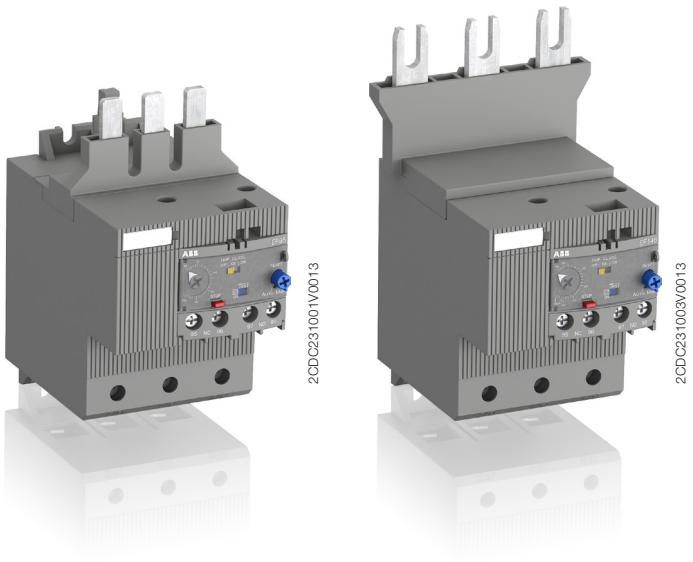
Data sheet

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

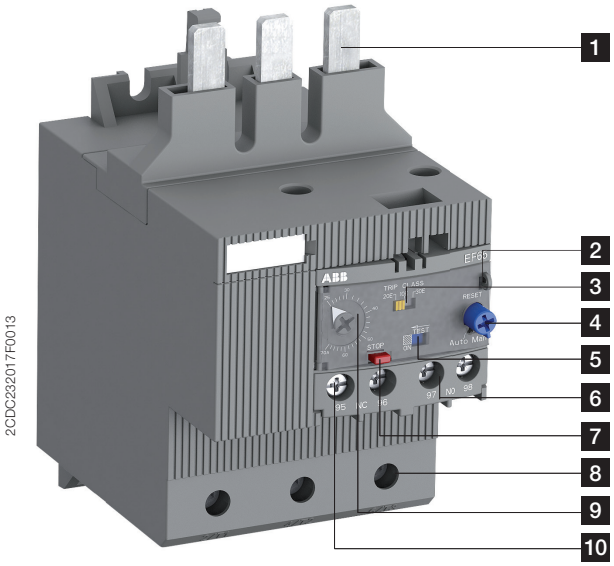
Order data

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

Setting range A	Type	Order code	Suitable for	Packing unit pc	Weight per pc kg
20 ... 56	EF65-56	1SAX331001R1102	AF40, AF52, AF65	1	0.821
25 ... 70	EF65-70	1SAX331001R1101	AF40, AF52, AF65	1	0.821
20 ... 56	EF96-56	1SAX341001R1102	AF80, AF96	1	0.802
36 ... 100	EF96-100	1SAX341001R1101	AF80, AF96	1	0.802
54 ... 150	EF146-150	1SAX351001R1101	AF116, AF140, AF146	1	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**

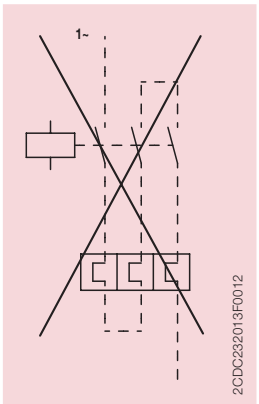
Application / internal function

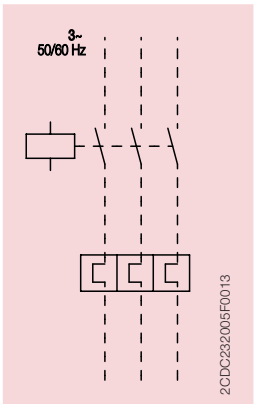
The self-supplied electronic overload relays are three pole electronic/mechanical devices. The motor current flows through build-in current transformers and an evaluation circuit will recognize an overload (over current). This will lead to a release of the relay and a change of the contacts switching 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 x I, tripping at 1.2 x 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.

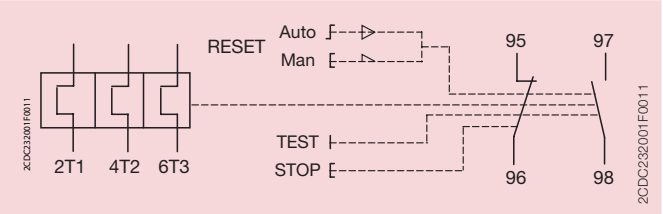
Operation mode





	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

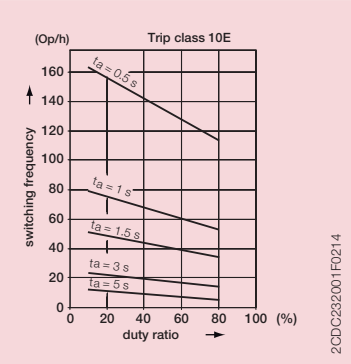
Wiring diagram



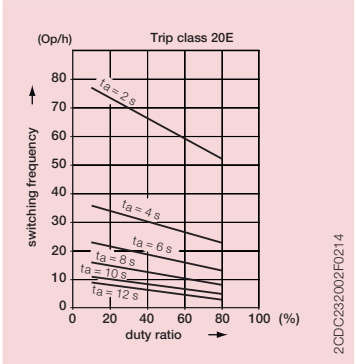
Resistance and power loss per pole and short-circuit protective devices

Type	Setting range		Resistance per pole	Power loss per pole		Short-circuit protective devices
	lower value A	upper value A	mΩ	at lower value W	at upper value W	coordination type 2
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

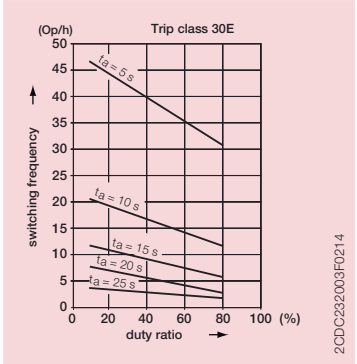
Intermittent periodic duty



Trip class 10E

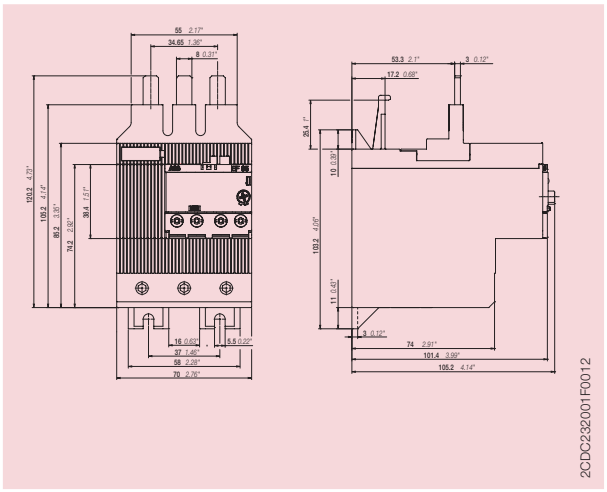


Trip class 20E

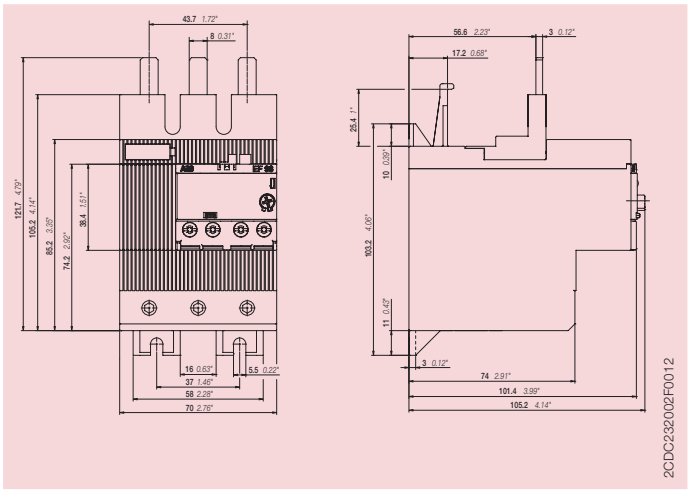


Trip class 30E

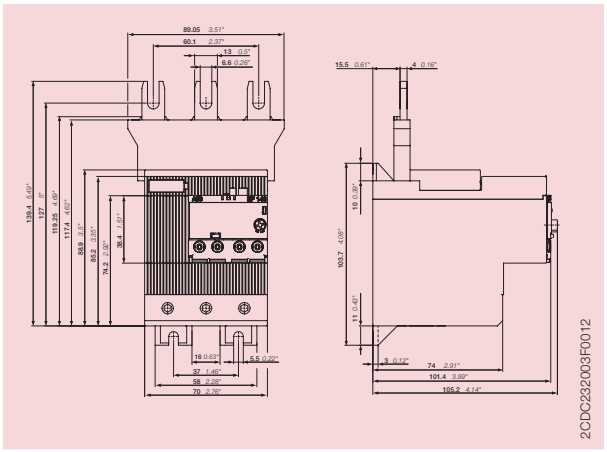
Dimensions



EF65-56 / EF65-70



EF96-56, EF96-100



EF146-150

Technical data IEC/EN

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

Main circuit

	EF65, EF96, EF146
Rated operational voltage U_e	1000 V AC
	- V DC
Setting range - electronic overload protection	see table on page 1
Rated operational current AC-3 I_e	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 U_{imp}	8 kV
Rated insulation voltage U_i	1000 V
Pollution degree	3
Overvoltage category	up to III

Electrical connection			EF65	EF96	EF146
Connecting capacity	rigid	1x	4 ... 35 mm²	4 ... 70 mm²	10 ... 95 mm²
		2x	4 ... 35 mm²	4 ... 35 mm²	10 ... 35 mm²
	flexible with ferrule	1x	4 ... 35 mm²	4 ... 50 mm²	10 ... 70 mm²
		2x	4 ... 35 mm²	4 ... 35 mm²	10 ... 35 mm²
	flexible with ferrule insulated	1x	4 ... 35 mm²	4 ... 50 mm²	10 ... 70 mm²
		2x	4 ... 35 mm²	4 ... 35 mm²	10 ... 35 mm²
	flexible	1x	4 ... 35 mm²	4 ... 70 mm²	10 ... 70 mm²
		2x	4 ... 35 mm²	4 ... 35 mm²	10 ... 35 mm²
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		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	3.00 A
at AC-15 at 220-230-240 V	NC, 95-96	3.00 A
	NO, 97-98	3.00 A
at AC-15 at 400 V	NC, 95-96	1.10 A
	NO, 97-98	1.10 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	1.50 A
	NO, 97-98	1.50 A
at DC-13 at 60 V	NC, 95-96	0.55 A
	NO, 97-98	0.55 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
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			95-96, 97-98
Connecting capacity	rigid	1x	1 ... 4 mm²
		2x	1 ... 4 mm²
	flexible with ferrule	1x	0.75 ... 2.5 mm²
		2x	0.75 ... 2.5 mm²
	flexible with ferrule insulated	1x	0.75 ... 2.5 mm²
		2x	0.75 ... 2.5 mm²
	flexible	1x	0.75 ... 2.5 mm²
		2x	0.75 ... 2.5 mm²
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 x 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			EF65	EF96	EF146
Connecting capacity	stranded	1x	AWG 10 ... 2	AWG 10 ... 2	AWG 6 ... 0
		2x	AWG 10 ... 2	AWG 10 ... 2	AWG 6 ... 2
	flexible	1x	AWG 10 ... 2	AWG 10 ... 2	AWG 6 ... 0
		2x	AWG 10 ... 2	AWG 10 ... 2	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	NC / NO	B600, Q600

Electrical connection			
Connecting capacity	stranded	1x	AWG 18 ... 10
		2x	AWG 18 ... 10
	flexible	1x	AWG 18 ... 10
		2x	AWG 18 ... 10
Stripping length			9 mm
Tightening torque			7 ... 11 lb.in
Recommended screw driver			Pozidriv 2

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Document number 2CDC107041D0201_Rev. B (06.2017)