POWERSWITCH
Solid-State Relay / - Contactor For Resistive Load
PK 9260

Translation of the original instructions

0269163

Solid-state relay PK 9260
without heat sink

Solid-state contactor PK 9260
with heat sink 20 A

Your Advantages
- High switching frequency and long life
- Space saving, only 22.5 mm width
- To be mounted on cooling surface with only 2 screws
- With heat sink for DIN-rail mounting
- Silent
- Vibration- and shock resistance

Features
- AC solid-state relay / -contactor
- PK 9260/_ _ _ according to IEC/EN 62314
  PK 9260/_ _ _ / _ _ according to IEC/EN 60947-4-2 and -4-3
- Load current up to 88 A, AC-51
- Switching at zero crossing for resistive loads
- 2 anti-parallel thyristors
- DCB technology (direct bonding method) for excellent heat transmission properties
- As option with:
  - M4 flat terminal or
  - M5 screw terminal for cable lug
- LED status indicator
- Peak reverse voltage up to ± 1600 V
- Insulation voltage 4000 V
- As option with heat sink, for DIN rail mounting

Product Description

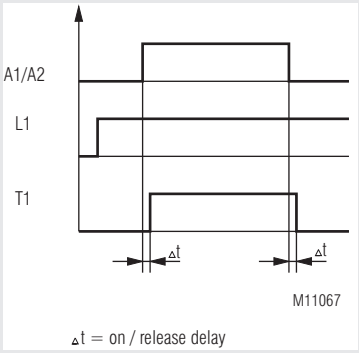
The solid-state relay PK 9260 is designed with 2 anti-parallel connected thyristors switching at zero crossing for resistive loads (e.g. heating systems). When connecting the control voltage the output of the solid-state relay is activated at the next zero crossing of the sinusoidal voltage. When disconnecting the control voltage the output is switched off at the next zero crossing of the load current.
The LED shows the state of the control input.

Approvals and Markings

CE | cULus LISTED *) Canada / USA | cULus *) Canada / USA

*) Depending on variant

Function Diagram



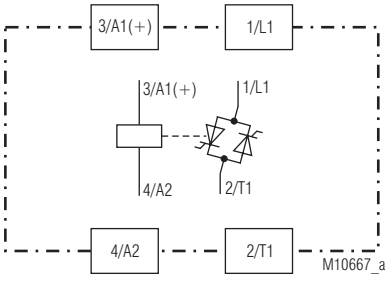
Δt = on / release delay

Applications

Solid-state relays switching at zero crossing:
For frequent no-wear and no-noise switching of:
- Heating systems
- Cooling systems
- 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.

Circuit Diagram



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 relays 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.

Connection Terminals

Terminal designation	Signal description
A1(+), A2	Control input
L1	Mains connection
T1	Load output

Operation 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.

Safety Notes For Variants With Fan

WARNING **Risk of fire or other thermal hazards!**
Danger to life, risk of serious injuries or property damage.
- The device has no overtemperature alarm. If the fan lais, the unit may overheat and become a fire hazard.
- The user must take precautions to detect a fan failure.

Control Circuit

Control voltage range [V]:	DC 4 ... 32	AC/DC 18 ... 30	AC 100 ... 240
Pick-up Voltage [V]:	3,0	10	80
Drop-out voltage [V]:	1.0	6.0	25
Nominal input current [mA]:	12	25 at 24 V AC	20 at 240 V AC
Turn-on delay [ms]:	≤ 1.0 + ½ cycle*	≤ 5 + ½ cycle*	≤ 10 + ½ cycle*
Turn-off delay [ms]:	≤ 1.0 + ½ cycle*	≤ 20 + 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 ... 240	48 ... 480	48 ...600
Peak reverse voltage [V]:	650	1200	1600
Frequency range [Hz]:	47 ... 63		

Solid-state relays without factory mounted heat sink / Heat sink see table

Load current I_{nenn} [A] / AC-51:	25	25*	35	50	50*	72	88
Approval	cULus	cULus	cULus	cULus	cULus	cULus	cULus
AC-51 Load current I_{nenn} [A] at T_u = 25°C (max. current at T_j < 125°C):	25	25*	35	50	50*	72	88
Max. overload current [A], t = 10 ms:	≤ 300	≤ 1150	≤ 400	≤ 620	≤ 1150	≤ 1050	≤ 1150
Load limit integral I^2t [A^2s]:	720	6600	800	1920	6600	5500	6600
Off-state leakage current [mA]	≤ 1.5						
Min. current [mA]	20						
On-state voltage at rated current [V]:	1.2	1.1	1.2	1.2	1.1	1.1	1.2
Off-state voltage dV/dt [V/µs]:	500	500	500	1000	1000	1000	1000
Rate of rise of current di/dt [A/µs]:	150	150	100	150	150	150	150

*) At variant /1_ _ : High I^2t value

Thermal Data - Solid-state relays -

Solid-state relays without heat sink Load current I_{nenn} [A] / AC-51:	25	25*	35	50	50*	72	88
Thermal resistance Junction ambient [K/W]:	10						
Thermal resistance Junction housing [K/W]:	0.55	0.25	0.48	0.36	0.25	0.35	0.25
Max. junction temperature [°C]:	≤ 125						

*) At variant /1_ _ : High I^2t value

Solid-state relays with factory mounted heat sink / Heat sink see table

AC-51 Load current I_{nenn} [A] at T_u = 40°C (acc. to EN 60947-4-3)	10	15	15*	20	30	40	40*	50	88
AC-51 Load current I_{nenn} [A] at T_u = 25°C (max. current at T_j < 125°C):	15	25	25*	35	35	50	50*	72	88
Factory mounted heat sink	/00	/03	/03	/04	/07	/05	/05	/06	/16
Approval with M4 Flat terminals Variant /xx0:	c UL us LISTED	c UL us LISTED	c UL us LISTED	c UL us LISTED	c UL us LISTED	c UL us LISTED	c UL us LISTED	c UL us LISTED	-
Approval with M5 screw or bolt terminals Variants /xx1 bzw. /xx2:	c UL us	c UL us	c UL us	c UL us	c UL us	c UL us	c UL us	c UL us	-
UL Data: Load current I_{nenn} [A]	7,5	15	15	20	25	35	35	50	-
Current reduction from T_U = > 40 °C [A / °C]	0,2	0,3	0,3	0,4	0,6	0,8	0,8	1,0	1,0
Max. overload current [A], t = 10 ms:	≤ 200	≤ 300	≤ 1150	≤ 400	≤ 400	≤ 620	≤ 1150	≤ 1050	≤ 1150
Load limit integral I^2t [A^2s]:	200	720	6600	800	800	1920	6600	5500	6600
Off-state leakage current [mA]	≤ 1,5								
Min. current [mA]	20								
On-state voltage at rated current [V]:	1,0	1,2	1,1	1,2	1,2	1,2	1,1	1,1	1,2
Off-state voltage dV/dt [V/µs]:	500	500	500	500	500	1000	1000	1000	1000
Rate of rise of current di/dt [A/µs]:	100	150	150	100	150	150	150	150	150

*) At variant /1_ _ : High I^2t value

Solid-state relays - Determine the heat sink

The heat generated by the load current must be dissipated by a suitable heat sink. It is imperative that the junction temperature of the semiconductor is maintained for all potential environmental temperatures of under 125°C. For this reason, it is important to keep the thermal resistance between the base plate of the solid-state relay and the heat sink to a minimum.
To protect the solid-state relay effectively from excess heating, a thermally conducting paste or a graphite gasket (see Accessories) should be applied before installation to the base plate of the heat sink between semiconductor relay and heat sink.
From the table, select a suitable heat sink with the next lowest thermal resistance. Thus, it is ensured that the maximum junction temperature of 125°C is not exceeded. The load current in relation to the environmental temperature can be seen from the table.

a)

Load current (A)	PK 9260 15 A Thermal resistance (K/W)					
15.0	6.8	6.0	5.3	4.6	4.0	3.0
13.5	7.7	6.9	6.0	5.3	4.5	3.5
12.0	8.5	8.0	7.0	6.0	5.3	4.4
10.5	-	9.0	8.0	7.0	6.0	5.0
9.0	-	-	9.0	8.0	7.0	6.0
7.5	-	-	-	9.0	8.5	7.0
6.0	-	-	-	-	-	8.0
4.5	-	-	-	-		-
3.0	-	-	-	-	-	-
1.5	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

b)

Load current (A)	PK 9260 25 A / 25A HI I²t Thermal resistance (K/W)					
25.0	3.0	2.7	2.3	1.9	1.5	1.0
22.5	3.5	3.0	2.7	2.3	1.9	1.4
20.0	4.0	3.8	3.3	2.8	2.3	1.8
17.5	5.0	4.5	4.0	3.4	2.8	2.2
15.0	6.0	5.5	4.9	4.2	3.5	2.9
12.5	7.9	7.0	6.3	5.0	4.5	3.7
10.	10.0	9.0	8.0	7.0	6.0	5.0
7.5	-	-	11.5	10.0	8.5	7.0
5.0	-	-	-	-	-	-
2.5	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

c)

Load current (A)	PK 9260 35 A Thermal resistance (K/W)					
35.0	1.6	1.4	1.2	0.9	0.7	0.4
31.5	2.0	1.7	1.4	1.2	0.9	0.6
28.0	2.4	2.1	1.8	1.5	1.2	0.9
24.5	3.0	2.6	2.3	1.9	1.5	1.2
21.0	3.8	3.3	2.9	2.5	2.0	1.6
17.5	4.9	4.4	3.8	3.3	2.7	2.0
14.0	6.6	5.9	5.0	4.5	3.8	3.0
10.5	9.5	8.5	7.5	6.5	5.5	4.6
7.0	-	-	-	-	-	7.6
3.5	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

d)

Load current (A)	PK 9260 50 A / 50 A Hi I²t Thermal resistance (K/W)					
50	0.8	0.7	0.6	0.4	0.3	0.2
45	1.0	0.9	0.8	0.6	0.5	0.3
40	1.3	1.2	1.0	0.8	0.6	0.5
35	1.7	1.5	1.3	1.1	0.9	0.7
30	2.2	2.0	1.7	1.4	1.2	0.9
25	3.0	2.6	2.3	2.0	1.7	1.3
20	4.0	3.7	3.3	2.8	2.4	1.9
15	6.0	5.5	4.9	4.2	3.6	3.0
10	10.0	9.0	8.0	7.0	6.0	5.0
5	-	-	-	-	-	-
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

e)

Load current (A)	PK 9260 72 A Thermal resistance (K/W)					
72.0	0.7	0.6	0.5	0.4	0.3	-
64.8	0.9	0.8	0.7	0.5	0.4	0.3
57.6	1.1	1.0	0.8	0.7	0.5	0.4
50.4	1.5	1.3	1.1	0.9	0.7	0.4
43.2	1.9	1.6	1.4	1.2	1.0	0.7
36.0	2.4	2.2	1.9	1.6	1.3	1.1
28.8	3.3	3.0	2.6	2.2	1.9	1.5
21.6	4.8	4.3	3.8	3.3	2.8	2.3
14.4	7.8	7.0	6.2	5.5	4.7	3.9
7.2	-	-	-	-	-	8.6
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

f)

Load current (A)	PK 9260 88 A Thermal resistance (K/W)					
88.0	0.6	0.5	0.4	0.3	-	-
79.2	0.7	0.6	0.5	0.4	0.3	-
70.4	0.9	0.8	0.7	0.6	0.4	0.3
61.6	1.2	1.0	0.9	0.7	0.6	0.4
52.8	1.5	1.3	1.1	1.0	0.8	0.6
44.0	2.0	1.8	1.5	1.3	1.1	0.9
35.2	2.7	2.4	2.1	1.8	1.5	1.2
26.4	3.9	3.5	3.1	2.7	2.3	1.9
17.6	6.3	5.7	5.0	4.4	3.8	3.1
8.8	-	-	-	9.7	8.3	7.0
	20	**30**	**40**	**50**	**60**	**70**
	Ambient temperature (°C)					

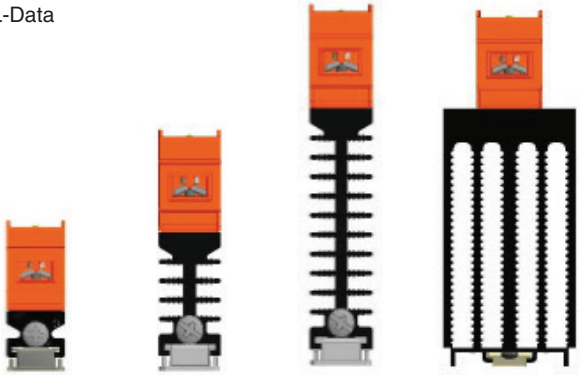
Solid-state with optimised heat sink
We recommend the following combination of solid-state relay and heat-sink depending on the load current and an ambient temperature of 40° C.

If the solid-state relays are used at ambient temperature above 40°C the load current has to be reduced according to the current reduction (A/°C see table).

Example:
Operation at T_U = 45°C; heat sink for 15 A with 0.3 A / °C
Current reduction: 5°C x 0.3 A / °C = 1.5 A
Max. load current: 15 A - 1.5 A = 13.5 A

Factory mounted heat sink

*) UL-Data



/00
7,5 A*)
10,0 A

/03
15,0 A*)
15,0 A

/04
20,0 A*)
20,0 A

/05
35,0 A*)
40,0 A

/07
25,0 A*)
30,0 A

/07
25,0 A cumulative*)
30,0 A cumulative

/07
25,0 A cumulative*)
30,0 A cumulative

/06
50,0 A*)
50,0 A

/06
50,0 A cumulative*)
50,0 A cumulative

/06
50,0 A cumulative*)
50,0 A cumulative

/16
- *)
88,0 A

/16
- *)
88,0 A cumulative

/16
- *)
88,0 A cumulative

General Technical Data

For variant /16:	Operationg voltage fan DC 24 V	
Operating mode:	Continuous operation (Current reduction above 40 °C)	
Temperature range		
Operation:	- 25 ... 60° C	
Storage:	- 25 ... 85° C	
Relative air humidity:	< 95 % non-condensing at 40 °C	
Clearance and creepage distances		
Rated impulse voltage / pollution degree:	6 kV / 3	IEC/EN 60664-1
EMC:	IEC/EN 61 000-6-4,	IEC/EN 61000-4-1
Electrostatic discharge (ESD):	8 kV air / 6 kV contact	IEC/EN 61000-4-2
HF irradiation:	10 V / m	IEC/EN 61000-4-3
Fast transients:	2 kV	IEC/EN 61000-4-4
Surge voltages		
Control circuit between A1 / A2:	1 kV	IEC/EN 61000-4-5
Between output and ground:	2 kV	IEC/EN 61000-4-5
HF-wire guided	10 V	IEC/EN 61000-4-6
Interference suppression:	Limit value class A	IEC/EN 60947-4-3
Degree of protection:	IP 20	IEC/EN 60529
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60068-2-6
Housing material:	PBT/PC flame resistant; UL 94 V0	
Base plate:	Aluminum, copper nickle-plated	
Mounting screws:	M4 x 20 mm	
Mounting torque:	2.5 Nm	
Connections load circuit /_ _ 0:	Mounting screws M4 Pozidrive 1 PT	
Mounting torque:	2.5 Nm	
Wire cross section:	2 x 1.5 ... 2.5 mm² solid or 2 x 2.5 ... 6 mm² solid oder 2 x 1.0 ... 2.5 mm² stranded wire with sleeve 2 x 2.5 ... 6 mm² stranded wire with sleeve 1 x 10 mm² stranded wire with sleeve	
Connections load circuit /_ _ 1:	Mounting screws M5	
Mounting torque:	2.5 Nm	
Cable lug (DIN 46234):	5 - 2.5; 5 - 6; 5 - 10; 5 - 16; 5 - 25	
Connections control circuit:	Mounting screws M3 Pozidrive 2 PT	
Mounting torque:	0.6 Nm	
Wire cross section:	1 x 0.5 ... 2.5 mm² solid or 2 x 0.5 ... 1.0 mm² solid or 1 x 0.5 ... 2.5 mm² stranded wire with sleeve	
Connections control circuit:	Cage clamp terminals	
Wire cross section:	0.2 ... 2.5 mm² solid or 0.25 ... 2.5 mm² 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		
Without heat sink:	Approx. 80 g	
With heat sink		
Load current		
10 A /00	Approx. 150 g	
15 A /03	Approx. 225 g	
20 A /04	Approx. 305 g	
30 A /07	Approx. 475 g	
40 A /05	Approx. 575 g	
50 A /06	Approx. 785 g	
88 A /16	Approx. 895 g	

Dimensions

Width x height x depth

Without heat sink

With screw terminals:	22.5 x 85 x 50 mm
With cable lug terminals:	22.5 x 139 x 50 mm

With heat sink

Load current	
10 A /00	22.5 x 99 x 68.4 mm
15 A /03	22.5 x 99 x 92.0 mm
20 A /04	22.5 x 99 x 131.0 mm
30 A /07	67.5 x 136 x 77.4 mm
40 A /05	45.0 x 105 x 135.0 mm
50 A /06	67.5 x 136 x 127.0 mm
88 A /16	67.5 x 161.6 x 127.0 mm

UL-Data acc. to UL508

Input
Wire connection:

Control circuit:	60°C / 75°C copper conductors only AWG 26 - 14 Sol/Str
Load circuit:	75°C copper conductors only AWG 14 - 8 Sol /Str 2.5 Nm

Note:
Control input AC 100 ... 240 V:
In the user circuit a surge arrester L/C SPD (VZCA/7) or R/C SPD (VZCA2/8) with min. 240V AC, 50/60Hz, VPR=2500V, type 1 or 2 or 3 with a discharge current of not less then 2000 A has to be installed.

More remarks for UL-Listed devices:
For the use in applications with pollution class 2

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Standard Type

PK 9260.91 AC 48 ... 480 V 25 A DC 4 ... 32 V

Article number:	0064884
• Load voltage:	AC 48 ... 480 V
• Load current:	25 A
• Control voltage:	DC 4 ... 32 V
• Width:	22.5 mm

Variants

PK 9260 .91 / _ _ _ / _ _ / 001

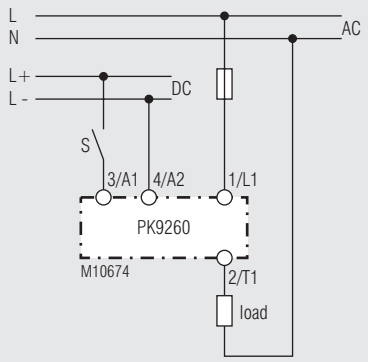
- 001 With removable cage clamp terminals on A1/A2
- _ _ Free Without heat sink
  - 00 With DIN rail adapter
  - 03 With heat sink 10 A
  - 04 With heat sink 20 A
  - 05 With heat sink 40 A
  - 06 With heat sink 50 A
  - 07 With heat sink 30 A
  - 16 With heat sink and fan 88A
- _ _ _
  - 0 M4 flat terminal
  - 1 M5 screw terminal (cable lug)
  - 2 M5 cable lug terminal (cable lug)
- _ _ _
  - 0 Switching at zero crossing
  - 1 Instantaneous switching
- _ _ _
  - 0 Standard
  - 1 With high I^2t-value

Ordering Examles for Variants

PK 9260.91 /1 0 0 /04 AC 48 ...480 V 20 A DC 4 ... 32 V

- DC 4 ... 32 V Control voltage
- 20 A Load current
- AC 48 ...480 V Load voltage
- /04 With heat sink 20 A
- /1 M4 flat terminal
- 0 Switching at zero crossing
- 0 With high I^2t-value
- PK 9260.91 Type

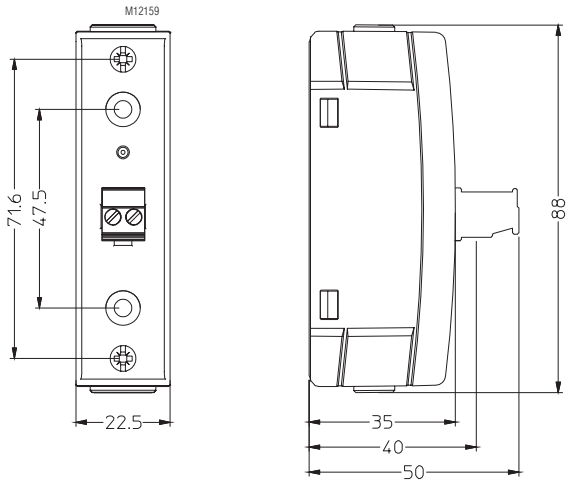
Connection Example



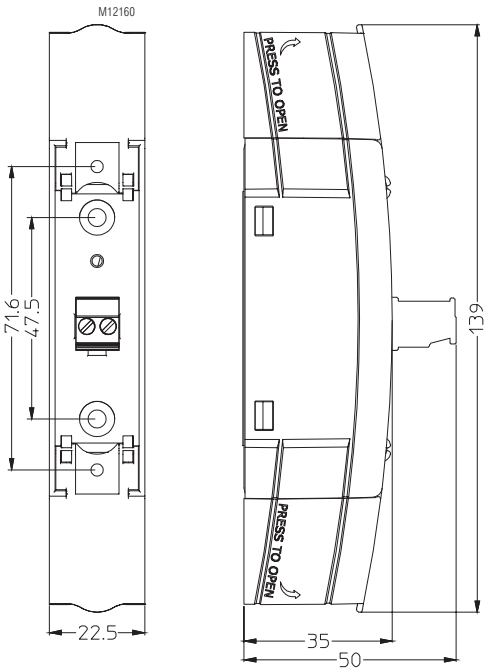
Single-phase

Dimensions

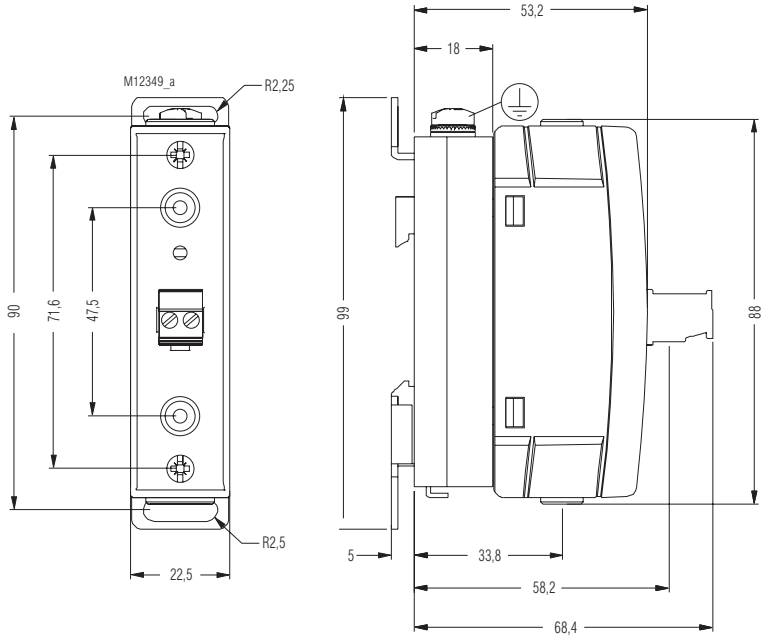
Flat terminals
PK 9260.91/_ _0



Screw terminals / cable lug terminals
PK 9260.91/_ _1

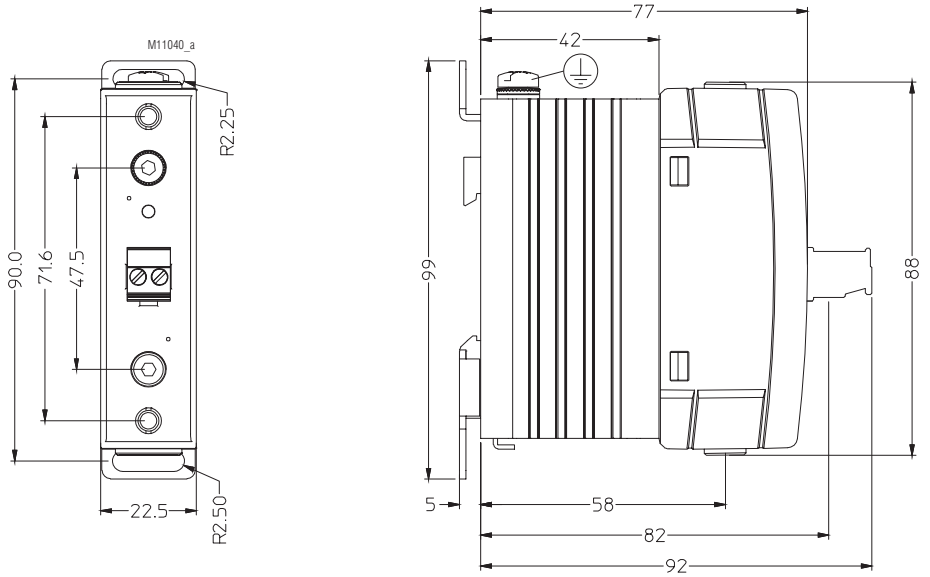


With DIN-rail adapter
PK 9260.91/_ _0/00

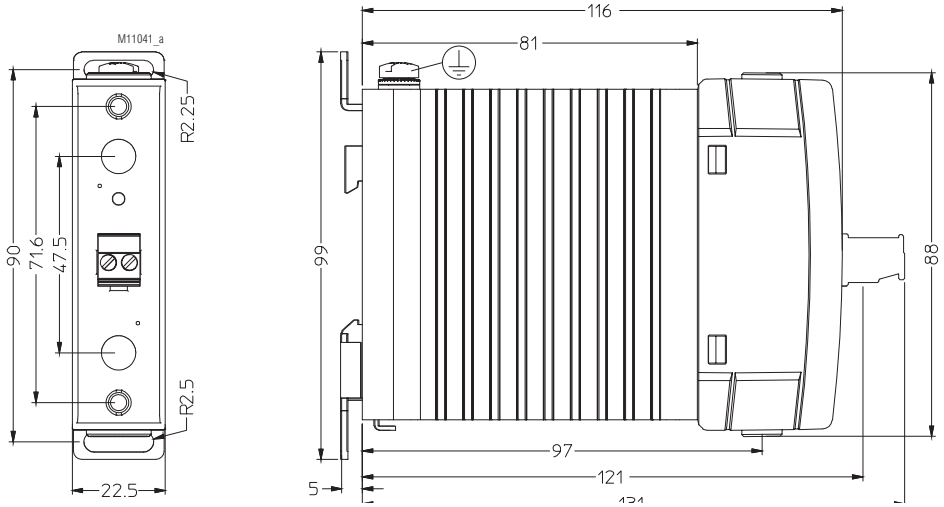


Dimensions

PK 9260.91/_ _0 /03

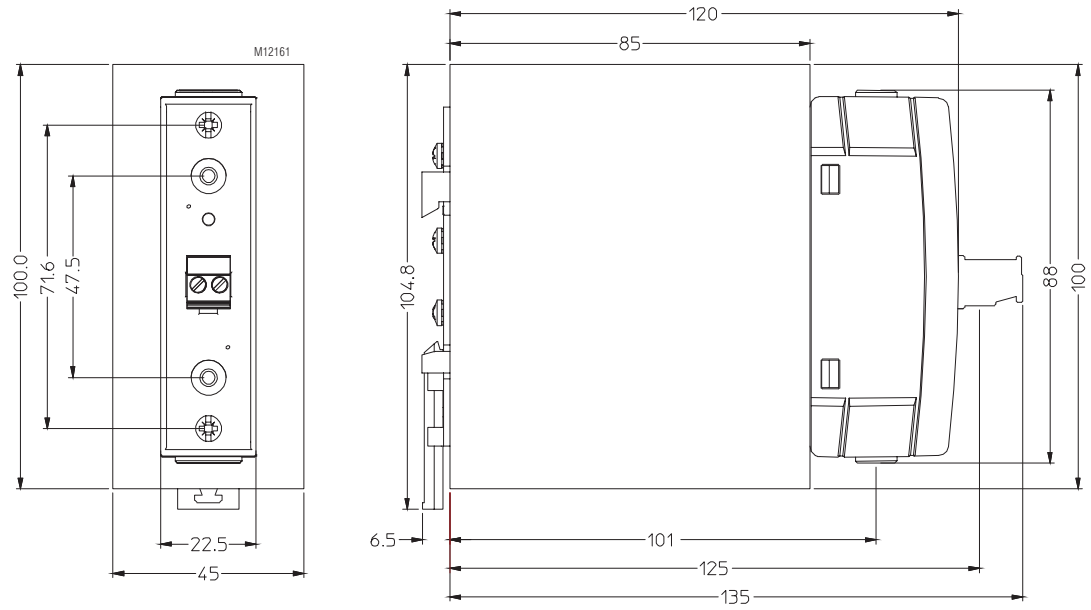


PK 9260.91/_ _0 /04

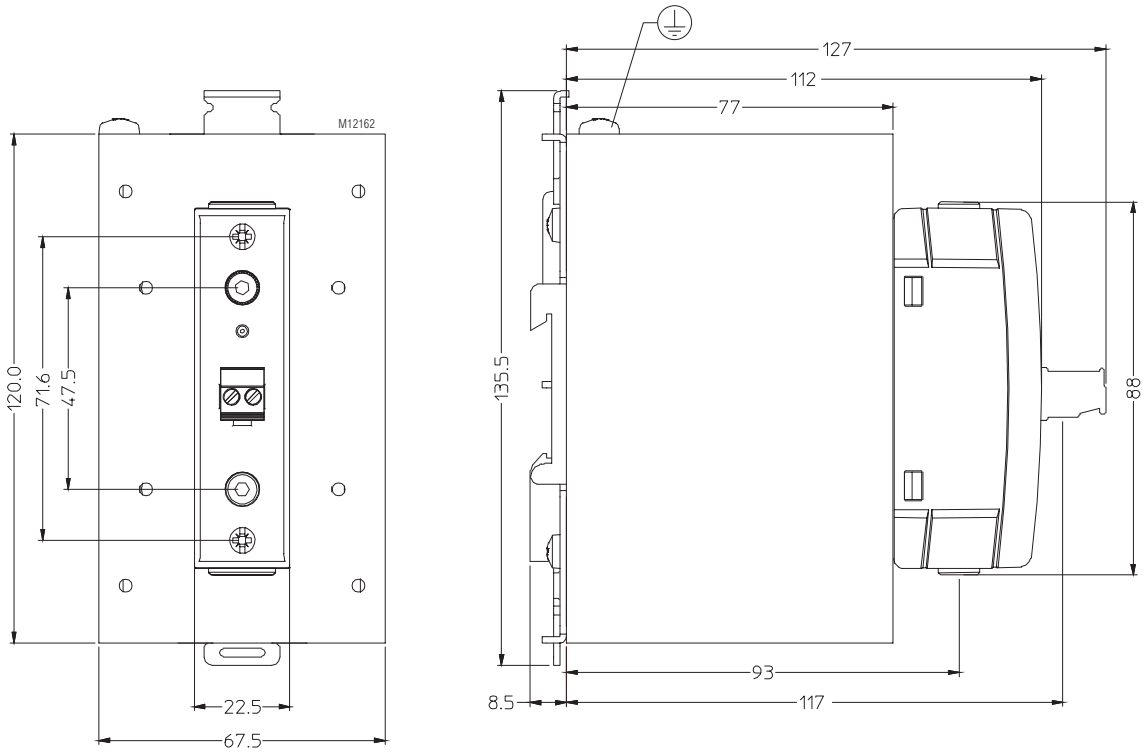


Dimensions

PK 9260.91/_ _0 /05

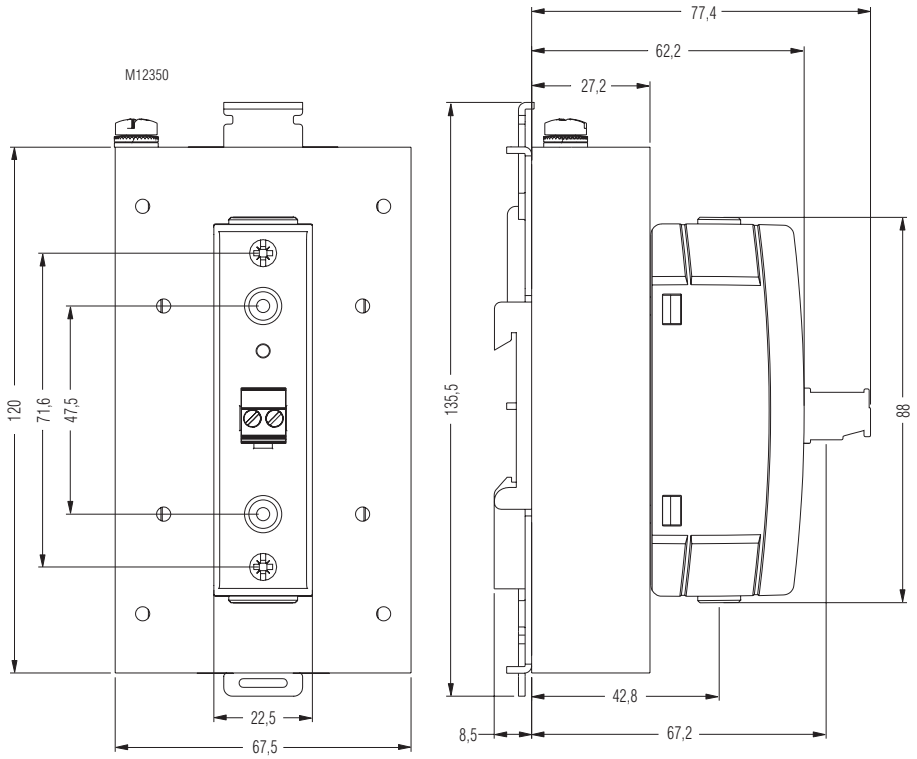


PK 9260.91/_ _0 /06



Dimensions

PK 9260.91/_ _0 /07



PK 9260.91/_ _0 /16