The HLMU Series is a universal voltage, encapsulated, 3-phase voltage monitor. It continuously measures the voltage of each of the three phases with microcontroller accuracy and compares the value to preset trip points. It separately senses phase reversal and loss; over, under and unbalanced voltages; and over or under frequency. Protection is assured during periods of large average voltage fluctuations, or when regenerated voltages are present. The unit trips within 200ms when phase loss is detected. Adjustable time delays are included to prevent nuisance tripping and short cycling of sensitive equipment. The isolated, 10A, DPDT relay contacts trip when a phase voltage exceeds the trip limits for the trip delay. Nominal line voltage, voltage unbalance, and time delays are knob adjustable. The phase loss setpoint and the acceptable frequency range are fixed. Both delta and wye systems can be monitored; no connection to neutral is required.

Features:

- Protects against phase loss & reversal; over, under & unbalanced voltages; & over & under frequency
- Encapsulated circuitry
- Isolated, 10A, DPDT output contacts
- LED indicates relay status, faults, & time delays
- Universal line voltage 200 to 480VAC in one unit
- Compact design
- Finger-safe terminal blocks, up to 12 AWG
- ASME A17.1 rule 210.6
- NEMA MG1 14:30, 14:35
- IEEE C62.41-1991 Level B

Approvals: CE, cULus LISTED

Auxiliary Products:

- **3-Phase fuse block/disconnect:** P/N: FH3P
- **2 Amp fuse:** P/N: P0600-11
- **DIN rail:** P/N: C103PM (Al)
- **DIN rail adaptor:** P/N: P1023-20

Available Models:

HLMUDLAAA	HLMUDRAAA
HLMUDN0405N	HLMUSR0604A
HLMUDNAAN	

If desired part number is not listed, please call us to see if it is technically possible to build.

For more information see:
Appendix B, page 166, Figure 17 for dimensional drawing.
Appendix C, page 168, Figure 12 for connection diagram.

Operation

Upon application of line voltage, the output is de-energized and the restart delay begins. If all the three-phase voltages are within the acceptable range, the output energizes at the end of the restart delay. The microcontroller circuitry automatically senses the voltage range, and selects the correct operating frequency (50 or 60Hz). The over and under voltage trip points are set at ± 10% of the adjusted line voltage. When the measured value of any phase voltage exceeds the acceptable range limits (lower or upper) the trip delay begins. At the end of the trip delay the output relay de-energizes. If the phase voltage returns to an acceptable value before the trip delay expires, the trip delay is reset and the output remains energized. Under, over, and unbalanced voltages plus over or under frequency must be sensed for the complete trip delay before the unit trips. The unit trips in 200ms when phase loss or reversal are sensed. The unit will not energize if a fault is sensed as the line voltage is applied.

Reset: Reset is automatic upon correction of the voltage or frequency fault or phase sequence.

Restart Delay Options:

L= Lockout or minimum OFF time. The restart delay begins when the output trips. The unit cannot be re-energized until the restart delay is complete. This provides a minimum off time or lockout time to allow equipment sensitive to short cycling, time to reset. If the fault is corrected after the restart delay is complete, the output energizes immediately. The restart delay also occurs when line voltage is applied/reapplied.

R= Restart Delay on fault correction. The restart delay begins when line voltage is reapplied or when a voltage fault is corrected. This option is normally selected when staggered restarting of multiple motors on a power system is required.

N= No Restart Delay. 0.6 second initialization delay on application of line voltage applies.

Restart Notes:

All restart options remain reset when the following conditions are detected:

1.) Phase loss (phase unbalance greater than 25%) 2.) Average line voltage less than 120VAC 3.) Phase reversal

The restart delay begins when the condition is corrected.

LED Operation

The LED flashes green during the restart delay, then glows green when the output energizes. It flashes red during the trip delay then glows red when the output de-energizes. It flashes red/green if phase reversal is sensed. If a fault is sensed during the restart delay, the LED will glow red during that portion or the full restart delay.

Order Table:

HLMU **X** **X** **X** **X** **X**

- **Output**
  - **D** - DPDT
  - **S** - SPDT
- **Restart Function**
  - **L** - Lockout, Min Off Time
  - **R** - Staggered Restarting
  - **N** - No Restart Delay
- **Voltage Unbalance**
  - **A** - Adjustable 2-10%
  - **Fixed** - Specify Unbalance **2-10**% in 1% increments, using two digits **[04]**
- **Trip Delay**
  - **A** - Adjustable 1-30s
  - **Fixed** - Specify delay **1-30**s in 1s increments, using two digits **[05]**
- **Restart Delay**
  - **A*** - Adjustable 0.6-300s
  - **N** - No Restart Delay

*Selection "A" is only available for Restart Functions "L" and "R"

Specifications

Line Voltage

Type	3-phase delta or wye with no connection to neutral			
Operating Voltage	200 - 480VAC	Range	Voltage Adj. Range	Frequency
		240	200-240VAC	50 or 60Hz
		380	340-420VAC	50Hz
		480	400-480VAC	60Hz
Line Voltage Max.	550VAC			
AC Line Frequency	50/60 Hz automatically detected			
Phase Loss	≥ 25% unbalance			
Response Time	≤200ms			

Undervoltage & Voltage Unbalance

Type	Voltage detection with delayed trip & automatic reset	
Overvoltage	Trip Voltage	109 - 113% of the adjusted line voltage
	Reset Voltage	≅ -3% of the trip voltage
Undervoltage	Trip Voltage	88 - 92% of the adjusted line voltage
	Reset Voltage	≅ +3% of the trip voltage
Voltage Unbalance	Trip Setpoint	Adjustable 2 - 10% or specify fixed unbalance of 2 - 10% in 1% increments
	Reset on Balance	≅ -0.7% unbalance
Trip Delay	Active On	Over/undervoltage, voltage unbalance, over/under frequency
	Range	Adjustable from 1 - 30s or specify fixed delay 1 - 30s in 1s increments
	Tolerance	± 15%
Restart Delay	Range	Adjustable from 0.6 - 300s; if no restart delay is selected a 0.6s initialization delay applies
	Tolerance	± 15%

Over/Under Frequency	±4%; Reset ±3%; 50/60 Hz
Phase Sequence	A, B, C, L1, L2, L3
Response Time-Phase Reversal & Phase Loss	≤200 ms
Reset	Automatic

Output

Type	Isolated Electromechanical Relay
Form	DPDT
Rating	10A resistive @ 240VAC; 8A resistive @ 277VAC; NO-1/4 hp @ 120VAC; 1/3 hp @ 240VAC
Life	Mechanical - 1 x 10^6 Electrical (at 10A) - DPDT - 1 x 30^3

Protection

Surge	IEEE C62.41-1991 Level B
Isolation Voltage	≥ 2500V RMS input to output
Circuitry	Encapsulated

Mechanical

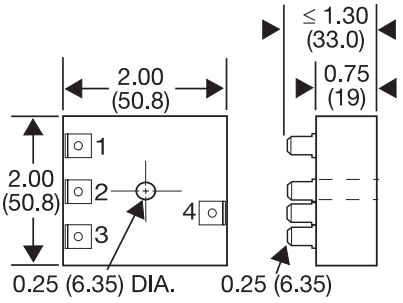
Mounting	Surface mount with one #10 (M5 x 0.7) screw
Note: 0.25 in.(6.35 mm) spacing between units or other devices is required	
Dimensions	3 x 2 x 1.64 in. (76.7 x 51.3 x 41.7 mm)
Termination	Screw terminal connection up to 12 AWG (3.3 mm^2) wire

Environmental

Operating / Storage Temperature	-40° to 60°C / -40° to 85°C
Humidity	95% relative, non-condensing
Weight	≅ 3.9 oz (111 g)

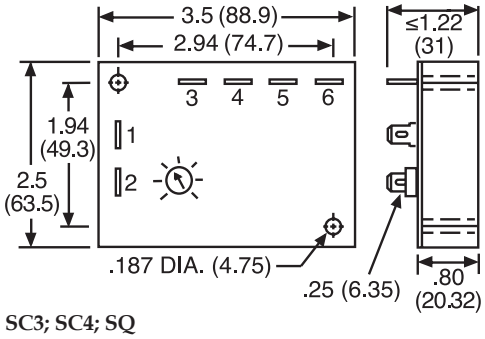
Appendix B - Dimensional Drawings

FIGURE 13



AF

FIGURE 14



SC3; SC4; SQ

FIGURE 15

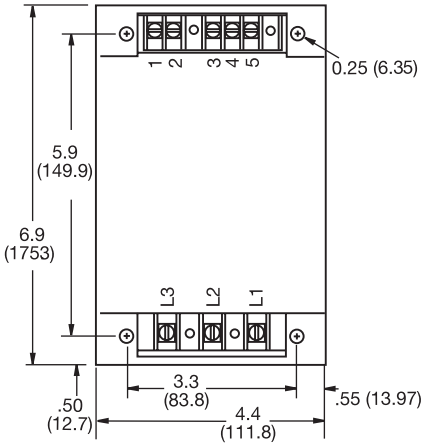
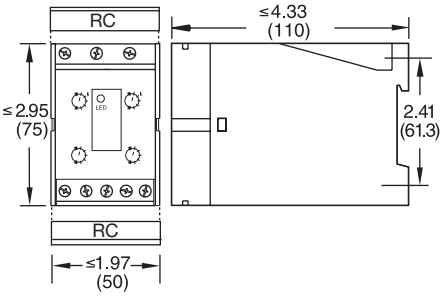
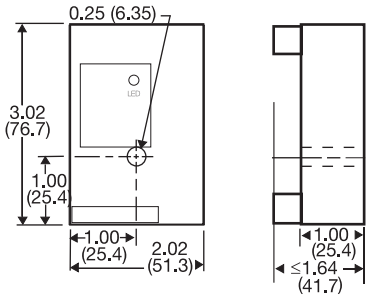


FIGURE 16

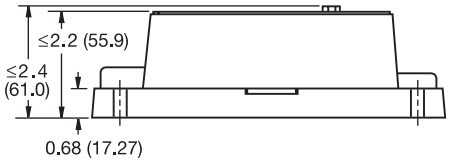


DLMU

FIGURE 17

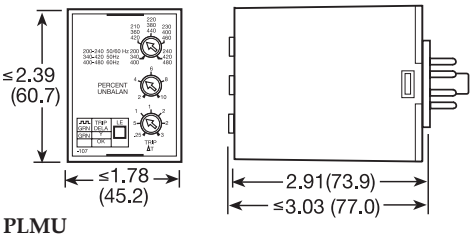


FB9L; HLMU; SCR9L



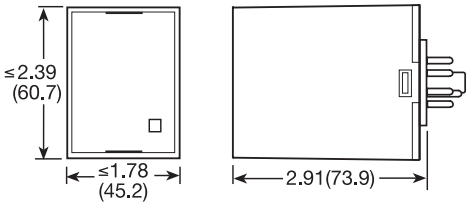
WVM

FIGURE 18



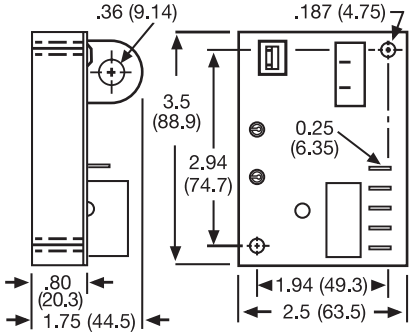
PLMU

FIGURE 19



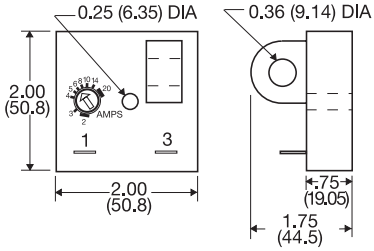
LLC4; LLC6; PLS

FIGURE 20



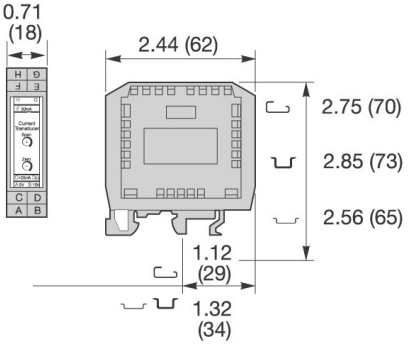
ECS; ECSW (ECS has spade connectors and ECSW has terminal board)

FIGURE 21



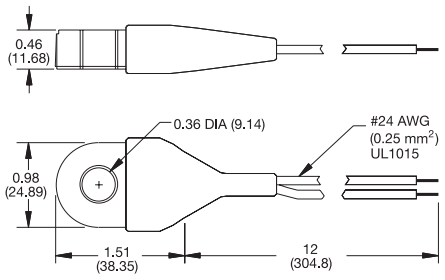
TCS; TCSA

FIGURE 22



DCSA

FIGURE 23

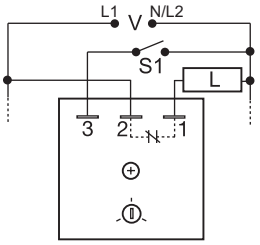


LCS

inches (millimeters)

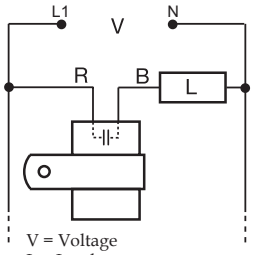
Appendix C - Connection Diagrams

FIGURE 1 - FSU1000 Series



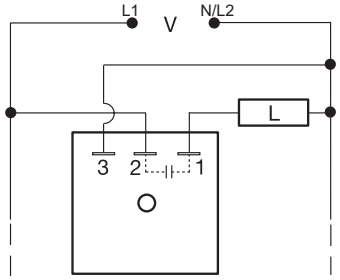
S1 = Optional low current switch
V = Voltage
L = Load

FIGURE 2 - FS100 Series



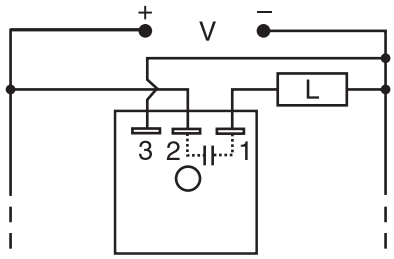
V = Voltage
L = Load
R = Red Wire
B = Black Wire

FIGURE 3 - FS100 Series



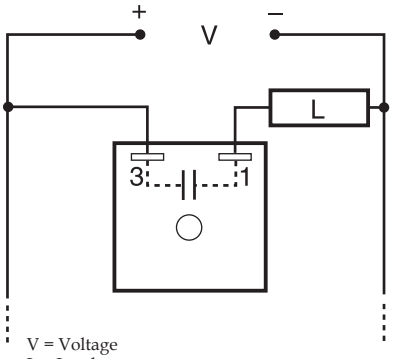
V = Voltage
L = Load

FIGURE 4 - FS200 Series



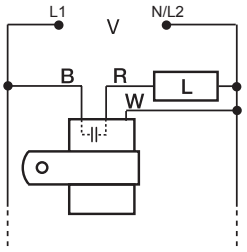
V = Voltage
L = Load

FIGURE 5 - FS300 Series



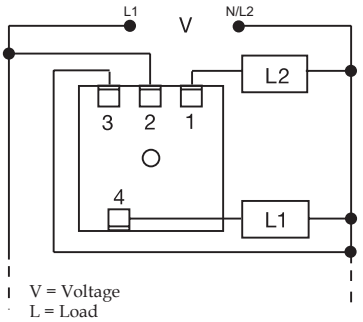
V = Voltage
L = Load
Note: Load may be in positive side.

FIGURE 6 - FS400 Series



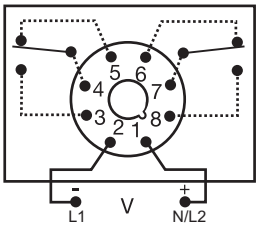
V = Voltage
L = Load
R = Red Wire
B = Black Wire
W= White Wire

FIGURE 7 - AF Series



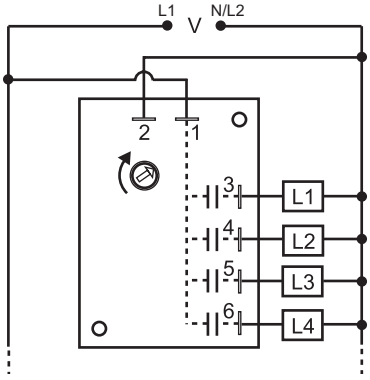
V = Voltage
L = Load

FIGURE 8 - FS500 Series



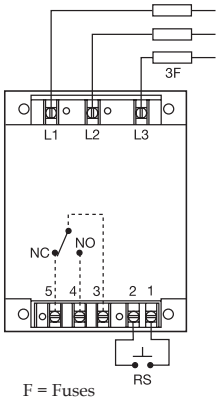
V = Voltage

FIGURE 9 - SC3/SC4 Series



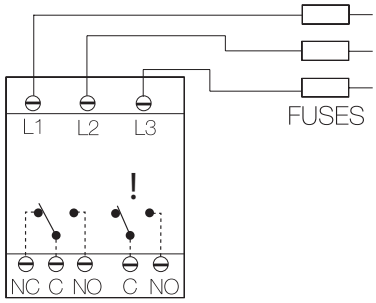
SC4 shown;
for SC3, terminal 6 & load L4 are eliminated.

FIGURE 10 - WVM Series



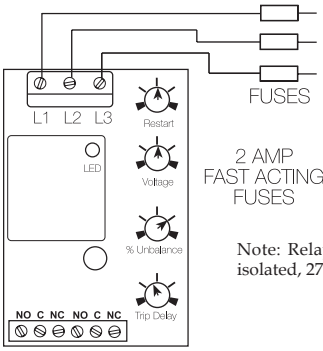
F = Fuses
NO = Normally Open
NC = Normally Closed
RS = Optional Remote Reset Switch
Relay contacts are isolated.
CAUTION:
2 amp max fast acting fuses must be installed externally in series with each input. (3)

FIGURE 11 - DLMU Series



L1, L2, L3 = Line Voltage Input
NO = Normally Open Contact
NC = Normally Closed Contact
C = Common, Transfer Contact
CAUTION: 2 amp max. fast acting fuses are recommended to protect the equipment's wiring. They are not required to protect the DLMU.
! = Select alarm contact connection as N.O. or N.C. when ordering; N.O. Shown.

FIGURE 12 - HLMU Series

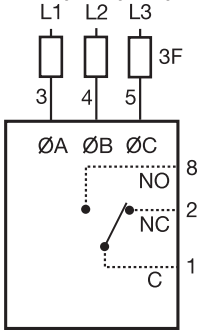


2 AMP
FAST ACTING
FUSES

Note: Relay contacts are isolated, 277VAC max.

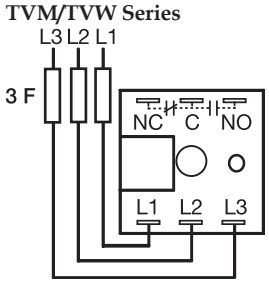
L1, L2, L3 = Line Voltage Input
NO = Normally Open Contact
NC = Normally Closed Contact
C = Common, Transfer Contact
CAUTION: 2 amp max. fast acting fuses are recommended to protect the equipment's wiring. They are not required to protect the HLMU.

FIGURE 13 - PLMU/PLM/PLR/PLS Series



F = Fuses
ØA = Phase A = L1
ØB = Phase B = L2
ØC = Phase C = L3
NO = Normally Open
NC = Normally Closed
2A fast acting fuses recommended for safety (not required)
Relay contacts are isolated.

FIGURE 14 - TVM/TVW Series



L1 = Phase A
L2 = Phase B
L3 = Phase C
NO = Normally Open
NC = Normally Closed
C = Common, Transfer Contact
Relay contacts are isolated.
F = 2A Fast acting fuses are recommended, but not required

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