Reverse Protection Relay
APR-S

CSM_APR-S_DS_E_3_2

Uses Voltage Detection to Determine Reverse Revolution of Three-phase Motor

- Detects motor reversal due to incorrect wiring.
- Direction of motor revolution is detected as soon as power is applied to the Relay. If the power is reversed, the magnetic contactor locks in the open state.
- The magnetic contactor can also be wired to protect it from being closed in open phase.
- Small, plug-in Relay that needs no adjustment.
- Uses voltage detection method to operate independently of load current.



APR-S (200/220 V)



APR-S380 (380/400 V)
APR-S440 (440 V)

Model Number Structure

■ Model Number Legend

APR-S□
1 2

1. Reverse Protection Relay

2. Control Power Supply Voltage
None: 200/220 VAC
380: 380/400 VAC
440: 440 VAC

Ordering Information

■ List of Models

Supply voltage	Model
200/220V	APR-S
380/400V	APR-S380
440V	APR-S440

■ Connecting Sockets (Order Separately)

Applicable model	Socket		Mounting bracket
	Type	Model	Model
APR-S	Front-mounting socket	PF083A	PFC-A6
	Back-mounting socket	PL08	PLC-7
APR-S380 APR-S440	Front-mounting socket	P2CF-11	---
	Back-mounting socket	PL11	Y92H-1

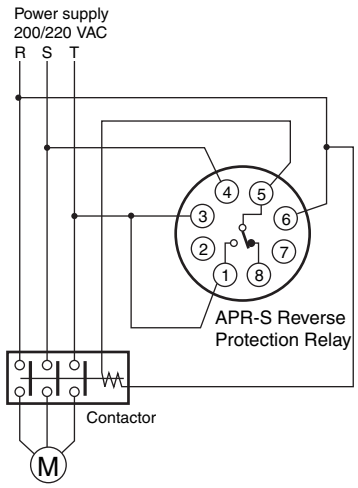
Specifications

■ Ratings/Characteristics

Type	APR-S	APR-S380	APR-S440
Supply voltage	3-phase, 200/220 VAC, 50/60 Hz	3-phase, 380/400 VAC, 50/60 Hz	3-phase, 440 VAC, 50/60 Hz
Operating voltage range	170 to 240 VAC	350 to 420 VAC	410 to 460 VAC
Operate time	100 ms max. (from power application to detection of motor direction)		
Control output	1.1 A at 200 VAC, cosϕ = 1, SPDT 2 A at 115 VAC, cosϕ = 1 0.6 A at 200 VAC, cosϕ = 0.4 1.2 A at 115 VAC, cosϕ = 0.4	1.1 A at 250 VAC, cosϕ = 1, SPDT 0.6 A at 250 VAC, cosϕ = 0.4	
Insulation resistance	100 MΩ min. (at 500 VDC)		
Dielectric strength	2,000 VAC, 50/60 Hz for 1 min		
Shock	Malfunction: 98 m/s^2 (approx. 10 G)		
Ambient temperature	–10 to 50 °C		
Life expectancy	Mechanical: 1,000,000 operations min. Electrical: 100,000 operations min.		
Weight	Approx. 100 g		

Connections

To Detect Reverse Phase or Open Phase

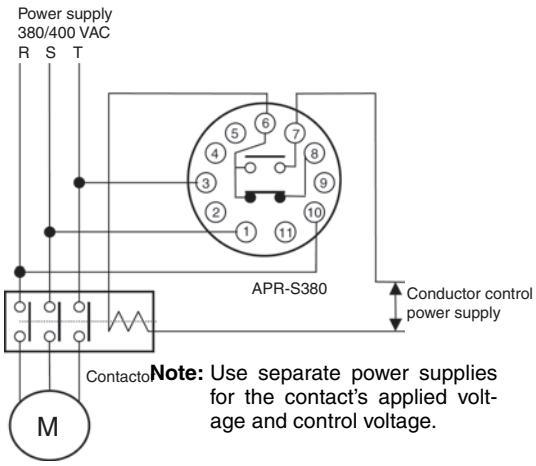


Operation

- Suppose the motor revolves in the forward direction when the input terminals ⑥, ④, and ③ of the APR-S are connected, in this sequence, to the power lines. The APR-S Relay turns ON when the phase sequence of the voltage is in the forward direction, that is, when the power lines R, S, and T are energized in this sequence. When the Relay turns ON, terminals ⑤ and ① conduct, energizing the contactor. If one of the three phases is reversed, the Relay does not turn ON and the contactor is not energized.
- To protect the motor from damage due to open phase, the wiring must be performed in exactly the same way as shown in this figure (i.e., so that the phase connecting the contactor coil is not the same as the phase connecting terminal ④ of the Relay).
  If phase R or T is open, the contactor does not operate because one side of its coil is not energized. If phase S (connected to terminal ④ of the Relay) opens, the Relay does not turn ON, allowing no current flow between terminals ⑤ and ①. The contactor therefore does not operate.
  Note, however, that the contactor is prevented from operating by preventing an open-phase voltage from flowing into the motor and not by the open-phase protection feature of the Relay.

Note: Open-phase detection is only possible when a 200/220-VAC APR-S is used with the wiring exactly the same as shown in the above diagram.

To Switch to Reverse Phase



Note: Use separate power supplies for the contact's applied voltage and control voltage.

Operation

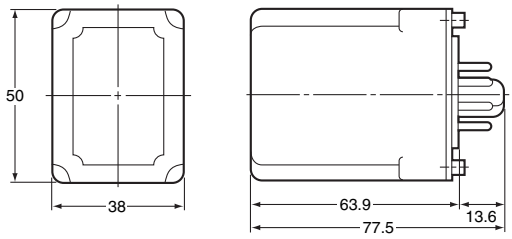
- Suppose the motor revolves in the forward direction when the input terminals ⑩, ①, and ③ of the APR-S are connected, in this sequence, to the power lines R, S, and T, respectively. The APR-S Relay turns ON when the phase sequence of the current is in the forward direction, that is, when the power lines R, S, and T are energized in this sequence. When the Relay turns ON, terminals ⑥ and ⑦ conduct, energizing the contactor. If one of the three phases is reversed, the Relay does not turn ON, and terminals ⑥ and ⑦ do not conduct, but a current flows between terminals ⑥ and ⑧, energizing the reverse-phase contactor.

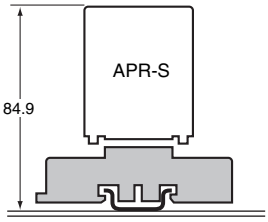
Note: Open-phase detection is not possible.

Accessories (Order Separately)

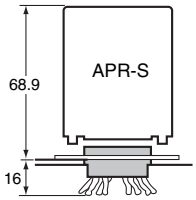
■ Dimensions

APR-S



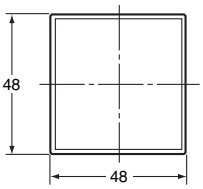


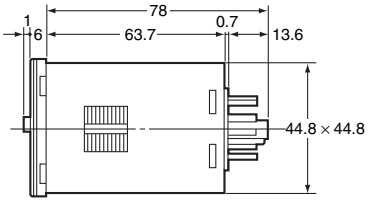
PF083A (Order separately)

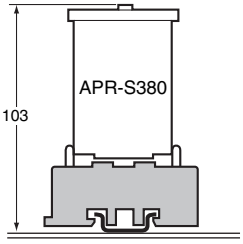


PL08 (Order separately)

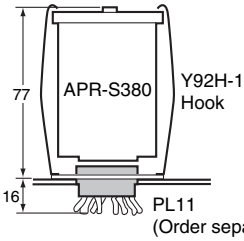
APR-S380/S440







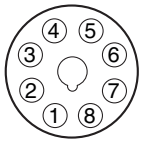
P2CF-11 (Order separately)



PL11
(Order separately)

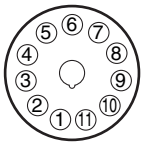
■ Terminal Arrangement

APR-S



(Bottom View)

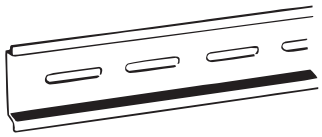
APR-S380/S440

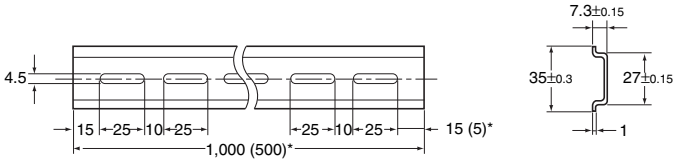


(Bottom View)

■ Accessories for Track Mounting

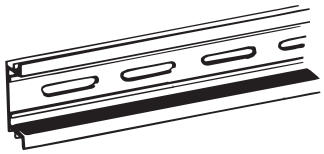
PFP-100N/PFP-50N Socket Mounting Track

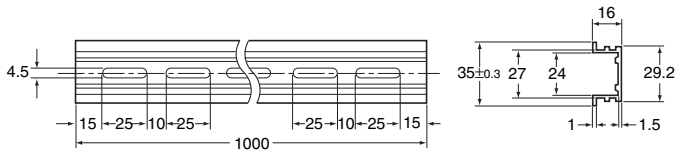




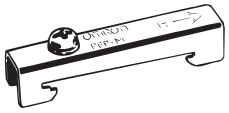
* The dimensions given in parentheses are for the PFP-50N Socket Mounting Track.

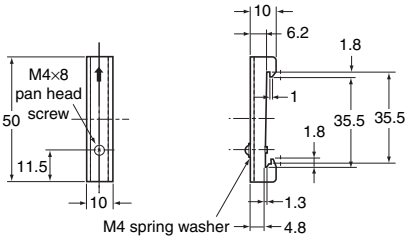
PFP-100N2 Socket Mounting Track



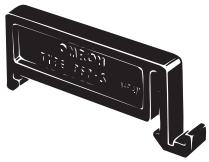


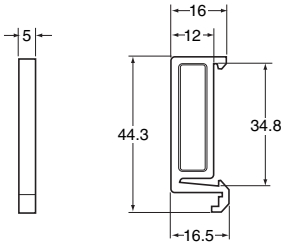
PFP-M End Plate





Spacer





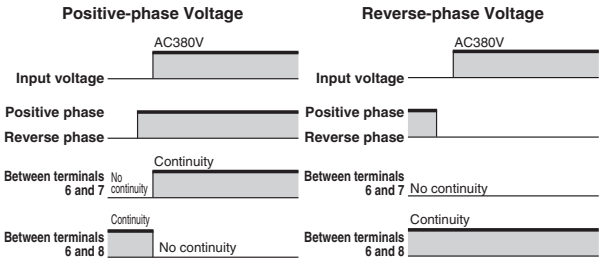
Safety Precautions

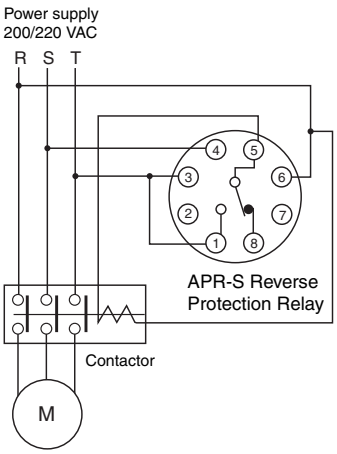
■ Correct Use

- With the APR-S, APR-S380, or APR-S440 an open phase at startup can be prevented only if connections are external and wiring has been performed to detect reverse phase and open phase at startup when the power supply is turned ON. When doing so, use an SE Static Motor Relay. An open phase when the power supply is turned ON can be detected only when it occurs between the APR-S, APR-S380, or APR-S440 and the power supply. An open phase cannot be detected on the load side.
- Suppose the motor revolves in the forward direction when the input terminals 6, 4, and 3 of the APR-S are connected, in this sequence, to the power lines. If the phase sequence of the power supply applied to the APR-S is a positive sequence (i.e., applying to R to S to T in the order of 6 to 4 to 3), the relay built into the APR-S will turn ON, there will be continuity between terminals 5 and 1, and the contactor will be energized. For reverse phase, the built-in relay will not turn ON and the contactor will not be energized.
- The positive phase sequence for the APR-S380 or APR-S440 corresponds to the following order of the input terminals: 10 to 1 to 3. If the phase sequence of the power supply applied to the APR-S380 or APR-S440 is a positive sequence (i.e., applying to R to S to T in the order of 10 to 1 to 3), the relay built into the APR-S380 or APR-S440 will turn ON, there will be continuity between terminals 6 and 7, and the contactor will be energized. For reverse phase, the built-in relay will not turn ON and the contactor will not be energized.
- An open phase when the power is turned ON cannot be detected by the APR-S380 or APR-S440.
- An open phase when the power is turned ON can be prevented when wiring is performed exactly as in the following figure (when wiring is performed so that the phase of the connected contactor coil for turning ON the power supply and the phase of the connected terminal 4 of the APR-S, APR-S380, or APR-S440 are not the same phase).

Operation Chart

Example: APR-S380





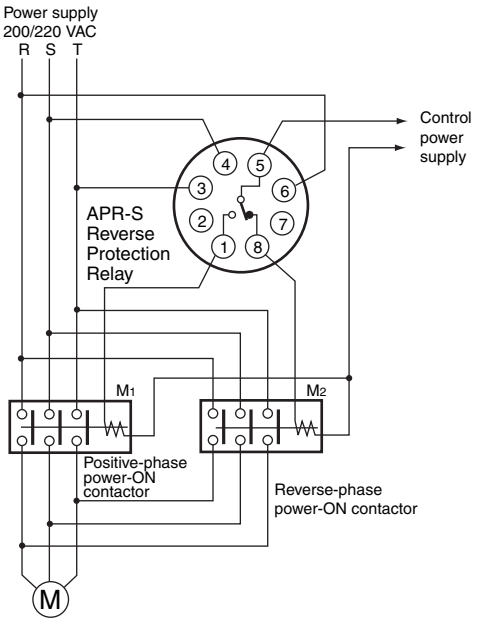
In the figure above, one side of the contactor coil will not be energized if either phase R or phase T is open phase, so the power supply will not turn ON. For open R phase (APR-S terminal 4), the built-in relay of the APR-S will not turn ON, and there will be no conductivity between terminals 5 and 1, so the contactor will not operate, and the power supply will not turn ON. **This protection is for an open phase when the power is turned ON and cannot ensure detection of an open phase when the motor is operating.**

- Incorrect wiring on the magnet contactor load side cannot be detected.
- A phase detection method is used, so usage is not possible with single phase.

Mounting

- If a back-mounting socket is used for mounting, mount the socket flush from the back of the panel (thickness: 1 to 4 mm) using screws, and insert the APR-S after the socket is sufficiently tightened. Make sure the socket is mounted with the key slot downward.
- If a front-mounting socket is used, mount the socket to the panel using screws, and insert the APR-S after the socket is sufficiently tightened.
- Use a mounting bracket to secure the APR-S reliably and prevent contact faults.

Switching to Reverse Phase



- Suppose the motor revolves in the forward direction when the input terminals 6, 4, and 3 of the APR-S are connected, in this sequence to the power lines, R, S, and T, respectively. If the phase sequence of the power supply applied is the positive sequence, the relay built into the APR-S will turn ON, there will be continuity between terminals 5 and 1, and the positive-phase power-ON contactor will be energized.
  For reverse phase, the built-in relay will not turn ON, there will be conductivity between terminals 5 to 8, and the reverse-phase power-ON contactor will be energized. In this way, the voltage supplied to the motor will remain positive phase whether the voltage applied is positive phase or reverse phase.

Note

The APR-S requires 100 ms after the voltage has been applied until positive phase and reverse phase are detected. Be sure to allow at least 100 ms to elapse before applying voltage to the control power supply after applying voltage to the APR-S.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

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