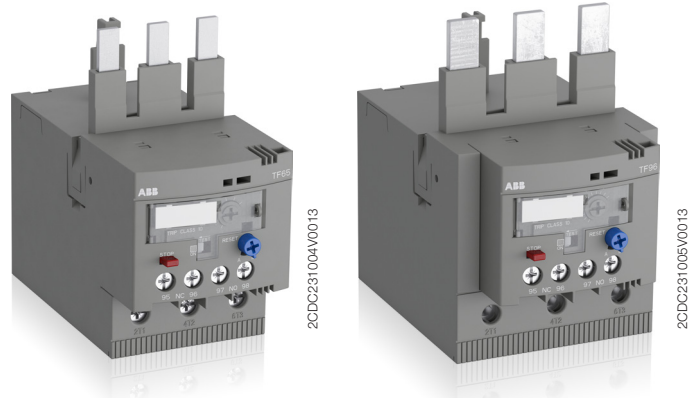


# Thermal overload relay TF65 and TF96

Thermal overload relays are economic electromechanical protection devices for the main circuit. They are used mainly to protect motors against overload and phase failures. Starter combinations are setup together with contactors.



## Description

- Overload protection – trip class 10
- Phase loss sensitivity
- Temperature compensation from -25 ... +60 °C
- Adjustable current setting for overload protection
- Automatic or manual reset selectable
- Suitable for three- and single-phase application
- Trip-free mechanism
- Status indication
- STOP and TEST function
- Direct mounting onto block contactors
- Sealable operating elements

## Order data

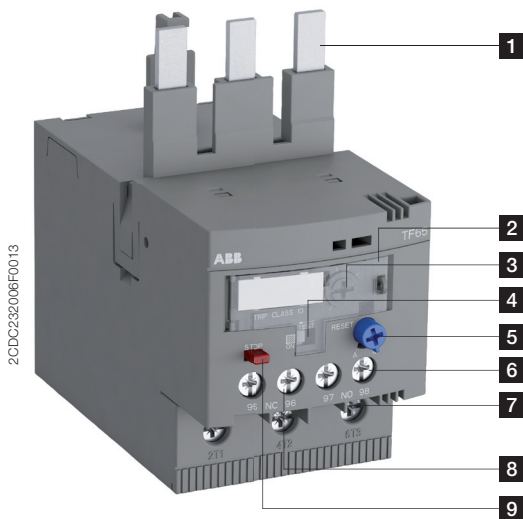
TF65 and TF96 screw terminal  
For AF contactors



Setting range	Type	Order code	Packing unit	Weight per PCE
A			PCE	kg
22.0 ... 28.0	TF65-28	1SAZ811201R1001	1	0.456
25.0 ... 33.0	TF65-33	1SAZ811201R1002	1	0.456
30.0 ... 40.0	TF65-40	1SAZ811201R1003	1	0.456
36.0 ... 47.0	TF65-47	1SAZ811201R1004	1	0.456
44.0 ... 53.0	TF65-53	1SAZ811201R1005	1	0.456
50.0 ... 60.0	TF65-60	1SAZ811201R1006	1	0.466
57.0 ... 67.0	TF65-67	1SAZ811201R1007	1	0.466
40.0 ... 51.0	TF96-51	1SAZ911201R1001	1	0.620
48.0 ... 60.0	TF96-60	1SAZ911201R1002	1	0.620
57.0 ... 68.0	TF96-68	1SAZ911201R1003	1	0.620
65.0 ... 78.0	TF96-78	1SAZ911201R1004	1	0.620
75.0 ... 87.0	TF96-87	1SAZ911201R1005	1	0.620
84.0 ... 96.0	TF96-96	1SAZ911201R1006	1	0.630

Suitable for mounting on:  
TF65: AF40, AF52, AF65  
TF96: AF80, AF96

## Functional description



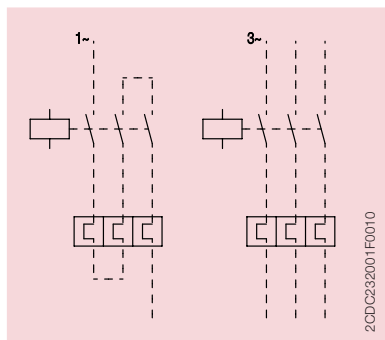
- 1** Terminals 1L1, 3L2, 5L3
- 2** Sealable operating elements
- 3** Current setting range  
Adjustable current setting for overload protection
- 4** TEST  
Status indication
- 5** RESET  
Automatic or manual reset selectable
- 6** Signaling contacts 97-98
- 7** Terminals 2T1, 4T2, 6T3
- 8** Tripping contacts 95-96
- 9** STOP

## Application / internal function

The thermal overload relays are three pole relays with bimetal tripping elements (1 per pole). The motor current flows through the bimetal tripping elements and heats them directly and indirectly. In case of an overload (over current), the bimetal elements become bent as a result of the heating. This leads to a release of the relay and a change of the contacts switching position (95-96 / 97-98). The contact 95-96 is used to control the load contactor.

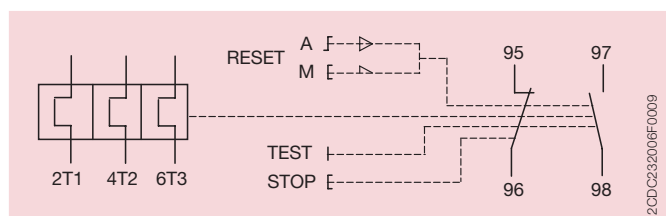
The overload relays have a setting scale in Amperes, which allows the direct adjusting of the relay without any additional calculation. In compliance with international and national standards, the setting current is the rated current of the motor and not the tripping current (no tripping at  $1.05 \times I$ , tripping at  $1.2 \times I$ ;  $I$  = setting current). The relays are constructed in way that they protect themselves in the event of an overload. The overload relay has to be protected against short-circuit. The appropriate short-circuit protective devices are shown in the table.

## Operation mode



	Contact 95-96	Contact 97-98	Status indication	Comment
Trip state	open	closed		
RESET state	closed	open	ON	
TEST manual reset mode	open	closed		
TEST auto reset mode	open	closed		while TEST is operated
STOP while device is in trip state	open	closed		STOP button has no function
STOP while device is in RESET state	open	open		while STOP button is pressed

## Wiring diagram

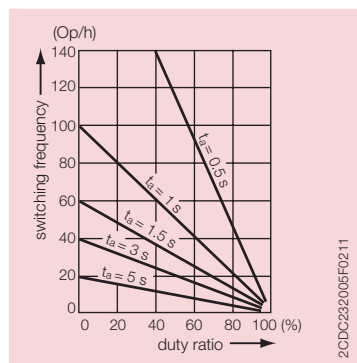


## Resistance and power loss per pole and short-circuit protective devices

Type	Setting range		Resistance per pole mΩ	Power loss		Short-circuit protective device coordination type 2
	lower value A	upper value A		at lower value W	at upper value W	
TF65-28	22.0	28.0	3.937	1.9	3.1	80 A, gG Type Fuses
TF65-33	25.0	33.0	3.474	2.2	3.8	80 A, gG Type Fuses
TF65-40	30.0	40.0	2.321	2.1	3.7	100 A, gG Type Fuses
TF65-47	36.0	47.0	1.645	2.1	3.6	125 A, gG Type Fuses
TF65-53	44.0	53.0	1.292	2.5	3.6	125 A, gG Type Fuses
TF65-60	50.0	60.0	0.939	2.3	3.4	125 A, gG Type Fuses
TF65-67	57.0	67.0	0.759	2.5	3.4	160 A, gG Type Fuses
TF96-51	40.0	51.0	1.647	2.6	4.3	125 A, gG Type Fuses
TF96-60	48.0	60.0	1.316	3.0	4.7	160 A, gG Type Fuses
TF96-68	57.0	68.0	0.992	3.2	4.6	160 A, gG Type Fuses
TF96-78	65.0	78.0	0.632	2.7	3.8	200 A, gG Type Fuses
TF96-87	75.0	87.0	0.516	2.9	3.9	200 A, gG Type Fuses
TF96-96	84.0	96.0	0.397	2.8	3.7	250 A, gG Type Fuses

## Technical diagrams

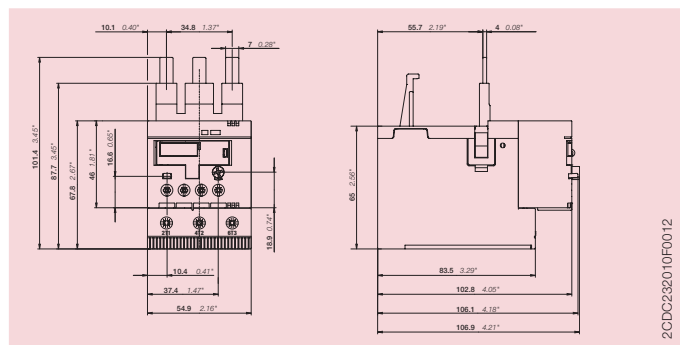
Intermittent periodic duty



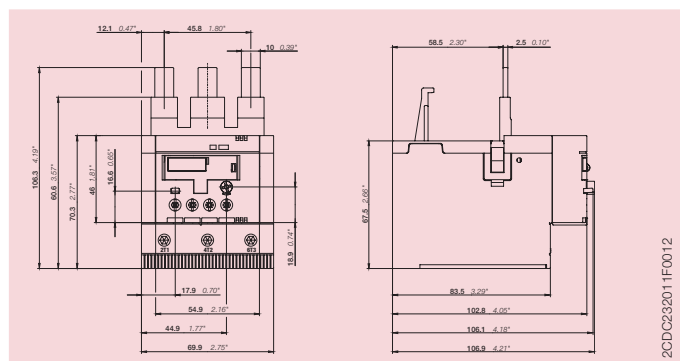
Motor starting time

## Dimensions

in mm and inches



TF65



TF96

## Technical data IEC/EN

Data at  $T_A = 40\text{ °C}$  and at rated values, if nothing else indicated

### Main circuit

		TF65 / TF96
Rated operational voltage $U_e$		690 V AC - V DC
Setting range - thermal overload protection		see table on page 1
Rated operational current AC-3 $I_e$		see upper value of setting range, table on page 3
Trip class		10
Rated frequency		50/60 Hz
Number of poles		3
Resistance per pole		see table on page 3
Power loss per pole		see table on page 3
Short-circuit protective devices		see table on page 3

		TF65 / TF96
Rated impulse withstand voltage $U_{imp}$		8 kV
Rated insulation voltage $U_i$		690 V
Pollution degree		3

Electrical connection		TF65	TF96
Connecting capacity	solid	1/2x 2.5 ... 16 mm <sup>2</sup>	1/2x 6 ... 35 mm <sup>2</sup>
		1x 2.5 ... 35 mm <sup>2</sup>	1x 6 ... 50 mm <sup>2</sup>
	stranded	1/2x 2.5 ... 16 mm <sup>2</sup>	1/2x 6 ... 35 mm <sup>2</sup>
		1x 2.5 ... 35 mm <sup>2</sup>	1x 6 ... 50 mm <sup>2</sup>
	flexible with ferrule	1/2x 2.5 ... 10 mm <sup>2</sup>	1/2x 6 ... 35 mm <sup>2</sup>
		1x 2.5 ... 35 mm <sup>2</sup>	1x 6 ... 50 mm <sup>2</sup>
flexible with insulated ferrule	1/2x 2.5 ... 4 mm <sup>2</sup>	1/2x 6 ... 16 mm <sup>2</sup>	
	1x 2.5 ... 35 mm <sup>2</sup>	1x 6 ... 50 mm <sup>2</sup>	
flexible without ferrule	1/2x 2.5 ... 16 mm <sup>2</sup>	1/2x 6 ... 35 mm <sup>2</sup>	
	1x 2.5 ... 35 mm <sup>2</sup>	1x 6 ... 50 mm <sup>2</sup>	
Stripping length		17 mm	22 mm
Tightening torques		4.0 ... 4.5 Nm	6.5 ... 9 mm
Connection screw		M6 (Pozidriv 2)	M8 (Hexagon 4)

## Auxiliary circuit

		95-96, 97-98
Rated operational voltage $U_e$		600 V
Conventional free air thermal current $I_{th}$	NC, 95-96	6 A
	NO, 97-98	4 A
Rated frequency		DC, 50/60 Hz
Number of poles		1NC + 1NO
Rated operational current $I_e$		
acc. to IEC/EN 60947-5-1 for utilization category		
at AC-15 at 110-120 V	NC, 95-96	3.00 A
	NO, 97-98	0.75 A
at AC-15 at 220-230-240 V	NC, 95-96	3.00 A
	NO, 97-98	0.75 A
at AC-15 at 440 V	NC, 95-96	0.75 A
	NO, 97-98	0.75 A
at AC-15 at 480-500 V	NC, 95-96	0.75 A
	NO, 97-98	0.75 A
at DC-13 at 24 V	NC, 95-96	1.25 A
	NO, 97-98	1.25 A
at DC-13 at 110-120-125 V	NC, 95-96	0.55 A
	NO, 97-98	0.55 A
at DC-13 at 250 V	NC, 95-96	0.27 A
	NO, 97-98	0.27 A
at DC-13 at 500 V	NC, 95-96	0.15 A
	NO, 97-98	0.15 A
Minimum switching capacity		17 V / 3 mA
Short-circuit protective devices	NC, 95-96	6 A, Type gG
	NO, 97-98	4 A, Type gG
<b>Isolation data</b>		<b>95-96, 97-98</b>
Rated impulse withstand voltage $U_{imp}$		6 kV
Rated insulation voltage $U_i$		690 V
Pollution degree		3
<b>Electrical connection</b>		<b>95-96, 97-98</b>
Connecting capacity	solid	1/2x 0.75 ... 4 mm <sup>2</sup>
	stranded	1/2x 0.75 ... 4 mm <sup>2</sup>
	flexible with ferrule	1/2x 0.75 ... 2.5 mm <sup>2</sup>
	flexible with ferrule insulated	1x 0.75 ... 2.5 mm <sup>2</sup>
		2x 0.75 ... 1.5 mm <sup>2</sup>
	flexible without ferrule	1/2x 0.75 ... 1 mm <sup>2</sup>
		1/2x 1 ... 2.5 mm <sup>2</sup>
Stripping length		9 mm
Tightening torques		1 ... 1.5 Nm
Connection screw		M3 (Pozidriv 2)

## General data

Duty time	100 %		
Operating frequency without early tripping	up to 15 operations/h or 60 operations/h with 40 % duty ratio, if the motor breaking current $6 \times I_n$ and the motor starting time does not exceed 1 s		
Dimensions (W x H x D)	see dimension drawing		
Weight	see ordering data		
Mounting	mount on the contactor and tighten the screws of the main circuit terminals or with single mounting kit on DIN rail (35 mm)		
Mounting position	position 1		
Minimum distance to other units same type	horizontal	none	
	vertical	not applicable	
Minimum distance to electrical conductive board	horizontal	up to 400 V	none
		up to 690 V	1 mm
	vertical		not applicable
Degree of protection	housing	IP20	
	main circuit terminals	IP10	
Altitude	up to 2000 m		

## Electromagnetic compatibility

Electromagnetic compatibility	not applicable
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## Environmental data

Ambient air temperature		
Operation	open - compensated	-25 ... +60 °C
	open	-25 ... +60 °C
Storage	-50 ... +85 °C	
Ambient air temperature compensation	acc. to IEC/EN 60947-4-1	
Vibration (sinusoidal) acc. to IEC/EN 60068-2-6 (Fc)	5g / 3 ... 150 Hz	
Shock (half-sine) acc. to IEC/EN 60068-2-27 (Ea)	25g / 11 ms	

## Standards / directives

Product standard	IEC/EN 60947-1
	IEC/EN 60947-4-1
	IEC/EN 60947-5-1
	UL 60947-1
	UL 60947-4-1
Low Voltage Directive	2006/95/EC
EMC Directive	2004/108/EC
RoHS Directive	2002/95/EC

## Technical data UL/CSA

### Full load amps and short-circuit protective devices

Type	Full load amps (FLA)	Short-circuit protective devices			
		480 / 600 V AC		480 / 600 V AC	
		SCCR	Fuse type	SCCR	Fuse type
TF65-28	28 A	5 kA	100 A, K5 / RK5	18 kA	110 A, Class J
TF65-33	33 A	5 kA	100 A, K5 / RK5	18 kA	110 A, Class J
TF65-40	40 A	5 kA	100 A, K5 / RK5	18 kA	110 A, Class J
TF65-47	47 A	5 kA	125 A, K5 / RK5	18 kA	125 A, Class J
TF65-53	53 A	10 kA	125 A, K5 / RK5	18 kA	125 A, Class J
TF65-60	60 A	10 kA	150 A, K5 / RK5	18 kA	150 A, Class J
TF65-67	67 A	10 kA	150 A, K5 / RK5	18 kA	150 A, Class J
TF96-51	51 A	5 kA	150 A, K5 / RK5	18 kA	125 A, Class J
TF96-60	60 A	10 kA	150 A, K5 / RK5	18 kA	150 A, Class J
TF96-68	68 A	10 kA	150 A, K5 / RK5	18 kA	150 A, Class J
TF96-78	78 A	10 kA	175 A, K5 / RK5	18 kA	175 A, Class J
TF96-87	87 A	10 kA	200 A, K5 / RK5	18 kA	200 A, Class J
TF96-96	96 A	10 kA	250 A, K5 / RK5	18 kA	200 A, Class J

### Main circuit

Maximum operational voltage	600 V AC
Trip rating	125 % of FLA
Full load amps (FLA)	see table above
Short-circuit rating RMS symmetrical	see table above
Short-circuit protective devices	see table above

Electrical connection		TF65	TF96
Connecting capacity	stranded	1x AWG 12 ... 2	1x AWG 8 ... 1
		2x AWG 12 ... 6	2x AWG 8 ... 3
	flexible without ferrule	1x AWG 12 ... 2	1x AWG 8 ... 1
		2x AWG 12 ... 6	2x AWG 8 ... 3
Stripping length		17 mm	22 mm
Tightening torques		35 ... 40 lb-in	57 .. 80 lb-in

### Auxiliary circuit

Conventional thermal current	NC, 95-96	6 A
	NO, 97-98	4 A
Making and breaking capacity	NC, 95-96	B600, Q600
	NO, 97-98	D300, Q600

Electrical connection		
Connecting capacity	stranded	1/2 x AWG 18 ... 12
	flexible without ferrule	1/2 x AWG 18 ... 12
Stripping length		9 mm
Tightening torques		9 ... 13 lb-in

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