POWERSWITCH
Solid-State Relay / - Contactor
PI 9260

0275015

Solid-state relay
without heat sink

Solid-state contactor
with heat sink 0.75 K/W

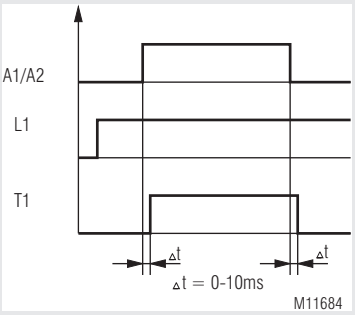
Your Advantages
- High switching frequency and long life
- With heat sink for DIN rail mounting
- Silent vibration and shock resistance
- Providing outstanding EMC properties

Features
- Three Phase AC solid-state contactor
- Meets generally the requirements of IEC/EN 60947-4-3
- Zero cross or immediate switching
- 2 anti-parallel thyristors for each pole
- Direct copper bonded (DCB) technology
- Self-lifting box contact terminals
- Peak reverse voltage up to ±1600Vp
- Wide range AC and DC input control voltage
- Delivered with integrated heat sink for DIN rail mounting
- IP20 Touch protection

Product Description

The solid-state relay PI 9260 was developed for switching resistive and inductive three-phase A.C. current loads, and therefore serves as a replacement for an electronic contactor. Both 2-phase and 3-phase controlled versions are available. The DCB technology (direct copper bonding) ensures very good thermal transmission, so that high load currents are possible. The solid-state relay can be mounted on a variety of cooling surfaces. The device is also available as a ready-to-use version with a pre-dimensioned heat sink. This can simply be snapped onto a wide DIN rail. An LED display signals the status of the control input.

Function Diagram



Approvals and Markings

CE

Applications

Solid state relays switching at zero crossing:

For frequent no-wear and no-noise switching of:

- heating systems
- cooling systems
- valves
- lighting systems

The solid-state relay switches at zero crossing and is suitable for many applications e.g. extrusion machines for plastic and rubber, packaging machines, solder lines, machines in food industry.

Function Notes

EMC disturbance during operation has to be reduced by corresponding measures and filters. If several solid-state relays are mounted together sufficient cooling and ventilation has to be provided.

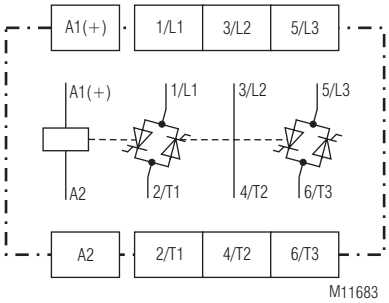
Notes

Depending on the application it may be useful to protect the solid-state relay with special superfast semiconductor fuses against shortcircuit.

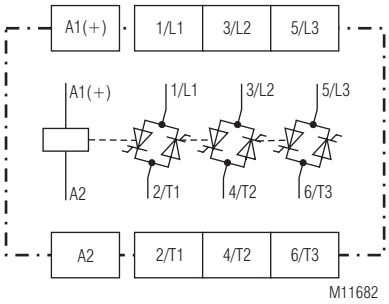
Without heat sink
The solid-state relay can be mounted on existing cooling surfaces. Depending on the load, sufficient ventilation has to be provided.

With heat sink
For optimised heat dissipation the solid-state relay can be delivered with special dimensioned heat sinks. Depending on the ambient conditions and the load this helps to select the correct solid-state relay and heat sink. The heat sinks can be clipped on DIN-rail.

Circuit Diagrams



PI 9260.92



PI 9260.93

Connection Terminals

Terminal Designation	Signal Designation
A1 (+)	+ / L
A2	- / N
L1, L2, L3	Mains connection
T1, T2, T3	Load output

Function

The PI 9260 range of three phase AC solid-state relay, better known as Solid-state relay (SSR) is designed with two anti-parallel thyristors for each pole and mounted on a direct copper bonded (DCB) substrate ensuring a high degree of reliability and robustness. The SSR's triggering circuit can be configured to switch resistive loads or inductive loads. Its fast response, high vibration and shock resistance, high current surge capabilities, low electromagnetic interference together with its inherent long life makes the SSR the obvious choice for many applications. Applications would be for heating and cooling systems, lighting displays, process control, plastic injection machines, motorised valves and many more uses.
Two modes of switching are available for the PI9260 range; the zero-cross switching and instant-on switching (also known as random switching). Zero-cross switching is the preferred mode, because the switching of the relay is synchronised with the mains voltage so that the switching is done at the point where the voltage across the relay is nearly zero. This reduces the electrical switching noise. Due to its low input current requirements the relay can be directly operated from most of the logic systems and computer interfaces. An LED indication shows when the relay is activated.

Two-phase controlled versions – PI 9260.92
In many three-phase applications where the neutral connection is not present in either wye or delta circuits, it is possible to switch on and off loads with only two of the three phases. By means of an internal shunted middle phase, the PI 9260.92 provides all the three phases to the load.
Because only two phases are being switched, the internal power loss is reduced and hence more current can be accommodated for a given heat-sink. It has also the advantage of using a smaller heat sink for the same current when compared to a three-switched phase contactor.

Three-phase controlled version PI 9260.93
This version is used in three-phase applications where all phases have to be switched on and off due to system requirements or in applications having wye connected loads with a neutral conductor. Since the SSR dissipates about 1W per ampere of load current, it is of great importance that an effective means of removing heat from the SSR is provided. Proper choice of heat sink is essential to fully utilise the SSR's current capability for a given ambient temperature. A well ventilated cabinet or panel is recommended. If this point is overlooked overheating will result, causing the SSR to lose control or be permanently damaged. The ratings listed below are valid only when the SSR is mounted alone. If more than one SSR is mounted side by side on the DIN rail then the current derating is necessary to keep the working temperature within acceptable limits. As a rule of thumb, 25% current derating is normally adequate. It is recommended that the spacing between two adjacent SSRs should be at least 30 mm.

Control Circuit

Control voltage range [V]:	DC 10 ... 32	AC 100 ... 230
Min. Pick-up voltage [V]:	8,0	80
Max. Drop out voltage [V]:	3.0	25
Max. input current [mA]:	12	20 at 230 V AC
Response time - turn on [ms]:	≤ 1.0 + ½ cycle*	≤ 10 + ½ cycle*
Response time - turn off [ms]:	≤ 1.0 + ½ cycle*	≤ 35 + ½ cycle*

*) ½ cycle delay only when switching at 0-crossing, at instantaneous switching the delay = 0

Output

Load voltage AC [V]:	24 ... 230	48 ... 480	48 ...600
Peak reverse voltage [V]:	650	1200	1600
Frequency range [Hz]:	47 ... 63		

Maximum Rated Operational current per pole at 40°C [A] AC 51: AC 53a:	20 **5**	30 **8**	50 **12**	60 **15**	60 **20**	60[1] **30**
Maximum Rated Operational current at 40°C mounted on /06 heat sink[2] [A] AC 51: AC 53a:	3 x 20 / 2 x 20 **3 x 5 / 2 x 5**	3 x 20 / 2 x 30 **3 x 8 / 2 x 8**	3 x 20 / 2 x 30 **3 x 12 / 2 x 12**	3 x 20 / 2 x 30 **3 x 15 / 2 x 15**	3 x 20 / 2 x 30 **3 x 20 / 2 x 20**	3 x 20 / 2 x 30[1] **3 x 20 / 2 x 30**
Max. overload current [A]. t = 10 ms:	≤ 300	≤ 400	≤ 620	≤ 1050	≤ 1150	≤ 1900
Load limit integral I^2t [A^2s]:	450	800	1900	5500	6600	18 000
Leakage current in off state [mA]	≤ 1.5					
On-state-voltage [V] at nominal current:	1.0	1.1	1.1	1.1	1.1	1.1
Off-state voltage [V/µs]:	200	1000	1000	1000	1000	1000
Rate of rise of current [A/µs]:	100	100	150	150	150	150

[1] Only available in 2 switched-pole versions

[2] Current derating factors for heat sink /06 above 40 °C: Three phase controlled versions = 0.32 A/K; Two phase controlled versions = 0.47 A/K

Thermal Data - Solid-state relay -

Thermal resistance junction-ambient [K/W]:	13					
Thermal resistance junction housing [K/W]:	0.6	0.6	0.5	0.35	0.3	0.3
Junction temperature [°C]:	≤ 125					

General Technical Data

Operating mode:	Continuous operation (Current reduction above 40 °C)	
Temperature range		
operation:	- 40 ... 80 °C	
storage:	- 40 ... 80 °C	
Relative air humidity:	< 50 % for < +40 °C and < 90 % for < + 20 °C	
Altitude:	1.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	6 kV / 2	IEC/EN 60 664-1
Over voltage category:	III	
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61 000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
Control circuit between A1 / A2:	1 kV	IEC/EN 61 000-4-5
between output and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A*) *) The device is designed for the usage under industrial conditions (Class A, EN 55011) When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
Degree of protection:	IP 20	IEC/EN 60 529
Vibration resistance:	2 g	IEC/EN 60 068-2-6
Housing material:	PBT/PC flame resistant; UL 94 V0	
Base plate:	Nickel plated aluminium	
Mounting screws:	M4 x 20 mm (with conical and plain washers)	
Fixing torque:	1.8 Nm	
Connections load circuit:	Mounting screws M4 Pozidrive PZ 2	
Fixing torque:	1.2 Nm	
Wire cross section:	2 x 1.5 ... 2.5 mm^2 solid or 2 x 2.5 ... 6 mm^2 solid oder 2 x 1.0 ... 2.5 mm^2 stranded wire with sleeve 2 x 2.5 ... 6 mm^2 stranded wire with sleeve 1 x 10 mm^2 stranded wire with sleeve	
Connections control circuit:	Mounting screws M3 Pozidrive PZ 1	
Fixing torque:	0.6 Nm	
Wire cross section:	1 x 0.5 ... 2.5 mm^2 solid or 2 x 0.5 ... 1.0 mm^2 solid or 1 x 0.5 ... 2.5 mm^2 stranded wire with sleeve	
Nominal insulation voltage		
Control circuit – load circuit:	4 $kV_{eff.}$	
Load circuit – base plate:	4 $kV_{eff.}$	
Overvoltage category:	III	
Weight		
PI9260.9X/_ _ _ :	268 g	
PI9260.9X/_ _ _ /06:	970 g	

Dimensions

Width x height x depth: 67,5 x 120 x 50 mm

Standard Type

PI 9260.92/000/06 AC 48 ... 480 V 2 x AC 30 A DC 10 ... 32 V
Article number: 0067462
- Load voltage: AC 48 ... 480 V
- Load current AC-51: 2 x 30 A
- **Load current AC-53a: 2 x 12 A**
- Control voltage: DC 10 ... 32 V
- With heat sink 0.75 K/W
- Width: 67.5 mm

PI 9260.93/000/06 AC 48 ... 480 V 3 x AC 20 A DC 10 ... 32 V
Article number: 0067464
- Load voltage: AC 48 ... 480 V
- Load current AC-51: 3 x 20 A
- **Load current AC-53a: 3 x 12 A**
- Control voltage: DC 10 ... 32 V
- With heat sink 0.75 K/W
- Width: 67.5 mm

Variants

PI 9260 .9_ / _ _ _ / _ _

00	Without heat sink
06	With heat sink 0.75 K/W
16	With heat sink 0.75 K/W and fan kit (on request)
0	without temperature protection
1	with temperature protection
0	Switching at zero crossing
1	Immediate switching
0	Standard
1	With high I^2t-value > 6600 A^2s
2	With high I^2t-value > 18000 A^2s
2	2-poles
3	3-poles

Ordering example for variants

PI 9260.93 /1 0 0 /06 AC 48 ...480 V 3 x AC 20 A DC 10 ... 32 V

Control voltage	DC 10 ... 32 V
Load current	3 x AC 20 A
Load voltage	AC 48 ...480 V
With heat sink 0.75 K/W	/06
Without temperature protection	0
Switching at zero crossing	0
With high I^2t-value > 6600 A^2s	1
3-poles	93
Type	PI 9260

Further variants

PI9260.92/200/06 AC 48 ... 480V 2 x AC 30 A AC 100 ... 230 V
Article number: 0067688
Load current AC-51: 2 x 30 A
Load current AC-53a: 2 x 30 A

PI9260.93/000/06 AC 48 ... 480V 3 x AC 20 A AC 100 ... 230 V
Article number: 0067687
Load current AC-51: 3 x 20 A
Load current AC-53a: 3 x 12 A

PI9260.93/100/06 AC 48 ... 480V 3 x AC 20 A DC 10 ... 32 V
Article number: 0067686
Load current AC-51: 3 x 20 A
Load current AC-53a: 3 x 20 A

Other variants on request.

Notes on Sizing for Selection of a Heat Sink

The heat generated by the load current flowing through the SSR has to be removed by a suitably chosen heat sink. It is essential that the junction temperature of the semiconductor is kept below 125 °C for all possible ambient temperatures. It is of paramount importance that the thermal resistance between the SSR base plate and the heat sink is kept to a minimum. A small amount of thermally conductive compound (or a similar interface material) should be applied to the base plate before assembly to the heat sink. The tables shown below can be used as a guide to select a suitable heat sink for various load currents and ambient temperatures situations.

a)

Load current (A)	3 Phase SSR Rating 20A/pole Thermal resistance (K/W)					
20	1.5	1.3	1.1	1.0	0.8	0.6
18	1.7	1.5	1.3	1.1	0.9	0.8
16	2.0	1.7	1.5	1.3	1.1	0.9
14	2.3	2.1	1.8	1.6	1.3	1.1
12	2.8	2.5	2.2	1.9	1.6	1.3
10	3.5	3.2	2.8	2.4	2.1	1.7
8	-	4.1	3.6	3.2	2.7	2.3
6	-	-	-	4.4	3.8	3.2
4	-	-	-	-	-	-
2	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

b)

Load current (A)	3 Phase SSR Rating 30A/pole Thermal resistance (K/W)					
30	0.7	0.6	0.5	0.4	0.3	0.2
27	0.8	0.7	0.6	0.5	0.4	0.3
24	1.0	0.9	0.8	0.6	0.5	0.4
21	1.2	1.1	0.9	0.8	0.6	0.5
18	1.5	1.4	1.2	1.0	0.8	0.7
15	2.0	1.8	1.5	1.3	1.1	0.9
12	2.7	2.4	2.1	1.8	1.5	1.2
9	3.8	3.4	3.0	2.6	2.2	1.8
6	-	-	-	4.2	3.6	3.0
3	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

c)

Load current (A)	3 Phase SSR Rating 50A/pole Thermal resistance (K/W)					
50	0.4	0.3	0.2	0.2	0.1	-
45	0.5	0.4	0.3	0.3	0.2	0.1
40	0.6	0.5	0.4	0.4	0.3	0.2
35	0.7	0.6	0.5	0.5	0.4	0.3
30	0.9	0.8	0.7	0.6	0.5	0.4
25	1.2	1.0	0.9	0.8	0.6	0.5
20	1.6	1.4	1.2	1.1	0.9	0.7
15	2.3	2.1	1.8	1.6	1.3	1.1
10	3.7	3.3	2.9	2.5	2.2	1.8
5	-	-	-	-	4.5	4.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

d)

Load current (A)	3 Phase SSR Rating 60A/pole Thermal resistance (K/W)					
60	0.3	0.3	0.2	0.2	0.1	-
52	0.4	0.3	0.3	0.2	0.2	0.1
48	0.5	0.4	0.4	0.3	0.2	0.2
42	0.6	0.5	0.5	0.4	0.3	0.2
36	0.8	0.7	0.6	0.5	0.4	0.3
30	1.0	0.9	0.8	0.7	0.6	0.4
24	1.3	1.2	1.0	0.9	0.7	0.6
18	2.0	1.8	1.6	1.4	1.1	0.9
12	3.0	2.8	2.5	2.2	1.9	1.6
6	-	-	-	-	4.2	3.5
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

e)

Load current (A)	2 Phase SSR Rating 20A/pole Thermal resistance (K/W)					
20	2.2	1.9	1.7	1.5	1.2	1.0
18	2.5	2.3	2.0	1.7	1.4	1.1
16	3.0	2.6	2.3	2.0	1.7	1.4
14	3.5	3.1	2.8	2.4	2.0	1.7
12	4.3	3.8	3.4	2.9	2.5	2.0
10	5.3	4.7	4.2	3.7	3.1	2.6
8	-	6.2	5.5	4.8	4.1	3.4
6	-	-	-	6.6	5.7	4.8
4	-	-	-	-	-	-
2	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

f)

Load current (A)	2 Phase SSR Rating 30A/pole Thermal resistance (K/W)					
30	1.0	0.9	0.8	0.6	0.5	0.3
27	1.3	1.0	0.9	0.8	0.6	0.4
24	1.5	1.3	1.1	1.0	0.8	0.6
21	1.9	1.7	1.4	1.2	1.0	0.8
18	2.3	2.1	1.8	1.5	1.3	1.0
15	3.0	2.6	2.3	2.0	1.7	1.4
12	4.0	3.6	3.2	2.7	2.3	1.9
9	5.5	5.1	4.5	3.9	3.3	2.8
6	-	-	-	6.3	5.4	4.5
3	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

g)

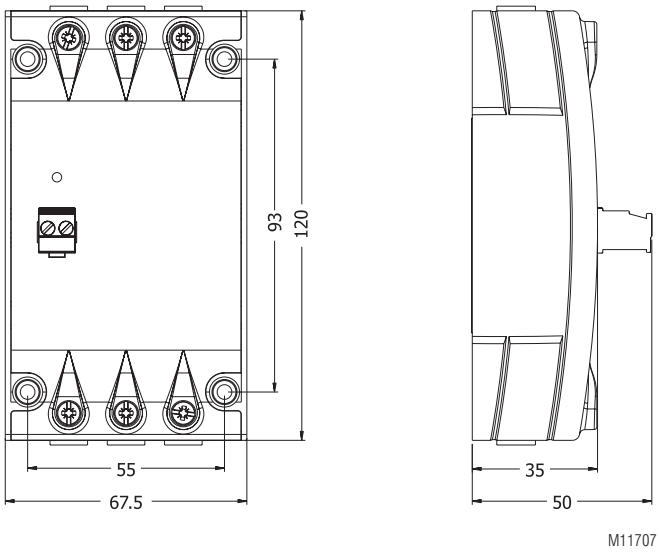
Load current (A)	2 Phase SSR Rating 50A/pole Thermal resistance (K/W)					
50	0.6	0.5	0.4	0.3	0.2	0.1
45	0.7	0.6	0.5	0.4	0.3	0.2
40	0.9	0.8	0.6	0.5	0.4	0.3
35	1.1	1.0	0.8	0.7	0.5	0.4
30	1.4	1.2	1.1	0.9	0.7	0.6
25	1.8	1.6	1.4	1.2	1.0	0.8
20	2.4	2.0	1.9	1.6	1.4	1.0
15	3.5	3.0	2.7	2.4	2.0	1.6
10	5.6	5.0	4.4	3.9	3.3	2.7
5	-	-	-	-	-	6.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

h)

Load current (A)	2 Phase SSR Rating 60A/pole Thermal resistance (K/W)					
60	0.5	0.4	0.4	0.3	0.2	0.1
52	0.6	0.5	0.5	0.4	0.3	0.2
48	0.8	0.7	0.6	0.5	0.4	0.3
42	0.9	0.8	0.7	0.6	0.5	0.4
36	1.2	1.1	0.9	0.8	0.6	0.5
30	1.5	1.4	1.2	1.0	0.9	0.7
24	2.0	1.8	1.5	1.3	1.1	0.9
18	3.0	2.7	2.4	2.1	1.7	1.4
12	4.8	4.3	3.8	3.3	2.9	2.4
6	-	-	-	-	6.3	5.3
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

Connection Example

PI9260.93/_ _ _/00



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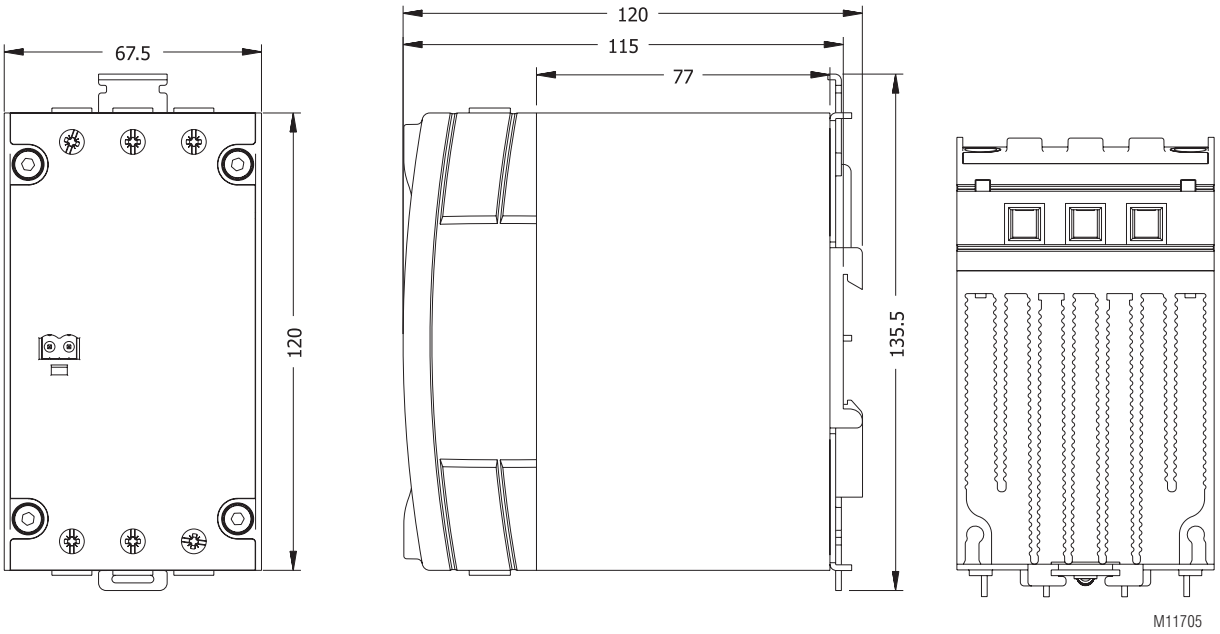
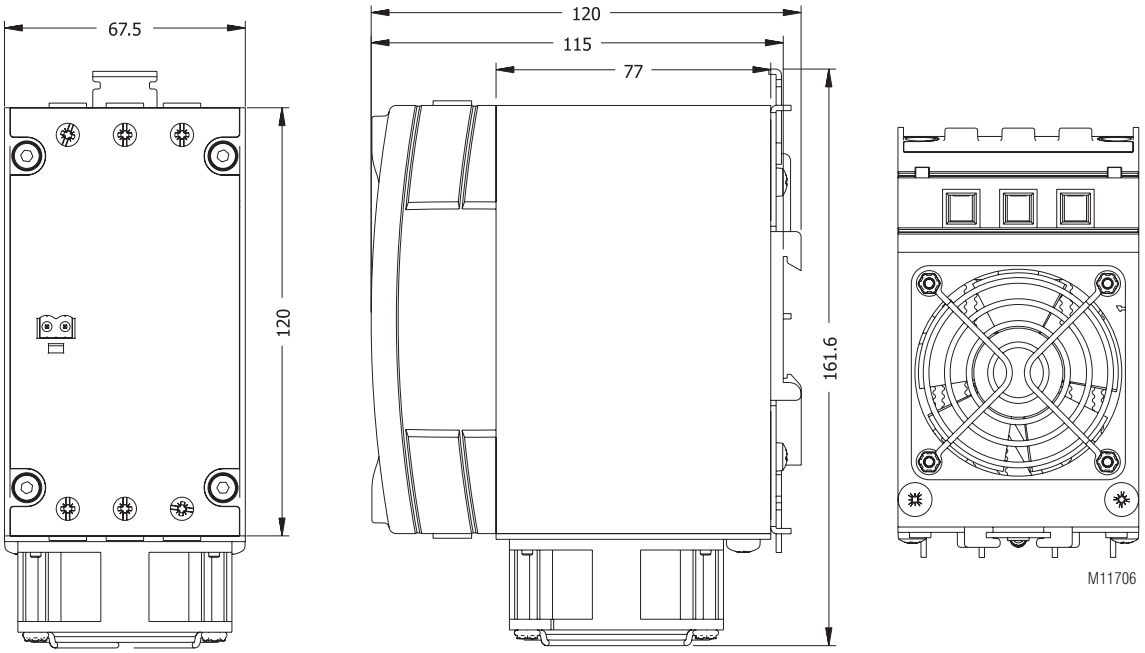
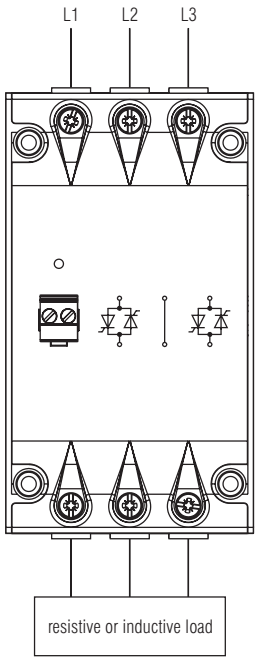


PI9260.93/_ _ _ /16 (on request)



Connection Example

Typical applications



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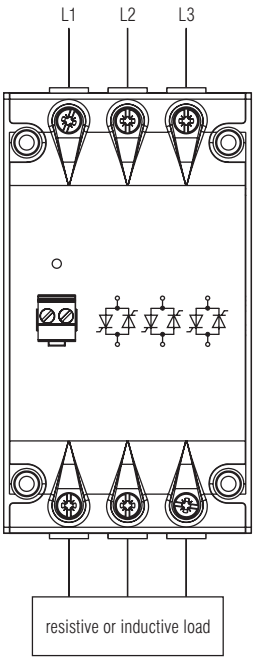

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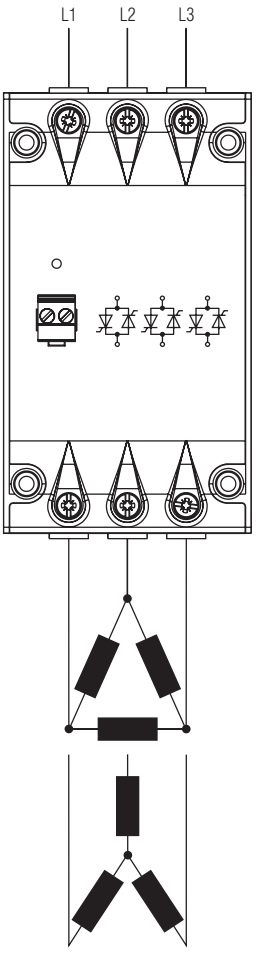

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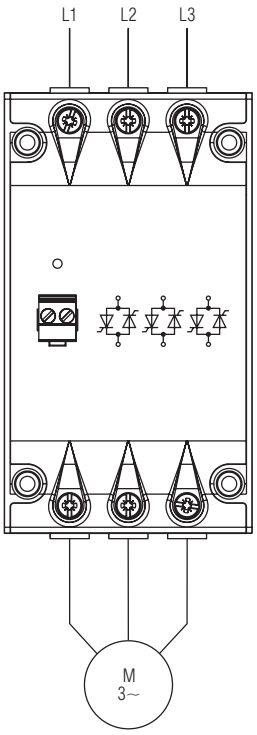

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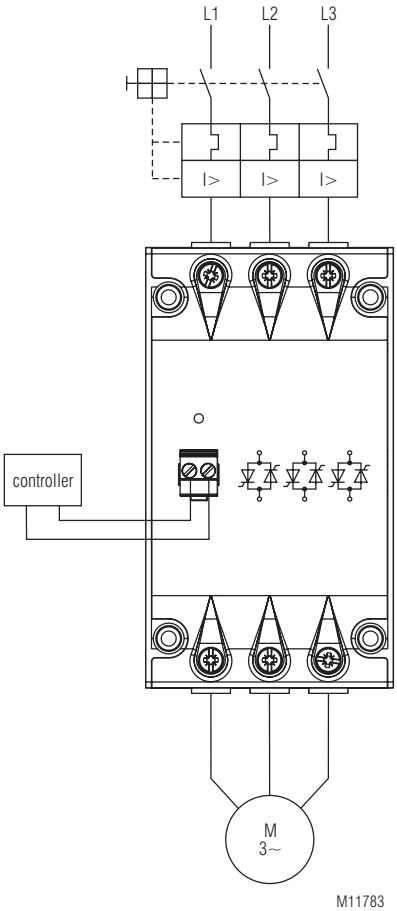
Three phase motor application



M11783