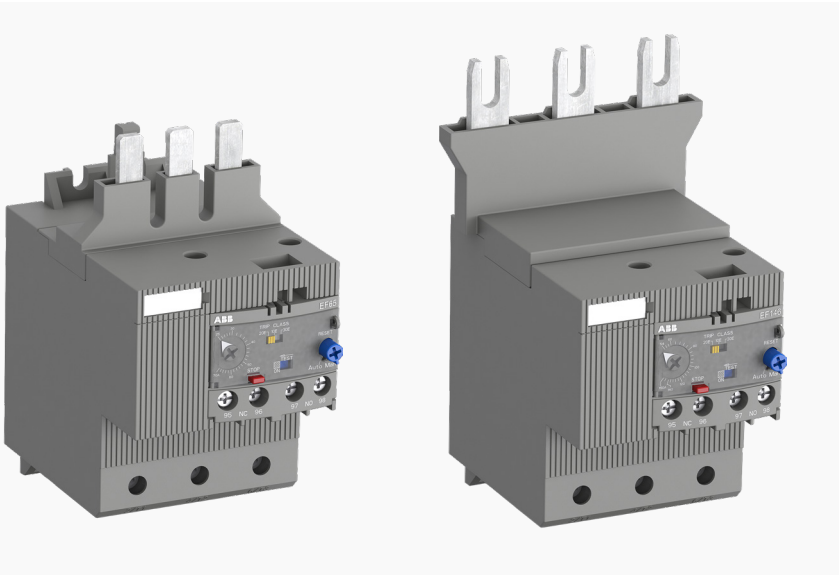


Electronic overload relay EF65, EF96 and EF146



Electronic overload relays offer reliable protection in case of overload and phase-failure. They are the alternative to thermal overload relays. Motor starters are combinations of overload relays and contactors.

Description

- Overload protection – trip class 10E, 20E, 30E selectable
- Phase loss sensitivity
- Temperature compensation from -25 ... +70 °C
- Adjustable current setting for overload protection
- Automatic or manual reset selectable
- Trip-free mechanism
- Status indication
- STOP and TEST function
- Direct mounting onto block contactors
- Sealable operating elements
- Self-supplied devices

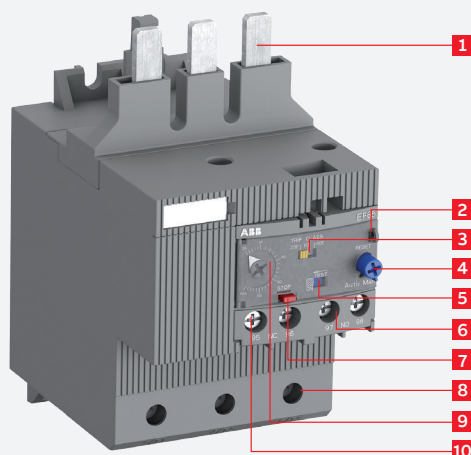


Order data

EF65, EF96, EF146 screw terminal
For AF40 ... AF146 block contactors

Setting range	Type	Order code	Weight Pkg (1 pce) kg
A			
20 ... 56	EF65-56	1SAX331001R1102	0.821
25 ... 70	EF65-70	1SAX331001R1101	0.821
20 ... 56	EF96-56	1SAX341001R1102	0.802
36 ... 100	EF96-100	1SAX341001R1101	0.802
54 ... 150	EF146-150	1SAX351001R1101	0.879

Suitable for mounting on: AF40, AF52, AF65, AF80, AF96, AF116, AF140, AF146



Functional description

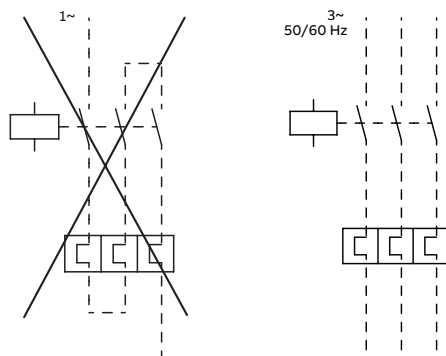
1. Terminals (1L1, 3L2, 5L3)
2. Sealable operating elements
3. Trip class 10E, 20E, 30E selectable
4. RESET
Automatic or manual reset selectable
5. TEST - Status indication
6. Signaling contacts 97-98
7. STOP
8. Terminals 2T1, 4T2, 6T3
9. Current setting range / Self-test function ST
Adjustable current setting for overload protection
10. Tripping contacts 95-96

Application / internal function

The self-supplied electronic overload relays are three pole electronic/mechanical devices. The motor current flows through build-in current transformers and an evaluation circuit will recognize an overload (over current). This will lead 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 electronic overload relay is self-supplied, which mean no extra external supply is needed.

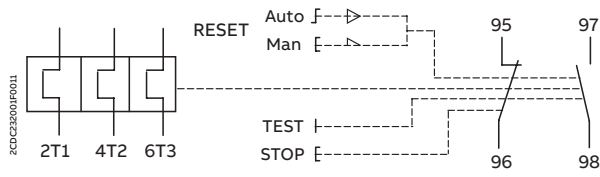
The overload relays have a setting scale in Amperes, which allows the direct adjusting of the relay without any additional calculation. In compliance with international and national standards, the setting current is the rated current of the motor and not the tripping current (no tripping at $1.05 \times I$, tripping at $1.2 \times I$; $I =$ setting current). The relays are constructed in a 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 following tables. To prevent thermal overloads in heavy duty applications, the correct cable sizes have to be selected.

Operation mode



	Contact 95-96	Contact 97-98	Opto-mechanical slide	Comment
Trip state	open	closed		
RESET state	closed	open	ON	
TEST manual reset mode	open	closed		
TEST auto reset mode	open	closed		
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

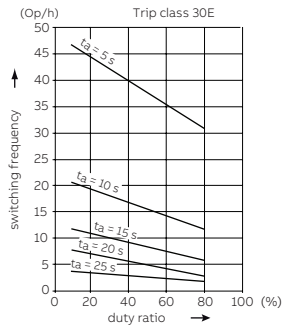
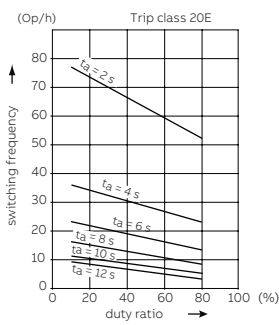
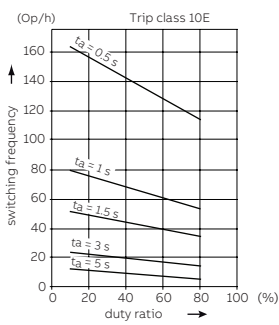
Wiring diagram



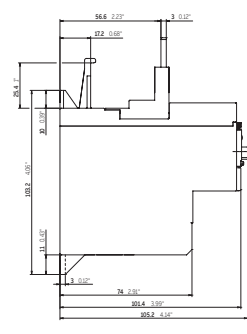
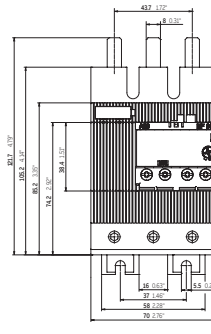
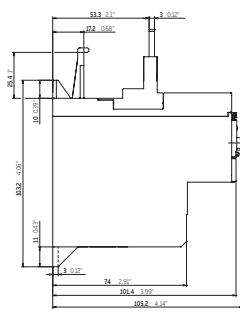
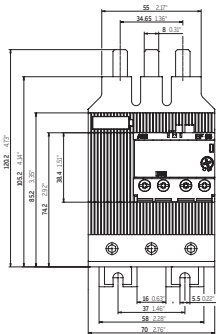
Resistance and power loss per pole and short-circuit protective devices

Type	Setting range		Resistance per pole mΩ	Power loss per pole at lower value at upper value		Short-circuit protective devices coordination type 2
	lower value A	upper value A		W	W	
EF65-56	20	56	0.09	0.04	0.28	Fuse 160 A, Type gG
EF65-70	25	70	0.09	0.06	0.45	Fuse 160 A, Type gG
EF96-56	20	56	0.09	0.04	0.28	Fuse 160 A, Type gG
EF96-100	36	100	0.09	0.12	0.90	Fuse 200 A, Type gG
EF146-150	54	150	0.07	0.21	1.58	Fuse 315 A, Type gG

Intermittent periodic duty

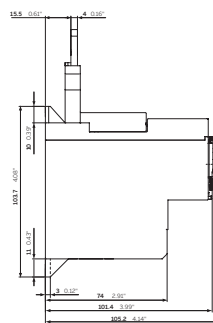
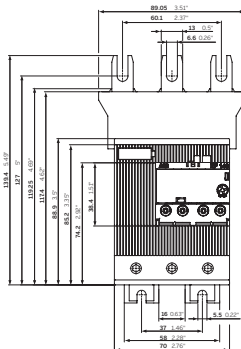


Dimensions



EF65-56 / EF65-70

EF96-56, EF96-100



EF146-150

Technical data IEC/EN

Data at Ta = 40 °C and at rated values, if nothing else indicated





Main circuit

	EF65, EF96, EF146
Rated operational voltage Ue	1000 V AC
	- V DC
Setting range - electronic overload protection	see table on page 1
Rated operational current AC-3 Ie	see upper value of setting range, on page 3
Trip class	10E, 20E, 30E, selectable
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

Isolation data

	EF65, EF96, EF146
Rated impulse withstand voltage Uimp	8 kV
Rated insulation voltage Ui	1000 V
Pollution degree	3
Overvoltage category	up to III

Electrical connection

Type	EF65	EF96	EF146
 rigid	1 x 4 ... 35 mm ² 2 x 4 ... 35 mm ²	1 x 4 ... 70 mm ² 2 x 4 ... 35 mm ²	1 x 10 ... 95 mm ² 2 x 10 ... 35 mm ²
 flexible with ferrule	1 x 4 ... 35 mm ² 2 x 4 ... 35 mm ²	1 x 4 ... 50 mm ² 2 x 4 ... 35 mm ²	1 x 10 ... 70 mm ² 2 x 10 ... 35 mm ²
 flexible with ferrule insulated	1 x 4 ... 35 mm ² 2 x 4 ... 35 mm ²	1 x 4 ... 50 mm ² 2 x 4 ... 35 mm ²	1 x 10 ... 70 mm ² 2 x 10 ... 35 mm ²
 flexible	1 x 4 ... 35 mm ² 2 x 4 ... 35 mm ²	1 x 4 ... 70 mm ² 2 x 4 ... 35 mm ²	1 x 10 ... 70 mm ² 2 x 10 ... 35 mm ²
Stripping length	20 mm	20 mm	20 mm
Tightening torque	4 Nm	6 Nm	8 Nm
Recommended screw driver	Pozidriv 2	Hexagon 4	Hexagon 4





Auxiliary circuit

		95-96, 97-98
Rated operational voltage U _e		600 V AC / DC
Conventional free air thermal current I _{th}		6 A
Rated frequency		DC, 50/60 Hz
Number of poles		1 N.C. + 1 N.O.
Rated operational current I _e acc. to IEC/EN 60947-5-1 for utilization category		
at AC-15 at 110-120 V	N.C. 95-96	3.00 A
	N.O. 97-98	3.00 A
at AC-15 at 220-230-240 V	N.C. 95-96	3.00 A
	N.O. 97-98	3.00 A
at AC-15 at 400 V	N.C. 95-96	1.10 A
	N.O. 97-98	1.10 A
at AC-15 at 480-500 V	N.C. 95-96	0.75 A
	N.O. 97-98	0.75 A
at DC-13 at 24 V	N.C. 95-96	1.50 A
	N.O. 97-98	1.50 A
at DC-13 at 60 V	N.C. 95-96	0.55 A
	N.O. 97-98	0.55 A
at DC-13 at 110-120-125 V	N.C. 95-96	0.55 A
	N.O. 97-98	0.55 A
at DC-13 at 250 V	N.C. 95-96	0.27 A
	N.O. 97-98	0.27 A
Minimum switching capacity		12 V / 3 mA $\lambda = 10^{-7}$; U _{kd} = 3 V / 500.000 operating cycles
Short-circuit protective devices		fuse 6 A, Type gG

Isolation data

		95-96, 97-98
Rated impulse withstand voltage U _{imp}		6 kV
Rated insulation voltage U _i		690 V
Pollution degree		3
Overvoltage category		up to III

Electrical connection

Type	95-96, 97-98	
 rigid	1 x 1 ... 4 mm ² 2 x 1 ... 4 mm ²	
 flexible with ferrule	1 x 0.75 ... 2.5 mm ² 2 x 0.75 ... 2.5 mm ²	
 flexible with ferrule insulated	1 x 0.75 ... 2.5 mm ² 2 x 0.75 ... 2.5 mm ²	
 flexible	1 x 0.75 ... 2.5 mm ² 2 x 0.75 ... 2.5 mm ²	
Stripping length		9 mm
Tightening torque		0.8 ... 1.2 Nm
Recommended screw driver		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
Mounting position		optional, position 1-6
Minimum distance to other units same type	horizontal	none
	vertical	not applicable
Minimum distance to electrical conductive board	horizontal	1.5 mm
	vertical	1.5 mm
Degree of protection	housing	IP20
	main circuit terminals	IP10
Maximum operating altitude		2000 m

Electromagnetic compatibility

Immunity acc. to IEC 60947-1		Environment A
Emission acc. to IEC 60947-1		Environment B

Environmental data

Ambient air temperature		
Operation	open - compensated	-25 ... +70 °C
	open	-25 ... +70 °C
Storage		-50 ... +85 °C
Ambient air temperature compensation		acc. to IEC/EN 60947-4-1
Resistance to vibrations acc. to IEC 60068-2-6		5g / 3 ... 150 Hz
Resistance to shock acc. to IEC 60068-2-27		15g / 11 ms

Standards / directives

Standards		IEC/EN 60947-1 IEC/EN 60947-4-1 IEC/EN 60947-5-1 UL 60947-1 UL 60947-4-1
Low Voltage Directive		2014/35/EU
EMC Directive		2014/30/EU
RoHS Directive		2011/65/EU
ATEX Directive		2014/34/EC

Technical data UL/CSA**Full load amps and short-circuit protective devices**

Type	Full load amps (FLA)	Short circuit protective devices					
		480 V AC		600 V AC		600 V AC	
		SCCR	Fuse type	SCCR	Fuse type	SCCR	Fuse type
EF65-56	56 A	10 kA	150 A, K5/RK5	10 kA	150 A, K5/RK5	100 kA	175 A, Class J
EF65-70	70 A	10 kA	150 A, K5/RK5	10 kA	150 A, K5/RK5	100 kA	175 A, Class J
EF96-56	56 A	10 kA	150 A, K5/RK5	10 kA	150 A, K5/RK5	100 kA	175 A, Class J
EF96-100	100 A	10 kA	200 A, K5/RK5	10 kA	200 A, K5/RK5	100 kA	225 A, Class J
EF146-150	150 A	10 kA	250 A, K5/RK5	10 kA	250 A, K5/RK5	100 kA	350 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

Type	EF65	EF96	EF146
stranded	1 x AWG 10 ... 2 2 x AWG 10 ... 2	1 x AWG 10 ... 2 2 x AWG 10 ... 2	1 x AWG 6 ... 0 2 x AWG 6 ... 2
flexible	1 x AWG 10 ... 2 2 x AWG 10 ... 2	1 x AWG 10 ... 2 2 x AWG 10 ... 2	1 x AWG 6 ... 0 2 x AWG 6 ... 2
Stripping length	20 mm	20 mm	20 mm
Tightening torque	55 lb.in	70 lb.in	70 lb.in
Recommended screw driver	Pozidriv 2	Hexagon 4	Hexagon 4

Auxiliary circuit

Conventional thermal current	6 A
Making and breaking capacity	N.C. / N.O. B600, Q600

Electrical connection

Type	EF65, EF96, EF146
stranded	1 x AWG 18 ... 10 2 x AWG 18 ... 10
flexible	1 x AWG 18 ... 10 2 x AWG 18 ... 10
Stripping length	9 mm
Tightening torque	7 ... 11 lb.in
Recommended screw driver	Pozidriv 2



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