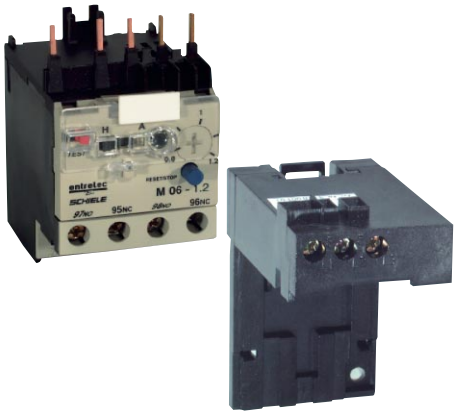
Thermal overload relays

Thermal overload relay M 06 for use with KL 2...- and KL 4... contactors

Accessories



- Modern motor protection relay for direct mounting to KL 2 and KL 4 mini contactors
- Separate mounting through adapter block
- Precise tripping characteristics
- Temperature compensated from -20°C to +55°C
- Phase failure sensitive to IEC 947 to give protection to motor on single phasing
- Electrically separate N/O and N/C contacts
- Hand/auto reset, manual trip test facility
- Fingerproof to VDE 0106, Part 100
- Safety isolation up to 400 V to VDE 0106, IEC 536
- Tripped indication
- Hand/auto reset, current setting can be sealed

- Approvals:

Characteristics

Thermal overload relay M 06

Type **M 06 ...**	Current range A	Order ref.:	Contact configuration	Fuse size aM[1] **A**	 gL[2] **A**	Weight kg	Dimensions page	
M 06-0.16	0.11...0.16	1 310 201 27		0.25	0.5			
M 06-0.23	0.16...0.23	1 310 202 27		0.25	0.5			
M 06-0.36	0.23...0.36	1 310 203 27		0.5	1			
M 06-0.54	0.36...0.54	1 310 204 27		1	1.5			
M 06-0.8	0.54...0.8	1 310 205 27		1	2			
M 06-1.2	0.8...1.2	1 310 206 27	1 N/O and 1 N/C	2	4	0.145	1688	
M 06-1.8	1.2...1.8	1 310 207 27		2	6			
M 06-2.6	1.8...2.6	1 310 208 27		4	8			
M 06-3.7	2.6...3.7	1 310 209 27		4	10			
M 06-5.5	3.7...5.5	1 310 210 27		6	16			
M 06-8	5.5...8	1 310 211 27		8	20			
M 06-11.5	8...11.5	1 310 212 27		10	25			

Accessories:
Adapter block to mount M 06 thermal overload relay separately snaps on to 35 mm DIN rail (DIN EN 50 022).

Type	Order ref.:	Weight kg	Dimensions page	
EM	3 310 001 01	0.100	1688	

Notes

Use of the back-up fuse quoted will give type 2 short-circuit protection to IEC 947-4.

Extract from IEC 947-4 : No damage shall occur to the motor protection relay.
Welding of contactor contacts is acceptable provided contacts can be easily separated.

Mounting : directly beneath contactor (only contactor with screw terminals).
For wiring, see page 1681.

Separate mounting: using adapter block quoted above
On front face of unit:
- Reset: selectable: hand ("H") or auto ("A")
- Blue button: stop and hand reset
- Yellow mechanical indicator: appears once relay has tripped.

[1] aM-fuse 10.3 x 38 mm to be used

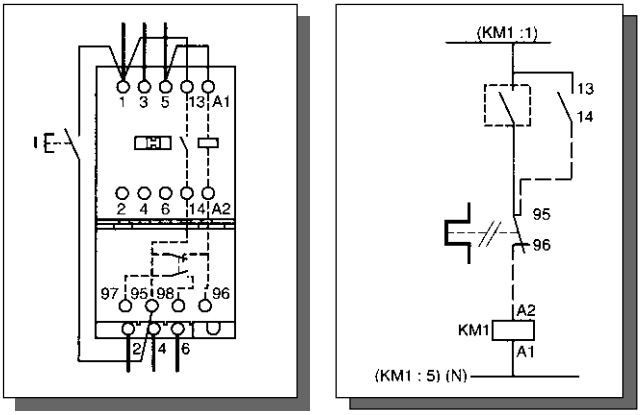
[2] gL-fuse up to 2 A, fuse terminal to be used

Thermal overload relay M 06
Technical information

Wiring

There are two ways to wire the M 06 thermal overload relay in the control cirucit

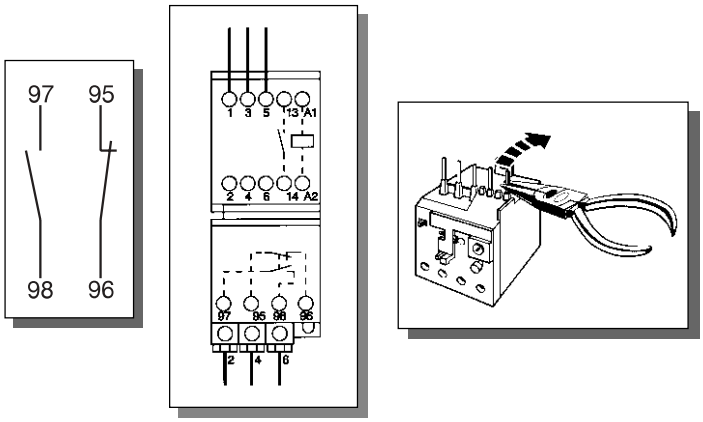
- Method 1 **(state in which supplied)**



Description:
Terminal 95 and terminal 96 are internally wired and connected to the pins on the right hand side of the relay. The pins go to terminals 14 (22) and A2 on the contactor.

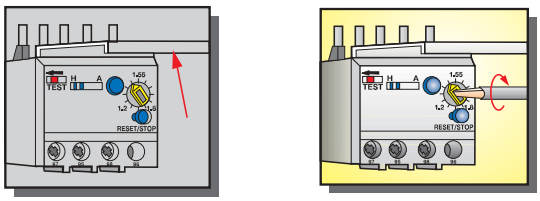
N/C contact 95/96 is connected in series with coil termination A2.

- Method 2



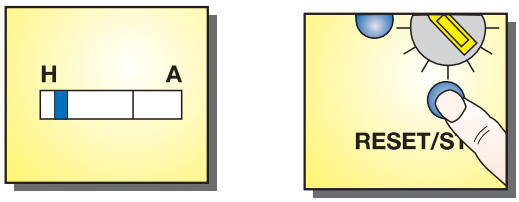
Description:
Internal wiring is not required when building up a control in the normal configuration. N/C contact 95/96 can be connected to coil termination A1. **When doing this, remove the two connecting pins using side cutting pliers.** This applies also where voltages applied to contactor and thermal overload relay are different.

Setting the relay



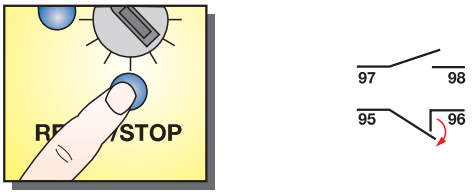
- Lift off transparent cover. Settings are now accessible.
- Set desired value using potentiometer with ampere dial plate.
- Setting can be locked by sealing the cover.

Hand/auto reset



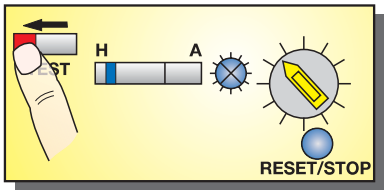
- Lift off transparent cover. The desired reset mode can now be set on a 2 position switch:
  - left hand position: ("H") = hand reset
  - right hand position: ("A") = automatic reset
- The cover, when closed, will lock the selector in position.
- To reset the overload relay by hand, press the blue RESET/STOP button.

STOP function



- Press blue RESET/STOP pushbutton to stop the relay.
- Pressing this button will only operate the N/C contact. The N/O button will remain unaffected.

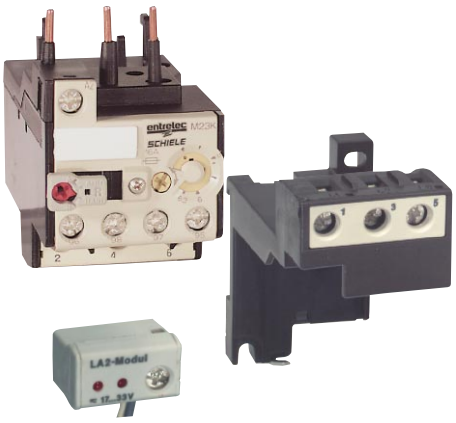
TEST function



- The test function is carried out by pressing the red TEST button with the 2 position switch in the "H" position.
- Pressing this button will simulate tripping of the overload relay:
  - both N/C and N/O auxiliary contacts will operate
  - the mechanical indicator will appear
- The cover, when closed, will lock the TEST function.
- To reset the overload relay, operate the blue RESET/STOP button.

Thermal overload relays M 23 K and M 40 K for use with compact contactors DL 4 K to DL 18 K

AC/DC-version



- Modern motor protection relay for direct mounting to KL 2 and KL 4 mini contactors
- Separate mounting through adapter block
- Precise tripping characteristics
- Temperature compensated from -20°C to +55°C
- Phase failure sensitive to IEC 947 to give protection to motor on single phasing
- Electrically separate N/O and N/C contacts
- Multi-function button
- Hand/auto reset, manual trip test facility
- Fingerproof to VDE 0106, Part 100
- Safety isolation up to 400 V to VDE 0106, IEC 536

- Approvals: M 23 K also (D) approved

Characteristics

Type	Setting range A	Max. permissible setting value for contactor type DL to A		Order ref.:	Contact configuration numbering	Max. fuse size class gL A	Weight kg	Terminal capacities	
M 23 K	0.12...0.18			1 245 501 27		0.75 flink			
	0.18...0.28			1 245 502 27		1 flink			
	0.28...0.4			1 245 503 27		2 flink			
	0.4...0.63			1 245 504 27		2			
	0.56...0.80			1 245 505 27		2			
	0.63...1.00			1 245 506 27		4			
	0.8...1.2			1 245 507 27		4			
	1.0...1.5			1 245 508 27		6			
	1.2...1.8			1 245 509 27		6			
	1.5...2.3			1 245 510 27	1 N/O 97 98 / 1 N/C 95 96	6			
	1.8...2.8			1 245 511 27		6			
	2.3...3.5			1 245 512 27		10			
	2.8...4			1 245 513 27		10			
	3.5...5	8.5	DL 4 K ..	1 245 514 27		16			
	4...6.3			1 245 515 27		16			
	5...7			1 245 516 27		20			
	5.6...8	11.5	DL 5 K ..	1 245 517 27		20			
	7...10			1 245 518 27		25			
	8...12.5			1 245 519 27		25			
	10...15	15.5	DL 7 K ..	1 245 520 27		35			
	11...17			1 245 521 27		40			
	15...23	22	DL 11 K	1 245 522 27		50		Main poles 2 x 1,5...6 mm², screws M 4 x 12 Auxiliary poles 2 x 1...1.5 mm², screws M 3.5 x 9	
M 40 K	11...17			1 245 634 27		40			
	16...25			1 245 635 27		50			
	20...32	30	DL 15 K	1 245 636 27		63			
	25...40	37	DL 18 K	1 245 637 27		80		Main poles 1 x 6...35 mm² screws M 6	

Accessories: terminal block for independent mounting

Type		Order ref.:
EM 2	for M 23 K	3 245 001 01
EM 3	for M 40 K*	3 245 010 01

* Remove terminal lugs on M 40 K. Fit lugs supplied with terminal block.

Replacements: **M 23 K replaces M 9 and M 22 K**
M 40 K replaces M 36 K

Multi-function button: possible settings - page 1687

Dimensions - page 1688

Accessories: indicator module to indicate switch positions

Type		Order ref.:	
LA 2.1	for 17...33 V AC/DC	3 245 002 01	with 2 LEDs
LA 2.2	for 110...250 V AC/DC	3 245 002 02	with neon-glow lamp

Thermal overload relays
M 80 N, M-b ...
and accessories

- Thermal overload relays for separate or direct mounting using connection links.
- Type M-bw relays with saturable core transformer are designed to give protection to high-inertia three phase AC motors
- Temperature compensated from -20°C to +60°C
- Phase failure sensitive to IEC 947 to protect motor on single phasing
- Electrically separate N/O and N/C contacts
- Multi-function button
- Trip times adjustable between 20 to 30 seconds on types M-bw 17 S to M-bw 207 S
- Optional terminal shrouds to give protection to VDE 0106 Part 100
- Safety isolation up to 400 V to VDE 0106, IEC 536

- Approvals:

Characteristics

Type	Setting range A	Max. permissible setting value for contactor type DL to A		Order ref.:	Contact configuration numbering	Max. fuse size class gL A	Weight kg	Terminal capacities	
M 80 N	32...50	44	DL 22 N	1 245 741 27		100			
	40...57			1 245 851 27		100			
	50...63	60	DL 30 N	1 245 852 27		100	0.27	Main poles: 1 x 6..35 mm², screws M 6, caged terminals	
	57...70			1 245 853 27		125			
	63...80	79	DL 42 N	1 245 854 27		125			
M-b 177 S	63...90			1 222 221 27		200			
	80...110			1 222 222 27		200			
	90...120	119	DL 65 N	1 222 110 27		224	0.75		
	110...135			1 222 111 27		315			
	120...150			1 222 112 27	1 N/O 1 N/C	315		Main poles: terminal lug 1 x 4..120 mm², M 8 x 20	
	135...160	170	DL 90 N	1 222 113 27	97 95	315			
	150...180	205	DL 110 N	1 222 114 27		315			
M-bw 17 S	4...6.3			1 222 100 27		25			
	5.6...8			1 222 101 27		40	1.3		
	8...12			1 222 102 27		63			
	11...17			1 222 103 27		80			
M-bw 37 S	15...23			1 222 104 27		125	1.3		
	22...32			1 222 105 27	98 96	160			
M-bw 47 S	30...46			1 222 106 27		200	1.3		
M-bw 77 S	42...62			1 222 107 27		224	1.3		
	56...80			1 222 108 27		250			
M-bw 117 S	80...120	119	DL 65 N	1 222 109 27		355	1.4	see table : Connection to main circuits	
M-bw 207 S	120...180	205	DL 110 N	1 222 115 27		500	1.5		
	150...210	215	DL 132 N	1 222 116 27		630			
M-bw 320 S	200...320	245	DL 132 N	1 222 117 27		500	2.3	M10x80	
	295	DL 165 N							
M-bw 721 Sw	310...500	460	DL 245 N	1 222 118 27		800	4.15	M16x120	
	450...720	499	DL 270 N	1 222 119 27		1000			

Accessories: Sets of links for connection to DL 65 N - DL 270 N, DL 22 N - DL 42 N contactors

for contactor type :	therm. overload type:	Order ref.:		for contactor type :	therm. overload type:	Order ref.:	
DL 65 N, DL 90 N	M-b 177 S 80...180	3 284 158 01		DL 132 N, DL 165 N	M-bw 320 S	3 292 070 01	
DL 65 N	M-b 177 S...90 A	3 284 158 02		DL 245 N	M-b 721 Sw	3 283 060 01	
DL 110 N, DL 132 N	M-bw 207 S	3 243 048 01		DL 270 N	M-b 721 Sw	3 184 334 01	
DL 22 N...DL 42 N	M 80 N	Links are supplied with overload					

Connection to main circuits

Overload Type	Screw connection by means of connecting washer mm²	Max. cable lug to DIN 46 234	Max. flat blade connection mm	Connecting screw	Connecting washer [1] DIN 46 288
M-bw 17 S	2 x 1 ... 4	5...25	15	M 5 x 16	A 5
M-bw 37 S	2 x 2.5 ... 10	5...25	15	M 5 x 16	A 5
M-bw 47 S	2 x 4 ... 16	5...25	15	M 5 x 16	B 5-1
M-bw 77 S	-	6...25	15	M 6 x 16	-
M-bw 177 S	-	8...25	20	M 8 x 16	-
M-bw 207 S	-	10...15	20	M 10 x 16	-

[1] For cable lug connection replace by spring ring and washer

Replacement: **M 80 N replaces M 81**

Dimensions pages 1688-1689

Description of functions page 1687

Accessories: reset button, terminal shrouds

Reset button with adjustable plunger length for molded and sheet-steel enclosure with cover

Type	Order ref.:	
Reset button round 22.5 mm Ø, front ring chromium legend insert black, "R" in white	3 720 420 28	

Terminal shrouds for use with contactors and thermal overload relays to VDE 0106, Part 100 (VBG-4)

Type	Order ref.:	Notes
DL 65 N / DL 90 N	3 284 148 04	retrofitting
DL 90 N + M-b 177 S / DL 65 N + M-b 177 S	3 284 148 05	not fitted as standard
DL 110 / 132 N + M-bw 207 -S	3 243 049 01	not fitted as standard
DL 110 N ... 270 N	3 284 156 02	shroud with M 12 connecting screw (1 set = 6 off)
M-bw 17 S ... M-bw 207 S	3 222 019 01	not fitted as standard
M-b 177 S	3 222 018 01	not fitted as standard
DLDAe 110 / 160 N (1 set = 3 off)	3 284 148 03	not fitted as standard

Fitting/supply at extra cost

General informations thermal overload relays

Thermal overload relays M 06, M 23 K, M 40 K, and M80 N to M-b 721 Sw

The thermal overload relays are all temperature compensated from -20°C to +60°C. This ensures that they remain fully operative even under extreme operating conditions and guarantees that the values specified by VDE 0660, Part 104, are met within this temperature range.
To protect three-phase motors in the event of phase failure, e.g., caused by broken wire or blown fuse, the relays are fitted with a differential tripping mechanism. This means the relay will trip even below the set rated current value (see characteristic curve) if the current in a three-phase network flows only through two conductors so that only two bi-metal elements heat up.
The relays are convertible from manual to auto reset. They are fitted with 1 N/C and 1 N/O contact as standard.

Thermal overload relay type M-bw with saturable transformer

Thermal overload relays with saturable transformers are used for the protection of heavy duty motors. The units comply with inertia group T II, but their trip characteristics are especially slow.

Type : LA 2.1 / LA 2.2 indicator module

Type LA modules are used as signaling and warning lights to indicate switch positions on units with snap-on front lables. For voltages up to 33 V, nonparallel arrangement of the LED will cause polarity independent indication with integral suppression on DC coils (protection from inductive peak voltages, suppression however being less than that of a recovery diode). One of the two LEDs will light, depending on polarity direction.

Mounting and wiring

Remove white device front label. Snap on LA module. The grey module flylead is preferably connected to A 2 termination of the coil. The brown module fly lead can be connected, as required, as an alarm signaling or switch position indicating lamp.
Connection: M 3 screw with washer to connect 2 x 1.5 mm^2.

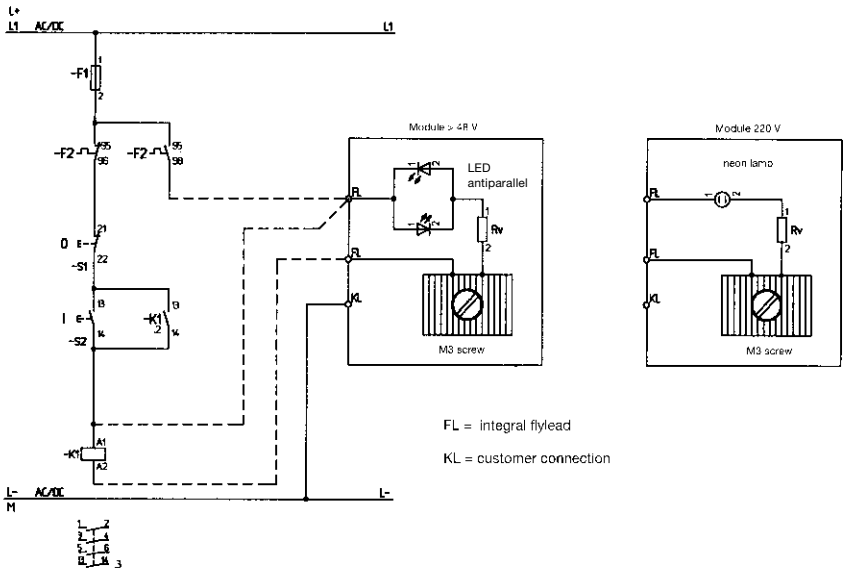
Versions

17...33 V AC/DC* with 2 LEDs
110...250 V AC/DC with neon lamp

* Can also be connected in series with a PLC-input.

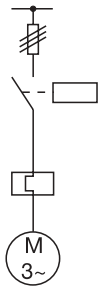
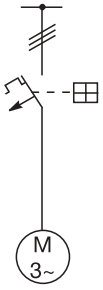
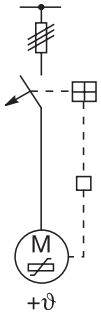
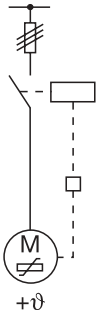
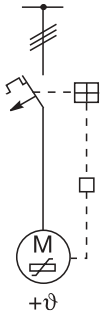
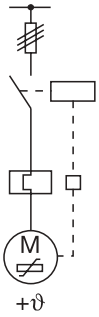
LA 2 module connected to o/l relay with c/o contact

LA2-Module



Motor protection - Typical applications

Select from the six options according to your requirements

Motor protection equipment	1	2	3	4	5	6
○ No protection ● Limited protection ● Full protection	Contactor, phase failure sensitive overload relay, fuse	Circuit breaker with thermal and electromagnetic overload trip device	Circuit breaker with electromagnetic overload trip device thermistor motor protection relay	Contactor, thermistor motor protection relay, fuse	Circuit breaker with thermal and electromagnetic overload trip device thermistor motor protection relay	Contactor, overload relay thermistor motor protetion relay, fuse
						
Continuous overloading	●	●	●	●	●	●
Starting and breaking times too long	●	●	●	●	●	●
Irregular intermittent duty	○	○	●	●	●	●
Switching frequency too high	○	○	●	●	●	●
Single phasing and current unbalance	●	●● [1)]	●	●	●	●
Voltage and frequency fluctuations	●	●	●	●	●	●
Rotor locked	●	●	●	●	●	●
Starting under locked rotor conditions						
Stator-critical motors	●	●	●	●	●	●
rotor-critical motors	●	●	●	●	●	●
Increased ambient temperature	○	○	●	●	●	●

[1)] When using phase-failure sensitive overload relay

General information for thermal overload relays

Motor Overload Protection

Thermal Overload Relays

General
Contactors and contactor assemblies can be supplied with thermal overload relays for the protection of motors against excessive high currents. When ordering, care must be taken to ensure that the correct relay current range is selected in conformity with the rated motor current. **The overload relays are designed for a switching frequency of 15 to 30 ops/hr. Higher switching frequencies heat up the bi-metal strips, thereby causing premature tripping.**

Technical details

Trip class of the thermal overload relays

Trip class		10 A	10	20	30
Max. trip time at 1.5 x current setting (warm state)	(s)	120	240	480	720
Trip time at 7.2 x current setting (cold state)	(s)	2...10	4...10	6...20	9...30

Notes

When the tripping time of 30 s is exceeded (at 7.2 x setting current from cold state) instead of the tripping class the maximum tripping time in seconds is indicated.

Our thermal overload relays correspond to tripping class 10.

Our thermal overload relays can also be used for protection of motors in the degree of protection EExe. For the selection of the thermal overload relays, please provide the following information: I_A / I_N and the T_E-time. Information can be taken from the motor rating label.

Characteristic trip curves are available on request.

When thermal overload relays are used in star-delta assemblies, set relay pointer to 0.58 times the value of the rated motor current or select suitable model.

Technical details - Thermal overload relays
IEC 947-4 and/or VDE 0660 Part 102

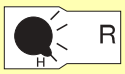
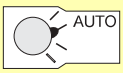
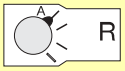
Main circuits

Overload type		M 06	M 23 K M 40 K	M 80 N	M-b 177 S	M-bw 17 S bw 207 S	M-bw 320 S	M-bw 721 Sw
Rated insulation voltage V_i		690	690	690	690	690	690	690
Current setting range	A	to 11.5 A	to 23 to 40	to 80	to 180	5.6...210	200...320	310...720
Power dissipation per pole circuits	W	2	1.3...2.0	1.9...4.8	5.3...12.8	4.5...6	-	-

Auxiliary circuits

Overload type		M 06	M 23 K M 40 K	M 80 N	M-b 177 S	M-bw 17 S bw 207 S	M-bw 320 S	M-bw 721 Sw
Rated insulation voltage V_i		690	400	400	400	400	400	400
Rated thermal current I_{th}	A	6	4	6	6	6	6	6
Max. control fuse rating	A/slow	6	6	6	6	6	6	6
AC 15	220 V/230	2.5	2	3	2	2	2	2
Rated operational current Ie	380 V/400	1.5	1.5	2	1.5	1.5	1.5	1.5
of c/o : A	500 V	1.0	0.5	1.5	0.5	0.5	0.5	0.5
DC 13	24 V	1	1	1	1	1	1	1
Rated operational current Ie	60 V	0.5	0.5	0.75	0.5	0.5	0.5	0.5
of c/o : A	110 V	0.4	0.25	0.4	0.25	0.25	0.25	0.25
L/R ≤ 15 ms	220 V	0.2	0.1	0.2	0.1	0.1	0.1	0.1
Shock resistance (half-sine wave, duration: 11 ms)	N/C	10 g	-	-	-	-	-	-
	N/O	10 g	-	-	-	-	-	-

Possible settings on M 23 K ... M-bw 721 Sw

Pressing the button :		**Multi-function button R : positions**			
		H [1]	**Hand**	**Auto**	**A** [1]
					
Resetting the relay		✘ [2]	✘ [2]		
Switching off the unit connected	Testing the N/C Contact 95-96 open		✘	✘	
Switching off the unit connected	Testing the N/O Contact 97-98 closed		✘	✘	
Reset		Manual reset		Auto reset	
Hints for setting	Red function selection	Gently turn red knob	State in which shipped	Press grey button (R), Gently turn red knob	Gently turn red knob

[1] N/C contact cannot inadvertently be operated in positions H and A.

[2] Allow unit a short time to cool in the tripped state. More technical information available on request.

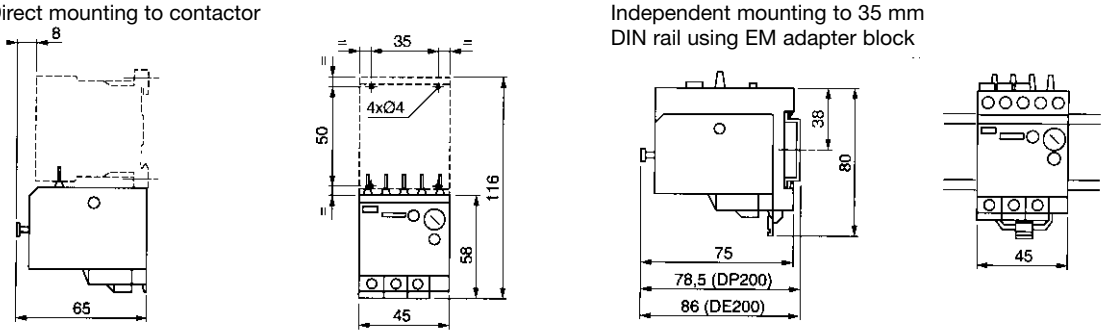
Brief description

In safety positions -A- and -H- the button functions for switching are locked whereas in positions -HAND- and -AUTO- the switching and the simulation of tripping directly at the relay is possible by operating the multi-function button.
In positions -H- and -HAND- the tripped relay must be reset manually, whereas in positions -AUTO- and -A- the tripped relay is reset automatically.

The setting of the functions is done by gently turning the red function selection knob (FWK) to the marks of the grey RESET-button (R). Passing from -HAND- to -AUTO- the grey RESET-button must be slightly pressed at the same time.

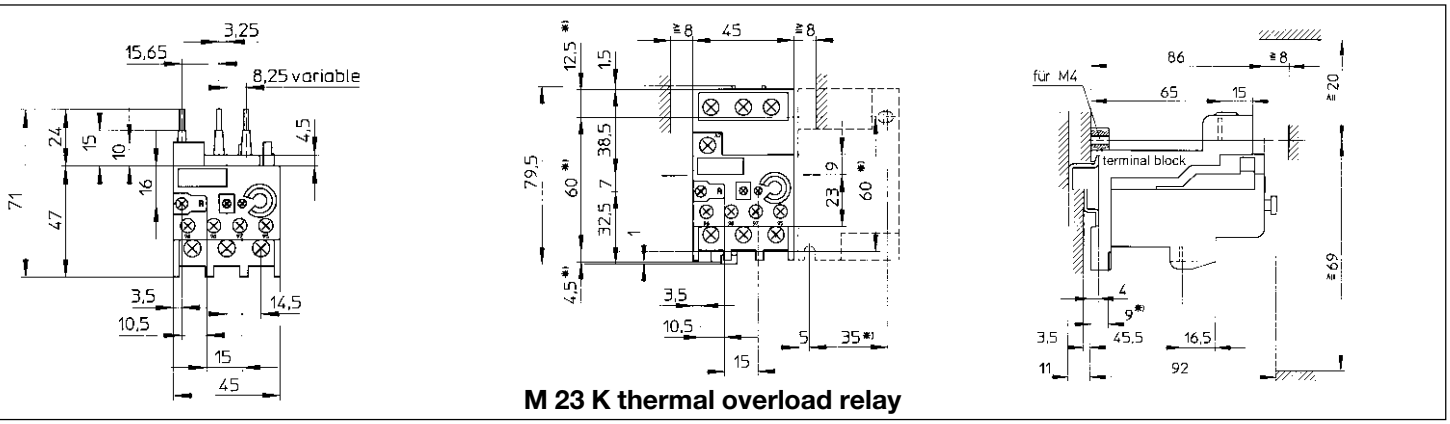
Dimensions - Thermal overload relays

Direct mounting to contactor

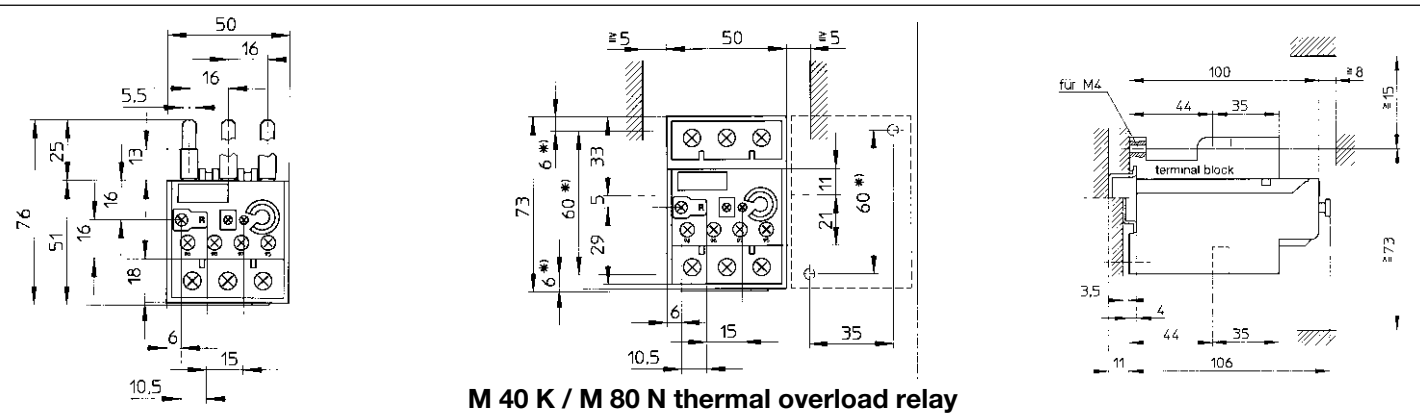


Independent mounting to 35 mm
DIN rail using EM adapter block

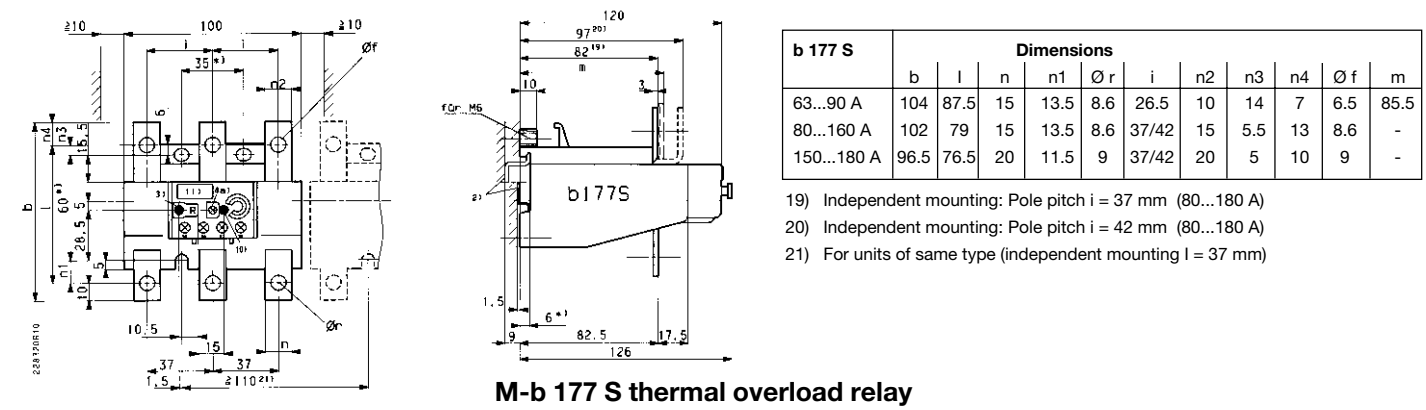
M 06 thermal overload relay



M 23 K thermal overload relay



M 40 K / M 80 N thermal overload relay

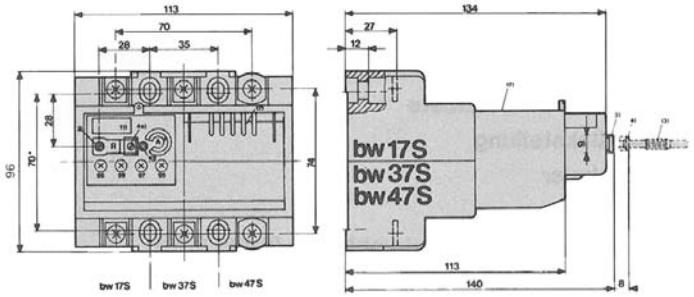


b 177 S	Dimensions										
	b	l	n	n1	Ø r	i	n2	n3	n4	Ø f	m
63...90 A	104	87.5	15	13.5	8.6	26.5	10	14	7	6.5	85.5
80...160 A	102	79	15	13.5	8.6	37/42	15	5.5	13	8.6	-
150...180 A	96.5	76.5	20	11.5	9	37/42	20	5	10	9	-

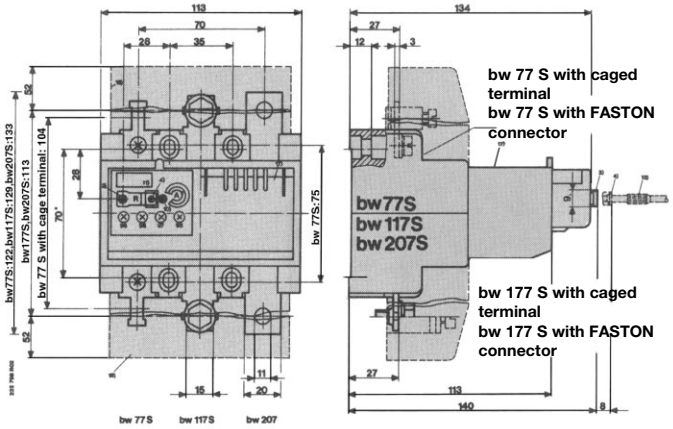
19) Independent mounting: Pole pitch i = 37 mm (80...180 A)
20) Independent mounting: Pole pitch i = 42 mm (80...180 A)
21) For units of same type (independent mounting l = 37 mm)

M-b 177 S thermal overload relay

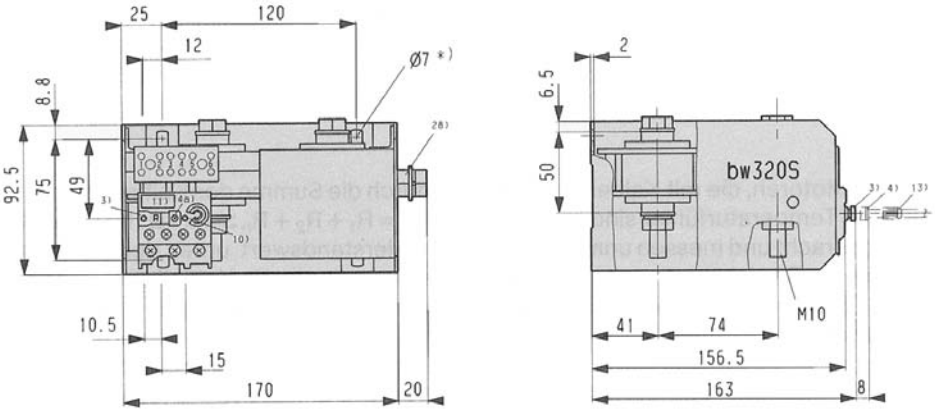
Dimensions - Thermal overload relays



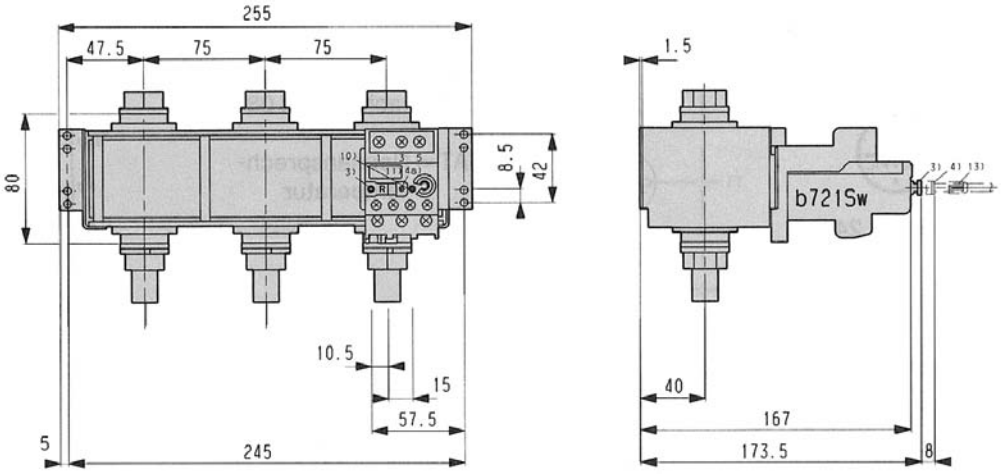
M-bw 17 S - 47 S thermal overload relays



M-bw 77 S - 207 S thermal overload relays



M-bw-320 S thermal overload relays



M-b 721 Sw thermal overload relays