

D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage



Contents

Description	Page
Current Monitoring Relays	V5-T5-3
Phase Monitoring Relays	
Product Selection Guide	V5-T5-6
D65VMC Series—Phase Reversal	V5-T5-7
D65PLR Series—Phase Loss and Reversal	V5-T5-9
D65PAR Series—Phase Loss, Reversal and Undervoltage	V5-T5-11
D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage	
Features	V5-T5-14
Product Selection	V5-T5-15
Technical Data and Specifications	V5-T5-15
Dimensions	V5-T5-16
Voltage Monitoring Relays	V5-T5-17
Ground Fault Monitoring Relays	V5-T5-31

D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage

Product Description

Eaton’s D65 Phase Monitoring Relay protects distribution systems supplying motor feeder or branch circuits against premature equipment failure caused by voltage faults on three-phase systems—wye or delta connected. Phase monitoring relays protect against voltage imbalance and single-phasing regardless of any regenerative voltages. The relay is energized when the phase sequence and all voltages are correct. Any of five abnormal conditions (phase loss, phase reversal, overvoltage, undervoltage or phase imbalance) will de-energize the relay. As standard, re-energization is automatic upon correction of the fault condition. The D65 can also be wired for manual reset.

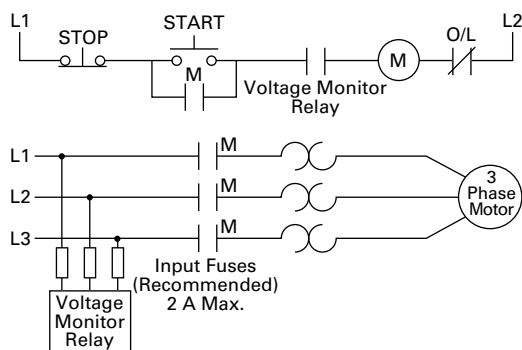
Application Description

Protective Functions

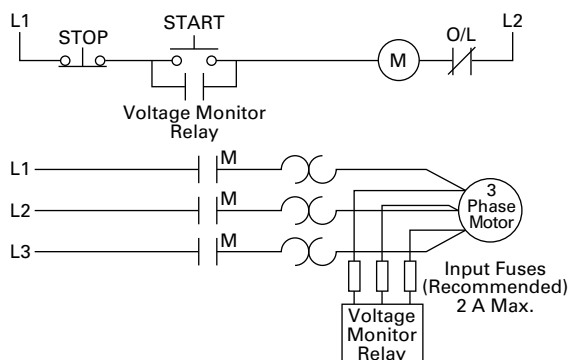
The D65 Series Relay makes separate trip decisions based on the status of the three-phase voltage inputs. Control power is derived from the three-phase voltage inputs. Separate control power is not required. The device will trip in response to any combination of the following conditions:

- **Undervoltage**—When voltage in all three lines of a three-phase system drops simultaneously. Undervoltage drop-out can be set at 80–95% of operating voltage. Unit trips when the average of all three lines is less than the adjusted set point for a period longer than the adjustable time delay drop-out (0.1–20 seconds). This time delay eliminates nuisance tripping caused by momentary voltage fluctuation.

- **Overvoltage**—Fixed at 110% of nominal, unit trips when the average of all three lines is greater than the fixed set point for a period longer than the time delay drop-out.
- **Phase Imbalance**—Imbalance of a three-phase system occurs when single-phase loads are connected such that one or two of the lines (phases) carry more or less of the load. This could cause motors to run at temperatures above published ratings. Unit trips when any one of the three lines is more than the adjusted set point below the average of all three lines. The percent phase imbalance is adjustable from 2–10% and also has a Disable setting for applications where poor voltage conditions could cause nuisance tripping.
- **Phase Loss (Single-Phasing)**—Total loss of one or more of the three phases. Typically caused by a blown fuse, broken wire or worn contact. This condition would result in a motor drawing locked rotor current during start-up. In addition, a three-phase motor will continue to run after losing a phase, resulting in potential motor burn-out. Unit trips on loss of any phase.
- **Phase Reversal**—Reversing any two of the three phases will cause a three-phase motor to run in the opposite direction. This may cause damage to machinery or injury to personnel. Unit trips if rotation (sequence) of the three phases is anything other than A-B-C.

**Typical Connections****Line Side Monitoring**

With the relay connected before the motor starter, the motor can be started in the reverse direction. However, the motor is unprotected against phase failures between the relay and the motor.

**Load Side Monitoring**

With the relay connected directly to the motor, the total feed lines are monitored. This connection should not be used with reversing motors.

**Features**

- Universal voltage range of 190–500 V provides the flexibility to cover a variety of applications (120 V and 600 V units also available)
- True RMS voltage sensing for improved accuracy
- Continued operation through phase loss conditions
- Automatic or manual reset after the fault condition is corrected
- Bi-color LED indicates normal condition and defines fault type for simpler troubleshooting
- D65VMLS can be mounted directly onto 35 mm DIN rail with no additional parts
- D65VMLP will plug into D3PA2 socket and mount on 35 mm DIN rail
- Small, compact size
- User-adjustable settings include nominal voltage, percent phase imbalance, undervoltage drop-out, time delay on undervoltage and time delay on restart after fault

**Operation**

The D65 provides protection against premature equipment failure caused by voltage faults on three-phase systems. The D65 is designed to be compatible with most wye or delta systems. In wye systems, a connection to a neutral is not required. D65 Phase Monitoring Relays protect against imbalanced voltages or single-phasing regardless of any regenerative voltages. The relay is energized when the phase sequence and all voltages are correct. Any one of five fault conditions will de-energize the relay. Re-energization is automatic upon correction of the fault condition.

Manual reset is available if a NC switch is wired to the appropriate terminals. A bi-color LED indicates normal condition and also provides specific fault indication to simplify troubleshooting. The percent phase imbalance is adjustable from 2–10%, and the undervoltage drop-out can be set at 80–95% of operating voltage. The adjustable time delay drop-out on undervoltage (0.3–30 sec) eliminates nuisance tripping caused by momentary voltage fluctuations.

**LED Operation**

LED Status	Plug-In and Surface-Mount Indication
Green steady	Normal/relay ON
Green flashing	Power-up/restart delay
Red steady	Reversal
Red single flash ①	Loss/imbalance
Red double flash ②	Undervoltage
Red triple flash ③	Overvoltage

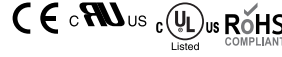
**Notes**

- ① Single flash = On 25 ms, Off 175 ms.  
 ② Double flash = On 25 ms, Off 25 ms, On 25 ms, Off 125 ms.  
 ③ Triple flash = On 25 ms, Off 25 ms, On 25 ms, Off 25 ms, On 25 ms, Off 75 ms.

**Standards and Certifications**

- CE (Low Voltage + EMC Directive EN60947-5-1)
- cULus listed (D65VMLS only)
- cRUus (D65VMMLP only)
- RoHS compliant

- UL Listed ①

**Product Selection****D65VM****D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage** ②

Mounting Style	Operating Voltage 50/60 Hz	Catalog Number
Surface-mount (DIN rail)	102–138 V	<b>D65VMLS120C</b>
	190–500 V	<b>D65VMLS480C</b>
	460–600 V	<b>D65VMLS600C</b>
Plug-in (DIN rail)	102–138 V	<b>D65VMMLP120</b>
	190–500 V	<b>D65VMMLP480</b> ③
	460–600 V	<b>D65VMMLP600</b>
8-pin socket	—	<b>D3PA2</b>
8-pin IP20 rated socket	—	<b>D3PA6</b>

**Technical Data and Specifications****D65VM Series—Phase Loss, Reversal, Imbalance and Under/Overvoltage**

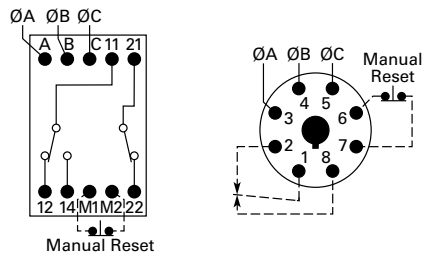
Description	Specification
Nominal voltages (50–60 Hz)	
For D65VMLS	102–138 V, 190–500 V, 460–600 V
For D65VMMLP	102–138 V, 190–500 V, 460–600 V
Connections	Wye or delta
Output contacts	
For D65VMLS	DPDT: NO: 10 A resistive at 277 Vac/30 Vdc, 1/2 hp at 120/240 Vac, B300 pilot duty, R300 NC: 10 A resistive at 277 Vac/30 Vdc, 1/3 hp at 120/240 Vac, B300 pilot duty, R300
For D65VMMLP	SPDT: 10 A SPDT at 277 Vac, 1 hp at 250 Vac, 1/2 hp at 120 Vac, C300 pilot duty
Dielectric	1000 V + (2 * nominal voltage rating) between input terminals and case or active circuitry
Operating temp.	–20 to 150 °F (–28 to 65 °C)
Response times	
Power up	1–300 seconds adjustable
Restart after fault	1–300 seconds adjustable
Dropout due to fault	100 ms fixed on phase loss and phase reversal; 0.3–30 sec adjustable for all other faults—unbalance, undervoltage, overvoltage
Mechanical life	10,000,000 operations
Electrical life	100,000 operations
Power consumption	40 VA
Hysteresis	2–3%

**Notes**

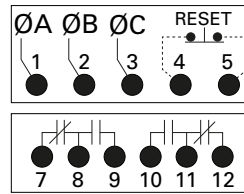
- ① When used with accompanying Eaton Socket (D65VMMLP only).
- ② Additional models available. Please visit our Web site for the latest offering.
- ③ Requires a 600 V-rated socket when used on system voltages greater than 300 V. The D3PA2 socket is rated 10 A, 600 V.

#### Wiring Diagrams

##### Plug-In



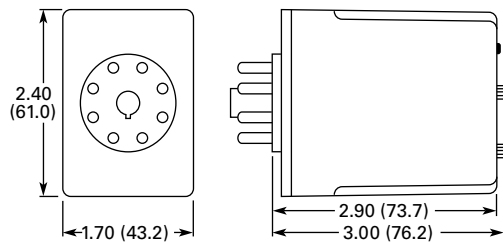
##### Surface-Mount



#### Dimensions

Approximate Dimensions in Inches (mm)

##### Plug-In



##### Surface-Mount

