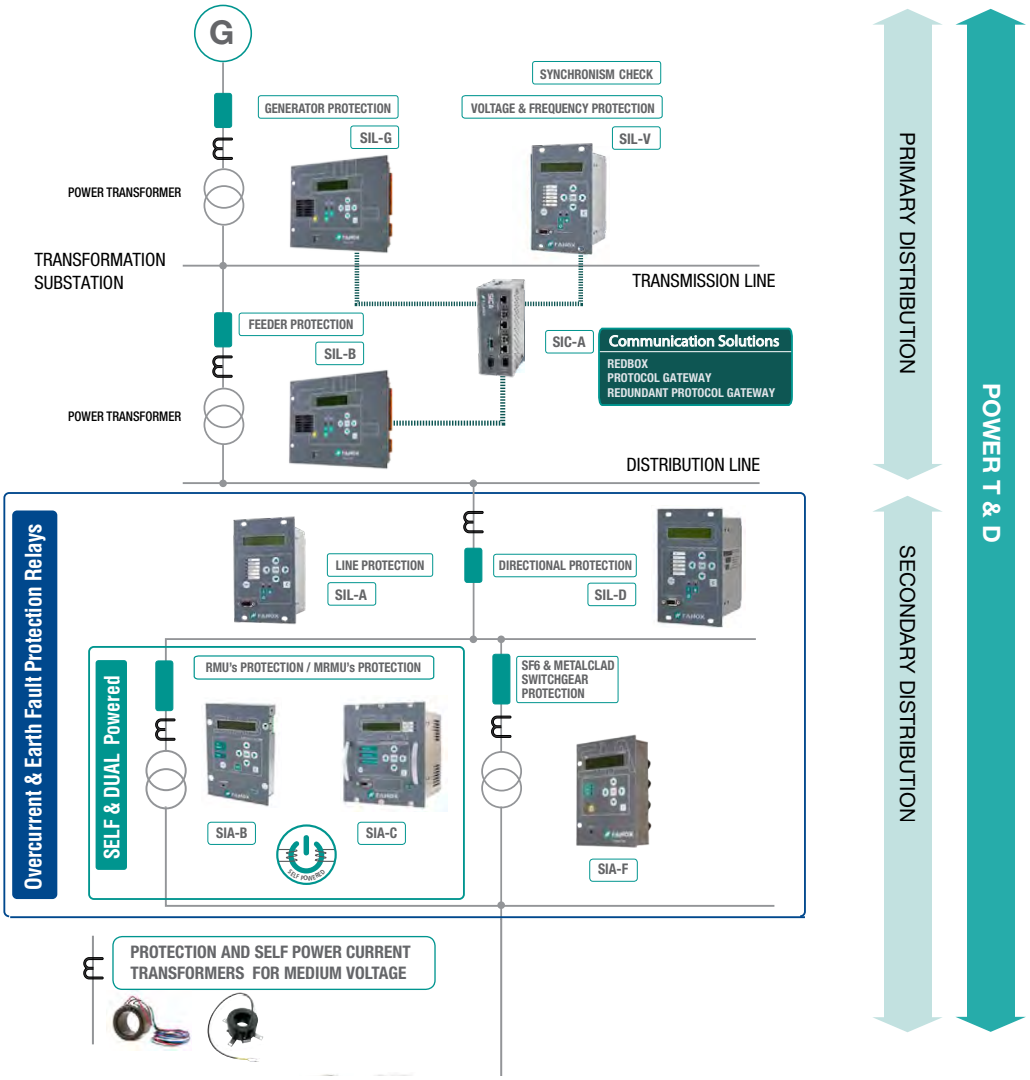
Product selection guide

FANOX power T&D

SIL

	OC & EF FOR PRIMARY DISTRIBUTION		FEEDER PROTECTION	GENERATOR PROTECTION	
	SIL-D	SIL-A	SIL-B	SIL-G	SIL-V
Auxiliary Supply	24-220 Vdc/48-230 Vac	24-220 Vdc/48-230 Vac	24–48Vdc 90-300Vdc/110-230 Vac	24–48Vdc 90-300Vdc/110-230 Vac	24-220 Vdc/48-230 Vac
Consumption	3,3 – 4,5 W	3,3 – 4,5 W	3,3 – 5,5 W	3,3 – 5,5 W	3,3 – 5,5 W
Current measurement	Standard CT 0,5VA	Standard CT 0,5VA	Standard CT 0,5VA	CT estándar 0,5VA	
LPCT		✔			
Voltage measurement			VT	VT	VT or directly from the line
VT connection type					Adjustable
50	2	2	2	2	
50N/G	2	2	2	2	
50/51	1	1			
50/51N/G		1			
67NI	2				
50/51/67N	2		2	2	
50/51/67			2	2	
52	1	1	1	1	1
BF	1	1	1	1	1
49		1	1	1	
49T	1	1	1	1	
79	1	1	1	1	1
46		1	1	1	
CLP	1	1	1	1	
74TCS	1	1	1	1	1
Trip Block	1	1			
68 (Trip Bus)		1			
86	✔	✔	✔	✔	✔
46BC		✔			
74CT					
Programmable Logic	V3	V3	V1	V1	V3
37		1	2	2	
59			2	2	2
59N			2	2	2
47					1
27			2	2	2
27V1					1
32/40			4	4	
81U/O			4	4	4
25			1	1	1
81R				4	2
78				2	1
IRIG-B			✔	✔	
Counters	✔	✔	✔	✔	✔
Commands	✔	✔	✔	✔	✔
Sett. Group	4	4	3	3	3
Inputs	6	6	8	8	6
Outputs	2 NO + 2 NC - NO	2 NO + 2 NC - NO	2 NC - NO + 5 NO	2 NC - NO + 5 NO	2 NO + 2 NC - NO
LEDs	8 configurable	8 configurable	6 configurable	6 configurable	8 configurable
HMI	20X2 LCD + 7 keys	20X2 LCD + 7 keys	20X2 LCD + 7 keys	20X2 LCD + 7 keys	20X2 LCD + 7 keys
52 & 79 HMI	2 led's + 3 keys	2 led's + 3 keys	2 led's + 3 keys	2 led's + 3 keys	2 led's + 3 keys
Event	200	200	1000	1000	200
Fault Report	20	20	20	20	20
Oscillography	5 records x 100 cycles	5 records x 100 cycles	2 records x 138 cycles	2 records x 138 cycles	5 records x 88 cycles
Current demand		✔			
Local Port (frontal)	RS232	RS232	USB	USB	RS232
Remote Port (rear)	RS485 or Ethernet	RS485 or Ethernet	RS485 + RS485 Ethernet + RS485	RS485 + RS485 Ethernet + RS485	RS485 or Ethernet
Communications Protocols	ModBus RTU IEC60870-5-103 IEC60870-5-104 DNP3.0 (TCP/IP) IEC61850	ModBus RTU IEC60870-5-103 IEC60870-5-104 DNP3.0 (TCP/IP)/Serial IEC61850	ModBus RTU IEC60870-5-103 IEC60870-5-104 DNP3.0 (TCP/IP) IEC61850	ModBus RTU IEC60870-5-103 IEC60870-5-104 DNP3.0 (TCP/IP) IEC61850	ModBus RTU IEC60870-5-103 IEC60870-5-104 DNP3.0 (TCP/IP) IEC61850
Size of	177 x 107 mm	177 x 107 mm	241,30 x 177,80 mm	241,30 x 177,80 mm	177 x 107 mm

PRODUCT APPLICATION GUIDE



More than
15 YEARS
in field

RECLOSER
control

SCADA
COMMUNICATIONS


RETROFIT
Applications

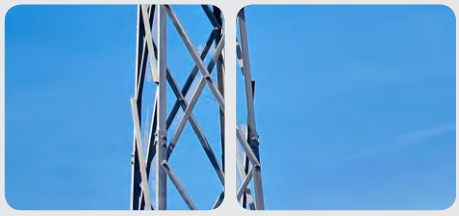
INTERNATIONAL
APPROVALS
ENA
ADWEA
FEWA & DEWA
SEC
K-ELEKTRIC
EDD, QTE, TNB...


LOAD
Management


Withdrawable
Relays

SIA

Protection relays for Secondary Distribution



Specially indicated for RMUs and SF6 insulated switchgears.

Models with standard and specific CTs and magnetic indicators.

Dual & Self powered protection relays.

Overcurrent & Earth Fault Protection.

Introduction to SIA Relays

The range of SIA relays is designed to protect the secondary transformer and distribution substations of electrical networks. Features include protection against instantaneous and inverse time overcurrent (for phase and neutral) as well as an external trip support (temperature, pressure, etc.)

The protection functions can be enabled by using both control panel and the communications link to the SICom progamme. Combining the setting and IEC/ANSI-IEEE curves available, allows for precise coordination with other equipment.

Dual & Self powered protection relays

The outstanding feature of the SIA-C and SIA-B models is that they are dual/self-powered and function by employing the operating current of the installation. This means that maintenance of transformer and distribution substations is heavily reduced. All batteries, chargers and other external power elements are made redundant.

Furthermore a great advantage is that these relays ease commissioning and start-up of installations, and also make it easier to manage the equipment in adverse conditions. All models can be powered from an external battery portable kit (Kitcom), guaranteeing total operation of the relay, including trip functions occurring due to external faults.

SIA-B

Overcurrent and Earth Fault Protection Relay for Secondary Distribution

Dual & Self Powered / Specific CTs

Main characteristics

- The SIA-B is a Dual & Self powered overcurrent protection relay using the operating current through three specific current transformers fitted on the lines. These transformers are also used to obtain current measurements. Optionally, SIAB relay can be used with auxiliary power supply (24 Vdc, 110 Vac or 230 Vac). The relay can be occasionally supplied by an external portable adapter (KITCOM).
- Internal commissioning battery as optional.
- Its compact size makes SIA-B really easy to install and its light weight helps the customer to save costs in transport.
- High electromagnetic conpoctibility (EMC)
- Low power consumption (0.5 W, 24 Vdc).
- Non-volatile RAM memory in order to store up to 100 events and 4 fault reports, without power supply thanks to its internal RTC (Real Time Clock).
- USB connection on the front (Modbus RTU communication protocol).
- Remote communications optional (RS485 Modbus RTU communication protocol).
- There is an optional bistable magnetic indicator which indicates the trip condition, maintaining their position even though the relay loses the supply (flag).
- In self powered modes, SIA-B starts-up from 0.4 Is of primary three phase current using specific CTs.

PROTECTIONS	
50	Phase instantaneous overcurrent
51	Phase inverse time overcurrent
50N	Neutral instantaneous overcurrent (calculated)
51N	Neutral inverse time overcurrent (calculated)
49T	External trip
49	Thermal image
	Trip Block for switch disconnector

Specific CTs for SIA-B Relays

TAPED CTS

Special CTs				
Type	Code	*In Range	CT Ratio	Class
CT08-5 Taped	**41465**	3-33 A	7.2 / 0.075 A	5P80
CT16-5 Taped	**41451**	6-65 A	14.4 / 0.075 A	5P80

* In is the value of the primary nominal current of the transformer.

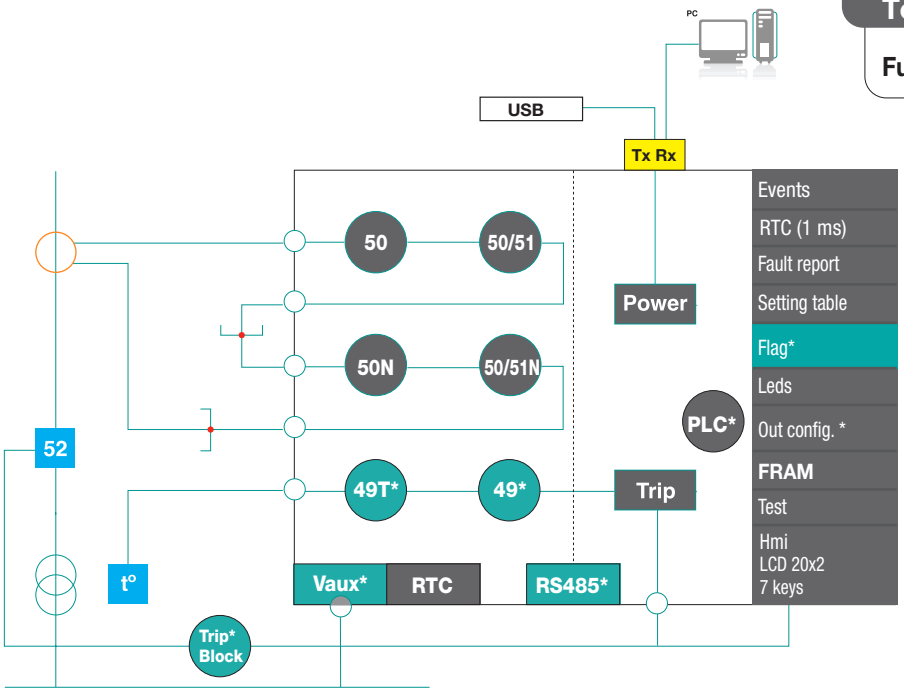
EPOXY RESIN

Special CTs				
Type	Code	*In Range	CT Ratio	Class
CT08-5	**41450**	3-33 A	7.2 / 0.075 A	5P80
CT16-5	**41458**	6-65 A	14.4 / 0.075 A	5P80
CT16-10	**41452**	6-65 A	14.4 / 0.075 A	10P80
CT32-5	**41453**	12-130 A	28.8 / 0.075 A	5P80
CT64-5	**41454**	25-260 A	57.6 / 0.075 A	5P80
CT128-5	**41455**	51-520 A	115.2 / 0.075 A	5P80
CT256-5	**41456**	102-1040 A	230.4 / 0.075 A	5P80

* In is the value of the primary nominal current of the transformer.

Technical specifications SIA-B

Functions diagram SIA-B

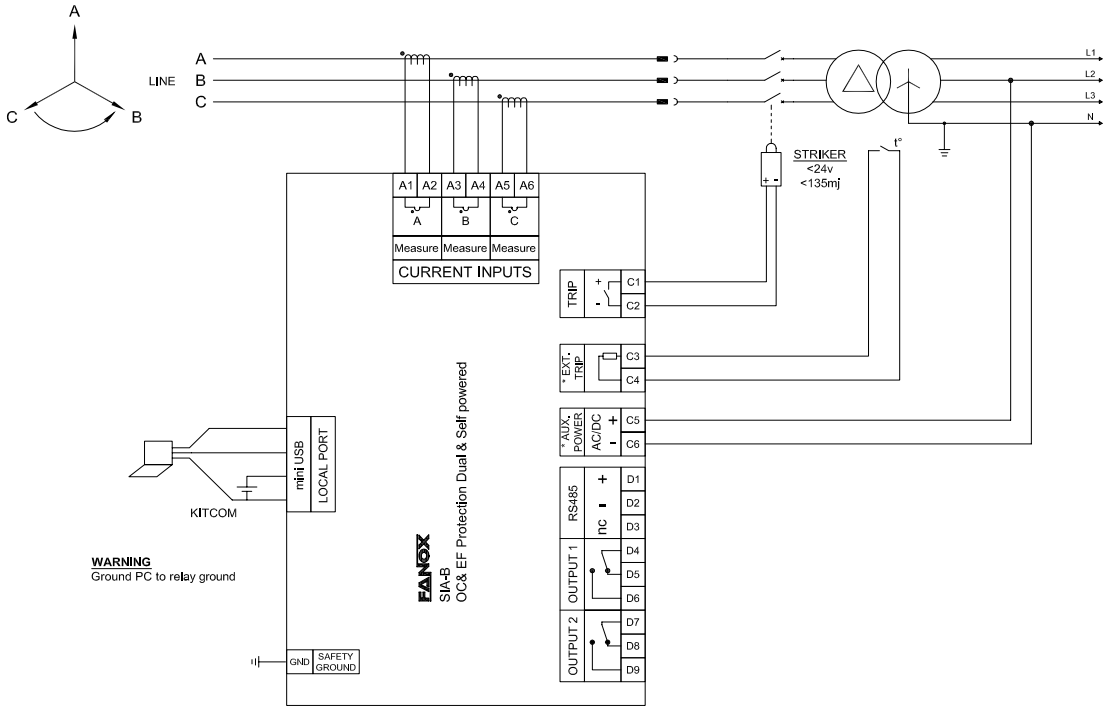


*** optional**

*Available by defafaut in models including outputs

Connections diagram SIA-B

- 3 CT power supply-measurement
  Striker



Technical parameters SIA-B and Specific CTs

Function 50	Permission: Yes/No
	Operating range: 0.20 to 20 x Is (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: ± 40 ms or ± 0.5% (greater of both)
Function 50N	Permission: Yes/No
	Operating range: 0.20 to 20 x Is (step 0.01)
	Operating time: 0.05 to 300 s (step 0.01s)
	Activation level 100%
	Deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: ± 40 ms or ± 0.5% (greater of both)
Function 50/51	Permission: Yes/No
	Operating range: 0.20 to 7 x Is (step 0.01)
	Curves: IEC 60255-151 and ANSI-IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: ± 40 ms or ± 5% (greater of both, considering the operating time is influenced by the used CT)
Function 50/51N	Permission: yes/no
	Operating range: 0.20 to 7 x Is (step 0.01)
	Curves: IEC 60255-151 and ANSI-IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: 5% or 40 ms (greater of both, considering the operating time is influenced by the used CT)

Technical parameters EPOXY RESINED CTS

Application	Indoor Use
Class of insulation	Class E
Frequency	50-60 Hz
Ratio	…/ 0,075 A
Primary Conductor	Cable max. ø 50 mm
Sec. wire diameter	Terminal for 6 mm2 solid/ 4 mm2 strand (Wire NOT included)
Test winding	0,288 A Nominal
Burden	0,1 VA
Protection	5P80/10P80
Material	PU & PA6.6

Function 49T (*)	Charging time 7 seconds
Function 49 (*)	Function permission: yes/no
	Tap: 0.10 a 2.40 Is (step 0.01)
	ζ heating: 3 a 600 minutes (step 1 min)
	ζ cooling: 1 a 6 x ζ heating (step 1)
	Alarm level: 20 a 99% (step 1 %)
	Trip level: 100%
	Trip reset: 95% of alarm level
	Timing accuracy: ± 5% regarding theoretical value
Trip Block (*)	Blocking: Yes/no
	Blocking limit: 1.5 to 20 x In (step 0.01)
Programmable logic control (PLC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_TIMERUP, NOR4_PULSE, NOR4_PULSES, AND4, AND4_PULSES, AND4_ TIMERUP, AND4_PULSE, AND4_LATCH, NAND4, NAND4_TIMERUP, NAND4_PULSE.
Trip output	24 Vdc; 135 mJ (activation of the striker or low powered coil)
Signalling outputs (*)	2 configurable outputs (output 2andoutput3): 220 Vdc – 8 A (30 W max) 250 Vac – 8 A (62,5 VA max)
Frequency	50/60Hz
Current measure	True RMS
	Sampling: 16 samples/cycle
	Accuracy depending on the used CT: <±5% with CT-5 type and <±10% with CT-10 type
Fault reports / Events	Four fault reports with 24 events per record /100 events
Communication	USB port: Modbus RTU
	*USB (Modbus RTU) + RS485 (Modbus RTU)
Auxiliary supply	230 Vac, ±20 %
	110 Vac, ±20 %
	24 Vdc, ±10 %
Battery supply	With USB KITCOM adapter
	Commissioning internal battery (*)
Self-power from current	Three phase self-power level: I > 0,4 x Is min
Environment	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80 ºC
	Humidity: 95%
Transformers	Power supply and measurement specific CTs
Mechanical features	Panel Mounting
	Height x Width Vertical model:167.80 x 120.65 (mm) Horizontal model:102.7 x 185.8 (mm)
	Depth Vertical model:56.2 mm Horizontal model: 59.7 mm
	IP-54 panel mounted

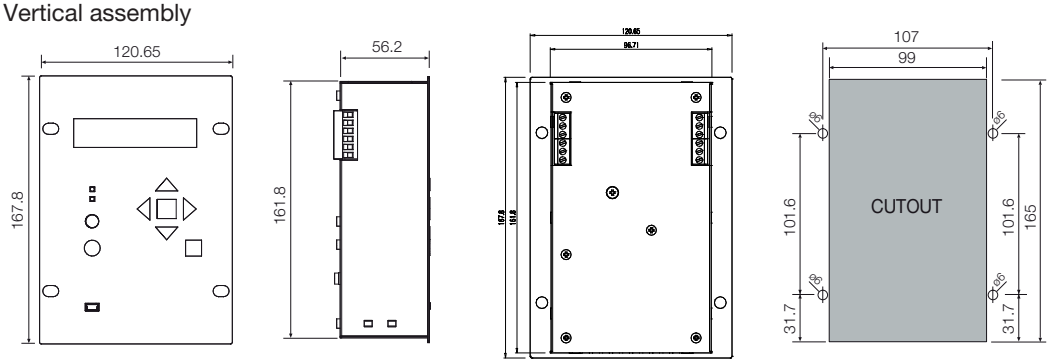
(*) Optional depending on model

Technical parameters TAPED CTS

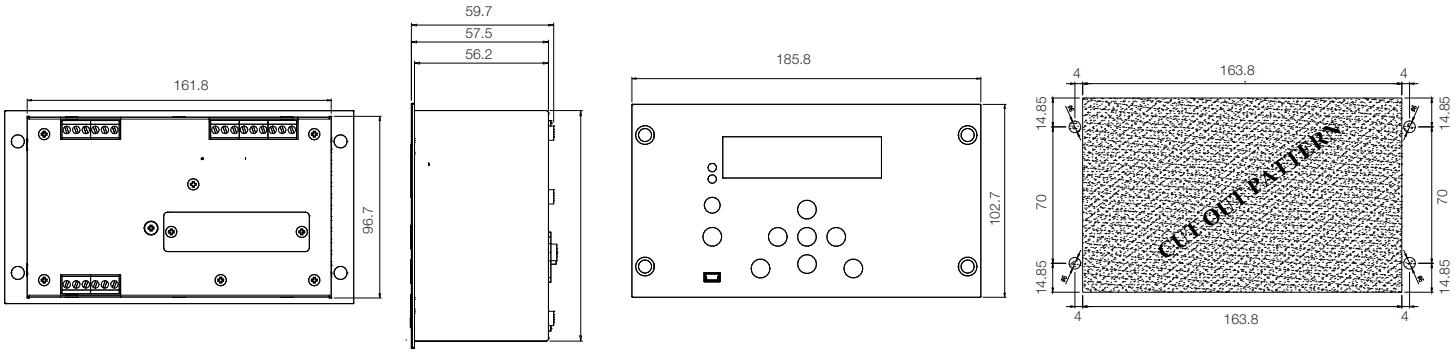
Application	Indoor Use
Class of insulation	Class A
Frequency	50-60 Hz
Ratio	…/ 0,075 A
Primary Conductor	Cable max. ø 75 mm
Sec. wire diameter /length	2,5 mm2 / 3250 mm (Wire included)
Test winding	0,288 A Nominal
Burden	0,05 VA
Protection	5P80

Dimensions and cutout SIA-B

Vertical assembly

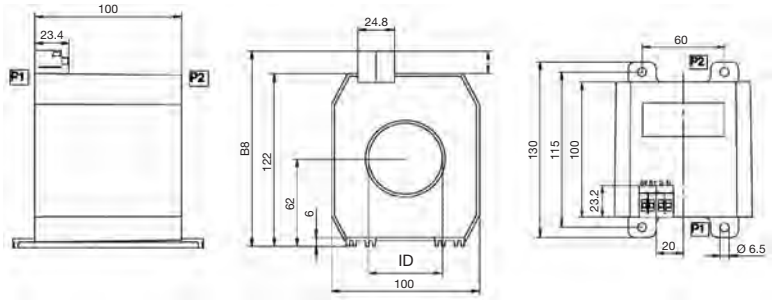


Horizontal assembly



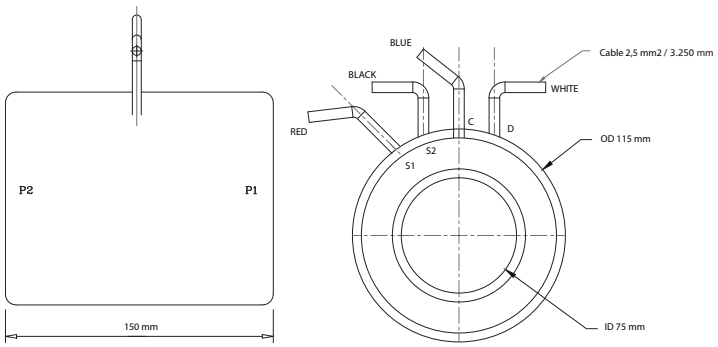
Digital outputs available depending on model.

Epoxy resin CT

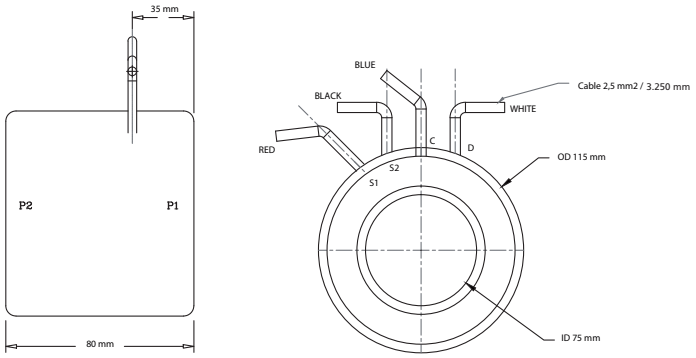


Type	ID (mm)	Code	Range (Is)	Class
CT08-5	45	**41450**	3-33 A	5P80
CT16-5	50	**41458**	6-65 A	5P80
CT16-10	50	**41452**	6-65 A	10P80
CT32-5	50	**41453**	12-130 A	5P80
CT64-5	50	**41454**	25-260 A	5P80
CT128-5	50	**41455**	51-520 A	5P80
CT256-5	50	**41456**	102-1040 A	5P80

CT08-05 Taped



CT16-05 Taped



SIA-B	Overcurrent & Earth Fault Protection Relay - Dual & Self Powered										
											PROTECTION FUNCTIONS 50 + 50/51 + 50N + 50/ 51N
	0										**PHASE MEASUREMENT** Defined by General Settings
		0									**NEUTRAL MEASUREMENT** Internal measurement
			0								**NET FREQUENCY** Defined by General Settings
				0 **1** **2** **3** **A** **B** **C** **D**							**POWER SUPPLY** Self powered Self powered + 230 Vac (Dual) Self powered + 110 Vac (Dual) Self powered + 24 Vdc (Dual) Self powered + Commissioning battery Self powered + 230 Vac (Dual) + Commissioning battery Self powered + 110 Vac (Dual) +Commissioning battery Self powered + 24 Vdc (Dual) + Commissioning battery
					0 **1** **B**						**ADDITIONAL FUNCTIONS** - + 49 + Trip Block for switch disconnector
						0 **1**					**COMMUNICATIONS** USB (Modbus RTU) USB (Modbus RTU) + RS485 (Modbus RTU)
							0 **1** **2**				**INPUTS-OUTPUTS** Trip (striker) Trip (striker) + External trip input (49T) + 1 magnetic indicator Trip (striker) + External trip input (49T) + 1 magnetic indicator + 2 outputs
								0 **1**			**MECHANICAL ASSEMBLY** Vertical Assembly Horizontal Assembly
									A **B** **C** **D**		**LANGUAGE** English, Spanish and German English, Spanish and Turkish English , Spanish and French English , Spanish and Russian
										A	**ADAPTATION** -

Example of ordering code:

SIA B	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**B**	**A**	*SIAB 0 0 0 0 1 0 1 0 B A*

Application and installation options for our SIA-B Relay

- **Specific Current Transformers** lay offers a really reduced dimensions, making this relay suitable for RMUs and compact switchgears in those installations where the space is critical.

The current adaptation is carried out by the specific external CTs, that apart from adapting the current to valid values for the relay electronic, allow to work with wider primary ranges than the standard CTs. E.g. With only one model of CT, CT-16, it is possible to protect switchgears from 300 kVAs to 1500 kVAS.

A suitable application is the transformation switchgears in wind turbines. In this case, the space is very reduced and protection for different powers with a unique CT is required.

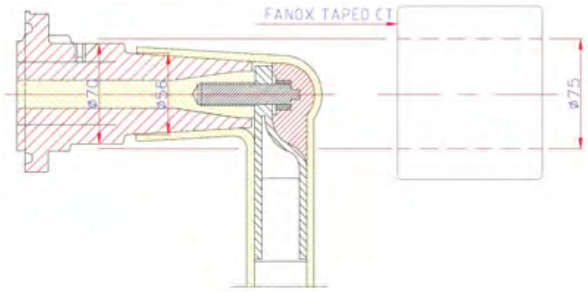
Apart from a complete protection, SIA-B is provided with events and fault reports for an exhaustive analysis of the fault situation, magnetic indicators (flags) to signal the trip maintaining their position even when the power supply is lost and front USB to power the relay and to communicate through a USB cable connected directly to the PC.

Understood these advantages, SIA-B relay becomes an optimum solution for the described applications and therefore, FANOX has developed a complete family of specific CTs for different primary ranges to adapt this solution to different installations.

- **Mounting solutions**

Installation on the bushings

Many switchgears manufacturers use standard cable connectors (bushings) with some pre-defined dimensions. This fact allows Fanox to design some taped CTs that are mounted on the bushings.



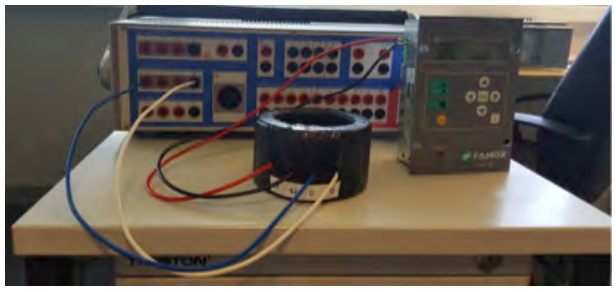
Installation on the cables

Other switchgears are provided with a gap (drawer) at the bottom part of the switchgear to access to the current cables. In this way, the CTs are mounted directly on the mentioned current cables. To cover this application, Fanox has designed some epoxy resin CTs with special anchors to be fixed at the bottom of the switchgear.

Test Winding

SIA-B relay works with current transformers with secondary different to 1 A or 5 A. For this reason, it is not possible to inject secondary current directly through CT S1-S2 terminals.

In this case, the current transformer, is provided with a second winding (C-D terminals) to inject secondary current. This secondary current will induce a primary current in the relay what facilitates the functional tests performance.



CURRENT TRANSFORMER	Injected current	Induced primary current
CT-08	1 A	25 A
CT-16	1 A	50 A
CT-32	1 A	100 A
CT-64	1 A	200 A
CT-128	1 A	400 A
CT-256	1 A	800 A

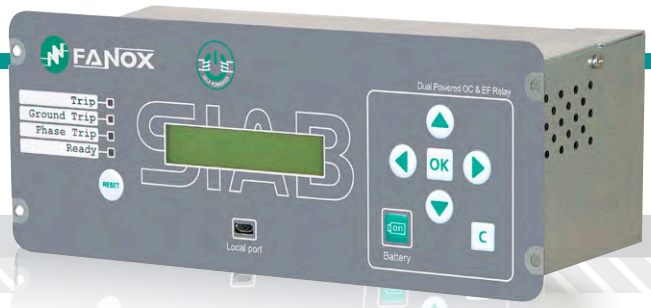
For example, with CT16, if 1A is injected through the test winding terminals, a primary current of 50 A will be read in the relay.

Depending on the used CT, the induced primary current when 1 A is injected is as follows:

SIA-B

Overcurrent & Earth Fault Protection Relay for Secondary Distribution

Dual & Self Powered / Standard CTs



Main characteristics

KEMA Laboratories
DNV·GL

SELF POWERED

- The SIA-B is an overcurrent protection relay with self powered and dual powered (Self-powering + Auxiliary power) options.
- The relay is self powered using the operating current through three /1 (<2VA) standard current transformers fitted on the lines. These transformers are also used to obtain current measurements. Besides, SIA-B relay can be used with auxiliary power supply (24-230 Vac/dc). The relay can be also supplied by a USB cable connected to the laptop, with the USB KITCOM adapter or an standard power bank.

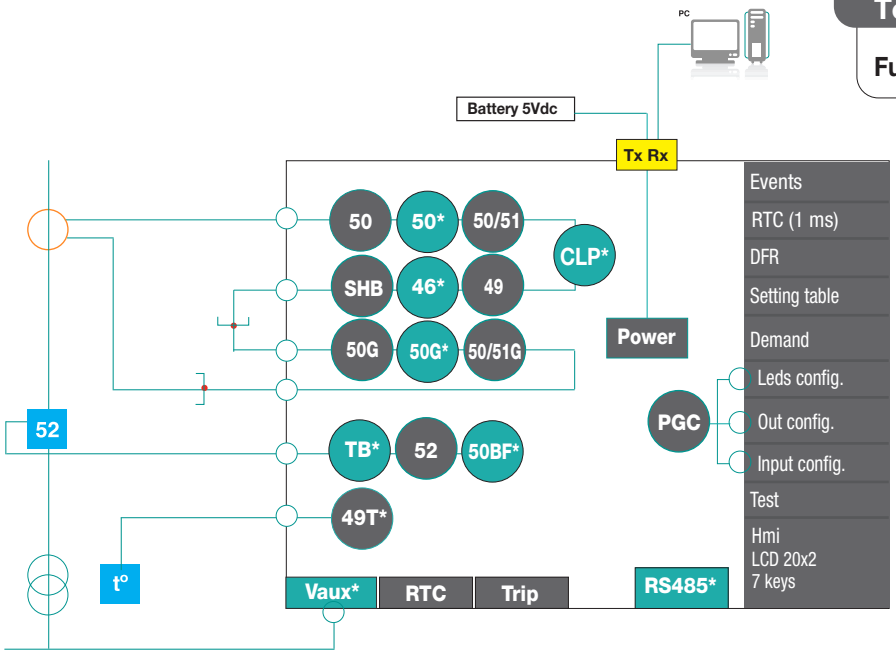
Multiple options for powering and communication

PROTECTIONS	
50	Instantaneous Phase overcurrent
50/51	Inverse time phase overcurrent
50G	Instantaneous Neutral overcurrent
50/51G	Inverse time neutral overcurrent
46	Negative Sequence instant. overcurrent
49	Thermal image
CLP	Cold Load Pick-up
SHB	Second Harmonic Blocking
50BF	Circuit Breaker opening failure
52	Circuit Breaker monitoring
49T	External trip
TB	Trip Block protection

- Internal commissioning battery included.
- 50_1, 50/51, 50G_1, 50/51G, 49, SHB, PGC protection functions.
- Micro USB front port connection (Modbus RTU protocol) for local communication. Remote communication through rear RS485 port (Modbus RTU or DNP 3.0 selectable by general setting) as optional.
- 49T function available through configurable inputs.
- 52 function to control the state of the circuit breaker.
- 50_2, 50G_2, CLP, 46, 50BF and trip block for switch disconnector as optional.
- Specific test menu is provided.
- High electromagnetic compatibility.
- The installation and subsequent maintenance of external batteries is eliminated. The operating costs of the centre are reduced.
- Really low start-up levels: 75 mA in three phase system /160 mA in single phase system.
- The line opening mechanism is activated by means of a striker PRT, operated by the energy supplied by the relay.
- There are 4 configurable LEDs. When the relay is switched off, their previous states can be checked by powering the relay up (by self-powering the relay, through USB cable, auxiliary voltage or pressing commissioning battery).
- The SIA-B is fitted with the demand of current (load data profiling) with the following characteristics:
  Number of records: 168
  Recording mode circular
  Sampling rate (interval): configurable through communications: 1 – 60 min.
- Non-volatile RAM memory in order to store up to 1.024 events, disturbance fault recording (DFR- 20 fault reports and 10 oscillographic records in COMTRADE format), maintaining date & time thanks to its internal RTC (Real Time Clock) even without power supply.

Technical specifications SIA-B

Functions diagram SIA-B

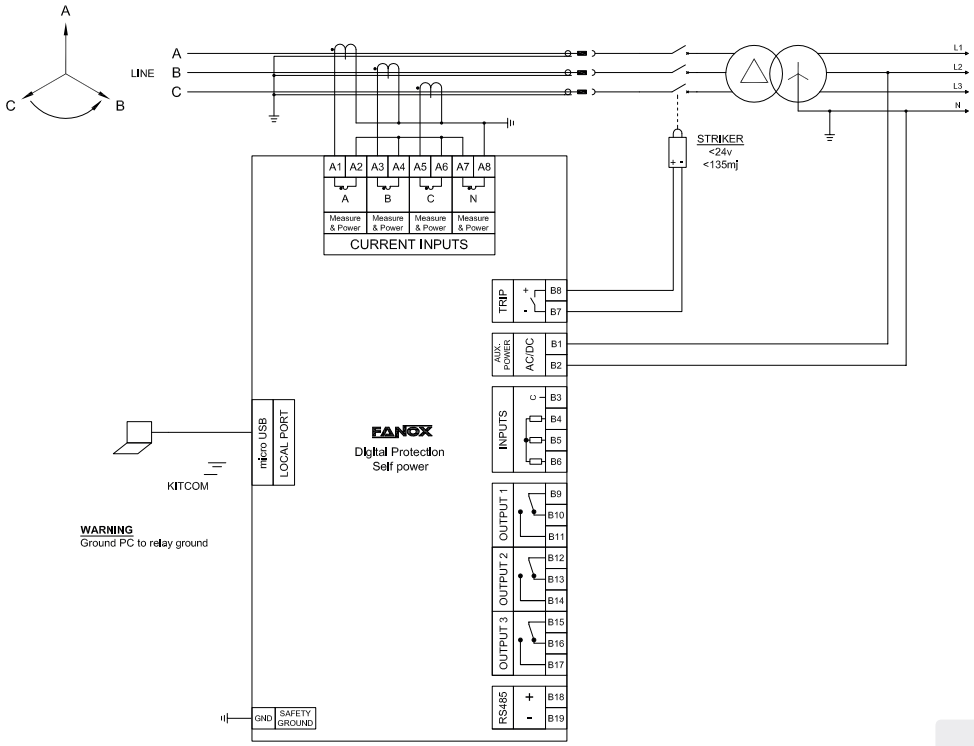


* optional

*Available through configurable inputs

Connections diagram SIA-B

- 3 CT power supply-measurement Rigid neutral



Technical parameters SIA-B

Function 50_1 **Function 50_2 (*)**	Function Enable: Yes/No/SHB
	Operating range: 0.10 to 20 x In (step 0.01 x In)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function 50G_1 **Function 50G_2 (*)**	Function Enable: Yes/No/SHB
	Operating range: 0.10 to 10 x In (step 0.01 x In)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function 50/51	Function Enable: Yes/No/SHB
	Operating range: 0.10 to 7 x In (step 0.01 x In)
	Curves: IEC 60255-151 and IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve, IEC long time inverse, IEEE Inverse curve, IEEE very inverse curve, IEEE extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)
	Dial (TMS): 0.01 to 1.5 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: Without SHB permitted: ± 30 ms or ± 5% (greater of both). With SHB permitted: ± 50 ms or ± 5% (greater of both).
Function 50/51G	Function Enable: Yes/No/SHB
	Operating range: 0.05 to 7 x In (step 0.01 x In)
	Curves: IEC 60255-151 and IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve, IEC long time inverse, IEEE Inverse curve, IEEE very inverse curve, IEEE extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)
	Dial (TMS): 0.01 to 1.5 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: Without SHB permitted: ± 30 ms or ± 5% (greater of both). With SHB permitted: ± 50 ms or ± 5% (greater of both).

Function 49	Function Enable: yes/no
	Tap: 0.10 to 2.40 xIn (step 0.01)
	ζ heating: 3 to 600 minutes (step 1 min)
	ζ cooling: 1 to 6 x ζ heating (step 1)
	Alarm level: 20 to 99% (step 1 %)
	Trip level: 100%
	Trip reset: 95% of alarm level
	Timing accuracy: ± 5% regarding theoretical value
Function SHB	Function Enable: Yes/No
	Current Tap: 5% to 50% (step 1%)
	Reset Time: 0.00 to 300 s (step 0.02 s)
Function 52	Maximum number of openings: 1 to 10000 (step 1)
	Maximum accumulated amps: 0 to 100000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excessive repeated openings: 1 to 10000 (step 1)
	Repetitive openings/time: 1 to 300 min (step 1 min)
Function CLP (*)	Function Enable: Yes/No
	Settings group: 1 to 4 (step 1)
	No load time: 0.02 to 300 s (step 0.01 s)
	Cold Load Time: 0.02 to 300 s (step 0.01 s)
	CLP activation threshold: 60 mA
	CLP reset threshold: 80 mA
Function 46 (*)	Function Enable: Yes/No
	Operating range: 0.10 to 7.00 xIn (step 0.01)
	Curves IEC 60255-151 and IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve IEC long time inverse, IEEE Inverse curve, IEEE very inverse curve, IEEE extremely inverse curve. Defined time : 0.02 to 300 s (step 0.01 s)
	Dial (TMS): 0.01 to 1.5 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
Function 49T	Available through configurable inputs
Function TRIP BLOCK (*)	Blocking: Yes/No
	Blocking limit: 1.5 to 20 x In (step 0.01)
Function 50BF (*)	Function Enable: yes/no
	Opening fault time: 0.02 to 1.00 s (step 0.01 s)
	Open circuit breaker activation threshold: 60 mA
	Function Pickup configurable: Equipment trip, activation of the opening fault input, circuit breaker open control activation.
Programmable logic control (PGC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_TIMERUP, NOR4_PULSE, NOR4_PULSES, AND4, AND4_LATCH, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE.
Settings tables	4 settings tables: Activated by inputs or by general settings
Events	1024 events
Disturbance Fault Recording (DFR)	20 fault reports, 16 events in each 10 Oscillographic records (50 cycles each)

(*) Optional depending on model

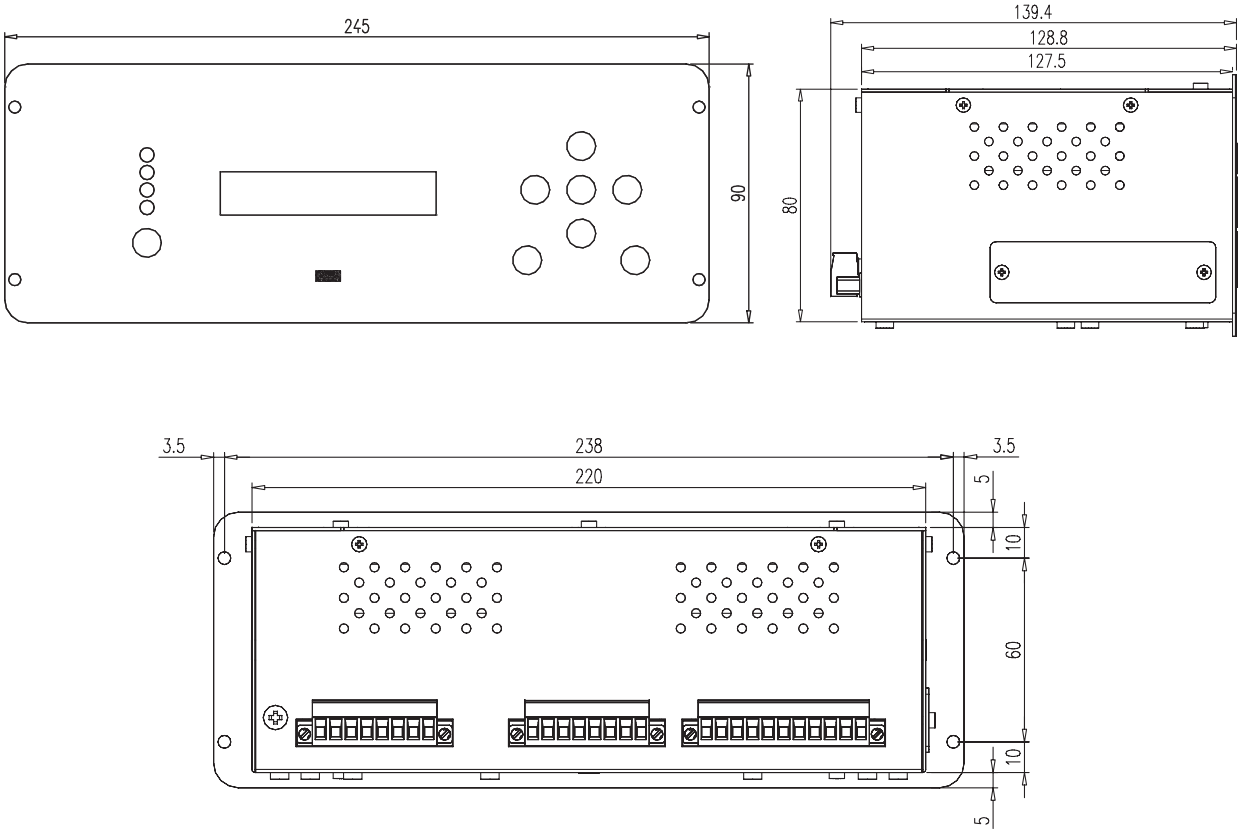
Technical parameters SIA-B

Load Data Profiling (Current Demand)	Demand of current with the following characteristics: • Number of records: 168 • Recording mode circular • Sampling rate (interval): configurable through communications: 1 – 60 min • Record format: Date/Time IMAX (in interval) IMAX (actual) IA IB IC IN
Trip output	For Striker: 24 Vdc-135 mJ
Signaling outputs	3 changeover outputs (output 1, output 2 and output 3): 250 Vac – 8 A 220 Vdc – 8 A
Signaling inputs	3 inputs: They are activated by short-circuiting the terminals without external supply
Frequency	50/60Hz

Current measurement	Fundamental values (DFT)
	Sampling: 16 samples/cycle
	Accuracy of ±2% on a band of ±20% over the nominal current and ±4% or ± 5mA (greater of both) over the rest of the range.
Communication	Micro USB front port: Modbus RTU
	RS485 port: Modbus RTU or DNP3.0 Serial (*)
Power supply	24-230 Vac/dc +10 % / 20%
Battery supply	With USB KITCOM adapter or standard power bank
	Internal commissioning battery
Self-power from current	Three phase self-power level: I > 75mA
Environment	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80 ºC
	Humidity: 95%
Transformers	Power supply and measurement CT /1
Mechanical features	Metallic box
	Panel Mounting
	Height x Width: 90 x 245 (mm)
	Depth: 139.4 (mm)
	IP-54
Weight	3 Kg.

(*) Optional depending on model

Dimensions and cutout SIA-B



SIA-B	Overcurrent & Earth Fault Protection Relay - Dual & Self Powered										
	1										**PHASE MEASUREMENT** In= 1 A: (0.10 - 30.00 A)
		1									**NEUTRAL MEASUREMENT** In= 1 A: (0.05 - 16.00 A)
			0								**NET FREQUENCY** Defined by General Settings
				A							**POWER SUPPLY** Self-powered + Commissioning battery
				F							Self-powered + 24-230 Vac/dc (Dual) + Commissioning battery
					C						**ADDITIONAL FUNCTIONS** + 49 + SHB + 4 Settings groups + LDP + DFR + 52
					D						+ 49 + SHB + 4 Settings groups + LDP + DFR + 52 + 46 + Trip Block for switch disconnector + 50_2 + 50G_2 + CLP + 50BF
						0					**COMMUNICATIONS** USB (Modbus RTU)
						2					USB (Modbus RTU) + RS485 (Modbus RTU or DNP3.0 Serial)
							3				**INPUTS AND OUTPUTS** 4 LEDs + Trip (Striker) + 3 Outputs + 3 Inputs
								2			**MECHANICAL ASSEMBLY** Extended Horizontal Assembly
									A		**LANGUAGE** English, Spanish and German
									B		English, Spanish and Turkish
									C		English , Spanish and French
									D		English , Spanish and Russian
										C	**ADAPTATION** Standard CTs /1

Example of ordering code:

SIA B	1	1	0	F	C	0	3	2	A	C	*SIA B 1 1 0 F C 0 3 2 A C*

SIA-C

Overcurrent and Earth Fault Protection Relay for Secondary Distribution

Dual & Self Powered

Main characteristics

- The SIA-C is a overcurrent protection relay with self powered and dual powered (self + auxiliary) models.
- The relay is self powered using the operating current through three /5 (5VA) or /1 (2.5VA) standard current transformers fitted on the lines. These transformers are also used to obtain current measurements. Optionally, SIAC relay can be used with auxiliary power supply (24 Vdc, 230 Vac, 48 Vdc or 100-230 Vdc/ac). The equipment can be occasionally supplied by an external battery portable kit (KITCOM).
- Internal Commissioning battery as optional.
- 50_1, 50/51, 50N/G_1, 50/51 N/G, PGC protection functions.
- 50_2, 50N/G_2, CLP, 79, 52,49T and 68 as optional.
- Specific test menu is provided.
- High electromagnetic compatibility.
- The installation and subsequent maintenance of batteries is eliminated. The operating costs of the centre are reduced.
- In self powered modes, the start-up of the relay from 0.1 times of the nominal current in three phases ensures capacity to trip at low energy levels.
- The line opening mechanism is activated either by means of a striker PRT, operated by the energy supplied by the relay itself, or by a coil using the TCM trip adapter in case it is necessary.
- There are bistable magnetic indicators which indicate the trip cause, maintaining their position even though the relay loses the supply (flags).
- Different sizes of SIA-C relay available by model list to fulfil all the needs of our customers and make the installation easier.
- SIA-C is fitted with the demand of current (Load Data Profiling) with the following characteristics:

  Number of records: 168
  Recording mode circular
  Sampling rate (interval): configurable through communications: 1 – 60 min
- Non-volatile RAM memory in order to store up to 1.024 events and 20 fault report, maintaining date & time, thanks to its internal RTC (Real time clock) even without power supply.

without power supply, maintaining the date and time, thanks to its internal RTC (Real time clock).

Suitable CTs for SIA-C Relays

Epoxy resin CT

Taped CT

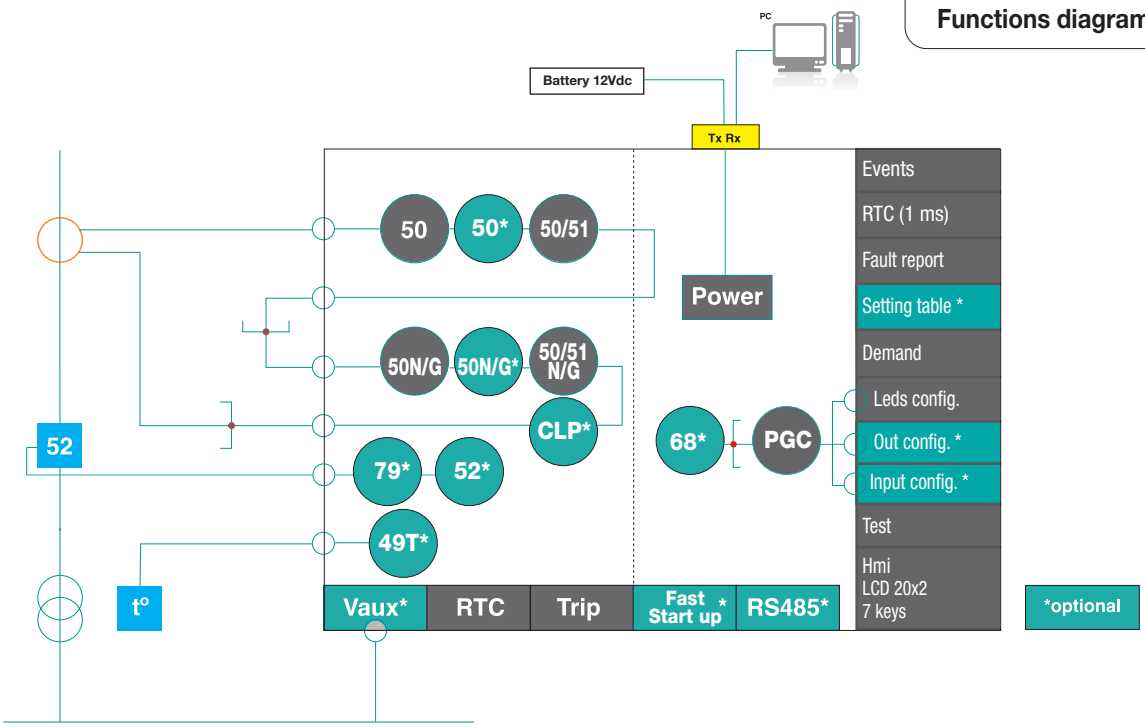
Primary .../ 1A	Code	Protection	Self power	Class	Type
30	13510	0,12 VA	2,5 VA	5P10	Epoxy resin CT
150	13515	2,9 VA		5P10	Epoxy resin CT
200	13516	2,9 VA		5P10	Epoxy resin CT
25 & 100	41740	2,5 VA		5P10	Taped

Primary .../ 5A	Code	Protection /Self power	Class	Type
200	13517	4,5 VA	5P10	Epoxy resin CT
300	13518	4,5 VA	5P10	Epoxy resin CT

For other transformation ratios please consult.

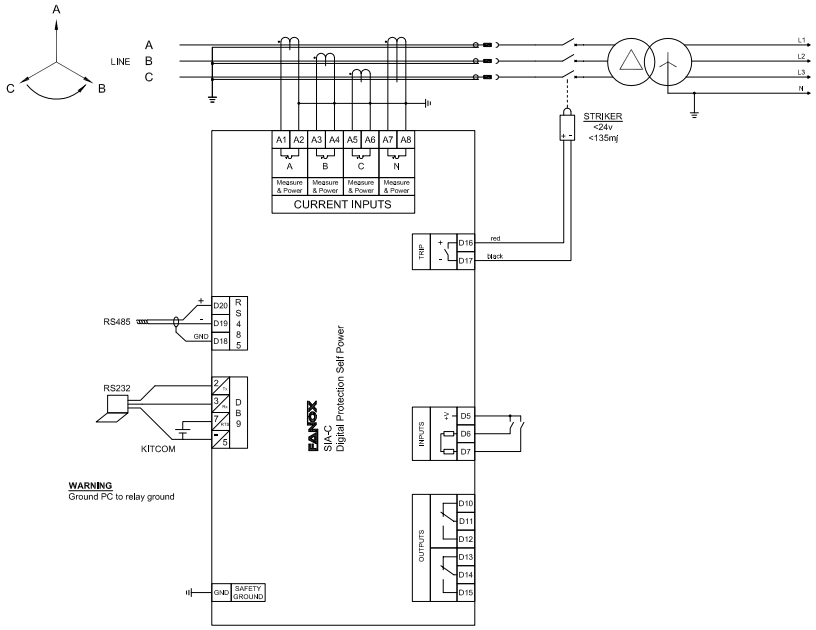
Technical specifications SIA-C

Functions diagram SIA-C

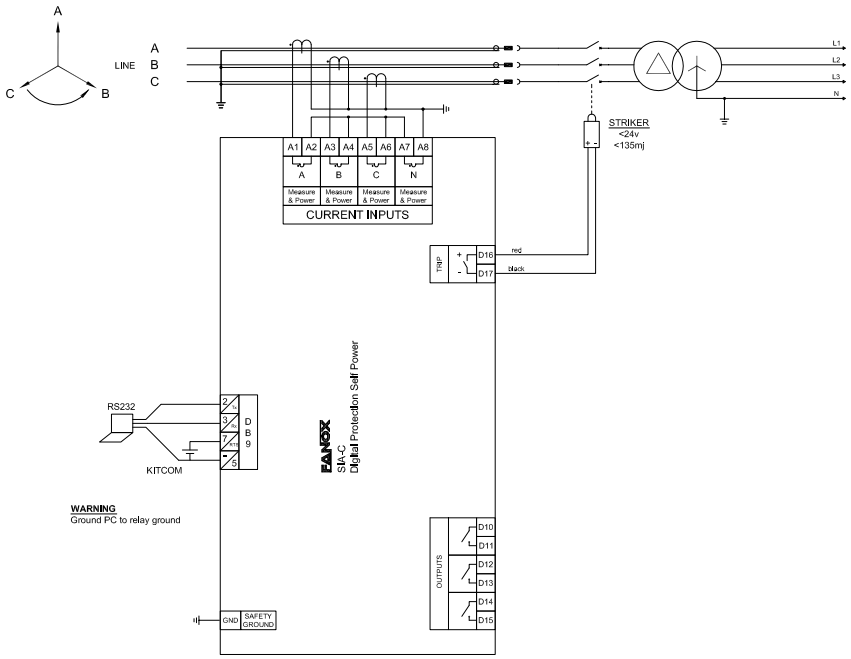


Connections diagram SIA-C

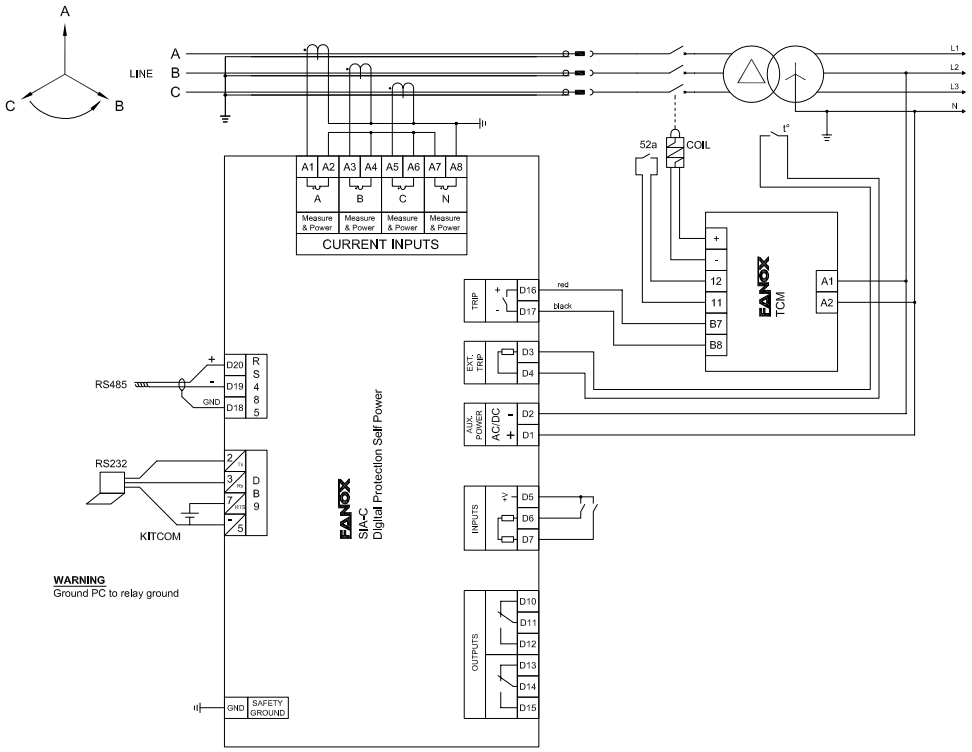
- 3 CT power supply-measurement
  1 CT neutral CT
  Striker



- 3 CT power supply-measurement
  Rigid neutral
  Striker
  Withdrawable model



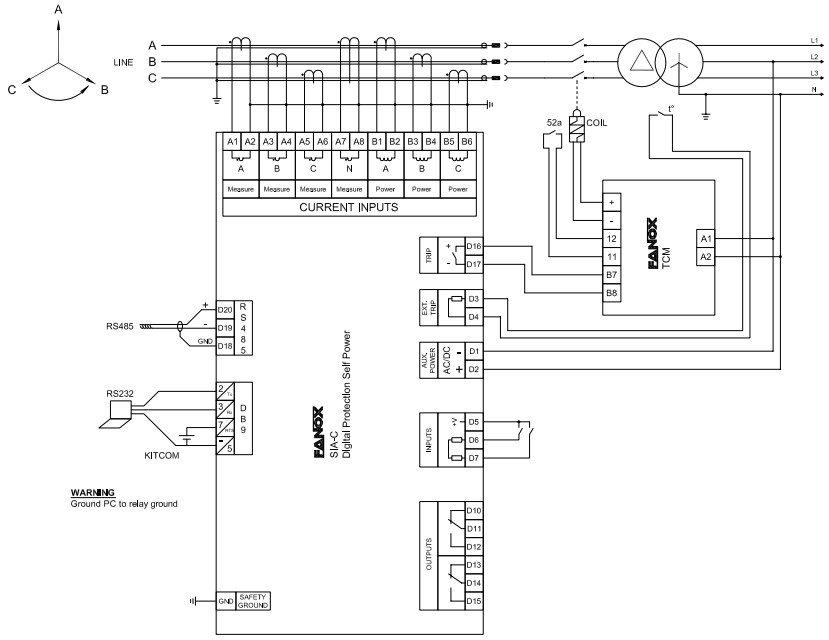
- 3 CT power supply-measurement
  Rigid neutral
  Potential free + TCM



Technical specifications SIA-C

- 3 CT measurement + 3 CT self power
  1 neutral CT
  Potential free + TCM

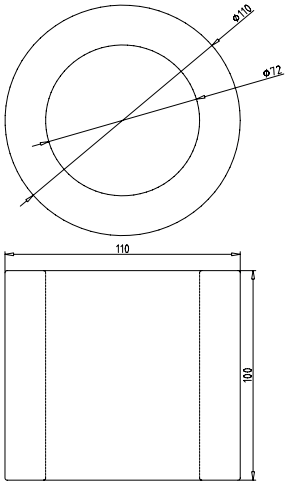
Connections diagram SIA-C



CTs Technical parameters and dimensions

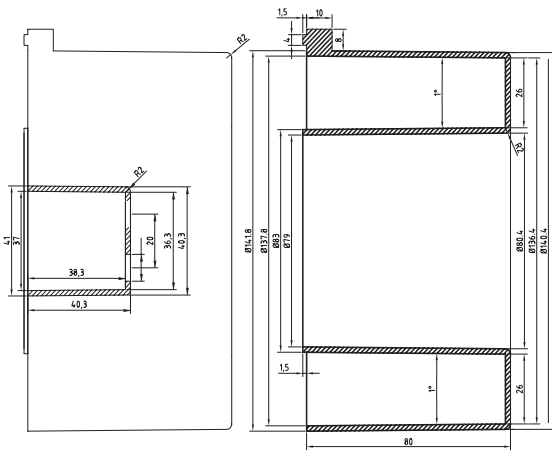
TAPED CT / CT-multitap 100-25

TECHNICAL PARAMETERS	CT-MULTITAP 100-25
Type	Taped
Maximum voltage Um	0,72 kV
Isolation voltage	3 kV
Isolation class	Class B
Short-circuit thermal intensity Ith	20 kA – 1s
Short-circuit dynamic intensity Idyn	50 kA
Enclosure	Plastic enclosure and internal resin, self-extinguishing, halogen-free UL94-VO
Standard	IEC 60044-1
Aprox. weight	3,5 Kgs
Secondary connection cables	3 PVC covered cables, halogen-free, 3x2,5 mm2 (length depending on the model). S1- Red, S2-Black, S3-White



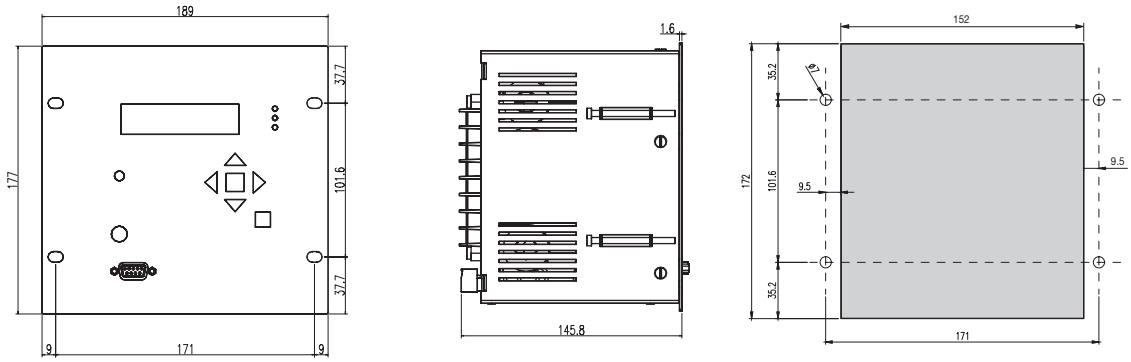
Epoxy resin CT

See technical parameters of epoxy resin CTs at page 70.



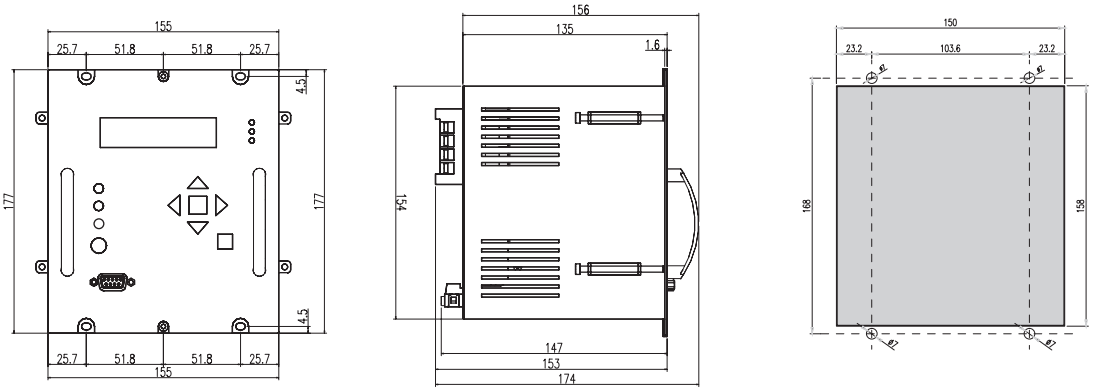
Vertical assembly

Mechanical assembly: D



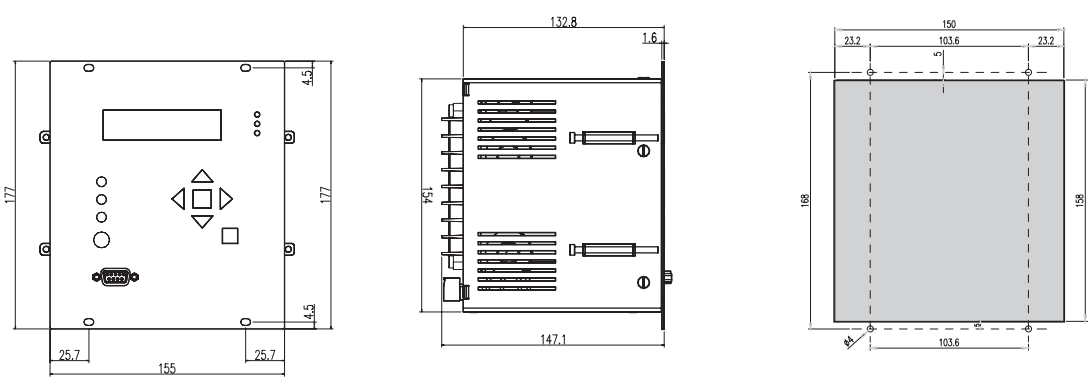
Withwadrable Vertical assembly Compact size

Mechanical assembly: F



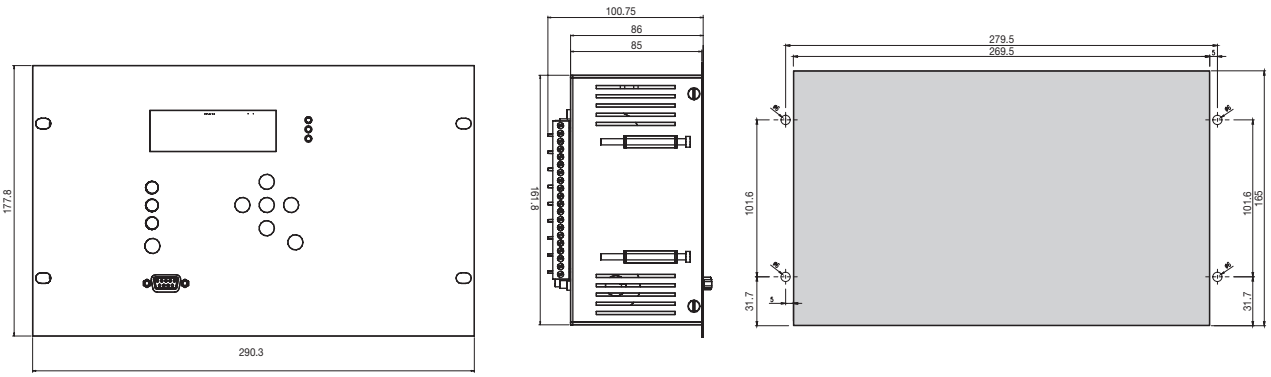
Vertical assembly Compact size

Mechanical assembly: E, G



Horizontal assembly

Mechanical assembly: B, C



Technical parameters SIA-C

Function 50_1 **Function 50_2 (*)**	Function Enable: yes/no
	Operating range: 0.10 to 30 x In (step 0.01 x In)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy:± 30 ms or ± 0.5% (greater of both)
Function 50N/G_1 **Function 50N/G_2 (*)**	Function Enable: yes/no
	Operating range: 0.10 to 30 x In (step 0.01 x In)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 20 ms or ± 0.5% (whichever is greater)
Function 50/51	Function Enable: yes/no
	Operating range: 0.10 to 7 x In (step 0.01 x In)
	Curves: IEC 60255-151 and ANSI-IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 5% or ±30 ms (whichever is greater) when the protection works with inverse time and ± 20 ms or ± 0.5% (whichever is greater) when it works with definite time
Function 50/51N/G	Function Enable: yes/no
	Operating range: 0.10 to 7 x In (step 0.01 x In)
	Curves: IEC 60255-151 and ANSI-IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 5% or ±30 ms (whichever is greater) when the protection works with inverse time and ± 20 ms or ± 0.5% (whichever is greater)when it works with definite time

Function CLP (*)	Function Enable: yes/no
	Settings group: 1 to 4 (step 1)
	No load Time: 0.02 to 300 s (step 0.01 s)
	Cold load Time: 0.02 to 300 s (step 0.01 s)
	CLP activation threshold: 8% In
	CLP reset threshold: 10% In
Function 49T (*)	Charging time 10 s
Function 68 (*)	Available through configurable inputs and outputs thanks to programmable logic

Programmable logic control (PGC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE
79	Function Enable: yes/no
	Hold permission: yes/no
	Number of reclosings: 1 to 5
	Reclosing time 1, 2, 3, 4, 5 : 0.02 to 300 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Replacement time: 0.02 to 300 s (step 0.01 s)
	Definitive opening time: 0.02 to 300 s (step 0.01 s)
Circuit breaker monitoring	Excessive number of openings: 1 to 10000 (step 1)
	Maximum accumulated amps: 0 to 100000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excessive repeated openings: 1 to 10000 (step 1)
	Time Excessive repeated openings: 1 to 300 min (step 1 min)
Settings tables (*)	Adaptation A and C: 3 settings tables Activated by inputs or by general settings. Adaptation B: 4 settings tables Activated by inputs or by general settings
Fault reports	20 fault reports, 16 events in each
Demand of current	Demand of current with the following characteristics • Number of records: 168 • Recording mode circular • Sampling rate (interval): configurable through communications: 1 – 60 min • Record format: Date/Time IMAX (in interval) IMAX (actual) IA - IC - IN - IB
Trip output	For Striker: 24 Vdc-135 mJ For coil (optionally with TCM adapter): 250 Vac – 8A 30 Vdc – 8A Resistive load (cos ϕ = 1)
Signalling outputs (*)	Up to 3 outputs (output 2, output 3 and output 4): 220 Vdc – 1 A (30 W max) 250 Vac – 1 A (62,5 VA max)
Signalling inputs (*)	2 inputs: 5-24 Vdc – 0,25 VA
Frequency	50/60Hz
Current measure	RMS
	Sampling: 16 samples/cycle
	Accuracy of ±2% on a band of ±20% over the nominal current and ±4% over the rest of the range.
Communication	RS232 port: Modbus RTU
	RS485 port: Modbus RTU (*)
Auxiliary supply (*)	230 Vac, ±20 % 24 Vdc ±10 % 48 Vdc ±10 % 100-230 Vdc/Vac ±15 %
Battery supply	Externally, with adapter (Kitcom) port DB9 Internal commissioning battery (*)
Self-power from current	One phase self-power level: I > 0,2 x In Three phases self-power level: I > 0,1 x In
Enviromental conditions	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80 ºC
	Humidity: 95%
Transformers	Power supply and measurement CT /5 or /1
Mechanical features	Metallic box
	Panel Mounting
	Vertical compact: 177 x 155 mm Vertical standard: 177 x 189 mm Horizontal: 177,80 x 290,3 mm
	IP-54
Weight	3,5 Kg

(*) Optional depending on model

SIA-C	Overcurrent & Earth Fault Protection Relay - Dual & Self Powered											PROTECTION FUNCTIONS 50_1 + 50/51 + 50N/G_1 + 50/51N/G + PGC
	1 5											**PHASE MEASUREMENT** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A)
		1 5 A B										**NEUTRAL MEASUREMENT** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A) In = 0,1 A; (0,01 – 3,00 A) In = 0,2 A; (0,02 – 6,00 A)
			5 6									**NET FREQUENCY** 50 Hz 60 Hz
				0 1 3 4 5 A B D E F								**POWER SUPPLY** Self powered Self powered + 230 Vac (Dual) Self powered + 24 Vdc (Dual) Self powered + 48 Vdc (Dual) Self powered + 85-265 Vac-dc (Dual) Self powered + Commissioning battery Self powered + 230 Vac (Dual) + Commissioning battery Self powered + 24 Vdc (Dual) + Commissioning battery Self powered + 48 Vdc (Dual) + Commissioning battery Self powered +100-230 Vac-dc (Dual) + Commissioning battery
					0 1 2 3 4							**ADDITIONAL FUNCTIONS** Striker Striker and with external trip (49T) Coil Coil and with external trip (49T) Striker and 230 Vac adapted external trip
						0 1						**COMMUNICATIONS** Local ModBus port (RS 232) + Remote ModBus port (RS485)
							0 1 2 3					**INPUTS-OUTPUTS** Trip Trip + 2 outputs Trip + 2 outputs + 2 inputs Trip + 3 outputs
								1 2				**MEMORY** Non-volatile RAM memory Non-volatile RAM memory + Fast start-up
									A B C D			**LANGUAGE** English, Spanish and German English, Spanish and Turkish English, Spanish and French English , Spanish and Russian
										B C D E F G		**MECHANICS** Horizontal assembly with 1 magnetic Flag Horizontal assembly with 3 magnetic Flag Vertical assembly with 1 magnetic Flag Vertical, Compact Size with 3 magnetic Flag Vertical, Compact Size, 3 Flags, Backlight LCD, withdrawable Vertical, Compact Size, 1 Flag, Backlight LCD
											- A B C	**ADAPTATION** 50_1 + 50/51 + 50N/G_1 + 50/51N/G + PGC + 50_2 + 50N/G_2 + 3 Settings groups + CLP + 4 Settings groups + 52 +79 +50_2 +50N/G_2 + 3 settings group

Example of ordering code:

SIA C	**1**	**1**	**5**	**0**	**0**	**0**	**3**	**2**	**A**	**F**	**A**	*SIAC 1 1 5 0 0 0 3 2 AFA*

Some success applications for our SIA-C Relay

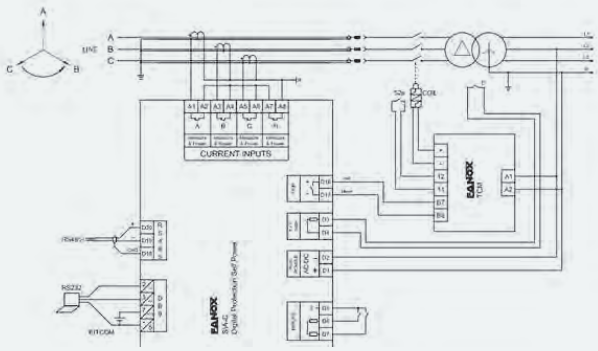
- **Withdrawable** Self powered model with a very compact size makes the installation and maintenance much easier.

- **Standby Earth Fault Relay** model designed as a backup protection to clear a remote earth fault on the downstream network. This relay performs 50P + 50/51P + 50N/G + 50/51N/G functions and shows 3 magnetic flags in its front indicating the tripping reason.

- Perfect solution for **RETROFIT applications.** Combined with TCM adapter this application is performed in these RMUs where the existing protection relay is replaced with a new generation digital relay like FANOX SIA-C.

  The auxiliary power of the RMU energizes the TCM that activates the coil when the relay detects a fault condition.

  RMU manufacturer do not require changing the existing circuit breaker and coil, SIA-C along with TCM adapter work as one supplying the energy needed to trip the coil. TCM provides the most common variety of auxiliary voltages that coils require: 48Vdc, 110Vdc or 220Vdc.



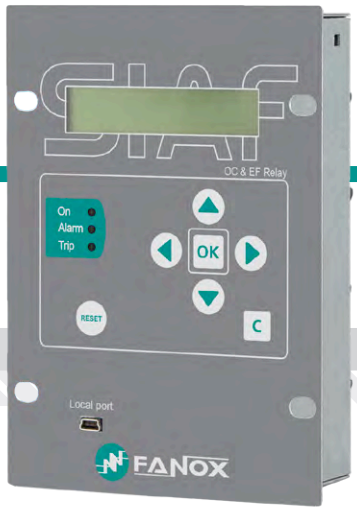
- **Ring Main Unit used for Metering (MRMU)** for MV applications (13.8kV, 36kV and 38kV) in a busbar rating up to 630A.

  In this application a protection relay is included to protect the line by tripping the circuit breaker of the position, apart from voltage and current meter or energy analyzer.

  Many MRMU manufacturers provide a 24 Vdc auxiliary power supply so the SIA-C Self and Dual Powered Relay at 24Vdc is the appropriate solution.

SIA-F

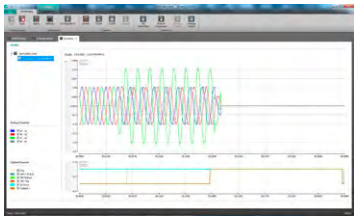
Overcurrent and Earth Fault Protection Relay for Secondary Distribution



Main specifications

- The SIA-F is an overcurrent protection relay with a switched auxiliary power supply (24-220 Vdc / 48-230 Vac). The current is measured by using /5 or /1 current transformers. The relay can be also power supplied by a USB cable connected to the laptop or an standard power bank.
- Protection functions: 50, 50/51, 50N/G, 50/51 N/G, CLP, 86, PGC.
- Trip block for switch disconnector, 49, 49T, 52, 50BF, 68 as optionals.
- High electromagnetic compatibility.
- With circuit breaker control and monitoring (circuit breaker status, number of openings, accumulated amperes, etc.).
- Compact size with reduced depth makes it easier to install and saves costs.
- USB connection on the front (Modbus RTU communication protocol).
- A specific test menu is provided.
- There are three configurable LED indicators on the front of the SIA-F equipment. By default, they indicate indicate if the equipment is On (LED ON), if an alarm has happened (LED ALARM) or if a trip has happened (LED TRIP).
- Programmable logic (PLC)
- 1 Oscillographic record, non-volatile RAM memory in order to store up to 200 events and 4 fault reports, without power supply thanks to its internal RTC (Real Time Clock)

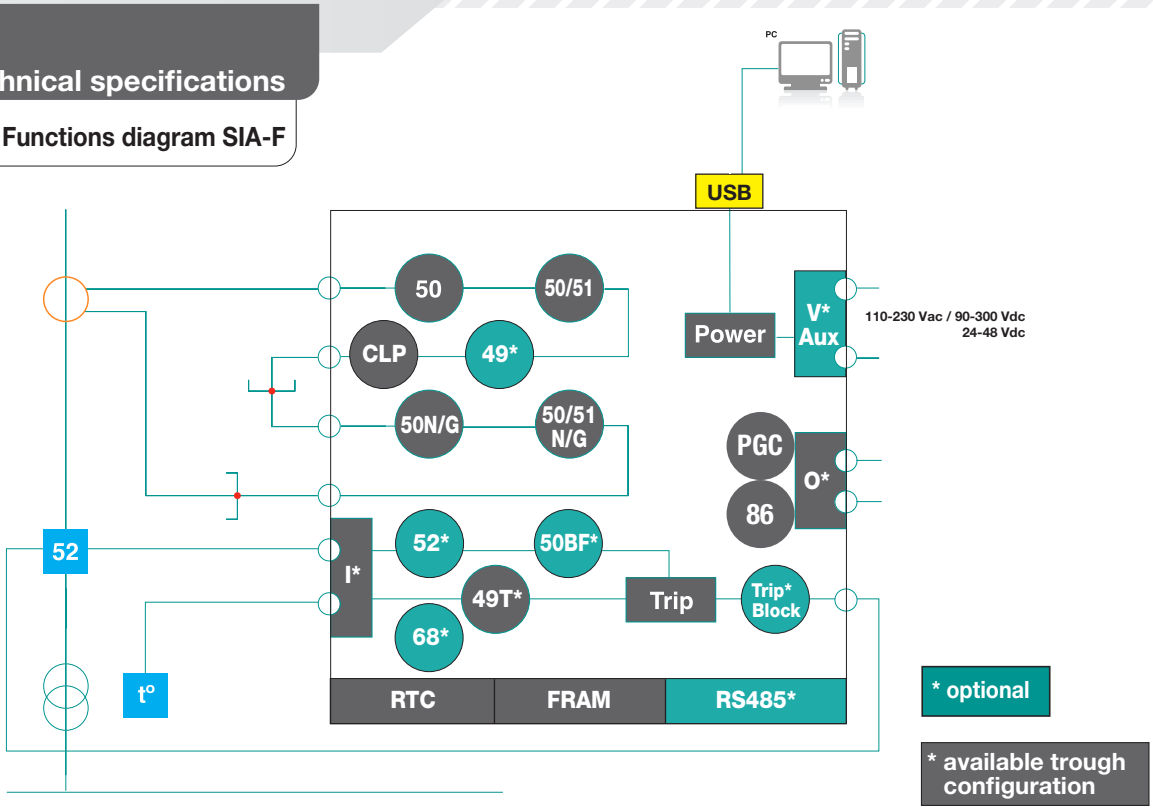
SIA-F powered by power bank.



Total state control of RMUs and SF6 insulated switchgears

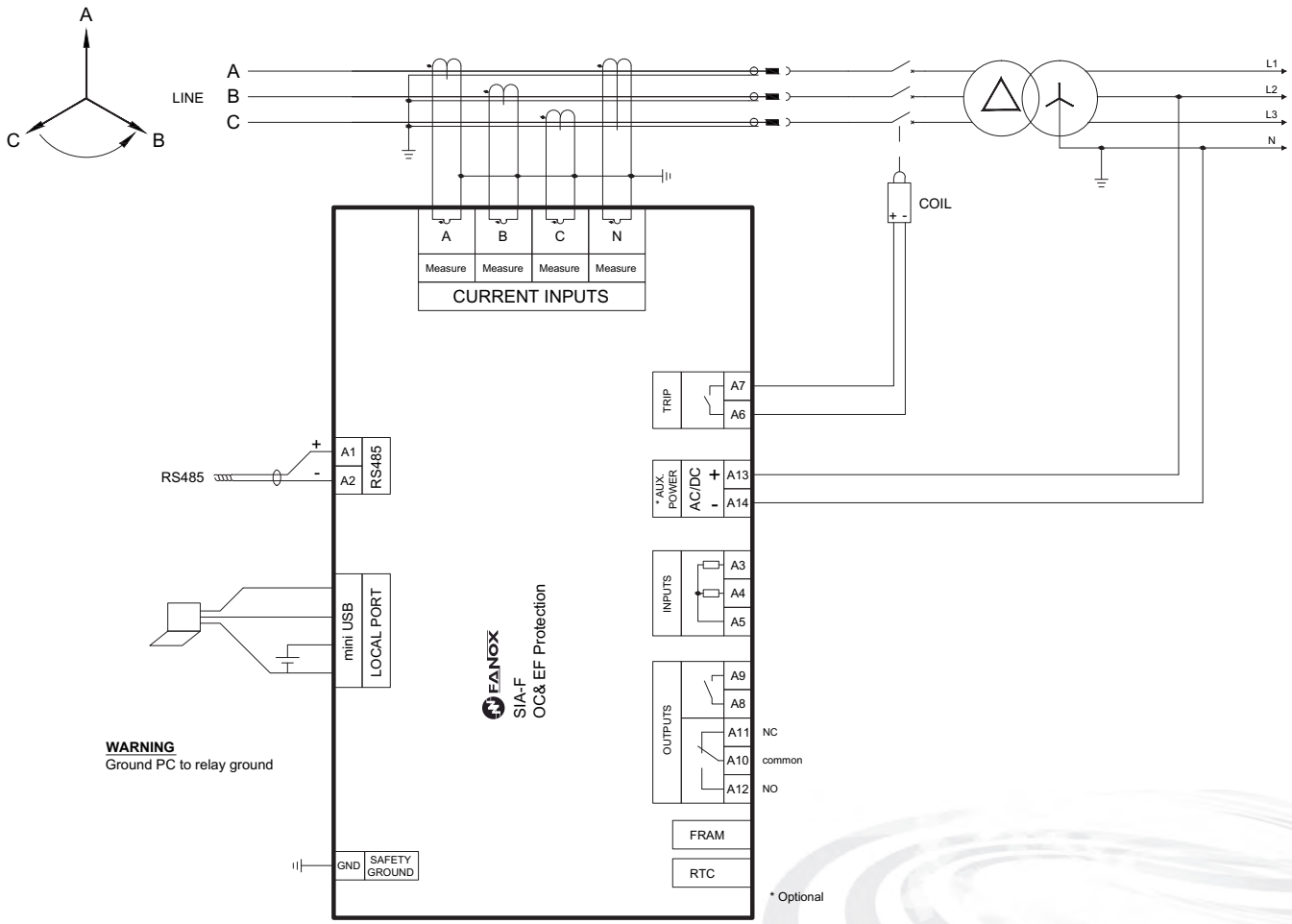
Technical specifications

Functions diagram SIA-F



Connections diagram SIA-F

- 3 CT measurement
  1 CT sensitive neutral



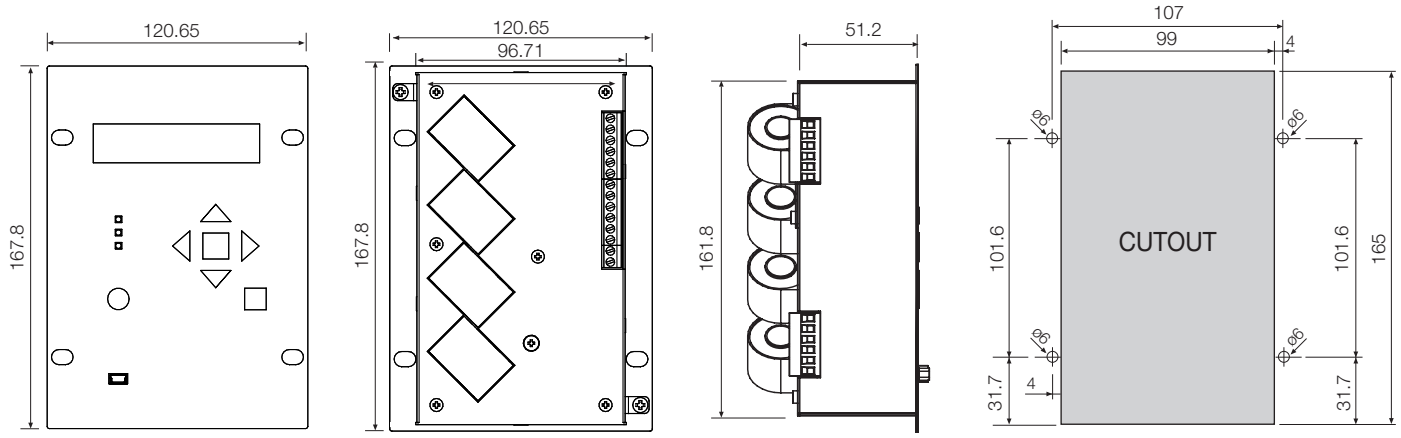
Technical parameters SIA-F

Function 50	Permission: Yes/No
	Operating range: 0.10 to 30 x In (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01s)
Function 50/51N/G	Permission: Yes/No
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±0,5% (greater of both)
Function 50N/G	Permission: Yes/No
	Operating range: 0.10 to 30 x In (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±0,5% (greater of both)
Function 50/51	Permission: Yes/No
	Operating range: 0.10 to 7 x In (step 0.01)
	Curves: IEC 60255-151 and ANSI-IEEE
	Operating time: IEC inverse curve, IEC very inverse curve, IEC extremely inverse curve, : ANSI inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Operating range: 0.10 to 7 x In (step 0.01)
	Curves: IEC 60255-151 and ANSI-IEEE
	Operating time: Operating time: IEC inverse curve, IEC very inverse curve, IEC extremely inverse curve: ANSI inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±5% (greater of both)
CLP	Permission: Yes/No
	Setting table: 1 to 3 (step 1)
	No load time:0.02 to 300 s (step 0.02 s)
	Cold load time: 0.02 to 300 s (step 0.01 s)
Trip block protection for the switchgear (*)	Blocking: Yes/no
	Blocking limit: 1.5 to 20 x In (step 0.01)
Circuit breaker monitoring 52 (*)	Excessive number of openings: 1 to 10000 (step 1)
	Maximum accumulated amps: 0 to 100000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excessive repeated openings: 1 to 10000 (step 1)
	Time Excessive repeated openings: 1 to 300 min (step 1 min)
Function 50BF(*)	permission : yes/no
	Opening failure time: 0.02 to 1.00 s (step 0.01 s)
	Open breaker activation threshold: 8% In
	Open breaker reset threshold: 10% In
	Function start: Device trip, opening failure input activation, breaker opening command activation

Function 49(*)	permission : yes/no
	Tap: 0.10 a 2.40 Inominal (step 0.01)
	ζ heating: 3 a 600 minutes (step 1)
	ζ cooling: 1 a 6 xζ heating (step 1)
	Alarm level: 20 a 99% (step 1)
	Trip level: 100%
	Trip reset: 95% of alarm level
	Timing accuracy: ± 5% or ± 2s (greater of both)
Function 68 (*)	Available through configurable inputs thanks to programmable logic
Programmable Logic Control (PGC)	OR4, OR4_LATCH, OR4_PULSES, OR4_ TIMERUP, OR4_PULSE, NOR4, NOR4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE
Function 86	Allows to latch (lock out) the contact trip due to programmable logic (PLC).
Function 49T (*)	Available through configurable inputs
Settings tables	3 settings tables
	Activated by general settings or by inputs
RTC	Capacitor charge time: 10 minutes
	Operation without auxiliary voltage: 72 hours
Trip output (configurable)	Potential free contact
Configurable outputs (*)	2 configurable outputs: 250 Vac – 8 A 30 Vdc – 5 A
Configurable inputs (*)	The same voltage as auxiliary power supply 2 configurable inputs
Current measure	True RMS
	Sampling: 16 samples/cycle
	Accuracy of ±2% in a band of ±20% over the rated current and ±4% for the rest of measurement range
	Saturation limit: 30 times rated current
Fault report	4 fault reports with 16 events each
Oscillography	16 samples/cycle
	Oscillo starting configuration
	1 records: 3 cycles pre-fault and 19 post-fault
	COMTRADE IEEE C37.111-199
	4 analogue channels and 32 digital channels
Communications	USB port (connector mini USB type A): Modbus RTU
	RS485 port: Modbus RTU or DNP3.0 Serial (*)
Auxiliary power supply(*)	24-220 Vdc / 48-230 Vac ±20%
Battery supply	Directly through the front USB port with a USB cable connected to the PC.
Environment	Operating temperature: -10 to 70ºC
	Storage temperature: -20 to 80 ºC
	Humidity: 95%
Transformers	3 or 4 CT /5, /1 or /0.2
Mechanical features	Metallic box
	Panel Mounting
	167,80 x 120,65 mm
	Depth: 74.6 mm
	IP-54 on panel

(*) Optional depending on model

Dimensions and cutout SIA-F



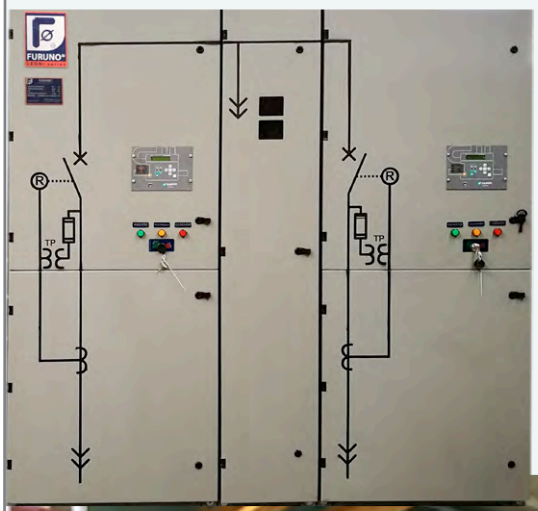
Selection & Ordering data SIA-F

SIA-F	Overcurrent & Earth Fault Protection Relay										
											PROTECTION FUNCTIONS 50 + 50/51 + 50N/G + 50/51N/G + 86 + PLC + Load Pick-up Cold
	1 5										**PHASE MEASUREMENT** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A)
		1 5 B									**NEUTRAL MEASUREMENT** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A) In = 0,2 A; (0,02 – 6,00 A)
			0								**NET FREQUENCY** Defined by General Setting
				C							**POWER SUPPLY** 24–220 Vdc / 48-230 Vac
					0 1 B C						**ADDITIONAL FUNCTIONS** - + 49 + 52 + 50BF + Trip block for switch disconnector + Trip block for switch disconnector + 49 + 52 + 50BF
						0 1 2					**COMMUNICATIONS** USB (Modbus RTU) USB (Modbus RTU) + RS485 (Modbus RTU) USB (Modbus RTU) + RS485 (DNP3.0 Serial)
							0 1				**INPUTS - OUTPUTS** Trip Trip + 2 inputs + 2 outputs
								0			**MECHANICS** Vertical assembly
									A B C D		**LANGUAGE** English, Spanish and German English, Spanish and Turkish English, Spanish and French English, Spanish and Russian
										A	**ADAPTATION** -

Example of ordering code:

SIA F	1	1	0	C	0	1	1	0	C	A	*SIAF 1 1 0 C 0 1 1 0 C A*


CELDA DE DERIVADO 3


FURUNO

SIL

FANOX power T&D

Protection relays for Primary and Secondary Distribution

Relays of SIL family are designed for protection of primary and secondary switching substations of electric distribution network.

IEC 61850

Introduction to SIL Relays

The Energy sector is now in process of a deep transformation all over the world. Due to the high demand of energy, new distribution lines are needed as well as advanced systems of supervision. Assuming the need of intelligent infrastructures, FANOX has developed SIL family in order to perform this function.

Relays of SIL family are designed for protection of primary and secondary switching substations of electric distribution network. The protection features include protection against current, voltage, frequency, power, and including functions as synchronism and autorecloser.

The protection functions can be enabled by using both the front panel and the communications link to the SICom programme.

The combination of the available IEC and ANSI-IEEE curves and settings allows a precise coodination with other equipments.

For a complete information management, several communication protocols are included in SIL family relays.

Communication protocols

Our relays incorpórate new industry trends as remote communication to facilitate the implementation of Smart Grid and predictive maintenance network:

- IEC 61850
- IEC 60870-5-103
- IEC 60870-5-104
- DNP3.0
- ModBus RTU

SIL-D

Overcurrent and Directional Earth Fault Protection

Main specifications

- SIL-D relay is an overcurrent and directional earth fault protection relay for Primary and Secondary Distribution.
- Auxiliary power supply (24-220 Vdc / 48-230 Vac).
- Protection functions: (2) 50 + 50/51 + (2) 50N/G + (2) 50N/51N/67N(1) + 52 + 50BF + 79 + 74TCS + CLP + 86 + 49T + 59N. Optionally, directional isolated neutral overcurrent(2) : 67NI_1 and 67NI_2.

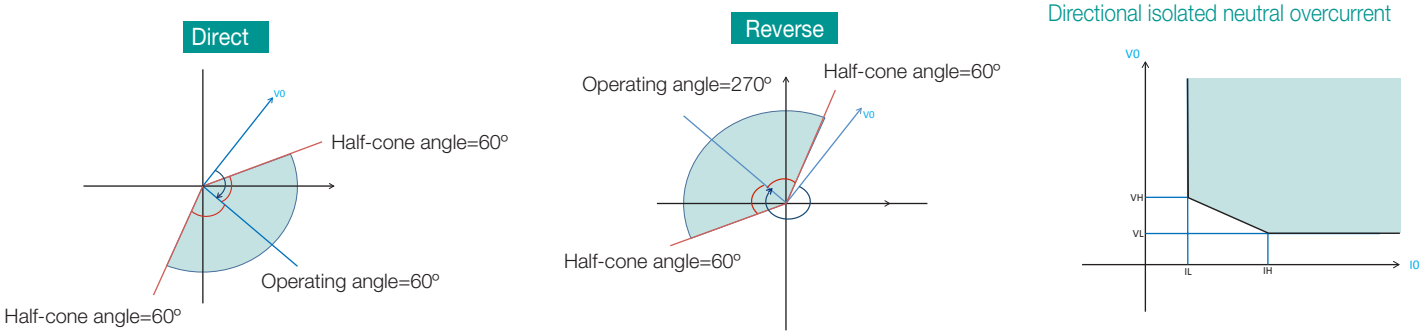
  It includes switch disconnector protection function by means of trip blocking.
- Function 67NI. Directional neutral isolated overcurrent with two neutral directional units: 67NI_1 and 67NI_2.

  This function is based on two supervisions: The analogue to the one that uses the 67N to check that the residual current is inside the defined area by the settings of directionality, operation angle and halfcone, and the second supervision of the modules of the residual voltage and current.

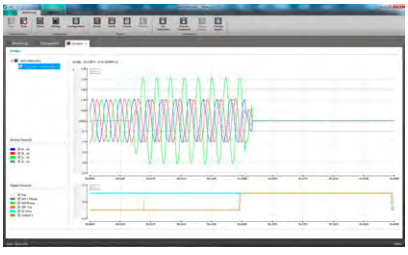
  To perform the directional detection, the residual voltage is used as polarization magnitude and the residual current as an operating magnitude. The intervention sector in forward direction is defined in the following way: the operating angle is rotated anticlockwise from the negative residual voltage,-V0 which gives us the maximum torque direction. A cone is drawn, with the half-cone angle adjusted, over this maximum torque direction. In the same way, the intervention sector in reverse direction is defined in the following way: the operating angle is rotated anticlockwise from the positive residual voltage, V0 which gives us the maximum torque direction. A cone is drawn, with the half-cone angle adjusted, over this maximum torque direction.

  When 67NI is not activated the functions works like 50/51G.

Graphical example for an Operating angle of 90° and a half-cone angle of 60°

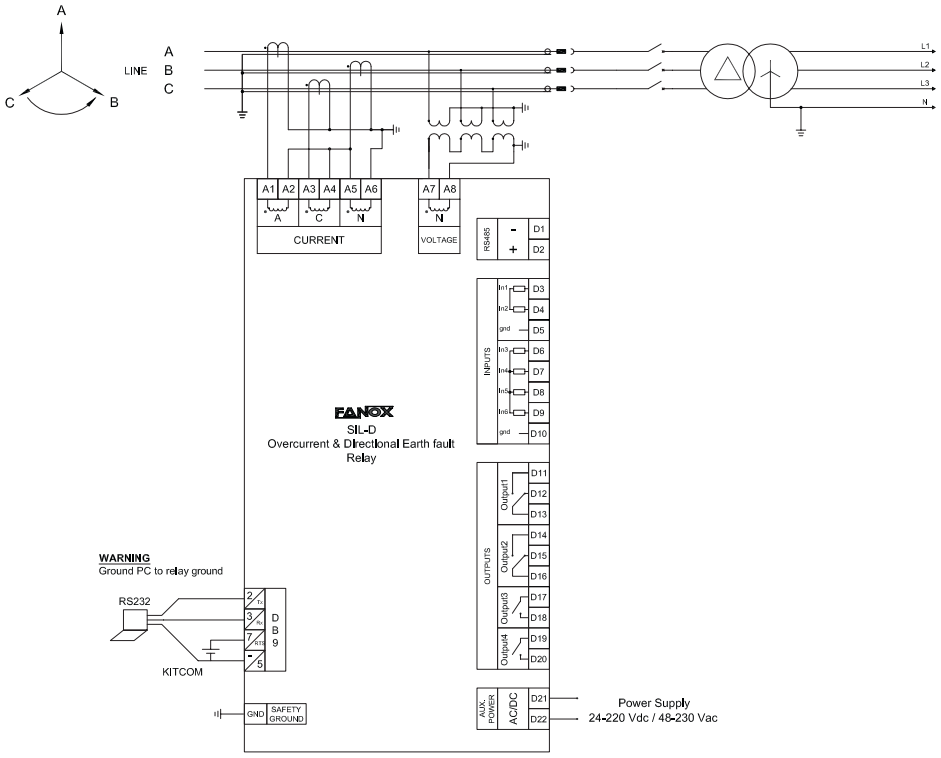


- 5 attempts of reclosing with 79 protection function (Recloser). Direct signalling/control of function 52 (Circuit breaker) and function 79 (Recloser).
- Metallic box with high electromagnetic compatibility level (EMC) and wide range of operating temperature.
- 1 rear port on the back with the following options respect to communication protocols:
  - One rear port RS485 with IEC60870-103 or Modbus RTU selectable by settings.
  - One rear port RJ45 with IEC 61850, DNP 3.0 TCP/IP or IEC 60870-5-104 (depending on the model).
- 5 Oscillographic records, non-volatile RAM memory in order to store up to 200 events and 20 fault reports, without power supply thanks to its internal RTC (Real Time Clock).

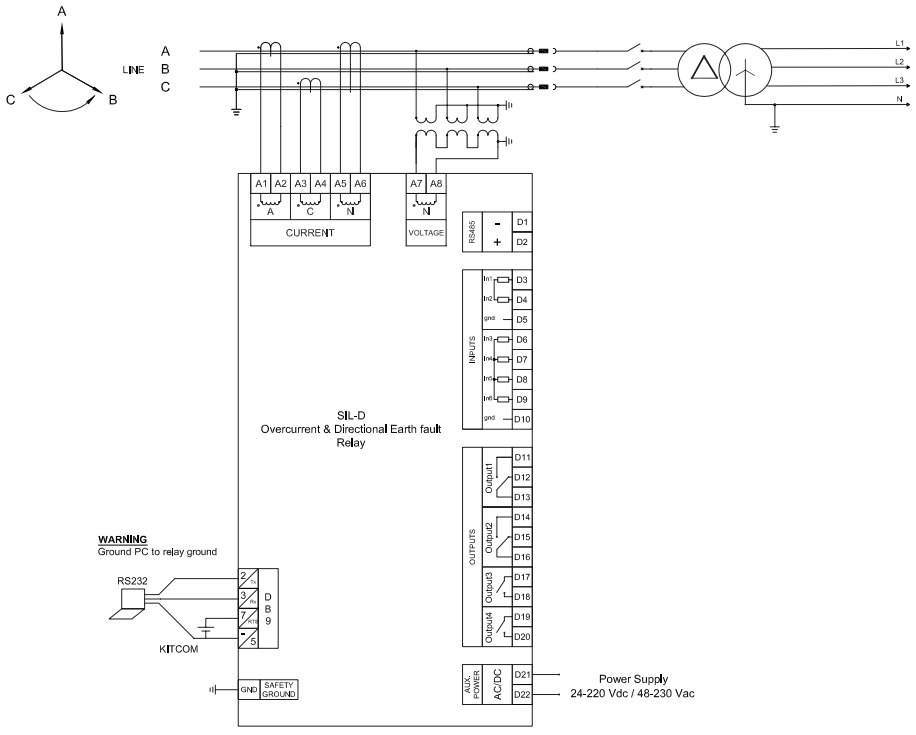


Additional information to fault reports

• 3 CT Phase Current



• 2 CT Phase Current + 1 Neutral CT



50(2)	Function permission: Yes/No
	Operating range: 0.10 to 30 xIn (step 0.01)
	Time delay: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
50N/G(2)	Function permission: Yes/No
	Operating range: 0.10 to 30 xIn (step 0.01)
	Time delay: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
50/51	Function permission: Yes/No
	Operating range: 0.10 to 7 xIn (step 0.01)
	Curves IEC 60255-151 and ANSI
	Time delay: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time : 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 2.20 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timer accuracy: ±5% or ±30 ms (whichever is greater)
67N(2)	Function permission: Yes/No
	Operating range: 0.10 to 7 xIn (step 0.01)
	V Operating range: 2 -65V (step 1V)
	Curves IEC 60255-151 and ANSI-IEEE
	Time delay: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Definite time: 0,02 to 300s (step
	Dial: 0.02 to 2.20 (step 0.01)
	Directionality: No/ Forward/ Reverse
	Operation angle: 0 to 359º (step 1º)
	Halfcone angle: 1 to 170º (step 1º)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timer accuracy: ±5% or ±30 ms (whichever is greater)
67NI*(2)	Function permission: Yes/No
	Operating range: 0.10 to 7.00 xIn (step 0.01)
	V Operating range: 2 -65V (step 1V)
	Time delay: 0.02 to 300 s (step 0.01 s)
	Directionality: No/ Forward/ Reverse
	Operation angle: 0 to 359º (step 1º)
	Halfcone angle: 1 to 170º (step 1º)
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Timer accuracy: ±5% or ±30 ms (whichever is greater)

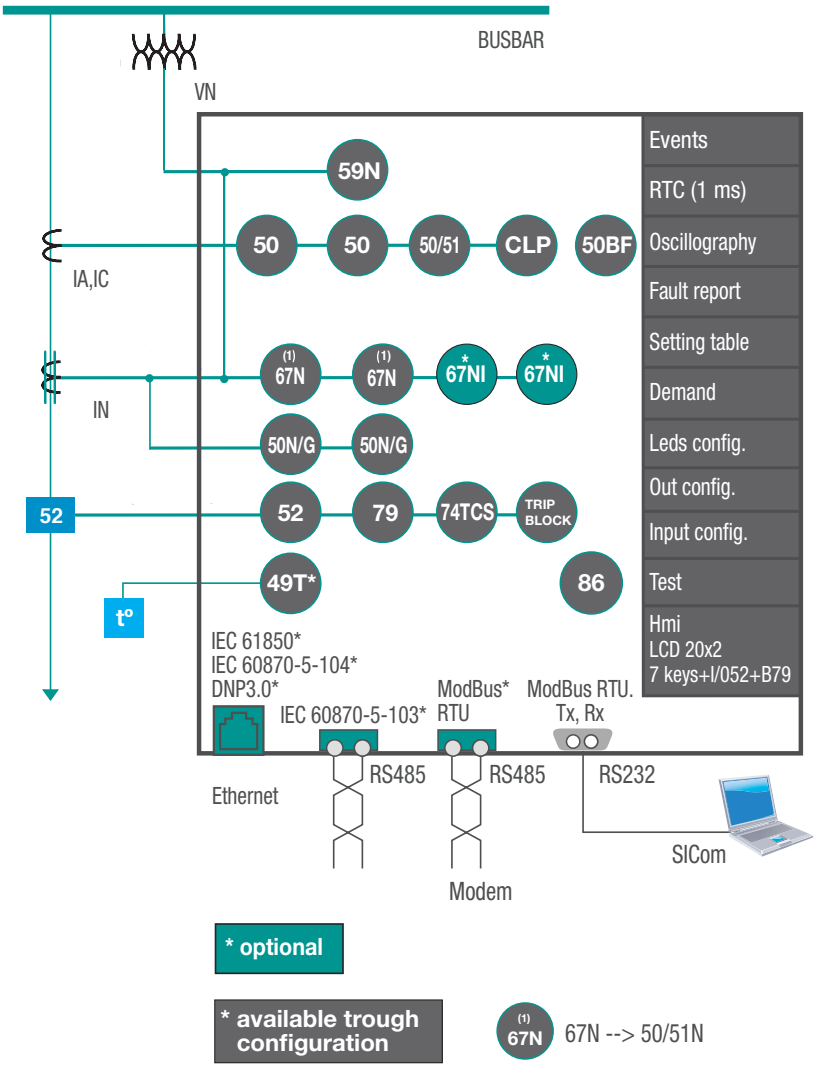
59N	Function permission: Yes/No
	V Operating range: 2 -65 V (step 1V)
	Operating range: 0.10 to 7.00 xIn (step 0.01)
	Reset time: 0.02 to 300s (step 0.01s)
Circuit breaker monitoring	Excessive number of openings: 1 to 10000 (step 1)
	Maximum accumulated amps: 0 to 100000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excessive repeated openings: 1 to 10000 (step 1)
	Time Excessive repeated openings: 1 to 300 min (step 1 min)
50BF	Function permission: Yes/No
	Opening fault time: 0.02 to 1.00 s (step 0.01 s)
	Open circuit breaker activation threshold: 8% In
	Open circuit breaker reset threshold: 10% In
	Function Pickup configurable: Equipment trip, activation of the opening fault input, circuit breaker open control activation.
79	Function permission: Yes/No
	Hold permission: Yes/No
	Number of reclosings: 1 to 5
	Reclosing time 1, 2, 3, 4, 5 : 0.02 to 300 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Replacement time: 0.02 to 300 s (step 0.01 s)
	Definitive opening time: 0.02 to 300 s (step 0.01 s)
74TCS	Function permission: Yes/No
	Time delay: 0.02 to 300 s (step 0.01 s)
	Trip continuity, in circuits A and B
	Configurable inputs
CLP	Function permission: Yes/No
	Settings group: 1 to 4 (step 1)
	No load Time: 0.02 to 300 s (step 0.01 s)
	Cold load Time: 0.02 to 300 s (step 0.01 s)
	CLP activation threshold: 8% In
	CLP reset threshold: 10% In
PLC	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE
86	Allows to latch (lock out) the contact trip due to programmable logic (PLC: LATCH).
49T	Available through configurable inputs thanks to the programmable logic
Trip Block	Blocking: Yes/No
	Blocking limit: 1.5 to 20 x In (step 0.01)
Settings tables	4 settings tables
	Activated by inputs or by general settings.

RTC	Capacitor charge time: 10 minutes
	Operation with no auxiliary voltage: 72 hours
Oscillography	16 samples/cycle
	Fault init configurable
	5 records of 100 cycles: 3 prefault and 97 postfault cycles
	COMTRADE IEEE C37.111-1991
	4 analog channels y 48 digital channels
Fault reports	20 fault reports with 24 events each one
Demand of current	Demand of current with the following characteristics: • Number of records: 168 • Recording mode circular • Sampling rate (interval): configurable through communications: 1 – 60 min Record format: Date/Time IMAX (in interval) IMAX (actual) IA IB IC IN
Configurable inputs	Same voltage as the auxiliary power supply 6 configurable inputs
Configurable outputs	250 Vac – 8 A 30 Vdc – 5 A
	4 configurable outputs • Output 1 and output 2: NC + NO • Output 2 and output 4: NO
Frequency	50/60 Hz selectable by general settings
Current measurement	Phase current (IA, IB, IC), neutral (IN) and maximum current (Imax)
	Real RMS
	Sampling: 16 samples/cycle
	±2% Accuracy over a band of ±20% over the nominal current and 4% over the rest of the range
	The measurement of IB is calculated and it is necessary a minimum of 0.25xIn for a correct measurement.
	Saturation limit: 30 times rated current
Voltage measurement	Residual voltage (VR)
	Real RMS
	Sampling: 16 samples/cycle
	±2% Accuracy in the range of 2 - 65V
Angle between VR and IR	±2° Accuracy angle
	Minimum current for a correct angle measurement: 0.3 x In
	Minimum voltage for a correct angle measurement: 2V
Communications	LOCAL COMMUNICATION 1 Local port RS232: ModBus RTU
	REMOTE COMMUNICATION (*) 1 remote port with the following options : • 1 Remote port RS485: ModBus RTU or IEC 60870-5-103 (by general settings) • 1 Remote port RJ45: IEC 61850, DNP3.0 TCP/IP or IEC 60870-104

Auxiliary power	24-110 Vdc /48-230 Vac ±20%
Environmental conditions	Operating temperature : -10 to 70ºC
	Storage temperature: -20 to 80ºC
	Relative humidity: 95%
Transformers	Measurement 3 or 4 CT /5 or /1
Mechanical Characteristics	Metallic box
	Panel mounted.
	Height x Width: 177 x 107 mm
	Depth: 122.1 mm
	IP-54 on pannel

(*) Optional depending on model

Functions diagram SIL-D

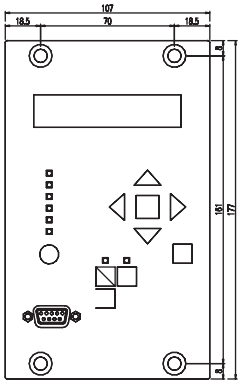


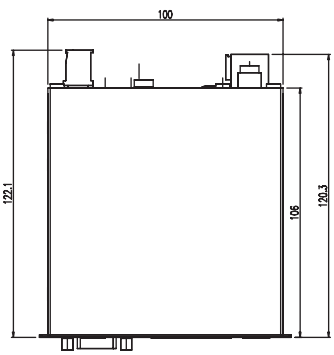
* optional

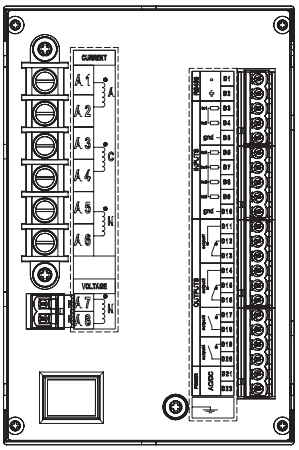
* available trough configuration

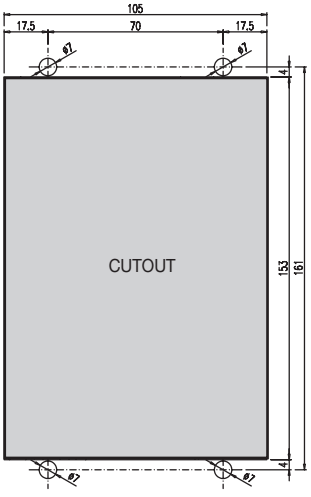
(1) 67N --> 50/51N

Dimensions and cut-out pattern SIL-D









SIL-D	Overcurrent & Directional Earth Fault Protection Relay										PROTECTION FUNCTIONS
											(2) 50 + 50/51 + (2) 50N/G + (2) 50N/51N/67N + 52 + 50BF + 79 + 74TCS + CLP + 86 + 49T + 59N + Trip block for switch disconnector
	X										**NOMINAL PHASE MEASUREMENT** LPCT (Primary = 50 – 800A Standard In = 1A (0.1-30.A) or 5A (0.5-150A) Sensitive In = 0.5A (0.05-15A) or 2.5A (0.25-75A)
	0										
	S										
		X									**NOMINAL NEUTRAL MEASUREMENT** LPCT (Neutral internally calculated) Standard In = 1A (0.1-30A) or 5A (0.5-150A) Sensitive In = 0.1A (0.01-3A) or 0.5A (0.05-15A)
		0									
		S									
			0								**NET FREQUENCY** (50Hz / 60Hz). Defined by Setting
				C							**POWER SUPPLY** 24-220 Vcc / 48-230 Vca
					0						**ADDITIONAL FUNCTIONS** - +67NI_1 + 67NI_2
					1						
						A					**REMOTE COMMUNICATIONS** RS232 (Modbus RTU) + RS485 (Modbus RTU or IEC 60870-5-103) RS232 (Modbus RTU) + RJ45 (IEC 61850) RS232 (Modbus RTU) + RJ45 (DNP3.0 TCP/IP) RS232 (Modbus RTU) + RJ45 (IEC60870-5-104)
						B					
						C					
						D					
							1				**INPUTS AND OUTPUTS** 6 Inputs + 4 Outputs
								2			**MECHANICS** Vertical assembly
									A		**LANGUAGES** English, Spanish and German English, Spanish and Turkish English, Spanish and French English, Turkish and Russian
									B		
									C		
									E		
										A	**ADAPTATION** -

Example of ordering code:

SIL-D	0	0	0	C	1	A	1	2	B	A	*SILD000C1A12BA*

SIL-A

Overcurrent and Earth Fault Relay for Primary and Secondary Distribution

Main characteristics

- The SIL-A is an overcurrent and earth fault protection relay for primary and secondary distribution with auxiliary power supply 24-220 Vdc/ 48-230 Vac). The current measurement is obtained either by standard current transformers /1 or /5, or by special Low Power Current Transformers (LPCT).
- Many protection functions: 50(2), 50N/G (2)(1), 50/51, 50/51N/G(1), 50BF, 46, 52, 79, 74TCS, COLD LOAD PICK-UP, 86, 49T and optionally 49, 74CT, 37, 46 BC, trip block for switch disconnector.
- Metallic box with high electromagnetic compatibility level (EMC) and wide range of operating temperature.
- Direct signalling/control both of the circuit breaker (52 function), both of the recloser (79 function).
- Trip bus protection function is available through configurable inputs and outputs thanks to the programmable logic.
- To allow the communication, relays have a communication port on the front of the equipment and remote communication with different options:

  One rear port on the back with the following options respect to communication protocols:

  - RS 485 PORT: IEC60870-103 or Modbus RTU selectable by settings
  - RJ 45 PORT: IEC 61850, DNP 3.0 or IEC 60870-5-104 (depending on model).
- The SIL-A has configurable inputs and outputs: 6 inputs (74TCS through configurable inputs) - and 4 outputs
- SIL-A is fitted with the demand of current with the following characteristics:

  Number of records: 168

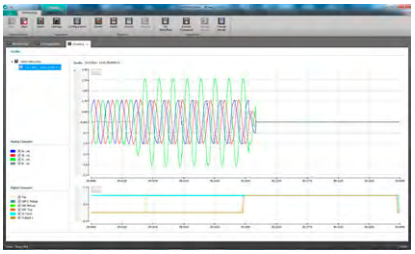
  Recording mode circular

  Sampling rate (interval): configurable through communications: 1 – 60 min

SIL-A relays installed in Azadi Football Stadium's electrical substation.

(1) Note:
- LPCT model: neutral current is calculated so overcurrent protection functions are 50N(2) and 50/51N
- Compact model: neutral current is measured so overcurrent protection functions are 50N/G(2) and 50/51 N/G

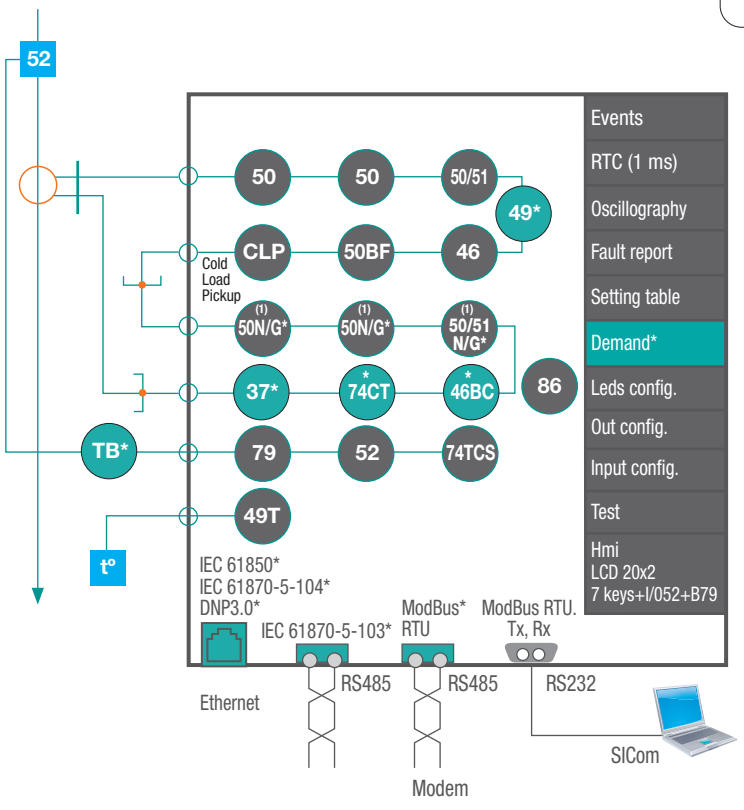
- 5 Oscillographic records, 20 fault reports and 200 events saved in non-volatile RAM memory with date / time even without power supply thanks to its internal RTC (Real Time Clock).



Additional information to fault reports

Technical specifications SIL-A

Functions diagram SIL-A



(1) Note:

- LPCT model: neutral current is calculated so overcurrent protection functions are 50N(2) and 50/51N
- Compact model: neutral current is measured so overcurrent protection functions are 50N/G(2) and 50/51 N/G

*** optional**

Technical parameters SIL-A

50(2)	Function permission: Yes/No
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
50N/G(2) (1)	Function permission: Yes/No
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
50/51	Function permission: Yes/No
	Operating range: 0.10 to 7 xIn (step 0.01)
	Curves IEC 60255-151 and ANSI
	Operating time: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time : 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 2.20 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timer accuracy: ±5% or ±30 ms (whichever is greater)
50/51N/G (1)	Function permission: Yes/No
	Operating range: 0.10 to 7 xIn (step 0.01)
	Curves IEC 60255-151 and ANSI
	Operating time: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time : 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 2.20 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timer accuracy: ±5% or ±30 ms (whichever is greater)
46	Function permission: yes/no
	Operating range: 0.10 to 7.00 xIn (step 0.01)
	Curves IEC 60255-151 and ANSI
	Operating time: IEC Inverse curve, IEC very inverse curve,IEC extremely inverse curve IEC long time inverse, ANSI Inverse curve, ANSI very inverse curve, ANSI extremely inverse curve.
	Defined time : 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 2.20 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timer accuracy: ±5% or ±30 ms (whichever is greater)
Circuit breaker monitoring	Excessive number of openings: 1 to 10000 (step 1)
	Maximum accumulated amps: 0 to 100000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excessive repeated openings: 1 to 10000 (step 1)
	Time Excessive repeated openings: 1 to 300 min (step 1 min)

50BF	Function permission: Yes/No
	Opening fault time: 0.02 to 1.00 s (step 0.01 s)
	Open circuit breaker activation threshold: 8% In
	Open circuit breaker reset threshold: 10% In
	Function Pickup configurable: Equipment trip, activation of the opening fault input, circuit breaker open control activation.
79	Function Permission: yes/no
	Hold permission: yes/no
	Number of reclosings: 1 to 5
	Reclosing time 1, 2, 3, 4, 5 : 0.02 to 300 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Replacement time: 0.02 to 300 s (step 0.01 s)
	Definitive opening time: 0.02 to 300 s (step 0.01 s)
74TCS	Function permission: Yes/No
	Operating time: 0.02 to 300 s (step 0.01 s)
	Trip continuity, in circuits A and B
	Configurable inputs
CLP	Permission: Yes/No
	Settings group: 1 to 4 (step 1)
	No load Time: 0.02 to 300 s (step 0.01 s)
	Cold load Time: 0.02 to 300 s (step 0.01 s)
	CLP activation threshold: 8% In
	CLP reset threshold: 10% In
PLC	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE
86	Allows to latch (lock out) the contact trip due to programmable logic (PLC: LATCH).
49T	Available through configurable inputs thanks to the programmable logic
49 (*)	Function permission: Yes/No
	Operating range: 0.1 to 2.4 xIn (step 0.01)
	ζ heating: 3 to 600 min (step 1 min)
	ζ cooling: 1 to 6 ζ heating (step 1)
	Alarm: 20 to 99 % (step 1%)
	Trip level: 100%
	Deactivation level: 95% of alarm level
	Trip time accuracy: ± 5% over the theoretical value
	Trip time curves are valid under 20 times the adjusted tap. With currents higher than 20 times the adjusted tap, trip time and thermal image value are truncated to 20 times the adjusted tap.
74CT (*)	Function permission: Yes/No
	Operating time: 0.02 to 300 s (step 0.01 s)
	Timing accuracy: ±30 ms or ±0.5% (greater of both)

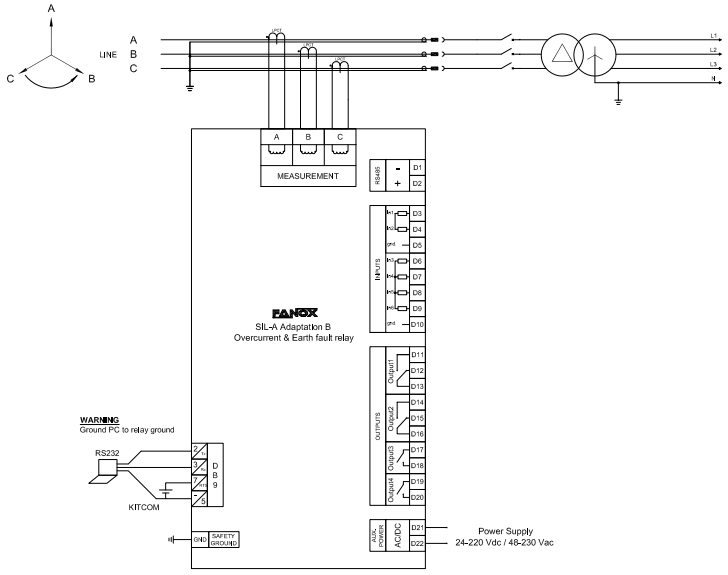
37 (*)	Function permission : yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 105%
	Instantaneous reset
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
46BC (*)	Function permission : yes/no
	Current tap: 15 to 100 %(step 1%)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
Trip block (*)	Blocking: Yes/No
	Blocking limit: 1.5 to 20 x In (step 0.01)
68	Available through configurable inputs and outputs thanks to programmable logic
Settings tables	4 settings tables
	Activated by inputs or by general settings.
RTC	Capacitor charge time: 10 minutes
	Operation with no auxiliary voltage: 72 hours
Oscillography	16 samples/cycle
	Fault init configurable
	5 records of 100 cycles: 3 prefault and 97 postfault cycles
	COMTRADE IEEE C37.111-1991
	4 analog channels y 48 digital channels
Fault reports	20 fault reports with 24 events each one
Demand of current	Demand of current with the following characteristics: • Number of records: 168 • Recording mode circular • Sampling rate (interval): configurable through communications: 1 – 60 min • Record format: Date/Time IMAX (in interval) IMAX (actual) IA IB IC IN
Configurable inputs	Same voltage as the auxiliary power supply 6 configurable inputs
Configurable outputs	250 Vac – 8 A 30 Vdc – 5 A
	4 configurable outputs • Output 1 and output 2: NC + NO • Output 2 and output 4: NO
Frequency	50/60 Hz selectable by general settings
Current measurement	Phase current (IA, IB, IC), neutral (IN), positive sequence (I1), negative sequence(I2), maximum current (Imax) and thermal image (TI)
	Real RMS
	Sampling: 16 samples/cycle
	±2% Accuracy over a band of ±20% over the nominal current and 4% over the rest of the range
	Saturation limit: 30 times rated current

Communications	LOCAL COMMUNICATION 1 Local port RS232: ModBus RTU
	REMOTE COMMUNICATION (*) 1 remote port with the following options : • 1 Remote port RS485: ModBus RTU, IEC 60870-5-103 or DNP3.0 Serial (by general settings) • 1 Remote port RJ45: IEC 61850, DNP3.0 TCP/IP, Modbus TCP/IP or IEC 60870-5-104 (depending on model)
Auxiliary power	24-220 Vdc /48-230 Vac ±20%
Environmental conditions	Operating temperature : -10 to 70ºC
	Storage temperature: -20 to 80ºC
	Relative humidity: 95%
Transformers	Measurement 3 or 4 CT /5 or /1
	Measurement 3 LPCT (current transformers with voltage output)
Mechanical Characteristics	Metallic box
	Panel mounted.
	Height x Width: 177 x 107 mm
	Depth: 122.1 mm
	IP-54 on pannel

(*) Optional depending on the model

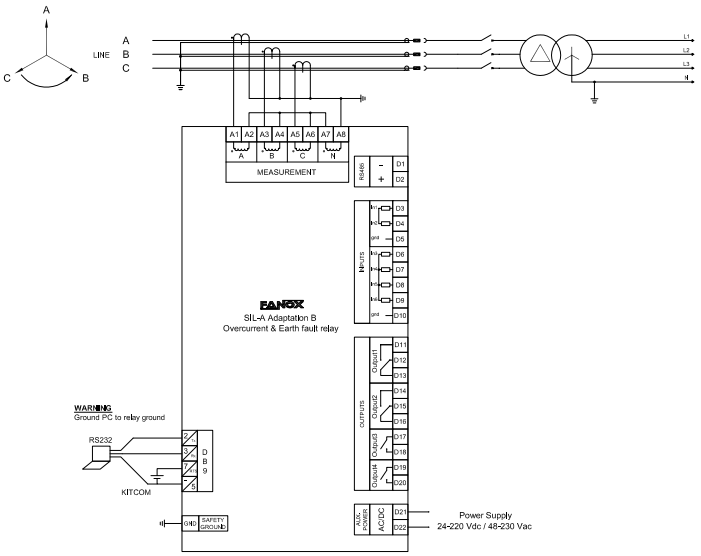
(1) LPCT model→50N/G, 50/51N: calculated neutral; Standard model→50N/G, 50/51N/G: measured neutral

• 3 LPCT Transformers

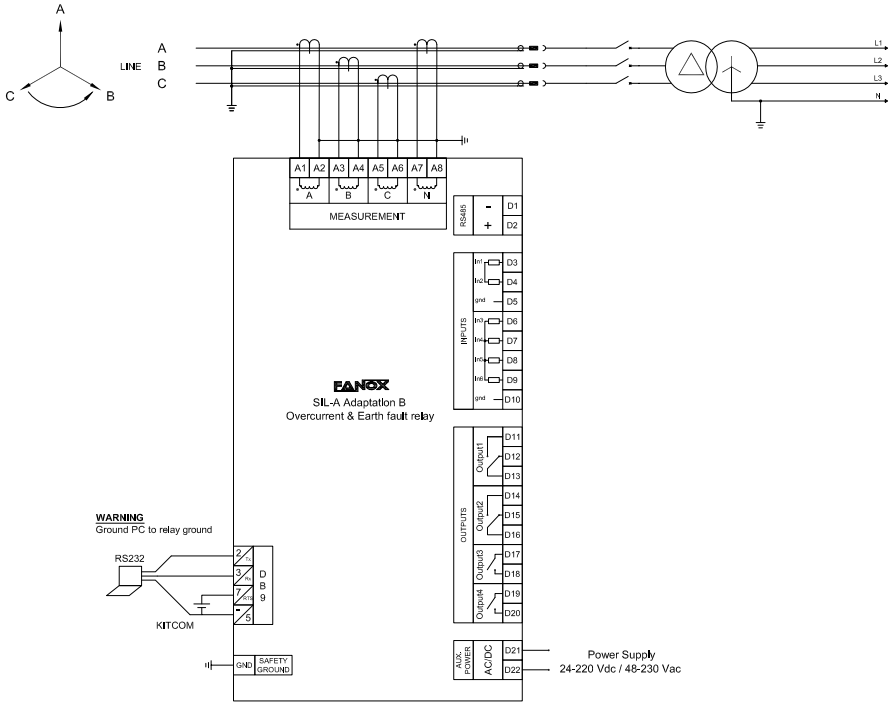


LPCT

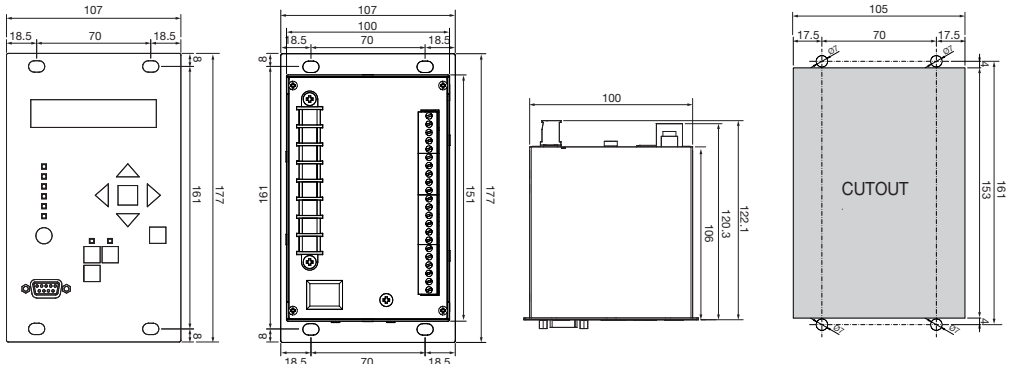
• 3 Standard Current Transformers



• 4 Standard Current Transformers



Connections diagram SIL-A



Selection & Ordering data SIL-A

SIL-A	Overcurrent & Earth Fault Protection Relay for Primary & Secondary										
											PROTECTION FUNCTIONS (2) 50 + 50/51 + (2) 50N/G(1) + 50/51 N/G(1) + 52 + 50BF + 46 + 79 + 74TCS + CLP + 86 + 49T
	X **0** **S**										**PHASE MEASUREMENT** LPCT (Primary = 50 – 800A Standard In = 1A (0.1-30.A) or 5A (0.5-150A) Sensitive In = 0.5A (0.05-15A) or 2.5A (0.25-75A)
		X **0** **S**									**NEUTRAL MEASUREMENT** LPCT (Neutral internally calculated) Standard In = 1A (0.1-30A) or 5A (0.5-150A) Sensitive In = 0.1A (0.01-3A) or 0.5A (0.05-15A)
			0								**NET FREQUENCY** Defined by Setting
				C							**POWER SUPPLY** 24-220 Vdc/48-230Vac
					0 **2**						**ADDITIONAL FUNCTIONS** - + 49 + 74CT + 37 + 46BC + Trip Block
						A **B** **D** **7** **8**					**REAR COMMUNICATIONS** RS232 (Modbus RTU) + RS485 (Modbus RTU or IEC 60870-5-103) RS232 (Modbus RTU) + RJ45 (IEC 61850) RS232 (Modbus RTU) + RJ45 (IEC 60870-5-104) RS232 (Modbus RTU) + RS485 (Modbus RTU or DNP3.0 serial) RS232 (Modbus RTU) + RJ45 (Modbus TCP/IP or DNP3.0 TCP/IP)
							1				**INPUTS-OUTPUTS** 6 Inputs + 4 Outputs
								2			**MECHANICS** Vertical assembly
									A **B** **C** **E**		**LANGUAGE** English, Spanish and German English, Spanish and Turkish English, Spanish and French English, Turkish and Russian
										B	**ADAPTATION** -

Example of ordering code:

SIL A	0	0	0	C	2	A	1	2	B	B	*SILA 0 0 0 C 2 A 1 2 B B*

SIL-B

Feeder Protection Relay for Primary Distribution

Main characteristics

- The SIL-B is a relay for primary distribution which is able to protect a feeder by means of current and voltage functions.

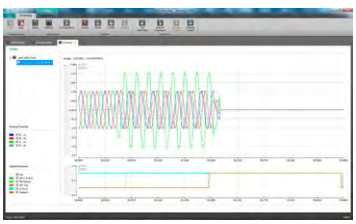
  It is normally used with a circuit breaker as cutting element.

- SIL-B is used with auxiliary power supply 110-230 Vac/90-300 Vdc or 24-48 Vdc.
- Protection functions available in SIL-B are the following:

  50 (2), 50N/G (2), 67 (2), 67N (2), 46, 59 (2), 59N (2), 27 (2), 32/40 (4), 79, 50BF, 52, 49, 86 Cold Load Pick-up, 49T, 74TCS.

  Optionally: 81 U/O, 25, 37 and IRIG-B.

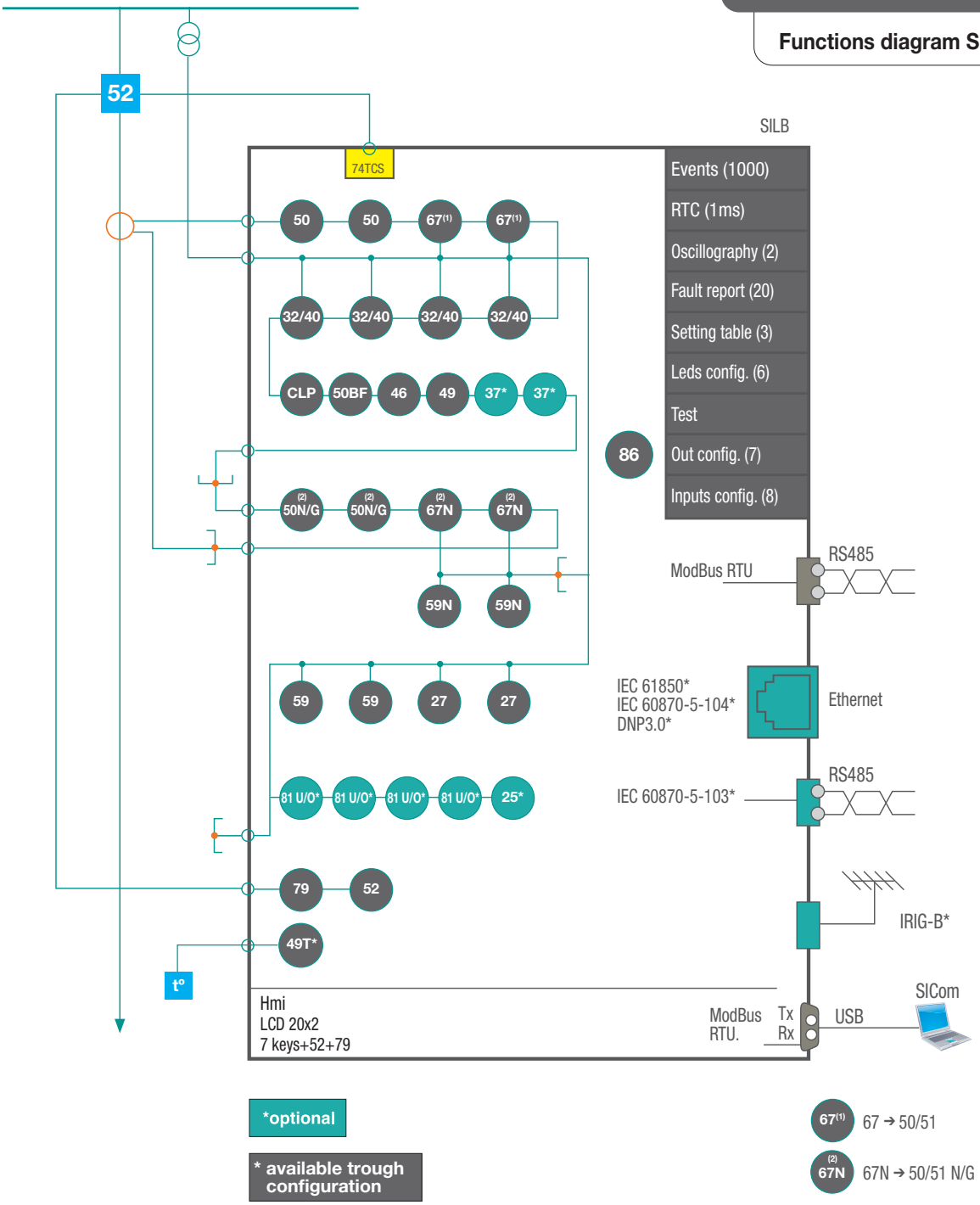
- 79 protection function (Recloser) allows up to 5 attempts of reclosing which can be programmed by the user.
- SIL-B has metallic box with high electromagnetic compatibility level (EMC) and wide range of operating temperature.
- Its reduced size makes the SIL-B relay easy to install and its light weight helps the customer to save costs in transport.
- Direct signalling/control both of the circuit breaker (52 function), both of the recloser (79 function).
- To allow the communication relays have a communication port on the front of the equipment.
- Two rear ports on the back for remote communication. Two communication protocols can be used simultaneously:
  - MODBUS RTU
  - IEC 60870-5-103, IEC 61850, DNP 3.0 or IEC 60870-5-104.
- SIL-B can show different measurements like:
  - Phase r.m.s. currents, neutral r.m.s. current, positive / negative sequence currents.
  - Phase r.m.s. voltages, residual neutral voltage r.m.s, voltage between phases and Busbar phase voltage.
  - Angle current of each phase respect to phase A voltage.
  - Cos Phi (power factor and each phase power factor).
  - Active power, reactive and apparent power (Total power and each phase power).
  - Line frequency and Busbar frequency.
  - Phase difference between phase B line voltage and busbar voltage.
- The SIL-B has 8 configurable inputs and 7 configurable outputs.
- 2 Oscillographic records, non-volatile RAM memory in order to store up to 1.000 events and 20 fault reports, without power supply thanks to its internal RTC (Real Time Clock).



Additional information to fault reports

Technical specifications SIL-B

Functions diagram SIL-B



Technical parameters SIL-B

50_1 **50_2**	Function permission: yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300.00 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: 30 ms
50N/G_1 **50N/G_2**	Function permission: yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300.00 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: 30 ms
67_1 **67_2**	Function permission: yes/no
	Operating range I: 0.10 to 7 xIn (step 0.01)
	Operating range V: 4 to 170V (step 1 V)
	IEC 60255-151 and IEEE curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 2.20 (step 0.01)
	Directionality: yes/no
	Operating angle: 0 to 359º (step 1º)
	Half cone angle: 0 to 170º (step 1º)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Voltage activation level: 100%
	Voltage deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: 5% or 30 ms (whichever is higher)
46	Function permission: yes/no
	Operating range: 0.10 to 1 xIn (step 0.01)
	IEC 60255-151 and IEEE curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 2.20 (step 0.01)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: 5% or 30 ms (whichever is higher)
49	Function permission: yes/no
	Tap: 0.10 a 2.40 Inominal (step 0.01)
	ζ heating: 3 to 600 minutes (step 1 min)
	ζ cooling: 1 a 6 times ζ heating (step 1)
	Alarm level: 20 to 99% (step 1%)
	Trip level: 100%
	Deactivation level: 95% of alarm level
	Timing accuracy: ± 5% respect of theorical value.
	Trip time curves are valid under 20 times the adjusted tap. With currents higher than 20 times the adjusted tap, trip time and thermal image value are truncated to 20 times the adjusted tap.
37_1 (*) **37_2 (*)**	Function permission: yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 105%
	Instantaneous reset
	Timing accuracy: 30 ms

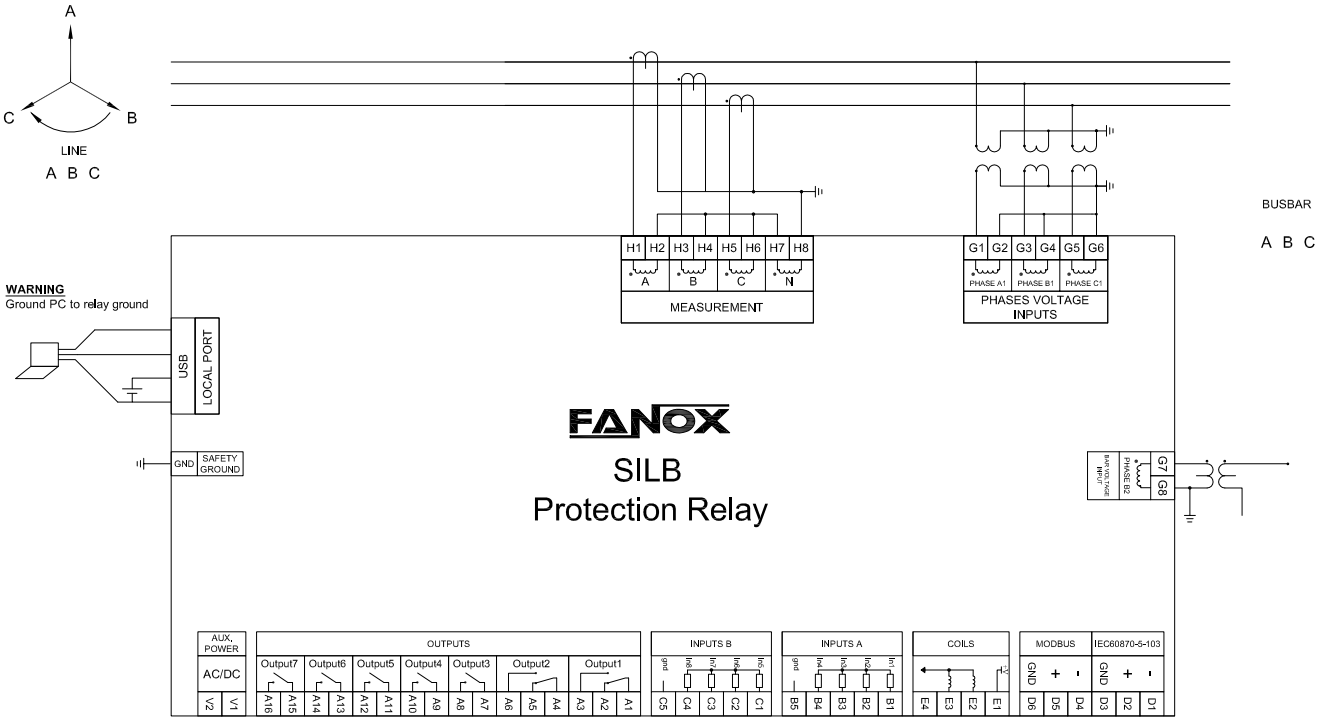
59_1 **59_2**	Function permission: yes/no
	Operating range: 4 to 170V (step 1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.2 to 1200.0 s (step 0.1 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: 30 ms
59N_1 **59N_2**	Function permission: yes/no
	Operating range: 4 to 170V (step 1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.2 to 1200.0 s (step 0.1 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: 30 ms
27_1 **27_2**	Function permission: yes/no
	Operating range: 4 to 170V (step 1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.2 to 1200.0 s (step 0.1 s)
	Activation level: 100%
	Deactivation level: 105%
	Temporized deactivation
	Timing accuracy: 30 ms
32_1 **32_2** **32_3** **32_4**	Function permission: yes/no
	Operating range: 1 to 10000 VA (step 1 VA) – secondary values
	Operating angle: 0 to 359º (step 1º)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Instantaneous deactivation
81_1 (*) **81_2 (*)** **81_3 (*)** **81_4 (*)**	Function permission: yes/no
	Type: Underfrequency or overfrecuency
	Operating range: 45.00 a 65.00 Hz (step 0.01 Hz)
	Operating time: 0.06 a 300 s (step 0.01 s)
	Reset time: 0.2 a 1200.0 s (step 0.1 s)
	Block function if phase b voltage is lower than 30 volts
	Activation level: 100%
	Underfrequency reset level: activation level + 50mHz Overfrequency reset level: activation level – 50 mHz
	Temporized deactivation
	Timing accuracy: 30 ms
Circuit breaker monitoring	Breaker state: start, open, closed, error, opening time, opening error, closure time, closure error
	52a input and/or 52b input
	Opening and closure commands
	Maximum number of openings alarm: 1 a 10000
	Total amps alarm: 0 to 100000 M(A^2)
	Excess repeated openings: 1 a 10000
	Repeated openings excess time: 1 to 300 min
50BF	Function permission : yes/no
	Opening failure time: 0.02 to 1.00 s (step 0. 01 s)
	Open breaker activation threshold: 8% In
	Open breaker reset time: 10% In
	Function start: Device trip, opening failure input activation, breaker opening command activation
79	Function permission : yes/no
	Wait permission: yes/no
	Number of reclosings: 1 to 5
	Reclosure times 1, 2, 3, 4, 5 : 0.02 to 300.00 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Replacement time: 0.02 to 300.00 s (step 0.01 s)
	Definitive opening time: 0.02 to 300 s (step 0.01 s)

25 (*)	Closure permission LLLB, LLDB, DLLB, DLDB: yes/no
	Live line/bar voltage level: 30 to 170 V (step 0.1 V)
	Dead line/bar voltage level: 4 to 170 V (step 0.1 V)
	Voltage supervisión temporisation: 0.02 to 300 s (step 0.01 s)
	Line-bar voltage difference: 4 to 170 V (step 0.1 V)
	Line-bar phase difference: 0 to 359º (step 1 º)
	Line-bar frequency difference : 0.02 to 0.50 Hz (step 0.01 Hz)
	Synchro temporization: 0.02 to 300 s (step 0.01 s)
	Phase B line voltage and busbar voltage: - Modules and phases using DFT - Frequency using hardware circuit with the passing through zero detection.
	Permission signal minimum time 150 ms
74TCS	Function permission: yes/no
	Operating time: 0.02 to 300 s (step 0.01 s)
	Command voltage presence: -40%
	Trip continuity, in circuit a and b.
CLP	Function permission: yes/no
	50_1 multiplier range: 1 to 5
	50_2 multiplier range: 1 to 5
	67_1 multiplier range: 1 to 5
	67_2 multiplier range: 1 to 5
	50N/G_1 multiplier range: 1 to 5
	50N/G_2 multiplier range: 1 to 5
	67N_1 multiplier range: 1 to 5
	67N_2 multiplier range: 1 to 5
	Time to pass to CLP: 1 a 18000 s (step 1 s)
	CLP duration time: 1 a 18000 s (step 1 s)
	CLP activation threshold: 8% In
	CLP deactivation threshold: 10% In
Programmable logic control (PLC)	OR16, OR16_LATCH, NOR16, NOR16_LATCH
86	Allows to latch (lock out) the contact trip due to programmable logic (PLC: OR_LATCH).
Settings tables	1 general settings table
	3 protection criteria tables
	Selectable by input or general setting.
RTC	Condenser charge time: 10 minutes
	Functioning without auxiliary voltage: 72 hours
Oscillography	16 samples/cycle
	Oscillo starting configuration
	2 records: 10 cycles pre-fault and 128 post-fault
	COMTRADE IEEE C37.111-1991
	8 analogue channels and 120 digital channels
Fault report	20 fault reports with 80 events in each
Configurable inputs	8 Configurable inputs The voltage of the inputs is the same as the auxiliary power supply
Configurable outputs	Configurable outputs 250 V AC – 8 A 30 V DC – 5 A
	Output 1 and output 2:Commuted (NC + NO) Others: NO
Frequency	50/60Hz
Current measurement	Phase currents (IA,IB,IC), neutral (IN), positive sequence (I1) and negative sequence (I2)
	Real RMS
	Sampling: 16 samples/cycle
	2% precision in a band covering ±20% of nominal current and ±4% in the rest of the range
	Saturation limit: 30 times rated current

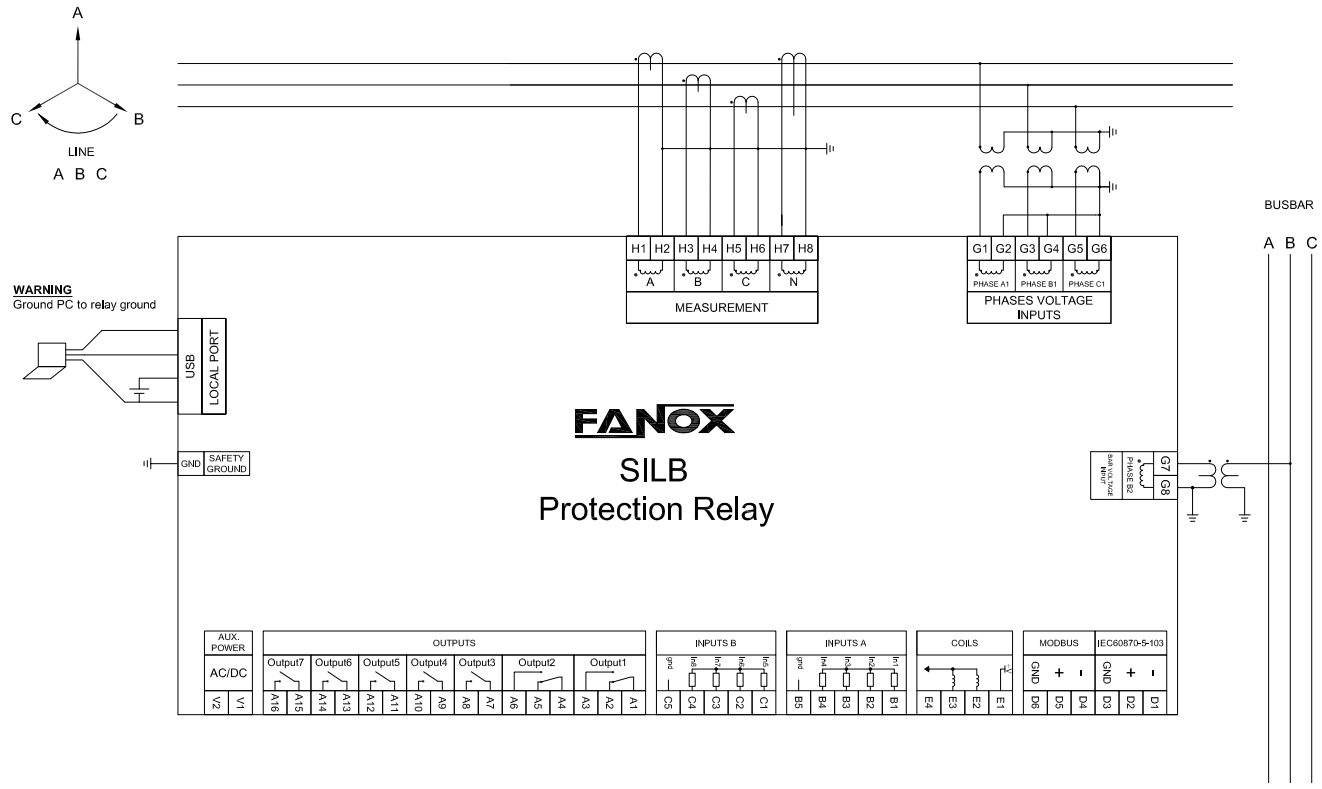
Voltage measurement	Phase voltage (VA,VB,VC), phase-phase voltage (VAB,VBC,VCA), neutral voltage (VN), bus voltage (VBB)
	The neutral voltage is calculated internally from the phase voltages.
	Real RMS
	Sampling: 16 samples/cycle
	2% precision in a band covering ±20% of nominal current and 4% in the rest of the range
	Measure: 4 to 185V
Angle accuracy	±2º
Power measurement	Total and per phase active power
	Total and per phase reactive power
	Total and per phase apparent power
	Total and per phase power factor
	2% accuracy in rated values with power factor between 1 and 0.7 (phase shift from 0 to ±45º).
Energy measurement	Positive and negative active energy
	Positive and negative reactive energy
Frequency measurement	Starting from phase B line voltage, passing through zero detection to line frequency Starting from phase B busbar voltage, passing through zero detection to busbar frequency.
	Minimum voltage: 30V
	Accuracy: ±0.01 Hz
Communications	Local port (USB): Modbus RTU
	Remote port RS485: Modbus RTU
	Remote port RS485: IEC 60870-5-103 (*)
	Remote port RJ45: IEC 61850, DNP3.0 or IEC60870-5-104 (*)
Power supply (*)	90 V DC – 300V DC / 110 V AC – 230 V AC ±20%
	24V DC - 48 V DC ±10%
Environmental conditions	Operating temperature: -10 to 70ºC
	Storage temperature: -20 to 80 ºC
	Relative humidity: 95%
Mechanical characteristics	Metal case
	Panel mounting
	Height x Width: 177.8 x 241.3 mm
	Depth: 116.75 mm
	IP-54

(*) Optional depending on model

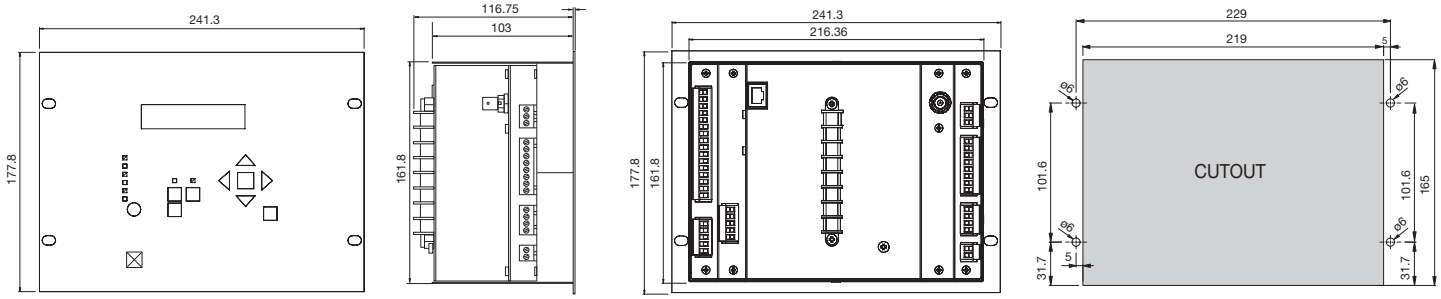
• 3 Phase Current Transformers



• 3 Phase Current Transformers + 1 Neutral



Dimensions and cutout pattern SIL-B



Selection & Ordering data SIL-B

SIL-B	Feeder Protection Relay for Primary Distribution										
	1 5										**PROTECTION FUNCTIONS** 50(2) + 50N/G(2)+ 67(2) + 67N(2) + 59(2) + 59N(2) + 27(2) + 32(4) + 52 + 50BF + 46 + 79 + 74TCS + Cold Load Pick-up + 49 + 86 + 49T
	1 5										**PHASE MEASUREMENT** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A)
		1 5									**NEUTRAL MEASUREMENT** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A)
			5 6								**NET FREQUENCY** 50 Hz 60 Hz
				A B							**POWER SUPPLY** 24-48 Vdc 90-300 Vdc / 110-230 Vac
					0 1 2						**ADDITIONAL FUNCTIONS** - + 81U/O(4) + 25 + 37(2) + 81U/O(4) + 25 + 37(2) + IRIG-B
						0 3 4 5 6					**COMMUNICATIONS** USB (Modbus RTU) + RS485 (Modbus RTU) + RS485 (IEC 60870-5-103) USB (Modbus RTU) + RS485 (Modbus RTU) + RJ45 (IEC 61850) USB (Modbus RTU) + RS485 (Modbus RTU) + RJ45 (DNP3.0 TCP/IP) USB (Modbus RTU) + RS485 (Modbus RTU) + RJ45 (IEC 60870-5-104) USB (Modbus RTU) + RS485 (Modbus RTU) + FOC-LC (IEC 61850 HSR)
							0				**INPUTS-OUTPUTS** 8 Inputs and 7 Outputs
								1			**MECHANICS** Horizontal assembly
									A B D		**LANGUAGE** English, Spanish, French and German English, Spanish , French and Turkish English , Spanish , French and Russian
										A	**ADAPTATION** -

Example of ordering code:

SILB	1	1	6	B	0	0	0	1	B	A	*SILB 1 1 6 B 0 0 0 1 B A*

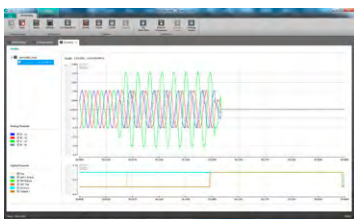
SIL-G

Generator Protection Relay

Main characteristics

- The SIL-G is a relay for the protection of generators which is able to protect a generator by means of current, voltage and frequency functions. It is normally used with a circuit breaker as cutting element.
- It is normally used in Cogeneration in power stations from gas, steam, hydraulic turbine, or diesel driven generators.
- SIL-G is used with auxiliary power supply (110-230 Vac/ 90-300 Vdc or 24-48 Vdc).
- Protection functions available in SIL-G are the following:

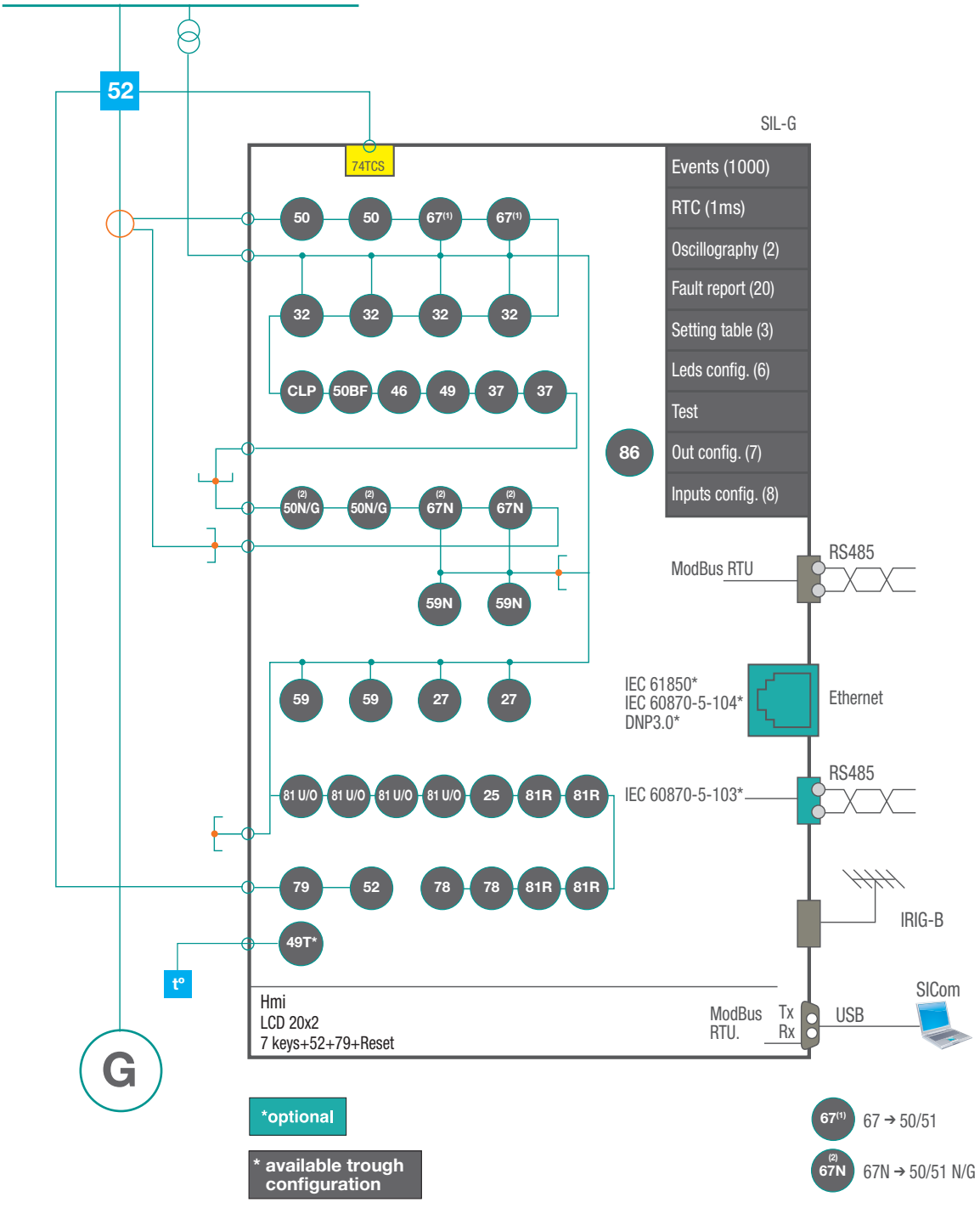
  81R (4), 78 (2), 81 U/O (4), 27, 32 (4), 59 (2), 59N (2), 25, 79, 50 (2), 50N/G (2), 67(2), 67N (2), 46, 50BF, 52, 49, 86, Cold Load Pick-up, 49T, 74TCS, 37 and IRIG-B.
- 79 protection function (Recloser) allows up to 5 attempts of reclosing which can be programmed by the user.
- SIL-G has metallic box with high electromagnetic compatibility level (EMC) and wide range of operating temperature.
- Its reduced size makes the SIL-G relay easy to install and its light weight helps the customer to save costs in transport.
- Direct signalling/control both of the circuit breaker (52 function), both of the recloser (79 function).
- To allow the communication relays have a communication port on the front of the equipment
- Two rear ports on the back for remote communication. Two communication protocols can be used simultaneously:
  - MODBUS RTU
  - IEC 60870-5-103, IEC 61850, DNP 3.0 or IEC 60870-5-104
- SIL-G can show different measurements:
  - Phase r.m.s. currents, neutral r.m.s. current, positive / negative sequence currents
  - Phase r.m.s. voltages, residual neutral voltage r.m.s, voltage between phases and Busbar phase voltage
  - Angle current of each phase respect to phase A voltage
  - Cos Phi (power factor and each phase power factor)
  - Active power, reactive and apparent power (Total power and each phase power)
  - Line frequency and Busbar frequency
  - Phase difference between phase B line voltage and busbar voltage
- The SIL-G has 8 configurable inputs and 7 configurable outputs apart from the specific inputs for the supervisión of trip coils (function 74TCS)
- 2 Oscillographic records, non-volatile RAM memory in order to store up to 1.000 events and 20 fault reports, without power supply thanks to its internal RTC (Real Time Clock).



Additional information to fault reports

Technical specifications SIL-G

Functions diagram SIL-G



81R_1 81R_2 81R_3 81R_4	Function permission: yes/no
	Type: Increment or Decrement
	Level: 0.1 to 5 Hz/s (step 0.1 Hz/s)
	Operating time: 0.3 to 40 s (step 0.1 s)
	Reset level: 0.2 to 1200 s (step 0.1 s)
78_1 78_2	Function permission: yes/no
	Level: 1 to 25. (step 1°)
	Reset time: 0.2 to 1200 s (step 0.1 s)
	Level accuracy: ±0.5°
50_1 50_2	Function permission: yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300.00 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
50N/G_1 50N/G_2	Function permission: yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300.00 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
67_1 67_2	Function permission: yes/no
	Operating range I: 0.10 to 7 xIn (step 0.01)
	Operating range V: 4 to 170V (step 1 V)
	IEC 60255-151 and IEEE curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 2.20 (step 0.01)
	Directionality: yes/no
	Operating angle: 0 to 359º (step 1º)
	Half cone angle: 0 to 170º (step 1º)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Voltage activation level: 100%
	Voltage deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ± 5% (greater of both).
67N_1 67N_2	Function permission: yes/no
	Operating range I: 0.10 to 7 xIn (step 0.01)
	Operating range V: 4 to 170 V (step 1 V)
	IEC 60255-151 and IEEE curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 2.20 (step 0.01)
	Directionality: yes/no
	Operating angle: 0 to 359º (step 1º)
	Half cone angle: 0 to 170º (step 1º)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Voltage activation level: 100%
	Voltage deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ± 5% (greater of both).

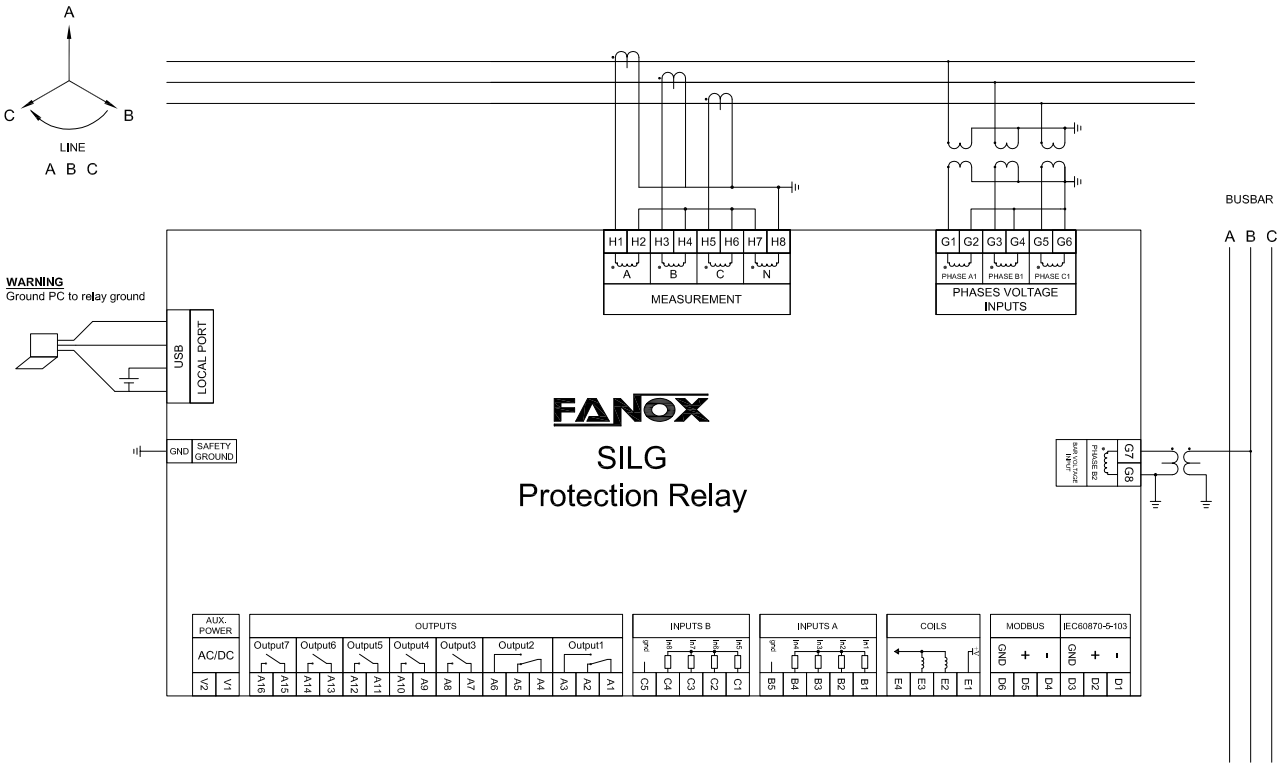
46	Function permission : yes/no
	Operating range: 0.10 to 1 xIn (step 0.01)
	IEC 60255-151 and IEEE curves
	Operating time: Inverse curve, very inverse curve, extremely inverse curve.
	Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.05 to 2.20 (step 0.01)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy: ±30 ms or ± 5% (greater of both).
49	Function permission: yes/no
	Tap: 0.10 a 2.40 Inominal (step 0.01)
	ζ heating: 3 a 600 minutos (step 1 min)
	ζ cooling: 1 a 6 veces ζ heating (step 1)
	Alarm level: 20 a 99% (step 1%)
	Trip level: 100%
	Deactivation level: 95% of alarm level
	Timing accuracy: ±30 ms or ± 5% (greater of both).
	Trip time curves are valid under 20 times the adjusted tap. With currents higher than 20 times the adjusted tap, trip time and thermal image value are truncated to 20 times the adjusted tap.
37_1 37_2	Function permission: yes/no
	Operating range: 0.10 to 30 xIn (step 0.01)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 105%
	Instantaneous reset
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
59_1 59_2	Function permission: yes/no
	Operating range: 4 to 170V (step 1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.2 to 1200.0 s (step 0.1 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ±40 ms or ± 0.5% (greater of both).
59N_1 59N_2	Function permission: yes/no
	Operating range: 4 to 170V (step 1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.2 to 1200.0 s (step 0.1 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ±40 ms or ± 0.5% (greater of both).
27_1 27_2	Function permission: yes/no
	Operating range: 4 to 170V (step 1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.2 to 1200.0 s (step 0.1 s)
	Activation level: 100%
	Deactivation level: 105%
	Temporized deactivation
	Timing accuracy: ±40 ms or ± 0.5% (greater of both).

32_1 32_2 32_3 32_4	Function permission: yes/no
	Operating range: 0 to 10000 VA (step 1 VA) – secondary values
	Operating angle: 0 to 359º (step 1º)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Instantaneous deactivation
81_1 81_2 81_3 81_4	Function permission: yes/no
	Type: Underfrequency or overfrecuency
	Operating range: 45.00 a 65.00 Hz (step 0.01 Hz)
	Operating time: 0.06 a 300 s (step 0.01 s)
	Reset time: 0.2 a 1200.0 s (step 0.1 s)
	Block function if phase b voltage is lower than 50 volts
	Activation level: 100%
	Underfrequency reset level: activation level + 50mHz
	Overfrequency reset level: activation level – 50 mHz
	Temporized deactivation
	Timing accuracy: ±40 ms or ± 0.5% (greater of both).
Circuit breaker monitoring	Breaker state: start, open, closed, error, opening time, opening error, closure time, closure error
	52a input and/or 52b input
	Opening and closure commands
	Maximum number of openings alarm: 1 a 10000
	Total amps alarm: 0 to 100000 (M(A^2))
	Excess repeated openings: 1 a 10000
	Repeated openings excess time: 1 to 300 min
50BF	Function permission: yes/no
	Opening failure time: 0.02 to 1.00 s (step 0. 01 s)
	Open breaker activation threshold: 8% In
	Open breaker reset time: 10% In
	Function start: Device trip, opening failure input activation, breaker opening command activation
79	Function permission: yes/no
	Wait permission: yes/no
	Number of reclosings: 1 to 5
	Reclosure times 1, 2, 3, 4, 5: 0.02 to 300.00 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Replacement time: 0.02 to 300.00 s (step 0.01 s)
	Definitive opening time: 0.02 to 300 s (step 0.01 s)
25	Closure permission LLLB, LLDB, DLLB, DLDB: yes/no
	Live line/bar voltage level: 30 to 170 V (step 0.1 V)
	Dead line/bar voltage level: 4 to 170 V (step 0.1 V)
	Voltage supervisión temporisation: 0.02 to 300 s (step 0.01 s)
	Line-bar voltage difference: 4 to 170 V (step 0.1 V)
	Line-bar phase difference: 0 to 359º (step 1 º)
	Line-bar frequency difference: 0.02 to 0.50 Hz (step 0.01 Hz)
	Synchro temporization: 0.02 to 300 s (step 0.01 s)
	Phase B line voltage and busbar voltage. Modules and phases using DFT Frequency using hardware circuit with the passing through zero detection.
	Permission signal minimum time 150 ms
74TCS	Function permission: yes/no
	Operating time: 0.02 to 300 s (step 0.01 s)
	Command voltage presence: -40%
	Trip continuity, in circuit a and b.
CLP	Function permission: yes/no
	50_1 multiplier range: 1 to 5
	50_2 multiplier range: 1 to 5
	67_1 multiplier range: 1 to 5
	67_2 multiplier range: 1 to 5
	50N/G_1 multiplier range: 1 to 5
	50N/G_2 multiplier range: 1 to 5
	67N_1 multiplier range: 1 to 5
	67N_2 multiplier range: 1 to 5
	Time to pass to CLP: 1 to 18000 s (step 1 s)
	CLP duration time: 1 to 18000 s (step 1 s)
	CLP activation threshold: 8% In
	CLP deactivation threshold: 10% In
49T	Available through configurable inputs

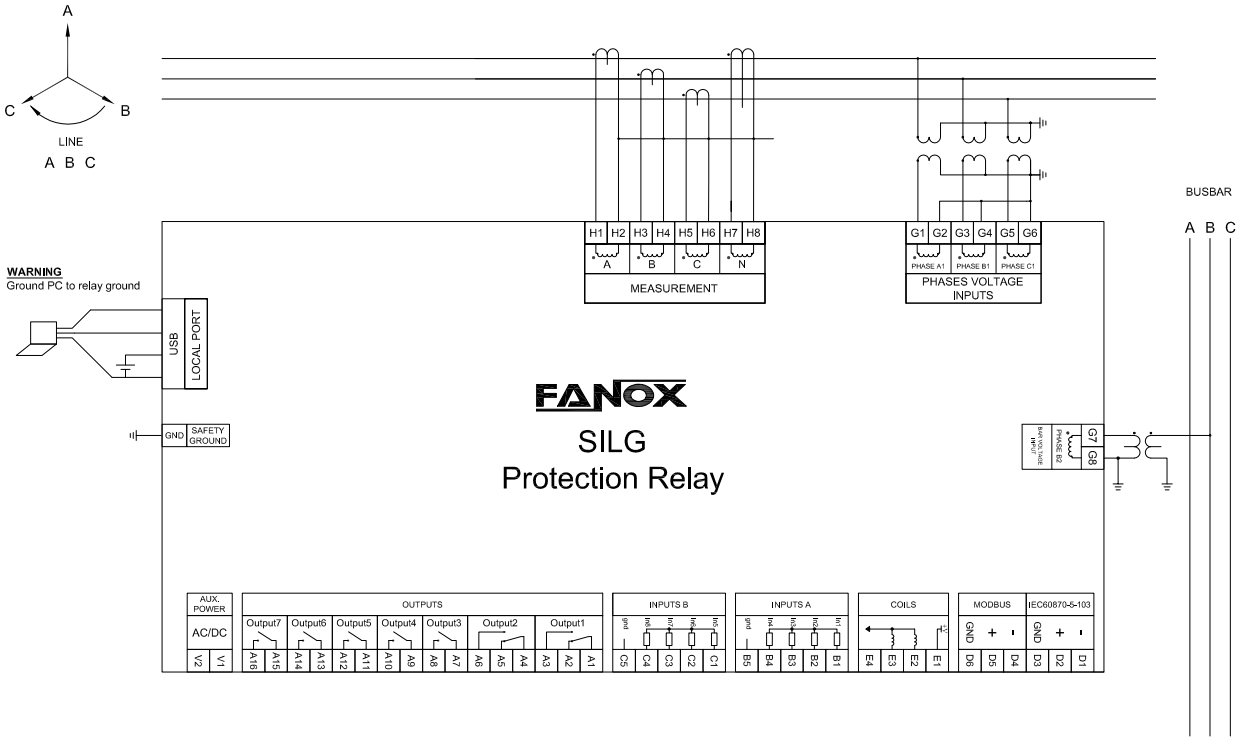
Programmable logic control (PLC)	OR16, OR16_LATCH, NOR16, NOR16_LATCH.
86	Allows to latch (lock out) the contact trip due to programmable logic (PLC: OR_LATCH).
Settings tables	3 settings tables
	Activated by general settings or by inputs
RTC	Capacitor charge time: 10 minutes
	Operation without auxiliary voltage: 72 hours
Oscillography	16 samples/cycle
	Oscillo starting configuration
	2 records: 10 cycles pre-fault and 128 post-fault
	COMTRADE IEEE C37.111-1991
	8 analogue channels and 120 digital channels
Fault report	20 fault reports with 80 events in each
configurable inputs	8 configurable inputs: The voltage of the inputs is the same as the auxiliary power supply
configurable outputs	7 configurable outputs: 250 V AC – 8 A 30 V DC – 5 A
	Output 1 and output 2: Commuted (NC + NO) Others: NO
Frequency	50/60Hz
Current measurement	Phase currents (IA,IB,IC), neutral (IN), positive sequence (I1) and negative sequence (I2)
	Real RMS
	Sampling: 16 samples/cycle
	2% precision in a band covering ±20% of nominal current and ±4% in the rest of the range
	Saturation limit: 30 times rated current
Voltage measurement	Phase voltage (VA,VB,VC), phase-phase voltage (VAB,VBC,VCA), neutral voltage (VN), bus voltage (VBB)
	The neutral voltage is calculated internally from the phase voltages.
	Real RMS
	Sampling: 16 samples/cycle
	2% precision in a band covering ±20% of nominal current and 4% in the rest of the range
	Measurement range: 4-185 V
Angle accuracy	±2º
Power measurement	Total and per phase active power
	Total and per phase reactive power
	Total and per phase apparent power
	Total and per phase power factor
	2% accuracy in rated values with power factor between 1 and 0.7 (phase shift from 0 to ±45º).
Energy measurement	Positive and negative active energy
	Positive and negative reactive energy
Frequency measurement	Starting from phase B line voltage, passing through zero detection to line frequency Starting from phase B busbar voltage, passing through zero detection to busbar frequency.
	Minimum voltage: 50V
	Accuracy: ±0.01 Hz
Communications	Local port (USB): Modbus RTU
	Remote port RS485: Modbus RTU
	Remote port RS485: IEC 60870-5-103 (*)
	Remote port RJ45: IEC 61850, DNP3.0 or IEC60870-5-104 (*)
Power supply (*)	90 V DC – 300V DC / 110 V AC – 230 V AC ±20%
	24V DC - 48 V DC ±10%
Environmental conditions	Operating temperature: -10 to 70ºC
	Storage temperature: -20 to 80 ºC
	Relative humidity: 95%
Mechanical characteristics	Metal case
	Panel mounting
	Height x Width: 177.8 x 241.3 mm
	Depth: 116.75 mm
	IP-54

(*) Optional depending on model

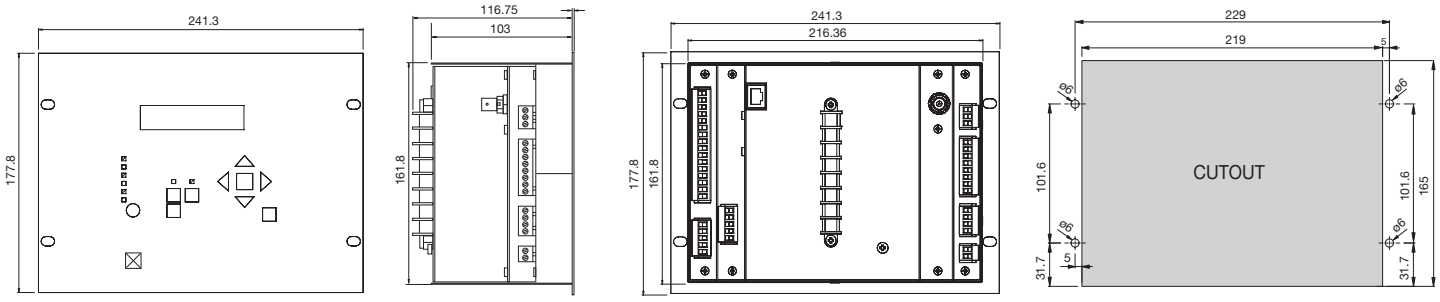
• 3 Phase Current Transformers



• **3** Phase Current Transformers
&
• **1** Neutral Current Transformers



Dimensions and cutout pattern SIL-G



Selection & Ordering data SIL-G

SIL-G	Voltage & Frequency Protection / Synchronism Check Relay										
											PROTECTION FUNCTIONS 81R(4) + 78(2) + 81U/O(4) + 59(2) + 59N(2) + 27(2) + 32(4) + 25 + 79 + 37(2) + 50(2) + 67(2) + 50N/G(2) + 67N(2) + 46 + 52 + 50BF + 74TCS + CLP + 49 + 86 + 49T
	1 **5**										**PHASE MEASUREMENT** In = 1 A; (0.10 – 30.00 A) In = 5 A; (0.50 – 150.00 A)
		1 **5**									**NEUTRAL MEASUREMENT** In = 1 A; (0.10 – 30.00 A) In = 5 A; (0.50 – 150.00 A)
			5 **6**								**NET FREQUENCY** 50 Hz 60 Hz
				A **B**							**POWER SUPPLY** 24 - 48Vdc 90 – 300Vdc / 110 – 230Vac
					4						**ADDITIONAL FUNCTIONS** + IRIG-B
						0 **3** **4** **5**					**COMMUNICATIONS** USB (Modbus RTU) + RS485 (Modbus RTU) + RS485 (IEC 60870-5-103) USB (Modbus RTU) + RS485 (Modbus RTU) + RJ45 (IEC 61850) USB (Modbus RTU) + RS485 (Modbus RTU) + RJ45 (DNP3.0 TCP/IP) USB (Modbus RTU) + RS485 (Modbus RTU) + RJ45 (IEC 60870-5-104)
							0				**INPUTS-OUTPUTS** 7 outputs + 8 inputs
								1			**MECHANICS** Horizontal assembly
									A **B** **D**		**LANGUAGE** English, Spanish, French and German English, Spanish , French and Turkish English , Spanish , French and Russian
										A	**ADAPTATION** -

Example of ordering code:

SIL G	5	1	5	B	4	0	0	1	B	A	*SILG5155B4001BA*

SIL-V

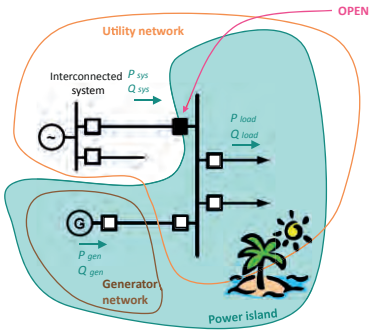
Voltage & Frequency Protection / Synchronism Relay

Main characteristics

- The SIL-V is a voltage and frequency protection relay and represents the best and precise protection soluctions for transformers and electrical machines, in high, medium and low voltage distribution systems. Also protects decoupling, load shedding and loss of main (islanding).
- It requires auxiliary power supply of 24-220 Vdc/48-230Vac.
- It uses a circuit breaker as a cut-off element to protect a feeder.
- Capability of measuring up to 1.000 volts when it is connected directly to the low voltage line.
- Protects decoupling, load shedding and loss of main (islanding).

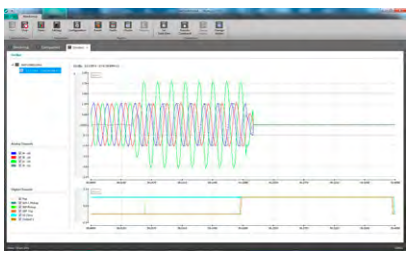
  Loss of Mains (islanding) occurs when part of the the public utility network loses connection with the rest of the system. If this situation is not detected, then the generator could remain connected, causing a safety hazard within the network.

  Automatic reconnection of the generator to the network may occur causing damage to the generator and the network. SIL-V protection relay detects this situation thanks to its voltage and frequency functions focused on the Rate of change of frequency (ROCOF) method.



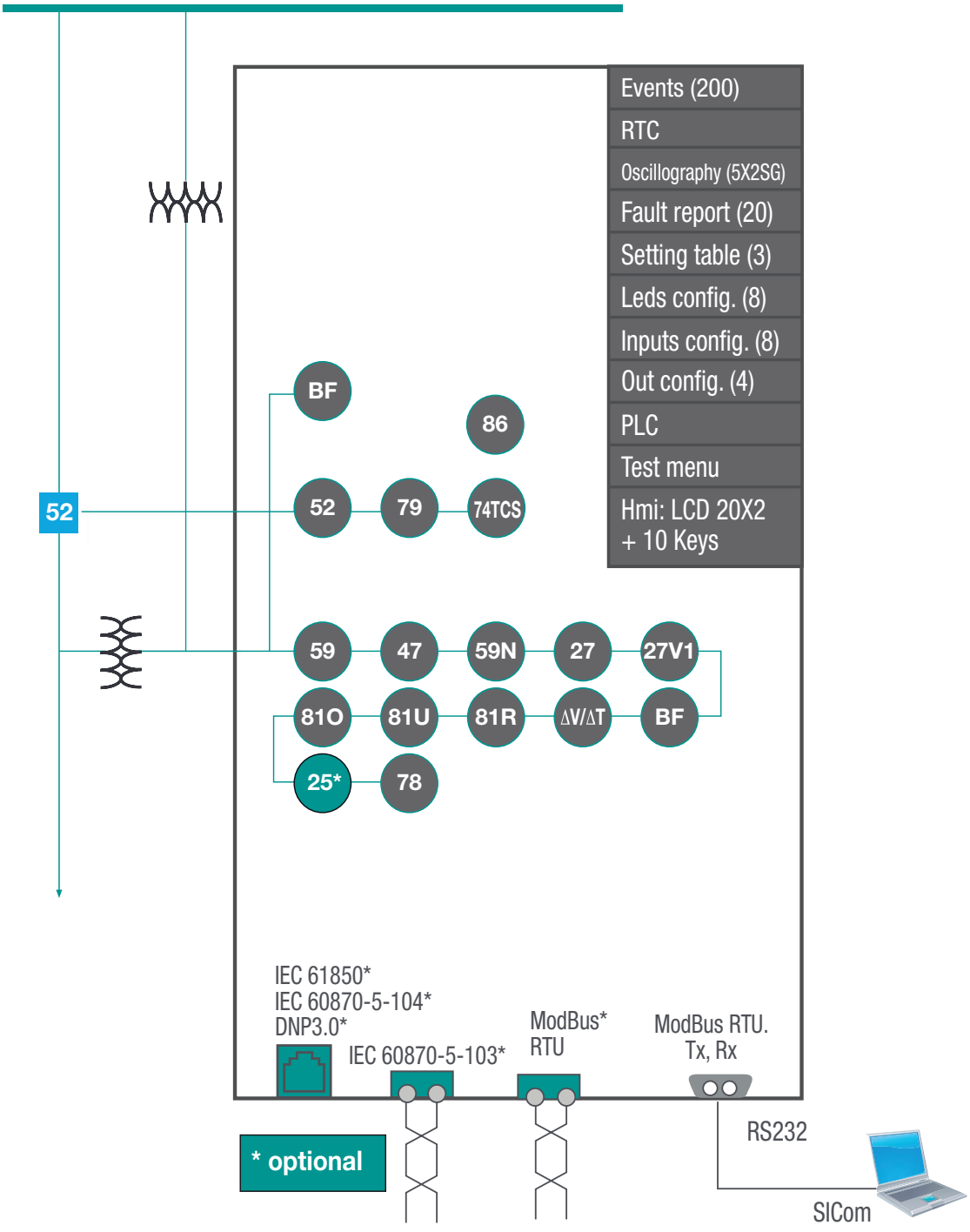
- Protection functions: 27(2), 27V1, 59(2), 47, 59N(2), ΔV/ΔT, 74TCS, BF, 52, 79, 81O/U(4), 81R(2), 86, 78 and optionally 25.

  Function 25 (Synchronism): Voltage difference, frequency slip, angle differences, DLDB, DLLB, LLDB, LLLB.
- 79 protection function (Recloser) allows up to 5 attempts of reclosing which can be programmed by the user.
- Direct signalling/control both of the circuit breaker (52 function), both of the recloser (79 function).
- Metallic box with high electromagnetic compatibilitu level (EMC) and wide range of operating temperature.
- To allow the communication it has a local ModBus RTU port on the front.
- Depending on the model there are different options for communicartion rear ports:
  - RS485 rear port with IEC60870-103 or Modbus RTU protocol selectable by settings.
  - RJ45 rear port with IEC61850, DNP3.0, Modbus TCP/IP or IEC60870-104, depending on the model.
- The SIL-V has 6 inputs and 4 outputs salidas configurables by the user.
- 5 Oscillographic records, non-volatile RAM memory in order to store up to 200 events and 20 fault reports, without power supply thanks to its internal RTC (Real Time Clock).



Technical specifications SIL-V

Functions diagram SIL-V



Technical parameters SIL-V

27_1 27_2	Function permission : yes/no
	Operating range: 3 to 555V (step 0.1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 105%
	Temporized deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
27V1	Function permission : yes/no
	Operating range: 3 to 555V (step 0.1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 105%
	Temporized deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
59_1 59_2	Function permission : yes/no
	Operating range: 6 to 999V (step 0.1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
59N_1 59N_2	Function permission : yes/no
	Operating range: 6 to 999V (step 0.1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
47	Function permission : yes/no
	Operating range: 6 to 999V (step 0.1 V)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ±30 ms or ± 0.5% (greater of both).
ΔV/Δt	Function permission : yes/no
	Type: Increment or Decrement
	Activation level: 1 to 200 V/s (step 1 V/s)
	Operating time: 1.00 to 40.00 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Timing accuracy: ±60 ms or ± 5% (greater of both).

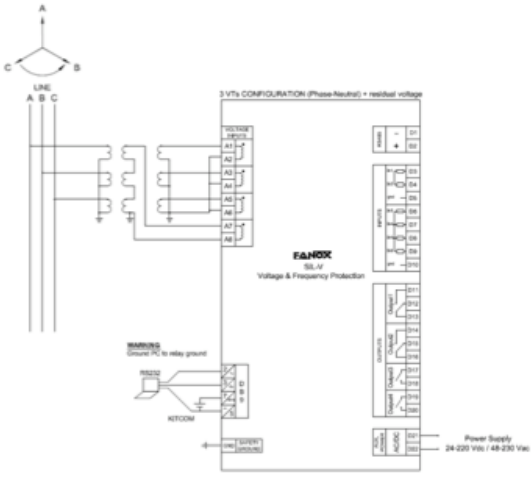
81_1 81_2 81_3 81_4	Function permission : yes/no
	Type: Underfrequency or overfrecuency
	Operating range: 45.00 a 65.00 Hz (step 0.01 Hz)
	Operating time: 0.06 a 300 s (step 0.01 s)
	Reset time: 0.02 a 300 s (step 0.01 s)
	Blocked function if phase b voltage is lower than 45 volts
	Activation level: 100%
	Underfrequency reset level: activation level + 50mHz Overfrequency reset level: activation level – 50 mHz
	Temporized deactivation
	The frequency measurement is an average value of the frequency measured during 8 cycles. The operating time will be the adjusted value plus a maximum of 160 ms (50Hz) or 133 ms (60 Hz) corresponding to the necessary 8 cycles to achieve the frequency measurement.
81R_1 81R_2	Function permission : yes/no
	Type: Incremento r Decrement
	Level: 0.1 to 5 Hz/s (step 0.1 Hz/s)
	Operating time: 0.06 to 40 s (step 0.01 s)
	Reset level: 0.06 to 40 s (step 0.01 s)
	Activation level: 100%
	Deactivation level: 90%
	Blocked function if phase b voltage is lower than 45 volts
	The frequency measurement is an average value of the frequency measured during 8 cycles. The operating time will be the adjusted value plus a maximum of 160 ms (50Hz) or 133 ms (60 Hz) corresponding to the necessary 8 cycles to achieve the frequency measurement.
78_1 78_2	Function permission : yes/no
	Level: 1 to 25. (step 1°)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Level accuracy: ±0.5°
	Blocked function if phase b voltage is lower than 45 volts
Circuit breaker monitoring	Maximum number of openings: 1 a 10000
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excess repeated openings: 1 a 10000
	Repeated openings excess time: 1 to 300 min
BF	Function permission : yes/no
	Opening failure time: 0.02 to 1.00 s (step 0. 01 s)
	Function start: configurable by the user
74TCS	Function permission: yes/no
	Operating time: 0.02 to 300 s (step 0.01 s)
	Trip continuity, in circuits A and B
	Configurable inputs

79	Function permission : yes/no
	Hold permission: yes/no
	Number of reclosings: 1 to 5
	Reclosure times 1, 2, 3, 4, 5 : 0.02 to 300.00 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Replacement time: 0.02 to 300.00 s (step 0.01 s)
	Definitive opening time: 0.02 to 300 s (step 0.01 s)
25 (*)	Dead voltage level: 3 to 555 V (step 0.1 V)
	Live voltage level: 6 to 999 V (step 0.1 V)
	Voltage supervision time: 0.02 to 300 s (step 0.01 s)
	Line-Bar voltage difference:4 to 50 V (step 0.1 V)
	Line-Bar phase difference: 2 to 90 °(step 0.1 °)
	Line-Bar frequency difference: 0.06 to 10 Hz (step 0.01 Hz)
	Synchro temporization: 0.02 to 300 s (step 0.01 s)
	Phase B line voltage and busbar voltage. Modules and phases using DFT Frequency using hardware circuit with the passing through zero detection.
	Permission signal minimum time 150 ms
49T	Available through configurable inputs
Programmable logic control (PLC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE
86	Allows to latch (lock out) the contact trip due to programmable logic (PLC: OR_LATCH).
Settings tables	3 settings tables
	Activated by general settings or by inputs
RTC	Capacitor charge time: 10 minutes
	Operation without auxiliary voltage: 72 hours
Oscillography	16 samples/cycle
	Oscillo starting configuration
	5 records: 3 cycles pre-fault and 85 post-fault
	COMTRADE IEEE C37.111-1991
	4 analogue channels and 64 digital channels
Fault report	20 fault reports with 24 events in each
configurable inputs	6 configurable inputs. The voltage of the inputs is the same as the auxiliary power supply
configurable outputs	4 configurable outputs: 250 V AC – 8 A 30 V DC – 5 A
	Output 1 and output 2: Commuted (NC + NO) Output 3 and Output 4: NO
Frequency	50/60Hz
Voltage measurement	Phase voltages (V-A, V-B, V-C), calculated neutral voltage (3V-0), residual voltage (V-R) (*), Busbar voltage (V-BB)(*), positive sequence voltage (V-1), negative sequence voltage (V-2), Maximum voltage (Vmax) and Minimum voltage (Vmin)
	Measurement range: Low scale (rated voltage<250 V)→3-250 V High scale (rated voltage>250V)→12-1000 V
Frequency measurement	Starting from phase B line voltage, passing through zero detection to line frequency
	Starting from phase B busbar voltage, passing through zero detection to busbar frequency.
	Line Phase B frequency
	Frequency derivative respect to the time
	Busbar phase B frequency (*)
	Busbar and line frequency difference (*)
	Minimum voltage (to achieve the measurement): 40V
	Accuracy: ±0.01 Hz

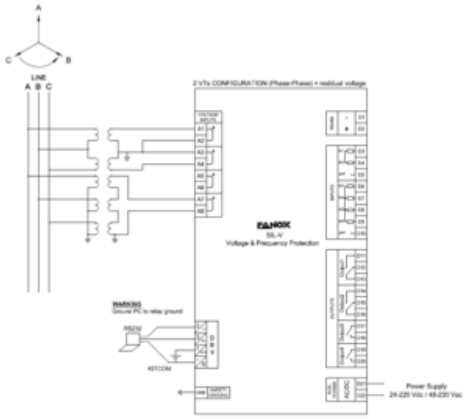
Communications	LOCAL COMMUNICATION 1 Local port RS232: ModBus RTU
	REMOTE COMMUNICATION (*) Remote ports with the following options : • 1 Remote port RS485: ModBus RTU or IEC 60870-5-103 (by general settings) • 1 RJ45 port: IEC 61850, DNP3.0 or IEC 60870-5-104
Auxiliary power supply	24-220 Vdc /48-230 Vac ±20%
Environmental conditions	Operating temperature: -10 to 70ºC
	Storage temperature: -20 to 80 ºC
	Relative humidity: 95%
Mechanical characteristics	Metal case
	Panel mounting
	Height x Width: 177 x 107 mm
	Depth: 122.1 mm
	IP-54

(*) Depending on model

3 VT Configuration (phase-neutral) + residual voltage

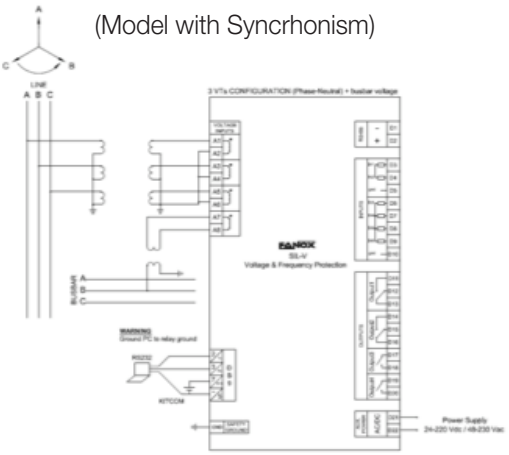


2VT Configuration (phase-phase) + residual voltage

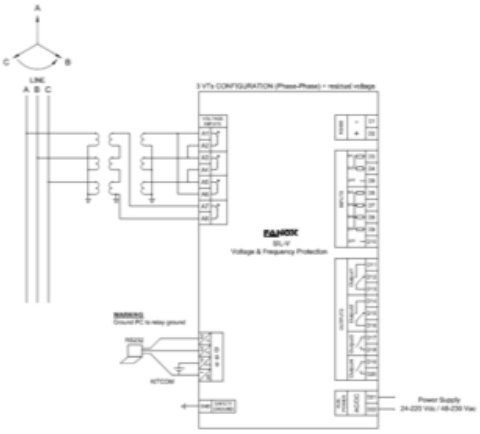


3 VT Configuration (phase-neutral) + busbar voltage

(Model with Syncrhonism)

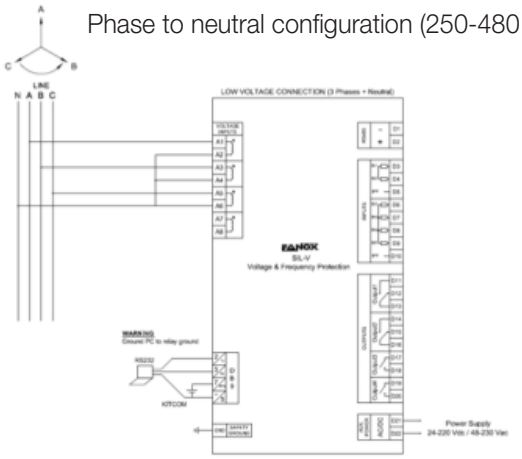


3 VT Configuration (phase-phase) + residual voltage

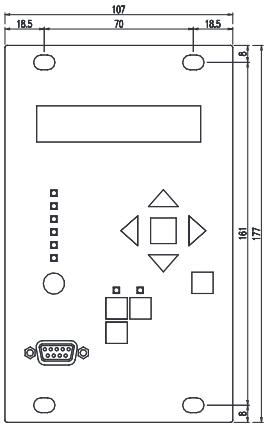


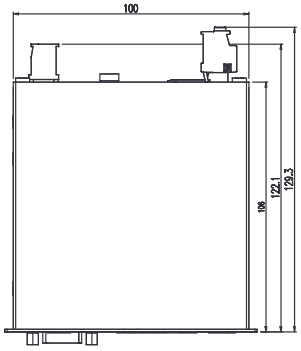
Connecting the relay directly to Low Voltage line

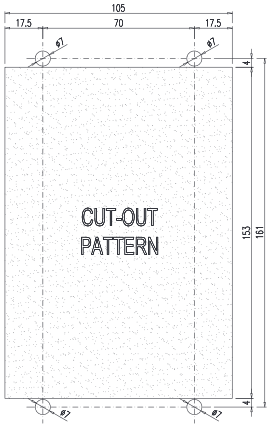
Phase to neutral configuration (250-480 V)

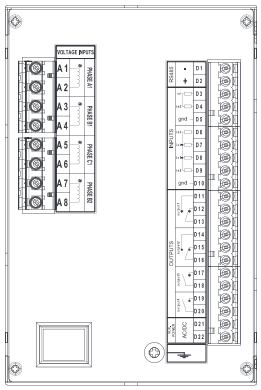


Dimensions and cutout pattern SIL-V









Selection & Ordering data SIL-V

SIL-V	Voltage & Frequency Protection / Synchronism Check Relay										PROTECTION FUNCTIONS
											(27(2) + 27V1 + 59(2) + 47 + 59N(2) + ΔV/ΔT + 74TCS + BF + 52 + 79 +81 U/O(4)+81R(2) + 86 + 78
	0										**NOMINAL PHASE MEASUREMENT** Defined by General Settings
		0									**NOMINAL NEUTRAL MEASUREMENT** Defined by General Settings
			0								**NET FREQUENCY** (50Hz / 60Hz). Defined by Setting
				C							**POWER SUPPLY** 24-220 Vcc/48-230 Vac
					0 2						**ADDITIONAL FUNCTIONS** - + 25
						A B C D					**REMOTE COMMUNICATIONS** RS232 (Modbus RTU) + RS485 (Modbus RTU or IEC 60870-5-103) RS232 (Modbus RTU) + RJ45 (IEC 61850) RS232 (Modbus RTU) + RJ45 (DNP3.0 TCP/IP) RS232 (Modbus RTU) + RJ45 (IEC 60870-5-104)
							1				**INPUTS AND OUTPUS** 6 Inputs 4 Outputs
								2			**MECHANICS** Vertical assembly
									A B C E		**LANGUAGES** English, Spanish and German English, Spanish and Turkish English, Spanish and French English, Turkish and Russian
										A	**ADAPTATION** -

Example of ordering code:

SIL V	0	0	0	C	2	A	1	2	B	A	*SILV 0 0 0 C 2 A 1 2 B A*

CT-MTP

Protection & Self Power Transformer for Medium Voltage

CURRENT TRANSFORMER FOR MV

- *Current transformer for indoor service and without primary coll.*
- *With one secondary for protection /1 or /5.*
- *Valid for protection or protection/self power.*
- *Standard IEC 60044-1.*

CT-MTP

Primary .../ 1A	Code	Protection	Self power	Class	Secondary
100	13512	0,12 VA	-	5P20	Simple
200	13513	0,12 VA	-	5P20	Simple
30	13510	0,12 VA	2,5 VA	5P10	Doble
150	13515	2,9 VA		5P10	Simple
200	13516	2,9 VA		5P10	Simple

Primary .../ 5A	Code	Protection / Self power	Class	Secondary
200	13517	4,5 VA	5P10	Simple
300	13518	4,5 VA	5P10	Simple

For other transformation ratios please consult.

TECHNICAL PARAMETERS

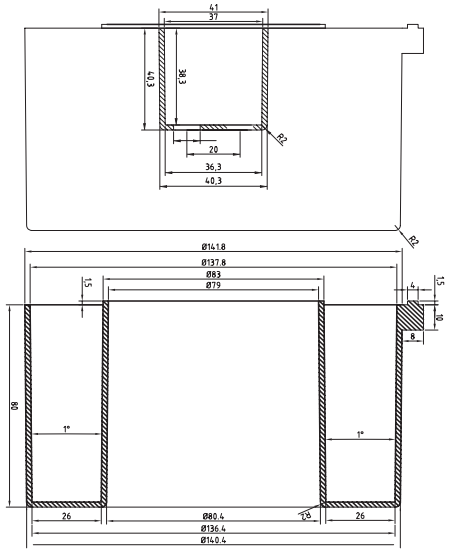
Type	Epoxy resin
Maximum voltage Um	0,72 kV
Isolation voltage	3 kV
Isolation class	Class B, 130°C
Short circuit thermal intensity Ith	20 kA – 1s
Dynamic Idyn	50 kA
Enclosure	Plastic enclosure and internal resin, self-extinguishing, halogen-free UL94-VO
Standards	IEC 60044-1
Aprox. weight	3,5 Kgs

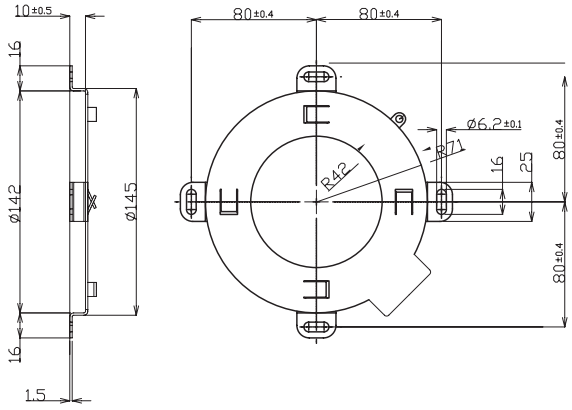
SECONDARY CONNECTION

- **SIMPLE SECONDARY (Only protection or protection/self power)**
  1 silicone covered YELLOW hose with thermo-shrinking reinforcement, halogen-free, 2 x 2,5mm2 , *length 2m, outer diameter 7 mm. Blue connection cable (S1) and brown (S2) with fork terminal.
- **DOBLE SECONDARY (Protection and self power)**
  PROTECTION: 1 silicone covered GREEN hose with thermo-shrinking reinforcement, halogen-free, 2 x 2,5mm2 , *length 2m, outer diameter 7 mm. Blue connection cable (S1) and brown (S2) with fork terminal.
  SELF POWER: 1 silicone covered YELLOW hose with thermo-shrinking reinforcement, halogen-free, 2 x 2,5mm2 , *length 2m, outer diameter 7 mm. Blue connection cable (S1) and brown (S2) with fork terminal.

*For other cable lengths please consult.

DIMENSIONS





FIXING BASE

CT-MTP

Protection & Measurement for Medium Voltage

CURRENT TRANSFORMER FOR MV

- *Up to 1200 A of primary current.*
- *Transformer ratio 1000/1.*
- *Terminal cover, poka yoke xing base*
- *Certicate model.*

CT-MTP

Primary .../ 1A	Model	Code	Accuracy	
			Measurement	Protection
1000	CT-MTP-1000:1-R (WITHOUT fixing base)	**41446**	0,2 s	5P10
1000	CT-MTP-1000:1-R-B (WITH fixing base)	**41448**	0,2 s	5P10
-	FIXING BASE	**41449**	-	-

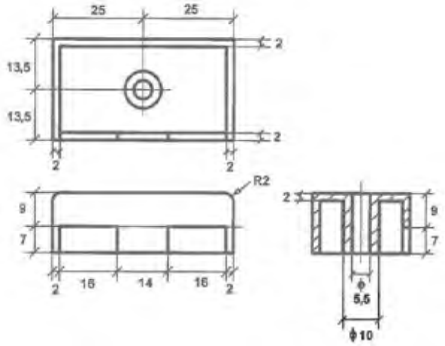
TESTS

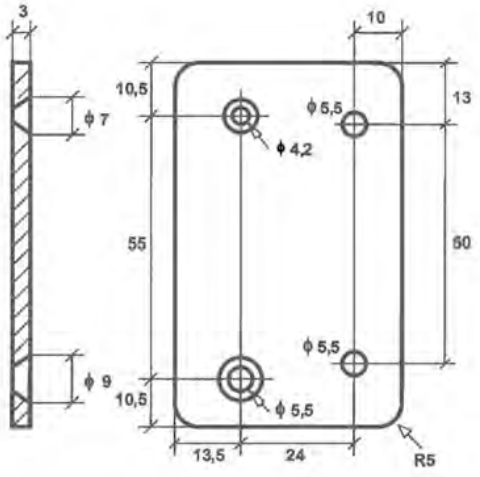
QUALIFICATION TESTS	STANDARDS
Heating test	UNE EN 61869-2 ap. 7.1.2
Accuracy test	UNE EN 61869-2 ap. 7. 1.3.1, 7.1.3.3
Short-time current tests	UNE EN 61869-2 ap. 7.1.4
Verification of the degree of protection provided by enclosure	UNE EN 61869-2 ap. 7.1.5
Tests with open secondary in fault conditions	UNE EN 61869-2 ap. 7.1.6
Saturation test for current and demagnetization	UNE EN 61869-2 ap. 7.1.3.4
Glow wire test	UNE EN 60.695-2-11 ap. 7.1.7

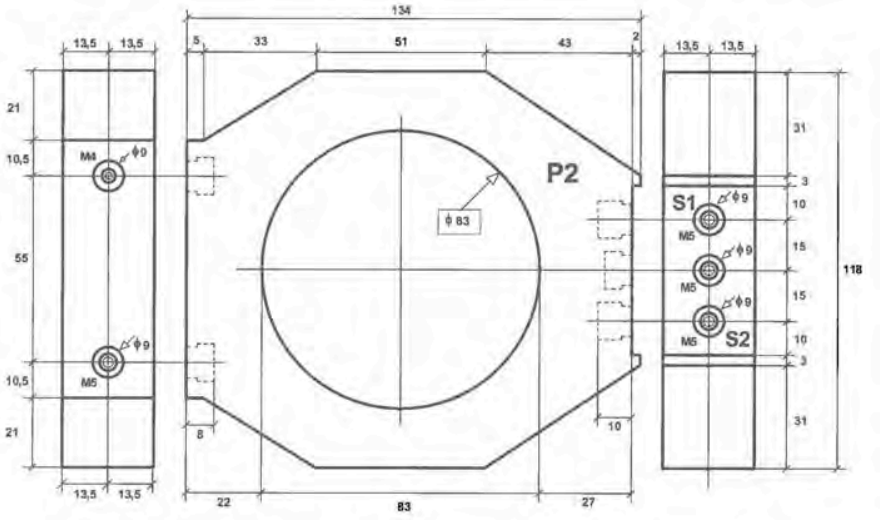
INDIVIDUAL TESTS	STANDARDS
Power-frequency withstand voltage test for primary winding insulation	UNE EN 61869-2 ap. 7.1.2
Power-frequency withstand voltage test for secondary terminals	UNE EN 61869-2 ap. 7.2.2
Determination of errors	UNE EN 61869-2 ap. 7.2.3.1, 7.1.3.3
Overvoltage test between turns	UNE EN 61869-2 ap. 7.2.3.4
Verification of markings	UNE EN 61869-2 ap. 7.3.3

CHARACTERISTICS AND DIMENSIONS

CHARACTERISTICS	
Overload	1,2 I_N
Frequency	50/60 Hz
Maximum Voltage Um	0,72 kV
Isolation Voltage	3 kV
Short circuit thermal current Ith	20 kA
Short circuit dynamic current Idyn	2,5xIth
Accuracy limit	150%
Security factor	5
Insulation class	E







TCM

Trip coil module TCM

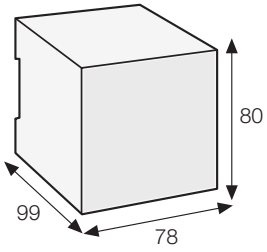
- *Connecting trip coil module to the potential-free trip contact of the relay it supplies necessary energy to trip the coil (30J).*
- *Its main functions is to adapt the relay to installations where the line opening system is activated by a coil, instead of a striker.*
- *The TCM (Trip Coil Module) is specifically designed to be used with SELF POWERED relays . (SIA-C, SIA-B).*

TCM

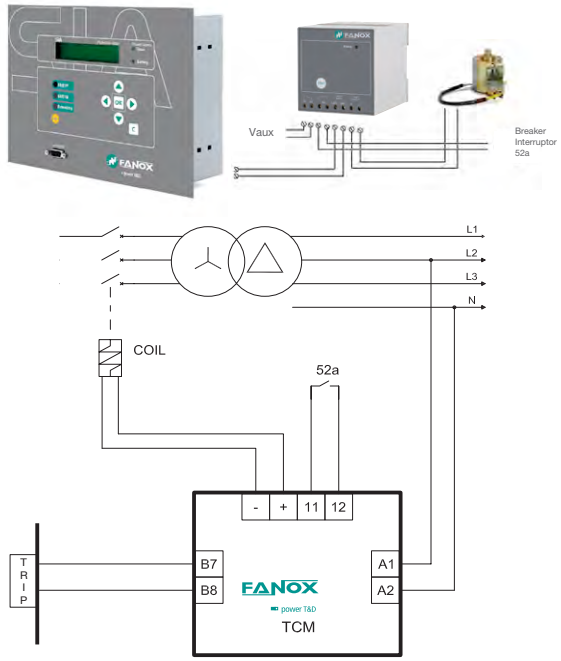
CHARACTERISTIC

Dimensions	78 x 80 x 99 mm
Weigth	580 gr.
Mounting	DIN Rail
Charging time	10 s
Trip capacity after charge	3 days
Power supply	230 Vac - 110 Vac

DIMENSIONS



CONEXIONADO



SELECTION & ORDERING DATA

TCM				
				POWER SUPPLY
	1			230 Vac
	2			110 Vac
				OUTPUT VOLTAGE FOR TRIP
		A		48 Vdc
		B		110 Vdc
		C		220 Vdc
				ADAPTATION
			A	Available for potential free contact

Example of ordering code:

TCM	1	A	A	*TCM1AA*

*TCM2CA is not available

STANDARDS

EN 50263 (2000)	"Electromagnetic Compatibility (EMC). Product standard for measuring relays and protection equipment ".
EN 61543 (1995) + A11 (2003)	"Residual current-operated protective devices (RCDs) for household and similar use. Electromagnetic compatibility".
IEC 60255-5 (1977)	"Electrical Relays. Part 5: Insulation tests for electrical relays".
EN 61000-4-11 (1994)	"Electromagnetic Compatibility. Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage variations immunity test".
EN 55014	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus
EN 55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

EN 61000-4-2.	Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-3	Electromagnetic compatibility (EMC)- Part 4-3: Testing and measurement techniques- Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4.	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/ burst immunity test
EN 61000-4-11.	Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
EN 61000-4-6	Electromagnetic compatibility (EMC) -- Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields.
EN 61000-4-8.	Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
EN 61000-4-5	Electromagnetic compatibility (EMC) -- Part 4-5: Testing and measurement techniques - Surge immunity test (IEC 61000-4-5:2005).

PRT

Striker

- *This is a single effect solenoid. The striker is spring operated.*
- *The striker is activated by low-power polarised electrical signal supplied by the relay in case of a fault.*
- *The striker is reset to its starting position manually.*

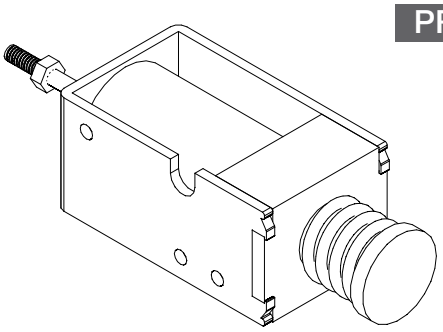
PRT-15

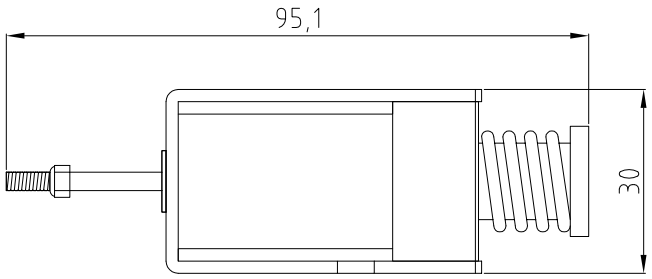
MODELS	PRT-15		PRT-8
Nominal voltage (Un)	3 Vdc	17 Vdc	6 Vdc
Spring travel	15 mm	15 mm	8 mm
Minimum trip voltage (with power supply)	1,4 V	6,5 V	4,5 V
Release Minimum energy	18 mJ	60 mJ	30 mJ
Spring strength start of travel (Fe)	36 N	37 N	37 N
Spring strength end of travel (Fe)	16 N	17 N	18 N
Insulation class	Y	Y	Y
Duty cycle at Un (ED)	80%	80%	100%
Resistance at 20ºC	1,1 Ohm	16 Ohm	38 Ohm
Protection degree	IP00	IP00	IP00
Operating temperature	-20ºC + 50ºC	-20ºC + 50ºC	-20ºC + 50ºC
Storage temperature	-20ºC + 75ºC	-20ºC + 75ºC	-20ºC + 75ºC
Code	**13007**	**13008**	**13014**

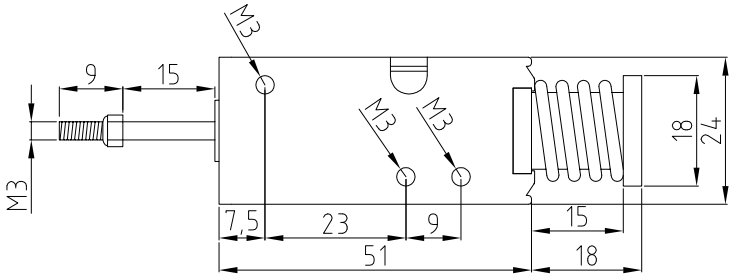
PRT-8

DIMENSIONS

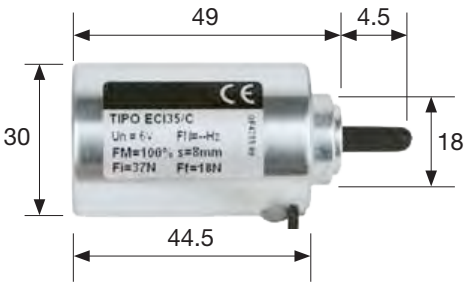
PRT-15







PRT-8



KITCOM

Battery power supply module

- *The KitCom is an adapter to supply SIA relays through the front communication port, allowing the communication with the computer simultaneously.*
- *This adapter is very useful in the commissioning processes of the transformation centres, allowing full verification of the centre, without any auxiliary power supply.*
- *The equipment has a microswitch that feeds the power supply with a LED (ON) when the voltage is adequate.*
- *In addition to all the necessary to give the power supply, this device has two LED associated with the Rx and Tx lines of communication, and they are used to verify that there is data traffic between the PC and the SIA relay.*

KITCOM

CHARACTERISTIC

The power comes from two AA batteries placed at the bottom of the device.

SIA-C

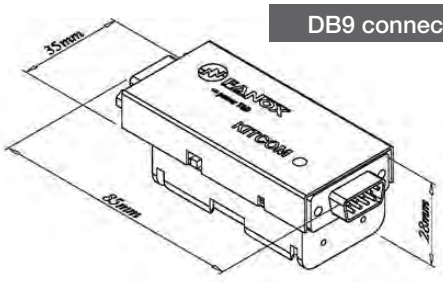
- two 1.5 Volts batteries AA type (IEC LR06)
- The equipment has a small Dc/Dc power supply that raises the voltage till the required 12 volts to operate the equipment. This operation includes the energy necessary to trip.
- With DB9 connection.

SIA-B

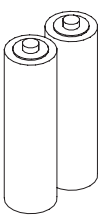
- two 1.5 Volts batteries AA type (IEC LR06)
- The equipment has a small Dc/Dc power supply that raises the voltage till the required 5 volts to operate the equipment. This operation includes the energy necessary to trip.
- With USB connection.

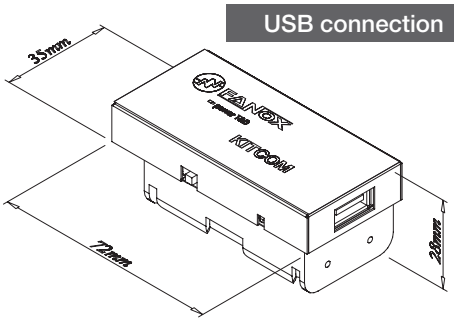
DIMENSIONS

DB9 connection



USB connection





SELECTION & ORDERING DATA

KITCOM						
		1 5				VOLTAGE 12 Vdc (SIA-C) 5 Vdc (SIA-B)
			D U			TO EQUIPMENT DB9 MALE (SIA-C) USB TYPE-A FEMALE (SIA-B)
				0 D U M		TO PC - DB9 FEMALE (SIA-C) USB TYPE-A MALE (SIA-B) USB TYPE-B FEMALE (SIA-B)
					0 3 4	BATTERY - 2 X AA without cover 2 X AA with cover
						ADAPTATION -

Kitcom example for SIA-C with DB9 and cover.

KITCOM	1	D	D	4	A	VOLTAGE *KITCOM1DD4A*

SICOM

Communication Software

The SICom program works with the Windows® Windows 7, Windows 8, Windows 8.1 and Windows 10 operating system and can be used to gain access to all of the relays information, to modify the settings and to save events using a graphic user interface.

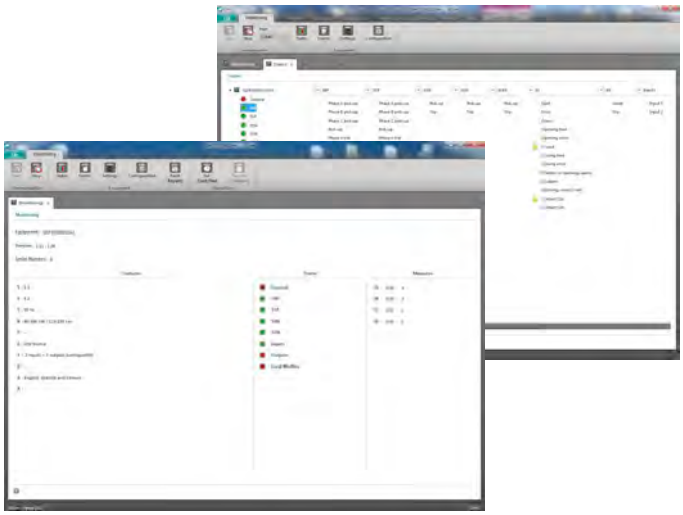
The main operations that can be carried out using the SICom program are as follows:

- General data reading: Complete model, Version, Serial number, etc.
- States reading
- Measurements reading
- Reading and changing settings
- Reading and changing configuration
- Reading and deleting events
- Reading and deleting fault reports
- Reading and deleting demand current (load data profiling)
- Reading and saving oscillographic records in Comtrade format
- Changing the user passwords
- Saving and Loading settings files
- Saving and Loading configuration files
- Saving events and fault reports
- Saving demand current (load data profiling)
- Date-time synchronization
- Configuring the communication parameters
- Reading and changing counters
- Commands for opening and closing the circuit breaker and block/unblock the recloser
- Configuration of the inputs
- Configuration of the outputs
- Configuration of the causes that start a Fault Report

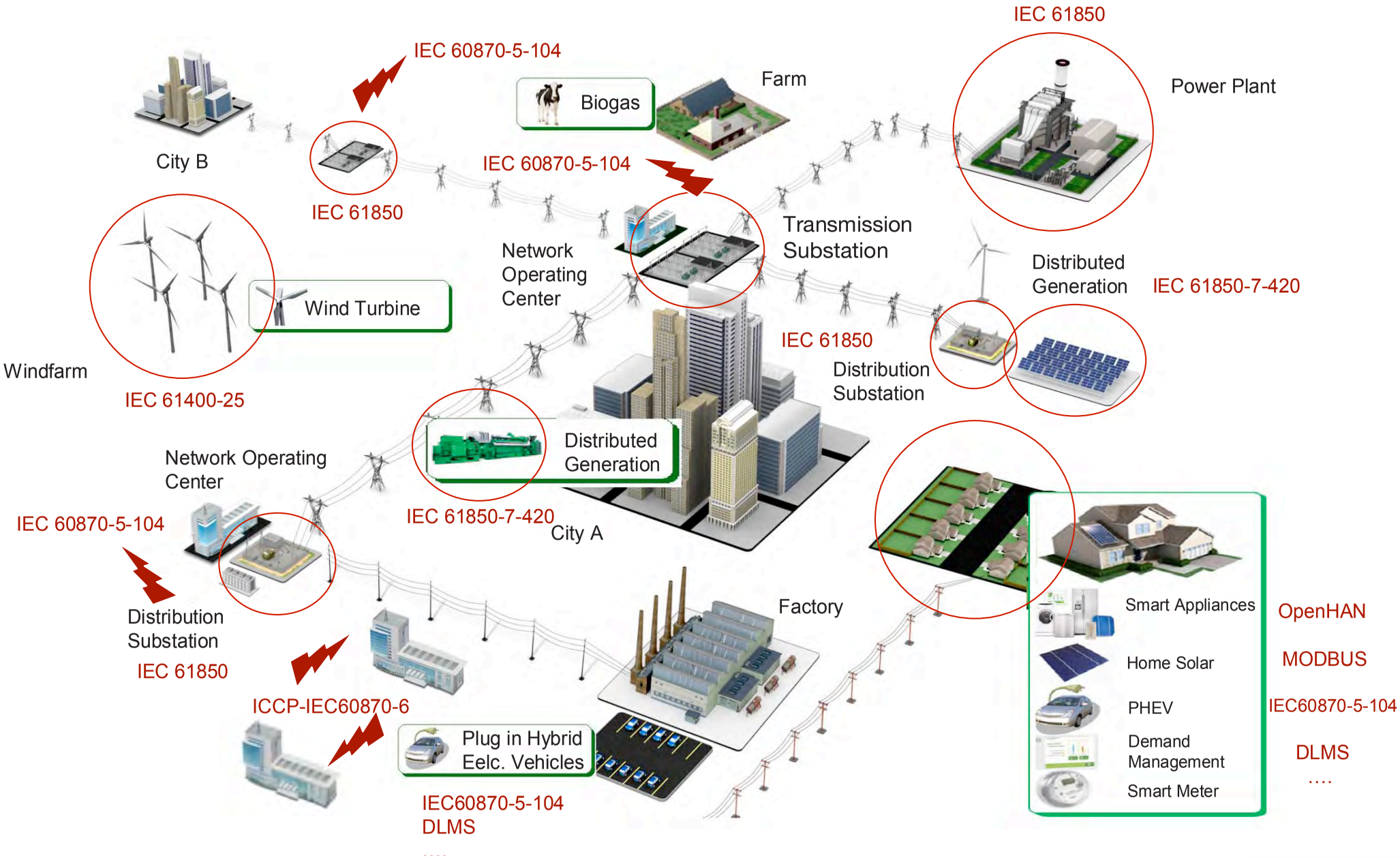
The update of the software does not require any user´s action, this is, if the computer is connected to Internet, SICom updates itself when it is started.

It will allow you to prepare all the settings and relay configurations without having the relay connected to the PC (offline mode), reducing engineering and commissioning time.

SICom program uses Modbus protocol, so only the ports with this protocol can be used to establish the communication.



What is a Smart Grid ?



SIC-A

Redundancy Protocols Gateway (PRP/HSR)

Smart Grid Communication Solutions

Provides any-to-any protocol conversion that permit the integration of equipment with proprietary and legacy protocols in a modern infrastructure with the most recent protocols and redundant topologies, including DLMS protocol required for Smart Metering.

Introduction to SIC-A

The use of information and communication technologies is globally increasing by the industry, as a base of a predictive maintenance and installations monitoring.

A traditional point of view about the energy sector was focused on a generation, transmission and distribution in a lineal way, where the communication was concentrated on the substation. The substations devices shared the information with the control center “in-situ” using serial protocols. With these protocols, the information was limited and it was insecure.

With the “Smart Grid” concept evolution, the energy generation is not restricted by specific generation centers. A huge radial infrastructure requires an advanced communication infrastructure. This concept includes not only the latest Ethernet protocols; also the redundant protocols become indispensable.

This technology implies an important technology leap for the industry, due to the transmission of a huge amount of data, in many cases in real time, is required.

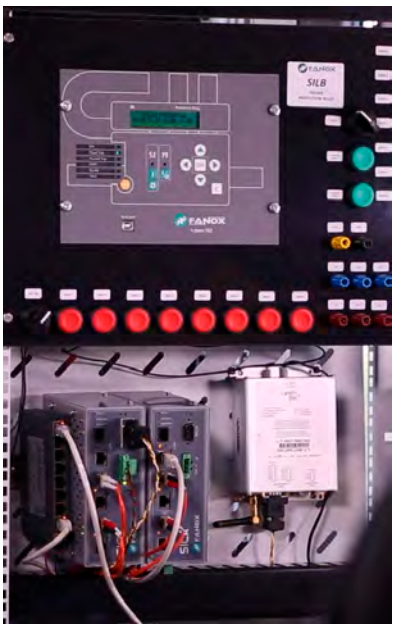
To implement these new technologies the industry requires an easy and flexible system that is able to adapt to its all requirements.

The protocols gateways provide an easy way to adapt the existing devices to the new technologies.

The communication redundancy is necessary when the loss of information is not acceptable. The Redundancy methods have evolved significantly, from the basic method of duplicating devices to the most advanced redundant protocols like HSR (High-availability Seamless Redundancy).

Most complete topology

Different topologies are possible combining the different redundancy possibilities (PRP/HSR) and the protocol conversion function.



SIC-A

Redundancy Protocols Gateway (PRP/HSR)

Main characteristics

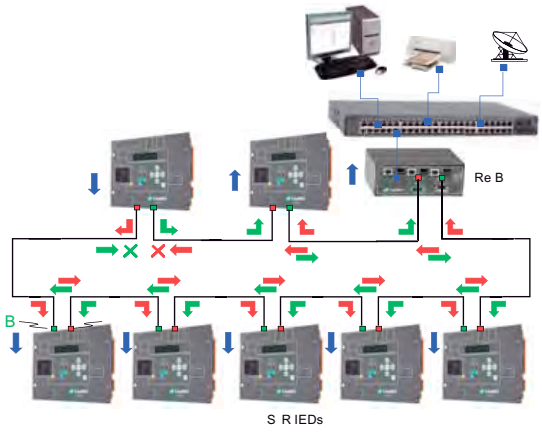
- SIC-A provides any-to-any protocol conversion that permit the integration of equipment with proprietary and legacy protocols in a modern infrastructure with the most recent protocols and redundant topologies.
- SIC-A can work as a multi-protocol conversor, as an unmanaged Redbox or as a redundant protocol gateway.
- SIC-A can manage upto 3000 data points of the most common protocols (Modbus, IEC 60870, DLMS, DNP3,…) or upto 800 data points of advanced protocols as IEC 61850.
- The device provides with HSR (High-availability Seamless Redundancy) is one of the chosen redundancy protocols for the substation automation as per the IEC 61850 standard. This redundancy is the evolution of the existing Parallel Redundancy Protocol (PRP).
- It is especially suited for applications that demand high availability and very short switch over time because it provides zero recovery time in case of the failure of any component. A good example of application may be the protection of automatized electrical substations or the control of synchronized drives, for instance.

Main applications

- **Redbox**

SIC-A Working as a Redbox allows the connection of HSR networks with traditional ones.

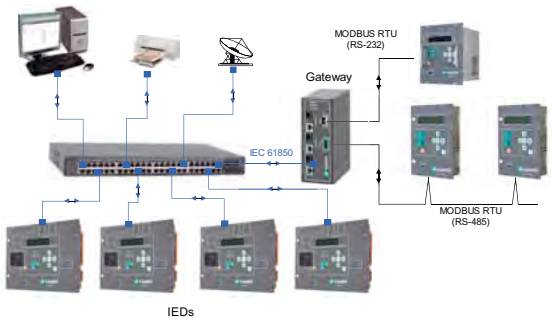
In case of PRP redundancy, SIC-A is not denominated Redbox, it would be a device that allows the integration into 2 independent networks through a 3rd Ethernet port.



Redbox

• **Protocol Gateway**

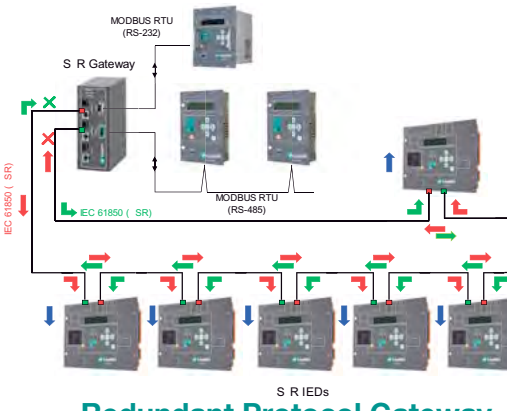
SIC-A device is able of communicating through serial communication RS-232 or RS-485 with multiple equipment with a Master serial protocol (Modbus, IEC69870-5-101, IEC60870-5-103, DLMS…) and dispose the information into an Ethernet protocol as IEC 61850 or IEC 60870-5-104. This way, devices with conventional protocols can be integrated in Ethernet networks with advanced protocols.



Protocol Gateway

• **Redundant Protocol Gateway**

It is the result of the combination of the functionality of a Gateway and the HSR redundancy. With this configuration, SIC-A allows the integration of equipment with serial communications in a HSR redundant network with an advanced protocol as IEC 61850 or IEC 60870-5-104.



Redundant Protocol Gateway

• **Most complete topology**

2 SIC-A in their topology of Redbox allow connecting a HSR redundant network with another PRP network.

This is a useful application that permits to coexist new networks with existing ones.

In the same way, SIC-A in its topology of PRP Gateway, would allow to integrate serial equipment with conventional protocols in a PRP network with an advanced Ethernet protocol as IEC61850, IEC 60870-5-104, etc.

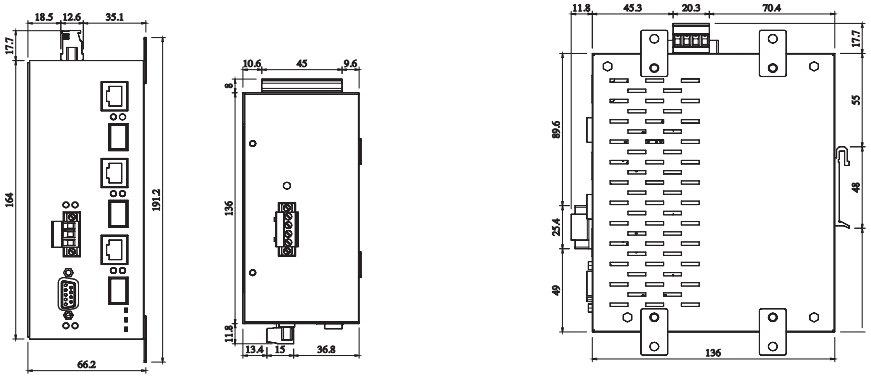
Technical specifications

Item	Unit	Value
Purpose of device	-	Protocol Gateway – Redbox – Protocol Redundant Gateway
Assembly (mounting) type	-	Mounted on standard 35 mm DIN bar and Wall mounting
Protection degree	-	IP20
Operating temperature range	°C	-40 to +85
Consumption	W	6 maximum
Auxiliary Power	Vdc/Vac	24*-110 / 48-230 ±20%
Weight	Kg	1
Diameter of adapters on terminals	mm2	0.5-2.5

Main specifications	
Management	Easy Connect Configuration utility
System Protocols	TCP/IP, UDP/IP, SMTP, POP, HTTP, FTP, SNMP, ICMP, DHCP, BOOTP, Telnet, DNS, ARP, PPPoE, DDNS
Device Security	NERC/CIP Compliant, SSHv2
Communication Security	SSL based VPN tunnel using Blowfish/AES/3DES
Logic Programming	AND/OR/NOT/Bit SHIFT/Split/Index support for digital and analog data, Delay operations
Network Management	SNMP Agent
Protocol Support	IEC 60870-5-101/103/104, DNP3 serial/TCP, Modbus RTU/ASCII/TCP, IEC 62056-DLMS, IEC 61850, IEC 61400
Supported Data Point	IEC 61850: 800
	DNP3, IEC 60870, Modbus and other proprietary protocols: 3000
Devices Supported	20 (10 over serial RS-485 recommended)
Serial interfaces	1 or 2 RS-485 - Terminals and/or 1 or 2 RS-232- DB9 *
Ethernet interfaces	1 RJ45 or 1 LC SFP 100Base-FX 1300nm *
HSR/PRP interfaces**	2 RJ45 or 2 LC SFP 100Base-FX 1300nm *
Time Synchronization	NTC/SNTP/MEA, Protocol Specific (IEC 104,/DNP3, etc.) RTC on-board
Redundancy**	Unmanaged. Compliant implementation of both PRP (IEC 62439-3-4) and HSR (IEC 62439-3-5).

* Model dependent
** Redundant functionality and redundant ports will be disabled if SIC-A2 model is selected

Dimensions and cutout pattern SIC-A



SIC-A	Redundancy Protocols Gateway (PRP/HSR)									Advanced protocol Gateway with redundancy
										FUNCTION
	1									Redbox
	2									Protocol Gateway
	3									Redundant Protocol Gateway
										POWER SUPPLY
		C								24*-110 / 48-230 Vdc-Vac ±20%
										ETHERNET PORT
			0							RJ45
			1							RJ45 + SFP LC Connector
										REDUNDANCY PORT
				0						RJ45
				1						RJ45 + SFP LC Connector
										SERIAL PORTS
					B					RS232 (DB9) + RS-485 (Terminal)
										REDUNDANCY TYPE
						0				None
						1				HSR
						2				PRP
										MASTER / CLIENT PROTOCOL
							A			None
							B			Modbus RTU
							C			IEC 60870-5-103
							D			DNP3.0 Serial
							E			IEC 60870-5-101
							F			DLMS/COSEM
							G			IEC 61850
							H			IEC 60870-5-104
							2			2 Protocols
										SLAVE/SERVER PROTOCOL
								A		None
								B		IEC 61850
								C		DNP3.0 TCP/IP
								D		IEC 60870-5-104
								E		MODBUS TCP/IP
								F		IEC 60870-5-101
								2		2 Protocols
										ADAPTATION
									A	-

* SIC-A Gateway using optical fiber will require a minimum voltage supply of 48 Vdc for its correct working.

SIC A	2	C	0	0	B	0	B	C	A	*SIC A 2 C 0 0 B 0 B C A*

R35
3K3
R33
4K7
C15
Q6
C945
CONTROL
CIRCUIT
150K
R43
2K25
R36
100K
Q1
A733
R54
100K
R15
3K15
D11
C15
3µ3/50V
R19
3K01
R20
3K09
R21
150K
R18
R16
R17
D POWER SUPPLY
R23

protection & control

PROTECTION & CONTROL

Index

ELECTRONIC PROTECTION & CONTROL OF MOTORS, GENERATORS AND PUMPS

CONTROL & MEASUREMENT

3
Three year guarantee

FANOX
protection & control

EARTH LEAKAGE PROTECTION

TRANSFORMERS

SURGE PROTECTION

CUSTOMIZED PRODUCTS AND BRANDLABELING


FANOX
protection & control
PROTECTION & CONTROL SPECIALISTS
Electronic Protection & Control of Motors, Generators and Pumps
Control & Measurement
Earth Leakage Protection
FANOX
protection & control
MOTOR MANAGEMENT SYSTEM
Multifunction
Fault reports
Self-diagnosis and installation monitoring
FANOX
protection & control
EQUIPMENTS FOR PROTECTION AGAINST TRANSIENT OVERVOLTAGE SPD
For low voltage supply lines
For photovoltaic and wind power installations
Compact equipments
FANOX
protection & control
TABLEAUX DE PROTECTION ELECTRONIQUE POUR POMPES SUBMERSIBLES
Protection optimale sans sonde ni relais de niveau
Installation simple à très faible coût
Pour installations neuves ou anciennes
FANOX
protection & control
SPÉCIALISTES DANS LA PROTECTION ET CONTRÔLE
Relais de protection de moteurs, generateurs et pompes
Protection différentielle
Protection contre les surtensions transitoire
Contrôle et mesure
FANOX
power T&D
SIL
Protection relays for primary and secondary distribution
FANOX
power T&D
Specialized in self powered relays
SIA/SIL
Secondary and Primary Distribution Protection Relays

ELECTRONIC PROTECTION & CONTROL OF MOTORS, GENERATORS AND PUMPS

Introduction

Fanox designs and manufactures the most reliable protection & control relays in the market. Products that efficiently prevent engine burnouts, saving costly repairs and preventing dreaded and unnecessary downtime in any important process.

The electric motor is one of the most important drives in industry, and plays a decisive role in the success of a production process. Valuable production processes and high value machinery can be completely paralyzed by one single motor failure. This poses the risk of great expenses, with the resulting costs significantly exceeding the cost of repairing the motor itself.

Experience shows that motor protection is still a novelty, and still not a priority amongst users. The high numbers of faults that occur every day are mainly due to overloads, locked rotor, phase failure or imbalance, heavy bursts of long duration or high duty cycle of operations, or overheating.

Over 60% of failures are due to causes not detected by conventional protection systems, causing excessive heat in the windings, leading to a drastic reduction of the electrical life of the motor.

The most significant technical advantages of Fanox designed equipment is:

- Continuous Thermal image memory of heating and cooling cycles of the engine's starting cycles, work overload and stoppages.
- The prompt detection of phase loss, even with the engine running at low loads, stopping quickly to avoid costly breakdowns.
- Identification of trip cause. The relays indicate the reason for tripping instantly allowing you to identify and act quickly on faults.

PBM

PBM Protection, Control and Monitoring System

MOTOR MANAGEMENT SYSTEM

INTEGRAL SOLUTION FOR MCCs ADAPTABLE TO EVERY CUSTOMER NEEDS

MULTIFUNCTION

FAULT REPORTS

4 fault reports with the following information: dates, measurements, status bits, inputs and outputs.

SELF-DIAGNOSIS, INSTALLATION MONITORING AND STATISTICS

- Earth toroidal disconnection monitoring.
- PTC sensor open circuit and short circuit detection.
- Magnetic module hardware monitoring.
- Non-volatile memory stored information coherence.
- Number of motor start ups.
- Medium and maximum current of last start up.
- Number of faults for the following functions: Overload, PTC, JAM, locked rotor and neutral faults.
- Operating hours counter.
- Test menu.

DESIGNED FOR SCADA APPLICATIONS

RTU Modbus protocol and RS485 communication

COMMANDS MANAGEMENT

- Start/Stop by 2 or 3 wires, without additional switches of push-buttons
- Remote Start/Stop, more efficiency and cost saving.

COMMUNICATION SOFTWARE PBCom

PBM B

PBM H

PROTECTION FUNCTIONS

- θ> Overload with thermal image
- Overheating protection (PTC sensor)
- Phase imbalance or phase failure
- Phase sequence
- **JAM** JAM detection
- Locked rotor detection
- I_g>> Instantaneous earth leakage overcurrent
- I_g> Earth leakage inverse time overcurrent
- I_0>> Instantaneous neutral overcurrent
- I_0> Neutral inverse time overcurrent
- I< Undercurrent

CE cULus LISTED

PBM B

BASE MODULE

Current measurement is obtained from the motor line through the magnetic module without need of external current transformers.

From 0,8 up to 25 A with internal current transformers.
Over 25 A with external current transformers.

MODELS		PBM-B1		PBM-B5	
		PBM-B11	PBM-B12	PBM-B51	PBM-B52
Adjustment range	Ib (A)	0,8-6A	0,8-6A	4-25A	4-25A
Auxiliary supply		110/230Vac-dc	24/48Vdc	110/230Vac-dc	24/48Vdc
Frequency		50/60/ variable (45-65) Hz			
Maximum motor nominal voltage		1.000 Vac			
CODE		17000	17002	17001	17003
For I_N of the motor below the minimum setting I_B		Pass the cables several times (n) through the holes in the relay I_B = n x I_N			
For I_N of the motor above the maximum setting I_B		Use 3 CT .../5 and the relay PBM B and pass the secondary through the holes			
OTHERS CHARACTERISTICS					
Optional		PBM-H display module HMI			
Inputs		1 x PTC temperature sensor, 1 x Toroidal transformer (external earth fault), 1 x Digital input 24 Vdc			
Outputs		2 x NO-NC contact			
Short circuit withstand rating		5000 A to 0,5s (SCR 5000@0,5s)			
Communication		RS485 ModBus RTU			
Signalling		5 signalling LEDs			
Reset mode		Manual, automatic and automatic time delayed			
Test		Specific test menu			
Operating temperature		- 10ºC + 60ºC			

PBM H

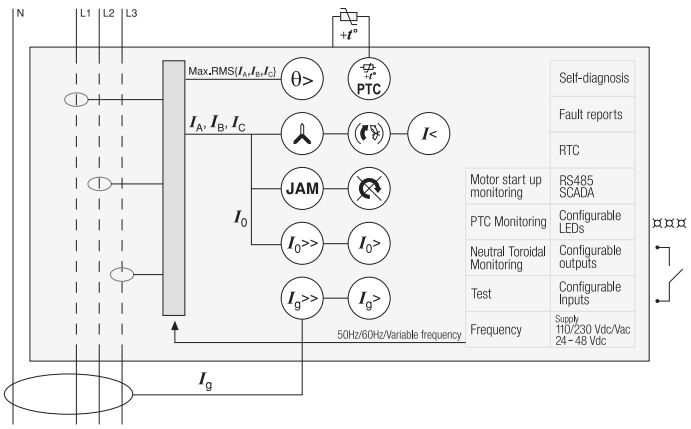
DISPLAY MODULE HMI

This is an optional display module with an LCD screen for signalling, control and setting.
The LEDs can be configured and are identified by labels.
Access to menus is intuitive and direct, making protection system commissioning easier.

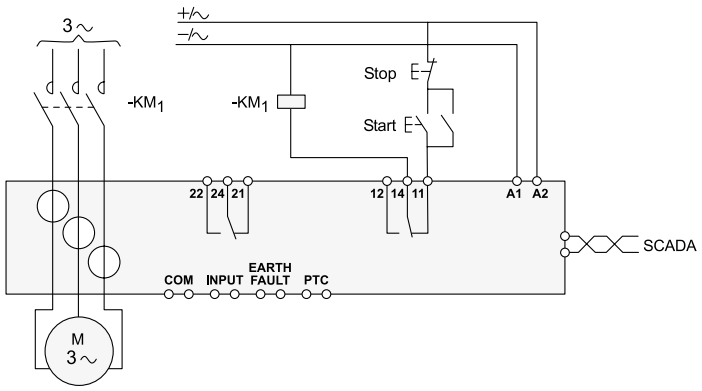
CODE	ACCESORIES	LANGUAGE
17015	PBM - H1S1	Spanish
17016	PBM - H1F1	French
17017	PBM - H1E1	English
17018	PBM - H1P1	Polish
17019	PBM - H1G1	German
79229	CD PBM	
17008	CDCNB CABLE 0,5 M	
17009	CDCN1 CABLE 1 M	

CHARACTERISTICS PBM H	
LCD Display	20 x 2 alphanumeric characters
Keyboard	9 keys
Communication	RJ45 connector to relay
Signalling	6 configurable signalling LEDs
Reset mode	Manual, automatic and automatic time delayed
Test	Specific test menu

FUNCTION DIAGRAM PBM B

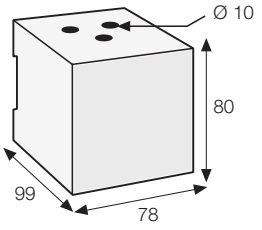


CONNECTION DIAGRAM PBM B

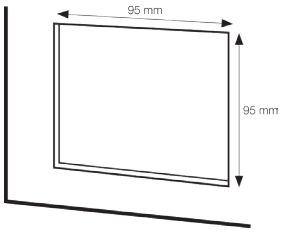


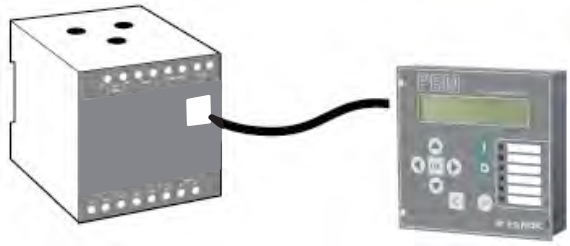
DIMENSIONS (mm)

PBM B



PBM H





GL

Motor Protection Relays

INTEGRAL MOTOR PROTECTION

- ***For 3-phase motors from 1 to 630 A and over. Cable feed through relay.***
- ***Precise motor heating and cooling memory, reproduces its thermal image.***
- ***Immediate detection of phase loss (3 s), even at reduced load.***
- ***Visual indication of tripping cause.***

For motors (1 to 630 A and over), in applications such as surface mounted pumps, compressors, mixers, ventilators, elevators, cranes, industrial refrigeration and in general for those motors requiring complete protection where over temperature (by means of PTC sensor) and incorrect phase sequence protection is required.

Its 7 trip classes cover all types of starting or working cycles.

EXTERNAL DISPLAY MODULE

By means of this plug-in optional accessory, the relay status can be seen and reset from the exterior of the electrical panel board.

Easy to install. Size of a Ø22 mm push button.

Suitable for motor control centres (MCC) and panel boards.

GL

PROTECTION FUNCTIONS

- I> Overload
- Phase imbalance or phase loss
- Overtemperature
- Phase sequence

ODGL

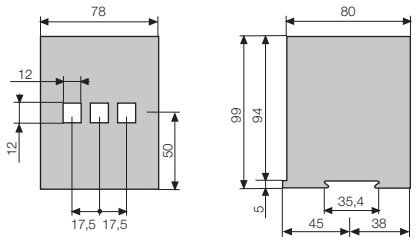
Models	Code	Relay type
ODGL	**12535**	GL

MODELS			GL 16	GL 40	GL 90
Adjustment range Motor 400 V 50/60 Hz	I_B (A)		4 - 16,7	15 - 40,5	40 - 91
	CV		3 - 10	10 - 25	30 - 60
	kW		2,2 - 7,5	7,5 - 18,5	22 - 45
Code: according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	230 Vac	single phase	**11303**	**11323**	**11343**
	115 Vac	single phase	**11302**	**11322**	**11342**
	24 Vac, dc	single phase	**11300**	**11320**	**11340**
For I_N of the motor below the minimum setting I_B			Pass the cables several times (n) through the holes in the relay I_B = n x I_N		
For I_N of the motor above the maximum setting I_B			Use 3 CT .../5 and the relay GL16 and pass the secondary through the holes		
External display module (optional)			ODGL		

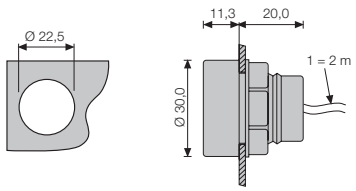
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	5 - 10 - 15 - 20 - 25 - 30 - 35
Phase sequence protection	ON ■□ OFF Actuates during the motor start
Phase imbalance protection	Over 40%. Tripping time < 3s
PTC Min/max cold resist.-Average trip / reset resist.	25Ω / 1500Ω - 3600Ω / 1800Ω
Reset mode	Manual and remote
Signalling LED's	4 LED's: ON + I> + +
Output contacts	1 relay with 1 NA + 1 NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	2,5 VA (115-230 Vac) - 1,5 W (24 Vdc)
Protection degree / weight / mounting	IP20 / 0,5 kg / DIN rail
Storage temperature	-30°C +70°C
Operating temperature / max. altitude	-15°C +60°C / 1000m ; -15°C +50°C / 3000m
Standards	IEC 255, IEC 947, IEC 801, EN 50081-2
	CE c UL us LISTED

Settings and curves, see pages 105 to 111.

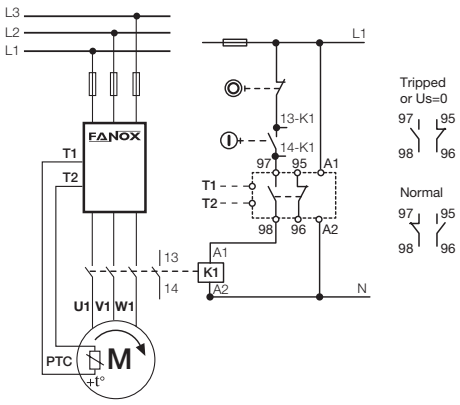
DIMENSIONS GL RELAY (mm)



DIMENSIONS ODGL MODULE (mm)



WIRING DIAGRAMS



INTEGRAL MOTOR PROTECTION

- ***For 3-phase motors from 60 to 200 A and over. Cable feed through relay.***
- ***Precise motor heating and cooling memory, reproduces its thermal image.***
- ***Immediate detection of phase loss (3 s), even at reduced load.***
- ***Visual indication of tripping cause.***

For 3 phase motors up to 200A, in applications such as surface mounted pumps, compressors, mixers, ventilators, elevators, cranes, industrial refrigeration and in general for those motors requiring complete protection where over temperature (by means of PTC sensor) and incorrect phase sequence protection is required.

Its 7 trip classes cover all types of starting or working cycles.

EXTERNAL DISPLAY MODULE

By means of this plug-in optional accessory, the relay status can be seen and reset from the exterior of the electrical panel board.

Easy to install. Size of a Ø22 mm push button.

Suitable for motor control centres (MCC) and panel boards.

GL 200

PROTECTION FUNCTIONS

- I> Overload
- Phase imbalance or phase loss
- Overtemperature
- Phase sequence

ODGL

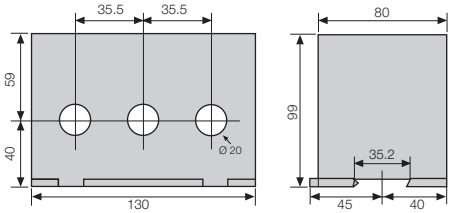
Models	Code	Relay type
ODGL	**12535**	GL

MODELS				GL 200
Adjustment range Motor 400 V 50/60 Hz	I_B (A)			60 - 200
	CV			50 - 150
	kW			37 - 110
Code: according to the relay voltage supply ac: 50/60 Hz	15%	230 Vac	single phase	**11363**
	15%	115 Vac	single phase	**11362**
	20%	24 Vac, dc	single phase	**11360**
External display module (optional)				ODGL

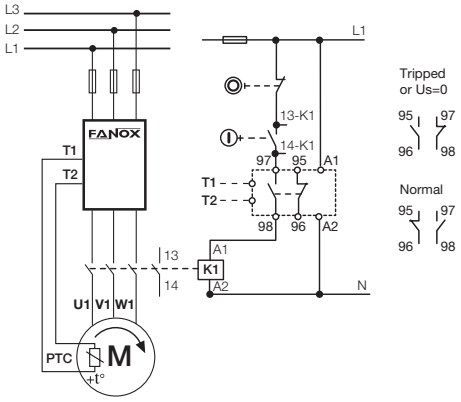
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	5 - 10 - 15 - 20 - 25 - 30 - 35
Phase sequence protection	ON ■□ OFF Actuates during the motor start
Phase imbalance protection	Over 40%. Tripping time < 3s
PTC Min/max cold resist.-Average trip / reset resist.	25Ω / 1500Ω - 3600Ω / 1800Ω
Reset mode	Manual and remote
Signalling LED's	4 LED's: ON + I> + ⅄ + (( )) + +t°
Output contacts	1 relay with 1 NA + 1 NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / screw torque	4.0 mm², No. 30 - 12AWG / 50Ncm, 4.4 LB - IN
Power consumption	2,5 VA (115-230 Vac) - 1,5 W (24 Vdc)
Protection degree / weight / mounting	IP20 / 1 kg / DIN rail
Storage temperature	-30°C +70°C
Operating temperature / max. altitude	-15°C +60°C / 1000m ; -15°C +50°C / 3000m
Standards	IEC 255, IEC 947, IEC 801, EN 50081-2
	CE c UL US LISTED

Settings and curves, see pages 105 to 111.

DIMENSIONS GL RELAY (mm)



WIRING DIAGRAMS



C

Motor Protection Relays

BASIC MOTOR PROTECTION

- ***For 3-phase motors from 1 to 630 A and over. Cable feed through relay.***
- ***Precise motor heating and cooling memory, reproduces its thermal image.***
- ***Immediate detection of phase loss (3 s), even at reduced load.***
- ***Visual indication of tripping cause.***

For motors of low and medium power in several applications such as compressors, ventilators, surface mounted pumps, conveyor belts, machine tools, and in general to protect motors which need dependable and accurate protection relays for every type of start.

Its 3 trip classes cover many types of starting or working cycles.

C

PROTECTION FUNCTIONS

I> Overload

Phase imbalance or phase loss

EXTERNAL DISPLAY MODULE

By means of this plug-in optional accessory, the relay status can be seen and reset from the exterior of the electrical panel board.

Easy to install. Size of a Ø22 mm push button.

Suitable for motor control centres (MCC) and panel boards.

ODC

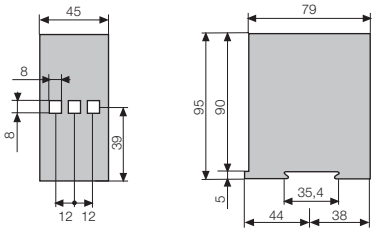
Models	Code	Relay type
ODC	**12530**	C

MODELS			C 9	C 21	C 45
Adjustment range Motor 400 V 50/60 Hz		I_B (A)	3 - 9,3	9 - 21,6	20 - 45,2
		CV	2 - 5,5	7,5 - 12	15 - 30
		kW	1,5 - 4	5,5 - 9	11 - 22
Code	according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	230 Vac single phase	**11203**	**11223**	**11243**
		115 Vac single phase	**11202**	**11222**	**11242**
		24 Vac, dc single phase	**11200**	**11220**	**11240**
For I_N of the motor below the minimum setting I_B			Pass the cables several times (n) through the holes in the relay I_B = n x I_N		
For I_N of the motor above the maximum setting I_B			Use 3 CT .../5 and the relay C9 and pass the secondary twice through the holes		
External display module (optional)			ODC		

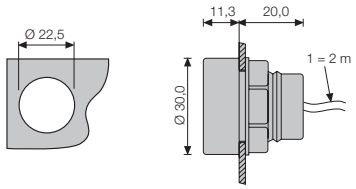
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	10 - 20 - 30
Phase imbalance protection	Over 40%. Tripping time < 3s
Reset mode	Manual and remote
Signalling LED's	3 LED's: ON + I> + ⅄
Output contacts	1 relay with 1 NO + 1 NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	**C9:** 6,5VA (230Vac) - 3VA (115Vac) / **C21-C45:** 2,5VA
Protection degree / weight / mounting	IP20 / 0,3 kg / DIN rail
Storage temperature	-30°C +70°C
Operating temperature / max. altitude	-15°C +60°C / 1000m ; -15°C +50°C / 3000m
Standards	IEC 255, IEC 947, IEC 801, EN 50081-2
	CE cULus LISTED

Settings and curves, see pages 105 to 111.

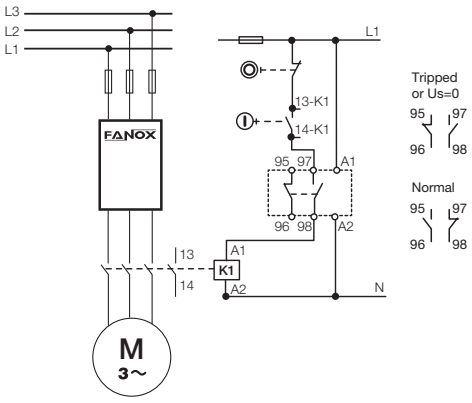
DIMENSIONS C RELAY (mm)



DIMENSIONS ODC MODULE (mm)



WIRING DIAGRAMS



EEx e Motor Protection Relays

MOTOR PROTECTION IN EXPLOSIVE OR HAZARDOUS AREAS

- *Certificates for use as category 3 - Directive ATEX 94/9/EC.*
- *For 3-phase motors up to 1000 Vac.*
- *Currents from 1,5 to 630 A and over.*
- *With thermal memory.*
- *Visual indication of tripping cause.*

These relays are applicable for EEx e motors with ratings up to 630A and above, operating in potentially explosive or hazardous areas such as petrochemical industries, plastic factories, etc. The relay is installed outside the explosive area.

G

PROTECTION FUNCTIONS

- I> Overload
- Phase imbalance or phase loss
- +t° Overtemperature

ATEX

The models G and BG are ATEX marked with certification for Category 3 use.

CE Ex II (3) G EEx e

PTB approval:

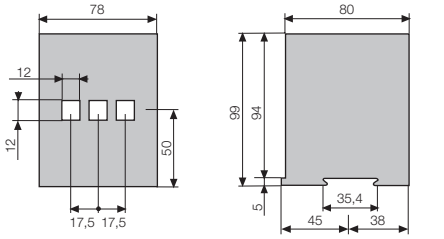
G and BG relays have been approved by the **Physikalisch-Technische Bundesanstalt-PTB** for the protection of EEx e explosion proof motors (DIN EN 50019 / DIN VDE 0170 /DIN VDE 0171 part 6) according to the stipulations and requirements of PTB. PTB report no. PTB Ex 3.43-30004/00.

Ex PTB Ex 3.43 - 30004/00

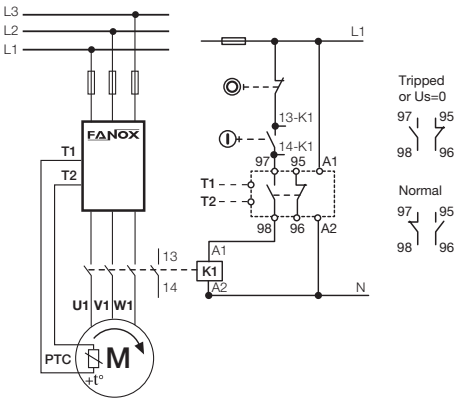
MODELS			G 17
Adjustment range Motor 400 V 50/60 Hz	I_B (A)		5 - 17,7
	CV		3 - 10
	kW		2,2 - 7,5
Code: according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	230 Vac	single phase	**10723**
	115 Vac	single phase	**10722**
	24 Vdc, ac		**10720**
For I_N of the motor below the minimum setting I_B			Pass the cables several times (n) through the holes in the relay I_B = n x I_N
For I_N of the motor above the maximum setting I_B			Use 3 CT's .../5 and pass their secondary twice (n=2) through the relay holes
External display module / Code no.			No

CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum motor nominal voltage	1000 V
15 adjustable tripping curves	Cold tripping times at 6 x I_B from 2 to 30s
Phase imbalance protection	Over 40%. Tripping time < 3s
PTC min/max cold resist. / Average trip resistance	100 Ω / 1500 Ω - 2750 Ω
Reset mode	Manual and remote
Signalling LED's	4 LED's: ON + one for each protection
Alimentación auxiliar monofásica • Voltage Us • Frequency • Consumption • Protection fuse	 115 - 230 Vac (+15% -6%) / 24 Vdc (±10%) 50/60 Hz (from 49 to 61,2 Hz) 2,5 VA (115 - 230 Vac) / 1,5 W (24 Vdc) GL 6 A
Output contacts • Switching capacity in abnormal conditions • Short-circuit resistance	1 relay with 1 NO + 1 NC I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A 1000 A
Short circuit withstand rating	5000 A at 0,5 s (SCR 5000@0,5 s)
Terminals max. section / Screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Protection degree / weight / mounting	IP20 / 0,5 kg / DIN rail
Storage temperature	-30°C +70°C
Operating temperature	-15°C +60°C
Standards CE cULus LISTED	EN 50081-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 60529, EN 60947-5-1, UL 508 EN 60947-1, EN 60947-4-1, EN 60255-8, EN 954-1, EN 60079-14, EN 60034-1, EN 50019

DIMENSIONS G RELAY (mm)



WIRING DIAGRAM



Settings and curves, see pages 105 to 111.

PS

SINGLE PHASE Pump Protection Relay without Level Sensors

SINGLE PHASE PUMP PROTECTION

Underload protection by undercurrent

- ***Eliminates need for level sensors to detect dry running.***
- ***For 1-phase motors from 3 to 16 A.***
- ***Precise motor heating and cooling memory, reproduces its thermal image.***
- ***Visual indication of trip cause.***
- ***Adjustable reset time for I<.***

Suitable for 1-phase submersible pumps. By monitoring undercurrent it avoids problems caused by dry running, cavitation, etc.

The great advantage of the PS relay is that, without requiring any external detectors like level electrodes, it monitors the load of the motor and stops it before an expensive breakdown occurs.

PS 11-R

PROTECTION FUNCTIONS

- I> Overload
- I< Undercurrent
- U> Overvoltage

WITHOUT LEVEL SENSORS

PS 16-R

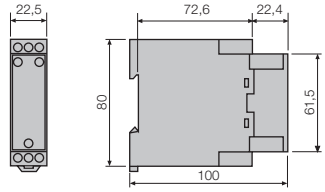
MODELS			PS 11-R	PS 16-R
Adjustment range Motor 400 V 50/60 Hz		I_B (A)	3 - 11	3 - 16
		CV	0,5 - 2	0,5 - 3
		kW	0,37 - 1,5	0,37 - 2,2
Code	according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	230 Vac single phase	**12164**	**12163**
		115 Vac single phase	**12171**	**12172**

CHARACTERISTICS		
Thermal memory / Overload trip	Yes / From 1,1 x I_B	
Maximum motor nominal voltage	230 Vac	
Trip classes (IEC 947-4-1)	10	
Undercurrent protection adjustable / Trip delay	From 0,4 to 0,9 x I_B / 5 s	
Overvoltage protection	From nominal V + 15%	
Reset mode for protection against dry running	I< automatic (adjustable) and remote. More info in page 110	
Reset mode for other protection functions	I> automatic and remote, U> automatic. More info in page 110	
Signalling LED's	3 LED's: ON + I> I< + U>	
Output contacts	1 relay with 1 NO	
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A	
Terminals: Max. section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN	
Power consumption	7 VA (230 Vac) - 4 VA (115 Vac)	3 VA (115-230 Vac)
Protection degree / weight / mounting	IP20 / 0,15 kg / DIN rail	IP20 / 0,3 kg / DIN rail
Storage temperature	-30°C +70°C	
Operating temperature / max. altitude	-15°C +60°C / 1000m; -15°C +50°C / 3000m	
Standards	IEC 255, IEC 947, IEC 801, EN 50081-2	
	CE	

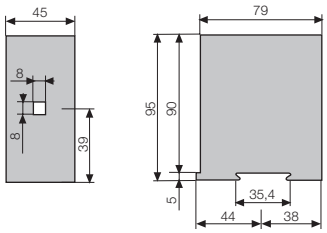
Settings and curves, see pages 105 to 111.

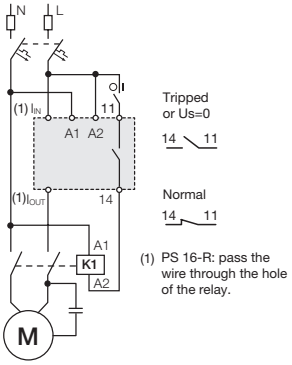
DIMENSIONS PS RELAY (mm)

PS 11-R



PS 16-R





THREE PHASE Pump Protection Relay without Level Sensors

THREE PHASE PUMP PROTECTION

Underload protection by undercurrent

- ***Eliminates need for level sensors to detect dry running.***
- ***For 3-phase motors from 1 to 630 A and over. Cable feed through.***
- ***Precise motor heating and cooling memory, reproduces its thermal image.***
- ***Visual indication of tripping cause.***
- ***Manual, remote and automatic reset.***

Suitable where the undercurrent (running without load) is critical, such us submersible pumps, surface pumps, etc. In these cases, when the equipment runs without load (dry well) the relay trips by undercurrent.

The great advantage of the P relay is that, without requiring any external detectors such as level electrodes, it monitors the load of the motor and stops it before an expensive breakdown occurs.

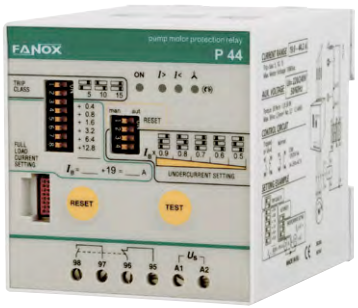
EXTERNAL DISPLAY MODULE

By means of this plug-in optional accessory, the relay status can be seen and reset from the exterior of the electrical panel board.

Easy to install. Size of a Ø22 mm push button.

Suitable for motor control centres (MCC) and panel boards.

P



PROTECTION FUNCTIONS

- $I>$ Overload
- $I<$ Undercurrent
- Phase imbalance or phase loss
- Phase sequence

WITHOUT LEVEL SENSORS

WITHOUT LEVEL SENSORS

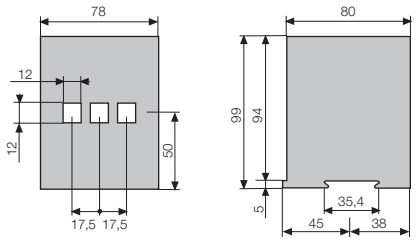
ODP

Models	Code	Relay type
ODP	**12540**	P

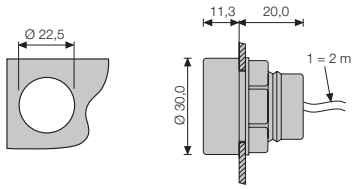
MODELS			P 19	P 44	P 90
Adjustment range Motor 400 V 50/60 Hz	I_B (A)		7 - 19,6	19 - 44,2	40 - 90,4
	CV		4 - 10	12,5 -27,5	27,5 - 55
	kW		3 - 7,5	9,2 - 20	20 - 40
Code: according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	230 Vac	single phase	**11403**	**11423**	**11443**
	115 Vac	single phase	**11402**	**11422**	**11442**
	24 Vac, dc	single phase	**11400**	**11420**	**11440**
For I_N of the motor below the minimum setting I_B			Pass the cables several times (n) through the holes in the relay I_B = n x I_N		
For I_N of the motor above the maximum setting I_B			Use 3 CT .../5 and the relay P 19		
External display module (optional)			ODP		

CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	5 - 10 - 15
Phase sequence protection	Yes
Phase imbalance protection	Over 40%. Tripping time < 3s
Undercurrent protection adjustable / Trip delay	From 0,5 to 0,9 x I_B . Operative from 0,3 x I_B/ 3s
Reset mode for protection against dry running	$I<$ manual, remote and automatic. More info in page 110
Reset mode for other protection functions	Manual, remote and automatic (every 15 minutes)
Short circuit withstand rating	5000 A at 0,5 s (SCR 5000@0,5 s)
Signalling LED's	4 LED's: ON + $I>$ + $I<$ +
Output contacts	1 relay with 1 NO + 1 NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	2,5 VA
Protection degree / weight / mounting	IP20 / 0,5 kg / DIN rail
Storage temperature	-30°C +70°C
Operating temperature / max. altitude	-15°C +60°C / 1000m; -15°C +50°C / 3000m
Standards	IEC 255, IEC 947, IEC 801, EN 50081-2
	CE cULus LISTED

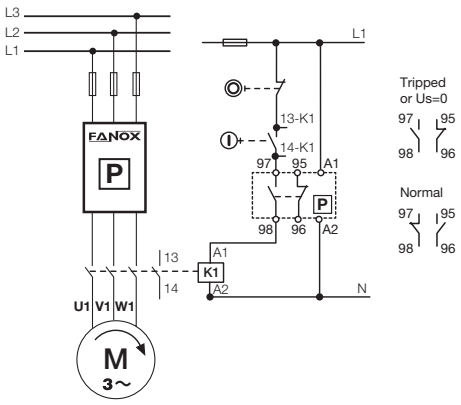
DIMENSIONS P RELAY (mm)



DIMENSIONS ODP MODULE (mm)



WIRING DIAGRAM



Settings and curves, see pages 105 to 111.

PF

THREE PHASE Pump Protection Relay without Level Sensors

THREE PHASE PUMP PROTECTION

Underload protection by cos φ

- ***Eliminates need for level sensors to detect dry running.***
- ***For 3-phase motors from 1 to 630 A and over. Cable feed through relay itself.***
- ***Precise motor heating and cooling memory, reproduces its thermal image.***
- ***Visual indication of tripping cause.***
- ***Adjustable reset time for cos φ.***

Suitable for 3-phase submersible pumps, petrol station pumps, and other type of pumps and systems where running without load is critical (dry well, broken transmission belt, etc.).

The great advantage of these relays is that, by using the motor itself as a sensor and without requiring any external detectors, they monitor the cos φ of the motor and stop it before a breakdown caused by dry running, cavitation or closed valve occurs.

PF

PROTECTION FUNCTIONS

- $I>$ Overload
- **cos** φ Underload
- Phase imbalance or phase loss
- Phase sequence

WITHOUT LEVEL SENSORS

WITHOUT LEVEL SENSORS

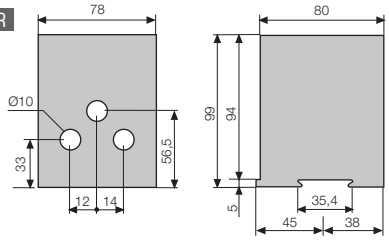
MODELS			PF 16-R	PF 47-R
Adjustment range Motor 400 V 50/60 Hz	I_B (A)		4 - 16,6	16 - 47,5
	CV		3 - 10	10 - 30
	kW		2,2 - 7,5	7,5 - 22
Adjustment range Motor 230 V 50/60 Hz	I_B (A)		4 - 16,6	16 - 47,5
	CV		1,5 - 5,5	5,5 - 15
	kW		1,1 - 4	4 - 11
Code — according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	400/440 Vac	3-phase (motor)	**12165**	**12167**
	230 Vac	3-phase (motor)	**12173**	**12168**
For I_N of the motor below the minimum setting I_B			Pass the cables several times (n) through the holes in the relay I_B = n x I_N	
For I_N of the motor above the maximum setting I_B			Use 3 CT .../5 and the relay PF16-R	
External display module (optional)			ODPF	

CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum motor nominal voltage	440 Vac
Trip classes (IEC 947-4-1)	10 - 20 - 30
Phase sequence protection	Yes
Phase imbalance protection	Over 40%. Tripping time < 3s
Underload protection by cos φ / Trip delay	cos φ adjustable from 0,15 to 1,0 / adjustable from 5 to 45s
Reset mode for protection against dry running	cos φ automatic (adjustable) and remote. More info in page 110
Reset mode for other protection functions	$I>$ Manual, remote and automatic. More info in page 110
Signalling LED's	4 LED's: ON + $I>$ + **cos** φ +
Output contacts	1 relay with 1 NO + 1 NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	1,5W - 12 VA (230 Vac) - 20 VA (400 Vac)
Protection degree / weight / mounting	IP20 / 0,5 kg / DIN rail
Storage temperature	-30°C +70°C
Operating temperature / max. altitude	-15°C +60°C / 1000m; -15°C +50°C / 3000m
Standards	IEC 255, IEC 947, IEC 801, EN 50081-2
	CE

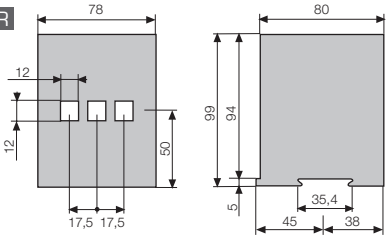
Settings and curves, see pages 105 to 111.

DIMENSIONS PS RELAY (mm)

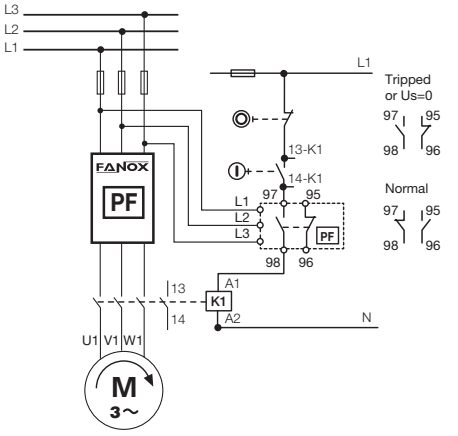
PF 16-R



PF 47–R



WIRING DIAGRAM



EXTERNAL DISPLAY MODULE

By means of this plug-in optional accessory, the relay status can be seen and reset from the exterior of the electrical panel board.

Easy to install. Size of a Ø22 mm push button.

Suitable for motor control centres (MCC) and panel boards.

This optional display module is mounted externally, e.g. on the panel door or a draw-out unit in a motor control centre (MCC) and connected to the relay by a flat cable (length 2 meters).

The module has the appropriate LED's to signal the trip cause and a reset push-button.

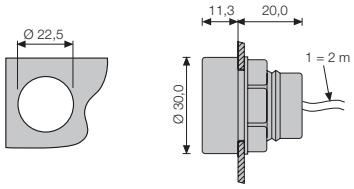
Weight: 0,05 kg.

Protection degree: IP50

ODPF

Model	Code	Relay type
ODPF	**12555**	PF

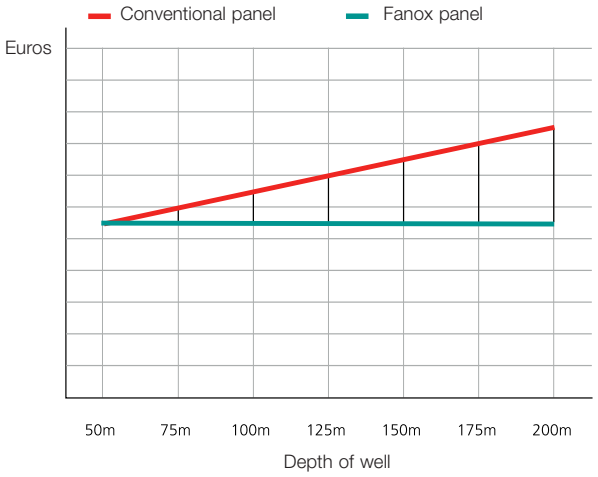
DIMENSIONS ODPF MODULE (mm)



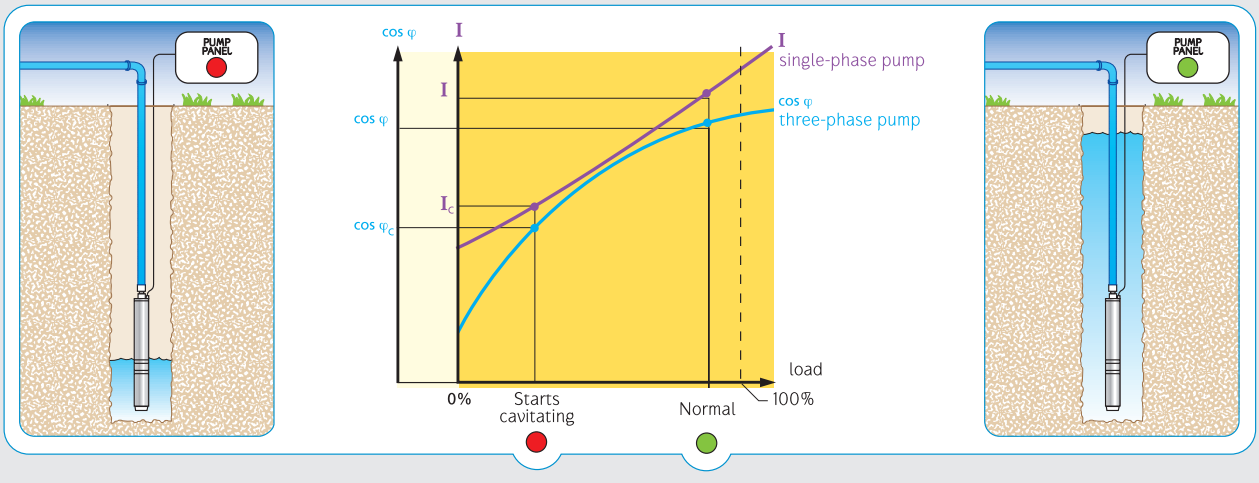
"The PS and PF electronic relays have been specially designed to provide complete protection for both single and three phase pumps and any other system where dry running is a critical factor."

Fanox panel	Conventional panel
Electronic relay	Thermal relay Level electrode relay as well as Level electrodes Level electrode wiring

COST COMPARISON



The graph shows that with FANOX SOLUTION you can save up to 35% of the cost of a pump protection system.



CBM

Panels for SUBMERSIBLE Pumps

SINGLE PHASE PUMPS

- *Thermal memory of motors heating and cooling cycles.*
- *Automatic reset, adjustable from 2 to 240 minutes for well filling,*
- *Indication of trip cause.*
- *Control point for pressure switch, buoy, programmer...*
- *Includes: circuit breaker 1P+N, PS-R electronic relay, contactor, LEDs and on/off switch.*

One of the most critical situations in pump operation is dry running. The solution offered by FANOX single-phase protection panels is based on measuring the undercurrent. In dry running situations a current decrease is detected. This reduction of consumed current is measured by the PS-R electronic relay fitted to the protection panel: when the preset undercurrent value is reached, it switches the pump off.

- *IP 55*

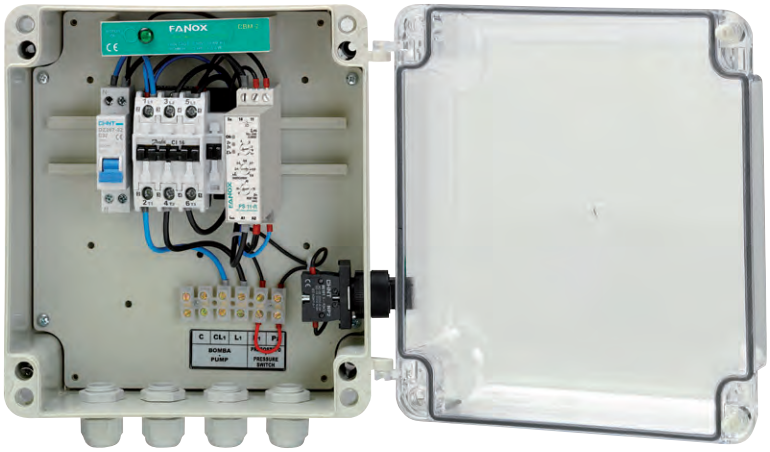
WITHOUT LEVEL SENSORS

WITHOUT LEVEL SENSORS

PROTECTION FUNCTIONS

- *I*> Overload
- *I*< Undercurrent
- *U*> Overvoltage
- *I*>> Short-circuit

CBM



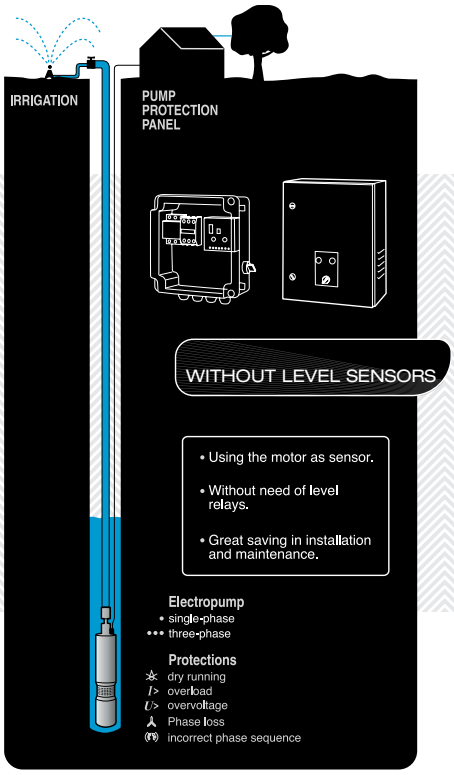
Pump protection without level sensor video demo:

Models	Code	Approx. motor current (Amps)	Power of single-phase 230 V motor		Adjustable well filling time (minutes)	Dimensions (mm)
			HP	kW		
CBM-2	**12312**	3 - 11	0.5 - 2	0.37 - 1.5	2 - 70	230 x 250 x 150
CBM-3	**12314**	11 - 16	2 - 3	1.5 - 2.2	2 - 240	230 x 250 x 150
CBM-4	**12313**	16 - 28	3 - 5	2.2 - 3.75	2 - 240	230 x 250 x 150

- *Equipment with halogen-free wiring*

Fanox Control Panels protect pumps against dry running without using level sensors.

- *Maximum protection without level electrodes or level relays.*
- *Electronic relay incorporated.*
- *Quick and easy installation, maintenance-free.*
- *Installation costs are significantly reduced.*
- *Can be adapted to installations already in service, without removing the pump.*



CBT

Panels for SUBMERSIBLE Pumps

THREE PHASE PUMPS

- *Thermal memory of motors heating and cooling cycles.*
- *Automatic reset for well filling. Adjustable from 2 to 75 minutes.*
- *Trip cause indication.*
- *Control point for pressure switch, buoy, programmer...*
- *Includes: circuit breaker 3P or 3P+N, PF-R electronic relay, contactor, LEDs and on/off switch.*
- *Models with metal enclosure also include voltmeter, ammeter and φ meter.*

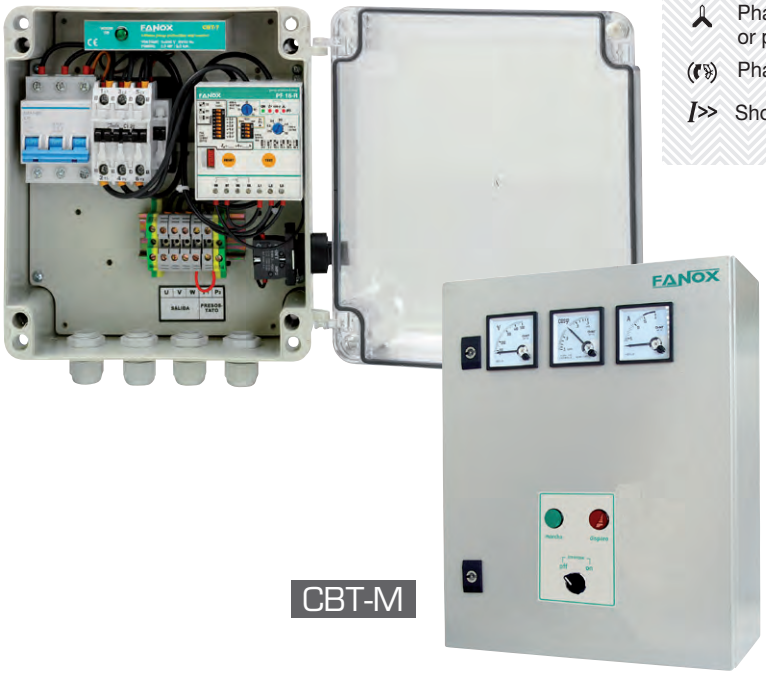
The cosine of phi (Cos φ) is the value of the cosine of the phase angle between the voltage and the intensity of the electrical current. This oscillates from a value slightly below 1 for a full load operating motor to almost 0 when it is dry running.

Therefore, in dry running situations, cos φ falls significantly. This reduction is monitored by the PF-R relay installed in FANOX three-phase protection panels, meaning that when it falls beneath the adjusted value, the panel shuts down the pump and protects it from damage.

- *IP 55*

WITHOUT LEVEL SENSORS

CBT



CBT-M

PROTECTION FUNCTIONS

- **cos** φ Underload
- *I*> Overload
- Phase imbalance or phase loss
- Phase sequence
- *I*>> Short-circuit

	Models	Code	Approx. motor current (Amps)	Power of three-phase 400 V motor		Adjustable well filling time (minutes)	Dimensions (mm)
				HP	kW		
PLASTIC	**CBT-1**	**12301**	1.1 - 2.0	0.5 - 1	0.37 - 0.75	2 - 75	230x250x150
	CBT-2	**12302**	2.8 - 3.8	1.5 - 2	1.1 - 1.5	2 - 75	230x250x150
	CBT-5	**12305**	5.5 - 9.5	3 - 5.5	2.2 - 4	2 - 75	230x250x150
	CBT-7	**12307**	13	7.5	5.5	2 - 75	230x250x150
	CBT-10	**12310**	16.5	10	7.5	2 - 75	230x250x150
	CBT-15	**12315**	24	15	11	2 - 75	230x250x150

- *Equipment with halogen-free wiring*
- *Models adapted to 3x230 V networks available.*

CBS

Panels for SUBMERSIBLE Pumps

THREE PHASE PUMPS WITH SOFT STARTER

- *Thermal memory of motors heating and cooling cycles.*
- *Automatic reset for well filling. Adjustable from 2 to 75 minutes.*
- *Trip cause indication.*
- *Control point for pressure switch, buoy, programmer...*
- *Plastic case.*
- *Includes: circuit breaker 3P+N, PF-R electronic relay, ES soft starter, contactor, LEDs and on/off switch.*

FANOX protection panels with progressive startup and shut -down are fitted with ES soft starters to prevent problems caused by water hammering or sudden start-ups and shut-downs.

Protection against dry running is provided by the PF-R relay that monitors the value of cos φ and shuts down the pump when it falls below the selected value.

- *IP 55*

CBS

PROTECTION FUNCTIONS

cos φ Underload
I> Overload
Phase imbalance or phase loss
Phase sequence
I>> Short-circuit
Soft start
Soft stop

WITHOUT LEVEL SENSORS

WITHOUT LEVEL SENSORS

	Models	Code	Approx. motor current (Amps)	Power of three-phase 400 V motor		Adjustable well filling time (minutes)	Dimensions (mm)
				HP	kW		
PLASTIC	**CBS-2/P**	**12321P**	3.8	0.5 - 2	0.37 - 1.5	2 - 75	250x300x150
	CBS-3/P	**12322P**	5.5	3	2,2	2 - 75	250x300x150
	CBS-5/P	**12323P**	7.0 - 9.5	4 - 5.5	3 - 4	2 - 75	250x300x150
	CBS-7/P	**12324P**	13	7.5	5.5	2 - 75	250x300x150
	CBS-10/P*	**12326P**	16.5	10	7.5	2 - 75	400x300x200
	CBS-12/P*	**12327P**	21	12.5	9.2	2 - 75	400x300x200
	CBS-15/P*	**12328P**	24	15	11	2 - 75	400x300x200
	CBS-20/P*	**12329P**	32	20	15	2 - 75	400x300x200
	CBS-25/P*	**12330P**	40	25	18.5	2 - 75	400x300x200
	CBS-30/P*	**12331P**	47	30	22	2 - 75	400x300x200

- *Equipment with halogen-free wiring*
- *Other voltages under request*

* Models available in metalic box.

GEN

Generator Protection Relay

GENERATOR PROTECTION

- ***For generators up to 1000 Vac.***
- ***With thermal memory.***
- ***Visual indication of trip cause.***
- ***Fast trip curves.***

This relay is specially applicable for protecting low voltage generators up to 1000 Vac, and currents up to 2000 A or higher.

Precise motor heating and cooling memory, reproduces its thermal image.

It offers a suitable protection offering the choice between 15 trip curves thus avoiding the generator working over its damage curve.

EXTERNAL DISPLAY MODULE

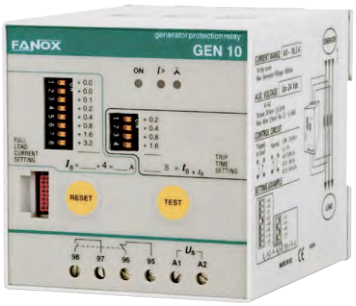
By means of this plug-in optional accessory the relay status can be seen and reset from the exterior of the electrical panel board.

Easy to install. Size of Ø22 mm push button.

OTHER RELAYS FOR GENERATORS:

- **U3N:** Three-phase voltage relay (See page 119).

GEN



PROTECTION FUNCTIONS

- $I>$ Overload
- Phase imbalance or phase loss

ODGEN

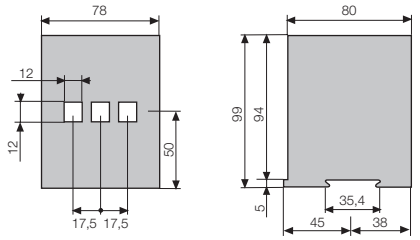
Models	Code	Relay type
ODGEN	**12545**	GEN

MODELS	**GEN 10**
Adjustment range I_B (A)	4 - 10,3
Auxiliary voltage supply (+15% -10%)	24 Vdc
Code	**11350**
For I_N of the generator above 10,3 A	Use 3 current transformers.../5
External display module (optional)	ODGEN

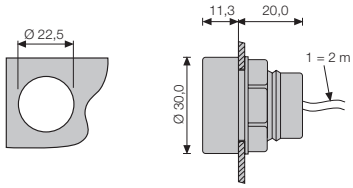
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x I_B
Maximum generator nominal voltage	1000 Vac
Trip time t6 x I_B	15 adjustable curves from 0,2 to 3 s.
Phase imbalance protection	Over 20%. Tripping time < 3s
Reset mode	Manual and remote
Signalling LED's	3 LED's: ON + one for each protection
Output contacts	1 relay with 1 NO + 1 NC
Switching power	I_{th}:5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Short circuit withstand rating	5000 A at 0,5 s (SCR 5000@0,5 s)
Terminals: Max.section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	1,5 W
Protection degree / weight / mounting	IP20 / 0,5 kg / DIN rail
Storage temperature	-30°C +70 °C
Operating temperature / max. altitude	-15°C +60°C / 1000m; -15°C +50°C / 3000m
Standards	IEC 255, IEC 801, EN 50081-2
	CE cULus LISTED

Settings and curves, see pages 105 to 111.

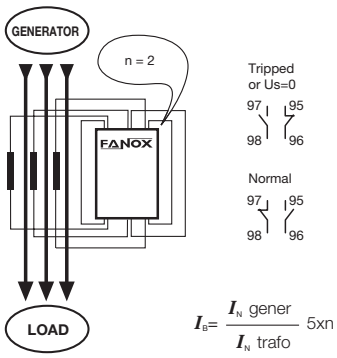
DIMENSIONS GEN RELAY (mm)



DIMENSIONS ODGEN MODULE (mm)



WIRING DIAGRAM



ES

Soft Starters and Motor Controller

- ***For three-phase induction motors of up to 22 kW / 400 V.***
- ***Built in heat dissipater and electro-mechanical bypass relay.***
- ***Substitutes the conventional contactors. One in direct start-up and three in star-delta start-up cycle. Offers greater life cycle.***

- Lower maintenance cost.
- No pressure surge when using pumps and compressors. Reduces hammering.
- Less current and voltage drop during start up. Allows for reduced power consumption.
- Mechanical dimensioning can be optimised.
- Simplified automation.
- Assembly, setting, installation, commissioning and maintenance are made easy by the compact design.
- Reduces start and stop torque, eliminating mechanical problems.
- Additional cooling is not necessary thanks to the bypass built-in relay.
- Substitutes the conventional contactors: one for direct start-up and three for star-delta start-up Y-Δ.

ES-3

ES-12

ES-25

ES-45

PROTECTION FUNCTIONS

- Soft start
- Soft stop

ES -25 and ES -45 model include:

- Phase imbalance or phase loss
- Overtemperature
- Phase sequence
- U> Overvoltage
- U< Undervoltage
- Hz > Overfrequency
- Hz < Overfrequency
- I> Overcurrent
- Long ramp

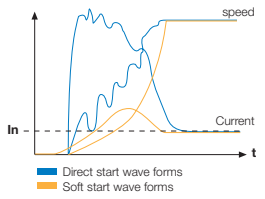
MODELS*		ES 400-3	ES 230-12	ES 400-12	ES 230/400-25E	ES 230/400-45E	ES 230/400-25F	ES 230/400-45F
Nominal voltage 50/60 Hz V±15%		400	230	400	220-400	220-400	220-400	220-400
Maximum current A		3	12	12	25	45	25	45
Motor power	kW	1,1	3	5,5	5,5/11	11/22	5,5/11	11/22
	CV	1,5	4	7,5	7,5/15	15/30	7,5/15	15/30
Code		**41803**	**41801**	**41812**	**41825-E**	**41845-E**	**41825-F**	**41845-F**

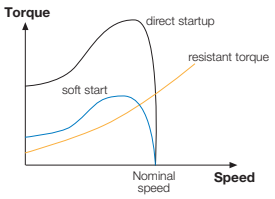
* Other voltages available upon request. (380V,480V and 600V)

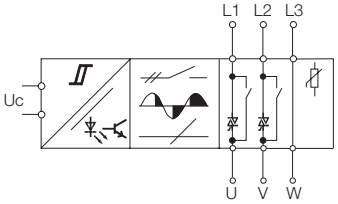
CHARACTERISTICS			
Control voltage (±15%)	A1-A2=24-100 Vac,dc / A1-A3=110-480 Vac	A1-A2=110-400 Vac	A1-A2=24 Vac/dc
Degree of protection	IP20		
Operating temperature	-20°C +50°C	-20°C +60°C	
Standards and approvals	IEC947-4-2 UL, CSA and CE mark		

INDICATIONS			
Supply	green	POWER ON green	POWER ON green
Ramps	yellow	RAMPING yellow	RAMPING yellow
Bypass relay	yellow	BYPASS yellow	BYPASS yellow
Alarm		OVERHEAT red	OVERHEAT red

ADJUSTMENTS		
Start torque (% of nominal torque)	0 - 85%	0 - 70%
Start-up time	0,5 - 5 s	1 - 10 s
Stop time	0,5 - 5 s	1 - 30 s







OPERATION

These units represent the best protection against premature ageing of motors and mechanical items.

Sudden starts and stops, that can produce damages in the bearings and gears of the motors, are eliminated.

They prevent frequent faults and objects falling onto conveyer belts.

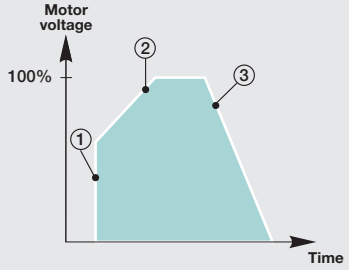
They reduce mechanical impact in motors, axles, gears and belts, significantly prolonging the operating life of the controlled units.

An electronic circuit with semiconductors starts the motor without using the contacts. Hence these do not withstand sparks or erosion.

When the minimal voltage of the motor is reached the semiconductors are bypassed by the relay contacts. Thanks to this technology, the ES starters have a longer operating life than conventional contactors.

They are easy to install and control. They can operate by means of an external control signal, such as a programmable automation.

POTENTIOMETER SETTING



① Par: INITIAL TORQUE.
Voltage when ramp-up begins.

② Ramp up time: RAMP UP.

③ Ramp-down time: RAMP DOWN.

Potentiometers ① ② and ③

- Initially set potentiometers ② and ③ to maximum.
- Connect the supply and set potentiometer ① so that the motor begins to rotate as soon as the supply is applied.
- Set the ramp-up and ramp-down times to the desired value.

MODE OF OPERATION

a) Change from on line direct start to soft start:

1) Cut off the cable from the motor and insert the ES starter.

2) Connect the control input to two of the input lines. Set the potentiometers according to the settings mode.

3) Reconnect the power supply.

On connecting C1, the starter performs a soft motor start. On disconnecting C1, the motor stops, the starter resets to zero and after 0.5 seconds a new soft start up may be performed.

b) Soft Start / Soft Stop

When S1 is closed (connection diagram), the soft motor start is realised according to the potentiometers setting of initial t and % torque.

When S1 is open the soft stop is done in accordance with the ramp down potentiometer setting.

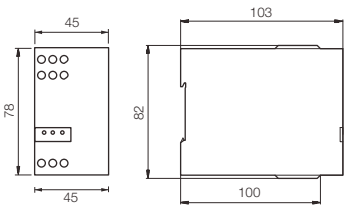
APPLICATIONS

For three-phase motors in applications such as:

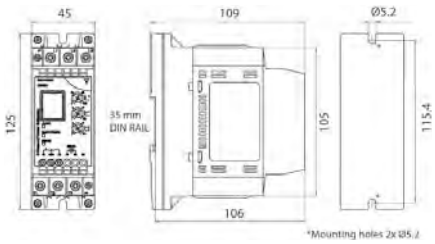
- Pumps.
- Cold compressors.
- Conveyor belts, lifting devices, etc.
- Mixers.
- Fans, extractor fans and blowers.
- Garage doors and elevators.
- Concrete mixers.
- Palletizer devices, etc.

DIMENSIONS (mm)

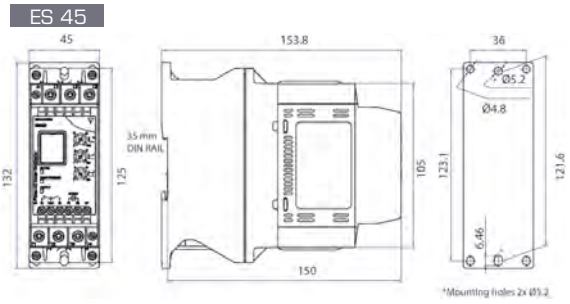
ES 3 -12



ES 25



ES 45



WIRING DIAGRAMS

ES 230-12

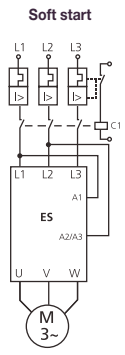


fig. 1

ES 400-3, 400-12

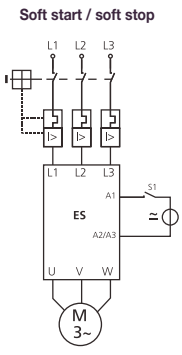


fig. 2

ES - 25E

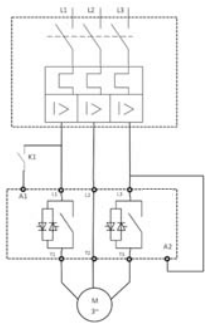


fig. 3

ES - 25F

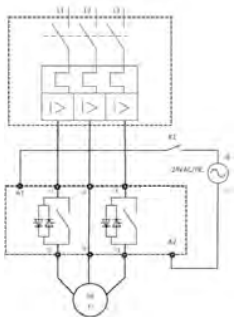


fig. 4

ES - 45E

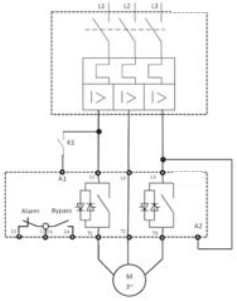


fig. 5

ES - 45F

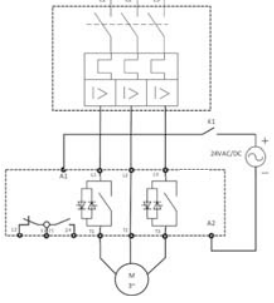


fig. 6

PTC

Thermistor Sensors

THERMISTOR SENSORS PTC

- *Connected to PBM B, GL, G, ST or MT relays to protect motors against overtemperature.*
- *PTC. Positive Temperature Coefficient*
- *PTC 120, and PTC 160 for internal mounting. Temperature threshold 120°C and PTC 160ºC.*
- *PTCEX 70, for external mounting. Temperature threshold 70°C.*

PTC

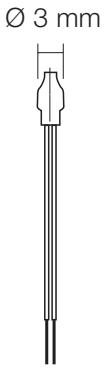
PTCEX 70

CE

PTC 120 /160

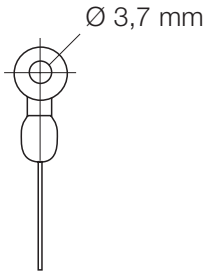
Models	PTC 120		PTC 160	PTCEX 70	
Code	**41700/41701**		**41702**	**41705**	
Threshold temperature	120°C		160°C	70°C	
Threshold resistance	≥ 1330 Ω		≥ 1330 Ω	≥ 1330 Ω	
Mounting	internal		internal	external	
Length in-built (m)	0,5	0,2	0,5	-	
Length of wire accessory (m)	-		-	0,5 **(17008)**	1 **(17009)**

DIMENSIONS PTC (mm)



PTC 120

PTC 160



PTCEX 70

THE MOTOR PROTECTION

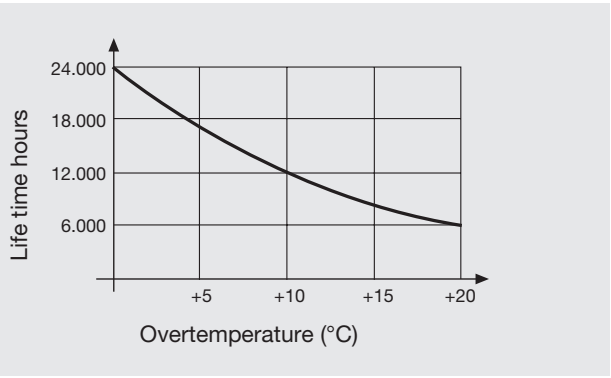
The electric motor is one of the most important operating devices in industry. Many times the shutdown of an industrial process is caused by a simple motor. High-cost production runs and valuable machinery can become paralysed at great cost, even more than the cost of rewinding the motor.

Experience shows that motor protection continues to be a problem, based on the number of breakdowns occuring every day.

Over 60% of failures are caused by overheating of the motor windings. These can be detected, and prevented, by measuring and analysing the current being absorbed by the motor, or by controlling temperature limits of the winding. The major causes are as follows:

- Overloads
- Locked rotor
- Over and undervoltage
- Phase imbalance or phase loss
- Long and heavy start-ups
- Excessive operating cycles
- Heating from non-electrical causes
- Inadequate motor ventilation
- High room temperature
- Insulation failure

The following diagram shows the dramatic decrease suffered in the electric life of a motor due to the excessive heat of the motor windings (Montsinger's rule).



As one can see, a 10ºC increase in temperature reduces the useful life of the motor by half.

The most reliable protection options in common use are:

- Fuses or circuit breakers for short-circuit protection.
- Electronic motor protection relays with thermal memory.
- Contactors for motor control.

FANOX RELAYS

Our R+D Division has allowed FANOX to develop a wide range of easy-to-install and operate electronic relays, at truly competitive prices, which will save downtime and money.

FANOX motor protection relays work with the current measured in real time. The current, which is read by three current transformers built into the relays, is electronically processed and used as a model of the thermal image of the motor, and is continously compared to the values set on the relay.

The three power supply cables to the motor are not directly connected to the relay, but pass through its corresponding CT holes.

This provides motor protection against:

- Overload: The relay creates a model of the thermal image of the motor during its heating and cooling cycles. In this way, in overload conditions, the relay will take into consideration previous operating conditions of the motor, and will trip quicker if the relay has detected previous occasions of overload. This thermal memory is independent of the auxiliary voltage supply of the relay and is stored even when this voltage is cut off or disconnected. The different trip curves available for selection in the relays allow for precise adjustment to any kind of motor start-up or work ing cycle.
- Phase imbalance and phase loss: even if the motor is running below its full load current.
- Incorrect phase sequence detection is highly important when the correct phase sequence is critical as in compressors, pumps, fans and other applications (GL, P, PF).
- Underload by undercurrent: protects the motor against working without load, very important in pumps (P and PS).
- Protection against no-load operation: underload protection by cos φ has been incorporated so that the relay differentiates precisely between very low load and no-load operations, and drops out in the latter case (PF).

In addition, when the relay is connected to thermistor sensors (PTC), it protects the motor against electrical and non-electrical overheating (GL, G).

A visual display of the cause allows maintenance personnel to identify and immediately act on the underlying causes. The use of the OD display makes this operation much easier.

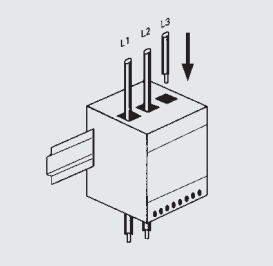
FANOX relays guarantee ideal protection for motors (pumps, compressors, fans, etc).

Installation and Adjustment guide

1 INSTALLATION

General

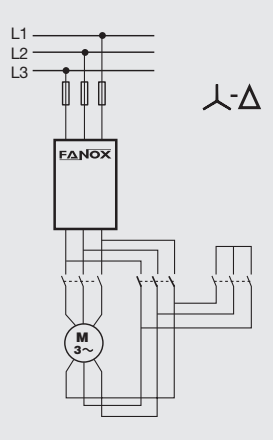
For correct installation and operation of Fanox relays, it is important to consider the following:



- After being fixed to the DIN rail, the cables for the three phases should be passed through the holes in the relay.

  The maximum section of 700V insulated wires that can pass through the holes are:

C	16 mm²
GL, P, PF, G, GEN	35 mm²
GL 200	70 mm²



- Assembly attached to other components: it is recommended to separate the relays of other units or items that could cause strong magnetic fields, such as power or control transformers, contactors, frequency variators or high current busbars.

- In star-delta starting, the relay or the current transformers must be installed between the fuses or circuit breaker and the contactor.

- Relays used in combination with frequency inverters:

  a) Not to be used with frequency inverters and fuel generators:

  - GL relays if the protection against phase sequence selector is in the "ON" position.
  - P and PF relays.

  b) The following can be used with frequency inverters and fuel generators:

  - GL relays if the protection against phase sequence selector is in the "OFF" position.
  - C, G and PS16-R.

  Never connect the relay or current transformers of the auxiliary power supply to the inverter output.

- Connection between the PTC sensors and the relay (GL and G). For PTC connection lengths over 100 m or when the influence of high frequency transient voltages is expected, it is adviseable to use screened cable and connect the screen to terminal T1.

Note: every relay comes with an instruction manual providing information on its correct installation and setup. Please follow this for guidance.

2 SETUP PROCEDURE

Correct order of steps during installation:

	C	GL	G	PS	P	PF	GEN
2.1 Select the trip class / tripping time	1st	1st	1st		1st	1st	1st
2.2 Adjust the I_B current of the relay	2nd	2nd	2nd	1st	2nd	2nd	2nd
2.3 Adjust the cos φ value (underload)						3rd	
2.3 Adjust the cos φ trip delay						4th	
2.4 Adjust the undercurrent level $I<$ (underload)				2nd	3rd		
2.5 Select ON /OFF incorrect phase sequence		3rd					
2.6 Reset	3rd	4th	3rd	3rd	4th	5th	3rd

After installation and setup and before starting up the motor, make sure the motor is in a cold state. This will ensure that both the relay and motor, will operate with the same thermal memory (cold condition).

2.1 Trip class / tripping time (IEC 947-4-1). Relays C, GL, P, PF, G and GEN

The different trip classes / tripping times enable the user to select the overload protection according to the various motor applications in either short or long start-ups and for different generator uses.

The class number or the tripping time refers to the maximum approximate time in seconds allowed for the direct start of the motor from a cold condition.

To select the trip class or tripping time ($t_{6 \times I_B}$) use the corresponding dip switches. The recommended values are listed in the following tables.

Motor with direct start-up

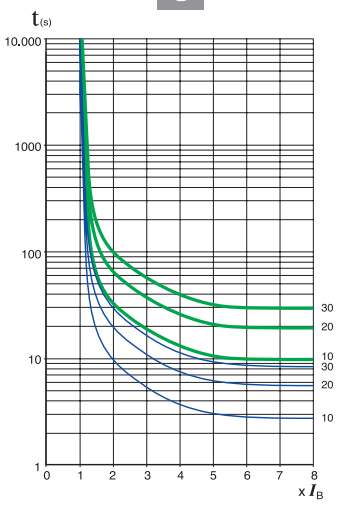
Start time (s) RPM t_s	Trip classes												Trip time
	Models												Model
	C9	C21	C45	GL16	GL40	GL90	GL200	P19	P44	P90	PF16-R	PF47-R	G17
1	10	10	10	10	10	10	10	5	5	5	10	10	4
2	10	10	10	10	10	10	10	10	10	10	10	10	6
3	10	20	20	15	15	15	15	10	10	10	20	20	10
4	20	20	20	20	20	20	20	15	15	15	20	20	12
5	20	30	30	20	20	25	25	15	15	15	20	20	16
6	20	30	30	25	25	25	25				30	30	18
7	30	30	30	30	30	30	30				30	30	22
8	30	30	30	30	30	35	35				30	30	24
9	30	30	30	35	35	35	35				30	30	28
10	30	30	30	35	35	35	35				30	30	30

Motor with star-delta start

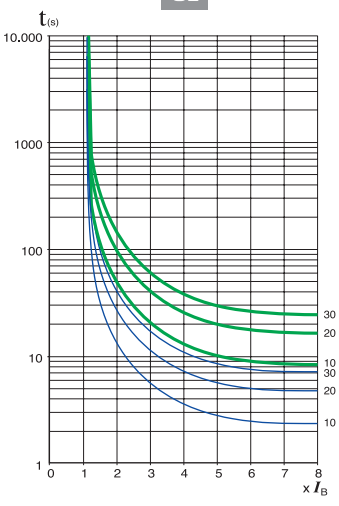
Y-Δ Start time (s) RPM t_s	Trip classes												Trip time
	Models												Model
	C9	C21	C45	GL16	GL40	GL90	GL200	P19	P44	P90	PF16-R	PF47-R	G17
5	10	10	10	10	10	10	10	5	5	5	10	10	4
10	10	10	10	10	10	10	10	10	10	10	10	10	6
15	20	20	20	10	15	15	15	10	10	10	10	20	8
20	20	20	30	20	20	20	20	15	15	15	20	20	10
25	30	30	30	20	20	25	25	15	15	15	20	20	14
30	30	30	30	20	25	30	30				20	30	16
35	30	30	30	20	30	35	35				20	30	18
40	30	30	30	25	30	35	35				30	30	20

Average trip curves (IEC 947-4-1)

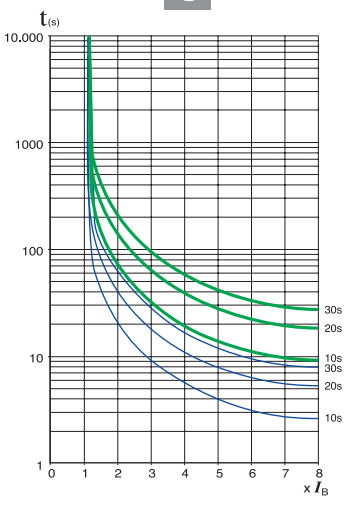
C



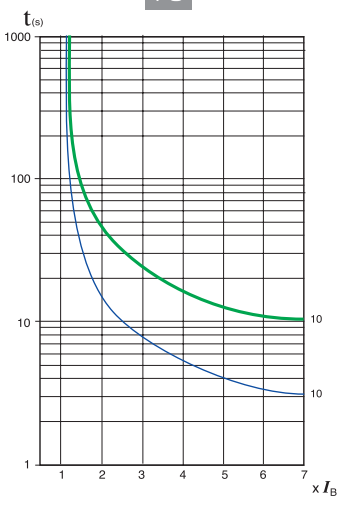
GL



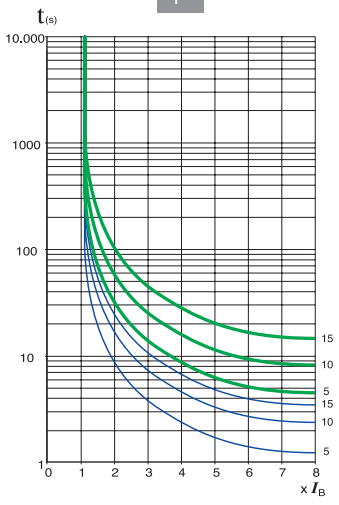
G



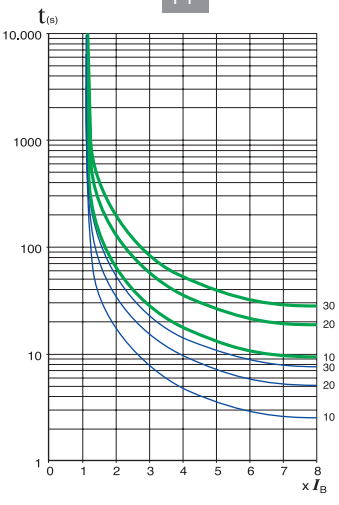
PS



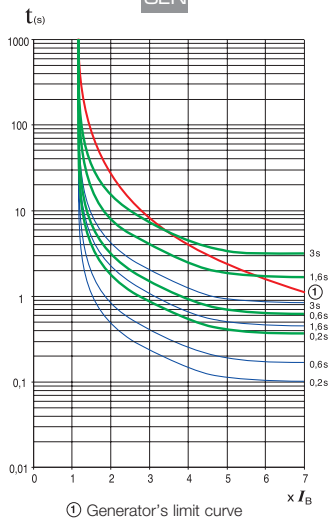
P



PF



GEN



① Generator's limit curve

Cold curve: represents the performance of the relay without any previous current flow, first start.

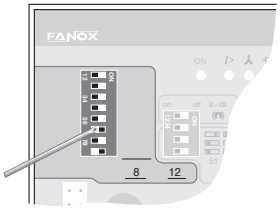
Warm curve: the tripping times decrease as the current flows, and is adapted to the motor heating condition based on the thermal memory. The warm condition (IEC-255) is reached after a current of 0.9 x I_N (motor rated current) flows during approximately 2 hours.

Installation and Adjustment guide

2.2 Current setting I_B.

Relays C, GL, P, PF, G, BG and GEN

Adjust the current I_B on the corresponding dipswitches (full load current). When setting the current take into account that the base current of the relay always remains added to the current selected with the dipswitches in "ON" position (to the right). The total addition is the set current I_B.
Overload tripping current from 1,1 x I_B

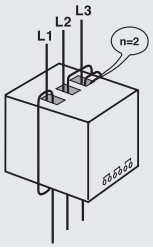


e.g.: relay GL16
I_B=8+4 =12 A

a) For motor or generator rated currents (I_N) within the range of the relay, the setting I_B must be equal to the I_N of the motor or generator.

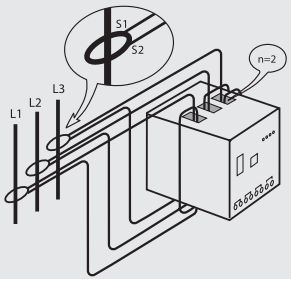
$$I_B = I_N$$

b) For motor rated currents below the range of the relay, the setting I_B must be equal to the rated current of the motor I_N multiplied by the number of times that the conductors have been passed through the relay holes.



$$I_B = I_N \times n$$

c) For motor or generator rated currents (I_N) above the range of the relay, use three current transformers .../5 in combination with the C9, GL16, P19, PF16-R, G17, BG17 or GEN10 according to application.



$$I_B = \frac{I_N \text{ motor}}{I_N \text{ trafo}} \times 5 \times n$$

always n ≥ 2

With current transformers it is always a must to pass the conductors 2 times or more through the holes of the relay.

PS relay

This adjustment is to be made according to the nominal current of the motor I_N indicated in its characteristics plate. The value to be set I_B is the same as I_N. The relay trips with overloads above 1,1 x IB I_B.

$$I_B = I_N$$

2.3 Underload by cos φ. PF.

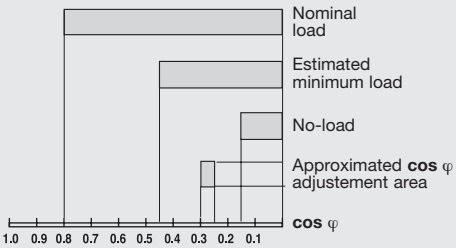
The cos φ underload trip level is set by means of a potentiometer with settings from 0,15 to 1,0.

Select this value taking into consideration the no-load motor cos φ and that corresponding to the estimated minimum operating load. Choose an intermediate value between these two cos φ levels and set it in the relay.

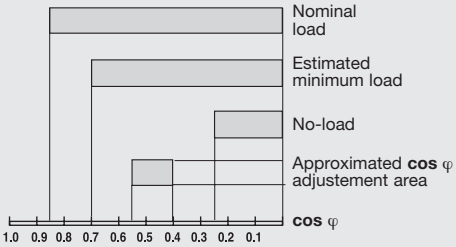
Select the underload trip delay from 5 to 45 seconds using the 3 corresponding dipswitches (trip delay).

For your guidance you can find two practical examples below.

a) A very oversized motor for its application. The cos φ of the motor is 0,15 when working without load.



b) A slightly oversized motor for its application. The cos φ of the motor is 0,25 when working without load.



If the above mentioned cos φ values are unknown, the underload trip setting can be made in the following way:

1. Set the underload trip delay to zero by moving the three dipswitches to the left (trip delay).
2. Using the potentiometer (cos φ setting), set the cos φ value to the minimum: 0,15.
3. Set the reset time to the minimum value using the potentiometer (cos φ reset time).
4. Start up the motor and run it with the minimum estimated load.
5. Slowly turn the cos φ potentiometer clockwise until the relay trips and the cos φ LED lights up.
6. Turn the cos φ potentiometer anticlockwise until the cos φ is set at approximately 30% less than the previous value (point 5).
7. Set the underload trip delay using the 3 corresponding dip switches. Set the reset time using the adequate potentiometer.

2.4 Undercurrent.

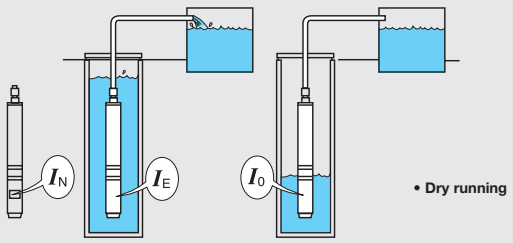
Single phase relay PS

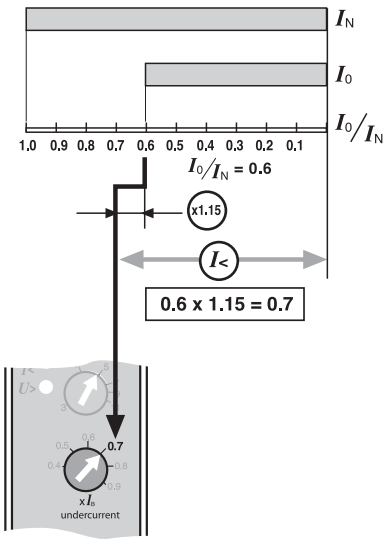
The setting of the underload trip level is made using a potentiometer in wich a factor between 0,4 and 0,9 is to be chosen. By multiplying this factor by the adjusted I_B we obtain a current value under which the relay will trip and disconnect the motor. The trip is delayed by 5 seconds.

a) If the value of the I_B of the motor without load is known:

- To avoid unwanted trips it is recommended to adjust the value 15% above the I_B of the motor without load.

Example:





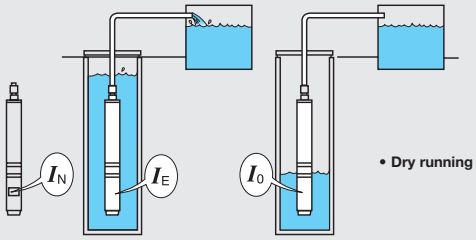
b) If the value of the I_B of the motor without load is unknown:

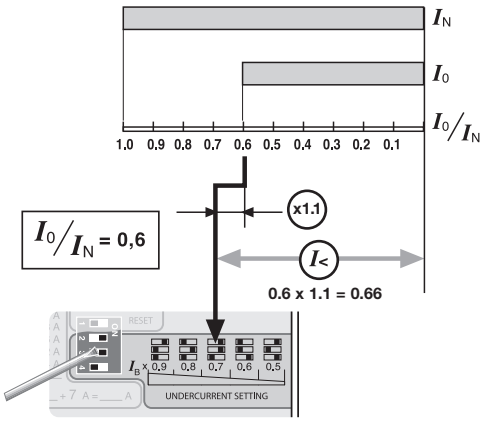
- If the pump is adequately dimensioned, the recommended value for this factor is 0,7. Adjust the potentiometer “undercurrent” to 0,7.
- If the pump is excessively dimensioned, and during its operation unwanted trips could occur, the underload adjusted factor should be reduced to approximately 0,6.

Three phase relay P

The undercurrent trip level in P relays is set using three dipswitches. To avoid nuisance trips, set this level to approximately 10% above the no-load motor current.

Example:





2.5 Phase sequence

Monitoring the current. GL and P relays

An incorrect phase sequence is detected by current sensing and it is only operative during the motor start-up. For correct detection the starting time must be longer than 0.2 s.

In GL relays the user can activate or desactivate this protection by means of a dipswitch. Should the right phase sequence be critical, move the dipswitch to the “ON” position. If this protection is not required, always leave it in the “OFF” position.

As this function is not compatible with the use of frequency inverters, where it is necessary to protect phase sequence in these installations, move the dipswitch to “OFF” and install the Fanox “S” model relay.

Monitoring the voltage. PF relays

An incorrect phase sequence is detected by voltage monitoring.
In the event that an incorrect phase sequence has been detected, the motor will not start-up since the relay has tripped because of previously detecting the wrong phase sequence.

Installation and Adjustment guide

2.6 Reset

Relays	manual	remote	autom.
C, GL, G, GEN	•	•	
P, PF	man	man	auto
PS		•	•

Manual reset:

	PS	P	PF	C	GL	G	GEN
I>	NO	<5 m	<7 m	<8 m	<8 m	<8 m	<1 m
I<	NO	2 s	-	-	-	-	-
cos φ	-	-	NO	-	-	-	-
	-	2 s	2 s (*)	2 s	2 s	2 s	2 s
	-	2 s	2 s (*)	2 s	2 s	-	-
U>	NO	-	-	-	-	-	-
	-	-	-	-	1 s (*)	1 s (*)	-

(*) After recovering normal conditions.

Remote reset:

	PS	P	PF	C	GL	G	GEN
I>	<1 m	<1 m	<3 m	<3 m	<3 m	<3 m	<1 m
I<	10 s	10 s	-	-	-	-	-
cos φ	-	-	10 s	-	-	-	-
	-	10 s	10 s	20 s	20 s	10 s	10 s
	-	10 s	10 s	10 s	10 s	-	-
U>	NO	-	-	-	-	-	-
	-	-	-	-	1 s (*)	1 s (*)	-

It is necessary to disconnect the auxiliar voltage more than 3 seconds after having waited the time indicated in the table.

Automatic reset:

		PS	P	PF	C	GL	G	GEN
I>		4 m	15 m	4 m	NO	NO	NO	NO
I<	PS11-R	2-70 m	15 m	-	-	-	-	-
	PS16-R	2-240 m						
cos φ		-	-	2-75m	-		-	
		-	15 m	4 m (*)	NO	NO	NO	NO
		-	15 m	4 m (*)	-	NO	-	-
U>		1 s (*)	-	-	-	-	-	-
		-	-	-	-	NO	NO	-

(*) After recovering normal conditions.

3 OPERATING TEST. C, GL, P, PF, G and GEN

To perform the trip test for phase loss, the current which passes through the relay must be higher than 0.7 of the set current I_B .Under these conditions, push and hold the TEST button for three seconds, the relay will trip due to phase loss and the corresponding LED will light up.

4 APPLICATIONS

Industries

- OEM (Original Equipment Manufacturers)
- Chemical and petrochemical
- Quarries, gravel pits and cement factories
- Steelworks, iron and steel industry
- Automotive
- Utilities and electric generation
- Water treatment and distribution
- Mining
- Food industry, sugar industry
- Marine and shipbuilding
- Timber industry
- Elevation industry
- HVAC (Heat Ventilation Air Condition)

Installations

- Motor Control Centers (MCC)
- EEx e motors in explosive environments
- Submergible pumps, in service stations and water pumping, surface pumps, etc
- Compressors
- Fans, blowers and ventilators
- Industrial refrigeration and air conditioning
- Centrifuges
- Presses
- Cranes, elevators, escalators and lifting machinery
- Machine tool
- Conveyor belts
- Mills and mixers
- Generators and alternators.

5 NOMINAL CURRENT RATING OF ASYNCHRONOUS THREE-PHASE MOTORS

The current values listed in the following table correspond to the average ratings given by various manufacturers. In some cases, these may not coincide exactly with the ratings listed on the motor data plates.

kW			0,75	1,1	1,5	2,2	3	3,7	4	5,5	7,5	11	15	18,5	22	30	37	45	55	75	90	110
CV			1	1,5	2	3	4	5	5,5	7,5	10	15	20	25	30	40	50	60	75	100	125	150
I_N (A) Average values	MOTOR 4P	230 V 50Hz	3,5	5	6,5	9,5	11	–	15	22	28	42	54	68	80	104	130	154	192	248	312	360
		400 V 50Hz	2	2,5	3,5	5	6,5	–	8,5	11	15	22	29	35	42	57	69	81	100	131	162	195
		440 V 50Hz	1,7	2,4	3,2	4,5	6	–	8	10,5	14	20	27	33	39	52	64	76	91	120	147	178
		220/240 V 60Hz	3,2	4,4	6,2	8,5	10,5	–	14	20	26	38	50	63	74	98	122	146	180	233	290	345
		440/460 V 60Hz	1,5	2,2	3	4,3	5,5	–	7,5	10	13	19	25	31	37	49	61	73	90	116	144	173
	MOTOR 2P	400 V 50Hz	2,0	2,8	3,8	5,5	7	–	9,5	13	16,5	24	32	40	47	64	79	92	113	149	183	220
		440/460 V 60Hz	1,9	2,5	3,4	4,8	6	7,5	–	11	15	21	27	33	39	53	65	79	95	120	153	183

Selection guide

• Motor management system

MODELS	Adjustment range I_B (A)	MOTOR CHARACTERISTICS 400V		PROTECTION FUNCTIONS						
		HP	kW	$I<$	Phase loss	Phase sequence	Overtemperature	JAM	Locked rotor	I_g / I_o
PBM B1	0,8 - 6	0,33 - 3	0,25 - 2,2	•	•	•	•	•	•	•
PBM B5	4 - 25	3 - 15	2,2 - 11	•	•	•	•	•	•	•

• Protection relays

MODELS	Adjustment range I_B (A)	MOTOR CHARACTERISTICS 400V		PROTECTION FUNCTIONS						
		HP	kW	$I>$	$I<$	cos φ	Phase loss	Phase sequence	Overtemperature	$U>$
C 9	3 - 9,3	2 - 5,5	1,5 - 4	•			•			
C 21	9 - 21,6	7,5 - 12	5,5 - 9	•			•			
C 45	20 - 45,2	15 - 30	11 - 22	•			•			
GL 16	4 - 16,7	3 - 10	2,2 - 7,5	•			•	ON	•	
GL 40	15 - 40,5	10 - 25	7,5 - 18,5	•			•	ON	•	
GL 90	40 - 91	30 - 60	22 - 45	•			•	ON	•	
GL 200	60 - 200	50 - 150	37 - 110	•			•	ON	•	
PS 11-R	3 - 11	0,5 - 2	0,37 - 1,5	•	•					•
PS 16-R	3 - 16	0,5 - 3	0,37 - 2,2	•	•					•
P 19	7 - 19,6	4 - 10	3 - 7,5	•	•		•	•		
P 44	19 - 44,2	12,5 - 27,5	9,2 - 20	•	•		•	•		
P 90	40 - 90,4	27,5 - 55	20 - 40	•	•		•	•		
PF 16-R	4 - 16,6	3 - 10	2,2 - 7,5	•		•	•	•		
PF 47-R	16 - 47,5	10 - 30	7,5 - 22	•		•	•	•		
G 17	5 - 17,7	3 - 10	2,2 - 7,5	•			•		•	
GEN 10	4 - 10,3	-	-	•			•			

$I>$	$I<$	cos φ				$U>$ / $U<$	I_N		JAM	I_g / I_o
Overload	Undercurrent	Underload	Phase loss Phase imbalance	Phase sequence	Overtemperature	Overvoltage / Undervoltage	Loss of neutral	Locked rotor	JAM	Earth leakage: differential/homopolar

CONTROL & MEASUREMENT

Introduction

Fanox' range of Control and Measurement relays come with many functions:

- **Phase and temperature control relays** for elevators with and without machine room. These indicate cause of failure, are self-powered and have a compact size of 22.5 mm (standard industrial size) which facilitates the installation of the product assembly.
- **Voltage relays** with direct adjustment potentiometer, which eliminates the calculation of percentage facilitating installation and commissioning.
- **Timers** multifunction microprocessor with built-in battery that allows programming without connecting auxiliary voltage.

S

PHASE Control Relays

PHASE CONTROL

- ***Self-powered by the voltage to be monitored.***
- ***Visual indication of trip cause.***
- ***DIN rail mounting.***

- To protect 3-phase devices and during operation of Lifts & Elevators.
- Suitable for air conditioning, cranes, hoists and similar installations for protection during startup.
- Sensitive to incorrect phase sequence.

S

PROTECTION FUNCTIONS

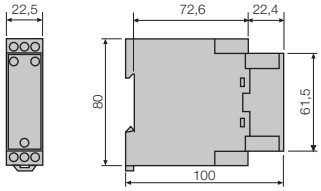
- Phase imbalance or phase loss
- Phase sequence

CE

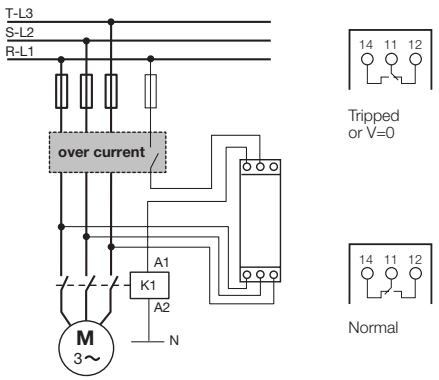
MODELS	S2	S4
Nominal voltage of the line to be monitored (±15%)	3 x 230 V	3 x 400 V
Voltage supply (±15%)	Self-powered (3-phase)	
Code	**12033**	**12034**

CHARACTERISTICS	
Nominal frequency	50/60 Hz
Control range	Phase loss: with resistive loads it trips when a phase loss occurs. With three-phase motors it trips if the voltage regenerated by the motor is lower than 60% of the main voltage. Phase imbalance > 40%
Trip time delay	< 0,1 s
Reset mode	Automatic
Signalling LED's	2 LED's: ON +
Output contacts	1 relay with 1 change over NO - NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Maximum terminal section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	7,5 VA (230 Vac) - 11 VA (400 Vac)
Protection degree / weight	IP20 / 0,12 kg
Storage / operation temperature	-30°C +70°C / -15°C +60°C

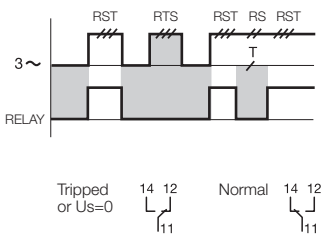
DIMENSIONS S RELAY (mm)



WIRING DIAGRAM



WORK LOGIC



ST / ST-D

PHASE and TEMPERATURE Relays

PHASE AND TEMPERATURE CONTROL

- ***Self-powered by the voltage to be monitored.***
- ***Visual indication of trip cause.***
- ***DIN rail mounting.***

- To protect 3-phase devices and during operation of Lifts & Elevators.
- Suitable for motors with built-in PTC sensors in applications such as elevators, cranes, hoists and similar installations.
- Sensitive to incorrect phase sequence.
- Monitoring of short circuit and ruptured wire in PTC circuit.

ST-D model:

Two output relays, one for phase imbalance, phase loss and phase sequence and the other for over temperature.

ST

ST-D

PROTECTION FUNCTIONS

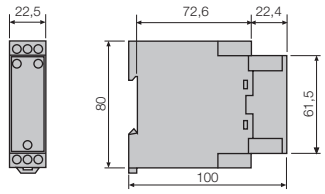
- Phase imbalance or phase loss
- Phase sequence
- Overtemperature
- Thermistor short-circuit

CE

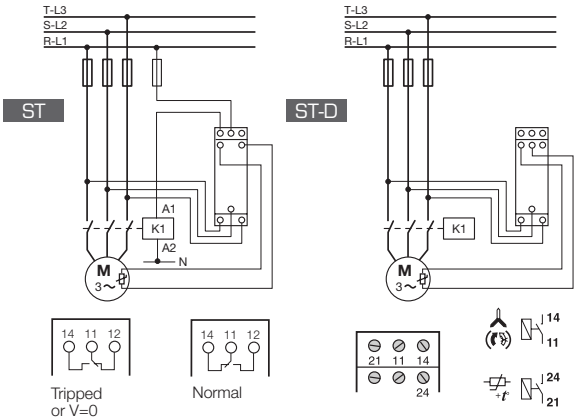
MODELS	ST2	ST4	ST2-D	ST4-D
Nominal voltage of the line to be monitored (±15%)	3 x 230 V	3 x 400 V	3 x 230 V	3 x 400 V
Voltage supply (±15%)	Self-powered (3-phase)			
Code	**12001**	**12012**	**12002**	**12013**

CHARACTERISTICS		
Nominal frequency	50/60 Hz	
Control range	Phase loss: with resistive loads it trips when a phase loss occurs. With three-phase motors it trips if the voltage regenerated by the motor is lower than 60% of the main voltage. Phase imbalance > 40%	
PTC sensor: min/max cold resist - Trip resist	100Ω / 1500Ω - 2300Ω	
Trip time delay	< 0,1 s	
Reset mode	Automatic	
Signalling LED's	3 LED's: ON + ⅄ +	
Output contacts	1 relay with 1 change over NO - NC	2 relays (⅄ +) with 1 NO
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A	
Maximum terminal section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN	
Power consumption	7,5 VA (230 Vac) - 11 VA (400 Vac)	
Protection degree / weight	IP20 / 0,12 kg	IP20 / 0,13 kg
Storage / operation temperature	-30°C +70°C / -15°C +60°C	

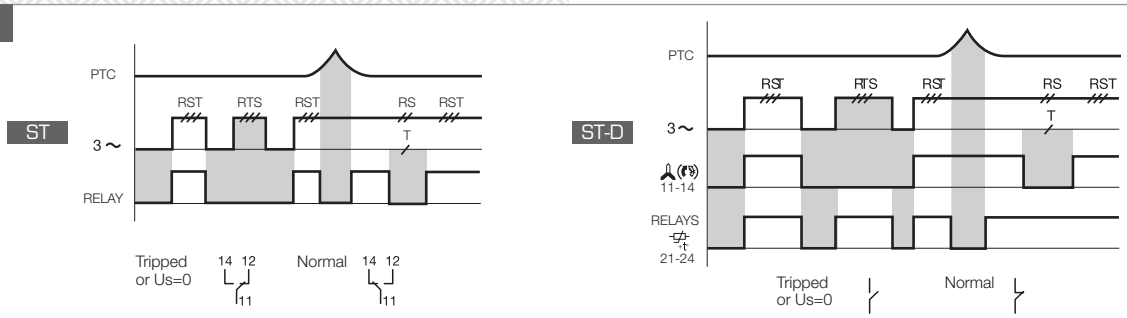
DIMENSIONS ST RELAY (mm)



WIRING DIAGRAM



WORK LOGIC



T2 - TST24

PHASE and TEMPERATURE Control Relays (Lifts)

- ***Protection relay against variations of the ambient temperature (min/max), overtemperature of the motor, phase sequence and phase imbalance or phase loss.***
- ***DIN rail mounting.***
- ***Visual indication of trip cause.***

TEMPERATURE CONTROL

- Controls the temperature of the motor room (relay + external module OD-T2) or the temperature inside switchboards where no motor room is present. (relay + internal sensor IN-T2).
- Designed according to the EN 81-1 standard and complying with the European Union Directive for Lifts (95/16/CE).
- Two adjustable temperature thresholds.

PHASE AND TEMPERATURE (PTC) RELAY

- To Protect 3-phase devices.
- Suitable for Motors with built-in PTC sensors in applications such as elevators, cranes, hoists and similar installations.
- Sensitive to incorrect phase sequence.
- Monitoring of short circuit and ruptured wire in PTC circuit.

T2

ODT
External module

TST24

INT2
Internal sensor

PROTECTION FUNCTIONS T2

- Temperature variation

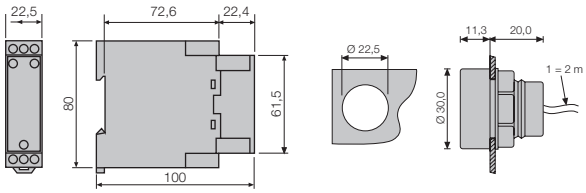
PROTECTION FUNCTIONS TST24

- Phase imbalance or phase loss
- Phase sequence
- Overtemperature
- Temperature variation
- Thermistor short-circuit

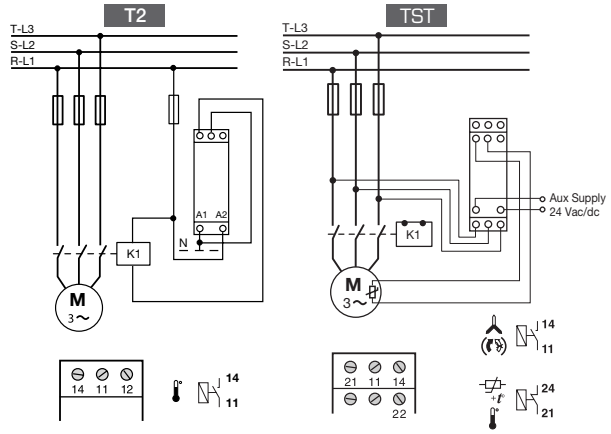
MODELS	T2		TST24	ODT2	INT2
Nominal voltage of the line to be monitored (± 15%)	-		3 x 400 V	-	-
Voltage supply (±15%)	230 Vac (Aux)	24 Vac, dc (Aux)	24 Vac, dc (Aux)	-	-
Code	**12051**	**12052**	**12090**	**12037**	**12036**

CHARACTERISTICS		
Nominal frequency	50/60 Hz	
Control range	Maximum temperature from 40°C to 55°C. Minimum temperature from -5°C to 5°C.	Phase loss: with resistive loads relay trips when a phase loss occurs. With three-phase motors relay trips if the voltage regenerated by the motor is lower than 60% of the main voltage. Phase imbalance > 40%. Maximum temperature setting from 40 °C a 55 °C. Minimum temperature setting from -5 °C a 5 °C.
Hysteresis	2°C	
PTC sensor: min/max cold resist - Trip resist	-	100Ω / 1500Ω - 2300Ω
Trip time delay	-	< 0,1 s
Reset mode	Automatic	
Signalling LED's	2 LED's: ON +	3 LED's: ON + +
Output contacts	1 relay with 1 change over NO - NC	1 relay NO-NC ( ) - 1 relay NO-NC ( )
Switching power	**T2:** I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A **TST24:** I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A; DC13 - 115V - 0,2A	
Maximum terminal section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN	
Power consumption	7,5 VA (230 Vac) - 11 VA (400 Vac)	
Protection degree / weight	IP20 / 0,12 kg	IP20 / 0,13 kg
Storage / operation temperature	-30°C +70°C / -15°C +60°C	

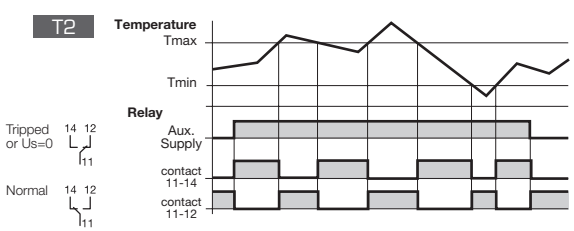
DIMENSIONS (mm)

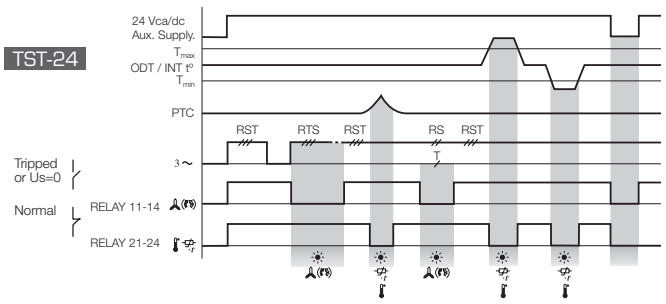


WIRING DIAGRAM



WORK LOGIC





MT2

TEMPERATURE Control Relay by Thermistors

TEMPERATURE CONTROL BY THERMISTORS

- ***Protection of the motor against overtemperature.***
- ***DIN rail mounting.***
- ***Visual indication of trip cause.***
- Controls the temperature by the use of thermistors (PTC sensors).
- Detects short-circuit (< 25Ω) and rupture in the circuit of sensors.
- Protects the motors against over temperature caused by excessive ambient temperature, insufficient ventilation or cooling, etc.
- Applicable in transformers and other machines.

MT2

PROTECTION FUNCTIONS

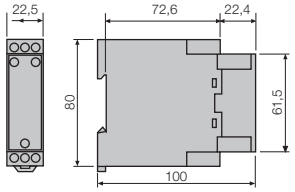
- Overtemperature
- Thermistor short-circuit

CE

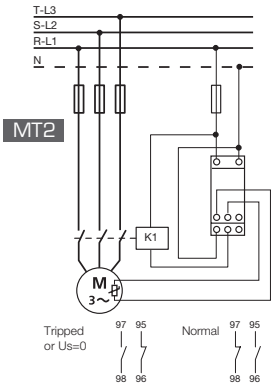
MODELS	MT2
Voltage supply (±15%)	230 Vac (Aux. supply)
Code	**12039**

CHARACTERISTICS	
Nominal frequency	50/60 Hz
Control range	According to the PTC installed
PTC sensor: min/max cold resist - Trip resist	25Ω / 1500Ω - 3600Ω. Reset 1800Ω
Trip time delay	< 0,1 s
Reset mode	Automatic (30s delay)
Signalling LED's	3 LED's: ON + +t° +
Output contacts	1 relay with NO-NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Maximum terminal section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	6 VA (230 Vac)
Protection degree / weight	IP20 / 0,12 kg
Storage / operation temperature	-30°C +70°C / -15°C +60°C

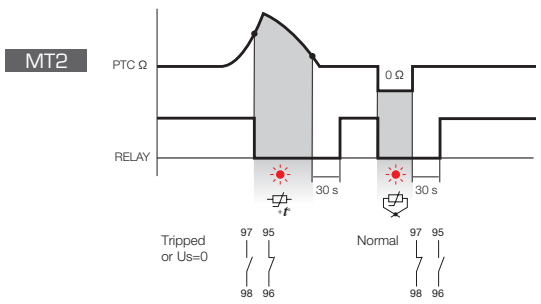
DIMENSIONS (mm)



WIRING DIAGRAM



WORK LOGIC



U1 D

VOLTAGE Control Relays

SINGLE - PHASE VOLTAGE RELAY

- ***Self-powered by the voltage to be monitored.***
- ***Visual indication of trip cause.***
- ***DIN rail mounting.***
- Minimum and maximum thresholds adjustable (two potentiometers).
- Adjustable trip time delay. Instantaneous reset. Protects equipment such as digital instruments or electrical equipment from voltage variations in the network.

U1 D

PROTECTION FUNCTIONS

U> Overvoltage

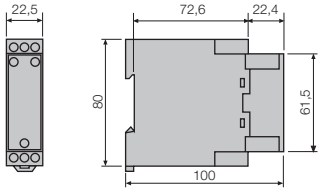
U< Undervoltage

CE

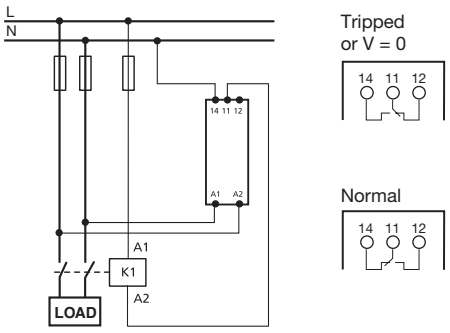
MODELS	U1D-24D	U1D-115	U1D-230
Frequency	DC	50/60 Hz	50/60 Hz
Maximum threshold V	23-28	105-135	215-275
Minimum threshold V	19-25	90-120	160-230
Code	**12028**	**12026**	**12027**

CHARACTERISTICS	
Type of supply to be monitored	Single phase
Auxiliary supply ±10%	Self-powered
Accuracy	***U>*** +4% -1%; ***U<*** +1% -4%
Trip time delay (TD)	0,1 to 6s (±20%) for ***U>*** ***U<***
Reset time delay (RD)	No
Reset mode	Automatic
Hysteresis	4% of the nominal voltage
Signalling LED's	3 LED's: ON + ***U>*** + ***U<***
Output contacts	1 relay with 1 change-over NO - NC
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / Screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN
Power consumption	3 VA (115 Vac) - 7 VA (230 Vac) - 0,7W (24 Vdc)
Protection degree / weight	IP20 / 0,11 kg
Storage / operation temperature	-30°C +70 °C / -15°C +60°C

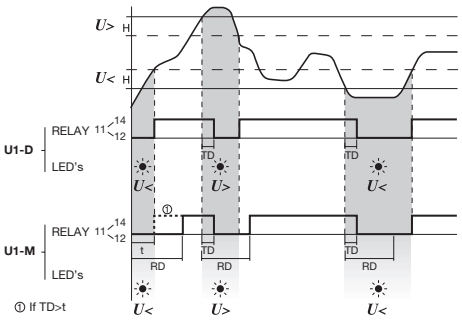
DIMENSIONS U1D RELAY (mm)



WIRING DIAGRAM



WORK LOGIC



U3

VOLTAGE Control Relays

THREE - PHASE VOLTAGE RELAY

- ***Self-powered by the voltage to be monitored.***
- ***Visual indication of trip cause.***
- ***DIN rail mounting.***

- Protects three-phase installations against voltage variations between phases, incorrect sequence of phases and phase loss.
- Adjustable minimum and maximum thresholds.
- Adjustable trip time delay.

U3S model:
- Model U3S-420 is valid for 400 and 440 nominal voltage.

U3N models:
- Two independent output relays.
- Includes protection against neutral loss.

U3 S

U3 N

PROTECTION FUNCTIONS

- U> Overvoltage
- U< Undervoltage
- Phase imbalance or phase loss
- Phase sequence

Model U3 N includes:
- I_N Loss of neutral

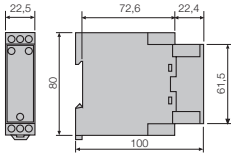
CE

MODELS	U3S-230	U3S-420	U3N-230	U3N-400	U3N-440
Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Maximum threshold V	210-290	380-500	230-260	400-460	440-500
Minimum threshold V	185-230	350-430	200-230	340-400	380-440
Code	**12071**	**12070**	**12056**	**12055**	**12057**

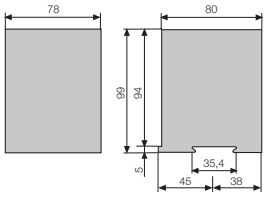
CHARACTERISTICS		
Type of supply to be monitored	Three phase	Three-phase with neutral
Auxiliary supply ±10%	Self-powered	
Accuracy	U> +4% -1%; U< +1% -4%	
Trip time delay (TD)	0,1 to 6s (±20%) for U> U<	0,1 to 3,7s (±20%) for U> U< I_N
Reset mode	Automatic	
Hysteresis	4% of the nominal voltage	
Signalling LED's	**U3S:** 4 LED's: ON + U> + + U< / **U3N:** 4 LED's: ON + U> + + U< I_N	
Output contacts	**U3S:** 1 relay with 1 change-over NO - NC / **U3N:** 2 relays with 1 NO	
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A	
Terminals: Max. section / Screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN	
Power consumption	**U3S:** 7,5 VA (230 Vac) - 11 VA (230 Vac) / **U3N:** 12 VA (230 Vac) - 20 VA (230 Vac)	
Protection degree / weight	IP20 / 0,11 kg	IP20 / 0,35 kg
Storage / operation temperature	-30°C +70 °C / -15°C +60°C	

DIMENSIONS RELAYS (mm)

U3 S

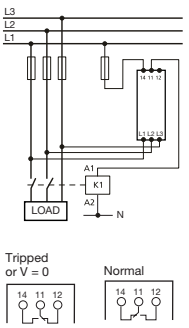


U3 N

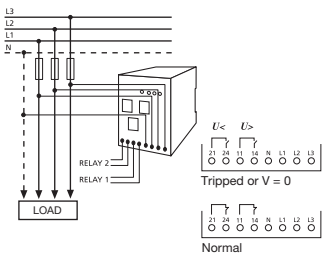


WIRING DIAGRAM

U3 S

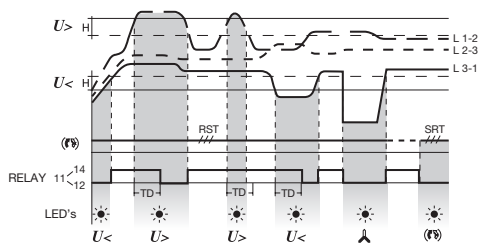


U3 N

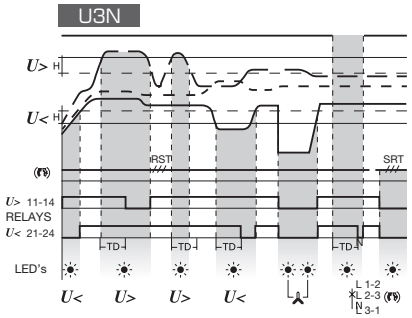


WORK LOGIC

U3S



U3N



Selection guide

CONTROL RELAYS

MODELS	NOMINAL VOLTAGE	RANGE						U>	U<		Hz> / Hz<
S2	3 x 230 Vac		•	•							
S4	3 x 400 Vac		•	•							
ST2	3 x 230 Vac		•	•	•		•				
ST4	3 x 400 Vac		•	•	•		•				
ST2-D	3 x 230 Vac		•	•	•		•				
ST4-D	3 x 400 Vac		•	•	•		•				
T2	230 Vca	-5° C / +5° C -40° C / +55° C				•					
T2	24 Vac-dc	-5° C / +5° C -40° C / +55° C				•					
TST-24	24 Vac-dc	-5° C / +5° C -40° C / +55° C	•	•	•	•	•				
MT2	230 Vac				•		•				
U1D-24D	24 Vdc	19 - 28						•	•		
U1D-115	115 Vac	90 - 135						•	•		
U1D-230	230 Vac	160 - 275						•	•		
U3S-230	230 Vac	185 - 290	•	•				•	•		
U3S-420	420 Vac	350 - 500	•	•				•	•		
U3N-230	230 Vac	200 - 260	•	•				•	•	•	
U3N-400	400 Vac	340 - 460	•	•				•	•	•	
U3N-440	440 Vac	380 - 500	•	•				•	•	•	

I> Overload

I< Undercurrent

cos φ Underload

Phase loss
Phase imbalance

Phase sequence

Overtemperature

U> / U< Overvoltage / Undervoltage

Loss of neutral

Hz> / Hz< Overfrequency / Underfrequency

Max / Min temperature

Thermistor short-circuit

MTR 10

Timers

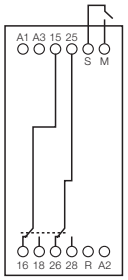
- ***Multifunction digital timer.***
- ***Possibility of programming up to 9 different times. Each time can be set from 0,1 seconds to 99 hours.***
- ***With built-in battery which allows timer to be programmed without connecting to auxiliary voltage. Complete battery discharge does not affect operation or adjustment settings.***
- For control and automation systems in industry.
- Command contact with 5 programmable functions.
- 2 digit, 7 segment LED displays and push-buttons provide programming, and during operation allow for monitoring of the time period and reviewing the programmed settings.
- 45 mm module size, 35 mm wide. DIN EN 50022-35 rail mounting.

MTR 10

Programmable parameters

- Initial state of output relays: energized (1H) or de-energized (1L).
- Working mode: cycle (C1) or non-cycle (C0).
- Number of different times per program: up to 8 in cycle mode and up to 9 in non-cycle mode.
- Time setting range: from 0,1 seconds to 99 hours.
- Command contact.

Auxiliary voltage
A1-A2: 230 Vac
A2-A3: 24 Vac, dc



MODEL	MTR 10	
Auxiliary power supply (+15 -10%)	230 V 50/60 Hz, 24 Vdc, ac	48 Vdc
Code	**12110**	**12111**

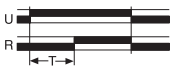
CHARACTERISTICS		
Time setting range	From 0,1 seconds to 99 hours	
Accuracy	1% ±10 ms	
Repeat accuracy	0,5%	
Number of different times per program	Up to 8 in cycle mode and 9 in no-cycle	
Output contacts	1 relay with 2 timed change over contacts NO-NC	
Switching power	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A	
Terminals: max section / screw torque	2,5 mm², No. 22 - 12AWG / 20Ncm, 1.8 LB - IN	
Mechanical / electrical life	>20 x 10^6 operations / >10^5 operations	
Consumption	8 VA (230 Vca) - 1W (24 Vdc)	2.5 VA (48 Vdc) - 1W (24 Vdc)
Protection degree / weight	IP 40 front / 0,15 kg	
Storage / operation temperature	-30°C +70°C / -20°C +55°C	
Standards	IEC 255	

CE

FUNCTION EXAMPLE DIAGRAMS

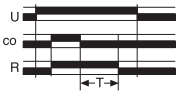
U: power supply **R**: relay output
Output relay at start: **1L** de-energized; **1H** energized.
Work mode: **CO** non-cycle; **C1** cycle.
Command contact: **cu**, **cr**, **cl**, **ci**, **co**.

Delay on
1L - CO - cu

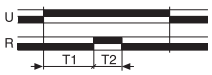


Timing on
1H - CO - cu

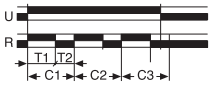
Delay off
With command contact
1H - CO - co



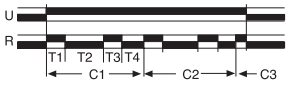
Double timing
1L - CO - cu



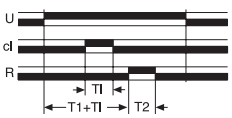
Double timing
Cycle work mode
1H - C1 - cu



Four timings
Cycle work mode
1H - C1 - cu



Timing with pause
by command contact
1L - CO - cl



Command contact Can be switched on in two ways:
- By closing an external voltage free contact between M and S
- By connecting 5-35 Vac,dc between M(+) and R(-)

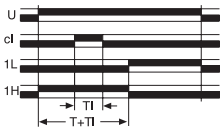
One of the following arrangements can be programmed:

Each diagram represents the effect of the command contact for the two initial states of the output relay: de-energized (1L) and energized (1H).

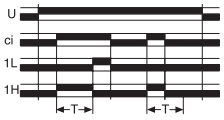
cu Switched off contact
Its function is blocked

cr Reset contact
When connected the output relay is de-energized; upon disconnecting, the programmed timing starts.

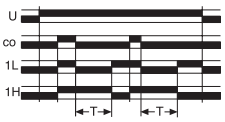
cl Pause contact
A pause in the timing takes place during its operation.



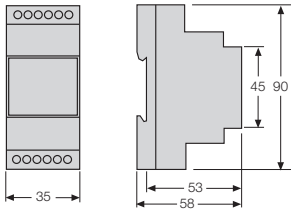
ci Delay on contact
When disconnected the output relay is de-energized; when connected the programmed timing starts.



co Delay off contact
When disconnected the output relay is de-energized. When connected, the relay is energized. When disconnected again, the programmed timing starts.



DIMENSIONS MTR 10 RELAY (mm)



25 years of protection

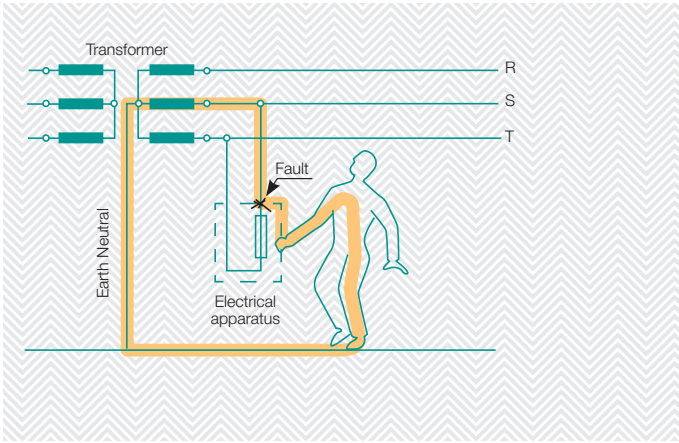
EARTH LEAKAGE PROTECTION

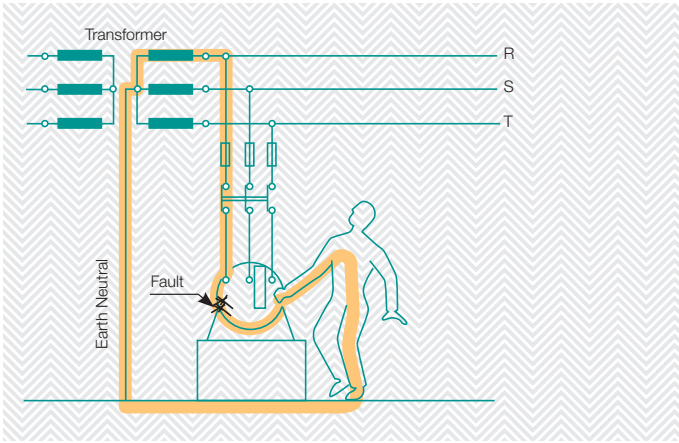
Introduction

The safety of people and human capital is always important. Fanox Earth Leakage Relays are the most effective devices to ensure protection against the dreaded risk of electrical leakage at low voltage.

Our relays feature characteristics that are ideal for preventing hazardous situations, such as:

- **Super Immune:** Our relays are specially designed to work in environments with extreme electrical noise, providing signal immunity to interferences such as frequency. This helps avoiding false alarms and unnecessary stops.
- **Enhanced security:** The enhanced security feature is a backup metering channel. An alarm is triggered to inform of the need for maintenance at the next halt.
- **Easy maintenance:** The equipment allows for testing without the need to stop any ongoing processes.
- **Small size of 22.5 mm:** The D30 relay is also known for its small size. It is ideal for manufacturers of MCC's which have limited panel space.
- **Versatile:** Positive or negative logic can be selected making the relay more flexible at use.





ELR

Earth Leakage Relays WITH BUILT-IN Toroidal Transformer

MULTIRANGE RELAY

- ***Electronic relays with adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- Sensitivity from 0,025 to 25A.
- Trip time delay from 0,02 to 5s.
- Modular size. DIN rail mounting.
- Protection front cover.

ELR-A

MULTIRANGE RELAY

- ***Electronic relays with adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- Sensitivity from 0,025 to 25A.
- Trip time delay from 0,02 to 5s.
- Compact device. Suitable for motor control centers (MCC).

ELR-T

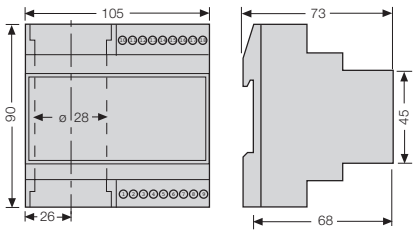
CE

MODELS	ELR-A		ELR-T60		ELR-T110	
Sensitivity	Adjustable from 0,025 A to 25 A		Adjustable from 0,025A to 25 A			
Trip time delay	Adjustable from 0,02 s to 5 s		Adjustable from 0,02 s to 5 s			
Aux. voltage supply 50/60 Hz	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac
Code	**41017**	**41015**	**41107**	**41105**	**41102**	**41100**

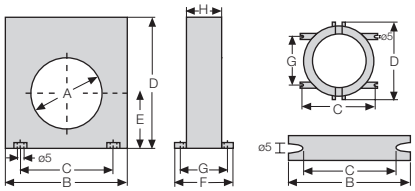
CHARACTERISTICS	
Toroidal transformer	**ELR-A:** Built-in Ø28 mm / **ELR-T:** Built-in Ø60 mm and Ø110 mm
Max. length between relay and transformer	-
Reset mode	Automatic, manual and remote (in manual mode disconnect the aux. supply during 1s)
Signalling LED's	2 LED's: ON + Trip
Output contacts mode	**ELR-A:** Selectable: normally de-energized or energized **ELR-T:** Normally de-energized
Output contacts	**ELR-A:** 2 change over NO-NC / **ELR-T:** 1 change over NO-NC
Switching power (resistive load)	5A - 250V
Maximum terminal section	2,5 mm^2
Maximum consumption	3 VA
Modular size	**ELR-A:** 6 modules x 17,5 mm = 105 mm / **ELR-T:** No
Frequency	50/60 Hz
Protection degree / weight	**ELR-A:** IP-20 / 0,4 kg / **ELR-T:** IP-20 / 0,4 y 0,6 kg
Storage / operation temperature	-10°C +60°C
Standards	IEC 41-1, IEC 255, VDE 0664, EN 50081-1, EN 50082-2

DIMENSIONS (mm)

ELR-A



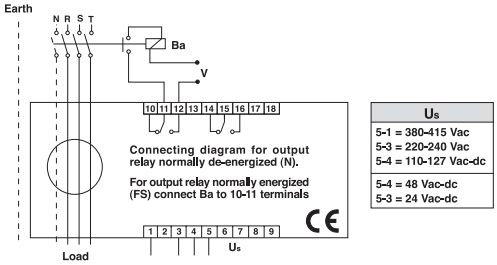
ELR-T



	A	B	C	D	E	F	G	H	K
ELR-T60	60	100	60	110	47	70	60	50	-
ELR-T110	110	150	110	160	70	70	60	50	-

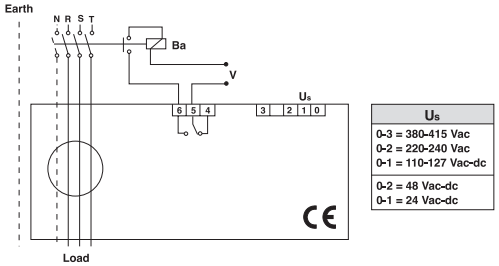
WIRING DIAGRAM

ELR-A



Us
5-1 = 380-415 Vac 5-3 = 220-240 Vac 5-4 = 110-127 Vac-dc
5-4 = 48 Vac-dc 5-3 = 24 Vac-dc

ELR-T



Us
0-3 = 380-415 Vac 0-2 = 220-240 Vac 0-1 = 110-127 Vac-dc
0-2 = 48 Vac-dc 0-1 = 24 Vac-dc

Earth Leakage Relays WITHOUT BUILT-IN Toroidal Transformer

RELAY WITH ADJUSTABLE DELAY TIME AND SENSITIVITY

ELR-B

- ***Electronic relays with adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- To be used with CT-1 and CTD-1 toroidal transformers (See page 137).
- Modular size. DIN rail mounting.
- Sealable front cover.

MULTIRANGE RELAY

ELR-3C

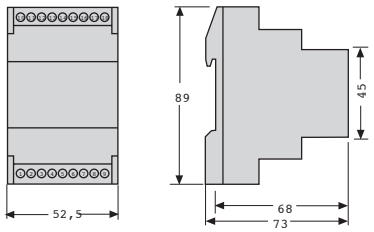
- ***Electronic relays with adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- To be used with CT-1 and CTD-1 toroidal transformers (See page 137).
- Modular size. DIN rail mounting.
- Sealable front cover.

CE

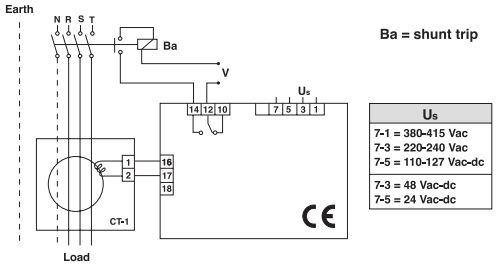
MODELS	ELR-B		ELR-3C	
Sensitivity	0,3 A or 0,5 A		Adjustable from 0,025 A to 25 A	
Trip time delay	0,02 s or 0,5 s		Adjustable from 0,02 s to 5 s	
Aux. voltage supply 50/60 Hz	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac
Code	**41012**	**41010**	**41005**	**41000**

CHARACTERISTICS	
Toroidal transformer	In combination with CT-1
Max. length between relay and transformer	20 m with cables twisted
Reset mode	Automatic, manual and remote (in manual mode disconnect the aux. supply during 1s)
Signalling LED's	2 LED's: ON + Trip
Output contacts mode	Normally de-energized
Output contacts	1 change over NO-NC
Switching power (resistive load)	5A - 250V
Maximum terminal section	2,5 mm²
Maximum consumption	3 VA
Modular size	3 modules x 17,5 mm = 52,5 mm
Frequency	50/60 Hz
Protection degree / weight	IP-20 / 0,2 kg
Storage / operation temperature	-10°C +60°C
Standards	IEC 41-1, IEC 255, VDE 0664, EN 50081-1, EN 50082-2

DIMENSIONS (mm)



WIRING DIAGRAM



D30 / DM30

Earth Leakage Relays WITHOUT BUILT- IN Toroidal Transformer

SUPERIMMUNIZED MULTIRANGE RELAY 22,5 mm

- ***Electronic relays with adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- Very high level of immunity.
- 22,5 mm wide. Saving space in the distribution board.
- DIN rail mounting.
- To be used with CT-1 and CTD-1 toroidal transformers (See page 137).
- Suitable for Motor Control Centres (MCC), electrical distribution boards and control panels in general.

D30

SUPERIMMUNIZED MULTIRANGE RELAY

- ***Electronic relays with adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- Very high level of immunity.
- Modular size. DIN rail mounting.
- To be used with CT-1 and CTD-1 toroidal transformers (See page 137).
- Suitable for electrical distribution boards and control panels in general.
- Sealable front cover

DM30

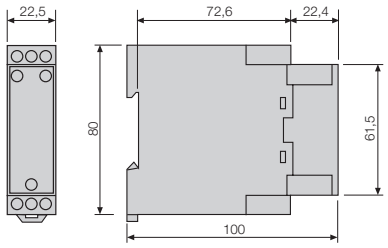
CE

MODELS	D30		DM30	
Sensitivity	Adjustable from 0,03 A to 30 A		Adjustable from 0,03 A to 30 A	
Trip time delay	Adjustable from 0,02 s to 5 s		Adjustable from 0,02 s to 5 s	
Aux. voltage supply 50/60 Hz	120 Vac	230 Vac	120 Vac	230 Vac
Code	**41021**	**41020**	**41023**	**41022**

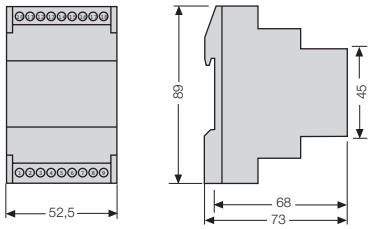
CHARACTERISTICS				
Toroidal transformer	In combination with CT-1			
Max. length between relay and transformer	Cable section mm^2			
	0,22 mm^2	0,75 mm^2	1 mm^2	1,5 mm^2
	Max. lenght m			
	15 m	55 m	75 m	110 m
Reset mode	Automatic, manual and remote (in manual mode disconnect the aux. Supply during 1s)			
Signalling LED's	2 LED's: ON + ⚡ (trip)			
Output contacts mode	Selectable: normally de-energized (N) or energized (P)			
Output contacts	1 change over NO-NC			
Switching power (resistive load)	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A			
Maximum terminal section	2,5 mm^2			
Maximum consumption	7 VA - 230 V		2,5 VA (120 - 230 V)	
Modular size	No. 22,5 mm wide		3 modules x 17,5 mm = 52,5 mm	
Frequency	50/60 Hz			
Protection degree / weight	IP-20 / 0,2 kg			
Storage / operation temperature	-10°C +60°C			
Standards	EN 50263, EN 61543 (A11), EN 60255-5, VDE 0664, 61008-1/A14, 61000-4-11			

DIMENSIONS (mm)

D30

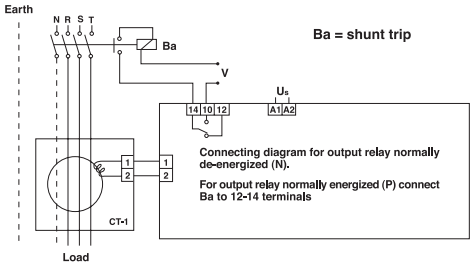


DM30

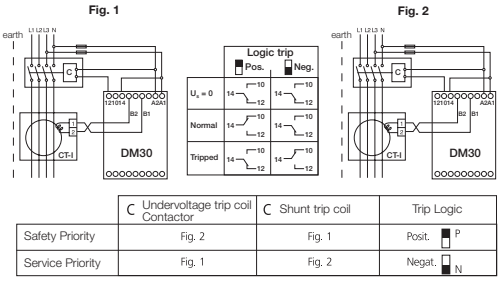


WIRING DIAGRAM

D30



DM30



	C Undervoltage trip coil Contactor	C Shunt trip coil	Trip Logic
Safety Priority	Fig. 2	Fig. 1	Posit. P
Service Priority	Fig. 1	Fig. 2	Negat. N

DR30

FANOX protection & control

SUPERIMMUNIZED MULTIRANGE RELAY WITH AUTOMATIC RECLOSING

- ***Electronic relays with automatic reclosing up to 3 attempts with defined (1 m) or adjustable (1 to 60 s) time.***
- ***Adjustable time delay and sensitivity.***
- ***Suitable for direct pulse current.***
- ***Immune to external disturbances.***
- Very high level of immunity.
- Modular size. DIN rail mounting.
- To be used with CT-1 and CTD-1 toroidal transformers (See page 137).
- Suitable for electrical distribution boards in general.
- Sealable front cover.

DR30F

DR30A

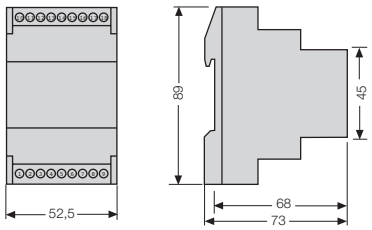
CE

MODELS	DR30F			DR30A		
Reclosing time	60 s			Adjustable from 1 s to 60 s		
Sensitivity	Adjustable from 0,03 A to 30 A					
Trip time delay	Adjustable from 0,02 s to 5 s					
Aux. voltage supply 50/60 Hz	120 Vac	230 Vac	24 Vdc	120 Vac	230 Vac	24 Vdc
Code	**41026**	**41024**	**41027**	**41028**	**41019**	**41029**

CHARACTERISTICS				
Toroidal transformer	In combination with CT-1			
Max. length between relay and transformer	Cable section mm^2			
	0,22 mm^2	0,75 mm^2	1 mm^2	1,5 mm^2
	Max. lenght m			
	15 m	55 m	75 m	110 m
Reset mode	Automatic, manual and remote (in manual mode disconnect the aux. Supply during 1s)			
Signalling LED's	2 LED's: ON + ⚡ (trip) / 2 LED's: Numbers of reclosing / 4 LED´s: % measurement			
Output contacts mode	Selectable: normally de-energized (N) or energized (P)			
Output contacts	2 change over NO-NC			
Switching power (resistive load)	I_{th}: 5A; AC15 - 250V - 2A; DC13 - 30V - 2A			
Maximum terminal section	2,5 mm^2			
Maximum consumption	2,5 VA - 230 V			
Modular size	3 modules x 17,5 mm = 52,5 mm			
Frequency	50/60 Hz			
Protection degree / weight	IP-20 / 0,2 kg			
Storage / operation temperature	-10°C +60°C			
Standards	EN 50263, EN 61543 (A11), EN 60255-5, VDE 0664, 61008-1/A14, 61000-4-11			

DIMENSIONS (mm)

DR30



WIRING DIAGRAM

Fig. 1

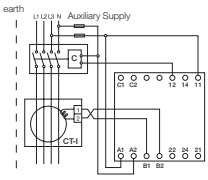
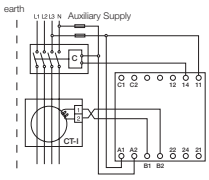
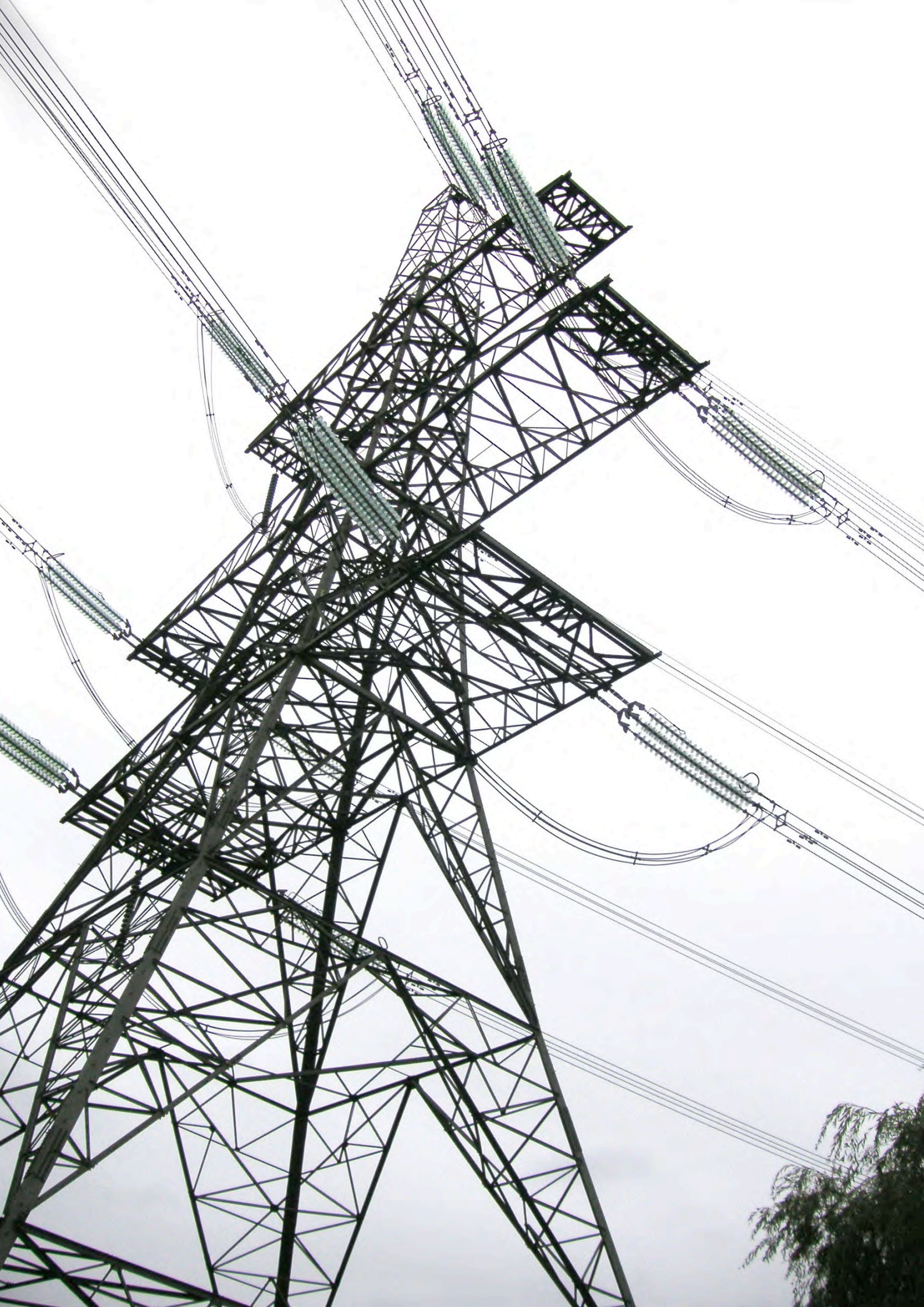


Fig. 2



	C Undervoltage trip coil Contactor	C Shunt trip coil	Trip Logic
Safety Priority	Fig. 2	Fig. 1	Posit. N ■□ P
Service Priority	Fig. 1	Fig. 2	Negat. N □■ P



Introduction

Current Transformers

Current transformers sample the line current and convert it into safety and measurable values for the normalized standards of instruments, metering devices and other metering and control devices.

Nominal values of the current transformers are defined as the ratio between the primary and the secondary current.

They are classified according to the main isolation used:

Wound Primary type, Bar Primary type, Toroidal type and for Terminal blocks type.

These current transformers can be used for two different purposes: Measurement or Protection. The correct choice of the CT is essential in order to avoid faults and degradation that would lead into economic losses or even into dangerous situations.

Both Measurement and Protection current transformers have to provide a secondary current that is proportional to the one of the primary.

- **The main purpose of Measurement Transformers** is to measure currents without the activation of corrective responses when abnormal values arise. Within the range of the nominal current good accuracy is needed while out of the threshold of the nominal range that accuracy is unnecessary. For that reason, the measurement transformers have a very low saturation factor and a low security factor to avoid overloads in the metering devices.
- **Protection transformers** are designed to give a warning or correction advice when abnormal values are measured. With high values of fault current, a high saturation factor is required in order to maintain a good accuracy. The secondary current, proportional to the primary, could reach very high values and should always be supported by protection devices.

Power transformers

The Power Transformers have a special winding which allows them to have a high voltage primary and a low voltage secondary. They have a very low nominal power and their unique purpose is to give a voltage sample of the power system to measure it with the incorporated instruments.

Being their principal objective the voltage sampling, they must be specially accurate so that they do not to distort the real values. The selection of the transformer will be conditioned by the accuracy required in its readings.

CT

Protection & Measurement for Low Voltage

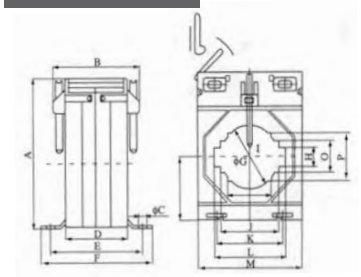
CURRENT TRANSFORMERS

- *Up to 3200 A of primary current.*
- *Transformer ratio .../5.*
- *Sealable plastic cover, metal brackets for fitting, bus-bar holders and DIN rail mounting accessories included.*
- *Standards: IEC 60044-1, BS 2627*

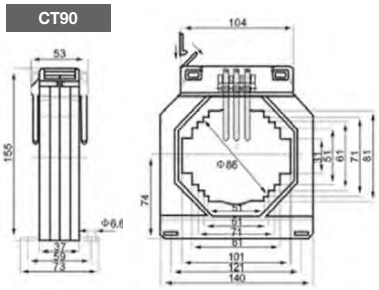
Primary .../ 5A	Model	Code	VA class		
			0,5	1	3
50	CT20	**41399**	1	1,5	2,5
75	CT20	**41400**	1,5	1,5	2,5
100	CT20	**41404**	2,5	2,5	5
125	CT20	**41405**	2,5	2,5	5
150	CT20	**41406**	2,5	5	5
200	CT30	**41412**	2,5	5	5
250	CT30	**41414**	5	5	5
300	CT30	**41416**	5	5	5
400	CT30	**41418**	5	5	5
500	CT50	**41422**	5	5	5
600	CT50	**41424**	5	5	5
800	CT50	**41426**	5	10	10
1000	CT50	**41428**	10	10	10
1200	CT50	**41429**	10	10	10
1200	CT70	**41390**	7,5	10	15
1500	CT70	**41430**	10	10	10
1600	CT90	**41391**	10	15	20
1800	CT70	**41431**	10	10	10
2000	CT70	**41432**	15	15	15
2000	CT90	**41392**	15	20	25
2200	CT90	**41433**	15	15	15
2500	CT90	**41434**	20	20	20
2800	CT90	**41435**	20	20	20
3000	CT90	**41436**	20	20	20
3200	CT90	**41438**	20	20	20

DIMENSIONS CT (mm)

CT20 CT30 CT50 CT70



CT90



mm	CT 20	CT 30	CT 50	CT 70
G Ø	30,5	31,5	51	65
A	78	78	110	126
B	47	47	56	56
C	6,6	6,6	6,6	6,6
D	35	35	40	40
E	55	55	62	62
F	71	71	76	76
H	11	11	12	12
I	11	16	21	21
J	26	31	51	61
K	44	44	68	86
L	31	41	61	81
M	62	62	86	104
O	21	21	31	31
P	26	26	44	56

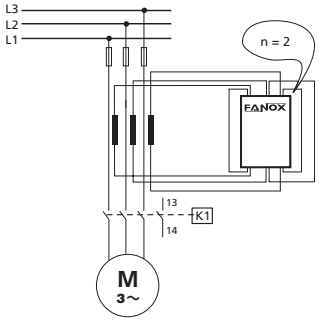
CT

Sealable plastic cover

CHARACTERISTICS	
Overload	1,2 I_N
Max. line voltage bus-bars / cable1000V	660V / 1000V
Frequency	50 / 60 Hz
Shrot circuiting termnial blocks for open secondary	YES
Maximum voltage Um	0,72 kV
Isolation voltage	3 kV

WIRING DIAGRAM FOR RELAYS

$$I_B = \frac{I_N \text{ motor}}{I_N \text{ CT}} \times 5 \times n$$



Max. size: bus-bars / Ø cable (mm) CT 20	31x11 / 11x26 / Ø 30.5
Max. size: bus-bars / Ø cable (mm) CT 30	41x11 / 16x26 / Ø 31
Max. size: bus-bars / Ø cable (mm) CT 50	61x12 / 21x44 / Ø 51
Max. size: bus-bars / Ø cable (mm) CT 70	81x12 / 31x56 / Ø 65
Max. size: bus-bars / Ø cable (mm) CT 90	101x31 / 51x81 / Ø 86

Protection & Measurement for Low Voltage

NARROW PROFILE CURRENT TRANSFORMERS

- *Up to 1200 A of primary current.*
- *Transformer ratio .../5.*
- *Sealable plastic cover, metal brackets for fitting, bus-bar holders and DIN rail mounting accessories included.*
- *Standards: IEC 60044-1, BS 2627.*

CT

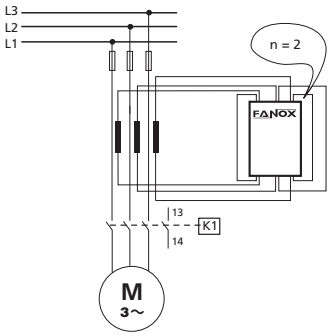
Sealable plastic cover

Primary .../ 5A	Model	Code	VA class		
			0,5	1	3
100	CT20N	**41380**	-	2,5	2,5
150	CT20N	**41381**	-	2,5	3,75
200	CT20N	**41382**	2,5	5	5
250	CT20N	**41383**	3,75	5	7,5
300	CT20N	**41384**	3,75	5	7,5
400	CT20N	**41385**	5	5	5
500	CT20N	**41386**	2,5	3,75	5
600	CT20N	**41380**	5	5	7,5

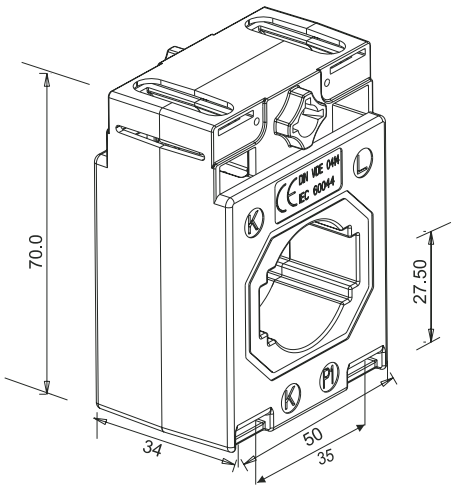
CHARACTERISTICS	
Overload	1,2 I_N
Max. line voltage bus-bars / cable1000V	660V / 1000V
Frequency	50 / 60 Hz
Shrot circuiting termnial blocks for open secondary	YES
Maximum voltage Um	0,72 kV
Isolation voltage	3 kV

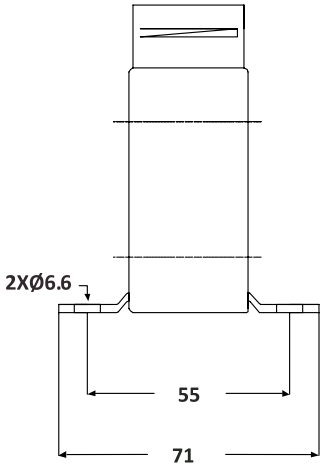
WIRING DIAGRAM FOR RELAYS

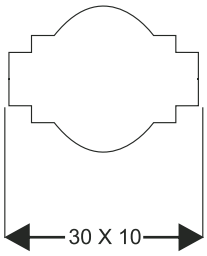
$$I_B = \frac{I_N \text{ motor}}{I_N \text{ CT}} \times 5 \times n$$



DIMENSIONS CT (mm)







CT80II / CT4II

Electric Energy Measurement for Remote Management in Low Voltage

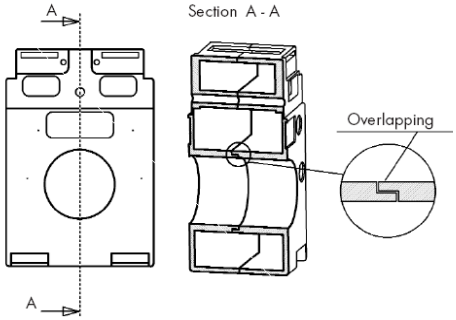
CURRENT TRANSFORMERS UP TO 1800 A

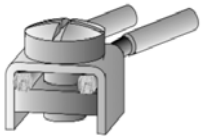
- *Transformer ratio 1200/5.*
- *Sealable plastic cover, fixing base and bus-bar.*
- *Certificate model for pricing.*

CT80II

CT4II

Primary .../ 5A	Model	Code	VA class 0,5 s
1200	CT80II	**41440**	5
1200	CT4II	**41445**	5





Housing clousing detail

Section
2,5x4 mm

CHARACTERISTICS	
Overload	1,5 I_N
Frecuency	50/60 Hz
Maximum Voltage Um	0,72 kV
Isolation voltage	3 kV
Short circuit thermal current Ith	72 kA
Short circuit dynamic current Idyn	2,5 x Ith
Accuracy limit	150 %
Security factor	5
Insulation class	E

STANDARDS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (7.1) Short circuit
UNE-EN 60 044-1 (7.2) Heating test
UNE-EN 60 044-1 (11.4) Determination of errors
UNE-EN 60695-2-11 Glow wire test

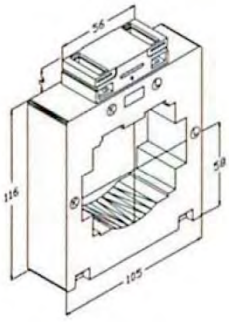
INDIVIDUAL TESTS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (5.3) Frequency withstand volt. between secondary windings
UNE-EN 60 044-1 (8.4) Overvoltage tests between turns
UNE-EN 60 044-1 (11.4, 11.5) Determination of errors

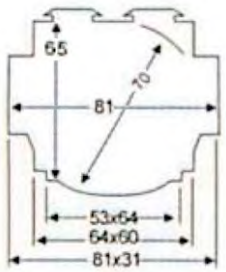
SUITABLE WIRES AND SECTORS CT80II
1x240 mm² / 2x240 mm² / 3x240 mm² / 4x240 mm² / 5x240 mm²
1x300 mm² / 2x300 mm² / 3x300 mm²
Primary passing through minimum dimensions (mm²) 81x65

SUITABLE WIRES AND SECTORS CT4II
Cu: 1x300 mm² / 2x300 mm² / 3x300 mm² / 4x300 mm²
Al: 2x240 mm² / 3x240 mm² / 4x240 mm² / 5x240 mm²
Primary passing through minimum dimensions (mm²) 3x100x12 mm

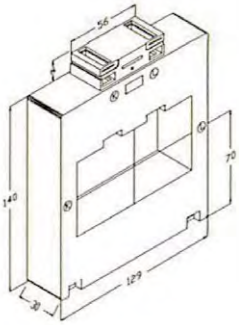
DIMENSIONS CT (mm) and MOUNTING

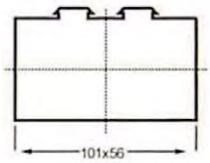
CT80II

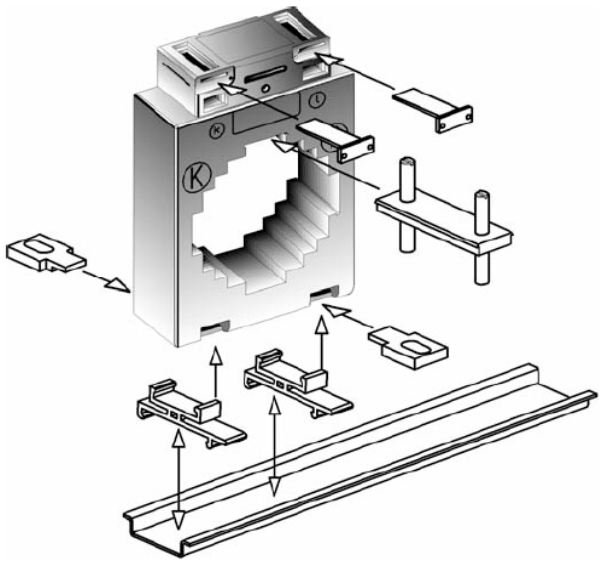




CT4II







Mounting detail

CT60II EXT

Electric Energy Measurement for Remote Management in Low Voltage

CURRENT TRANSFORMER FOR OUTDOOR

- *Designed for **outdoor** installation.*
- *Transformer ratio 400/5.*
- *Compact size.*
- *With core and cable incorporated.*

Primary .../ 5A	Model	Code	VA class 0,5 s
400	CT60II EXT/1,5	**41443**	5
400	CT60II EXT/2,5	**41442**	5

CT60II EXT

ELECTRICAL CHARACTERISTICS	
Frecuency	50/60 Hz
Transformer ratio	400/5
Maximum Voltage secondary open	48 Vpeak
Accuracy voltage	5 VA
Maximum Voltage Um	0,72 kV
Isolation voltage	3 kV
Accuracy class	0,5s
Security factor	5
Protection degree	IP 65
Accuracy limit	150 %
Insulation class	E

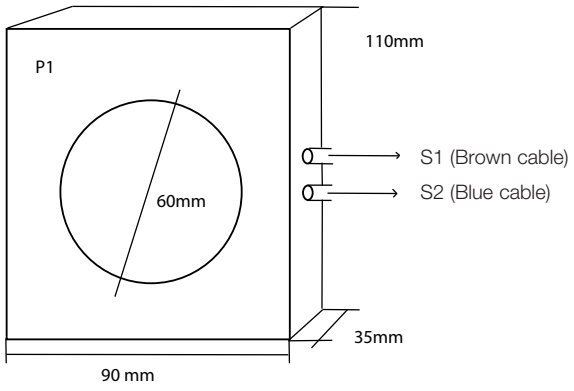
MECHANICAL CHARACTERISTICS	CT60II EXT/1,5	CT60II EXT/2,5
Material	Resin DIAPOL 509	
Secondary cable	RZ1-K Black	
Cable type	Bipolar (Blue and Brown)	
Terminals	Without terminals	
Cable section	1,5 mm^2	2,5 mm^2
Cable length	6 m	10 m
Inner diameter	60 mm maximum	
Outer diameter	110 x 90 mm	
Height	35 mm	

INDIVIDUAL TESTS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (7.1) Short circuit
UNE-EN 60 044-1 (7.2) Heating test
UNE-EN 60 044-1 (11.4) Determination of errors
UNE-EN 60.695-2-11 Glow wire test
UNE-EN 60 044-1 (7.4) Wet test for outdoor type transformers
UNE-EN 62208 (9.11) Verification of resistance to weathering
UNE-EN 20324 Degrees of protection provided by enclosures (IP65)

ADMISSIBLE STEPS	
1x50, 2x50, 1x95 (terminals included)	Suitable
1x150 (terminals included)	Suitable
2x95, 2x150, 3x150, 3x95 (terminals included)	Suitable
1x240, pletina 60x10 (terminals included)	Suitable

INDIVIDUAL TESTS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (5.3) Frequency withstand volt. between secondary windings
UNE-EN 60 044-1 (8.4) Overvoltage tests between turns
UNE-EN 60 044-1 (11.4, 11.5) Determination of errors

DIMENSIONS CT (mm)



CT80 ABR

Electric Energy Measurement for Remote Management in Low Voltage

SPLIT CORE CURRENT TRANSFORMERS

- *Up to 3200 A of primary current.*
- *Transformer ratio .../5.*
- *Fixing base and bus-bar included.*
- *Standards: IEC 60044-1, BS 2627*

Primary .../ 5A	Model	Code	VA class		
			0,5	1	3
100	CT80I ABR	**41480**	-	-	1,5
150	CT80I ABR	**41481**	-	-	2,5
200	CT80I ABR	**41482**	-	1,5	2,5
250	CT80I ABR	**41483**	-	1,5	3,75
300	CT80I ABR	**41484**	1,5	2,5	5
400	CT80I ABR	**41485**	2,5	5	10
500	CT80II ABR	**41486**	2,5	5	10
600	CT80II ABR	**41487**	2,5	5	15
750	CT80II ABR	**41488**	2,5	7,5	15
800	CT80II ABR	**41489**	2,5	10	15
1000	CT80II ABR	**41490**	5	10	20
1200	CT80II ABR	**41491**	5	15	20
1500	CT80III ABR	**41492**	7,5	10	25
1800	CT80III ABR	**41493**	10	15	30
2000	CT80III ABR	**41494**	15	20	30
2200	CT80III ABR	**41495**	15	20	30
2500	CT80III ABR	**41496**	15	25	30
2800	CT80III ABR	**41497**	15	25	30
3000	CT80III ABR	**41498**	20	30	40
3200	CT80III ABR	**41499**	20	30	40

CHARACTERISTICS	
Overload	1,2 I_N
Frecuency	50 / 60 Hz
Shrot circuiting termnial blocks for open secondary	YES
Maximum voltage Um	0,72 kV
Isolation voltage	3 kV
Short circuit thermal current Ith	72 kA
Short circuit dynamic current Idyn	2,5 x Ith
Accuracy limit	120 %
Security factor	5
Insulation class	F

CT80 ABR

Sealable plastic cover

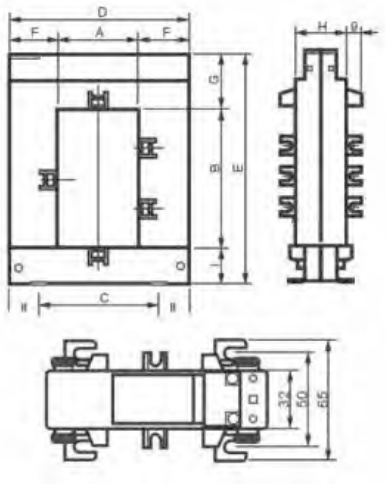
CE

INDIVIDUAL TESTS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (5.3) Frequency withstand volt. between secondary windings
UNE-EN 60 044-1 (8.4) Overvoltage tests between turns
UNE-EN 60 044-1 (11.4, 11.5) Determination of errors

STANDARDS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (7.1) Short circuit
UNE-EN 60 044-1 (7.2) Heating test
UNE-EN 60 044-1 (11.4) Determination of errors
UNE-EN 60695-2-11 Glow wire test

ADMISSIBLES STEPS	
1x240, 2x240, 1x300, 2x300 (terminals included)	Suitable
Bar 80x50	Suitable

DIMENSIONS CT (mm)



mm	CT80I	CT 80II	CT 80III
A	20	50	80
B	30	80	120
C	51	78	108
D	89	114	144
E	111	145	185
F	34	32	32
G	47	32	332
H	40	32	32
I	32	33	33

* Other sizes upon request. Please consult.

CT80II ABR

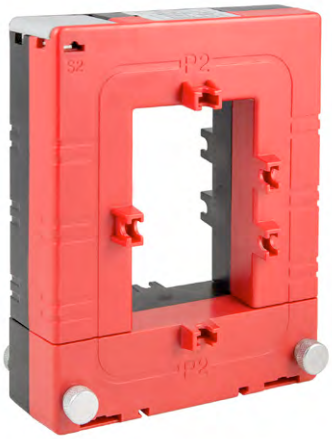
Electric Energy Measurement for Remote Management in Low Voltage

SPLIT CORE CURRENT TRANSFORMERS

- *Transformer ratio 1200/5.*
- *Sealable plastic cover, fixing base and bus-bar.*
- *Certificate model for pricing.*

CT80II ABR

Sealable plastic cover



Primary .../ 5A	Model	Code	VA class 0,5
1200	CT80II ABR	**41441**	5

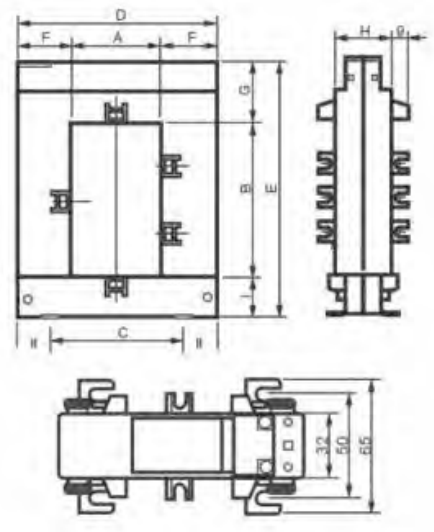
CHARACTERISTICS	
Overload	1,5 I_N
Frecuency	50/60 Hz
Short circuiting terminal blocks for opensecondary	YES
Maximum voltage secondary open	48 V
Maximum Voltage Um	0,72 kV
Isolation voltage	3 kV
Short circuit thermal current Ith	72 kA
Short circuit dynamic current Idyn	2,5 x Ith
Accuracy limit	150 %
Security factor	5
Insulation class	E

STANDARDS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (7.1) Short circuit
UNE-EN 60 044-1 (7.2) Heating test
UNE-EN 60 044-1 (11.4) Determination of errors
UNE-EN 60695-2-11 Glow wire test

INDIVIDUAL TESTS
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (5.3) Frequency withstand volt. between secondary windings
UNE-EN 60 044-1 (8.4) Overvoltage tests between turns
UNE-EN 60 044-1 (11.4, 11.5) Determination of errors

ADMISSIBLES STEPS	
1x240, 2x240, 1x300, 2x300 (terminals included)	Suitable
Bar 80x50	Suitable

DIMENSIONS CT (mm)



mm	CT80II EXT
A	50
B	80
C	78
D	114
E	145
F	32
G	32
H	32
I	33

CT

Protection & Measurement for Low Voltage

TOROIDAL TRANSFORMERS

- *Provided burden up to 15 VA.*
- *Transformer ratio .../5.*
- *Fixing base included.*
- *Standards: IEC 60044-1, BS 2621.*

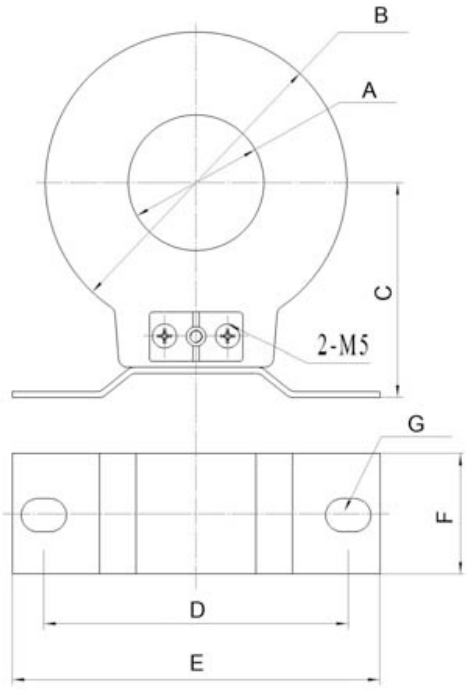
CT

CE

Primary .../ 5A	Code	Model	VA class
			0,5
50	**41365**	CT50A	5
75	**41366**	CT50B	5
100	**41367**	CT50D	5
150	**41368**	CT50C	15
200	**41369**	CT50C	15
300	**41371**	CT50C	15

CHARACTERISTICS	
Line voltage	600 V
Ø cable (mm) CT50A	Ø 30
Ø cable (mm) CT50B	Ø 30
Ø cable (mm) CT50C	Ø 45
Ø cable (mm) CT50D	Ø 30

DIMENSIONS (mm)



mm	CT50A	CT50B	CT50C	CT50D
A Ø	30	30	45	30
B	89	89	100	89
C	70,5	70,5	73	70,5
D	85	85	101	85
E	112	112	122	112
F	75	52	40	45
G	12x15	12x15	12x15	12X15

CT-1 / CTD-1

Earth Leakage Protection & Measurement for Low Voltage

FOR EARTH LEAKAGE RELAYS

- To be used with ELR-B, ELR-3C, D30, DM30 and DR30 relays.
- The transformer and relay assembly sensitivity is fixed by the relay.
- The toroidal transformer CTD-1/28 is specifically designed for DIN rail mounting.

CE

Characteristics	CT-1
Thermoplastic material	UL 94-V0
Operating frequency	47-63 Hz
Insulation	2,5 Kv 50 Hz, 1 min
Protection degree	IP 20
Continuous overload	1000A
Thermal overload	40 kA (1sec)
Operating temperature	De 0 a + 50 ºC, U.R./R.H <90% n.c.
Storage temperature	De -20 a +70 ºC
Connections	Screw, Max 1,5 mm2

CT-1

CT-1/35...210

CT-1/300
CT-1/350

CT-1/400

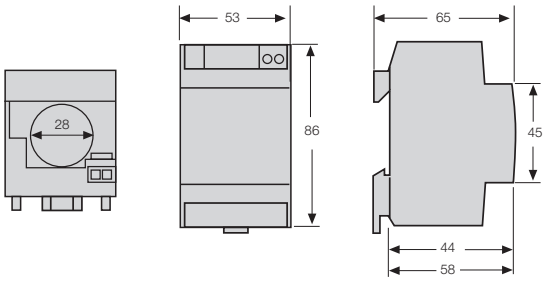
CTD-1/28

DIMENSIONS (mm) AND WEIGHT (KG.)

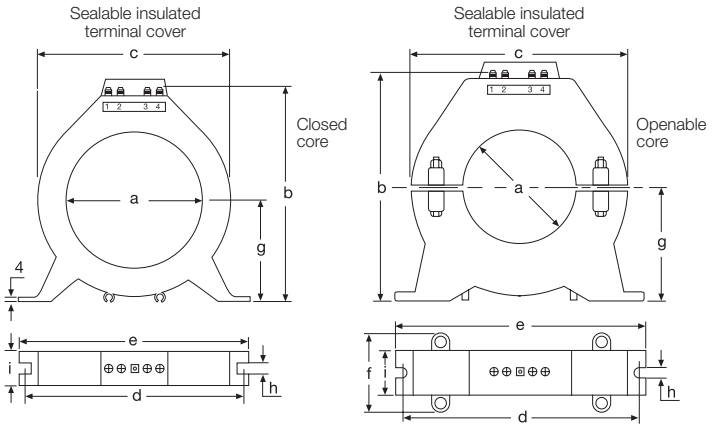
Type	Code	Core	a	b	c	d	e	f	g	h	i	Weight
CT-1/35	41060	Closed	35	88	73	92	100	-	40	6	28	0,2
CT-1/60	41065	Closed	60	112	98	116	125	-	55	6	28	0,3
CT-1/80	41070	Closed	80	132	118	136	146	-	65	6	28	0,5
CT-1/110	41075	Closed	110	158	148	166	178	-	78	6	28	0,5
CT-1/160	41080	Closed	160	265	255	265	275	-	130	8,5	45	1,4
CT-1/210	41085	Closed	210	315	305	310	325	-	155	8,5	45	1,5
CT-1/300	41088	Closed	300	385	364	-	-	-	187	-	51+10	4,4
CT-1/350	41090	Closed	350	445	434	-	-	-	217	-	41+10	4,8
CT-1/400	41092	Closed	270	410	475	463	28	170	351	66	-	8,3
CTA-1/60	41066	Open	60	125	116	13	140	45	60	8,5	34	0,3
CTA-1/110	41076	Open	110	215	205	220	235	70	105	8,5	40	0,5
CTA-1/160	41081	Open	160	265	255	265	275	75	130	8,5	45	1,4
CTA-1/210	41086	Open	210	315	305	310	325	75	155	8,5	45	1,5

Type	Code	Inner Ø	Weight (kg)
CTD-1/28	41055	28 mm	0,2

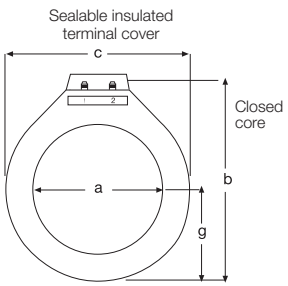
CTD-1/28



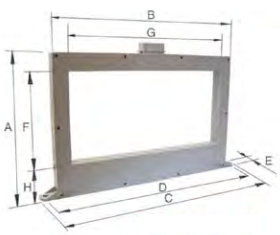
CT-1/35...210



CT-1/300
CT-1/350



CT-1/400



CLR

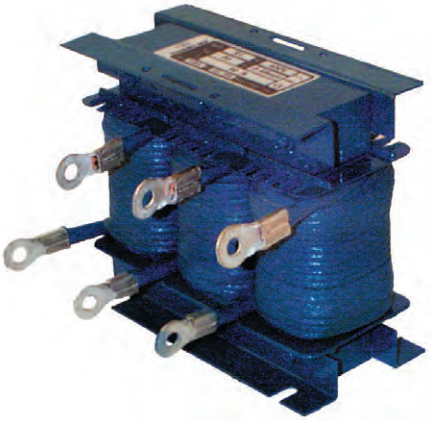
Current Limiting & Filtering

CURRENT LIMITANT INPUT REACTOR

- *Nominal Current: 250 A*
- *Input voltage: 480 V (Up to 690V)*
- *Inductance: 0.095mH*
- *Linearity whitout saturation until: 1.5 x In*
- *Maximum thermal overload: 1.3 x In*
- *Frequency: 50 or 60 Hz*
- *Thermal Class: F (140 ºC) / Ta= 40ºC*
- *Protection against indirect contacts*
- *Connections by terminals*
- *Winding Class H (200ºC) and Isolating Class F (140º), Voltage Test 3KV against mass*

Three phase reactor to absorb line spikes, switching voltage dips, to eliminate harmonics or decrease the di/dt that semiconductors are affected.Ripple decrease at switching frequency and its main harmonics. Continuous service and inner installation.

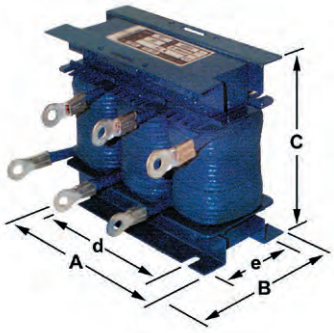
CLR



Model	Code
CLR 250A INPUT REACTOR	41735

STANDARDS
IEC 60289
IEC 60076
IEC 60726
Directives 2006/95/CEE

DIMENSIONS (mm)



Dimensions mm	
A	240
B	210
C	230
d	185
e	85

PT

Voltage transformation for Low Voltage

POTENTIAL TRANSFORMER

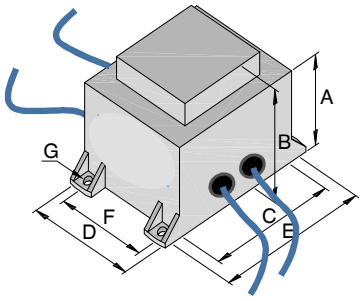
Transformer designed in double cell, encapsulated in poliuretane.

- *Dielectrical strength 3000Vac 50Hz between primary and secondary.*
- *Input voltage: 480V ± 5%.*
- *Output voltage: 120V.*
- *Burden: 50VA Max.*
- *Weight: 1,2kg.*
- *Possibility of soldering over PCB.*
- *Accuracy class: 1.*

PT

Model	Code
PT 50VA 480/120	41460

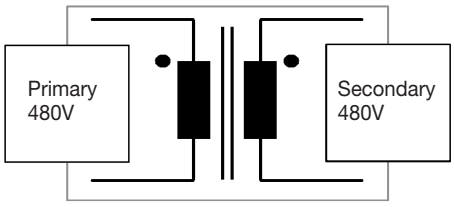
DIMENSIONS (mm)



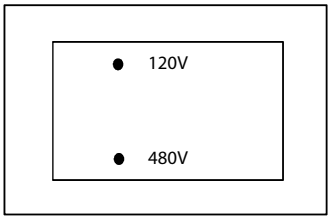
Dimensions mm	
A	52
B	65
C	81
D	68
E	91
F	57
G	4,5

Cables
Lenght: 150 mm minimum
Section: 0,75 mm maximum

ELECTRIC SCHEME



MARKING



SURGE PROTECTION

Introduction

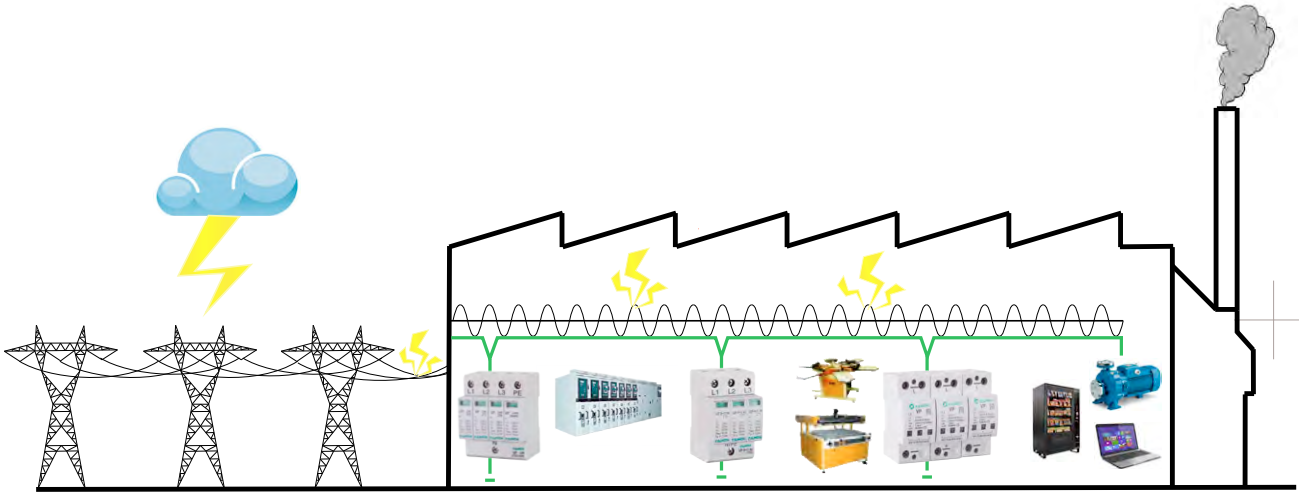
The surge protection relays protect installations and eliminate the effects of power surges. They offer the highest level of security in low voltage lines, continuous processes, domestic and tertiary facilities, etc.

They are suitable for manufacturers and system integrators of industrial equipment, photovoltaic applications, wind turbines, etc.

Devices connected to the mains are increasingly susceptible to electrical disturbances in the grid. Hence it is essential to provide adequate protection to avoid major economic and material losses.

The most visible and destructive power surges are often caused by atmospheric discharges (lightning strikes). However, this is not the most common source of such disturbances, as in most cases, the main sources of surges are within the facility installation itself, amongst others for the following reasons:

- Performance of circuit breakers and fuses.
- Connection and disconnection of inductive loads.
- Switching of motors and machines.
- Electrostatic discharge.
- Capacitor's power factor correction.
- Energy transfers in generator sets.



VP B

Power Supply Systems & Installations

SURGES TYPE B (CLASS I)

- *Compact equipments for all distribution systems.*
- *High discharge capacity by "Spark Gap" technology.*
- *Visual indication of a fault in the equipment.*
- *With thermal separation device.*
- *Remote signalling of the protection status.*

CE

	POWER SUPPLY NETWORK							
Code	**41648**	**41642**	**41643**	**41644**	**41645**	**41646**	**41641**	**41647**
Model	**VP B25 255/NPE**	**VP B25 275/1**	**VP B25 275/1+NPE**	**VP B25 275/2**	**VP B25 275/2+NPE**	**VP B25 275/3**	**VP B25 275/3+NPE**	**VP B25 275/4**
According to IEC 61643-1 (Class)	Class I							
Type of network	TT	TT/TN	TT/TN	TN	TT/TN	TN	TT/TN	TN
Electrical line	-	1P+NPE	1P+N+PE	1P+N+PE 2P+NPE	2P+N+PE	2P+N+PE 3P+PE 3P+NPE	3P+N+PE 3P+PE	3P+N+PE
Nominal voltage **Un** (Vac)	230 Vac							
Maximum continuous operating voltage **Uc** (Vac)	255 Vac	275 Vac						
Nominal discharge current (8/20 µs) **In** (kA)	50 kA							
Maximum discharge current (8/20 µs) **Imax** (kA)	100 kA							
Impulse current (10/350 µs) **Iimp** (kA)	25 kA							
Protection level **Up** (kV) at 30 kA	< 1,8 kV							
Response time **ta** (ns)	< 100 ns	< 25 ns						
Maximum back-up fuse (A gL/gG)	160							
Nº Modules	1		2		3		4	

VP B+C

Power Supply Systems & Installations

SURGES TYPE B+C (CLASS I+II)

- *Compact equipments for all distribution systems.*
- *High discharge capacity by "Spark Gap" technology.*
- *Visual indication of a fault in the equipment.*
- *With thermal separation device.*
- *Remote signalling of the protection status.*
- *Plug-in protection modules which facilitate maintenance.*

CE

	POWER SUPPLY NETWORK							
Code	**41631**	**41632**	**41633**	**41636**	**41637**	**41638**	**41639**	**41640**
Model	**B+C60 255/NPE**	**B+C60 255/1**	**B+C60 275/1+NPE**	**B+C60 275/2**	**B+C60 275/2+NPE**	**B+C60 275/3**	**B+C60 275/4**	**B+C60 275/3+NPE**
According to IEC 61643-1 (Class)	I+II (Class)							
Type of network	TT	TT/TN	TT/TN	TN	TT/TN	TN	TN	TT/TN
Electrical line	-	1P+NPE	1P+N+PE	1P+N+PE 2P+NPE	2P+N+PE	2P+N+PE 3P+PE 3P+NPE	3P+N+PE	3P+N+PE 3P+PE
Nominal voltage **Un** (Vac)	230 Vac							
Maximum continuous operating voltage **Uc** (Vac)	255 Vac	275 Vac						
Nominal discharge current (8/20 µs) **In** (kA)	30 kA							
Maximum discharge current (8/20 µs) **Imax** (kA)	60 kA							
Protection level **Up** (kV) at 30 kA	< 1,5 kV							
Response time **ta** (ns)	< 25 ns							
Maximum back-up fuse (A gL/gG)	125							
Nº Modules	1		2		3		4	

VP C

Power Supply Systems & Installations

SURGES TYPE C (CLASS II)

- *Compact equipments for all distribution systems.*
- *High discharge capacity via zinc oxide varistors and gas dischargers.*
- *With thermal separation device.*
- *Visual indication of a fault in the equipment.*
- *Remote signalling of the protection status.*
- *Plug-in protection modules which facilitate maintenance.*

CE

	POWER SUPPLY NETWORK									
Code	**41600**	**41602**	**41603**	**41604**	**41607**	**41606**	**41610**	**41609**	**41624**	**41625**
Model	**VP C40 275/1**	**VP C40 250/NPE**	**VP C40 275/2**	**VP C40 275/1+NPE**	**VP C40 275/3**	**VP C40 275/2+NPE**	**VP C40 275/4**	**VP C40 275/3+NPE**	**VP C20 275/1+NPE**	**VP C20 275/3+NPE**
According to IEC 61643-1 (Class)	Class II									
Type of network	TT/TN	TT	TN	TT/TN	TN	TT/TN	TN	TT/TN		
Electrical line	1P+NPE (1) (2) (3)	1P+N+PE 2P+N+PE 3P+N+PE 3P+PE	1P+N+PE 2P+NPE	1P+N+PE	2P+N+PE 3P+PE 3P+NPE	2P+N+PE	3P+N+PE	3P+N+PE 3P+PE	1P+N+PE	3P+N+PE 3P+PE
Nominal voltage **Un** (Vac)	230 Vac									
Maximum continuous operating voltage **Uc** (Vac)	275 Vac	250 Vac	275 Vac							
Nominal discharge current (8/20 µs) **In** (kA)	20 kA								10	
Maximum discharge current (8/20 µs) **Imax** (kA)	40 kA								20	
Protection level **Up** (kV)	< 1,2 kV	< 1,5 kV	< 1,2 kV						< 1,0 kV	
Protection level at 5 kA (kV)	< 1,0 kV	--	< 1,0 kV						< 0,95 kV	
Response time **ta** (ns)	< 25 ns	<100 ns	< 25 ns							
Maximum back-up fuse (A gL/gG)	125	--	125						100	
Nº Modules	1	1	2	2	3	3	4	4	2	4
Plug-in modules code	**41611**	**41612**	**41611**	**41611/41612**	**41611**	**41611/41612**	**41611**	**41611/41612**	**41626/41627**	**41626/41627**

By using individual devices instead of compact ones, they can be installed in:

(1) TN-S System:
- 2 units of VP C40 275/1 ➔ 1P+N+PE
- 3 units of VP C40 275/1 ➔ 2P+N+PE or 3P+PE
- 4 units of VP C40 275/1 ➔ 3P+N+PE

(2) TN-C System:
- 2 units of VP C40 275/1 ➔ 2P+NPE
- 3 units of VP C40 275/1 ➔ 3P+NPE

(3) TT System:
- 1 unit of VP C40 275/1 + 1 unit VP C40 250/NPE ➔ 1P+N+PE
- 2 units of VP C40 275/1 + 1 unit VP C40 250/NPE ➔ 2P+N+PE
- 3 units of VP C40 275/1 + 1 unit VP C40 250/NPE ➔ 3P+N+PE or 3P+PE

TYPE B (Class I)

TYPE B + C (Class I+II)

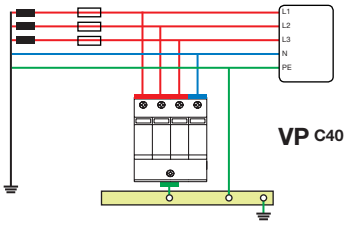
TYPE C (Class II)

CE

WIRING DIAGRAM

TN-S SYSTEM

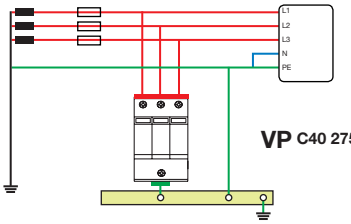
3F + N + PE



VP C40 275/4

TN-C SYSTEM

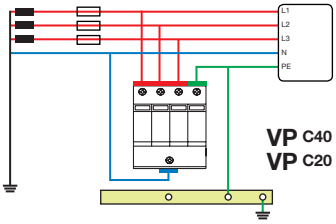
3F + NPE



VP C40 275/3

TT SYSTEM

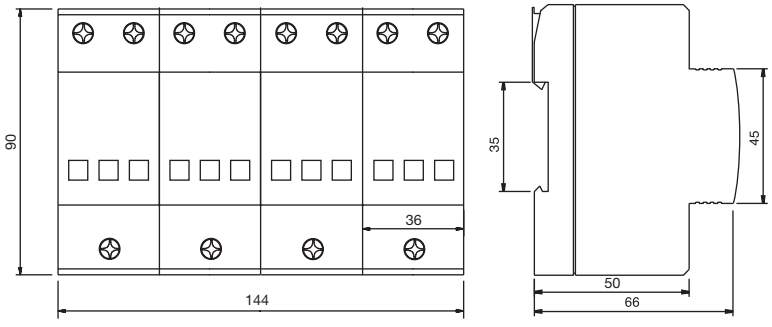
3F + N



VP C40 275/3+NPE
VP C20 275/3+NPE

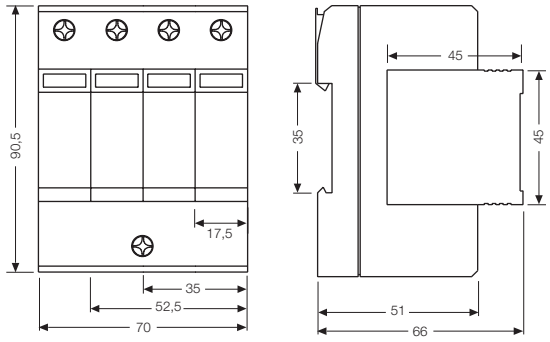
DIMENSIONS (mm)

TYPE B (Class I)



*Width depending on number of modules

TYPE B + C (Class I+II) and TYPE C (Class II)



*Width depending on number of modules

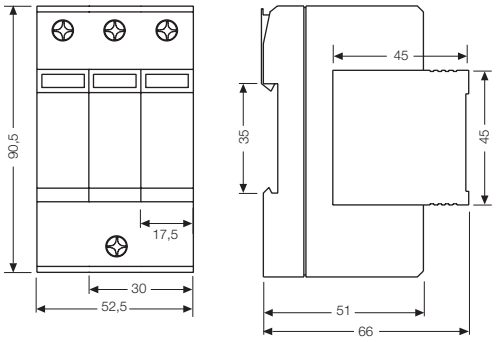
VP C

PHOTOVOLTAIC Applications

- *Compact equipment for photovoltaic installations.*
- *High discharge capacity via zinc oxide varistors and gas dischargers.*
- *With thermal separation device.*
- *Visual indication of a fault in the equipment.*
- *Remote signalling of protection status.*
- *Plug-in protection modules which facilitate maintenance.*

	PHOTOVOLTAIC APPLICATIONS	
Code	**41605**	**41608**
Model	**VP C40 PV500**	**VP C40 PV1000**
According to IEC 61643-1 (Class)	II	
Photovoltaic line	2F+PE	2F+PE
Maximum service voltage in direct current **Uoc**$_{max}$ (Vdc)	< 500	< 1000
Maximum continuous operating voltage **Uc** (L-PE) (Vdc)	250	500
Nominal discharge current (8/20 µs) **In** (kA)	20	
Maximum discharge current (8/20 µs) **Ima**x (kA)	40	
Protection level **Up** (kV)	< 1,8	< 3,6
Protection level at 5 kA (kV)	< 1,5	< 3
Response time **ta** (ns)	< 25	< 25
Maximum back-up fuse (A gL/gG)	125	125
Nº Modules	3	3
Plug-in modules code	**41614**	**41616**

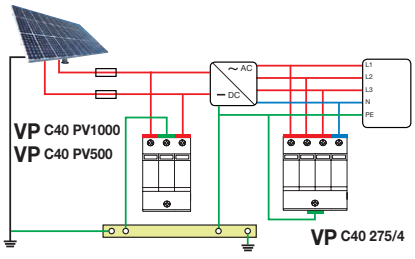
DIMENSIONS (mm)



WIRING DIAGRAM

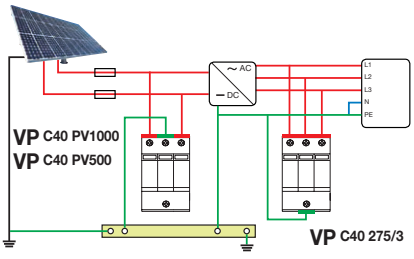
TN-S SYSTEM

3F + N + PE



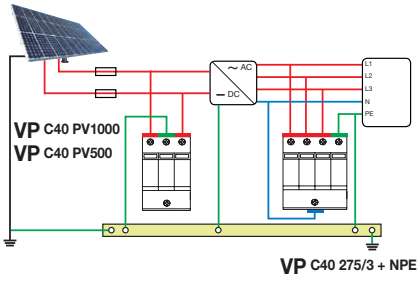
TN-C SYSTEM

3F + NPE



TT SYSTEM

3F + N



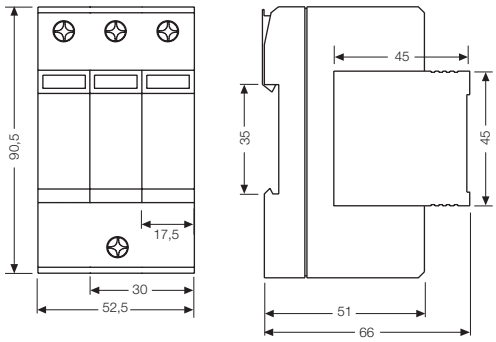
VP C

WIND Power Applications

- *Compact equipment for wind power installations.*
- *High discharge capacity via zinc oxide varistors and gas dischargers.*
- *With thermal separation device.*
- *Visual indication of a fault in the equipment.*
- *Remote signalling of protection status.*
- *Plug-in protection modules which facilitate maintenance.*

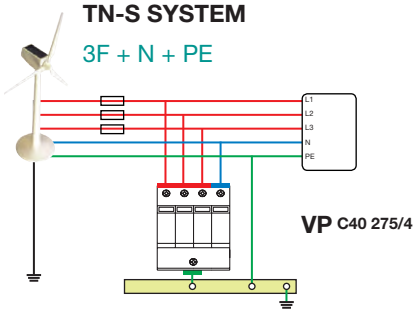
	WIND POWER APPLICATIONS
Code	**41622**
Model	**VP C30 600/3**
According to IEC 61643-1 (Class)	II
Type of network	TT/TN
Eolic line	2F+N+PE 3F+PE 3F+NPE
Nominal voltage **Un** (Vca)	600
Maximum continuous operating voltage **Uc** (Vca)	600
Nominal discharge current (8/20 µs) **In** (kA)	15
Maximum discharge current (8/20 µs) **Imax** (kA)	30
Protection level **Up** (kV)	< 2,8
Protection level at 5 kA (kV)	< 2,4
Response time **ta** (ns)	< 25
Maximum back-up fuse (A gL/gG)	63
Nº modules	3
Plug-in modules code	**41623**

DIMENSIONS (mm)



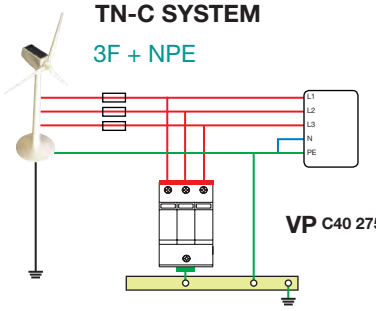
WIRING DIAGRAM

TN-S SYSTEM
3F + N + PE



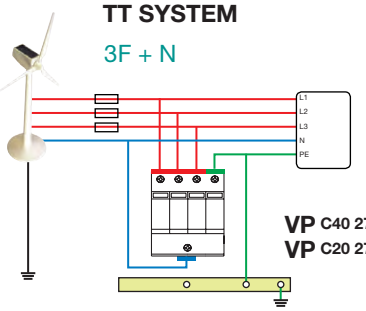
VP C40 275/4

TN-C SYSTEM
3F + NPE



VP C40 275/3

TT SYSTEM
3F + N



VP C40 275/3+NPE
VP C20 275/3+NPE

SST

Protection against Transient Overvoltage

SURGE ARRESTERS

Surge arrester for low voltage power supply systems. Protection against transient overvoltage that may arise in the electrical supply, at the boundaries

from lightning protection zone 0B-1 and higher.

- *UL 1449 3rd with SCCR 200KArms.*
- *MOV technology, high energy discharge capacity.*
- *Thermaly protected.*
- *Visual fault indication*
- *Remote signalling.*
- *Low voltage protection level.*
- *Metalic box.*
- *Surge event counter.*
- *Failure pre-test.*
- *Filtering function.*

Ideal for applications with low discharge capacity required such as:

- *Instalations with electronic equipments and microprocessor-based systems.*
- *Switchboards.*
- *Secondary panels.*

SST

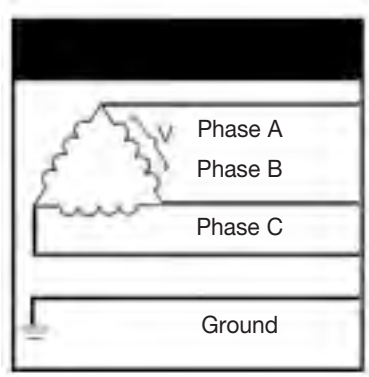
CE

TECHNICAL PARAMETERS

Model	**SST480D200AF/M**
Nominal voltage	480 V
Discharge capacity	200 KA
Maximum continuois operating voltaje Uc	550 V
Current counter	≥ 200 A (Reset button)
Failure pre-test	Press 2S (Test button)
Filtering	L-N, N-PE, L = PE
Power status indication	LED ON encendido = OK
Working status indication	LED ON Blue = OK ; Blue LED ON Azul OFF y Red LED ON = FAILURE
Power connecting cable	8 AWG L1 = Yeloww L2 = Green L3 = Red N = Blue/Brown PE = Black
Signal cable	16 AWG C = Red NC = Blue NO = Brown
Working temperature range	-40ºC + 70ºC
Working humidity relative	5-95% (25ºC)
Working altitude	≤ 2 km
Dimensions W x D x H (mm)	256 x 205 x 104
Net weight	5,4 Kg

	L-N	**L-L**	**L-G**
Nominal voltage level	N/A	480	480
Voltage protection ratings (VPR @6KV/ 3kA)	N/A	2200	1900

DISTRIBUTION DIAGRAM



3 Hots + Grnd

Other models available

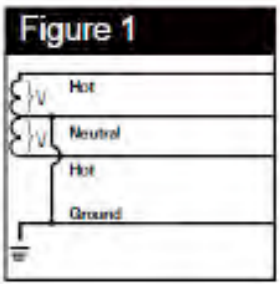
OTHER MODELS AVAILABLE

Code configuration for other models is done as follows:

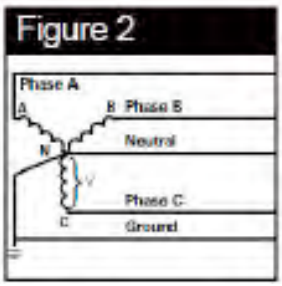
Code: SST ☐☐☐ **/ P (Plastic) or M (Metal)**

- Optional functions:
  - C= Surge counter
  - T= Failure test
  - A= Remote alarm
  - F= Noise filtering
- Max. surge current per phase (from 50KA - 300 KA/Phase)
- Voltage for power distribution system

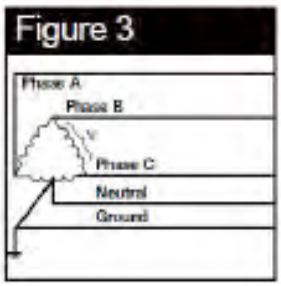
Figures	Distribution diagrams	L-N	L-L	L-G	Model
Figure 1	2 Hots + 1 Neu + 1 Grnd (2L+N+G)	120	240	120	120SP
Figure 2	3 Hots + 1 Neu + 1 Grnd (3L+N+G)	127	220	127	127Y
		220	380	220	220Y
		240	415	240	240Y
		277	480	277	277Y
		347	600	347	347Y
Figure 3	3 Hots + (B-HIGH) + 1 Neu + 1 Grnd (3L+N+G)	120	240	120	120H
Figure 4	3 Hots + Grnd (3L+G)	N/A	240	240	240D
		N/A	480	480	480D
		N/A	600	600	600D
Figure 5	1 Hot + 1 Neu + 1 Grnd (L+N+G)	127	N/A	127	127S
		240	N/A	240	240S



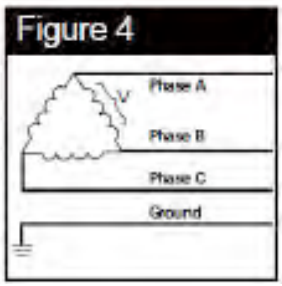
SPLIT



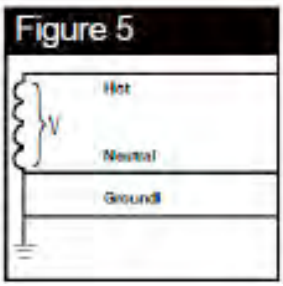
WYE



HI-LEG DELTA (B High)



DELTA & HRG WYE



SINGLE POLE


"We fulfill our
customers necessities
adapting our product.
We give solutions"
FANOX
protection & control

CUSTOMIZED PRODUCTS AND BRANDLABELING

Introduction

Every day an increasing number of companies are considering the option of outsourcing their design and product development.

Fanox is the perfect technology partner to carry out these activities. Our R & D department is prepared to operate as an integral part of our clients business – adapting to their needs by developing custom designs.

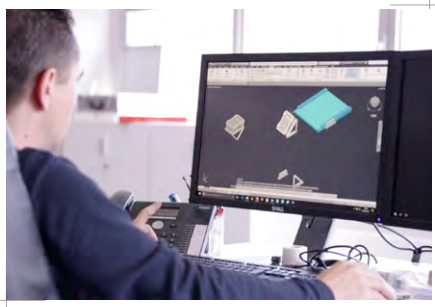
Fanox is a leader in the customization of products for reputable manufacturers, and we offer added value at a very competitive price. Fanox provides additional performance characteristics to the equipment thanks to continuous improvement of electronics – spear heading a rapidly moving technology sector.

We have **high expertise** in the area of **electronics** related to:

- Protection
- Control
- Measurement
- Communication

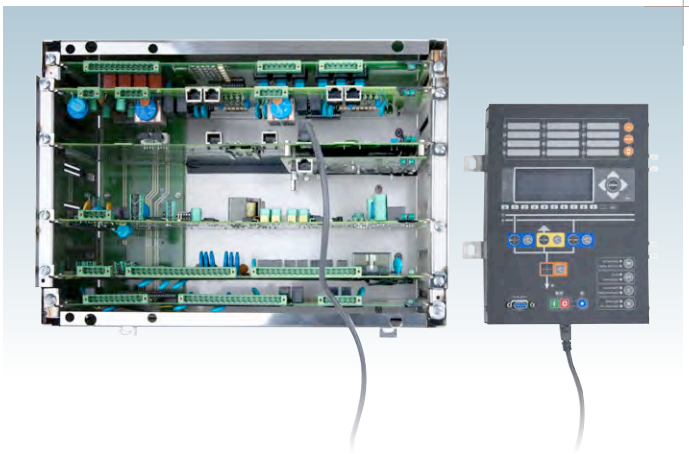
We provide you with important assets of **high skills and experience** in:

- Systems Engineering (Hardware, Software and Communication)
- Ability to adapt to different protocols (RTU's)
- Conformity and adaptation to international standards
- Design of systems and schemes tailored to the needs of customers
- Prototype design and production
- Testing
- Delivery of finished product – Brand Labelling

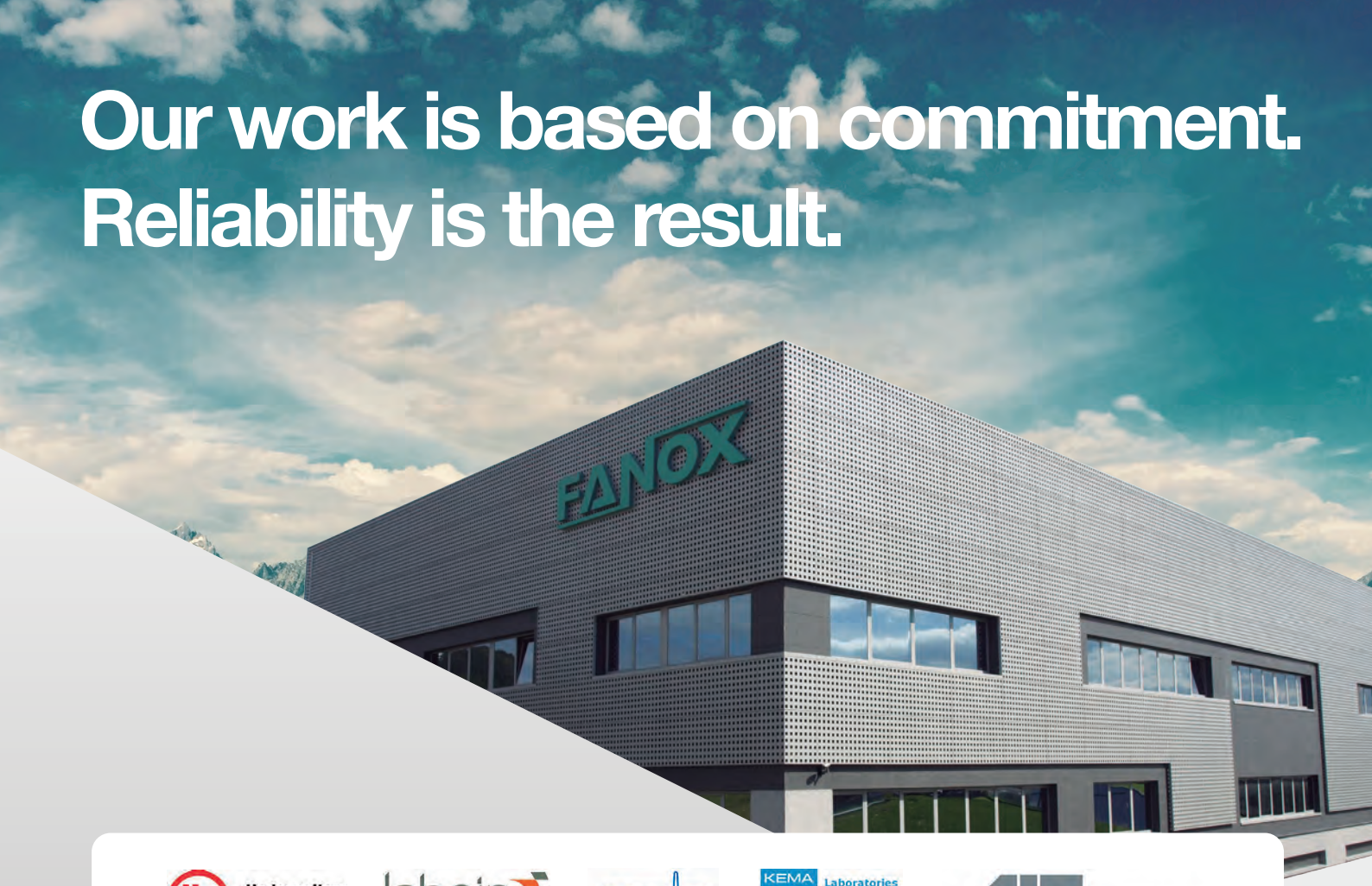


Some of our custom developments:

- Digital controller for fan coil units, which includes power and alarm management functions, which is incorporated in centralized control systems for hotels and large office buildings through Modbus communication protocol.
- Control equipment for electric transformer substations, which set levels of communication speed and immunity to external disturbances beyond the reach of any industrial PLC.
- Load limiter for lifting systems being used by leading manufacturers of overhead cranes and lifting platforms.
- Control and management of SF6 Switchgear for high/medium voltage substations.
- 3-Phase distribution line switch disconnection with incorporated Electronic Sectionaliser
- Fault passage detection system and geographical location of power failures in the section between an electrical substation and the consumer. Designed to detect faults in medium and high voltage, with remote real-time indication at Control Centre.
- Management Systems for Zigbee Communication protocols.



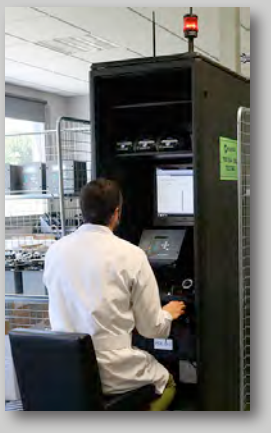
Our work is based on commitment. Reliability is the result.



The quality of all of our products has been certificated by independent & recognized laboratories, and approved in several Electrical Utilities around the world.

The quality of our products and services are in line with international standards.

100% of Fanox Relays are quality tested several times throughout the production process.



IQNET awarded the QUALITY MANAGEMENT SYSTEM, certificate in 1993 – ISO 9001:2008

Years ago we perceived the giant potential of self-powered protection relays. Now we are the world's leaders in SELF-POWERED technology thanks to our hard work, know-how and experience. Along the way, we have launched overcurrent, earth fault, undervoltage and overvoltage, frequency or feeder relays, and in recent years we are focused on recloser control technologies.

We live in a world of continuous change and we will face the future as we did in the past: with the flexibility to evolve and with the mind set on incoming new customers' requirements and market opportunities.

25 years of protection

FANOX

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