Fuji Electric

Innovating Energy Technology

Manual Motor Starters
Magnetic Contactors

RoHS Compliant

USEH530c

Advanced Motor Protection and Control – Fuji Electric DUO series

Fuji Electric's new motor control system for the international market.

The DUO series adds a new family of compact, high-performance combination starters to manual motor starters BM3 series, magnetic contactors SK and SC-E series, and thermal overload relays TK12 and TK-E series to form a complete line-up of motor control products.

Responding to today's market needs, Fuji Electric DUO series was designed to provide various distinctive features.

ULTIMATE COST SAVING SOLUTION

- The number of components like Circuit Breakers can be reduced. (See page 4 to 7 for detail.)
- Combination starters combined with manual motor starters and contactors, provides 52% reduction for mounting space and 90% reduction for wiring work to make a control panel.

RESPONSE TO THE INTERNATIONAL MARKET

- Short-circuit protective coordination between protective devices and the equipment to be protected.
- Conformance to UL including Type E, Type F, CSA, IEC and other international standards.

SAFETY AND ECOLOGICAL CONSIDERATION

- Application of international standards in safety features such as terminals with finger protection.
- Use of recycled materials to help conserve the environment and save resources.

Fuji Electric meets emerging needs with a new form of motor protection.

DUO SERIES

Manual motor starters (MMS)

BM3 series

Manual Motor Starters that provide optimal protection by integrating the functions of a molded case circuit breaker and thermal overload relay into a highly compact unit.

Rated current: 0.16 to 32A, 10 to 63A
Short circuit current rating : 22, 50kA 480VAC
Width: 45mm, 55mm

Contactors and thermal overload relays

SK series

Compact magnetic contactors and small capacity motor control for 3 to 5HP, 480VAC.

Rated capacity: AC-3 3 to 5HP, 480VAC
Width: 45mm

SC-E series **TK-E series**

Magnetic contactors and thermal overload relays featuring terminals with finger protection for 5 to 100HP.

Rated capacity: AC-3 5 to 100HP
Width: 43,54,67mm (5 to 50HP)
88,100,115mm (60 to 100HP)

Combination starters

Provide the ability to configure combination starters for compact, reliable motor protection by combining a manual motor starter and a magnetic contactor.

Manual Motor Starters BM3 series

Conforming to international standards and combining compactness with high breaking performance, this versatile series features leading-edge motor protection.

Molded case circuit breaker and thermal overload relay functions integrated into a highly compact unit.

Circuit breaker functions

- Short-circuit protection
- Overcurrent protection
- Line protection

+

Thermal overload relay functions

- Overload protection
- Phase-loss protection
- Rated current adjustment
- Ambient temperature compensation

Manual motor starter advantages

Compactness	Mounting space: MCCB + Thermal overload relay: 100% MMS: **43**% (**57**% reduction)
Reduction in wiring work	MCCB + Contactor + Thermal overload relay: 100% MMS + Contactor: **50**% (**50**% reduction)
Standards	• IEC 60947-1, 60947-2, 60947-4-1, UL 508, CSA C22.2 No.14
Approved	• cUL (File No. E163944, E211710), TÜV (R205062B)
Ecological design	• Recyclable thermoplastic resin used in plastic parts • Indication of materials used • Cadmium-free contacts

Magnetic Contactors SK and SC-E series

A full line-up consisting of the mini-contactor SK series for 3 to 5HP, 480VAC use and the SC-E series for 5 to 100HP 480VAC use.

- Finger protection standard
- Lug terminal

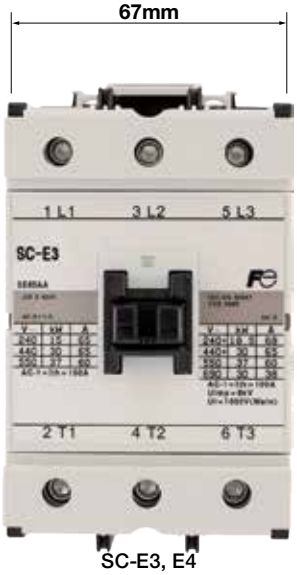
SK series

SK06, 09, 12

SC-E series

SC-E02 to E05

SC-E1 to E2S

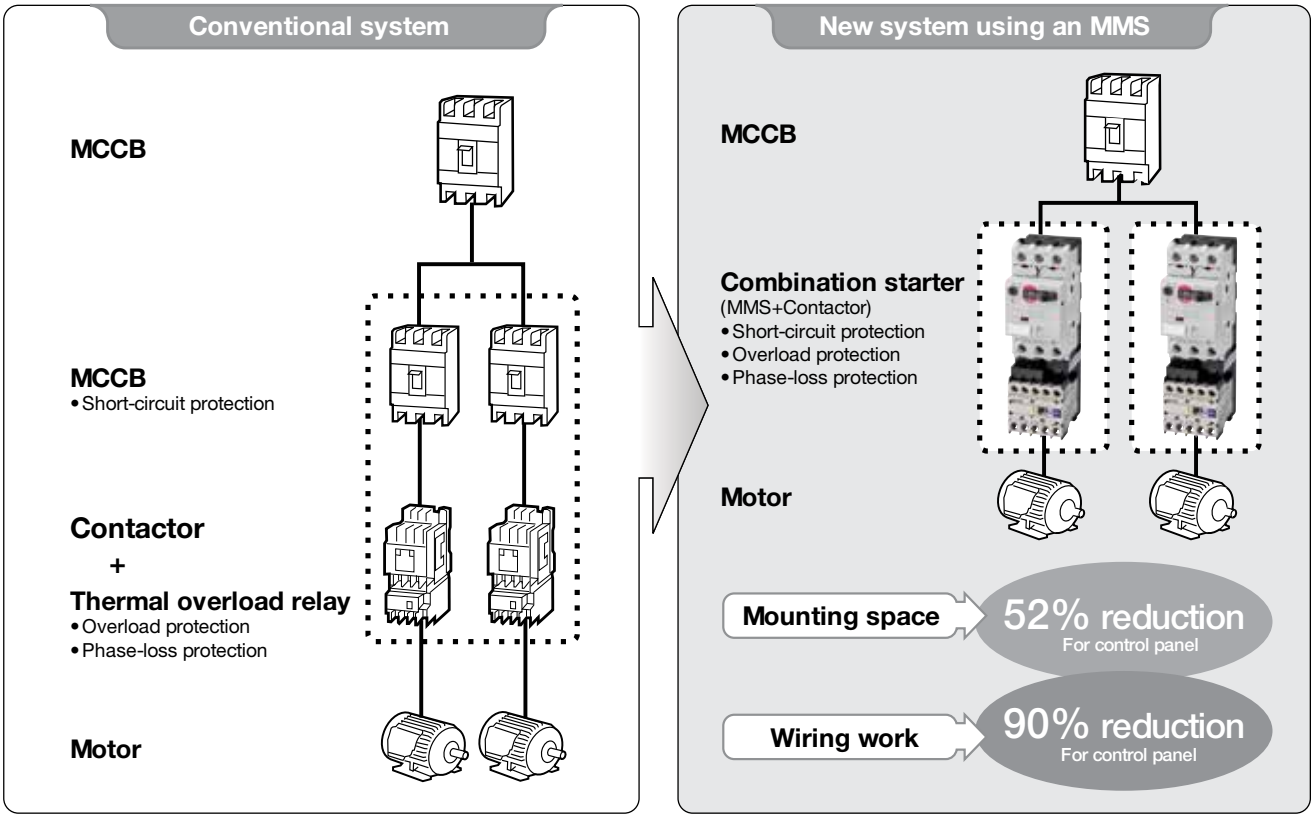


SC-E3, E4

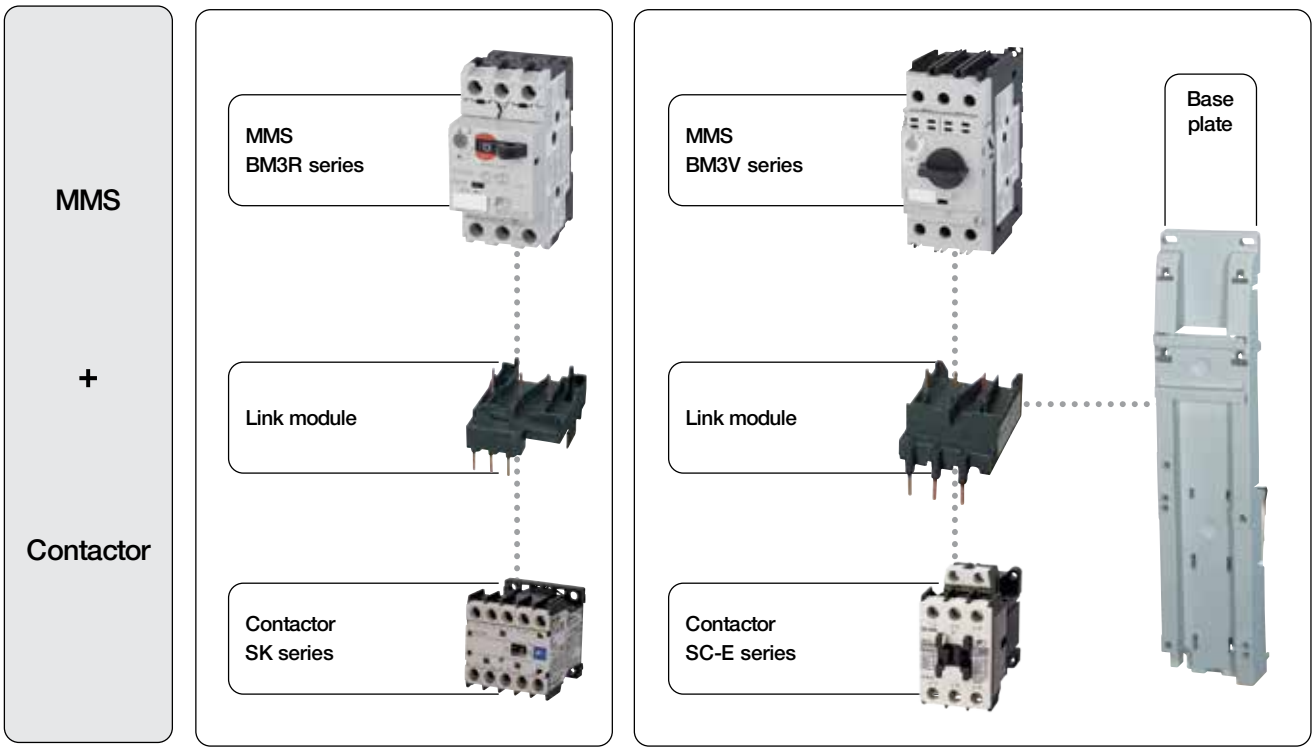
Combination of Manual Motor Starters and Magnetic Contactors

A line-up that aims to set a new world standard for compactness, high performance, and utility in combination starters.

Space-saving, reliable motor protection achieved by combining a manual motor starter and magnetic contactor.



Combination starters can be easily configured with a manual motor starter, magnetic contactor and other parts.



Ultimate Cost Saving Solution with DUO series

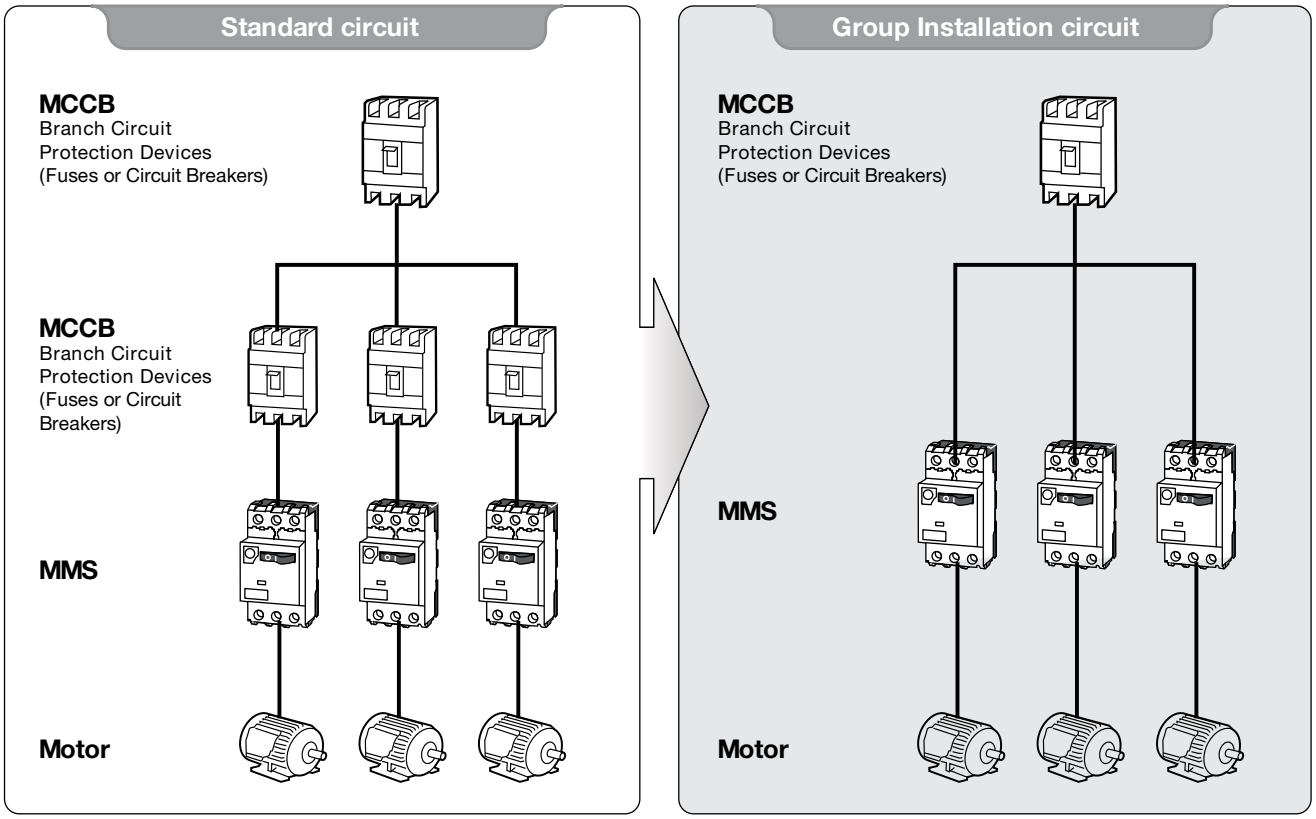
Fuji Electric Manual Motor Starter (MMS) intends to apply for manual motor starting application.
As UL listed manual motor controller per UL508, they provide overload protection but are required to be installed with short circuit protection devices (Fuses or Circuit Breakers) on the upstream.
However, according to National Electrical Code (NEC), you can save the cost of short circuit protection devices and can make a smaller panel using DUO series.
The following are case studies for the cost saving use of Fuji Electric's DUO series.

Case study 1 : Group Motor Installation

Per NEC430-52 and -53, the combination with a specific rated Fuse or Circuit Breaker allows several motors in a circuit composition.
Fuji Electric MMS are cUL listed per group installation regulations of NEC.
Two or more motors can be connected to one branch circuit when the MMS is used with a specific current rated branch circuit protection device (see remarks below).

The advantages of Group Installation are as follows.

- ***The number of components (i.e. Circuit Breakers) can be reduced***
- ***The wire size can be reduced by 1/3 - 1/10 under certain conditions***
- ***The area inside the control panel can be minimized***



Remarks :
Per NEC regulations, to connect several motors on one branch circuit protection device, note the following conditions (A) or (B) or (C) and condition (D) listed NEC article 430.53 must be complied.
(A) : Not over 1 horsepower
(B) : If smallest rated motor protected
(C) : Other group installation
(D) : Single motor taps.
For complete details, please refer to NEC book.

Case study 2 : Self-Protected Combination Motor Controller / TYPE E and TYPE F

Fuji Electric MMS are cUL listed as a Self-Protected Combination Controller such as Type E and Type F.
To apply MMS as Self-Protected Combination Controller, MMS must be attached to short circuit alarm contact block (**BZ0TKUAB**).
32A frame type, BM3R series must also be attached to the line side terminal cover **(BZ0TCRE)** because the Self-Protected Combination Controller has the clearance and creepage distance requirements as UL489 regulation.
(63A frame type, BM3V series complies with their regulation without terminal cover.)

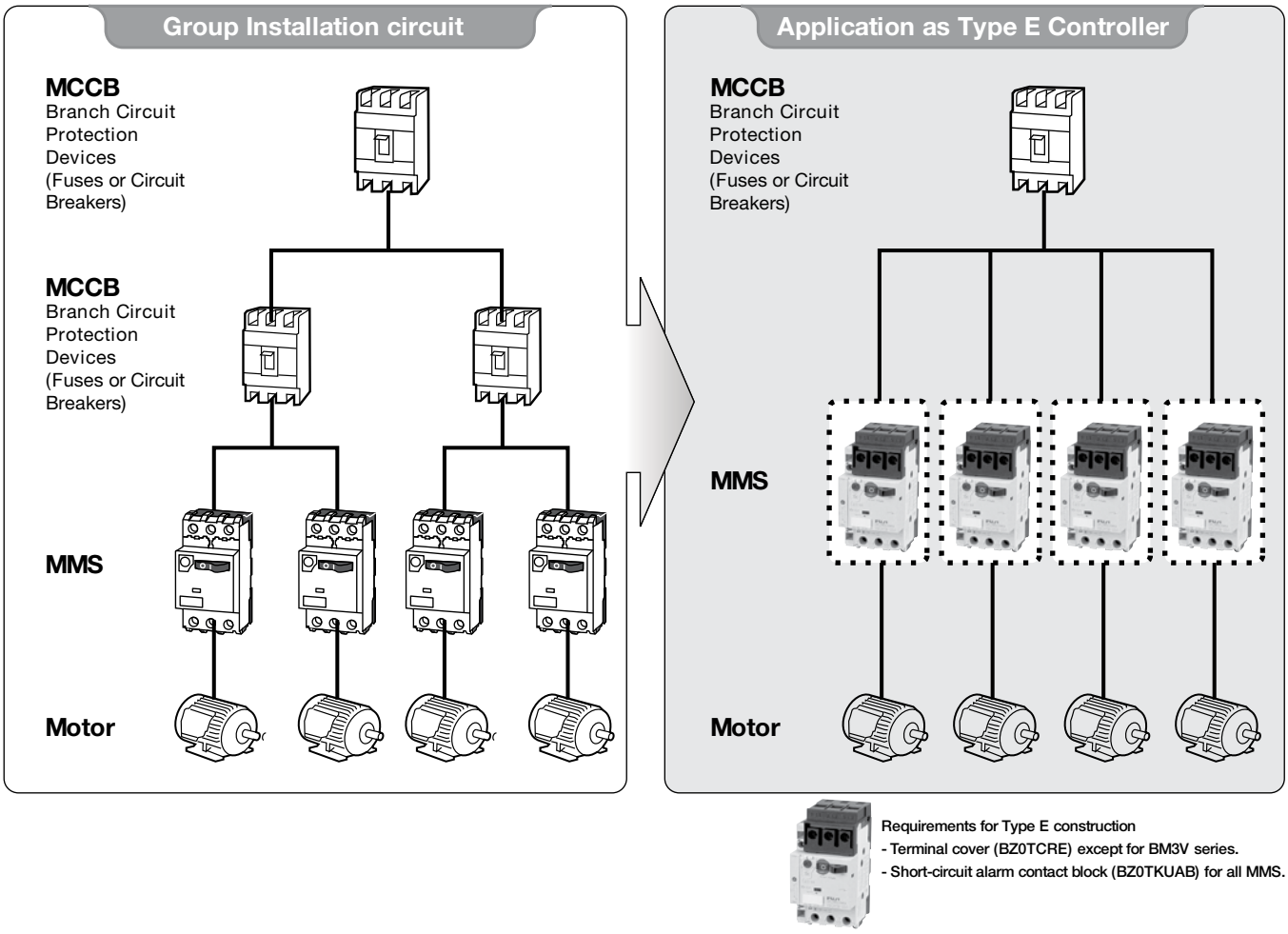
(1) Combination motor controller**, Type E,** when only MMS is used.
(Manual Self-Protected Combination Motor Controller according to UL508)

(2) Combination motor controller**, Type F,** when MMS is used with Fuji Electric SC-E, SK contactor.
(Manual Self-Protected Combination Motor Controller + Magnetic contactor according to UL508)

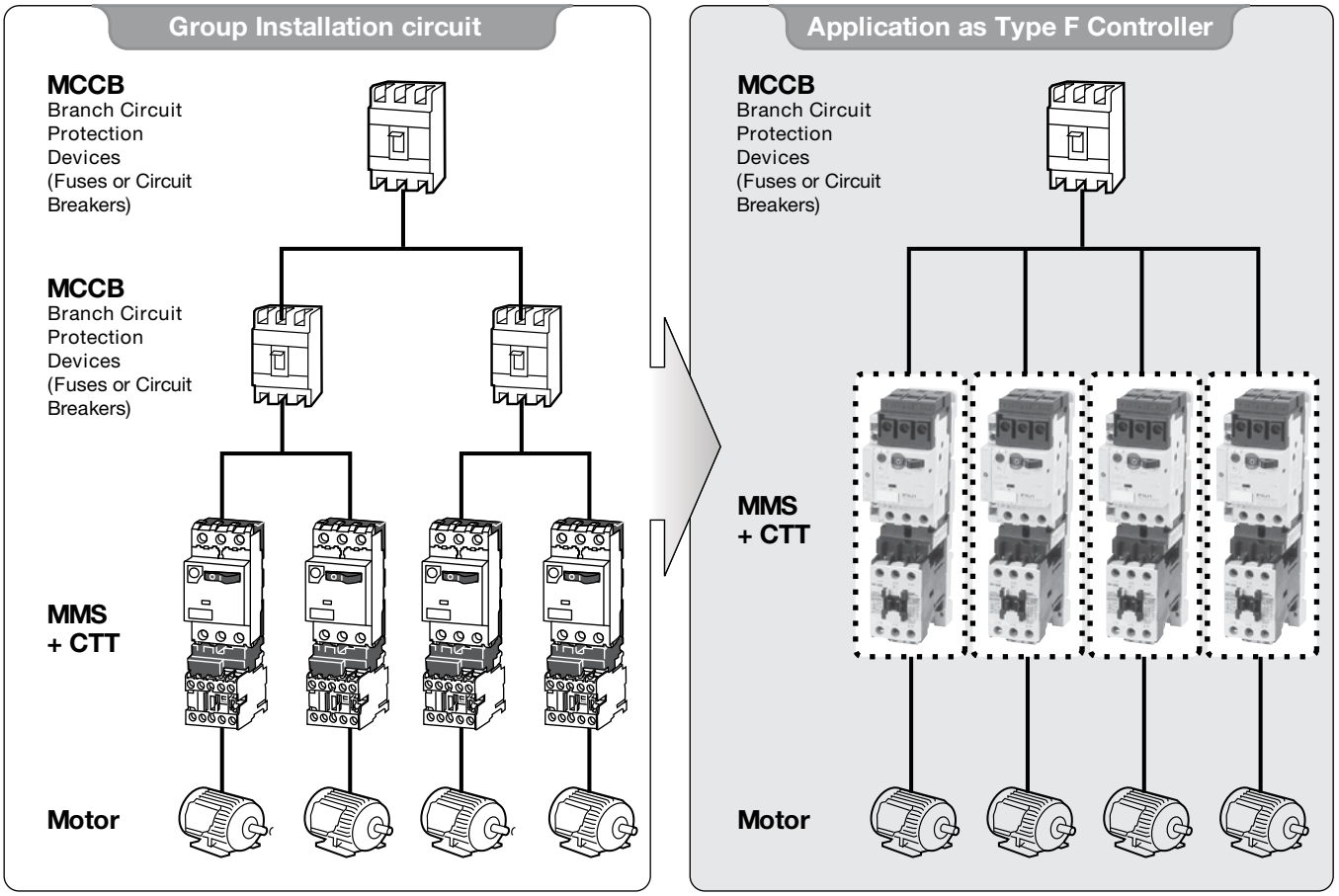
The advantage of a Self-Protected Combination Motor Controller is that it can replace a **UL489 Circuit Breaker.**
This means that in a motor branch circuit, the UL489 Circuit Breaker upstream can be eliminated.
MMS has a trip function like a Circuit Breaker for the purpose of protection against short-circuit.
Therefore, the number of components can be reduced and will result in saving more space than the ordinary Group Installation.

* The self-protected combination motor controller can be used as branch circuit protection in Motor Circuit only.
They cannot be applied to any other loads such as resistance load.

Example of Type E application



Example of Type F application



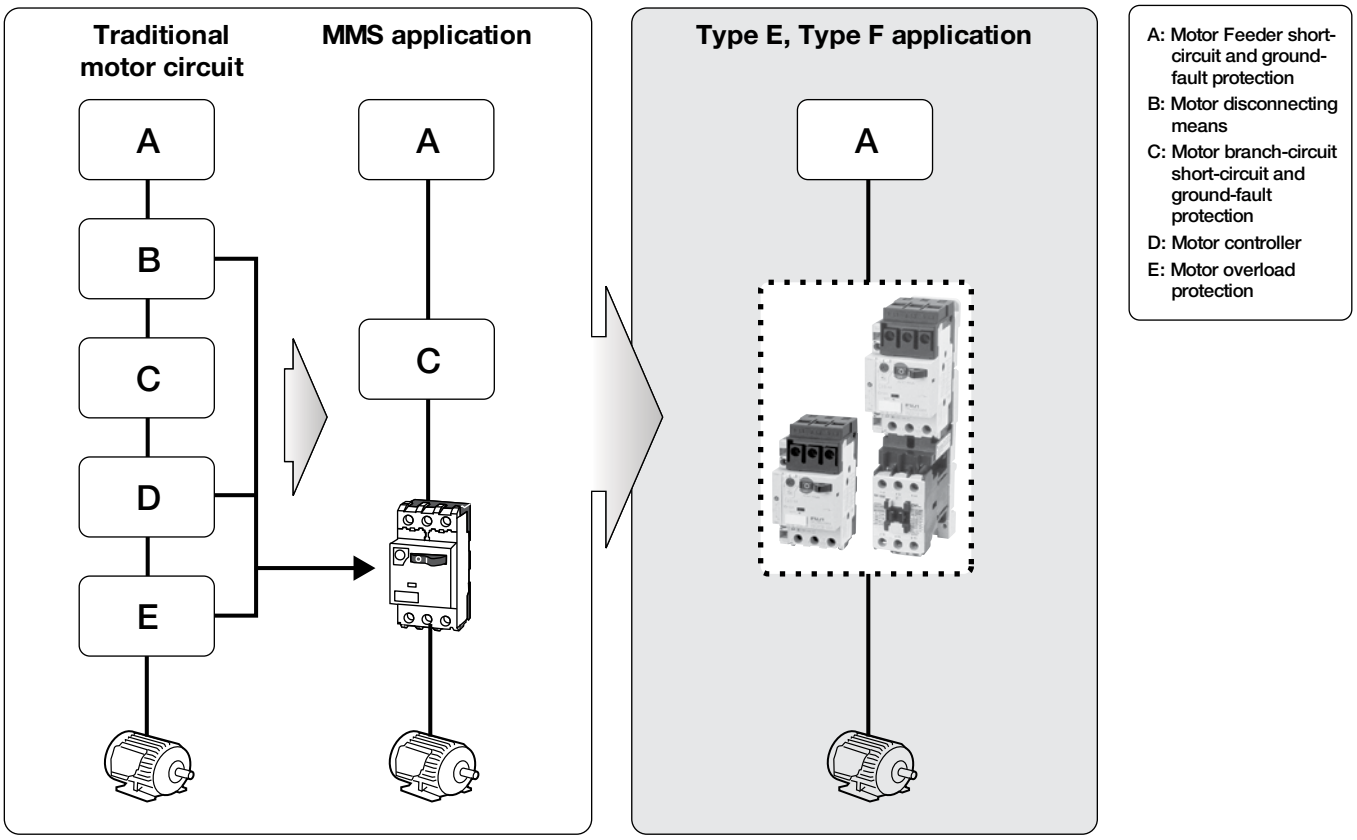
Requirements for Type F construction
- Must be used with contactor for motor control fuction.
- Terminal cover (BZ0TCRE) except for BM3V series.
- Short-circuit alarm contact block (BZ0TKUAB) for all MMS.

Case study 3 : Motor Disconnecting Means

Per NEC 430.102, a disconnecting means must be applied to each controller.
Fuji Electric MMS are also cUL listed as "Suitable as **Motor disconnect"** and can be applied as a Motor disconnect.

The advantage of using MMS for disconnect means :

- An extra component will not be needed because the MMS has a dual function, which will lead to smaller space requirement and less components.



DUO SERIES

CONTENTS

Manual Motor Starters
Quick Reference Guide

■ 32A Frame Types and Ratings

Adjustable thermal-magnetic trip type			**Standard breaking capacity** **BM3RSB-□**  KK01-317							
Number of poles			3							
Handle type			Rocker							
Rated current Ie		(A)	0.16 to 32							
Rated operational voltage Ue		(V)	200 to 690							
Rated frequency		(Hz)	50/60							
Rated insulation voltage Ui		(V)	690							
Rated impulse withstand voltage Uimp		(kV)	6							
Utilization category	IEC 60947-2 Circuit breaker		Cat. A							
	IEC 60947-4-1 Motor starter		AC-3							
Trip class IEC 60947-4-1			10							
Instantaneous trip characteristic			13 × Ie max.							
Power loss (total of 3-pole)			7W: In=0.16 to 25A 8.5W: In=32A							
Mechanical durability (operations)			100,000: In=0.16 to 25A 70,000: In=32A							
Electrical durability (operations)			100,000: In=0.16 to 25A 70,000: In=32A							
Max. operations per hour (motor start-up)			25							
Phase-loss protection			Provided							
Trip indicator			Provided							
Test trip function			Provided							
Adjustable current range			UL/CSA 3phase HP rating (HP) *2				Instantaneous trip current (A)	UL/CSA Short circuit current rating (kA) *3			Maximum listed branch circuit protection *3
Code *1	Ie: Min.–Max. (A)		200-208VAC	220-240VAC	440-480VAC	550-600VAC		240VAC	480VAC	600VAC	Fuse or MCCB (A)
P16	0.1–0.16		In accordance with Motor full load current				2.1	100	50	10	500
P25	0.16–0.25						3.3	100	50	10	500
P40	0.25–0.4						5.2	100	50	10	500
P63	0.4–0.63						8.2	100	50	10	500
001	0.63–1					1/2	13	100	50	10	500
1P6	1–1.6				3/4	3/4	20.8	100	50	10	500
2P5	1.6–2.5		1/2	1/2	1	1-1/2	32.5	100	50	10	500
004	2.5–4		3/4	3/4	2	3	52	100	50	10	500
6P3	4–6.3		1	1-1/2	3	5	81.9	100	50	10	500
010	6.3–10		2	3	5	7-1/2	130	100	22	10	500
013	9–13		3	3	7-1/2	10	169	100	22	10	500
016	11–16		3	5	10	10	208	100	22	10	500
020	14–20		5	5	10	15	260	50	22	10	500
025	19–25		7-1/2	7-1/2	15	20	325	50	22	10	500
032	24–32		10	10	20	30	416	50	22	10	500
Dimensions (mm) W X H X D			45 X 90 X 66								
Mass (g)			350								
Optional accessory	Auxiliary contact block		○								
	Alarm contact block		○								
	Auxiliary and alarm contact block		○								
	Short-circuit alarm contact block		○								
	Shunt trip device		○								
	Undervoltage trip device		○								
	External operating handle		–								
Standard			IEC 60947-1, 60947-2, 60947-4-1, UL 508, CSA C22.2 No.14								

Notes: *1 Replace the □ mark in the part number by current range codes.
*2 The BM3RSB is cUL listed as HP rated motor controllers.
*3 The BM3RSB is cUL listed for group Installation as per NEC430-53(C).

○ Available – Not available

■ 32A Frame Types and Ratings

Adjustable thermal-magnetic trip type	**High breaking capacity** **BM3RHB-□**

AF01-42

Number of poles		3
Handle type		Rotary
Rated current Ie	(A)	0.16 to 32
Rated operational voltage Ue	(V)	200 to 690
Rated frequency	(Hz)	50/60
Rated insulation voltage Ui	(V)	690
Rated impulse withstand voltage Uimp	(kV)	6
Utilization category	IEC 60947-2 Circuit breaker	Cat. A
	IEC 60947-4-1 Motor starter	AC-3
Trip class IEC 60947-4-1		10
Instantaneous trip characteristic		13 × Ie max.
Power loss (total of 3-pole)		7W: In=0.16 to 25A 8.5W: In=32A
Mechanical durability (operations)		100,000: In=0.16 to 25A 70,000: In=32A
Electrical durability (operations)		100,000: In=0.16 to 25A 70,000: In=32A
Max. operations per hour (motor start-up)		25
Phase-loss protection		Provided
Trip indicator		Provided
Test trip function		Provided

Adjustable current range		UL/CSA 3phase HP rating (HP) *2				Instantaneous trip current (A)	UL/CSA Short circuit current rating (kA) *3			Maximum listed branch circuit protection *3
Code *1	Ie: Min.–Max. (A)	200-208VAC	220-240VAC	440-480VAC	550-600VAC		240VAC	480VAC	600VAC	Fuse or MCCB (A)
P16	0.1–0.16	In accordance with Motor full load current				2.1	100	50	10	500
P25	0.16–0.25					3.3	100	50	10	500
P40	0.25–0.4					5.2	100	50	10	500
P63	0.4–0.63					8.2	100	50	10	500
001	0.63–1				1/2	13	100	50	10	500
1P6	1–1.6			3/4	3/4	20.8	100	50	10	500
2P5	1.6–2.5	1/2	1/2	1	1-1/2	32.5	100	50	10	500
004	2.5–4	3/4	3/4	2	3	52	100	50	10	500
6P3	4–6.3	1	1-1/2	3	5	81.9	100	50	10	500
010	6.3–10	2	3	5	7-1/2	130	100	50	10	500
013	9–13	3	3	7-1/2	10	169	100	50	10	500
016	11–16	3	5	10	10	208	100	50	10	500
020	14–20	5	5	10	15	260	100	50	10	500
025	19–25	7-1/2	7-1/2	15	20	325	100	50	10	500
032	24–32	10	10	20	30	416	100	50	10	500

Dimensions (mm) W X H X D		45 X 90 X 79
Mass (g)		370
Optional accessory	Auxiliary contact block	○
	Alarm contact block	○
	Auxiliary and alarm contact block	○
	Short-circuit alarm contact block	○
	Shunt trip device	○
	Undervoltage trip device	○
	External operating handle	○
Standard		IEC 60947-1, 60947-2, 60947-4-1, UL 508, CSA C22.2 No.14

Notes: *1 Replace the □ mark in the part number by current range codes. ○ Available – Not available
*2 The BM3RHB is cUL listed as HP rated motor controllers.
*3 The BM3RHB is cUL listed for group Installation as per NEC430-53(C).

■ 63A Frame Types and Ratings

Adjustable thermal-magnetic trip type		**Standard breaking capacity** **BM3VSB-□**  AF01-47								
Number of poles		3								
Handle type		Rotary								
Rated current Ie	(A)	10 to 63								
Rated operational voltage Ue	(V)	200 to 690								
Rated frequency	(Hz)	50/60								
Rated insulation voltage Ui	(V)	1000								
Rated impulse withstand voltage Uimp	(kV)	8								
Utilization category	IEC 60947-2 Circuit breaker	Cat. A								
	IEC 60947-4-1 Motor starter	AC-3								
Trip class IEC 60947-4-1		10								
Instantaneous trip characteristic		13 x Ie max.								
Power loss (total of 3-pole)		11W: In=10 to 32A 15W: In=40 to 50A 17W: In=63A								
Mechanical durability (operations)		50,000								
Electrical durability (operations)		25,000								
Max. operations per hour (motor start-up)		25								
Phase-loss protection		Provided								
Trip indicator		Provided								
Test trip function		Provided								
Adjustable current range		UL/CSA 3phase HP rating (HP) *2				Instantaneous trip current (A)	UL/CSA Short circuit current rating (kA) *3			Maximum listed branch circuit protection *3
Code *1	Ie: Min.–Max. (A)	200-208VAC	220-240VAC	440-480VAC	550-600VAC		240VAC	480VAC	600VAC	Fuse or MCCB (A)
010	6.3–10	2	3	5	7-1/2	130	100	22	10	600
013	9–13	3	3	7-1/2	10	169	100	22	10	600
016	11–16	3	5	10	10	208	100	22	10	600
020	14–20	5	5	10	15	260	100	22	10	600
025	19-25	7-1/2	7-1/2	15	20	325	100	22	10	600
032	24-32	10	10	20	30	416	100	22	10	600
040	28-40	10	10	30	30	520	100	22	10	600
050	35-50	15	15	30	40	650	100	22	10	600
063	45-63	20	20	40	60	819	100	22	10	600
Dimensions (mm) W X H X D		55 X 110 X 96								
Mass (g)		780								
Optional accessory	Auxiliary contact block	○								
	Alarm contact block	○								
	Auxiliary and alarm contact block	○								
	Short-circuit alarm contact block	○								
	Shunt trip device	○								
	Undervoltage trip device	○								
	External operating handle	○								
Standard		IEC 60947-1, 60947-2, 60947-4-1, UL 508, CSA C22.2 No.14								

Notes: *1 Replace the □ mark in the part number by current range codes.
*2 The BM3VSB is cUL listed as HP rated motor controllers.
*3 The BM3VSB is cUL listed for group Installation as per NEC430-53(C).

○ Available – Not available

63A Frame types and ratings

Adjustable thermal-magnetic trip type		**High breaking capacity** **BM3VHB-□**  AF01-43								
Number of poles		3								
Handle type		Rotary								
Rated current Ie	(A)	10 to 63								
Rated operational voltage Ue	(V)	200 to 690								
Rated frequency	(Hz)	50/60								
Rated insulation voltage Ui	(V)	1000								
Rated impulse withstand voltage Uimp	(kV)	8								
Utilization category	IEC 60947-2 Circuit breaker	Cat. A								
	IEC 60947-4-1 Motor starter	AC-3								
Trip class IEC 60947-4-1		10								
Instantaneous trip characteristic		13 x Ie max.								
Power loss (total of 3-pole)		11W: In=10 to 32A 15W: In=40 to 50A 17W: In=63A								
Mechanical durability (operations)		50,000								
Electrical durability (operations)		25,000								
Max. operations per hour (motor start-up)		25								
Phase-loss protection		Provided								
Trip indicator		Provided								
Test trip function		Provided								
Adjustable current range		UL/CSA 3phase HP rating (HP) *2				Instantaneous trip current (A)	UL/CSA Short circuit current rating (kA) *3			Maximum listed branch circuit protection *3
Code *1	Ie: Min.–Max. (A)	200-208VAC	220-240VAC	440-480VAC	550-600VAC		240VAC	480VAC	600VAC	Fuse or MCCB (A)
010	6.3–10	2	3	5	7-1/2	130	100	50	10	600
013	9–13	3	3	7-1/2	10	169	100	50	10	600
016	11–16	3	5	10	10	208	100	50	10	600
020	14–20	5	5	10	15	260	100	50	10	600
025	19-25	7-1/2	7-1/2	15	20	325	100	50	10	600
032	24-32	10	10	20	30	416	100	50	10	600
040	28-40	10	10	30	30	520	100	50	10	600
050	35-50	15	15	30	40	650	100	50	10	600
063	45-63	20	20	40	60	819	100	50	10	600
Dimensions (mm)	W X H X D	55 X 110 X 96								
Mass (g)		780								
Optional accessory	Auxiliary contact block	○								
	Alarm contact block	○								
	Auxiliary and alarm contact block	○								
	Short-circuit alarm contact block	○								
	Shunt trip device	○								
	Undervoltage trip device	○								
	External operating handle	○								
Standard		IEC 60947-1, 60947-2, 60947-4-1, UL 508, CSA C22.2 No.14								

Notes: *1 Replace the □ mark in the part number by current range codes.
*2 The BM3VHB is cUL listed as HP rated motor controllers.
*3 The BM3VHB is cUL listed for group Installation as per NEC430-53(C).

○ Available – Not available

Manual Motor Starters
Type E Ratings

• BM3RSB (Type E ratings)

Manual motor starters		3 phase motor		Short circuit rating(kA)	
Code	Ie; Min-Max. (A)	Rated capacity (HP) 220-240V AC	Rated capacity (HP) 440-480V AC	up to 240V AC	up to 480/277V AC
P16	0.1-0.16	In accordance with Motor full load current		100	50
P25	0.16-0.25			100	50
P40	0.25-0.4			100	50
P63	0.4-0.63			100	50
001	0.63-1.0			100	50
1P6	1-1.6		3/4	100	50
2P5	1.6-2.5	1/2	1	100	50
004	2.5-4	3/4	2	100	50
6P3	4-6.3	1-1/2	3	100	50
010	6.3-10	3	5	100	22
013	9-13	3	7-1/2	100	22
016	11-16	5	10	100	22
020	14-20	5	10	100	22
025	19-25	7-1/2	15	50	22
032	24-32a	10	20	50	22

To make an application for use with Type E controller, you need to prepare BZ0TCRE and BZ0TKUAB accessories for BM3RSB separately.

• BM3RHB (Type E ratings)

Manual motor starters		3 phase motor		Short circuit rating(kA)	
Code	Ie; Min-Max. (A)	Rated capacity (HP) 220-240V AC	Rated capacity (HP) 440-480V AC	up to 240V AC	up to 480/277V AC
P16	0.1-0.16	In accordance with Motor full load current		100	50
P25	0.16-0.25			100	50
P40	0.25-0.4			100	50
P63	0.4-0.63			100	50
001	0.63-1.0			100	50
1P6	1-1.6		3/4	100	50
2P5	1.6-2.5	1/2	1	100	50
004	2.5-4	3/4	2	100	50
6P3	4-6.3	1-1/2	3	100	50
010	6.3-10	3	5	100	50
013	9-13	3	7-1/2	100	50
016	11-16	5	10	100	50
020	14-20	5	10	100	50
025	19-25	7-1/2	15	100	50
032	24-32	10	20	100	50

To make an application for use with Type E controller, you need to prepare BZ0TCRE and BZ0TKUAB accessories for BM3RHB separately.

• BM3VSB (Type E ratings)

Manual motor starters		3 phase motor		Short circuit rating(kA)	
Code	Ie; Min-Max. (A)	Rated capacity (HP) 220-240V AC	Rated capacity (HP) 440-480V AC	up to 240V AC	up to 480/277V AC
010	6.3-10	3	5	100	22
013	9-13	3	7-1/2	100	22
016	11-16	5	10	100	22
020	14-20	5	10	100	22
025	19-25	7-1/2	15	100	22
032	24-32	10	20	100	22
040	28-40	10	30	100	22
050	35-50	15	30	100	22
063	45-63	20	40	100	22

To make an application for use with Type E controller, you need to prepare BZ0TKUAB accessories for BM3VSB separately.

• BM3VHB (Type E ratings)

Manual motor starters		3 phase motor		Short circuit rating(kA)	
Code	Ie; Min-Max. (A)	Rated capacity (HP) 220-240V AC	Rated capacity (HP) 440-480V AC	up to 240V AC	up to 480/277V AC
010	6.3-10	3	5	100	50
013	9-13	3	7-1/2	100	50
016	11-16	5	10	100	50
020	14-20	5	10	100	50
025	19-25	7-1/2	15	100	50
032	24-32	10	20	100	50
040	28-40	10	30	100	50
050	35-50	15	30	100	50
063	45-63	20	40	100	50

To make an application for use with Type E controller, you need to prepare BZ0TKUAB accessories for BM3VHB separately.

Ordering Information

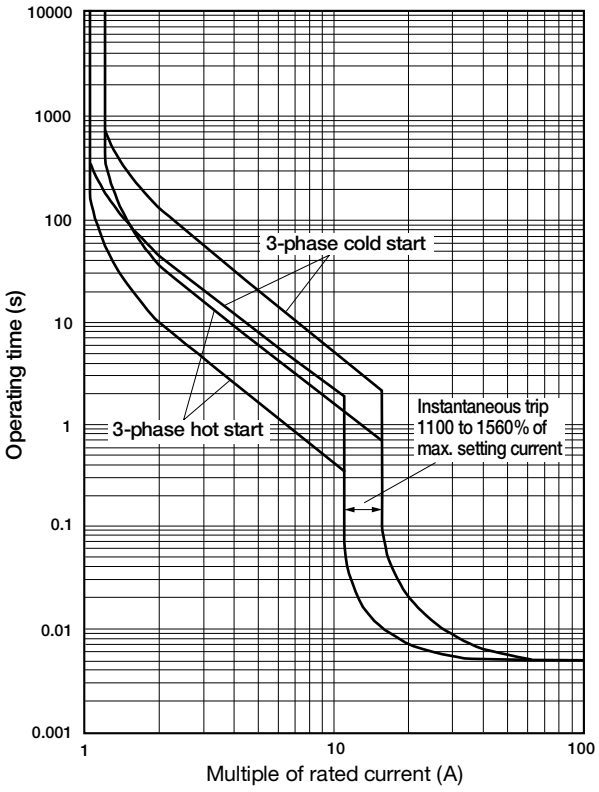
Specify the following:
1. Part number
2. Accessories if required

BM3 V H B - 063

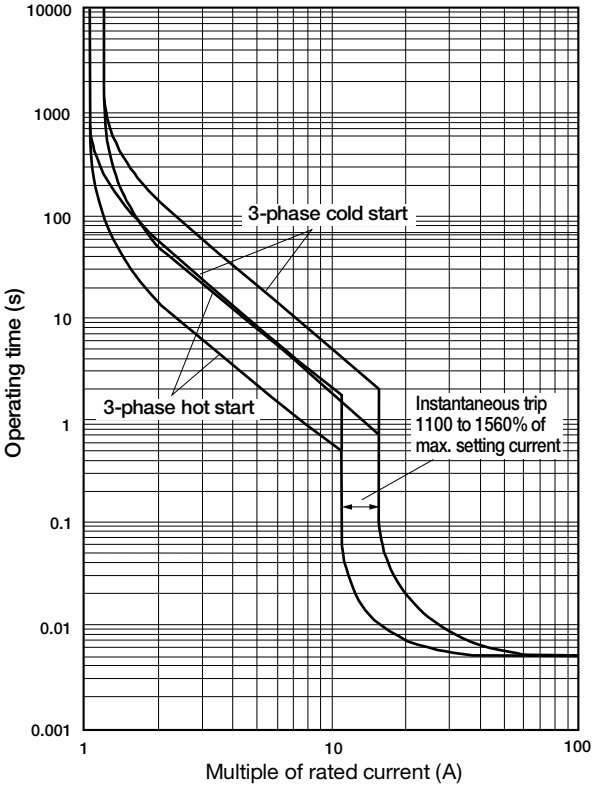
- Product category
- Frame size
  - R: 32A Frame 45mm wide
  - V: 63A Frame 55mm wide
- Breaking capacity
  - S: Standard breaking capacity
  - H: High breaking capacity
- Operating characteristic
  - B: Adjustable thermal-magnetic trip
- Rated current code (see page 9 to 12)

Characteristic Curves

• BM3RSB, RHB



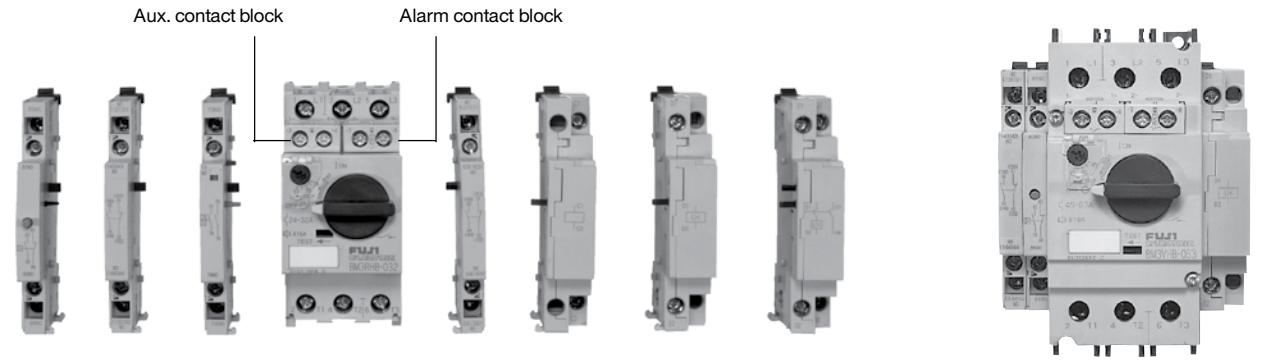
• BM3VSB, VHB



Manual Motor Starters
Optional Accessories

Features

- All accessories can be used with BM3R (45mm wide) and BM3V (55mm wide) frames.
- Accessories are easily mounted.
- Internal auxiliary contact blocks and alarm contact blocks can be mounted on front side.
- External auxiliary contact blocks can be mounted on either the right or left side.
- Shunt trip and undervoltage trip devices are available in a wide range of operating voltages.
- Standard and emergency external handles are available.
- IP20 terminal cover prevents accidental contact to electrically charged parts.



Aux. contact blocks
Aux. and alarm contact block
Short-circuit alarm contact block

Aux. contact blocks
Shunt-trip device
Undervoltage trip device

AF01-76

Part Number and Ratings

• Auxiliary Contact Blocks (W)

Description	Starter type	Mounting	Contact arrangement	Part number	Mass (g)
 AF01-60L  AF01-59, 01-58 These blocks are linked to the ON/OFF operation of the MMS. Up to two contact blocks can be mounted to the right/left front, and up to two contact blocks can be mounted to the right/left sides.	BM3R BM3V	Front	1NO 1NC	**BZ0WIA** **BZ0WIB**	9
		Left side	2NO 1NO+1NC 2NC	**BZ0WUAAL** **BZ0WUABL** **BZ0WUBBL**	45
		Right side	2NO 1NO+1NC 2NC	**BZ0WUAAR** **BZ0WUABR** **BZ0WUBBR**	45

• Alarm Contact Blocks (K)

Description	Starter type	Mounting	Contact arrangement	Part number	Mass (g)
 AF01-60R This block operates when the MMS trips due to overload, phase-loss, or short-circuit. It is not linked to the ON/OFF operation of the MMS. Note: Operation can be checked with the test trip function.	BM3R BM3V	Front (Right side only)	1NO 1NC	**BZ0KIA** **BZ0KIB**	9

• Auxiliary and Alarm Contact Blocks (WK)

Description	Starter type	Mounting	Contact arrangement	Part number	Mass (g)
 AF01-57 • This contact block combines auxiliary contact and alarm contact that operate in the event of an overload, phase loss, or short-circuit. Alarm contact is not linked to the ON/OFF operation of the MMS. • An alarm is displayed in the contact block's indicator when the alarm contact operates. Note: Operation can be checked with the test trip function.	BM3R BM3V	Left	1NO (Aux.)+ 1NO (Alarm) 1NC (Aux.)+ 1NO (Alarm) 1NO (Aux.)+ 1NC (Alarm) 1NC (Aux.)+ 1NC (Alarm)	**BZ0WKUAA** **BZ0WKUBA** **BZ0WKUAB** **BZ0WKUBB**	45

• Short-circuit Alarm Contact Block (KI)

Description	Starter type	Mounting	Contact arrangement	Part number	Mass (g)
 AF01-56 • The contacts operate only when the MMS has tripped due to a short-circuit. • When these contacts operate, the blue reset button extends out, and a trip indication is displayed. • The power to the MMS can be turned ON after pressing the reset button. Note: Operation can be checked with the test trip function. Be sure to press the reset button before mounting to the MMS.	BM3R BM3V	Left	1NO+1NC	**BZ0TKUAB**	45

• Shunt Trip Devices (F)

Description	Starter type	Mounting	Coil voltage	Part number	Mass (g)
 AF01-55 This device is used to remotely trip the MMS. Notes: • This device cannot be used together with an undervoltage trip device. • When the MMS has been tripped with the shunt trip device, press the reset button before turning ON the power.	BM3R BM3V	Right	24VAC 50/60Hz 48VAC 60Hz 48VAC 50Hz/60VAC 60Hz 100VAC 50Hz/100–110VAC 60Hz 110–127VAC 50Hz/120VAC 60Hz 200VAC 50Hz/200–220VAC 60Hz 220–230VAC 50Hz/240–260VAC 60Hz 240VAC 50Hz/277VAC 60Hz 380–400VAC 50Hz/400–440VAC 60Hz 415–440VAC 50Hz/460–480VAC 60Hz 500VAC 50Hz/600VAC 60Hz 24–60V DC * 110-240V DC *	**BZ0FAZU** **BZ0FBZU** **BZ0FCZU** **BZ0F1ZU** **BZ0FDZU** **BZ0FEZU** **BZ0FFZU** **BZ0FGZU** **BZ0FHZU** **BZ0F4ZU** **BZ0FJZU** **BZ0FKZUD** **BZ0FLZUD**	115

Note: * The time rating of coil is 5s.

• Undervoltage Trip Devices (R)

Description	Starter type	Mounting	Coil voltage	Part number	Mass (g)
 AF01-54 R types This device automatically trips the MMS when the control circuit voltage drops below the specified value. Notes: • This device cannot be used together with a shunt trip device. • When the MMS has been tripped with the undervoltage trip device, press the reset button before turning ON the power.	BM3R BM3V	Right	24VAC 50Hz 24VAC 60Hz 48VAC 50Hz 48VAC 60Hz 100VAC 50Hz/100–110VAC 60Hz 110–127VAC 50Hz/120VAC 60Hz 200VAC 50Hz/200–220VAC 60Hz 220–230VAC 50Hz/240–260VAC 60Hz 240VAC 50Hz/277VAC 60Hz 380–400VAC 50Hz/400–440VAC 60Hz 415–440VAC 50Hz/460–480VAC 60Hz 500VAC 50Hz/600VAC 60Hz	**BZ0RAZ1U** **BZ0RAZ2U** **BZ0RBZ1U** **BZ0RBZU** **BZ0R1ZU** **BZ0RDZU** **BZ0REZU** **BZ0RFZU** **BZ0RGZU** **BZ0RHZU** **BZ0R4ZU** **BZ0RJZU**	115

Manual Motor Starters
Optional Accessories

• External Operating Handles

Description	Starter type	Handle type	Part number	Mass (g)
 KK02-305 •Used to operate an MMS installed inside a panel, from the outside of the panel. •Equipped with an interlock mechanism that prevents someone from mistakenly opening the panel door when the MMS is in the ON state. •The shaft can be cut to match the distance between the MMS and the panel door.	BM3RH	Standard (black) Emergency (red/yellow)	**BZ0VBBL** **BZ0VYRL**	160 160
 KK02-306 •Door interlock function •OFF lock function •Can be locked OFF with up to three padlocks. Note: Padlocks not included. •Release screw allows the door to be opened with the handle in the ON position. •IP54 enclosure	BM3V	Standard (black) Emergency (red/yellow)	**BZ0VBBM** **BZ0VYRM**	160 160

• Line Side Terminal Cover

Description	Starter type	Part number	Mass (g)
 Used for making Type E or Type F condition	BM3R	**BZ0TCRE**	30

• Others

Description	Starter type	Part number	Mass (g)
Push-in lug  Used for screw mounting. 10 pcs/pack	BM3R	**BZ0SET**	2.0
Terminal cover for IP20  Prevents accidental contact to charged parts. 6 pcs/pack	BM3V	**BZ0TCV**	0.6
Dummy cover  KK02-39 •Used to cover the open space if an internally mounted accessory should become unnecessary. •Mounts to either the left-front or right-front position. •10 pcs/pack	BM3R BM3V	**BZ0CFG**	1.4

Ratings of Accessories

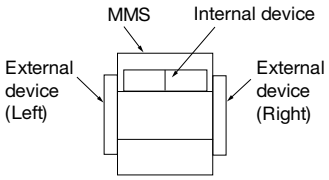
Accessory type		Auxiliary contact block/front	Auxiliary contact block/side	Alarm contact block	Aux. and alarm contact block	Short-circuit alarm contact block
Part number		**BZ0WI**	**BZ0WU**	**BZ0KI**	**BZ0WKU**	**BZ0TKUAB**
Standard		IEC 60947-5-1, UL 508				
Rated operational current (A)	48V AC AC-15	5	6	5	6	6
	125V AC	3	4	3	4	4
	230V AC	1.5	4	1.5	4	4
	400V AC	–	2.2	–	2.2	2.2
	500V AC	–	1.5	–	1.5	1.5
	690V AC	–	0.6	–	0.6	0.6
	48V DC DC-13	1.38	5	1.38	5	5
	110V DC	0.55	1.3	0.55	1.3	1.3
	220V DC	0.27	0.5	0.27	0.5	0.5
Contact rating code UL 508		B300	A600	B300	A600	A600
		Q300	P300	Q300	P300	P300
Min. voltage and current		17V 5mA				

Accessory type		Shunt trip device	Undervoltage device
Part number		BZ0F	BZ0R
Standard		IEC 60947-1, UL 508	
Rated insulation voltage (V AC)	IEC 60947	690	
	UL 508	600	
No. of ON-OFF operations		5000	
Operating time (ms)		20	
Power consumption	Inrush (VA/W)	21/12	
	Sealed (VA/W)	8/1.2	
Voltage range	Tripping voltage (V)	0.7 to 1.1Ue	0.35 to 0.7Ue
	Closing voltage (V)	–	0.85 to 1.1Ue
Time rating of coil (s)		AC: Continuous	AC: Continuous
		DC: 5	

Note: Ue: Rated Voltage

Manual Motor Starters
Optional Accessories

■ Available accessory configuration



Internal devices

Auxiliary contact block (W) Alarm contact block (K)

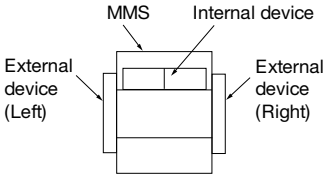
External devices

Auxiliary contact (W2) Auxiliary and alarm contact block (WK) Short-circuit alarm contact block (KI)

Shunt trip device (F) Undervoltage trip device (R)

Adj. thermal-magnetic trip type MMS		BM3RSB, BM3RHB						BM3VSB, BM3VHB					
Internal accessory			W	W	K	W+W	W+K		W	W	K	W+W	W+K
External accessory	W2 (Left)	W2	W2W	W2W	W2K	W2WW	W2WK	W2	W2W	W2W	W2K	W2WW	W2WK
	W2 (Right)	W2	W2W	W2W	W2K	W2WW	W2WK	W2	W2W	W2W	W2K	W2WW	W2WK
	WK (Left)	WK	WKW	WKW	WKK	WKWW	WKWK	WK	WKW	WKW	WKK	WKWW	WKWK
	KI (Left)	KI	KIW	KIW	KIK	KIWW	KIWK	KI	KIW	KIW	KIK	KIWW	KIWK
	F (Right)	F	WF	WF	KF	WWF	WKF	F	WF	WF	KF	WWF	WKF
	R (Right)	R	WR	WR	KR	WWR	WKR	R	WR	WR	KR	WWR	WKR
	W2 (Left)+F	W2F	W2WF	W2WF	W2KF	W2WWF	W2WKF	W2F	W2WF	W2WF	W2KF	W2WWF	W2WKF
	W2 (Left)+R	W2R	W2WR	W2WR	W2KR	W2WWR	W2WKR	W2R	W2WR	W2WR	W2KR	W2WWR	W2WKR
	WK+F	WKF	WKWF	WKWF	WKKF	WKWWF	WKWKF	WKF	WKWF	WKWF	WKKF	WKWWF	WKWKF
	WK+R	WKR	WKWR	WKWR	WKKR	WKWWR	WKWKR	WKR	WKWR	WKWR	WKKR	WKWWR	WKWKR
	KI+F	KIF	KIWF	KIWF	KIKF	KIWWF	KIWKF	KIF	KIWF	KIWF	KIKF	KIWWF	KIWKF
	KI+R	KIR	KIWR	KIWR	KIKR	KIWWR	KIWKR	KIR	KIWR	KIWR	KIKR	KIWWR	KIWKR
	W2 (Left)+ W2 (Left)	W2W2	W2W2W	W2W2W	W2W2K	W2W2WW	W2W2WK	W2W2	W2W2W	W2W2W	W2W2K	W2W2WW	W2W2WK
	W2 (Left)+ W2 (Right)	W2W2	W2W2W	W2W2W	W2W2K	W2W2WW	W2W2WK	W2W2	W2W2W	W2W2W	W2W2K	W2W2WW	W2W2WK

■ Available Accessory Configuration (continued)



Internal devices

⊡ Auxiliary contact block (W) ◉ Alarm contact block (K)

External devices

⊡ Auxiliary contact (W2) ◉ Auxiliary and alarm contact block (WK) ◎ Short-circuit alarm contact block (KI)

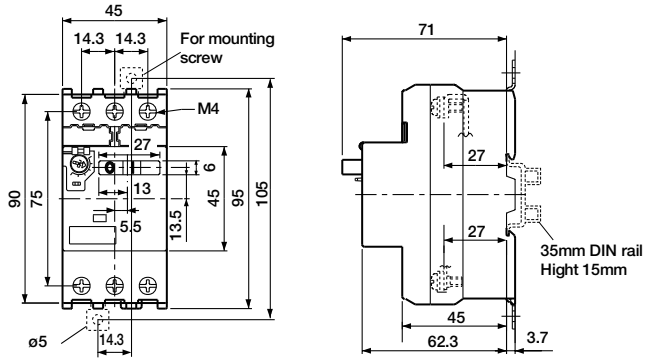
▯ Shunt trip device (F) ■ Undervoltage trip device (R)

Adj. thermal-magnetic trip type MMS		**BM3RSB, BM3RHB**						**BM3VSB, BM3VHB**					
Internal accessory			W	W	K	W+W	W+K		W	W	K	W+W	W+K
External accessory	W2 (Right)+ W2 (Right)	W2W2	W2W2W	W2W2W	W2W2K	W2W2WW	W2W2WK	W2W2	W2W2W	W2W2W	W2W2K	W2W2WW	W2W2WK
	W2 (Left)+ WK	W2WK	W2WKW	W2WKW	W2WKK	W2WKWW	W2WKWK	W2WK	W2WKW	W2WKW	W2WKK	W2WKWW	W2WKWK
	W2 (Right)+ WK	W2WK	W2WKW	W2WKW	W2WKK	W2WKWW	W2WKWK	W2WK	W2WKW	W2WKW	W2WKK	W2WKWW	W2WKWK
	W2 (Left)+ KI	W2KI	W2KIW	W2KIW	W2KIK	W2KIWW	W2KIWK	W2KI	W2KIW	W2KIW	W2KIK	W2KIWW	W2KIWK
	W2 (Right)+ KI	W2KI	W2KIW	W2KIW	W2KIK	W2KIWW	W2KIWK	W2KI	W2KIW	W2KIW	W2KIK	W2KIWW	W2KIWK
	KI+WK	KIWK	KIWKW	KIWKW	KIWKK	KIWKWW	KIWKWK	KIWK	KIWKW	KIWKW	KIWKK	KIWKWW	KIWKWK
	W2 (Left)+ W2 (Left)+F	W2W2F	W2W2WF	W2W2WF	W2W2KF	W2W2WWF	W2W2WKF	W2W2F	W2W2WF	W2W2WF	W2W2KF	W2W2WWF	W2W2WKF
	W2 (Left)+ W2 (Left)+R	W2W2R	W2W2WR	W2W2WR	W2W2KR	W2W2WWR	W2W2WKR	W2W2R	W2W2WR	W2W2WR	W2W2KR	W2W2WWR	W2W2WKR
	W2 (Left)+ WK+F	W2WKF	W2WKWF	W2WKWF	W2WKKF	W2WKWWF	W2WKWKF	W2WKF	W2WKWF	W2WKWF	W2WKKF	W2WKWWF	W2WKWKF
	W2 (Left)+ WK+R	W2WKR	W2WKWR	W2WKWR	W2WKKR	W2WKWWR	W2WKWKR	W2WKR	W2WKWR	W2WKWR	W2WKKR	W2WKWWR	W2WKWKR
	W2 (Left)+ KI+F	W2KIF	W2KIWF	W2KIWF	W2KIKF	W2KIWWF	W2KIWKF	W2KIF	W2KIWF	W2KIWF	W2KIKF	W2KIWWF	W2KIWKF
	W2 (Left)+ KI+R	W2KIR	W2KIWR	W2KIWR	W2KIKR	W2KIWWR	W2KIWKR	W2KIR	W2KIWR	W2KIWR	W2KIKR	W2KIWWR	W2KIWKR
	KI+WK+F	KIWKF	KIWKWF	KIWKWF	KIWKKF	KIWKWWF	KIWKWKF	KIWKF	KIWKWF	KIWKWF	KIWKKF	KIWKWWF	KIWKWKF
	KI+WK+R	KIWKR	KIWKWR	KIWKWR	KIWKKR	KIWKWWR	KIWKWKR	KIWKR	KIWKWR	KIWKWR	KIWKKR	KIWKWWR	KIWKWKR

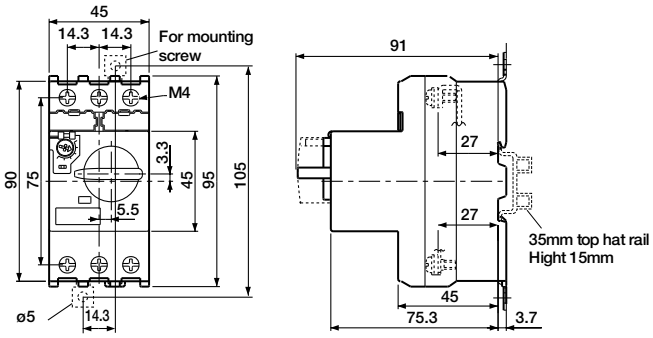
Manual Motor Starters
Dimensions

■ Dimensions, mm

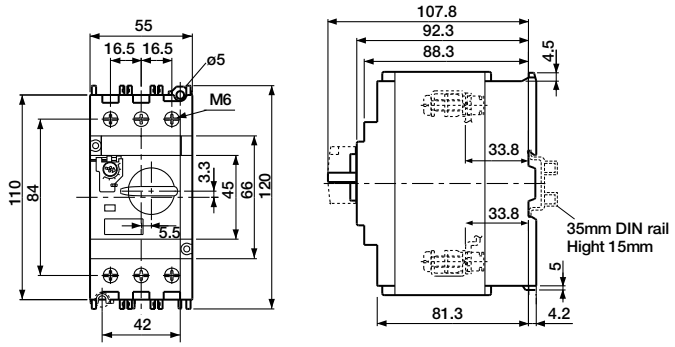
• Rocker handle types BM3RSB



• Rotary handle types BM3RHB

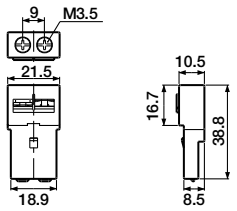


• Rotary handle types BM3VSB, BM3VHB

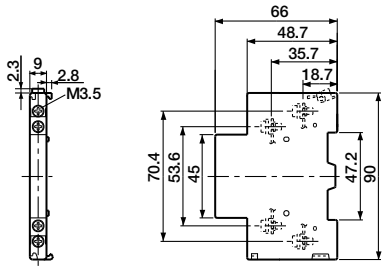


Accessories

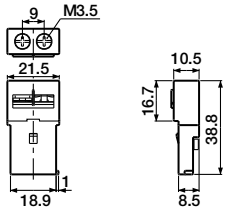
• Auxiliary contact blocks, front mounting
BZ0WI



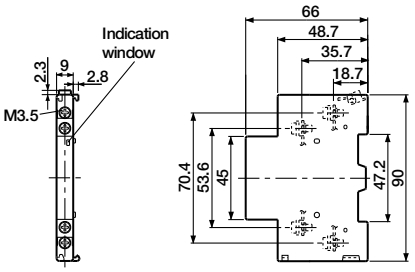
• Auxiliary contact blocks, side mounting
BZ0WU



• Alarm contact blocks, front mounting
BZ0KI



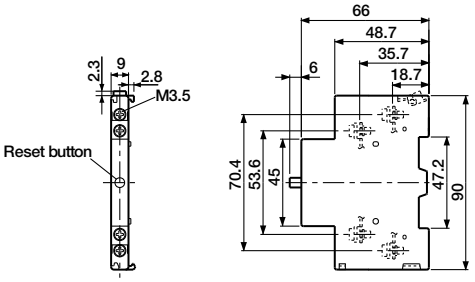
• Auxiliary and alarm contact blocks
BZ0WKU



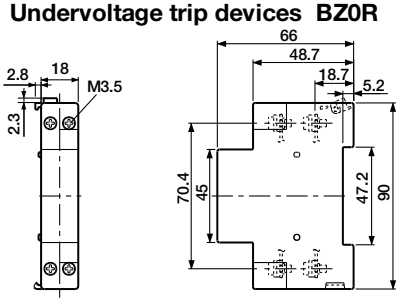
■ Dimensions, mm

Accessories

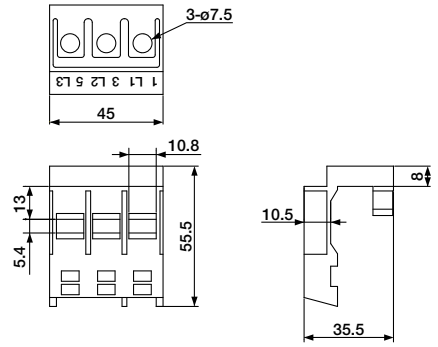
• Short-circuit alarm contact block BZ0TKUAB



• Shunt trip devices BZ0F
Undervoltage trip devices BZ0R

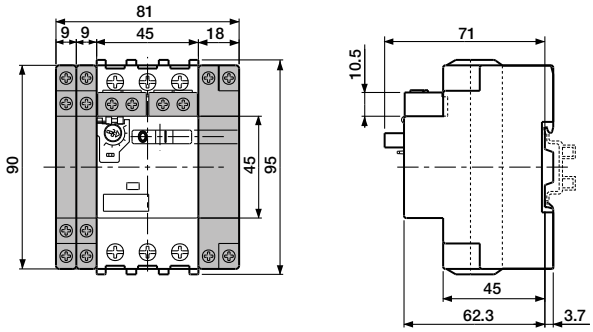


• BZ0TCRE

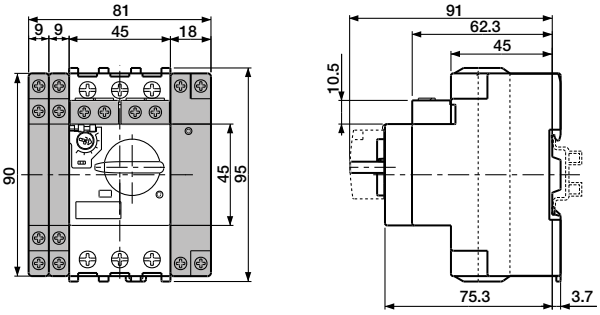


MMS with accessories

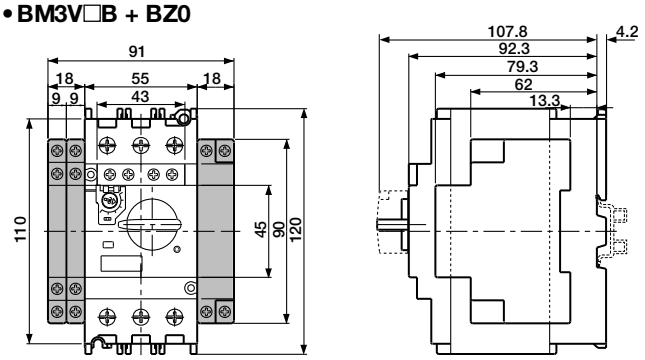
• BM3RSB + BZ0



• BM3RHB + BZ0

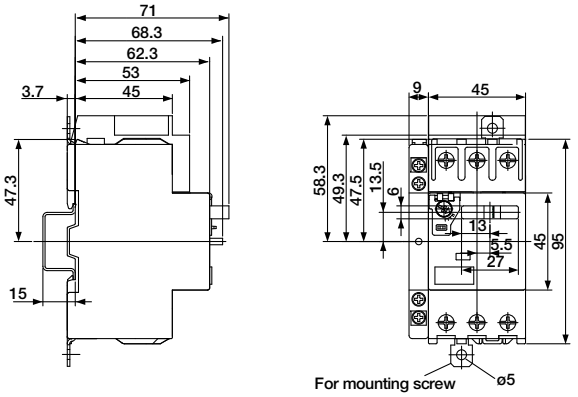


• BM3V□B + BZ0

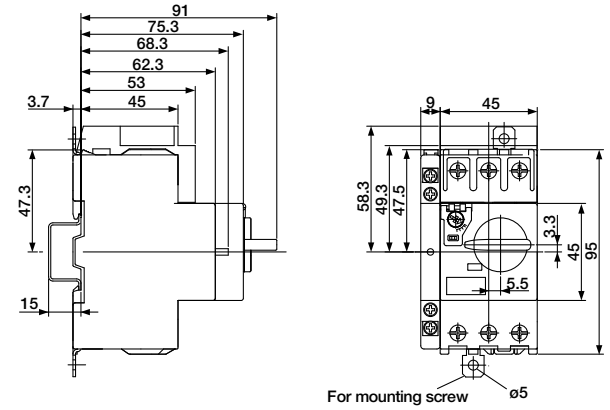


Type E construction

• BM3RSB



• BM3RHB



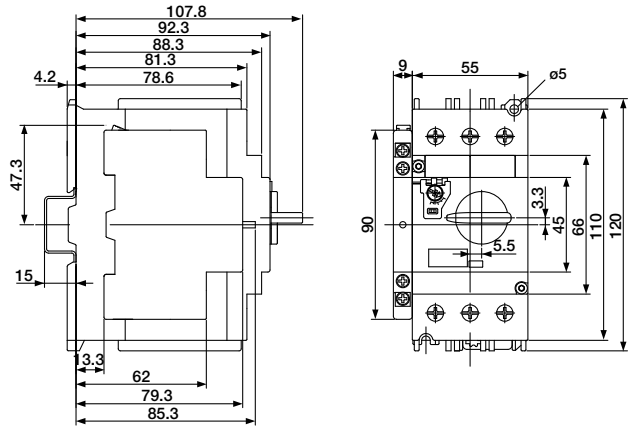
MMS	Line side terminal cover	Short-circuit alarm contact block	Mass (g)
BM3RSB	BZ0TCRE	BZ0TKUAB	425

MMS	Line side terminal cover	Short-circuit alarm contact block	Mass (g)
BM3RHB	BZ0TCRE	BZ0TKUAB	445

Dimensions, mm

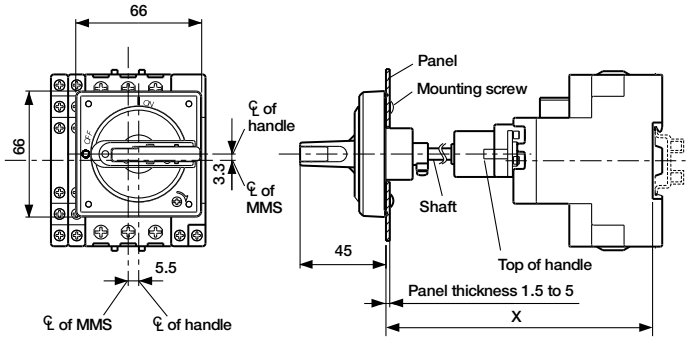
Type E construction

• BM3VSB, BM3VHB



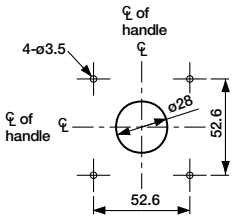
MMS	Line side terminal cover	Short-circuit alarm contact block	Mass (g)
BM3VSB,VHB	-	BZ0TKUAB	825

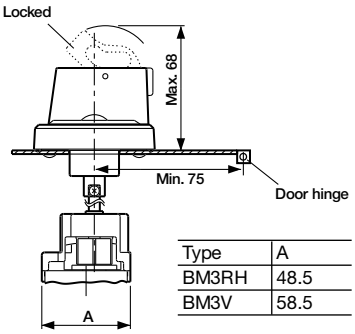
External operation handle BZ0V



Type	X min.	X max.
BZ0VBBL, BZ0VYRL	139 ±2	289 ±2
BZ0VBBM, BZ0VYRM	156 ±2	306 ±2

Panel drilling

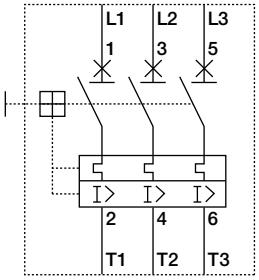




Type	A
BM3RH	48.5
BM3V	58.5

Wiring Diagrams

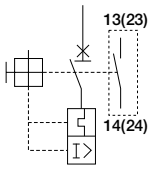
• MMS



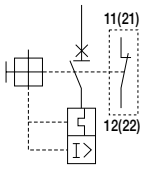
• Auxiliary contact blocks

Front mounting

BZ0WIA

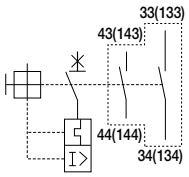


BZ0WIB

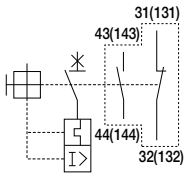


Side mounting

BZ0WUAAL



BZ0WUABL



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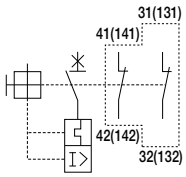
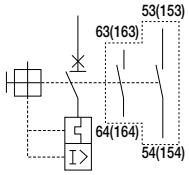


BZ0WUAAR



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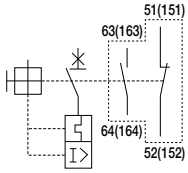

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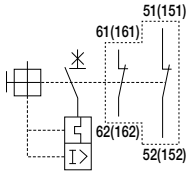
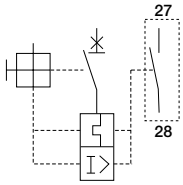


• Alarm contact blocks

Front mounting

BZ0KIA



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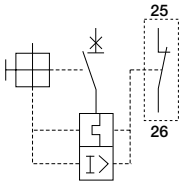
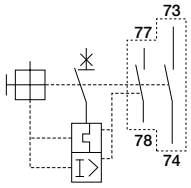


• Auxiliary and alarm contact blocks

BZ0WKUAA



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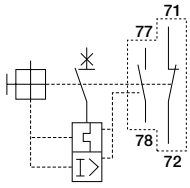

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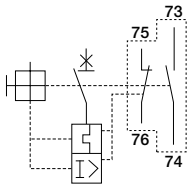
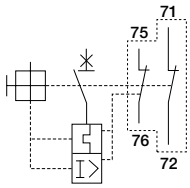
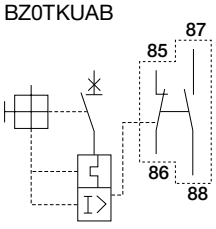


BZ0WKUBB



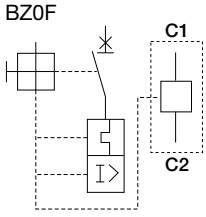
• Short-circuit alarm contact blocks

BZ0TKUAB



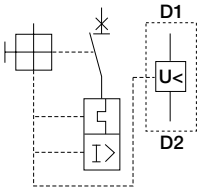
• Shunt trip devices

BZ0F



• Undervoltage trip devices

BZ0R



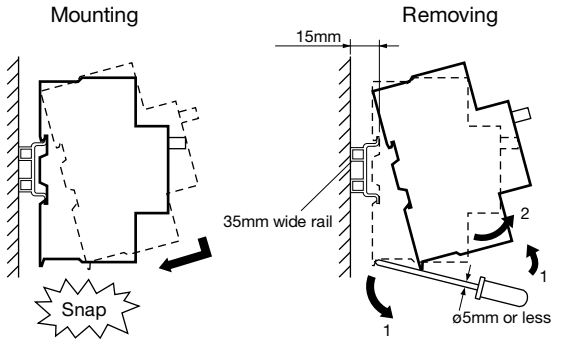
■ Standard Operating Conditions

Ambient temperature	Operating: −5 to +55°C Storage: −40 to +65°C	No sudden temperature changes resulting in condensation or icing.
Humidity	45 to 85%RH	
Altitude	2000m or lower	
Atmosphere	No excessive dust, smoke, corrosive gases, flammable gases, steam or salt.	
Vibration	10 to 55Hz 15m/s^2	No abnormal shock or vibration
Shock	50m/s^2	

■ Mountings

• Rail mounting

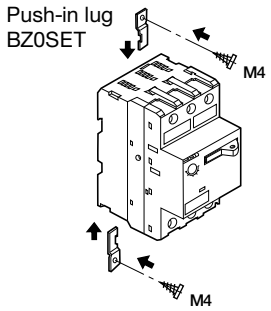
The MMS can be mounted to a 35mm DIN rail. Secure the rail with screws at mounting pitch of less than 400mm for the BM3R type and less than 300mm for the BM3V type.
Applicable rail:
Use a 15mm-high TH35-15 (Fuji Electric model TH35-15AL) rail conforming to EN-50022 and IEC715.
The standard rail mounting direction is horizontal. When using the MMS on a vertically mounted rail, use Fuji Electric end clamp kits



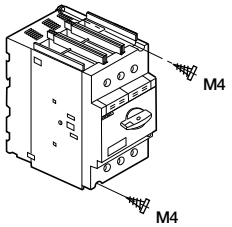
• Screw mounting

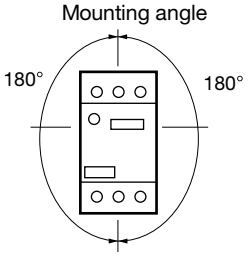
The separately sold push-in lug (BZ0SET) is required for screw mounting the BM3R frame. The BM3V frame can be screw mounted directly to the panel.

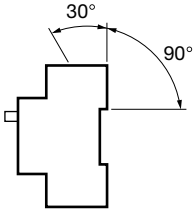
BM3RSB
BM3RHB



BM3VSB
BM3VHB



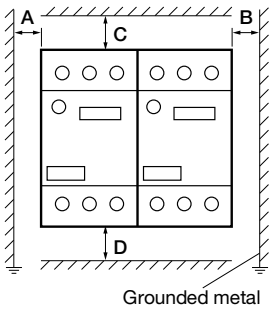




■ Arc Space

The arc space required when mounting is shown in the table below.

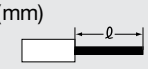
Type	Rated operational voltage Ue (V)	Min. distance to grounded metal (mm) A, B	C, D
BM3RS	Up to 460	15	20
	500	15	30
	Up to 690	40	40
BM3RH	Up to 500	15	30
	Up to 690	40	50
BM3V	Up to 500	15	40
	Up to 690	40	50



When frames are mounted side-by-side, operating conditions such as a high ambient temperature or using the maximum setting for continuous current may cause slight changes in operating characteristics due to temperature rises.
Under such conditions, it is recommended that the frames be separated by at least 5mm.

■ Wirings

While pressing the wire with a screwdriver, tighten the screw to the specified tightening torque.

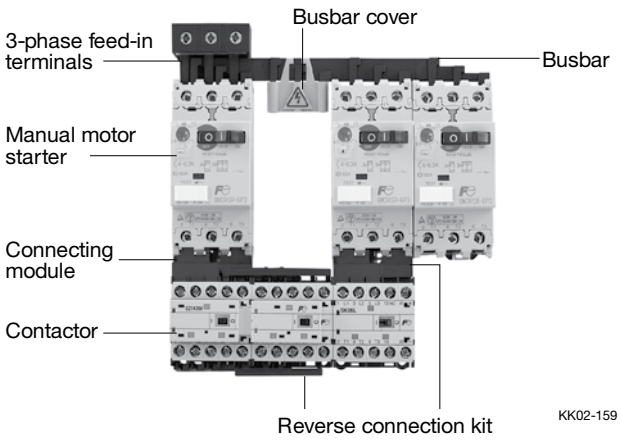
Type		BM3R	BM3V	BZ0 Accessories
Solid wire (mm)		ø1.6 to 2.6	ø1.6 to 2.6	ø1 to 1.6
Stranded wire (mm^2)	Single-wire	1 to 10	1 to 25	0.5 to 2.5
	2-wire	1 to 6	1 to 16	0.5 to 2.5
AWG	Single-wire	18 to 8	18 to 4	18 to 14
	2-wire	18 to 10	18 to 4	18 to 14
Sheath stripping length (mm) 		Approx.10	Approx.13	Approx.10
Terminal screw		Pan head screw (PZ2) M4	Pan head screw (PZ2) M6	Pan head screw (PZ2) M3.5
Tightening torque (N·m)		2	4	0.8

Note: There is no need for a crimp terminal or any other terminal on the end of the connection wire.

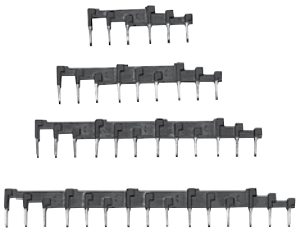
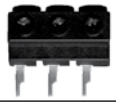
Features

- The busbar system reduces wiring time and saves floorspace.
- The busbar makes it easy to power from 2 to 5 manual motor starters – with no wiring needed.
- The 3-phase feed-in terminals are used to connect the wire for the power supply circuit.
- The busbar cover guards against accidental contact with non-connected busbar terminals (charged parts).

<Note>
If using BZ0TCRE terminal cover with BM3R series MMS, the busbar system can not be used.



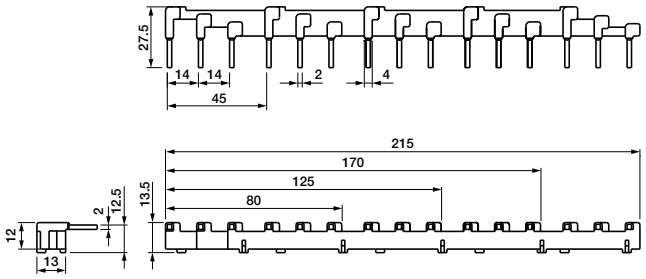
Part number and ratings

Description	Used with	Specification		Part number	Mass (g)
Busbar	BM3R	Continuous current: 64A max. Pin connection	2-BM3R, modular space: 45mm	**BZ0BR02A**	30
			3-BM3R, modular space: 45mm	**BZ0BR03A**	50
			4-BM3R, modular space: 45mm	**BZ0BR04A**	70
			5-BM3R, modular space: 45mm	**BZ0BR05A**	90
	BM3R+1-external accessory, 9mm wide		2-BM3R, modular space: 54mm	**BZ0BR12A**	30
			3-BM3R, modular space: 54mm	**BZ0BR13A**	55
			4-BM3R, modular space: 54mm	**BZ0BR14A**	80
			5-BM3R, modular space: 54mm	**BZ0BR15A**	105
 KK02-164	BM3R+2-external accessory, 9mm wide or BM3R+1-external accessory, 18mm wide	Continuous current: 64A max. Fork connection	2-BM3R, modular space: 63mm	**BZ0BR22A**	45
			4-BM3R, modular space: 63mm	**BZ0BR24A**	100
	BM3V	Continuous current: 126A max. Pin connection	2-BM3V, modular space: 55mm	**BZ0BV02A**	140
			3-BM3V, modular space: 55mm	**BZ0BV03A**	240
			4-BM3V, modular space: 55mm	**BZ0BV04A**	340
	BM3V+1-external accessory, 9mm wide		2-BM3V, modular space: 64mm	**BZ0BV12A**	150
			3-BM3V, modular space: 64mm	**BZ0BV13A**	270
			4-BM3V, modular space: 64mm	**BZ0BV14A**	380
	BM3V+2-external accessory, 9mm wide or BM3V+1-external accessory, 18mm wide		2-BM3V, modular space: 73mm	**BZ0BV22A**	165
			4-BM3V, modular space: 73mm	**BZ0BV24A**	425
3-phase feed-in terminal  AF01-70R	BM3R	Continuous current: 64A max. Applicable cable size: 25mm^2 max.		**BZ0BFRA**	40
	BM3V	Continuous current: 126A max. Applicable cable size: 50mm^2 max.		**BZ0BFVA**	170
Busbar cover  AF01-70L	BZ0BR	For pin connection		**BZ0BCRA**	10
		For fork connection		**BZ0BCRB**	5
	BZ0BV	For pin connection		**BZ0BCVA**	5

■ Dimensions, mm

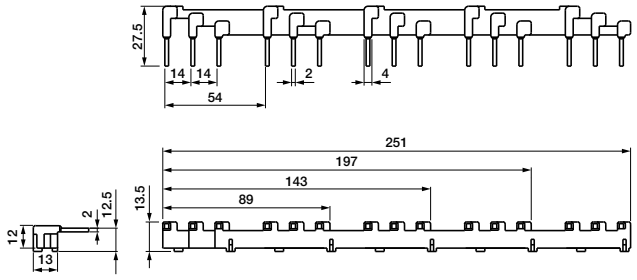
• For BM3R

BZ0BR0 Without external accessory



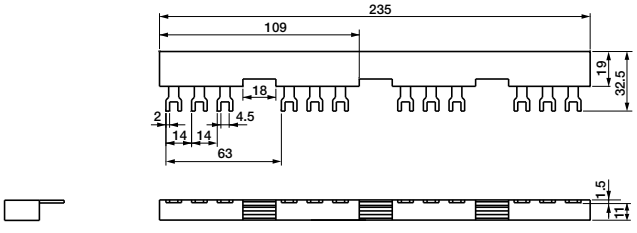
BZ0BR02A: 80mm
BZ0BR03A: 125mm
BZ0BR04A: 170mm
BZ0BR05A: 215mm

BZ0BR1 With 1-external accessory



BZ0BR12A: 89mm
BZ0BR13A: 143mm
BZ0BR14A: 197mm
BZ0BR15A: 251mm

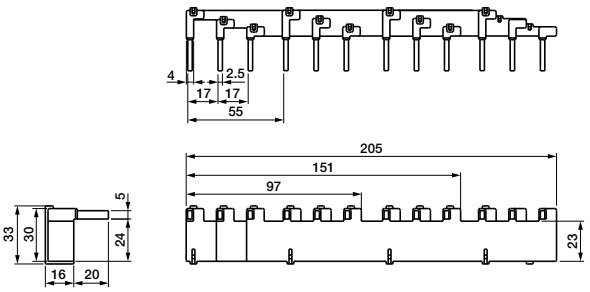
BZ0BR2 With 2-external accessory, 9mm wide
With 1-external accessory, 18mm wide



BZ0BR22A: 109mm
BZ0BR24A: 235mm

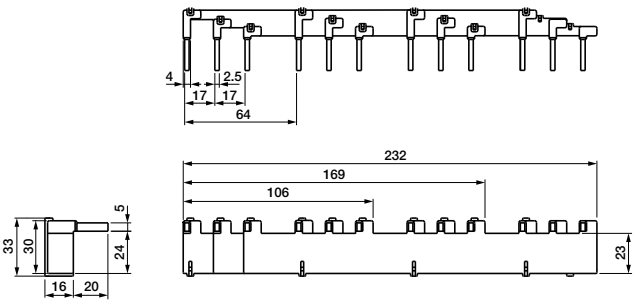
• For BM3V

BZ0BV0 Without external accessory



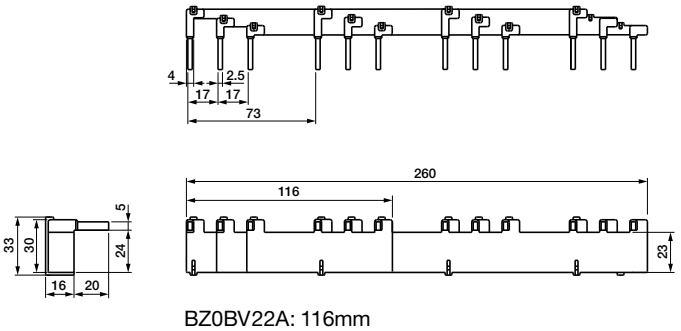
BZ0BV02A: 97mm
BZ0BV03A: 151mm
BZ0BV04A: 205mm

BZ0BV1 With 1-external accessory, 9mm wide



BZ0BV12A: 106mm
BZ0BV13A: 169mm
BZ0BV14A: 232mm

BZ0BV2 With 2-external accessory, 9mm wide
With 1-external accessory, 18mm wide

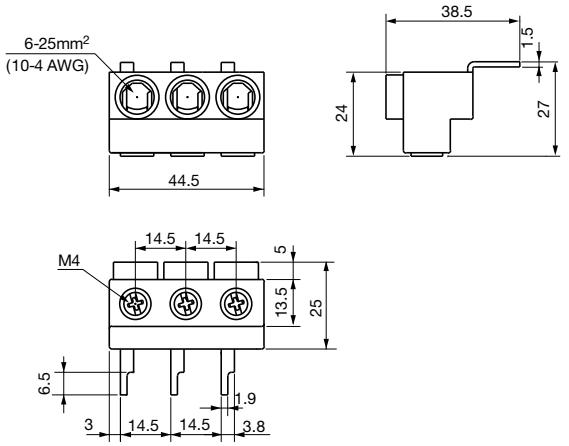


BZ0BV22A: 116mm
BZ0BV24A: 260mm

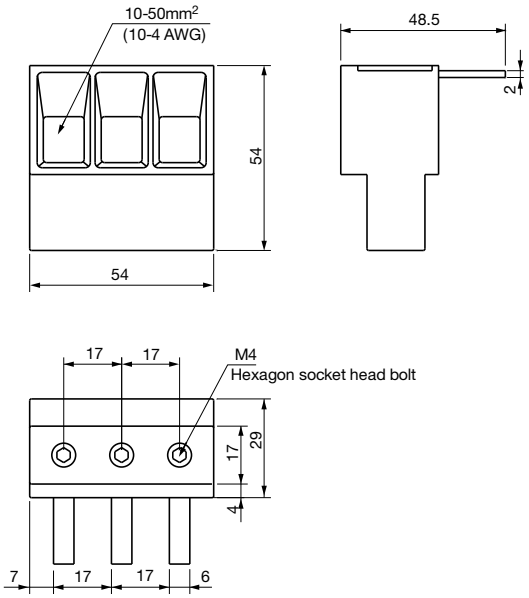
■ Dimensions, mm

• 3-phase feed-in terminals

BZ0BFRA



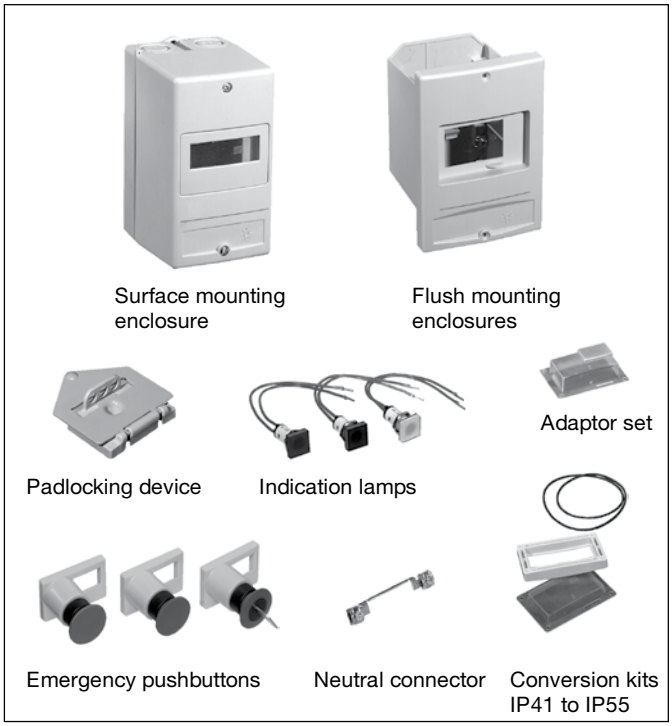
BZ0BFVA



Manual Motor Starters
Enclosures

Features

- Accommodates a variety of manual motor starters (BM3RSB-P16 to 025). Put the manual motor starter inside an enclosure for use in harsh environments. Surface mounting and flush mounting types available.
- IP41 and IP55 enclosure protection degree available.
- Manual motor starters (BM3RSB-P16 to 025) equipped with internal accessories and the following external accessories can be used inside an enclosure:
  Left side: One auxiliary contact block (W) or one auxiliary and alarm contact block (WK)
  Right side: One shunt trip device (F) or one undervoltage trip device (R)
- A wide variety of enclosure accessories are available. Padlocking device, emergency mushroom head pushbutton, conversion kit, and indicator lamps.



Part number and ratings

Enclosures for BM3RSB-P16 to 025

Mounting	Specification	Part number	Mass (g)
Surface	IP41	BZ0CSLA	320
	IP55 (with conversion kit)	BZ0CSLB	340
Flush	IP41	BZ0CFLA	240
	IP55 (with conversion kit)	BZ0CFLB	260

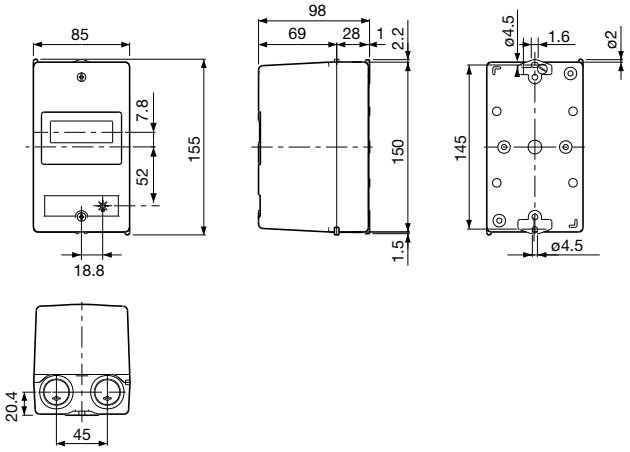
Accessories for enclosures

Description	Specification	Part number	Mass (g)
Padlocking device	OFF locking possible using up to three padlocks with a 5 to 8mm shackle diameter.	**BZ0CKA**	90
Emergency pushbutton	Momentary	**BZ0CPM**	55
	Push-lock turn reset	**BZ0CPL**	55
	Key operated	**BZ0CPK**	90
Conversion kit	Converts IP41 to IP55	**BZ0CCA**	25
Adaptor set	For BM3RS + undervoltage trip device with auxiliary contact.	**BZ0CUA**	20
Neutral connector	Used inside the enclosure for neutral and ground connection.	**BZ0CNA**	10
Indication lamp	Green, 100–120V AC	**BZ0CLGA**	15
	Green, 200–240V AC	**BZ0CLGB**	15
	Green, 380–440V AC	**BZ0CLGC**	15
	Green, 480–500V AC	**BZ0CLGD**	15
	Green, 500–600V AC	**BZ0CLGE**	15
	Red, 100–120V AC	**BZ0CLRA**	15
	Red, 200–240V AC	**BZ0CLRB**	15
	Red, 380–440V AC	**BZ0CLRC**	15
	Red, 480–500V AC	**BZ0CLRD**	15
	Red, 500–600V AC	**BZ0CLRE**	15
	White, 100–120V AC	**BZ0CLCA**	15
	White, 200–240V AC	**BZ0CLCB**	15
	White, 380–440V AC	**BZ0CLCC**	15
	White, 480–500V AC	**BZ0CLCD**	15
	White, 500–600V AC	**BZ0CLCE**	15

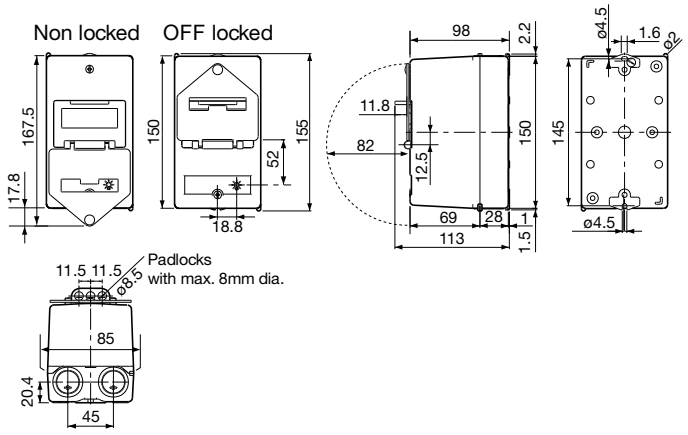
Notes: • The padlocking device cannot be used together with the emergency pushbutton or undervoltage trip device with auxiliary contact.
• The emergency pushbutton cannot be used together with the undervoltage trip device with auxiliary contact.

■ Dimensions, mm

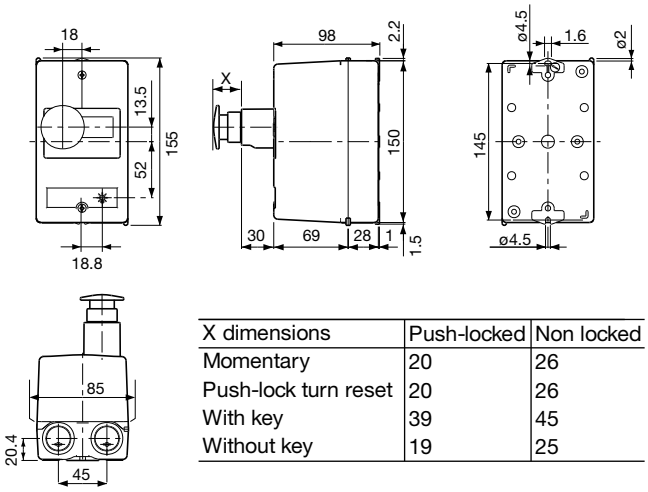
• Surface Mounting
For without Accessory



For with Padlocking Device

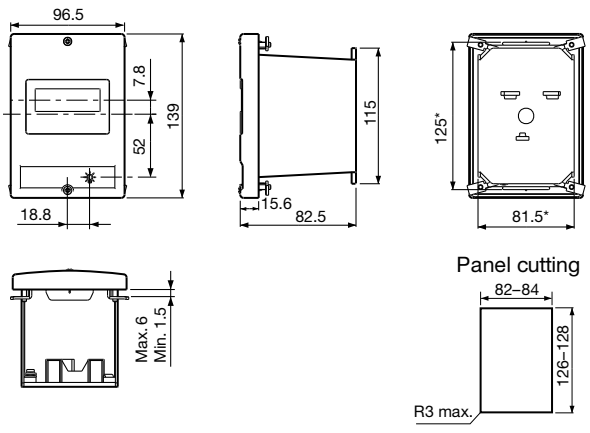


For with Emergency Pushbutton

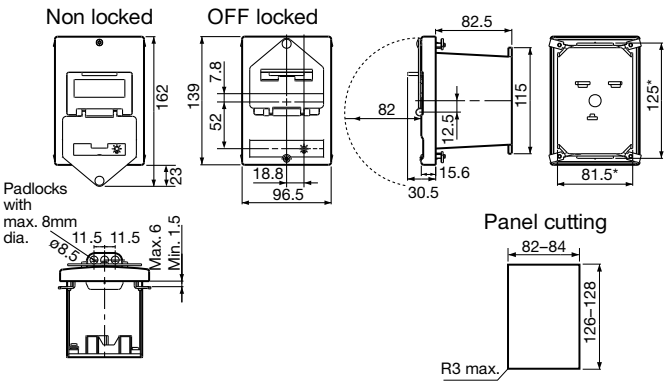


X dimensions	Push-locked	Non locked
Momentary	20	26
Push-lock turn reset	20	26
With key	39	45
Without key	19	25

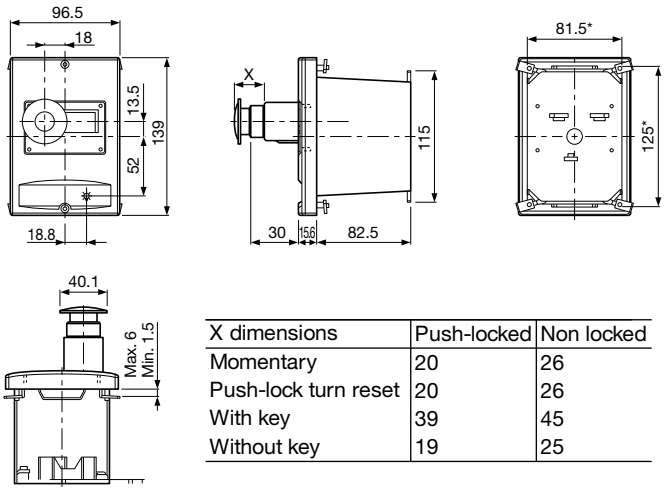
• Flush mounting
For without Accessory



For with Padlocking Device

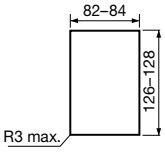


For with Emergency Pushbutton



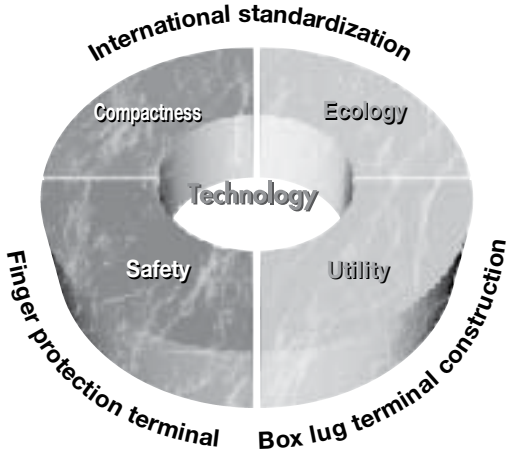
X dimensions	Push-locked	Non locked
Momentary	20	26
Push-lock turn reset	20	26
With key	39	45
Without key	19	25

Panel cutting



3 to 100HP at 480V AC
The SK and SC-E series further enhance the high reliability of the SC series with full conformance to International standards.

In addition to the five basic concepts of the existing SC series magnetic contactors and motor starters — international standardization, compactness, safety, utility, and ecology — the SK and SC-E series take the line-up to the next step in utility with a new finger protection terminal and box lug terminal construction.



International standardization
IEC 60947-4-1, EN 60947-4-1, VDE 0660
UL 508, CSA C 22.2, JIS C 8201-4-1
[Approved cUL (File No. E42419, E44592),
TÜV (R2018010, R2150072, R50013402)]

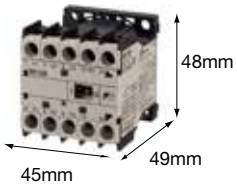
Compactness
- SK06, SK09, SK12 : 45mm wide
  SC-E02 to E05: 43mm wide, SC-E1 to E2S: 54mm wide
  SC-E3, E4: 67mm wide, SC-E5: 88mm wide
  SC-E6: 100mm wide, SC-E7: 115mm wide
- Reducing mounting area

Safety
- Terminals with finger-touch protection (DIN 57106/ VDE 0106 Teil100)

Utility
- Box lug terminal construction
- Long electrical life
- Reduction of wiring work

Ecology
- Reducing power consumption
- Recycled thermoplastic resin used for plastic parts
- The names of materials are indicated on all major parts to facilitate their recycling

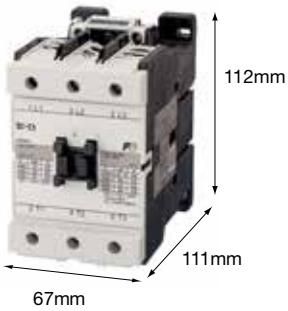
SK series



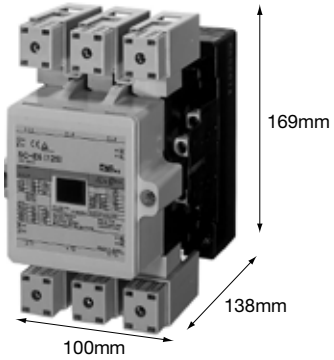
SK06, 09, 12

SC-E series

SC-E1 to E2S

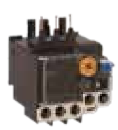


SC-E3, E4



SC-E6 with SUPER magnet

Contactor							
AC operating	**SK06A**	**SK09A**	**SK12A**	**SC-E02**	**SC-E03**	**SC-E04**	**SC-E05**
DC operating	**SK06G(2.4W)**	**SK09G(2.4W)**	**SK12G(2.4W)**	**SC-E02/G**	**SC-E03/G**	**SC-E04/G**	**SC-E05/G**
	SK06L(1.2W)	**SK09L(1.2W)**	**SK12L(1.2W)**				
				 AF01-12	 AF01-11	 AF01-10	 KK01-105
Rating of 3-phase motor (HP)							
200V	1-1/2	2	3	2	3	5	5
220-240V	2	3	3	2	3	5	7 1/2
400-480V	3	5	5	5	7 1/2	10	15
550-600V	3	5	5	5	7 1/2	10	15
Rated operational current (A)							
200V	6.9	7.8	11	7.8	11	17.5	17.5
220-240V	6.8	9.6	9.6	6.8	9.6	15.2	22
400-480V	4.8	7.6	7.6	7.6	11	14	21
550-600V	6.1	6.1	6.1	6.1	9	11	17
Rated thermal current AC-1 (A)	20	20	20	20	20	25	32
Auxiliary contact	1NO, 1NC	1NO, 1NC	1NO, 1NC	–	–	–	–
Dimensions W×H×D (mm) AC operated	45×48×49			43×80×81			
Dimensions W×H×D (mm) DC operated	45×48×49			43×80×108			
Standard	IEC 60947-1, EN 60947-4-1, VDE 0660, UL 508, CSA C22.2						

Thermal overload relay	**TK12**	**TK12**	**TK12**	**TK26E**	**TK26E**	**TK26E**	**TK26E**
				 KKD14-114	 KKD14-114	 KKD14-114	 KKD14-114
Ampere setting range (A)	0.1–0.15	0.1–0.15	0.1–0.15	0.1–0.15	0.1–0.15	0.1–0.15	0.1–0.15
	0.13–0.2	0.13–0.2	0.13–0.2	0.13–0.2	0.13–0.2	0.13–0.2	0.13–0.2
	0.18–0.27	0.18–0.27	0.18–0.27	0.18–0.27	0.18–0.27	0.18–0.27	0.18–0.27
	0.24–0.36	0.24–0.36	0.24–0.36	0.24–0.36	0.24–0.36	0.24–0.36	0.24–0.36
	0.34–0.52	0.34–0.52	0.34–0.52	0.34–0.52	0.34–0.52	0.34–0.52	0.34–0.52
	0.48–0.72	0.48–0.72	0.48–0.72	0.48–0.72	0.48–0.72	0.48–0.72	0.48–0.72
	0.64–0.96	0.64–0.96	0.64–0.96	0.64–0.96	0.64–0.96	0.64–0.96	0.64–0.96
	0.8–1.2	0.8–1.2	0.8–1.2	0.8–1.2	0.8–1.2	0.8–1.2	0.8–1.2
	0.95–1.45	0.95–1.45	0.95–1.45	0.95–1.45	0.95–1.45	0.95–1.45	0.95–1.45
	1.1–1.65	1.1–1.65	1.1–1.65	1.1–1.65	1.1–1.65	1.1–1.65	1.1–1.65
	1.4–2.1	1.4–2.1	1.4–2.1	1.4–2.1	1.4–2.1	1.4–2.1	1.4–2.1
	1.7–2.6	1.7–2.6	1.7–2.6	1.7–2.6	1.7–2.6	1.7–2.6	1.7–2.6
	2.2–3.4	2.2–3.4	2.2–3.4	2.2–3.4	2.2–3.4	2.2–3.4	2.2–3.4
	2.8–4.2	2.8–4.2	2.8–4.2	2.8–4.2	2.8–4.2	2.8–4.2	2.8–4.2
	4–6	4–6	4–6	4–6	4–6	4–6	4–6
		5–7.5	5–7.5	5–7.5	5–7.5	5–7.5	5–7.5
		6–9	6–9	6–9	6–9	6–9	6–9
			7–10.5	7–10.5	7–10.5	7–10.5	7–10.5
			9–13			9–13	9–13
						12–18	12–18
							16–22
							20–26
Dimensions W×H×D (mm)	45×61.5×55			53×60.5×80.5			
Standard	IEC 60947-1, EN 60947-4-1, VDE 0660, UL 508, CSA C22.2						

Contactors SK and SC-E series

Quick Reference Guide

Contactors	AC operating	**SC-E1**	**SC-E2**	**SC-E2S**	**SC-E3**	**SC-E4**	**SC-E5**	**SC-E6**	**SC-E7**
	DC operating	**SC-E1/G**	**SC-E2/G**	**SC-E2S/G**	**SC-E3/G**	**SC-E4/G**			
		 AF01-8	 AF01-7	 AF01-6	 AF01-5	 AF01-4	 AF01-3	 AF01-2	 AF01-1
Rating of 3-phase motor (HP)									
200V		7 1/2	10	15	20	25	30	40	50
220-240V		10	15	20	25	30	30	40	50
400-480V		25	30	30	50	50	60	75	100
550-600V		25	30	30	50	50	75	100	125
Rated operational current (A)									
200V		25.3	32.2	48.3	63.1	78.2	92	119.6	149.5
220-240V		28	42	54	68	80	80	104	130
400-480V		34	40	40	65	65	77	96	124
550-600V		27	32	32	52	52	77	99	125
Rated thermal current AC-1(A)		50	60	65	100	105	150	150	200
Auxiliary contact		–	–	–	–	–	2NO+2NC	2NO+2NC	2NO+2NC
Dimension	AC operated	54×90×96			67×112×111		88×155×132	100×169×13	115×175×140
W×H×D (mm)	DC operated	54×90×121.5			67×112×130				
Standard		IEC 60947-1, EN 60947-4-1, VDE 0660, UL 508, CSA C22.2							

Thermal overload relay	**TK-E2**	**TK-E2**	**TK-E2**	**TK-E3**	**TK-E3**	**TK-E5**	**TK-E6**	**TK-E6**
	 KK01-88	 KK01-88	 KK01-88	 KK01-87	 KK01-87	 KK01-85	 KK01-84	 KK01-84
Ampere setting range(A)	4–6 5–8 6–9 7–11 9–13 12–18 18–26 24–36	4–6 5–8 6–9 7–11 9–13 12–18 18–26 24–36 32–42	4–6 5–8 6–9 7–11 9–13 12–18 18–26 24–36 32–42 40–50 44–54	7–11 9–13 12–18 18–26 24–36 28–40 34–50 45–65 48–68 64–80	7–11 9–13 12–18 18–26 24–36 28–40 34–50 45–65 48–68	18–26 24–36 28–40 34–50 45–65 65–95 85–105	45–65 53–80 65–95 85–125	45–65 53–80 65–95 85–125 110–160
Dimensions W×H×D (mm)	54×78.5×97			68×89.5×107.5		76.5×105×106	100×122×123	
Standard	IEC 60947-1, EN 60947-4-1, VDE 0660, UL 508, CSA C22.2							

■ Available Coil

• AC coil, SC-E02 to SC-E4

Code	Coil operating voltage and frequency
24VAC	24V AC 50Hz / 24–26V AC 60Hz
48VAC	48V AC 50Hz / 48–52V AC 60Hz
100VAC	100V AC 50Hz / 100–110V AC 60Hz
110VAC	100–110V AC 50Hz / 110–120V AC 60Hz
120VAC	110–120V AC 50Hz / 120–130V AC 60Hz
200VAC	200V AC 50Hz / 200–220V AC 60Hz
220VAC	200–220V AC 50Hz / 220–240V AC 60Hz
400VAC	380–400V AC 50Hz / 400–440V AC 60Hz
440VAC	415–440V AC 50Hz / 440–480V AC 60Hz
500VAC	480–500V AC 50Hz / 500–550V AC 60Hz

• Super Magnet Coil, SC-E5 to SC-E7

Code	Coil operating voltage and frequency
24V	24–25V AC 50/60Hz, 24V DC
48V	48–50V AC 50/60Hz, 48V DC
100V	100–127V AC 50/60Hz, 100–120V DC
200V	200–250V AC 50/60Hz, 200–240V DC
400V	380–450V AC 50/60Hz
500V	460–575V AC 50/60Hz

• DC coil, SC-E02/G to SC-E4/G

Code	Coil operating voltage
12VDC	12V DC
24VDC	24V DC
48VDC	48V DC
100VDC	100V DC
110VDC	110V DC
200VDC	200V DC

■ Coil Characteristics

• AC operation

Frame size	Power consumption (VA)		Power loss (W)		Pick-up voltage (V) *1	Drop-out voltage (V) *1	Operating time (ms)	
	Inrush 50/60 Hz	Sealed 50/60 Hz	50Hz	60Hz			Coil ON → Contact ON	Coil OFF → Contact OFF
E02 to E05	90/95	9/9	2.7	2.8	0.85–1.1 X US	0.2–0.75 X US	9–20	5–16
E1 to E2S	120/135	12.7/12.4	3.6	3.8	0.85–1.1 X US	0.2–0.75 X US	10–17	6–13
E3, E4	180/190	13.3/13.4	4.5	5	0.85–1.1 X US	0.2–0.75 X US	10–18	8–18
E5	80/95	4/4.6	3.2	3.6	0.85–1.1 X US	0.2–0.75 X US	39–45	27–33
E6, E7	190/230	4.9/5.8	3.4	3.7	0.8–1.1 X US	0.1–0.65 X US	31–37	30–36

Note: *1 US: Rated coil voltage

• DC operation

Frame size	Power consumption (VA)		Time constant (ms)	Pick-up voltage (V) *1	Drop-out voltage (V) *1	Operating time (ms)	
	Inrush	Sealed				Coil ON → Contact ON	Coil OFF → Contact OFF
E02/G to E05/G	7	7	50	0.85–1.1 X US	0.1–0.75 X US	45–49	10–26
E1/G to E2S/G	9	9	60	0.85–1.1 X US	0.1–0.75 X US	40–50	8–17
E3/G, E4/G	12	12	70	0.85–1.1 X US	0.1–0.75 X US	60–70	14–21
E5	20	2.8	1	0.85–1.1 X US	0.1–0.75 X US	35–41	26–32
E6, E7	225	3.2	1	0.8–1.1 X US	0.1–0.65 X US	28–34	27–33

Note: *1 US: Rated coil voltage

■ Auxiliary Contact Ratings for UL and CSA

Frame size	Rated insulation voltage (V)	Rated thermal current (A)	Making and breaking current (A)					
			AC (rating code A600)			DC (rating code Q300)		
			Voltage	Making	Breaking	Voltage	Making	Breaking
E02 to E4, E02/G to E4/G	–	–	–	–	–	–	–	–
E5 to E7	600	10	120V	60	6	125	0.55	0.55
			240V	30	3	250V	0.27	0.27
			480V	15	1.5			
			600V	12	1.2			

Contactors SC-E series

Ordering information and Characteristics

■ Ordering information

Specify the following :
1. Part number
2. Operating coil voltage code

SC-E 02 /G - 24VDC

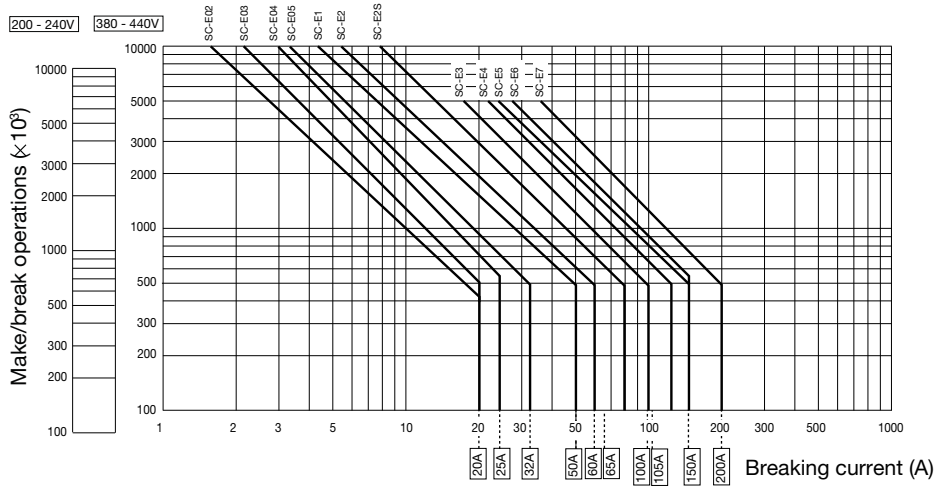
- **Product category**
- **Frame size**
- **AC coil operating: None**
  DC coil operating: /G
- **Operating coil voltage code** (see page 34)

SC-E 5 - 24V

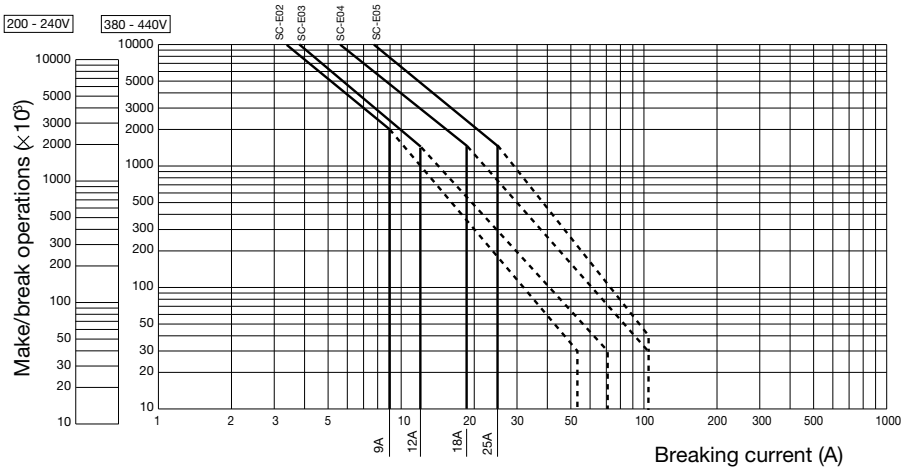
- **Product category**
- **Frame size**
- **Operating coil voltage code** (see page 34)

■ Electrical durability

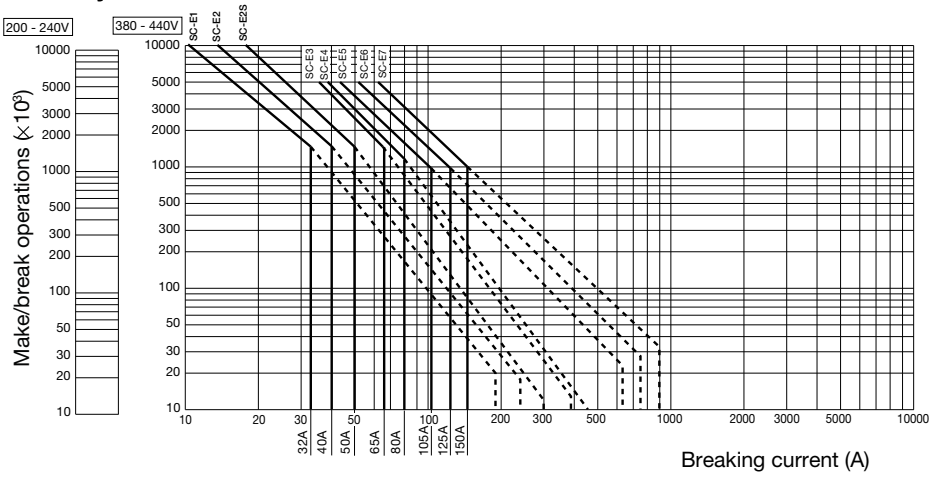
• AC-1 duty / SC-E02 to SC-E7



• AC-3 duty / SC-E02 to SC-E05



• AC-3 duty / SC-E1 to SC-E7



• Auxliary Contact Blocks with Terminal Covers

Applicable contactor	Mounting	No. of contacts	Contact arrangement	Part number
SC-E02 to E4 SC-E02/G to E4/G	Front mounting	4	4NO	SZ-A40/T
			3NO+1NC	SZ-A31/T
			2NO+2NC	SZ-A22/T
		2	2NO	SZ-A20/T
			1NO+1NC	SZ-A11/T
			2NC	SZ-A02/T
	Side mounting	2	1NO+1NC	SZ-AS1/T
SC-E5, E6, E7	Side mounting	2	1NO+1NC	SZ-AS2/T

Front mounting

KK02-081

SZ-A22/T

AF88-080

SZ-A11/T

Side mounting

SZ-AS1/T
SZ-AS2/T

KK01-090

Contact Ratings
• Based on UL and CSA

Rated thermal current (A)	Making and breaking current (A) AC (rating code A600)			DC (rating code Q300)		
	Volts	Making	Breaking	Volts	Making	Breaking
10	120V	60	6	125V	0.55	0.55
	240V	30	3	250V	0.27	0.27
	480V	15	1.5			
	600V	12	1.2			

• Main Circuit Surge Suppression Units

Applicable contactor	Mounting	Rated voltage and frequency	CR constant	Applicable 3-phase motor	Part number
SC-E02 to E05	Front mounting	250V AC	C=0.22 μF	200–240V AC	**SZ-ZM1E**
SC-E02/G to E05/G	Side mounting	50/60Hz	R=100 Ω	1-1/2–5HP	**SZ-ZM2E**
SC-E1 to E4	Front mounting	250V AC	C=0.33 μF	200–240V AC	**SZ-ZM3E**
SC-E1/G to E4/G	Side mounting	50/60Hz	R=47Ω	1-1/2–30HP	**SZ-ZM4E**

Main circuit surge suppression units

KK02-077

Front mounting
SZ-ZM1E

KK02-079

Side mounting
SZ-ZM4E

• Coil Surge Suppression Units

Applicable contactor		Operating coil voltage	Device	Operation indicator	Part number
SC-E02 to E05	SC-E02/G to E05/G	24–48V AC/DC	Varistor	–	**SZ-Z1**
		100–250V AC/DC		–	**SZ-Z2**
	–	380–440V AC/DC		–	**SZ-Z3**
SC-E02 to E05	SC-E02/G to E05/G	24–48V AC/DC		Red LED	**SZ-Z6**
		100–250V AC/DC		Red LED	**SZ-Z7**
SC-E1 to E4	SC-E1/G to E4/G	24–48V AC/DC		–	**SZ-Z31**
		100–250V AC/DC		–	**SZ-Z32**
	–	380–440V AC/DC		–	**SZ-Z33**
SC-E02 to E05	SC-E02/G to E05/G	24–48V AC/DC	CR	–	**SZ-Z4**
		100–250V AC/DC		–	**SZ-Z5**
SC-E02 to E05	SC-E02/G to E05/G	24–48V AC/DC		Red LED	**SZ-Z8**
		100–250V AC/DC		Red LED	**SZ-Z9**
SC-E1 to E4	–	24–48V AC/DC		–	**SZ-Z34**
		100–250V AC/DC		–	**SZ-Z35**
–	SC-E1/G to E4/G	24–48V AC/DC		–	**SZ-Z36**
		100–250V AC/DC		–	**SZ-Z37**

Coil surge suppression unit

CR
SZ-Z4

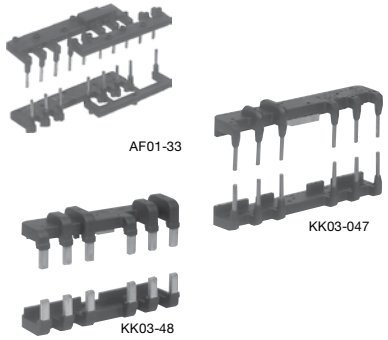
AF88-766

Contactors SC-E series
Optional Accessories

• Power Connection Kit for Reversing for SC-E Contactor

Description	Applicable contactor	Part number	Mass (g)
Line side wire kit	SC-E02 to E05	**SZ-ERW1/A**	19
Load side wire kit	SC-E02/G to E05/G	**SZ-ERW1/B**	17
Load side wire kit for the contactor to be connected with overload relay.		**SZ-ERW1/D**	13
Line side wire kit	SC-E1 to E2S,	**SZ-ERW2/A**	48
Load side wire kit	SC-E1/G to E2S/G,	**SZ-ERW2/B**	42
Load side wire kit for the contactor to be connected with overload relay.		**SZ-ERW2/D**	31
Line side wire kit	SC-E3,E4	**SZ-ERW3/A**	162
Load side wire kit	SC-E3/G,E4/G	**SZ-ERW3/B**	138
Load side wire kit for the contactor to be connected with overload relay.		**SZ-ERW3/D**	110

Power Connection kit for reversing for SC-E contactor



• Mechanical Interlock Unit

Description	Applicable contactor	Part number	Mass (g)
	SC-E02 to E4 SC-E02/G to E4/G	**SZ-RM**	27

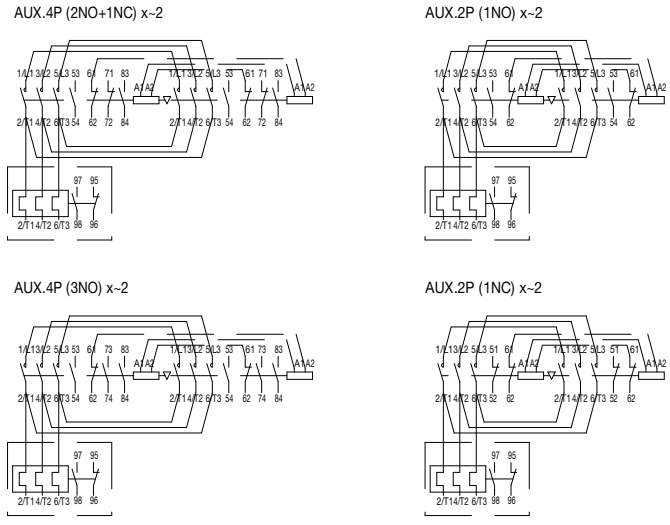
Mechanical interlock unit

• Preparing to Make Reversing Contactors and Motor Starters

<For SC-E contactor>
1. SC-E_ x 2
2. SZ-ERW_/A x 1
3. SZ-ERW_/B x 1
4. SZ-RM x 1
5. SZ-_A/T x 2

<For SC-E motor starters>
1. SC-E_ x 2
2. TK-E_ X1
3. SZ-ERW_/A x 1
4. SZ-ERW_/D x 1
5. SZ-RM x 1
6. SZ-_A/T x 2

Example of connecting, SC-E reversing motor starter



Replacement Coils

Replacement coil for SC-E series, AC coil is available, DC coil is not available

Contactor part number	AC coil part number	Super magnet coil part number
SC-E02 to E05	**4NC0H-#MC**	**N/A**

Replace the # symbol with the desired code, shown in the chart below.

Code letter #	AC coil 60Hz	AC coil 50Hz
E	24-26V	24V
F	48-52V	48V
A	100-110V	100V
1	110-120V	100-110V
G	120-130V	110-120V
B	200-220V	200V
2	220-240V	200-220V
C	400-440V	380-400V
4	440-480V	415-440V
5	550-600	500-550V

Contactor part number	AC coil part number (Chart 1)	Super magnet coil part number (Chart 2)
SC-E1, E2 and E2S	**SZ-GM/N1-#**	**N/A**
SC-E3 and E4	**SZ-GM/N2S-#**	**N/A**
SC-E5	**N/A**	**SZ-GS/N5-#**
SC-E6 and E7	**N/A**	**SZ-GS/N6-#**

Replace the # symbol with the desired code, shown in the charts below.

Chart 1 : AC coil

Code letter #	AC coil 60Hz	AC coil 50Hz
24	24-26V	24V
48	48-52V	48V
100	100-110V	100V
110	110-120V	100-110V
120	120-130V	110-120V
200	200-220V	200V
220	220-240V	200-220V
400	400-440V	380-400V
440	440-480V	415-440V
500	500-550V	480-500V

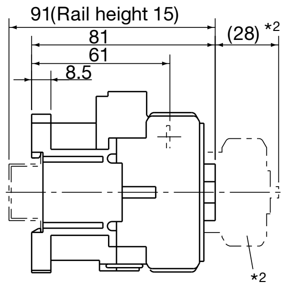
Chart 2 : Super magnet coil

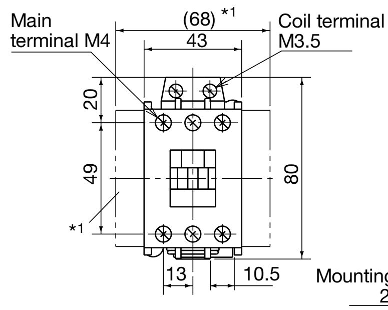
Code letter #	AC coil 50/60Hz	DC
24	24-25V	24V
48	48-50V	48V
100	100-127V	100-120V
200	200-250V	200-240V
400	380-450V	N/A
500	460-575V	N/A

Contactors SC-E series
Dimensions

■ Dimensions, mm

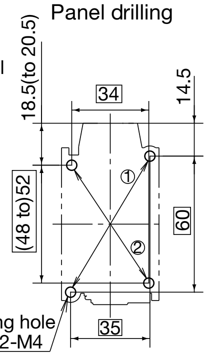
• Non-reversing AC operated
SC-E02, E03, E04, E05





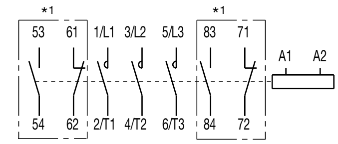
Mass: 0.33kg

Panel drilling



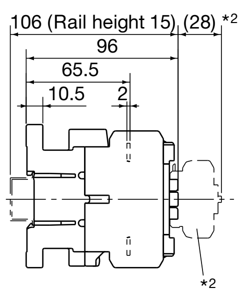
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: 35 × 60　②: 35 × (48 to) 52

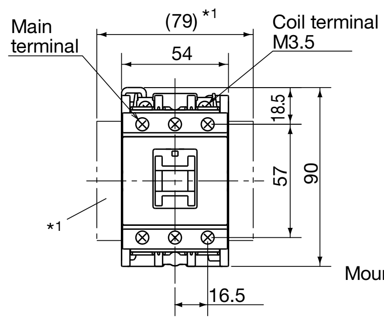
■ Wiring diagrams



*1 In case of aux. contact 2NO+2NC

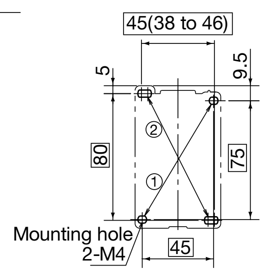
SC-E1, E2, E2S



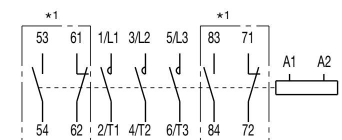


Mass : 0.58kg

Panel drilling

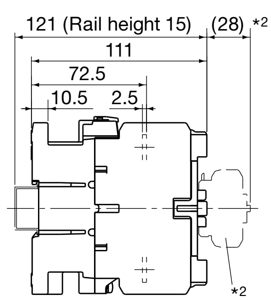


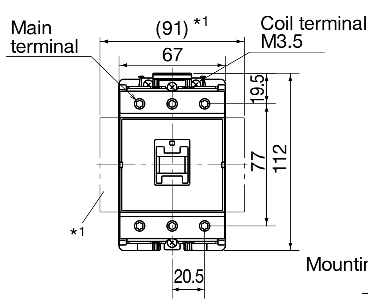
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: 45×75　②: 45 (38 to 46)×80



*1 In case of aux. contact 2NO+2NC

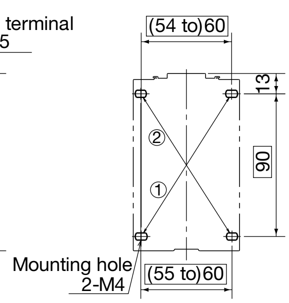
SC-E3, E4



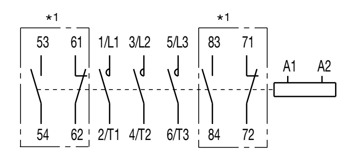


Mass: 1.1kg

Panel drilling

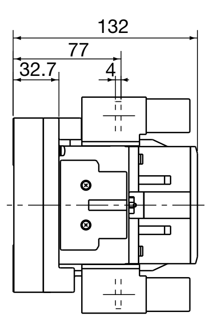


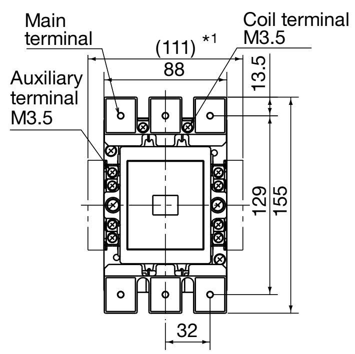
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: (55 to) 60 × 90　②: (54 to) 60 × 90



*1 In case of aux. contact 2NO+2NC

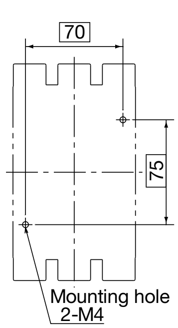
SC-E5

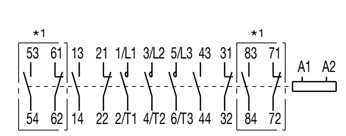




Mass: 2.0kg

Panel drilling





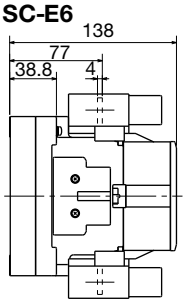
*1 In case of aux. contact 4NO+4NC

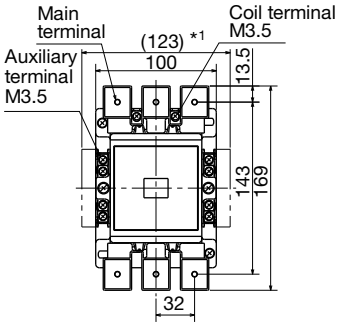
*1 Side mounting aux. contact block
*2 Front mounting aux. contact block

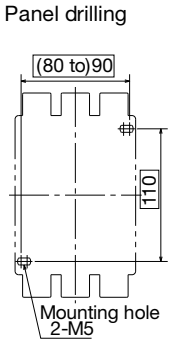
■ Dimensions, mm

• Non-reversing AC operated

SC-E6

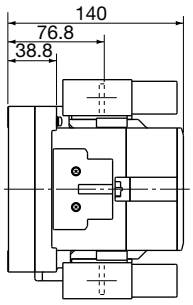


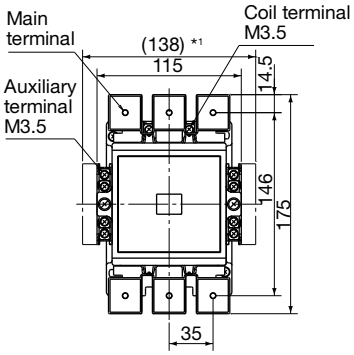


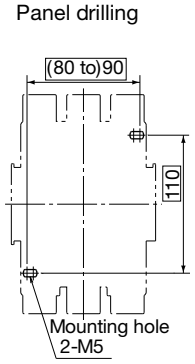


Mass: 2.6kg

SC-E7



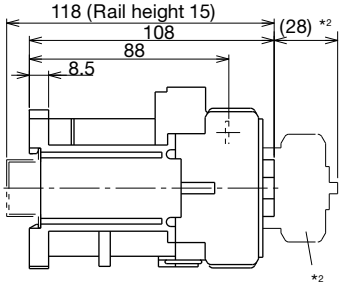


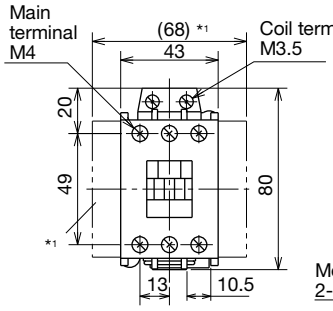


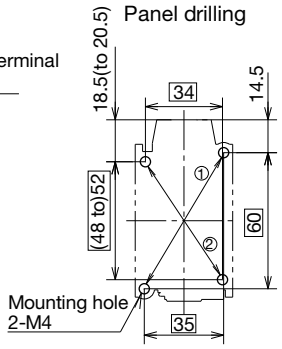
Mass: 2.9kg

• Non-reversing DC operated

SC-E02/G, E03/G, E04/G, E05/G



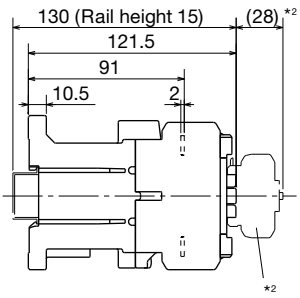


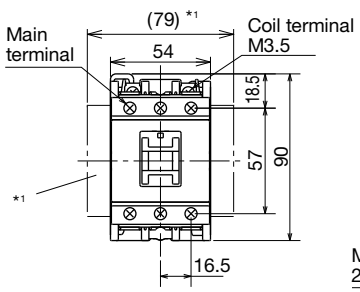


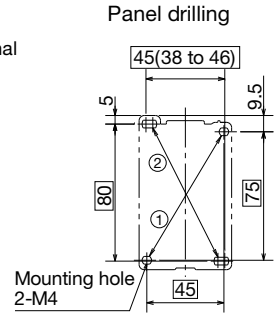
Mass: 0.59kg

Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: 35 × 60 ②: 35 × (48 to) 52

SC-E1/G, E2/G, E2S/G





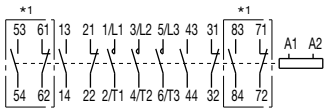


Mass: 0.79kg

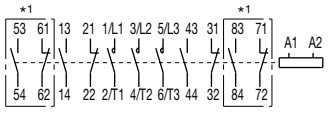
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: 45×75 ②: 45 (38 to 46)×80

*1 Side mounting aux. contact block
*2 Front mounting aux. contact block

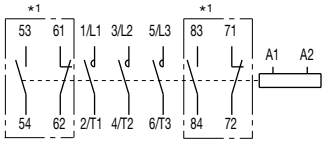
■ Wiring diagrams



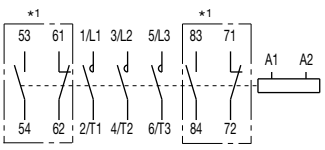
*1 In case of aux. contact 4NO+4NC



*1 In case of aux. contact 4NO+4NC



*1 In case of aux. contact 2NO+2NC

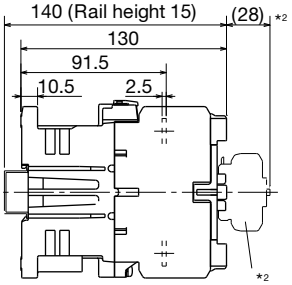


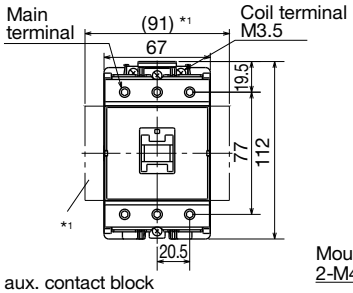
*1 In case of aux. contact 2NO+2NC

Contactors SC-E series
Dimensions

■ Dimensions, mm

• Non-reversing DC operated
SC-E3/G, E4/G

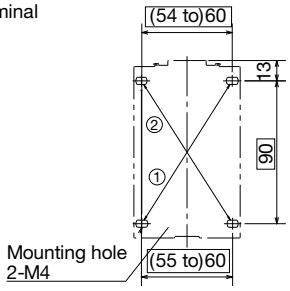


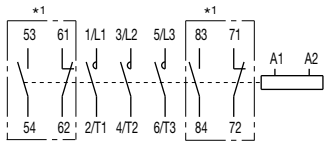


Mass: 1.4kg

*1 Side mounting aux. contact block
*2 Front mounting aux. contact block

Panel drilling

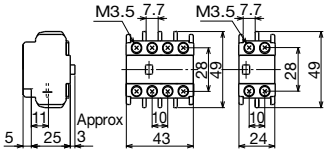




*1 In case of aux. contact 2NO+2NC

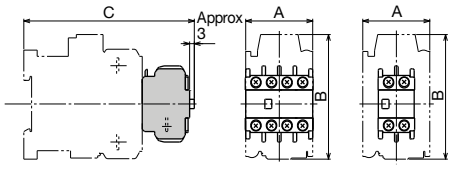
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: (55 to) 60 × 90 ②: (54 to) 60 × 90

• Auxiliary contact blocks Front mounting
SZ-A40/T, A31/T, A22/T, A20/T, A11/T, A02/T for SC-E02 to E4



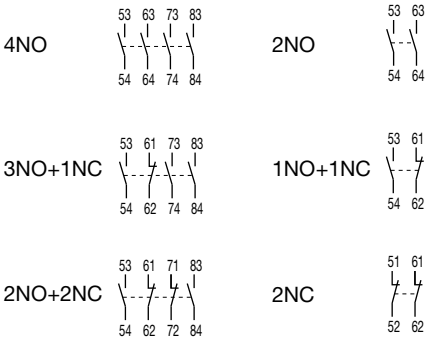
SZ-A40/T, A31/T, A22/T Mass: 36g
SZ-A20/T, A11/T, A02/T Mass: 20g

Contactor with aux. contact block

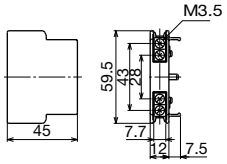


Type	A	B	C
SC-E02, E03, E04, E05	43	80	109
SC-E1, E2, E2S	54	90	124
SC-E3, E4	67	112	139

■ Wiring diagrams

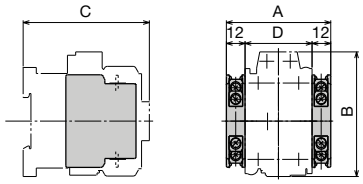


• Auxiliary contact blocks Side mounting
SZ-AS1/T, for SC-E02 to E4



Mass: 28g

Contactor with aux. contact block

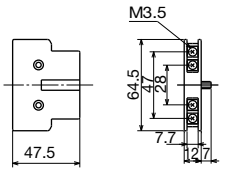


Type	A	B	C	D
SC-E02, E03, E04, E05	67	80	81	43
SC-E1, E2, E2S	78	90	96	54
SC-E3, E4	91	112	111	67

1NO+1NC Mounted on right side

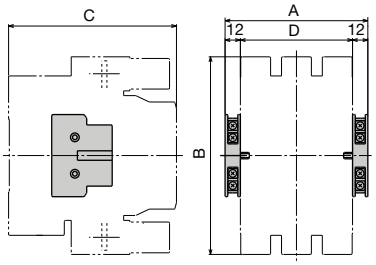
Mounted on left side

SZ-AS2/T, for SC-E5 to E7



Mass: 40g

Contactor with aux. contact block



Type	A	B	C	D
SC-E5	112	155	132	88
SC-E6	124	169	138	100
SC-E7	139	175	140	115

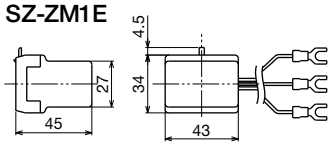
1NO+1NC Mounted on right side

Mounted on left side

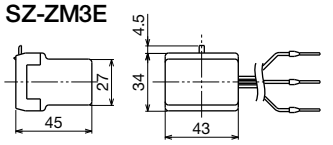
■ Dimensions, mm

• Main circuit surge suppression units

SZ-ZM1E

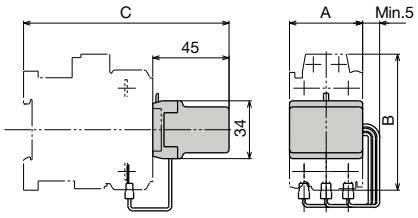


SZ-ZM3E



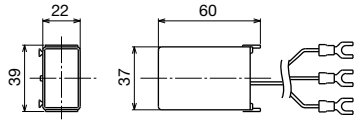
Mass: 60g

Contactor with surge suppression unit

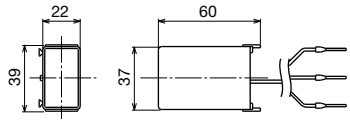


Type	A	B	C
SC-E02+SZ-ZM1E SC-E03 SC-E04 SC-E05	43	80	121
SC-E1+SZ-ZM3E SC-E2 SC-E2S	54	90	136
SC-E3+SZ-ZM3E SC-E4	67	112	151

SZ-ZM2E

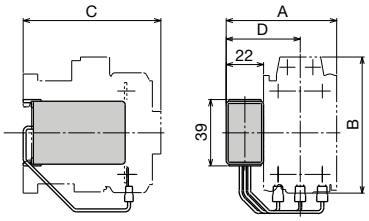


SZ-ZM4E



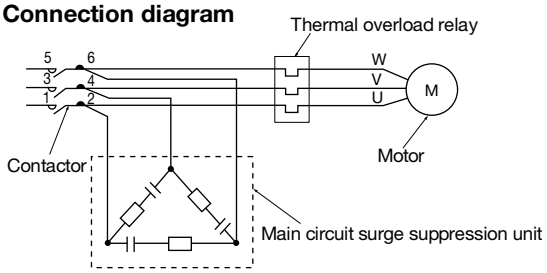
Mass: 60g

Contactor with surge suppression unit



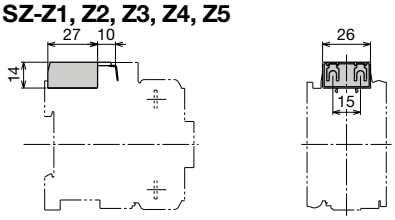
Type	A	B	C	D
SC-E02+SZ-ZM2E SC-E03 SC-E04 SC-E05 SC-E1	65	80	81	43.5
SC-E2+SZ-ZM2E SC-E2S	76	90	96	49
SC-E3+SZ-ZM2E SC-E4	89	112	111	55.5

Connection diagram



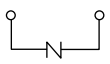
• Coil surge suppression units

SZ-Z1, Z2, Z3, Z4, Z5

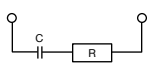


Mass: 14g

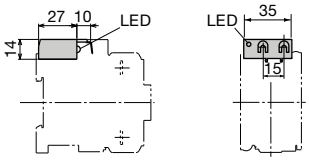
SC-E02 to E05 + SZ-Z1 to Z3
(Built-in varistor)



SC-E02 to E05 + SZ-Z4, Z5
(Built-in CR)

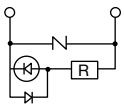


SZ-Z6, Z7, Z8, Z9

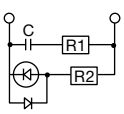


Mass: 16g

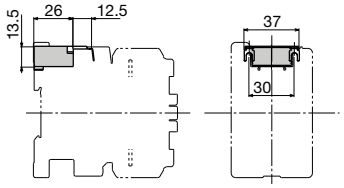
SC-E02 to E05 + SZ-Z6, Z7
(Built-in varistor with operating indicator)



SC-E02 to E05 + SZ-Z8, Z9
(Built-in CR with operating indicator)

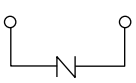


SZ-Z31, Z32, Z33, Z34, Z35, Z36, Z37

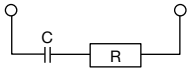


Mass: 15g

SC-E1 to E4 + SZ-Z31 to Z33
(Built-in varistor)



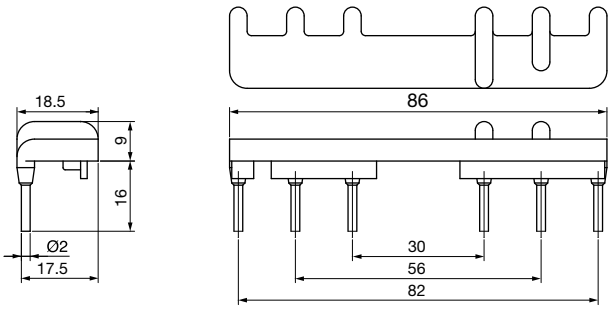
SC-E1 to E4 + SZ-Z34, Z35
(Built-in CR)
SC-E1/G to E4/G + SZ-Z36, Z37
(Built-in CR)



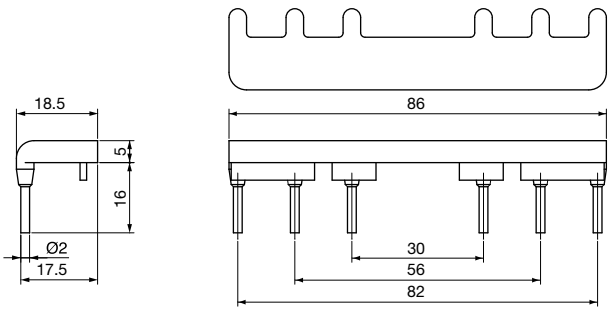
Dimensions, mm

- **Power connection kit for reversing for SC-E**

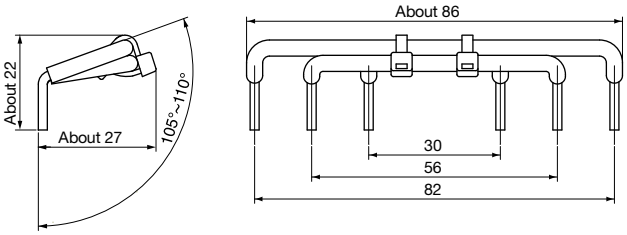
SZ-ERW1/A



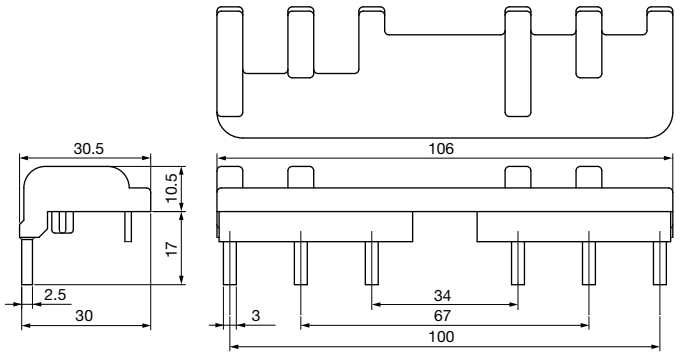
SZ-ERW1/B



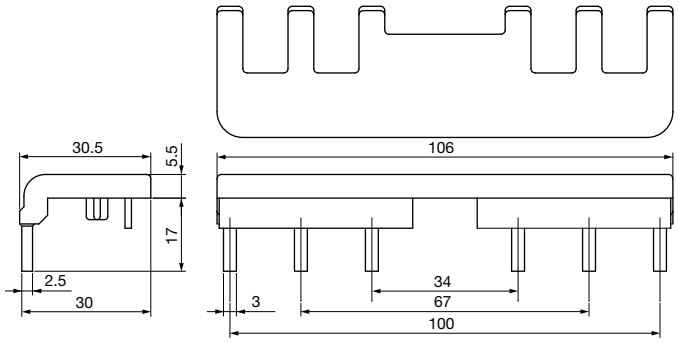
SZ-ERW1/D



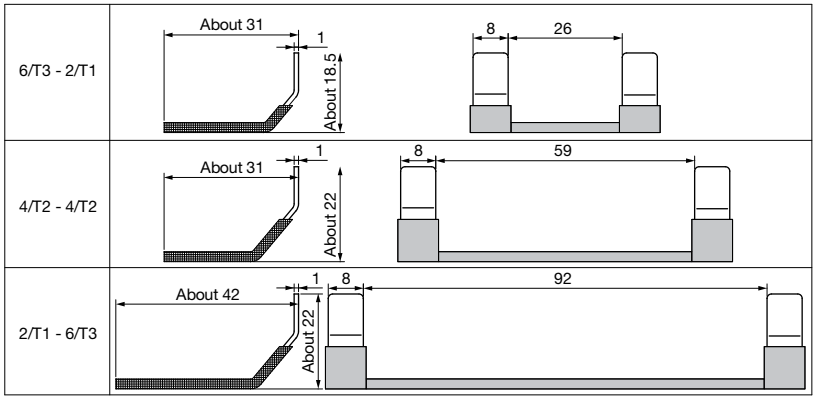
SZ-ERW2/A



SZ-ERW2/B



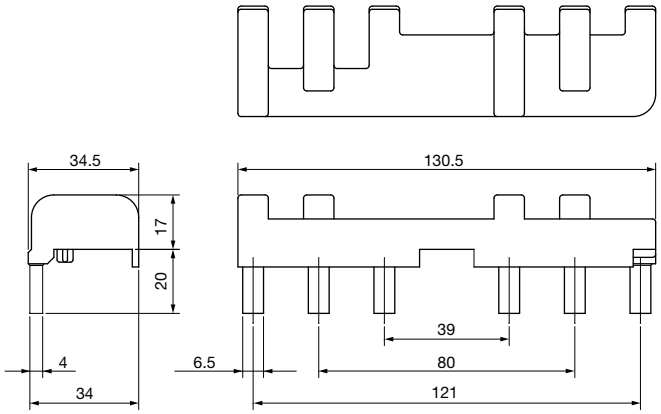
SZ-ERW2/D



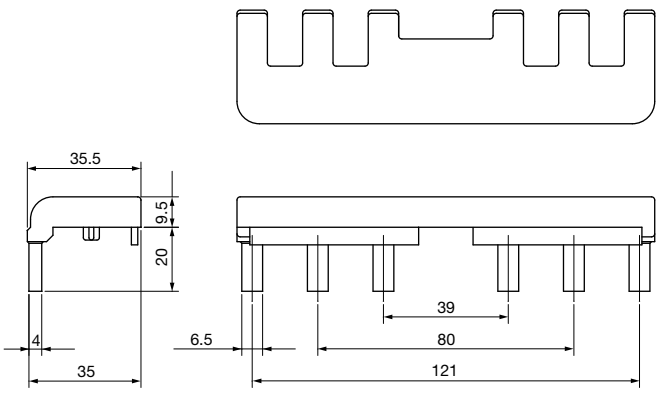
Dimensions, mm

Power connection kit for reversing for SC-E

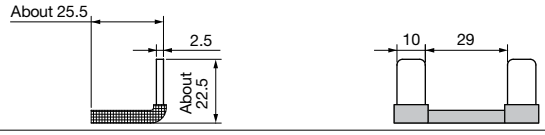
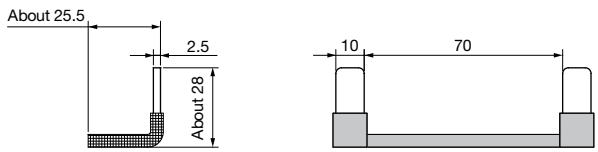
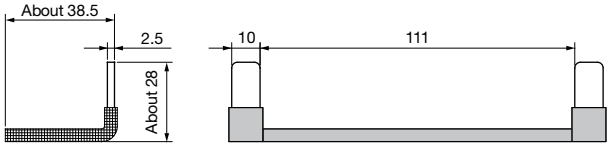
SZ-ERW3/A



SZ-ERW3/B



SZ-ERW3/D

6/T3 - 2/T1	
4/T2 - 4/T2	
2/T1 - 6/T3	

■ Standard operating conditions

The magnetic contactors are manufactured for use in the standard operating conditions given in the table at the right. Consult Fuji Electric before using the magnetic contactors in different conditions.

Ambient temperature	Operating: –5 to 55˚C No sudden temperature changes resulting in condensation or icing (The average temperature over a 24-hour period must not exceed 35˚C) Storage: –40 to 65˚C
Humidity	45 to 85%RH
Altitude	2000m or lower
Atmosphere	No excessive dust, smoke, corrosive gases, flammable gases, steam, or salt
Vibration	10 to 55Hz 15m/s^2
Shock	50m/s^2
Mounting	Screw mounting, 35mm DIN rail mounting (SC-E02 to SC-E4)
Mounting angle	
Standard	IEC 60947-4-1, EN 60947-4-1, VDE 0660 JIS C 8201-4-1, JEM 1038 UL 508, CSA C22.2

■ Wirings

• Connection wires and terminal processing

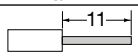
Be sure to perform wiring correctly with reference to the connections diagram. Main terminals for models SC-E02 to SC-E7 are wired using solid wires or stranded wires. Stranded wires or flexible stranded wires can be connected by twisting them together, crimping a sleeve (ferrule) onto them before connecting.

• Tightening torque

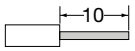
If wires are not tightened sufficiently, they may become hot or come loose and result in a fire, short-circuit, electric shock, or some other potentially dangerous situation. Be sure to tighten the wires to the torques specified in the tables below.

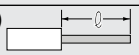
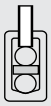
• Connectable wire sizes, tightening tools, tightening torques

Main circuit

Contactor type		SC-E02 SC-E02/G	SC-E03 SC-E03/G	SC-E04 SC-E04/G	SC-E05 SC-E05/G
Solid wire (mm^2)	One	0.75 to 4		0.75 to 6	
	Two	1 to 4		1.5 to 6	
Stranded wire (mm^2)	One	0.75 to 4		0.75 to 6	
	Two	1 to 4		1.5 to 6	
AWG	One	12 max.		10 max.	
	Two	12 max.		10 max.	
Sheath stripping length (mm)					
Terminal screw size		M4			
Tool		⊕Phillips screwdriver, H-type, No. 2 (ISO 8764) ⊖Flat-blade screwdriver, 1×5.5×L-type, B (ISO 2830)			
Tightening torque (N·m)		1.2 to 1.5			

Control circuit

Solid or stranded wire (mm^2)	One	0.75 to 2.5 (ø1 to 1.6)
	Two	0.75 to 2.5
AWG	One	18 to 14
	Two	18 to 14
Sheath stripping length (mm)		
Fork terminal		Max. 7.7mm wide
Terminal screw size		M3.5
Tool		⊕Phillips screwdriver, H-type, No. 2 (ISO 8764) ⊖Flat-blade screwdriver, 1×5.5×L-type, B (ISO 2830)
Tightening torque (N·m)		0.8 to 1

Contactor type			SC-E1, E2, E2S SC-E1/G, E2/G, E2S/G	SC-E3, E4 SC-E3/G, E4/G	SC-E5, E6	SC-E7
Top-only connection 	Solid or stranded wire (mm^2) *1		0.75 to 35	1.5 to 70	4 to 70	4 to 120
	Flexible stranded wire with sleeve (mm^2) *1		0.75 to 25	1.5 to 50	2.5 to 50	2.5 to 95
	Flexible stranded wire without sleeve (mm^2) *1		0.75 to 25	1.5 to 50	4 to 50	4 to 95
	AWG		18 to 2	16 to 2/0	12 to 2/0	12 to 250MCM
	Solid or stripping length (mm) 		15	19.5	26.5	28.5
Bottom-only connection 	Single stranded wire (mm^2) *1		0.75 to 25	1.5 to 50	4 to 70	4 to 120
	Flexible stranded wire with sleeve (mm^2) *1		0.75 to 16	1.5 to 35	2.5 to 50	2.5 to 95
	Flexible stranded wire without sleeve (mm^2) *1		0.75 to 16	1.5 to 35	4 to 50	4 to 95
	AWG		18 to 3	16 to 1/0	12 to 2/0	12 to 250MCM
	Sheath stripping length (mm) 		12.5	16	26.5	28.5
Top/bottom connection 	Solid or stranded wire (mm^2) *1	Top/bottom	0.75 to 25	1.5 to 50	4 to 70	4 to 120
	Flexible stranded wire with sleeve (mm^2) *1	Top/bottom	0.75 to 16	1.5 to 35	2.5 to 50	2.5 to 95
	Flexible stranded wire without sleeve (mm^2) *1	Top/bottom	0.75 to 16	1.5 to 35	4 to 50	4 to 95
	AWG	Top/bottom	18 to 3	16 to 1/0	12 to 2/0	12 to 250MCM
Tool			⊕Phillips screwdriver, H-type, No. 2 (ISO 8764) ⊖Flat-blade screwdriver, 1×5.5×L-type, B (ISO 2830)	◎Hex. wrench 4 (ISO 2936)		
Tightening torque (N·m)			2.5	8		10
Self-locking torque (N·m) *2			1	2		

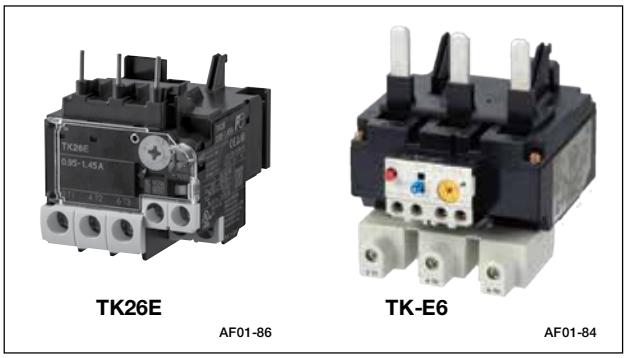
Notes: *1 Stranded wire (0 to 25mm^2) consists of 7 wires or less.
Stranded wire (35 to 120mm^2) consists of 19 wires or less.
Flexible stranded wire consists of more number wires than the above.

*2 The tightening bolt must be loosened in order to insert the wire. However, stop loosening the bolt when the anti-drop attachment on the bottom of the bolt reaches the top edge of the terminal. If a torque exceeding that given in the table is applied in this state, the retaining bracket may come loose.

TK-E series with Open-phase Protection Device

Features

- This relay protects motor windings from burning due to overloads, locked rotor current, or open-phases.
- Maintenance and inspection safety has been improved by employing a finger protection mechanism to cover exposed terminals (conforms to DIN 57106, VDE 0106 Teil 100).
- A high-precision scale for the current adjustment dial enables easy and exact current setting.
- The operating status can be visually checked with ease.
- The relays can be manually tripped. A trip-free mechanism is also provided.
- Base unit can be added to enable separate-mounting types of the TK26E, E2, and E3 models.



TK26E AF01-86 **TK-E6** AF01-84

Part Number and Specification

Applicable contactor	Part number	Aux. contact	Trip category (JIS)	No. of heater elements	Power consumption per pole	Provided functions
SC-E02 to E05, E02/G to E05/G	**TK26E**	1NO+1NC	10A	3	1.7VA	Overload, phase-loss protection Ambient temperature compensation Manual or auto reset selectable Manual trip mechanism Trip indicator
SC-E1 to E2S, E1/G to E2S/G	**TK-E2**				3.8VA	
SC-E3, E4, E3/G, E4/G	**TK-E3**				6.6VA	
SC-E5	**TK-E5**				6.6VA	
SC-E6, E7	**TK-E6**				8.0VA	

Note: Separerate mounting type is available for TK-E6. The part number is TK-E6H.

Ampere Ranges (Part Number Codes)

Thermal overload relay type				
TK26E	**TK-E2**	**TK-E3**	**TK-E5**	**TK-E6, E6H ***
0.1–0.15 (P10)				
0.13–0.2 (P13)				
0.18–0.27 (P18)				
0.24–0.36 (P24)				
0.34–0.52 (P34)				
0.48–0.72 (P48)				
0.64–0.96 (P64)				
0.8–1.2 (P80)				
0.95–1.45 (P95)				
1.1–1.65 (1P1)				
1.4–2.1 (1P4)				
1.7–2.6 (1P7)				
2.2–3.4 (2P2)				
2.8–4.2 (2P8)				
4–6 (004)	4–6			
5–7.5 (005)				
	5–8			
6–9 (006)	6–9			
7–10.5 (007)				
	7–11	7–11		
9–13 (009)	9–13	9–13		
12–18 (012)	12–18	12–18		
16–22 (016)				
	18–26	18–26	18–26	
20–26 (020)				
	24–36	24–36	24–36	
		28–40	28–40	
	32–42			
		34–50	34–50	
	40–50			
	44–54			
		45–65	45–65	45–65
		48–68		
				53–80
		64–80		
			65–95	65–95
			85–105	
				85–125
				110–160

Standards

IEC 60947-4-1, EN60947-4-1
VDE 0660, JIS C 8201-4-1
UL 508, CSA C22.2

Ordering Information

Specify the following:
1. Part number
2. Ampere range

TK26E - P80

Product category

Ampere Range Code

TK- E 2 - 4 – 6

Product Category

Frame Size

Ampere Range

Note: * Applicable only for separate-mounting type. Not applicable for use in combination with a magnetic contactor

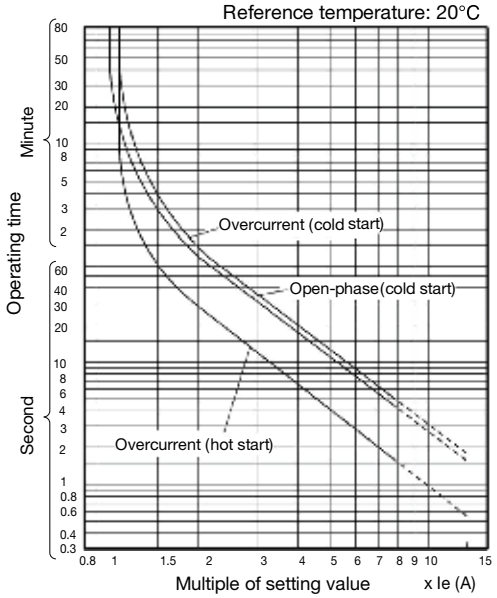
■ Auxiliary Contact Ratings

• Based on UL and CSA

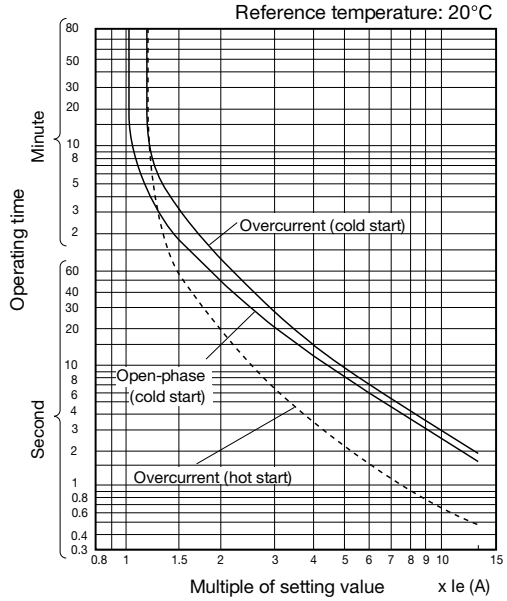
Part number	Rated insulation voltage (V)	Rated thermal current (A)	Making and breaking current (A)					
			AC (rating code B600)			DC (rating code R300)		
			Voltage (V)	Making (A)	Breaking (A)	Voltage (V)	Making (A)	Breaking (A)
TK26E	600	5	120	30	3	120	0.22	0.22
TK-E2, E3			240	15	1.5	250	0.11	0.11
TK-E5			480	7.5	0.75			
TK-E6			600	6	0.6			

■ Operating Characteristics (mean value)

•TK26E



•TK-E2 to E6, E6H



■ Optional Accessories for TK-E series

• Base Unit for Separate Mounting

The base unit modifies thermal overload relays to separate mounting that can be mounted to 35mm-wide IEC top hat rail or secured with screws.

Applicable thermal overload relay	Type
TK26E	**TZ1H26E**
TK-E2	**SZ-HDE**
TK-E3	**SZ-HEE**

• Trip Indicator

Reports any tripping action at a thermal overload relay through its LED display.

Applicable thermal overload relay	Rated voltage	Type
TK-E2 to TK-E6	100–110V AC, 50/60Hz	**SZ-L100N2**
	200–220V AC, 50/60Hz	**SZ-L200N2**

• Reset Release Button

Reset a thermal overload relay from the rear side of the board or a distant location.

Applicable thermal overload relay	Load length (mm)	Type
TK26E	300	**SZ-R1**
	500	**SZ-R2**
	700	**SZ-R3**
TK-E2 to TK-E6	300	**SZ-R4**
	500	**SZ-R5**
	700	**SZ-R6**

• Dial Cover

Protects the setting current value of a thermal overload relay from being changed unintentionally.

Applicable thermal overload relay	Type
TK-E02 to TK-E6	**SZ-DA**

KK01-108

Base unit
SZ-HDE

AF00-291

Trip indicator
SZ-L200N2

AF88-585

Reset release button
SZ-R1

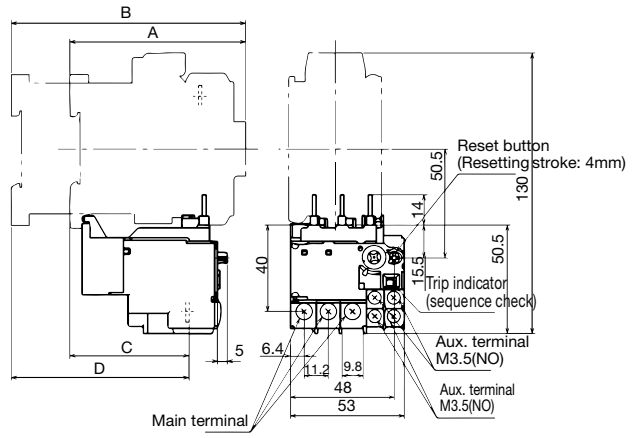
AF88-1056

Dial cover
SZ-DA

Thermal Overload Relays TK-E series
Dimensions

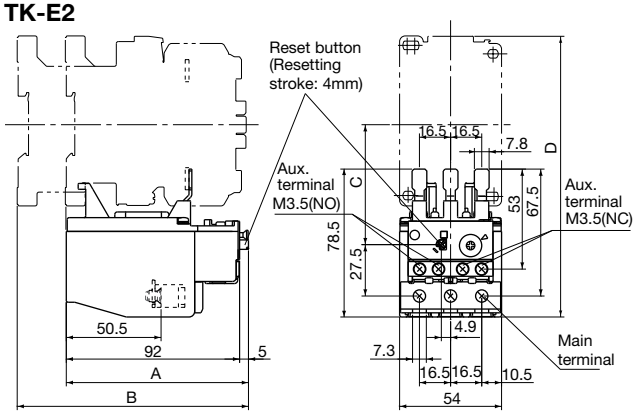
■ Dimensions, mm

TK26E



Contactor	A	B	C	D
SC-E02 to 05	81	–	55.5	–
SC-E02/G to 05/G	–	108	–	82.5

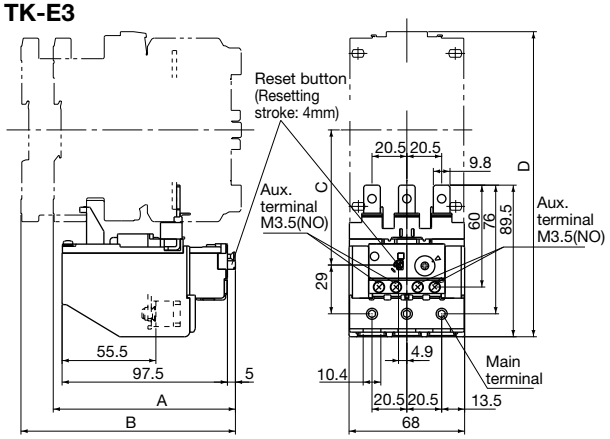
TK-E2



Contactor	A	B	C	D
SC-E1 to E2S	97	–	63.5	149
SC-E1/G to E2S/G	–	123	63.5	149

Mass: 0.25kg

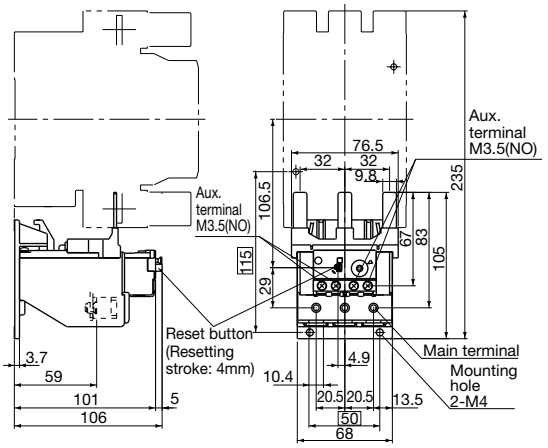
TK-E3



Contactor	A	B	C	D
SC-E3, E4	107.5	–	79.5	180
SC-E3/, E4/G	–	126.5	79.5	180

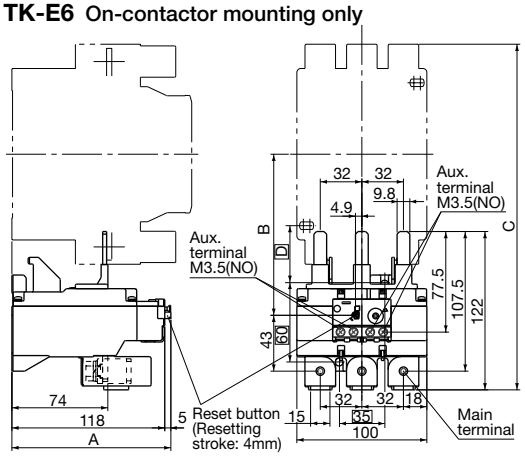
Mass: 0.34kg

TK-E5 On-contactor mounting only



Mass: 0.37kg

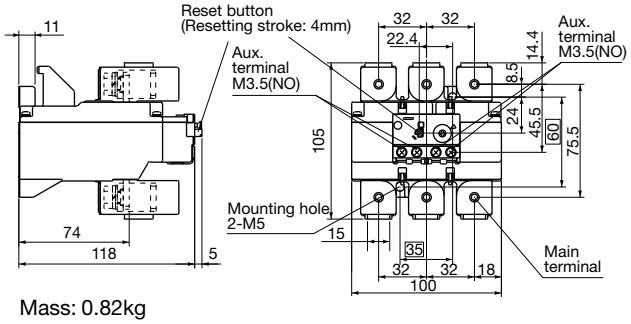
TK-E6 On-contactor mounting only



Contactor	A	B	C	D
SC-E6	123	124	266.5	45
SC-E7	123	129	274	50

Mass: 0.71kg

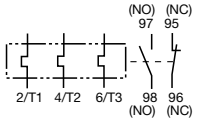
TK-E6H For separate mounting only



Mass: 0.82kg

■ Wiring Diagrams

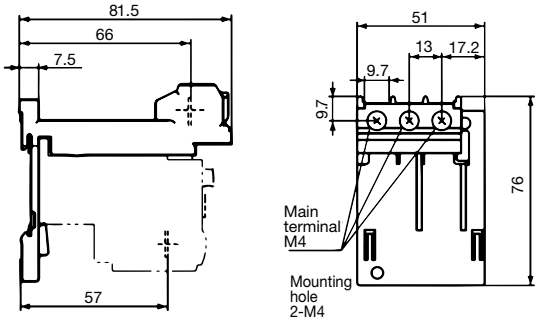
3-heater element



■ Dimensions, mm

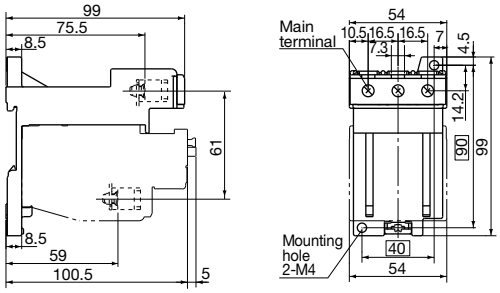
• Base Units for Separate Mounting

TZ1H26E



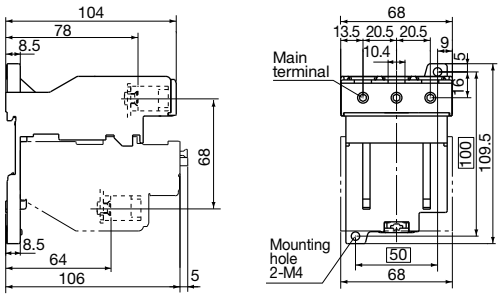
Mass: 0.04kg

SZ-HDE



Mass: 0.1kg

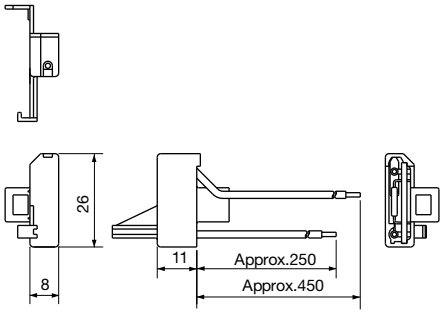
SZ-HEE



Mass: 0.15kg

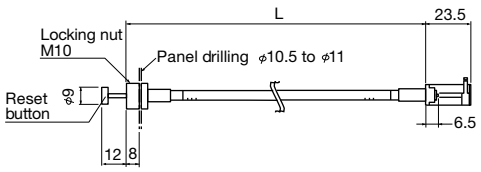
• Trip Indicators

SZ-L100N2, L200N2



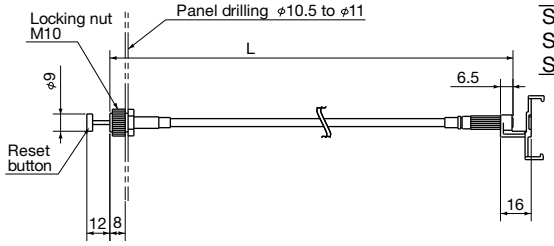
• Reset Release Button

SZ-R1, R2, R3



Type	L
SZ-R1	300
SZ-R2	500
SZ-R3	700

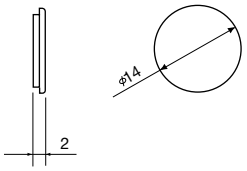
SZ-R4, R5, R6



Type	L
SZ-R4	300
SZ-R5	500
SZ-R6	700

• Dial Cover

SZ-DA



■ Standard Operating Conditions

The thermal overload relays are manufactured for use in the standard operating conditions given in the table at the right. Consult Fuji Electric before using the thermal overload in different conditions.

Ambient temperature	Operating: –5 to 55˚C No sudden temperature changes resulting in condensation or icing (The average temperature over a 24-hour period must not exceed 35˚C) Storage: –40 to 65˚C
Humidity	45 to 85%RH
Atmosphere	No excessive dust, smoke, corrosive gases, flammable gases, steam, or salt
Vibration	10 to 55Hz 15m/s^2
Shock	50m/s^2

■ Wiring

• Connection wires and terminal processing

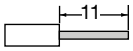
Be sure to perform wiring correctly referring to the connection diagram. Main terminals for models TK26E to TK-E6 are wired using solid wires or stranded wires. Stranded wires or flexible stranded wires can be connected by twisting them together crimping a sleeve (ferrule) onto them before connecting.

• Tightening torque

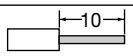
If wires are not tightened sufficiently, they may become hot or come loose and result in a fire, short-circuit, electric shock, or some other potentially dangerous situation. Be sure to tighten the wires to the torques specified in the tables below.

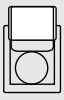
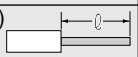
• Wire Sizes, Tightening Tools, Tightening Torques

Main Circuit

Thermal overload relay type Base unit type		TK26E TZ1H26E
Solid wire (mm^2)	One	0.75 to 4
	Two	1 to 4
Stranded wire (mm^2)	One	0.75 to 4
	Two	1 to 4
AWG	One	12 max.
	Two	12 max.
Sheath stripping length (mm)		
Terminal screw size		M4
Tool		⊕ Phillips screwdriver, H-type, No. 2 (ISO 8764) ⊖ Flat-blade screwdriver, 1×5.5×L-type, B (ISO 2830)
Tightening torque [N·m(lb·in)]		1.2 to 1.5 (11 to 13)

Control Circuit

Single stranded wire (mm^2)	One	0.75 to 2.5 (ø1 to ø1.6)
	Two	0.75 to 2.5
AWG	One	18 to 14
	Two	18 to 14
Sheath stripping length (mm)		
Fork terminal		Max. 7.7mm wide (R2-3.5)
Terminal screw size		M3.5
Tool		⊕ Phillips screwdriver, H-type, No. 2 (ISO 8764) ⊖ Flat-blade screwdriver, 1×5.5×L-type, B (ISO 2830)
Tightening torque [N·m(lb·in)]		0.8 to 1 (7 to 9)

Thermal overload relay type Base unit type		TK-E2 SZ-HDE	TK-E3 SZ-HEE	TK-E5 –	TK-E6, E6H –
	Single stranded wire (mm^2) *1	0.75 to 16	1.5 to 35		16 to 70
	Flexible stranded wire with sleeve (mm^2) *1	0.75 to 16	1.5 to 35		16 to 70
	Flexible stranded wire without sleeve (mm^2)	0.75 to 16	1.5 to 35		16 to 70
	AWG	6 max.	2 max.		00 max.
	Sheath stripping length (mm) 	18	21		23
	Tool	⊕ Phillips screwdriver, H-type, No. 2 (ISO 8764) ⊖ Flat-blade screwdriver, 1×5.5×L-type, B (ISO 2830)	◎ Hex. wrench 4 (ISO 2936)		
	Tightening torque (N·m)	2.5	6		10

Notes: *1 Stranded wire (0 to 25mm^2) consists of 7 wires or less.
Stranded wire (35 to 120mm^2) consists of 19 wires or less.
Flexible stranded wire consists of more number wires than the above.

■ Type Number Nomenclature

● Type Number Nomenclature (Type Number = Product Code)

• Magnetic Contactors

SK 12 A H R - 2 01 W

Basic type number
Mini-Contactor

Frame size
06, 09, or 12

Operating method
A : AC-operated model
G : DC-operated model (2.4W)
L : DC-operated model (1.2W)

Auxiliary contact
Blank : Bifurcated contact
H : Single button contact

Non-reversing or reversing
Blank : Non-reversing
R : Reversing

Reversing conductor
W : Wire
M : Molded (Only for Combination Starter)
Note: Specify this for a reversing model.

Auxiliary contact arrangement
10 : 1NO
01 : 1NC

Coil voltage

AC operation		E	24V AC
		F	48V AC
		1	100V AC
		H	110V AC
		K	120V AC
		2	200V AC
		M	220V AC
		P	240V AC
		S	380V AC
		4	400V AC
		T	440V AC
		5	500V AC
DC operation	2.4W	B	12V DC
		E	24V DC
		F	48V DC
		G	60V DC
		1	100V DC
		H	110V DC
		K	120V DC
		2	200V DC
		Y	210V DC
		M	220V DC
	1.2W	B	12V DC
		E	24V DC
		F	48V DC

Note: Products cannot be manufactured for all possible type numbers.

Ratings

■ Main Circuit Ratings

● IEC-conformance Ratings (IEC 60947-4-1, EN 60947-4-1, and VDE 0660)

Type	Max. motor capacity [kW]				Operational current [A]						Conventional free air thermal current [A] (Rated thermal current)
	3-phase squirrel-cage motor (AC-3)				3-phase squirrel-cage motor (AC-3)				Resistance (AC-1)		
	200-240V	380-440V	500-550V	600-690V	200-240V	380-440V	500-550V	600-690V	200-240V	380-440V	
SK06	1.5	2.2	3	3	6	6	5	3.5	12	12	20
SK09	2.2	4	4	4	9	9	7	5	16	16	20
SK12	3	5.5	5.5	4	12	12	9	5	20	20	20

Note: AC-3 electrical durability: 1,000,000 operations

● UL/CSA-conformance Ratings (UL60947-4-1A and CSA C22.2)

Type	Max. motor capacity [HP]				Operational current [A]				Rated continuous current [A]
	3-phase motor				3-phase motor				
	200V	220-240V	440-480V	550-600V	200V	220-240V	440-480V	550-600V	
SK06	1-1/2	2	3	5	6.9	6.8	4.8	6.1	20
SK09	2	3	5	5	7.8	9.6	7.6	6.1	20
SK12	3	3	5	5	11	9.6	7.6	6.1	20

Type	Max. motor capacity [HP]			Operational current [A]			Rated continuous current [A]
	Single-phase motor			Single-phase motor			
	110-120V	200V	220-240V	110-120V	200V	220-240V	
SK06	1/2	3/4	1	9.8	7.9	8	20
SK09	3/4	1	1-1/2	13.8	9.2	10	20
SK12	1	1-1/2	2	16	11.5	12	20

Note: Use wires that are rated for 75°C.

■ Auxiliary Circuit Ratings

● IEC-conformance Ratings (Standard Models: Bifurcated Contact)

Type	Conventional free air thermal current [A] (Rated thermal current)	Making and breaking current (AC)	Rated operational current [A]						Minimum voltage and current
			AC rated operational voltage [V]	AC-15 (Ind. load)	AC-12 (Res. load)	DC rated operational voltage [V]	DC-13 (Ind. load)	DC-12 (Res. load)	
SK06 **SK09** **SK12**	10	30	100-120	3	6	24	2	3	5V DC, 3mA
		30	200-240	3	6	48	1	2	
		10	380-440	1	6	110	0.3	1.5	
		5	500-600	0.5	3	220	0.2	0.5	

Note: The failure level is 10 $^{-7}$ for a normal environment without dust, dirt, or corrosive gas.
The ratings of additional auxiliary contacts are the same as those given above.

● IEC-conformance Ratings (Single Button Contact)

Type	Conventional free air thermal current [A] (Rated thermal current)	Making and breaking current (AC)	Rated operational current [A]						Minimum voltage and current
			AC rated operational voltage [V]	AC-15 (Ind. load)	AC-12 (Res. load)	DC rated operational voltage [V]	DC-13 (Ind. load)	DC-12 (Res. load)	
SK06□H **SK09□H** **SK12□H**	10	60	100-120	6	10	24	4	8	24V DC, 10mA
		60	200-240	6	10	48	1	3.5	
		60	380-440	6	10	110	0.5	2.5	
		30	500-600	3	5	220	0.25	0.8	

Note: The failure level is 10 $^{-7}$ for a normal environment without dust, dirt, or corrosive gas.
The ratings of additional auxiliary contacts are the same as those given above.

● UL/CSA-conformance Ratings (Bifurcated Contact or Single Button Contact)

Type	Rated continuous current [A]	Rated operational current [A]						Rating code	
		AC			DC				
		Rated operational voltage [V]	Making	Breaking	Rated operational voltage [V]	Making	Breaking	AC	DC
SK06 **SK09** **SK12**	10	120	60	6	125	0.55	0.55	A600	Q300
		240	30	3					
		480	15	1.5	250	0.27	0.27		
		600	12	1.2					

■ Operating Coil Voltages

● AC-operated Models

Type	Order voltage	Code	Coil voltage and frequency
SK06A **SK09A** **SK12A**	24V AC	E	24V 50Hz / 24-26V 60Hz
	48V AC	F	48V 50Hz / 48-52V 60Hz
	100V AC	1	100V 50Hz / 100-110V 60Hz
	110V AC	H	100-110V 50Hz / 110-120V 60Hz
	120V AC	K	110-120V 50Hz / 120-130V 60Hz
	200V AC	2	200V 50Hz / 200-220V 60Hz
	220V AC	M	200-220V 50Hz / 220-240V 60Hz
	240V AC	P	220-240V 50Hz / 240-260V 60Hz
	380V AC	S	346-380V 50Hz / 380-420V 60Hz
	400V AC	4	380-400V 50Hz / 400-440V 60Hz
	440V AC	T	415-440V 50Hz / 440-480V 60Hz
	500V AC	5	480-500V 50Hz / 500-550V 60Hz

● DC-operated Models (2.4W)

Type	Order voltage	Code	Coil voltage
SK06G **SK09G** **SK12G**	12V DC	B	12V DC
	24V DC	E	24V DC
	48V DC	F	48V DC
	60V DC	G	60V DC
	100V DC	1	100V DC
	110V DC	H	110V DC
	120V DC	K	120V DC
	200V DC	2	200V DC
	210V DC	Y	210V DC
	220V DC	M	220V DC

● DC-operated Models (1.2W)

Type	Order voltage	Code	Coil voltage
SK06L **SK09L** **SK12L**	12V DC	B	12V DC
	24V DC	E	24V DC
	48V DC	F	48V DC

■ Operating Coil Characteristics

● AC-operated Models

Type	Power consumption [VA]				Watt loss [W]		Pick-up voltage [V]		Drop-out voltage [V]		Operating times [ms]	
SK06A SK09A SK12A	Inrush		Sealed								Coil ON Contact ON	Coil OFF Contact OFF
	200V 50Hz	220V 60Hz	200V 50Hz	220V 60Hz	200V 50Hz	220V 60Hz	50Hz	60Hz	50Hz	60Hz		
	22	25	4.5	4.5	1.2	1.3	122-135	128-138	80-89	83-96	17-26	8-11

Note 1. The characteristics are for the following coil ratings: 200V, 50Hz/200 to 220V, 60Hz.
Note 2. The electromagnet capacity is the same even when the rated coil voltage is not 200V AC.
Note 3. The operating times are for 200V AC, 50Hz.
Note 4. The pick-up voltage and drop-out voltage for a 100V (100V AC, 50 Hz/100 to 110V, 60Hz) coil are approximately half of the values that are given in the above table.
Note 5. The values in the above table are examples for a cold status at 20°C.

● DC-operated Models (2.4W)

Type	Power consumption [W]		Time constant [ms]	Pick-up voltage [V]	Drop-out voltage [V]	Operating times [ms]	
SK06G SK09G SK12G	Inrush	Sealed	Sealed			Coil ON Contact ON	Coil OFF Contact OFF
	24V	24V					
	2.4	2.4	20	10-11	4-6	22-24	5-6

Note 1. The characteristics are for the following coil rating: 24V DC.
Note 2. The electromagnet capacity is the same even when the rated coil voltage is not 24V DC.
Note 3. The values in the above table are examples for a cold status at 20°C.

● DC-operated Models (1.2W)

Type	Power consumption [W]		Time constant [ms]	Pick-up voltage [V]	Drop-out voltage [V]	Operating times [ms]	
SK06L SK09L SK12L	Inrush	Sealed	Sealed			Coil ON Contact ON	Coil OFF Contact OFF
	24V	24V					
	1.2	1.2	20	13-14	4-5	30-33	8-9

Note 1. The characteristics are for the following coil rating: 24V DC.
Note 2. The electromagnet capacity is the same even when the rated coil voltage is not 24V DC.
Note 3. The values in the above table are examples for a cold status at 20°C.

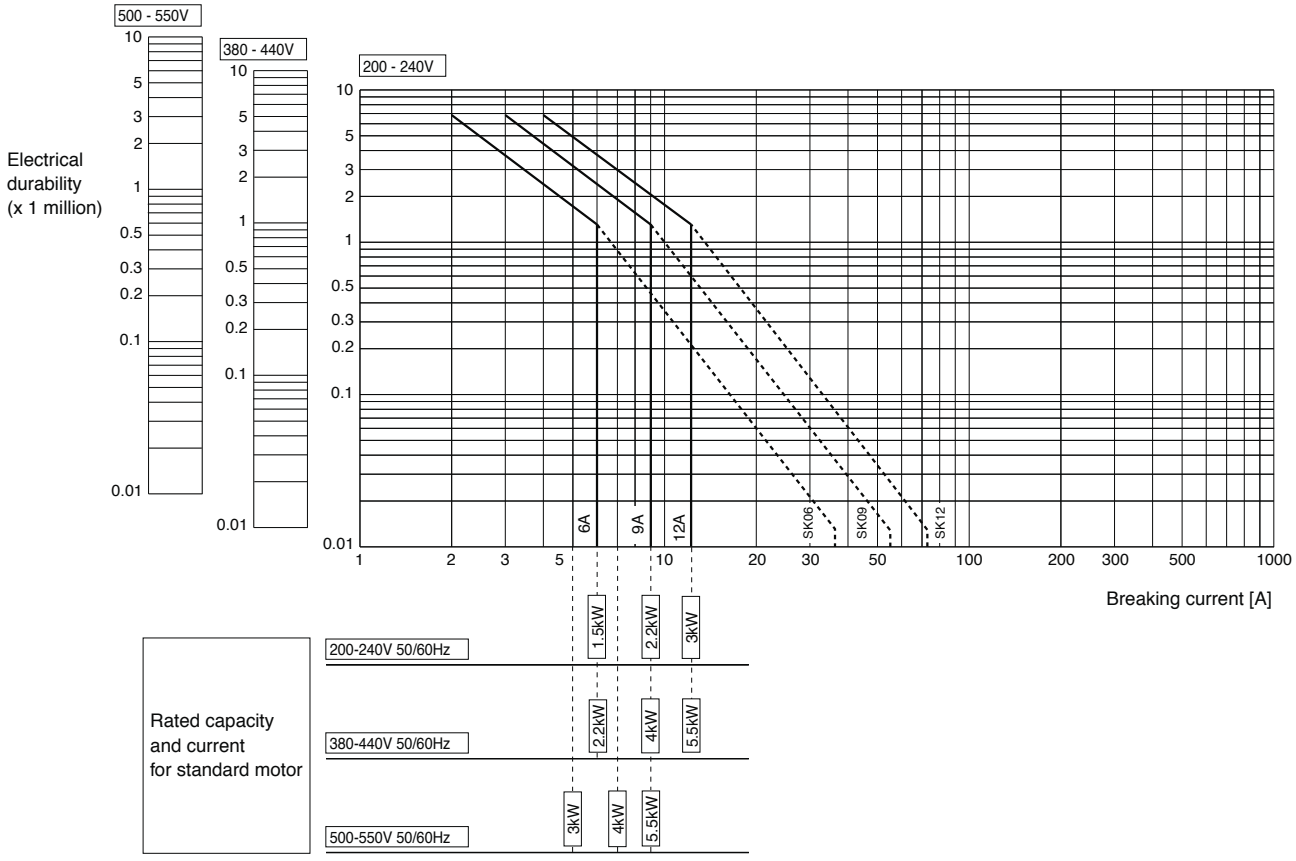
Mini-Contactors SK series
Characteristics

■ Performances

Type	Rated operational voltage [V]	Rated operational current [A]	Making/breaking current [A]		Operating cycles per hour [times/hour]	Durability (Operations)	
			Making	Breaking		Mechanical	Electrical
SK06	220	6	72	60	1800	10 million	1 million
	440	6	72	60			
SK09	220	9	108	90			
	440	9	108	90			
SK12	220	12	144	120			
	440	12	144	120			

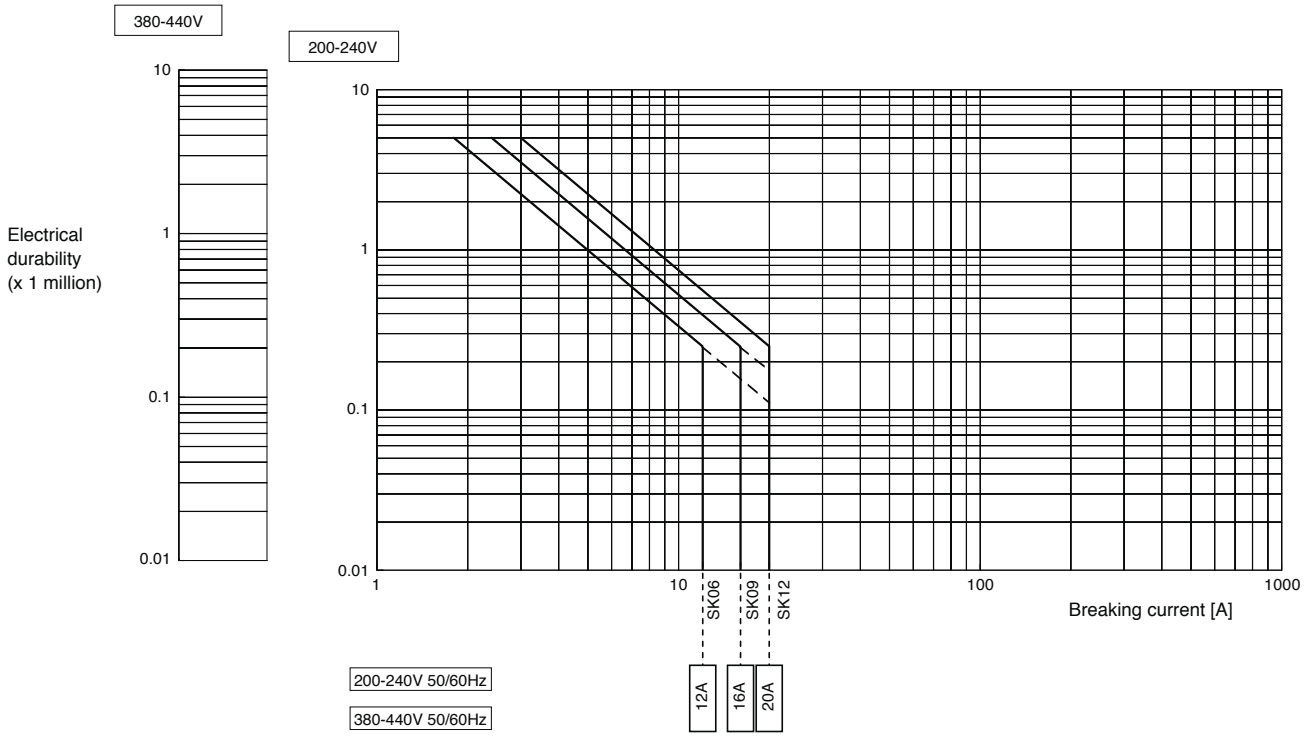
■ AC-3 Breaking Current and Electrical Durability

● SK06 to SK12



■ AC-1 Breaking Current and Electrical Durability

● SK06 to SK12



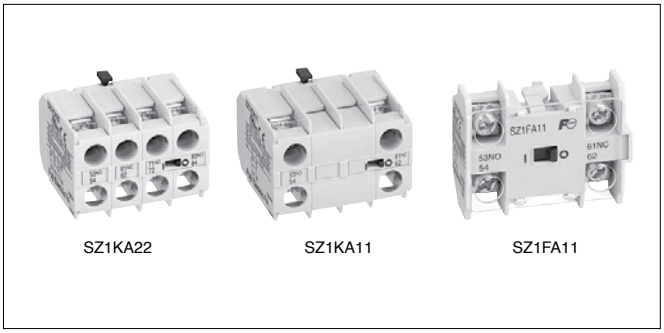
Optional Unit

■ **Type Numbers and Product Codes**

Product name	Type	Specification	Used with
Auxiliary Contact Blocks (Front mounting, Bifurcated Contact)	**SZ1KA40**	Contact arrangement: 4NO	SK06 to SK12 *1
	SZ1KA31	Contact arrangement: 3NO+1NC	
	SZ1KA22	Contact arrangement: 2NO+2NC	
	SZ1KA13	Contact arrangement: 1NO+3NC	
	SZ1KA04	Contact arrangement: 4NC	
	SZ1KA20	Contact arrangement: 2NO	SK06 to SK12
	SZ1KA11	Contact arrangement: 1NO+1NC	
	SZ1KA02	Contact arrangement: 2NC	
Auxiliary Contact Blocks (Front mounting, Single Button Contact)	**SZ1KA40H**	Contact arrangement: 4NO	SK06 to SK12 *1
	SZ1KA31H	Contact arrangement: 3NO+1NC	
	SZ1KA22H	Contact arrangement: 2NO+2NC	
	SZ1KA13H	Contact arrangement: 1NO+3NC	
	SZ1KA04H	Contact arrangement: 4NC	
	SZ1KA20H	Contact arrangement: 2NO	SK06 to SK12
	SZ1KA11H	Contact arrangement: 1NO+1NC	
	SZ1KA02H	Contact arrangement: 2NC	
Auxiliary Contact Blocks (Small Front mounting, Bifurcated Contact)	**SZ1FA11**	Contact arrangement: 1NO+1NC	SK06 to SK12
Auxiliary Contact Blocks (Small Front mounting, Single Button Contact)	**SZ1FA11H**	Contact arrangement: 1NO+1NC	SK06 to SK12
Mechanical Interlock Units	**SZ1KRM**	Reversing assembly and mechanical interlock	SK06 to SK12
Reversing Connection Kit (wiring)	**SZ1KRW1W**	Reversing Connection Kit for main circuit	SK06 to SK12
Main Circuit Surge Suppression Unit *2	**SZ-ZM2**	Built-in CR (3-phase motor, 200V, 0.1 to 2.2kw)	SK06 to SK12
Standalone Installation Unit *2 (for Main Circuit Surge Suppression Unit)	**SZ-ZMH**	For Main Circuit Surge Suppression Unit	SZ-ZM2
Coil Surge Suppression Units (surge suppression only)	**SZ1KZ1**	Built-in varistor: 24 to 48V AC/DC	SK06 to 12
	SZ1KZ2	Built-in varistor: 48 to 125V AC/DC	
	SZ1KZ3	Built-in varistor: 100 to 240V AC/DC	
Coil Surge Suppression Units (with Operation Indicator Lamps)	**SZ1KZ4**	Built-in varistor and LED: 24 to 48V AC/DC	SK06 to SK12
	SZ1KZ5	Built-in varistor and LED: 48 to 125V AC/DC	
Operation Indicator Units	**SZ1KL1**	Built-in LED: 12 to 24V AC/DC	SK06 to SK12
	SZ1KL2	Built-in LED: 24 to 48V AC/DC	
	SZ1KL3	Built-in LED: 48 to 125V AC/DC	
Thermal Overload Relay Reset Releases	**SZ-R1**	Release length: 300mm	TK12
	SZ-R2	Release length: 500mm	
	SZ-R3	Release length: 700mm	
Link Module	**BZ0LRK12AA**	Links to Manual Motor Starter	SK06 to SK12
Reversing Connection Unit (Insert)	**SZ1KRW1M**	Reversing Connection Unit (Insert) for main circuit	SK06 to SK12

*1 These options cannot be used with 1.2W DC Magnetic Contactors and Starters from SK06 to SK12L.
*2 Use the SZ-ZM2 Main Circuit Surge Suppression Unit together with the SZ-ZMH Standalone Installation Unit.

Auxiliary Contact Blocks



■ Features

- Easily add on auxiliary contacts.
- You can add auxiliary contacts without increasing the footprint to contribute to control panel downsizing.
- Many different contact variations in two external sizes.
- Models with double contacts are available for high reliability to achieve a minimum operating voltage and current of 5V DC, 3mA.

■ Ordering Information (Types)

- Auxiliary Contact Blocks

SZ1KA22
①Type

■ Ordering Information (Types)

Product name	Number of contacts	Contact arrangement	Mounting	Used with	Type
Auxiliary Contact Blocks with Bifurcated Contacts	4	4NO	Front mounting	SK06 to SK12 *1	**SZ1KA40**
		3NO+1NC			**SZ1KA31**
		2NO+2NC			**SZ1KA22**
		1NO+3NC			**SZ1KA13**
		4NC			**SZ1KA04**
	2	2NO	Front mounting	SK06 to SK12	**SZ1KA20**
		1NO+1NC			**SZ1KA11**
		2NC			**SZ1KA02**
Auxiliary Contact Blocks with Single Contacts	4	4NO	Front mounting	SK06 to SK12 *1	**SZ1KA40H**
		3NO+1NC			**SZ1KA31H**
		2NO+2NC			**SZ1KA22H**
		1NO+3NC			**SZ1KA13H**
		4NC			**SZ1KA04H**
	2	2NO	Front mounting	SK06 to SK12	**SZ1KA20H**
		1NO+1NC			**SZ1KA11H**
		2NC			**SZ1KA02H**
Small Auxiliary Contact Block with Bifurcated Contacts	2	1NO+1NC	Front mounting	SK06 to SK12	**SZ1FA11**
Small Auxiliary Contact Block with Single Contacts	2	1NO+1NC	Front mounting	SK06 to SK12	**SZ1FA11H**

*1These options cannot be used with 1.2W DC Magnetic Contactors and Starters from SK06 to SK12L.

■ Ratings

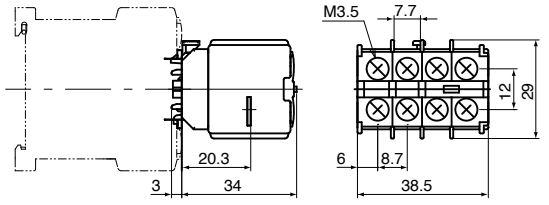
Type	Conventional free air thermal current (Rated continuous current) [A]	Making and breaking current (AC) [A]	Rated operational current [A]						Minimum voltage and current
			AC			DC			
			Rated operational voltage [V]	Ind. load (AC-15)	Res. load (AC-12)	Rated operational voltage [V]	Ind. load (DC-13)	Res. load (DC-12)	
SZ1KA□ SZ1FA□ (Bifurcated contacts)	10	30	AC100 - 120	3	6	24 DC	2	3	5V DC, 3mA
		30	AC200 - 240	3	6	48 DC	1	2	
		10	AC380 - 440	1	6	110 DC	0.3	1.5	
		5	AC500 - 600	0.5	3	220 DC	0.2	0.5	
SZ1KA□H SZ1FA□H (Single contacts)	10	60	AC100 - 120	6	10	24 DC	4	8	24V DC, 10mA
		60	AC200 - 240	6	10	48 DC	1	3.5	
		60	AC380 - 440	6	10	110 DC	0.5	2.5	
		30	AC500 - 600	3	5	220 DC	0.25	0.8	

Mini-Contactors SK series
Optional Accessories

■ Dimensions, mm

- **SZ1KA40**
- **SZ1KA31**
- **SZ1KA22**
- **SZ1KA13**
- **SZ1KA04**
- **SZ1KA40H**
- **SZ1KA31H**
- **SZ1KA22H**
- **SZ1KA13H**
- **SZ1KA04H**

4-pole

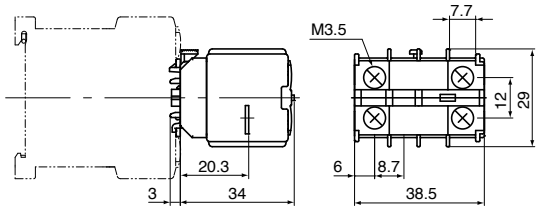


Mass : 34g

Type	Contact arrangement	
SZ1KA40 **SZ1KA40H**	4NO	53 63 73 83 54 64 74 84
SZ1KA31 **SZ1KA31H**	3NO+1NC	53 61 73 83 54 62 74 84
SZ1KA22 **SZ1KA22H**	2NO+2NC	53 61 71 83 54 62 72 84
SZ1KA13 **SZ1KA13H**	1NO+3NC	53 61 71 81 54 62 72 82
SZ1KA04 **SZ1KA04H**	4NC	51 61 71 81 52 62 72 82

- **SZ1KA20**
- **SZ1KA11**
- **SZ1KA02**
- **SZ1KA20H**
- **SZ1KA11H**
- **SZ1KA02H**

2-pole

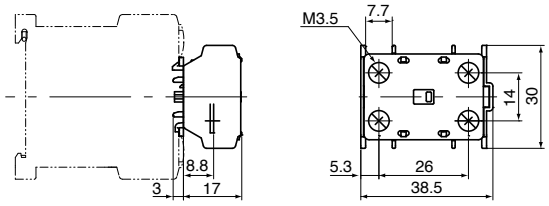


Mass : 29g

Type	Contact arrangement	
SZ1KA20 **SZ1KA20H**	2NO	53 63 54 64
SZ1KA11 **SZ1KA11H**	1NO+1NC	53 61 54 62
SZ1KA02 **SZ1KA02H**	2NC	51 61 52 62

- **SZ1FA11**
- **SZ1FA11H**

Small,
2-pole



Mass : 17g

Type	Contact arrangement	
SZ1FA11 **SZ1FA11H**	1NO+1NC	53 61 54 62

Mechanical Interlock Unit and Power Connection Kit for Reversing

■ Features

- Mechanically prevent two Magnetic Contactors from turning ON at the same time.
- Combine a Reversing Connection Kit with an Interlock Unit to easily configure a reversing Magnetic Contactors.
- Mounting two Magnetic Contactors on the front surface reduces the mounting footprint and contributes to downsizing control panels.

SZ1KRM

SZ1KRW1W

■ Types

- Mechanical Interlock Unit: Joins two Magnetic Contactors to mechanically lock them.

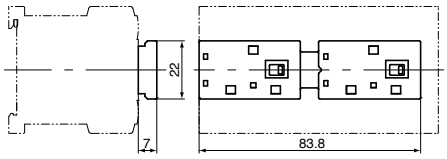
Product name	Used with	Type
Mechanical Interlock Unit	SK06, SK09, and SK12	**SZ1KRM**

- Power Connection Kit for Reversing: Used to reverse the circuit wiring between the main circuit terminals.

Product name	Wire size	Number of conductors per set	Used with	Type
Power Connection Kit for Reversing	AWG14 (1.6 dia.)	• One set for power supply side • One set for load side	SK06, SK09, and SK12	**SZ1KRW1W**

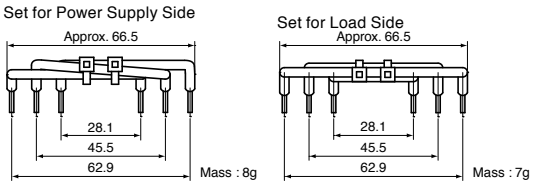
■ Dimensions, mm

- Mechanical Interlock Unit



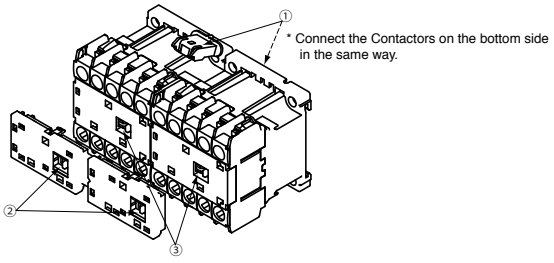
Mass : 11g

- Power Connection Kit for Reversing

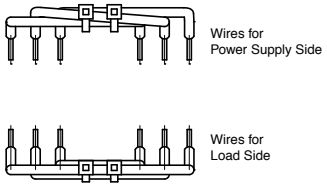


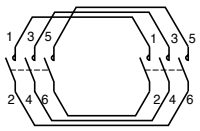
■ Mounting Procedures

- Interlock Unit
  (1) Connect two Magnetic Contactors with the two connection pieces ①.
  (2) Move the moveable projections ② on the Interlock Unit to the right side.
  (3) Insert the Interlock Unit directly from the top so that it is aligned with the projections ③ on the moveable portion on the Magnetic Contactors.
  (4) After you mount the Interlock Unit, slide the projection on the indicator window on the right side and then on the left side to confirm that they move smoothly.



- Power Connection Kit for Reversing
  Connect the Kit to the main circuit terminals. There are wires for the power supply side and wires for the load side. Be sure to connect them to the correct sides.





⚠Caution Precaution for Correct Use

- When the Magnetic Contactors are switched rapidly, use an electrically interlock, such as a delay relay, to ensure a switching time of at least 15ms for the contacts of the two Magnetic Contactors.

Main Circuit Surge Suppression Unit and Separate Installation Unit

■ Features

- Absorbs the surge voltage that is generated from three-phase motors when the Magnetic Contactor is switched to suppress the effects of surge voltage.
- Combination with a Separate Installation Unit enables both screw mounting and DIN rail mounting. (The SZ-ZM2 Main Circuit Surge Suppression Unit must be used with a Separate Installation Unit to secure it.)

SZ-ZM2

SZ-ZMH

■ Ratings and Types

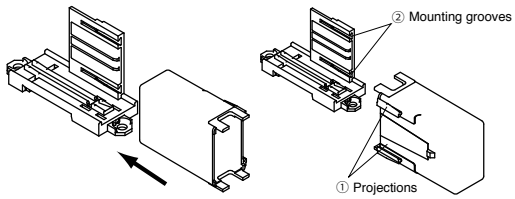
Product name	Rated voltage and frequency	Applicable 3-phase motors	Type
Main Circuit Surge Suppression Unit	250V AC, 50/60Hz	200 to 240V AC, 0.1 to 2.2kW	SZ-ZM2
Separate Installation Unit	-	-	SZ-ZMH

■ Performances

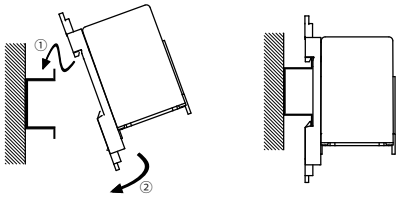
Item		Performance
Dielectric strength	Between terminals	Rated voltage × 230% for 1 min
	Between terminals and Unit outer case	Rated voltage × 2 + 1,000V for 1 min
Insulation resistance	Between terminals	2,000MΩ min.
	Between terminals and Unit outer case	2,000MΩ min. per terminal
Electrostatic capacity tolerance (at 1kHz)		±10%
Durability		1 million operations

■ Mounting Procedures

- Combining the Main Circuit Surge Suppression Unit and Separate Installation Unit
  Align projections ① on the Main Circuit Surge Suppression Unit with the mounting grooves ② on the inner surface of the Separate Installation Unit and press in firmly in the direction indicated by the arrow until the Units click into place.



- Mounting to a Rail
  (1) Catch the black hook on the top of the Unit on the rail.
  (2) Press down on the Unit and press it against the rail, and latch the bottom hook on the rail.
  * Always attach the Main Circuit Surge Suppression Unit with the Separate Installation Unit before mounting them to the rail.

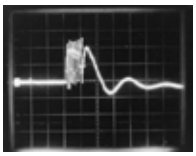


- Connection to the Magnetic Contactor
  To connect the Main Circuit Surge Suppression Unit to the Magnetic Contactor, attach each of the terminals 2, 4, and 6 on the load side of the Magnetic Contactor to any of the leads on the Unit.

■ Main Circuit Surge Suppression Characteristics

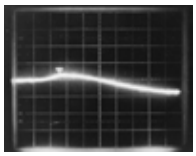
(220V AC, 2.2kW motor)

- Without Main Circuit Surge Suppression Unit



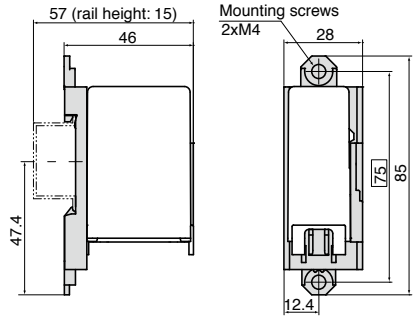
(No.CP-485)

- With Main Circuit Surge Suppression Unit

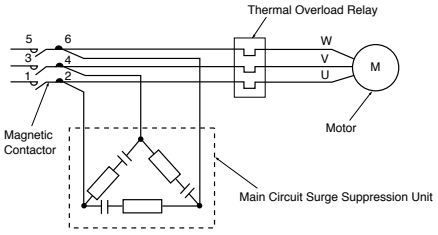


(No.CP-486)

■ Dimensions, mm



■ Circuit Connection Diagram



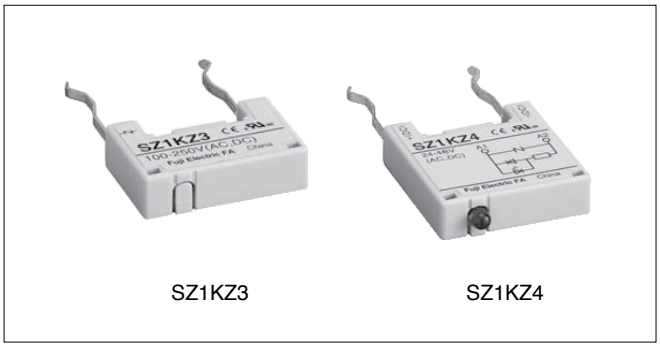
⚠Caution Precaution for Correct Use

- Do not use the Main Circuit Surge Suppression Unit near inverter circuits or in other locations where a large harmonic component is present.

Coil Surge Suppression Units and Operation Indicator Lamps

■ Features

- The Main Circuit Surge Absorber Unit absorbs the surge voltage that is generated when the coil in a Magnetic Contactor turns OFF. This suppresses malfunctioning of electronic circuits.
- The Operation Indicator Unit indicates with an LED when voltage is applied to the coil terminals.

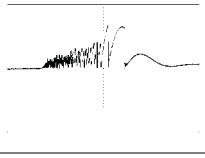
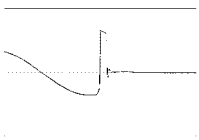


■ Ratings and Types

Product name	Surge suppression element	Specification	Operation indicator lamp	Control circuit voltage		Type
				AC	DC	
Coil Surge Suppression Units	Varistor	Varistor voltage: 100V	-	24-48V	Not required *	**SZ1KZ1**
		Varistor voltage: 240V		48-125V		**SZ1KZ2**
		Varistor voltage: 470V		100-250V		**SZ1KZ3**
		Varistor voltage: 100V	LED (red)	24-48V	Not required *	**SZ1KZ4**
		Varistor voltage: 240V		48-125V		**SZ1KZ5**
Operation Indicator Units	-	-	LED (red)	12-24V	12-24V	**SZ1KL1**
				24-48V	24-48V	**SZ1KL2**
				48-125V	48-125V	**SZ1KL3**

Note: * A varistor is built into the SK☐G and SK☐L for DC operation.

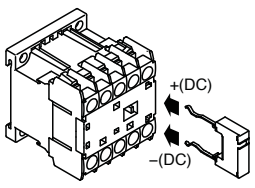
■ Coil Surge Suppression Characteristics

Product	Application	Characteristics (200V AC coil)
Without Surge Suppression Unit	A sharp surge voltage is generated from the coil due to coil inductance as a result of the rapid change in voltage when the coil turns OFF. This becomes noise to surrounding electronic devices, and can cause malfunctions and circuit destruction.	SK12A  (0.1ms/div, 1kV/div)
Models with varistors built in	When the surge voltage reaches a certain level, current flows to the varistor that is connected in parallel with the coil. This serves to control the peak surge voltage. Varistors can be applied to either AC or DC. The suppressed surge voltage is approximately the varistor voltage.	SK12A + SZ1KZ3  (2ms/div, 200V/div)

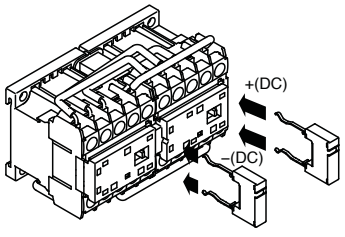
■ Mounting methods

(1) Insert the Unit into the mounting holes in the Magnetic Contactor. The Unit must be oriented properly top to bottom. Do not mount the Unit backwards.

- Mounting to Non-reversing Magnetic Contactors

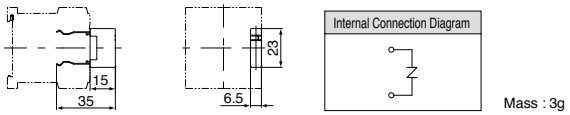


- Mounting to Reversing Magnetic Contactors



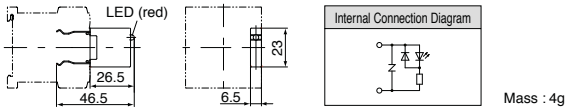
■ Dimensions, mm

- SZ1KZ1 to SZ1KZ3
  (Coil Surge Suppression Units)



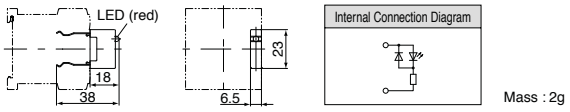
Mass : 3g

- SZ1KZ4 and SZ1KZ5
  (Coil Surge Suppression Units with Operation Indicator Lamps)



Mass : 4g

- SZ1KL1 to SZ1KL3
  (Operation Indicator Units)



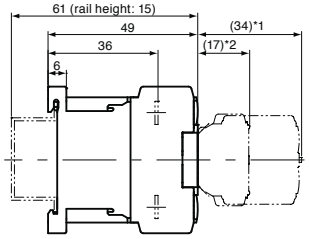
Mass : 2g

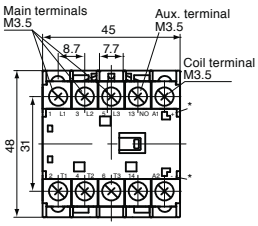
Mini-Contactors SK series
Dimensions

■ Dimensions, mm

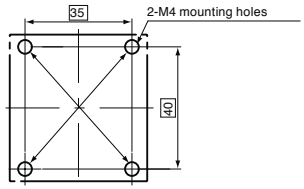
● Magnetic Contactors

•SK06□ , SK09□ , SK12□





Mounting Hole Dimensions

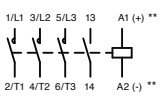
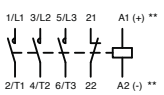


[NOTES]
*1 With SZ1KA□ Auxiliary Contact Blocks.
*2 With SZ1FA□ Auxiliary Contact Blocks.

[NOTE]
Mount the Auxiliary Overload Relay with two mounting holes in diagonally opposed corners.

Mass : 0.14kg (For AC-operated models.)
0.17kg (For DC-operated models.)

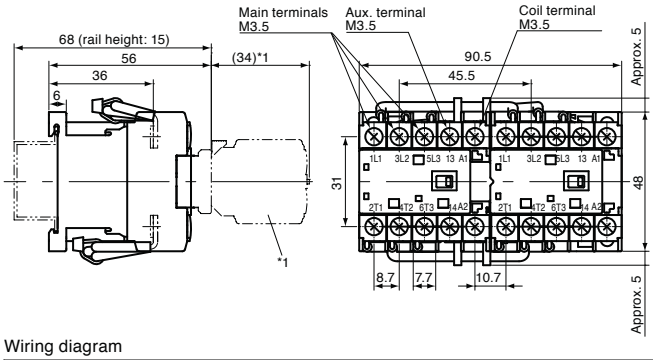
Wiring diagram

Auxiliary contacts	
1NO	1NC
	

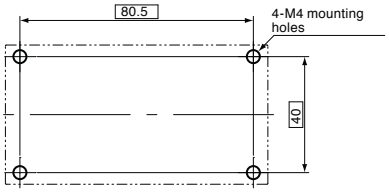
** For DC-operated models.

● Magnetic Contactors

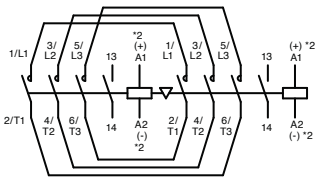
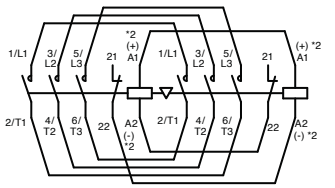
SK06□ R, SK09□ R, SK12□ R



Mounting Hole Dimensions



Wiring diagram

1NO x 2	1NC x 2
	

Mass : 0.32kg (AC-operated model)
0.38kg (DC-operated model)

[NOTE]
*1 With Auxiliary Contact Blocks.
*2 For DC-operated models.

• Thermal Overload Relays

TK 12 W A - 009

Basic type number
TK : 2E Thermal Overload Relay (with phase-loss detection)

Frame size
12

Mounting
W : On-contactor mounting

Reset method
Blank : Manual reset (standard)
A : Automatic reset

Ampere setting range
P10 : 0.1-0.15A
P13 : 0.13-0.2A
P18 : 0.18-0.27A
P24 : 0.24-0.36A
P34 : 0.34-0.52A
P48 : 0.48-0.72A
P64 : 0.64-0.96A
P80 : 0.8-1.2A
P95 : 0.95-1.45A
1P4 : 1.4-2.1A
1P7 : 1.7-2.6A
2P2 : 2.2-3.4A
2P8 : 2.8-4.2A
004 : 4-6A
005 : 5-7.5A
006 : 6-9A
007 : 7-10.5A
009 : 9-13A

Thermal Overload Relay TK12 series
Characteristics

■ Auxiliary Circuit Ratings

● Ratings for IEC Standard Compliance

Type	Conventional free air thermal current [A] (Rated continuous current)	Rated operational current [A]					Minimum voltage and current
		Rated operational voltage [V]	AC-15 (Ind. load)		DC-13 (Ind. load)		
			NC contacts	NO contacts	NC contacts	NO contacts	
TK12	5	24	3 (0.5)	3 (0.5)	1.1(0.3)	1.1 (0.3)	DC5V, 3mA
		100-120	2.5 (0.5)	2.5 (0.5)	0.28	0.28	
		200-240	2 (0.5)	1.5 (0.5)	0.14	0.14	
		380-440	1 (0.5)	0.75 (0.5)	–		
		500-600	0.6 (0.5)	0.6 (0.5)	–		

Numbers in brackets ( ) are for automatic reset.

● Ratings for UL and CSA Standard Compliance

Type	Rated continuous current [A]	Rated operational current [A]						Rating code	
		AC			DC				
		Rated operational voltage [V]	Making	Breaking	Rated operational voltage [V]	Making	Breaking	AC	DC
TK12	5	120	30	3	125	0.22	0.22	B600	R300
		240	15	1.5					
		480	7.5	0.75	250	0.11	0.11		
		600	6	0.6					

■ Operating Characteristics (Specifications)

● 3-pole Circuits

Standard	Operating limit		Overload (hot start)	Locked rotor (cold start)	Ambient temperature
	Non-tripping	Tripping			
IEC 60947-4-1	105% Ie (for less than 2h)	120% Ie (for less than 2h)	Tripping class 10A: 150% Ie for less than 2min	Tripping class 10A: 720% Ie for 2 to 10 s max.	20℃

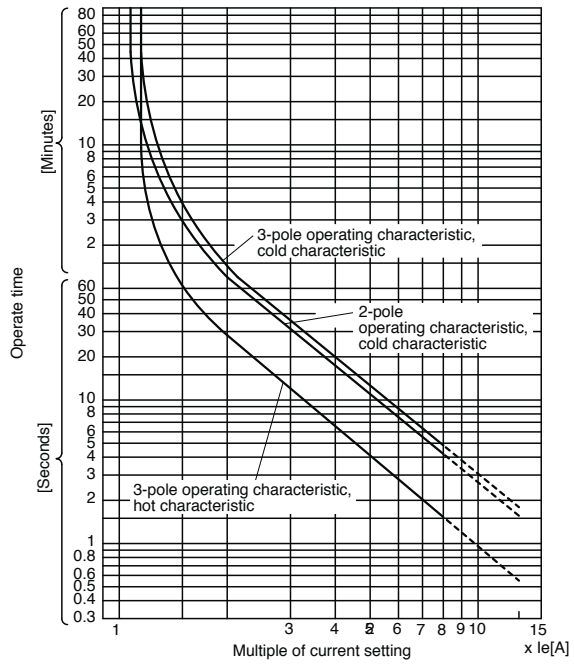
● 2-pole Circuits

Standard	Phase-loss protection	Non-tripping	Operation (hot start)	Ambient temperature
IEC 60947-4-1	Provided.	2-pole: 100% Ie 1-pole: 90% Ie	2-pole: 115% Ie (for less than 2h) 1-pole:0% Ie	20℃

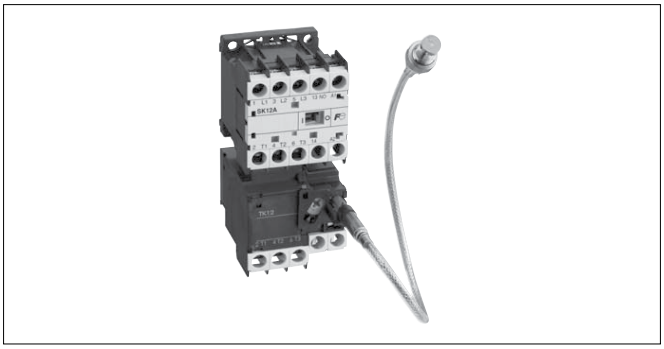
■ Operating Characteristics Curves (Average Values)

● Tripping Class 10A

TK12 series, Ambient temperature: 20°C



Thermal Overload Relay Reset Releases



■ Features

- A Reset Release is used to enable resetting a Thermal Relay from the front surface of the panel or from a remote location.

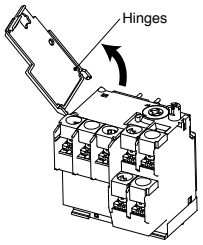
■ Ratings and Types

Product name	Release length [mm]	Mass [g]	Used with	Type
			2E Thermal Overload Relay	
Thermal Overload Relay Reset Releases	300	30	TK12 (Packaged together with Reset Releases for the TR-0N and 5-1N.)	**SZ-R1**
	500	40		**SZ-R2**
	700	50		**SZ-R3**

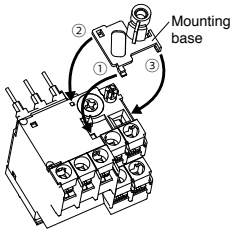
■ Mounting Procedure

- SZ-R1, R2, R3

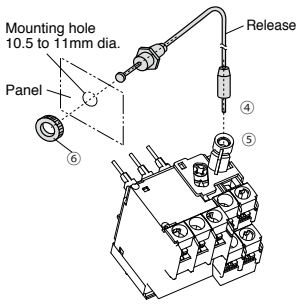
(1) Remove the front cover.
The cover can be easily removed as shown in the figure if you hold the cover near the hinges and pull strongly.



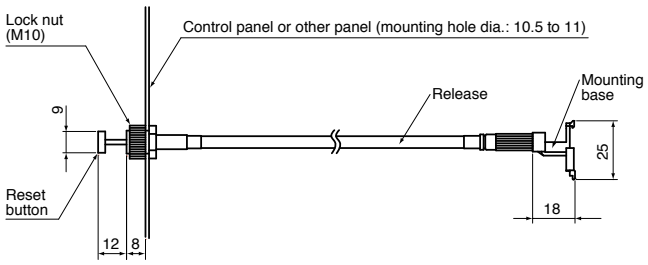
(2) Insert the tab ① on the mounting base into the hole in the Thermal Relay and then latch the tabs ② and ③. To remove the mounting base, use a fine screwdriver to disengage tabs ② and ③.



(3) Tighten the male thread ④ on the Release in the female thread ⑤ on the mounting base. Remove the nut ⑥ from the Release, insert the Release through the panel from the back of the panel, and tighten the nut ⑥ from the front of the panel to secure the Release.

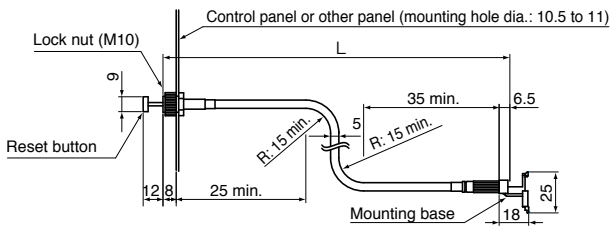


■ Dimensions, mm



⚠Caution Precaution for Correct Use

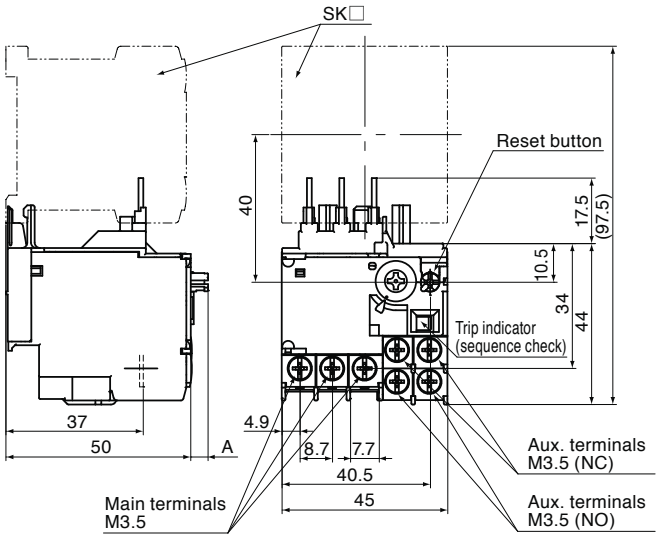
- When mounting the Release, do not allow the lead to bend within 25mm from the panel and within 35mm of the mounting base.
- Do not bend the lead of the Release to a radius of less than 15mm. (Refer to the figure on the right.)
- Prepare a mounting hole with a diameter of 10.5 to 11mm.



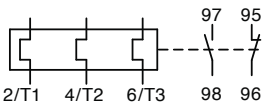
Thermal Overload Relays TK 12 series
Dimensions

■ Dimensions, mm

TK12



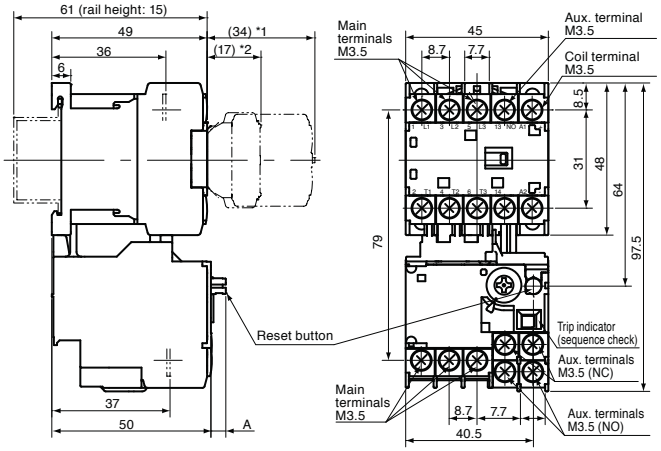
Wiring diagram



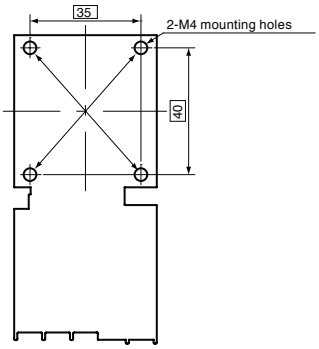
Mass : 0.1kg

Dimension A
- Manually reset state: 5mm
- Automatically reset state: 2mm

● Magnetic Starters (reference)
SK□ + TK12



Mounting Hole Dimensions

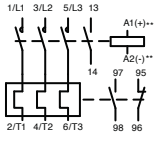
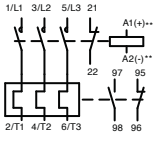


[NOTE]
Mount the Auxiliary Overload Relay with two mounting holes in diagonally opposed corners.

Dimension A
- Manually reset state: 5mm
- Automatically reset state: 2mm

[NOTES]
*1 With SZ1KA□ Auxiliary Contact Blocks.
*2 With SZ1FA□ Auxiliary Contact Blocks.

Wiring diagram

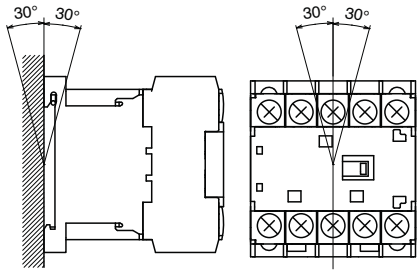
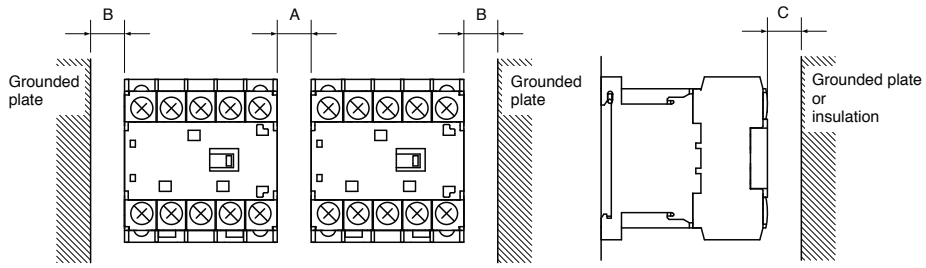
Auxiliary contacts	
1NO	1NC
	

** For DC-operated models.

Mass : 0.24kg (AC-operated model)
0.27kg (DC-operated model)

■ Normal Operating Conditions and Correct Mounting

● Standard Operating Conditions

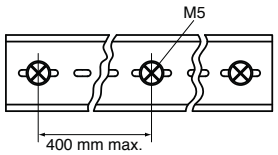
Ambient temperature *1	–10 to 55°C with no sudden temperature changes resulting in condensation or icing (The average temperature over a 24-hour period must not exceed 35°C.)
Ambient humidity	45% to 85% RH (with no condensation)
Altitude	2,000 m max.
Atmosphere	No excessive dust, smoke, corrosive gasses, inflammable gases, steam, or salts
Storage temperature	–40 to 60°C
Vibration resistance	10 to 55Hz, 15m/s^2
Shock resistance	50m/s^2
Mounting	Screw mounting 35mm-wide top hat rail (Refer to the rail mounting in the next item.)
Mounting angle	
Mounting gaps *2	Provide the mounting gaps and arc space that are given in the following table when you mount the product. A[mm] | B[mm] | C[mm] 0 | 10 | 2 

Note *1: The ambient temperature is the temperature near the product during operation.
Note *2: If Magnetic Starters are used in combination with Thermal Overload Relays and the products are used with continuous through current without providing gaps, temperature increases will reduce the life of the coil.Also, the characteristics of the Thermal Overload Relays will vary somewhat from the mutual thermal effects between the heaters.When using the products under these conditions, separate the products from each other by at least 5 mm (dimension A).

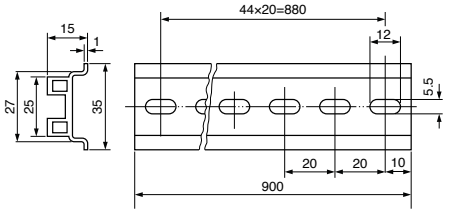
● Rail Mounting

The SK06 to SK12 Magnetic Motors and Starters can be mounted to 35mm-wide support rails. Secure the rail with the mounting pitch that is shown in the figure at the right.

Example of Applicable Rail: TH35-15AL



• Mounting Rail

Type	TH35-15AL
Material	Aluminum
External dimensions	

● Voltage Fluctuation Range in Control Circuits and Voltage Drop

• SK06 to SK12A (AC Operation)

Drop-out voltage (operating voltage): 85% to 110% of rated voltage
However, there is an official rated inrush voltage, but usage is possible without contact welding even if the voltage drops to 75% of the rating when the main contacts close.

• SK06 to SK12G, L-shape Drop (DC Operation)

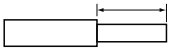
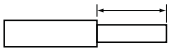
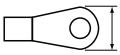
Drop-out voltage (operating voltage): 85% to 110% of rated voltage at ambient temperature of 55°C and 80% to 110% of rated voltage at ambient temperature of 40°C.
However, there is an official rated inrush voltage, but usage is possible without contact welding even if the voltage drops to 75% of the rating when the main contacts close.

■ Wiring

● Wiring and Terminal Processing
Make all connections correctly according to the connection diagram. For the SK06 to SK12, you can use solid wires, stranded wires, or crimped terminals for the main terminals, auxiliary terminals, and coil terminals.

● Tightening Torque
If the Magnetic Contactor or Switch is not mounted completely, the shock when the Contactor or Switches is turned ON may cause the contacts to jump or may reduce the durability. Also, if wires are not tightened sufficiently, they may become hot or loose, resulting in a fire, short-circuit, electric shock or some other potentially dangerous situation. Be sure to tighten the wires to the torque that is specified in the following table.

● Terminals, Wire Sizes, and Tightening Torque
1) Terminals can be wired with solid wires, stranded wires, or crimped terminals can be used to connect the terminals. To use round crimped terminals, remove the terminal cover before you connect them to the terminals.
2) The connectable wire sizes and tightening torque are given in the following table.

			Main terminals	Control and auxiliary terminals
Direct connection	Solid wire	[mm]	1 wire (1.2 to 2mm dia.) 2 wires (1.2 to 1.6mm dia.) 2 wires (1.6 to 2mm dia.)	
		[AWG]	1 wire x (16 to 12) 2 wires x (16 to 14) 2 wires x (14 to 12)	
	Stranded wires	[mm^2]	1 wire x (0.75 to 2.5) 2 wires x (0.75 to 1.5) 2 wires x (1.5 to 2.5)	
		[AWG]	1 wire x (18 to 14) 2 wires x (18 to 16) 2 wires x (16 to 14)	
	Sheath stripping length [mm] 		10	
	Flexible stranded wires with sleeves	[mm^2]	1 wire x (0.75 to 2.5) 2 wires x (0.75 to 1.5) 2 wires x (1.5 to 2.5)	
		[AWG]	1 wire x (18 to 14) 2 wires x (18 to 16) 2 wires x (16 to 14)	
	Sleeve length [mm] 		10	
Terminal connection	Stranded wires or flexible stranded wires	[mm^2]	0.75 to 4	0.75 to 2.5
		[AWG]	18 to 10	18 to 14
	Largest crimped terminal [mm] 		7.7	
Terminal screw size			M3.5	
Tightening tool			Phillips H2 screwdriver Flat-blade screwdriver, 1x5.5xL, type B	
Flat-blade screwdriver, 1×5.5×L, type B		[N・m]	0.8 to 1.0	

Note 1. Flexible stranded wires without sleeves cannot be used. Attach sleeves before connecting the wires.
・0.75 to 4mm2 (AWG 18 to 12) stranded wire: 7 strands or less
・Flexible stranded wire: More strands that given above.
Note 2. Use DIN 46228-compliant sleeves.
・For 1.5 to 2.5mm2 (AWG 16 to 14) wires, use sleeves without insulating sheaths.
・You will not be able to insert the sleeves for some crimping tools. Use a Phoenix Contact CRIMPFOX 6 crimping tool or the equivalent. Observe manufacture instructions on the wire sheath stripping lengths.
Note 3. For compliance with UL or CSA standards, you must use AWG 14 or 12 wires. Also, you must use solid wires, or use stranded or flexible stranded wires with crimped terminals or sleeves.
Note 4. Two crimped terminals can be connected.
Note 5. Do not connect anything to terminals that are not wired.
Note 6. After you bend or otherwise arrange the connected wires after wiring, make sure that the tightening torque is still correct.
Note 7. If 18 A or higher will continuously flow through a Magnetic Contactor in an environment that exceeds 40°C, wiring with 4mm2 or AWG 12 wires.

● Handling Thermal Overload Relays

1) Adjusting the Current [Figure 1]
Turn the adjustment dial within the scale so that the total load current of the motor aligns with the triangle mark. Performance may not be dependable if the dial is set outside of the range of the scale.

2) Operation Indication [Figure 1]
When the Thermal Overload Relay operates, the white trip indicator will disappear in the operation indication window. (The white indicator will not be hidden if the Thermal Overload Relay is tripped in auto-reset status.)

3) Sequence Check [Figure 1]
You can perform a sequence check by pressing the white trip indicator in the direction of the arrow.

4) Reset Method [Figure 1]
When the Thermal Overload Relay operates, remove the cause of the error (e.g., an overload) and then press the reset button. (The Thermal Overload Relay will not reset unless it has cooled sufficiently.)

5) Auto-reset Status and Two-wire Circuits
If the Thermal Overload Relay is in auto-reset status for a 2-wire circuit and the Thermal Overload Relay resets automatically, the motor will restart operation automatically. Take adequate precautions for this.

6) Changing between Manual Resetting and Auto Resetting [Figure 2]
Use the following procedure to change between manual resetting and auto resetting. Reverse the procedure to change between auto resetting and manual resetting.

① Open the front cover.
② Use a screwdriver or similar device to press the reset button and turn it 90° clockwise.
③ Make sure that the reset button remains in the pressed state.
④ Close the front cover.

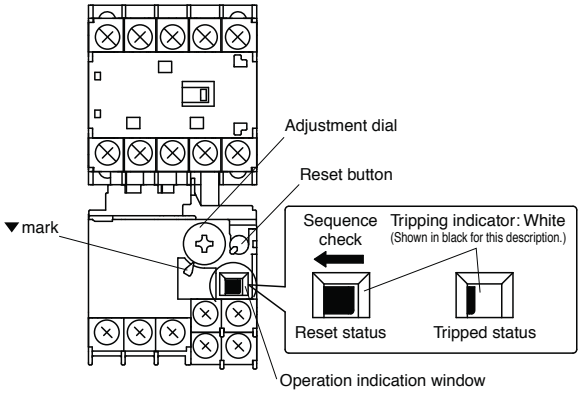


Figure 1

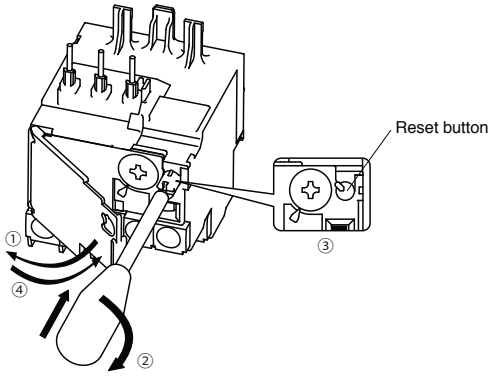
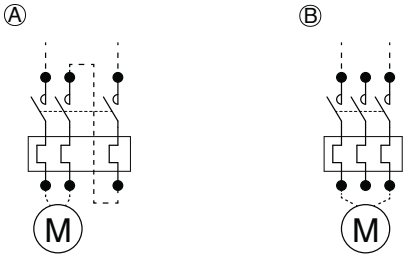


Figure 2

● Application in Single-phase Motor Circuits and DC Motor Circuits
The TK12 Thermal Overload Relays are equipped with open-phase protection. If current does not flow on all phases, the reduced operating current may cause the TK12 to operate unnecessarily. If you use the TK12 in a single-phase motor circuit or DC motor circuit, perform either Ⓐ or Ⓑ.
Ⓐ Connect the wiring so that series current flows to all of the poles.
Ⓑ Set the adjustment dial to a setting that is 5% to 10% higher than normal.



● Ambient Temperature Compensation Characteristics

Changes in the ambient environment will affect the operation of the Thermal Overload Relay. The operational current will be higher at lower temperatures and lower at higher temperatures, i.e., compensation of operating characteristics will not be complete. Adjust the current according to the application environment.

The compensation coefficient for adjusting the current depends on the ambient temperature, as shown in Figure 3. If the ambient temperature in the application changes greatly, e.g., by 20°C, use the following example as a guide to calculate the adjusted current value after compensation.

Example: Calculation Method for Dial Adjustment at an Ambient Temperature of 55°C

$$\frac{\text{Dial current at 20°C}}{\text{Compensation coefficient at ambient temperature of 55°C}} = \text{Dial current at ambient temperature of 55°C}$$

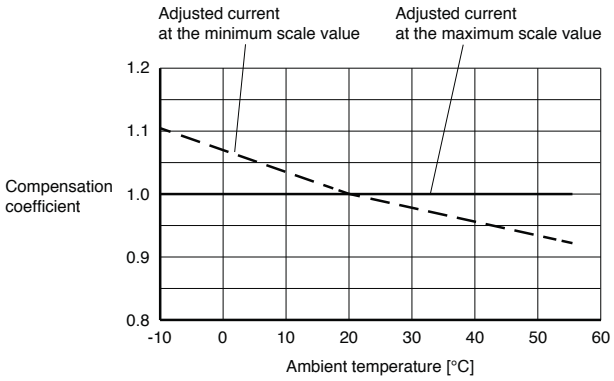


Figure 3

● Mounting the Thermal Overload Relay to and Removing It from the Magnetic Contactor

I. Mounting [Figure 4]

1) Loosen terminals 2, 4, and 6 on the Magnetic Contactor.
2) Insert the posts on the Thermal Overload Relay into the holes on the Magnetic Contactor in the direction shown by the arrows.
3) Insert the main circuit section of the Thermal Overload Relay on the right sides of the terminal screws.
4) Tighten the terminal screws on the Magnetic Contactor to the specified torque.

II. Removing [Figure 4]

1) Loosen the terminals screws on the Magnetic Contactor.
2) Move the Thermal Overload Relay left and right and pull it free from the Magnetic Contactor.

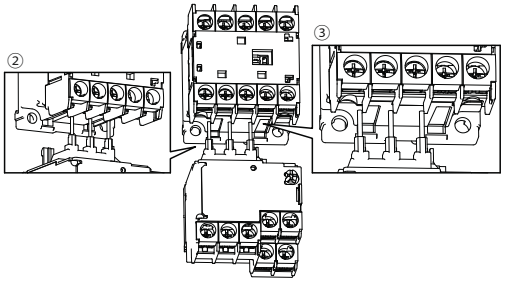


Figure 4

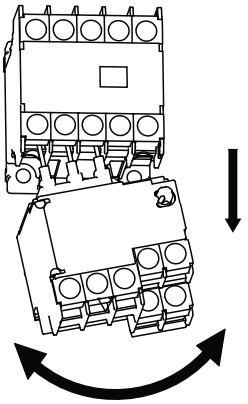


Figure 5

Features

- The user can assemble a combination starter by combining a BM3 series manual motor starter and an SC-E series or SK series magnetic contactor according to the load motor capacity.
- The manual motor starter provides overload, phase-loss, and short-circuit protections for the motor circuit, and incorporates a dial for flexible adjustment to match the total load current of the motor.
- The magnetic contactor allows remote ON/OFF operation of the motor circuit with high frequency, and features a electrical durability of one million operations.
- The manual motor starter and magnetic contactor are connected via link module and mounted to a base plate.

BM3RSB-013 +SK12A

BM3VHB-050 + SC-E2S

Combinations meeting for North American market

• BM3RSB, BM3RHB (General)

220-240V AC		440-480V AC		MMS part number			Contactor part number	Link module	Base plate
HP rating (HP)	Rated current (A)	HP rating (HP)	Rated current (A)	Part number		Current range (A)			
-	-	-	-	**BM3RSB-P16**	**BM3RHB-P16**	0.1-0.16	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
-	-	-	-	**BM3RSB-P25**	**BM3RHB-P25**	0.16-0.25	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
-	-	-	-	**BM3RSB-P40**	**BM3RHB-P40**	0.25-0.4	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
-	-	-	-	**BM3RSB-P63**	**BM3RHB-P63**	0.4-0.63	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
-	-	-	-	**BM3RSB-001**	**BM3RHB-001**	0.63-1	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
-	-	3/4	1.6	**BM3RSB-1P6**	**BM3RHB-1P6**	1-1.6	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
1/2	2.2	1	2.1	**BM3RSB-2P5**	**BM3RHB-2P5**	1.6-2.5	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
3/4	3.2	2	3.4	**BM3RSB-004**	**BM3RHB-004**	2.5-4	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
1-1/2	6	3	4.8	**BM3RSB-6P3**	**BM3RHB-6P3**	4-6.3	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
-	-	5	7.6	**BM3RSB-010**	**BM3RHB-010**	6.3-10	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
3	9.6	7-1/2	11	**BM3RSB-013**	**BM3RHB-013**	10-13	**SC-E03** **SC-E03/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
5	15.2	10	14	**BM3RSB-016**	**BM3RHB-016**	11-16	**SC-E04** **SC-E04/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
5	15.2	10	14	**BM3RSB-020**	**BM3RHB-020**	14-20	**SC-E04** **SC-E04/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
7-1/2	22	15	21	**BM3RSB-025**	**BM3RHB-025**	18-25	**SC-E05** **SC-E05/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A
10	28	20	27	**BM3RSB-032**	**BM3RHB-032**	24-32	**SC-E1** **SC-E1/G**	BZ0LRE32AA BZ0LRE32GA	BZ0BPRE32A BZ0BPRE32A

• BM3RSB, BM3RHB (Type F coordination)

220-240V AC		440-480V AC		MMS part number			Contactor part number	Link module	Base plate	Short-circuit ratings at 480Y/277 AC (kA)	
HP rating (HP)	Rated current (A)	HP rating (HP)	Rated current (A)	Part number		Current range (A)				for BM3RSB	for BM3RHB
-	-	-	-	**BM3RSB-P16**	**BM3RHB-P16**	0.1-0.16	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	65	65
-	-	-	-	**BM3RSB-P25**	**BM3RHB-P25**	0.16-0.25	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	65	65
-	-	-	-	**BM3RSB-P40**	**BM3RHB-P40**	0.25-0.4	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	65	65
-	-	-	-	**BM3RSB-P63**	**BM3RHB-P63**	0.4-0.63	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	65	65
-	-	-	-	**BM3RSB-001**	**BM3RHB-001**	0.63-1	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	65	65
-	-	3/4	1.6	**BM3RSB-1P6**	**BM3RHB-1P6**	1-1.6	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	65	65
1/2	2.2	1	2.1	**BM3RSB-2P5**	**BM3RHB-2P5**	1.6-2.5	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	65
3/4	3.2	2	3.4	**BM3RSB-004**	**BM3RHB-004**	2.5-4	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	65
1-1/2	6	3	4.8	**BM3RSB-6P3**	**BM3RHB-6P3**	4-6.3	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	65
-	-	5	7.6	**BM3RSB-010**	**BM3RHB-010**	6.3-10	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	25	65
3	9.6	-	-	**BM3RSB-010**	**BM3RHB-010**	6.3-10	**SC-E03** **SC-E03/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	25	65
-	-	7-1/2	11	**BM3RSB-013**	**BM3RHB-013**	10-13	**SC-E03** **SC-E03/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	25	65
5	15.2	10	14	**BM3RSB-016**	**BM3RHB-016**	11-16	**SC-E04** **SC-E04/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	25	65
5	15.2	10	14	**BM3RSB-020**	**BM3RHB-020**	14-20	**SC-E04** **SC-E04/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	25	65
7-1/2	22	15	21	**BM3RSB-025**	**BM3RHB-025**	18-25	**SC-E05** **SC-E05/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	25	50
10	28	20	27	**BM3RSB-032**	**BM3RHB-032**	24-32	**SC-E1** **SC-E1/G**	BZ0LRE32AA BZ0LRE32GA	BZ0BPRE32A BZ0BPRE32A	25	50

To make an application for Type F condition, You need to prepare BZ0TCRE and BZ0TKUAB accessories separately.

• BM3VSB, BM3VHB (General)

220-240V AC		440-480V AC		MMS part number			Contactor part number	Link module	Base plate
HP rating (HP)	Rated current (A)	HP rating (HP)	Rated current (A)	Part number		Current range (A)			
3	9.6	5	7.6	**BM3VSB-010**	**BM3VHB-010**	6.3-10	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A
3	9.6	7-1/2	11	**BM3VSB-013**	**BM3VHB-013**	10-13	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A
5	15.2	10	14	**BM3VSB-016**	**BM3VHB-016**	11-16	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A
5	15.2	10	14	**BM3VSB-020**	**BM3VHB-020**	14-20	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A
7-1/2	22	15	21	**BM3VSB-025**	**BM3VHB-025**	18-25	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A
10	28	20	27	**BM3VSB-032**	**BM3VHB-032**	24-32	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A
10	28	30	40	**BM3VSB-040**	**BM3VHB-040**	28-40	**SC-E2**	BZ0LVE51AA	BZ0BPVE51A
							SC-E2/G	BZ0LVE51GA	BZ0BPVE51A
15	42	30	40	**BM3VSB-050**	**BM3VHB-050**	35-50	**SC-E2S**	BZ0LVE51AA	BZ0BPVE51A
							SC-E2S/G	BZ0LVE51GA	BZ0BPVE51A
20	54	40	52	**BM3VSB-063**	**BM3VHB-063**	45-63	**SC-E3**	BZ0LVE65AA	BZ0BPVE65A
							SC-E3/G	BZ0LVE65GA	BZ0BPVE65A

• BM3VSB, BM3VHB (Type F coordination)

220-240V AC		440-480V AC		MMS part number			Contactor part number	Link module	Base plate	Short-circuit ratings at 480Y/277 AC (kA)	
HP rating (HP)	Rated current (A)	HP rating (HP)	Rated current (A)	Part number		Current range (A)				for BM3VSB	for BM3VHB
3	9.6	5	7.6	**BM3VSB-010**	**BM3VHB-010**	6.3-10	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A		
3	9.6	7-1/2	11	**BM3VSB-013**	**BM3VHB-013**	10-13	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A		
5	15.2	10	14	**BM3VSB-016**	**BM3VHB-016**	11-16	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A		
5	15.2	10	14	**BM3VSB-020**	**BM3VHB-020**	14-20	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A		
7-1/2	22	15	21	**BM3VSB-025**	**BM3VHB-025**	18-25	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A		
10	28	20	27	**BM3VSB-032**	**BM3VHB-032**	24-32	**SC-E1**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E1/G	BZ0LVE51GA	BZ0BPVE51A		
10	28	30	40	**BM3VSB-040**	**BM3VHB-040**	28-40	**SC-E2**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E2/G	BZ0LVE51GA	BZ0BPVE51A		
15	42	30	40	**BM3VSB-050**	**BM3VHB-050**	35-50	**SC-E2S**	BZ0LVE51AA	BZ0BPVE51A	25	65
							SC-E2S/G	BZ0LVE51GA	BZ0BPVE51A		
20	54	40	52	**BM3VSB-063**	**BM3VHB-063**	45-63	**SC-E3**	BZ0LVE65AA	BZ0BPVE65A	25	65
							SC-E3/G	BZ0LVE65GA	BZ0BPVE65A		

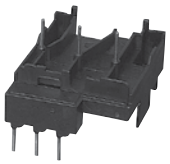
To make an application for Type F condition, You need to prepare BZ0TKUAB accessories separately.

● Combinations with Manual Motor Starter

Magnetic Contactor type	AC480Y/277V		
	Combined MMS		Short-circuit Current Rating (SCCR) [kA]
	Type	Ampere setting range [A]	
SK06	BM3RS□-P40	0.25-0.4	65
	BM3RS□-P63	0.4-0.63	65
	BM3RS□-001	0.63-1	65
	BM3RS□-1P6	1-1.6	65
	BM3RS□-2P5	1.6-2.5	50
	BM3RS□-004	2.5-4	50
	BM3RS□-6P3	4-6.3	50
	BM3RH□-P40	0.25-0.4	65
	BM3RH□-P63	0.4-0.63	65
	BM3RH□-001	0.63-1	65
	BM3RH□-1P6	1-1.6	65
	BM3RH□-2P5	1.6-2.5	65
	BM3RH□-004	2.5-4	65
	BM3RH□-6P3	4-6.3	65
SK09	BM3RS□-P40	0.25-0.4	65
	BM3RS□-P63	0.4-0.63	65
	BM3RS□-001	0.63-1	65
	BM3RS□-1P6	1-1.6	65
	BM3RS□-2P5	1.6-2.5	50
	BM3RS□-004	2.5-4	50
	BM3RS□-6P3	4-6.3	50
	BM3RS□-010	6.3-10	25
	BM3RH□-P40	0.25-0.4	65
	BM3RH□-P63	0.4-0.63	65
	BM3RH□-001	0.63-1	65
	BM3RH□-1P6	1-1.6	65
	BM3RH□-2P5	1.6-2.5	65
	BM3RH□-004	2.5-4	65
	BM3RH□-6P3	4-6.3	65
	BM3RH□-010	6.3-10	25
SK12	BM3RS□-P40	0.25-0.4	65
	BM3RS□-P63	0.4-0.63	65
	BM3RS□-001	0.63-1	65
	BM3RS□-1P6	1-1.6	65
	BM3RS□-2P5	1.6-2.5	50
	BM3RS□-004	2.5-4	50
	BM3RS□-6P3	4-6.3	50
	BM3RS□-010	6.3-10	25
	BM3RS□-013	9-13	25
	BM3RH□-P40	0.25-0.4	65
	BM3RH□-P63	0.4-0.63	65
	BM3RH□-001	0.63-1	65
	BM3RH□-1P6	1-1.6	65
	BM3RH□-2P5	1.6-2.5	65
	BM3RH□-004	2.5-4	65
	BM3RH□-6P3	4-6.3	65
	BM3RH□-010	6.3-10	25
	BM3RH□-013	9-13	10

■ Optional accessories

• Link modules

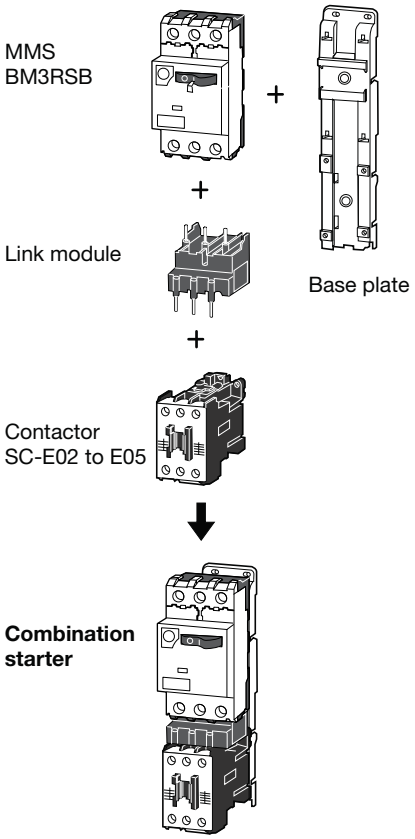
Description	Applicable MMS	Applicable magnetic contactor	Operating coil	Type	Mass (g)
 (No.KK01-153) The link module connects the manual motor starter and magnetic contactor electrically and mechanically.	BM3R	SC-E02, E03, E04, E05	AC	**BZ0LRE22AA**	25
		SC-E02/G, E03/G, E04/G, E05/G	DC	**BZ0LRE22GA**	35
		SC-E1	AC	**BZ0LRE32AA**	45
		SC-E1/G	DC	**BZ0LRE32GA**	60
	BM3V	SC-E1, E2, E2S	AC	**BZ0LVE51AA**	45
		SC-E1/G, E2/G, E2S/G	DC	**BZ0LVE51GA**	60
		SC-E3	AC	**BZ0LVE65AA**	65
		SC-E3/G	DC	**BZ0LVE65GA**	80

• Base plates

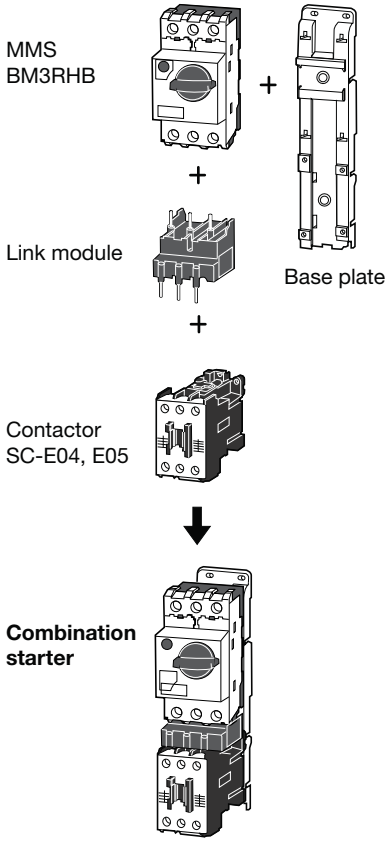
Description	Applicable MMS	Applicable magnetic contactor	Operating coil	Type	Mass (g)
 (No.KK01-155) The base plate is a plastic plate to which the combination starter is mounted. The base plate can then be mounted to a panel with screws or to a DIN rail.	BM3R	SC-E02, E03, E04, E05	AC	**BZ0BPRE22A**	100
		SC-E02/G, E03/G, E04/G, E05/G	DC	**BZ0BPRE22A**	100
		SC-E1	AC	**BZ0BPRE32A**	160
		SC-E1/G	DC	**BZ0BPRE32A**	160
	BM3V	SC-E1, E2, E2S	AC	**BZ0BPVE51A**	160
		SC-E1/G, E2/G, E2S/G	DC	**BZ0BPVE51A**	160
		SC-E3	AC	**BZ0BPVE65A**	195
		SC-E3/G	DC	**BZ0BPVE65A**	195

■ Combination starter configurations

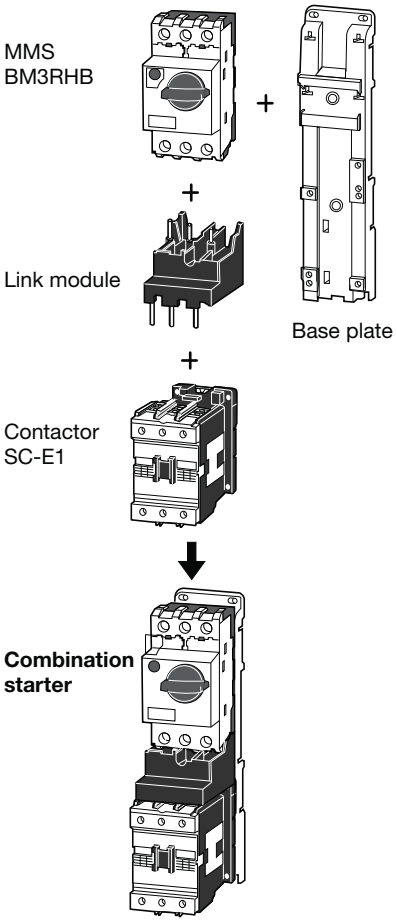
• BM3RSB+SC-E02 to E05



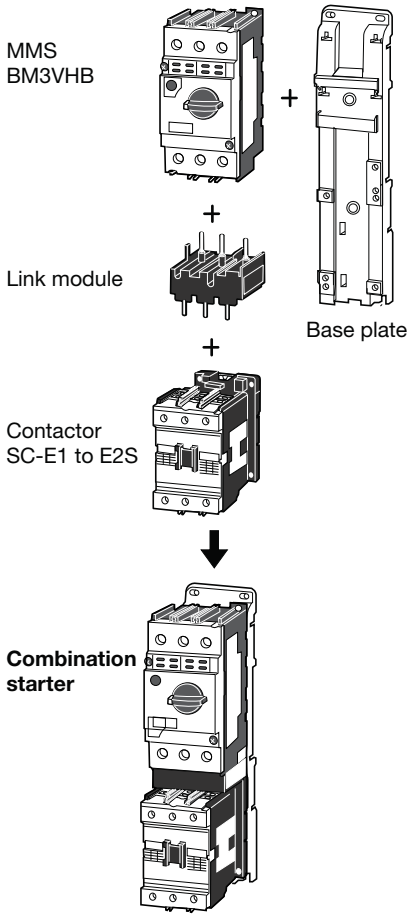
• BM3RHB+SC-E04, E05



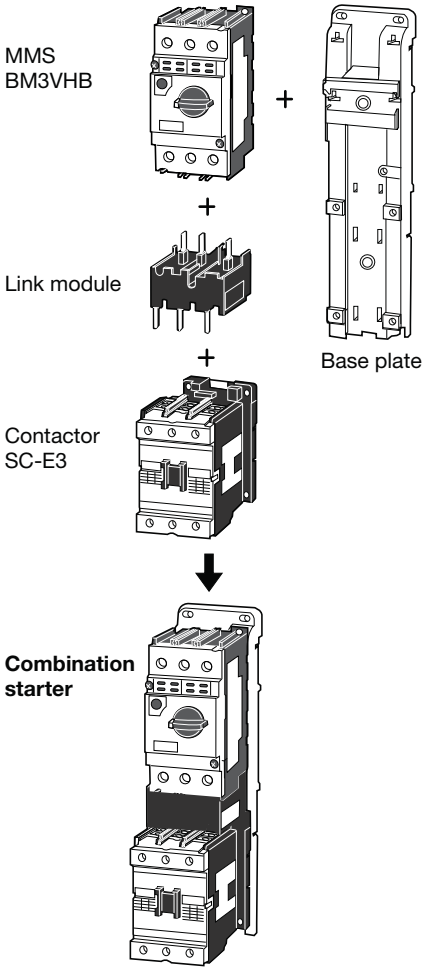
• BM3RHB+SC-E1



• BM3VHB+SC-E1 to E2S



• BM3VHB+SC-E3

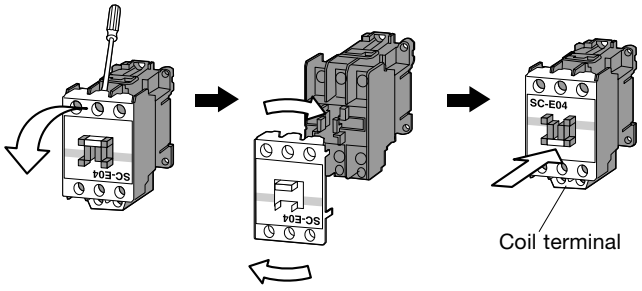


■ Notes for mounting an MMS and contactor

When the manual motor starter and magnetic contactor are configured as a combination starter, the nameplate ends up facing the wrong direction because the coil terminal of the magnetic contactor faces downward. Use the following procedure to turn the nameplate upside down.

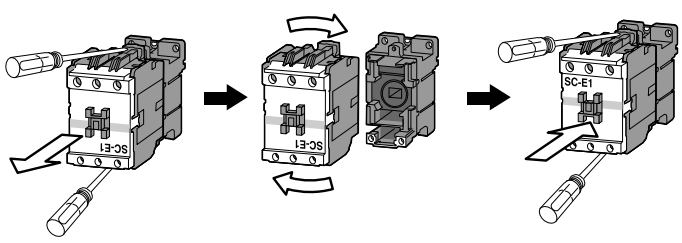
For SC-E02 to SC-E05 magnetic contactors

- Insert a flat-blade screwdriver between the arc-chamber of the S phase or V phase and the terminal screw, and lift the arc-chamber to remove it.
- After removing the cover, turn the cover 180 degrees (top to bottom), then re-mount it onto the magnetic contactor.
- Align the cover with the top and bottom terminals and press it on firmly by hand.



For SC-E1 to SC-E3 magnetic contactors

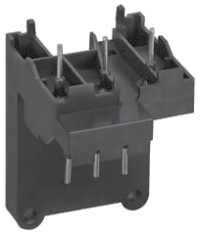
- Use a Phillips screwdriver to remove the two screws securing the front and back bodies.
- Remove the front body and turn it 180 degrees (top to bottom), then re-mount it with the screws.
- Make sure that no foreign matter enters the interior of the magnetic contactor during this removal and re-mounting procedure.



Link Module and Power Connection Kit for Reversing (Insert)

■ Features

- Connect a Manual Motor Starter and a Magnetic Contactor directly through a Link Module.
- A Reversing Connection Kit (Insert) for Combination Starters has joined the lineup.



BZ0LRK12AA

SZ1KRW1M

■ Types

- Link Module: Electrically and mechanically connects a Manual Motor Starter and Magnetic Contactor.

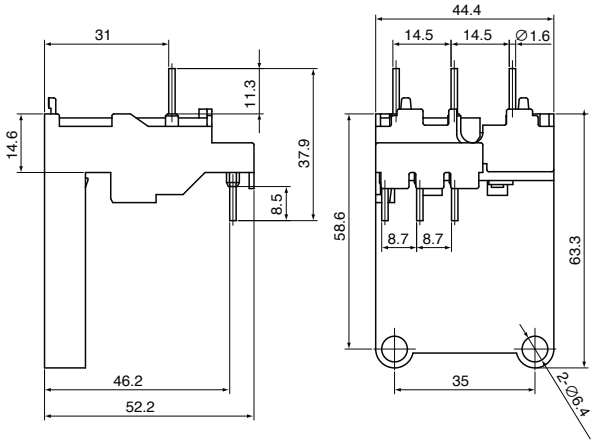
	Applicable MMS	Applicable Magnetic Contactors	Type
 Photo No. KKD11-101	BM3RSB BM3RHB	SK06, SK09, and SK12	**BZ0LRK12AA**

- Power Connection Kit for Reversing (Insert): Used to reverse the circuit wiring between the main circuit terminals.

	Wire size	Number of conductors per set	Applicable MMS	Applicable types	Type
 Photo No. KKD11-113	1.6 dia.	• One set for power supply side • One set for load side	BM3RSB BM3RHB	SK06, SK09, and SK12	**SZ1KRW1M**

■ Dimensions, mm

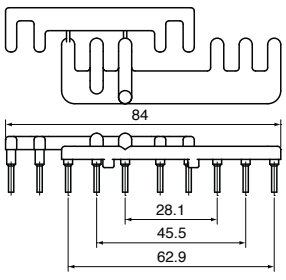
- Link Module



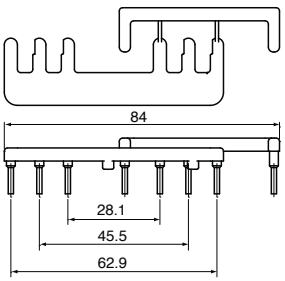
Mass : 25g

- Power Connection Kit for Reversing (Insert)

[Insert for Power Supply Side] [Insert for Load Side]



Mass : 17g

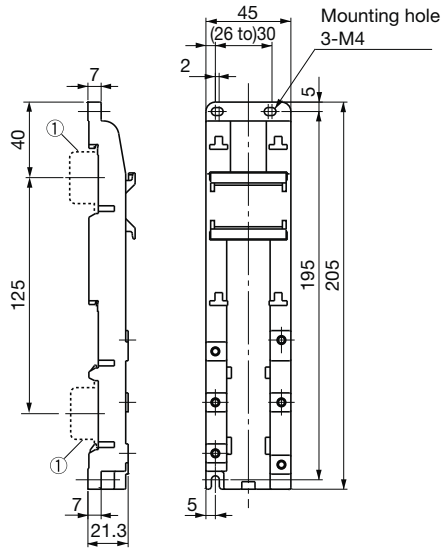


Mass : 13g

■ Dimensions, mm

• Base plates

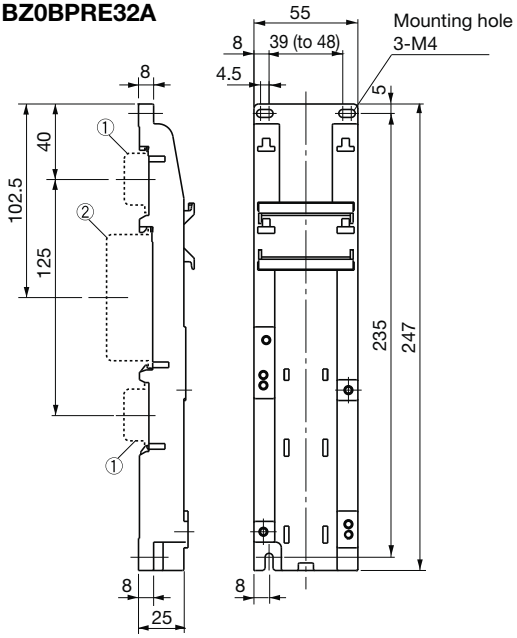
BZ0BPRE22A



①35mm wide rail (hight 15mm) x 2

Base plate type	Applicable type	
	MMS	Contactor
BZ0BPRE22A	BM3RSB	SC-E02, E03, E04, E05
	BM3RHB	E02/G, E03/G, E04/G, E05/G

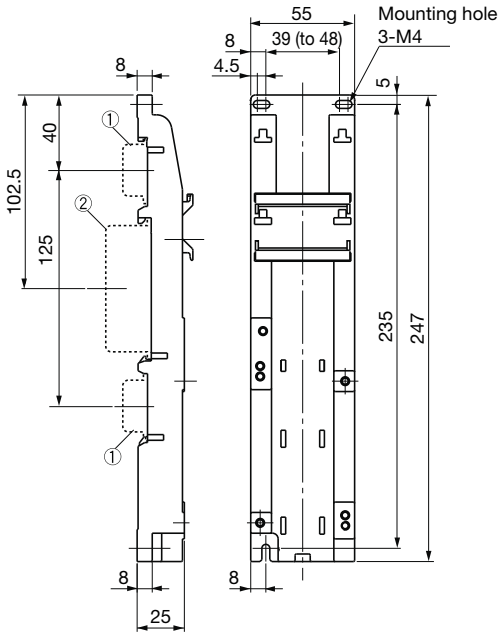
BZ0BPRE32A



①35mm wide rail (hight 15mm) x 2
②75mm wide rail (hight 25mm) x 1

Base plate type	Applicable type	
	MMS	Contactor
BZ0BPRE32A	BM3RSB	SC-E1, E1/G
	BM3RHB	

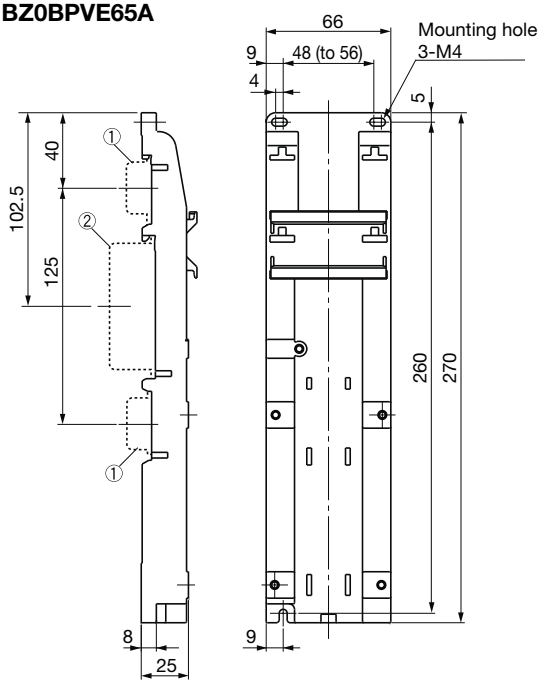
BZ0BPVE51A



①35mm wide rail (hight 15mm) x 2
②75mm wide rail (hight 25mm) x 1

Base plate type	Applicable type	
	MMS	Contactor
BZ0BPVE51A	BM3VSB	SC-E1, E2, E2S,
	BM3VHB	E1/G, E2/G, E2S/G

BZ0BPVE65A



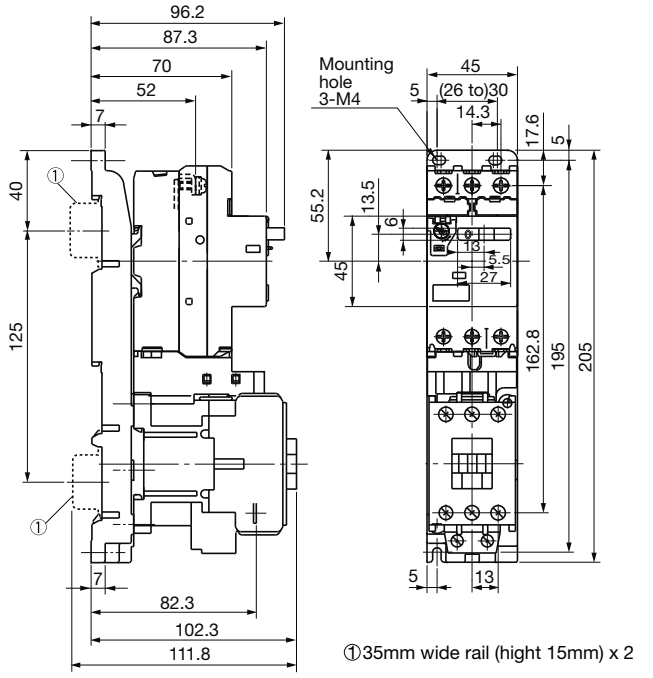
①35mm wide rail (hight 15mm) x 2
②75mm wide rail (hight 25mm) x 1

Base plate type	Applicable type	
	MMS	Contactor
BZ0BPVE65A	BM3VSB	SC-E3, E3/G
	BM3VHB	

■ Dimensions, mm

• Combination

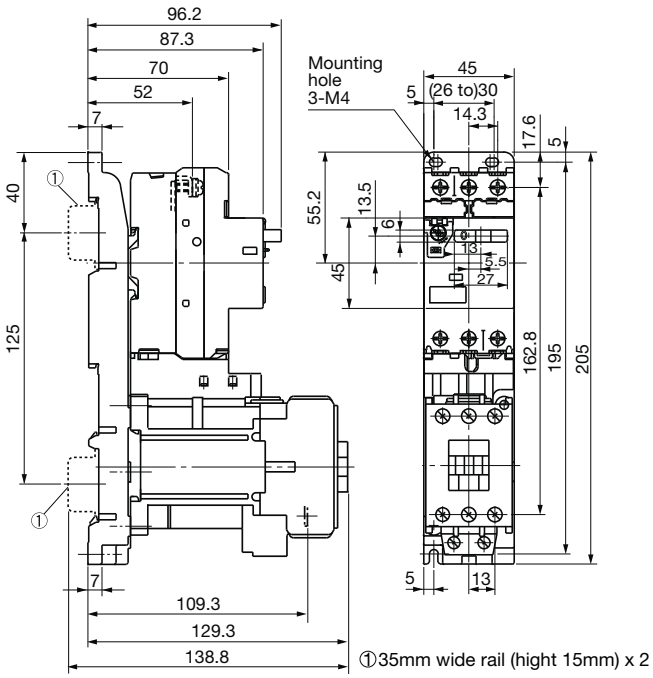
BM3RSB + SC-E02 to E05



①35mm wide rail (hight 15mm) x 2

MMS	Contactors	Link module	Base plate	Mass (g)
BM3RSB	SC-E02, E03, E04, E05	BZ0LRE22AA	BZ0BPRE22A	820

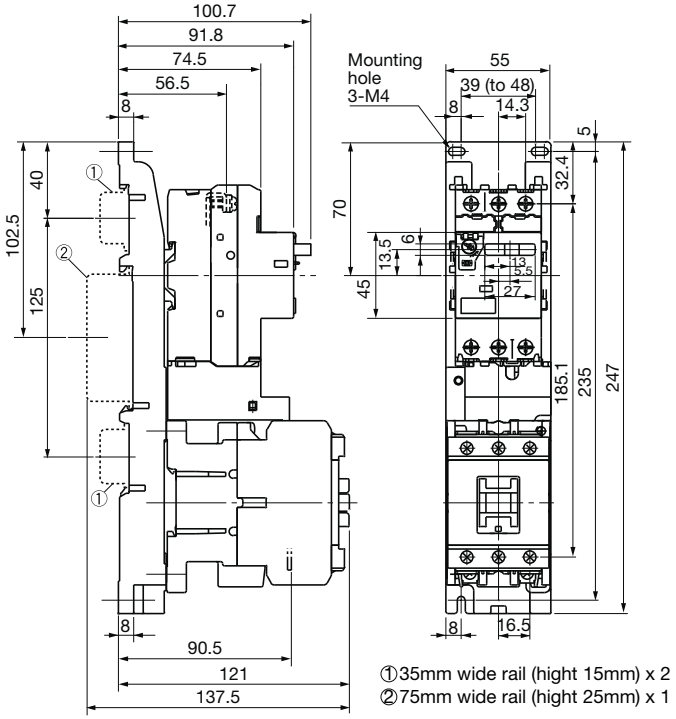
BM3RSB + SC-E02/G to E05/G



①35mm wide rail (hight 15mm) x 2

MMS	Contactors	Link module	Base plate	Mass (g)
BM3RSB	SC-E02/G, E03/G, E04/G, E05/G	BZ0LRE22GA	BZ0BPRE22A	1,065

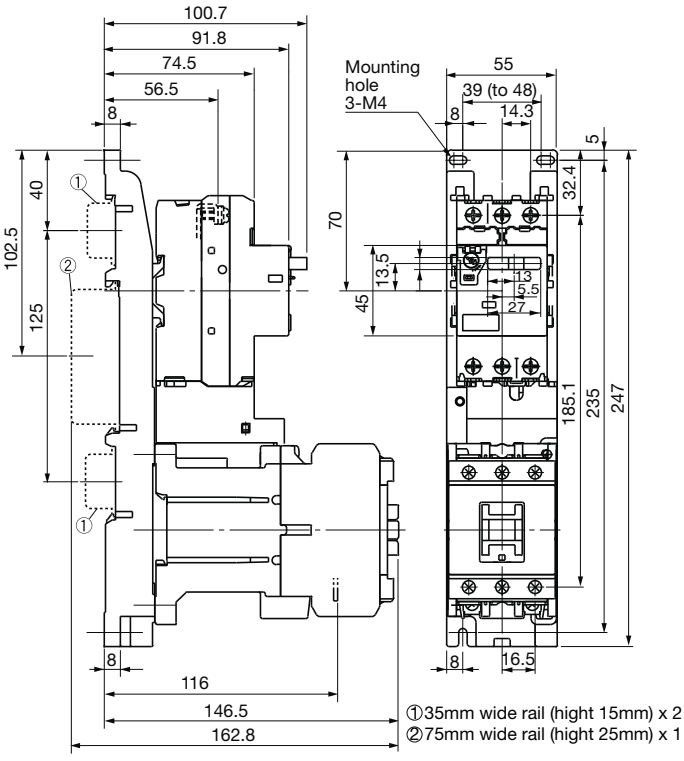
BM3RSB + SC-E1



①35mm wide rail (hight 15mm) x 2
②75mm wide rail (hight 25mm) x 1

MMS	Contactors	Link module	Base plate	Mass (g)
BM3RSB	SC-E1	BZ0LRE32AA	BZ0BPRE32A	1,135

BM3RSB + SC-E1/G



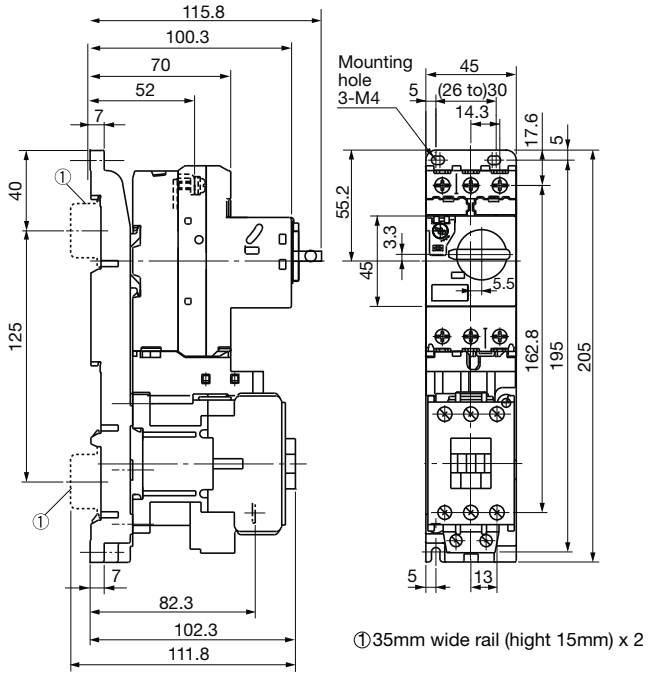
①35mm wide rail (hight 15mm) x 2
②75mm wide rail (hight 25mm) x 1

MMS	Contactors	Link module	Base plate	Mass (g)
BM3RSB	SC-E1/G	BZ0LRE32GA	BZ0BPRE32A	1,360

Combination Starters
Dimensions

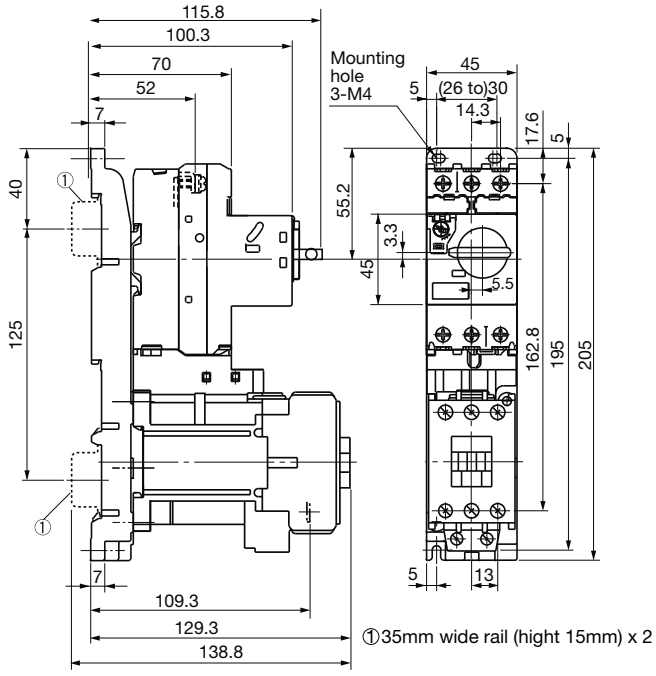
■ Dimensions, mm
• Combination

BM3RHB + SC-E02 to E05



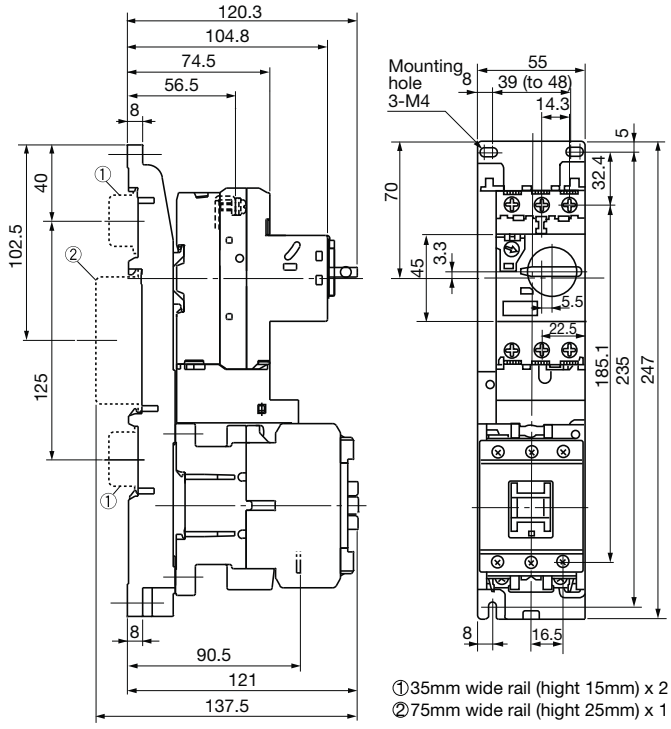
MMS	Contactors	Link module	Base plate	Mass (g)
BM3RHB	SC-E02, E03, E04, E05	BZ0LRE22AA	BZ0BPRE22A	840

BM3RHB + SC-E02/G to E05/G



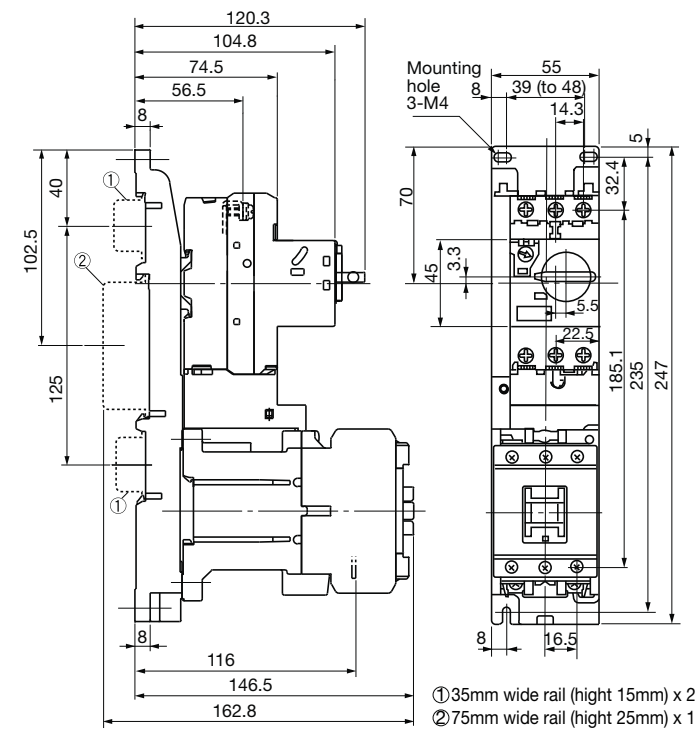
MMS	Contactors	Link module	Base plate	Mass (g)
BM3RHB	SC-E02/G, E03/G, E04/G, E05/G	BZ0LRE22GA	BZ0BPRE22A	1,085

BM3RHB + SC-E1



MMS	Contactors	Link module	Base plate	Mass (g)
BM3RHB	SC-E1	BZ0LRE32AA	BZ0BPRE32A	1,155

BM3RHB + SC-E1/G

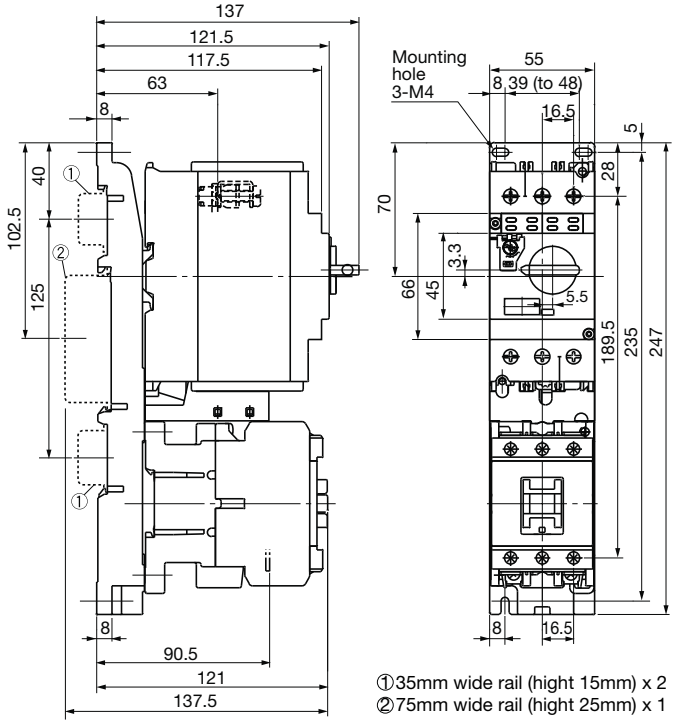


MMS	Contactors	Link module	Base plate	Mass (g)
BM3RHB	SC-E1/G	BZ0LRE32GA	BZ0BPRE32A	1,380

■ Dimensions, mm

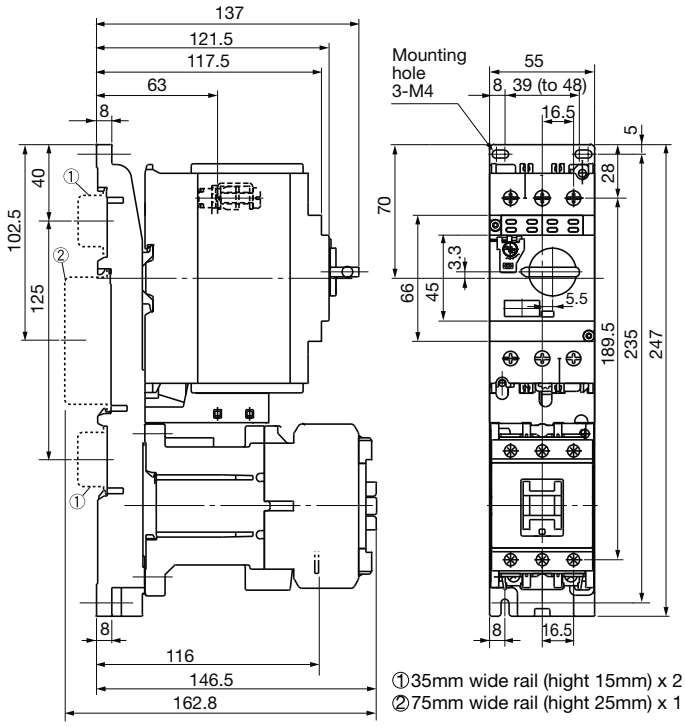
• Combination

BM3V□B + SC-E1, E2, E2S



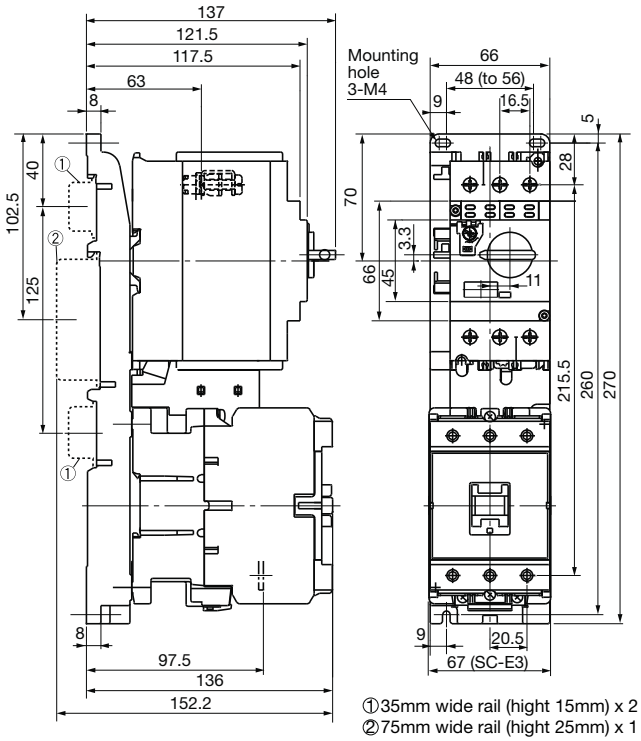
MMS	Contactors	Link module	Base plate	Mass (g)
BM3VSB BM3VHB	SC-E1, E2, E2S	BZ0LVE51AA	BZ0BPVE51A	1,580

BM3V□B + SC-E1/G, E2/G, E2S/G



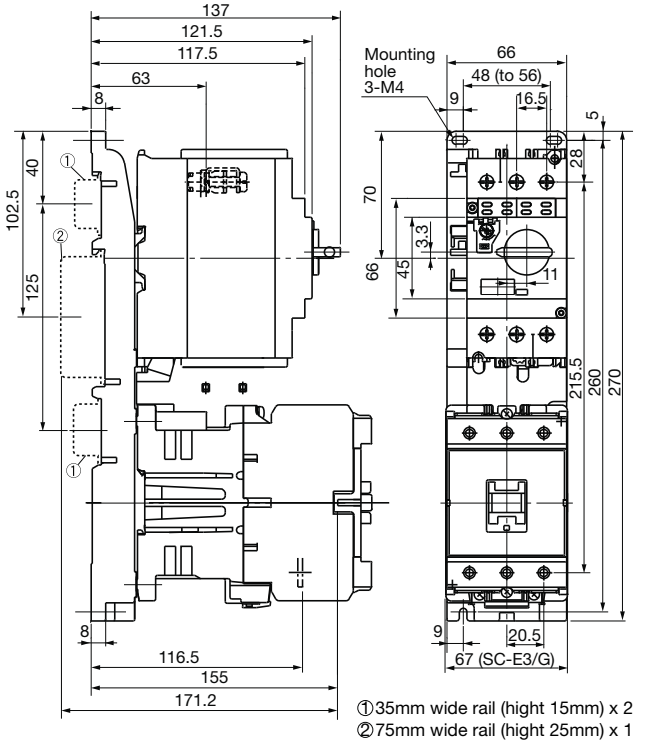
MMS	Contactors	Link module	Base plate	Mass (g)
BM3VSB BM3VHB	SC-E1/G, E2/G, E2S/G	BZ0LVE51GA	BZ0BPVE51A	1,810

BM3V□B + SC-E3



MMS	Contactors	Link module	Base plate	Mass (g)
BM3VSB BM3VHB	SC-E3	BZ0LVE65AA	BZ0BPVE65A	2,080

BM3V□B + SC-E3/G

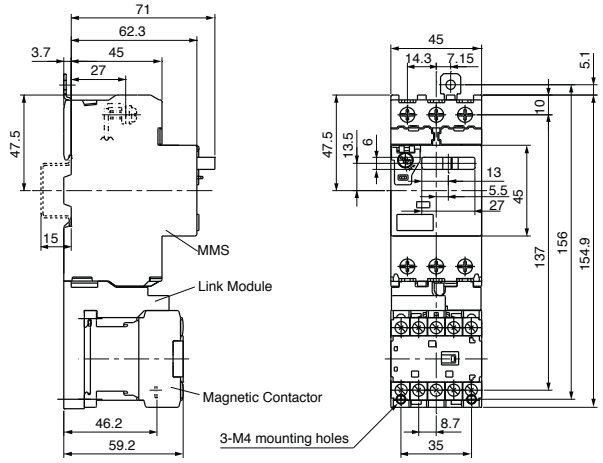


MMS	Contactors	Link module	Base plate	Mass (g)
BM3VSB BM3VHB	SC-E3/G	BZ0LVE65GA	BZ0BPVE65A	2,400

Combination Starters
Dimensions

■ Combination Starter Dimensions, mm

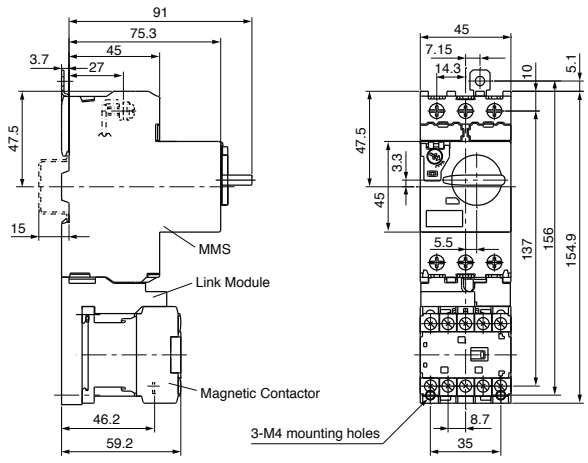
● BM3RS + SK□



Rail mounting :
35mm rail (height: 15) x 1

MMS type	Magnetic Contactor type	Link Module type	Mass [g]
BM3RSB	SK06A, SK09A, SK12A	BZ0LRK12AA	520
BM3RSR	SK06G, SK09G, SK12G SK06L, SK09L, SK12L		550

● BM3RH + SK□

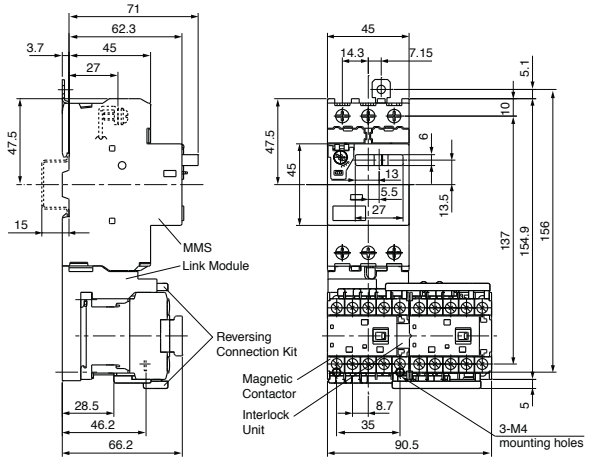


Rail mounting :
35mm rail (height: 15) x 1

MMS type	Magnetic Contactor type	Link Module type	Mass [g]
BM3RHB	SK06A, SK09A, SK12A	BZ0LRK12AA	540
BM3RHR	SK06G, SK09G, SK12G SK06L, SK09L, SK12L		570

■ Reversing Combination Starter Dimensions, mm

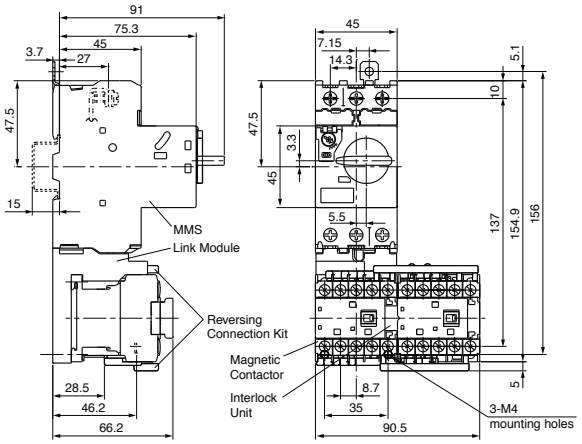
● BM3RS + SK□R



Rail Mounting :
35mm rail (height: 15) x 1

MMS type	Magnetic Starter type	Link Module type	Reversing Connection Kit	Interlock Unit	Mass [g]
BM3RSB	SK06A, SK09A, SK12A	BZ0LRK12AA	SZ1KARW1M	SZ1KRM	700
BM3RSH	SK06G, SK09G, SK12G SK06L, SK09L, SK12L				760

● BM3RH + SK□R



Rail mounting :
35mm rail (height: 15) x 1

MMS type	Magnetic Starter type	Link Module type	Reversing Connection Kit	Interlock Unit	Mass [g]
BM3RHB	SK06A, SK09A, SK12A	BZ0LRK12AA	SZ1KARW1M	SZ1KRM	720
BM3RHR	SK06G, SK09G, SK12G SK06L, SK09L, SK12L				780

Appendix 1 : Construction of combination motor controllers

The UL508 standard defines 6 categories depending on the construction type for the combination motor controllers. The type and component function is shown below.

Type	Component	Component standard	Component funciton per NEC			
			Disconnect	Branch circuit protection	Motor control	Motor overload
A	Manual disconnect	UL98,UL1087	X			
	Fuse	UL248		X		
	Magnetic	UL508			X	
	Overload relay	UL508				X
B	Manual disconnect	UL98,UL1087	X			
	Motor short-circuit Protector	UL508		X		
	Magnetic	UL508			X	
	Overload relay	UL508				X
C	Inverse time Circuit Breaker	UL489	X	X		
	Magnetic	UL508			X	
	Overload relay	UL508				X
D	Instantaneous Circuit Breaker	UL489	X	X		
	Magnetic	UL508			X	
	Overload relay	UL508				X
E	Self-Protected control device	UL508	X	X	X	X
F	Manual Self-protected combination motor controller	UL508	X	X		X
	Magnetic	UL508			X	

Fuji Electric MMS is indicated on the label with "Manual Self-Protected Combination Motor Controller" (TYPE E) and "Combination Motor Controller" (TYPE F).

Appendix 2 : Short circuit coordination comparison

UL508 (Part IV, Combination Motor Controllers) and IEC60947-4-1 are the two major standards concerning the combination of the MMS and the Contactor. In IEC60947-4-1, it only regulates the short-circuit protective coordination between the Contactor and the Circuit Breaker. However, in UL508, it takes the combination of the MMS and Contactor as a united component and requires additional performances besides the short-circuit test.
UL standard is available for another standard related short circuit coordination, that is **UL subject 508E**
(IEC type "2" Coordination Short Circuit Tests of Electromagnetic Motor Controllers in accordance with IEC Publication 947-4-1)
UL subject 508E is to certify that the coordination between the MMS and Contactor comply with IEC60947-4-1 type 2 requirements.
Fuji Electric combination Starters are also cUL listed UL subject 508E, which means that it comforms to both UL and IEC regulation for short-circuit coordination.

Test	UL508 Type F	IEC60947-4-1		UL subject 508E
		Type 1	Type 2	
Short-Circuit Coordination	X - The contactor may be damaged - It may not be suitable for further service without repair or replacement.	X - The contactor may be damaged - It may not be suitable for further service without repair or replacement.	X - No damage except light welding of the contacts of the contactor. - It shall be suitable for further use.	X - No damage except light welding of the contacts of the contactor. - It shall be suitable for further use.
Current withstand	X	-	-	-
Dielectric voltage withstand	X	X	X	X
Calibration	X	-	X	X
Temperature	X	-	-	-
Effective region	North America	Europe	Europe	North America

Coordination details between MMS and Contactor as UL508 Type F, please see page 56, 57, as UL subject 508E, please see page 79, 80.

• BM3RSB, BM3RHB (UL subject E coordination)

220-240V AC		440-480V AC		MMS part number			Contactor part number	Link module	Base plate	Short-circuit ratings at 480V AC (kA)	
HP rating (HP)	Rated current (A)	HP rating (HP)	Rated current (A)	Part number		Current range (A)				for BM3RSB	for BM3RHB
-	-	-	-	**BM3RSB-P16**	**BM3RHB-P16**	0.1-0.16	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
-	-	-	-	**BM3RSB-P25**	**BM3RHB-P25**	0.16-0.25	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
-	-	-	-	**BM3RSB-P40**	**BM3RHB-P40**	0.25-0.4	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
-	-	-	-	**BM3RSB-P63**	**BM3RHB-P63**	0.4-0.63	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
-	-	-	-	**BM3RSB-001**	**BM3RHB-001**	0.63-1	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
-	-	3/4	1.6	**BM3RSB-1P6**	**BM3RHB-1P6**	1-1.6	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
1/2	2.2	1	2.1	**BM3RSB-2P5**	**BM3RHB-2P5**	1.6-2.5	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
3/4	3.2	2	3.4	**BM3RSB-004**	**BM3RHB-004**	2.5-4	**SC-E02** **SC-E02/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
1-1/2	6	3	4.8	**BM3RSB-6P3**	**BM3RHB-6P3**	4-6.3	**SC-E04** **SC-E04/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	50	50
3	9.6	5	7.6	**-**	**BM3RHB-010**	6.3-10	**SC-E04** **SC-E04/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	-	50
3	9.6	7-1/2	11	**-**	**BM3RHB-013**	10-13	**SC-E05** **SC-E05/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	-	50
5	15.2	10	14	**-**	**BM3RHB-016**	11-16	**SC-E05** **SC-E05/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	-	50
5	15.2	10	14	**-**	**BM3RHB-020**	14-20	**SC-E05** **SC-E05/G**	BZ0LRE22AA BZ0LRE22GA	BZ0BPRE22A BZ0BPRE22A	-	50
7-1/2	22	15	21	**-**	**BM3RHB-025**	18-25	**SC-E1** **SC-E1/G**	BZ0LRE32AA BZ0LRE32GA	BZ0BPRE32A BZ0BPRE22A	-	50
10	28	20	27	**-**	**BM3RHB-032**	24-32	**SC-E1** **SC-E1/G**	BZ0LRE32AA BZ0LRE32GA	BZ0BPRE32A BZ0BPRE22A	-	50

• BM3VSB, BM3VHB (UL subject E coordination)

220-240V AC		440-480V AC		MMS part number			Contactor part number	Link module	Base plate	Short-circuit ratings at 480V AC (kA)	
HP rating (HP)	Rated current (A)	HP rating (HP)	Rated current (A)	Part number		Current range (A)				for BM3VSB	for BM3VHB
3	9.6	5	7.6	**BM3VSB-010**	**BM3VHB-010**	6.3-10	**SC-E1** **SC-E1/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50
3	9.6	7-1/2	11	**BM3VSB-013**	**BM3VHB-013**	10-13	**SC-E1** **SC-E1/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50
5	15.2	10	14	**BM3VSB-016**	**BM3VHB-016**	11-16	**SC-E1** **SC-E1/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50
5	15.2	10	14	**BM3VSB-020**	**BM3VHB-020**	14-20	**SC-E1** **SC-E1/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50
7-1/2	22	15	21	**BM3VSB-025**	**BM3VHB-025**	18-25	**SC-E1** **SC-E1/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50
10	28	20	27	**BM3VSB-032**	**BM3VHB-032**	24-32	**SC-E1** **SC-E1/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50
10	28	30	40	**BM3VSB-040**	**BM3VHB-040**	28-40	**SC-E2** **SC-E2/G**	BZ0LVE51AA BZ0LVE51GA	BZ0BPVE51A BZ0BPVE51A	25	50

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