

## ELECTRONIC PROTECTION & CONTROL OF MOTORS, GENERATORS AND PUMPS



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### PROTECTION & CONTROL SPECIALISTS



### MOTOR MANAGEMENT SYSTEM



### SOLUTIONS FOR MOTOR MANAGEMENT



### TERRAIN DE PROTECTION ELECTRIQUE POUR TOUTES LES TENSIONNES



### SPECIALISTS DANS LA PROTECTION ET CONTROL



### SIL

Protection relays for primary and secondary distribution



### 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 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

Operation check on LEDs and outputs.

#### DESIGNED FOR SCADA APPLICATIONS

RTU Modbus protocol and RS485 communication

#### MODULAR AND SCALABLE

The basic functions of the system can be extended with different modules (PBM H, PBM D...)

#### COMMUNICATION SOFTWARE PBCom

### PBM B



### PBM H



### PROTECTION FUNCTIONS

- $\theta >$  Overload with thermal image
- $I_{t'} >$  Overheating protection (PTC sensor)
- $\Delta$  Phase imbalance or phase failure
- $(\text{P})$  Phase sequence
- JAM** JAM detection
- $\text{X}$  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



## 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	lb (A)		0,8-6A	0,8-6A	4-25A	4-25A
Auxiliary supply	110/230Vac-dc		24/48Vdc		110/230Vac-dc	
Frequency	50/60/ variable (45-65) Hz					
Maximum motor nominal voltage	1.000 Vac					
CODE	17000		17002		17001	
For $I_N$ of the motor below the minimum setting $I_B$	Pass the cables several times (n) through the holes in the relay $I_B = n \times I_N$					
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	- 10°C + 60°C					

## PBM H

### DISPLAY MODULE HMI

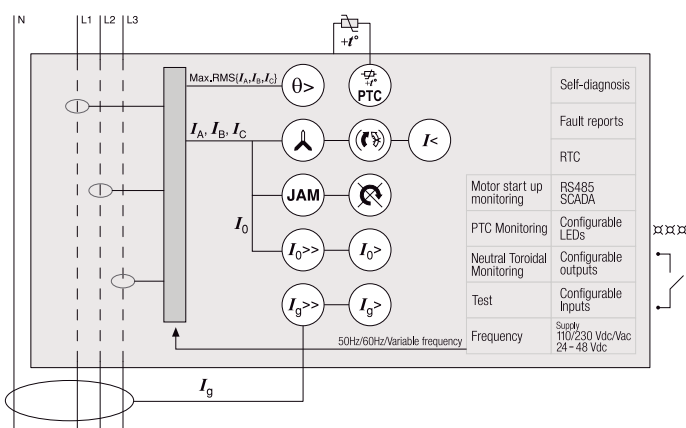
This is an optional display module with an LCD screen for signalling, control and setting. The LEDs can be configured and are identified by labels. Access to menus is intuitive and direct, making protection system commissioning easier.

CODE	ACCESORIES	LANGUAGE
17004	PBM-HS display	Spanish
17005	PBM-HS display	French
17006	PBM-HS display	English
17007	PBM-HS display	Polish
17010	PBM-HS display	German
79229	CD PBM	
17008	CDCNB CABLE 0,5 M	
17009	CDCN1 CABLE 1 M	

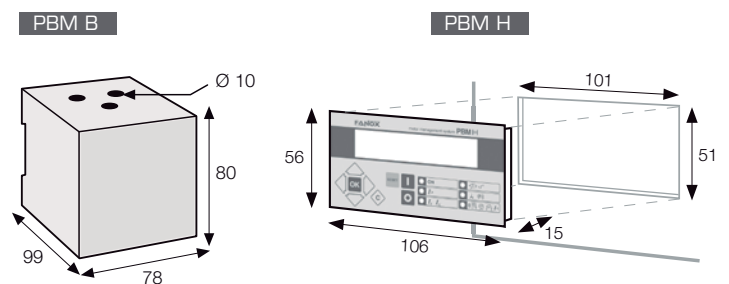
  

CHARACTERISTICS PBM H	
LCD Display	20 x 2 alphanumeric characters
Keyboard	9 keys
Communication	RJ45 connector to relay
Signalling	6 configurable signalling LEDs
Reset mode	Manual, automatic and automatic time delayed
Test	Specific test menu

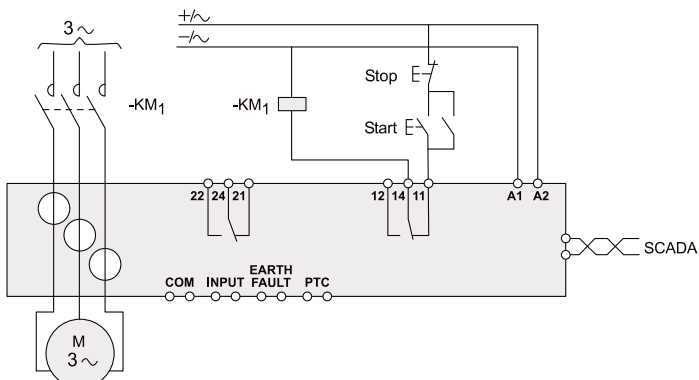
### FUNCTION DIAGRAM PBM B



### DIMENSIONS (mm)



### CONNECTION DIAGRAM PBM B



PBM Motor Management System Video demo:



## 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



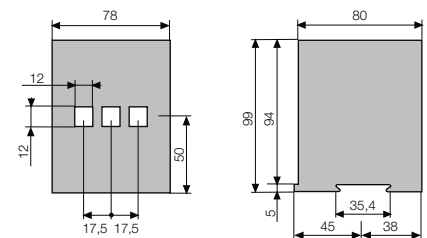
Models	Code	Relay type
ODGL	12535	GL

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 $I_s = n \times I_n$		
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		

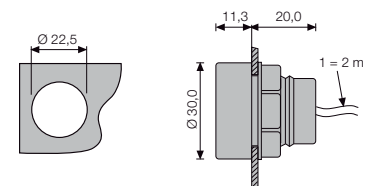
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x $I_B$
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	5 - 10 - 15 - 20 - 25 - 30 - 35
Phase sequence protection	ON <input type="checkbox"/> OFF Actuates during the motor start
Phase imbalance protection	Over 40%. Tripping 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> + Phase + Overtemp
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 mm <sup>2</sup> , 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

Settings and curves, see pages 107 to 113.

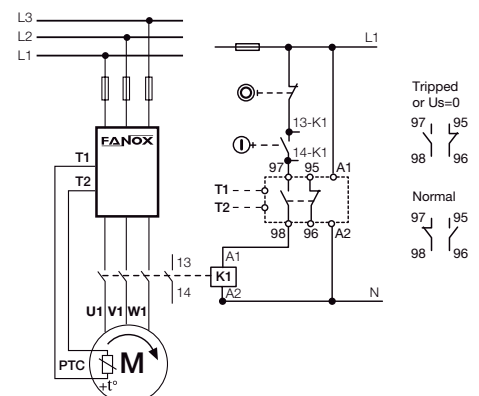
### DIMENSIONS GL RELAY (mm)



### 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

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

### ODGL



Models	Code	Relay type
ODGL	<b>12535</b>	GL

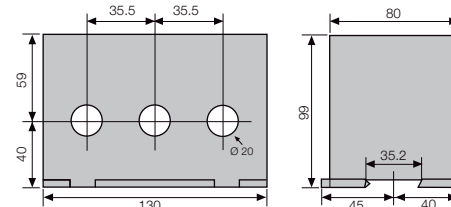
MODELS		GL 200	
Adjustment range Motor 400 V 50/60 Hz	$I_B$ (A)	60 - 200	
	CV	50 - 150	
	kW	37 - 110	
Code according to the relay voltage supply ac: 50/60 Hz	15%	230 Vac	single phase
	15%	115 Vac	single phase
	20%	24 Vac, dc	single phase
External display module (optional)			ODGL

CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From $1,1 \times I_B$
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	5 - 10 - 15 - 20 - 25 - 30 - 35
Phase sequence protection	ON <input type="checkbox"/> 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 + $I >$ + $\Delta$ ( $\Phi$ ) + $\frac{PTC}{T}$
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 mm <sup>2</sup> , 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

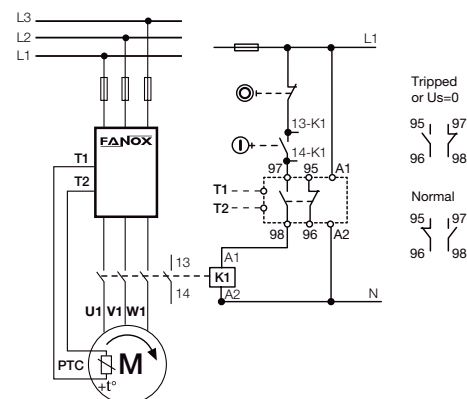


Settings and curves, see pages 107 to 113.

### DIMENSIONS GL RELAY (mm)



### WIRING DIAGRAMS





## 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.

### 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.

C



### PROTECTION FUNCTIONS

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

ODC



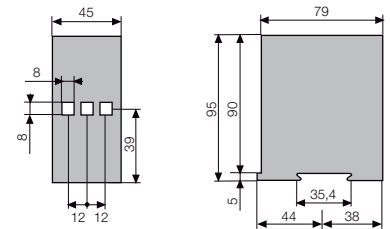
Models	Code	Relay type
ODC	12530	C

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
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 $I_s = n \times I_n$		
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		

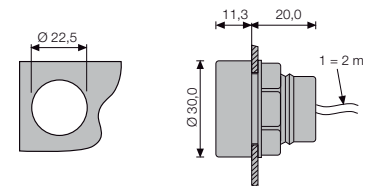
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From $1,1 \times I_B$
Maximum motor nominal voltage	1000 Vac
Trip classes (IEC 947-4-1)	10 - 20 - 30
Phase imbalance protection	Over 40%. Tripping time < 3s
Reset mode	Manual and remote
Signalling LED's	3 LED's: ON + $I >$ + $\Delta$
Output contacts	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 mm <sup>2</sup> , 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

Settings and curves, see pages 107 to 113.

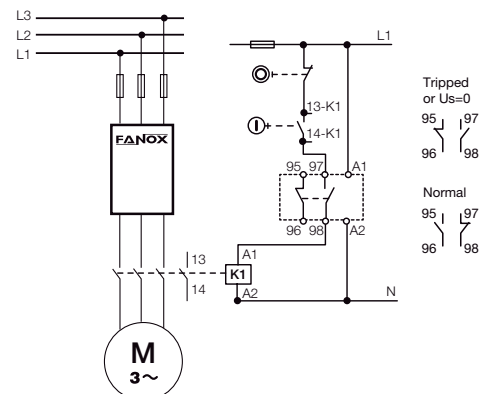
### DIMENSIONS C RELAY (mm)



### 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

- Overload
- ⚡ Phase imbalance or phase loss
- 🔥 Overtemperature



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

### 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.

CE EEx e

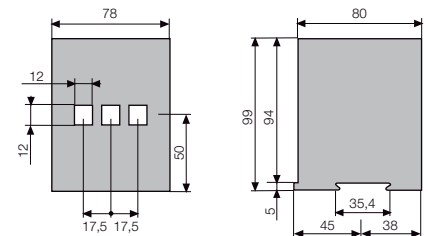
PTB Ex 3.43 - 30004/00

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	<b>10723</b>
	115 Vac single phase	<b>10722</b>
	24 Vdc, ac	<b>10720</b>
For $I_N$ of the motor below the minimum setting $I_B$		Pass the cables several times (n) through the holes in the relay $I_B = n \times I_N$
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

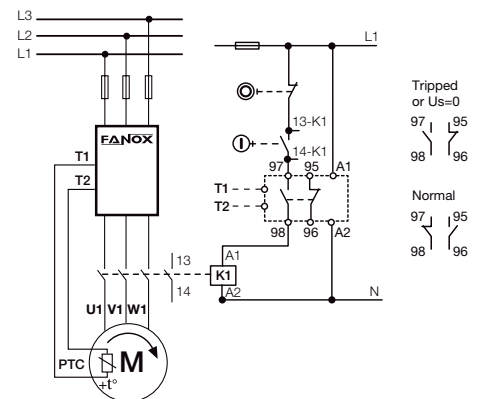
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From 1,1 x $I_B$
Maximum motor nominal voltage	1000 V
15 adjustable tripping curves	Cold tripping times at 6 x $I_B$ from 2 to 30s
Phase imbalance protection	Over 40%. Tripping time < 3s
PTC min/max cold resist. / Average trip resistance	100 $\Omega$ / 1500 $\Omega$ - 2750 $\Omega$
Reset mode	Manual and remote
Signalling LED's	4 LED's: ON + one for each protection
Alimentación auxiliar monofásica	
• Voltage $U_s$	115 - 230 Vac (+15% -6%) / 24 Vdc ( $\pm 10\%$ )
• Frequency	50/60 Hz (from 49 to 61,2 Hz)
• Consumption	2,5 VA (115 - 230 Vac) / 1,5 W (24 Vdc)
• Protection fuse	GL 6 A
Output contacts	1 relay with 1 NO + 1 NC
• Switching capacity in abnormal conditions	$I_B$ : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
• Short-circuit resistance	1000 A
Short circuit withstand rating	5000 A at 0,5 s (SCR 5000@0,5 s)
Terminals max. section / Screw torque	2,5 mm <sup>2</sup> , 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	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 107 to 113.

## 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

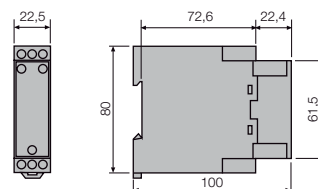
CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From $1,1 \times I_B$
Maximum motor nominal voltage	230 Vac
Trip classes (IEC 947-4-1)	10
Undercurrent protection adjustable / Trip delay	From 0,4 to $0,9 \times I_B / 5$ s
Overvoltage protection	From nominal V + 15%
Reset mode for protection against dry running	$I<$ automatic (adjustable) and remote. More info in page 92
Reset mode for other protection functions	$I>$ automatic and remote, $U>$ automatic. More info in page 92
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 mm <sup>2</sup> , No. 22 - 12AWG / 20Ncm, 1,8 LB - IN
Power consumption	<b>PS11-R</b> : 7 VA (230 Vac) - 4 VA (115 Vac) <b>PS16-R</b> : 3 VA (115-230 Vac)
Protection degree / weight / mounting	IP20 / 0,15 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



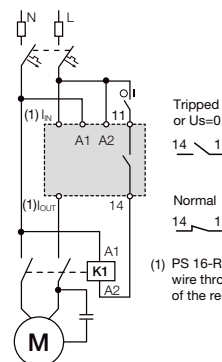
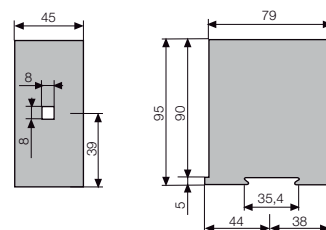
Settings and curves, see pages 107 to 113.

### DIMENSIONS PS RELAY (mm)

PS 11-R



PS 16-R



Tripped or  $U_s=0$

14 11

Normal

14 11

(1) PS 16-R: pass the wire through the hole of the relay.

## 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 as 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
- (R) Phase sequence

## WITHOUT LEVEL SENSORS

ODP



Models	Code	Relay type
ODP	12540	P

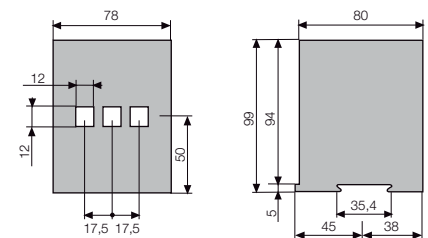
MODELS		P 19	P 44	P 90
Adjustment range Motor 400 V 50/60 Hz	$I_B$ (A)	7 - 19,6	19 - 44,2	40 - 90,4
	CV	4 - 10	12,5 - 27,5	27,5 - 55
	kW	3 - 7,5	9,2 - 20	20 - 40
Code according to the relay voltage supply (+15% -10%) ac: 50/60 Hz	230 Vac single phase	11403	11423	11443
	115 Vac single phase	11402	11422	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 $I_B = n \times I_N$		
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 92
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< + ⚡ (R)
Output contacts	1 relay with 1 NO + 1 NC
Switching power	$I_m$ : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / screw torque	2,5 mm <sup>2</sup> , 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

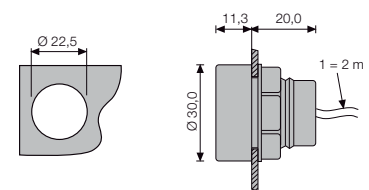


Settings and curves, see pages 107 to 113.

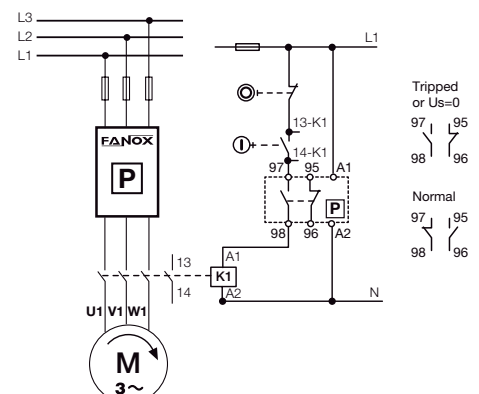
### DIMENSIONS P RELAY (mm)



### DIMENSIONS ODP MODULE (mm)



### WIRING DIAGRAM



## THREE PHASE Pump Protection Relay without Level Sensors

### THREE PHASE PUMP PROTECTION

#### Underload protection by $\cos \varphi$

- 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  $\cos \varphi$ .

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  $\cos \varphi$  of the motor and stop it before a breakdown caused by dry running, cavitation or closed valve occurs.

PF



### PROTECTION FUNCTIONS

- $I >$  Overload
- $\cos \varphi$  Underload
- $\Delta$  Phase imbalance or phase loss
- $(\text{R})$  Phase sequence

WITHOUT LEVEL SENSORS  
WITHOUT LEVEL SENSORS

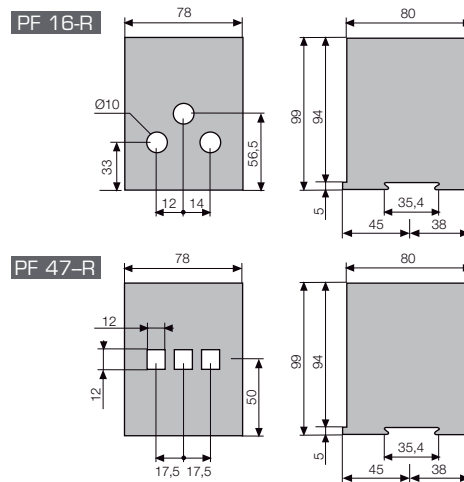
MODELS		PF 16-R	PF 47-R
Adjustment range Motor 400 V 50/60 Hz	$I_B$ (A)	4 - 16,6	16 - 47,5
	CV	3 - 10	10 - 30
	kW	2,2 - 7,5	7,5 - 22
Adjustment range Motor 230 V 50/60 Hz	$I_B$ (A)	4 - 16,6	16 - 47,5
	CV	1,5 - 5,5	5,5 - 15
	kW	1,1 - 4	4 - 11
Code	according to the relay voltage supply (+15% -10%) ac: 50/60 Hz		
	400/440 Vac 3-phase (motor)	<b>12165</b>	<b>12167</b>
	230 Vac 3-phase (motor)	<b>12173</b>	<b>12168</b>
For $I_N$ of the motor below the minimum setting $I_B$		Pass the cables several times (n) through the holes in the relay $I_B = n \times I_N$	
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 $1,1 \times I_B$
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 $\cos \varphi$ / Trip delay	$\cos \varphi$ adjustable from 0,15 to 1,0 / adjustable from 5 to 45s
Reset mode for protection against dry running	$\cos \varphi$ automatic (adjustable) and remote. More info in page 92
Reset mode for other protection functions	$I >$ $\Delta$ $(\text{R})$ Manual, remote and automatic. More info in page 92
Signalling LED's	4 LED's: ON + $I >$ + $\cos \varphi$ + $\Delta$ $(\text{R})$
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 mm <sup>2</sup> , 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

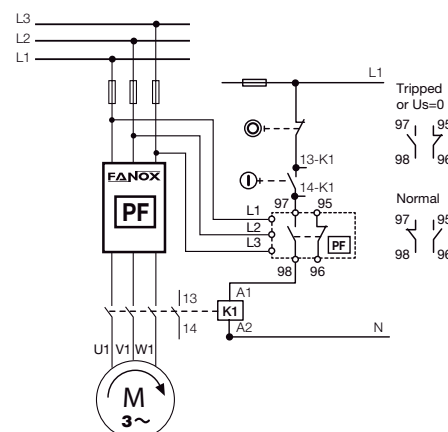


Settings and curves, see pages 107 to 113.

### DIMENSIONS PS RELAY (mm)



### 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.

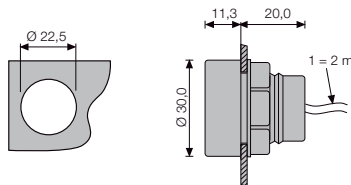
Protection degree: IP50

### ODPF



Model	Code	Relay type
ODPF	<b>12555</b>	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.”**

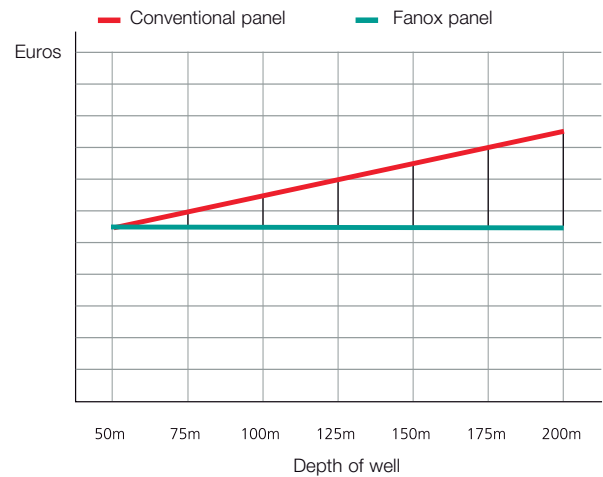
#### Fanox panel

Electronic relay

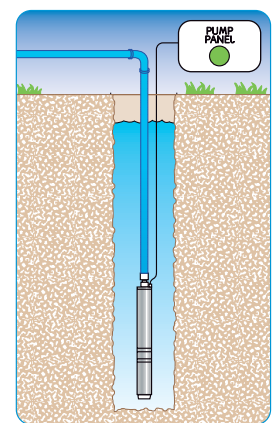
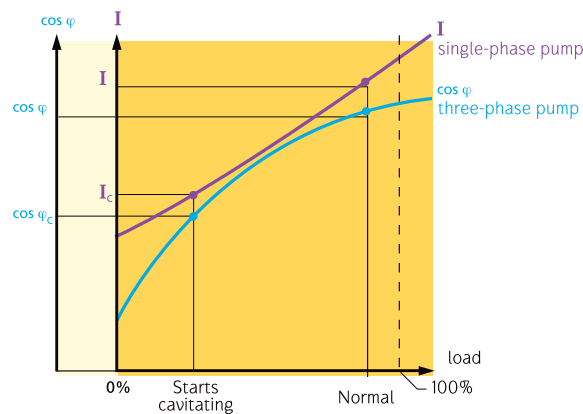
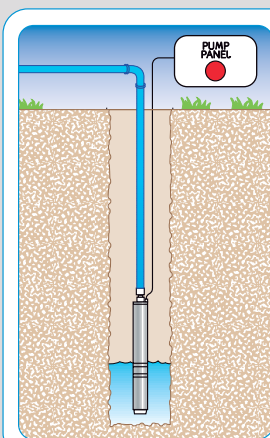
#### Conventional panel

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.



## Panels for SUBMERSIBLE Pumps

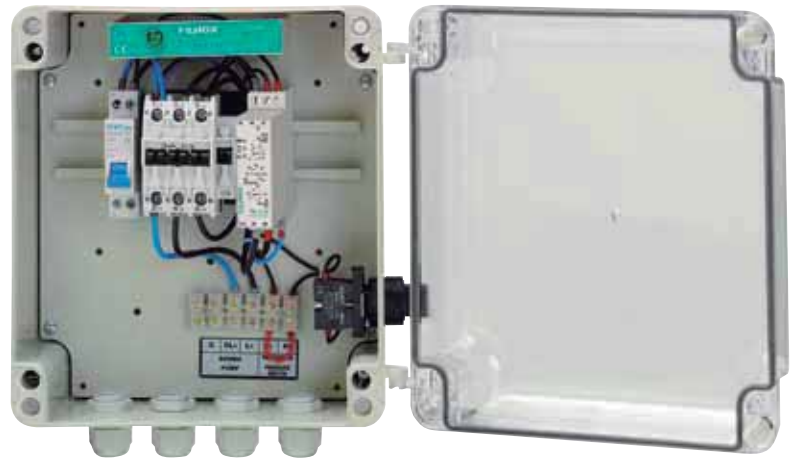
### SINGLE PHASE PUMPS

- 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.

## WITHOUT LEVEL SENSORS

CBM



### PROTECTION FUNCTIONS

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



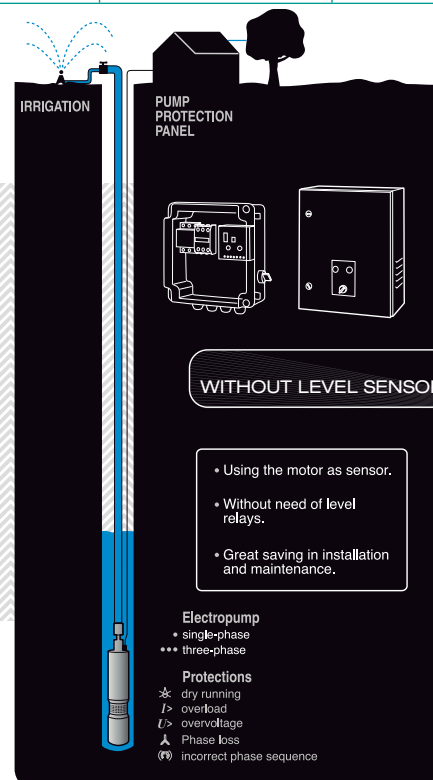
Pump protection without level sensor video demo:

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

- 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.



## 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  $\varphi$  meter.

The cosine of phi ( $\cos \varphi$ ) 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,  $\cos \varphi$  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.

### WITHOUT LEVEL SENSORS

CBT



CBT-M



### PROTECTION FUNCTIONS

- $\cos \varphi$  Underload
- $I >$  Overload
- $\Delta$  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
METAL	CBT-20M	12316	32	20	15	2 - 75	230x250x150
	CBT-25M	12317	40	25	18.5	2 - 75	230x250x150
	CBT-30M	12318	47	30	22	2 - 75	230x250x150
	CBT-40M	12319	64	40	30	2 - 75	600x500x200
	CBT-50M	12320	79	50	37	2 - 75	600x500x200
	CBT-60M	12332	92	60	45	2 - 75	600x500x200

- Equipment with halogen-free wiring

## 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...
- Metal 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  $\cos \varphi$  and shuts down the pump when it falls below the selected value.

CBS



### PROTECTION FUNCTIONS

- $\cos \varphi$  Underload
- $I >$  Overload
- $\Delta$  Phase imbalance or phase loss
- $(\text{R})$  Phase sequence
- $I >>$  Short-circuit
- $\sim$  Soft start
- $\sim$  Soft stop

**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		
METAL	<b>CBS-2*</b>	<b>12321</b>	3.8	0.5 - 2	0.37 - 1.5	2 - 75	400x300x200
	<b>CBS-3*</b>	<b>12322</b>	5.5	3	2,2	2 - 75	400x300x200
	<b>CBS-5*</b>	<b>12323</b>	7.0 - 9.5	4 - 5.5	3 - 4	2 - 75	400x300x200
	<b>CBS-7*</b>	<b>12324</b>	13	7.5	5.5	2 - 75	500x400x200
	<b>CBS-10</b>	<b>12326</b>	16.5	10	7.5	2 - 75	500x400x200
	<b>CBS-12</b>	<b>12327</b>	21	12.5	9.2	2 - 75	500x400x200
	<b>CBS-15</b>	<b>12328</b>	24	15	11	2 - 75	500x400x200
	<b>CBS-20</b>	<b>12329</b>	32	20	15	2 - 75	600x400x200
	<b>CBS-25</b>	<b>12330</b>	40	25	18.5	2 - 75	600x400x200
	<b>CBS-30</b>	<b>12331</b>	47	30	22	2 - 75	600x500x200

- Equipment with halogen-free wiring

\* Models available in plastic box.

## 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:

- **H:** Frequency relay (See page 102).
- **U3N:** Three-phase voltage relay (See page 101).

GEN



### PROTECTION FUNCTIONS

- Overload
- ⚡ Phase imbalance or phase loss

ODGEN



Models	Code	Relay type
ODGEN	<b>12545</b>	GEN

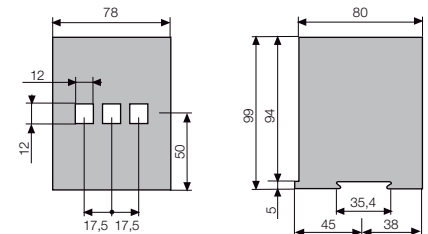
MODELS	GEN 10
Adjustment range $I_B$ (A)	4 - 10,3
Auxiliary voltage supply (+15% -10%)	24 Vdc
Code	<b>11350</b>
For $I_N$ of the generator above 10,3 A	Use 3 current transformers.../5
External display module (optional)	ODGEN

CHARACTERISTICS	
Thermal memory / Overload trip	Yes / From $1,1 \times I_B$
Maximum generator nominal voltage	1000 Vac
Trip time $t_6 \times I_B$	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 mm <sup>2</sup> , 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

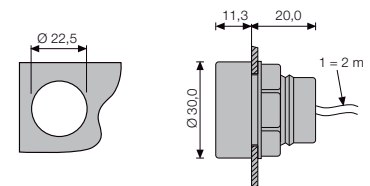


Settings and curves, see pages 107 to 113.

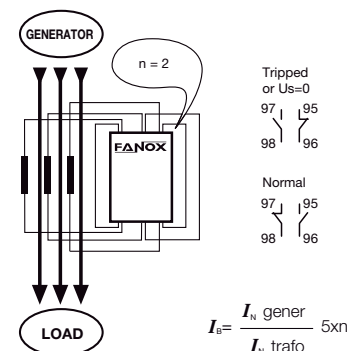
### DIMENSIONS GEN RELAY (mm)



### DIMENSIONS ODGEN MODULE (mm)



### WIRING DIAGRAM





## 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  $\Delta$ .

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
- Overvoltage
- Undervoltage
- Overfrequency
- Overfrequency
- Overcurrent
- Long ramp

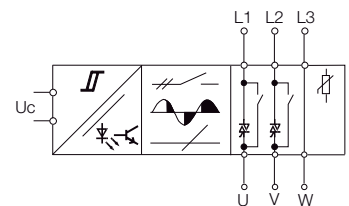
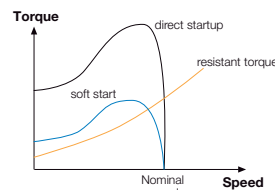
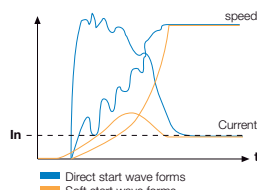
MODELS*	ES 400-3	ES 230-12	ES 400-12	ES 230/400-25E	ES 230/400-45E	ES 230/400-25F	ES 230/400-45F
Nominal voltage 50/60 Hz $V_{\pm 15\%}$	400	230	400	220-400	220-400	220-400	220-400
Maximum current A	3	12	12	25	45	25	45
Motor power	kW	1,1	3	5,5	5,5/11	11/22	5,5/11
	CV	1,5	4	7,5	7,5/15	15/30	7,5/15
Code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

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

CHARACTERISTICS	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	
Control voltage ( $\pm 15\%$ )	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	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
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	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
Start torque (% of nominal torque)	0 - 85%	0 - 70%	0 - 70%
Start-up time	0,5 - 5 s	1 - 10 s	1 - 10 s
Stop time	0,5 - 5 s	1 - 30 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.

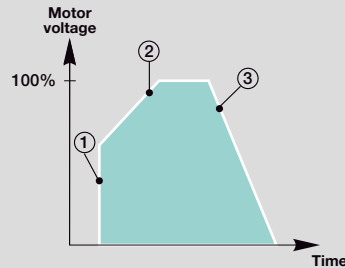
They reduce mechanical impact in motors, axles, gears and belts, significantly prolonging the operating life of the controlled units.

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.

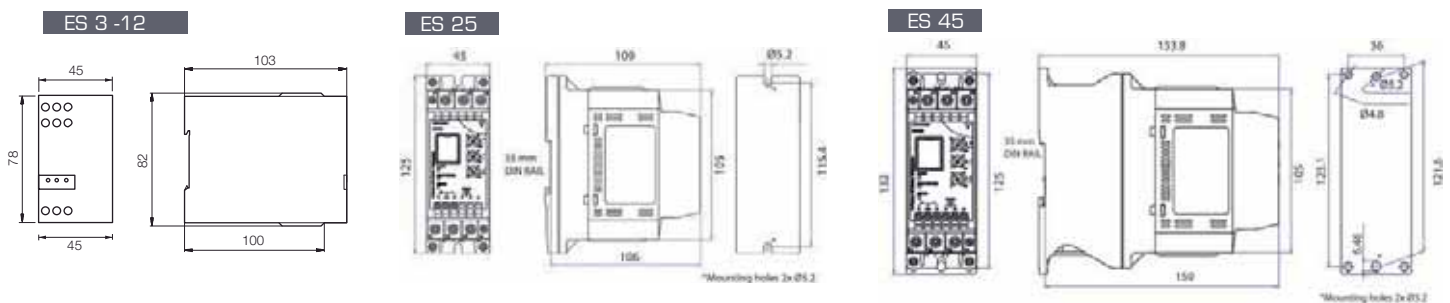
When S1 is open the soft stop is done in accordance with the ramp down potentiometer setting.

### APPLICATIONS

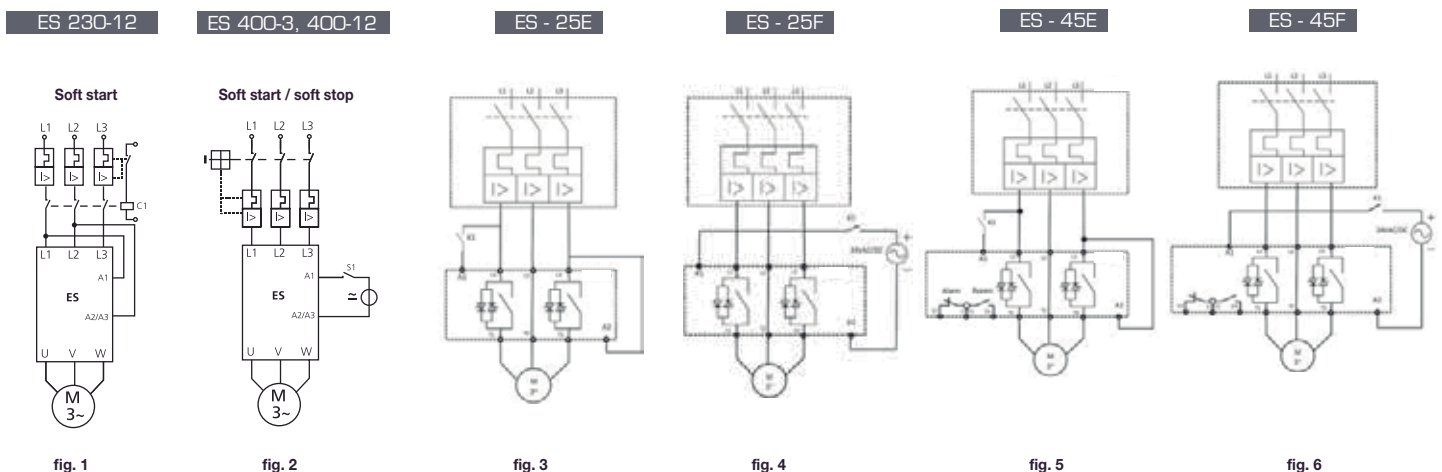
For three-phase motors in applications such as:

- 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)



### WIRING DIAGRAMS



## Manual Motor Starters

### MANUAL MOTOR STARTERS

- **Overload, phase loss and short-circuit protection.**
- **Overload range adjustable from 0,1 to 32A.**
- **Wide range of accessories.**
- Suitable for small size motors in machine-tools, conveyor systems, etc.
- Modular size 45 mm. DIN rail mounting (EN 50022-35).
- Isolating and main switch function (IEC 204-1).

M

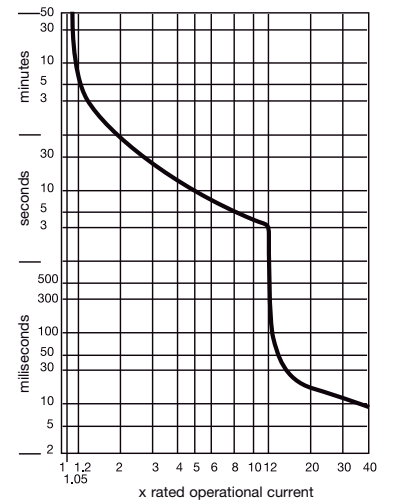


### CHARACTERISTICS

Rated operational voltage Ue	690 V
Rated impulse withstand voltage Vimp	6 kV
Frequency	40/60 Hz
Mechanical or electrical operations	100.000
Max. operating frequency	30 m/h
Current heat losses (3-phases)	5,8 W
Opening time	7 ms
Terminal section	2 x 6 mm <sup>2</sup>
Screw torque	1,2 Nm
Protection degree	IP20
Fixed magnetic trip (A)	12 x I ±20%

Code	Model	Range A	Motor 3F, AC3 kW - 400 V
35016	M-0,16	0,1 - 0,16	-
35000	M-0,25	0,16 - 0,25	0,06
35001	M-0,4	0,25 - 0,4	0,09
35002	M-0,63	0,4 - 0,63	0,12
35003	M-1	0,63 - 1	0,25
35004	M-1,6	1 - 1,6	0,55
35005	M-2,5	1,6 - 2,5	0,75
35006	M-4	2,5 - 4	1,5
35007	M-6,3	4 - 6,3	2,2
35008	M-10	6,3 - 10	4
35009	M-16	10 - 16	7,5
35010	M-20	16 - 20	9
35011	M-25	20 - 25	12,5
35012	M-32	25 - 32	15

Cold state curve.  
For warm state multiply t x 0,25



### AUXILIARY CONTACTS

Rated operational voltage	500 V
Rated impulse withstand voltage	4 kV
Maximum current I <sub>m</sub>	6 A
Rated current AC-15:230/400 V	3,5 / 2 A
Terminal section	2 x 2,5 mm <sup>2</sup>
Screw torque	1 Nm



### Rated short circuit breaking capacity I<sub>cu</sub> (DIN VDE 0660 part 101; IEC 947-2)

Manual motor starter models	Switching capacity I <sub>cu</sub> [kA]						Back-up fuse			
					With limiter M-SB		Fuses gL, aM (A)			
V	230	400	500	690	230	400	230	400	500	690
M-0,16 a M-1,6	Not required				Not required		Not required			
M - 2,5	3				2,5		25			
M - 4	3				2,5		35			
M - 6,3	3				2,5		50			
M - 10	6	3	2,5		50		80	50	35	
M - 16	10	6	2,5	2	100	50	80	80	63	35
M-20 a M-32	10	6	2,5	2	100	50	80	80	63	50

## ACCESSORIES

- Current limiter M-SB (IN=32A), increases the short circuit capacity up to 50kA/400V. Assembly: under the manual motor starter or remotely.
- Undervoltage trip and remote trip.
- Enclosures, auxiliary contacts, emergency push-button and indicator lights.



## DESCRIPTION / MODEL / CODE

- Current limiter **M-SB** **03990**
- Auxiliary contacts (\*NO early make)

Contact	Side mounting	Inside mounting	Front mounting
2 NA	<b>M-HS20</b> <b>03901</b>		
NO + NC	<b>M-HS11</b> <b>03900</b>		<b>FHMS11</b> <b>03931</b>
NO	<b>M-HS10</b> <b>39011</b>	<b>M-SHS10</b> <b>03906</b>	<b>FHMS10</b> <b>03932</b>
2 NC	<b>M-HS02</b> <b>03903</b>		
NC	<b>M-HS01</b> <b>39031</b>	<b>M-SHS01</b> <b>03907</b>	<b>FHMS01</b> <b>03933</b>
NO*+ NC	<b>M-VHS11</b> <b>03902</b>		

- Remote trip and undervoltage trip (Inside mounting)

V / Hz	Remote	Undervoltage
24 / 50-60	<b>M-AS-05</b> <b>03923</b>	<b>M-UN-05</b> <b>03913</b>
110 / 50 120 / 60	<b>M-AS-15</b> <b>03920</b>	<b>M-UN-15</b> <b>03910</b>
220-240 / 50 240 / 60	<b>M-AS-25</b> <b>03921</b>	<b>M-UN-25</b> <b>03911</b>
380-415 / 50 440 / 60	<b>M-AS-45</b> <b>03922</b>	<b>M-UN-45</b> <b>03912</b>
500 / 50		<b>M-UN-55</b> <b>03915</b>

- Enclosures

Surface mounting IP41	<b>M-GE</b> <b>03950</b>
Flush mounting IP41	<b>M-FP</b> <b>03940</b>
IP55 Kit (M-GE and M-FP)	<b>M-BS</b> <b>03948</b>
IP 54 Enclosure, 5 poles CEE-17	<b>M-GC</b> <b>04055</b>
Idem with phase inverter	<b>M-GC1</b> <b>04056</b>

- Emergency stop-operation for M-GE and M-FP

Push-button type IP55	<b>M-PT</b> <b>03980</b>
Self-locking type IP55	<b>M-PV</b> <b>03981</b>
Self-locking with key IP55	<b>M-PS</b> <b>39822</b>

- Busbar

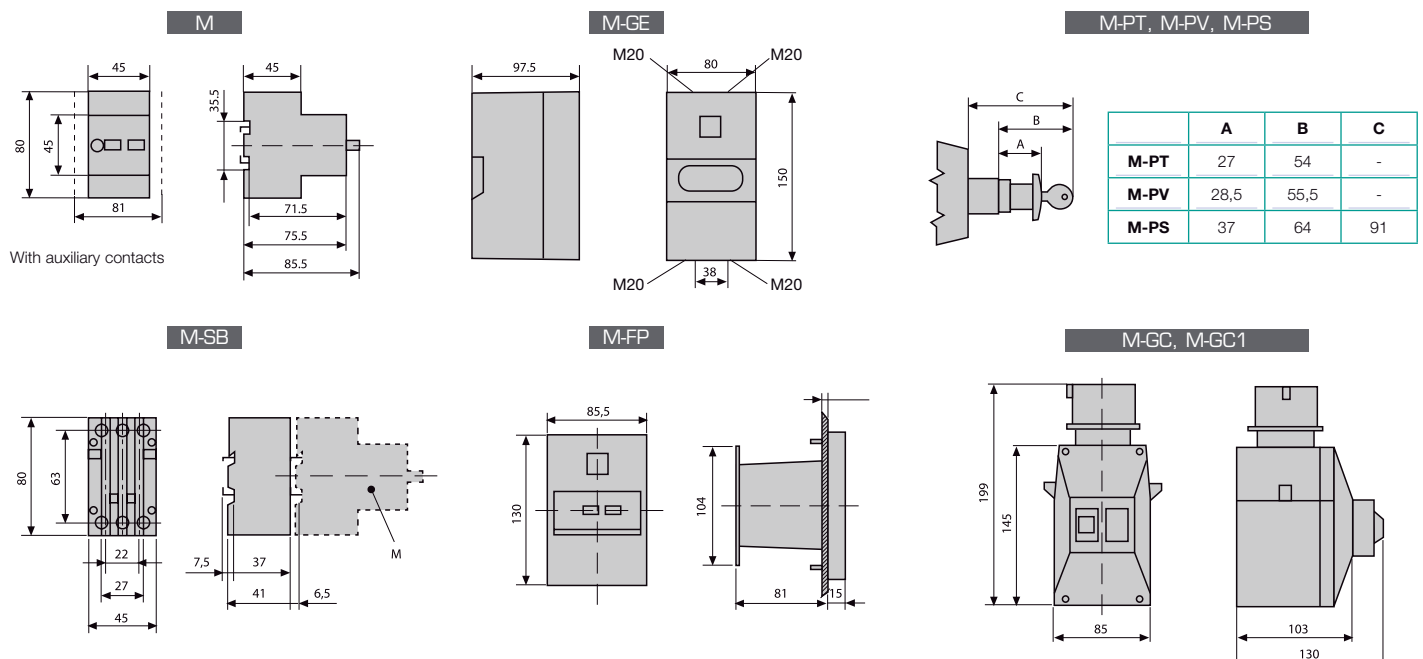
Busbar-2	<b>M-SBD-12</b> <b>03991</b>
Busbar-3	<b>M-SBD-13</b> <b>03992</b>
Busbar-4	<b>M-SBD-14</b> <b>03993</b>
Busbar-5	<b>M-SBD-15</b> <b>03994</b>
Input terminals	<b>M-SBDE1</b> <b>03995</b>

- Others for enclosures M-GE and M-FP

Padlocking feature (max. 3)	<b>M-VSL</b> <b>03988</b>
N-terminal	<b>M-N</b> <b>03949</b>
Pilot light, white, 220-240V	<b>M-LM</b> <b>39701</b>
Pilot light, white, 380-440V	<b>M-LM1</b> <b>39702</b>
Pilot light, green, 220-240V	<b>M-LM-G</b> <b>39711</b>
Pilot light, green, 380-440V	<b>M-LM1-G</b> <b>39712</b>
Pilot light, red, 220-240V	<b>M-LM-R</b> <b>39721</b>
Pilot light, red, 380-440V	<b>M-LM1-R</b> <b>39722</b>



## DIMENSIONS (mm)



## 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 160°C.
- PTCEX 70, for external mounting. Temperature threshold 70°C.

PTC



PTCEX 70

CE

Models	PTC 120		PTC 160	PTCEX 70	
Code	41700/41701		41705	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)



PTC 120 /160

### DIMENSIONS PTC (mm)

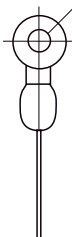
Ø 3 mm



PTC 120

PTC 160

Ø 3,7 mm



PTCEX 70



## THE MOTOR PROTECTION

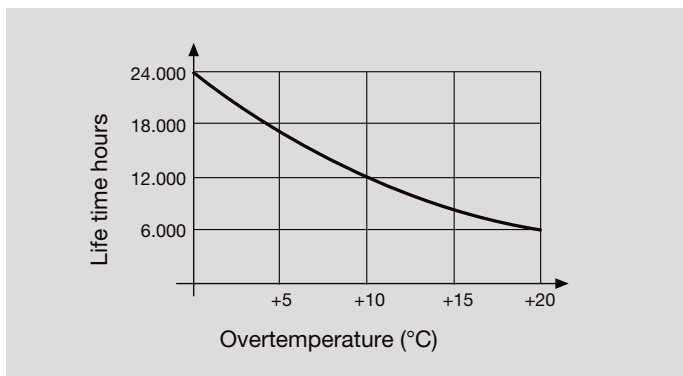
The electric motor is one of the most important operating devices in industry. Many times the shutdown of an industrial process is caused by a simple motor. High-cost production runs and valuable machinery can become paralysed at great cost, even more than the cost of rewinding the motor.

Experience shows that motor protection continues to be a problem, based on the number of breakdowns occurring 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 10°C 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 continuously 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  $\cos \varphi$  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.

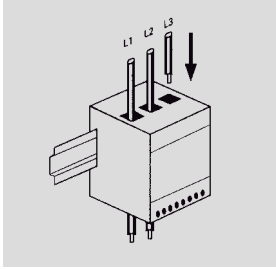
FANOX relays guarantee ideal protection for motors (pumps, compressors, fans, etc).

# Installation and Adjustment guide

## 1 INSTALLATION

### General

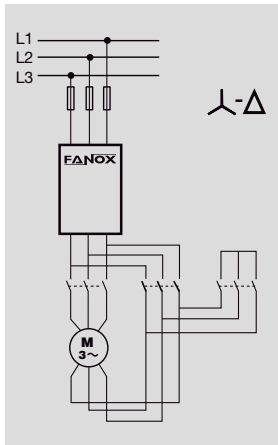
For correct installation and operation of Fanox relays, it is important to consider the following:



- 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:

<b>C</b>	16 mm <sup>2</sup>
<b>GL, P, PF, G, GEN</b>	35 mm <sup>2</sup>
<b>GL 200</b>	70 mm <sup>2</sup>



- 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 and G relays.

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 advisable 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:

	<b>C</b>	<b>GL</b>	<b>G</b>	<b>PS</b>	<b>P</b>	<b>PF</b>	<b>GEN</b>
<b>2.1 Select the trip class / tripping time</b>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>		1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>
<b>2.2 Adjust the <math>I_B</math> current of the relay</b>	2 <sup>nd</sup>	2 <sup>nd</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	2 <sup>nd</sup>	2 <sup>nd</sup>
<b>2.3 Adjust the <math>\cos \varphi</math> value (underload)</b>						3 <sup>rd</sup>	
<b>2.3 Adjust the <math>\cos \varphi</math> trip delay</b>						4 <sup>th</sup>	
<b>2.4 Adjust the undercurrent level <math>I_{&lt;}</math> (underload)</b>				2 <sup>nd</sup>	3 <sup>rd</sup>		
<b>2.5 Select ON /OFF incorrect phase sequence</b>		3 <sup>rd</sup>					
<b>2.6 Reset</b>	3 <sup>rd</sup>	4 <sup>th</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	3 <sup>rd</sup>

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.

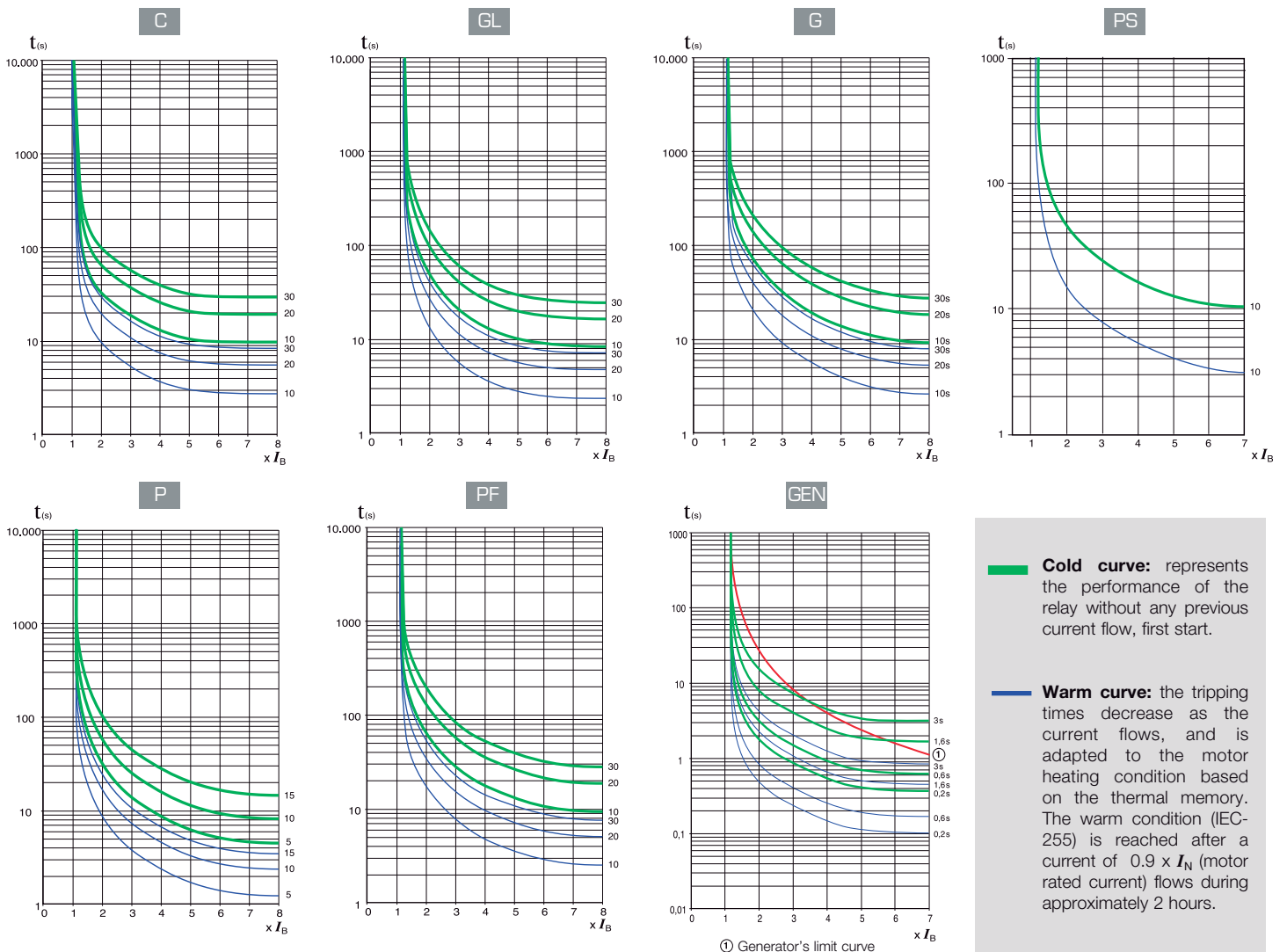
### Motor with direct start-up

Start time (s)	Trip classes												Trip time	
	Models													Model
	C9	C21	C45	GL16	GL40	GL90	GL200	P19	P44	P90	PF16-R	PF47-R		
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

Start time (s)	Trip classes												Trip time	
	Models													Model
	C9	C21	C45	GL16	GL40	GL90	GL200	P19	P44	P90	PF16-R	PF47-R		
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)



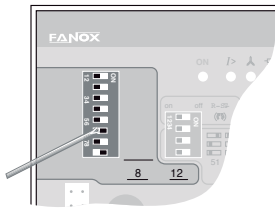
- Cold curve:** represents the performance of the relay without any previous current flow, first start.
- Warm curve:** the tripping times decrease as the current flows, and is adapted to the motor heating condition based on the thermal memory. The warm condition (IEC-255) is reached after a current of  $0.9 \times I_N$  (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  $1,1 \times I_B$

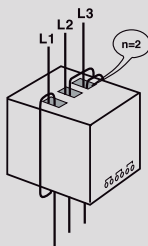


e.g.: relay GL16  
 $I_B = 8 + 4 = 12 \text{ A}$

- 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.

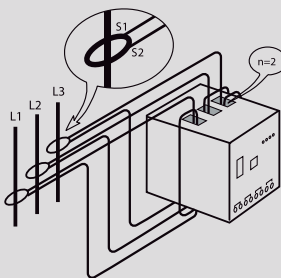
$$I_B = I_N$$

- 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  $n \geq 2$

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  $1,1 \times I_B$ .

$$I_B = I_N$$

## 2.3 Underload by $\cos \varphi$ . PF.

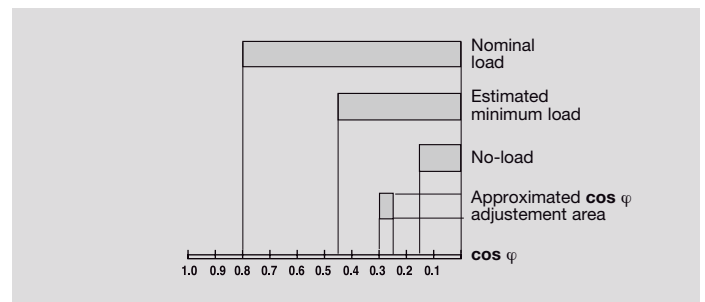
The  $\cos \varphi$  underload trip level is set by means of a potentiometer with settings from 0,15 to 1,0.

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

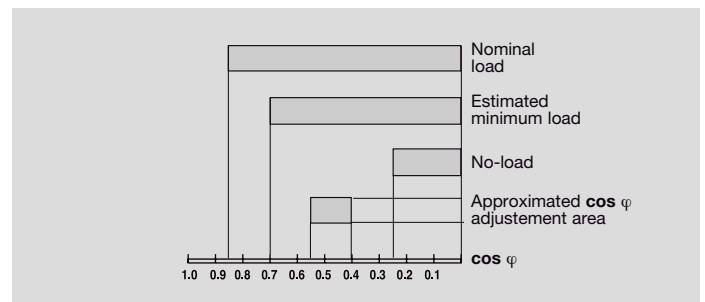
Select the underload trip delay from 5 to 45 seconds using the 3 corresponding dipswitches (trip delay).

For your guidance you can find two practical examples below.

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



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



If the above mentioned  $\cos \varphi$  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 ( $\cos \varphi$  setting), set the  $\cos \varphi$  value to the minimum: 0,15.
3. Set the reset time to the minimum value using the potentiometer ( $\cos \varphi$  reset time).
4. Start up the motor and run it with the minimum estimated load.
5. Slowly turn the  $\cos \varphi$  potentiometer clockwise until the relay trips and the  $\cos \varphi$  LED lights up.
6. Turn the  $\cos \varphi$  potentiometer anticlockwise until the  $\cos \varphi$  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.

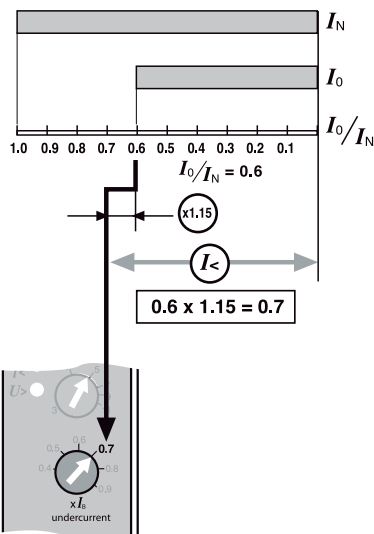
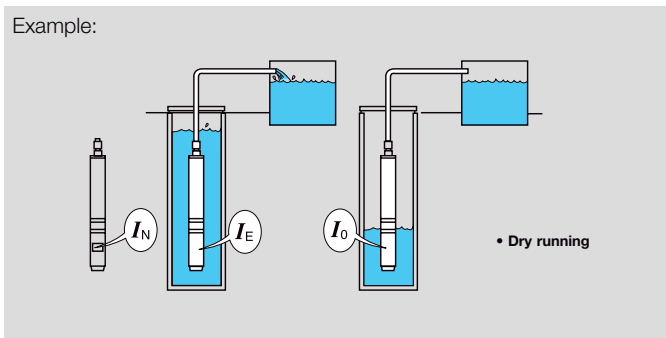
### Single phase relay PS

The setting of the underload trip level is made using a potentiometer in which 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:



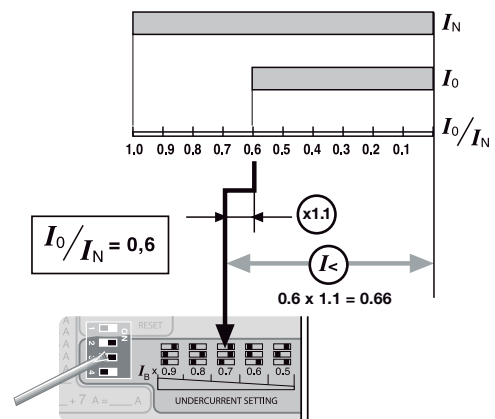
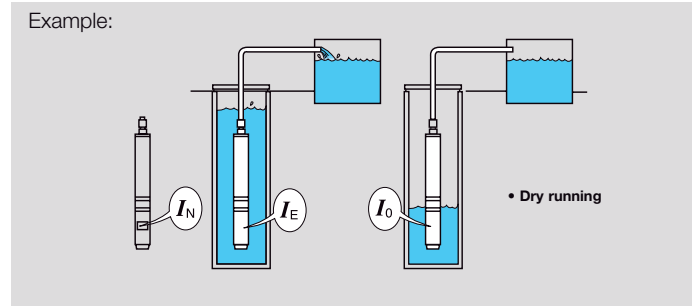
b) If the value of the  $I_b$  of the motor without load is unknown:

- 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 deactivate 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	-	-	-	-	-
$\cos \varphi$	-	-	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	-	-	-	-	-
$\cos \varphi$	-	-	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 auxiliary 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						
$\cos \varphi$	-	-	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
- Submersible 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	
$I_N$ (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	$I <$				JAM		$I_g / I_o$
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	$I >$	$I <$	$\cos \varphi$				$U >$
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	•			•		•	
GL 40	15 - 40,5	10 - 25	7,5 - 18,5	•			•		•	
GL 90	40 - 91	30 - 60	22 - 45	•			•		•	
GL 200	60 - 200	50 - 150	37 - 110	•			•		•	
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	-	-	•			•			

$I >$ Overload	$I <$ Undercurrent	$\cos \varphi$ Underload	 Phase loss Phase imbalance	 Phase sequence	 Overtemperature	$U > / U <$ Overvoltage / Undervoltage	$\ast_N$ Loss of neutral	 Locked rotor	JAM JAM	$I_g / I_o$ Earth leakage: differential/homopolar
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# 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.
- **Electrical multimeters** that measure up to 30 parameters of the power line being able to display all the values without programming changes.
- **Temperature and process controllers** that enable a reliable and simple, fast and accurate performance, combining PID function with Fuzzy Logic and Autotuning.
- **Timers** multifunction microprocessor with built-in battery that allows programming without connecting auxiliary voltage.



## 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

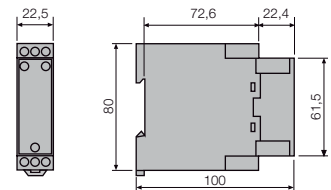
- Phase imbalance or phase loss
- Phase sequence

CE

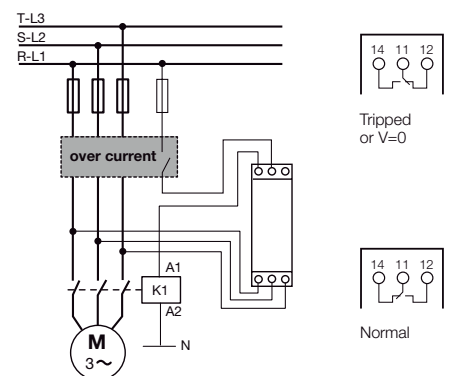
MODELS	S2	S4
Nominal voltage of the line to be monitored ( $\pm 15\%$ )	3 x 230 V	3 x 400 V
Voltage supply ( $\pm 15\%$ )	Self-powered (3-phase)	
Code	12033	12034

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 mm <sup>2</sup> , 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

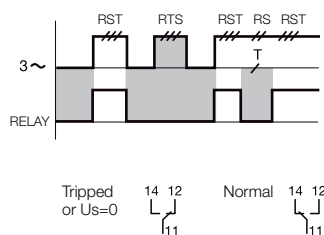
### DIMENSIONS S RELAY (mm)



### 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



### PROTECTION FUNCTIONS





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

ST-D

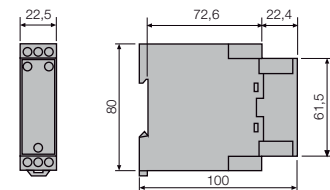


CE

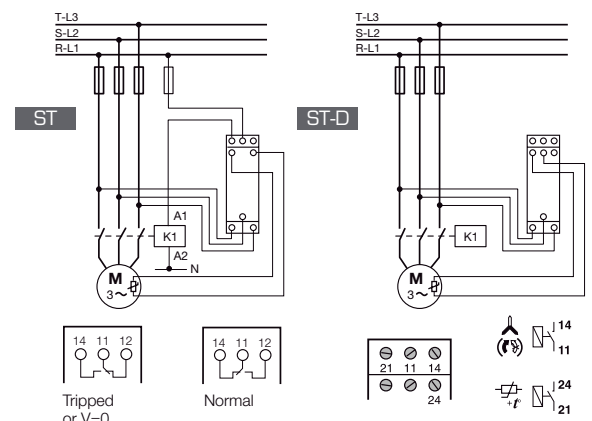
MODELS	ST2	ST4	ST2-D	ST4-D
Nominal voltage of the line to be monitored ( $\pm 15\%$ )	3 x 230 V	3 x 400 V	3 x 230 V	3 x 400 V
Voltage supply ( $\pm 15\%$ )	Self-powered (3-phase)			
Code	12001	12012	12002	12013

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	100 $\Omega$ / 1500 $\Omega$ - 2300 $\Omega$
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 mm <sup>2</sup> , 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

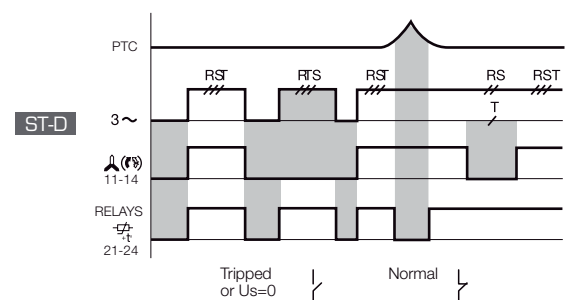
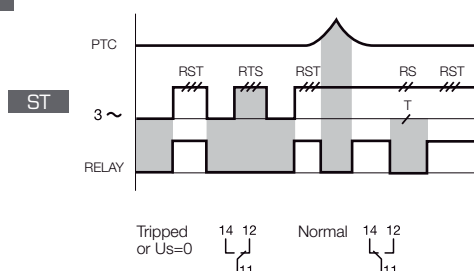
### DIMENSIONS ST RELAY (mm)



### 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



### PROTECTION FUNCTIONS T2

- Temperature variation

TST24



ODT  
External module



INT2  
Internal sensor

### PROTECTION FUNCTIONS TST24

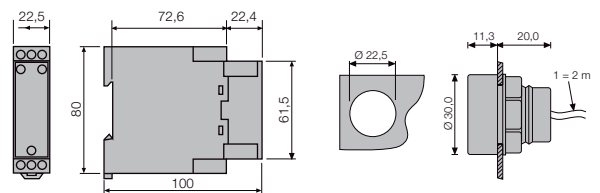
- Phase imbalance or phase loss
- Phase sequence
- Overtemperature
- Temperature variation
- Thermistor short-circuit



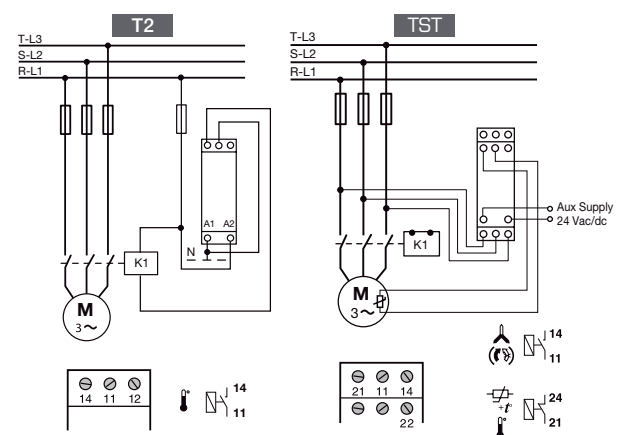
MODELS	T2		TST24	ODT2	INT2
Nominal voltage of the line to be monitored ( $\pm 15\%$ )	-		3 x 400 V	-	-
Voltage supply ( $\pm 15\%$ )	230 Vac (Aux)	24 Vac, dc (Aux)	24 Vac, dc (Aux)	-	-
Code	12051	12052	12090	12037	12036

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	<b>T2:</b> I <sub>n</sub> : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A <b>TST24:</b> I <sub>n</sub> : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A; DC13 - 115V - 0,2A
Maximum terminal section / screw torque	2,5 mm <sup>2</sup> , 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

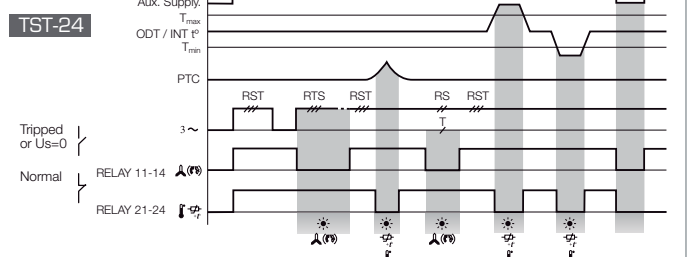
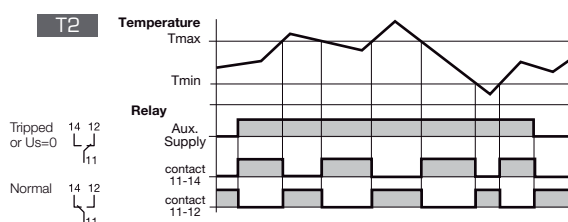
### DIMENSIONS (mm)



### WIRING DIAGRAM



### WORK LOGIC



## 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

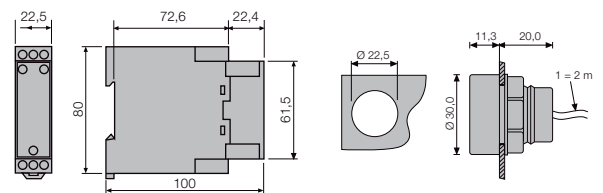
-  Overtemperature
-  Thermistor short-circuit



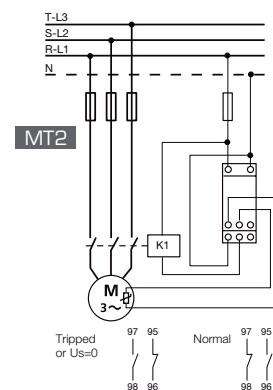
MODELS	MT2
Voltage supply (±15%)	230 Vac (Aux. supply)
Code	12039

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 +  + 
Output contacts	1 relay with NO-NC
Switching power	I <sub>m</sub> : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Maximum terminal section / screw torque	2,5 mm <sup>2</sup> , 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

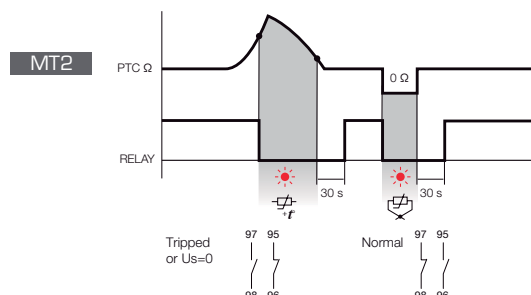
### DIMENSIONS (mm)



### 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

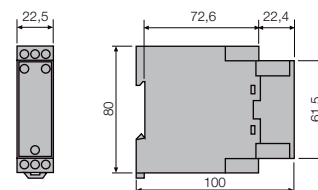
- $U>$  Overvoltage
- $U<$  Undervoltage



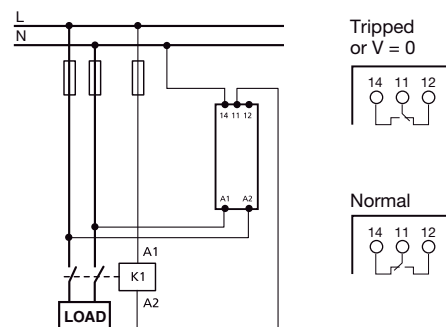
MODELS	U1D-24D	U1D-115	U1D-230
Frequency	DC	50/60 Hz	50/60 Hz
Maximum threshold V	23-28	105-135	215-275
Minimum threshold V	19-25	90-120	160-230
Code	12028	12026	12027

CHARACTERISTICS	
Type of supply to be monitored	Single phase
Auxiliary supply $\pm 10\%$	Self-powered
Accuracy	$U>$ +4% -1%; $U<$ +1% -4%
Trip time delay (TD)	0,1 to 6s ( $\pm 20\%$ ) for $U>$ $U<$
Reset time delay (RD)	<b>U1D:</b> 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	$I_n$ : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: Max. section / Screw torque	2,5 mm <sup>2</sup> , 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

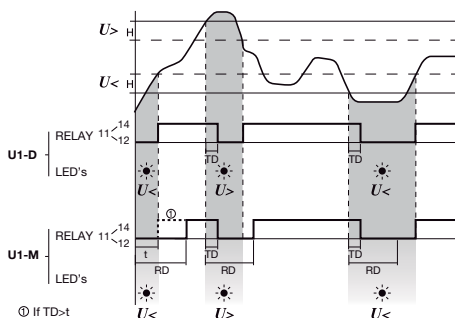
### DIMENSIONS U1D RELAY (mm)



### WIRING DIAGRAM



### WORK LOGIC



## 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.

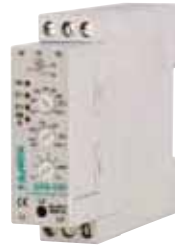
#### U3S model:

- 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:

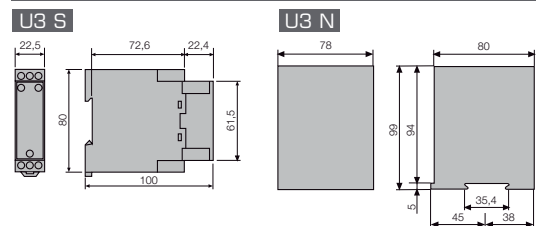
- $I_N$  Loss of neutral



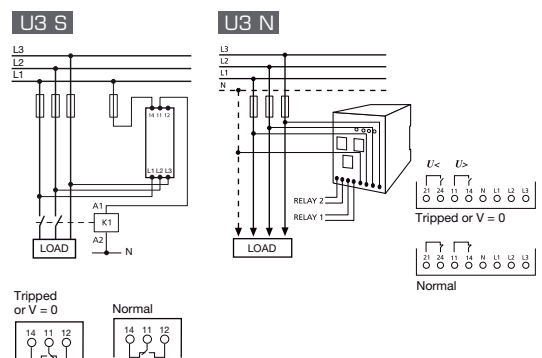
MODELS	U3S-230	U3S-420	U3N-230	U3N-400	U3N-440
Frequency	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Maximum threshold V	210-290	380-500	230-260	400-460	440-500
Minimum threshold V	185-230	350-430	200-230	340-400	380-440
Code	12071	12070	12056	12055	12057

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

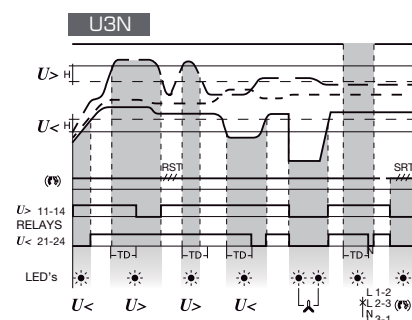
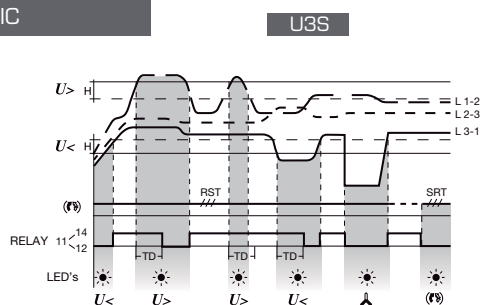
### DIMENSIONS RELAYS (mm)



### WIRING DIAGRAM








### WORK LOGIC



# Selection guide

## CONTROL RELAYS


MODELS	NOMINAL VOLTAGE	RANGE						$U >$	$U <$	$I_N$	$\frac{Hz >}{Hz <}$
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

$\cos \varphi$   
Underload

  
Phase loss  
Phase imbalance

  
Phase sequence

  
Overtemperature

$\frac{U >}{U <}$   
Overvoltage /  
Undervoltage

$I_N$   
Loss of neutral

$\frac{Hz >}{Hz <}$   
Overfrequency /  
Underfrequency

  
Max / Min  
temperature

  
Thermistor  
short-circuit

## Timers

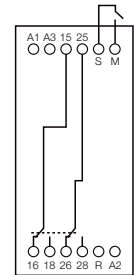
- Multifunction digital timer.
- Possibility of programming up to 9 different times. Each time can be set from 0,1 seconds to 99 hours.
- With built-in battery which allows timer to be programmed without connecting to auxiliary voltage. Complete battery discharge does not affect operation or adjustment 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 <sub>th</sub> : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Terminals: max section / screw torque	2,5 mm <sup>2</sup> , No. 22 - 12AWG / 20Ncm, 1,8 LB - IN
Mechanical / electrical life	>20 x 10 <sup>6</sup> operations / >10 <sup>5</sup> 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

**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:

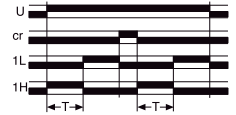
Each diagram represents the effect of the command contact for the two initial states of the output relay: de-energized (1L) and energized (1H).

#### cu Switched off contact

Its function is blocked

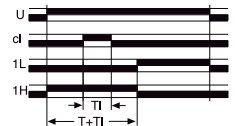
#### cr Reset contact

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.



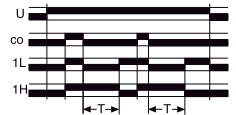
#### ci Delay on contact

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.



### 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.**

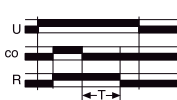
**Delay on**  
1L - CO - cu



**Timing on**  
1H - CO - cu



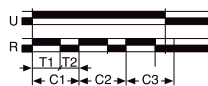
**Delay off**  
With command contact  
1H - CO - co



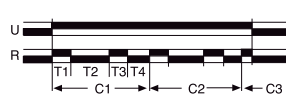
**Double timing**  
1L - CO - cu



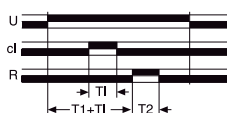
**Double timing**  
Cycle work mode  
1H - C1 - cu



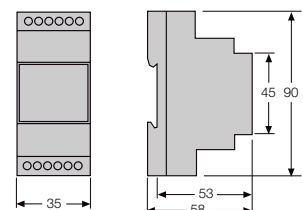
**Four timings**  
Cycle work mode  
1H - C1 - cu



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



### DIMENSIONS MTR 10 RELAY (mm)





## Electrical Multimeters

- Measure and display more than 30 parameters of a three phase line with or without neutral. True RMS values.
- All values can be read without making program changes.
- Reduced size 96x96 mm. Flush mounted in panel.
- EMM 5 and EMM 7 with ModBus communication.
- Displays with red LED's of 3 digits with 7 segments for easy reading.
- Membrane push-buttons.
- Automatic scale of units.
- With active, reactive and apparent energy counter.
- Calculates the current demand and the active, reactive and apparent power demand.
- Models with ModBus communication.
- Suitable for all electrical switchboards used in the industrial field for instruments, motors, generators, etc.
- The multimeter **EMM 3** has the functions of Amperemeter, Voltmeter and Frequencymeter.
- The multimeter **EMM 5** has pulses output and optional communication facility.
- The multimeter **EMM 7** has the following options:
  - X: Power supply of 20~60 Vac/dc.
  - Y: Power supply of 90~250 Vac/dc.
  - A: Analogue output.
  - D: Digital input for doble tariff of energy.
  - F: Profibus protocol.
  - N: Direct neutral measure.
  - T: Galvanic insulation on current inputs.
- **NRG Communication Software.**  
Available for models with communication.

EMM 3



EMM 5



EMM 7



### PARAMETERS

<b>V</b>	Voltage
<b>A</b>	Current
<b>Cos φ</b>	Power factor (PF)
<b>W</b>	Active power (P)
<b>VAr</b>	Reactive power (Q)
<b>VA</b>	Apparent power (S)
<b>kWh</b>	Active energy counter
<b>kVarh</b>	Reactive energy counter
<b>kVAh</b>	Apparent energy counter
<b>Hz</b>	Frequency
<b>°C</b>	Temperature
<b>Max</b>	Maximum values
<b>Avg</b>	Average values
<b>MaxD</b>	Maximum average values
<b>⌚</b>	Hour counter
<b>🔔</b>	Alarm

MODELS			EMM 3	EMM 5-P / EMM 5-C	EMM 7	
Code	according to the auxiliary supply of the electrical multimeter (±15%) 50/60 Hz	3-Phase Power Supply L2-L3	110 Vac	<b>41250</b>	<b>41265/41280</b>	<b>41295</b>
			230 Vac	<b>41255</b>	<b>41270/41285</b>	
			400 Vac	<b>41260</b>	<b>41275/41290</b>	

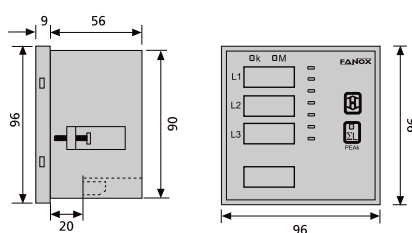
For 1-phase power supply please consult.

CHARACTERISTICS			
Supply	Self-powered	Self-powered	V.Aux.
Voltage input	4 wire input for 3 phase with or without neutral (in this case don't connect N)		
• Input impedance	1 MΩ	1 MΩ	1 MΩ
• Continuous overload	+ 20 %	+ 20 %	+ 20 %
Current input	From 0,02 to 5 A. Use always 3 CT.../5. Multimeters self-consumption < 0,5 VA		
• CT primary $I_N$ current	Range between 5 and 10.000 A. This value has to be programmed by the user in the multimeter		
• Continuous overload	+ 30 %	+ 30 %	+ 30 %
Communication RS485 ModBus	No	<b>EMM 5-P:</b> No / <b>EMM 5-C:</b> Yes	Yes
Digital output	No	<b>EMM 5-P:</b> Yes / <b>EMM 5-C:</b> No	Yes
Analogue output	No	No	Optional
Maximum terminal section	2,5 mm <sup>2</sup>		
Front protection degree / weight	IP52 / 0,5 kg		
Storage / operation temperature; humidity	-25 °C to 70 °C / -10 °C to 60 °C ; < 90 %		
Standards	IEC EN 50081-2, IEC EN 50082-1, IEC EN 61010-1		

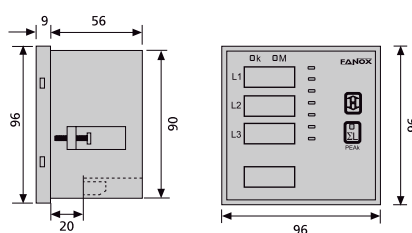
## MEASURED PARAMETERS

EMM 3	EMM 5	EMM 7	Parameters	Measured parameters				Range	Accuracy % ± digits
•	•	•	<b>V<sub>L-N</sub></b> Voltage	V <sub>L1-N</sub>	V <sub>L2-N</sub>	V <sub>L3-N</sub>	∑V <sub>L-N</sub>	20~290 V <sub>rms</sub>	±0,5 ± 1
•	•	•	<b>V<sub>L-L</sub></b> Voltage	V <sub>L1-2</sub>	V <sub>L2-3</sub>	V <sub>L3-1</sub>	∑V <sub>L-L</sub>	20~500 V <sub>rms</sub>	±0,5 ± 1
•	•	•	<b>A</b> Current	I <sub>L1</sub>	I <sub>L2</sub>	I <sub>L3</sub>	∑I <sub>L</sub>	0,02~5 A <sub>rms</sub>	±0,5 ± 1
		•	<b>N</b> Neutral Current	I <sub>n</sub>				0,02~5 A <sub>rms</sub>	±0,5 ± 1
	•	•	<b>PF</b> Power factor cos φ	PF <sub>L1</sub>	PF <sub>L2</sub>	PF <sub>L3</sub>	∑PF <sub>L</sub>	0,1~1 (+ind ; -cap)	±1 ± 1
	•	•	<b>W</b> Active power	P <sub>L1</sub>	P <sub>L2</sub>	P <sub>L3</sub>	∑P <sub>L</sub>	0,01~9990 kW	±1 ± 1
	•	•	<b>VAr</b> Reactive power	Q <sub>L1</sub>	Q <sub>L2</sub>	Q <sub>L3</sub>	∑Q <sub>L</sub>	0,01~9990 kVAr	±1 ± 1
	•	•	<b>VA</b> Apparent power	S <sub>L1</sub>	S <sub>L2</sub>	S <sub>L3</sub>	∑S <sub>L</sub>	0,01~9990 kVA	±1 ± 1
	•	•	<b>kWh</b> Active energy counter	∑kWh				0~10 <sup>9</sup> kWh	Class 2
	•	•	<b>kVArh</b> Reactive energy count.	∑kVArh				0~10 <sup>9</sup> kVArh	Class 2
	•	•	<b>kVAh</b> Apparent energy count.	∑kVAh				0~10 <sup>9</sup> kVAh	Class 2
•	•	•	<b>Hz</b> Frequency	F <sub>L1</sub>				40~500 Hz	±0,5 ± 1
	•	•	<b>°C</b> Temperature	T	Measured with internal sensor			0~70 °C	±2 °C
	•	•	⊕ Hour counter	H	Resolution in 1/10 of hour				±1 %
•	•	•	<b>Max</b> Maximum values	V <sub>L1-N max</sub>	V <sub>L2-N max</sub>	V <sub>L3-N max</sub>		Values every second	
•				V <sub>L1-L2 max</sub>	V <sub>L2-L3 max</sub>	V <sub>L3-L1 max</sub>			
•	•	•		I <sub>L1 max</sub>	I <sub>L2 max</sub>	I <sub>L3 max</sub>			
		•		I <sub>N max</sub>					
	•	•		∑W <sub>max</sub>	∑VAr <sub>max</sub>	∑VA <sub>max</sub>			
•			<b>Min</b> Minimum values	V <sub>L1-N min</sub>	V <sub>L2-N min</sub>	V <sub>L3-N min</sub>			
	•	•	<b>Avg</b> Average values	I <sub>L1 avg</sub>	I <sub>L2 avg</sub>	I <sub>L3 avg</sub>		Values over last 15 minutes	
		•		I <sub>N avg</sub>					
	•	•		∑W <sub>avg</sub>	∑VAr <sub>avg</sub>	∑VA <sub>avg</sub>			
•	•	•	<b>MaxD</b> Maximun average val.	I <sub>L1 max (avg)</sub>	I <sub>L2 max (avg)</sub>	I <sub>L3 max (avg)</sub>		Values over last 15 minutes	
		•		I <sub>N max (avg)</sub>					
	•	•		∑W <sub>max (avg)</sub>	∑VAr <sub>max (avg)</sub>	∑VA <sub>max (avg)</sub>			

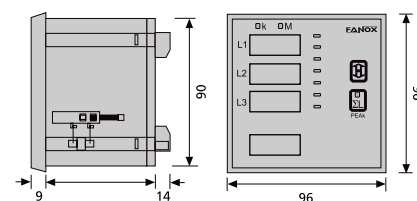
DIMENSIONS EMM 3 RELAY (mm)



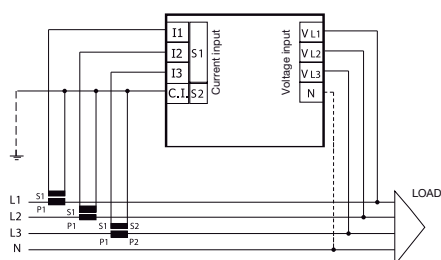
DIMENSIONS EMM 5 RELAY (mm)



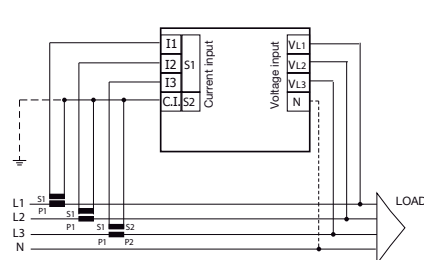
DIMENSIONS EMM 7 RELAY (mm)



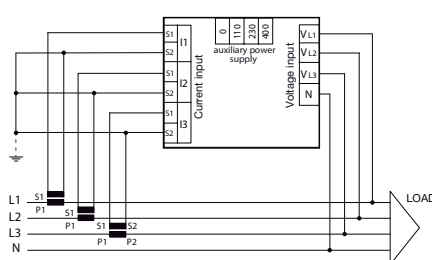
WIRING DIAGRAM EMM 3



WIRING DIAGRAM EMM 5



WIRING DIAGRAM EMM 7



## Temperature and Process Controllers

- Provide simple reliable and economic control of industrial processes.
- Complete range of controllers adapted to most industrial applications.
- Quick and exact operation as result of PID action improved with FUZZY logic.
- Permit calculation of the most efficient parameters thanks to the AUTOTUNING function.
- ModBus RS485 Communication.

### INDUSTRIES AND APPLICATIONS

- Chemical Industries
- Plastics treatment industries
- Paper processing industries
- Welding equipment
- Oven manufacturing
- Other types of industries and applications...

### PROCESSES

- Control of temperature, pressure, flow, level, volume processes, etc...
- Industrial equipment control
- Valve positioners control
- Servo operation and speed variators control
- Process limit values control
- Other types of processes...

TP 720



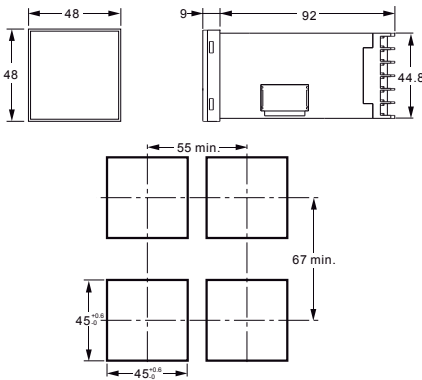
TP 731



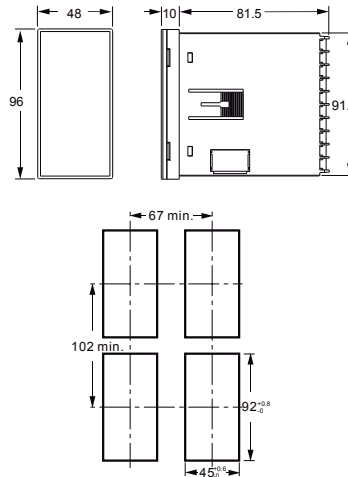
TP 750



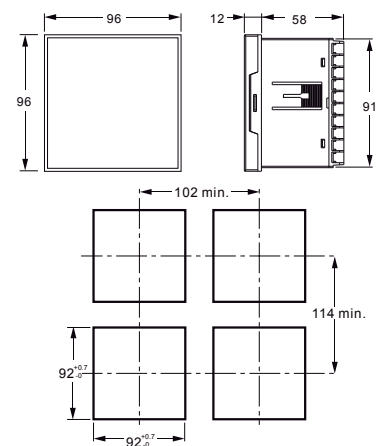
DIMENSIONS TP 720 RELAY (mm)



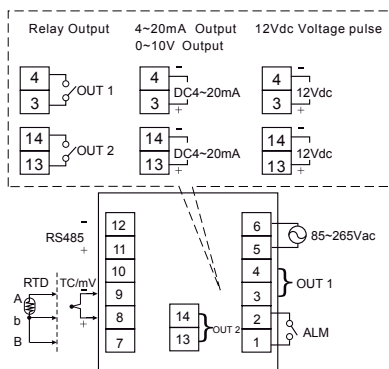
DIMENSIONS TP 731 RELAY (mm)



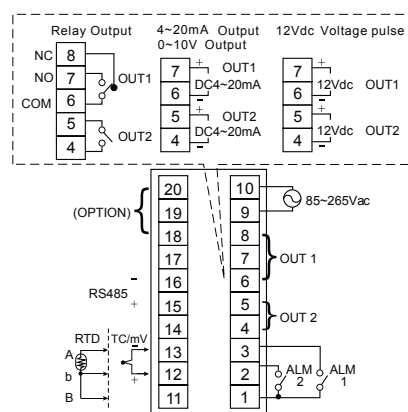
DIMENSIONS TP 750 RELAY (mm)



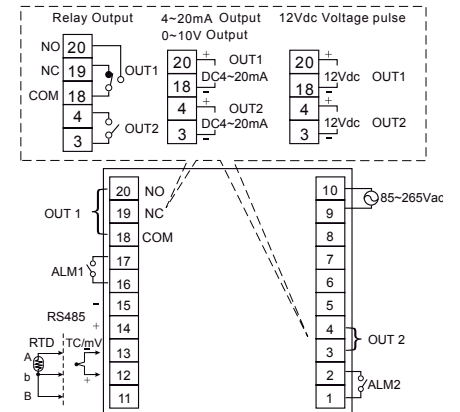
WIRING DIAGRAM TP 720



WIRING DIAGRAM TP 731



WIRING DIAGRAM TP 750



SPECIFICATIONS	
Power Supply	85~265 Vac, 50/60 Hz
Power Consumption	7 VA
Input resistance	> 1 MΩ
Input compensation	-1999~9999
Digital filtering	10~100 Times
Settings range	-1999~9999

INPUT SIGNAL	RANGE	ACCURACY
<b>Thermocouple</b>		
K	-200 ~ 1270 °C	0,3 % ± 1 digit
J	-210 ~ 1200 °C	0,3 % ± 1 digit
R (1)	-50 ~ 1760 °C	0,3 % ± 1 digit
S (1)	-50 ~ 1760 °C	0,3 % ± 1 digit
B (2)	250 ~ 1820 °C	± 8°C ± 1 digit
E	-200 ~ 1000 °C	0,3 % ± 1 digit
N	-200 ~ 1300 °C	0,3 % ± 1 digit
T	-200 ~ 400 °C	± 2°C ± 1 digit
<b>RTD</b>		
PT100	-200 ~ 850 °C	0,3 % ± 1 digit
JPT100	-200 ~ 850 °C	0,3 % ± 1 digit
<b>Analogue signal</b>		
mV	0 ~ 350 mV	0,3 % ± 1 digit
mA(3)	4~20 mA	

(1) R & S, accuracy ± 19°C when the range is 0~500°C  
(2) B does not guarantee accuracy for the range 0~400°C  
(3) mA only for TP 720

ALARM FUNCTION	
Types of alarm	Absolute value alarm Discrepancy alarm Area alarm
Set value	0 ~ 99 s
Alarm Output	SPST NA, 5A/250Vac (TP 720 3A)
Method of action	Alarm activation Deactivation delay
Output signal	Alarm relay output

OTHER FUNCTIONS	
Sensor break detection	Indication on front (TP 720)
Irregularities detection at heater supply	Alarm when there is no current or the set value is reached (TP 720)
Remote setting	Capacity to change adjustment
Parameters lock	3 access levels which permit:
Level 1	Input signal, alarm adjustment, adjustment values, control type
Level 2	Alarm adjustment, adjustment values, control type
Level 3	Total lock

MARK	EN 61010, EN 61000, EN 55011
------	------------------------------

CONTROL FUNCTIONS	
Control method	ON/OFF PID + Autotuning PID + FUZZY + Autotuning
Fraction value	0~9999
Integral time	0~9999
Differential time	0~9999
Hysteresis Alarm setting	0~9999
Sampling interval	0,2 s
Output control cycle	0,1~999,9 s

OUTPUT SIGNAL			
Main control	<b>TP 720</b>	<b>TP 731</b>	<b>TP 750</b>
Relay	SPST NO 3A/250Vac	SPDT NO-NC 5A/250Vac	SPDT NO-NC 5A/250Vac
Pulse (SSR)	0/12 Vdc (NPN) ; Max. 20 mA		
Analogue (Retransmission)	4~20 mA 0~10 Vcc Max. 600 Ω		
Secondary Control	<b>TP 720</b>	<b>TP 731</b>	<b>TP 750</b>
Relay	SPST NO 3A/250Vac	SPST NO 5A/250Vac	SPST NO 5A/250Vac
Pulse (SSR)	0/12 Vdc (NPN) ; Max. 20 mA		
Analogue (Retransmission)	4~20 mA 0~10 Vdc Max. 600 Ω		

STRUCTURE			
Models	<b>TP 720</b>	<b>TP 731</b>	<b>TP 750</b>
Assembly	On panel	On panel	On panel
IP Protection	IP 65	IP 56	IP65

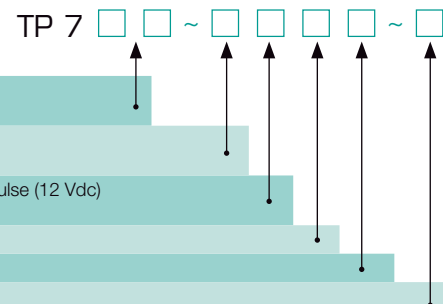
COMMUNICATIONS	
Interface	RS485
Protocol	ModBus RTU or ASCII
Data Format	8 bits, Bit Check: odd/even/none Stop Bit: 1 or 2 bits
Speed (bauds)	600, 1200, 2400, 4800, 9600, 19200, 38000
Address	000~255
Memory	EEPROM

LED'S			
Models	<b>TP 720</b>	<b>TP 731</b>	<b>TP 750</b>
Output	x 1	x 2	x 2
Alarm	x 1	x 2	x 2
Celsius			x 1
Fahrenheit			x 1

7 SEGMENT DISPLAY			
Models	<b>TP 720</b>	<b>TP 731</b>	<b>TP 750</b>
Red PV	0,36"	0,36"	0,56"
Green SV	0,28"	0,36"	0,36"

## TP 7 MODEL LIST

Dimensions	20 · 48 x 48 mm 31 · 48 x 96 mm	50 · 96 x 96 mm	
Control Output 1	1 · Output relay 2 · Output 4~20 mA	3 · Output 0~10 Vdc 4 · Voltage pulse (12 Vdc)	
Control Output 2	0 · None 1 · Output relay	2 · Output 4~20 mA 3 · Output 0~10 Vdc	4 · Voltage pulse (12 Vdc)
Alarm Output	1 · 1 set	2 · 2 sets	
Retransmission	0 · None	1 · 4~20 mA DC	
Communications	0 · None 1 · RS485	2 · Heater break detection (only TP 720)	



Other options, configurations or sizes, please consult

## Circular Amp Chart Recorder

### AMP CHART RECORDER

Circular Chart Recorder products serves industrial market requirements for high quality data acquisition and monitoring products and systems.

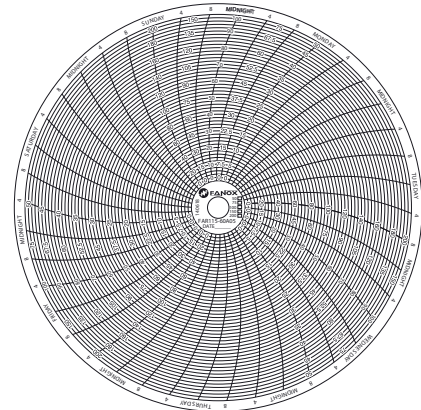
- Highly Precise sealed potentiometer as a feedback element.
- Highly precise & Accurate Stepper motor.
- Calibration through 2 potentiometers.
- Simple Interface
- IP 65

Specifically designed for alternant current. In case customer provides external transmitter adapted to FAR input signal, other variable processes could be registered.

### FAR



### CIRCULAR CHART REGISTRY



Model	Code
FAR 115-60A05	41725

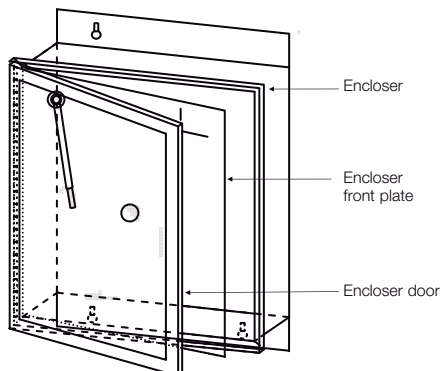
### CHARACTERISTICS

Power Supply	110 VAC - 50 / 60 Hz
Accuracy	1.5 % F.S.
Input Signal Range	0-5 Aac Current
Chart Speed	Selectable 24 HRS/REV or 168 HRS/REV
Chart Speed Variation	±2% 50/60 Hz
Operating Conditions	0 to 50 °C & 0 to 80% RH
Disposable Fiber tip Pen	Red/Green
Mounting	Wall / Panel mountable Encloser

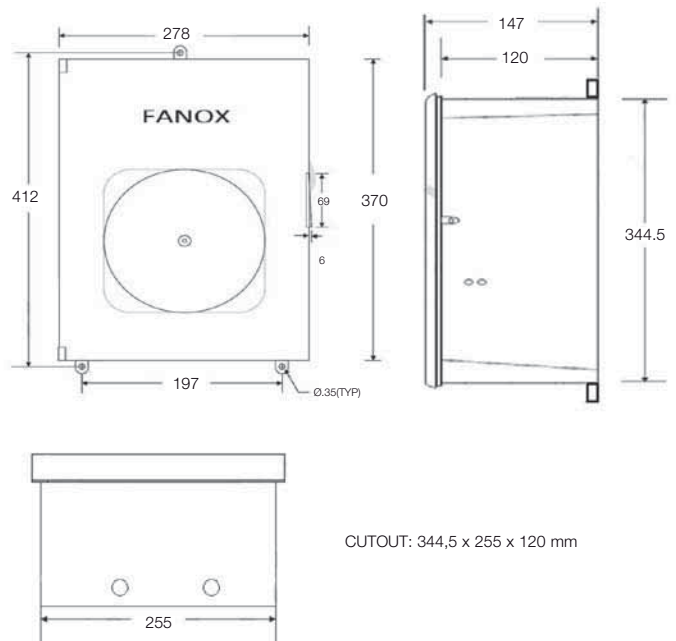
### ACCESORIES

Charts	50 for each recorder
Pens	5 for each recorder

### DESIGN



### DIMENSIONS and CUTOUT (mm)



## Current Measurement for Chart Recorder

### MULTITAP TRANSFORMER

- Ratings: 200 / 150 / 100 / 75 / 50:5, 10VA.
- 600V, 10 kV.
- Laminated Steel Core.
- Ext. PVC coating.

Model	Code
CT MULTITAP 50-75-100-150-200/5	41726

### Accuracy class 0.5

Primary .../ 5A	Burden
50	5VA
75	5VA
100	5VA
150	7.5VA
200	10VA

### 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 60.695-2-11 Glow wire test

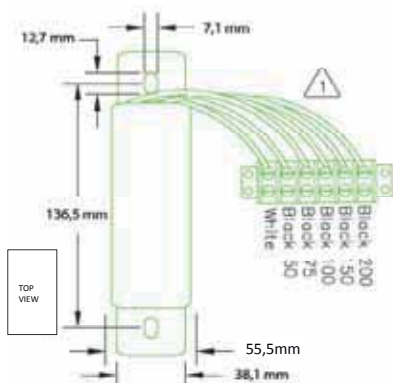
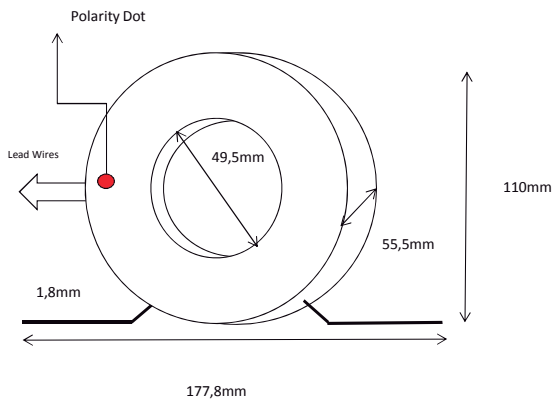
### CT-M



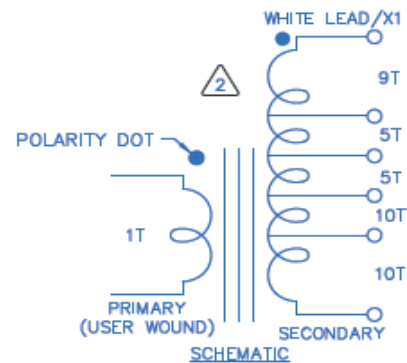
### INDIVIDUAL TESTS

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 [mm]



### WINDING

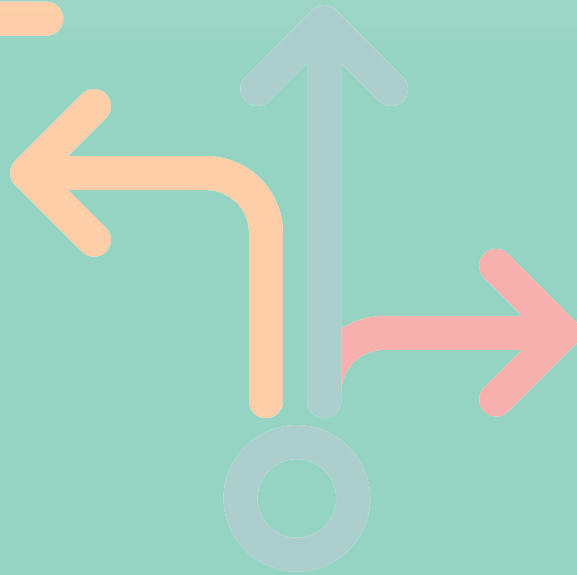
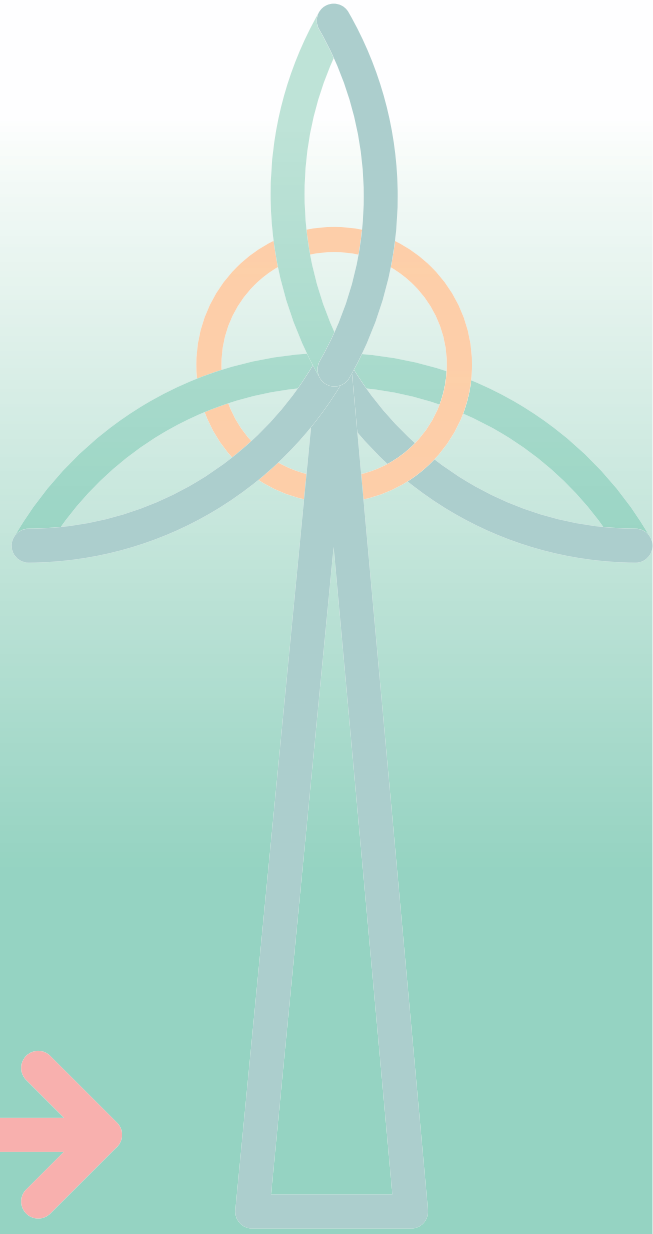


### NOTES:

- LEAD WIRES ARE #12 AWG STYLE 1015, 105°C, 600V, 2,5 mm<sup>2</sup>
- WINDING WIRE IS REA #14 AWG HTAIH
- LEAD WIRES LENGTH 180 mm



25  
years  
of protection

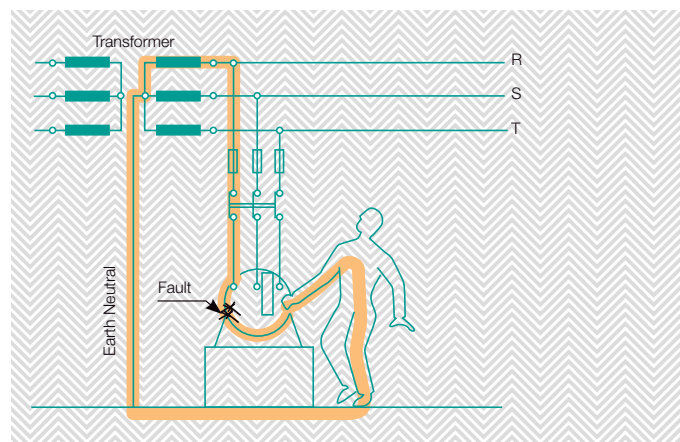
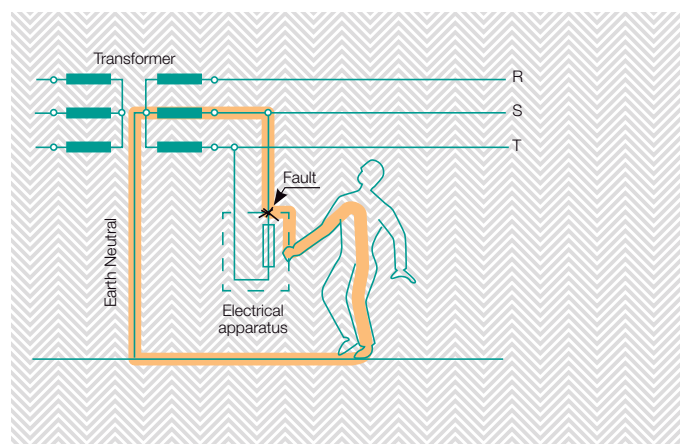


## Introduction

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.



## 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).

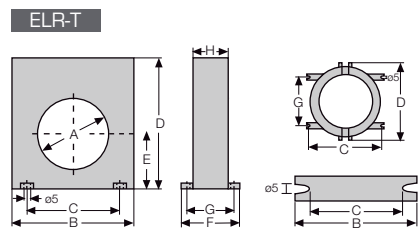
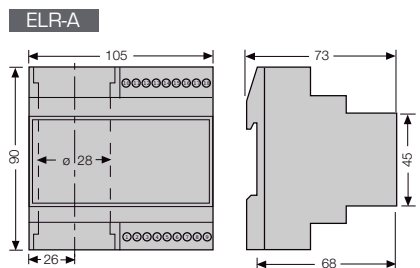
### ELR-T



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

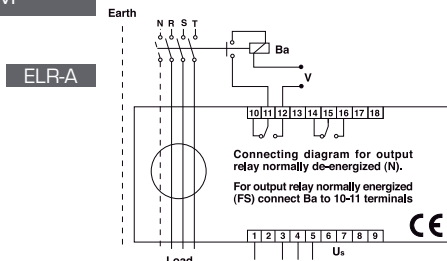
CHARACTERISTICS	
Toroidal transformer	<b>ELR-A:</b> Built-in Ø28 mm / <b>ELR-T:</b> Built-in Ø60 mm and Ø110 mm
Max. length between relay and transformer	-
Reset mode	Automatic, manual and remote (in manual mode disconnect the aux. supply during 1s)
Signalling LED's	2 LED's: ON + Trip
Output contacts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



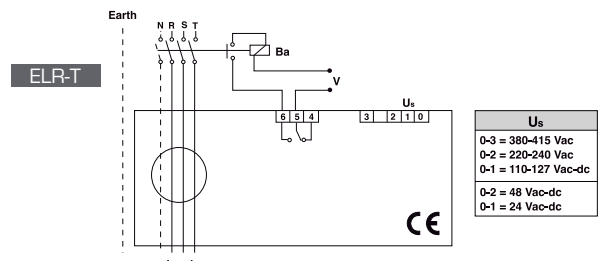
	A	B	C	D	E	F	G	H	K
<b>ELR-T60</b>	60	100	60	110	47	70	60	50	-
<b>ELR-T110</b>	110	150	110	160	70	70	60	50	-

### WIRING DIAGRAM



**U<sub>s</sub>**

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



**U<sub>s</sub>**

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

- *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 120).
- Modular size. DIN rail mounting.
- Sealable front cover.

### ELR-B



### MULTIRANGE RELAY

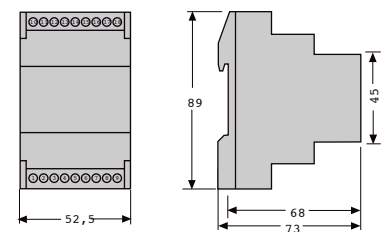
- *Electronic relays with adjustable time delay and sensitivity.*
- *Suitable for direct pulse current.*
- *Immune to external disturbances.*
- To be used with CT-1 and CTD-1 toroidal transformers (See page 120).
- Modular size. DIN rail mounting.
- Sealable front cover.

### ELR-3C



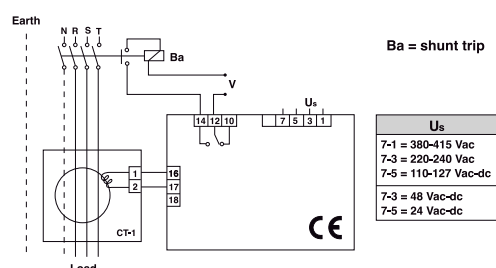
MODELS	ELR-B		ELR-3C	
Sensitivity	0,3 A or 0,5 A		Adjustable from 0,025 A to 25 A	
Trip time delay	0,02 s or 0,5 s		Adjustable from 0,02 s to 5 s	
Aux. voltage supply 50/60 Hz	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac	24-48 Vdc, ac	110 Vdc, ac 230-400 Vac
Code	<b>41012</b>	<b>41010</b>	<b>41005</b>	<b>41000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

### DIMENSIONS (mm)



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 mm <sup>2</sup>
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

### 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 120).
- 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 120).
- Suitable for electrical distribution boards and control panels in general.
- Sealable front cover

### DM30

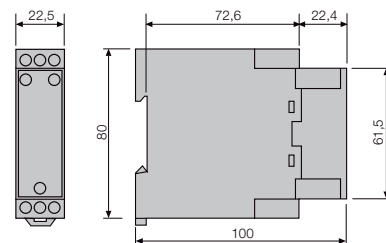


MODELS	D30		DM30	
Sensitivity	Adjustable from 0,03 A to 30 A		Adjustable from 0,03 A to 30 A	
Trip time delay	Adjustable from 0,02 s to 5 s		Adjustable from 0,02 s to 5 s	
Aux. voltage supply 50/60 Hz	120 Vac	230 Vac	120 Vac	230 Vac
Code	<b>41021</b>	<b>41020</b>	<b>41023</b>	<b>41022</b>

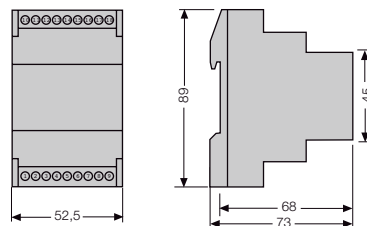
CARACTERÍSTICAS				
Toroidal transformer	In combination with CT-1			
Max. length between relay and transformer	Cable section mm <sup>2</sup>			
	0,22 mm <sup>2</sup>	0,75 mm <sup>2</sup>	1 mm <sup>2</sup>	1,5 mm <sup>2</sup>
	Max. length m			
	15 m	55 m	75 m	110 m
Reset mode	Automatic, manual and remote (in manual mode disconnect the aux. Supply during 1s)			
Signalling LED's	2 LED's: ON + $\frac{1}{2}$ (trip)			
Output contacts mode	Selectable: normally de-energized (N) or energized (P)			
Output contacts	1 change over NO-NC			
Switching power (resistive load)	I <sub>th</sub> : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A			
Maximum terminal section	2,5 mm <sup>2</sup>			
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)

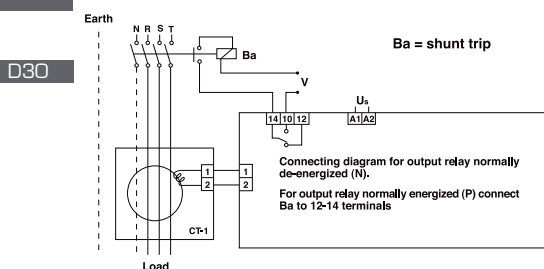
#### D30



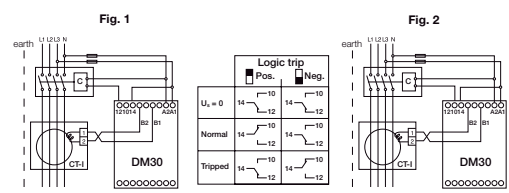
#### DM30



### WIRING DIAGRAM



### DM30



	C Undervoltage trip coil Contactor	C Shunt trip coil	Trip Logic
Safety Priority	Fig. 2	Fig. 1	Posit. $\frac{1}{2}$
Service Priority	Fig. 1	Fig. 2	Negat. $\frac{1}{2}$

## 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 120).
- Suitable for electrical distribution boards in general.
- Sealable front cover.

### DR30F



### DR30A

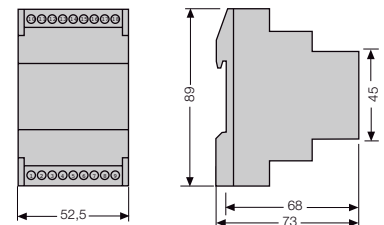


MODELS	DR30F			DR30A		
Reclosing time	60 s			Adjustable from 1 s to 60 s		
Sensitivity	Adjustable from 0,03 A to 30 A					
Trip time delay	Adjustable from 0,02 s to 5 s					
Aux. voltage supply 50/60 Hz	120 Vac	230 Vac	24 Vdc	120 Vac	230 Vac	24 Vdc
Code	<b>41026</b>	<b>41024</b>	<b>41027</b>	<b>41028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

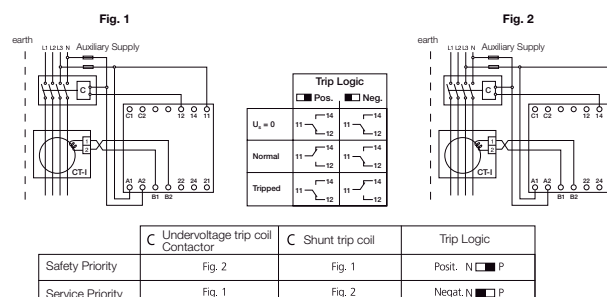
CHARACTERISTICS	
Toroidal transformer	In combination with CT-1
Max. length between relay and transformer	Cable section mm <sup>2</sup>
	0,22 mm <sup>2</sup> 0,75 mm <sup>2</sup> 1 mm <sup>2</sup> 1,5 mm <sup>2</sup>
	Max. length m
	15 m    55 m    75 m    110 m
Reset mode	Automatic, manual and remote (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 <sub>th</sub> : 5A; AC15 - 250V - 2A; DC13 - 30V - 2A
Maximum terminal section	2,5 mm <sup>2</sup>
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)

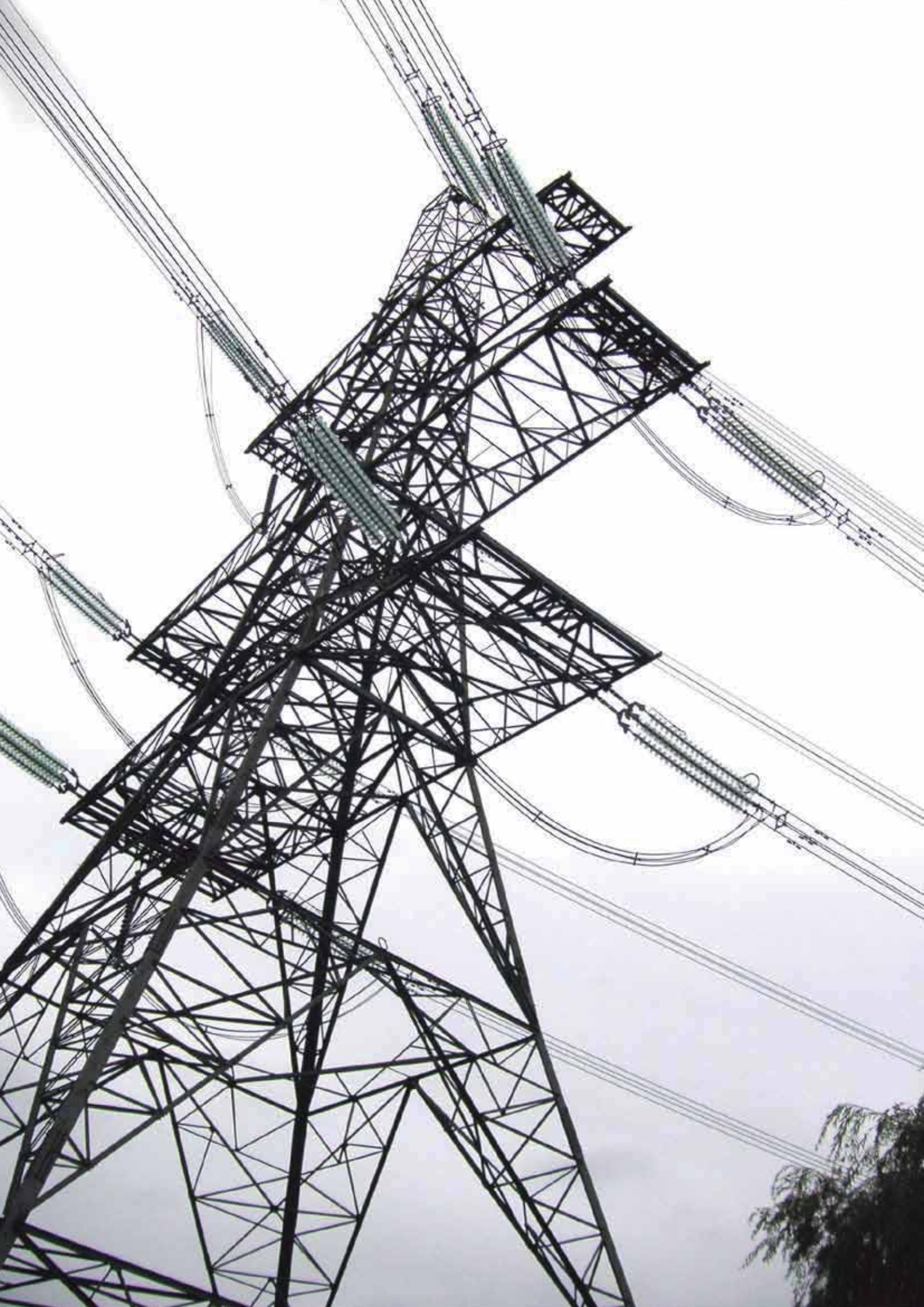
#### DR30



### WIRING DIAGRAM







## 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.



## Protection & Measurement for Low Voltage

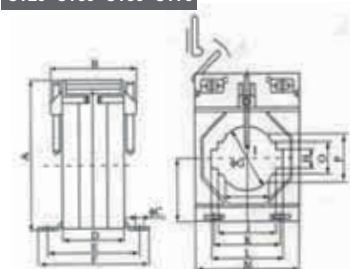
### CURRENT TRANSFORMERS

- 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

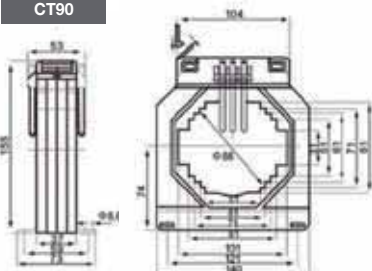
### DIMENSIONS CT (mm)

CT20 CT30 CT50 CT70

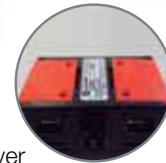


mm	CT 20	CT 30	CT 50	CT 70
G Ø	30,5	31,5	1	65
A	78	78	110	126
B	47	47	56	56
C	6,6	6,6	6,6	6,6
D	35	35	40	40
E	55	55	62	62
F	71	71	76	76
H	11	11	12	12
I	11	16	21	21
J	26	31	51	61
K	44	44	68	86
L	31	41	61	81
M	62	62	86	104
O	21	21	31	31
P	26	26	44	56

CT90



CT



Sealable plastic cover

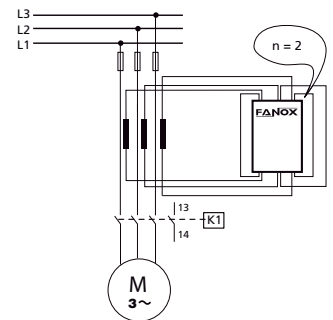
CE

### CHARACTERISTICS

Overload	1,2 I <sub>n</sub>
Max. line voltage bus-bars / cable	1000V
Frequency	50 / 60 Hz
Shrot circuiting termnial blocks for open secondary	YES
Maximum voltage U <sub>m</sub>	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.

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 / cable 1000V	660V / 1000V
Frequency	50 / 60 Hz
Shrot circuiting terminal blocks for open secondary	YES
Maximum voltage $U_m$	0,72 kV
Isolation voltage	3 kV

CT



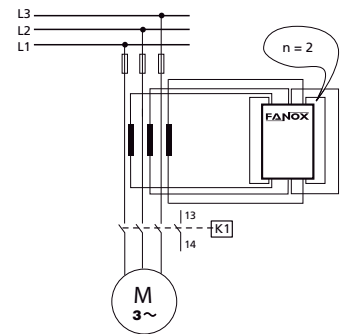
Sealable plastic cover



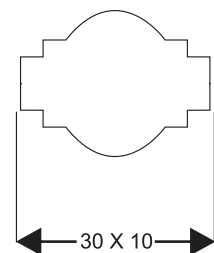
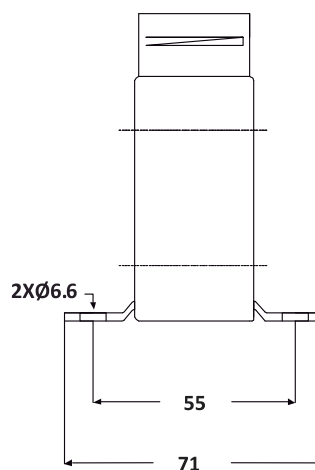
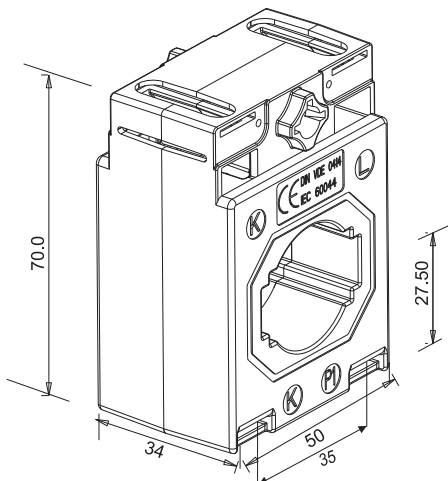
CE

### 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.

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

### CHARACTERISTICS

Overload	$1,5 I_N$
Frequency	50/60 Hz
Maximum Voltage Um	0,72 kV
Isolation voltage	3 kV
Short circuit thermal current I <sub>th</sub>	72 kA
Short circuit dynamic current I <sub>dyn</sub>	2,5 x I <sub>th</sub>
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

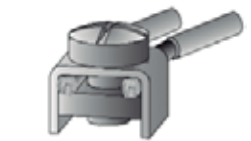
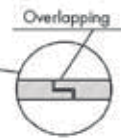
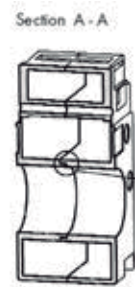
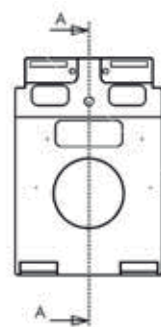
### SUITABLE WIRES AND SECTORS CT80II

1x240 mm <sup>2</sup> / 2x240 mm <sup>2</sup> / 3x240 mm <sup>2</sup> / 4x240 mm <sup>2</sup> / 5x240 mm <sup>2</sup>
1x300 mm <sup>2</sup> / 2x300 mm <sup>2</sup> / 3x300 mm <sup>2</sup>
Primary passing through minimum dimensions (mm <sup>2</sup> ) 81x65

### CT80II



### CT4II



Housing closing detail

Section  
2,5x4 mm

### INDIVIDUAL TESTS

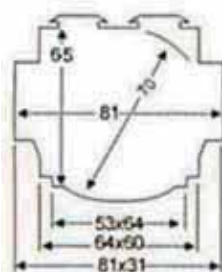
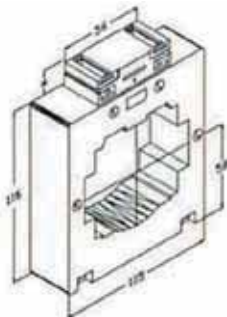
UNE-EN 60 044-1 (8.1, 11.7, 12.7) Terminal marking and nameplate
UNE-EN 60 044-1 (5.3) Frequency withstand volt. between secondary windings
UNE-EN 60 044-1 (8.4) Overvoltage tests between turns
UNE-EN 60 044-1 (11.4, 11.5) Determination of errors

### SUITABLE WIRES AND SECTORS CT4II

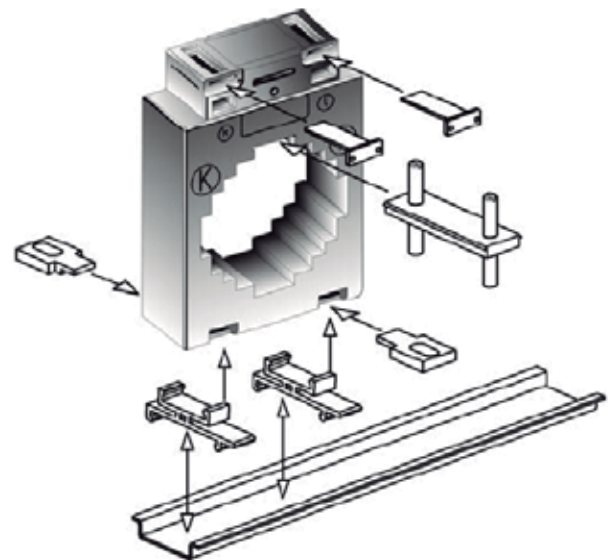
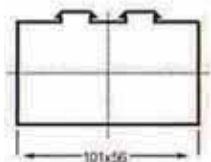
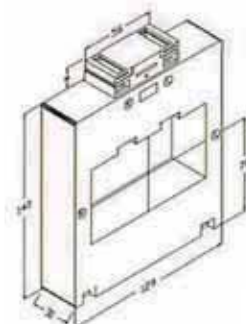
Cu: 1x300 mm <sup>2</sup> / 2x300 mm <sup>2</sup> / 3x300 mm <sup>2</sup> / 4x300 mm <sup>2</sup>
Al: 2x240 mm <sup>2</sup> / 3x240 mm <sup>2</sup> / 4x240 mm <sup>2</sup> / 5x240 mm <sup>2</sup>
Primary passing through minimum dimensions (mm <sup>2</sup> ) 3x100x12 mm

### 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

### ELECTRICAL CHARACTERISTICS

Frequency	50/60 Hz
Transformer ratio	400/5
Maximum Voltage secondary open	48 V <sub>peak</sub>
Accuracy voltage	5 VA
Maximum Voltage U <sub>m</sub>	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 <sup>2</sup>	2,5 mm <sup>2</sup>
Cable length	6 m	10 m
Inner diameter	60 mm maximum	
Outer diameter	110 x 90 mm	
Height	35 mm	

### 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

### CT60II EXT



CE

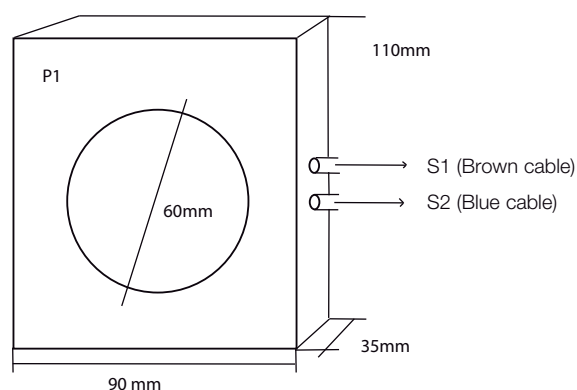
### INDIVIDUAL TESTS

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)

### 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 $I_n$
Frequency	50 / 60 Hz
Shrot circuiting terminal blocks for open secondary	YES
Maximum voltage $U_m$	0,72 kV
Isolation voltage	3 kV
Short circuit thermal current $I_{th}$	72 kA
Short circuit dynamic current $I_{dyn}$	2,5 x $I_{th}$
Accuracy limit	120 %
Security factor	5

### 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

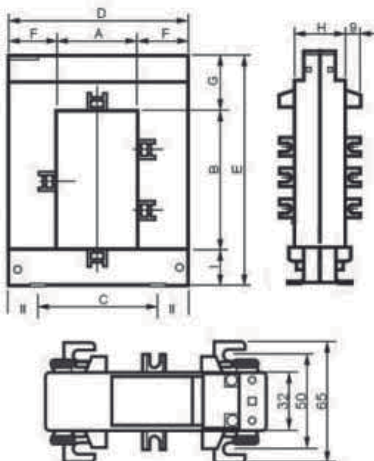
### STANDARDS

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	CT 80I	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.

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

### CHARACTERISTICS

Overload	1,5 $I_N$
Frequency	50/60 Hz
Short circuiting terminal blocks for opensecondary	YES
Maximum voltage secondary open	48 V
Maximum Voltage $U_m$	0,72 kV
Isolation voltage	3 kV
Short circuit thermal current $I_{th}$	72 kA
Short circuit dynamic current $I_{dyn}$	2,5 x $I_{th}$
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

### ADMISSIBLES STEPS

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

### CT80II ABR



Sealable plastic cover

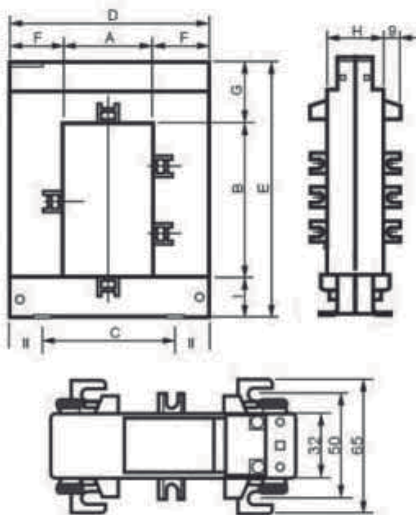


CE

### 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

### DIMENSIONS CT (mm)



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

## 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.

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

CT

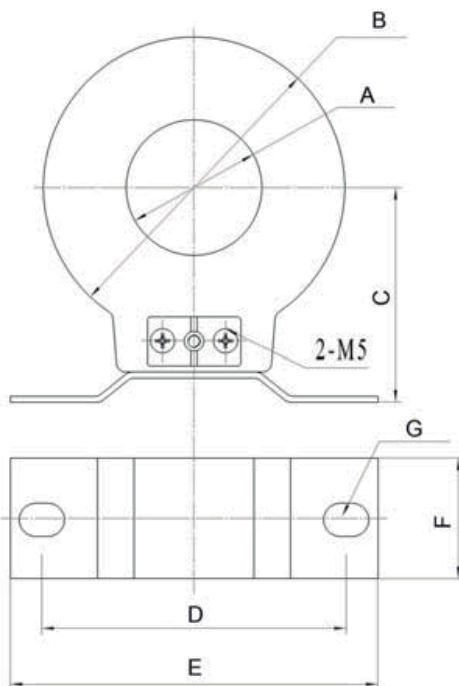


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### CHARACTERISTICS

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	44	44	45	30
B	102	102	100	89
C	74	74	73	70,5
D	102	102	101	85
E	123	123	122	112
F	120	80	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.

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 °C, U.R./R.H <90% n.c.
Storage temperature	De -20 a +70 °C
Connections	Screw, Max 1,5 mm2

CE

CT-1



CT-1/35...210



CT-1/300  
CT-1/350



CT-1/400



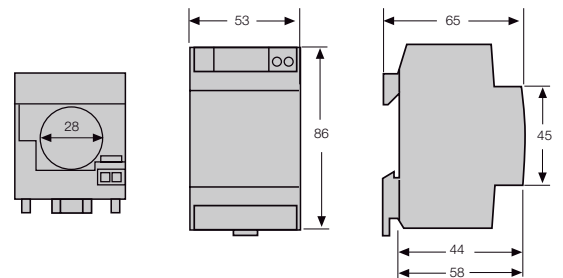
CTD-1/28

### DIMENSIONS (mm) AND WEIGHT (KG.)

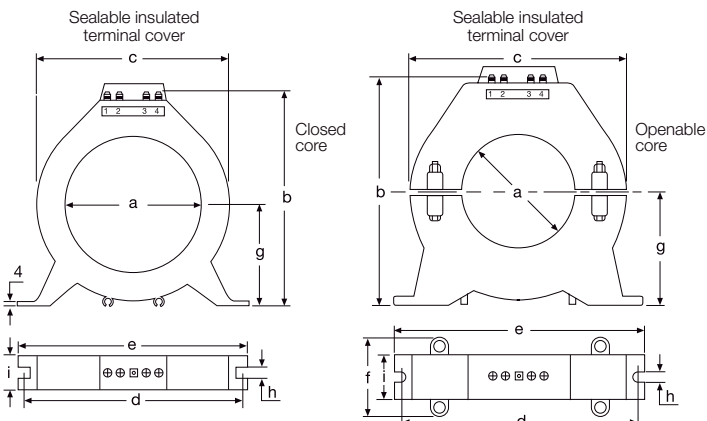
Type	Code	Core	a	b	c	d	e	f	g	h	i	Weight
CT-1/35	41060	Closed	35	88	73	92	100	-	40	6	28	0,2
CT-1/60	41065	Closed	60	112	98	116	125	-	55	6	28	0,3
CT-1/80	41070	Closed	80	132	118	136	146	-	65	6	28	0,5
CT-1/110	41075	Closed	110	158	148	166	178	-	78	6	28	0,5
CT-1/160	41080	Closed	160	265	255	265	275	-	130	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	41076	Open	60	125	116	13	140	45	60	8,5	34	0,3
CTA-1/110	41081	Open	110	215	205	220	235	70	105	8,5	40	0,5
CTA-1/160	41086	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

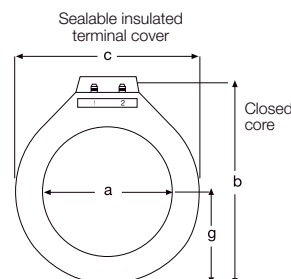
CTD-1/28



CT-1/35...210



CT-1/300  
CT-1/350



CT-1/400



## Current Limiting & Filtering

### CURRENT LIMITANT INPUT REACTOR

- **Nominal Current:** 250 A
- **Input voltage:** 480 V (Up to 690V)
- **Inductance:** 0.095mH
- **Linearity without saturation until:**  $1.5 \times I_n$
- **Maximum thermal overload:**  $1.3 \times I_n$
- **Frequency:** 50 or 60 Hz
- **Thermal Class:** F (140 °C) /  $T_a = 40^\circ\text{C}$
- **Protection against indirect contacts**
- **Connections by terminals**
- **Winding Class H (200°C) and Isolating Class F (140°), 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



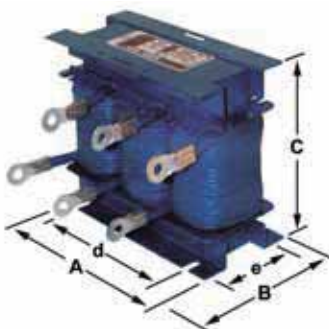
CE

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

## 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  $\pm 5\%$ .
- **Output voltage:** 120V.
- **Burden:** 50VA Max.
- **Weight:** 1,2kg.
- **Possibility of soldering over PCB.**
- **Accuracy class:** 1.

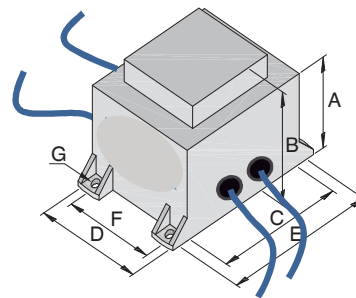
PT



CE

Model	Code
PT 50VA 480/120	41460

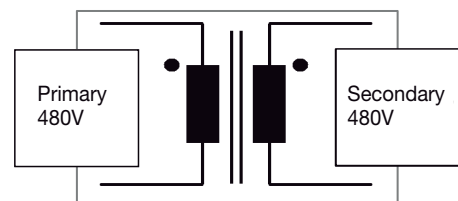
### DIMENSIONS (mm)



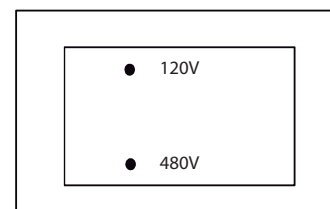
Dimensions mm	
A	52
B	65
C	81
D	68
E	91
F	57
G	4,5

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

### ELECTRIC SCHEME



### MARKING



# SURGE PROTECTION

## Introduction

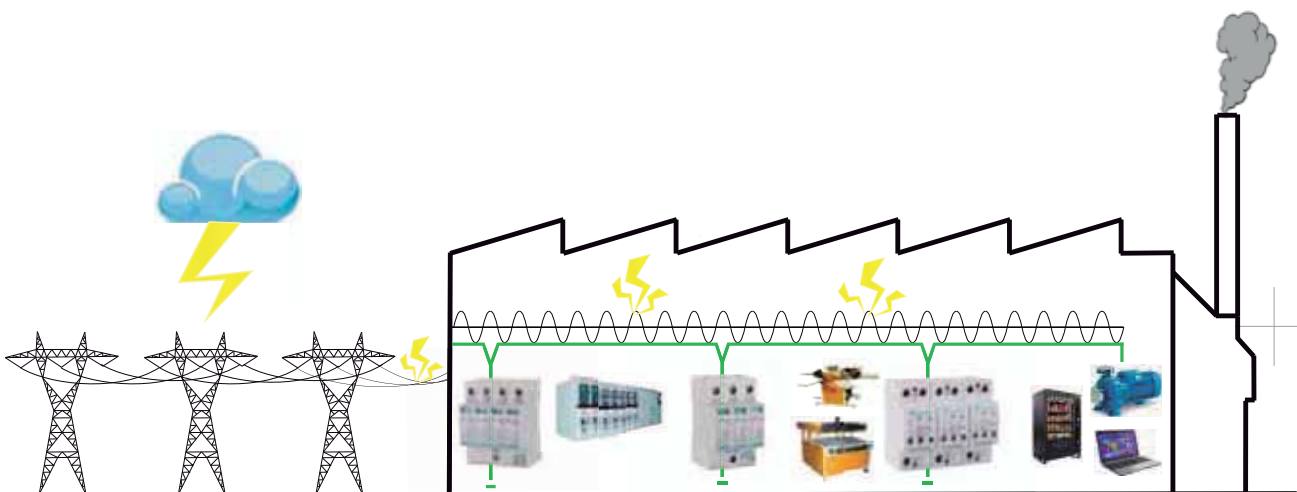
The surge protection relays protect installations and eliminate the effects of power surges. They offer the highest level of security in low voltage lines, continuous processes, domestic and tertiary facilities, etc.

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.



Code	POWER SUPPLY NETWORK							
	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	TN-S	TT/TN-S	TN-S	TT/TN-S	TN-S	TN-S	TT/TN-S
Electrical line	-	1F+NPE (TN-C)	1F+N+PE(TT)	1F+N+PE (TN-S) 2F+NPE (TN-C)	2F+N+PE (TT)	2F+N+PE (TN-S) 3F+PE (TN-S) 3F+NPE (TN-C)	3F+N+PE (TN-S)	3F+N+PE (TT) 3F+PE (TT)
Nominal voltage <b>Un</b> (Vac)	230 Vac							
Maximum continuous operating voltage <b>Uc</b> (Vac)	255 Vac	275 Vac						
Nominal discharge current (8/20 μs) <b>In</b> (kA)	50 kA							
Maximum discharge current (8/20 μs) <b>Imax</b> (kA)	100 kA							
Impulse current (10/350 μs) <b>Iimp</b> (kA)	25 kA							
Protection level <b>Up</b> (kV) at 30 kA	< 1,8 kV							
Response time <b>ta</b> (ns)	< 100 ns	< 25 ns						
Maximum back-up fuse (A gL/gG)	160							
N° Modules	1	2		3		4		

## 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

Code	POWER SUPPLY NETWORK							
	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	TN-S	TT/TN-S	TN-S	TT/TN-S	TN-S	TN-S	TT/TN-S
Electrical line	-	1F+NPE (TN-C)	1F+N+PE(TT)	1F+N+PE (TN-S) 2F+NPE (TN-C)	2F+N+PE (TT)	2F+N+PE (TN-S) 3F+PE (TN-S) 3F+NPE (TN-C)	3F+N+PE (TN-S)	3F+N+PE (TT) 3F+PE (TT)
Nominal voltage <b>Un</b> (Vac)	230 Vac							
Maximum continuous operating voltage <b>Uc</b> (Vac)	255 Vac	275 Vac						
Nominal discharge current (8/20 μs) <b>In</b> (kA)	30 kA							
Maximum discharge current (8/20 μs) <b>Imax</b> (kA)	60 kA							
Protection level <b>Up</b> (kV) at 30 kA	< 1,5 kV							
Response time <b>ta</b> (ns)	< 25 ns							
Maximum back-up fuse (A gL/gG)	125							
N° Modules	1	2		3		4		

## 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

Code	POWER SUPPLY NETWORK									
	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	TT/TN	TT	TT/TN	TT	TT/TN	TT		
Electrical line	1P+NPE (1) (2) (3)	1P+N 2P+N 3P+N 3P	1F+N+PE 2F+NPE	1F+N	2P+N+PE 3P+PE 3P+NPE	2P+N	3P+N+PE	3P+N 3P	1P+N	3P+N 3P
Nominal voltage <b>Un</b> (Vac)	230 Vac									
Maximum continuous operating voltage <b>Uc</b> (Vac)	275 Vac	250 Vac	275 Vac							
Nominal discharge current (8/20 μs) <b>In</b> (kA)	20 kA								10	
Maximum discharge current (8/20 μs) <b>Imax</b> (kA)	40 kA								20	
Protection level <b>Up</b> (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 <b>ta</b> (ns)	< 25 ns	<100 ns	< 25 ns							
Maximum back-up fuse (A gL/gG)	125	--	125						100	
N° Modules	1	1	2	2	3	3	4	4	2	4
Plug-in modules code	<b>41611</b>	<b>41612</b>	<b>41611</b>	<b>41611/41612</b>	<b>41611</b>	<b>41611/41612</b>	<b>41611</b>	<b>41611/41612</b>	<b>41626/41627</b>	<b>41626/41627</b>

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

(1) TN-S System:

- 2 units of VP C40 275/1 → 1F+N+PE
- 3 units of VP C40 275/1 → 2F+N+PE or 3F+PE
- 4 units of VP C40 275/1 → 3F+N+PE

(2) TN-C System:

- 2 units of VP C40 275/1 → 2F+NPE
- 3 units of VP C40 275/1 → 3F+NPE

(3) TT System:

- 1 unit of VP C40 275/1 + 1 unit VP C40 250/NPE → 1F+N
- 2 units of VP C40 275/1 + 1 unit VP C40 250/NPE → 2F+N
- 3 units of VP C40 275/1 + 1 unit VP C40 250/NPE → 3F+N or 3F

**TYPE B (Class I)**



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



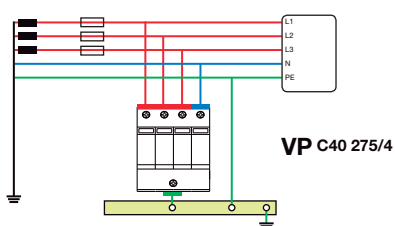
**TYPE C (Class II)**



**WIRING DIAGRAM**

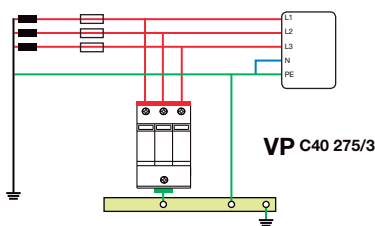
**TN-S SYSTEM**

3F + N + PE



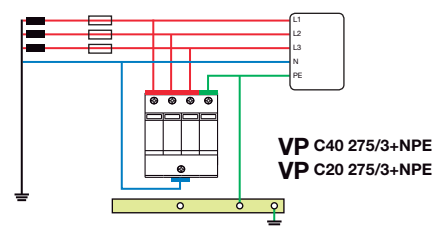
**TN-C SYSTEM**

3F + NPE



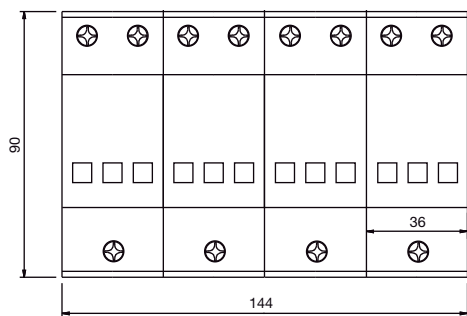
**TT SYSTEM**

3F + N



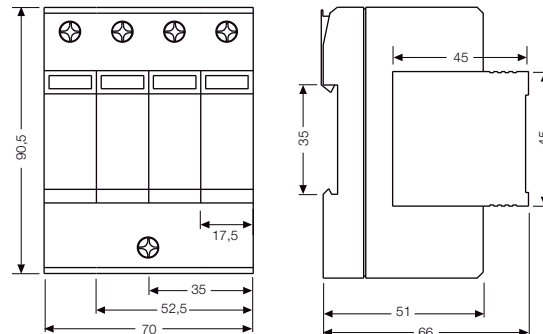
**DIMENSIONS (mm)**

**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

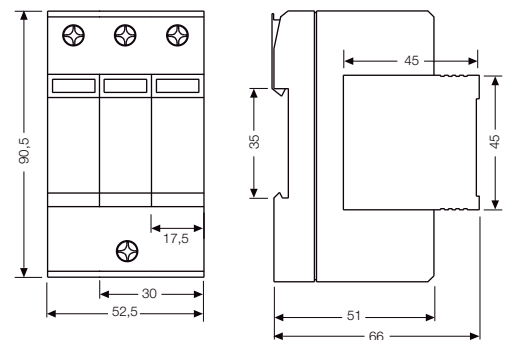
## PHOTOVOLTAIC Applications

- 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.



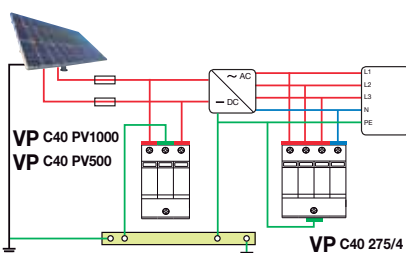
Code	PHOTOVOLTAIC APPLICATIONS	
	41605	41608
Model	VP C40 PV500	VP C40 PV1000
According to IEC 61643-1 (Class)	II	
Photovoltaic line	2F+PE	2F+PE
Maximum service voltage in direct current $U_{oc,max}$ (Vdc)	< 500	< 1000
Maximum continuous operating voltage $U_c$ (L-PE) (Vdc)	250	500
Nominal discharge current (8/20 $\mu$ s) $I_n$ (kA)	20	
Maximum discharge current (8/20 $\mu$ s) $I_{max}$ (kA)	40	
Protection level $U_p$ (kV)	< 1,8	< 3,6
Protection level at 5 kA (kV)	< 1,5	< 3
Response time $t_a$ (ns)	< 25	< 25
Maximum back-up fuse (A gL/gG)	125	125
N° Modules	3	3
Plug-in modules code	41614	41616

DIMENSIONS (mm)

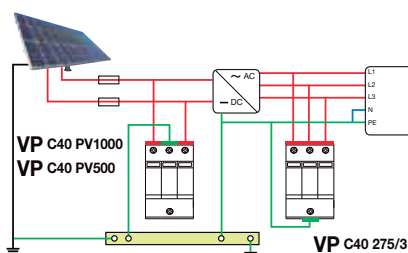


### WIRING DIAGRAM

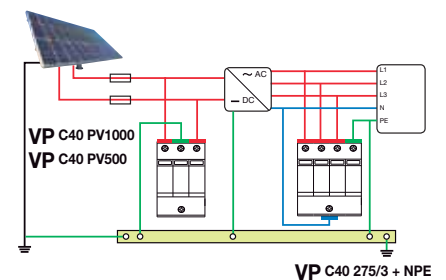
#### TN-S SYSTEM 3F + N + PE



#### TN-C SYSTEM 3F + NPE



#### TT SYSTEM 3F + N



## WIND Power Applications

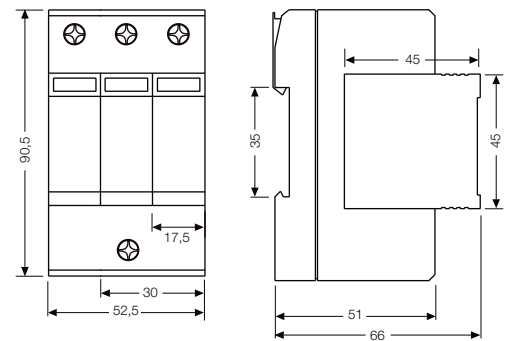
- Compact equipment for wind power installations.
- High discharge capacity via zinc oxide varistors and gas dischargers.
- With thermal separation device.
- Visual indication of a fault in the equipment.
- Remote signalling of protection status.
- Plug-in protection modules which facilitate maintenance.



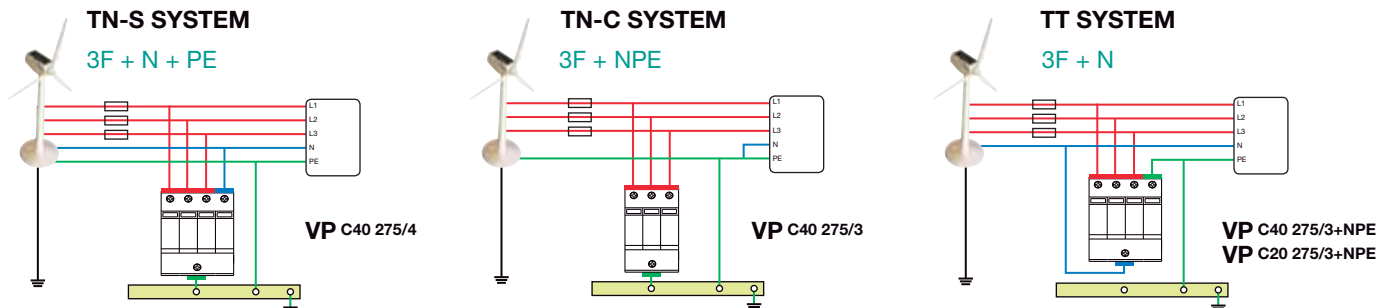
CE

WIND POWER APPLICATIONS	
Code	<b>41622</b>
Model	<b>VP C30 600/3</b>
According to IEC 61643-1 (Class)	II
Type of network	TT/TN
Eolic line	2F+N+PE 3F+PE 3F+NPE
Nominal voltage <b>Un</b> (Vca)	600
Maximum continuous operating voltage <b>Uc</b> (Vca)	600
Nominal discharge current (8/20 μs) <b>In</b> (kA)	15
Maximum discharge current (8/20 μs) <b>I<sub>max</sub></b> (kA)	30
Protection level <b>Up</b> (kV)	< 2,8
Protection level at 5 kA (kV)	< 2,4
Response time <b>ta</b> (ns)	< 25
Maximum back-up fuse (A gL/gG)	63
N° modules	3
Plug-in modules code	<b>41623</b>

DIMENSIONS (mm)



### WIRING DIAGRAM





## 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 200KA rms.
- MOV technology, high energy discharge capacity.
- Thermally protected.
- Visual fault indication
- Remote signalling.
- Low voltage protection level.
- Metallic 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

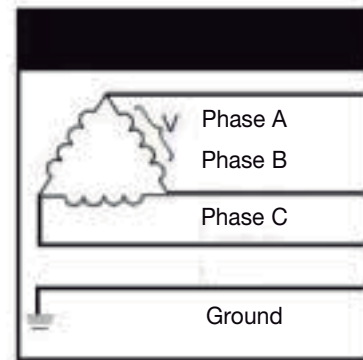


CE

### TECHNICAL PARAMETERS

Model	SST480D200AF/M
Nominal voltage	480 V
Discharge capacity	200 KA
Maximum continuous operating voltage U <sub>c</sub>	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 = Yellow L2 = Green L3 = Red N = Blue/Brown PE = Black
Signal cable	16 AWG C = Red NC = Blue NO = Brown
Working temperature range	-40°C + 70°C
Working humidity relative	5-95% (25°C)
Working altitude	≤ 2 km
Dimensions W x D x H (mm)	256 x 205 x 104
Net weight	5,4 Kg

### DISTRIBUTION DIAGRAM



3 Hots + Grnd

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

## Other models available

### OTHER MODELS AVAILABLE

Code configuration for other models is done as follows:

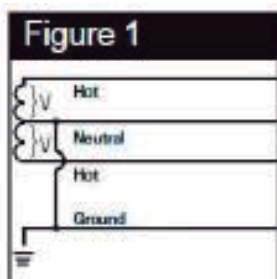
Code: SST    / P (Plastic) or M (Metal)

Optional functions:  
 C= Surge counter  
 T= Failure test  
 A= Remote alarm  
 F= Noise filtering

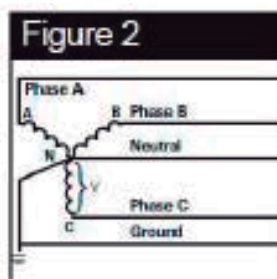
Max. surge current per phase (from 50KA - 300 KA/Phase)

Voltage for power distribution system

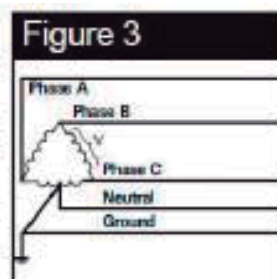
Figures	Distribution diagrams	L-N	L-L	L-G	Model
Figure 1	2 Hots + 1 Neu + 1 Grnd (2L+N+G)	120	240	120	120SP
Figure 2	3 Hots + 1 Neu + 1 Grnd (3L+N+G)	127	220	127	127Y
		220	380	220	220Y
		240	415	240	240Y
		277	480	277	277Y
Figure 3	3 Hots + (B-HIGH) + 1 Neu + 1 Grnd (3L+N+G)	347	600	347	347Y
		120	240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



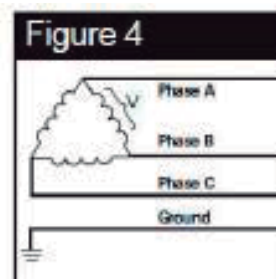
SPLIT



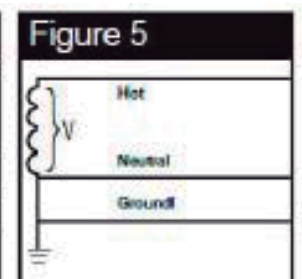
WYE



HI-LEG DELTA (B High)



DELTA & HRG WYE



SINGLE POLE