RM1E

1-pole, solid state relay anolog switching

RM1E..AA

RM1E..V

Main features

- AC Solid State Relay
- Analog switching (phase-angle control) for resistive and slightly inductive load applications
- 4 - 20 mA or 0 -10 V control input
- Rated operational current: 25, 50, 100 and 125 AACrms
- Rated operational voltage: Up to 600 VACrms
- Variable intensity LED-indication according to input current
- Integral snubber network
- Polarized lockable control connector for safe connection for voltage controlled version

Description

The analog switching relay works in accordance with the phase angle control principle, i.e., the output switching point in the AC sine wave depends on the control input which can be either 4-20 mA or 0-10 VDC.

4 mA or 0 VDC corresponds to zero output power whilst 20 mA or 10 VDC corresponds to full output power (near linear power response). The relay switches off every time the output current crosses zero and switches ON in accordance with the applied control input.

Applications

Plastic injection machines, Extrusion machines, Blow moulding machines, Thermoformers, Dryers, Electrical ovens, Fryers, Shrink tunnels, Air handling units, Sterilisation equipment, Climatic chambers, Ovens and furnaces, Ambient heating.

Main functions

- 1-pole phase angle switching
- Proportional output with current control (4-20 mA) or voltage control (0-10 V)
- 4kV isolation input to output

Order code

RM1E □□□□□

Enter the code option instead of □. Refer to the Selection guide section for valid part numbers.

Code	Option	Description	Comments
RM	-	Solid state relay	
1	-	1-pole switching	
E	E	Analog switching	
□	23	Rated voltage: 90-280 VAC	Max. 265 VAC for RM1E..V..
	48	Rated voltage: 200-550 VAC	
	60	Rated voltage: 410-660 VAC	
□	AA	Control input: 4-20 mADC	
	V	Control input: 0-10 VDC	RM1E..V.. require an external supply voltage
□	25	Rated operational current: 25 AAC	
	50	Rated operational current: 50 AAC	
	100	Rated operational current: 100 AAC	
	125	Rated operational current: 125 AAC	

Selection guide

Rated voltage, Blocking voltage	Control voltage	Maximum rated operational current			
		25 AAC (525 A²s)	50 AAC (1800 A²s)	100 AAC (6600 A²s)	125 AAC (18000 A²s)
230 VAC, 650 Vp	4-20 mA	RM1E23AA25	RM1E23AA50	RM1E23AA100	RM1E23AA125
	0-10 VDC	RM1E23V25	RM1E23V50	RM1E23V100	RM1E23V125
480 VAC, 1200 Vp	4-20 mA	RM1E48AA25	RM1E48AA50	RM1E48AA100	RM1E48AA125
	0-10 VDC	RM1E48V25	RM1E48V50	RM1E48V100	RM1E48V125
600 VAC, 1400 Vp	4-20 mA	RM1E60AA25	RM1E60AA50	RM1E60AA100	-
	0-10 VDC	RM1E60V25	RM1E60V50	RM1E60V100	-

Carlo Gavazzi compatible components

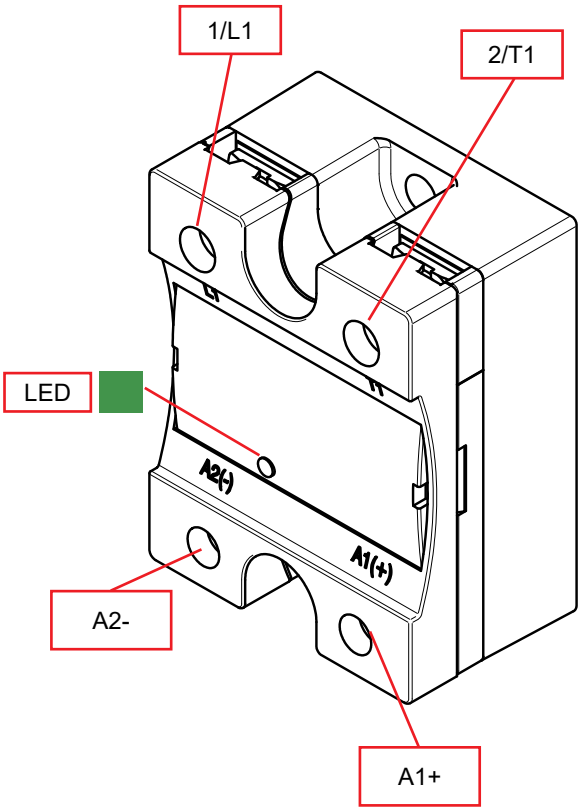
Description	Component code	Notes
FASTON terminals	RM48F*, RM63F*	- Faston tabs, F0 = flat 0°, F4 = angled 45°, pack size: 20 pieces
Cable	RCS3-100-1	- Cable accessory for RM1E..V, 3-wire, 100cm long
Fork terminals	RM635FK, RM635FKP	- Terminal adaptors for 35mm² cable, pack size: 10 pieces
Thermal pads	KK071CUT	- Graphite thermal pad with adhesive on one side, pack size: 50 pieces
Touch safety cover	RMIP20	- IP20 protection degree, pack size: 20 pieces
Heatsinks	RHS	- Heatsink and accessories
Mounting screws kit	SRWKITM5X10MM	- M5 x 10 mm with captivated washer, pack size: 20 pieces

Carlo Gavazzi further reading

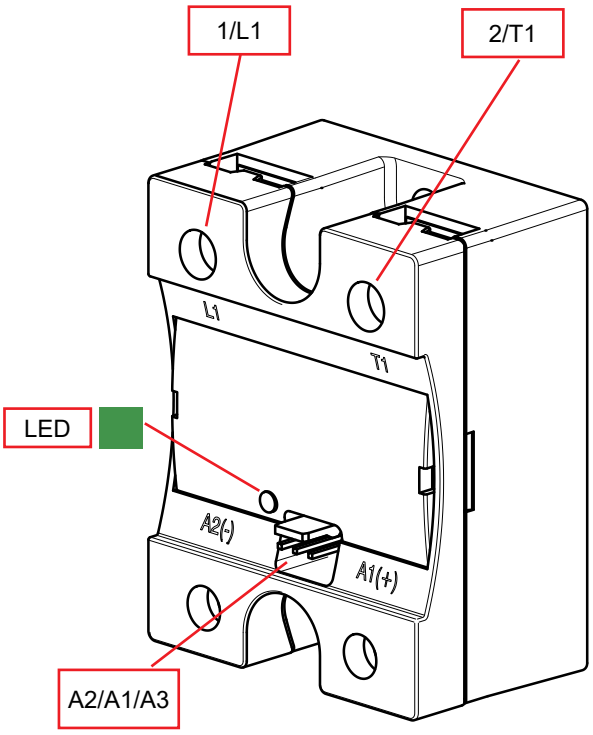
Information	Where to find it	Notes
Datasheet	https://gavazziautomation.com/images/PIM/DATASHEET/ENG/SSR_Accessories.pdf	Solid state relay Accessories (including Heatsinks)
	https://www.gavazziautomation.com/en-global/products/solid-state-relays/heatsink-selector-tool	Online Heatsink selector tool

Structure

RM1E..AA



RM1E..V



Element	Component	Function
1/L1	Power connection	Mains connection
2/T1	Power connection	Load connection
A1+, A2-	Control connection	Terminals for current input (RM1E..AA..)
A1, A2, A3	Control connection	Terminals for voltage input (RM1E..V..)
LED	ON indicator	Indicates presence of control input

Features

General data

Material	Noryl, black	
Mounting	Panel mount	
Touch Protection	IP20	
Baseplate	25 A, 50 A 100 A, 125 A	Aluminium Copper, nickel-plated
Overvoltage Category	III, 6 kV (1.2/50 µs) rated impulse withstand voltage	
Isolation	Input and Output to case Input to Output	4000 Vrms 4000 Vrms
Weight	25 A, 50 A 100 A, 125 A	approx. 60g approx. 100g

Performance

Output specifications

	RM1E..25	RM1E..50	RM1E..100	RM1E..125
Max. operational current[1]: AC-51 @ Ta=25°C	25 AAC	50 AAC	100 AAC	125 AAC
Operational frequency range	45 to 65 Hz			
Leakage current @ rated voltage	<3 mAAC			
Minimum operational current	150 mAAC	250 mAAC	400 mAAC	500 mAAC
Repetitive overload current t=1 s	< 55 AAC	< 125 AAC	< 150 AAC	< 200AAC
Non-repetitive surge current (I_{TSM}), t=10 ms	325 Ap	600 Ap	1150 Ap	1900 Ap
I^2t for fusing (t=10 ms), minimum	525 A^2s	1800 A^2s	6600 A^2s	18000 A^2s
Power factor	>0.75 at rated voltage			
Critical dV/dt (@Tj init = 40°C)	1000 V/µs			
General use endurance testing acc. to UL 508[2]	100,000 cycles	100,000 cycles	100,000 cycles	6,000 cycles

1: with appropriate heatsink. Refer to Heatsink selection section for further details.
2: UL requirement for General Use Endurance Testing is 6,000 cycles.

Output voltage specifications

	RM1E23..	RM1E48..	RM1E60..
Operational voltage range **RM1E..AA** **RM1E..V**	 90 to 280 VACrms 90 to 265 VACrms	 200 to 550 VACrms 200 to 550 VACrms	 410 to 660 VACrms 410 to 660 VACrms
Blocking voltage	650 Vp	1200 Vp	1400 Vp

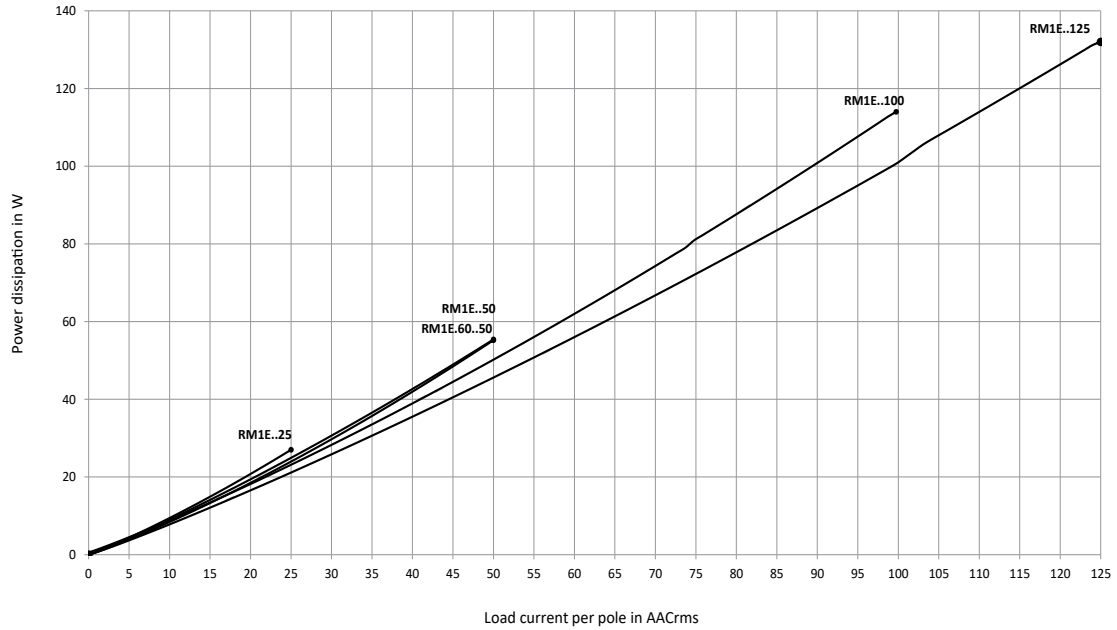
Inputs specifications

Current controlled input	RM1E..AA
Control current range (A1-A2)	4-20 mADC
Pick-up current	4.2 mADC
Drop-out current	4.1 mADC
Response time (input to output)	≤ 20 ms
Voltage drop	< 10 VDC @ 20 mA
Dynamic impedance	≥ 330 Ω
Max. allowable input current	50 mA
Reverse polarity protected	Yes

Voltage controlled input	RM1E..V
Supply voltage, Vss (A3-A2)	24 VDC ±20%
Max. supply current	15 mA @ 19.2 VDC 20 mA @ 30 VDC
Control voltage, Vcc (A1-A2)	0-10 VDC
Pick up voltage	0.2 VDC
Drop out voltage	0.1 VDC
Control input current	0.15 mA @10 VDC
Response time (input to output)	≤ 20 ms
Supply reverse protected	Yes

Note: The use of twisted pair cable for the control input is recommended

Output power dissipation



Heatsink selection

With the output fully ON (360° conduction angle).

Thermal resistance [°C/W] of RM1E..25

Load current [A]	Surrounding ambient temperature [°C]					
	20	30	40	50	60	70
25.0	3.23	2.80	2.37	1.94	1.51	1.09
22.5	3.70	3.21	2.73	2.24	1.75	1.26
20.0	4.30	3.74	3.17	2.61	2.05	1.49
17.5	5.07	4.41	3.76	3.10	2.44	1.78
15.0	6.12	5.33	4.54	3.75	2.96	2.17
12.5	7.58	6.61	5.64	4.66	3.69	2.72
10.0	9.80	7.19	6.14	5.08	4.02	2.97
7.5	13.5	11.8	10.09	8.37	6.66	4.94
5.0	nh	18.3	15.7	13.04	10.39	7.74
2.5	nh	nh	nh	nh	nh	nh

Thermal resistance [°C/W] of RM1E..50

Load current [A]	Surrounding ambient temperature [°C]					
	20	30	40	50	60	70
50.0	1.25	1.07	0.88	0.70	0.52	0.34
45.0	1.46	1.25	1.04	0.84	0.63	0.42
40.0	1.73	1.49	1.25	1.01	0.77	0.52
35.0	2.08	1.80	1.51	1.23	0.94	0.66
30.0	2.56	2.22	1.87	1.53	1.18	0.84
25.0	3.24	2.81	2.38	1.95	1.52	1.09
20.0	4.26	3.71	3.15	2.59	2.03	1.47
15.0	5.99	5.22	4.45	3.67	2.90	2.12
10.0	9.49	8.27	7.06	5.85	4.64	3.43
5.0	nh	17.5	15.0	12.4	9.91	7.39

Thermal resistance [°C/W] of RM1E60..50

Load current [A]	Surrounding ambient temperature [°C]					
	20	30	40	50	60	70
50.0	0.99	0.81	0.63	0.44	0.26	0.08
45.0	1.28	1.07	0.86	0.65	0.44	0.23
40.0	1.64	1.40	1.15	0.91	0.67	0.42
35.0	2.11	1.82	1.54	1.25	0.96	0.67
30.0	2.60	2.25	1.90	1.55	1.20	0.85
25.0	3.30	2.86	2.43	1.99	1.55	1.11
20.0	4.36	3.79	3.22	2.65	2.08	1.51
15.0	6.1	5.4	4.6	3.77	2.97	2.18
10.0	9.76	8.52	7.3	6.0	4.8	3.54
5.0	nh	nh	15.47	12.85	10.24	7.6

Thermal resistance [°C/W] of RM1E..100

Load current [A]	Surrounding ambient temperature [°C]					
	20	30	40	50	60	70
100.0	0.60	0.52	0.43	0.34	0.26	0.17
90.0	0.74	0.64	0.54	0.44	0.34	0.24
80.0	0.91	0.79	0.68	0.56	0.45	0.33
70.0	1.09	0.96	0.82	0.68	0.55	0.41
60.0	1.33	1.16	1.00	0.83	0.66	0.50
50.0	1.66	1.45	1.24	1.04	0.83	0.62
40.0	2.16	1.89	1.62	1.35	1.08	0.81
30.0	3.01	2.64	2.26	1.88	1.51	1.13
20.0	4.73	4.14	3.55	2.96	2.37	1.78
10.0	9.94	8.70	7.45	6.21	4.97	3.73

nh' means no heatsink necessary. The SSR should still be tightened to a surface to ensure optimal thermal dissipation.

Heatsink selection (continued)

Thermal resistance [°C/W] of RM1E..125

Load current [A]	Surrounding ambient temperature [°C]					
	20	30	40	50	60	70
125.0	0.63	0.55	0.47	0.40	0.32	0.24
112.5	0.73	0.64	0.54	0.45	0.36	0.27
100.0	0.84	0.74	0.63	0.52	0.42	0.32
87.5	0.99	0.87	0.74	0.62	0.50	0.37
75.0	1.20	1.05	0.90	0.75	0.60	0.45
62.5	1.48	1.30	1.11	0.93	0.74	0.56
50.0	1.92	1.68	1.44	1.20	0.96	0.72
37.5	2.65	2.32	1.98	1.65	1.32	0.99
25.0	4.12	3.60	3.09	2.57	2.06	1.54
12.5	8.55	7.48	6.41	5.34	4.27	3.21

Thermal data

	RM1E..25	RM1E..50	RM1E60..50	RM1E..100	RM1E..125
Max. junction temperature	125°C	125°C	125°C	125°C	125°C
Max. heatsink temperature	100°C	100°C	100°C	100°C	100°C
Junction to case thermal resistance, R_{thjc}	<0.80°C/W	<0.50°C/W	<0.72°C/W	<0.35°C/W	<0.30°C/W
Case to heatsink thermal resistance, R_{thcs}[3]	< 0.20°C/W	< 0.20°C/W	< 0.20°C/W	<0.10°C/W	<0.10°C/W

3. Thermal resistance case to heatsink values are applicable upon application of a fine layer of silicon based thermal paste HTS02S from Electrolube between SSR and heatsink

Compatibility and conformance

Approvals	
Standards compliance	LVD: EN 60947-4-3 EMCD: EN 60947-4-3 cURus: UL508 Recognized (E80573), NRNT2, NRNT8 CSA: C22.2 No.14, (204075)
UL short circuit current rating	65k Arms (refer to short circuit current section, Type 1 – UL508)

Electromagnetic compatibility (EMC) - Immunity	
Electrostatic discharge (ESD)	EN/IEC 61000-4-2 8 kV air discharge, 4 kV contact (PC2)
Radiated radio frequency	EN/IEC 61000-4-3 10 V/m, from 80 MHz to 1 GHz (PC1) 10 V/m, from 1.4 to 2 GHz (PC1) 3 V/m, from 2 to 2.7 GHz (PC1)
Electrical fast transient (burst)	EN/IEC 61000-4-4 Output: 2 kV, 5 kHz (PC2) Input: 1 kV, 5 kHz (PC2)
Conducted radio frequency	EN/IEC 61000-4-6 10 V/m, from 0.15 to 80 MHz (PC1)
Electrical surge	EN/IEC 61000-4-5 Output, line to line: 1 kV (PC2) Output, line to earth: 1 kV (PC2) Output, line to earth: 2 kV (PC2, with external for RM1E60..V..) Input, line to line: 1 kV (PC2) Input, line to earth: 2 kV (PC2)
Voltage dips	EN/IEC 61000-4-11 0% for 0.5, 1 cycle (PC2) 40% for 10 cycles (PC2) 70% for 25 cycles (PC2) 80% for 250 cycles (PC2)
Voltage interruptions	EN/IEC 61000-4-11 0% for 5000 ms (PC2)

Electromagnetic compatibility (EMC) - Emissions	
Radio interference field emission (radiated)	EN/IEC 55011 Class B: from 30 to 1000 MHz
Radio interference voltage emissions (conducted)	EN/IEC 55011 Class A: from 0.15 to 30 MHz (External filter may be required)

Note:

- Use of AC solid state relays may, according to the application and the load current, cause conducted radio interferences. Use of mains filters may be necessary for cases where the user must meet E.M.C requirements. The capacitor values given inside the filtering specification tables should be taken only as indications, the filter attenuation will depend on the final application.
- The manufacturer has set the maximum allowable deviation under the influence of RFI to +/- 1.0% FSD or +/-1 step in distributed modes.
- Control input lines must be installed together to maintain products' susceptibility to Radio Frequency interference.

- Performance Criteria 1 (PC1): No degradation of performance or loss of function is allowed when the product is operated as intended.
- Performance Criteria 2 (PC2): During the test, degradation of performance or partial loss of function is allowed. However when the test is complete the product should return operating as intended by itself.
- Performance Criteria 3 (PC3): Temporary loss of function is allowed, provided the function can be restored by manual operation of the controls.

Environmental specifications

Operating temperature	-20°C to +70°C (-4°F to +158°F)
Storage temperature	-20°C to +100°C (-4°F to +212°F)
Relative humidity	95% non-condensing @ 40°C
Pollution degree	2
Installation altitude	0-1000 m. Above 1000 m derate linearly by 1% of FLC per 100 m up to a maximum of 2000 m
Vibration resistance	5g / axis (2-100Hz, IEC 60068-2-6, EN 50155, EN 61373)
Impact resistance	15/11 g/ms (EN 50155, EN 61373)
EU RoHS compliant	Yes
China RoHS	

The declaration in this section is prepared in compliance with People's Republic of China Electronic Industry Standard SJ/T11364-2014: Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products.

Part Name	**Toxic or Harardous Substances and Elements**					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Power Unit Assembly	x	O	O	O	O	O

O: Indicates that said hazardous substance contained in homogeneous materials fot this part are below the limit requirement of GB/T 26572.

X: Indicates that said hazardous substance contained in one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

这份申明根据中华人民共和国电子工业标准
SJ/T11364-2014：标注在电子电气产品中限定使用的有害物质

零件名称	有毒或有害物质与元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴化联苯 (PBB)	多溴联苯醚 (PBDE)
功率单元	x	O	O	O	O	O

O:此零件所有材料中含有的该有害物低于GB/T 26572的限定。

X: 此零件某种材料中含有的该有害物高于GB/T 26572的限定。

Short circuit protection

Protection Co-ordination, Type 1 vs Type 2:

Type 1 protection implies that after a short circuit, the device under test will no longer be in a functioning state. In Type 2 co-ordination the device under test will still be functional after the short circuit. In both cases, however the short circuit has to be interrupted. The fuse between enclosure and supply shall not open. The door or cover of the enclosure shall not be blown open. There shall be no damage to conductors or terminals and the conductors shall not separate from terminals. there shall be no breakage or cracking of insulating bases to the extent that the integrity of the mounting of live parts is impaired. Discharge of parts or any risk of fire shall not occur.

The product variants listed in the table hereunder are suitable for use on a circuit capable of delivering not more than 65,000 Arms Symmetrical Amperes, 600Volts maximum when protected by fuses. Tests at 65,000A were performed with Class J, fast acting: please refer to the table below for maximum allowed ampere rating of the fuse. Use fuses only.

Protection co-ordination Type 1 according to UL 508				
Part No.	**Prospective short circuit current [kArms]**	**Max. fuse size [A]**	**Class**	**Voltage [VAC]**
RM1E..25	65	30	J or CC	Max. 600
RM1E..50..		30 20	J HSJ20(Mersen)*	
RM1E..100		80 60	J HSJ60(Mersen)*	
RM1E..125		125 60	J HSJ60(Mersen)*	

Protection co-ordination Type 2 (IEC/EN 60947-4-3)				
Part No.	**Prospective short circuit current [kArms]**	**Mersen***		**Size**
		Max. fuse size [A]	**Part number**	
RM1E.xx.25..(xx=23 or 48)	10	25	6.9gRB 10-25	10.3 x 38
RM1E.60..25		20	6.9gRB 10-20	10.3 x 38
RM1E.xx.50.. (xx=23)		50	6.9zz CP gRC 14x51/50	14 x 51
RM1E.xx.50.. (xx=48 or 60)		50	6.9zz CP gRC 22x58/50	22 x 58
RM1E.xx.100.. (xx=23 or 48)		100	6.9zz CP gRC 22x58/100	22 x 58
RM1E.60.100..		80	6.9zz CP gRC 22x58/80	22 x 58
RM1E.xx.125.. (xx=23 or 48)		125	6.921 CP URGD 27x60/125	27 x 60

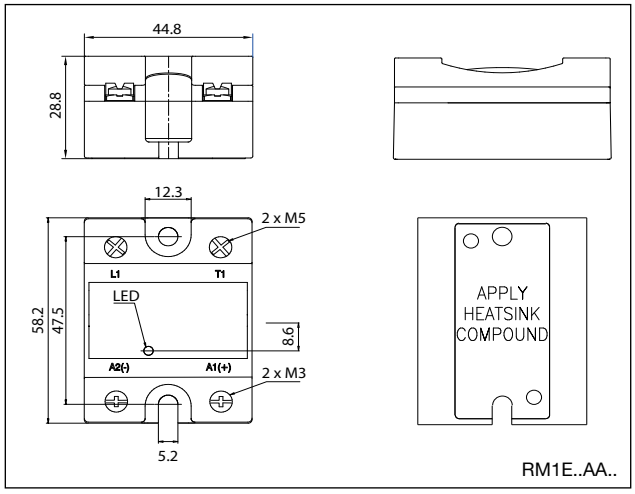
zz = 00, without fuse trip indication,
zz = 21, with fuse trip indication.
* formerly Ferraz Shawmut

Protection co-ordination Type 2 with Minature Circuit Breakers (M.C.B.s)				
Solid State Relay type	**ABB Model no. for Z - type M. C. B. (rated current)**	**ABB Model no. for B - type M. C. B. (rated current)**	**Wire cross sectional area [mm^2]**	**Minimum length of Cu wire conductor [m][4]**
RM1E..25	S201 - Z4 (4A)	S201 - B2 (2A)	1.0 1.0 1.5	21.0 21.0 31.5
	S201 - Z6 UC (6A)	S201 - B2 (2A)		
RM1E..50	S201 - Z10 (10A)	S201-B4 (4A)	1.0 1.5 2.5	7.6 11.4 19.0
	S201 - Z16 (16A)	S201-B6 (6A)	1.0 1.5 2.5 4.0	5.2 7.8 13.0 20.8
	S201 - Z20 (20A)	S201-B10 (10A)	1.5 2.5	12.6 21.0
	S201 - Z25 (25A)	S201-B13 (13A)	2.5 4.0	25.0 40.0
	S202 - Z25 (25A)	S202-B13 (13A)	2.5 4.0	19.0 30.4
RM1E..100	S201 - Z20 (20A)	S201-B10 (10A)	1.5 2.5 4.0	4.2 7.0 11.2
	S201 - Z32 (32A)	S201-B16 (16A)	2.5 4.0 6.0	13.0 20.8 31.2
	S202 - Z20 (20A)	S202-B10 (10A)	1.5 2.5 4.0	1.8 3.0 4.8
	S202 - Z32 (32A)	S202-B16 (16A)	2.5 4.0 6.0 10.0	5.0 8.0 12.0 20.0
	S202 - Z50 (50A)	S202-B25 (25A)	4.0 6.0 10.0	14.8 22.2 37.0
RM1E..125	S201-Z50 (50A)	S201-B25 (25A)	4.0 6.0 10.0 16.0	4.8 7.2 12.0 19.2
	S201-Z63 (63A)	S201-B32 (32A)	6.0 10.0 16.0	7.2 12.0 19.2

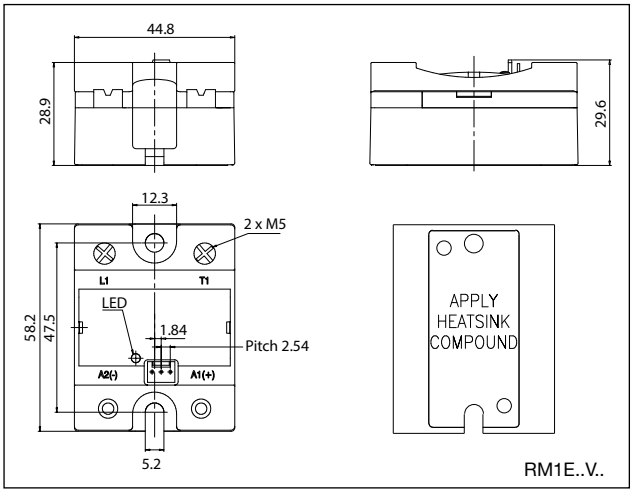
4. Between MCB and Load (including return path which goes back to the mains).

Note: A prospective current of 6 kA and a 230 / 400 V power supply is assumed for the above suggested specifications. For cables with different cross section than those mentioned above please consult Carlo Gavazzi's Technical Support Group.

Dimensions

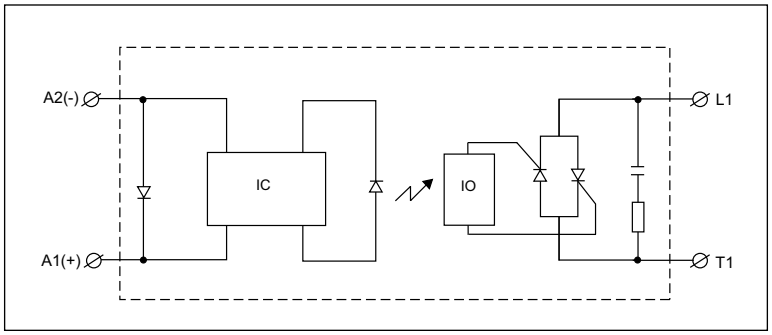


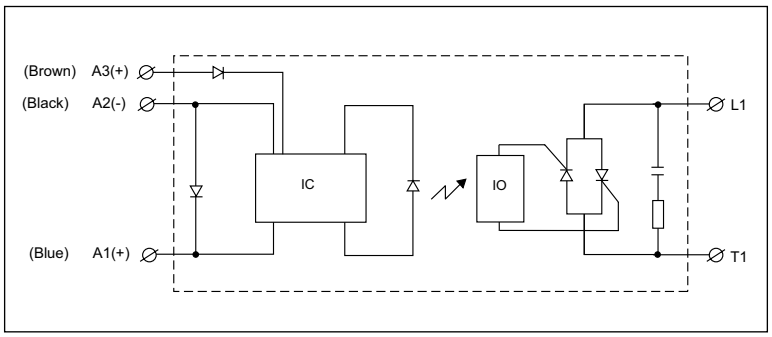
All dimensions in mm



All dimensions in mm

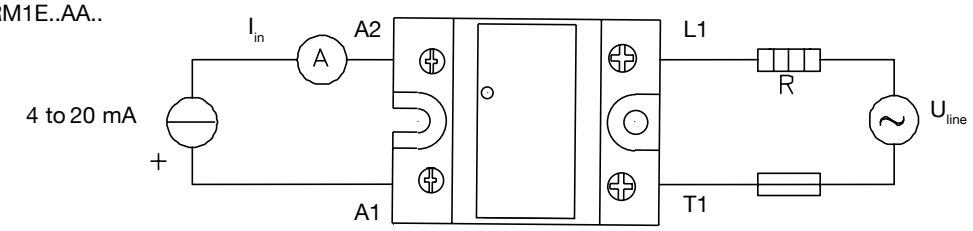
Functional diagram



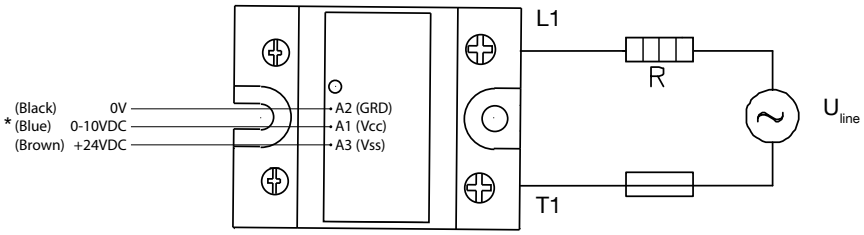


Connection diagram

RM1E..AA..



RM1E..V..

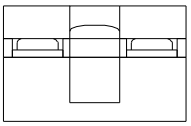
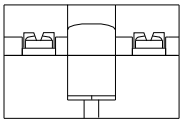
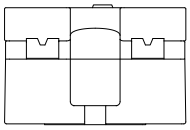
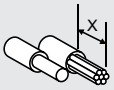


* color reference linked to cable accessory RCS3-100-1

Transfer Characteristics
Output power as a function of control output

Control current (mA)	Control voltage (VDC)	Output power (%)
4	0	0
8	2.5	25
12	5	50
16	7.5	75
20	10	99

Connection specifications

Connection terminals	1/L1, 2/T1		RM1E..AA A1, A2	RM1E..V A1, A2, A3
				
Mounting screws (SSR to heatsink)	M5, not provided with SSR (refer to **SRWKITM5X10MM** in the Compatible components section)			
Mounting torque (SSR to heatsink)	1.5 - 2.0 Nm (13.3 - 17.7 lb-in)			
Connection type	M5 screw with captivated washer		M3 screw with captivated washer	3 pins, pitch 2.54 mm square pin 0.64” Accessory: **RCS3-100-1** terminated cable
Stripping length	12 mm		8 mm	
Rigid (solid & stranded) UR/CSA rated data 	1x 2.5 – 6.0 mm² 1x 14 – 10 AWG	2x 2.5 – 6.0 mm² 2x 14 – 10 AWG	1x 0.5 – 2.5 mm² 1x 18 – 12 AWG	
Flexible with end sleeve 	1x 1.0 – 4.0 mm² 1x 18 – 12 AWG	2x 1.0 – 2.5 mm² 2x 2.5 – 4.0 mm² 2x 18 – 14 AWG 2x 14 – 12 AWG	1x 0.5 – 2.5 mm² 1x 18 – 12 AWG	
Flexible without end sleeve 	1x 1.0 – 6.0 mm² 1x 18 – 10 AWG	2x 1.0 – 2.5 mm² 2x 2.5 – 6.0 mm² 2x 18 – 14 AWG 2x 14 – 10 AWG		
Torque specifications 	Pozidriv, PZ2 2.4 Nm (21.2 lb-in)		Pozidriv, PZ1 0.5 Nm (4.4 lb-in)	
Aperture for termination lug (fork or ring)	12 mm		7.5 mm	