Semiconductor contactors, Solid-state relays

Content

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Semiconductor contactor R100.xx and R300.xx
Solid-state relays R111, R12x and R31x
Benefits and advantages

R100.xx range

R100.20

R100.45

R300.xx range

R 300.20

R111 range

R111/45

R12x range

R122/50

R31x range

R311/25

- **Compact design**
- **Zero voltage or instantaneous tripping**
- **LED display**
- **Protected against electric shock**
- **Integrated heat sink**
- **Ready for use**
- **Mounting on 35 mm DIN rail or screw mounting on plate**

Properties

- Load current range 20 A, 30 A and 45 A
- DC control
- Single-pole, thre-pole
- Switching by thyristors
- Peak inverse voltage 1200 V
- Insulation voltage > 4000 V
- Connecting terminals for 2 x 2.5 mm² or 1 x 4 mm²

Special properties

- The semiconductor relay R100.45-SG is internally protected against overload with overload signaling via signaling output.
- Cables with a conductor cross section up to 1 x 25 mm² can be connected to the output terminals of the semiconductor relays R100.45 and R100.45-SG.

Application

- Contactless and wear-free switching of ohmic and inductive 1-phase and 3-phase AC loads with high switching frequency.

Approvals

- Depending on the device:

- **Standard design**
- **Zero voltage tripping, radio interference supressed**
- **LED display**
- **Screw mounting or snap-on mounting with adapter for 35 mm DIN rail according to DIN EN 50022**

Properties

- R11x and R12x range - load side:
  Thyristors for AC-51 and AC-53 up to 690 V AC and 100 A
- R31x - load side:
  Alternistor for AC-51 and AC-53 up to 530 V AC and 50 A with internal RC circuit and overvoltage protection
- Electrical isolation by means of optocoupler between control circuit and load circuit
- Protection against electric shock:
  R111 and R115 range with additional terminal cover
- Control side protected against reversed polarity

Special properties of R31x range

- Screw mounting

Application

- Contactless and wear-free switching of 1-phase and 3-phase AC loads up to a power factor of cos φ = 0.5.

Approvals

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Semiconductor contactor
R100.xx and R300.xx range
Ordering details

2CDC 301 006 F 0003

R 100.20

2CDC 301 007 F 0003

R 100.30-ZS

2CDC 301 008 F 0003

R 100.45

2CDC 301 005 F0004

R 300.20

R100.xx range

- Compact design
- Zero voltage and instantaneous switching
- Rated operating voltage V_e 42-660 V AC
- LED for status indication
- Current ranges: 20 A, 30 A, 45 A (thyristors)
- Integrated heat sink, ready for use
- Mounting on 35 mm DIN rail or screw mounting on plate
- Cage terminal with integrated protection against electric shock (touch proof)

Type	Rated control circuit voltage V_c	Rated load current I_e max.	AC51 at 25 °C	AC53a at 25 °C	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg/lb
Zero voltage switching, width: 22.5 mm								
R100.20	4-32 V DC	20 A	20 A	5 A	1SAR 111 020 R 8607	1		0.25/0.55
Instantaneous switching, width: 22.5 mm								
R100.30-IO	4,5-32 V DC	30 A	30 A	15 A	1SAR 113 030 R 8607	1		0.25/0.55
Zero voltage switching, width: 22.5 mm								
R100.30-ZS	4-32 V DC	30 A	30 A	15 A	1SAR 111 030 R 8607	1		0.25/0.55
Zero voltage switching, width: 45 mm								
R100.45	4-32 V DC	45 A	45 A	20 A	1SAR 111 045 R 8607	1		0.49/1.08
Zero voltage switching, width: 45 mm, with integrated overtemperature protection and signalling output								
R100.45-SG	4-32 V DC	45 A	45 A	20 A	1SAR 111 045 R 9607	1		0.49/1.08

R300.xx range NEW

- Compact design
- Zero voltage switching
- Rated operating voltage V_e 40-660 V AC
- LED for status indication
- Current ranges: 3 x 20 A, 3 x 25 A (thyristors)
- Integrated heat sink, ready for use
- Mounting on 35 mm DIN rail or screw mounting on plate
- Cage terminal with integrated protection against electric shock (touch proof)

Type	Rated control circuit voltage U_c	Rated load current I_e max.	AC51 at 25 °C	AC53a at 25 °C	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg/lb
Zero voltage switching, width: 45 mm								
NEW R300.20	4.5-32 V DC	3x20 A	3x20 A	3x15 A	1SAR 131 020 R8207	1		0,38/0.84
Zero voltage switching, width: 45 mm								
NEW R300.25	4.5-32 V DC	3x25 A	3x25 A	3x15 A	1SAR 131 030 R8207	1		0,68/0.15

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Solid-state relays
R111, R12x and R31x range
Ordering details


2CDC 301 001 F 0003

R111/45


2CDC 301 002 F 0003

R111/20


2CDC 301 004 F 0003

R120/25


1SAR 111 025 F 4609

R 126/25


2CDC 301 005 F 0003

R122/50


1SAR 131 025 F4814

R 311/25

R111 range

- Standard design
- Single-phase
- Zero voltage switching
- Cost-saving

Type	Rated control circuit voltage V_c	Rated load current I_e AC1	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg/lb
Load voltage: 24-280 V AC						
R111/25	3-32 V DC	25 A	1SAR 111 025 R 0102	1		0.11/0.24
R111/45	3-32 V DC	50 A	1SAR 111 050 R 0102	1		0.11/0.24
Load voltage: 42-530 V AC						
R111/20	3-32 V DC	25 A	1SAR 111 025 R 0106	1		0.11/0.24
R111/40	3-32 V DC	50 A	1SAR 111 050 R 0106	1		0.11/0.24
R111/90	3-32 V DC	90 A	1SAR 111 090 R 0106	1		0.11/0.24

R12x range

- Standard design with protection against electric shock (touch proof)
- Zero voltage switching
- Single-phase
- LED for status indication
- Same basis dimensions and drilling distances as for the standard series (easy interchangeability)

Type	Rated control circuit voltage V_c	Rated load current I_e AC1	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg/lb
Load voltage: 24-265 V AC						
R120/25	3-32 V DC	25 A	1SAR 111 025 R 4609	1		0.06/0.13
R120/50	3-32 V DC	50 A	1SAR 111 050 R 4609	1		0.06/0.13
Load voltage: 42-530 V AC						
R121/25	4-32 V DC	25 A	1SAR 111 025 R 4606	1		0.06/0.13
R121/50	4-32 V DC	50 A	1SAR 111 050 R 4606	1		0.06/0.13
R121/75	4-32 V DC	75 A	1SAR 111 075 R 4606	1		0.10/0.22
R121/100	4-32 V DC	100 A	1SAR 111 100 R 4606	1		0.10/0.22
R126/25	24-265 V AC / 24-48 V DC	25 A	1SAR 111 025 R 4707	1		0.06/0.13
R126/50	24-265 V AC / 24-48 V DC	50 A	1SAR 111 050 R 4707	1		0.06/0.13
R126/75	24-265 V AC / 24-48 V DC	75 A	1SAR 111 075 R 4707	1		0.10/0.22
R126/100	24-265 V AC / 24-48 V DC	100 A	1SAR 111 100 R 4707	1		0.10/0.22
Load voltage: 42-660 V AC						
R122/50	4-32 V DC	50 A	1SAR 111 050 R 4607	1		0.06/0.13
R122/75	4-32 V DC	75 A	1SAR 111 075 R 4607	1		0.10/0.22
R122/100	4-32 V DC	100 A	1SAR 111 100 R 4607	1		0.10/0.22

R31x range

- Standard design
- Zero voltage switching
- Three-phase
- LED for status indication
- Integrated protection against electric shock (no additional terminal cover necessary)
- Same basis dimensions and drilling distances as for the standard series (easy interchangeability)

Load voltage: 12-530 V AC

Type	Rated control circuit voltage V_c	Rated load current I_e AC1	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg/lb
R311/25	10-40 V DC	25 A	1SAR 131 025 R 4814	1		0.38/0.84
R311/55	10-40 V DC	55 A	1SAR 131 055 R 4814	1		0.38/0.84
R315/55	20-265 V AC/DC	55 A	1SAR 131 055 R 4914	1		0.38/0.84

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Solid-state relays - Accessories
Heat sink KK
Ordering details

KK-2,6

2CDC 301 011 F 0003

KK-R111-2,1

2CDC 301 012 F 0003

KK-R111-1,5

2CDC 301 013 F 0003

KK-R111-0,7

2CDC 301 014 F 0003

Heat sink for single-phase solid-state relays R111, R120, R121, R122, R126

Type	Description	Order code	Pack. unit pieces	Price 1 piece	Weight 1 piece kg/lb
For screw mounting on mounting plate					
KK-2,6	Heat sink 2,6 K/W[1]	GHR 110 9401 P 0001	1		0.12/0.26
KK-1,8	Heat sink 1,8 K/W[1]	GHR 110 9401 P 0002	1		0.20/0.44
KK-0,7	Heat sink 0,7 K/W[1]	GHR 110 9404 P 0001	1		0.65/1.43
For DIN rail mounting					
KK-R111-2,1	Heat sink 2,1 K/W[1]	GHR 110 9402 P 0001	1		0.29/0.64
KK-R111-1,5	Heat sink 1,5 K/W[1]	GHR 110 9405 P 0001	1		0.42/2.20
KK-R111-0,7	Heat sink 0,7 K/W[1]	GHR 110 9406 P 0001	1		1.02/2.20
KK-R111-0,5	Heat sink 0,5 K/W[1]	GHR 110 9407 P 0001	1		1.30/2.86

Heat sink for three-phase solid-state relays R311, R315

For DIN rail mounting

KK-R311-0,8	Heat sink 0,8 K/W[1]	GHR 310 9401 P 0001	1		1,00/2.20

Further accessories

	Terminal cover for single-phase relays R111, R115	GHR 110 6605 P 0001	1		0.05/0.11
	Rapid-fastening plate for single-phase solid-state relays	GHR 110 1105 R 0001	1		0.045/0.01
	Rapid-fastening plate for three-phase solid-state relays	GHR 310 1105 R 0001	1		0.05/0.11
EMV - 100	EMC filter for single-phase solid-state relays	GHR 110 0000 R 0001	1		0.10/0.22
EMV - 300	EMC filter for three-phase solid-state relays	GHR 310 0000 R 0001	1		0.10/0.22
TP-01	Heat transfer foil for single-phase relays	GHR 110 9500 P 0001	1		0.001/0.002
TP-03	Heat transfer foil for three-phase relays	GHR 310 9500 P 0001	1		0.005/0.011

[1] Use heat transfer paste or heat transfer foil TP-01 or TP-03 when mounting solid-state relays.

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Semiconductor contactors
R100.xx range
Technical data

Type	R100.20	R100.30-IO	R100.30-ZS	R100.45	R100.45-SG
Output circuit					
Switching element	Thyristor				
Rated operating voltage V_e (V_{eff}max)	42-660 V AC				
Period. peak inverse voltage (V_{peak})	1200 V_{pp}				
Rated load AC-51 at Ta = 25 °C	20 A AC	30 A AC		45 A AC	
current AC-53a at Ta = 25 °C	5 A AC	15 A AC		20 A AC	
Operating frequency	45-65 Hz				
Max. off-state leakage current (at V_{max} and T = 25 °C)	< 3 mA_{rms}				
Minimum load current	350 mA	150 mA		150 mA	
Max. surge current I_{TSM} (t = 10 ms)	250 A	400 A		1150 A	
Max. overcurrent (t = 1 s)	< 35 A AC	< 125 A AC		< 125 A AC	
Max. load integral $\int i^2dt$ (t = 10 ms)	310 A^2s	1800 A^2s		6600 A^2s	
Conducting state voltage at I_{max} and T = 25 °C (V_{peak})	1.6 V_{rms}				
Critical current gradient di/dt	≥ 10 A/µs	≥ 100 A/µs		≥ 150 A/µs	
Permissible commutating voltage gradient du/dt	500 V/µs				
Permissible static voltage gradient du/dt	500 V/µs				
Input circuit					
Control voltage	4-32 V DC	4-32 V DC	4.5-32 V DC	4.5-32 V DC	4-32 V DC
Make voltage max.	3.8 V DC	3.8 V DC	4.25 V DC	4.25 V DC	3.8 V DC
Inverse polarity voltage		32 V DC			
Break voltage min.	1.2 V DC	1.2 V DC	1 V DC	1 V DC	1.2 V DC
Input current (at V_{max}) max.	12 mA	12 mA	15 mA	15 mA	12 mA
Turn-on time max.	1 period	1 period	1 s	1 s	1 period
Turn-off time max.	1 period				
General data					
Power factor (cos φ)	≥ 0.5 (at 600 V AC)				
Operating temperature	-30 °C ...+80 °C				
Storage temperature	-40 °C ... 100 °C				
Barrier-layer temperature	125 °C				
Proof voltage	4000 V				
Dielectric strength	4000 V				
Cond. cross section input terminals	max.2 x 2.5 mm^2 / 1 x 4 mm^2				
Cond. cross section output terminals	max.2 x 2.5 mm^2 /1 x 4 mm^2 1 x 25 mm^2 (R100.45)				

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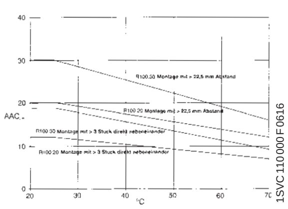
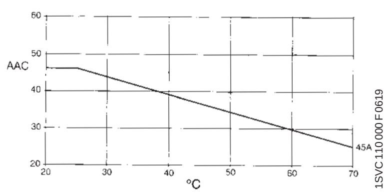
Load limit curves

Load current at ambient temperature

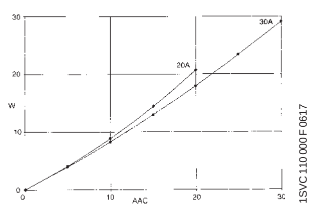


R100.20 / R100.30

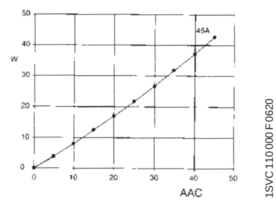


R100.45

Dissipation at load current



R100.20 / R100.30



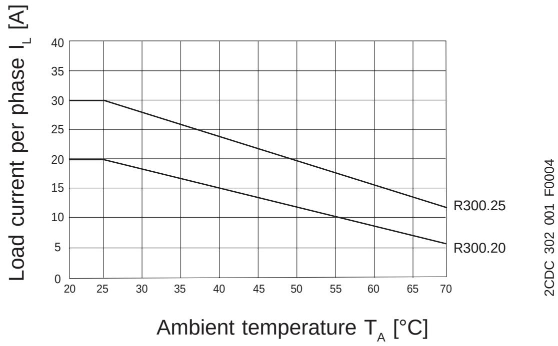
R100.45

Semiconductor contactors
R300.xx range
Technical data

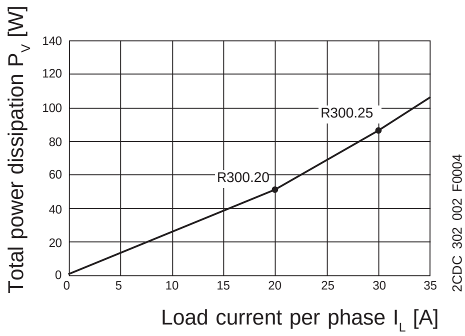
Type	R300.20	R300.25
Output circuit		
Switching element	Thyristor	
Rated operating voltage	40-660 V AC	
Period. peak inverses voltage (V_{peak})	1200 V_{pp}	
Rated load current AC-51	3x20 A	3x25 A
at Ta = 25 °C AC-53a	3x15 A	3x15 A
Operating frequency	45-65 Hz	
Max. off-state leakage current (at V_{rms} and operational frequency)	< 3 mA	
Minimum load current	150 mA	
Max. surge current (T = 25 °C, t = 10 ms)	600 Apk	
Max. overcurrent (t = 1 s)	< 125 A	
Max. load integral $\int i^2 dt$ (t = 10 ms)	1800 A^2s	
Conducting state voltage at I_{rms}	1.6 V_{rms}	
Critical current gradient di/dt	≥ 100 A/µs	
Permissible commutating voltage gradient du/dt	500 V/µs	
Permissible static voltage gradient du/dt	500 V/µs	
Input circuit		
Control voltage	5-32 V DC	
Make voltage	4.7 V DC	
Inverse polarity voltage	-32 V DC	
Break voltage	1.2 V DC	
Maximum input current	24 mA	
Turn-on time	< 1 periode	
Turn-off time	< 1 periode	
General data		
Power factor (cos φ)	≥ 0.5 (at 600 V AC)	
Operating temperature	-30 °C ...+70 °C	
Storage temperature	-40 °C ... +80 °C	
Rated insulation voltage Input to output	≥ 4000 V_{rms} AC	
Output to case	≥ 4000 V_{rms} AC	
Conductor cross section rigid	0.5-4.0 mm^2 (20-12 AWG)	
stranded with wire end ferrules	0.5-2x2.5 mm^2 (20-2x12 AWG)	
Approvals	UL, cULus CSA (pending)	

Load limit curves

Derating curve



Dissipation curve



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Solid-state relays
R111 range
Technical data

Type	R111/25	R111/45	R111/20	R111/40	R111/90
Output circuit					
Switching element	Thyristor				
Rated operating voltage V_e (V_{eff}max)	24-280 V AC		42-530 V AC		
Period. peak inverse voltage (V_{peak})	650 V_{pp}		1200 V_{pp}		
Rated load current AC-51 AC-53a	25 A_{rms} 5 A_{rms}	50 A_{rms} 15 A_{rms}	25 A_{rms} 5 A_{rms}	50 A_{rms} 15 A_{rms}	90 A_{rms} 20 A_{rms}
Operating frequency	45-65 Hz				
Max. off-state leakage current (at V_{max} and T = 25 °C)	3 mA				
Minimum load current	20 mA_{rms}				
Max. surge current I_{TSM} (t = 20 ms)	250 A	600 A	250 A	600 A	1000 A
Max. overcurrent (t = 1 s)	55 A	125 A	55 A	125 A	150 A
Max. load integral $\int i^2dt$ (t = 10 ms)	310 A^2s	1800 A^2s	310 A^2s	1800 A^2s	5000 A^2s
Conducting state voltage at I_{max} and T = 25 °C (V_{peak})	1.6 V				
Permissible voltage gradient du/dt	500 V/µs				
Critical current gradient di/dt	100 A/s				
Thermal resistance barrier/base max.	1.25 K/W	0.65 K/W	1.25 K/W	0.65 K/W	0.3 K/W
Thermal resistance barrier/ambient max.	12 K/W				
Input circuit					
Control voltage	3-32 V DC				
Make voltage max.	3 V DC				
Break voltage min.	1 V DC				
Input impedance	1.5 kΩ				
Max. input current (at V_{max})	-				
Turn-on time max.	0.5 periods				
Turn-off time max.	0.5 periods				
Input circuit					
Power factor (cos φ)	0.5-1[1)]				
Operating temperature	-20 °C ... +70 °C				
Barrier-layer temp.	125 °C				
Storage temperature	-40 °C ... 100 °C				
Proof voltage	4000 V				
Dielectric strength	4000 V				

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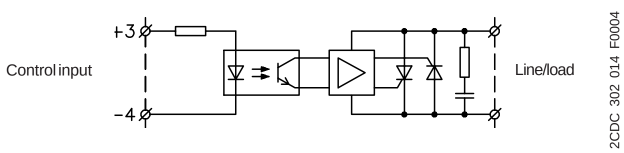
Circuit diagram R111



1) If the limit values are observed, the solid-state relays are suitable for switching inductive loads.

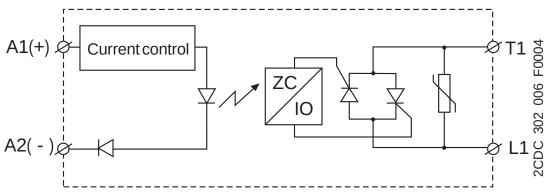
Solid-state relays
R12x range
Technical data

Type	R120/25	R120/50	R121/25 R126/25	R121/50 R126/50	R121/75 R126/75	R121/100 R126/100	R122/50	R122/75	R122/100
Output circuit									
Switching element	Thyristor								
Rated operating voltage V_e (V_{rms}max)	24-265 V AC		42-530 V AC				42-660 V AC		
Period. peak inverse voltage (V_{peak})	650 V_{pp}		1200 V_{pp}		1600 V_{pp}				
Rated load current AC-51 AC-53a	25 A_{rms} 5 A_{rms}	50 A_{rms} 15 A_{rms}	25 A_{rms} 5 A_{rms}	50 A_{rms} 15 A_{rms}	75 A_{rms} 20 A_{rms}	100 A_{rms} 30 A_{rms}	50 A_{rms} 15 A_{rms}	75 A_{rms} 20 A_{rms}	100 A_{rms} 30 A_{rms}
Operating frequency	45-65 Hz								
Max. off-state leakage current (at V_{max} and T = 25 °C)	3 mA								
Minimum load current	150 mA_{rms}								
Max. surge current I_{TSM} (t = 10 ms)	250 A	600 A	250 A	600 A	1000 A	1500 A	600 A	1000 A	1500 A
Max. overcurrent (t = 1 s)	55 A	125 A	55 A	125 A	150 A	200 A	125 A	150 A	200 A
Max. load integral $\int i^2dt$ (t = 10 ms)	310 A^2s	1800 A^2s	310 A^2s	1800 A^2s	6600 A^2s	18000 A^2s	1800 A^2s	6600 A^2s	18000 A^2s
Conducting state voltage at I_{max} and T = 25 °C (V_{peak})	1.6 V								
Permissible voltage gradient du/dt	500 V/µs								
Critical current gradient di/dt	100 A/s								
Thermal resistance barrier/base max.	0.8 K/W	0.5 K/W	0.8 K/W	0.5 K/W	0.2 K/W	0.2 K/W	0.5 K/W	0.2 K/W	0.2 K/W
Thermal resistance barrier/ambient max.	20 K/W		20 K/W			15 K/W	20 K/W		15 kW

Type	R120	R121	R122	R126	
Output circuit					
Control voltage	3-32 V DC	4-32 V DC	4-32 V DC	24-265 V AC / 24-48 V DC	
Make voltage max.	3.75 V DC			22 V AC/DC	
Break voltage min.	1 V DC			6 V AC/DC	
Input impedance	1.5 kΩ			44 kΩ	
Max. input current (at V_{max})	10 mA			5 mA	
Max. turn-on time period	0.5 ms			1 ms	
Max. turn-off time period	0.5 ms			1 ms	

Type	R12x
General data	
Power factor (cos φ)	0.5-1[1]
Operating temperature	-20 °C ... +70 °C
Barrier-layer temp.	125 °C
Storage temperature	-40 °C ... 100 °C
Proof voltage	4000 V
Dielectric strength	4000 V

Circuit diagram R12x



[1] If the limit values are observed, the solid-state relays are suitable for switching inductive loads.

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Solid-state relays
R31x range
Technical data

Typ	R311/25	R311/55	R351/55
Output circuit			
Switching element	Alternistor		
Rated operating voltage V_e (V_{rms}max)	12-530 V AC		
Period. peak inverse voltage (V_{peak})	1200 V_{pp}		
Rated load current AC51 AC53a	25 A_{rms} 5 A_{rms}	55 A_{rms} 15 A_{rms}	
Operating frequency	45-65 Hz		
Max. off-state leakage current (at V_{max} and T = 25 °C)	10 mA		
Minimum load current	100 mA	200 mA	
Max. surge current I_{TSM} (t = 20 ms)	230 A	550 A	
Max. overcurrent (t = 1 s)	37 A	85 A	
Max. load integral $\int i^2dt$ (t = 10 ms)	265 A^2s	1500 A^2s	
Conducting state voltage at I_{max} and T = 25 °C (V_{peak})	1,6 V		
Permissible voltage gradient du/dt	500 V/µs		
Critical current gradient di/dt	50 A/s	100 A/s	
Thermal resistance barrier/base max.	0.5 K/W	0.2 K/W	
Thermal resistance barrier/ambient max.	1.5 K/W	0.6 K/W	
Input circuit			
Control voltage	10-40 V DC		20-265 V AC/DC
Make voltage max.	10 V DC		20 V AC/DC
Break voltage min.	3 V DC		5 V AC/DC
Max. input current (at V_{max})	18 mA (bei 10 V DC) 28 mA (bei 40 V DC)		20 mA AC/DC
Max. turn-on time period	10 ms		10 ms
Max. turn-off time period	20 ms		40 ms
Gerneral data			
Operating temperature	-20 °C ... +70 °C		
Storage temperature	-40 °C ... 100 °C		
Barrier-layer temp.	125 °C		
Test voltage	4000 V		
Dielectric strength	4000 V		

Switching of motors with R311/R315

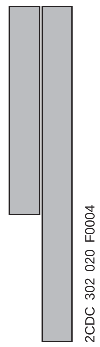
Selection tables 380/400 V

Direct start

motor power [kW]	[A_{rms}]
0,25	0,8
0,37	1,1
0,55	1,5
0,75	1,9
1,1	2,6
1,5	3,5
2,2	4,7
3,0	6,2
4,0	8,1
5,5	10,7
7,5	15,0

relay type [A]

25 55

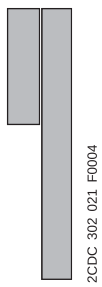


Star-delta start

motor power [kW]	[A_{rms}]
1,1	1,5
1,5	2,1
2,2	3,0
3,0	4,0
4,0	4,6
5,5	6,2
7,5	8,7
11,0	12,1
15,0	16,2

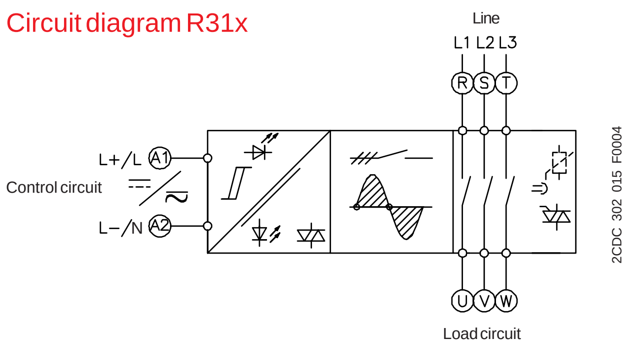
relay type [A]

25 55



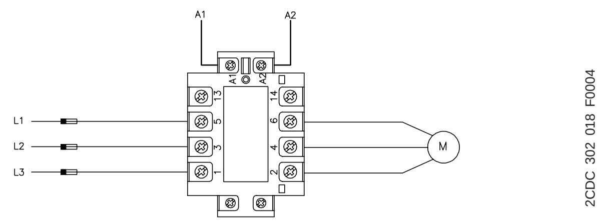
* $I/\sqrt{3}$

Circuit diagram R31x

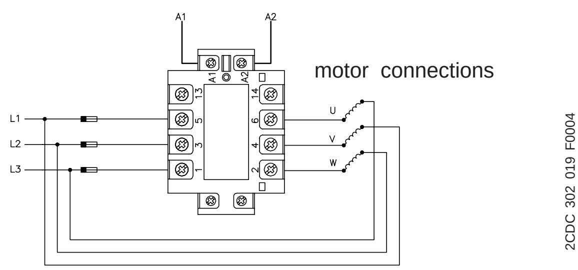


Examples of connection

Direct start



Star-delta start



7

Procedure for choosing a solid-state relay

Choosing the suitable solid-state relay is easy to do, if the following 4 questions are answered.

1. How much is the maximum load current?
2. Which control voltage is used?
3. Which load voltage is required?
4. Is the device operated continuously or in duty cycles?

Knowing these data you can easily choose a suitable relay by means of the technical data specified in this catalog.

Procedure for choosing a suitable heat sink

After having selected the relay, a heat sink suitable for the specific application has to be chosen. For this, the following two questions are of importance.

1. How much is the maximum load current?
2. How much is the ambient temperature during operation?

If you know the ambient temperature during operation, you can determine the thermal resistance between the bottom of the solid-state relay and the environment using a matrix as it is shown below. The respective matrixes for the other relays are shown on the following pages. Knowing the thermal resistance and the technical data of the heat sink, you can then choose a suitable heat sink.

load current [A]	thermal resistance [K/W]						power dissipation [W]
50,0	1,03	0,86	0,70	0,53	0,37	0,20	61
45,0	1,27	1,09	0,90	0,71	0,52	0,33	53
40,0	1,54	1,32	1,10	0,89	0,67	0,45	46
35,0	1,85	1,59	1,34	1,08	0,82	0,57	39
30,0	2,26	1,95	1,65	1,34	1,03	0,72	33
25,0	2,85	2,47	2,08	1,70	1,32	0,94	26
20,0	3,73	3,24	2,75	2,26	1,77	1,27	20
15,0	5,22	4,54	3,86	3,19	2,51	1,83	15
10,0	8,21	7,16	6,11	5,05	4,00	2,95	10
5,0	17,2	15,0	12,9	10,7	8,51	6,33	5
	20	30	40	50	60	70	

T_A ambient temperature [°C]

1SVC 110 000 F 0631

The selection of the heat sink directly affects the warming of the relay.

Relay temperature T =
ambient temperature + (dissipation * thermal resistance)

The calculated value for the relay temperature should not exceed 100 °C. Otherwise, danger of fire as well as danger of damage to the device exist.

Example

Choosing the solid-state relay:

1. The maximum load current is 30 A
2. A control voltage of 230 V AC is used
3. The load voltage is 400 V AC
4. The relay shall be used at continuous operation

→ Possible relays:
R 126/50 - R 126/75 - R 126/100
Chosen relay:
R 126/50

Choosing the heat sink:

1. The maximum load current is 30 A
2. The ambient temperature during operation is 40 °C

The thermal resistance can be determined using the load current-ambient temperature matrix.

The Y axis of the diagram shows the load current, the X axis shows the ambient temperature in °C. The thermal resistance can be read at the cross-point of the load current with the ambient temperature. In our example the thermal resistance is 1.65 K/W (kelvin/watt).

Consequently, the required heat sink must have a value of at least 1.65 K/W. Here it has to be observed that the quality of the heat sink increases with a reduction of the temperature/power ratio which means that a heat sink with a ratio of 0.5 K/W provides better heat dissipation than a heat sink with a ratio of 1.5 K/W.

The power dissipation can be read from the right column of the matrix. In our example it is 33 W.

Knowing the thermal resistance, you can now choose a suitable heat sink using the technical data.

Example 1: Heat sink KK-R111-2,1
T = 40 °C + (33 W + 2.1 K/W) = 40 °C + 69.3 °C = 109.3 °C **Too hot!**

Example 2: Heat sink KK-R111-1,5
T = 40 °C + (33 W + 1.5 K/W) = 40 °C + 49.5 °C = 89.5 °C **OK!**

Example 3: Heat sink KK-R111-0,5
T = 40 °C + (33 W + 0.5 K/W) = 40 °C + 16,5 °C = 56.5 °C ***OK!***

Due to reasons of space and costs, example 2 is the most commonly used case.

The calculated values apply for continuous duty; during cycling the heating is lower depending on the duty cycle.

7

R111 range

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
25	2	1.7	1.4	1	0.71	0.40	32
22.5	2.5	2.1	1.8	1.4	1	0.66	27
20	3.1	2.7	2.3	1.9	1.4	1	23
17.5	4.	3.5	3	2.5	2	1.4	20
15	4.9	4.3	3.7	3.1	2.5	1.9	16
12.5	6.2	5.4	4.6	3.9	3.1	2.3	13
10	8.1	7.1	6.1	5.1	4	3	10
7.5	11.3	9.9	8.5	7.1	5.6	4.2	7
5	-	15.6	13.3	11.1	8.9	6.7	5
2.5	-	-	-	-	18.7	14	2

T_A ambient temperature [°C]

2CDC 302 011 F0004

R111/20 - R111/25

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
50	0.92	0.76	0.60	0.45	0.29	-	63
45	1.2	0.99	0.80	0.62	0.44	0.26	55
40	1.5	1.3	1.1	0.85	0.63	0.42	47
35	1.9	1.6	1.4	1.1	0.89	0.63	40
30	2.4	2.1	1.8	1.5	1.2	0.91	33
25	3	2.7	2.3	1.9	1.5	1.1	26
20	3.9	3.5	3	2.5	2	1.5	20
15	5.5	4.8	4.1	3.4	2.7	2.1	15
10	8.6	7.5	6.4	5.4	4.3	3.2	9
5	17.9	15.6	13.4	11.2	8,9	6.7	4

T_A ambient temperature [°C]

2CDC 302 012 F0004

R111/40 - R111/45

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
90	0.63	0.53	0.42	0.32	-	-	97
80	0.81	0.69	0.57	0.45	0.33	-	84
70	1	0.89	0.75	0.61	0.47	0.33	71
60	1.3	1.2	1	0.83	0.66	0.49	59
50	1.7	1.5	1.3	1.1	0.85	0.64	47
40	2.2	1.9	1.7	1.4	1.1	0.83	36
30	3.1	2.7	2.3	1.9	1.5	1.2	26
20	4.8	4.2	3.6	3	2.4	1.8	17
10	10	8.8	7.5	6.3	5	3.8	8

T_A ambient temperature [°C]

2CDC 302 013 F0004

R111/90

R12x range

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
25,0	2,70	2,34	1,98	1,61	1,25	0,89	28
22,5	3,10	2,69	2,28	1,86	1,45	1,04	24
20,0	3,61	3,13	2,65	2,18	1,70	1,23	21
17,5	4,26	3,70	3,14	2,59	2,03	1,47	18
15,0	5,14	4,47	3,80	3,14	2,47	1,80	15
12,5	6,38	5,56	4,73	3,91	3,09	2,27	12
10,0	8,25	7,19	6,14	5,08	4,02	2,97	9
7,5	11,4	9,94	8,49	7,04	5,59	4,14	7
5,0	17,7	15,4	13,2	11,0	8,74	6,51	4
2,5	-	-	-	-	18,2	13,6	2

T_A ambient temperature [°C]

2CDC 302 007 F0004

R120/25 - R121/25 - R126/25

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
50,0	1,03	0,86	0,70	0,53	0,37	0,20	61
45,0	1,27	1,09	0,90	0,71	0,52	0,33	53
40,0	1,54	1,32	1,10	0,89	0,67	0,45	46
35,0	1,85	1,59	1,34	1,08	0,82	0,57	39
30,0	2,26	1,95	1,65	1,34	1,03	0,72	33
25,0	2,85	2,47	2,08	1,70	1,32	0,94	26
20,0	3,73	3,24	2,75	2,26	1,77	1,27	20
15,0	5,22	4,54	3,86	3,19	2,51	1,83	15
10,0	8,21	7,16	6,11	5,05	4,00	2,95	10
5,0	17,2	15,0	12,9	10,7	8,51	6,33	5

T_A ambient temperature [°C]

2CDC 302 008 F0004

R120/50 - R121/50 - R122/50 - R126/50

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
75,0	0,91	0,78	0,65	0,52	0,39	0,26	77
67,5	1,10	0,96	0,81	0,66	0,51	0,36	68
60,0	1,34	1,17	1,00	0,83	0,66	0,49	59
52,5	1,60	1,40	1,20	1,00	0,80	0,60	50
45,0	1,93	1,68	1,44	1,20	0,96	0,72	42
37,5	2,38	2,08	1,78	1,49	1,19	0,89	34
30,0	3,06	2,68	2,30	1,91	1,53	1,15	26
22,5	4,21	3,68	3,16	2,63	2,10	1,58	19
15,0	6,51	5,70	4,88	4,07	3,26	2,44	12
7,5	13,5	11,77	10,09	8,41	6,73	5,04	6

T_A ambient temperature [°C]

2CDC 302 009 F0004

R121/75 - R122/75 - R126/75

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	70	power dissipation P_V [W]
100,0	0,54	0,45	0,36	0,27	0,18	0,09	111
90,0	0,68	0,58	0,47	0,37	0,27	0,17	97
80,0	0,86	0,74	0,62	0,50	0,38	0,26	84
70,0	1,08	0,94	0,80	0,66	0,52	0,38	71
60,0	1,37	1,20	1,03	0,85	0,68	0,51	59
50,0	1,70	1,49	1,28	1,06	0,85	0,64	47
40,0	2,21	1,93	1,66	1,38	1,10	0,83	36
30,0	3,06	2,68	2,30	1,91	1,53	1,15	26
20,0	4,78	4,18	3,59	2,99	2,39	1,79	17
10,0	9,98	8,73	7,49	6,24	4,99	3,74	8

T_A ambient temperature [°C]

2CDC 302 010 F0004

R121/100 - R122/100 - R126/100

R31x range

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	power dissipation P_V [W]	thermal protection [°C]
25	0,46	0,36	0,26	-	-	101	70°C
22,5	0,62	0,50	0,39	0,8	-	88	80°C
20	0,81	0,68	0,55	0,42	0,28	76	
17,5	1,0	0,91	0,76	0,60	0.44	64	90°C
15	1,4	1,2	1,0	0,85	0,66	53	
12,5	1,9	1,6	1,4	1,1	0,95	43	
10	2,4	2,1	1,8	1,5	1,2	33	
7,5	3,4	3,0	2,5	2,1	1,7	24	
5	5,3	4,7	4,0	3,3	2,6	15	
2,5	11,2	9,8	8,4	7,0	5,6	7	

T_A ambient temperature [°C]

2CDC 302 016 F0004

R311/25

load current I_C [A]	thermal resistance [K/W] at T_A 20	30	40	50	60	power dissipation P_V [W]	thermal protection [°C]
55	-	-	-	-	-	215	80°C
50	0,28	-	-	-	-	191	
45	0,35	0,29	-	-	-	167	
40	0,45	0,38	0,31	-	-	145	90°C
35	0,58	0,50	0,42	0,33	0,25	123	
30	0,75	0,65	0,55	0,46	0,36	103	
25	0,96	0,84	0,72	0,60	0,48	83	
20	1,3	1,1	0,93	0,78	0,62	65	
15	1,8	1.5	1,3	1,1	0,85	47	
10	2,7	2,.4	2,0	1,7	1,4	30	
5	5,5	4,8	4,1	3,5	2,8	15	

T_A ambient temperature [°C]

2CDC 302 017 F0004

R311/55 - R315/55

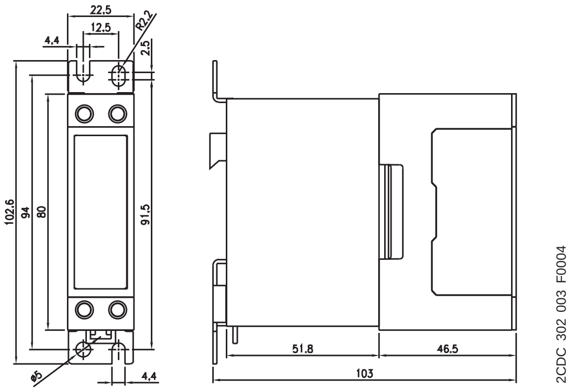
7

Semiconductor contactor R100.xx and R300.xx
Solid-state relays R111, R12x and R31x
Dimensional drawings

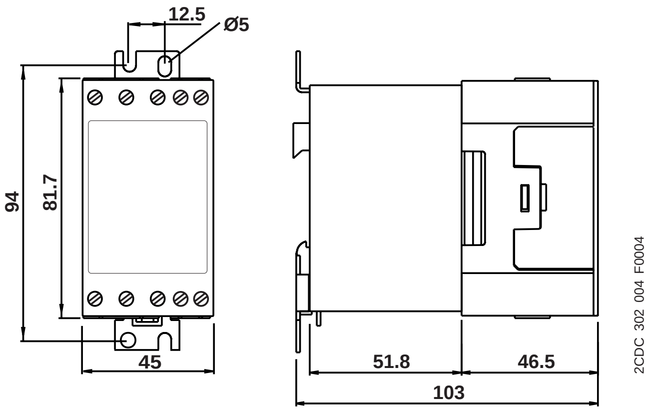
Dimensional drawings

Dimensions in mm

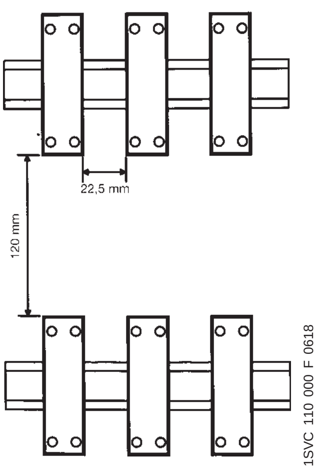
Semiconductor contactors



R100.20, R100.30

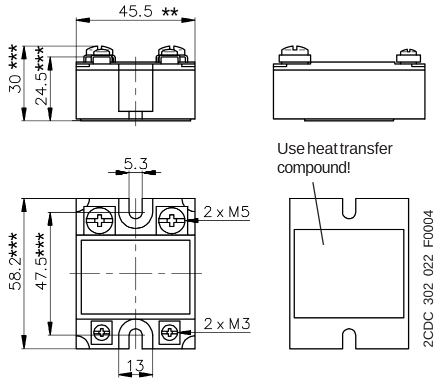


R100.45, R100.45-SG
R300.20, R300.25



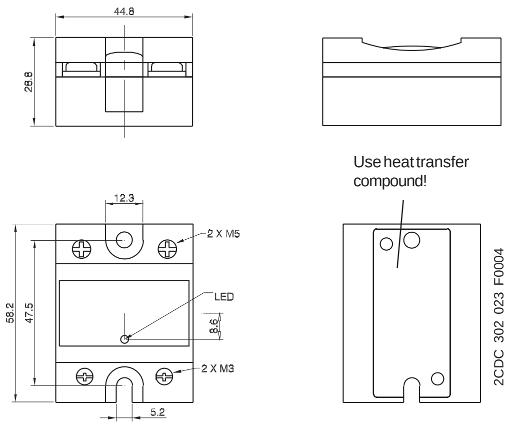
DIN rail mounting for R100.xx

Solid-state relays

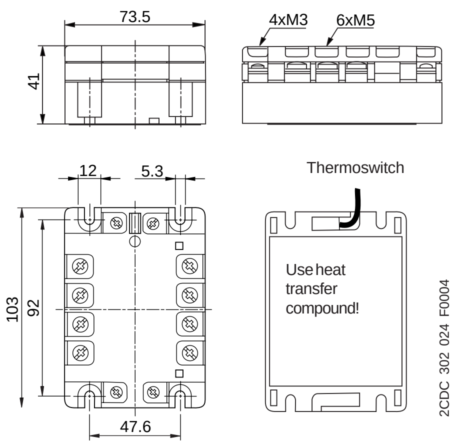


** = 0.4 mm
*** = 0.5 mm

R111



R120, R121, R122, R126



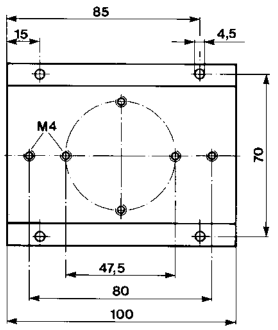
R311, R315

7

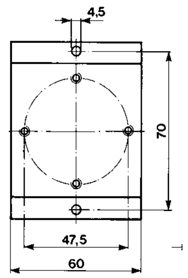
Dimensional drawings

Dimensions in mm

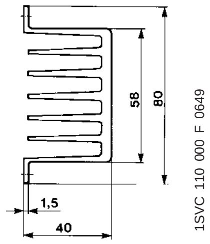
Heat sinks for screw mounting on a mounting plate for solid-state relays R111



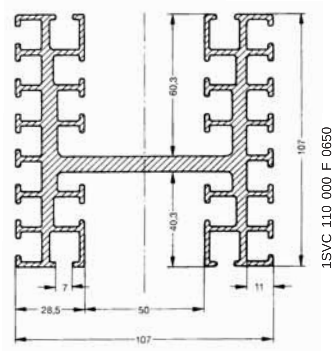
KK-1,8



KK-2,6



KK-1,8 / KK-2,6

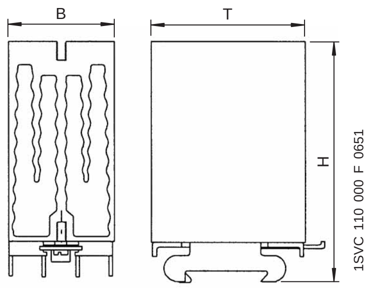


KK-0,7 (length 100 mm)

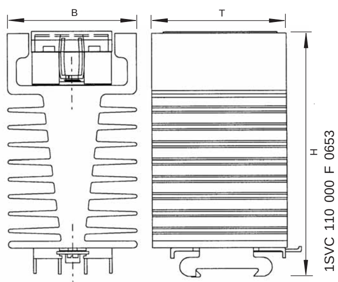
Heat sinks for DIN rail mounting

Dimensions, heat sink only

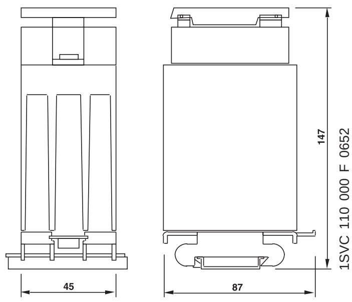
Type	W	D	H
KK-R111-2,1	51	65	65
KK-R111-1,5	45	87	97
KK-R111-0,7	80	85	139
KK-R111-0,5	120	85	139
KK-R311-0,8	114	85	139



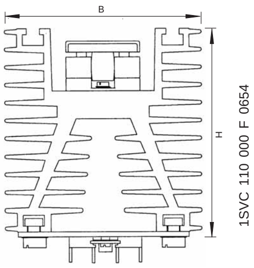
KK-R111-2,1
KK-R111-1,5



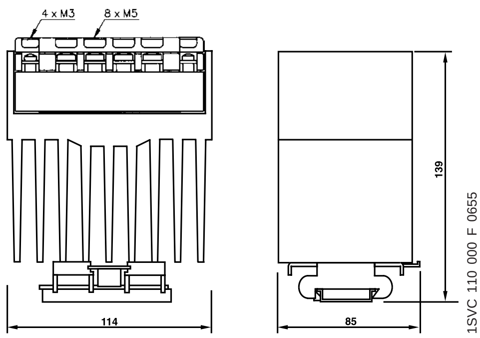
KK-R111-0,7



KK-R111-1,5



KK-R111-0,5



KK-R311-0,8