



CONNECTION



AUTOMATION



CONTROLS



PROTECTION

P
Penoresan.com

Monitors
voltage, phase,
thermistor, current



entrelec®

VOLTAGE/PHASE MONITORS



THREE-PHASE VOLTAGE MONITORS, MOTOR PROTECTORS
Pages 1440-1462



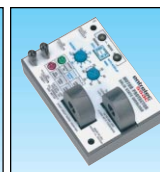
PHASE MONITORING RELAYS
Pages 1442-1453, 1456-1462, 1466



PHASE UNBALANCE RELAYS
Pages 1442-1452, 1454-1455



PHASE SEQUENCE RELAYS
Pages 1444, 1447, 1453, 1458-1461

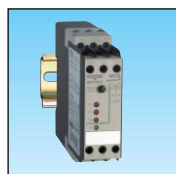


SOLID-STATE OVERLOAD & MONITOR
Pages 1454-1455



SINGLE-PHASE VOLTAGE MONITORING
Pages 1462-1466

THERMISTOR MONITORS



THERMISTOR MOTOR PROTECTION RELAYS
Pages 1468-1474

CURRENT MONITORS



CURRENT MONITORING RELAYS
Pages 1484-1497



WINDOW CURRENT SENSOR
Pages 1488-1489



AC CURRENT SENSOR, PLC INTERFACE
Page 1490



AC CURRENT INDICATOR
Page 1493



INSULATION RESISTANCE MONITORS
Pages 1494-1495

VOLTAGE/PHASE MONITORS

Accessories	1476-1477
mecotron® relays, dimensions	1477
Approvals	1478
Compact 3-Phase voltage monitor	1450-1451
Cos ϕ inductive load monitor relay	1467
Dimensions, mecotron® relays	1477
Inductive load monitor	1467
Insulation resistance monitors	1494-1495
Load limit curves	1479
Mechanical outlines	1477
Motor protectors	1442-1456, 1459
See also thermistor motor protection relays.	
Overload protection	1454-1455
Overvoltage/undervoltage monitors	within pages 1442-1466
Phase loss relays	1442-1452, 1454-1458, 1461-1462, 1466
Phase monitoring relays	1442-1453, 1456-1462, 1466
Phase reversal relays	within pages 1442-1459
Phase sequence relays	1444, 1447, 1453, 1458-1461
Phase unbalance relays	1442-1452, 1454-1455
Power factor monitor	1467

Selection guide	1440-1441
Short-cycling protection relays	1442-1443, 1450-1451, 1454
Single-phase voltage monitors	1462-1466
Solid-state overload and monitor	1454-1455
Standards	1478
Three-phase voltage monitors,	
8 pin plug-in	1448-1449, 1456
compact	1450-1451
DIN 3 rail	1444-1447, 1453, 1457-1458
surface mount	1442-1443, 1452
surface mount or DIN 3 rail	1445
Undervoltage monitoring relays	1448, 1452, 1456

THERMISTOR MOTOR PROTECTION RELAYS

Accessories	1476-1477
Thermistor relays, dimensions	1477
Approvals	1478
Dimensions, thermistor relays	1477
Load limit curves	1479
Mechanical outlines	1477
Standards	1478
Thermistor motor protection relays	1468-1474
Winding overtemperature monitors	1468-1474

CURRENT MONITORS/SENSORS

Accessories	1496-1497
mecotron® sensors, dimensions	1496
AC current indicator	1493
AC current sensor, PLC interface	1490
AC current transducer	1491-1492
Analog output current sensor	1491-1492
Current monitoring relays	1484-1486, 1490
Current transformers, CT	1496
Dimensions, mecotron® sensors	1496
Electronic overload	1494-1495
Go, No/Go current sensors	1490, 1493
Insulation resistance monitors	1494-1495
Jam detectors	1484, 1486-1487, 1490
Loop powered AC current transducer	1491-1492
Overcurrent/undercurrent monitor/sensor	1487-1489
Selection guide	1482-1483
Self-powered current switch	1490, 1493
Window current sensor	1488-1489

Voltage Monitors Selection Guide

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:

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.

[illegible]

1441

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

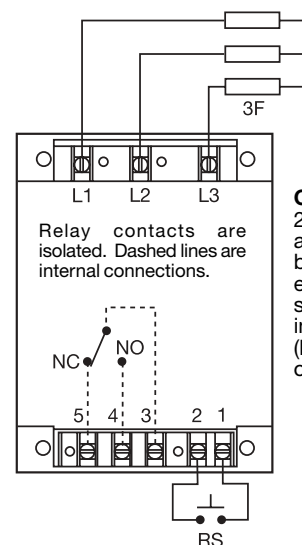
10
YEAR
WARRANTY

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

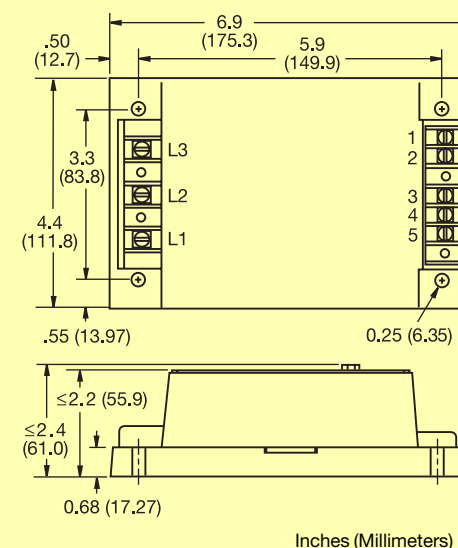
Y WVM Series	X 3 Phase Line Voltage	X Unbalance	X Trip Delay	X Reset Method	X Restart Delay
	-6 - 200 ... 240 V AC	-1 - 2 ... 10%	-1 - 0.25 ... 30 s	-A - Switch Selectable: Automatic Restart Upon Fault Trip	(Switch Selectable Reset Only) -L - 0.25 ... 64 s
	-8 - 355 ... 425 V AC			-R - Switch Selectable: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

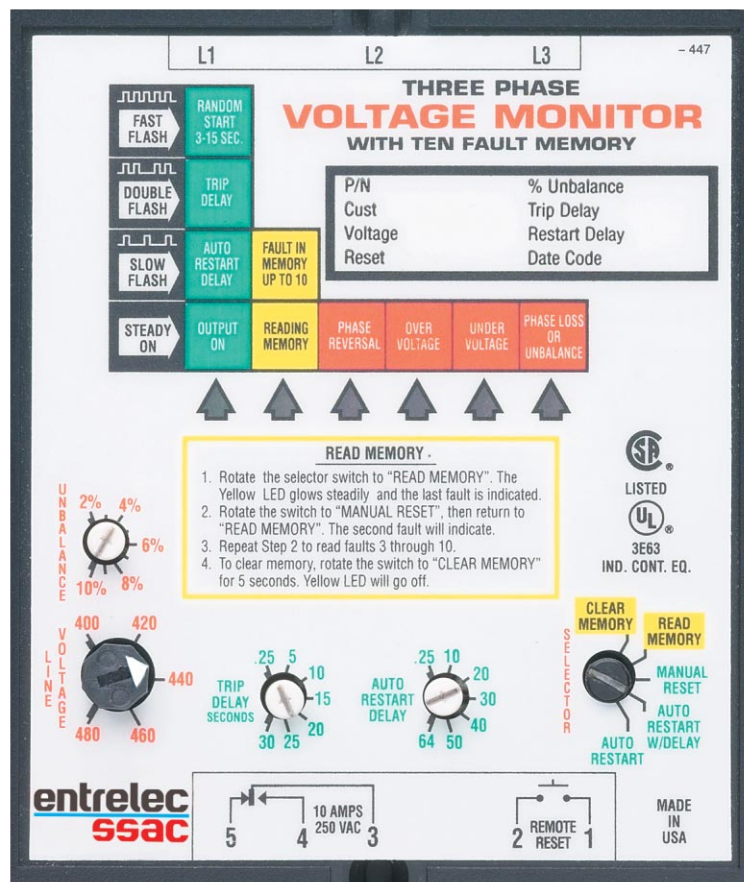
Example P/Ns: **Y WVM011AL, Y WVM011M**

Technical Data

Line Voltage	
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
Overvoltage, Undervoltage, & Voltage Unbalance	
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%
Phase Loss	
Response Time	≥ 15% unbalance ≤ 200 ms
Random Start Delay Range	
Reset (Restart) Delay	3 ... 15 s
Low Range	0.25 ... 64 s +/-15%
Normal Range	6 ... 300 s +/-15%
High Range	0.25 ... 64 m +/-15%
Fault Memory	
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	
Output	
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
Protection	
Surge	IEEE 587 Level B
Isolation Voltage	≥ 2500 V RMS input to output
Mechanical	
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 ²) wire
Environmental	
Operating/Storage Temperature	-40°C ... +65°C / -40°C ... +85°C
Weight	≅ 25 oz (709 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
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 ≥ 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:

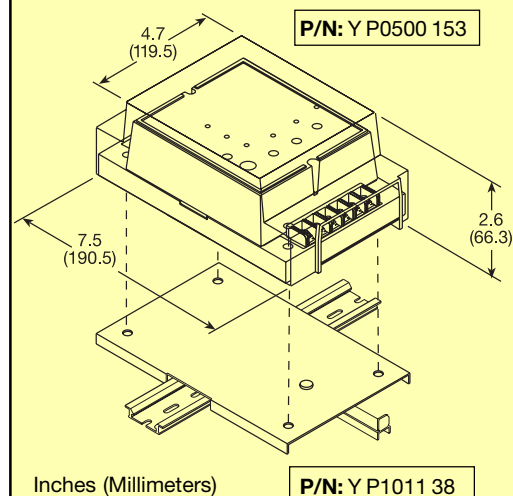
(P/N includes an **R**)
When a fault is sensed for the full trip delay, the output relay de-energizes. Upon correction of the fault, a restart delay begins. At the end of this delay, the output will re-energize after a random start delay. If a fault occurs during timing, the time delay will be reset 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)



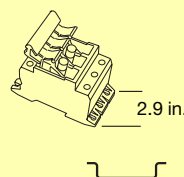
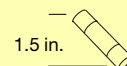
35mm DIN Rail Adaptor

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.

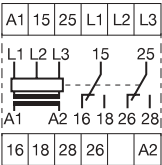
The output relay is energized as long as phases are balanced and phase sequence is correct (rotary switch right-handed polarized). It will de-energize as soon as unbalance exceeds the set threshold (adjustable between 5% and 15% unbalance).

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:
110...130 V AC	220...240 V/50 Hz	2 450 320 02	--	380...415 V/50 Hz	2 450 320 05	--	440 V/60 Hz	2 450 320 07
220...240 V AC	220...240 V/60 Hz	2 450 321 02	2 450 421 02	380...415 V/60 Hz	2 450 321 05	--	480...500 V/50 Hz	2 450 321 07
380...415 V AC	--	2 450 322 02	--	--	2 450 322 05	2 450 422 05	480...500 V/60 Hz	2 450 322 07
440 V AC	--	--	--	--	--	--	600 V/60 Hz	--
480...500 V AC	--	--	--	--	--	2 450 423 06	--	--
500...550 V AC	--	--	--	--	2 450 322 07	--	--	2 450 424 07
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
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 Vnom.	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

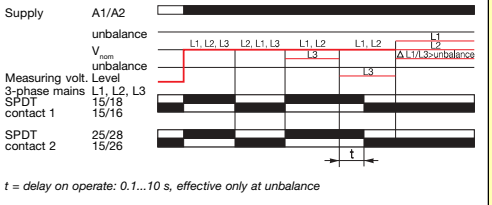
Output circuit

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 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		1 x 10 ⁵ operations
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL

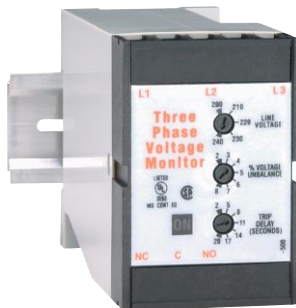
General data

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 14 AWG (2 x 2.5 mm ²)
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

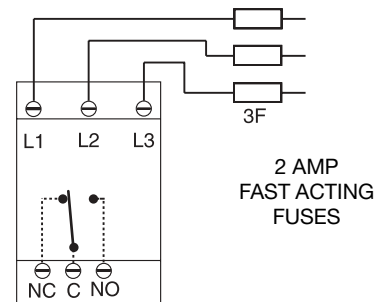
The DLM Series continuously measures the voltage of each of the three phases. It separately senses under and over voltage, voltage unbalance including phase loss and phase reversal. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present.

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.

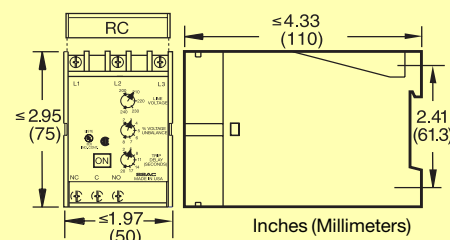
Voltage	Voltage Unbalance	Trip Delay	Part Number
120 V AC	2 ... 8%	2 ... 20 s	Y DLM411
240 V AC	2 ... 8%	2 ... 20 s	Y DLM611
380 V AC	2 ... 8%	2 ... 20 s	Y DLM811
480 V AC	2 ... 8%	2 ... 20 s	Y DLM911
600 V AC	2 ... 8%	2 ... 20 s	Y DLM011

Technical Data

Line Voltage			
Type		3 phase Delta or Wye with no connection to neutral	
Operating Voltage	Line Voltage Range	Line Voltage Max.	Calibration Frequency
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	
Overvoltage, Undervoltage & Voltage Unbalance			
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	
Phase Reversal			
Response Time -- Phase Reversal		≤100 ms	
Reset		Automatic	
Output			
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 ⁶ ; Electrical -- 1 x 10 ⁵		
Protection		Surge	
Isolation Voltage		≥ 2500 V RMS input to output	
Circuitry		Encapsulated	
Mechanical			
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 ²) wire	
		Touch proof terminal covers are included	
Environmental			
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

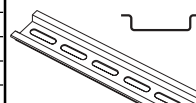
Note: A 60 Hz unit used on 50 Hz will shift by -1. A 50 Hz unit used on 60 Hz will shift by +1. (Ex. 4% unbalance on 60 Hz, would be 3% unbalance on 50 Hz.)



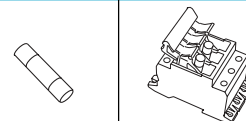
RC = Removable Terminal Cover

Accessories

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



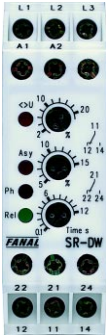
Fuse 2A fast acting
1.5" x 13/32"
(38.1 mm x 10.3 mm)
P/N: Y P0600 11



3-phase fuse
block/disconnect
P/N: Y P0700 241

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

Line Voltage

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

Overvoltage, Undervoltage & Voltage Unbalance

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

Output

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

Protection

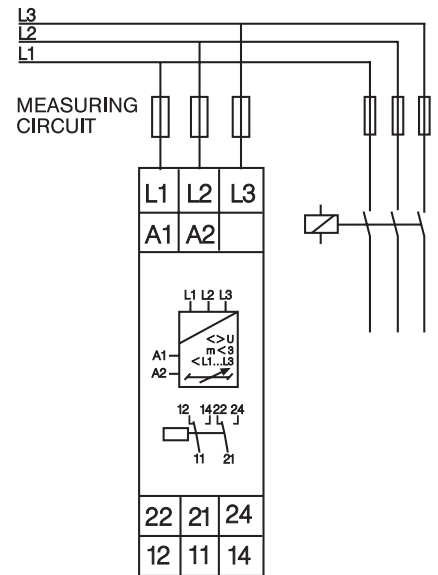
Isolation Voltage	VDE 0160 Input to output
Protection to DIN 40 050/ IEC 529	Enclosure IP 30
	Terminals IP 10

Mechanical

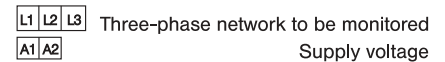
Mounting	EN 50 022 DIN 3 Rail
Termination	2 #14 AWG (1.5 mm ²) wire per terminal

Environmental

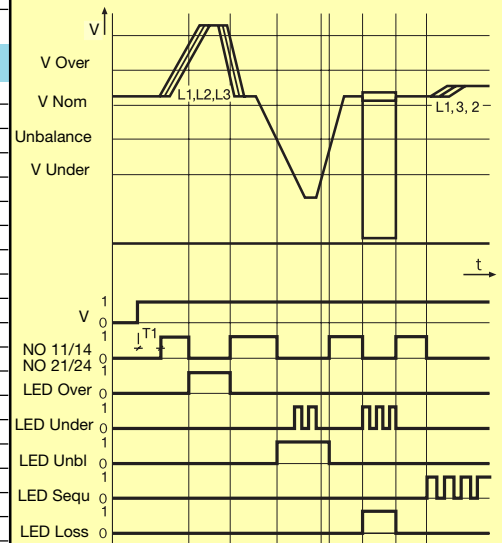
Operating Temperature	-20°C ... +55°C
Weight	≅ 6.5 oz (185 g)



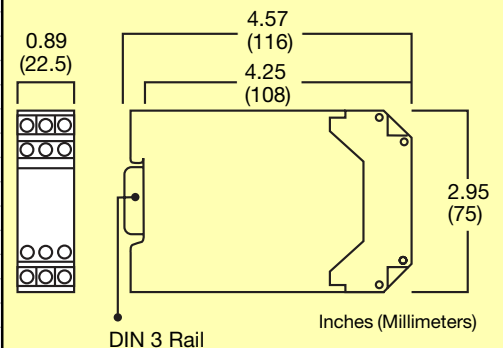
Connection diagram for 3 phase voltage monitoring



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.

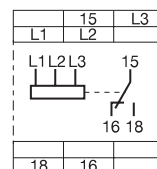
The output relay de-energizes 500 ms after the set unbalance level has been exceeded or immediately after failure of one of the phases. The lighting LED displays an energized output relay.

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 _{nom} .	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

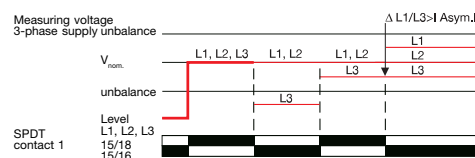
Output circuit

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 ⁶ operations	
Maximum electrical life (to AC 12 / 230 V / 4 A)	3 x 10 ⁵ operations	
Short-circuit proof, max. fuse rating	10 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 ²)
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

TEN YEAR
WARRANTY

Description

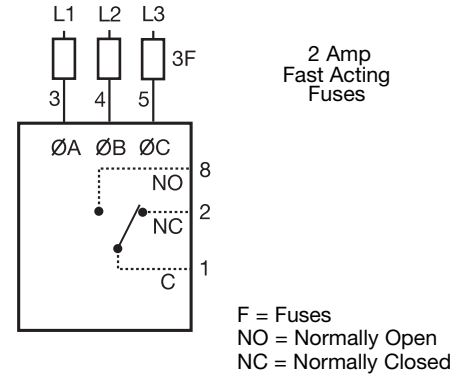
The PLM Series continuously measures the voltage of each of the three phases. It separately senses Undervoltage, Voltage Unbalance (including Phase Loss), and Phase Reversal. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present. Both Delta 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) Specify: 4, 5, 6, 7, or 8%	X Trip Delay (Fixed) Specify from 2 ... 20 s in 1 s increments (Insert 0 before 1 ... 9)
	6 - 240 V AC		
	8 - 380 V AC		
	9 - 480 V AC		

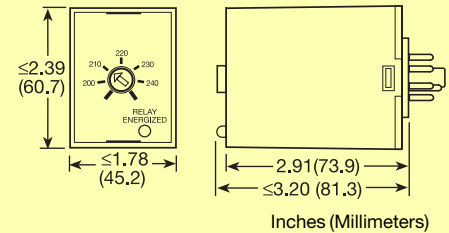
Example P/N: **Y PLM6405**

Technical Data

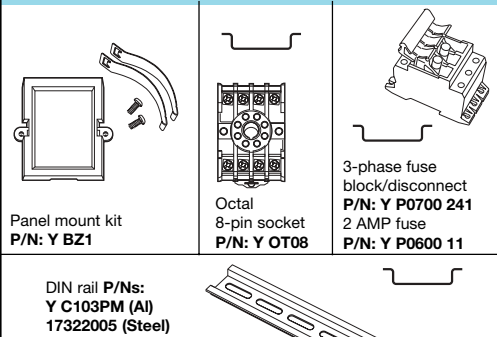
Line Voltage										
Type			3 phase Delta or Wye with no connection to neutral							
Operating Voltage:										
UL	CSA	Model	Adj. Line Voltage Range	Line Voltage Max.	Calibration			Frequency		
•	•	240	200 ... 240 V AC	270 V AC				60 Hz		
•		380	360 ... 430 V AC	480 V AC				50 Hz		
•	•	480	400 ... 480 V AC	530 V AC				60 Hz		
Line Frequency			50 ... 60 Hz							
Phase Sequence			ABC							
Low Voltage and Voltage Unbalance										
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	
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.)										
Trip Delay:		Range		Factory fixed from 2 ... 20 s						
		Tolerance		+/-15%						
Phase Reversal										
Response Time -- Phase Reversal			≤ 100 ms							
Reset			Automatic							
Output										
Type			Electromechanical relay							
Form			Single pole double throw (SPDT)							
Rating			8 A resistive at 240 V AC							
Protection										
Surge			IEEE 587 Level B							
Isolation Voltage			≥ 2500 V RMS input to output							
Circuitry			Encapsulated (380 & 480 V units only)							
Mechanical										
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)							
Environmental										
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



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

10
YEAR
WARRANTY

Description

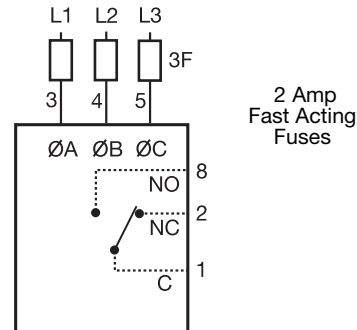
The PLMU Series continuously measures the voltage of each of the three phases to provide protection for three phase motors and sensitive loads. Its microcontroller senses under and overvoltage, voltage unbalance, phase loss, and phase reversal. Protection is provided even when regenerated voltages are 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)

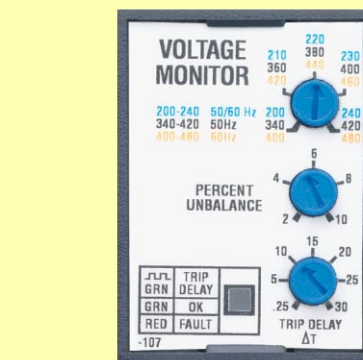
Voltage Unbalance	Trip Delay	Part Number
Adjustable 2 ... 10%	Adjustable 0.25 ... 30 s	Y PLMU11

Available with Fixed Unbalance and Trip Delay

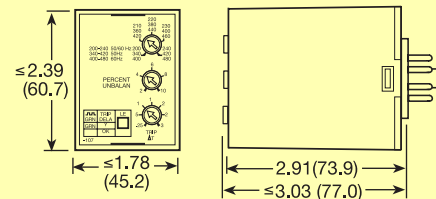
Technical Data

Line Voltage											
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							
Overvoltage, Undervoltage, & Voltage Unbalance											
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	
Trip Delay Range					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						
Phase Reversal & Phase Loss Trip Time					≤ 150 ms						
Phase Loss Set Point					≥ 15% unbalance						
Reset Type					Automatic						
Output Type					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						
Life					Mechanical -- 1 x 10 ⁶ ; Electrical -- 1 x 10 ⁵						
Protection											
Surge					IEEE 587 Level B						
Isolation Voltage					≥ 2500 V RMS input to output						
Mechanical											
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)						
Environmental											
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.

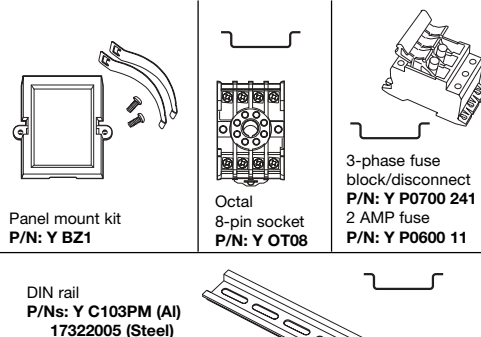


Faceplate View



Inches (Millimeters)

Accessories



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.

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

10
YEAR
WARRANTY



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

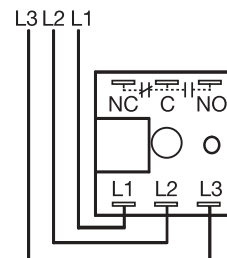
Upon application of line voltage, the restart delay begins. The output relay is de-energized during restart delay and the LED flashes green. Under normal conditions, the output energizes and the LED glows green after restart delay. Undervoltage, overvoltage, and voltage unbalance must be sensed for continuous 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		[0.3 ... 1]	[0.5 ... 1]
	230 A - 230 V AC	4, 5, 6, 7, 8, 9, or 10	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

Line Voltage		
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
Overvoltage, Undervoltage, & Voltage Unbalance		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		≤ ±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
Phase Reversal & Phase Loss Response		≤ 200 ms; automatic reset
Phase Loss		≥ 15% unbalance
Output		Isolated SPDT relay contacts
Rating	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 ⁶ ; Electrical --1 x 10 ⁵
Protection		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
Mechanical		
Mounting		Surface mount with one #8 (M5 x 0.8) screw
Termination		0.25 in. (6.35 mm) male quick connect terminals
Environmental		
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)

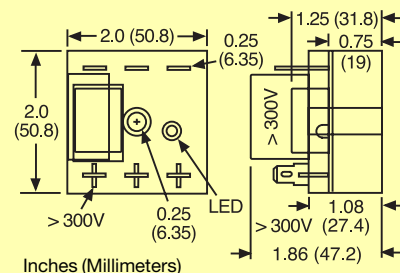
Operating Temperature:

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.)



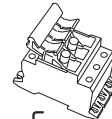
Accessories



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



10
YEAR
WARRANTY

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.

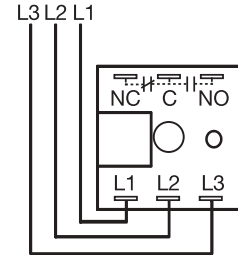
Operation

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 Series	X Line Voltage Wide Range	X Voltage Unbalance	X Trip Delay	X Restart Delay
	5 - 208 ... 240 V AC	Specify Fixed Percentage	Specify Fixed Delay In Seconds (S)	Specify Fixed Delay In Seconds (S)
	6 - 208, 220, 230 & 240 V AC	4, 5, 6, 7, 8, 9, or 10	In 0.1 s Increments [0.2 ... 1]	In 0.1 s Increments [0.2 ... 1]
	8 - 380, 400 & 415 V AC		In 1 s Increments [1 ... 100]	In 1 s Increments In Minutes (M) [1 ... 999]
	9 - 430, 440, 460 & 480 V AC			In 1 M Increments

Example P/N: Y TVW645S10S

Technical Data

Line Voltage	
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
Overvoltage, Undervoltage, & Voltage Unbalance	
Overvoltage & Undervoltage	Voltage detection with delayed trip & automatic reset
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
Phase Reversal & Phase Loss Response	
Phase Loss	≤ 200 ms; automatic reset
Phase Loss	≥ 15% unbalance
Output	
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 ⁶ ; Electrical --1 x 10 ⁵
Protection	
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
Mechanical	
Mounting	Surface mount with one #8 (M5 x 0.8) screw
Termination	0.25 in. (6.35 mm) male quick connect terminals
Environmental	
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)

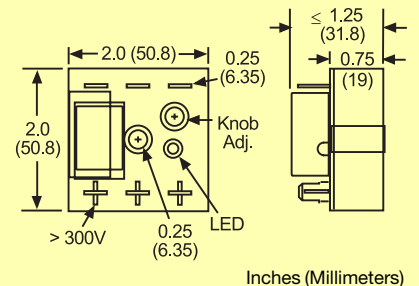
FPM = Flashes per minute
FPS = Flashes per second

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



TEN YEAR
WARRANTY

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

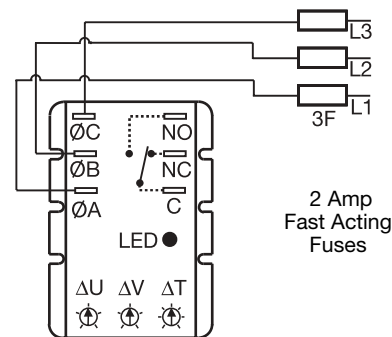
The RLM Series of encapsulated three phase voltage monitors continuously measures the voltage of each of the three phases. Its circuit design separately senses Phase Reversal, Undervoltage, and Voltage Unbalance including Phase Loss. Protection is assured during periods of large average voltage fluctuations, 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

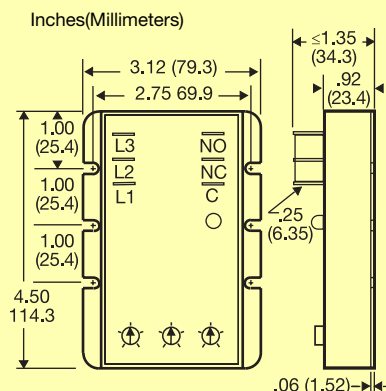
Y RLM Series	X Line Voltage	X Voltage Unbalance	X Trip Delay
	-6 - 240 V AC	-1 - Adjustable: 2 ... 6 %	-1 - Adjustable: 2 ... 20 s
	-9 - 480 V AC	-Fixed: Specify: 4, 5, 6, 7, or 8 %	-Fixed:
			Specify delay in s,
	-8 - 380 V AC	-1 - Adjustable: 2 ... 8 % (380 V AC only)	2 ... 20 s in 1 s increments
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

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

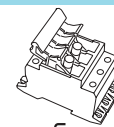
Technical Data

Line Voltage												
Type			3 phase Delta or Wye with no connection to neutral									
Operating Voltage:												
UL	CSA	Model	Adj. Line Voltage Range	Line Voltage Max.				Calibration Frequency				
•	•	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									
Undervoltage and Voltage Unbalance												
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		
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.)												
Trip Delay:		Range	Adjustable or Factory fixed from 2 ... 20 s									
		Tolerance	Adjustable: Guaranteed range; Factory fixed: +/-15%									
Phase Reversal												
Response Time -- Phase Reversal			≤100 ms									
Reset			Automatic									
Output												
Type			Electromechanical relay									
Form			Single pole double throw (SPDT)									
Rating			8 A resistive at 240 V AC; max. voltage 277 V AC									
Protection												
Surge			IEEE 587 Level B									
Isolation Voltage			≥ 2500 V RMS input to output									
Circuitry			Encapsulated									
Mechanical												
Mounting			Surface mount with two #8 (M4 x 0.7) screws									
Termination			0.25 in. (6.35 mm) male quick connect terminals									
Environmental												
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.

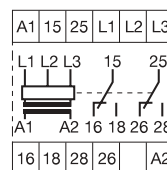
■ Approvals:

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.



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	A1-A2	160...300 V AC	-	3 VA
	A1-A2	300...500 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 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}	Monitoring voltage adjustable
		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

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

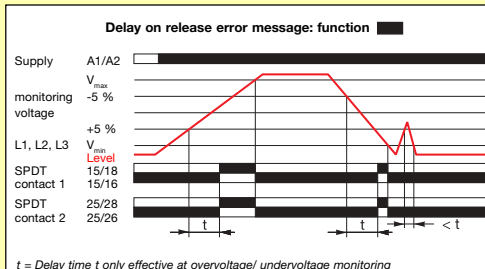
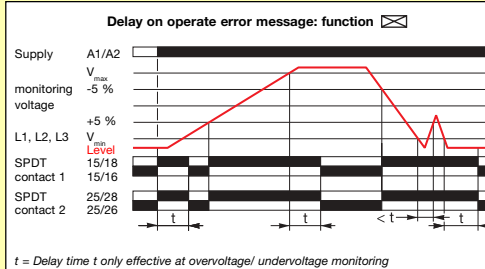
Output circuit 15-16/18, 25-26/28

Rated voltage	VDE 0110, IEC 947-1	Relay, 2 SPDT contacts, closed-circuit principle
Rated switching voltage max.	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 ⁶ operations	
Maximum electrical life (to AC 12 / 230 V / 5 A)	1 x 10 ⁶ 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	Snap-on mounting/Screw mounting by adapter
Cable size stranded with wire end ferrule	2 x 14 AWG (2 x 2.5 mm ²)
Weight	approx. 0.66 lb (300 g)

2 Functions



Penoresan.com

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

Solid-State Overload & Monitor ESTM Series Motor Protectors



TEN YEAR
WARRANTY

- Protection of a Line Monitor & Overload in One Package
- Protects Against: Overload, Phase Loss, Current Unbalance, Phase Reversal and Short Cycling
- Meets NEC Code for Motor Overloads
- 1.25 ... 80 A in 3 Adjustable Ranges
- Fast 2.5 s Trip On Phase Loss, Hot or Cold Motor

Description

The ESTM Series protects against premature motor winding failure caused by electrical overheating. It provides the protection of a voltage monitor and an overload in one package. Microcomputer based circuitry calculates overload trip times while compensating for hot/cold motors and additional heat from phase unbalance. Unique patented design requires only two small sensors to measure current in all three phases. The ESTM can be used with any brand of contactor. It provides protection for one motor against phase loss, unbalance, phase reversal, and rapid cycling. Other features are a fast trip delay on phase loss, switch selectable manual reset or automatic restart with delay; remote reset by removing input voltage, and a random start delay after a power outage (auto restart only). Connecting a DC voltmeter to the meter terminals allows for accurate setting of the full load current over a wide 4:1 range. Because of its solid state design, the overcurrent trip point is not affected by ambient temperature.

US Patent #6040689

■ Approvals:   

Voltage	FLA Range	Trip Curve	Part Number
24, 120, 230 V AC	1.25 ... 5 A	NEMA Class 20	Y ESTMA5N20
24, 120, 230 V AC	5 ... 20 A	NEMA Class 20	Y ESTMA20N20
24, 120, 230 V AC	20 ... 80 A	NEMA Class 20	Y ESTMA80N20

Technical Data

Motor Protection

Overload Type	Solid state current sensing; meets NEMA class 20 trip curve
Overload Range	1.25 ... 80 A in 3 adjustable ranges, 60 Hz, +/-1%
Phase Reversal	Trips in ≤ 1 s with motor load ≥ 50% unbalance & motor loaded to ≥ 70%
Phase Loss/Unbalance	Trips in 2.5 s +/-30% with ≥ 50% of minimum FLA setting & current unbalance ≤ 40%

Reset (Restart)

Type	Manual reset & automatic restart with a delay
Automatic Restart with Delay: Mode	Restart delay begins when a fault trips the unit or when input voltage is applied
Delay Adjustment	Knob with reference dial
Ranges	Switch selectable on the unit 2 ... 100 s +/-10% or +/-0.5 s, whichever is greater 2 ... 100 m +/-10% or +/-0.5 m, whichever is greater
Auto-Trip Counter	If unit trips 3 times consecutively, unit will lockout until manually reset

Input

Voltage	24, 120, & 230 V AC, +/-20%, 60 Hz
Power Consumption	0.5 VA @ 24 V AC; 1.2 VA @ 120 V AC; 2.2 VA @ 230 V AC

Output

Type	Solid state								
Form	Single Pole-closed during normal operation								
Rating	<table border="1"> <thead> <tr> <th>Input</th><th>Max. Output A</th></tr> </thead> <tbody> <tr> <td>24 V AC</td><td>1.5 @ 40°C, 1.0 A @ 60°C</td></tr> <tr> <td>120 V AC</td><td>1.0 @ 50°C, 0.6 A @ 60°C</td></tr> <tr> <td>230 V AC</td><td>0.5 @ 50°C, 0.2 A @ 60°C</td></tr> </tbody> </table>	Input	Max. Output A	24 V AC	1.5 @ 40°C, 1.0 A @ 60°C	120 V AC	1.0 @ 50°C, 0.6 A @ 60°C	230 V AC	0.5 @ 50°C, 0.2 A @ 60°C
Input	Max. Output A								
24 V AC	1.5 @ 40°C, 1.0 A @ 60°C								
120 V AC	1.0 @ 50°C, 0.6 A @ 60°C								
230 V AC	0.5 @ 50°C, 0.2 A @ 60°C								

Inrush	10 A
Voltage Drop	≤ 1.25 V
Leakage Current	0.7 mA @ 24 V AC; 3 mA @ 120 V AC; 6 mA @ 230 V AC

Protection Surge

Dielectric	≥ 2000 V RMS terminals to mounting surface
Short-Circuit Rating	80 A Unit - 10 KA @ 600 V; 5, 20 A Units - 5 KA @ 600 V

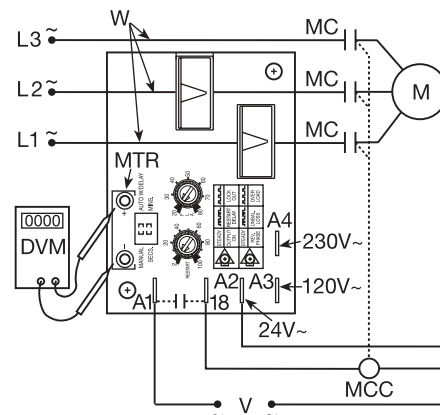
Mechanical

Mounting	Surface mount with two #6 (M 3.5 x 0.6) screws
Connection Terminals	0.25 in (6.35 mm) male quick connect terminals
Wire Selection	50 ... 80 A use #4 AWG (21.1 mm ²) 90°C THHN wire

Environmental

Operating/Storage Temperature	-40°C ... +60°C / -40°C ... +85°C
Humidity	95% relative, non-condensing
Weight	6.7 oz (190 g)

Wires must be properly insulated *



W = Wire V = Voltage MC = Motor Contactor
M = Motor MTR = Meter DVM = Digital Voltmeter
MCC = Motor Contactor Coil

* 50 to 80 A use 4 AWG 90°C THHN wire.

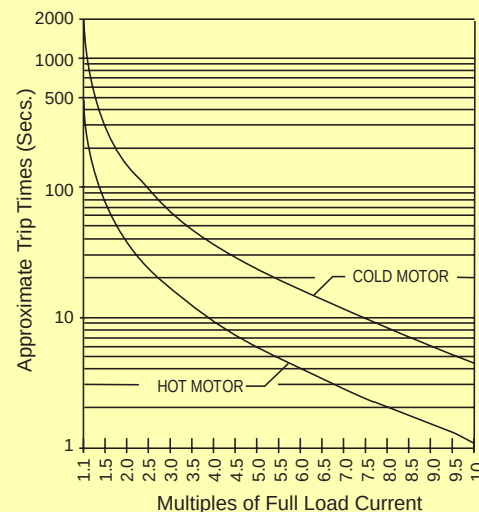
Short-Circuit Rating 80 A Unit - 10KA @ 600 V
5 & 20 A Units - 5KA @ 600 V

Caution: Line Voltage On All Connections & Meter Terminals

A2, A3, A4:
Select The Correct Terminal For The Input Voltage Used

Note: Phase reversal, phase loss are not sensed until the motor is energized & conditions of Phase Reversal, Phase Loss/Unbalance specifications are met.

ESTM...N20 Trip Curves (Balanced Currents)





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

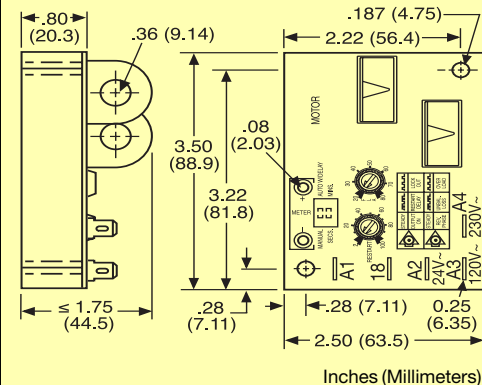
Overload Adjustment:

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



10 YEAR
WARRANTY

- 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:   

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

Line Voltage

Type 3 phase Delta or Wye with no connection to neutral

Nominal Voltage	Undervoltage Dropout Adjustment Range	Calibration Frequency
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

Response Times

Pull-in	≤ 400 ms
Drop-out	≤ 1 s

Output

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

Protection

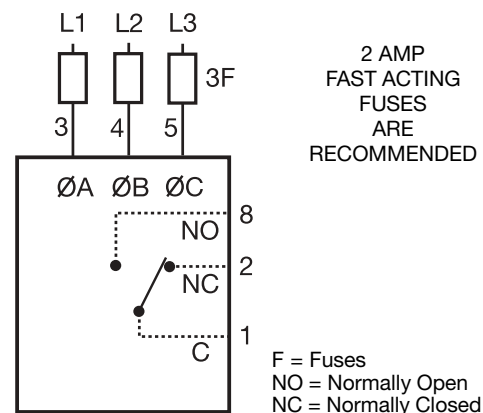
Isolation Voltage	120 & 240 V AC	≥ 1500 V RMS input to output
	380 & 480 V AC	≥ 2500 V RMS input to output

Mechanical

Mounting	Plug-in socket
Termination	8-pin, octal plug

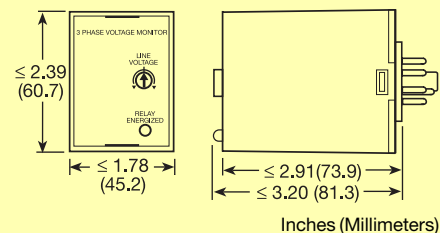
Environmental

Operating Temperature	0°C ... +55°C
Storage Temperature	-40°C ... +85°C
Weight	≅ 6 oz (170 g)

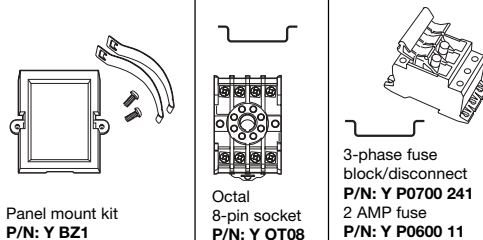


Relay contacts are isolated. Dashed lines are internal connections.

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.



Accessories



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

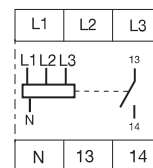
Operation

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.

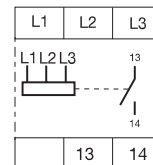
The product with neutral monitoring can also be used in single-phase power supplies by jumpering the three terminals (L1, L2, L3) and connecting only one phase.

■ Approvals:

with neutral monitoring:



without neutral monitoring:



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 operation on operate		± 20%

Display of operational status

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

Output circuit

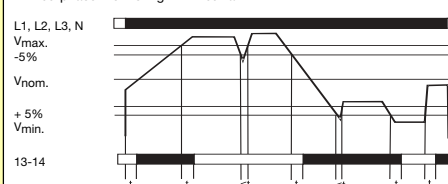
		Relay, 1N/O contact, closed-circuit principle
Rated voltage	VDE 0110, IEC947-1	250 V
Rated switching voltage max.		250 V AC
Rated switching current	AC 12 (resistive)	4 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	4 A (at 24 V)
Rated switching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

General data

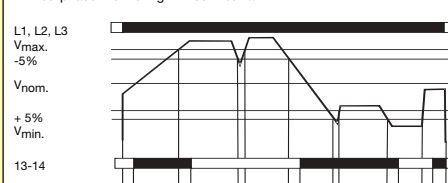
Rated impulse withstand voltage V_{imp}		4 kV (overvoltage category III)
Isolation voltage	Input - output	400 V
Operating temperature		-20°C ... +60°C
Storage temperature		-40°C ... +85°C
Mounting position		any
Mounting to DIN-rail (EN 50022)		Snap-on mounting
Cable size stranded with wire end ferrule		2 x 16 AWG (2 x 1.5 mm ²)
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®



- Monitors three-phase supply voltage for incorrect phase sequence, overvoltage, undervoltage
- Monitoring range: 0.9 to 1.1 V_N
- 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-phase voltage monitoring versions: 220 V, 400 V, 500 V
- 3 supply voltage versions: 110...130 V, 220...240 V, 380...415 V

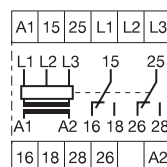
Operation

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:



Penoresan.com

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		
	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	message: overvoltage, low voltage 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_{nom}	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_{nom} (0.85/1.1 for 380 V/50 Hz version)
Reset value at overvoltage/ undervoltage	0.95/1.05- V_{nom} (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

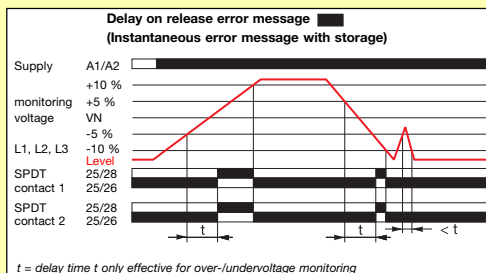
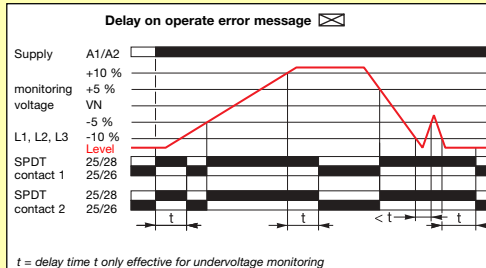
Output circuit

	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 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		1 x 10 ⁵ 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 ²)
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



10 YEAR
WARRANTY

- 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

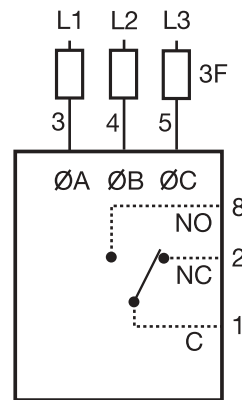
Description

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 380 & 480 V AC 10 A resistive at 240 V AC 8 A resistive at 240 V AC

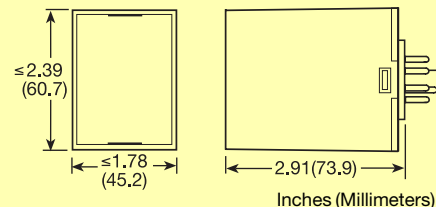
Maximum Voltage	250 V AC
Protection	
Isolation Voltage	120 & 240 V AC 380 & 480 V AC ≥ 1500 V RMS input to output ≥ 2500 V RMS input to output

Mechanical

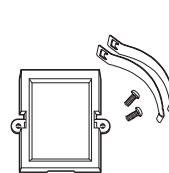
Mounting	Plug-in socket
Termination	8-pin, octal plug

Environmental

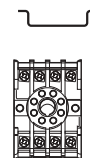
Operating Temperature	-40°C ... +55°C
Storage Temperature	-40°C ... +85°C
Weight	≅ 6 oz (170 g)



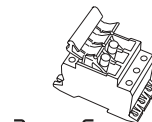
Accessories



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.

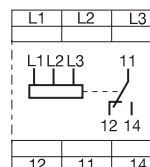
CE



- 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

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

Input circuit

Supply voltage - power consumption = Measuring voltage	L1, L2, L3	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.	L1, L2, L3	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

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 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 ⁵ 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 ²)
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

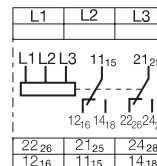
Operation

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

Measuring circuit

Monitoring voltage V _{nom} .	L1, L2, L3	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 **15-16/18, 25-26/28** 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 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 ⁵ operations
Short-circuit proof, max. fuse rating		10 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 ²)
Weight		approx. 0.33 lb (150 g)
Dimensions (W x H x D)		22.5 x 78 x 101 mm

1 Function



P
Penoresan.com

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

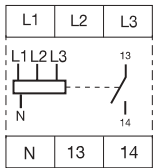
Operation

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.

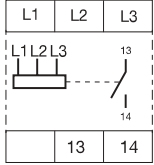
The product with neutral monitoring can also be used in single-phase power supplies by jumpering the three terminals (L1, L2, L3) and connecting only one phase.

■ 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

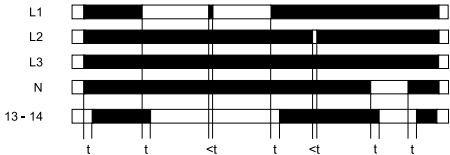
P/N:

Technical data

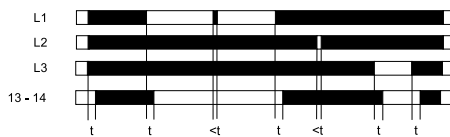
Input circuit		L1 - L2- L3 (-N)
Supply voltage	L - N	220...240 V
	L - L	380...440 V
Tolerance		-15%; +15%
Supply voltage frequency		50...60 Hz
Frequency tolerance		± 10%
Duty time		100 %
Measuring circuit		
Switch-off value at phase failure		60% (V_{nom})
Switch-in value		65% (V_{nom})
Frequency		50...60 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 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		1 x 10 ⁵ 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 ²)
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



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.

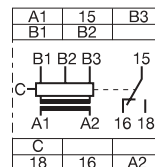
The output relay energizes when the monitored voltage exceeds the set response value. It de-energizes when the voltage is below the set response value within the hysteresis value.

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

	P/ N:	P/ N:	P/ N:
	50...500 mV	1...10 V	/.../
	0.3...3 V	5...50 V	30...300 V
	0.5...5 V	10...100 V	50...500 V
24 V AC	2 430 831 90	2 430 831 91	2 430 831 92
42...48 V AC	2 430 831 80	2 430 831 81	2 430 831 82
110...130 V AC	2 430 831 00	2 430 831 01	2 430 831 02
220...240 V AC	2 430 831 10	2 430 831 11	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

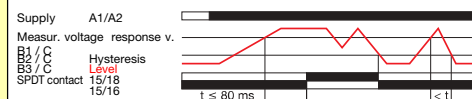
Output circuit 15-16/18

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 ⁶ operations
Maximum electrical life (to AC 12 / 230 V / 4 A)		3 x 10 ⁵ operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

General data

Rated impulse withstand voltage V _{imp}	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 ²)
Weight	approx. 0.33 lb (150 g)
Dimensions (W x H x D)	22.5 x 78 x 101 mm

1 Function



t = Delay on operate* max. 80 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.

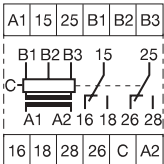
The overvoltage mode (OV) means, if the monitored value is above the set value, the output relay will energize. The undervoltage mode (UV) means, if the monitored value is below the set value, the output relay will energize.

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		P/N:	Voltage measuring ranges without delay on operate		P/N:
	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: 50...500 mV 0.3...3 V 0.5...5 V	P/N: 1...10 V 5...50 V 10...100 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	Message of error, overvoltage, undervoltage
Delay on operate time adjustable	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

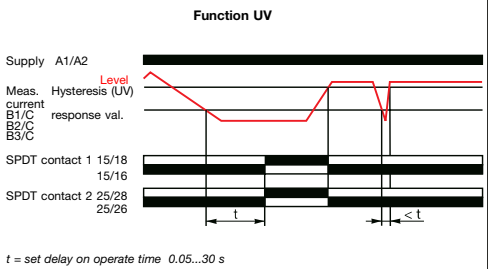
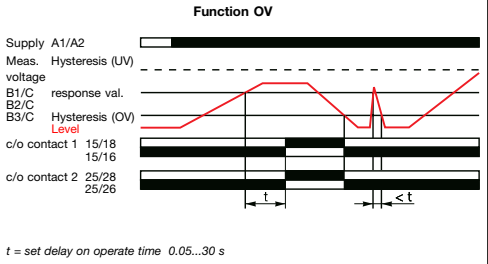
Hysteresis (ref. to the response value) settable	5...30 %
Measuring cycle max.	80 ms
Temperature error	≤ 0.06 % / °C
Error within the tolerance of supply voltage	≤ 0.5 %

Display of operational status

Supply voltage	LED, green
Output relay energized	LED, yellow
Output circuit	15-16/18, 25-26/28
Rated voltage	VDE0100, IEC 947-1
Rated switching voltage max.	400 V
Rated switching current	AC 12 (resistive)
Rated switching current	AC 15 (inductive)
Rated switching current	DC 12 (resistive)
Rated switching current	DC 13 (inductive)
Maximum mechanical life/ operations	30 x 10 ⁶ operations
Maximum electrical life (to AC 12 / 230 V / 5 A)	1 x 10 ⁵ 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 ²)
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:

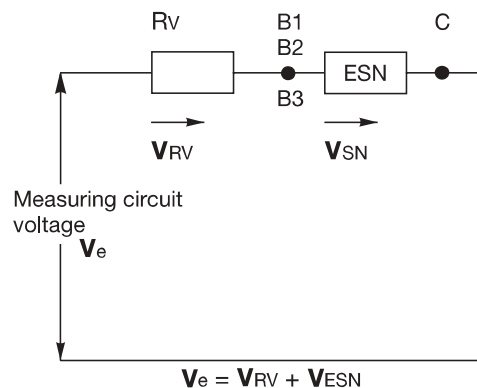
Measuring voltage to be monitored: 12 V DC
Undervoltage monitoring with delay on "ON": 20 s
Response voltage: 13.2 V
Selection ESN mecotron; with delay on "ON"
Measuring ranges from 5...50 V
Terminal setting: 5...50 V B2/C
Selection switch function: overvoltage (OV)/undervoltage (UV) to UV
Selection 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:

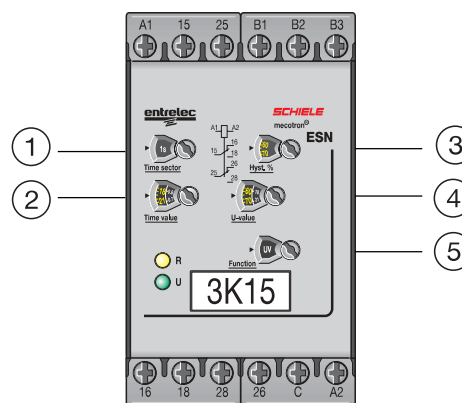
Voltage to be monitored (Measuring voltage): V_e : 600 V
Range of the ESN (Measuring voltage of the ESN): $V_{B2...C}$: 50...500 V
Input resistance R_i of the ESN = 951 k Ω

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

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

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 over-load	Overload for $t < 1 \text{ s}$
50...500 mV	7.7 k Ω	B1/C	10 V	25 V
0.3...3 V	46.5 k Ω	B2/C	60 V	80 V
0.5...5 V	77.5 k Ω	B3/C	80 V	100 V
1...10 V	19 k Ω	B1/C	100 V	120 V
5...50 V	95 k Ω	B2/C	150 V	200 V
10...100 V	190 k Ω	B3/C	300 V	400 V
/.../	-	B1/C	-	-
30...300 V	570 k Ω	B2/C	500 V	550 V
50...500 V	951 k Ω	B3/C	550 V	550 V

Single phase monitoring relay

EFN mecotron® 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

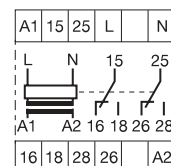
The EFN monitors single phase supply voltages for phase failure, overvoltage and undervoltage conditions. The output relay will de-energize if one of the fault conditions occurs. The nature of the fault will be indicated by an LED. When the phase is present and monitored voltage conditions are normal, 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.

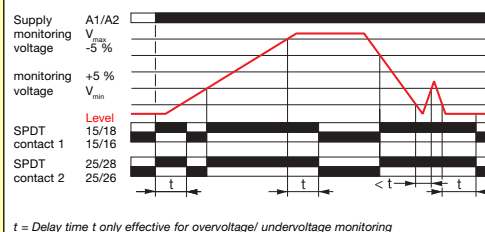
Switch position : Alarm tripping indicating that voltage that has exceeded or dropped below the set value will be suppressed during the set delay time. Momentary voltage fluctuations will thus not initiate alarm tripping.

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.

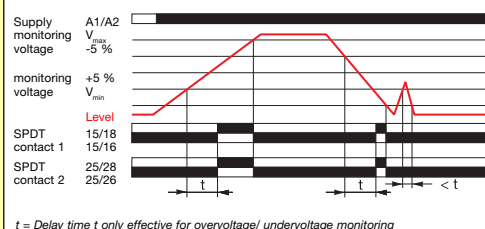


2 Functions

Delay on operate error message: Function



Delay on release error message: Function



Technical data

Input circuit

V_{min} adjustable from	Monitoring voltage V_{max} adjustable from	Supply voltage, 50...60 Hz P/N:	
80...120 V AC	120...160 V AC	80...160 V AC	160...300 V AC
160...220 V AC	220...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

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	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	5 A (at 230 V)
Rated switching current	3 A (at 230 V)
Rated switching current	5 (at 24 V)
Rated switching current	2.5 (at 24 V)
Maximum mechanical life/ operations	30 x 10 ⁶ operations
Maximum electrical life (to AC 12 / 230 V / 5 A)	1 x 10 ⁵ 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 ²)
Weight	approx. 0.66 lb (300 g)
Dimensions (W x H x D)	45 x 78 x 101 mm

Cos-Phi monitoring relay (C) LWN mecotron® for monitoring load states



- Monitors status of inductive loads
- Sector monitoring $\cos \phi$ min and $\cos \phi$ 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 $\cos \phi$ max and $\cos \phi$ 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 $\cos \phi$ 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 $\cos \phi$ max. must be greater than the $\cos \phi$ 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

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

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 %

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

Current range

Possible overload current input

Hysteresis (referring to the ϕ angle, in °) 4°

Measuring cycle max. 300 ms

Display of operating status

Supply voltage LED, green

$\cos \phi$ min. decreased LED, red

$\cos \phi$ max. exceeded LED, red

Output circuit

15-16/18, 25-26/28 2 relays, each with 1 SPDT contact

for $\cos \phi$ min. and $\cos \phi$ max., 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) 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 10⁶ operations

Maximum electrical life (acc. to AC 12 / 230 V / 4 A) 1 x 10⁵ operations

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

General data

Rated impulse withstand voltage V_{imp} 4 kV

Operating temperature -25°C ... +65°C

Storage temperature -40°C ... +85°C

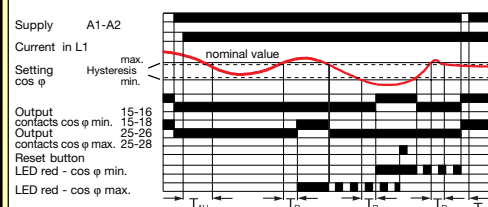
Mounting position any

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

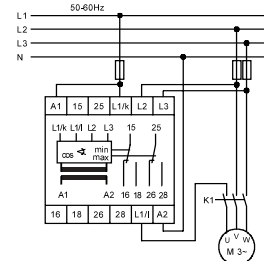
Wire size stranded with wire end ferrule 2 x 14 AWG (2 x 2.5 mm²)

Weight approx. 0.66 lb (300 g)

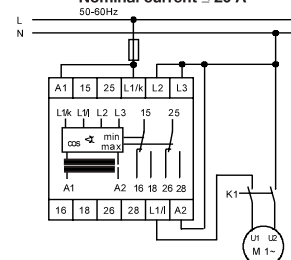
1 Function



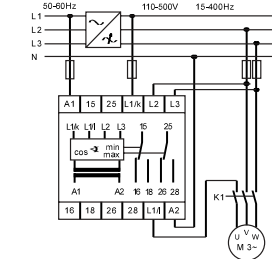
Nominal current ≤ 20 A



Nominal current ≤ 20 A



Nominal current ≤ 20 A



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.

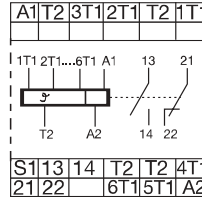
The PTC resistor sensors are connected in series with terminals T1 and T2 (respectively T1 and T2x, without short-circuit detection). The number of PTC resistor sensors that can be connected to the measuring circuit is limited by the sum of PTC resistor sensors of the individual resistor.

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

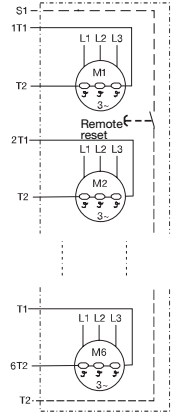
Under normal operating conditions, their resistance value is below the response value of the MSN. If only one of the PTC resistors heats up excessively, the output relay is de-energized. It is again energized automatically after the PTC resistor sensor has cooled down in the case of auto reset. Auto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



Technical data

Input circuit

Supply voltage - power consumption	A1-A2	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	1T1, 2T1,... 6T1-T2	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 mm² 400 m at 2.5 mm²
Remote reset	S1-T2	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 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		1 x 10 ⁵ operations
Short-circuit proof, max. fuse rating		10 A / fast, operation 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 with adapter
Wire size stranded with wire end ferrule		2 x 14 AWG (2 x 2.5 mm²)
Weight		approx. 0.51 lb (230 g)
Dimensions (W x H x D)		45 x 78 x 101 mm

Further application possibilities:

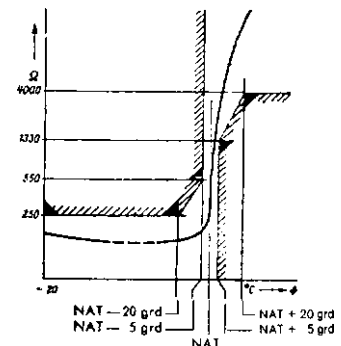
Temperature monitoring of equipment fitted with PTC resistor sensors, e.g.:

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

Resistance characteristic

of one temperature sensor to DIN 44 081.

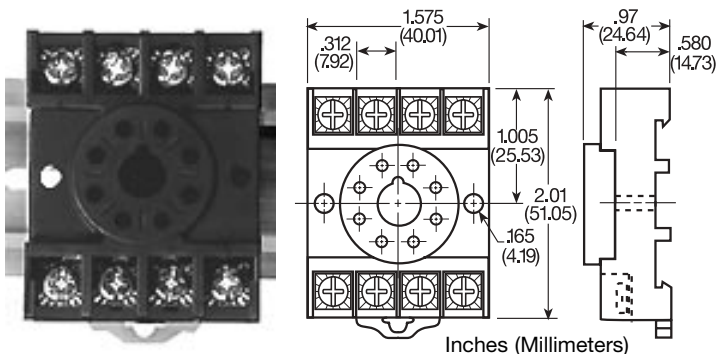
NAT = rated response temperature



Accessories—Motor Protectors

DIN Rail or Surface Mount Sockets

8 Pin Octal Socket

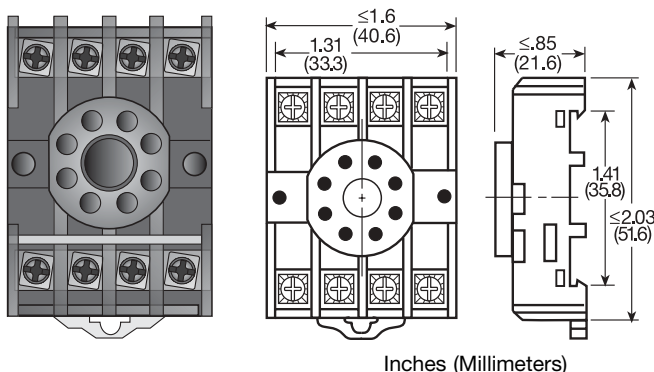


Description

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 mm²) 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 mm²) wires. Rated 10 A at 300 V AC.

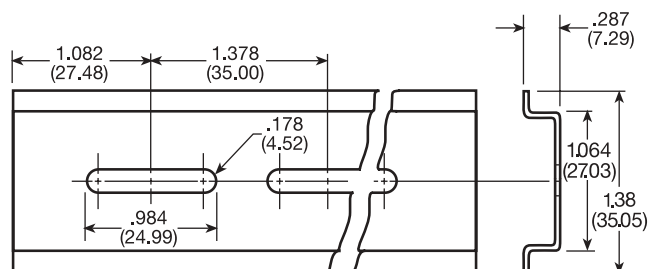
P/N: Y NDS 8

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.

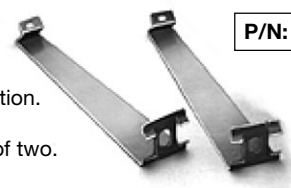
P/N: Y C103PM (Al)
17322005 (Steel)



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

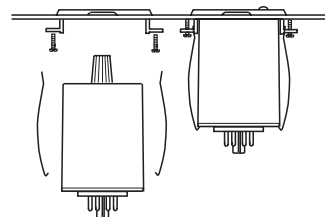
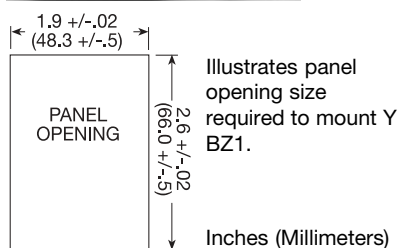
Panel Mount Kit

Description

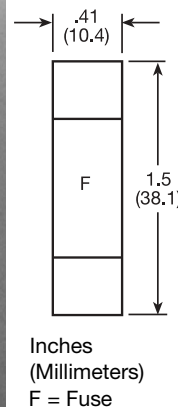
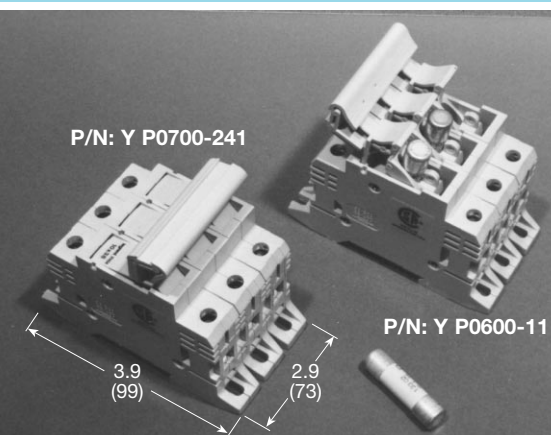
Provides an easy method of through-the-panel mounting of Entrelec SSAC 8 or 11 pin plug-in timers, flashers, and other controls. May be mounted in panels up to 0.125 in. (3.2 mm) thick. Includes two clamps and two screws.



P/N: Y BZ1



Three Phase Fuse Block/Disconnect



Description

Three phase fuse block disconnect designed for use with HRC midjet 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)

Midjet 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 ²)
Y P1015 64	AWG 14/16 (2.5/1.3 mm ²)
Y P1015 14	AWG 18/22 (0.93/0.33 mm ²)

Mechanical Outline and Accessories for mecotron® Monitoring Relays



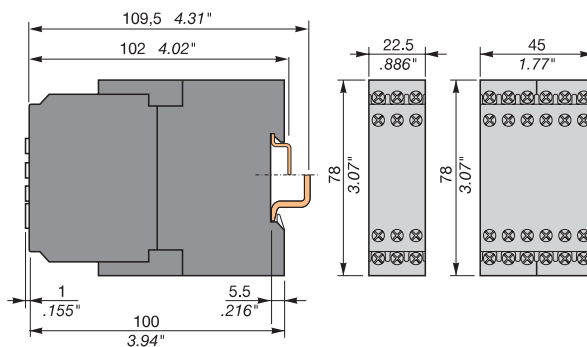
ESS
22.5 mm



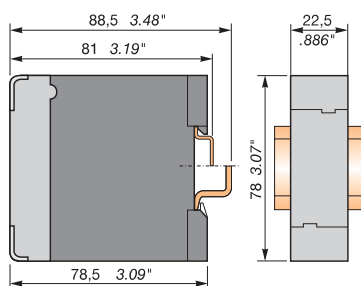
ESN
45 mm



S and N Series:
Screw Connection



PFE
22.5 mm



E Series:
Screw Connection



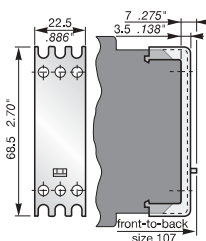
On the S Series, terminals with cable guides greatly simplify installation. This also applies to wire end ferrules with insulating collars.

Accessories

Sealable covers

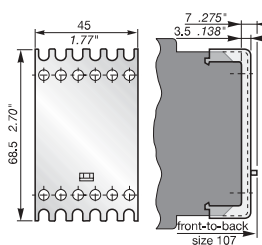
P/N: 3 430 005 01

Sealable cover for mecotron series 22.5 mm wide

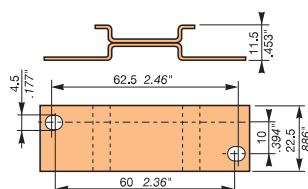


P/N: 3 440 005 01

Sealable cover for mecotron series 45 mm wide



Adapter for screw mounting



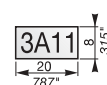
In 22.5 mm width
In 45 mm width

P/N: 3 430 029 01
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

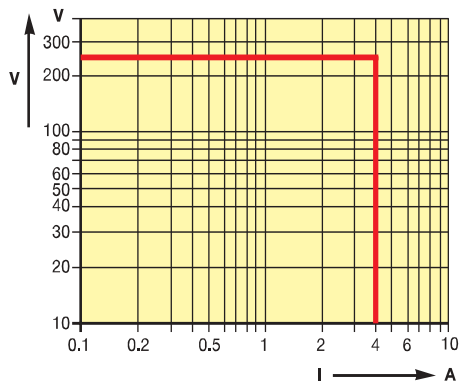
*UL's Component Recognition Service covers the testing and evaluation of component products that are incomplete or restricted in performance capabilities. These components will later be used in complete end-products or systems Listed by UL.

**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.

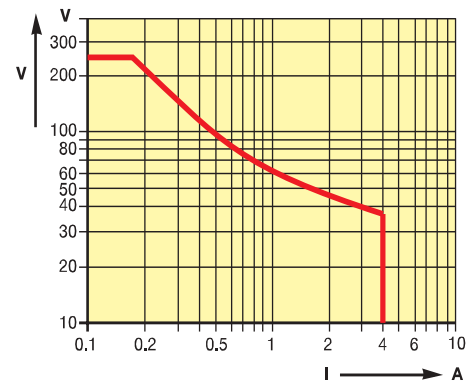
Load limit curves

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

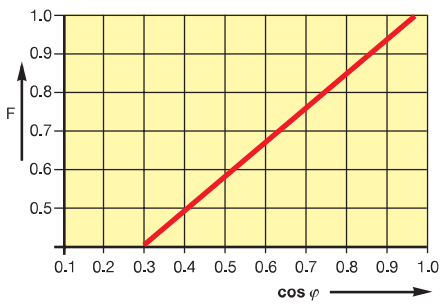
AC load (resistive)



DC load (resistive)

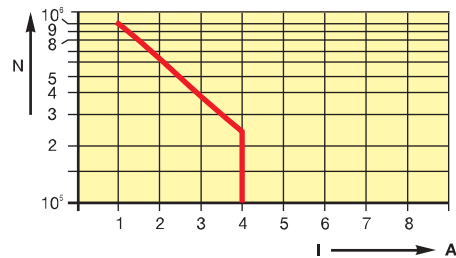


Reduction factor at inductive AC load



Reduction factor F
at inductive load

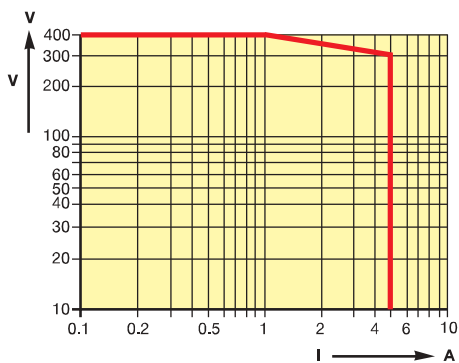
Contact life/ no. of operations



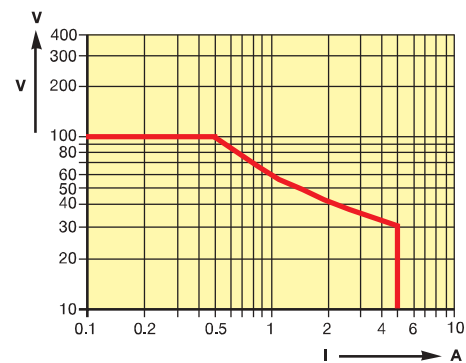
Contact life/
no. of operations N
220 V 50 Hz I AC
360 operations/h

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

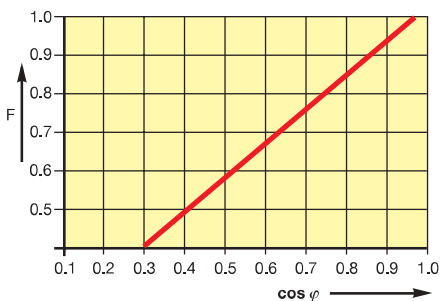
AC load (resistive)



DC load (resistive)

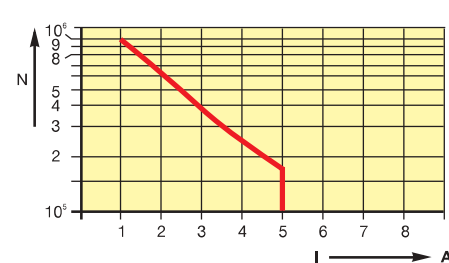


Reduction factor at inductive AC load



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



Penoresan.com

Current sensors



P
Penoresan.com

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:

DIN Rail Mounting
Surface Mounting
Screw Terminals
Quick Connects

SRN

Page 1484

•
w/adaptor
•

SRS

Page 1486

•
w/adaptor
•

ECSW

Pages 1488-1489

•
•

ECS

Page 1487

•
•
•

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 Ω
10 ... 110 K Ω

•

•

•

•

•

•

•

•

•

•

•

•

•

•

•

Delay(s):

Trip
Inrush

•

•

•

•

•

Indicator LED(s):

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

•

•

•

•

•

•

•

•

•

•

Dimensions:

in

1.77 x 3.07 x ≤ 3.98

0.886 x 3.07 x ≤ 3.98

2.50 x 3.50 x 1.75

(W x H x D)

mm

45 x 78 x ≤ 101

22.5 x 78 x ≤ 101

63.5 x 88.9 x 44.5

SRN

SRS

ECSW

ECS

Page 1484

Page 1486

Pages 1488-1489

Page 1487

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

•

•

•

IWN (AC)

Page 1494

•

w/adaptor

•

•

•

•

•

•

•

•

•

•

•

•

•

IWN (DC)

Page 1495

•

w/adaptor

•

•

•

•

•

•

•

•

•

(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®

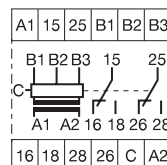


- Monitors AC or DC currents in 6 ranges covering 3 mA ... 15 A
- 3 measuring ranges covered by unit
- Switching hysteresis adjustable from 5...30 %
- Without or with delay on operate from 0.05...30 s
- 2 SPDT contacts
- 2 LEDs to indicate operational status
- 4 supply voltage versions, from 24...240 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

Supply voltage	With delay on operate Current measuring ranges P/N:	Without delay on operate Current measuring ranges 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
110...130 V AC	2 450 125 00	2 450 115 00
220...240 V AC	2 450 120 00	2 450 110 00
380...415 V AC	2 450 121 00	2 450 111 00
	2 450 122 00	2 450 112 00

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	A1-A2	24...240 V AC/DC - 2 VA
	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
Duty time	100 %

Measuring circuit

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

Measuring circuit

Measuring current input	B1/C	3...30 mA	0.3...1.5 A
	B2/C	10...100 mA	1...5 A
	B3/C	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

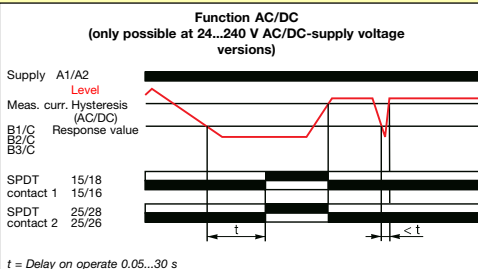
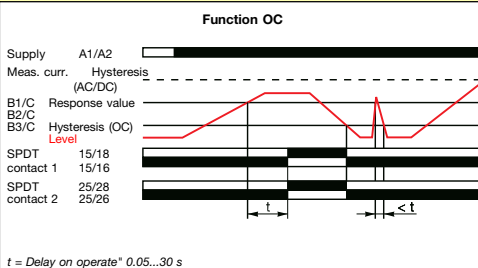
Output circuit 15-16/18, 25-26/28

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		30 x 10 ⁶ operations
Maximum electrical life (acc. to AC 12 / 230 V / 5 A)		3 x 10 ⁵ 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 ... +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 ²)
Weight	approx. 0.66 lb (300 g)

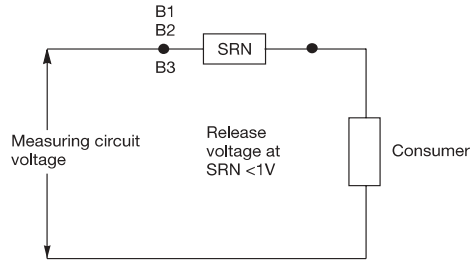
2 Functions



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

Current monitoring relays SRS and SRN mecotron®

Application



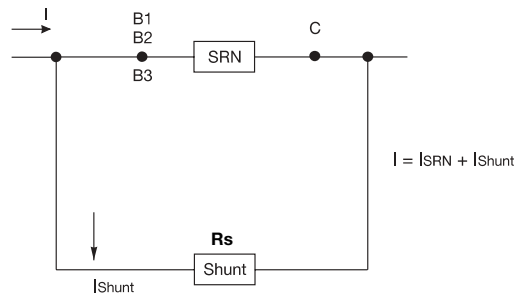
Voltage drop caused by internal resistance R_i of the SRN is negligible (less than 1 V). Thus the SRN can also be used at high measuring circuit voltages.

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.

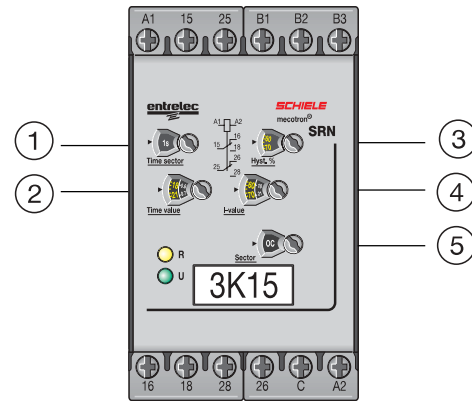
R_s selected 1.3 mΩ (nearest standard value)

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 SRN mecotron®				
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

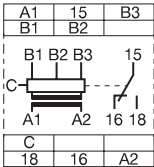
Current monitoring relay **SRS mecotron®**



- 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.

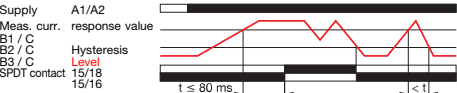


To extend the measuring range, use current monitoring relay type SRN shown on page 1484.

■ Approvals:   

Current measur. range: 3...30 mA, 10...100 mA, 0.1...1 A	
Supply voltage 50...60 Hz	P/N:
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	
Sealable transparent cover	3 430 005 01
Adapter for screw mounting	3 430 029 01
Current transformer see "SRN"	

1 Function



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 current input	B1/C, B2/C, B3/C	3...30 mA	10...100 mA	0.1...1 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 %	
Input resistance		33 Ohm	10 Ohm	1 Ohm
Possible permanent overload		50 mA	150 mA	1.5 A
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

Output circuit 15-16/18 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 ⁵ operations
Maximum electrical life (acc. to AC 12 / 230 V / 4 A)		3 x 10 ⁵ operations
Short-circuit proof, max. fuse rating		10 A / fast, operating class gL

General data

Rated impulse withstand voltage V _{imp}	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 ²)
Weight	approx. 0.33 lb (150 g)
Dimensions (W x H x D)	22.5 x 78 x 101 mm

Over/Under Current Sensing ECS Series Current Sensor



- 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)

TEN YEAR
WARRANTY

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:

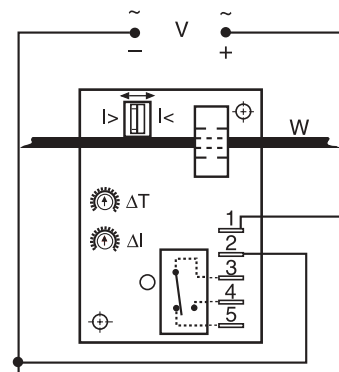
Ordering Table

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

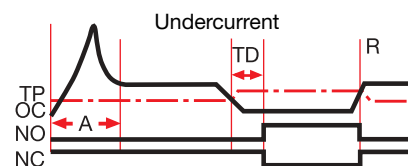
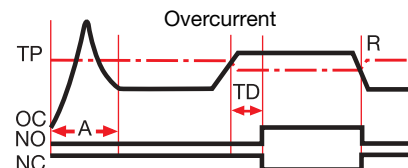
Example P/N: Y ECS41AC
Fixed - Y ECSH610AD

Technical Data

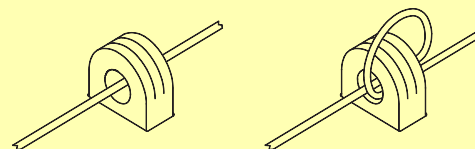
Sensor	
Type	Toroidal, through hole wiring
Mode	Over or undercurrent, switch selectable on the unit or factory fixed
Trip Point Range	0.5 ... 50 A in 3 adjustable ranges or fixed
Tolerance: Adjustable	Guaranteed range
Fixed	0.5 ... 25 A: 0.5 A or +/-5% whichever is less; 26 ... 50 A: +/-2.5%
Maximum Allowable Current	Steady - 50 A turns; Inrush - 300 A turns for 10 s
Trip Point Hysteresis	$\pm$ +/-5%
Trip Point vs. Temperature	+/-5%
Response Time	$\leq$ 75 ms
Frequency	45 ... 500 Hz
Type of Detection	Peak detection
Trip Delay	
Type	Analogue
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 - 1×10^6 ; Electrical - 1×10^5
Protection	
Circuitry	Encapsulated
Isolation Voltage	$\geq$ 2500 V RMS input to output
Insulation Resistance	$\geq$ 100 M Ω
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	$\approx$ 6.4 oz (181 g)



Relay contacts are isolated.
Dashed lines are internal connections.



V = Voltage W = Insulated Wire Carrying Monitored Current I_> = Overcurrent I_< = 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

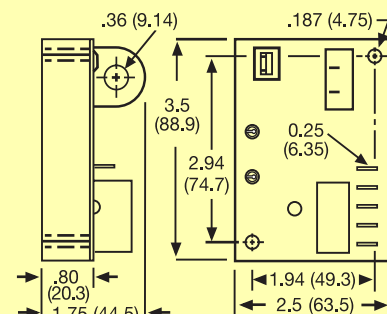


Multiple Turns To Increase Sensitivity

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.



Inches (Millimeters)

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



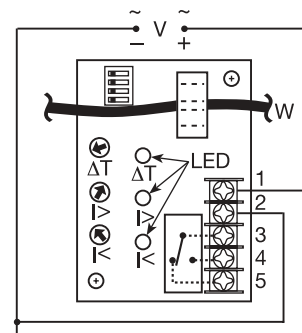
TEN YEAR
WARRANTY

- 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
 I> = Adjustable Overcurrent
 I< = Adjustable Undercurrent

Ordering Table

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

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 ²) 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 ⁶ ; Electrical: 1 x 10 ⁵
Latch	Electrical
Type Reset Function	Remove input voltage Switch selectable latching function

Selector Switch

ON ↔ OFF

SW1	Not Used
SW2	Latched
SW3	Zero I Output Normally Energized

Mode Selection Switches

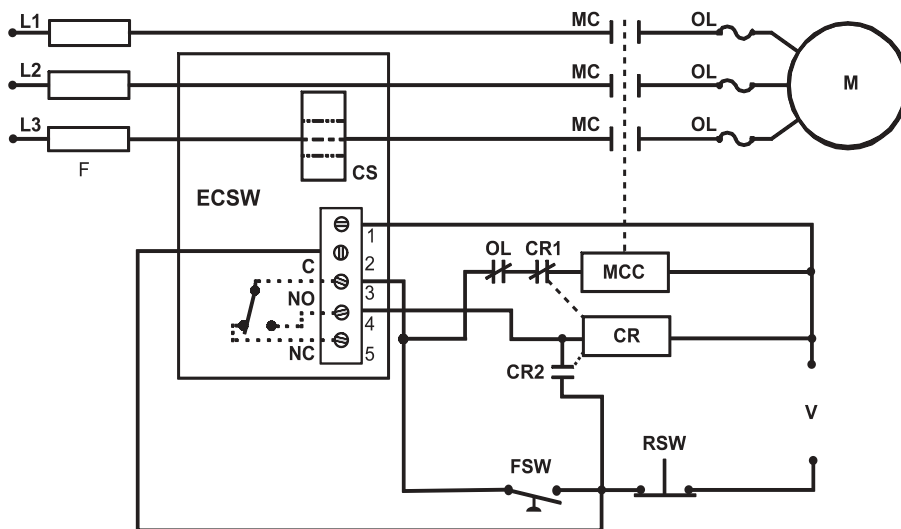
- SW1 = Latched or Auto reset selector
 OFF - automatic relay reset after a fault
 ON - output relay latches after a fault trips the unit
- SW2 = Zero current detection - (below 250mA)
 OFF - zero current detection disabled
 ON - zero current detection enabled
- SW3 = Output during normal operation
 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

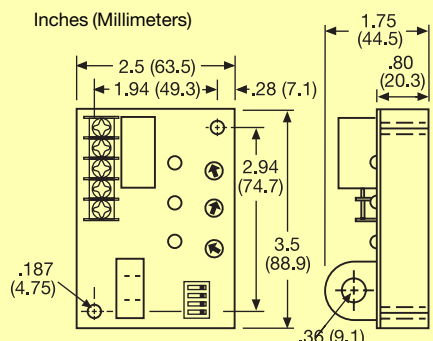
(Continued on following page.)

Window Current Sensor ECSW Series Current Sensor



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

Protection	Surge	IEEE 587 Level A
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		0.197 in. (5 mm) terminal blocks for up to #12 (3.2 mm ²) AWG wire
Environmental		
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



10 YEAR
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)	0...5 mA, 0...10 mA, 0...20 mA, or 0...50 mA AC
4 factory calibrated ranges in mA AC	+/-0.5% of full scale
Factory Calibration	
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 ² ... 2.5 mm ²)

Environmental

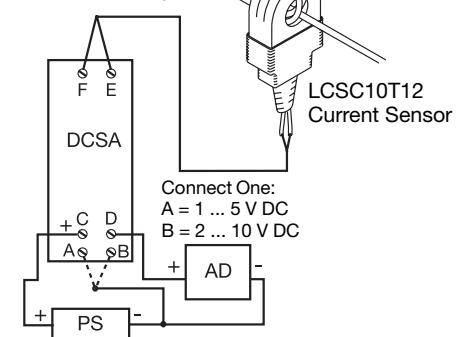
Operating Temperature	-30°C ... +60°C
Storage Temperature	-40°C ... +85°C
Humidity	95% relative, non-condensing
Weight	DCSA ≅ 1.6 oz (45.4 g)

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	20 ... 100 Hz / 30 ... 100 Hz
Sensor Hole	0.36 in. (9.14 mm) for up to #4 AWG (21.1 mm ²) THHN wire
Weight	LCS ≅ 1 oz (28.3 g)

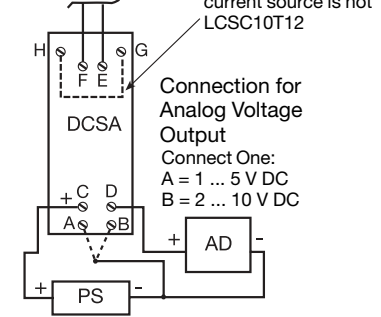
*Minimum loop power supply voltage equals the minimum sensor voltage 10 V DC plus the voltage drop developed across all the other loop devices at 20 mA.

Connection for
4 ... 20 mA Loop



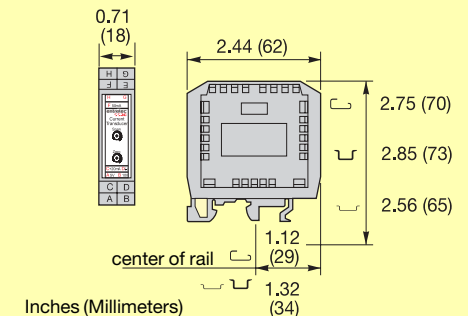
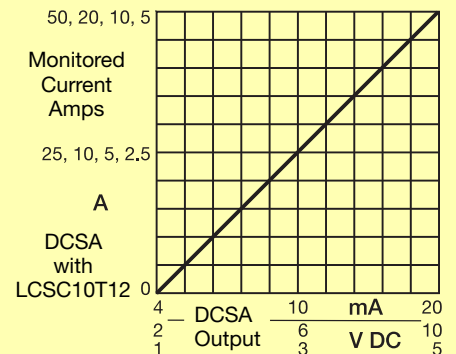
Connect One:
A = 1 ... 5 V DC
B = 2 ... 10 V DC

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

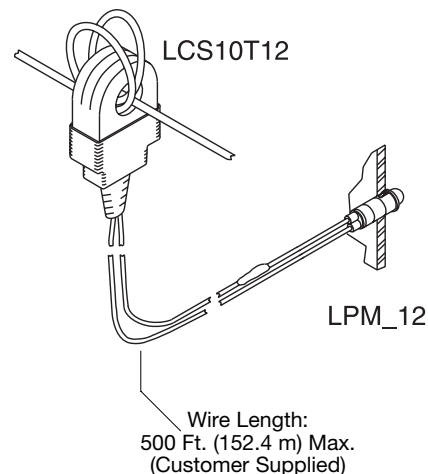




- Low Cost Go/No Go Indication
- May Be Connected To Wires Up To 500 Feet (152.4 m) Long
- Remote Current Monitoring of Currents Up To 50 A
- Green or Red LED Indicator Available

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.

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.

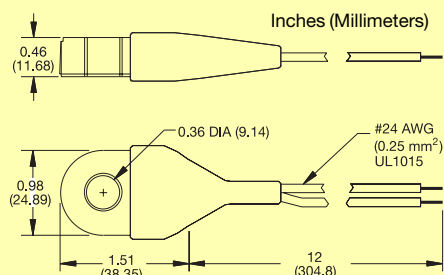


CAUTION: The LCS10T12 must be connected to the LPM12 or LPMG12 before current flows to prevent damage or a shock hazard. Monitored wires must be properly insulated.

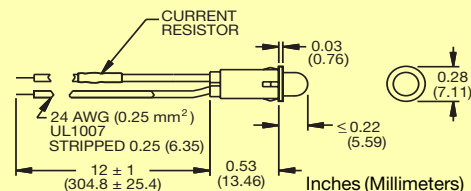
Description	Part Number
AC Current Sensor	Y LCS10T12
Red LED Indicator	Y LPM12
Green LED Indicator	Y LPMG12

Specifications

Current Range				2 ... 50 A AC	
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 mm²) 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.

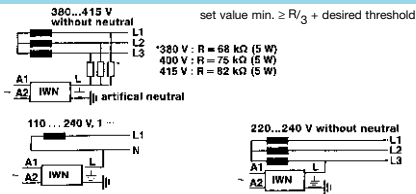
Fault storage/Remote Reset

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

Supply voltage - power consumption	A1-A2	24...240 V AC/DC	-	approx. 4.5 VA / W
	A1-B2	110...130 V AC	-	approx. 3 VA
	A1-A2	220...240 V AC	-	approx. 3 VA

Tolerance of supply voltage	-15 % ... +10 %
Supply voltage frequency	50...60 Hz
Duty time	100 %

Measuring circuit

Measuring input	L, PE
Response value	1...11 kΩ, 10...110 kΩ
AC current internal resistance min.	100 kΩ
DC current internal resistance min.	100 kΩ
Test resistance	820 Ω
Max. isolation voltage (L-PE)	415 V AC
Measuring DC voltage max.	30 V DC
Cable length for delete-check button max.	10 m

Time delay

see diagram

Display of operational status

Supply voltage	LED, green
Output relay energized	LED, red

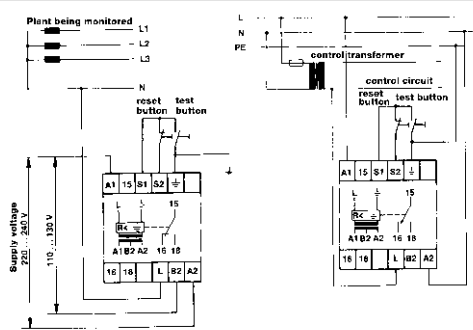
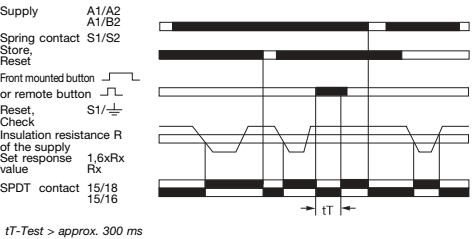
Output circuit

	15-16/18	Relay, 1 SPDT contact, open 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/ operations		30 x 10 ⁶ operations
Maximum electrical life (to AC 12 / 230 V / 5 A)		1 x 10 ⁵ operations
Short-circuit proof, max. fuse rating		5 A / fast, operating class gL

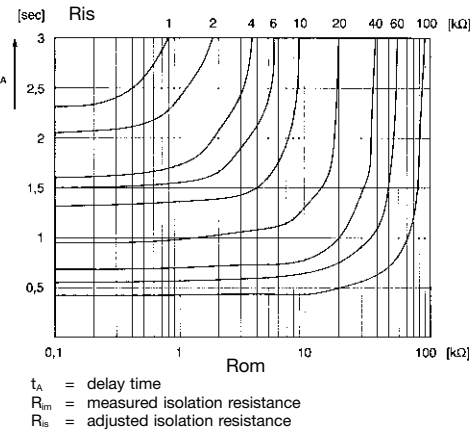
General data

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 14 AWG (2 x 2.5 mm ²)
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.

Technical data

Input circuit

Supply voltage - power consumption	A1-A2	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-, $\pm$	
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

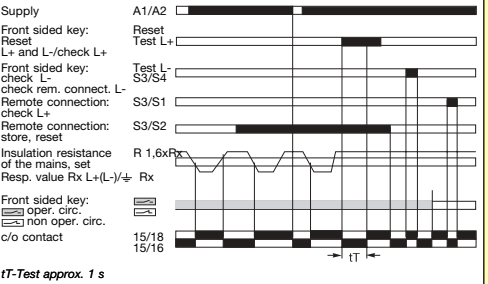
	15-16/18	Relay, 1 SPDT, operating/non-operating principle select.
Rated voltage	VDE0100, IEC 947-1	400 V
Rated switching voltage max.		400 V AC
Rated switching current	AC 12 (resistive)	5 A (at 230 V)
Rated switching current	AC 15 (inductive)	3 A (at 230 V)
Rated switching current	DC 12 (resistive)	5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

General data

Rated impulse withstand voltage Vimp		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 ²)
Weight		approx. 0.66 lb (300 g)
Dimensions (W x H x D)		45 x 78 x 101 mm

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

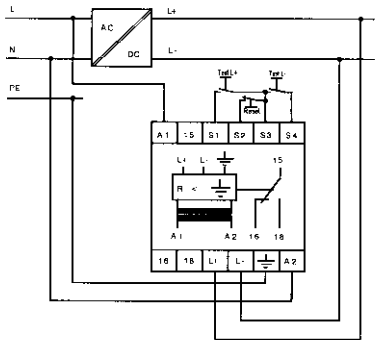
1 Function



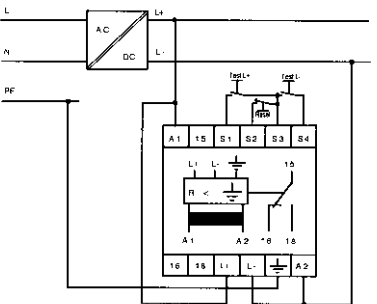
Application examples

for any power supply AC or DC

Supply 24...240 V AC



Supply 24...240 V DC



Mechanical Outline and Accessories for mecotron® Current Sensors



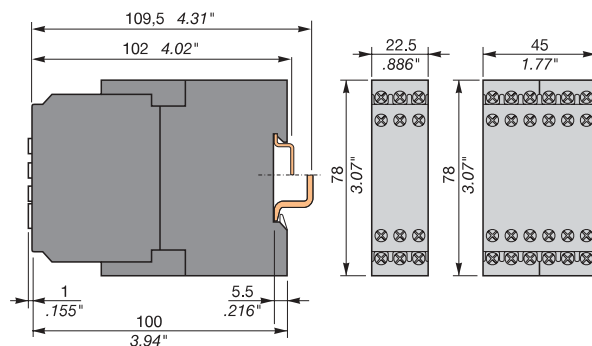
SRS
22.5 mm



SRN
45 mm



S and N Series:
Screw Connection



Easy mounting



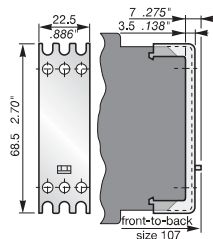
On the S Series, terminals with cable guides greatly simplify installation. This also applies to wire end ferrules with insulating collars.

Accessories

Sealable covers

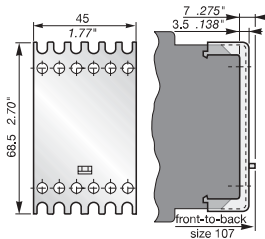
P/N: 3 430 005 01

Sealable cover for mecotron® series 22.5 mm wide



P/N: 3 440 005 01

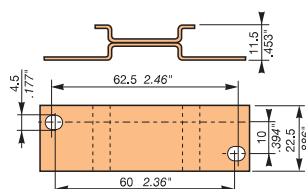
Sealable cover for mecotron® series 45 mm wide



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

