



CONNECTION



AUTOMATION



CONTROLS



PROTECTION



# Monitors voltage, phase, thermistor, current

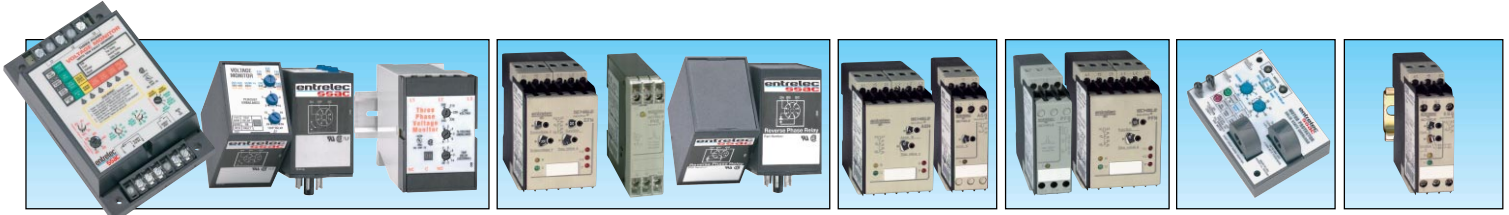


**entelec**<sup>®</sup>

# Monitors 8

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# Voltage Monitors Selection Guide

## Three Phase

### Directions:

- 1.) Select the style of product packaging you require.
- 2.) For general features, control, and protection, reference the table below.
- 3.) Find the product name and catalog page number at the top of each column. For complete product specifications, reference the catalog pages.



### General Features:

	WVM	ASN	PVN	PFN	DLM	SR-DW	PLM	PLMU	PLR	PLS
	Pages 1442-1443	Page 1444	Page 1453	Page 1458	Page 1445	Page 1446	Page 1448	Page 1449	Page 1456	Page 1459
DIN Rail Mounting	w/adaptor	•	•	•	•	•	w/socket	w/socket	w/socket	w/socket
Surface Mounting	•	w/adaptor	w/adaptor	w/adaptor	•	w/adaptor	w/socket	w/socket	w/socket	w/socket
8-Pin Plug-In										
Screw Terminals	•	•	•	•	•	•				
Quick Connects										

### Output:

DPDT Relay(s)		•	•	•		•				
SPDT Relay	•				•		•	•	•	•
SPST-NO										

### Line V Connection:

Wired Phase-to-Phase	•	•	•	•	•	•	•	•	•	•
Universal Voltage								•		
Wired Phase-to-Neutral										
Single Phase										
Trip Point(s) Adjustable	•	•	•		•	•	•	•	•	
Trip Point(s) Fixed				•						
Supply Voltage Required		•	•	•						

### Protection:

Phase Sequence	•	•	•	•	•	•	•	•	•	•
----------------	---	---	---	---	---	---	---	---	---	---

### Phase Loss (!):

Motor (On Start Up Only)	•	•	•	•	•	•	•	•	•	•
Motor (While Operating)	•	•	•	•	•	•	•	•	•	•
Undervoltage	•	•	•	•	•	•	•	•	•	•
Overvoltage	•	•	•	•	•	•	•	•	•	•
Unbalance (Asymmetry)	•	•			•	•	•	•	•	•
Rapid Recycling	•		•					•		

### Time Delays & Reset:

Trip Delay	•	•	•	•	•		•	•		
Restart Delay	•		•	•				•		
Automatic Restart	•	•	•	•	•	•	•	•	•	•
Manual Reset	•									

### Indicator LED(s):

Output ON/OFF	•	•	•	•	•	•	•	•	•	
Supply ON/OFF		•	•	•						
Fault(s)	•	•	•	•		•				
Timing	•							•		

### Dimensions:

(W x H x D)	in	4.4 x 6.9 x 2.4	1.77 x 3.07 x ≤ 3.98				1.97 x 2.95 x 4.33	0.886 x 3.07 x 4.5	1.78 x 2.39 x ≤ 3.2		
	mm	111.8 x 175.3 x 61.0	45 x 78 x ≤ 101				50 x 75 x 110	22.5 x 75 x 116	45.2 x 60.7 x ≤ 81.3		
		Pages 1442-1443	Page 1444	Page 1453	Page 1458	Page 1445	Page 1446	Page 1448	Page 1449	Page 1456	Page 1459
		WVM	ASN	PVN	PFN	DLM	SR-DW	PLM	PLMU	PLR	PLS

### Motor Controls:



**Motor Load Monitoring Relay**  
 Senses Power Factor (Cos φ)  
 Max. & Min. Load Trip Points  
 2 SPDT Relay Outputs  
 LWN Mecotron **Page 1467**



**Motor Winding Over Temperature Relay**  
 Senses Temperature from PTCs in Windings  
 1 Sensing Circuit - **See MSE Page 1468 & MSS Pages 1469-1470**  
 2 Sensing Circuits - **See MSS Page 1471**  
 3 Sensing Circuits - **See MSS Page 1473**  
 6 Sensing Circuits & Memory - **See MSN Page 1474**

! Phase loss protection for resistive and non-rotating loads. Motor protection can be affected by regenerated voltages.





### 3 Phase Voltage Monitor WVM Series Motor Protector



ANSI Device #27/47/59



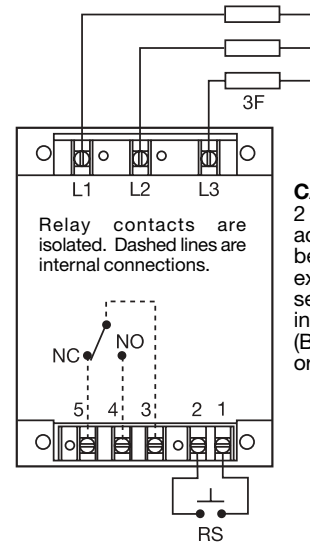
- Protects Against: Phase Loss & Reversal; Over, Under & Unbalanced Voltages; Short Cycling
- 10 Fault Memory & Status Displayed on 6 LED Readout
- Switch Selectable Automatic Restart, Delayed Automatic Restart, & Manual Reset
- Isolated 10 A SPDT Relay Contacts

#### Description

The WVM Series provides protection against premature equipment (motor) failure caused by voltage faults on the 3 Phase Line. The WVM's microcontroller design provides reliable protection even if regenerated voltages are present. It combines dependable fault sensing with a 10 fault memory and a 6 LED status display. Part instrument, part control, the WVM protects your equipment when you're not there and displays what happened when you return. The WVM is fully adjustable and includes time delays to prevent nuisance tripping and improve system operation. Time delays include a 0.25 to 30 s adjustable trip delay, an adjustable 0.25 to 64 m (in 3 ranges) restart delay, plus a unique 3 to 15 s true random start delay. The random start delay prevents voltage sags caused by simultaneous restarting of numerous motor loads after a power outage.

ASME A17.1 rule 210.6, NEMA MG1 14:30, 14:35, IEEE 587-1980 Level B

■ Approvals:



**CAUTION:**  
2 amp max fast acting fuses must be installed externally in series with each input. (3) (Bussman KTK-2 or equivalent)

F = Fuses RS = Optional Remote Reset Switch  
NO = Normally Open NC = Normally Closed

#### Ordering Table

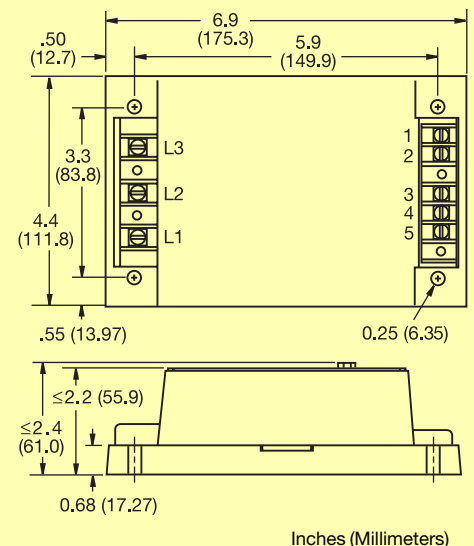
<b>Y WVM Series</b>	<b>X 3 Phase Line Voltage</b>	<b>X Unbalance</b>	<b>X Trip Delay</b>	<b>X Reset Method</b>	<b>X Restart Delay</b>
	-6 - 200 ... 240 V AC	1 - 2 ... 10%	1 - 0.25 ... 30 s	-A - Switch Selectable: Automatic Restart Upon Fault Trip	(Switch Selectable Reset Only)
	-8 - 355 ... 425 V AC			-R - Switch Selectable: Automatic Restart Upon Fault Correction	-L - 0.25 ... 64 s
	-9 - 400 ... 480 V AC			-M - Manual Reset Only (Onboard Reset Switch- No Restart Delay)	-N - 6 ... 300 s
	-0 - 500 ... 600 V AC				-H - 0.25 ... 64 m

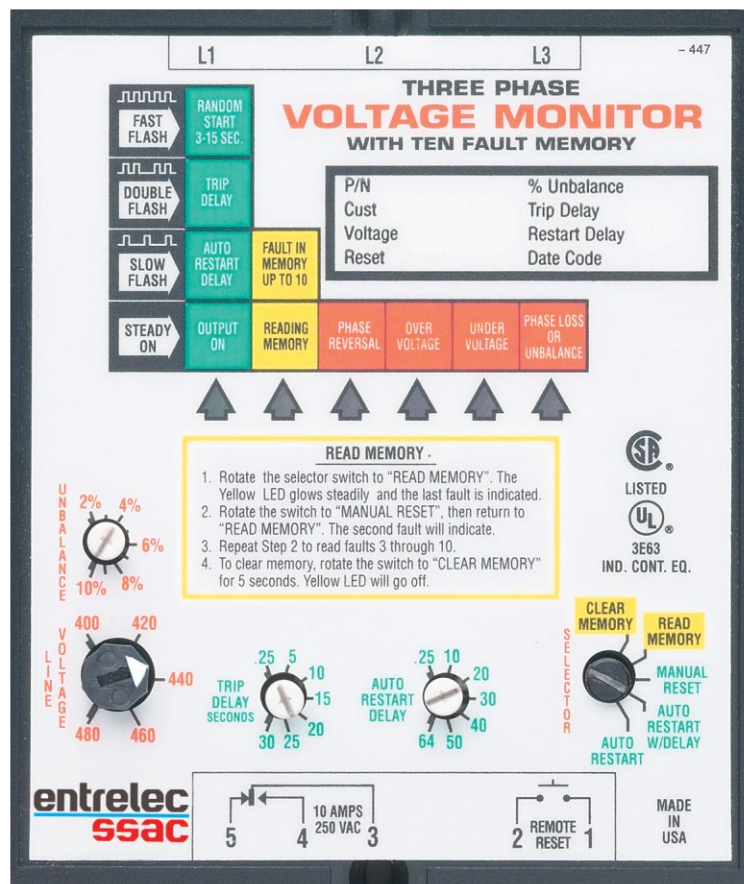
**Example P/Ns: Y WVM011AL, Y WVM011M**

#### Technical Data

<b>Line Voltage</b>	
Type	3 phase Delta or Wye with no connection to neutral
Operating Voltage	Adjustment Range
240 V AC	200 ... 240 V AC
380 V AC	355 ... 425 V AC
480 V AC	400 ... 480 V AC
600 V AC	500 ... 600 V AC
<b>Overvoltage, Undervoltage, &amp; Voltage Unbalance</b>	
Overvoltage Trip Point	109 ... 113% of adjusted voltage
Reset Voltage	-2% of trip point
Undervoltage Trip Point	88 ... 92% of adjusted voltage
Reset Voltage	+2% of trip point
Voltage Unbalance	Adjustable from 2 ... 10%
Trip Delay	Adjustable from 0.25 ... 30 s +/-15%
<b>Phase Loss</b>	
Response Time	≥ 15% unbalance
	≤ 200 ms
<b>Random Start Delay Range</b>	
	3 ... 15 s
<b>Reset (Restart) Delay</b>	
Low Range	0.25 ... 64 s +/-15%
Normal Range	6 ... 300 s +/-15%
High Range	0.25 ... 64 m +/-15%
<b>Fault Memory</b>	
Type	Nonvolatile RAM
Capacity	Stores last 10 faults
Status Indicators	6 LEDs provide existing status & memory readout
Note: 50% of operating line voltage must be applied to L1 & L2 for operation of status indicators	
<b>Output</b>	
Type	Electromechanical relay
Form	Isolated single pole double throw (SPDT)
Rating	10 A resistive @ 250 V AC 6 A inductive (0.4 PF) at 250 V AC
<b>Protection</b> Surge	
	IEEE 587 Level B
Isolation Voltage	≥ 2500 V RMS input to output
<b>Mechanical</b>	
Mounting	Surface with 2 or 4 #8 (M4 x 0.7) screws
Termination	Screw terminals with captive wire clamps for up to #12 AWG (3.2 mm <sup>2</sup> ) wire
<b>Environmental</b>	
Operating/Storage Temperature	-40°C ... +65°C / -40°C ... +85°C
Weight	≅ 25 oz (709 g)

Selected Unbalance %	Reset %
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1
10	9





### Operation

The output relay is energized when all conditions are acceptable and the WVM is reset. A restart and/or random start delay may occur before the output relay is energized.

**Field Adjustment:** Select the line voltage listed on the motor's name plate. This automatically sets the over and undervoltage trip points. Consult the equipment's manufacturer specifications for the correct trip delay, unbalance percentage, and restart/reset operation and restart delay. Make connection to all three line phases as shown in the connection diagram. Apply power. If the relay fails to energize, view the LEDs for the cause, and correct the problem. If the phase sequence is incorrect, swap any two wires. No further adjustment should be required to achieve maximum equipment protection.

**Read Memory:** Fault(s) stored in the memory are indicated when the yellow LED is flashing. To read memory, rotate selector from Manual to Read Memory. The last fault will be displayed. Repeat this operation to read the second to the last fault. Repeat until up to 10 faults are noted.

**Memory Reset:** To clear the memory of all faults stored, rotate selector to Clear Memory for 5 seconds. The yellow LED will turn off.

**Memory Overload:** The 11th fault causes the first to be removed from memory. Only the 10 most recent faults are retained.

**Random Start Delay:** A new 3 to 15 s random start delay is selected by the microcontroller when a fault is corrected and when the operating voltage (L1, L2, L3) is applied to the WVM. A random start delay does not occur when the reset is manual.

**Automatic Restart:** Upon fault correction, the output will re-energize after a random start delay.

**Automatic Restart Upon Fault Trip:** When a fault is sensed for the full trip delay, the output de-

energizes and a restart delay is initiated. This delay locks out the output for the delay period. Should the fault be corrected by the end of the restart delay, the output will re-energize after a random start delay. A restart delay will also occur when operating voltage (L1, L2, L3) is applied to the WVM.

**Manual Reset:** After a fault condition is corrected, the WVM can be manually reset. There are two methods; a switch on the unit or a customer supplied remote switch.

**Manual Reset Units:** (P/N ends with **M**) These part numbers have a 3 position selector switch. An on board momentary reset switch is provided on the unit for manual reset.

**Switch Selected Reset Units:** (P/N includes an **A** or **R**) These part numbers have a 5 position selector switch. Rotate selector switch from the Manual Reset position to Auto Restart w/ Delay then back again to Manual Reset within 3 seconds. The output will immediately energize.

**Remote Reset:** Reset (Restart) is accomplished by a momentary contact closure across terminals 1 & 2. The output will immediately energize. Remote switch requirements are  $\geq 10$  mA at 20 V DC and the reset terminals are not isolated from line voltage. A resistance of  $\leq 20K\Omega$  across terminals 1 & 2 will cause immediate automatic restart.

### Automatic Restart Upon Fault Correction:

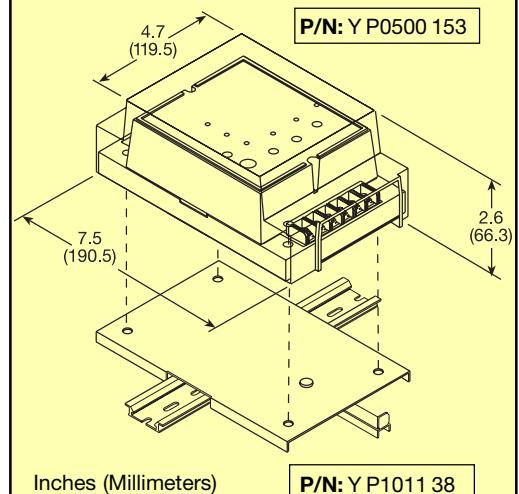
(P/N includes an **R**)  
When a fault is sensed for the full trip delay, the output relay de-energizes. Upon correction of the fault, a restart delay begins. At the end of this delay, the output will re-energize after a random start delay. If a fault occurs during timing, the time delay will be reset to zero, and the output will not energize until the restart delay is completed.

## 3 Phase Voltage Monitor WVM Series Motor Protector

### Accessories

#### Clear Tamperproof Cover

The P0500-153 protects against unauthorized adjustment of the trip points. It prevents the resetting of manual units by the equipment's operator. It isolates line-level connection points preventing contact during troubleshooting operations. Alignment dimples allow drilling (5 places) for limited access to adjustment knobs and the reset switch. Included are (2) spacers, (5) hole plugs. 7.5 x 4.7 x 2.6 in. (190.5 x 119.4 x 66 mm)



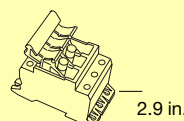
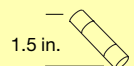
#### 35mm DIN Rail Adaptor

The P1011-38 provides an easy method of mounting the WVM Series on 35mm DIN rail. Constructed of rugged black anodized steel, the P1011-38 adaptor includes four mounting screws. 7 x 4.5 x .33 in. (177.8 x 114.3 x 8.4 mm)



#### Midget Fuse

Fast acting fuse for use with voltage monitors. Rated 2 A at 500 V AC.  
1.5 x 0.41 in. (38.1 x 10.3 mm)  
P/N: Y P0600 11



Three phase fuse block disconnect designed for use with HRC midget fuses [1.5 x 0.41 in.] (38.1 x 10.3 mm) rated up to 25 A at 600 V AC. Surface or 35mm DIN rail mountable. 3.9 x 2.9 x 2.2 in. (99 x 73 x 54 mm)  
P/N: Y P0700 241

# Phase unbalance relay ASN mecotron®



- Monitors three phase supply voltage for phase unbalance
- Phase failure, even in case of 95% phase regeneration
- Phase sequence
- Adjustable delay on operate from 0.1...10 s
- Adjustable switching threshold from 5...15 % unbalance
- 2 SPDT contacts
- 4 LEDs to indicate all operational states
- 3 three-phase voltage ranges:  
220 V, 400 V, 500 V
- Several supply voltage versions

## Operation

The ASN monitors three phase supply voltages for phase unbalance, failure of one of the phases, and incorrect phase sequences. In case of a fault, the output relay will de-energize. Status of the fault will be indicated by one of the LEDs.

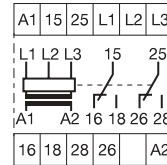
The output relay is energized as long as phases are balanced and phase sequence is correct (rotary switch right-handed polarized). It will de-energize as soon as unbalance exceeds the set threshold (adjustable between 5% and 15% unbalance).

A response time delay of 0.1 secs to 10 secs can be set on a potentiometer to prevent erroneous tripping of the relay during motor start.

Phase failure and phase sequence are indicated without delay.

With motors running on two phases, return voltage (of more than 95%) may be produced so that the output relay cannot de-energize despite failure of a phase.

■ Approvals:



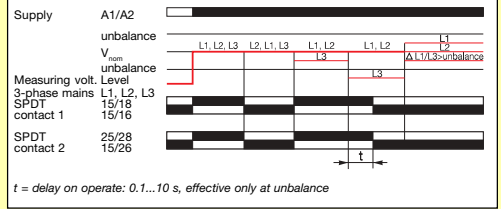
Supply voltage/ 50...60 Hz	Monitoring voltage (3-phase), special measuring ranges, frequencies and voltages on request						P/N:	P/N:	P/N:
	P/N:	P/N:	P/N:	P/N:	P/N:				
	220...240 V/50 Hz	220...240 V/60 Hz	380...415 V/50 Hz	380...415 V/60 Hz	440 V/60 Hz	480...500 V/50 Hz	480...500 V/60 Hz	600 V/60 Hz	
110...130 V AC	2 450 320 02	--	2 450 320 05	--	--	2 450 320 07	--	--	
220...240 V AC	2 450 321 02	2 450 421 02	2 450 321 05	--	--	2 450 321 07	--	--	
380...415 V AC	2 450 322 02	--	2 450 322 05	2 450 422 05	--	2 450 322 07	--	--	
440 V AC	--	--	--	--	2 450 423 06	--	--	--	
480...500 V AC	--	--	--	--	--	--	2 450 424 07	--	
500...550 V AC	--	--	--	2 450 322 07	--	2 450 932 01	--	--	
600 V AC	--	--	--	--	--	--	--	2 450 426 08	

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

Input circuit	
Supply voltage - power consumption	A1-A2 all voltage ranges -3 VA
Tolerance of supply voltage	-15 % ... +10 %
Supply voltage frequency	50...60 Hz
Duty time	100 %
Time circuit	
Delay on operate time adjustable	0.1...10 s
Timing error within tolerance of supply voltage	≤ 0.5 %
Timing error within temperature range	≤ 0.06 % / °C
Measuring circuit	
Monitoring voltage V <sub>nom</sub> .	L1, L2, L3 220...240 V AC 380...415 V AC 440 V AC 480...500 V AC
Frequency	50 Hz
Unbalance adjustable	5...15 %
Switching hysteresis (referred to set unbalance)	20 %
Measuring cycle max.	< 100 ms
Temperature error	≤ 0.06 % / °C
Error within tolerance of supply voltage	≤ 0.5 %
Display of operating status	
Supply voltage	V LED, green
Output relay energized	R LED, yellow
Unbalance	A LED, red
Phase failure and phase sequence error	P LED, red
Output circuit	
	15-16/18, 25-26/28 Relay, 2 SPDT contacts, closed-circuit principle
Rated voltage	VDE 0110, IEC 947-1 400 V
Rated switching voltage max.	400 V AC
Rated switching current	AC 12 (resistive) 5 A (at 230 V)
Rated switching current	AC 15 (inductive) 3 A (at 230 V)
Rated switching current	DC 12 (resistive) 5 A (at 24 V)
Rated switching current	DC 13 (inductive) 2.5 A (at 24 V)
Maximum mechanical life	30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)	1 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating	5 A / fast, operating class gL
General data	
Rated impulse withstand voltage V <sub>imp</sub>	4 kV
Operating temperature	-25°C ... +65°C
Storage temperature	-40°C ... + 85°C
Mounting position	any
Mounting to DIN rail (EN 50022)	Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight	approx. 0.66 lb (300)
Dimensions (W x H x D)	45 x 78 x 101 mm

## 1 Function





# 3 Phase Voltage Monitor DLM Series Motor Protector



ANSI Device #27/47/59



- Protects Against: Phase Loss, Phase Reversal, Overvoltage, Undervoltage, and Voltage Unbalance
- 35 mm DIN Rail or Surface Mounting
- SPDT Isolated 10 A Relay Contacts
- LED Glows when All Conditions are Acceptable
- Line Voltage 110 ... 600 V AC, in 5 Ranges
- Simple 3 Wire Connection for Delta or Wye Systems

### Description

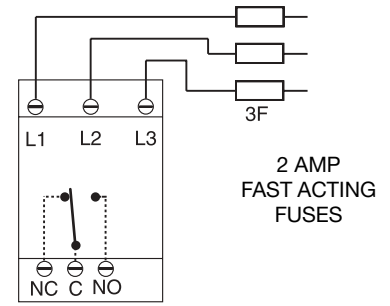
The DLM Series continuously measures the voltage of each of the three phases. It separately senses under and over voltage, voltage unbalance including phase loss and phase reversal. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present.

### Operation

The output relay is energized and the LED glows when all voltages are acceptable and the phase sequence is correct. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous trip delay period before the relay and the LED are de-energized. Re-energization is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied.

ASME A17.1 rule 210.6, NEMA MG1 14:30, 14:35, IEEE 587-1980 Level B

- Approvals:



F = Fuses NO = Normally Open  
NC = Normally Closed

**CAUTION:** 2 amp max fast acting fuses must be installed externally in series with each input. (3) (Bussman KTK-2 or equivalent)

**Field Adjustment:** Set voltage, delay period, and voltage unbalance percentage (consult equipment manufacturer's specifications). Make connection to all three line phases as shown in the connection diagram. Apply power. If the relay fails to energize, check the wiring of all 3 phases, voltage, and phase sequence. If phase sequence is incorrect, swap any two wires. No further adjustment should be required to achieve maximum equipment protection.

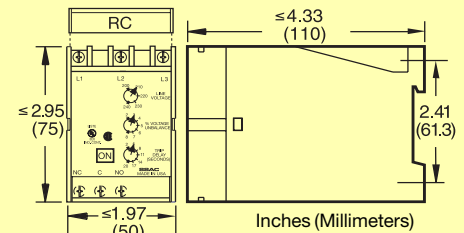
Voltage	Voltage Unbalance	Trip Delay	Part Number
120 V AC	2 ... 8%	2 ... 20 s	Y DLM411
240 V AC	2 ... 8%	2 ... 20 s	Y DLM611
380 V AC	2 ... 8%	2 ... 20 s	Y DLM811
480 V AC	2 ... 8%	2 ... 20 s	Y DLM911
600 V AC	2 ... 8%	2 ... 20 s	Y DLM011

### Technical Data

<b>Line Voltage</b>		3 phase Delta or Wye with no connection to neutral	
Type			
<b>Operating Voltage</b>	<b>Line Voltage Range</b>	<b>Line Voltage Max.</b>	<b>Calibration Frequency</b>
120	110 ... 130 V AC	145 V AC	60 Hz
240	200 ... 240 V AC	270 V AC	60 Hz
380	360 ... 430 V AC	480 V AC	50 Hz
480	400 ... 480 V AC	530 V AC	60 Hz
600	500 ... 600 V AC	600 V AC	60 Hz
Line Frequency	50 ... 60 Hz		
Phase Sequence	ABC		
<b>Overvoltage, Undervoltage &amp; Voltage Unbalance</b>			
Type	Voltage detection with delayed trip & automatic reset		
Overvoltage & Undervoltage:			
Undervoltage Trip Point	88 ... 92% of adjusted line voltage		
Reset Voltage	+3% of trip voltage		
Overvoltage Trip Point	109 ... 113% of adjusted line voltage		
Reset Voltage	-3% of trip voltage		
Voltage Unbalance:			
Trip Unbalance	Adjustable from 2 ... 8%		
Trip Delay:	Range	Adjustable from 2 ... 20 s	
	Tolerance	Adjustable-Guaranteed range	
<b>Phase Reversal</b>			
Response Time -- Phase Reversal	≤100 ms		
Reset	Automatic		
<b>Output</b>			
Type	Electromechanical relay		
Form	Single pole double throw (SPDT)		
Rating	10 A resistive @ 240 V AC; 1/4 hp @ 125 V AC; 1/3 hp @ 250 V AC; max. voltage 277 V AC		
Life	Mechanical -- 1 x 10 <sup>6</sup> ; Electrical -- 1 x 10 <sup>5</sup>		
<b>Protection</b>	Surge	IEEE 587 Level B	
Isolation Voltage	≥ 2500 V RMS input to output		
Circuitry	Encapsulated		
<b>Mechanical</b>			
Mounting	Surface with 2 #8 (M4 x 0.7) screws or 35 mm DIN rail		
Package	4.33 x 2.95 x 1.97 in. (110 x 75 x 50 mm)		
Termination	Screw terminals with captive wire clamps for up to #14 AWG (2.5 mm <sup>2</sup> ) wire Touch proof terminal covers are included		
<b>Environmental</b>			
Operating/Storage Temperature	-40°C ... +60°C / -40°C ... +85°C		
Humidity	95% relative, non-condensing		
Weight	120 & 240 V AC	≅ 8.6 oz (244 g)	
	380 ... 600 V AC	≅ 16.3 oz (462 g)	

Reset on Balance	
Selected Unbalance	Reset %
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2

**Note:** A 60 Hz unit used on 50 Hz will shift by -1. A 50 Hz unit used on 60 Hz will shift by +1. (Ex. 4% unbalance on 60 Hz, would be 3% unbalance on 50 Hz.)



RC = Removable Terminal Cover

### Accessories

DIN rail P/Ns: Y C103PM (Al) 17322005 (Steel)		Fuse 2A fast acting 1.5" x 13/32" (38.1 mm x 10.3 mm) P/N: Y P0600 11		3-phase fuse block/disconnect P/N: Y P0700 241	
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See accessory page at the end of this section.



### 3 Phase Voltage Monitor SR-DW Motor Protector



Representative photo

- Protects Against: Phase Loss, Phase Reversal, Overvoltage, Undervoltage, and Voltage Unbalance
- 35 mm DIN Rail Mounting
- DPDT Isolated 5 A Relay Contacts
- Green LED (relay) Glows when All Conditions are Acceptable
- Line Voltage 127 ... 400 V AC, in 4 Ranges
- Simple 3 Wire Connection for Delta or Wye Systems

#### Description

The SR-DW protects sensitive 3 phase loads from adverse voltage conditions. It continuously measures the voltage of each of the three phases. Protection is provided against phase loss, phase reversal, over, under and unbalanced voltages. The SR-DW is fully adjustable so the proper protection can be selected for each load. Four LEDs are included to indicate voltage and phase faults. A trip delay is included to prevent nuisance tripping.

#### Operation

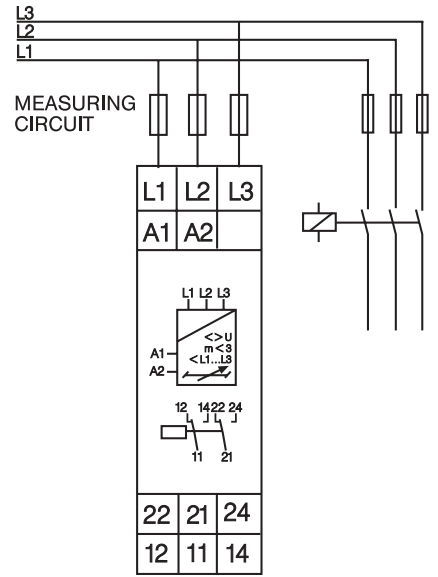
The output relay is energized and the green LED glows when all voltages are acceptable and the phase sequence is correct. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous trip delay period before the relay and the green LED are de-energized. Re-energization is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied.

■ Approvals:

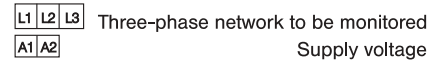
Supply Voltage	Input Voltage	Unbalance	Trip Delay	Part Number
127 V AC	3 x 208 ... 230 V AC	5 ... 15%	0.1 ... 12 s	F 012 466 000
220 V AC	3 x 208 ... 230 V AC	5 ... 15%	0.1 ... 12 s	F 012 466 100
230 V AC	3 x 380 ... 415 V AC	5 ... 15%	0.1 ... 12 s	F 012 466 200
400 V AC	3 x 380 ... 415 V AC	5 ... 15%	0.1 ... 12 s	F 012 466 900

#### Technical Data

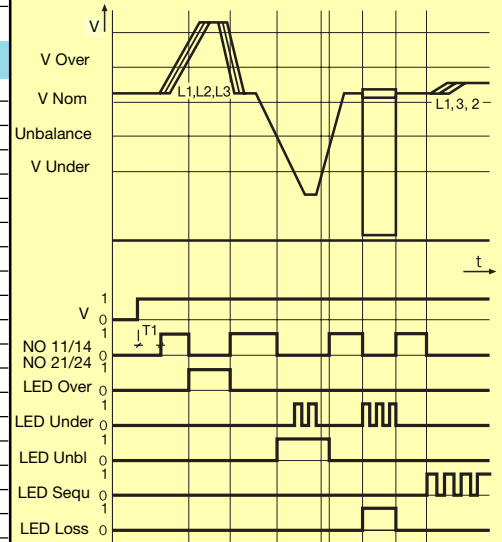
<b>Line Voltage</b>	
Type	3 phase Delta or Wye with no connection to neutral
Line Voltage (Input Voltage)	3 x 208 ... 230 VAC; 3 x 380 ... 415 VAC
Supply Voltage	127 ... 400 V AC; +/-20%
Line Frequency	50 ... 60 Hz
Phase Sequence	ABC
<b>Overvoltage, Undervoltage &amp; Voltage Unbalance</b>	
Type	Voltage detection
Overvoltage & Undervoltage:	
Undervoltage Trip Point	80 ... 98% of line voltage
Overvoltage Trip Point	102 ... 120% of line voltage
Voltage Unbalance (Asymmetry):	
Trip Unbalance	Adjustable from 5 ... 15%
Trip Delay:	
Range	Adjustable from 0.1 ... 12 s
Tolerance	Adjustable-Guaranteed range
Response Time -- Supply Voltage Applied	≤ 80 ms
Reset	Automatic
Restart Delay	0.5 s
LED Indicators -- 4	
	Red Over & undervoltage
	Red Unbalance (Asymmetry)
	Red Phase loss & sequence
	Green Relay energized
<b>Output</b>	
Type	Electromechanical relay
Form	2 x Isolated single pole double throw (2 x SPDT)
Rating	AC 1 5 A @ 230 V AC
	AC 15 1.5 A @ 230 V AC
Maximum Voltage	≤ 250 V AC
<b>Protection</b>	
Isolation Voltage	VDE 0160 Input to output
Protection to DIN 40 050/ IEC 529	Enclosure IP 30
	Terminals IP 10
<b>Mechanical</b>	
Mounting	EN 50 022 DIN 3 Rail
Termination	2 #14 AWG (1.5 mm <sup>2</sup> ) wire per terminal
<b>Environmental</b>	
Operating Temperature	-20°C ... +55°C
Weight	≅ 6.5 oz (185 g)



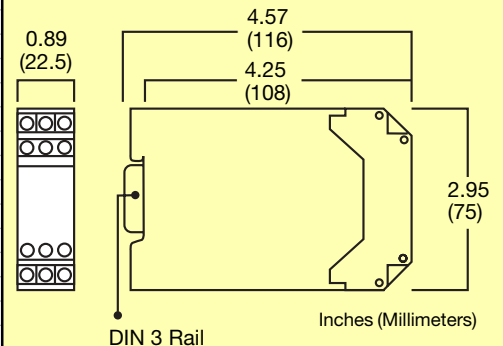
Connection diagram for 3 phase voltage monitoring



#### Time Diagram



T1 = Restart Delay  
NO = Normally Open Contact 11/14, 21/24  
V = Voltage  
t = Time



## Phase unbalance relay ASS mecotron®



- Monitors three-phase supply voltage for phase unbalance and phase sequence.
- Monitoring of phase failure, even in case of 95% phase regeneration
- Fixed response delay of 0.5 s
- Switching threshold adjustable between 5% and 15% unbalance
- 1 SPDT contact
- LED to indicate operational status
- 2 supply and measuring voltage ranges:  
220...240 V and 380...415 V
- Phase sequence monitoring

## Operation

The ASS monitors three-phase supply voltage for phase unbalance and phase failure even in case of 95% regeneration of that phase.

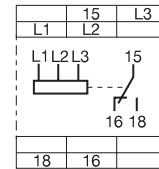
The output relay de-energizes 500 ms after the set unbalance level has been exceeded or immediately after failure of one of the phases. The lighting LED displays an energized output relay.

The switching threshold for permissible unbalance is infinitely adjustable between 5 and 15%.

During motor start, momentary unbalances may occur. The fixed response delay of 500 ms prevents this short term unbalance from tripping the relay.

With motors running on two phases return voltage of more than 95% may occur so that the output relay cannot deenergize despite failure of a phase.

■ Approvals:



### Supply voltage = monitored voltage

	P/N: 50 Hz	P/N: 60 Hz
220...240 V AC	2 430 864 11	2 430 865 11
380...415 V AC	2 430 864 31	2 430 865 31

### Accessories

	P/N:
Sealable transparent cover	3 430 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

### Input circuit

Supply voltage - power consumption	220...240 V AC	-	2 VA
= Measuring voltage	380...415 V AC	-	2 VA
Tolerance of supply voltage	-20 % ... +20 %		
Supply voltage frequency	50 Hz		
Duty time	100 %		

### Timing circuit

Delay on operate time fixed to	500 ms for "phase unbalance" message		
Timing error within the tolerance of supply voltage	≤ 0.5 %		
Timing error within temperature range	≤ 0.06 % / °C		

### Measuring circuit

Monitoring voltage V <sub>nom</sub>	L1, L2, L3	220...240 V AC	380...415 V AC
Frequency		50 Hz	
Phase unbalance adjustable		5...15 %	
Switching hysteresis (re. to the response value)		20 %	
Temperature error		≤ 0.06 % / °C	
Error within the tolerance of supply voltage		≤ 0.5 %	

### Display of operational status

Output relay energized R-LED, yellow

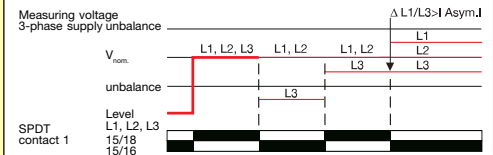
### Output circuit

	15-16/18	Relay, 1 SPDT contact, closed-circuit principle
Rated voltage	VDE 0110, IEC 947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life/ operations		30 x 10 <sup>6</sup> operations
Maximum electrical life (to AC 12 / 230 V / 4 A)		3 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

### General data

Rated impulse withstand voltage V <sub>imp</sub>	4 kV	
Operating temperature	-25°C ... +65°C	
Storage temperature	-40°C ... +85°C	
Mounting position	any	
Mounting to DIN rail (EN 50022)	Snap-on mounting/ Screw mounting by adapter	
Cable size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )	
Weight	approx. 0.66 lb (300 g)	
Dimensions (W x H x D)	22.5 x 78 x 101 mm	

## 1 Function



# 3 Phase Voltage Monitor PLM Series Motor Protector



ANSI Device #47/27

- Protects Against: Phase Loss, Phase Reversal, Undervoltage, & Unbalanced Voltages
- 8 Pin Plug-in Base
- Adjustable Low Voltage Trip Point
- Factory Fixed Unbalance and Trip Delay
- Line Voltages 200 ... 480 V AC, in 3 Ranges
- SPDT Isolated 8 A Relay Contacts

### Description

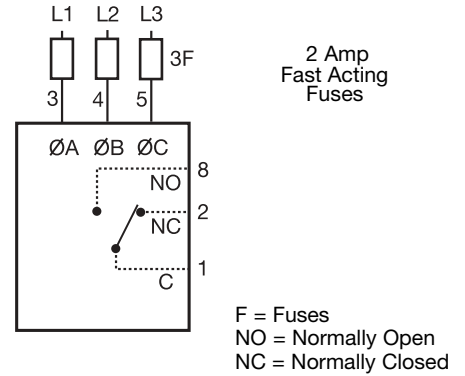
The PLM Series continuously measures the voltage of each of the three phases. It separately senses Undervoltage, Voltage Unbalance (including Phase Loss), and Phase Reversal. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present. Both Delta and Wye systems can be monitored; no connection to neutral is required. 380 V AC and 480 V AC units are encapsulated.

### Operation

The output relay is energized and the LED glows when all voltages are acceptable and the phase sequence is correct. Under and unbalanced voltages (including phase loss) must be sensed for a continuous trip delay period before the relay and the LED are de-energized. Re-energization is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied.

ASME A17.1 rule 210.6, NEMA MG1 14:30, 14:35, IEEE 587-1980 Level B

- Approvals:



Dashed lines are internal connections.

**CAUTION:** 2 amp max fast acting fuses must be installed externally in series with each input. (3) (Bussman KTK-2 or equivalent)

### Ordering Table

Y PLM Series	X Line Voltage	X Voltage Unbalance (Fixed)	X Trip Delay (Fixed)
	-6 - 240 V AC	-Specify: 4, 5, 6, 7, or 8%	-Specify from 2 ... 20 s in 1 s increments (Insert 0 before 1 ... 9)
	-8 - 380 V AC		
	-9 - 480 V AC		

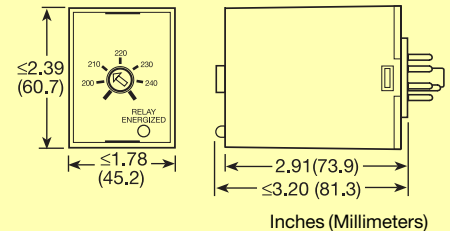
Example P/N: **Y PLM6405**

### Technical Data

<b>Line Voltage</b>			
Type		3 phase Delta or Wye with no connection to neutral	
Operating Voltage:			
<b>UL CSA Model</b>	<b>Adj. Line Voltage Range</b>	<b>Line Voltage Max.</b>	<b>Calibration Frequency</b>
• 240	200 ... 240 V AC	270 V AC	60 Hz
• 380	360 ... 430 V AC	480 V AC	50 Hz
• 480	400 ... 480 V AC	530 V AC	60 Hz
Line Frequency		50 ... 60 Hz	
Phase Sequence		ABC	
<b>Low Voltage and Voltage Unbalance</b>			
Type		Voltage detection with delayed trip & automatic reset	
Low Voltage:	Trip Voltage	88 ... 92% of adjusted line voltage	
	Reset Voltage	Plus 3% of trip voltage	
Voltage Unbalance:			
	Trip Unbalance	Factory fixed from 4 ... 8%	
	Reset on Balance (%):	Selected Unbalance 4 5 6 7 8 Reset 3.6 4.5 5.4 6.3 7.2	
<b>Note:</b> A 60 Hz unit used on 50 Hz will shift by -1. A 50 Hz unit used on 60 Hz will shift by +1. (Ex: 4% unbalance on 60 Hz would be 3% unbalance on 50 Hz.)			
Trip Delay:	Range	Factory fixed from 2 ... 20 s	
	Tolerance	+/-15%	
<b>Phase Reversal</b>			
Response Time -- Phase Reversal		≤ 100 ms	
Reset		Automatic	
<b>Output</b>			
Type		Electromechanical relay	
Form		Single pole double throw (SPDT)	
Rating		8 A resistive at 240 V AC	
<b>Protection</b>			
Surge		IEEE 587 Level B	
Isolation Voltage		≥ 2500 V RMS input to output	
Circuitry		Encapsulated (380 & 480 V units only)	
<b>Mechanical</b>			
Mounting*		8 pin plug-in socket rated 600 V AC	
Package		3.2 x 2.39 x 1.78 in. (81.3 x 60.7 x 45.2 mm)	
<b>Environmental</b>			
Operating Temperature		240 & 380 V AC: -40°C ... +60°C 480 V AC: -40°C ... +50°C	
Storage Temperature		-40°C ... +85°C	
Weight		240 V AC ≅ 6.1 oz (173 g) 380 & 480 V AC ≅ 9.3 oz (264 g)	

\*CAUTION: Select an octal socket rated for 600 V AC operation.

**Field Adjustment:** Set voltage adjustment knob at the desired operating line voltage. Apply power. If the relay fails to energize, check wiring of all 3 phases, voltage, and phase sequence. If phase sequence is incorrect, swap any two wires. No further adjustment should be required.



### Accessories

<p>Panel mount kit P/N: <b>Y BZ1</b></p>	<p>Octal 8-pin socket P/N: <b>Y OT08</b></p>	<p>3-phase fuse block/disconnect P/N: <b>Y P0700 241</b> 2 AMP fuse P/N: <b>Y P0600 11</b></p>
<p>DIN rail P/Ns: <b>Y C103PM (Al)</b> <b>17322005 (Steel)</b></p>		

See accessory page at the end of this section.

# 3 Phase Voltage Monitor PLMU Series Universal Plug-in Monitor



ANSI Device #27/47/59



- Protects Against: Phase Loss, Phase Reversal, Overvoltage, Undervoltage, & Unbalanced Voltages
- Octal Plug-in with SPDT Isolated 10 A Contacts
- Operates from 200 ... 480 V AC
- LED Indicator Glows Green when Voltages are Acceptable, Red for Faults
- Simple 3-Wire Connection for Delta or Wye Systems

### Description

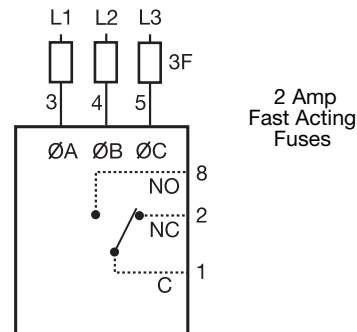
The PLMU Series continuously measures the voltage of each of the three phases to provide protection for three phase motors and sensitive loads. Its microcontroller senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are present. Universal voltage operation and standard base connection allows the PLMU to replace hundreds of competitive part numbers.

### Operation

Upon application of power, a 0.6 s random start delay begins and the PLMU measures the voltage levels and line frequency and selects the voltage range. The output relay is energized and the LED glows green when all voltages are acceptable and the phase sequence is correct. LED flashes green during trip delay, glows red when output de-energizes. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous trip delay before the relay de-energizes. Re-energization is automatic upon fault correction. The output relay will not energize if a fault condition is sensed as three phase input voltage is applied. Line voltage is selected with the knob, setting the over and undervoltage trip points. Voltage range is automatically selected by the microcontroller.

ASME A17.1 rule 210.6; NEMA MG1 14:30, 14:35; IEEE 587-1980 Level B

- Approvals:



F = Fuses

ØA = Phase A = L1

ØB = Phase B = L2

ØC = Phase C = L3

NO = Normally Open

NC = Normally Closed

Relay contacts are isolated. Dashed lines are internal connections.

CAUTION: 2 amp max fast acting fuses should be installed externally in series with each input. (3) (Bussman KTK-2 or equivalent)

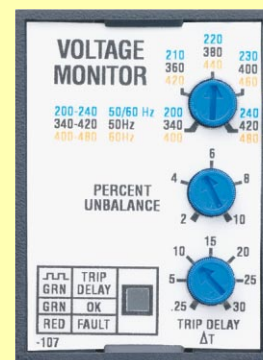
Voltage Unbalance	Trip Delay	Part Number
Adjustable 2 ... 10%	Adjustable 0.25 ... 30 s	Y PLMU11

Available with Fixed Unbalance and Trip Delay

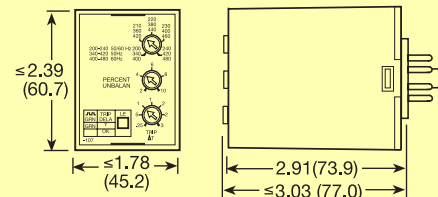
### Technical Data

<b>Line Voltage</b>	
Type	Three phase Delta or Wye with no connection to neutral
Line Voltage	200 ... 480 V AC +/-15%; 50 ... 60 Hz +/-2 Hz
Adjustable Voltage Ranges (Automatic Range Selection)	200 ... 240 V AC, 50 ... 60 Hz 340 ... 420 V AC, 50 Hz 400 ... 480 V AC, 60 Hz Maximum voltage 552 V AC
Phase Sequence	ABC
<b>Overvoltage, Undervoltage, &amp; Voltage Unbalance</b>	
Type	Voltage detection with delayed trip & automatic reset
Overvoltage & Undervoltage	
Undervoltage Trip Point	88 ... 92% of adjusted line voltage
Reset Voltage	+2% of trip voltage
Overvoltage Trip Point	109 ... 113% of adjusted line voltage
Reset Voltage	-2% of trip voltage
Voltage Unbalance Trip Point	Adjustable from 2 ... 10% or fixed 4 ... 10%
Reset on Balance (%):	
Selected Unbalance	2 3 4 5 6 7 8 9 10
Reset	1.5 2.5 3.5 4.5 5.4 6.3 7.2 8.1 9
<b>Trip Delay Range</b>	Adj. from 0.25 ... 30 s or fixed 2 ... 30 s +/-15%
Severe Unbalance - 2X Selected Unbalance	0.25 ... 2 s; if trip delay is less than 2 s; the trip delay is used
Random Start Delay	≅ 0.6 s
<b>Phase Reversal &amp; Phase Loss Trip Time</b>	≤ 150 ms
Phase Loss Set Point	≥ 15% unbalance
Reset Type	Automatic
<b>Output Type</b>	Energized when voltages are acceptable
Rating	10 A resistive @ 240 V AC; 1/4 hp @ 125 V AC; 1/3 hp @ 250 V AC; max. voltage 277 V AC Mechanical -- 1 x 10 <sup>6</sup> ; Electrical -- 1 x 10 <sup>6</sup>
Life	
<b>Protection</b>	
Surge	IEEE 587 Level B
Isolation Voltage	≥ 2500 V RMS input to output
<b>Mechanical</b>	
Mounting*	Plug-in socket rated 600 V AC
Termination	8-Pin octal plug
Package	3.03 x 2.39 x 1.78 in. (77.0 x 60.7 x 45.2 mm)
<b>Environmental</b>	
Operating Temperature	-40°C ... +60°C
Storage Temperature	-40°C ... +85°C
Weight	≅ 8.6 oz (244 g)

\*CAUTION: Select an octal socket rated for 600 V AC operation.



Faceplate View



Inches (Millimeters)

### Accessories

<p>Panel mount kit P/N: Y BZ1</p>	<p>Octal 8-pin socket P/N: Y OT08</p>	<p>3-phase fuse block/disconnect P/N: Y P0700 241 2 AMP fuse P/N: Y P0600 11</p>
<p>DIN rail P/Ns: Y C103PM (Al) 17322005 (Steel)</p>		

See accessory page at the end of this section.



# Compact 3 Phase Voltage Monitor TVM Series The Net™ Motor Protector



ANSI Device #27/47/59

- Protects Against: Phase Loss, Phase Reversal, Under, Over, and Unbalanced Voltages, Short Cycling
- Fixed Trip Points and Delays
- Fixed Voltages from 208 .. 480 V AC
- Isolated 10 A, SPDT Relay Contacts
- Bi-color LED Indicator Shows: Output Status, Faults, Time Delays

### Description

Provides protection for motors and other sensitive loads. Continuously measures voltage for each of the three phases using a new microcomputer circuit design that senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are present. Includes a trip delay to prevent nuisance tripping and a restart delay to prevent short cycling after a momentary power outage.

### Operation

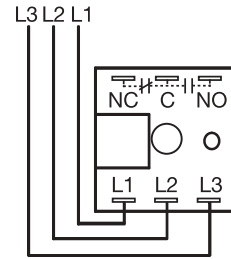
Upon application of line voltage, the restart delay begins. The output relay is de-energized during restart delay and the LED flashes green. Under normal conditions, the output energizes and the LED glows green after restart delay. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous trip delay period before the output is de-energized. The output will not de-energize if a fault is corrected during the trip delay. The LED flashes red during the trip delay, then glows red when output de-energizes. The restart delay begins as soon as the output relay de-energizes. If the restart delay is completed when the fault is corrected, the output relay will energize immediately.

The output relay will not energize if a fault or phase reversal is sensed as three phase input voltage is applied. The LED alternately flashes green then red if phase reversal is sensed.

**Reset:** Reset is automatic upon correction of a fault.

ASME A17.1 rule 210.6, NEMA MG1 14:30, 14:35, IEEE 587-1980 Level B

- Approvals: Patent Pending



Relay contacts are isolated. Dashed lines are internal connections.

L1 = Phase A L2 = Phase B L3 = Phase C

### Ordering Table

Y TVM Series	X Line Voltage	X Voltage Unbalance	X Trip Delay	X Restart Delay
	208 A - 208 V AC	Specify Fixed Percentage	Specify Fixed Delay In Seconds (S)	Specify Fixed Delay In Seconds (S)
	220 A - 220 V AC	4, 5, 6, 7, 8, 9, or 10	[0.3 ... 1]	[0.5 ... 1]
	230 A - 230 V AC		In 0.1 s Increments	In 0.1 s Increments
	240 A - 240 V AC		[1 ... 100]	[1 ... 100]
	380 A - 380 V AC		In 1 s Increments	In 1 s Increments
	400 A - 400 V AC			In Minutes (M)
	415 A - 415 V AC			[1 ... 999]
	440 A - 440 V AC			In 1 M Increments
	460 A - 460 V AC			
	480 A - 480 V AC			

Example P/N: **Y TVM240A45S10S**

### Technical Data

<b>Line Voltage</b>		
Type		Three phase Delta or Wye with no connection to neutral
Input Voltage		208 ... 480 V AC (see Ordering Table)
Tolerance/Frequency		-20% ... +10% / 50 ... 60 Hz
Phase Sequence		ABC
<b>Overvoltage, Undervoltage, &amp; Voltage Unbalance</b>		Voltage detection with delayed trip & automatic reset
<b>Overvoltage &amp; Undervoltage</b>		
Undervoltage Trip Point		88 ... 92% of the selected line voltage
Reset Voltage		≅ +3% of trip voltage
Overvoltage Trip Point		109 ... 113% of the selected line voltage
Reset Voltage		≅ -3% of trip voltage
Trip Variation vs Temperature		≤ +/-3%
Voltage Unbalance		Factory fixed, from 4 ... 10%
Trip Delay Range		Fixed, from 0.3 ... 100 s, +/-15% or +/-0.2 s, whichever is greater
Restart Delay Range		Fixed, from 0.5 s ... 1000 m, +/-15% or +/-0.2 s, whichever is greater
<b>Phase Reversal &amp; Phase Loss Response</b>		≤ 200 ms; automatic reset
Phase Loss		≥ 15% unbalance
<b>Output</b>		Isolated SPDT relay contacts
Rating	Type	
	208 ... 240 V AC (40°C)	10 A resistive @125 V AC, 5 A @ 250 V AC, 1/4 hp @ 125 V AC
	380 ... 480 V AC	10 A resistive @ 240 V AC, 1/4 hp @ 125 V AC, 1/3 hp @ 250 V AC; max. voltage 277 V AC
Life		Mechanical--1 x 10 <sup>6</sup> ; Electrical --1 x 10 <sup>5</sup>
<b>Protection</b>		Surge IEEE 587 Level B
Dielectric Breakdown	208 ... 240 V AC	≥ 1500 V RMS between input & output terminals
	380 ... 480 V AC	≥ 2500 V RMS between input & output terminals
<b>Mechanical</b>		
Mounting		Surface mount with one #8 (M5 x 0.8) screw
Termination		0.25 in. (6.35 mm) male quick connect terminals
<b>Environmental</b>		
Storage Temperature		208 ... 240 V AC: -30°C ... +85°C 380 ... 480 V AC: -40°C ... +85°C
Humidity		95% relative, non-condensing
Weight		208/240: ≅ 2.8 oz (79.4 g) 380/480: ≅ 4.3 oz (121.9 g)

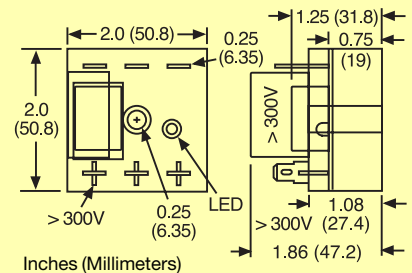
### Operating Temperature:

Line VAC	Output A/Line V	Unmounted	On Metal Surface
208/240V	@1A, Nom.V	-25°C...+60°C	≤+75°C
208/240V	@1A, +110%V	-25°C...+45°C	≤+65°C
380/480V	@1A, Nom.V	-40°C...+55°C	≤+65°C
380/480V	@1A, +110%V	-40°C...+45°C	≤+55°C
208/240V	Storage Temp	-30°C...+85°C	
380/480V	Storage Temp	-40°C...+85°C	

### Reset on Balance (%):

Selected Unbalance	Reset
4	3.5
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1
10	9

Note: A 60 Hz unit used on 50 Hz will shift by -1. A 50 Hz unit used on 60 Hz will shift by +1. (Ex. 4% unbalance on 60 Hz, would be 3% unbalance on 50 Hz.)



### Accessories

Female quick connect P/Ns: Y P1015 13 (AWG 10/12) Y P1015 64 (AWG 14/16) Y P1015 14 (AWG 18/22)	Fuse 2A fast acting 1.5" x 13/32" (38.1 mm x 10.3 mm) P/N: Y P0600 11	3-phase fuse block/disconnect P/N: Y P0700 241

See accessory page at the end of this section.

# Compact 3 Phase Voltage Monitor TVW Series The Net™ Motor Protector



ASME A17.1 rule 210.6, NEMA MG1 14:30, 14:35,  
IEEE 587-1980 Level B

- Protects Against: Phase Loss, Phase Reversal, Under, Over, and Unbalanced Voltages, Short Cycling
- Fixed or Adjustable Trip Points and Delays
- Voltages from 208 ... 480 V AC
- Isolated 10 A, SPDT Relay Contacts
- Bi-color LED Indicator Shows: Output Status, Faults, Time Delays, and Set Point

**Description** Preliminary Data Sheet - Available 1st quarter 2002

Provides protection for motors and other sensitive loads. Continuously measures the voltage of each of the three phases using a new microcontroller circuit design that senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are present. Includes a trip delay to prevent nuisance tripping and a restart delay to prevent short cycling after a momentary power outage.

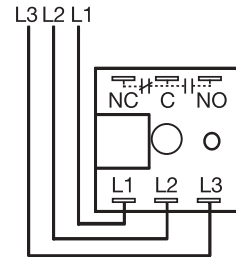
### Operation

Upon application of line voltage, the restart delay begins. The output is de-energized during restart delay. Under normal conditions, the output energizes after the restart delay. Undervoltage, overvoltage, and voltage unbalance must be sensed for the complete trip delay period before the output de-energizes. The restart delay begins as soon as the output de-energizes. If the restart delay is completed when a fault is corrected, the output energizes immediately. The output will not energize if a fault is sensed as the input voltage is applied. If the voltage selector is set between two voltage marks (e.g. between 220 and 230 V), the LED will flash red rapidly. The TVW provides fault protection at the lower of the two line voltages (e.g., 220 V).

**Reset:** Reset is automatic upon correction of a fault.

Patent Pending

- Approvals: - Pending



Relay contacts are isolated. Dashed lines are internal connections.

L1 = Phase A L2 = Phase B L3 = Phase C

## Ordering Table

Y TVW	X	X	X	X
<b>Series</b>	<b>Line Voltage Wide Range</b>	<b>Voltage Unbalance</b>	<b>Trip Delay</b>	<b>Restart Delay</b>
	-5 - 208 ... 240 V AC	Specify Fixed Percentage	Specify Fixed Delay In Seconds (S)	Specify Fixed Delay In Seconds (S)
	<b>Selectable</b>	4, 5, 6, 7, 8, 9, or 10	In 0.1 s Increments	In 0.1 s Increments
	-6 - 208, 220, 230 & 240 V AC		In 1 s Increments	In 1 s Increments
	-8 - 380, 400 & 415 V AC			In Minutes (M)
	-9 - 430, 440, 460 & 480 V AC			In 1 M Increments

Example P/N: **Y TVW645S10S**

## Technical Data

<b>Line Voltage</b>		
Type		Three phase Delta or Wye with no connection to neutral
Input Voltage		208 ... 480 V AC in 4 ranges
Tolerance/Frequency		-30% ... +20% / 50 ... 60 Hz
Phase Sequence		ABC
<b>Overvoltage, Undervoltage, &amp; Voltage Unbalance</b>		Voltage detection with delayed trip & automatic reset
Overvoltage & Undervoltage		
Undervoltage Trip Point		88 ... 92% of the selected line voltage
Reset Voltage		≅ +3% of trip voltage
Overvoltage Trip Point		109 ... 113% of the selected line voltage
Reset Voltage		≅ -3% of trip voltage
Trip Variation vs Temperature		≤ +/-2%
Voltage Unbalance		Factory fixed, from 4 ... 10%
Reset On Balance		≅ -0.7% unbalance
Trip Delay Range		Fixed, from 0.2 ... 100 s, +/-15% or +/-0.1 s, whichever is greater
Restart Delay Range		Fixed, from 0.4 s ... 999 m, +/-15% or +/-0.1 s, whichever is greater
<b>Phase Reversal &amp; Phase Loss Response</b>		≤ 200 ms; automatic reset
Phase Loss		≥ 15% unbalance
<b>Output</b>		Type Isolated SPDT relay contacts
Rating	208 ... 240 V AC (55°C)	10 A resistive @125 V AC, 5 A @ 250 V AC, 1/4 hp @ 125 V AC
	380 ... 480 V AC	10 A resistive @ 240 V AC, 1/4 hp @ 125 V AC, 1/3 hp @ 250 V AC; max. voltage 277 V AC
Life		Mechanical--1 x 10 <sup>6</sup> ; Electrical --1 x 10 <sup>5</sup>
<b>Protection</b>		Surge IEEE 587 Level B
Dielectric Breakdown	208 ... 240 V AC	≥ 1500 V RMS between input & output terminals
	380 ... 480 V AC	≥ 2500 V RMS between input & output terminals
<b>Mechanical</b>		
Mounting		Surface mount with one #8 (M5 x 0.8) screw
Termination		0.25 in. (6.35 mm) male quick connect terminals
<b>Environmental</b>		
Storage Temperature		-40°C ... +85°C
Humidity		95% relative, non-condensing
Weight		≅ 2.8 oz (79 g)

## LED Flashing Notes

Trip Delay	Red	ON/OFF	115 FPM
Restart Delay	Green	ON/OFF	57 FPM
PH Reversal	Red/Green		115 FPM
Voltage Selector Between Marks	Red	ON/OFF	460 FPM (7.5 FPS)

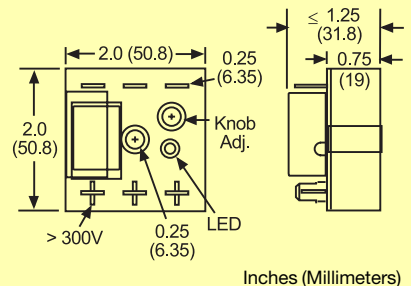
FPM = Flashes per minute  
FPS = Flashes per second

## LED Operation:

The LED flashes green during the restart delay, then glows green when the output energizes. It flashes red during the trip delay. It flashes red/green if phase reversal is sensed. If the voltage selector knob is between settings, it rapidly flashes red.

## Operating Temperature:

Line VAC	Output A/Line V	Unmounted	On Metal Surface
208/240V	@1A, Nom.V	-40°C...+70°C	+75°C
208/240V	@1A, +110%V	-40°C...+65°C	+70°C
380/480V	@1A, Nom.V	-40°C...+65°C	+70°C
380/480V	@1A, +110%V	-40°C...+60°C	+65°C



## Accessories

Female quick connect P/Ns: Y P1015 13 (AWG 10/12) Y P1015 64 (AWG 14/16) Y P1015 14 (AWG 18/22)	Fuse 2A fast acting 1.5" x 13/32" (38.1 mm x 10.3 mm) P/N: Y P0600 11	3-phase fuse block/disconnect P/N: Y P0700 241

See accessory pages at the end of this section.

# 3 Phase Voltage Monitor RLM Series Motor Protector



ANSI Device #47/27

- Protects Against: Phase Loss, Phase Reversal, Undervoltage, & Unbalance Voltages
- Industrial Packaging with Encapsulated Circuitry
- Fully Adjustable or Factory Fixed
- SPDT Isolated 8 A Contacts
- LED Glows When All Conditions are Acceptable
- Line Voltages 200 ... 480 V AC, in 3 Ranges

### Description

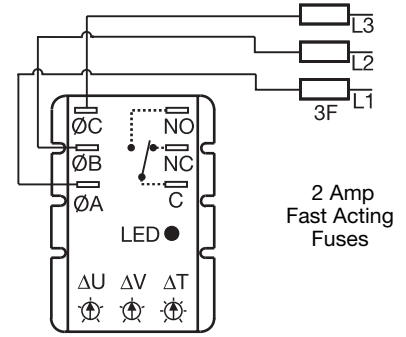
The RLM Series of encapsulated three phase voltage monitors continuously measures the voltage of each of the three phases. Its circuit design separately senses Phase Reversal, Undervoltage, and Voltage Unbalance including Phase Loss. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present. Both Delta and Wye systems can be monitored; no connection to neutral is required.

### Operation

The output relay is energized and the LED glows when all voltages are acceptable and the phase sequence is correct. Undervoltage and voltage unbalance must be sensed for a continuous trip delay period before the relay and the LED are de-energized. Re-energization is automatic upon correction of the fault condition. The output relay will not energize if a fault condition is sensed as power is applied.

ASME A17.1 rule 210.6, NEMA MG1 14:30, 14:35, IEEE 587-1980 Level B

Approvals:



- F = Fuses
- ØA = Phase A = L1
- ØB = Phase B = L2
- ØC = Phase C = L3
- ΔU = Unbalance Adjustment
- ΔV = Line Voltage Adjustment
- ΔT = Trip Delay Adjustment

**CAUTION:** 2 amp max. fast acting fuse must be installed externally in series with each input. (3) (Bussman KTK-2 or equivalent)

### Ordering Table

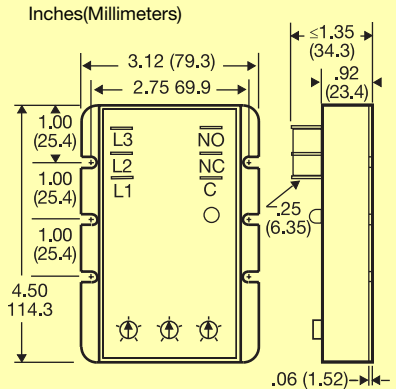
Y RLM Series	X Line Voltage	X Voltage Unbalance	X Trip Delay
-6 - 240 V AC	-1 - Adjustable: 2 ... 6 %	-1 - Adjustable: 2 ... 20 s	-1 - Adjustable: 2 ... 20 s
-9 - 480 V AC	-Fixed: Specify: 4, 5, 6, 7, or 8 %	-Fixed: Specify delay in s, 2 ... 20 s in 1 s increments (insert 0 before 2 ... 9)	
-8 - 380 V AC	-1 - Adjustable: 2 ... 8 % (380 V AC only)		
	-Fixed: Specify: 4, 5, 6, 7, or 8 %		

Example P/N: **Y RLM611** Fixed - **Y RLM9405**

### Technical Data

<b>Line Voltage</b>		3 phase Delta or Wye with no connection to neutral						
Type		3 phase Delta or Wye with no connection to neutral						
Operating Voltage:								
<b>UL CSA</b>	<b>Model</b>	<b>Adj. Line Voltage Range</b>	<b>Line Voltage Max.</b>	<b>Calibration Frequency</b>				
•	240	200 ... 240 V AC	270 V AC	60 Hz				
•	380	360 ... 430 V AC	480 V AC	50 Hz				
•	480	400 ... 480 V AC	530 V AC	60 Hz				
Line Frequency		50 ... 60 Hz						
Phase Sequence		ABC						
<b>Undervoltage and Voltage Unbalance</b>								
Type		Voltage detection with delayed trip & automatic reset						
Undervoltage:	Trip Voltage	88 ... 92% of adjusted line voltage						
	Reset Voltage	+3% of trip voltage						
Voltage Unbalance:	Trip Unbalance	240 & 480 V AC Adj. 2 ... 6%; 380 V AC Adj. 2 ... 8%; or fixed at 4, 5, 6, 7, or 8%						
Reset on Balance (%): Selected Unbalance		2	3	4	5	6	7	8
Reset		1.8	2.7	3.6	4.5	5.4	6.3	7.2
<b>Note:</b> A 60 Hz unit used on 50 Hz will shift by -1. A 50 Hz unit used on 60 Hz will shift by +1. (Ex: 4% unbalance on 60 Hz would be 3% unbalance on 50 Hz.)								
Trip Delay:	Range	Adjustable or Factory fixed from 2 ... 20 s						
	Tolerance	Adjustable: Guaranteed range: Factory fixed: +/-15%						
<b>Phase Reversal</b>								
Response Time -- Phase Reversal		≤100 ms						
Reset		Automatic						
<b>Output</b>								
Type		Electromechanical relay						
Form		Single pole double throw (SPDT)						
Rating		8 A resistive at 240 V AC; max. voltage 277 V AC						
<b>Protection</b>								
Surge		IEEE 587 Level B						
Isolation Voltage		≥ 2500 V RMS input to output						
Circuitry		Encapsulated						
<b>Mechanical</b>								
Mounting		Surface mount with two #8 (M4 x 0.7) screws						
Termination		0.25 in. (6.35 mm) male quick connect terminals						
<b>Environmental</b>								
Operating Temperature		-40°C ... +60°C						
Storage Temperature		-40°C ... +85°C						
Humidity		95% relative, non-condensing						
Weight		≈ 8.7 oz (247 g)						

**Field Adjustment:** Set voltage, delay period, and voltage unbalance percentage (consult equipment manufacturer's specifications). Make connection to all three line phases as shown in the connection diagram. Apply power. If the relay fails to energize, check the wiring of all 3 phases, voltage, and phase sequence. If phase sequence is incorrect, swap any two wires. No further adjustment should be required to achieve maximum equipment protection.



### Accessories

Female quick connect P/Ns: Y P1015 13 (AWG 10/12) Y P1015 64 (AWG 14/16) Y P1015 14 (AWG 18/22)	Fuse 2A fast acting 1.5" x 13/32" (38.1 mm x 10.3 mm) P/N: Y P0600 11	3-phase fuse block/disconnect P/N: Y P0700 241

See accessory page at the end of this section.

# Phase monitoring relay PVN mecotron® with adjustable min./max. voltage monitoring



- Monitors three-phase supply voltage for incorrect phase sequence as well as overvoltage/ undervoltage
- 3 voltage monitoring ranges: from 160...580 V
- 3 phases voltage section monitoring,  $V_{min}$  and  $V_{max}$  adjustable
- 2 SPDT contacts
- 5 LEDs to indicate all operational states

## Operation

The PVN monitors three-phase supply voltage for incorrect phase sequence, overvoltage, undervoltage and failure of one of the three phases.

The output relay de-energizes if one of the above faults occurs. The LEDs indicate nature of the fault. The output relay remains energized with correct phase sequence (rotary field right handed polarized) and correct voltage.

If the voltage exceeds the rated value  $V_{max}$  or if it falls below  $V_{min}$ , the output relay will de-energize. It will automatically energize again as soon as the voltage again attains the rated value, the set hysteresis of 5% thereby being effective.

## Time delay

Selector switch ☒/■ is used to set the time delay of the PVN as required in the application. Setting (☒): Alarm tripping indicating that voltage has exceeded or dropped below the set value will be suppressed during the set delay time.

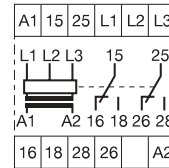
■ Approvals:

Momentary voltage fluctuations will not initiate alarm tripping.

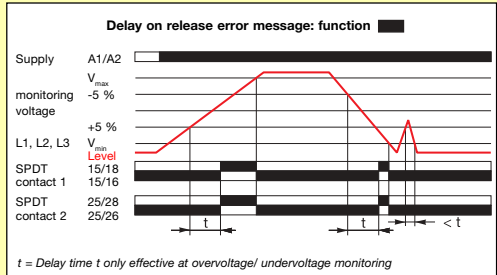
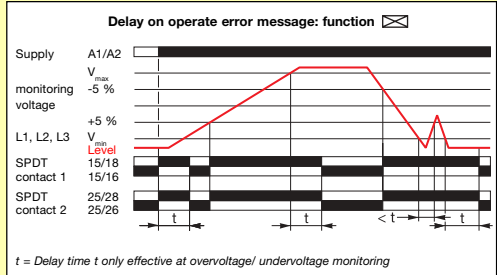
Setting (■): Alarm tripping will be instantaneous and will also be stored during the set delay time. Momentary undervoltage conditions will be recognized and, for better evaluation, prolonged by the set time.

## Return voltage

With motors running on two phases the produced return voltage may be so high that the output relay cannot de-energize if one of the phases fails. For such application, we recommend the use of phase unbalance relay ASN.



## 2 Functions



Monitoring voltage (3-phase mains) 50...60 Hz	
$V_{min}$ adjustable from	$V_{max}$ adjustable from
160...220 V AC	220...300 V AC
300...380 V AC	420...500 V AC
350...430 V AC	500...580 V AC

Supply voltage 50...60 Hz		
P/N:		
90...145 V AC	160...300 V AC	300...500 V AC
2 450 300 12	2 450 301 12	--
2 450 300 15	2 450 301 15	2 450 302 15
2 450 300 17	--	2 450 302 17

Accessories		P/N:
Sealable transparent cover		3 440 005 01
Adapter for screw mounting		3 430 029 01

## Technical data

Input circuit		Supply voltage - power consumption	
Supply voltage - power consumption	<b>A1-A2</b>	160...300 V AC	3 VA
	<b>A1-A2</b>	300...500 V AC	3 VA
Tolerance of supply voltage		-15 % ... +10 %	
Supply voltage frequency		50...60 Hz	
Duty time		100 %	
Timing circuit		Monitoring voltage adjustable	
Delay on operate time adjustable		0.1...10 s	
Delay on release time adjustable		0.1...10 s	
Timing error within tolerance of supply voltage		≤ 0.5 %	
Timing error within temperature range		≤ 0.06 % / °C	
Measuring circuit		L1, L2, L3	
Response value adjustable for overvoltage and undervoltage	$V_{min} / V_{max}$	160...220 V AC / 220...300 V AC 300...380 V AC / 420...500 V AC 350...430 V AC / 500...580 V AC	
Frequency		50...60 Hz	
Hysteresis (ref. to the set response value)		5 %	
Measuring cycle max.		80 ms	
Temperature error		≤ 0.06 % / °C	
Error within tolerance of supply voltage		≤ 0.5 %	
Display of operational status		Relay, 2 SPDT contacts, closed-circuit principle	
Supply voltage		V LED, green	
Output relay energized		R LED, yellow	
Overvoltage		> V LED, red	
Undervoltage		< V LED, red	
Phase failure and phase sequence failure		P LED, red	
Output circuit		15-16/18, 25-26/28	
Rated voltage	VDE 0110, IEC 947-1	400 V	
Rated switching voltage max.		400 V AC	
Rated switching current	AC 12 (resistive)	5 A (at 230 V)	
Rated switching current	AC 15 (inductive)	3 A (at 230 V)	
Rated switching current	DC 12 (resistive)	5 A (at 24 V)	
Rated switching current	DC 13 (inductive)	2.5 A (at 24 V)	
Maximum mechanical life		30 x 10 <sup>6</sup> operations	
Maximum electrical life (to AC 12 / 230 V / 5 A)		1 x 10 <sup>6</sup> operations	
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL	
General data		4 kV	
Rated impulse withstand voltage $V_{imp}$		-25°C ... +65°C	
Operating temperature		-40°C ... +85°C	
Storage temperature		any	
Mounting position		any	
Mounting to DIN rail		Snap-on mounting/Screw mounting by adapter	
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )	
Weight		approx. 0.66 lb (300 g)	

Note:  
Dimensions (W x H x D), 45 x 78 x 101 mm







### Operation

When input voltage is applied, the output energizes either immediately, or after a delay and the green LED glows as long as three phase currents and sequence are acceptable. Upon fault detection, red LED glows, and trip delay begins. Trip delay for overload is determined by trip curve of unit. Trip delays for phase loss and phase reversal are fixed. If the fault is corrected during trip delay, the delay resets. At the end of the trip delay, the output de-energizes. Reset mode is determined by the reset switch setting. A phase reversal fault must be manually reset.

**Automatic Restart Mode:** Upon application of input voltage, restart delay begins. The output is de-energized during restart delay, and energizes when it ends. Faults (except phase reversal) are displayed until the unit trips. A new restart delay begins as soon as the unit trips. Transferring the reset switch to the manual position during the restart delay energizes output.

**Auto-Trip Counter:** Three consecutive trips and unit will lockout until manually reset. The green indicator flashes during lockout. The auto-trip counter is reset when the unit operates for five minutes without detecting a fault.

**Manual Reset Mode:** Upon application of input voltage, the output energizes. When a fault trips the unit, the output must be manually reset. Faults are displayed until reset. Removing input voltage resets unit.

### Indicators

#### Green LED:

- OFF** - Output de-energized
- ON Steady** - Output energized
- Single Flash** - Lockout after 3 consecutive trips, output is de-energized
- Double Flash** - Restart delay, output is de-energized

#### Red LED:

- OFF** - Average current is acceptable
- ON Steady** - Phase reversal
- Single Flash** - Overload
- Double Flash** - Current unbalance or phase loss

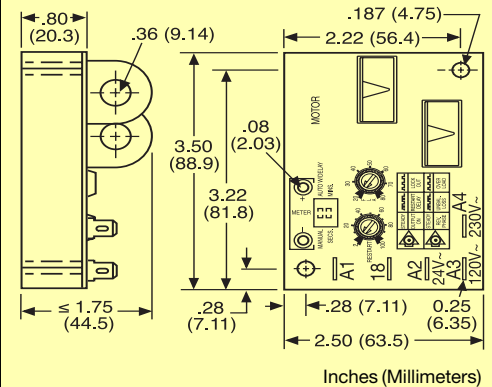
#### Overload Adjustment:

The FLA adjustment is knob adjustable over a wide 4:1 range. Select the FLA rating shown on the motor name plate. Connecting a digital DC voltmeter to meter terminals provides an accurate means of setting the FLA.

Note: A voltmeter with an input impedance of  $\geq 5 \text{ M}\Omega$  is recommended.

DC Voltage vs. FLA Setting			
Meter Volts	FLA Set Point (Amps)		
	1.25 - 5	5 - 20	20 - 80
0	1.25	5	20
0.5	1.63	6.50	26.00
1.0	2	8	32
1.5	2.38	9.5	38
2.0	2.75	11	44
2.5	3.13	12.5	50
3.0	3.5	14	56
3.5	3.86	15.5	62
4.0	4.25	17	68
4.5	4.62	18.5	74
5.0	5	20	80

## Solid-State Overload & Monitor ESTM Series Motor Protectors



### Accessories

Female quick connect P/Ns:  
**Y P1015 13** (AWG 10/12)  
**Y P1015 64** (AWG 14/16)  
**Y P1015 14** (AWG 18/22)



See accessory page at the end of this section.

### 3 Phase Voltage Monitor PLR Series Motor Protector



- Protects Against: Phase Loss (On Startup), Phase Reversal, Undervoltage
- Used Where Moderate Voltage Unbalance Protection is Not Required
- Direct Replacement for Most Popular 3 Phase Monitors
- 8-Pin Octal Base Connection
- SPDT Isolated 5 A Relay Contacts

#### Description

The PLR Series provides an excellent means of preventing motor startup during adverse voltage conditions. Proper A-B-C sequence must occur in order for the PLR's output contacts to energize. In addition, the relay will not energize when an undervoltage or phase loss condition is present.

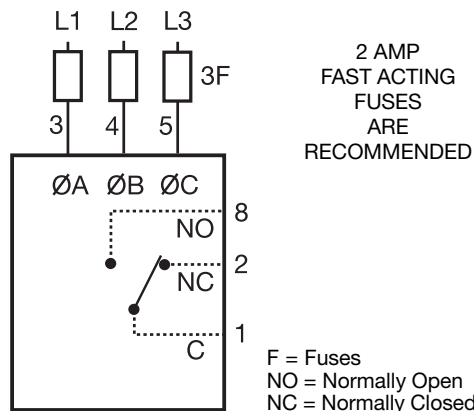
#### Operation

Internal relay is energized and LED glows when phase sequence and voltages are acceptable. When properly adjusted, relay will de-energize if phase loss or undervoltage occurs. Reset is automatic upon correction of the fault.

**Field Adjustment:** Turn the adjustment knob fully counterclockwise and apply three-phase power. LED should now be ON. Increase adjustment until LED goes OFF. Decrease adjustment until LED glows again. If nuisance tripping occurs, decrease the adjustment slightly.

NEMA MG1 14:30, 14:35 IEEE 587-1980 Level B  
AMSE A17.1 rule 210.6

- Approvals:



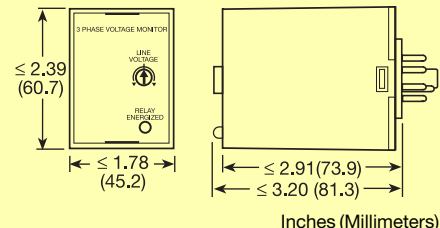
Relay contacts are isolated. Dashed lines are internal connections.

**NOTE:** When properly adjusted and operating in an average system, a voltage unbalance of 10% or more is required for phase loss detection. When a phase is lost while the motor is running, a voltage will be induced into the open phase nearly equal in magnitude to the normal phase-to-phase voltage. This condition is known as regeneration. **When regenerated voltages are present, the voltage unbalance during single phasing may not exceed 10% for some motors.** The PLR Series may not provide protection under this condition. For systems that require superior phase loss protection, select the PLMU Series.

Voltage	Part Number
95 ... 140 V AC	Y PLR120A
190 ... 270 V AC	Y PLR240A
340 ... 450 V AC	Y PLR380A
380 ... 500 V AC	Y PLR480A

#### Technical Data

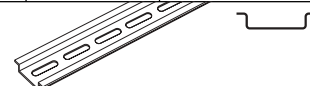
<b>Line Voltage</b>			
Type	3 phase Delta or Wye with no connection to neutral		
<b>Nominal Voltage</b>	<b>Undervoltage Dropout</b>	<b>Adjustment Range</b>	<b>Calibration Frequency</b>
120 V AC	85 ... 130 V AC		50 ... 60 Hz
240 V AC	170 .. 240 V AC		50 ... 60 Hz
380 V AC	310 ... 410 V AC		50 Hz
480 V AC	350 ... 480 V AC		50 ... 60 Hz
Phase Sequence	ABC		
<b>Response Times</b>			
Pull-in	≤ 400 ms		
Drop-out	≤ 1 s		
<b>Output</b>			
Type	Electromechanical relay, energized when all voltages are acceptable		
Form	Single pole double throw (SPDT)		
Rating	5 A resistive at 240 V AC		
Maximum Voltage	250 V AC		
<b>Protection</b>			
Isolation Voltage	120 & 240 V AC	≥ 1500 V RMS input to output	
	380 & 480 V AC	≥ 2500 V RMS input to output	
<b>Mechanical</b>			
Mounting	Plug-in socket		
Termination	8-pin, octal plug		
<b>Environmental</b>			
Operating Temperature	0°C ... +55°C		
Storage Temperature	-40°C ... +85°C		
Weight	≅ 6 oz (170 g)		



#### Accessories

Panel mount kit P/N: Y BZ1	Octal 8-pin socket P/N: Y OT08	3-phase fuse block/disconnect P/N: Y P0700 241 2 AMP fuse P/N: Y P0600 11

DIN rail P/Ns:  
Y C103PM (Al)  
17322005 (Steel)



See accessory page at the end of this section.

## Phase monitor relay PVE mecotron® economy



- Monitors three-phase supply voltage and single-phase supply voltage for phase failure as well as overvoltage and undervoltage
- Monitoring of neutral available
- 1 N/O contact
- Voltage monitoring range  
L1-L2-L3: 3x 260...480 V AC  
L-N: 150...275 V AC

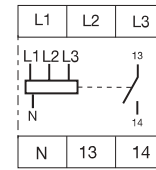
### Operation

The PVE monitors supply voltage for under-voltage, overvoltage and phase failure. If one of the above faults occurs, the output relay deenergizes and the yellow LED extinguishes. If the voltage exceeds the voltage value  $V_{max}$  or falls below the voltage value  $V_{min}$ , the output relay de-energizes. It will automatically energize as soon as the voltage returns to the monitoring range, a set hysteresis of 5% thereby being effective. When all three phases are operating with correct voltage the output relay remains energized.

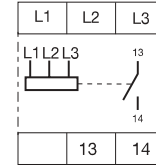
The product with neutral monitoring can also be used in single-phase power supplies by jumpering the three terminals (L1, L2, L3) and connecting only one phase.

■ Approvals:

with neutral monitoring:



without neutral monitoring:



### Supply voltages = Monitoring voltages

	P/N:
with neutral monitoring	2 550 870 94
without neutral monitoring	2 550 871 95

### Accessories

	P/N:

### Technical data

#### Input circuit L1 - L2- L3 (-N)

Supply voltage	L - N	185...265 V
	L - L	320...460 V
Tolerance		-15%; +10%
Frequency		50...60 Hz
Frequency tolerance		± 10 %
Duty time		100 %

#### Measuring circuit

Switch-off value for overvoltage	L - N	265 V
	L - L	460 V
Switch-in value for overvoltage	L - N	252 V
	L - L	437 V
Switch-off value for undervoltage	L - N	185 V
	L - L	320 V
Switch-on value for undervoltage	L - N	194 V
	L - L	336 V
Frequency		50...60 Hz
Frequency tolerance		± 10 %
Measuring cycle max.		80 ms

#### Time circuit

Delay on operate		500 ms
Delay on operate at over / undervoltage		500 ms
Tolerance of delay on operate		± 20%

#### Display of operational status

Output relay energized	R LED, yellow
------------------------	---------------

#### Output circuit

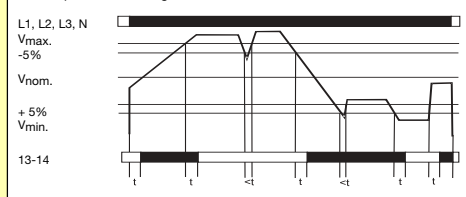
Rated voltage	VDE 0110, IEC947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life		3 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

#### General data

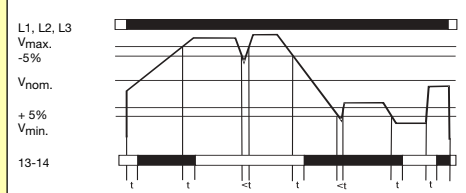
Rated impulse withstand voltage $V_{imp}$		4 kV (overvoltage category III)
Isolation voltage	Input - output	400 V
Operating temperature		-20°C ... +60°C
Storage temperature		-40°C ... +85°C
Mounting position		any
Mounting to DIN-rail (EN 50022)		Snap-on mounting
Cable size stranded with wire end ferrule		2 x 16 AWG (2 x 1.5 mm <sup>2</sup> )
Weight		approx. 0.17 lb (75 g)
Dimensions (W x H x D)		22.5 x 78 x 78.5 mm

## 2 Functions

Three-phase monitoring with neutral



Three-phase monitoring without neutral





# Phase sequence relay PFN mecotron®



## Operation

The PFN monitors three-phase supply voltage for incorrect phase sequence, overvoltage, undervoltage and failure of one of the three phases. The output relay de-energizes and the LEDs indicate nature of the fault if one of the above faults occurs. The output relay remains energized with correct phase sequence (rotary field right handed polarized) and correct voltage. If the voltage exceeds 1.1 times the rated value or falls below 0.9 times the rated value, the output relay will de-energize. It will automatically energize again as soon as the voltage again attains the rated value, the set hysteresis of 5% thereby being effective.

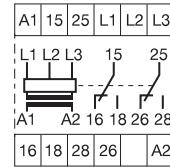
A delay on operate or on release time can be set for the overvoltage and undervoltage monitoring functions. The delay time is adjusted with a potentiometer. Phase failure and incorrect phase sequence are indicated without delay.

With motors running on two phases the regenerated voltage may be so high that the output relay cannot de-energize if one of the phases fails. For such application, we recommend the use of phase unbalance relay ASN.

Approvals:



- Monitors three-phase supply voltage for incorrect phase sequence, overvoltage, undervoltage
- Monitoring range: 0.9 to 1.1 V<sub>N</sub>
- Fixed switching hysteresis of 5 %
- Selectable delay on operate or on release of 0.1 ... 10 s on overvoltage or undervoltage
- 2 SPDT contacts
- 5 LEDs to indicate all operational states
- 3 three-voltage monitoring versions: 220 V, 400 V, 500 V
- 3 supply voltage versions: 110...130 V, 220...240 V, 380...415 V



### Monitoring voltage (3-phase) Types for special measuring ranges and voltages on request

Supply voltage 50...60 Hz	P/N: 220 V/50 Hz	P/N: 380 V/50 Hz	P/N: 400 V/50 Hz	P/N: 400 V/60 Hz	P/N: 500 V/50 Hz
110...130 V AC	2 450 310 02	2 450 310 04	2 450 310 05		2 450 310 07
220...240 V AC	2 450 311 02	2 450 311 04	2 450 311 05		2 450 311 07
380...415 V AC	2 450 312 02	2 450 312 04	2 450 312 05	2 450 412 05	2 450 312 07

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

### Input circuit

Supply voltage - power consumption	A1-A2	110...130 V AC	-	3 VA
	A1-A2	220...240 V AC	-	3 VA
	A1-A2	380...415 V AC	-	3 VA

Tolerance of supply voltage	-15 % ... +10 %
Supply voltage frequency	50...60 Hz

### Time circuit

Delay on operate time adjustable	0.1...10 s
Delay on release time adjustable	0.1...10 s
Timing error within tolerance of supply voltage	≤ 0.5 %
Timing error within temperature range	≤ 0.06 % / °C

### Measuring circuit

	L1, L2, L3
Monitoring voltage V <sub>nom</sub>	220 V AC 380 V AC 400 V AC 500 V AC
Frequency	50 Hz or 60 Hz
Response value at overvoltage/ undervoltage	0.9/1.1·V <sub>Nom</sub> (0.85/1.1 for 380 V/50 Hz version)
Reset value at overvoltage/ undervoltage	0.95/1.05·V <sub>Nom</sub> (0.9/1.05 for 380 V/50 Hz version)
Measuring cycle max.	80 ms
Hysteresis (fixed)	5 %
Temperature error	≤ 0.06 % / °C
Error within tolerance of supply voltage	≤ 0.5 %

### Display of operating status

Supply voltage	V LED, green
Output relay energized	R LED, yellow
Overvoltage	>V LED, red
Undervoltage	<V LED, red
Phase failure and phase sequence error	P LED, red

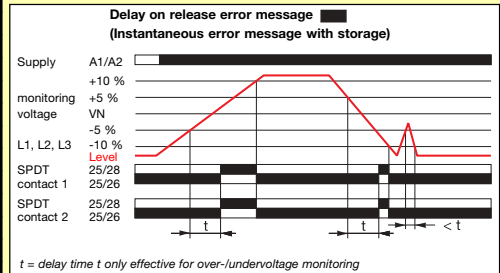
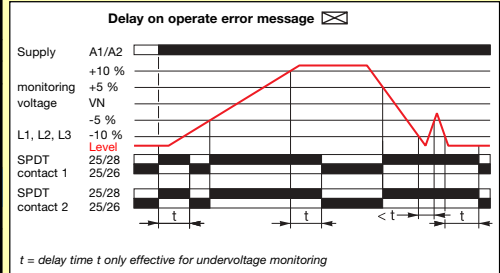
### Output circuit

	15-16/18, 25-26/28	Relay, 2 SPDT contacts, closed-circuit principle
Rated voltage	VDE 0110, IEC 947-1	400 V
Rated switching voltage max.		400 V AC
Rated switching current	AC 12 (resistive)	5 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	5 A (at 24 V)
Rated switching current	DC 13 (inductive)	2.5 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		1 x 10 <sup>6</sup> operations
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL

### General data

Rated impulse withstand voltage V <sub>imp</sub>	4 kV
Operating temperature	-25°C ... +65°C
Storage temperature	-40°C ... +85°C
Mounting position	any
Mounting to DIN rail (EN 50022)	Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight	approx. 0.66 lb (300 g)

## 2 Functions



Note:  
Dimensions (W x H x D), 45 x 78 x 101 mm

# Reverse Phase Relay PLS Series Motor Protector



- Protects Against Phase Reversal
- Low Cost Protection, One Unit for All Sized Motors
- 3 Wire Connection for Delta or Wye Systems
- Octal Base Connection--One Replaces Most Models
- SPDT Isolated Relay Contacts
- Factory Calibrated--No Adjustments Required

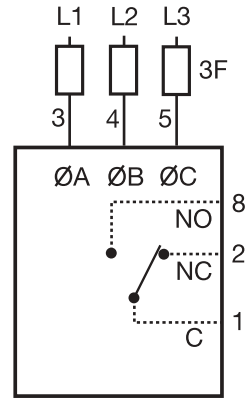
### Description

The PLS Series is a low cost phase sensitive control that provides an isolated contact closure when the proper A-B-C phase sequence is applied. Protects sensitive 3 phase equipment and equipment operators from reverse rotation. Designed to be compatible with motor overloads or other 3 phase equipment protection devices. Protection for equipment control centers where frequent reconnection or electrical code makes reverse rotation protection essential. Examples include, mobile refrigerated containers, construction equipment, hoists, pumps, conveyors, elevators and escalators.

### Operation

The internal relay is energized when the phase sequence is correct. The output relay will not energize if the phases are reversed. Reset is automatic upon correction of the fault.

■ Approvals:



2 AMP  
FAST ACTING  
FUSES  
ARE  
RECOMMENDED

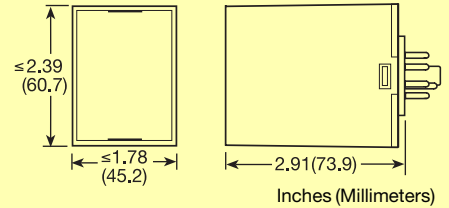
F = Fuses  
NO = Normally Open  
NC = Normally Closed

Relay contacts are isolated. Dashed lines are internal connections.

Voltage	Part Number
120 V AC	Y PLS120A
208/240 V AC	Y PLS240A
380/415 V AC	Y PLS380A
440/480 V AC	Y PLS480A

### Technical Data

Line Voltage				
Type	3-phase Delta or Wye with no connection to neutral			
Nominal Voltage	Minimum Voltage	Maximum Voltage	Calibration Frequency	
120 V AC	95 V AC	135 V AC	50 ... 60 Hz	
208/240 V AC	175 V AC	255 V AC	50 ... 60 Hz	
380/415 V AC	310 V AC	430 V AC	50 Hz	
440/480 V AC	380 V AC	500 V AC	50 ... 60 Hz	
Phase Sequence	ABC			
Response Times				
Pull-in	≤ 30 ms			
Drop-out	≤ 25 ms			
Output				
Type	Electromechanical relay, energized when the phase sequence is correct			
Form	Isolated SPDT			
Rating	120 & 240 V AC	10 A resistive at 240 V AC		
	380 & 480 V AC	8 A resistive at 240 V AC		
Maximum Voltage	250 V AC			
Protection				
Isolation Voltage	120 & 240 V AC	≥ 1500 V RMS input to output		
	380 & 480 V AC	≥ 2500 V RMS input to output		
Mechanical				
Mounting	Plug-in socket			
Termination	8-pin, octal plug			
Environmental				
Operating Temperature	-40°C ... +55°C			
Storage Temperature	-40°C ... +85°C			
Weight	≅ 6 oz (170 g)			



### Accessories

<p>Panel mount kit P/N: Y BZ1</p>	<p>Octal 8-pin socket P/N: Y OT08</p>	<p>3-phase fuse block/disconnect P/N: Y P0700 241 2 AMP fuse P/N: Y P0600 11</p>
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DIN rail  
P/Ns:  
Y C103PM (Al)  
17322005 (Steel)

See accessory page at the end of this section.

**Phase sequence relay**  
**PFE mecatron®**

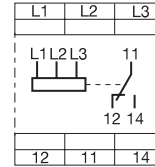


- Monitors three-phase input power supply for incorrect phase sequence
- Without delay on "ON"
- 1 SPDT contact
- LED to indicate state of relay
- Continuous voltage range covering 208...440 V 50/60 Hz

**Operation**

The PFE monitors three-phase supply voltage for incorrect phase sequence. The output relay remains energized with correct phase sequence. It resets and the yellow LED extinguishes in the case of incorrect phase sequence or failure of a phase.

With motors running on two phases, the PFE is able to monitor regenerated voltages up to 60% of the original voltage. If the voltage is higher, the output relay can not de-energize. For such application, we recommend the use of phase unbalance relay ASN.



■ Approvals:

Supply voltage = Monitoring voltage	P/N:
208...440 V AC	2 550 824 91

Accessories	P/N:
Adaptor for screw mounting	3 430 029 01

**Technical data**

**Input circuit**

Supply voltage - power consumption = Measuring voltage	<b>L1, L2, L3</b>	208...440 V AC	-	15 VA
Tolerance of supply voltage			-10 % ... +10 %	
Supply voltage frequency			50...60 Hz	
Duty time			100 %	

**Measuring circuit**

Monitoring voltage Vnom.	<b>L1, L2, L3</b>	208...440 V AC
Frequency		50...60 Hz
Measuring cycle max.		500 ms
Temperature error		≤ 0.06 % / °C
Error within tolerance of supply voltage		≤ 0.5 %

**Display of operating status**

Output relay energized R LED, yellow

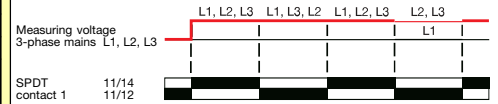
**Output circuit**

Output circuit	<b>11-12/14</b>	Relay, 1 SPDT contact, closed-circuit principle
Rated voltage	VDE 0110, IEC 947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

**General data**

Rated impulse withstand voltage Vimp		4 kV
Operating temperature		-25°C ... +65°C
Storage temperature		-40°C ... + 85°C
Mounting position		any
Mounting to DIN rail (EN 50022)		Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule		2 x 16 AWG (2 x 1.5 mm <sup>2</sup> )
Weight		approx. 0.17 lb (75 g)
Dimensions (W x H x D)		22.5 x 78 x 78.5 mm

**1 Function**



## Phase sequence relay PFS mecotron®



- Monitors three-phase supply voltage for incorrect phase sequence and phase failure
- No time delay
- 2 SPDT contacts
- LED to indicate state of relay
- Continuous voltage range covering 200...500 V 50/60 Hz

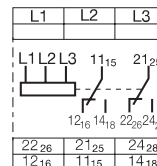
### Operation

The PFS monitors three-phase input power supply voltage for incorrect phase sequence and phase failure. The output relay remains energized with correct phase sequence.

It resets and the yellow LED extinguishes in the case of incorrect phase sequence or failure of a phase.

With motors running on two phases the PFS is able to monitor regenerated voltages up to 60% of the original voltage. If the voltage is higher the output relay can not de-energize. For such application, we recommend the use of phase unbalance relay ASN.

■ Approvals:



#### ATTENTION!

If several PFS units are placed side by side and supply voltage is higher than 415 V, spacing between the individual units must be 10 mm minimum.

Supply voltage = Monitoring voltage	P/N:
200...500 V AC	2 430 824 93

Accessories	P/N:
Sealable transparent cover	3 430 005 01
Adapter for screw mounting	3 430 029 01

### Technical data

#### Input circuit

Supply voltage - power consumption = Measuring voltage	<b>L1, L2, L3</b>	200...500 V AC	-	15 VA
Tolerance of supply voltage			-15 % ... +10 %	
Supply voltage frequency			50...60 Hz	
Duty time			100 %	

#### Measuring circuit

Monitoring voltage V <sub>nom</sub> .	<b>L1, L2, L3</b>	220...500 V AC
Frequency		50...60 Hz
Measuring cycle max.		500 ms

#### Display of operating status

Output relay energized R LED, yellow

#### Output circuit

Output circuit	<b>15-16/18, 25-26/28</b>	Relay, 2 SPDT contacts, closed-circuit principle
Rated voltage	VDE 0110, IEC 947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

#### General data

Rated impulse withstand voltage V <sub>imp</sub>		4 kV
Operating temperature		-25°C ... +65°C
Storage temperature		-40°C ... + 85°C
Mounting position		any
Mounting to DIN rail (EN 50022)		Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight		approx. 0.33 lb (150 g)
Dimensions (W x H x D)		22.5 x 78 x 101 mm

### 1 Function





# Phase monitor relay PBE mecotron® economy



- Monitors three-phase supply voltage and single-phase supply voltage for phase failure
- Monitoring of neutral available
- 1 N/O contact
- Voltage monitoring range  
L1-L2-L3: 380...480 V AC  
L-N: 220...240 V AC

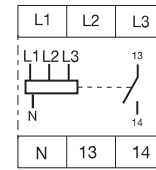
## Operation

The PBE monitors supply voltage for phase failure. If the above fault occurs the output relay deenergizes and the yellow LED extinguishes. It will automatically energize as soon as the voltage returns to the monitoring range. When all three phases are operating, the output relay remains energized.

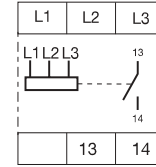
The product with neutral monitoring can also be used in single-phase power supplies by jumpering the three terminals (L1, L2, L3) and connecting only one phase.

■ Approvals:

with neutral monitoring:



without neutral monitoring:



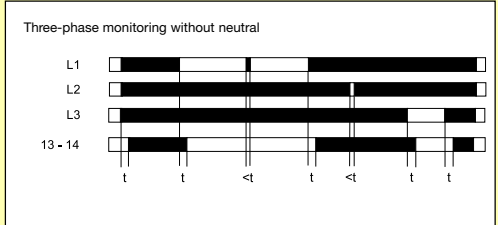
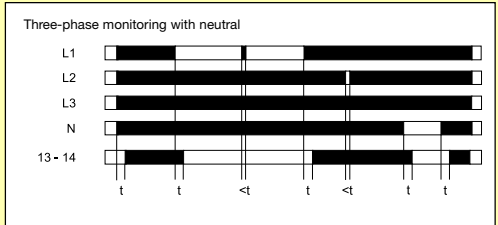
Supply voltages = Monitoring voltages	
	P/N:
with neutral monitoring	2 550 881 94
without neutral monitoring	2 550 882 95

Accessories	
	P/N:

## Technical data

Input circuit		L1 - L2- L3 (-N)
Supply voltage	L - N	220...240 V
	L - L	380...440 V
Tolerance		-15%; +15%
Supply voltage frequency		50...60 Hz
Frequency tolerance		± 10%
Duty time		100 %
Measuring circuit		
Switch-off value at phase failure		60% ( $V_{nom}$ )
Switch-in value		65% ( $V_{nom}$ )
Frequency		50...60 Hz
Frequency tolerance		± 10%
Measuring cycle max.		40ms
Time circuit		
Delay on operate		500 ms
Delay on operate at phase failure		100 ms
Tolerance of delay on operate		± 20%
Display of operational status		
Output relay energized		R LED yellow
Output circuit		13-14
		Relay, 1 n/o contact, closed-circuit principle
Rated voltage	VDE 0110, IEC947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life		3 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		1 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL
General data		
Rated impulse withstand voltage $V_{imp}$		4 kV (overvoltage category III)
Isolation voltage	Input - output	400 V
Operating temperature		-20°C ... +60°C
Storage temperature		-40°C ... +80°C
Mounting position		any
Mounting to DIN-rail (EN 50022)		Snap-on mounting
Cable size stranded with wire end ferrule		2 x 16 AWG (2 x 1.5 mm <sup>2</sup> )
Weight		approx. 0.17 lb (75 g)
Dimensions (W x H x D)		22.5 x 78 x 78.5 mm

## 2 Functions






## Voltage monitoring relay ESS mecotron®

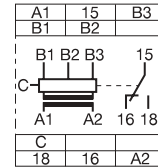


- Monitors AC or DC voltages from 50 mV to 500 V in 8 ranges
- Up to 3 measuring ranges in one unit
- Switching hysteresis adjustable from 5...30 %
- No time delay
- 1 SPDT contact
- 2 LEDs to indicate operational status
- 4 Supply voltage versions, from 24...240 V AC

## Operation

The voltage being monitored is applied to the terminals B1 or B2 or B3 and C. The output relay energizes when the monitored voltage exceeds the set response value. It de-energizes when the voltage is below the set response value within the hysteresis value. Hysteresis is adjustable from 5...30 %. Measuring, output, and supply circuits are electrically isolated to prevent mutual interference. As one measuring cycle takes 80 ms, changes in voltage can quickly be detected. Supply voltage must be applied at least 50 ms before applying measuring voltage.

■ Approvals:   



To extend the measuring range, please refer to page 1465.

### Supply voltage 50...60 Hz

	Voltage measuring ranges		P/ N:
	P/ N:	P/ N:	/.../
24 V AC	50...500 mV 2 430 831 90	1...10 V 2 430 831 91	30...300 V 2 430 831 92
42...48 V AC	0.3...3 V 2 430 831 80	5...50 V 2 430 831 81	30...300 V 2 430 831 82
110...130 V AC	0.3...3 V 2 430 831 00	5...50 V 2 430 831 01	30...300 V 2 430 831 02
220...240 V AC	0.3...3 V 2 430 831 10	5...50 V 2 430 831 11	30...300 V 2 430 831 12

### Accessories

	P/ N:
Sealable cover	3 430 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

### Input circuit

Supply voltage - power consumption	A1-A2	24 V AC	-	1 VA
	A1-A2	42...48 V AC	-	1 VA
	A1-A2	110...130 V AC	-	1 VA
	A1-A2	220...240 V AC	-	1 VA
Tolerance of supply voltage		-15 % ... +10 %		
Supply voltage frequency		50...60 Hz		
Duty time		100 %		

### Measuring circuit

Measuring voltage inputs	B1/C	0.05...0.5 V	1...10 V	/.../
	B2/C	0.3...3 V	5...50 V	30...300 V
	B3/C	0.5...5 V	10...100 V	50...500 V
Hysteresis (ref. to the response value) adjustable		5...30 %		
Measuring cycle max.		80 ms		
Temperature error		≤ 0.06 % / °C		
Error within the tolerance of supply voltage		≤ 0.5 %		
Overload of the measuring inputs		See table on page 1465.		

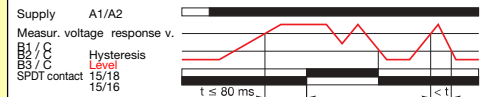
### Display of operational status

Supply voltage		LED, green
Output relay energized		LED, yellow
<b>Output circuit</b>	<b>15-16/18</b>	Relay, 1 SPDT contact, open circuit principle
Rated voltage	VDE0100, IEC 947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life/ operations		30 x 10 <sup>6</sup> operations
Maximum electrical life (to AC 12 / 230 V / 4 A)		3 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

### General data

Rated impulse withstand voltage V <sub>imp</sub>		4 kV
Operating temperature		-20°C ... +60°C
Storage temperature		-40°C ... +80°C
Mounting position		any
Mounting to DIN rail (EN 50022)		Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight		approx. 0.33 lb (150 g)
Dimensions (W x H x D)		22.5 x 78 x 101 mm

## 1 Function



$t = \text{Delay on operate}^* \text{ max. } 80 \text{ ms}$

# Voltage monitoring relay ESN mecotron®



- Monitors AC or DC voltages from 50 mV to 500 V in 8 ranges
- Up to 3 measuring ranges in one unit
- Convertible to overvoltage or undervoltage monitoring
- Switching hysteresis adjustable from 5...30 %
- With or without delay on operate 0.05...30 s
- 2 SPDT contacts
- 2 LEDs to indicate operational status
- 4 supply voltage versions
- Version 24...240 V AC/DC, covers a frequency range of 16 Hz to 400 Hz

## Operation

The voltage being monitored is applied to the terminals B1 or B2 or B3 and C. The unit can be set for 2 monitoring modes by a rotary switch on the front face.

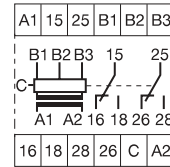
The overvoltage mode (OV) means, if the monitored value is above the set value, the output relay will energize. The undervoltage mode (UV) means, if the monitored value is below the set value, the output relay will energize.

The output relay de-energizes when the monitored value is above or below the set hysteresis percentage. Hysteresis is adjustable from 5...30 %.

Measuring, output, and supply voltage circuits are electrically isolated to prevent mutual interference. As one measuring cycle takes only 80 ms, changes in voltage can quickly be detected.

The delay on operate values can be set infinitely from 0.05...1 s and 1.5...30 s, thus ensuring optimal adaptation to application requirements.

■ Approvals:



Supply voltage 50...60 Hz	Voltage measuring ranges with delay on operate		Voltage measuring ranges without delay on operate			
	P/N: 50...500 mV 0.3...3 V 0.5...5 V	P/N: 1...10 V 5...50 V 10...100 V	P/N: /.../ 30...300 V 50...500 V	P/N: 50...500 mV 0.3...3 V 0.5...5 V	P/N: 1...10 V 5...50 V 10...100 V	P/N: /.../ 30...300 V 50...500 V
24...240 V AC/DC	2 450 225 00	2 450 225 01	2 450 225 02	2 450 215 00	2 450 215 01	2 450 215 02
110...130 V AC	2 450 220 00	2 450 220 01	2 450 220 02	2 450 210 00	2 450 210 01	2 450 210 02
220...240 V AC	2 450 221 00	2 450 221 01	2 450 221 02	2 450 211 00	2 450 211 01	2 450 211 02
380...415 V AC	2 450 222 00	2 450 222 01	2 450 222 02	2 450 212 00	2 450 212 01	2 450 212 02

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

### Input circuit

Supply voltage - power consumption	A1-A2	24...240 V AC/DC	-	2 VA / W
	A1-A2	110...130 V AC	-	2 VA
	A1-A2	220...240 V AC	-	2 VA
	A1-A2	380...415 V AC	-	2 VA

Tolerance of supply voltage: -15 % ... +10 %

Supply voltage frequency: 50...60 Hz

### Timing circuit

Delay on operate time adjustable: Message of error, overvoltage, undervoltage  
0.05...1 s and 1.5...30 s

Timing error within the tolerance of supply voltage: ≤ 0.5 %

Timing error within the temperature range: ≤ 0.06 % / °C

### Measuring circuit

Measuring voltage inputs	B1/C	0.05...0.5 V	1...10 V	/.../
	B2/C	0.3...3 V	5...50 V	30...300 V
	B3/C	0.5...5 V	10...100 V	50...500 V

Hysteresis (ref. to the response value) settable: 5...30 %

Measuring cycle max.: 80 ms

Temperature error: ≤ 0.06 % / °C

Error within the tolerance of supply voltage: ≤ 0.5 %

### Display of operational status

Supply voltage: LED, green

Output relay energized: LED, yellow

Output circuit: 15-16/18, 25-26/28 Relay, 2 SPDT contacts, open circuit principle

Rated voltage: VDE0100, IEC 947-1 400 V

Rated switching voltage max.: 400 V AC

Rated switching current AC 12 (resistive): 5 A (at 230 V)

Rated switching current AC 15 (inductive): 3 A (at 230 V)

Rated switching current DC 12 (resistive): 5 A (at 24 V)

Rated switching current DC 13 (inductive): 2.5 A (at 24 V)

Maximum mechanical life/ operations: 30 x 10<sup>6</sup> operations

Maximum electrical life (to AC 12 / 230 V / 5 A): 1 x 10<sup>6</sup> operations

Short-circuit proof, max. fuse rating: 5 A / fast, operating class gL

### General data

Rated impulse withstand voltage V<sub>imp</sub>: 4 kV

Operating temperature: -25°C ... +65°C

Storage temperature: -40°C ... +85°C

Mounting position: any

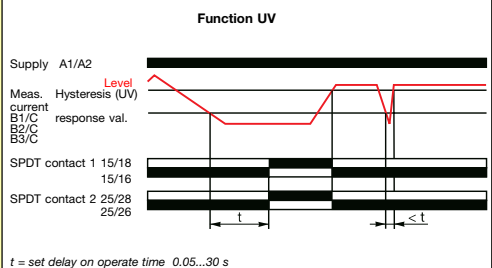
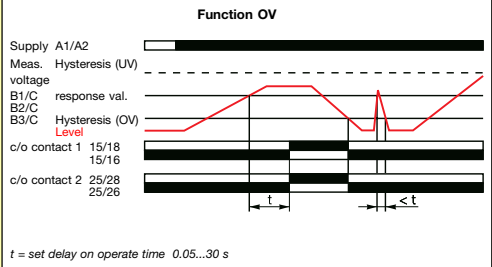
Mounting to DIN rail (EN 50022): Snap-on mounting/Screw mounting by adapter

Cable size stranded with wire end ferrule: 2 x 14 AWG (2 x 2.5 mm<sup>2</sup>)

Weight: approx. 0.66 lb (300 g)

Dimensions (W x H x D): 45 x 78 x 101 mm

## 2 Functions



## Voltage monitoring relay ESS and ESN mecotron®

### Applications

Because the ESN only needs the measuring voltage  $V_{ESN}$  it is possible to use it with voltages greater than 500 V in combination with an additional resistor. This additional resistor must be at least fit to the  $V_{RV}$  voltage.

### Setting

To set the response sensitivity, the delay on operate value must be set to the smallest value.

### Example:

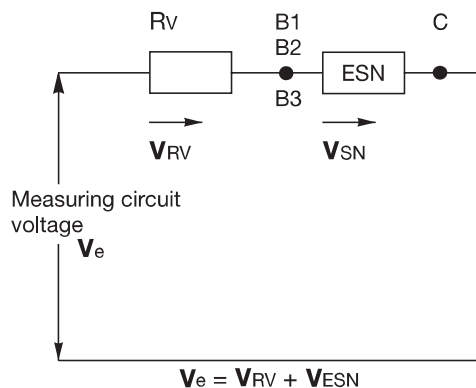
Measuring voltage to be monitored: 12 V DC  
 Undervoltage monitoring with delay on "ON": 20 s  
 Response voltage: 13.2 V  
 Selection ESN mecotron; with delay on "ON"  
 Measuring ranges from 5...50 V  
 Terminal setting: 5...50 V B2/C  
 Selection switch function: overvoltage (OV)/undervoltage (UV) to UV  
 Selection switch time sector: to 30 s  
 Potentiometer time value: to 20 s  
 Potentiometer U-value: Measuring voltage level to 12  
 Potentiometer Hyst. %:  $(13.2 - 12) V = 1.2 V = 10 \%$  of the measuring voltage level; to 10

### Setting

To set the response sensitivity the delay on operate value must be set to the smallest value.

### Range expansion

Expanding of the ranges can be done with a resistor  $R_V$  connected in series to the measuring input.



### Example:

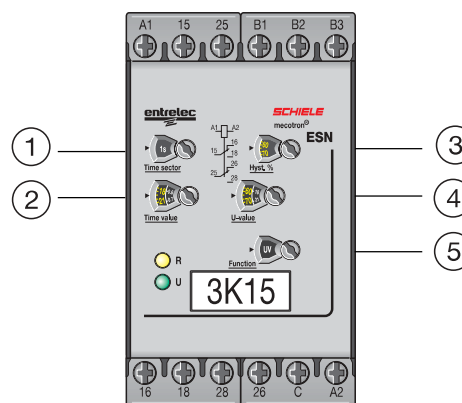
Voltage to be monitored (Measuring voltage):  $V_e$ : 600 V  
 Range of the ESN (Measuring voltage of the ESN):  $V_{B2...C}$ : 50...500 V  
 Input resistance  $R_i$  of the ESN = 951 k $\Omega$

$$R_V = R_i \times \frac{V_e - V_{ESN}}{V_{ESN}} = 951 \text{ k}\Omega \times \frac{600 \text{ V} - 500 \text{ V}}{500 \text{ V}} = 190.2 \text{ k}\Omega$$

$$R_V = 190.2 \text{ k}\Omega$$

### Resistive load

The size of the additional resistors  $R_V$  are generally sufficient if they are sized for a power consumption of 0.5 W.



- ① Time sector: Time selection switch, 0.5...1 s or 1.5...30 s
- ② Time value: Setting the desired time value
- ③ Hyst. %: Setting the response threshold/ hysteresis
- ④ U-value: Setting the desired voltage value
- ⑤ Function: Selection switch overvoltage (OV) / undervoltage (UV)

### Voltage measurement ranges

Voltage measuring range	Input resistance $R_i$	Terminal setting / Measuring input	Permanent overload	Overload for $t < 1 \text{ s}$
50...500 mV	7.7 k $\Omega$	B1/C	10 V	25 V
0.3...3 V	46.5 k $\Omega$	B2/C	60 V	80 V
0.5...5 V	77.5 k $\Omega$	B3/C	80 V	100 V
1...10 V	19 k $\Omega$	B1/C	100 V	120 V
5...50 V	95 k $\Omega$	B2/C	150 V	200 V
10...100 V	190 k $\Omega$	B3/C	300 V	400 V
/.../	-	B1/C	-	-
30...300 V	570 k $\Omega$	B2/C	500 V	550 V
50...500 V	951 k $\Omega$	B3/C	550 V	550 V



# Single phase monitoring relay EFN meco-tron® with adjustable min./max. voltage monitoring



- Monitors single-phase supply voltage for phase failure as well as overvoltage and undervoltage
- 2 voltage monitoring ranges: from 80 ... 300 V
- 1 phase voltage section monitoring,  $V_{min}$  and  $V_{max}$  are adjustable
- 2 SPDT contacts
- 5 LED displays to identify all states
- Adjustable delay on operate and on release 0.1 ...10s

## Operation

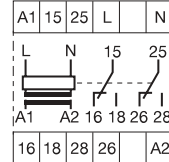
The EFN monitors single phase supply voltages for phase failure, overvoltage and undervoltage conditions. The output relay will de-energize if one of the fault conditions occurs. The nature of the fault will be indicated by an LED. When the phase is present and monitored voltage conditions are normal, the output relay will remain in the energized state. It will de-energize once voltage exceeds the set  $V_{max}$  value or drops below the set  $V_{min}$  value. It will automatically re-energize, taking into account the factory set hysteresis of 5 per cent, once voltage returns in the selected voltage frame.

## Time delay

Selector switch ☒ / ■ is used to set the delay time of the EFN as required by specific voltage conditions.

Switch position ☒ : Alarm tripping indicating that voltage that has exceeded or dropped below the set value will be suppressed during the set delay time. Momentary voltage fluctuations will thus not initiate alarm tripping.

Switch position ■ : Alarm tripping will be instantaneous and will also be stored during the set delay time. Momentary undervoltage conditions will be recognized and, for better evaluation, prolonged by the set time.



$V_{min}$ adjustable from	Monitoring voltage $V_{max}$ adjustable from
80...120 V AC	120...160 V AC
160...220 V AC	220...300 V AC

Supply voltage, 50...60 Hz	P/N:
80...160 V AC	160...300 V AC
2 450 200 11	--
--	2 450 201 12

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

### Input circuit

Supply voltage - power consumption	A1-A2	80...160 V AC	-	3 VA
	A1-A2	160...300 V AC	-	3 VA
Tolerance of supply voltage			-15 % ... +10 %	
Supply voltage frequency			50...60 Hz	
Duty time			100 %	

### Timing circuit

Delay on operate time settable	0.1...10 s
Delay on release time settable	0.1...10 s
Timing error within the tolerance of supply power	≤ 0.5 %
Timing error within temperature range	≤ 0.06 % / °C

### Measuring circuit

	L, N	Monitoring voltage adjustable
Response value adjustable for overvoltage and undervoltage	$V_{min} / V_{max}$	80...160 V AC / 160...300 V AC
Frequency		50...60 Hz
Hysteresis (re. to the set response value)		5 %
Measuring cycle max.		80 ms
Temperature error		≤ 0.06 % / °C
Error within the tolerance of supply power		≤ 0.5 %

### Display of operational status

Supply voltage	V LED, green
Output relay energized	R LED, yellow
Overvoltage	> V LED, red
Undervoltage	< V LED, red
Phase failure	P LED, red

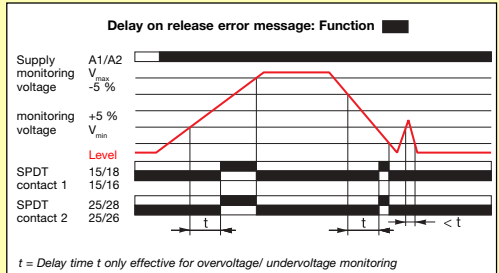
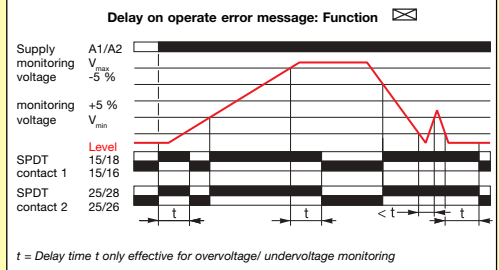
### Output circuit

	15-16/18, 25-26/28	Relay, 2 SPDT contacts, closed circuit principle
Rated voltage	VDE 0110, IEC 947-1	400 V
Rated switching voltage max.		400 V AC
Rated switching current	AC 12 (resistive)	5 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	5 (at 24 V)
Rated switching current	DC 13 (inductive)	2.5 (at 24 V)
Maximum mechanical life/ operations		30 x 10 <sup>6</sup> operations
Maximum electrical life (to AC 12 / 230 V / 5 A)		1 x 10 <sup>6</sup> operations
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL

### General data

Rated impulse withstand voltage V imp	4 kV
Operating temperature	-25°C ... +65°C
Storage temperature	-40°C ... +85°C
Mounting position	any
Mounting to DIN rail (EN 50022)	Snap-on mounting/ Screw mounting by adapter
Cable size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight	approx. 0.66 lb (300 g)
Dimensions (W x H x D)	45 x 78 x 101 mm

## 2 Functions






# Cos-Phi monitoring relay LWN mecatron<sup>®</sup> for monitoring load states



- Monitors status of inductive loads
- Sector monitoring cos φ min and cos φ max in one unit
- 2 SPDT contacts
- Suppression time for starting-up adjustable from 0.3...30 s
- Directly measurable up to 20 A
- Reaction delay adjustable from 0.2...2 s
- 1 or 3-phase monitoring
- 3 LEDs to display all operational states

## Operation

The LWN module monitors load status of inductive loads. The primary application is to monitor asynchronous motors (squirrel cage), having single or 3-phase power supplies, under varying load conditions. The measuring principle is based on the evaluation of the phase angle (φ) between voltage and current in a single phase. The phase angle is nearly inversely proportional to the load. Therefore, cosine φ, measured relatively from 0 to 1, measures the relationship of effective power to apparent power. A value of 0 indicates a low inductive load and a value of 1 indicates a large inductive load. Threshold limits for cos φ max and cos φ min may be set using the LWN monitoring relay. If either set limit has been reached, an LED lights and the relay will be de-energized. When cos φ again falls within acceptable limits, the relay will revert to its operational state and the LED will resume a steady flashing mode.

■ Approvals:   

This message can be deleted by the reset button or by switching off the supply. A delay time (Time S) of 0.3 to 30 sec. can be set for starting-up of the motor.

It is also possible to set a reaction delay time (Time R) of 0.2 to 2 sec. for the operating state, to suppress unavoidable load peak-to-peak values. To guarantee a correct function of the reaction delay time (Time R), the set value for cos φ max. must be greater than the cos φ min. plus the hysteresis. The displays for overload and low load must not be active simultaneously. Because supply and measuring circuits are electrically isolated internally, the LWN can be used in different AC power sources for monitoring.

Supply voltages	Monitoring voltage up to 5 A P/N:	Monitoring voltage up to 20 A P/N:
24...240 V AC/DC	2 450 335 00	2 450 335 01
110...130 V AC	2 450 330 00	2 450 330 01
220...240 V AC	2 450 331 00	2 450 331 01
380...440 V AC	2 450 332 00	2 450 332 01
480...500 V AC	2 450 334 00	2 450 334 01

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

### Input circuit

Supply voltage - power consumption	A1-A2	24...240 V AC/DC	-	8.4 VA
	A1-A2	110...130 V AC	-	3.6 VA
	A1-A2	220...240 V AC	-	3.6 VA
	A1-A2	380...440 V AC	-	3.6 VA
	A1-A2	480...500 V AC	-	3.6 VA

Tolerance of supply voltage	-15 % ... +10 %
Supply voltage frequency AC version	50...60 Hz
Supply voltage frequency 24...240 V AC/DC version	15...400 Hz
Duty time	100 %
<b>Timing circuit</b>	Starting time time-S and reaction time delay time-R
Timing error within the tolerance of supply voltage	≤ 0.5 %
Timing error within temperature range	≤ 0.06 % / °C

### Measuring circuit

Measuring circuit input	<b>L1, L2, L3</b>
Voltage range	110...500 V AC
Measuring current input - output	L1/k - L1/l

	Version 5 A	Version 20 A
Current range	0.5...5 A	2...20 A
Possible overload current input	25 A for 3 s	100 A for 3 s
Hysteresis (referring to the j angle, in °)	4°	
Measuring cycle max.	300 ms	

### Display of operating status

Supply voltage	LED, green
cos φ min. decreased	LED, red
cos φ max. exceeded	LED, red

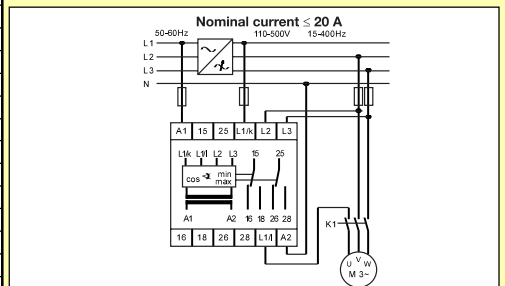
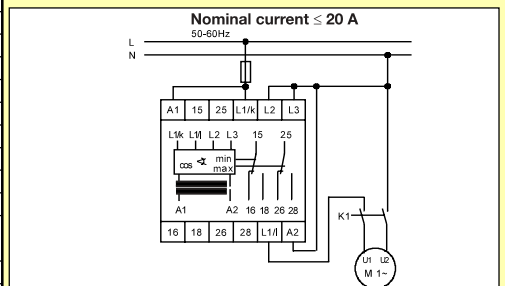
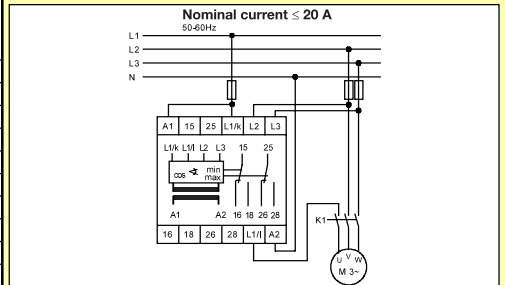
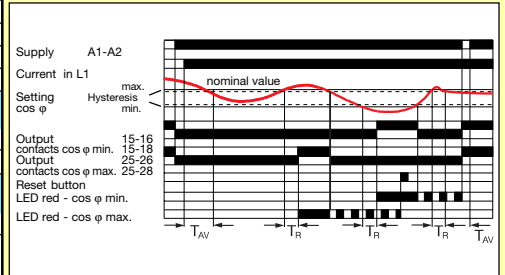
<b>Output circuit</b>	<b>15-16/18, 25-26/28</b>	2 relays, each with 1 SPDT contact for cos φ min. and cos φ max., closed-circuit principle
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Rated voltage	VDE 0110, IEC 947-1	400 V
Rated switching voltage max.		400 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 <sup>6</sup> operations
Short-circuit proof, max. fuse rating		5 A / fast, operation class gL

### General data

Rated impulse withstand voltage V <sub>imp</sub>	4 kV
Operating temperature	-25°C ... +65°C
Storage temperature	-40°C ... +85°C
Mounting position	any
Mounting to DIN rail (EN 50022)	Snap-on mounting/Screw mounting with adapter
Wire size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight	approx. 0.66 lb (300 g)

## 1 Function



Note:  
Dimensions (W x H x D), 45 x 78 x 101 mm

# Thermistor Motor protection relay MSN mecotron® with 6 sensor circuits and total evaluation, with configurable non-volatile storage



Reset/  
Test

- Total evaluation of up to 6 sensor circuits
- Short-circuit monitoring of the sensor circuit
- Continuous supply voltage range 24...240 V AC/DC
- Configurable non-volatile storage
- 2 Storages resettable
- Remote reset capability
- Autoreset
- Storage reset and test button
- 2 output contacts: 1 n/o and 1 n/c contact
- 7 LEDs

## Operation

The MSN protects and monitors motors that are fitted with PTC resistor sensors. The temperature sensors are incorporated in the starter windings and measure temperature rise. Thus, good protection is guaranteed under the following operating conditions: **heavy duty, high switching frequency, single phasing, high operating temperature, insufficient cooling.**

The relay is independent of motor rated current, insulation class, and method of starting.

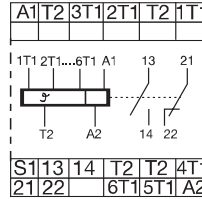
The PTC resistor sensors are connected in series with terminals T1 and T2 (respectively T1 and T2X, without short-circuit detection). The number of PTC resistor sensors that can be connected to the measuring circuit is limited by the sum of PTC resistor sensors of the individual resistor.

$$R_G = R_1 + R_2 + R_N \leq 1.5 \text{ k}\Omega$$

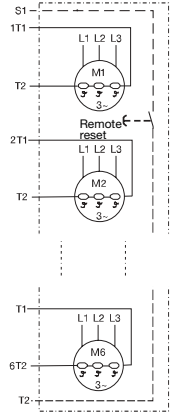
Under normal operating conditions, their resistance value is below the response value of the MSN. If only one of the PTC resistors heats up excessively, the output relay is de-energized. It is again energized automatically after the PTC resistor sensor has cooled down in the case of auto reset. Auto reset is achieved by a permanent link (jumper)

■ Approvals:

of the terminals S1 and T2. In the case of manual reset, the reset button must be pressed. Remote resetting is achieved by a short-time linking of the terminals S1 and T2.



Jumper S1-T2  
= without storage



Supply voltage	Ref. no.:
24 V...240 AC/DC	2 450 025 01
Accessories	Ref. no.:
Sealable transparent cover	3 430 005 01
Adapter for screw mounting	3 430 029 01

### Technical data

Input circuit	
Supply voltage - power consumption	<b>A1-A2</b> 24...240 V AC/DC - approx. 1.5 VA / W (24 V) approx. 1.5 W (240 V DC) approx. 3.3 VA (240 V AC/ 60 Hz)
Tolerance of supply voltage	-15 % ... +10 %
Frequency of AC supply	15...400 Hz
Duty time	100 %

Measuring circuit	
Measuring inputs	<b>1T1, 2T1,... 6T1-T2</b> 6 sensor circuits
Total resistance in cold state	≤ 1.5 kΩ per sensor circuit
Response value (relay de-energizes)	3.6 kΩ ± 5%
Reset value (relay energizes)	1.6 kΩ ± 5%
Voltage at xT1-T2, opened	max. 6.5 V DC
Voltage at xT1-T2, at 4000 Ω	≤ 3.5 V DC
Max. cable length, unshielded	≤ 100 m at 0.75 mm <sup>2</sup> 400 m at 2.5 mm <sup>2</sup>
Remote reset	<b>S1-T2</b> n/o contact
Max. cable length between S1 and T2	≤ 50 m

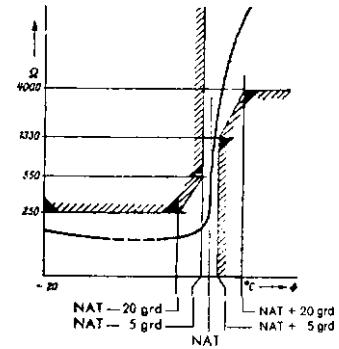
Display of operating status	
Supply voltage "U"	LED, green
Fault tripping sensor circuit 1...6 "F1"..."F6"	LED, red
Output circuit	
Rated voltage	VDE 0100, IEC947-1 250 V
Rated switching voltage max.	250 V AC
Rated switching current	AC 12 (resistive) 4 A (at 230 V)
Rated switching current	AC 15 (inductive) 3 A (at 230 V)
Rated switching current	DC 12 (resistive) 4 A (at 24 V)
Rated switching current	DC 13 (inductive) 2 A (at 24 V)
Maximum mechanical life	30 x 10 <sup>8</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)	1 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating	10 A / fast, operation class gL

General data	
Rated impulse withstand voltage V <sub>imp</sub>	4 kV
Operating temperature	-25°C ... +65°C
Storage temperature	-40°C ... +85°C
Mounting position	any
Mounting to DIN rail (EN 50022)	Snap-on mounting/ Screw mounting with adapter
Wire size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight	approx. 0.51 lb (230 g)
Dimensions (W x H x D)	45 x 78 x 101 mm

**Further application possibilities:**  
Temperature monitoring of equipment fitted with PTC resistor sensors, e.g.:

- Machine roller bearings
- Hot-air ventilators
- Oil
- Air
- Heating installations

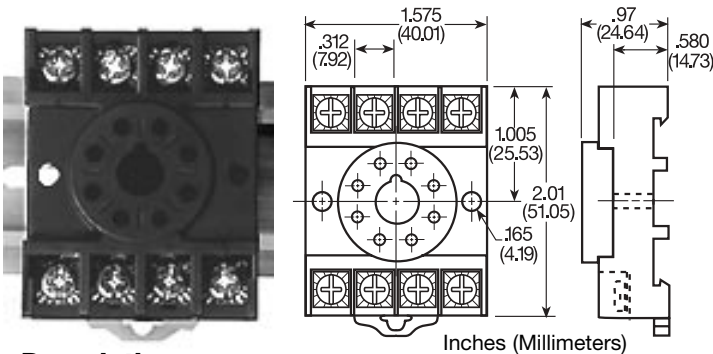
**Resistance characteristic**  
of one temperature sensor to DIN 44 081.  
NAT = rated response temperature



## Accessories—Motor Protectors

### DIN Rail or Surface Mount Sockets

#### 8 Pin Octal Socket

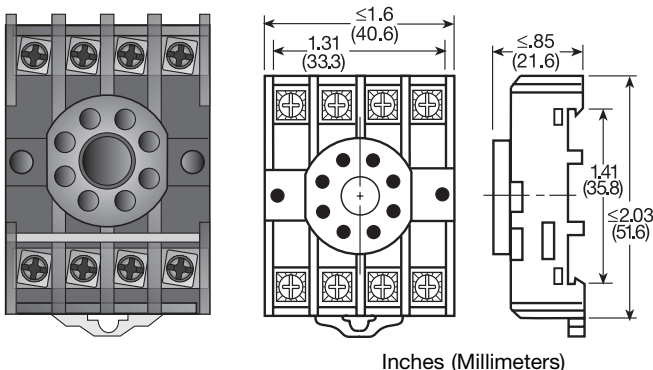


#### Description

8 pin DIN rail or surface mount socket. Y OT08 is rated at 10 A at 600 V AC and has screw terminals. Y OT08PC is rated at 10 A at 300 V AC and has pressure clamp terminals. For use with AWG 12 to 22 (3.2 to 0.33 mm<sup>2</sup>) wire sizes.

Part Number	Rating	Termination
Y OT08	600 V AC	Screws
Y OT08PC	300 V AC	Pressure Clamps

#### 8 Pin Octal Socket



#### Description

May be surface mounted with two #6 (M 3.5 x 0.6) screws or snaps onto a 35 mm DIN rail by means of a spring mechanism which also allows for easy removal. Screw terminals with captive wire clamps accept up to two #14 AWG (2.45 mm<sup>2</sup>) wires. Rated 10 A at 300 V AC.

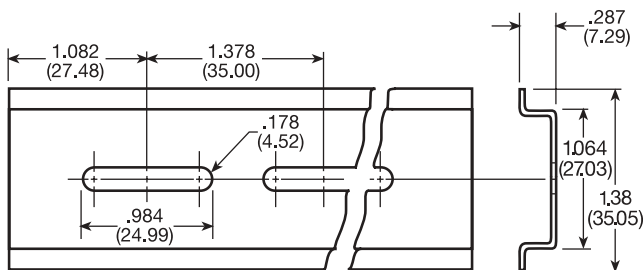
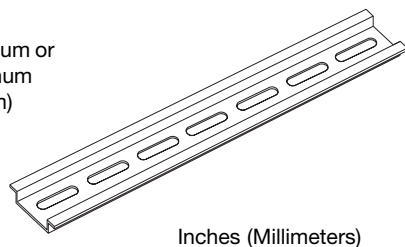
P/N: Y NDS 8

### DIN Rail

#### Description

Industry standard 35 mm aluminum or steel DIN rail. Y C103PM aluminum rail is available in 36 in. (91.4 cm) lengths. 17322005 steel rail is available in 78 in. (2 m) lengths.

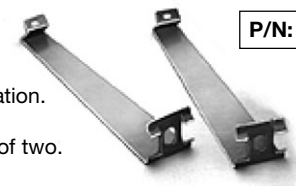
P/N: Y C103PM (Al)  
17322005 (Steel)



### Hold-Down Brackets

#### Description

Securely mounts plug in controls in any position. Also provides protection against vibration. Select the Y PSC8 for use with Y NDS8 socket. Comes in sets of two.



P/N: Y PSC8

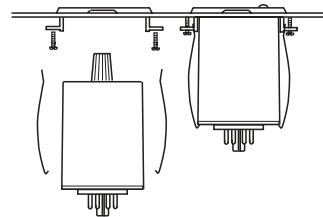
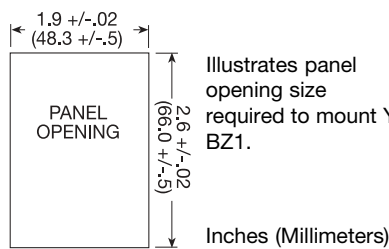
### Panel Mount Kit

#### Description

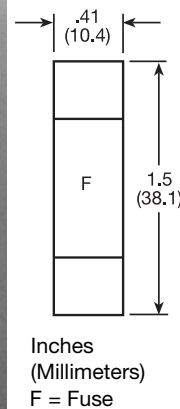
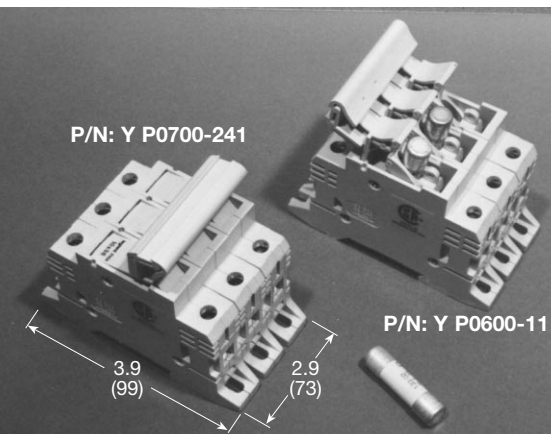
Provides an easy method of through-the-panel mounting of Entelec SSAC 8 or 11 pin plug-in timers, flashers, and other controls. May be mounted in panels up to 0.125 in. (3.2 mm) thick. Includes two clamps and two screws.



P/N: Y BZ1



### Three Phase Fuse Block/Disconnect



#### Description

Three phase fuse block disconnect designed for use with HRC midget fuses [1.5 x .41 in. (38.1 x 10.4 mm)] rated up to 25 A at 600 V AC. Surface or 35mm DIN rail mountable. 3.9 x 2.9 x 2.2 in. (99 x 73.7 x 55.9 mm)

#### Midget Fuse

Fast acting fuse for use with voltage monitors. Rated 2 A at 500 V AC. 1.5 x .41 in. (38.1 x 10.4 mm)

Part Number	Description
Y P0700 241	Fuse Block
Y P0600 11	Fuse

### Female Quick Connect Terminals



#### Description

These 0.25 in. (6.35 mm) female terminals are constructed with an insulator barrel to provide strain relief. L = 0.83 (21.1) W = 0.3 (7.6) Inches (Millimeters)

Part Number	Wire Size
Y P1015 13	AWG 10/12 (5.3/3.2 mm <sup>2</sup> )
Y P1015 64	AWG 14/16 (2.5/1.3 mm <sup>2</sup> )
Y P1015 14	AWG 18/22 (0.93/0.33 mm <sup>2</sup> )



# Mechanical Outline and Accessories for mecotron® Monitoring Relays



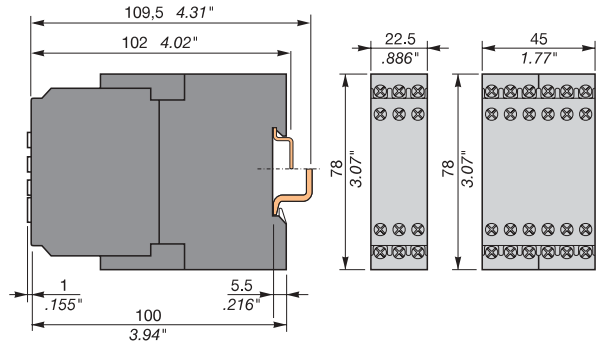
**ESS**  
22.5 mm



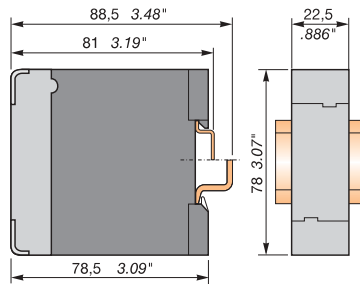
**ESN**  
45 mm



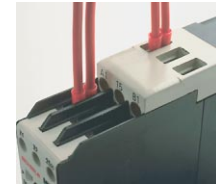
**S and N Series:**  
Screw Connection



**PFE**  
22.5 mm



**E Series:**  
Screw Connection

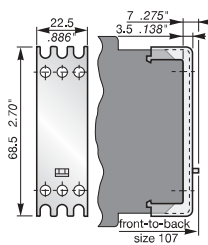


On the S Series, terminals with cable guides greatly simplify installation. This also applies to wire end ferrules with insulating collars.

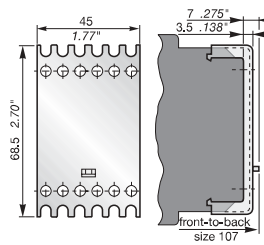
## Accessories

### Sealable covers

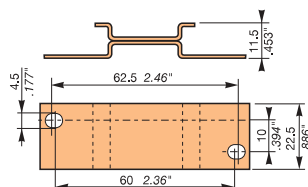
**P/N: 3 430 005 01**  
Sealable cover for mecotron series 22.5 mm wide



**P/N: 3 440 005 01**  
Sealable cover for mecotron series 45 mm wide



### Adapter for screw mounting



In 22.5 mm width **P/N: 3 430 029 01**  
In 45 mm width **P/N: 3 440 029 01**

### Marker label



**P/N: 4 366 017 01**



## Standards and approvals for measuring and monitoring relays

### mecotron® measuring and monitoring relays

The mecotron® range has been designed and developed taking into consideration all relevant standards for measuring and monitoring relays.

Product standard: IEC 255 part 6  
 Electromagnetic compat.: 93 / 68 / EWG  
 Low-voltage directive: 93 / 68 / EWG

Mechanical shock resistance: IEC 68 part 2-6: 10 G  
 Environmental tests: IEC 68 part 2-30: 24 h cycle, 55°C, 93% rel, 96 h  
 Isolation tests:  
 Overvoltage category: III to VDE 0110, IEC 664; C to IEC 255-5  
 Pollution category: III to VDE 0110, IEC 664; C to IEC 255-5

Test voltage: 2.5 kV / 50 Hz / 1 min. between all isolated circuits

EMC tests: EN 50082-2  
 ESD: IEC 1000-4-2, EN 61000-4-2 level 3 (6 kV / 8 kV)  
 HF radiation resistance: IEC 1000-4-3, EN 61000-4-3 level 3 (3 V / m)  
 Burst: IEC 1000-4-4, EN 61000-4-4 level 3 (2 kV 5 k Hz)  
 Surge: IEC 1000-4-5, EN 61000-4-5 level 4 (2 kV L-L)  
 HF line emission: IEC 1000-4-6, EN 61000-4-6 level 3 (10 V)

Rated impulse withstand voltage VDE 0110, IEC 664 between all isolated circuits: 4 kV / 1.2 - 50 µs

#### Special standards and tests

*mecotron® PFN, PVN, ASN, EFN, LWN, PFS, PFE, PBE, PVE and ASS*

Rated insulation voltage to VDE 0110, IEC 947-1 between supply and Measuring and output circuit: 500 V

*mecotron® ESN and SRN*

Rated insulation voltage to VDE 0110, IEC 947-1 between all isolated circuits: 400 V

*mecotron® ESS, SRS, MSS, MSE, and MSN*

Rated insulation voltage VDE 0110, IEC 947-1 between supply and Measuring and output circuit: 250 V

*mecotron® IWN AC*

Product norm: IEC 255 part 6 to VDE 0413 part 2  
 Rated insulation voltage VDE 0110, IEC 947-1 between supply and Measuring and output circuit: 400 V

*mecotron® IWN DC*

Rated insulation voltage VDE 0110, IEC 947-1 between measuring and supply circuit: 320 V  
 between output circuit and other circuits: 400 V

### Entrelec SSAC measuring and monitoring relays

Entrelec SSAC products have been designed, developed, and tested in accordance with all relevant norms and standards.

Product standards: EN50082-2, EN61010-1  
 Electromagnetic compatibility: 89/336/EEC  
 Low-voltage directive: 93/68/EEC  
 Low-voltage directive tests: EN61010-1

#### CE Conditions of Acceptability

Products Containing DIP Switches:  
 Power must be removed from the unit when a switch position is changed.

Products with Solid-State Outputs:  
 Loads rated above 1 A, must be evaluated for CE use when used with solid-state output products.

#### UL and CSA Approvals

When UL/CSA approvals are indicated, Entrelec SSAC products are UL Recognized\* (UL Listed\*\* for DLM and WVM Series) and CSA Certified under the file numbers listed below. These products are tested to the requirements of UL508 - Industrial Control Equipment. CSA Certified products are tested to the requirements of C22.2 Number 14 - Industrial Control Equipment.

Agency	Standard Number	File Number
Underwriters Laboratories (UL)	UL 508	E57310
Canadian Standards Association (CSA)	C22.2 Number 14	LR57415

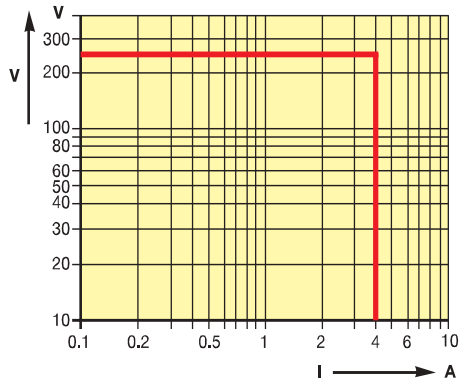
\*UL's Component Recognition Service covers the testing and evaluation of component products that are incomplete or restricted in performance capabilities. These components will later be used in complete end-products or systems Listed by UL.

\*\*The UL Listed Mark on a product indicates that samples of that complete product have been tested by UL to nationally recognized Safety Standards and found to be free from reasonably foreseeable risk of fire, electric shock, and related hazards.

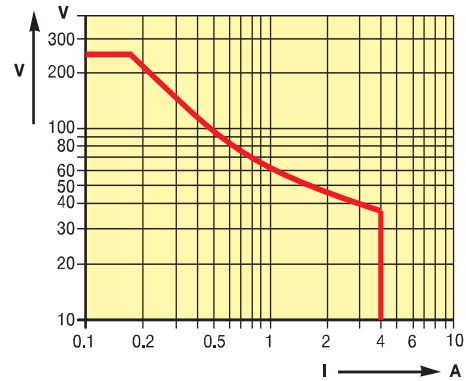
## Load limit curves

### Load limit curves for the mecotron®-S series (22.5 mm) and the mecotron®-E series (22.5 mm)

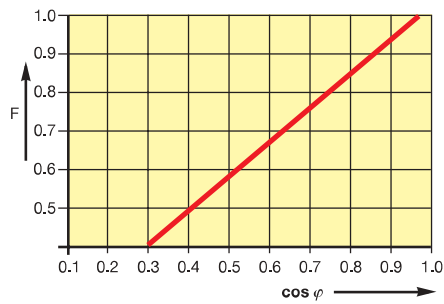
AC load (resistive)



DC load (resistive)

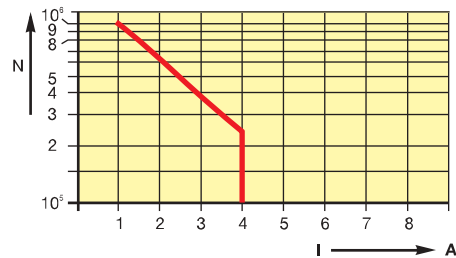


Reduction factor at inductive AC load



Reduction factor F  
at inductive load

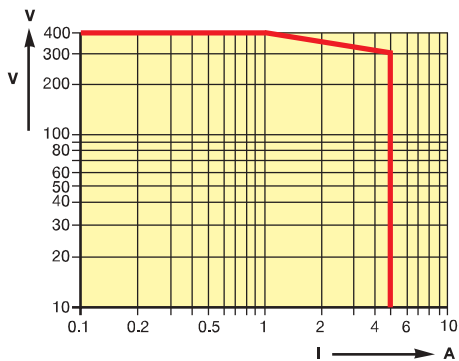
Contact life/ no. of operations



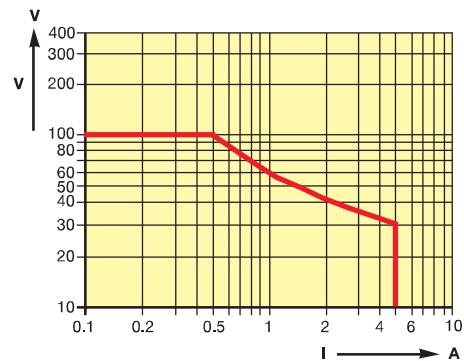
Contact life/  
no. of operations N  
220 V 50 Hz I AC  
360 operations/h

### Load limit curves for the mecotron®-N series (45 mm)

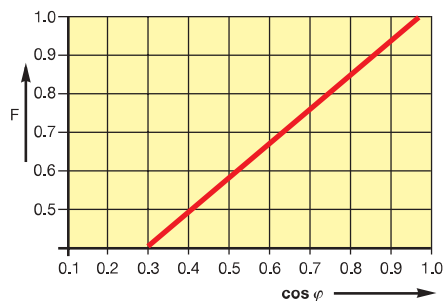
AC load (resistive)



DC load (resistive)

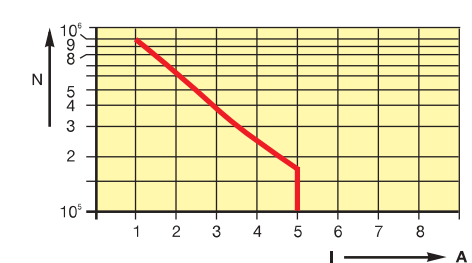


Reduction factor at inductive AC load

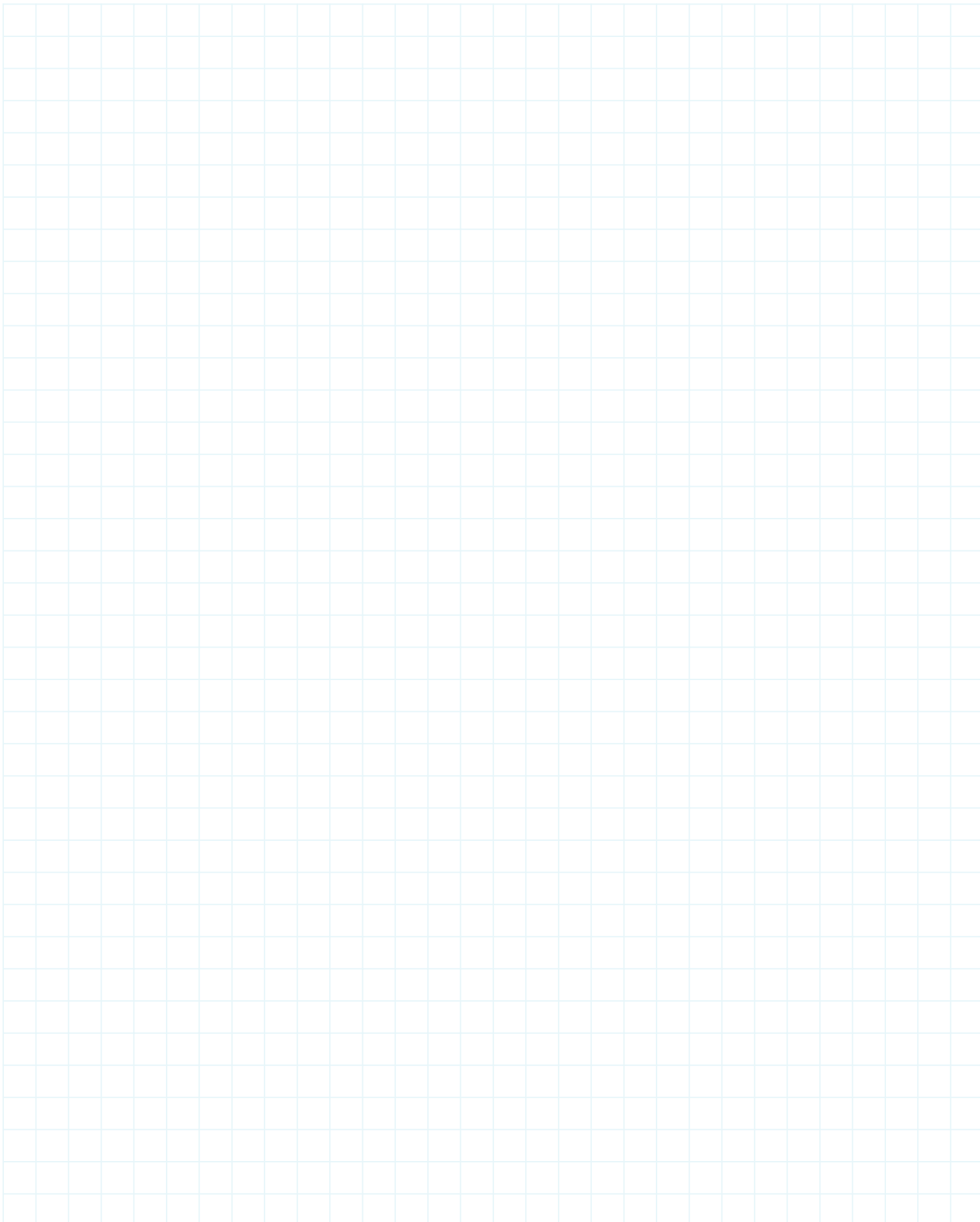


Reduction factor F  
at inductive load

Contact life/ no. of operations



Contact life/  
no. of operations N  
220 V 50 Hz I AC  
360 operations/h





# Current sensors



## Current Monitoring Selection Guide

### Directions:

- 1.) Select the style of product packaging you require.
  - 2.) For general features, control, and specific ratings, reference the table below.
  - 3.) Find the product name and catalog page number in each column.
- For complete product specifications, reference the catalog pages.

## Sensing/Control Relays



AC/DC version w/selectable over or undercurrent; relay output.



AC/DC current trip points as low as 3mA; adjustable hysteresis; relay output.



Adjustable, AC over & undercurrent trip points w/ selectable response modes.



Selectable AC over or undercurrent; adjustable trip point & delay.

### General Features:

	SRN Page 1484	SRS Page 1486	ECSW Pages 1488-1489	ECS Page 1487
DIN Rail Mounting	•	•	•	•
Surface Mounting	w/adaptor	w/adaptor	•	•
Screw Terminals	•	•	•	•
Quick Connects				•

### Output:

DPDT Relay	•			
SPDT Relay		•	•	•
SPST Solid State				

### Monitored Current:

AC	•	•	•	•
DC	•	•		
Three Phase				

### Supply Voltage:

24 VAC		•	•	•
24 ... 240 V AC/DC	•			
42 ... 48 V AC		•	•	•
110 ... 130 V AC	•	•	•	•
220 ... 240 V AC	•	•	•	•
380 ... 415 V AC	•			
12 & 24 V DC			•	•
3 ... 50 V DC				

### Trip Range(s):

Fixed				
Adjustable	•	•	•	•
3 mA ... 1 A	•	•		
0.3 ... 15 A	•		•	
2 ... 45 A fixed / 2... 20 adjustable				
0 ... 50 A				
0.5 ... 50 A			•	•
1 ... 11 K $\Omega$				
10 ... 110 K $\Omega$				

### Delay(s):

Trip	•		•	•
Inrush			•	•

### Indicator LED(s):

Output ON/OFF	•	•	•	
Supply ON/OFF	•	•		
Fault(s)			•	•
Timing			•	

Dimensions:	in	1.77 x 3.07 x $\leq$ 3.98	0.886 x 3.07 x $\leq$ 3.98	2.50 x 3.50 x 1.75
(W x H x D)	mm	45 x 78 x $\leq$ 101	22.5 x 78 x $\leq$ 101	63.5 x 88.9 x 44.5

	SRN Page 1484	SRS Page 1486	ECSW Pages 1488-1489	ECS Page 1487
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# Current Monitoring Selection Guide

## Analog Output

## Insulation Monitor



Low cost AC current switch; direct connection to digital PLC input; sinking or sourcing.



Current transducer; linear output proportional to the RMS AC current



Monitor AC current flow with visual indication up to 500 feet from source.



Monitor insulation resistance between ungrounded AC power and earth ground conductors.



Monitor insulation resistance between ungrounded DC power and earth ground conductors.

**TCS**

Page 1490  
w/adaptor

•

•

Current Switch  
1 A Solid State

•

Self-Powered (AC)

Self-Powered

•

•

•

**TCSA**

Page 1491  
w/adaptor

•

•

Linear Output  
4 to 20 mA

•

Loop Powered

•

•

**LCS/LPM**

Page 1493

•

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**IWN (AC)**

Page 1494

w/adaptor

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**IWN (DC)**

Page 1495

w/adaptor

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•

(2) L+L- Fault

•

2.0 x 2.0 x 1.75

50.8 x 50.8 x 44.5

0.98 x 1.51 x 0.46

24.89 x 38.35 x 11.68

1.77 x 3.07 x ≤ 3.98

45 x 78 x ≤ 101

**TCS**

Page 1490

**TCSA**

Page 1491

**LCS/LPM**

Page 1493

**IWN (AC)**

Page 1494

**IWN (DC)**

Page 1495

# Current monitoring relay **SRN mecotron®**

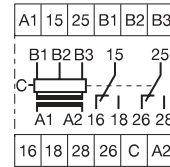


- Monitors AC or DC currents in 6 ranges covering 3 mA ... 15 A
- 3 measuring ranges covered by unit
- Switching hysteresis adjustable from 5...30 %
- Without or with delay on operate from 0.05...30 s
- 2 SPDT contacts
- 2 LEDs to indicate operational status
- 4 supply voltage versions, from 24...240 V AC/DC up to 415 V AC
- Version 24...240 V AC/DC with convertible undercurrent/ overcurrent monitoring, frequency range from 16 Hz to 400 Hz

## Operation

The current being monitored is applied to the terminals B1 or B2 or B3 and C. The output relay energizes when the monitored current exceeds the set response value. It de-energizes when the current is below the set response value within the hysteresis range. The AC/DC version has a built-in selection switch on the front face where the energizing mode of the output relays can be preselected. In the OC position, the output relay will energize when the monitored current exceeds the set response value. In the UC position, the output relay energizes when the current is below the set response value. Hysteresis is adjustable from 5...30 % related to the response value. Measuring, output and supply circuits are electrically isolated to prevent mutual interference. As one measuring cycle takes only 80 ms, changes in current can quickly be detected. Delay on "ON" is continuously adjustable from 0.05 to 1 second or 1.5 to 30 seconds, thus ensuring optimal adaptation to application requirements.

■ Approvals:



### Supply voltage 50...60 Hz

	With delay on operate		Without delay on operate	
	Current measuring ranges P/N:	P/N:	Current measuring ranges P/N:	P/N:
24...240 V AC/DC	3...30 mA 10...100 mA 0.1...1 A	0.3...1.5 A 1...5 A 3...15 A	3...30 mA 10...100 mA 0.1...1 A	0.3...1.5 A 1...5 A 3...15 A
110...130 V AC	2 450 125 00	2 450 125 01	2 450 115 00	2 450 115 01
220...240 V AC	2 450 120 00	2 450 120 01	2 450 110 00	2 450 110 01
380...415 V AC	2 450 121 00	2 450 121 01	2 450 111 00	2 450 111 01
	2 450 122 00	2 450 122 01	2 450 112 00	2 450 112 01

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01
Current monitoring, see following page	

## Technical data

### Input circuit

Supply voltage - power consumption	<b>A1-A2</b>	24...240 V AC/DC - 2 VA
	<b>A1-A2</b>	110...130 V AC - 2 VA
	<b>A1-A2</b>	220...240 V AC - 2 VA
	<b>A1-A2</b>	380...415 V AC - 2 VA
Tolerance of supply voltage		-15 % ... +10 %
Supply voltage frequency		50...60 Hz
Duty time		100 %

### Measuring circuit

Delay on operate time adjustable		0.05...1 s and 1.5...30 s
Timing error within tolerance of supply voltage		≤ 0.5 %
Timing error within temperature range		≤ 0.06 % / °C

### Measuring circuit

Measuring current input	<b>B1/C</b>	3...30 mA	0.3...1.5 A
	<b>B2/C</b>	10...100 mA	1...5 A
	<b>B3/C</b>	0.1...1 A	3...15 A

Hysteresis (ref. to the response value) adjustable		5...30 %
Measuring cycle max.		80 ms
Temperature error		≤ 0.06 % / °C
Error within tolerance of supply voltage		≤ 0.5 %

### Display of operational status

Supply voltage		LED, green
Output relay energized		LED, yellow

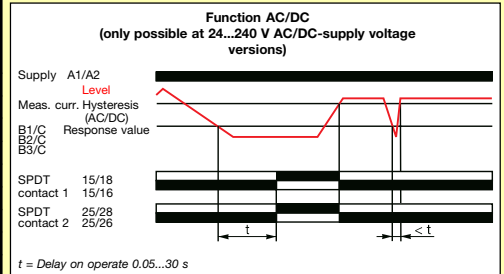
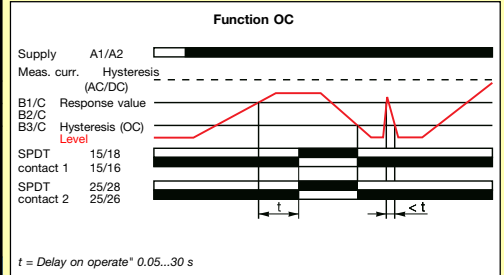
### Output circuit

Rated voltage	<b>15-16/18, 25-26/28</b>	Relay, 2 SPDT contacts, open-circuit principle
Rated switching voltage max.	VDE0100, IEC 947-1	400 V
Rated switching current		400 V AC
Rated switching current	AC 12 (resistive)	5 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	5 A (at 24 V)
Rated switching current	DC 13 (inductive)	2.5 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		3 x 10 <sup>5</sup> operations
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL

### General data

Rated impulse withstand voltage V <sub>imp</sub>		4 kV
Operating temperature		-25°C ... +60°C
Storage temperature		-40°C ... +85°C
Mounting position		any
Mounting to DIN rail (EN 50022)		Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight		approx. 0.66 lb (300 g)

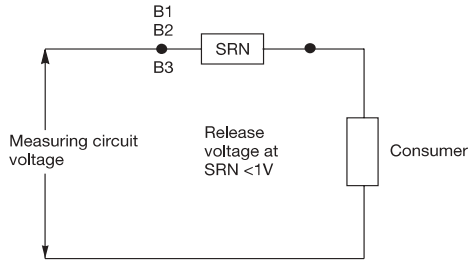
## 2 Functions



Note: Dimensions (W x H x D), 45 x 78 x 101 mm

# Current monitoring relays SRS and SRN mecotron®

## Application



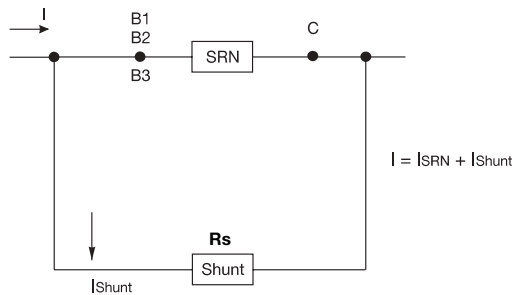
Voltage drop caused by internal resistance  $R_i$  of the SRN is negligible (less than 1 V). Thus the SRN can also be used at high measuring circuit voltages.

## Setting up

Set delay time to minimum before setting the "desired" response value.

## Measuring range extension

Measuring ranges can be extended by the use of current transformers or shunts which must be connected in parallel to the measuring input.



## Example:

Current to be monitored: 110 A  
 selected range of SRN: 1...5 A

Multiple of range "n":  $n = \frac{110}{3} \approx 37$

(3 was chosen being the average of measuring range of 1 A to 5 A).

$$\text{Shunt resistor "Rs"} = \frac{\text{Input resistance "Ri"}}{\text{Multiple of range "n"} - 1}$$

$$R_s = \frac{R_i}{n-1} = \frac{18 \text{ m}\Omega}{37-1} \approx 0.58 \text{ m}\Omega$$

18 mΩ = input resistance SRN 1...5 A according to technical data.

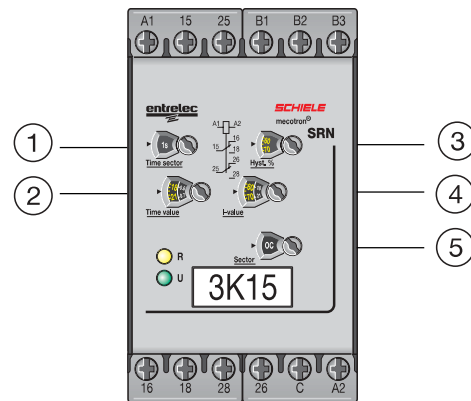
$R_s$  selected 1.3 mΩ (nearest standard value)

## Calculation of shunt load

Power consumption  $P_v = (\text{extended value} - \text{basic value})^2 \times \text{shunt resistance}$

$$P_v = (110 \text{ A} - 3 \text{ A})^2 \times 0.0005 \approx 5.8 \text{ Watt}$$

With respect to temperature rise, the shunt must be rated **at least** twice the rating calculated.



- ① Time sector: Time selection switch, 0.05...1 s or 1.5...30 s
- ② Time value: Setting the desired time value
- ③ Hyst. %: Setting the response threshold/ hysteresis
- ④ I-value: Setting the desired current value
- ⑤ Sector: Only for AC/DC-versions:  
 Selection switch overcurrent (OC)  
 Selection switch undercurrent (AC/DC)

## Current measuring ranges / current transformer

Current measuring range	Input resistance $R_i$	Terminal arrangement/ Measuring input	Continuous overload	Overload for $t < 1 \text{ s}$
3...30 mA	33 Ω	B1/C	50 mA	300 mA
10...100 mA	10 Ω	B2/C	150 mA	1 A
0.1...1 A	1 Ω	B3/C	1.5 A	10 A
The table below is only valid for the current monitor <b>SRN mecotron®</b>				
0.3...1.5 A	0.06 Ω	B1/C	2 A	15 A
1...5 A	0.018 Ω	B2/C	7 A	50 A
3...15 A	0.006 Ω	B3/C	20 A	100 A

Current transformer	Rated current	Power/class	sec. 5 A	sec. 1 A
IT 50-200	50 A	2 VA/1	4 450 116 50	4 450 116 10
	75 A	2.5 VA/1	4 450 116 51	4 450 116 11
	100 A	2.5 VA/1	4 450 116 52	4 450 116 12
	150 A	5 VA/1	4 450 116 53	4 450 116 13
	200 A	5 VA/1	4 450 116 54	4 450 116 14
IT 200-600	200 A	5 VA/1	4 450 117 50	4 450 117 10
	300 A	5 VA/1	4 450 117 51	4 450 117 11
	400 A	5 VA/1	4 450 117 52	4 450 117 12
	500 A	5 VA/1	4 450 117 53	4 450 117 13
	600 A	5 VA/1	4 450 117 54	4 450 117 14



## Current monitoring relay SRS mecotron®



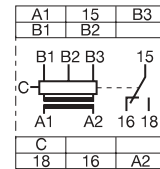
- Monitors AC or DC currents in three ranges from 3 mA ... 1 A
- 3 measuring ranges covered by one unit
- Switching hysteresis adjustable from 5...30 %
- No time delay
- 1 SPDT contacts
- 2 LEDs to indicate operational status
- 4 supply voltage versions, from 24...240 V AC

## Operation




The current being monitored is applied to terminals B1, B2 or B3 and C. The output relay energizes when the current being monitored exceeds the set response value. It de-energizes when the current is below the set response value within the hysteresis range.

Hysteresis is adjustable from 5...30 % related to the response value. Measuring, output, and supply circuits are electrically isolated to prevent mutual interference.

One measuring cycle takes only 80 milliseconds; changes in current are quickly detected.



To extend the measuring range, use current monitoring relay type SRN shown on page 1484.

■ Approvals:   

Current measur. range: 3...30 mA, 10...100 mA, 0.1...1 A	P/N:
Supply voltage 50...60 Hz	
24 V AC	2 430 841 91
42...48 V AC	2 430 841 81
110...130 V AC	2 430 841 01
220...240 V AC	2 430 841 11

Accessories	P/N:
Sealable transparent cover	3 430 005 01
Adapter for screw mounting	3 430 029 01
Current transformer see "SRN"	

## Technical data

### Input circuit

Supply voltage - power consumption	<b>A1-A2</b>	24 V AC	- 1 VA
	<b>A1-A2</b>	42...48 V AC	- 1 VA
	<b>A1-A2</b>	110...130 V AC	- 1 VA
		220...240 V AC	- 1 VA
Tolerance of supply voltage			-15 % ... +10 %
Supply voltage frequency			50...60 Hz
Duty time			100 %
<b>Measuring circuit</b>			
Measuring current input	<b>B1/C, B2/C, B3/C</b>	3...30 mA	10...100 mA
Hysteresis (ref. to the response value) adjustable			0.1...1 A
			5...30 %
Measuring cycle max.			80 ms
Temperature error			≤ 0.06 % / °C
Error within tolerance of supply voltage			≤ 0.5 %
Input resistance		33 Ohm	10 Ohm
Possible permanent overload		50 mA	150 mA
Pulse overload for t < 1 s		300 mA	1 A
			10 A

### Display of operational status

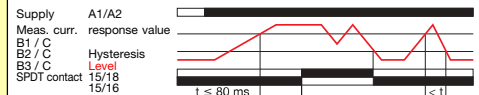
Supply voltage		LED, green
Output relay energized		LED, yellow
<b>Output circuit</b>	<b>15-16/18</b>	Relay, 1 SPDT contact, open-circuit principle

Rated voltage	VDE0100, IEC 947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching current	DC 13 (inductive)	2 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		3 x 10 <sup>6</sup> operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

### General data

Rated impulse withstand voltage V <sub>imp</sub>		4 kV
Operating temperature		-20°C ... +60°C
Storage temperature		-40°C ... +85°C
Mounting position		any
Mounting to DIN rail (EN 50022)		Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight		approx. 0.33 lb (150 g)
Dimensions (W x H x D)		22.5 x 78 x 101 mm

## 1 Function



# Over/Under Current Sensing ECS Series Current Sensor



TEN YEAR  
**10**  
WARRANTY

- Toroidal Through Hole Wiring
- 0.5...50 A Trip Point
- Adjustable or Factory Fixed Trip Delays
- 10 A SPDT Isolated Output Contacts
- 5% Trip Point Hysteresis (Dead Band)

### Description

The ECS Series of Single Phase AC Current Sensors is a universal, overcurrent or undercurrent sensing control. Its built-in toroidal sensor eliminates the inconvenience of installing a stand-alone current transformer. Includes onboard adjustments for current sensing mode, trip point, and trip delay. Detects over or undercurrent events like locked rotor, loss of load, an open heater or lamp load, or proves an operation is taking place or has ended.

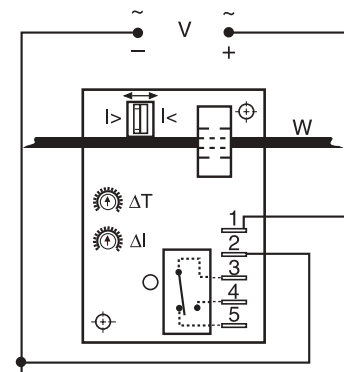
### Adjustment

Select the desired function, over or under current sensing. Set the trip point and trip delay to approximate settings. Apply power to the ECS and the monitored load. Turn adjustment and watch the LED. LED will light; turn slightly in opposite direction until LED is off. Adjustment can be done while connected to the control circuitry if the trip delay is set at maximum.

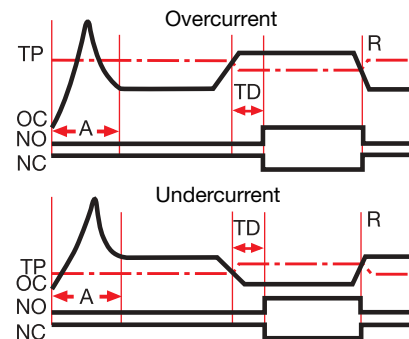
### Operation

When a fault is sensed throughout the trip delay, the output relay is energized. When the current returns to the normal run condition, the output and the delay are reset. If a fault is sensed and then corrected before the trip delay is completed, the relay will not energize and the trip delay is reset to zero.

■ Approvals: CE



Relay contacts are isolated.  
Dashed lines are internal connections.



V = Voltage W = Insulated Wire Carrying Monitored Current > = Overcurrent  
 < = Undercurrent TP = Trip Point R = Reset  
 OC = Monitored Current NO = Normally Open Contact NC = Normally Closed Contact  
 A = Sensing Delay on Start Up TD = Trip Delay

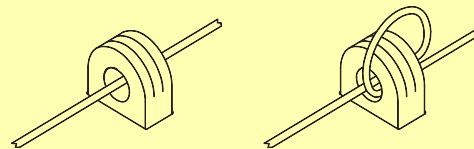
### Ordering Table

X Series	X Input	X Trip Point	X Trip Delay	X Sensing Delay on Start up
<b>Y ECS</b> - (selectable over or undercurrent sensing)	<b>-1</b> - 12 V DC	Fixed -	<b>-F</b> - Factory	Blank - 0
<b>Y ECSH</b> - (overcurrent sensing)	<b>-2</b> - 24 V AC	Specify <b>2 ... 50 A</b>	Fixed: Specify	<b>-C</b> - 1 s
<b>Y ECSL</b> - (undercurrent sensing)	<b>-3</b> - 24 V DC	in 1 A increments	<b>.08 ... 50 s</b>	<b>-D</b> - 2 s
	<b>-4</b> - 120 V AC	<b>Adjustable Ranges</b>	<b>Adjustable Ranges</b>	<b>-E</b> - 3 s
	<b>-6</b> - 230 V AC	<b>-0</b> - 0.5 ... 5 A	<b>-A</b> - 0.150 ... 7 s	<b>-F</b> - 4 s
		<b>-1</b> - 2 ... 20 A	<b>-B</b> - 0.5 ... 50 s	<b>-G</b> - 5 s
		<b>-H</b> - 5 ... 50 A		<b>-H</b> - 6 s

Example P/N: **Y ECS41AC**  
Fixed - **Y ECSH610AD**

### Technical Data

Sensor	
Type	Toroidal, through hole wiring
Mode	Over or undercurrent, switch selectable on the unit or factory fixed
Trip Point Range	0.5 ... 50 A in 3 adjustable ranges or fixed
Tolerance: Adjustable	Guaranteed range
Fixed	0.5 ... 25 A: 0.5 A or +/-5% whichever is less; 26 ... 50 A: +/-2.5%
Maximum Allowable Current	Steady - 50 A turns; Inrush - 300 A turns for 10 s
Trip Point Hysteresis	≅ +/-5%
Trip Point vs. Temperature	+/-5%
Response Time	≤ 75 ms
Frequency	45 ... 500 Hz
Type of Detection	Peak detection
Trip Delay	
Type	Analog
Range: Adjustable	0.150 ... 7 s; 0.5 ... 50 s (Guaranteed ranges)
Factory Fixed	0.08 ... 50 s (+/-10%)
Delay vs. Temperature	+/-15%
Sensing Delay on Startup	Factory fixed 0 ... 6 s +40% ... 0%
Input	
Voltage	24 , 120, or 230 V AC; 12 or 24 V DC
Tolerance	12 V DC & 24 V DC/AC: -15% ... +20% 120 & 230 V AC: -20% ... +10%
Line Frequency	50 ... 60 Hz
Output	
Type	Electromechanical relay
Form	Isolated single pole double throw (SPDT)
Rating	10 A resistive at 240 V AC; 1/4 hp at 125 V AC; 1/2 hp at 250 V AC
Life	Mechanical - 1 x 10 <sup>6</sup> ; Electrical - 1 x 10 <sup>5</sup>
Protection	
Circuitry	Encapsulated
Isolation Voltage	≥ 2500 V RMS input to output
Insulation Resistance	≥ 100 MΩ
Mechanical	
Mounting	Surface mount with two #6 (M3.5 x 0.6) screws
Termination	0.25 in. (6.35 mm) male quick connect terminals (5)
Humidity	95% relative, non-condensing
Operating/Storage Temperature	-40°C ... +60°C / -40°C ... +85°C
Weight	≅ 6.4 oz (181 g)

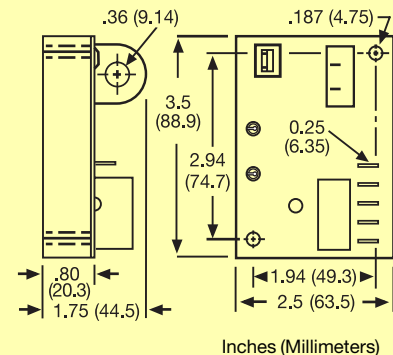


### Multiple Turns To Increase Sensitivity

To increase sensitivity, multiple turns may be made through the ECS's toroidal sensor. The trip point range is divided by the number of turns through the toroidal sensor to create a new range.

### Using an External Current Transformer (CT)

Select a 2 VA, 0 to 5 A output CT, rated for the current to be monitored. Select ECS adjustment range 0. Pass the CT's secondary wire lead through the ECS's toroid.



### Accessories

- Female quick connect P/Ns:
- Y P1015 13** (AWG 10/12)
- Y P1015 64** (AWG 14/16)
- Y P1015 14** (AWG 18/22)



See accessory page at the end of this section.

# Window Current Sensor ECSW Series Current Sensor

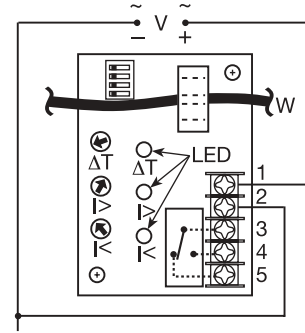


- Overcurrent & Undercurrent (Window Current) Sensing
- Adjustable Overcurrent & Undercurrent Trip Points
- Current Sensor is Included
- 10 A SPDT Isolated Output Contacts
- LED Indicators

### Description

The ECSW Series of single phase, AC window current sensors includes adjustable overcurrent and undercurrent trip points. Detects locked rotor, loss of load, an open heater or lamp load, a broken belt, a jam or loss of suction. LEDs aid in trip point adjustment and provide fault indication. The built-in toroidal sensor eliminates the need for an external current transformer. The output can be electrically latched after a fault, or automatically reset. Remote resetting of a latched output by removing input voltage. The unit includes switch selectable zero current detection and normally de-energized or energized output operation. Time delays are included to improve operation and eliminate nuisance tripping.

Approvals:



V = Voltage W = Monitored Wire  
 ΔT = Adjustable Trip Delay  
 > = Adjustable Overcurrent  
 < = Adjustable Undercurrent

## Ordering Table

<b>Y</b> ECSW Series	<b>X</b> Input -1 - 12 V DC -2 - 24 V AC -3 - 24 V DC -4 - 120 V AC -6 - 230 V AC	<b>X</b> Trip Point Range Adjustable Ranges -L - 0.5 ... 5 A -M - 2 ... 20 A -H - 5 ... 50 A	<b>X</b> Trip Delay -A - Adjustable 0.15 ... 7 s -B - Adjustable 0.5 ... 50 s -F - Fixed	<b>X</b> Sensing Delay on Start Up -B - 0.1 s -C - 1 s -D - 2 s -E - 3 s -F - 4 s -G - 5 s -H - 6 s	<b>X</b> Connection -T - Terminal Blocks
----------------------	--	---	---	--	---

If Fixed Delay is selected, insert delay [0.08 ... 50] in seconds.  
 0.1 ... 2 s in 0.1 s increments  
 2 ... 50 s in 1 s increments

Example P/N: **Y ECSW4LBCT**

## Technical Data

Sensor	
Type	Toroid, through hole wiring for up to #4 AWG (21.1 mm <sup>2</sup> ) THHN wire
Mode	Over and undercurrent trip points (window current sensing)
Trip Point Range	0.5 ... 50 A in 3 adjustable ranges or fixed
Tolerance	Adjustable – guaranteed range Fixed – 0.5 ... 25 A - 0.5 A or +/-5% whichever is less; 26 ... 50 A - +/-2.5%
Maximum Allowable Current	Steady - 50 A turns; Inrush - 300 A turns for 10 s
Trip Point vs. Temperature & Voltage	+/-5%
Response Time	≤ 75 ms
Frequency	45 ... 500 Hz
Type of Detection	Peak detection
Zero Current Detection	< 250 mA turns typical
Time Delay	
Range	0.15 ... 50 s in 2 adjustable ranges or 0.08 ... 50 s fixed
Tolerance	Adjustable: guaranteed range; Fixed; +/-10%
Sensing Delay On Start Up	Fixed ≅ 0.1 ... 6 s in 1 s increments
Tolerance	+40% -0%
Delay vs. Temperature & Voltage	+/-15%
Input	
Voltage	24, 120, or 230 V AC; 12 or 24 V DC
Tolerance	+/-20%
AC Line Frequency	50 ... 60 Hz
Output	
Type	Electromechanical relay
Mode: Switch selectable	ON - Energized during normal operation, de-energized after a fault OFF - De-energized during normal operation, energizes during a fault
Form	Isolated, SPDT
Rating	10 A resistive at 240 V AC; 1/4 hp at 125 V AC; 1/2 hp at 250 V AC
Life	Mechanical: 1 x 10 <sup>6</sup> ; Electrical: 1 x 10 <sup>5</sup>
Latch	Electrical Remove input voltage Type Reset Function Switch selectable latching function

### Selector Switch

ON ↔ OFF

SW1	<input type="checkbox"/>	Not Used
SW2	<input type="checkbox"/>	Latched
SW3	<input type="checkbox"/>	Zero I Output Normally Energized

### Mode Selection Switches

SW1 = Latched or Auto reset selector  
 OFF - automatic relay reset after a fault  
 ON - output relay latches after a fault trips the unit

SW2 = Zero current detection - (below 250mA)  
 OFF - zero current detection disabled  
 ON - zero current detection enabled

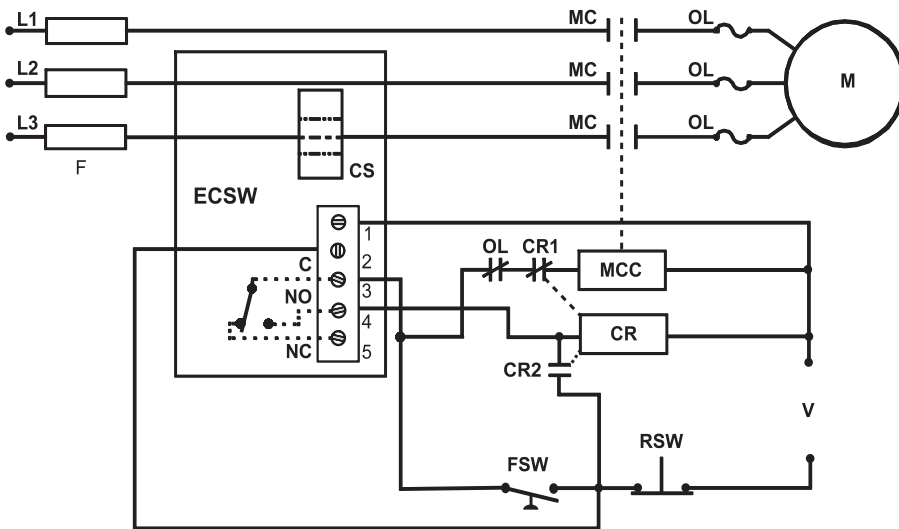
SW3 = Output during normal operation  
 OFF - output relay de-energized  
 ON - output relay energized

### Operation

When the input voltage is applied, sensing delay on startup begins and the output transfers (if normally energized is selected). Upon completion of the startup delay, sensing of the monitored current begins. As long as current is above undercurrent trip point and below the overcurrent trip point (inside the window), the output relay remains in its normal operating condition and both red LEDs are OFF. The green LED glows when the output is energized. If current varies outside the window, the associated red LED glows, and the trip delay begins. If the current remains

*(Continued on following page.)*

**Typical Pump or Fan Protection Circuit**



**Note:** The output is normally de-energized. The zero current detection circuitry is enabled and a manual reset external latch has been added.

F = Fuses MC = Motor Contactor OL = Overload M = Motor  
 CS = Current Sensor MCC = Motor Contactor Coil CR = Control Relay  
 FSW = Fan or Float Switch RSW = Reset Switch

**Operation (cont.)**

outside the window for the full trip delay, the relay transfers to fault condition state. If the current returns to normal levels (inside the window) during the trip delay, the red LED goes OFF, the trip delay is reset, and the output remains in the normal condition.

**Reset:** Remove input voltage or open latch switch. If zero current detection is selected, the unit will reset as soon as zero current is detected.

**Operation With Zero Current Detection Enabled:** If the current decreases to zero within the trip delay period, then zero current is viewed as an acceptable current level. The unit's output remains in its normal operating state. This allows the monitored load to cycle ON and OFF without nuisance tripping the ECSW. Zero current is defined as current flow of less than 250 milliamp-turns. Note: When zero current detect is selected, the latching operation of switch SW2 is canceled; the output will not latch after a fault trip.

**Notes on Operation:**

- 1) There is no hysteresis on the trip points. The overcurrent and undercurrent trip points should be adjusted to provide adequate protection against short cycling.
- 2) If the upper set point is set below the lower set point, both red LEDs will glow indicating a setting error.
- 3) If zero current detection is selected (SW2 ON), and the system is wired to disconnect the monitored load, the system may short cycle. After the unit trips, the load de-energizes, and zero current is detected. The ECSW resets, and the load energizes again immediately and may be short cycled.
- 4) The sensing delay on start up only occurs when input voltage is applied. When zero current detection is selected, the trip delay must be longer than the duration of the inrush current or the unit will trip on the inrush current.

**Window Current Sensor  
 ECSW Series  
 Current Sensor**

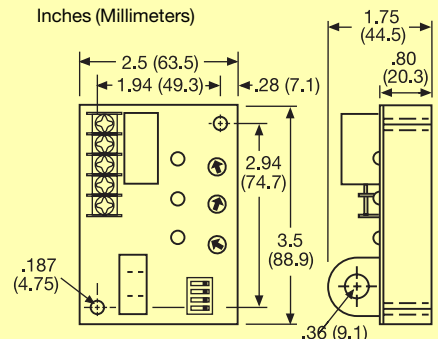
**Typical Pump or Fan Protection Circuit Operation**

**Window Current Sensing:** With the ECSW connected as shown in the diagram, a load may be monitored and controlled for over and undercurrent. The ECSW Series' on board CT (CS) may be placed on the line or load side of the contactor. The ECSW selection switches are set for zero current sensing (see Selector Switch SW2) and the output selection is normally de-energized (see Selector Switch SW3). The input voltage (V) is applied to the ECSW continually. As the control switch (FSW) is closed, the input voltage (V) is applied to the motor contactor coil (MCC), and the motor (M) energizes. As long as the current remains below the overcurrent and above the undercurrent trip points, the ECSW's output contacts remain de-energized. If the load current should rise above or fall below a trip point, for the full trip delay, the normally open (NO) contact will close, energizing the control relay (CR) coil. The CR normally closed contact (CR1) opens and the MCC de-energizes and CR latches-on through its normally open contacts (CR2). Reset is accomplished by momentarily opening the normally closed reset switch (RSW).

**Note:** If the current falls to zero within the trip delay, the ECSW remains de-energized. The sensing delay on startup occurs when input voltage is applied therefore trip delay must be longer than the duration of the motor's inrush current. The external latching relay CR2 is required in this system to prevent rapid cycling. A timer can be added to provide an automatic reset.

**Technical Data (cont.)**

<b>Protection</b>	Surge	IEEE 587 Level A
Circuitry		Encapsulated
Isolation Voltage		≥ 2500 V RMS input to output
Insulation Resistance		≥ 100 MΩ
<b>Mechanical</b>		
Mounting		Surface mount with two #6 (M3.5 x 0.6) screws
Termination		0.197 in. (5 mm) terminal blocks for up to #12 (3.2 mm <sup>2</sup> ) AWG wire
<b>Environmental</b>		
Operating Temperature		-40° C ... +60° C
Storage Temperature		-40° C ... +85° C
Humidity		95% relative, non-condensing
Weight		≅ 6.4 oz (181 g)





# AC Current Transducer

## DCSA Series

### Loop Powered



TEN YEAR  
10  
WARRANTY

- Mounts on DIN 1 or DIN 3 Rail
- 0 ... 50 A in 4 Ranges using LCSC10T12 Sensor
- Loop Powered from 10 ... 30 V DC
- Linear Output from 4 ... 20 mA, 1 ... 10 V DC
- Zero and Span Adjustments
- Separate Sensor & Control Unit

#### Description

The DCSA Series is a loop powered, linear output current transducer that provides an output that is directly proportional to the RMS AC current passing through the LCSC10T12 sensor. The DCSA provides either an analog current or voltage: 4 to 20 mA, 1 to 5 V DC, or 2 to 10 V DC. Each unit is factory calibrated for monitoring (with the LCSC10T12 connected) from 0 to 5, 0 to 10, 0 to 20, or 0 to 50 A in four ranges. Zero and span adjustments allow field calibration if needed. The DCSA mounts on both DIN 1 and DIN 3 rails.

#### Operation

The DCSA varies the effective resistance of its output in direct proportion to the current flowing in the conductor monitored by the LCSC10T12. Connecting terminals C & D provides a 4 to 20 mA DC current. Connect the power supply to terminals C & A to get 1 to 5 V DC at terminal D. Connect the power supply to terminals C & B to get 2 to 10 V DC at terminal D.

■ Approvals:



Current Range with LCSC10T12	DCSA Input Range (F to E)	Part Number
0 ... 5 A	0 ... 5 mA AC	Y DCSA5
0 ... 10 A	0 ... 10 mA AC	Y DCSA10
0 ... 20 A	0 ... 20 mA AC	Y DCSA20
0 ... 50 A	0 ... 50 mA AC	Y DCSA50
	Toroidal Sensor	Y LCSC10T12

#### Technical Data

##### DCSA Current Transducer

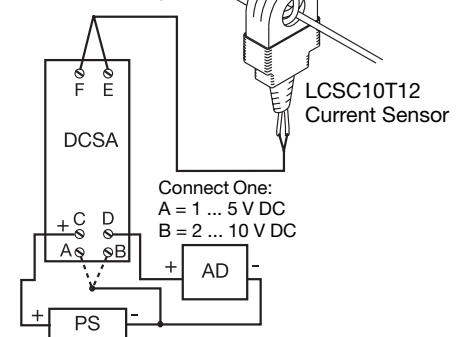
Input	
Ranges (without LCSC10T12 connected) 4 factory calibrated ranges in mA AC Factory Calibration	0...5 mA, 0...10 mA, 0...20 mA, or 0...50 mA AC +/-0.5% of full scale
Repeat Accuracy	+/-0.25% of full scale under fixed conditions
Response Time	≅ 300 ms
Temperature Coefficient	+/-0.05%/°C
Input To Output	Not isolated
Output	
Type: Analog	Current directly proportional to input current
Range	4 ... 20 mA; or 1 ... 5 V DC or 2 ... 10 VDC
Supply Voltage*	10 ... 30 V DC
Momentary Voltage	40 V DC for 1 m
Zero Adjust	≅ 3.75 ... 4.25 mA
Span Adjust	18 mA ... 22 mA
Adjustment	Mini-screw, multi-turn potentiometer
Protection	
Dielectric Breakdown	≥ 2500 V RMS terminals to mounting surface
Insulation Resistance	≥ 100 MΩ
Polarity	Units are reverse polarity protected
Mechanical	
Mounting	DIN 1 & DIN 3 rail mounting
Termination	Wire clamp
	For 22 ... 14 AWG (.336 mm <sup>2</sup> ... 2.5 mm <sup>2</sup> )
Environmental	
Operating Temperature	-30°C ... +60°C
Storage Temperature	-40°C ... +85°C
Humidity	95% relative, non-condensing
Weight	DCSA ≅ 1.6 oz (45.4 g)

##### LCSC10T12 Toroidal Sensor

Number of Turns	1000
Nominal Output Current Full Range	0 ... 50 mA
Maximum Allowable Current	Steady – 50 A turns Inrush – 300 A turns for 10 s
Burden	≤ 0.5 VA
Frequency	0 ... 20A / 21 ... 50A 20 ... 100 Hz / 30 ... 100 Hz
Sensor Hole	0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm <sup>2</sup> ) THHN wire
Weight	LCS ≅ 1 oz (28.3 g)

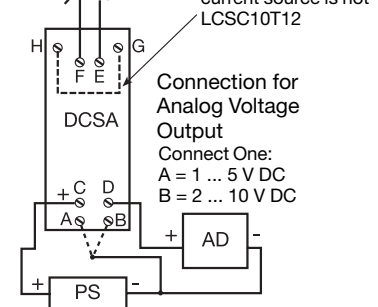
\*Minimum loop power supply voltage equals the minimum sensor voltage 10 V DC plus the voltage drop developed across all the other loop devices at 20 mA.

Connection for  
4 ... 20 mA Loop



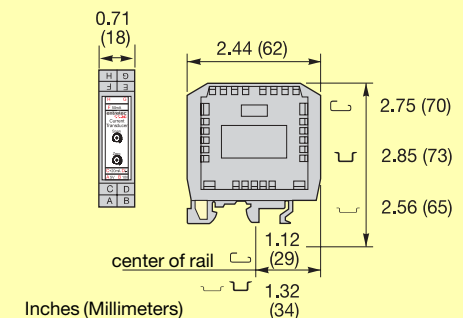
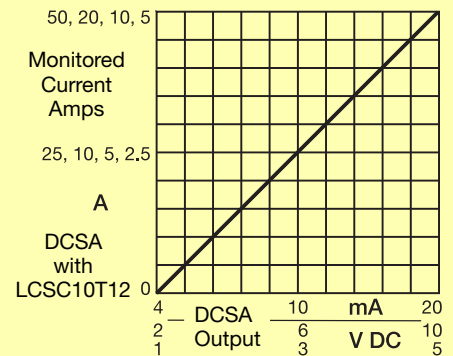
Connect One:  
A = 1 ... 5 V DC  
B = 2 ... 10 V DC

To LCSC10T12  
Current Sensor



Connection for  
Analog Voltage  
Output  
Connect One:  
A = 1 ... 5 V DC  
B = 2 ... 10 V DC

AD = Instrument, Meter, or PLC Input  
PS = Power Supply



#### Current Sensor LCSC10T12





# AC Current Indicator LCS10T12 & LPM Go-Glow Indicator



- Low Cost Go/No Go Indication
- May Be Connected To Wires Up To 500 Feet (152.4 m) Long
- Remote Current Monitoring of Currents Up To 50 A
- Green or Red LED Indicator Available

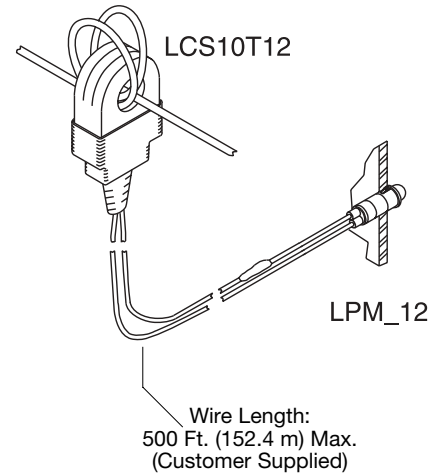
### Description

The LCS10T12 connected to the LPM12 or LPMG12 indicator is a low cost, easy to use, go/no go indication system for the remote monitoring of current flow. The LCS10T12 is installed on an adequately insulated wire of the monitored load. Its 12 in. (30.4 cm) leads are connected to the LPM12 or LPMG12 panel mount indicator directly or via customer supplied wires up to 500 feet (152.4 m) long.

### Operation

When the monitored current is 5 ampere-turns, the panel mount LPM indicator will glow. The LCS10T12 is designed to maximize the light output of the panel mount indicator. It can be used to monitor current flow of less than 5 A by passing the monitored conductor 2 or more times through the sensor.

■ Approvals:

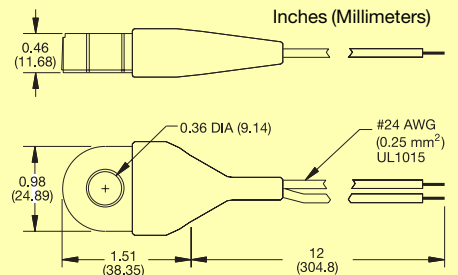


**CAUTION:** The LCS10T12 must be connected to the LPM12 or LPMG12 before current flows to prevent damage or a shock hazard. Monitored wires must be properly insulated.

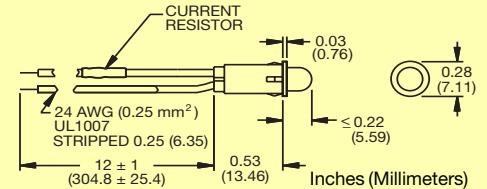
Description	Part Number
AC Current Sensor	Y LCS10T12
Red LED Indicator	Y LPM12
Green LED Indicator	Y LPMG12

### Technical Data

Specifications		2 ... 50 A AC			
Current Range	Wire Passes	Min. Current	Max. Current	Max. Inrush	Max. Wire Dia.
	1	5 A	50 A	120 A	0.355 in. (9.0 mm)
	2	2.5 A	25 A	60 A	0.187 in. (4.7 mm)
	3	1.7 A	16.6 A	40 A	0.15 in. (3.8 mm)
	4	1.3 A	12.5 A	30 A	0.125 in. (3.2 mm)
	5	5/X	50/X	120/X	
Maximum Current	50 ampere-turns continuous				
Frequency	50 ... 60 Hz				
DC Resistance	65 Ω				
Sensor Hole	0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm <sup>2</sup> ) THHN wire				
Termination	12 in. (30.4 cm) wire leads				
Operating Temperature	-40°C ... +60°C				
Weight	LCS: ≅ 0.8 oz (23 g) LPM: ≅ 0.2 oz (6 g)				



The LCS10T12 AC current sensor is installed on a wire of the monitored load. Its wire leads connect to the LPM12 or LPMG12 panel mount indicator.



Panel mount indicator designed to match the output of SSAC's LCS10T12. The LPM12 and LPMG12 come with 12 in. (30.4 cm) wires and a one piece mounting clip. Both devices install quickly in a 0.25 in. (6.35 mm) hole in panels from 0.031 ... 0.062 in. (0.79 ... 1.6 mm) thick.

# Insulation Monitor IWN mecotron® AC



- Monitors insulation resistance between ungrounded AC supply voltages and earthed conductors
- 2 measuring ranges from 1...110 kΩ
- Manual reset capability
- Suitable for insulation monitoring of single phase or three phase power supplies
- Performance check with front mounted test button or remote test button
- 1 SPDT contact
- Faults are displayed by the yellow LED
- LED indicates supply voltage ON
- Acc. to VDE 0413 part 2

## Operation

The IWN is designed for an insulation resistance range of 1...110 kΩ in 2 ranges. The desired range - 1...11 kΩ and 10...110 kΩ - is set with a front mounted switch. Setting range changeover helps to adapt the IWN to most application requirements. The output relay energizes and the yellow LED lights up as soon as insulation resistance is below the set response value and resets as soon as insulation resistance exceeds 1.6 times the response value.

## Test

Insulation resistance breakdown can be simulated with the front mounted "Test" button. The output relay will energize after the test button has been pressed. A remote test button can be connected via terminals S1- $\frac{1}{2}$ . Tripping will be caused by a normally-open contact.

■ Approvals:

## Function

The IWN is used to monitor insulation of single phase or three phase AC supply voltages. It is mainly used to monitor auxiliary circuits that are electrically isolated from supply voltage circuits. The IWN monitors insulation resistance between ungrounded AC supply voltages and grounded conductors. A superposed DC measuring voltage is used for measurement. The unit complies with VDE 0413/part 2/1.73.

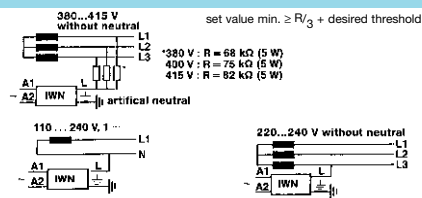
## Fault storage/Remote Reset

The tripped state can be stored by connecting terminal S1 to S2; or a normally closed reset switch can be connected to S1 and S2: pressing the button resets the unit.

## Attention

The IWN is designed for AC supply voltage. Rectifiers that are connected in series should be electrically isolated from the IWN. The unit may be powered by the supply voltage being monitored.

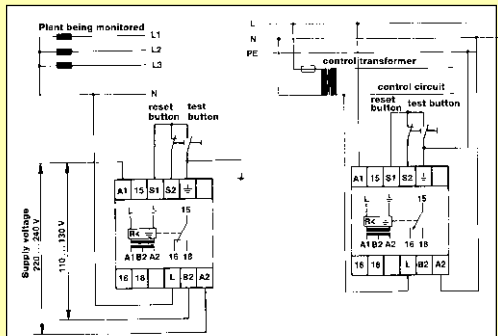
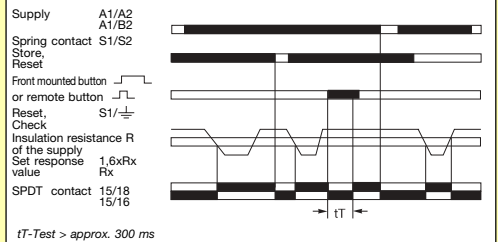
### Application examples for different supply voltages



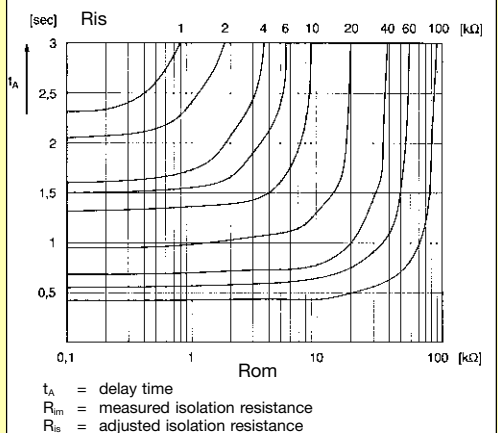
### Technical data

Input circuit		Insulation resistance range 1...110 kΩ	
Supply voltage - power consumption		Supply voltage	P/N:
A1-A2	24...240 V AC/DC	24...240 V AC/DC	2 450 075 00
A1-B2	110...130 V AC	110...130 V, 220...240 V AC	2 450 071 00
A1-A2	220...240 V AC		
Accessories		P/N:	
Sealable transparent cover		3 440 005 01	
Adapter for screw mounting		3 430 029 01	
Output circuit			
15-16/18		Relay, 1 SPDT contact, open circuit principle	
Rated voltage		VDE 0110, IEC 947-1	
Rated switching voltage max.		400 V	
Rated switching current AC 12 (resistive)		5 A (at 230 V)	
Rated switching current AC 15 (inductive)		3 A (at 230 V)	
Rated switching current DC 12 (resistive)		5 A (at 24 V)	
Rated switching current DC 13 (inductive)		2.5 A (at 24 V)	
Maximum mechanical life/ operations		30 x 10 <sup>6</sup> operations	
Maximum electrical life (to AC 12 / 230 V / 5 A)		1 x 10 <sup>6</sup> operations	
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL	
General data			
Rated impulse withstand voltage V <sub>imp</sub>		4 kV	
Operating temperature		-25°C ... +65°C	
Storage temperature		-40°C ... +85°C	
Mounting position		any	
Mounting to DIN rail (EN 50022)		Snap-on mounting/ Screw mounting by adapter	
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )	
Weight		approx. 0.66 lb (300 g)	
Dimensions (W x H x D)		45 x 78 x 101 mm	

### 1 Function



The response time varies with the severity of the fault and the selected trip point. (See graph below)



# Insulation Monitor IWN mecotron® DC



- Monitors insulation resistance in ungrounded pure DC supply voltage from 24...220 V DC
- Adjustable response range from 10...110 kΩ
- Display of insulation breakdown by 2 LEDs, L+, L-
- Front face selection switch for operating or non-operating principle
- Front face as well as external test/ reset capability
- 1 SPDT contact

## Operation

The IWN is designed for insulation resistance monitoring in ungrounded, pure DC supply voltage with or without filtering. Because of its electrical isolation between supply and measuring circuit, it can be used with an external auxiliary voltage, or where the supply voltage to be monitored is also the primary supply. An insulation resistance breakdown is evaluated separately for L+ or L- and is displayed by an LED. A balanced earth fault cannot be detected. The response value is infinitely adjustable in a range from 10...110 kΩ and can be adapted to prevailing local conditions. If the insulation resistance decreases below the set response value, the relay will transfer and the fault LED will light.

## Test

An insulation resistance breakdown can be simulated with the front mounted "Test" button. The output relay will transfer after the test button has been pressed. A remote test button for L+ can be connected via terminals S1- S3 (S4-S3 for L-).

■ Approvals:

## Application

The IWN is used to monitor DC auxiliary circuits that are electrically isolated from primary supply voltage circuits, as well as plants powered by batteries.

### Fault storage/Remote Reset

The tripped state can be stored by connecting terminals S2-S3; or a normally closed reset switch can be connected to S1 and S2: pressing the button resets the unit.

### Operate current/non-operate current selection switch

Selected by a front-mounted switch; when an insulation breakdown occurs, the output relay transfers to the rest position or to the energized position.

### Transparent cover

To prevent unauthorized adjustment, a sealable transparent cover is available.

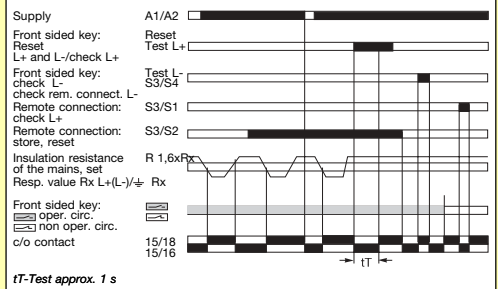
Insulation resistance range 1...110 kΩ	P/N:
Supply voltage 24...240 V AC/DC	2 450 065 00

Accessories	P/N:
Sealable transparent cover	3 440 005 01
Adapter for screw mounting	3 430 029 01

## Technical data

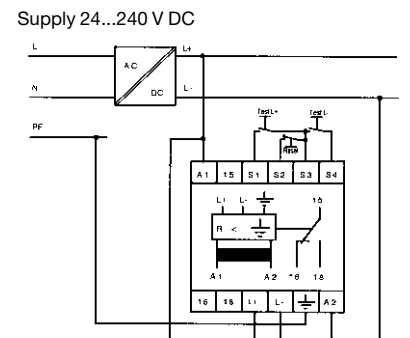
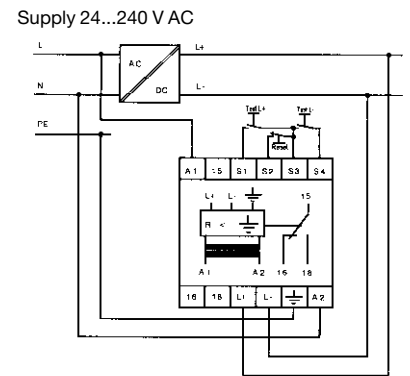
Input circuit		A1-A2
Supply voltage - power consumption		24...240 V AC/DC - approx. 5.5 VA / W
Tolerance of supply voltage	24...240 V AC	-15 % ... +10 % (50...60 Hz)
	24...240 V DC	-15 % ... +10 %
Duty time		100 %
Measuring circuit		
Measuring input	L+, L-, $\frac{\text{---}}{\text{---}}$	
Response value		10...110 kΩ
Internal resistance min.		57 kΩ
Measuring voltage		24...240 V DC
Isolation voltage max.		300 V DC
Cable length for delete and check button		max. 10 m
Time delay		
		< 1 s at R isolation
		< 0.9 x response value
Display of operational status		
Supply voltage		LED, green
Fault at L+		LED, red
Fault at L-		LED, red
Output circuit		15-16/18
Rated voltage	VDE0100, IEC 947-1	Relay, 1 SPDT, operating/non-operating principle select.
Rated switching voltage max.		400 V
Rated switching current	AC 12 (resistive)	400 V AC
		5 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	5 A (at 24 V)
Rated switching current	DC 13 (inductive)	2.5 A (at 24 V)
Maximum mechanical life		30 x 10 <sup>6</sup> operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		1 x 10 <sup>6</sup> operations
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL
General data		
Rated impulse withstand voltage V <sub>imp</sub>		4 kV
Operating temperature range		-25°C ... +65°C
Storage temperature range		-40°C ... +85°C
Mounting position		any
Mounting on DIN rail (EN 50022)		Snap-on mounting/screw mounting with adapter
Cable size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm <sup>2</sup> )
Weight		approx. 0.66 lb (300 g)
Dimensions (W x H x D)		45 x 78 x 101 mm

## 1 Function



## Application examples

for any power supply AC or DC



# Mechanical Outline and Accessories for mecotron® Current Sensors



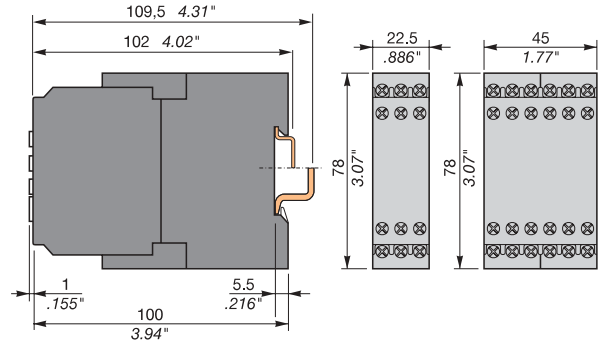
**SRS**  
22.5 mm



**SRN**  
45 mm



**S and N Series:**  
Screw Connection



Easy mounting



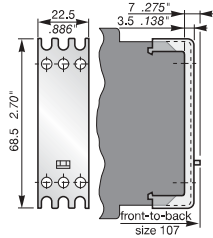
On the S Series, terminals with cable guides greatly simplify installation. This also applies to wire end ferrules with insulating collars.

## Accessories

### Sealable covers

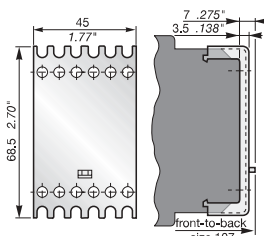
P/N: 3 430 005 01

Sealable cover for mecotron®  
series 22.5 mm wide



P/N: 3 440 005 01

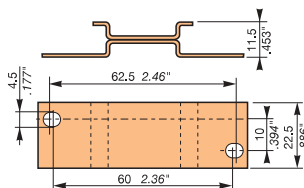
Sealable cover for mecotron®  
series 45 mm wide



### Current transformers

Current transformer	Rated current	Power/class	sec. 5 A	sec. 1 A
IT 50-600	50 A	2 VA/1	4 450 116 50	4 450 116 10
	75 A	2.5 VA/1	4 450 116 51	4 450 116 11
	100 A	2.5 VA/1	4 450 116 52	4 450 116 12
	150 A	5 VA/1	4 450 116 53	4 450 116 13
	200 A	5 VA/1	4 450 116 54	4 450 116 14
IT 200-600	200 A	5 VA/1	4 450 117 50	4 450 117 10
	300 A	5 VA/1	4 450 117 51	4 450 117 11
	400 A	5 VA/1	4 450 117 52	4 450 117 12
	500 A	5 VA/1	4 450 117 53	4 450 117 13
	600 A	5 VA/1	4 450 117 54	4 450 117 14

### Adapter for screw mounting



In 22.5 mm width  
In 45 mm width

P/N: 3 430 029 01  
P/N: 3 440 029 01

### Marker label



P/N: 4 366 017 01

