IEC Motor Controls

Section 17

Fuji Motor Controls

GH Series Motor Controls

Cutler-Hammer Motor Controls

EATON

Bryant Manual Motor Controls

Motor Monitor Relays

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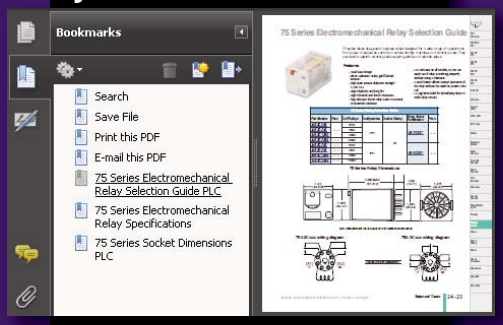

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Motor Controls

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Fuji Electric IEC Motor Controls

AUTOMATIONDIRECT has cooperated with Fuji Electric to offer a complete line of IEC electric motor controls.

The DUO line (SC-E contactors and TK-E overloads) is fully integrated so multiple motor speed controller solutions are possible with a minimum number of components. The conventional motor starters in the DUO line can accommodate electric motors up to 100 horsepower at 480VAC. The larger motor contactors feature the SUPERMAGNET™ coil for greater reliability and positive pick-up and drop-out.

Now available: 440-480 VAC and 500-550 VAC Coil Voltages

The Odyssey Series of contactors and overload relays also features the SUPERMAGNET™ coil and come in sizes up to 361 A, AC-3 operation (300 horsepower at 480 VAC). Odyssey Series contactors are available in four sizes with overload relays to match any motor to 300 horsepower.

Now available: 380-450 VAC and 460-575 VAC Coil Voltages

Both the DUO and Odyssey lines are available in 24 VAC, 24 VDC, 120 VAC, 240 VAC, 380-575 VAC. The motor contactors are rated up to 690 VAC, 3-phase.

Conformance to IEC standards:
- Short-circuit protective coordination between protective devices and the equipment to be protected

Response to the international market:
- Conformance to CE, IEC, UL, CSA and other international standards

Safety and environmental consideration:
- Application of international standards in safety features such as terminals with finger protection
- Use of recycled materials

Use contactors for:

- Electronic switching
- Lighting
- Resistive loads
- Non-motor related inductive loads
- Disconnect switches
- VFD bypass/isolation

Use starters for:

- Inductive motor starting and control
- Fulfillment of NEC 430 and 409
- NEMA starter replacement/retrofit

DUO Series: SC-E series contactors and TK-E series overload relays

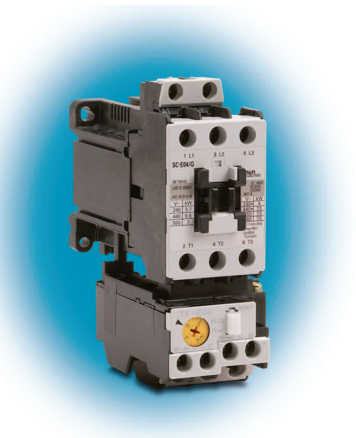
1/2 to 100 hp
9 - 150A (AC3) rated current

SC-E Series Contactor Features

- 5 to 100 hp at 480 VAC
- cULus and CSA approval, CE mark, meets JIS and IEC standards.
- Models SC-E02-xxx to SC-E4-xxx have3-pole main circuits and come in threesizes with widths of 43 mm, 54 mm, and67 mm.
- Models SC-E1-xxx to SC-E7-xxx employ a box terminal structure; allowing wires to be connected directly to the main circuit.
- Has a finger-protection terminal structure that prevents the exposure of live parts.
- Models SC-E5-xxx to SC-E7-xxx use a SUPERMAGNETTM (AC-input/DC-output operation) for high operating reliability

TK-E Series Overload Features

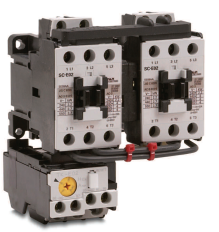
- Isolated NO and NC contacts can be used with different potentials
- A high-precision scale for the current adjustment dial enables easy and exact current setting
- The operating status can be visually checked with ease
- The relays can be manually tripped. A tripfree mechanism is also provided
- Base unit can be added to enable separate mounting of the TK-E02, E2, and E3-xxx models
- IEC-947, UL, CSA, CE



Traditional starters

Fuji's DUO line offers a complete range of components for building a traditional starter utilizing overload relays, auxiliary and alarm contacts, and mechanical interlocks to create a reversing unit.

Build a reversing starter with DUO line components



Fuji Electric IEC Motor Controls

Odyssey 3N series contactors and matching overload relays

The Odyssey series, from 60 to 300 hp at 480 V, uses Fuji's unique SUPERMAGNET technology for greater reliability. The SUPERMAGNET holds without chattering even if the line voltage drops to 65% of its rated value, preventing contact and coil damage.

60 to 300 hp at 480 V
180 - 361A (AC3) rated current

3N Series Contactor Features

- Provides higher current and horsepower capabilities than SC-E series. Designed for reliable use in applications requiring constant switching, reduced coil energy consumption, and increased horsepower capabilities.
- Available in 154 mm and 169 mm frame widths
- SUPERMAGNET™ for high operating reliability.
- Use with Odyssey 3N series overload relays.
- IEC-947, UL, CSA, CE

3N Series Overload Features

- Overload, phase loss protection
- Isolated NO and NC contacts
- Ambient temperature compensation
- Trip indicator
- Finger protection terminals
- IEC-947, UL, CSA, CE

Use Odyssey components to build a traditional starter

Manual Motor Starters (MMS)

Circuit breakers for motor use that provide optimal protection by integrating the functions of a molded case circuit breaker and thermal overload relay into a compact unit.

BM3 Series

- Rated Current: 0.16 to 32A, 10 to 63A
- Short Circuit Current Rating: 100 kA at 240V, 50 kA at 480V, 10 kA at 600V
- Widths: 45 mm and 55 mm

Combination Starters

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

CHECK OUT OUR PRICES

Motor Controls	AutomationDirect Fuji		Allen-Bradley	GE	ABB
9 Amp Contactor	$13.75 SC-E02-110VAC		$90.00 * 100-C09D10	$110.60 CL00A310TJ	$69.58 * A9-30-10-84
40 Amp Contactor	$48.75 SC-E2-110VAC		$202.00 100-C37D00	$257.25 CL06A311MJ	$264.92 * A40-30-10-84
10 Amp Motor Starter	$49.00 BM3RHB-010		$207.00 140M-C2E-C10	$100.4	$171.03 MS325-12.5

VS.

*** This product includes 1 N.O. Aux contact**

All prices are U.S. published prices. AutomationDirect prices are from March 2011 Price List. Allen-Bradley prices taken from www.rockwellautomation.com/en/e-tools 2/21/11 GE prices taken from www.grainger.com 2/22/11.. ABB prices taken from www.galco.com 2/22/11. Prices and specifications may vary by dealer and configuration. Prices subject to change without notice.

Auxiliary contact blocks

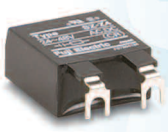
Mechanical interlocks

Reversing kits

Terminal Covers

Replacement Coils

Surge suppressors



and more!

What Fuji Motor Control Do I Need?

There are four basic motor control options available: Basic contactors, traditional starters, manual motor starters, or combination starters. Follow these 3 steps to choose the best fit.

1 What does the application require?

Basic Contactors Only

Contactor

Typical applications:

- Electronic switching
- Lighting
- Resistive loads
- Non-motor-related inductive loads
- Disconnect switches
- VFD bypass/isolation

Traditional Starters

Contactor and overload relay

Typical applications:

- Inductive motor starting and control
- NEC 430 and 409 fulfillment
- Nm starter replacement/retrofit

Manual Motor Starters

Manual motor starter (MMS)

Typical applications:

- Inductive motor starting and manual control
- NEC 430 fulfillment
- Lockout/tagout
- UL 508, type E
- Not AC-4 rated

Combination Starters

Manual motor starter, contactor, link module, and base plate

Typical applications:

- Inductive motor starting and control
- NEC 430 and 409 fulfillment
- Lockout/tagout
- UL 508, type F

2 Consider these factors when selecting components:

- Load type: Resistive (AC-1) or inductive (AC-3)
- Duty cycle: One direction, reversing, plugging (AC-4); Refer to IEC Utilization Chart on page 17-78
- Horsepower (HP) and full load amperage (FLA); Refer to motor data plate information.

3 Select your components.

Duo Series

SC-E Contactor See page 17-5

- 1/2 to 100 hp @ 480 V
- 9-150 A (AC3)

Odyssey Series

3N Contactor See page 17-52

- 60 to 300 hp
- 180-361 A (AC3)

Duo Series

SC-E Contactor See page 17-5

TK-E Overload relay See page 17-21

- 1/2 to 100 hp @ 480 V

Odyssey Series

3N Contactor See page 17-52

3N Overload relay See page 17-55

- 60 to 300 hp

Duo Series

BM3 Manual motor starter

- 1/2 to 40 hp @ 480 V See page 17-28

Duo Series

BM3 Manual motor starter See page 17-28

SC-EContactor See page 17-5

BZ0L link module See page 17-43

BZ0BP base plate

- 1/2 to 40 hp @ 480 V

Fuji Duo Series SC-E Contactors

Features

- 5 to 100 hp at 480 VAC
- cULus and CSA approval, CE mark, meets JIS and IEC standards.
- Models SC-E02-xxx to SC-E4-xxx have 3-pole main circuits and come in three sizes with widths of 43 mm, 54 mm, and 67 mm.
- Models SC-E1-xxx to SC-E7-xxx employ a box terminal structure; allowing wires to be connected directly to the main circuit.
- Has a finger-protection terminal structure that prevents the exposure of live parts.
- Models SC-E5-xxx to SC-E7-xxx use a SUPERMAGNET™ (AC-input/DC-output operation) for high operating reliability and requires no surge suppressor.

Small Size

- SC-E02-xxx to E05-xxx: 43mm wide
- SC-E1-xxx to E2S-xxx: 54mm wide
- SC-E3-xxx, E4-xxx: 67mm wide
- SC-E5-xxx: 88mm wide

SC-E2S

SC-E7

Safety

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

Utility

- Box lug terminal construction
- Long electrical life
- Easy to wire

Environmental

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

Standards & Approvals

- UL listed , file E42419, Standard UL 508
- cUL listed, file E42419, Standard CSA C 22.2 No.14
- VDE 0660
- JIS C 8201-4-1
- IEC 60947-4-1 / EN 60947-4-1
- CE compliant

Optional accessories

- Auxiliary contact blocks
- Coil surge suppression units
- Replacement coils for contactor sizes SC-E5 and larger

SC-E Series Contactors Specifications - UL and CSA

Model	Price	Nominal Coil Voltage	Rated Capacity (HP)						Rated AC-3 Current (A) [note 1]	Rated AC-1 Thermal Current (A) [note 2]	SCCR Ratings (KA)	Rated Insulation Voltage (V)	Frame Width (mm)
			3-Phase Motor				1-Phase Motor						
			200V	220–240V	400–480V	550–600V	100–120V	220–240V					
SC-E02-24VAC	<--->	24VAC	2	2	5	5	1/3	1	9	20	5	690	43
SC-E02-110VAC	<--->	110VAC											
SC-E02-220VAC	<--->	220VAC											
SC-E02-440VAC	<--->	440-480VAC											
SC-E02-500VAC	<--->	500-550VAC											
SC-E02G-24VDC	<--->	24VDC											
SC-E03-24VAC	<--->	24VAC	3	3	7.5	7.5	1/2	2	12	20			
SC-E03-110VAC	<--->	110VAC											
SC-E03-220VAC	<--->	220VAC											
SC-E03-440VAC	<--->	440-480VAC											
SC-E03-500VAC	<--->	500-550VAC											
SC-E03G-24VDC	<--->	24VDC											
SC-E04-24VAC	<--->	24VAC	5	5	10	10	1	3	18	25			
SC-E04-110VAC	<--->	110VAC											
SC-E04-220VAC	<--->	220VAC											
SC-E04-440VAC	<--->	440-480VAC											
SC-E04-500VAC	<--->	500-550VAC											
SC-E04G-24VDC	<--->	24VDC											
SC-E05-24VAC	<--->	24VAC	5	7.5	15	15	2	3	25	32			
SC-E05-110VAC	<--->	110VAC											
SC-E05-220VAC	<--->	220VAC											
SC-E05-440VAC	<--->	440-480VAC											
SC-E05-500VAC	<--->	500-550VAC											
SC-E05G-24VDC	<--->	24VDC											

TABLE CONTINUED NEXT PAGE

Notes: 1. AC3 type loads consist of squirrel cage three-phase motors; occasional, limited jogging duty.
2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

Fuji Duo Series SC-E Contactors

SC-E Series Contactors Specifications - UL and CSA												
Model	Price	Nominal Coil Voltage	Rated Capacity (HP)						Rated AC-3 Current (A) [note 1]	Rated AC-1 Thermal Current (A) [note 2]	SCCR Ratings (KA)	Rated Insulation Voltage (V)	Frame Width (mm)
			3-Phase Motor				1-Phase Motor						
			200V	220–240V	400–480V	550–600V	100–120V	220–240V					
SC-E1-24VAC	<--->	24VAC	7.5	10	25	25	2	3	32	50	5	690	54
SC-E1-110VAC	<--->	110VAC											
SC-E1-220VAC	<--->	220VAC											
SC-E1-440VAC	<--->	440-480VAC											
SC-E1-500VAC	<--->	500-550VAC											
SC-E1G-24VDC	<--->	24VDC											
SC-E2-24VAC	<--->	24VAC	10	15	30	30	3	5	40	60			
SC-E2-110VAC	<--->	110VAC											
SC-E2-220VAC	<--->	220VAC											
SC-E2-440VAC	<--->	440-480VAC											
SC-E2-500VAC	<--->	500-550VAC											
SC-E2G-24VDC	<--->	24VDC											
SC-E2S-24VAC	<--->	24VAC	15	20	30	30	3	10	50	65			
SC-E2S-110VAC	<--->	110VAC											
SC-E2S-220VAC	<--->	220VAC											
SC-E2S-440VAC	<--->	440-480VAC											
SC-E2S-500VAC	<--->	500-550VAC											
SC-E2SG-24VDC	<--->	24VDC											
SC-E3-24VAC	<--->	24VAC	20	25	50	50	5	15	65	100			67
SC-E3-110VAC	<--->	110VAC											
SC-E3-220VAC	<--->	220VAC											
SC-E3-440VAC	<--->	440-480VAC											
SC-E3-500VAC	<--->	500-550VAC											
SC-E3G-24VDC	<--->	24VDC											
SC-E4-24VAC	<--->	24VAC	25	30	50	50	5	15	80	105			
SC-E4-110VAC	<--->	110VAC											
SC-E4-220VAC	<--->	220VAC											
SC-E4-440VAC	<--->	440-480VAC											
SC-E4-500VAC	<--->	500-550VAC											
SC-E4G-24VDC	<--->	24VDC											
SC-E5-24V	<--->	24VAC/VDC	30	30	60	75	7.5	15	105	150	10		88
SC-E5-100V	<--->	110VAC/VDC											
SC-E5-200V	<--->	220VAC/VDC											
SC-E5-400V	<--->	380-450VAC											
SC-E5-500V	<--->	460-575VAC											
SC-E6-24V	<--->	24VAC/VDC	40	40	75	100	10	20	125	150			100
SC-E6-100V	<--->	110VAC/VDC											
SC-E6-200V	<--->	220VAC/VDC											
SC-E6-400V	<--->	380-450VAC											
SC-E6-500V	<--->	460-575VAC											
SC-E7-24V	<--->	24VAC/VDC	50	50	100	125	15	25	150	200			115
SC-E7-100V	<--->	110VAC/VDC											
SC-E7-200V	<--->	220VAC/VDC											
SC-E7-400V	<--->	380-450VAC											
SC-E7-500V	<--->	460-575VAC											

Notes: 1. AC3 type loads consist of squirrel cage three-phase motors; occasional, limited jogging duty.
2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

Fuji Duo Series SC-E Contactors

SC-E Series Contactors Specifications - IEC												
Contactor Type	Rated Capacity (kW)				Rated Operating Current (A)						Rated Thermal Current (A)	Internal Auxilliary Contact Arrange-ment
	3-Phase Motor AC-3 / AC-4				3-Phase Motor AC-3 / AC-4				Resistive Load AC-1			
	200-240V	380-440V	500-550V	600-690V	200-240V	380-440V	500-550V	600-690V	200-240V	380-440V		
SC-E02(G)-xxx	2.2 / 2.2	4 / 4	4 / NA	4 / NA	9 / 9	9 / 9	7 / NA	5 / NA	20	20	20	-
SC-E03(G)-xxx	3 / 3	5.5 / 5.5	5.5 / NA	5.5 / NA	12 / 12	12 / 12	9 / NA	7 / NA	20	20	20	-
SC-E04(G)-xxx	4 / 4	7.5 / 7.5	7.5 / NA	7.5 / NA	18 / 18	18 / 18	13 / NA	9 / NA	25	25	25	-
SC-E05(G)-xxx	5.5 / 4	11 / 7.5	11 / NA	7.5 / NA	25 / 18	25 / 18	17 / NA	9 / NA	32	32	32	-
SC-E1(G)-xxx	7.5 / 7.5	15 / 15	15 / NA	11 / NA	32 / 32	32 / 32	24 / NA	15 / NA	50	50	50	-
SC-E2(G)-xxx	11 / 11	18.5 / 18.5	18.5 / NA	15 / NA	40 / 40	40 / 40	29 / NA	19 / NA	60	60	60	-
SC-E2S(G)-xxx	15 / 11	22 / 18.5	25 / NA	22 / NA	50 / 40	50 / 40	38 / NA	26 / NA	65	65	65	-
SC-E3(G)-xxx	18.5 / 18.5	30 / 30	37 / NA	30 / NA	68 / 68	65 / 65	60 / NA	38 / NA	100	100	100	-
SC-E4(G)-xxx	22 / 18.5	40 / 30	37 / NA	37 / NA	80 / 68	80 / 65	60 / NA	44 / NA	105	105	105	-
SC-E5-xxx	30 / 30	55 / 55	5 5/ NA	55 / NA	105 / 105	105 / 105	85 / NA	64 / NA	150	150	150	2NO+2NC
SC-E6-xxx	37 / 37	60 / 60	6 0 / NA	60 / NA	125 / 125	125 / 125	90 / NA	72 / NA	150	150	150	2NO+2NC
SC-E7-xxx	45 / 45	75 / 75	75 / NA	90 / NA	150 / 150	150 / 150	120 / NA	103 / NA	200	200	200	2NO+2NC

Internal Auxiliary Contact Ratings

Internal Auxiliary Contact Ratings - UL and CSA						
Frame Size (note 1)	Rated Insulation Voltage (V)	NEMA ICS 5-2000 Ratings (note 2)				
		AC Ratings			DC Ratings	
		Designation	Making VA	Breaking VA	Designation	Making/Breaking VA
E5 to E7-xxx	690	A600	7200	720	Q300	69

Notes:
1. E02(G) to E4(G) do not have internal auxiliary contact.
2. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, see page 17-77.

Internal Auxiliary Contact Ratings - IEC, JIS									
Based on IEC 60974-4-1, EN 60947-4-1, JIS C 8201-4-1									
Frame Size (note 1)	Rated Insulation Voltage (V)	Rated Thermal Current (A)	Making and Breaking Capacity (A)		Rated Operational Current (A)				Minimum Operating Voltage and Current
			AC Voltage	Amps	AC Voltage	AC-15 (Ind. load)	DC Voltage	DC-13 (Ind. load)	
E5 to E7-xxx	690	10	120V	60	120V	6	24V	3	5VDC, 3mA
			220V	30	220V	3	48V	1.5	
			440V	15	440V	1.5	110V	0.55	
			600V	12	600V	1.2	220V	0.27	

Note 1: E02(G) to E4(G) do not have internal auxiliary contact.

Fuji Duo Series SC-E Contactors

Coil Characteristics

AC Coil Characteristics								
Frame Size	Power Consumption (VA)		Power Loss (W)		Pick-Up Voltage (V)	Drop-Out Voltage (V)	Operating Time (ms)	
	Inrush	Sealed	50Hz	60Hz			Coil ON to Contact ON	Coil OFF to Contact OFF
	50/60Hz	50/60Hz						
E02 to E05-xxx	90/95	9/9	2.7	2.8	0.85 - 1.1 x U.S. rated coil voltage	0.2 - 0.75 x U.S. rated coil voltage	9-20	5-16
E1 to E2S-xxx	120/135	12.7/12.4	3.6	3.8	0.85 - 1.1 x U.S. rated coil voltage	0.2 - 0.75 x U.S. rated coil voltage	10-17	6-13
E3, E4-xxx	180/190	13.3/13.4	4.5	5	0.85 - 1.1 x U.S. rated coil voltage	0.2 - 0.75 x U.S. rated coil voltage	10-18	8-18
E5-xxx	80/95	4/4.6	3.2	3.6	0.85 - 1.1 x U.S. rated coil voltage	0.2 - 0.75 x U.S. rated coil voltage	39-45	27-33
E6, E7-xxx	190/230	4.9/5.8	3.4	3.7	0.8 - 1.1 x U.S. rated coil voltage	0.1 - 0.65 x U.S. rated coil voltage	31-37	30-36

DC Coil Characteristics						
Frame Size	Power Consumption (W)		Pick-Up Voltage (V)	Drop-Out Voltage (V)	Operating Time (ms)	
	Inrush	Sealed			Coil ON to Contact ON	Coil OFF to Contact OFF
E02G to E05G-xxx	7	7	0.85 - 1.1 x U.S. rated coil voltage	0.1 - 0.75 x U.S. rated coil voltage	45-49	10-26
E1G to E2SG-xxx	9	9	0.85 - 1.1 x U.S. rated coil voltage	0.1 - 0.75 x U.S. rated coil voltage	40-50	8-17
E3G, E4G-xxx	12	12	0.85 - 1.1 x U.S. rated coil voltage	0.1 - 0.75 x U.S. rated coil voltage	60-70	14-21
E5-xxx	20	2.8	0.85 - 1.1 x U.S. rated coil voltage	0.1 - 0.75 x U.S. rated coil voltage	35-41	26-32
E6, E7-xxx	225	3.2	0.8 - 1.1 x U.S. rated coil voltage	0.1 - 0.65 x U.S. rated coil voltage	28-34	27-33

Operating Coil	
AC Coil, SC-E02-xxx to SC-E4-xxx	
Voltage Code	Coil Operating Voltage / Frequency
24VAC	24VAC 50Hz / 24-26VAC 60Hz
110VAC	100-110VAC 50Hz / 110-120VAC 60Hz
220VAC	200-220VAC 50Hz / 220-240VAC 60Hz
440VAC	415-440VAC 50Hz / 440-480VAC 60Hz
500VAC	480-500VAC 50Hz / 500-550VAC 60Hz

Operating Coil	
AC/DC Coil (SUPERMAGNET), SC-E5-xxx to SC-E7-xxx	
Voltage Code	Coil Operating Voltage / Frequency
24V	24-25VAC 50/60Hz; 24VDC
100V	100-127VAC 50/60Hz; 100-120VDC
200V	200-250VAC 50/60Hz; 200-240VDC
400V	380-450VAC 50/60Hz
500V	460-575VAC 50/60Hz

Operating Coil	
DC Coil, SC-E02G-xxx to SC-E4G-xxx	
Voltage Code	Coil Operating Voltage
24VDC	24VDC

Performance Data

Frame size	Making current (A)		Breaking current (A)		Operating cycles	Durability (operations)	
	220V	440V	220V	440V	per hour	Electrical	Mechanical
SC-E02	108	108	90	90	1800	2 million	10 million
SC-E03	144	144	120	120	1800	1.5 million	10 million
SC-E04	216	216	180	180	1800	1.5 million	10 million
SC-E05	250	250	200	200	1200	1.5 million	10 million
SC-E1	384	384	320	320	1200	1.5 million	10 million
SC-E2	480	480	400	400	1200	1.5 million	10 million
SC-E2S	500	500	400	400	1200	1.5 million	10 million
SC-E3	816	780	680	650	1200	1.5 million	5 million
SC-E4	816	800	680	650	1200	1 million	5 million
SC-E5	1260	1260	1050	1050	1200	1 million	5 million
SC-E6	1500	1500	1250	1250	1200	1 million	5 million
SC-E7	1800	1800	1500	1500	1200	1 million	5 million

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Fuji Duo Series SC-E Contactors

Standard operating conditions

The magnetic contactors are manufactured for use in the standard operating conditions given in the table.

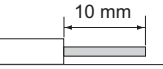
Standard Operating Conditions	
Ambient Temperature	Operating: -5 to 55°C No sudden temperature changes resulting in condensation or icing (The average temperature over a 24-hour period must not exceed 35°C) Storage: -40 to 65°C
Humidity	45 to 85%RH
Altitude	2000m or lower
Atmosphere	No excessive dust, smoke, corrosive gases, flammable gases, steam, or salt
Vibration	10 to 55Hz 15m/s^2
Shock	50m/s^2
Mounting	35mm IEC DIN rail mounting (SC-E02 to SC-E4), screw mounting
Mounting Angle	
Standard	IEC 947-4-1, EN 60947-4-1, VDE 0660 JIS C 8201-4-1, JEM 1038 UL 508, file E42419; CSA C22.2, file 20479

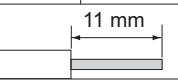
Wiring

Be sure to perform wiring correctly with reference to the wiring diagrams. 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 and crimping a sleeve (ferrule) onto them before connecting.

Tightening torque

If wires are not tightened sufficiently, they may become hot or loosen, resulting in a fire, short-circuit, electric shock, or other potentially dangerous situation. Tighten wires to the torques specified in these tables.

Wire Sizes, Tightening Torques - Control Circuit		
Solid or Stranded Wire (mm^2)	***One***	0.75 to 2.5 (1 to 1.6 mm diameter)
	Two	0.75 to 2.5 (1 to 1.6 mm diameter)
AWG	***One***	18 to 14
	Two	18 to 14
Insulation Stripping Length		
Fork Terminal		Max. 7.7mm wide
Terminal Screw Size		M3.5
Tool		Phillips screwdriver, H-type, No. 2 (ISO 8764); ADC part number DN-SP1 or DN-SP2
		Flat-blade screwdriver, 1 x 5.5 x L-type, B (ISO 2830); ADC part number DN-SS5
Tightening Torque (N·m)		0.8 to 1

Wire Sizes, Tightening Torques - Main Circuit					
Contactor Type		***SC-E02-xxx***	***SC-E03-xxx***	***SC-E04-xxx***	***SC-E05-xxx***
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.	
Insulation Stripping Length					
Terminal Screw Size		M4			
Tool		Phillips screwdriver, H-type, No. 2 (ISO 8764); ADC part number DN-SP1 or DN-SP2			
		Flat-blade screwdriver, 1 x 5.5 x L-type, B (ISO 2830); ADC part number DN-SS5			
Tightening Torque (N·m)		1.2 to 1.5			

Fuji Duo Series SC-E Contactors

Tightening torque (continued)

Wire Sizes, Tightening Torques - Main Circuit						
Contactor Type			***SC-E1, E2, E2S-xxx***	***SC-E3, E4-xxx***	***SC-E5, E6-xxx***	***SC-E7-xxx***
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)		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)		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)	***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); ADC part number DN-SP1 or DN-SP2	Hex. wrench 4 (ISO 2936)		
			Flat-blade screwdriver, 1 x 5, 5xL-type, B (ISO 2830); ADC part number DN-SS5			
Tightening Torque (Nm)			2.5	8		10
Self-locking Torque (Nm) 2			1	2		

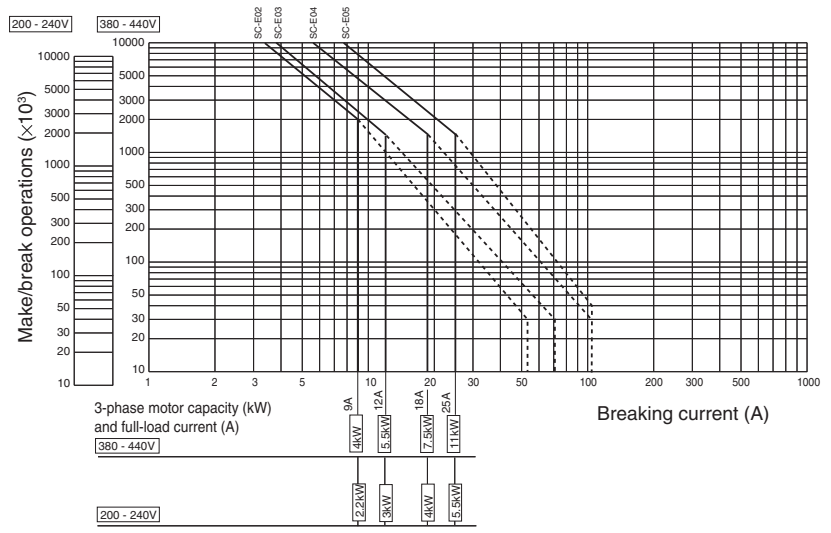
Note 1: Stranded wire (0 to 25mm^2) consists of 7 wires or less. Stranded wire (35 to 120mm^2) consists of 19 wires or less. Flexible stranded wire consists of more number wires than the above.

Note 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 loosen.

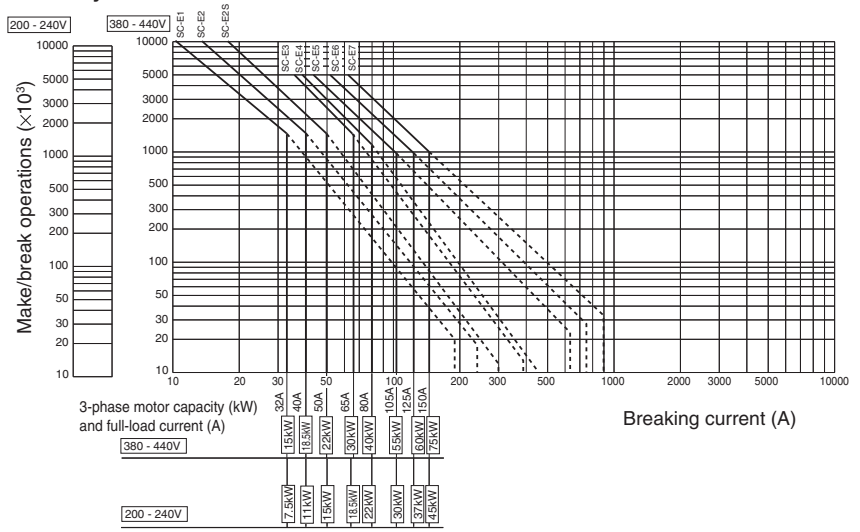
Fuji Duo Series SC-E Contactors

Electrical durability

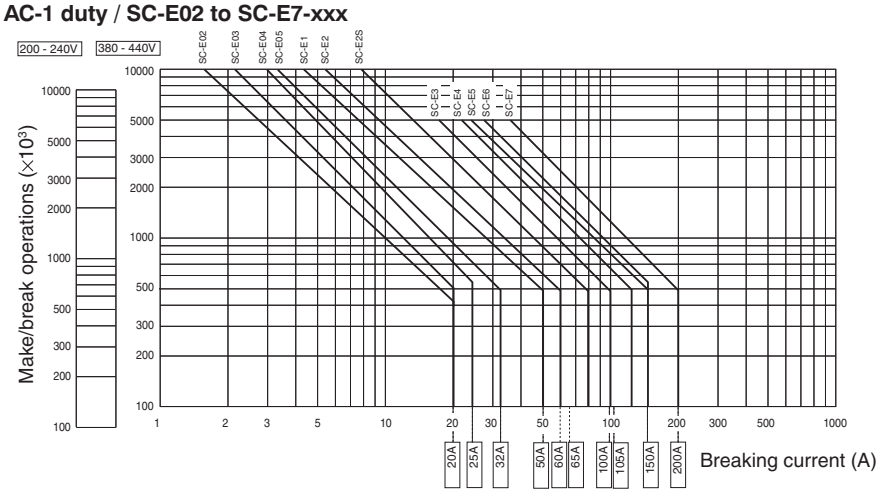
AC-3 duty / SC-E02 to SC-E05-xxx



AC-3 duty / SC-E1 to SC-E7-xxx

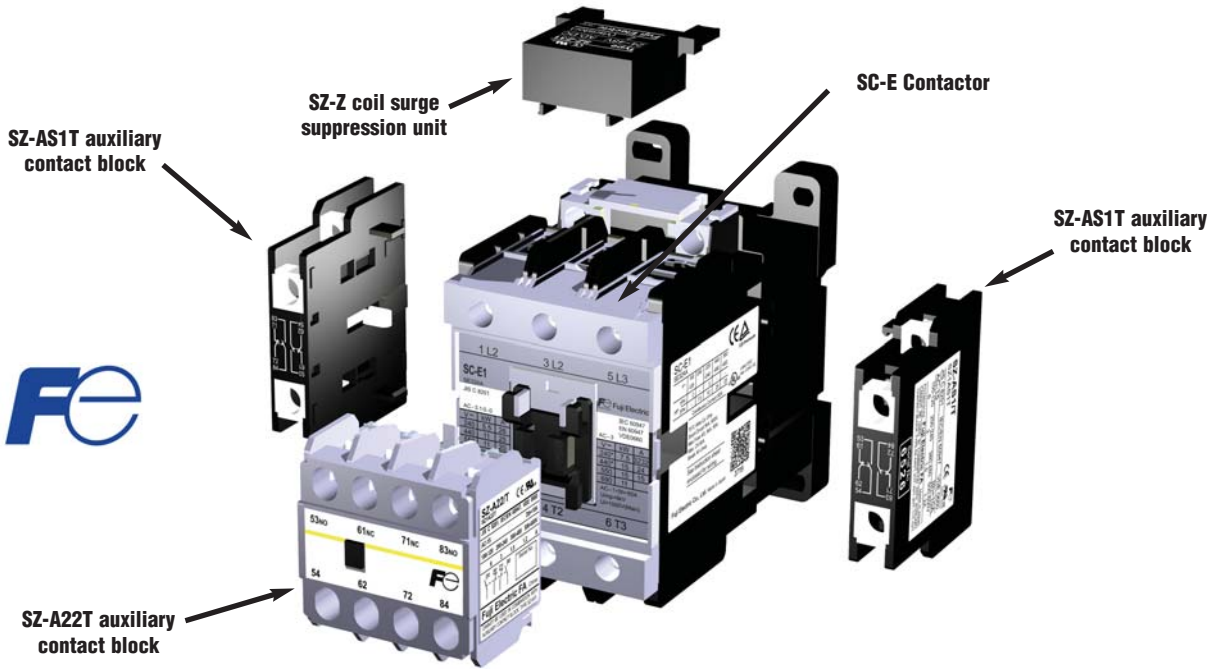


AC-1 duty / SC-E02 to SC-E7-xxx



Fuji Duo Series SC-E Contactors Accessories

Optional accessories



Auxiliary contact blocks with terminal covers

The front mounting auxiliary contact block allows two or four auxiliary contacts to be added without increasing the mounting area of the magnetic contactors. The side mounting auxiliary contact block allows two auxiliary contacts to be added to the magnetic contactors without increasing the depth.


SZ-A22T


SZ-A11T


SZ-AS1T


SZ-AS2T

Auxiliary Contact Blocks with Terminal Covers					
Part Number	***Price***	***Applicable Contactor***	***Mounting***	***Number of Contacts***	***Contact Arrangement***
SZ-A22T	<--->	SC-E02(G)-xxx to E4(G)-xxx	Front mounting	4	2NO + 2NC
SZ-A20T	<--->			2	2NO
SZ-A11T	<--->				1NO + 1NC
SZ-AS1T	<--->	SC-E02(G)-xxx to E4(G)-xxx	Side mounting	2	1NO + 1NC
SZ-AS2T	<--->	SC-E5, E6, E7-xxx		2	1NO + 1NC

Accessory Auxiliary Contact Ratings - UL and CSA				
NEMA ICS 5-2000 Ratings *(note 1)*				
AC Ratings			***DC Ratings***	
Designation	***Making VA***	***Breaking VA***	***Designation***	***Making/Breaking VA***
A600	7200	720	Q300	69
more information, refer to Control Circuit Contact Electrical Ratings, page 17-77				

Caution on use:

1. Front mounting auxiliary contact block and side mounting block cannot be attached to one contactor at the same time.
2. Only one front mounting block can be attached to one contactor.
3. Where mechanical latch unit is already attached, only side mounting auxiliary contact block can be attached.
4. Where interlock unit is already attached, side mounting auxiliary contact block can be attached on one side only.

Accessory Auxiliary Contact Ratings - IEC and JIS continued on next page.

Fuji Duo Series SC-E Contactors Accessories

Accessory Auxiliary Contact Ratings - IEC and JIS							
Rated Thermal Current (A)	Making and Breaking Capacity at AC (A)		Rated operational current (A)				Minimum Operating Voltage and Current
			AC		DC		
			Voltage	AC-15 (Ind. load)	Voltage	DC-13 (Ind. load)	
10	120V	60	120V	6	24V	3	5VDC, 3mA
	220V	30	220V	3	48V	1.5	
	440V	15	440V	1.5	110V	0.55	
	600V	12	600V	1.2	220V	0.27	

Coil surge suppression units

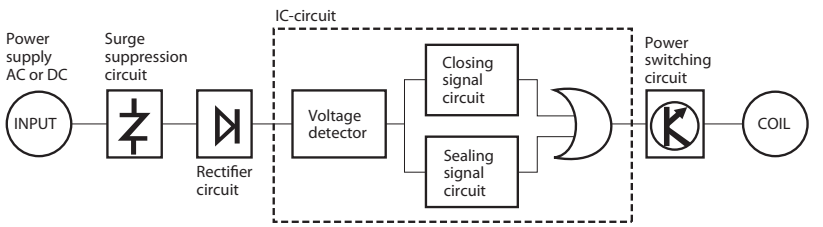
SZ-Z1

SZ-Z37

Suppress surge voltage due to contactor ON-OFF operations; easily connect to contactor coil terminals.

Coil Surge Suppression Units					
Part Number	Price	Applicable Contactor		Operating Coil Voltage	Device
		AC Operated	DC Operated		
SZ-Z1	<--->	SC-E02-xxx to E05-xxx	SC-E02G-xxx to E05G-xxx	24-48V AC/DC	Varistor
SZ-Z2	<--->			100-250V AC/DC	
SZ-Z31	<--->	SC-E1-xxx to -E4xxx	SC-E1G-xxx to E4G-xxx	24-48V AC/DC	
SZ-Z32	<--->			100-250V AC/DC	
SZ-Z4	<--->	SC-E02-xxx to E05-xxx	SC-E02G-xxx to E05G-xxx	24-48V AC/DC	capacitor / resistor
SZ-Z5	<--->			100-250V AC/DC	
SZ-Z34	<--->	SC-E1-xxx to E4-xxx	-	24-48V AC/DC	
SZ-Z35	<--->			100-250V AC/DC	
SZ-Z36	<--->	-	SC-E1G-xxx to E4G-xxx	24-48V AC/DC	
SZ-Z37	<--->			100-250V AC/DC	
SC-E02 to E05				380-440V AC/DC	
SC-E1 to E4				380-440V AC/DC	

Note: Super Magnet Coils on SC-E5, SC-E6, and SC-E7 contactors have internal surge suppression. See diagram below.



Replacement contactor coils

SZ-GSN5-100

SC-E Series Replacement Contactor Coils			
Part Number	Price	Applicable Contactor	Coil Voltage
SZ-GSN5-100	<--->	SC-E5-xxx	100-127VAC 50/60Hz / 100-120VDC
SZ-GSN6-100	<--->	SC-E6-xxx, SC-E7-xxx	100-127VAC 50/60Hz / 100-120VDC
SZ-GSN5-200	<--->	SC-E5-xxx	200-250VAC 50/60Hz / 200-240VDC
SZ-GSN6-200	<--->	SC-E6-xxx, SC-E7-xxx	200-250VAC 50/60Hz / 200-240VDC
SZ-GSN5-24	<--->	SC-E5-xxx	24-25VAC/ 50/60Hz / 24VDC
SZ-GSN6-24	<--->	SC-E6-xxx, SC-E7-xxx	24-25VAC/ 50/60Hz / 24VDC
Replacement coils are available for contactor sizes SC-E5 and larger only.			
Replacement coils are not available for coil codes 440VAC, 500VAC, 400V, 500V.			

Fuji Duo Series SC-E Accessories

Connection kits for reversing SC-E contactors

SZ-ERW1A

Line Side Wiring

SZ-ERW1B

Load Side Wiring

SZ-ERW1D

Load Side Wiring

SZ-ERW2A

Line Side Wiring

SZ-ERW2B

Load Side Wiring

SZ-ERW2D

Load Side Wiring

SZ-ERW3A

Line Side Wiring

SZ-ERW3B

Load Side Wiring

SZ-ERW3D

Load Side Wiring

Connection Kits			
Part Number	**Price**	**Description**	**Use with Contactors**
SZ-ERW1A	<--->	Line side reversing connection kit.	SC-E02-xxx to SC-E05-xxx
SZ-ERW1B*	<--->	Load side reversing connection kit. For wiring load side when using contactors only or with a MMS device.	
SZ-ERW1D	<--->	Load side reversing connection kit. For wiring load side when using two contactors with a thermal overload relay.	
SZ-ERW2A	<--->	Line side reversing connection kit.	SC-E1-xxx to SC-E2S-xxx
SZ-ERW2B*	<--->	Load side reversing connection kit. For wiring load side when using contactors only or with a MMS device.	
SZ-ERW2D	<--->	Load side reversing connection kit. For wiring load side when using two contactors with a thermal overload relay.	
SZ-ERW3A	<--->	Line side reversing connection kit.	SC-E3-xxx to SC-E4-xxx
SZ-ERW3B*	<--->	Load side reversing connection kit. For wiring load side when using contactors only or with a MMS device.	
SZ-ERW3D	<--->	Load side reversing connection kit. For wiring load side when using two contactors with a thermal overload relay.	

**** When using the SZ-ERWxB, a TK-E thermal overload relay must be separately mounted and wired using an SZ-HxE base. To assemble a TK-E overload directly to the contactor use a SZ-ERWxD load side connection kit.***

Mechanical interlock unit

SZ-RM

Mechanical Interlock Unit			
Part Number	**Price**	**Description**	**Use with Contactors**
SZ-RM	<--->	Used when building a reversing starter. Prevents both contactors from being pulled in at once.	SC-E02-xxx to SC-E4-xxx

NOTE: Mechanical interlock unit cannot be used with SC-E5-xxx through E7-xxx contactors.

Parts for reversing Fuji SC-E contactors

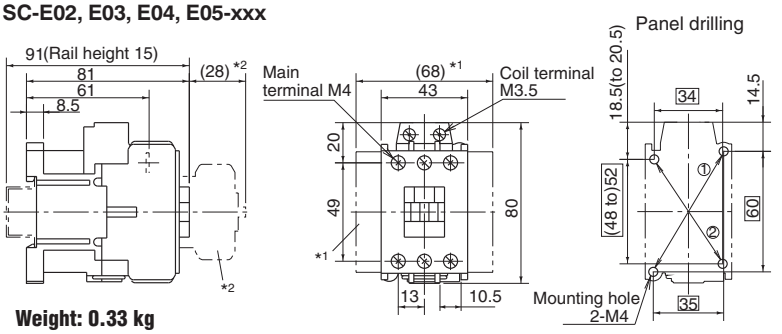
- SC-E (Contactors - qty. 2)
- SZ-ERWxA (Line side connection kit - qty. 1)
- SZ-ERWxB* (Load side connection kit - qty. 1)
- SZ-RM (Mechanical interlock - qty. 1)
- SZ-AxxT (Auxiliary contact blocks - qty. 1)

Fuji Duo Series SC-E Contactors

Dimensions (mm)

Contactors

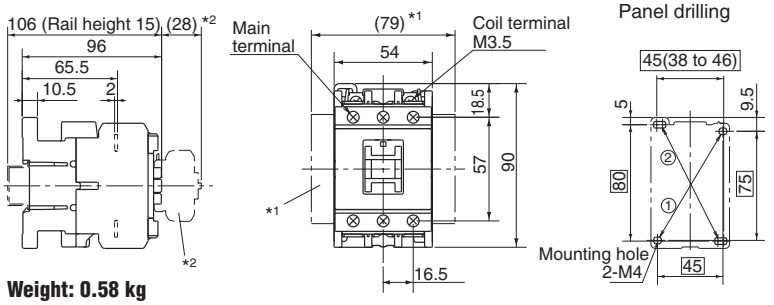
SC-E02, E03, E04, E05-xxx



Weight: 0.33 kg

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

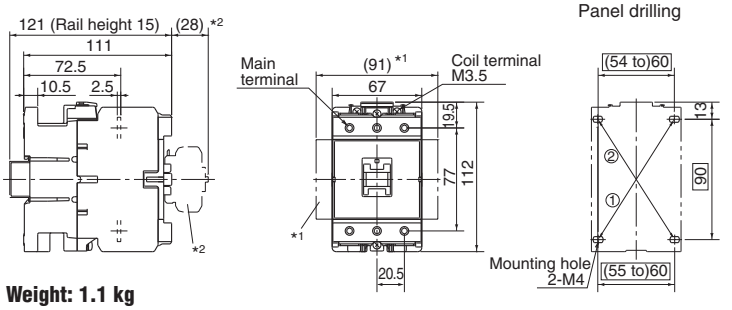
SC-E1, E2, E2S-xxx



Weight: 0.58 kg

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

SC-E3, E4-xxx



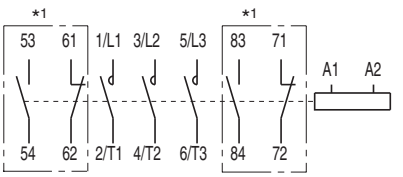
Weight: 1.1 kg

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

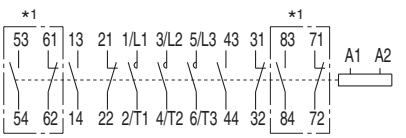
Wiring diagrams

Contactors

SC-E02 to E05-xxx
SC-E1 to E4-xxx
SC-E02G to E05G-xxx
SC-E1G to E4G-xxx
SC-E2S, E2SG-xxx



SC-E5, E6, E7-xxx



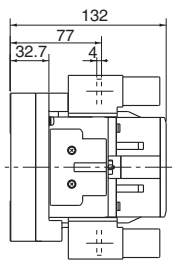
*1 In case of aux. contact 4NO+4NC

Fuji Duo Series SC-E Contactors

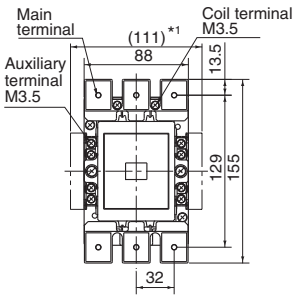
Dimensions (mm)

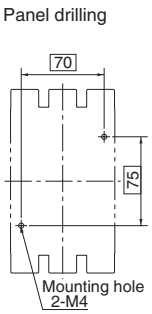
Contactors

SC-E5-xxx



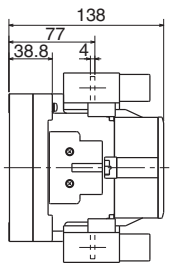
Weight: 2.0 kg



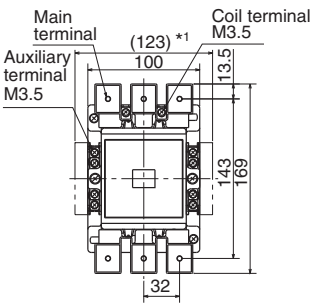


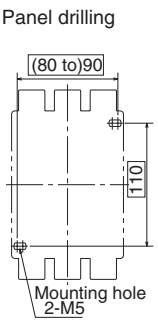
*1 Side mounting aux. contact block
*2 Front mounting aux. contact block

SC-E6-xxx

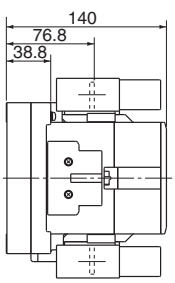


Weight: 2.6 kg

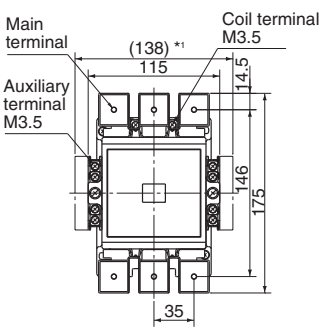


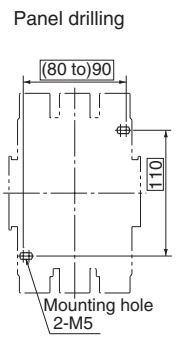


SC-E7-xxx

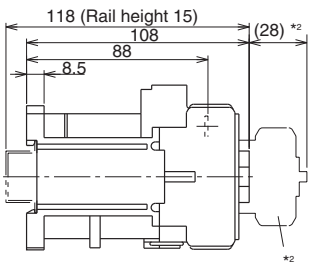


Weight: 2.9 kg

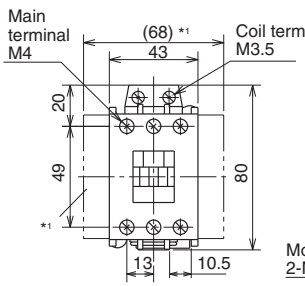


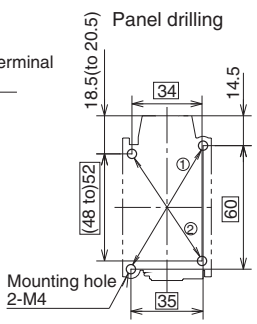


SC-E02G, E03G, E04G, E05G-xxx



Weight: 0.59 kg





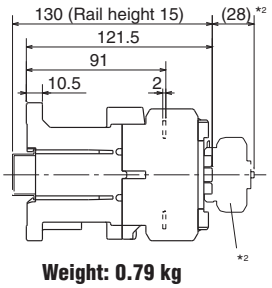
Use the two mounting holes on a diagonal line
① or ② to mount contactor
① 35 × 60 ②: 35 × (48 to) 52

Fuji Duo Series SC-E Contactors

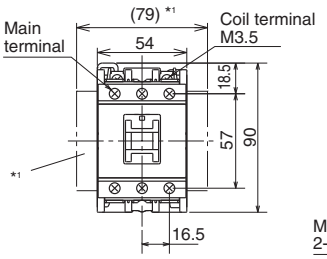
Dimensions (mm)

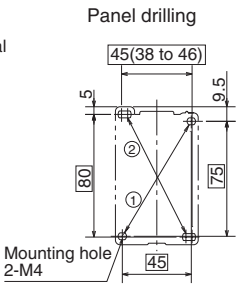
Contactors

SC-E1G, E2G, E2SG-xxx



Weight: 0.79 kg

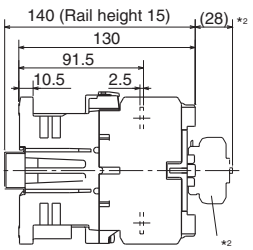




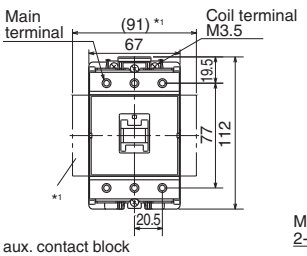
*1 Side mounting aux. contact block
*2 Front mounting aux. contact block

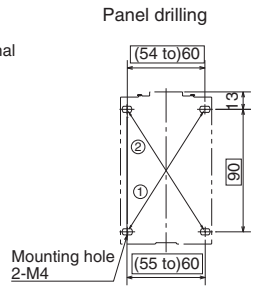
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: 45×75 ②: 45 (38 to 46)×80

SC-E3G, E4G-xxx



Weight: 1.4 kg





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

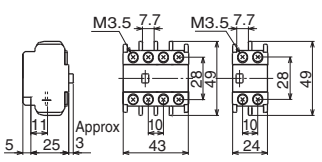
Use the two mounting holes on a diagonal line
① or ② to mount contactor
①: (55 to) 60×90 ②: (54 to) 60×90

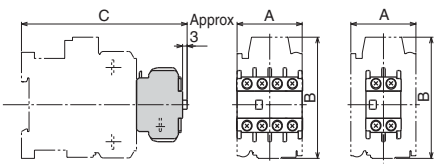
Dimensions-mm

Auxiliary contact blocks - front mounting

SZ-A22T, A20T, A11T for SC-E02 (G)-xxx to E4 (G)-xxx

Contactor with aux. contact block





A22T **Weight: 36 g**
SZ-A20T, A11T **Weight: 20 g**

Type	A	B	C
SC-E02, E03, E04, E05-xxx	43	80	109
SC-E1, E2, E2S-xxx	54	90	124
SC-E3, E4-xxx	67	112	139
SC-E02G, E03G, E04G, E05(G)-xxx	43	80	136
SC-E1G, E2G, E2SG-xxx	54	90	149.5
SC-E3G, E4G-xxx	67	112	158

Wiring diagrams

SZ-A22T, A20T, A11T

2NO

1NO+1NC

2NO+2NC

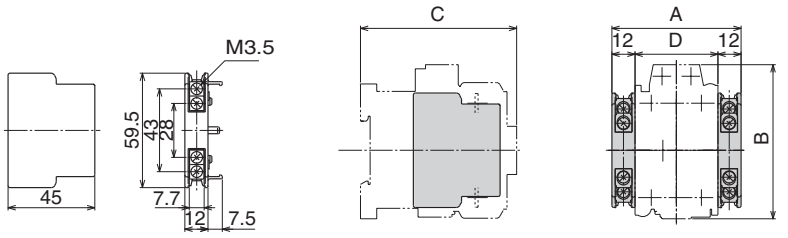
Fuji Duo Series SC-E Contactors

Dimensions (mm)

Auxiliary contact blocks - side mounting

SZ-AS1T for SC-E02(G)-xxx to E4(G)-xxx

Contactor with aux. contact block

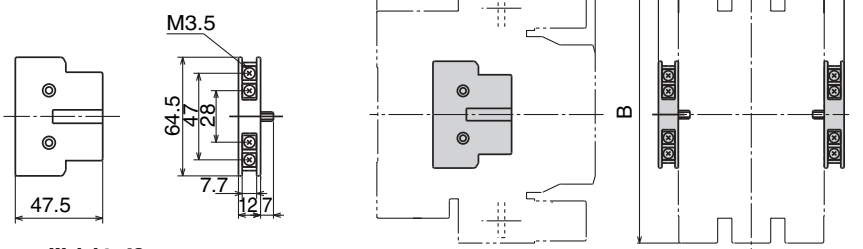


Weight: 28 g

Type	A	B	C	D
SC-E02, E03, E04, E05-xxx	67	80	81	43
SC-E1, E2, E2S-xxx	78	90	54	54
SC-E3, E4-xxx	91	112	67	67
SC-E02G, E03G, E04G, E05(G)-xxx	67	80	108	43
SC-E1G, E2G, E2SG-xxx	78	90	121.5	54
SC-E3G, E4G-xxx	91	112	130	67

SZ-AS2T for SC-E5 to E7-xxx

Contactor with aux. contact block



Weight: 40 g

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

Wiring diagrams

1 N.O. + 1 N.C.

Mounted on right side

Mounted on left side

1 N.O. + 1 N.C.

Mounted on right side

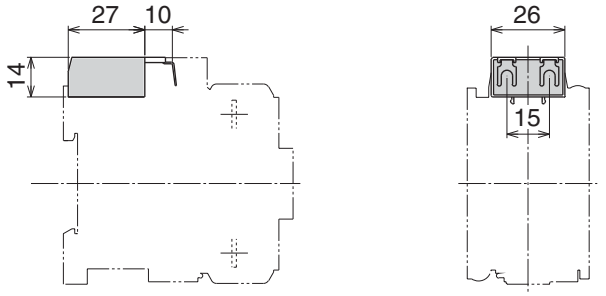
Mounted on left side

Fuji Duo Series SC-E Contactors

Dimensions (mm)

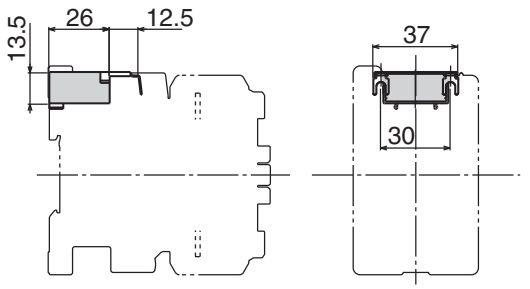
Coil surge suppression units

SZ-Z1, Z2, Z4, Z5



Weight: 14 g

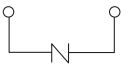
SZ-Z31, Z32, Z34, Z35, Z36, Z37



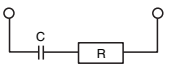
Weight: 15 g

Wiring diagrams

SC-E02 to E05-xxx + SZ-Z1, Z2
(Built-in varistor)

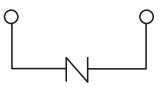


SC-E02 to E05-xxx + SZ-Z4, Z5
(Built-in capacitor/resistor)



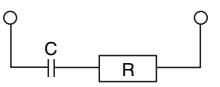
SC-E1 to E4-xxx + SZ-Z31, Z32

(Built-in varistor)



SC-E1 to E4-xxx + SZ-Z34, Z35
(Built-in capacitor/resistor)

SC-E1G to E4G-xxx + SZ-Z36, Z37
(Built-in capacitor/resistor)



Fuji Duo Series TK-E Overload Relays

TK-E series thermal overload relays with open-phase protective 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)
- Isolated NO and NC contacts can be used with different potentials
- 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 of the TK-E02, E2, and E3-xxx models

TK-E02-900

TK-E3-5000

TK-E2-800

TK-E5-3600

Standards

UL listed, file E44592, Standard UL 508
cUL listed, file E44592, CSA C22.2 No. 14
IEC 60947-4-1, EN60947-4-1
VDE 0660, JIS C 8201-4-1
CE Compliant

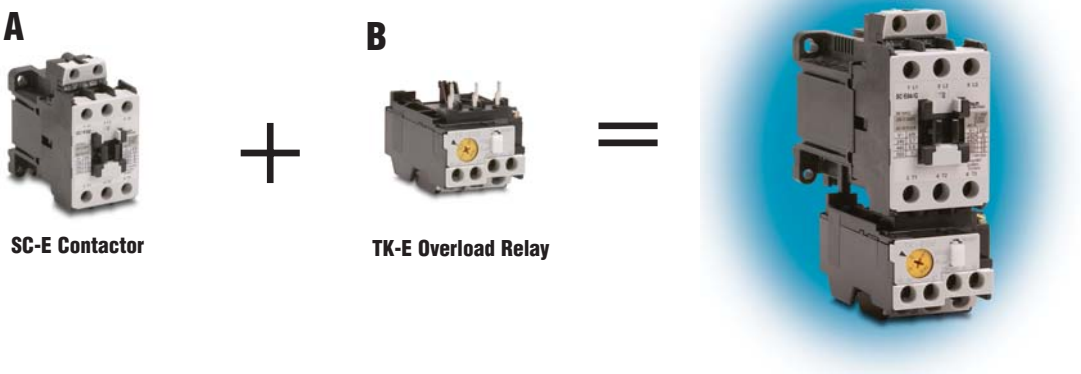
TK-E6-6500

TK-E Series Overloads			
Part Number	Price	Amperage Adjustment Range (A)	Frame Width/ Contactor
TK-E02-15	<--->	0.1 - 0.15	53mm SC-E02(G) through SC-E05(G) For separate mounting, use with optional base unit SZ-HCE on page 17-26
TK-E02-20	<--->	0.13 - 0.2	
TK-E02-24	<--->	0.15 - 0.24	
TK-E02-30	<--->	0.2 - 0.3	
TK-E02-36	<--->	0.24 - 0.36	
TK-E02-54	<--->	0.36 - 0.54	
TK-E02-72	<--->	0.48 - 0.72	
TK-E02-96	<--->	0.64 - 0.96	
TK-E02-120	<--->	0.8 - 1.2	
TK-E02-145	<--->	0.95 - 1.45	
TK-E02-220	<--->	1.4 - 2.2	
TK-E02-260	<--->	1.7 - 2.6	
TK-E02-340	<--->	2.2 - 3.4	
TK-E02-420	<--->	2.8 - 4.2	
TK-E02-600	<--->	4.0 - 6.0	
TK-E02-800	<--->	5.0 - 8.0	
TK-E02-900	<--->	6.0 - 9.0	
TK-E02-1100	<--->	7.0 - 11.0	
TK-E02-1300	<--->	9.0 - 13.0	
TK-E02-1800	<--->	12 - 18	
TK-E02-2200	<--->	16 - 22	
TK-E02-2500	<--->	20 - 25	

TK-E Series Overloads (continued)			
Part Number	Price	Amperage Adjustment Range (A)	Frame Width/ Contactor
TK-E2-600	<--->	4 - 6	54mm SC-E1(G) through SC-E2S(G) For separate mounting, use with optional base unit SZ-HDE on page 17-26
TK-E2-800	<--->	5 - 8	
TK-E2-900	<--->	6 - 9	
TK-E2-1100	<--->	7 - 11	
TK-E2-1300	<--->	9 - 13	
TK-E2-1800	<--->	12 - 18	
TK-E2-2600	<--->	18 - 26	
TK-E2-3600	<--->	24 - 36	
TK-E2-4200	<--->	32 - 42	
TK-E2-5000	<--->	40 - 50	
TK-E2-5400	<--->	44 - 54	
TK-E3-1100	<--->	7 - 11	68mm SC-E3(G) through SC-E4(G) For separate mounting, use with optional base unit SZ-HEE on page 17-24
TK-E3-1300	<--->	9 - 13	
TK-E3-1800	<--->	12 - 18	
TK-E3-2600	<--->	18 - 26	
TK-E3-3600	<--->	24 - 36	
TK-E3-4000	<--->	28 - 40	
TK-E3-5000	<--->	34 - 50	
TK-E3-6500	<--->	45 - 65	
TK-E3-6800	<--->	48 - 68	
TK-E3-8000	<--->	64 - 80	

TK-E Series Overloads (continued)			
Part Number	Price	Amperage Adjustment Range (A)	Frame Width/ Contactor
TK-E5-2600	<--->	18 - 26	76.5mm SC-E5
TK-E5-3600	<--->	24 - 36	
TK-E5-4000	<--->	28 - 40	
TK-E5-5000	<--->	34 - 50	
TK-E5-6500	<--->	45 - 65	
TK-E5-9500	<--->	65 - 95	
TK-E5-10500	<--->	85 - 105	
TK-E6-6500	<--->	45 - 65	100mm SC-E6 SC-E7
TK-E6-8000	<--->	53 - 80	
TK-E6-9500	<--->	65 - 95	
TK-E6-12500	<--->	85 - 125	
TK-E6-16000	<--->	110 - 160	

Fuji Duo Series Contactor and Overload Relay Selection Tables



100-240V Single Phase Motor (1/3 to 25 hp)

Step 1. Select a contactor from page 17-5 based on motor voltage and horsepower.

Step 2. Select an overload relay from page 17-21 based on motor full load current.

Check the data plate on the motor for the hp, volts and full-rated amps.

Motor			
HP 5	Volts 460	Phase 3	Type P
RPM 1725	Amps 7.6	Hz 60	SF 1.15
Design B	AMB 40°C	Insul Class F	
Duty Cont	Encl TEFC	Code K	

Motor horsepower

Motor voltage

Motor full-load rated amperage (FLA)

Three Phase Motors - Refer to tables on following page

Step 1. Select a SC-E contactor from Column A based on motor voltage, and horsepower.

Step 2. Select a TK-E overload relay from Column B to work with the SC-E contactor selected in Step 1. The motor full load current (FLA) should be within the adjustable current range of the overload relay.

Fuji Duo Series Overload Relay Selection Tables

220-240V 3-Phase Motor (0.5 to 50 hp)[1]

Overload Relay Selection for 220–240V 3-phase motors				
Motor Rating		*A*	*B*	
Motor HP	*Motor Full Load Amperage (FLA)* [2]	*Contactor*	*Overload Relay*	
			Part Number	*Adjustable Current Range*
1/2	2.2	SC-E02-xxxx	TK-E02-260	1.7 to 2.6 Amps
3/4	3.5		TK-E02-420	2.8 to 4.2 Amps
1	4.2		TK-E02-600	4 to 6 Amps
1-1/2	6		TK-E02-800	5 to 8 Amps
2	6.8		TK-E02-900	6 to 9 Amps
3	9.6	SC-E03-xxxx	TK-E02-1300	9 to 13 Amps
5	15.2	SC-E04-xxxx	TK-E02-1800	12 to 18 Amps
7-1/2	22	SC-E05-xxxx	TK-E02-2500	20 to 25 Amps
10	28	SC-E1-xxxx	TK-E2-3600	24 to 36 Amps
15	42	SC-E2-xxxx	TK-E2-4200	32 to 42 Amps
20	54	SC-E3-xxxx	TK-E3-6500	45 to 65 Amps
25	68	SC-E4-xxxx	TK-E3-6800	48 to 68 Amps
30	80	SC-E5-xxxx	TK-E5-9500	65 to 95 Amps
40	104	SC-E6-xxxx	TK-E6-12500	85 to 125 Amps
50	130	SC-E7-xxxx	TK-E6-16000	110 to 160 Amps

Note 1: For 220-240 V three-phase motors up to 150 hp refer to the Fuji Odyssey series.

Note 2: Per NEC 2005 table 430.250

440-480V 3-Phase Motor (0.5 to 100 hp)[1]

Overload Relay Selection for 440–480V 3-phase motors				
Motor Rating		*A*	*B*	
Motor HP	*Motor Full Load Amperage (FLA)* [2]	*Contactor*	*Overload Relay*	
			Part Number	*Adjustable Current Range*
1/2	1.1	SC-E02-xxxx	TK-E02-145	0.95 to 1.45 Amps
3/4	1.6	SC-E02-xxxx	TK-E02-220	1.4 to 2.2 Amps
1	2.1	SC-E02-xxxx	TK-E02-260	1.7 to 2.6 Amps
1-1/2	3.0	SC-E02-xxxx	TK-E02-420	2.8 to 4.2 Amps
2	3.4	SC-E02-xxxx	TK-E02-420	2.8 to 4.2 Amps
3	4.8	SC-E02-xxxx	TK-E02-600	4 to 6 Amps
5	7.6	SC-E02-xxxx	TK-E02-900	6 to 9 Amps
7 1/2	11	SC-E03-xxxx	TK-E02-1300	9 to 13 Amps
10	14	SC-E04-xxxx	TK-E02-1800	12 to 18 Amps
15	21	SC-E05-xxxx	TK-E02-2500	20 to 25 Amps
20	27	SC-E1-xxxx	TK-E2-3600	24 to 36 Amps
25	34	SC-E1-xxxx	TK-E2-4200	32 to 42 Amps
30	40	SC-E2-xxxx	TK-E2-4200	32 to 42 Amps
40	52	SC-E3-xxxx	TK-E3-6500	45 to 65 Amps
50	65	SC-E5-xxxx	TK-E3-6800	48 to 68 Amps
60	77	SC-E5-xxxx	TK-E5-9500	65 to 95 Amps
75	96	SC-E6-xxxx	TK-E6-12500	85 to 125 Amps
100	124	SC-E7-xxxx	TK-E6-16000	110 to 160 Amps

Note 1: For 440-480 V three-phase motors up to 300 hp refer to the Fuji Odyssey series.

Note 2: Per NEC 2005 table 430.250

Fuji Duo Series TK-E Overload Relays

Standard Operating 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

Specifications

Model	*Applicable Contactor Non-reversing*	*Auxilliary Contact*	*Trip Class IEC 60947-4-1*	*No. of Heater Elements*	*Power Consumption per Pole (VA)*	*Features*
TK-E02-xxx	SC-E02, E03, E04, E05-xxx	1NO+1NC	10A	3	2.2	Overload, open-phase protection, Ambient temperature compensation, Manual/auto reset selectable, Manual trip mechanism, Trip indicator
TK-E2-xxx	SC-E1, E2, E2S-xxx				3.8	
TK-E3-xxx	SC-E3, E4-xxx				6.6	
TK-E5-xxx	SC-E5-xxx				6.6	
TK-E6-xxx	SC-E6, E7-xxx				8.0	

Auxiliary Contact Ratings - UL and CSA

Model	*Rated Insulation Voltage (V)*	*NEMA ICS 5-2000 Ratings* (note 1)				
		AC Ratings			*DC Ratings*	
		Designation	*Making VA*	*Breaking VA*	*Designation*	*Making/Breaking VA*
TK-E02-xxx to TK-E6-xxx	690	B600	3600	360	R300	28

Notes:

1. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 17-77.

Auxiliary contact ratings - JIS and IEC

Model	*Rated Insulation Voltage (A)*	*Rated Thermal Current (A)*	*Rated Operational Current (A)*				*Minimum Voltage and Current*
			AC Voltage (V)	*AC15 (Ind. load)*	*DC Voltage (V)*	*DC13 (Ind. load)*	
TK-E02-xxx	690	5	24	3 (0.3) *	24	1.1 (0.3)	3VDC, 5mA
			100-120	2.5 (0.3) *	100-120	0.28	
			200-240	2 (0.3) *	200-240	0.14	
			380-440	1 (0.3) *			
			500-600	0.6 (0.3) *			
TK-E2-xxx	690	5	24	3 (0.5) *	24	1.1 (0.3)	3VDC, 5mA
TK-E3-xxx			100-120	2.5 (0.5) *	100-120	0.28	
TK-E5-xxx			200-240	2 (0.5) *	200-240	0.14	
TK-E6-xxx			380-440	1 (0.5) *			
			500-600	0.6 (0.5) *			

Note: * In case of auto-reset type NO contact.

Fuji Duo Series TK-E Overload Relays

Wiring

Be sure to wire the relays correctly using the wiring diagrams on the supplied installation sheets. Main terminals for models TK-E02-xxx to TK-E6-xxx are wired using solid wires or stranded wires. Stranded wires or flexible stranded wires can be connected by twisting them together and crimping a sleeve (ferrule) onto them before connecting.

Tightening torque

If wires are not tightened sufficiently, they may become hot or loosen 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 these tables.

Wire Sizes, Tightening Torques - Main Circuit

Thermal Overload Relay Model	TK-E2-xxx	TK-E3-xxx	TK-E5-xxx	TK-E6-xxx
Single Stranded Wire (mm 2)	0.75 to 16	1.5 to 35		16 to 70
Flexible Stranded Wire with Sleeve (mm 2)	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.
Insulation Stripping Length	18 mm	21 mm		23 mm
Tool	Phillips screwdriver, H-type, No. 2 (ISO 8764); ADC part number DN-SP1 or DN-SP2	Hex. wrench 4 (ISO 2936)		
	Flat-blade screwdriver, 1 x 5.5 x L-type, B (ISO 2830); ADC part number DN-SS5			
Tightening Torque (N·m)	2.5	6		10

Note: 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 wires than the above.

Wire Sizes, Tightening Torques - Main Circuit

Thermal Overload Relay Type		TK-E02-xxx
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.
Insulation Stripping Length (mm)		11 mm
Terminal Screw Size		M4
Tool		Phillips screwdriver, H-type, No. 2 (ISO 8764); ADC part number DN-SP1 or DN-SP2
		Flat-blade screwdriver, 1 x 5.5 x L-type, B (ISO 2830); ADC part number DN-SS5
Tightening Torque [N·m (lb·in)]		1.2 to 1.5 (11 to 13)

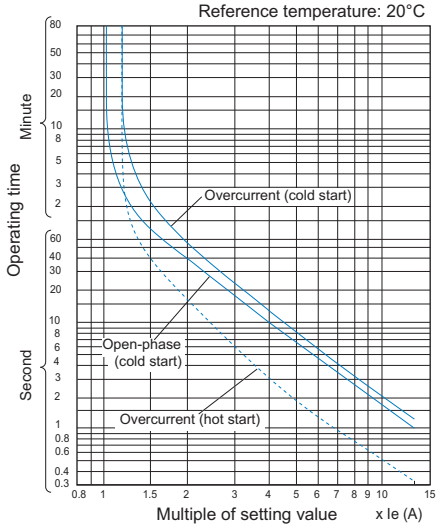
Wire Sizes, Tightening Torques - Control Circuit

Single Stranded Wire (mm^2)	One	0.75 to 2.5 (ø 1 to ø 1.6)
	Two	0.75 to 2.5
AWG	One	18 to 14
	Two	18 to 14
Insulation Stripping Length (mm)		10 mm
Fork Terminal		Max. 7.7mm wide (R2-3.5)
Terminal Screw Size		M3.5
Tool		Phillips screwdriver, H-type, No. 2 (ISO 8764); ADC part number DN-SP1 or DN-SP2
		Flat-blade screwdriver, 1 x 5.5 x L-type, B (ISO 2830); ADC part number DN-SS5
Tightening Torque [N·m (lb·in)]		0.8 to 1 (7 to 9)

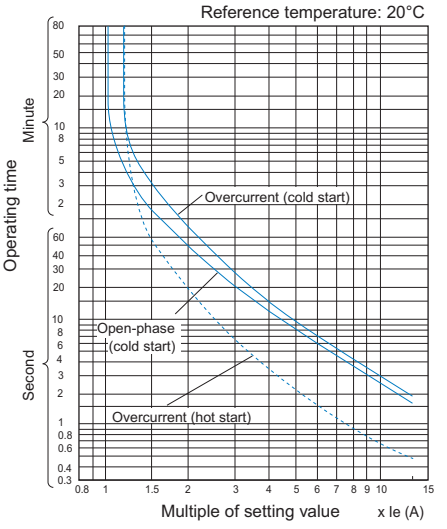
Fuji Duo Series TK-E Overload Relays

Operating characteristics

TK-E02-xxx



TK-E2 to E6 -xxx



Optional accessories

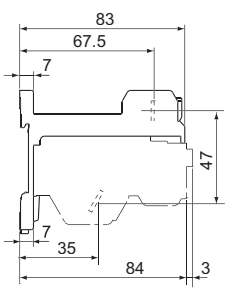
Base units for separate mounting

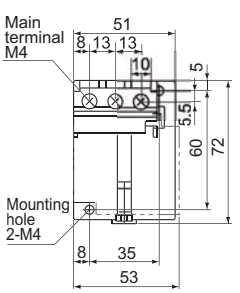
Allows TK-E02, E2, and E3 series thermal overload relays to be separately mounted to 35mm wide DIN rail, or screw mounted to panel.

Mounting Base Unit		
Part Number	***Applicable Overload Relays***	***Price***
SZ-HCE	TK-E02-xxx	<--->
SZ-HDE	TK-E2-xxx	<--->
SZ-HEE	TK-E3-xxx	<--->

SZ-HCE

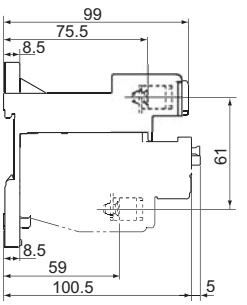
SZ-HCE

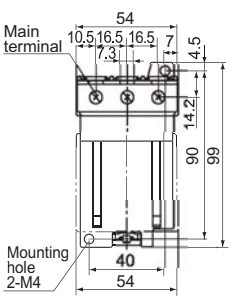




SZ-HDE

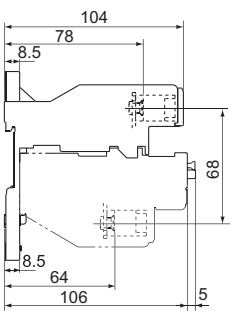
SZ-HDE

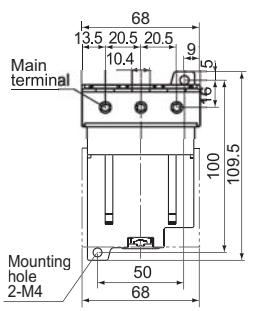




SZ-HEE

SZ-HEE



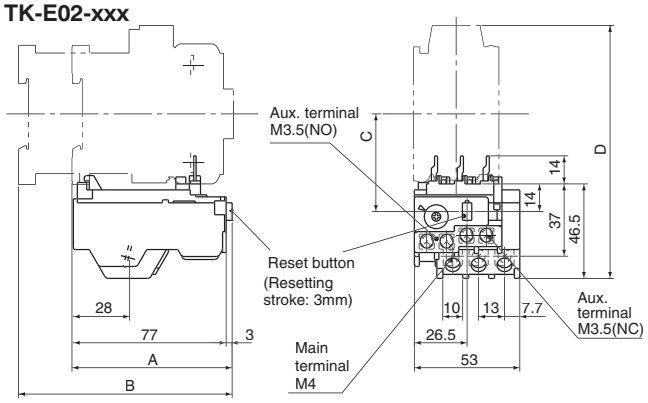


Fuji Duo Series TK-E Overload Relays

Dimensions (mm)

Overload relays

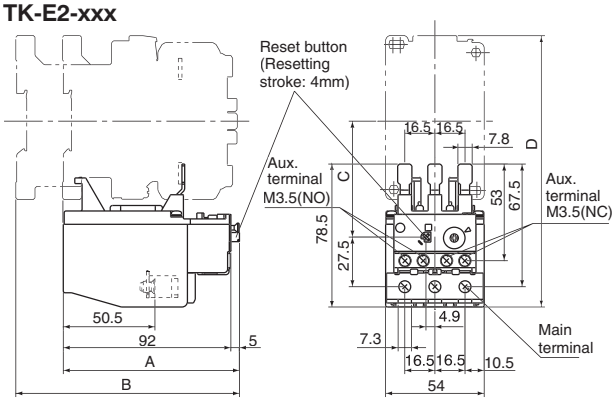
TK-E02-xxx



Contactor	A	B	C	D
SC-E02 to 05	80.5	-	49	127.5
SC-E02G to 05G	-	107.5	49	127.5

Weight: 0.13kg

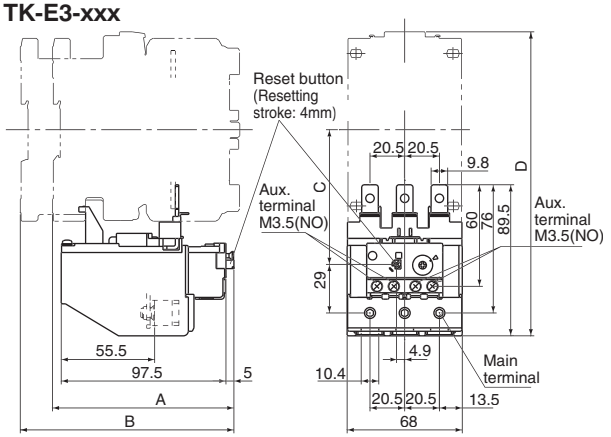
TK-E2-xxx



Contactor	A	B	C	D
SC-E1 to E2S	97	-	63.5	149
SC-E1G to E2SG	-	123	63.5	149

Weight: 0.25kg

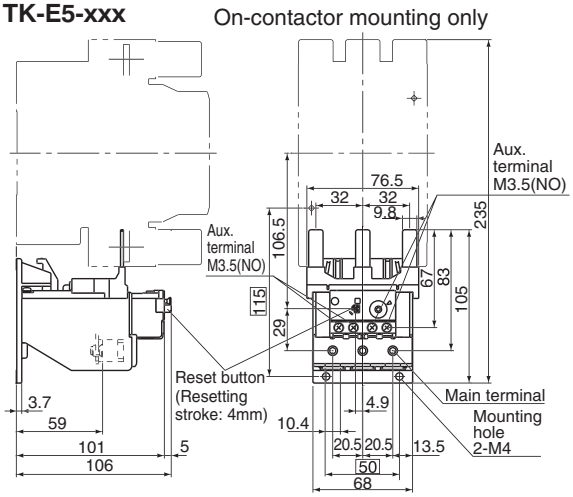
TK-E3-xxx



Contactor	A	B	C	D
SC-E3, E4	107.5	-	79.5	180
SC-E3, E4G	-	126.5	79.5	180

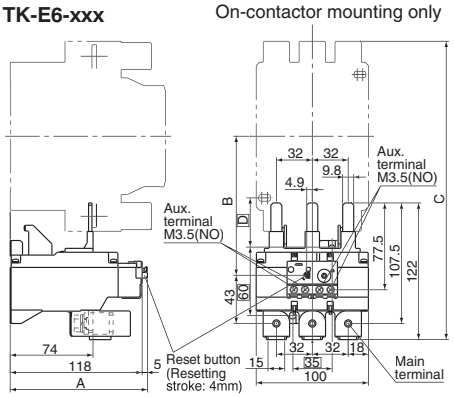
Weight: 0.34kg

TK-E5-xxx On-contactor mounting only



Weight: 0.37kg

TK-E6-xxx On-contactor mounting only

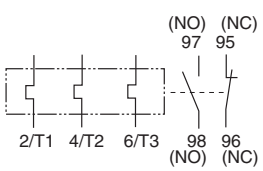


Contactor	A	B	C	D
SC-E6	123	124	266.5	45
SC-E7	123	129	274	50

Weight: 0.71kg

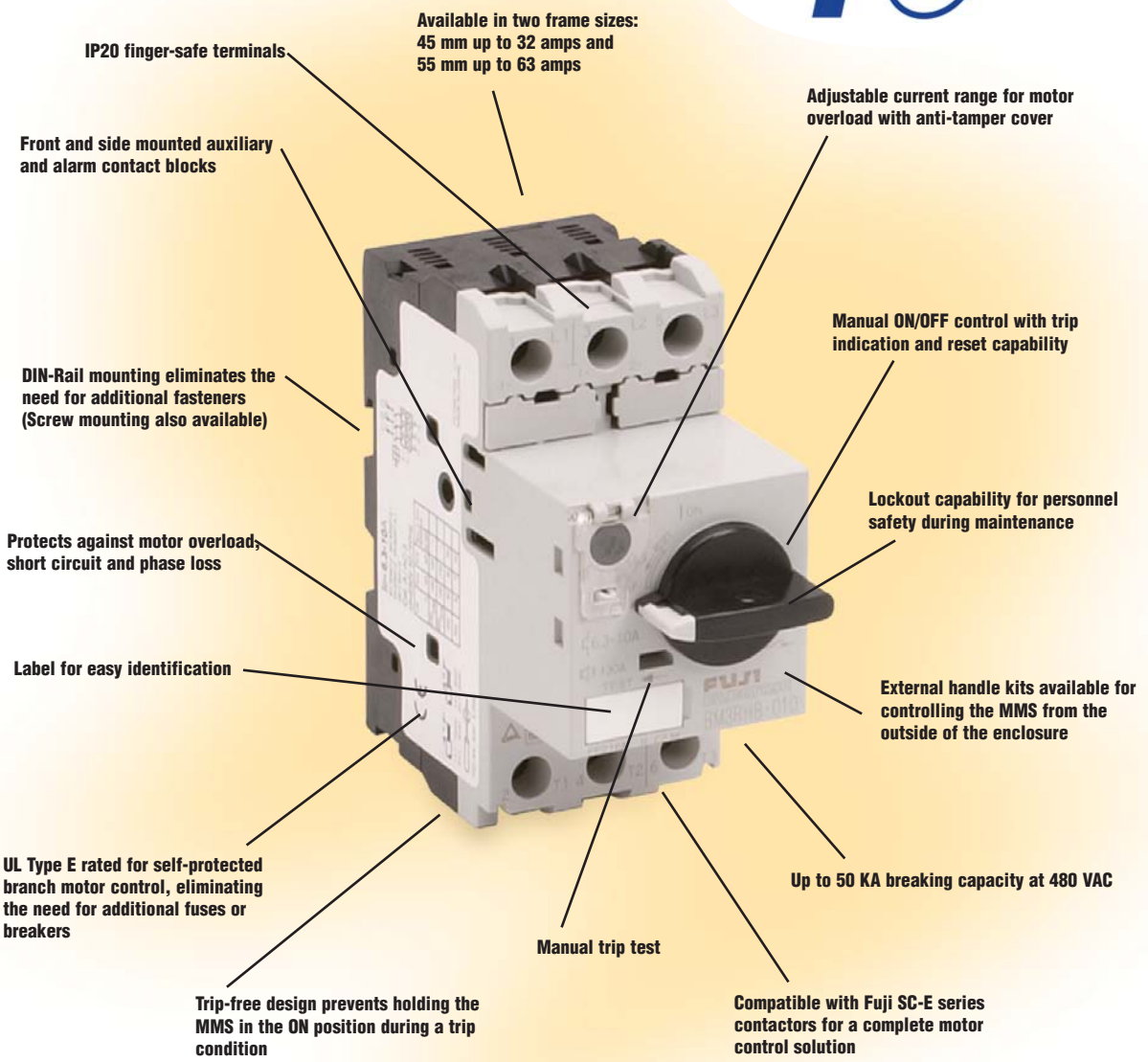
Wiring diagram

3-heater element



Fuji Duo Series Manual Motor Starters

The manual motor starter is a protective device for motor use that provides optimal protection by integrating the functions of a molded case circuit breaker and thermal overload relay into a compact unit. Since Fuji's MMS is UL listed for Category E self-protected motor control, it can be used for motor branch circuit protection without the need for additional protection such as fuses or molded case circuit breakers. The MMS is available in a 32A version with a 45 mm frame width, and a 63A version with a 55 mm frame width. Both MMS versions have high breaking capacities, up to 100,000A in some ranges. A wide range of accessories is available, including shunt trips and undervoltage releases.



Auxiliary and alarm contact blocks

Shunt trips and undervoltage releases

MMS external handles

MMS Busbars

Accessories

Fuji Duo Series Manual Motor Starters

General Information

Features

- Adjustable thermal-magnetic trip
- Available in two frame sizes, 45 mm width and 55 mm width
- A wide motor capacity range up to 40 hp, 3-phase (440/480 VAC, 63A); 60 hp @ 600 V
- Rotary handle operators
- On/Off and trip state indicators for all frames
- Max. breaking capacity of 100 kA (240 VAC)
- Common accessories to reduce inventory
- A wide rated operational current range of up to 32A for the 45 mm wide and 63A for the 55 mm wide starters
- ON/OFF and trip indicators for instant status recognition
- Accessories such as auxiliary contact blocks, shunt trip devices, and undervoltage trip devices are compatible with the 45 mm and 55 mm wide frame sizes
- External operating handles are available as optional accessories
- Lockout/tagout feature

Standards

- UL listed, file E163944, Standard UL 508
- cUL listed, file E163944, CSA C22.2 No.14
- TÜV, CE
- cULus listed for group installation per NEC 430-53(c)

BM3RHB-xxx Models (45mm wide)

Rated current: 0.16 to 32A

Rated insulation voltage: 690V

Operation handle: Rotary

Short circuit current rating:

- 100 kA at 240 VAC
- 50 kA at 480 VAC

NOTE: When using BM3RHB-xxx MMS in a UL Type E application, you must also use part numbers BZ0TKUAB (short-circuit contact block) and BZ0TCRE (line side terminal cover).

BM3VHB-xxx Models (55mm wide)

Rated current: 10 to 63A

Rated insulation voltage: 1000V

Operation handle: Rotary

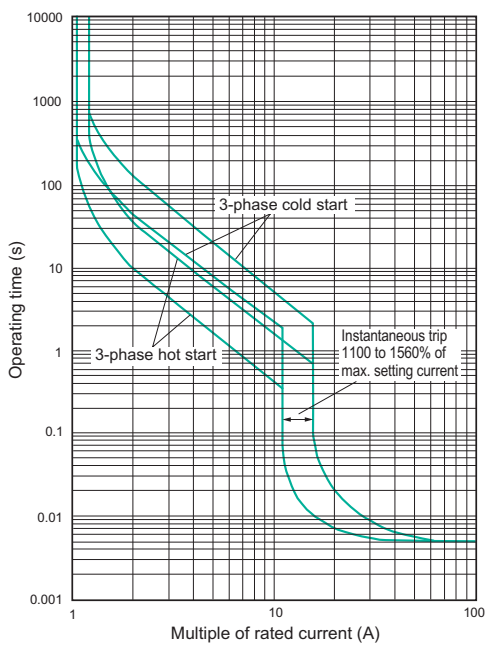
Short circuit current rating:

- 100 kA at 240 VAC
- 50 kA at 480 VAC

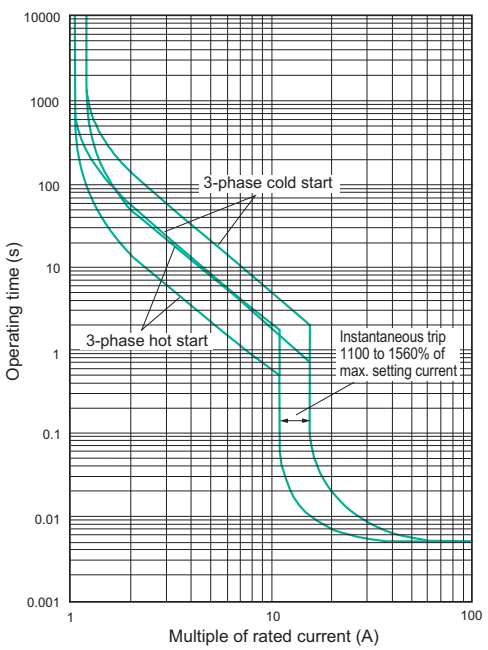
NOTE: When using BM3VHB-xxx MMS in a UL Type E application, you must also use part number BZ0TKUAB (short-circuit contact block).

Characteristic curves

BM3RHB



BM3VHB



Fuji Duo Series Manual Motor Starters

BM3RHB-xxx Specifications

General Specifications: 45 mm Frame Width - BM3RHB-XXX Series											
Part Number	Price	Adjustable Current Range	UL/CSA 3-Phase HP Rating[1]				Instant-aneous Trip Current (A)	UL/CSA Short Circuit Current Rating (kA)[2]			Max. Listed Branch Circuit Protection - Fuse or MCCB (A)[2]
		Ie: Min.-Max. (A)	200-208VAC	220-240VAC	440-480VAC	550-600VAC		240VAC	480VAC	600VAC	
BM3RHB-P16	<--->	0.1-0.16	Rated to motor full-load amperage		In accordance with motor full-load current		2.1	100	50	10	500
BM3RHB-P25	<--->	0.16-0.25					3.3	100	50	10	500
BM3RHB-P40	<--->	0.25-0.4					5.2	100	50	10	500
BM3RHB-P63	<--->	0.4-0.63					8.2	100	50	10	500
BM3RHB-001	<--->	0.63-1			1/2	1/2	13	100	50	10	500
BM3RHB-1P6	<--->	1-1.6	1/4	1/3	3/4	3/4	20.8	100	50	10	500
BM3RHB-2P5	<--->	1.6-2.5	1/2	1/2	1	1-1/2	32.5	100	50	10	500
BM3RHB-004	<--->	2.5-4	3/4	3/4	3	3	52	100	50	10	500
BM3RHB-6P3	<--->	4-6.3	1	1-1/2	5	5	81.9	100	50	10	500
BM3RHB-010	<--->	6.3-10	2	3	7-1/2	7-1/2	130	100	50	10	500
BM3RHB-013	<--->	9-13	3	3	10	10	169	100	50	10	500
BM3RHB-016	<--->	11-16	3	5	10	10	208	100	50	10	500
BM3RHB-020	<--->	14-20	5	5	15	15	260	100	50	10	500
BM3RHB-025	<--->	19-25	7-1/2	7-1/2	20	20	325	100	50	10	500
BM3RHB-032	<--->	24-32	10	10	30	30	416	100	50	10	500

Note 1: BM3RHB-xxx are cUL listed as HP rated motor controllers. *Note 2: BM3RHB-xxx are cUL listed for group installation per NEC430-53(C).*

General Specifications: 45 mm Frame Width - BM3RHB-XXX Series - continued		
Features		Adjustable thermal-magnetic trip type
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 x 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
Dimensions (mm) WxHxD		45x90x79
Weight (oz/g)		13.05 / 370
Optional Accessories	Auxiliary Contact Block	Yes
	Alarm Contact Block	Yes
	Auxiliary and Alarm Contact Block	Yes
	Short-Circuit Alarm Contact Block	Yes
	Shunt Trip Device	Yes
	Undervoltage Trip Device	Yes
	External Operating Handle	Yes
Standards & Agency Approvals		IEC 60947-1, 60947-2, 60947-4-1, UL 508 file E163944, CSA C22.2 No.14 file 20479

Fuji Duo Series Manual Motor Starters

BM3VHB-xxx Specifications

General Specifications: 55 mm Frame Width - BM3VHB-XXX Series											
Part Number	Price	Adjustable Current Range	UL/CSA 3-Phase hp Rating[1]				Instant-aneous Trip Current (A)	UL/CSA Short Circuit Current Rating (kA)[2]			Max. Listed Branch Circuit Protection - Fuse or MCCB (A)[2]
		Ie: Min.-Max. (A)	200-208VAC	220-240VAC	440-480VAC	550-600VAC		240VAC	480VAC	600VAC	
BM3VHB-010	<--->	6.3-10	2	3	5	7-1/2	130	100	50	10	600
BM3VHB-013	<--->	9-13	3	3	7-1/2	10	169	100	50	10	600
BM3VHB-016	<--->	11-16	3	5	10	10	208	100	50	10	600
BM3VHB-020	<--->	14-20	5	5	10	15	260	100	50	10	600
BM3VHB-025	<--->	19-25	7-1/2	7-1/2	15	20	325	100	50	10	600
BM3VHB-032	<--->	24-32	10	10	20	30	416	100	50	10	600
BM3VHB-040	<--->	28-40	10	10	30	30	520	100	50	10	600
BM3VHB-050	<--->	35-50	15	15	30	40	650	100	50	10	600
BM3VHB-063	<--->	45-63	20	20	40	60	819	100	50	10	600

Note 1: BM3VHB-xxx are cUL listed as HP rated motor controllers. *Note 2: BM3VHB-xxx are cUL listed for group installation per NEC430-53(C).*

General Specifications: 55 mm Frame Width - BM3VHB-XXX Series - continued		
Features		Adjustable thermal-magnetic trip type
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)		1,000
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
Dimensions (mm) WxHxD		55x110x96
Weight (oz/g)		27.51 / 780
Optional Accessories	Auxiliary Contact Block	Yes
	Alarm Contact Block	Yes
	Auxiliary and Alarm Contact Block	Yes
	Short-Circuit Alarm Contact Block	Yes
	Shunt Trip Device	Yes
	Undervoltage Trip Device	Yes
	External Operating Handle	Yes
Standards & Agency Approvals		IEC 60947-1, 60947-2, 60947-4-1, UL 508 file E163944, CSA C22.2 No.14 file 20479

Fuji Duo Series Manual Motor Starters

DIN-rail mounting

The MMS can be mounted to a 35 mm DIN rail. Secure the rail with screws at mounting pitch of less than 400 mm for the BM3R type and less than 300 mm for the BM3V type.

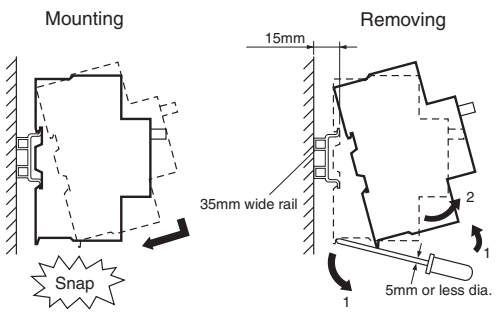
Applicable rail:

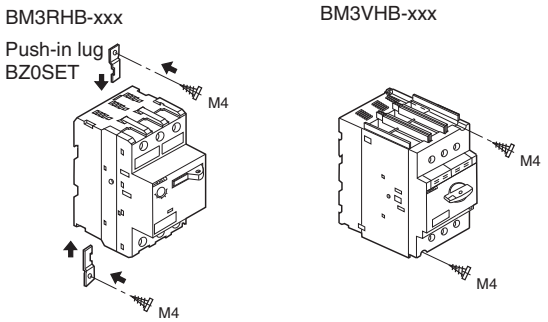
Use a 15 mm-high DIN rail, such as our DN-R35HS1, which conforms to EN-50022 and IEC715.

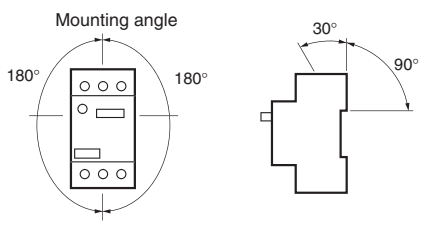
The standard DIN rail mounting direction is horizontal. When using the MMS on vertically mounted DIN rail, use end clamps.

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.







Wiring

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

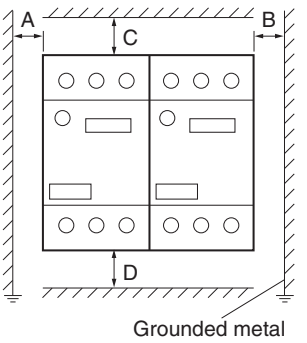
Environmental Specifications		
Ambient Temperature	Operating: -5 to +55°C Storage: -40 to +65°C	No sudden temperature changes resulting in condensation or icing.
Humidity	45 to 85%RH	
Altitude	2000m or lower	
Atmosphere	No excessive dust, smoke, corrosive gases, flammable gases, steam or salt.	
Vibration	10 to 55Hz 15m/s2	No abnormal shock or vibration.
Shock	50m/s2	

Wiring Specifications

Wire Size and Tightening Torque				
Type		***BM3RHB-XXX***	***BM3VHB-XXX***	***BZ0 Accessories***
Solid Wire (mm)		1.6 to 2.6 dia.	1.6 to 2.6 dia.	1 to 1.6 dia.
Stranded Wire (mm^2)	***Single-wire*** ***2-wire***	1 to 10 1 to 6	1 to 25 1 to 16	0.5 to 2.5 0.5 to 2.5
AWG	***Single-wire*** ***2-wire***	18 to 8 18 to 10	18 to 4 18 to 4	18 to 14 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.				

Arc Space Requirements

Arc Space Requirements			
Part Number	Rated operational voltage Ue	Minimum distance to grounded metal (mm)	
	(V)	A,B	C,D
BM3RHB-XXX	Up to 500	15	30
	Up to 690	40	50
BM3VHB-XXX	Up to 500	15	40
	Up to 690	40	50



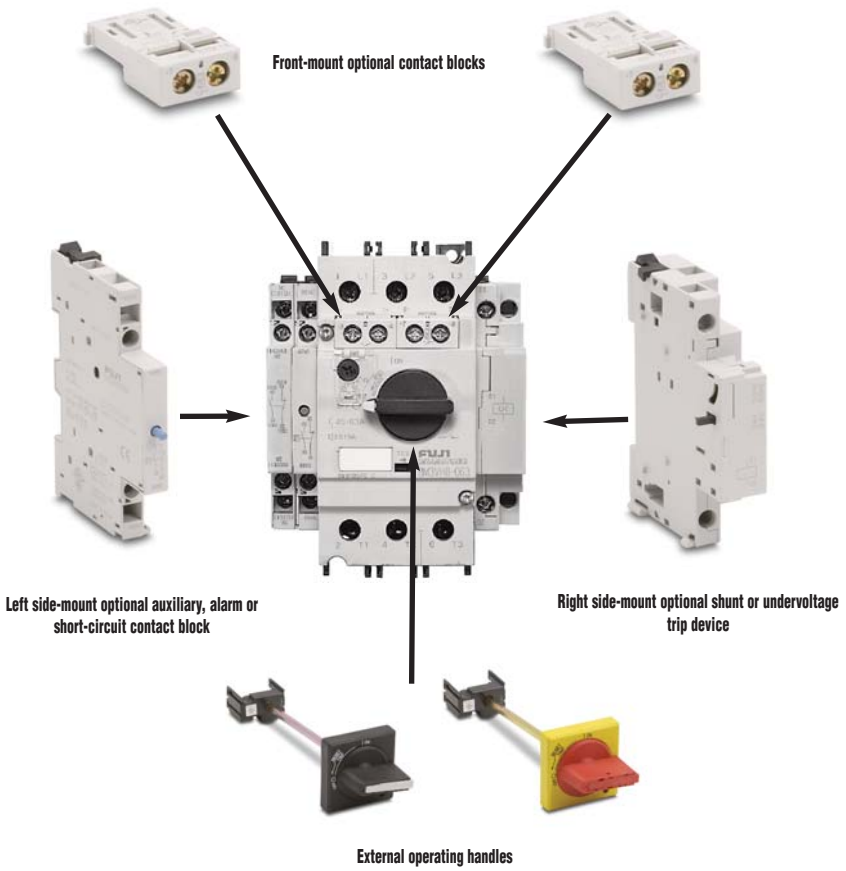
When frames are mounted side-by-side, operating conditions such as a high ambient temperature or using the maximum setting for continuous carrying current may cause slight changes in operating characteristics due to temperature rises. Under such conditions, it is recommended that the frames be separated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

Fuji Duo Series Manual Motor Starters Accessories

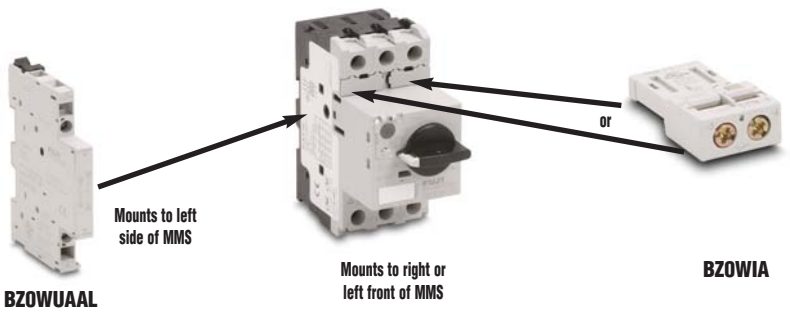
Optional accessories

- All accessories can be used with BM3R (45 mm wide) and BM3V (55 mm wide) frames
- Accessories are easily mounted
- Internally-mountable auxiliary contact blocks and alarm contact blocks can be front mounted
- Side-mountable auxiliary contact blocks can be mounted on the left side
- Shunt trip and undervoltage trip devices are available in a wide operating coil voltage range and mount on the right side
- Standard and emergency external handles are available
- IP20 terminal cover helps prevent accidental contact with electrically charged parts
- Optional front mounted contact and alarm blocks eliminate horizontal space needed with the DIN rail

Installation of optional contact blocks and trip devices



Auxiliary contact blocks



Auxiliary Contact Blocks						
Part Number	***Price***	***Description***	***Starter Type***	***Mounting***	***Contact Arrangement***	***Weight (g/lb)***
BZ0WIA	<--->	These contact blocks do not discriminate between OFF, overload, phase-loss, or short circuit. The blocks are linked to the ON/OFF operation of the MMS, and also operate in the event of an overload, phase-loss, or short circuit. Up to two contact blocks can be mounted to the right/left front, and up to two contact blocks can be mounted to the left sides.	BM3RHB-XXX BM3VHB-XXX	Front	1NO	9/0.02
BZ0WIB	<--->				1NC	
BZ0WUAAL	<--->			Left side	2NO	45/0.1
BZ0WUABL	<--->				1NO + 1NC	
BZ0WUBBL	<--->				2NC	

Fuji Duo Series Manual Motor Starters Accessories

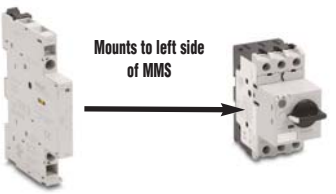
Accessories (continued)

Alarm contact blocks

BZ0KIA

Alarm Contact Blocks						
Part Number	*Price*	*Description*	*Starter Type*	*Mounting*	*Contact Arrangement*	*Weight (g/lb)*
BZ0KIA	<--->	• 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.***	BM3RHB-XXX BM3VHB-XXX	Front (Right side only)	1NO	9/0.02
BZ0KIB	<--->				1NC	

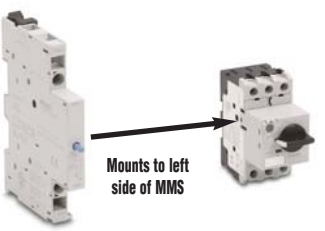
Auxiliary and alarm contact blocks



BZ0WKUAA

Combination Auxiliary/Alarm Contact Blocks						
Part Number	*Price*	*Description*	*Starter Type*	*Mounting*	*Contact Arrangement*	*Weight (g/lb)*
BZ0WKUAA	<--->	• This contact block combines an auxiliary contact and an alarm contact that operates 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.***	BM3RHB-XXX BM3VHB-XXX	Left	1NO (Aux.) + 1NO (Alarm)	45/0.1

Short-circuit alarm contact blocks



BZ0TKUAB

Note 1: Required when using MMS in a UL Type E application.

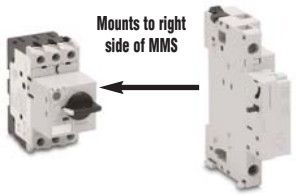
Note 2: Do not configure this with an auxiliary contact block; the contact will only close when a short circuit occurs.

Short-Circuit Alarm Contact Block						
Part Number	*Price*	*Description*	*Starter Type*	*Mounting*	*Contact Arrangement*	*Weight (g/lb)*
BZ0TKUAB	<--->	• The contacts operate only when the MMS has tripped due to a short-circuit (cannot be checked with trip test function). • 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: Be sure to press the reset button before mounting to the MMS.	BM3RHB-XXX BM3VHB-XXX	Left	1NO + 1NC	45/0.1

Fuji Duo Series Manual Motor Starters Accessories

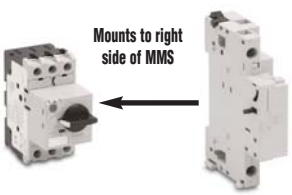
Accessories (continued)

Shunt trip devices



BZ0FAZU

Shunt Trip Devices						
Part Number	***Price***	***Description***	***Starter Type***	***Mounting***	***Contact Arrangement***	***Weight (g/lb)***
BZ0FAZU	<--->	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.***	BM3RHB-XXX BM3VHB-XXX	Right	24V 50/60Hz	115/0.25
BZ0FDZU	<--->				110-127V 50Hz/120V 60Hz	
BZ0FKZUD	<--->				24-60VDC (time rating of coil is 5s)	



BZ0RDZU

Undervoltage trip devices

Undervoltage Trip Devices						
Part Number	***Price***	***Description***	***Starter Type***	***Mounting***	***Contact Arrangement***	***Weight (g/lb)***
BZ0RAZ2U	<--->	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.***	BM3RHB-XXX BM3VHB-XXX	Right	24V 60Hz	115/0.25
BZ0RDZU	<--->				110-127V 50Hz/120V 60Hz	
BZ0R4ZU	<--->				415-440V 50Hz/460-480V 60Hz	

BZ0SET

Push-in lug

Push-in Lug				
Part Number	***Price***	***Description***	***Starter type***	***Weight (g/lb)***
BZ0SET	<--->	Push-in mounting lug. Required for screw mounting of MMS; quty: 10/pkg ***Note: See page 17-32 for installation instructions***	BM3RHB-XXX	2.0/.004

BZ0TCRE

Terminal Cover

Terminal Cover			
Part Number	***Price***	***Description***	***Starter Type***
BZ0TCRE	<--->	Line side terminal cover. ***Note: BZ0TCRE required only when using BM3RHB-xxx MMS in a UL Type E application (along with short circuit alarm contact block BZ0TKUAB).***	BM3RHB-XXX

Fuji Duo Series Manual Motor Starters Accessories

Accessories (continued)

External operating handles

BZ0VBBL

BZ0VYRL

External Operating Handles					
Part Number	***Price***	***Description***	***Starter Type***	***Handle Type***	***Weight (g/lb)***
BZ0VBBL	<--->	• 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. • Door interlock function • OFF lock function • Can be locked OFF with up to three padlocks. Note: Padlocks are to be provided by the customer. • Release screw allows the door to be opened with the handle in the ON position. • IP54 enclosure	BM3RHB-XXX	Standard (black)	160/0.35
BZ0VYRL	<--->			Emergency (red/yellow)	160/0.35
BZ0VBBM	<--->		BM3VHB-XXX	Standard (black)	160/0.35
BZ0VYRM	<--->			Emergency (red/yellow)	160/0.35

NOTE: Premade MMS enclosures are currently not available.

Accessory specifications

Trip Device Specifications			
Accessory Type and Part Number		Shunt trip device	Undervoltage device
		BZ0Fxxx	BZ0Rxxx
Standard		IEC 60947-1, UL 508	
Rated Insulation Voltage (VAC)	***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 1.1 Ue	0.35 to 0.7 Ue
	Closing Voltage (V)	-	0.85 to 1.1 Ue
Time Rating of Coil (s)		AC: Continuous	AC: Continuous
		DC: 5	

Fuji Duo Series Manual Motor Starters Accessories

Accessory specifications (continued)

Contact Block Specifications						
Accessory Type and Part Number		Auxiliary contact block/front	Auxiliary contact block/side	Alarm contact block	Aux. and alarm contact block	Short-circuit alarm contact block
		BZ0WIA, BZ0WIB *(note 3)*	***BZ0WUAAL, BZ0WUABL, BZ0WUBBL***	***BZ0KIA, BZ0KIB*** *(note 3)*	***BZ0WKUAA***	***BZ0TKUAB***
Standard		IEC 60947-5-1, UL 508				
Rated Operational Current (A)	***48VAC AC-15*** *(note 2)*	5	6	5	6	6
	125VAC	3	4	3	4	4
	230VAC	1.5	4	1.5	4	4
	400VAC	(note 3)	2.2	(note 3)	2.2	2.2
	500VAC		1.5		1.5	1.5
	690VAC		0.6		0.6	0.6
	48VDC DC-13 *(note 2)*	1.38	5	1.38	5	5
	110VDC	0.55	1.3	0.55	1.3	1.3
	220VDC	0.27	0.5	0.27	0.5	0.5
Contact Rating Code UL 508 *(note 1)*	***AC***	B300	A600	B300	A600	A600
	DC	Q300	P300	Q300	P300	P300
Min. Voltage and Current		17V / 5mA				

Note 1: NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 17-77.

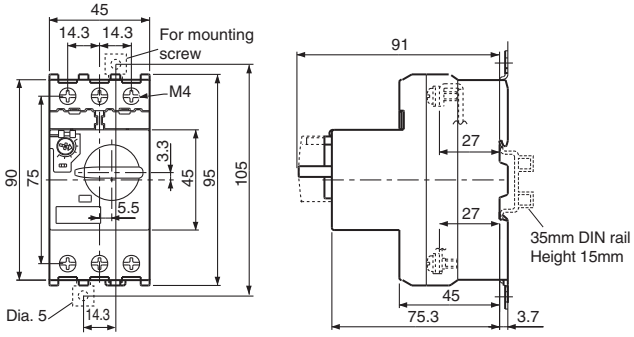
Note 2: IEC utilization category. For more information, refer to page 17-78.

Note 3: The indicated contacts should not be used in control circuits higher than 300V.

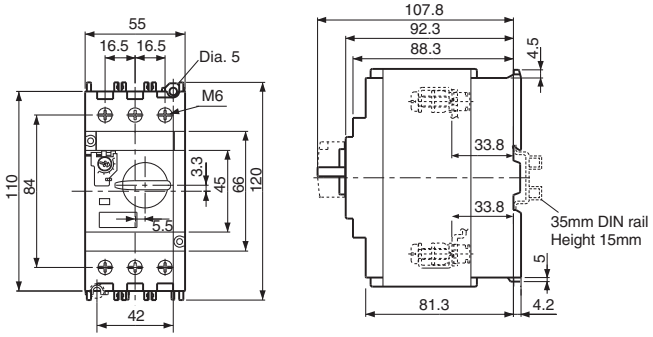
Dimensions (mm)

Manual motor starters

Rotary handle types BM3RHB-xxx



Rotary handle types BM3VHB-xxx

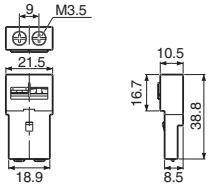


Fuji Duo Series Manual Motor Starters Accessories

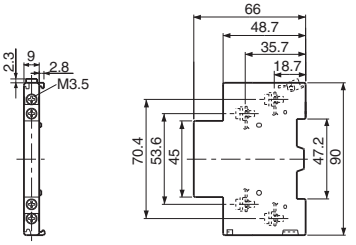
Dimensions (continued - mm)

Accessories

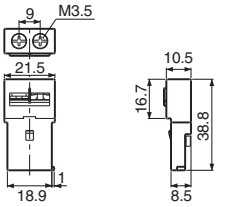
Auxiliary contact blocks, front mounting
BZ0WIA, BZ0WIB



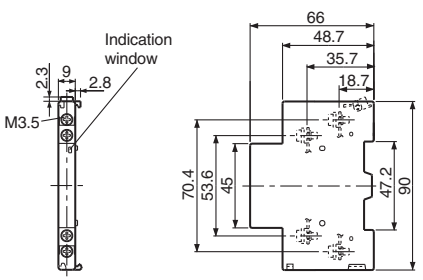
Auxiliary contact blocks, side mounting
BZ0WUAAL, BZ0WUABL, BZ0WUBBL



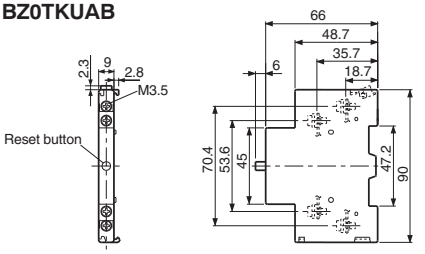
Alarm contact blocks, front mounting
BZ0KIA, BZ0KIB



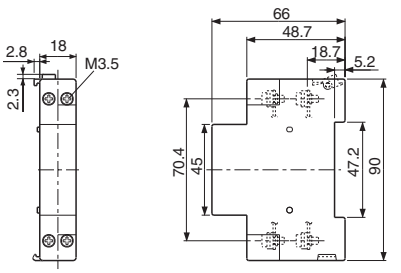
Auxiliary and alarm contact blocks
BZ0WKUAA



Short-circuit alarm contact block
BZ0TKUAB

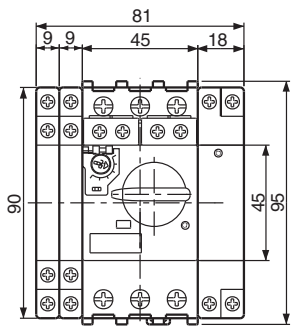


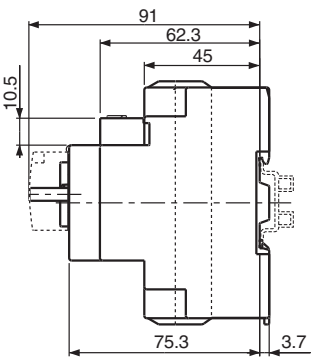
Shunt trip devices BZ0Fxxxx
Undervoltage trip devices BZ0Rxxxx



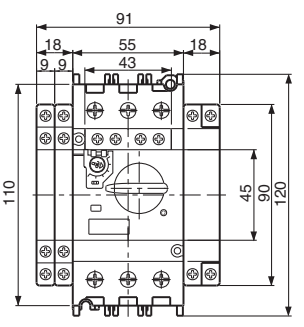
MMS with accessories

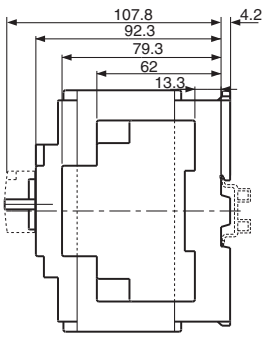
BM3RHB-xxx + BZ0xxxxx





BM3VHB-xxx + BZ0xxxxx



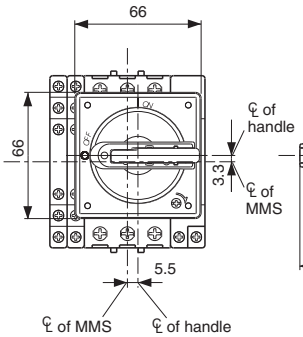


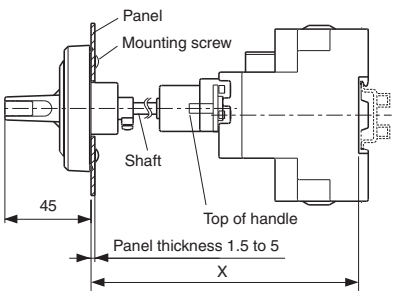
Fuji Duo Series Manual Motor Starters Accessories

Dimensions (continued - mm)

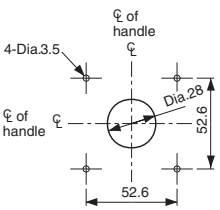
External operation handle dimensions and panel drilling

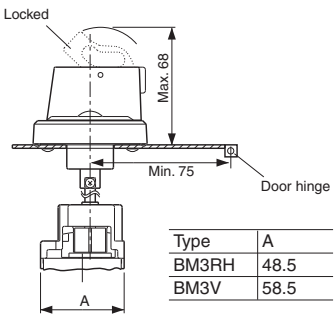
External operation handle BZ0Vxxx





Panel drilling



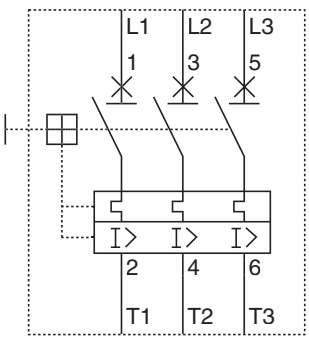


Type	X min.	X max.
BZ0VBBL, BZ0VYRL	139 ±2	289 ±2
BZ0VBBM, BZ0VYRM	156 ±2	306 ±2

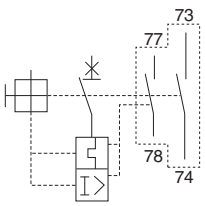
Type	A
BM3RH	48.5
BM3V	58.5

Wiring diagrams

MMS

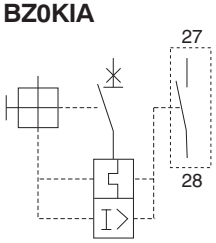


Auxiliary and alarm contact blocks BZ0WKUAA

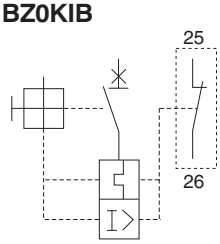


Alarm contact blocks
Front mounting

BZ0KIA



BZ0KIB



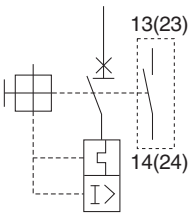
Fuji Duo Series Manual Motor Starters Accessories

Wiring diagrams (continued)

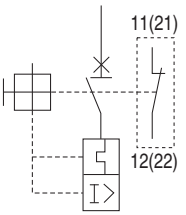
Auxiliary contact blocks

Front mounting

BZ0WIA

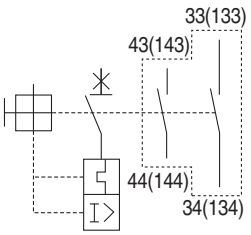


BZ0WIB

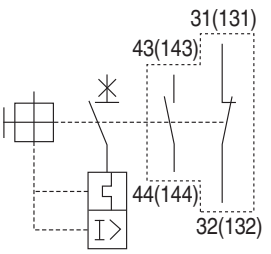


Side mounting

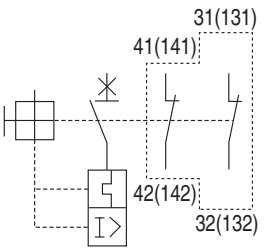
BZ0WUAAL



BZ0WUABL

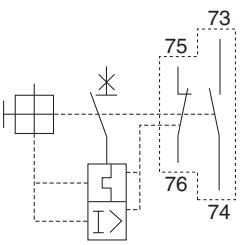


BZ0WUBBL



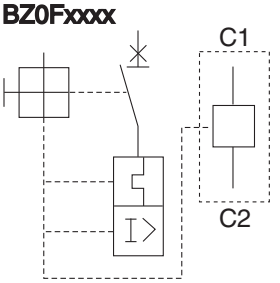
Short-circuit alarm contact blocks

BZ0TKUAB



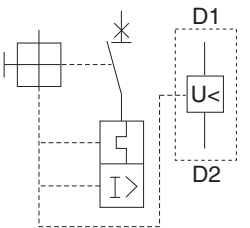
Shunt trip devices

BZ0Fxxxx



Undervoltage trip devices

BZ0Rxxxx

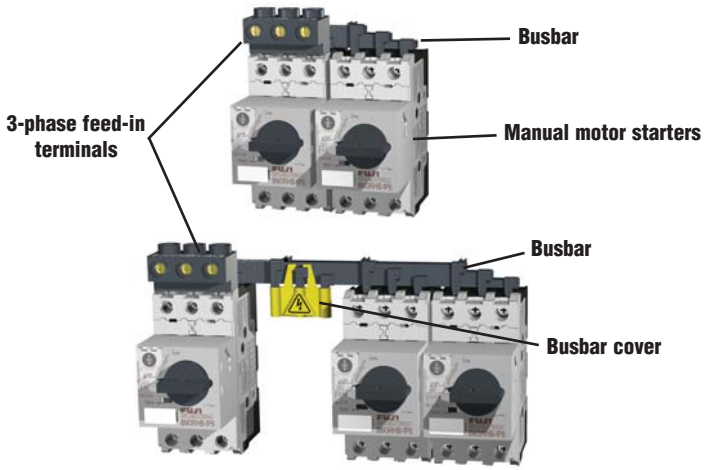


Fuji Duo Series Manual Motor Starters Accessories

Busbar system

Features

- The busbar system reduces wiring time and saves floor space.
- 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 touching of nonconnected busbar terminals (charged parts).




BZ0BR02A


BZ0BR03A


BZ0BR04A


BZ0BR05A


BZ0BR12A


BZ0BR13A


BZ0BR14A


BZ0BR15A


BZ0BV02A


BZ0BV03A

Note: Busbar photos continued on next page.


BZ0BFRA


BZ0BFVA


BZ0BCRA


BZ0BCVA

Busbar System Components and Ratings

Part Number	Price	Description	Used with	Specifications		Weight (g)
BZ0BR02A	<--->	Busbar	BM3R	Continuous current: 64A max. pin connection	2-BM3R, modular space: 45mm	30
BZ0BR03A	<--->				3-BM3R, modular space: 45mm	50
BZ0BR04A	<--->				4-BM3R, modular space: 45mm	70
BZ0BR05A	<--->				5-BM3R, modular space: 45mm	90
BZ0BR12A	<--->		BM3R+ 1 external accessory, 9mm wide		2-BM3R, modular space: 54mm	30
BZ0BR13A	<--->				3-BM3R, modular space: 54mm	55
BZ0BR14A	<--->				4-BM3R, modular space: 54mm	80
BZ0BR15A	<--->				5-BM3R, modular space: 54mm	105
BZ0BV02A	<--->		BM3V	Continuous current: 126A max. pin connection	2-BM3V, modular space: 55mm	140
BZ0BV03A	<--->				3-BM3V, modular space: 55mm	240
BZ0BV04A	<--->				4-BM3V, modular space: 55mm	340
BZ0BV12A	<--->		BM3V + 1 external accessory, 9mm wide		2-BM3V, modular space: 64mm	150
BZ0BV13A	<--->				3-BM3V, modular space: 64mm	270
BZ0BV14A	<--->				4-BM3V, modular space: 64mm	380
BZ0BFRA	<--->	3-phase feed-in terminal	BM3R	Continuous current: 64A max. Applicable cable size: 25mm^2 max.		40
BZ0BFVA	<--->		BM3V	Continuous current: 126A max. Applicable cable size: 50mm^2 max.		170
BZ0BCRA	<--->	Busbar cover	BZ0BR	For pin connection NOTE: Some fine tuning and fitting adjustments may be needed.		10
BZ0BCVA	<--->		BZ0BV			5

Fuji Duo Series Manual Motor Starters Accessories

Busbar system (continued)

BZ0BV04A

BZ0BV12A

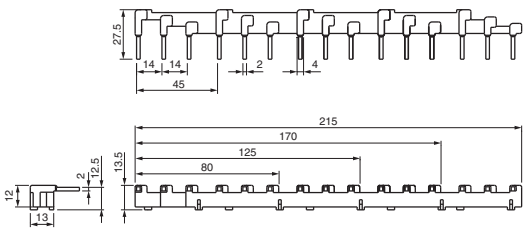
BZ0BV13A

BZ0BV14A

Dimensions (mm)

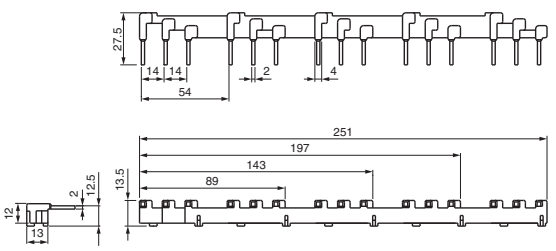
For BM3RHB-xxx

BZ0BR0xx Without external accessory



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

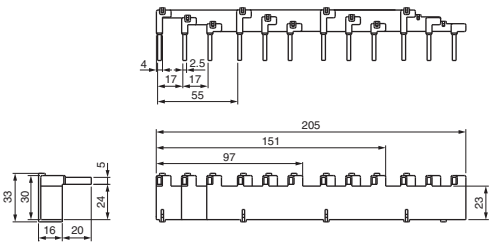
BZ0BR1xx With 1 external accessory



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

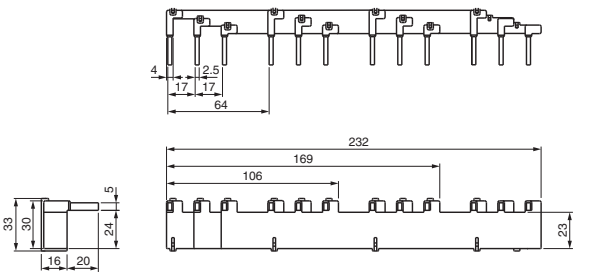
For BM3VHB-xxx

BZ0BV0xx Without external accesssory



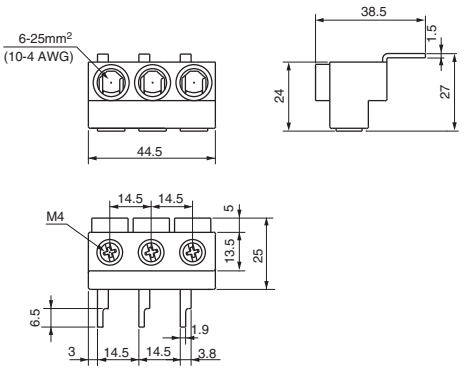
BZ0BV02A: 97 mm
BZ0BV03A: 151 mm
BZ0BV04A: 205 mm

BZ0BV1xx With 1 external accessory, 9mm wide

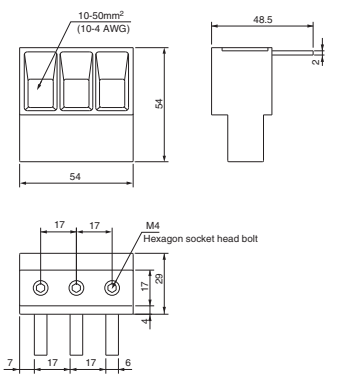


BZ0BV12A: 106 mm
BZ0BV13A: 169 mm
BZ0BV14A: 232 mm

BZ0BFRA 3-phase feed-in terminals



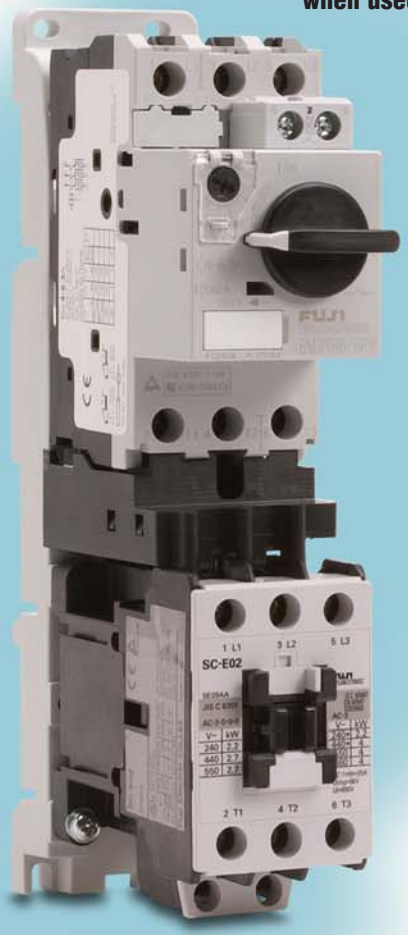
BZ0BFVA



Building a Fuji Duo Series Combination Starter

The Fuji SC-E series contactors work with the MMS to create starters for particular applications. The MMS combination starters can accommodate motors up to 40 horsepower at 480 VAC or 60 horsepower at 600 VAC.

1/2 to 40 hp at 480 V when used with SC-E contactor



Combination starters used for:

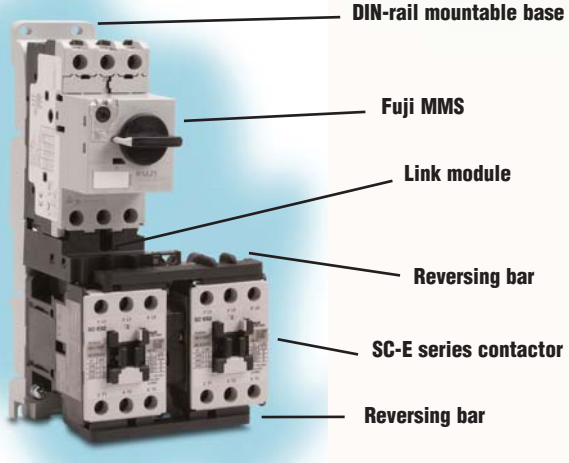
- Induction motor starting and control
- Fulfillment of NEC 430
- UL508E, type 2 coordination for group motor rating installation (See parts list for details)

SC-E Series Contactor Features

- 1/2 to 40 hp at 480 V
- AC and DC coils with a wide range of voltages
- Finger protection terminals
- Compact frame sizes (45 mm and 55 mm)
- IEC-947, UL, CSA, CE

Manual Motor Starter Features

- Circuit breaker functions plus overload relay functions in a highly compact unit
- Two frame sizes up to 63A
- Multiple coil voltages
- IEC-947
- UL listed, file E211710, Standard 508
- cUL listed, file E211710, Standard CSA C22.2 No. 14



MMS reversing starter

Build your MMS reversing starter from these Fuji components. Reversing busbars and mechanical interlocks are designed to integrate with the MMS and SC-E series contactors.

Fuji Duo Series Combination Starters

General information

Description

The user can assemble a combination starter by combining a BM3 series manual motor starter and an SC-E series magnetic contactor to achieve a compact motor control that minimizes enclosure space requirements.

The manual motor starter provides overload, phase-loss, and short-circuit protection for the motor circuit, and incorporates a dial for flexible adjustment to match the full load current of the motor.

The magnetic contactor allows remote ON/OFF operation of the motor circuit with high frequency, and features an electrical durability of one million operations.

The manual motor starter and magnetic contactor are connected with a link module and mounted to a base plate.

Features

- Consists of a manual motor starter and magnetic contactor that can be assembled by the user to achieve a compact motor control circuit.
- Protects the motor from short-circuit and overcurrent accidents in the three-phase motor circuit within a range between 20 hp at 240 VAC and 30 hp at 415 VAC, up to a current level of 50A.
- Conforms to IEC 60947 requirements for magnetic motor starters and circuit breakers of protective coordination types 1 and 2, greatly reducing the possibility of an accident causing damage to other equipment.
- Can be mounted to IEC top hat rail using the base plate.
- Modular wiring system requires less wiring, shortens required mounting time, and decreases the mounting area.

UL Type E Self-Protected Manual Motor Starter and Contactor

IEC 60947-4-1

Type 1:

Coordination requires that, under short-circuit conditions, the contactor or starter shall cause no danger to persons or installation and may not be suitable for further service without repair and replacement of parts.

Type 2:

Coordination requires that, under short-circuit conditions, the contactor or starter shall cause no danger to persons or installation and shall be suitable for further use. The risk of contact welding is recognized, in which case the manufacturer shall indicate the measures to be taken regarding the maintenance of the equipment.

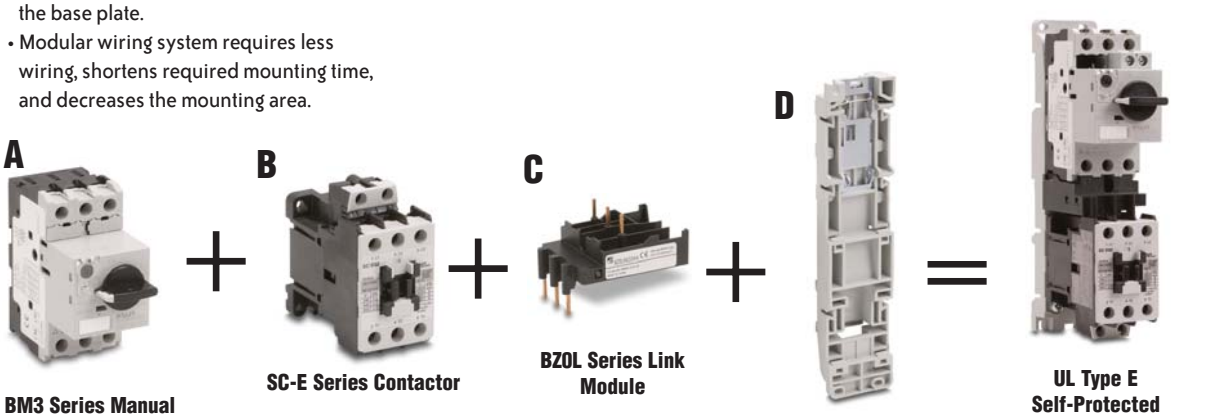
NOTE: Refer to UL 508E and UL 508F for more information.

Choosing 45 mm or 55 mm frame width

The Fuji MMS is available in 45 mm and 55 mm frame widths. The 45 mm frame size is capable of controlling motors up to 20 horsepower while the 55 mm frame size can handle motors up to 40 horsepower at 480 volts AC. The frame sizes overlap in motor sizing though the breaking capacity remains the same.

For controlling a group of motors up to 20 horsepower, the 45 mm frame size is the perfect answer. For motor sizes 20 to 40 horsepower @480 VAC, the 55 mm frame is specified.

If your motors range from below 20 horsepower to 40 horsepower, consider using the 55 mm frame. Though the individual costs per unit is more expensive for the 55 mm frame width in sizes below 20 horsepower, construction cost's are reduced by standardizing on the same frame size.



BM3 Series Manual Motor Starter

SC-E Series Contactor

BZ0L Series Link Module

BZ0BP Series Base Plate

UL Type E Self-Protected Manual Motor Controller and Contactor

Fuji Duo Series Combination Starter Selection Table - 45 mm

Use this selection table to select 45 mm frame width (A) Manual Motor Starter, (B) Contactor, (C) Link Module, and (D) Base Plate for a Combination Starter

Combination Starter Selection Table - 45 mm									
Three Phase Motor					A	B	C	D	
220-240 Volt		440-480 Volt							
Motor Horsepower (hp) See Note 1 below	Motor Full-Load Amperage (FLA) See Note 4 below	Motor Horsepower (hp) See Note 1 below	Motor Full-Load Amperage (FLA) See Note 4 below	Manual Motor Starter Adjustable Current Range (A)	Manual Motor Starter See Note 2 below for UL Type E applica-tions.	Contactor The contactor part number needs the coil voltage suffix. See Note 3 below.	Link Module	Base Plate	SCCR at 480Y/277 VAC (kA) type F coordination
-	-	-	-	0.1 to 0.16	BM3RHB-P16	SC-E02-110VAC	BZ0LRE22AA	BZ0BPRE22A	65
						SC-E02G-24VDC	BZ0LRE22GA		
-	-	-	-	0.16 to 0.25	BM3RHB-P25	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
-	-	-	-	0.25 to 0.4	BM3RHB-P40	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
-	-	-	-	0.4 to 0.63	BM3RHB-P63	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
-	-	-	-	0.63 to 1.0	BM3RHB-001	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
-	-	0.75	1.6	1.0 to 1.6	BM3RHB-1P6	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
0.5	2.2	1	2.1	1.6 to 2.5	BM3RHB-2P5	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
0.75	3.2	2	3.4	2.5 to 4.0	BM3RHB-004	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
1.5	6	3	4.8	4.0 to 6.3	BM3RHB-6P3	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
-	-	5	7.6	6.3 to 10	BM3RHB-010	SC-E02-110VAC	BZ0LRE22AA		65
						SC-E02G-24VDC	BZ0LRE22GA		
3	9.6	7.5	11	9 to 13	BM3RHB-013	SC-E03-110VAC	BZ0LRE22AA		65
						SC-E03G-24VDC	BZ0LRE22GA		
5	15.2	10	14	11 to 16	BM3RHB-016	SC-E04-110VAC	BZ0LRE22AA		65
						SC-E04G-24VDC	BZ0LRE22GA		
5	15.2	10	14	14 to 20	BM3RHB-020	SC-E04-110VAC	BZ0LRE22AA		65
						SC-E04G-24VDC	BZ0LRE22GA		
7.5	22	15	21	19 to 25	BM3RHB-025	SC-E05-110VAC	BZ0LRE22AA		50
						SC-E05G-24VDC	BZ0LRE22GA		
10	28	20	27	24 to 32	BM3RHB-032	SC-E1-110VAC	BZ0LRE32AA	BZ0BPRE32A	50
						SC-E1G-24VDC	BZ0LRE32GA		

Note 1: When a horsepower rating is listed on two rows, the motor full-load amperage must be known so you can select the MMS with the best adjustable current range for your application. For example, if you have a 230V, 5 hp, 15.2A motor, you can select a MMS with either a 11-16A range or a 14-20A range. Consult the motor data plate or motor manufacturer.

Note 2: When using BM3RHB-xxx MMS in a UL Type E application, you must also use part numbers BZ0TKUAB (short-circuit contact block) and BZ0TCRE (line side terminal cover).

Note 3: For AC coil voltages other than 110VAC, substitute the "110VAC" in the part number with "220VAC" for 220/240VAC coils or "24VAC" for 24VAC coils. For example, if the table lists a SC-E02-110VAC contactor for your application and you need a contactor with a 220VAC coil, use contactor SC-E02-220VAC.

Note 4: Per NEC 2005 Table 430.250

Fuji Duo Series Combination Starter Selection Table - 55 mm

Use this selection table to select 55 mm frame width (A) Manual Motor Starter, (B) Contactor, (C) Link Module, and (D) Base Plate for a Combination Starter

Combination Starter Selection Table - 55 mm									
Three Phase Motor					A	B	C	D	
220-240 Volt		*440-480 Volt*							
Motor horsepower (hp) See Note 1 below	*Motor Full-Load Amperage (FLA) See Note 4 below*	*Motor Horsepower (hp) See Note 1 below*	*Motor Full-Load Amperage (FLA) See Note 4 below*	*Manual Motor Starter Adjustable Current Range (A)*	*Manual Motor Starter See Note 2 below for UL Type E applica-tions.*	*Contactor The contactor part number needs the coil voltage suffix. See Note 3 below.*	*Link Module*	*Base Plate*	*SCCR at 480Y/277 VAC (kA) type F coordina-tion*
3	9.6	5	7.6	6.3 to 10	BM3VHB-010	SC-E1-110VAC	BZ0LVE51AA	BZ0BPVE51A	65
						SC-E1G-24VDC	BZ0LVE51GA		
3	9.6	7.5	11	9 to 13	BM3VHB-013	SC-E1-110VAC	BZ0LVE51AA		65
						SC-E1G-24VDC	BZ0LVE51GA		
5	15.2	10	14	11 to 16	BM3VHB-016	SC-E1-110VAC	BZ0LVE51AA		65
						SC-E1G-24VDC	BZ0LVE51GA		
5	15.2	10	14	14 to 20	BM3VHB-020	SC-E1-110VAC	BZ0LVE51AA		65
						SC-E1G-24VDC	BZ0LVE51GA		
7.5	22	15	21	19 to 25	BM3VHB-025	SC-E1-110VAC	BZ0LVE51AA		65
						SC-E1G-24VDC	BZ0LVE51GA		
10	28	20	27	24 to 32	BM3VHB-032	SC-E1-110VAC	BZ0LVE51AA		65
						SC-E1G-24VDC	BZ0LVE51GA		
10	28	30	40	28 to 40	BM3VHB-040	SC-E2-110VAC	BZ0LVE51AA		65
						SC-E2G-24VDC	BZ0LVE51GA		
15	42	30	40	35 to 50	BM3VHB-050	SC-E2S-110VAC	BZ0LVE51AA		65
						SC-E2SG-24VDC	BZ0LVE51GA		
20	54	40	52	45 to 63	BM3VHB-063	SC-E3-110VAC	BZ0LVE65AA	BZ0BPVE65A	65
						SC-E3G-24VDC	BZ0LVE65GA		

Note 1: When a horsepower rating is listed on two rows, the motor full-load amperage must be known so you can select the MMS with the best adjustable current range for your application. For example, if you have a 230V, 10 hp, 28A motor, you can select a MMS with either a 24-32A range or a 28-40A range. Consult the motor data plate or motor manufacturer.

Note 2: When using BM3VHB-xxx MMS in a UL Type E application, you must also use part number BZ0TKUAB (short-circuit contact block).

Note 3: For AC coil voltages other than 110VAC, substitute the "110VAC" in the part number with "220VAC" for 220/240VAC coils or "24VAC" for 24VAC coils. For example, if the table lists a SC-E1-110VAC contactor for your application and you need a contactor with a 220VAC coil, use contactor SC-E1-220VAC.

Note 4: Per NEC 2005 Table 430.250

Fuji Duo Series Combination Starter

BM3RHB-xxx Manual Motor Starter Prices			
Part Number	Price	Part Number	Price
BM3RHB-P16	<--->	BM3RHB-6P3	<--->
BM3RHB-P25	<--->	BM3RHB-010	<--->
BM3RHB-P40	<--->	BM3RHB-013	<--->
BM3RHB-P63	<--->	BM3RHB-016	<--->
BM3RHB-001	<--->	BM3RHB-020	<--->
BM3RHB-1P6	<--->	BM3RHB-025	<--->
BM3RHB-2P5	<--->	BM3RHB-032	<--->
BM3RHB-004	<--->		

Note: When using BM3RHB-xxx MMS in a UL type E application, you must also use part number BZ0TKUAB (short circuit contact block) and BZ0TCRE (line side terminal cover).

BM3VHB-xxx Manual Motor Starter Prices			
Part Number	Price	Part Number	Price
BM3VHB-010	<--->	BM3VHB-032	<--->
BM3VHB-013	<--->	BM3VHB-040	<--->
BM3VHB-016	<--->	BM3VHB-050	<--->
BM3VHB-020	<--->	BM3VHB-063	<--->
BM3VHB-025	<--->		

Note: When using BM3VHB-xxx MMS in a UL type E application you must also use part number BZ0TKUAB (short circuit contact block).

Contactor Prices							
Part Number	Price	Part Number	Price	Part Number	Price	Part Number	Price
SC-E02-24VAC	<--->	SC-E05-24VAC	<--->	SC-E2S-24VAC	<--->	SC-E5-24V	<--->
SC-E02-110VAC	<--->	SC-E05-110VAC	<--->	SC-E2S-110VAC	<--->	SC-E5-100V	<--->
SC-E02-220VAC	<--->	SC-E05-220VAC	<--->	SC-E2S-220VAC	<--->	SC-E5-200V	<--->
SC-E02G-24VDC	<--->	SC-E05G-24VDC	<--->	SC-E2SG-24VDC	<--->	SC-E6-24V	<--->
SC-E03-24VAC	<--->	SC-E1-24VAC	<--->	SC-E3-24VAC	<--->	SC-E6-100V	<--->
SC-E03-110VAC	<--->	SC-E1-110VAC	<--->	SC-E3-110VAC	<--->	SC-E6-200V	<--->
SC-E03-220VAC	<--->	SC-E1-220VAC	<--->	SC-E3-220VAC	<--->	SC-E7-24V	<--->
SC-E03G-24VDC	<--->	SC-E1G-24VDC	<--->	SC-E3G-24VDC	<--->	SC-E7-100V	<--->
SC-E04-24VAC	<--->	SC-E2-24VAC	<--->	SC-E4-24VAC	<--->	SC-E7-200V	<--->
SC-E04-110VAC	<--->	SC-E2-110VAC	<--->	SC-E4-110VAC	<--->		
SC-E04-220VAC	<--->	SC-E2-220VAC	<--->	SC-E4-220VAC	<--->		
SC-E04G-24VDC	<--->	SC-E2G-24VDC	<--->	SC-E4G-24VDC	<--->		

Link modules and base plates

Link modules

BZ0LRE22A

BZ0LRE22GA

BZ0LRE32AA

BZ0LRE32GA

BZ0LVE51AA

BZ0LVE51GA

BZ0LVE65AA

BZ0LVE65GA

Link modules						
Part Number	Price	Description	Applicable MMS	Applicable Magnetic Contactor	Operating Coil (V)	Weight (g/lb)
BZ0LRE22AA	<--->	The link module connects the manual motor starter and magnetic contactor electrically and mechanically.	BM3RHB-xxx	SC-E02, E03, E04, E05-xxxVAC	AC	25/0.055
BZ0LRE22GA	<--->			SC-E02G, E03G, E04G, E05G-xxxVDC	DC	35/0.077
BZ0LRE32AA	<--->			SC-E1-xxxVAC	AC	45/0.1
BZ0LRE32GA	<--->			SC-E1G-xxxVDC	DC	60/0.13
BZ0LVE51AA	<--->		BM3VHB-xxx	SC-E1, E2, E2S-xxxVAC	AC	45/0.1
BZ0LVE51GA	<--->			SC-E1G, E2G, E2SG-xxxVDC	DC	60/0.13
BZ0LVE65AA	<--->			SC-E3-xxxVAC	AC	65/0.14
BZ0LVE65GA	<--->			SC-E3G-xxxVDC	DC	80/0.176

Fuji Duo Series Combination Starters

Base plates


BZ0BPRE22A


BZ0BPRE32A

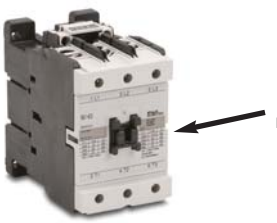

BZ0BPVE51A


BZ0BPVE65A

Base Plates						
Part Number	***Price***	***Description***	***Applicable MMS***	***Applicable Magnetic Contactor***	***Operating Coil (V)***	***Weight (g/lb)***
BZ0BPRE22A	<--->	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.	BM3RHB-xxx	SC-E02, E03, E04, E05, SC-E02G, E03G, E04G, E05G-xxx	AC/DC	100/0.22
BZ0BPRE32A	<--->			SC-E1, SC-E1G-xxx	AC/DC	160/0.35
BZ0BPVE51A	<--->		BM3VHB-xxx	SC-E1, E2, E2S, SC-E1G, E2G, E2SG-xxx	AC/DC	160/0.35
BZ0BPVE65A	<--->			SC-E3, SC-E3G-xxx	AC/DC	195/0.43

How to reverse the contactor nameplate

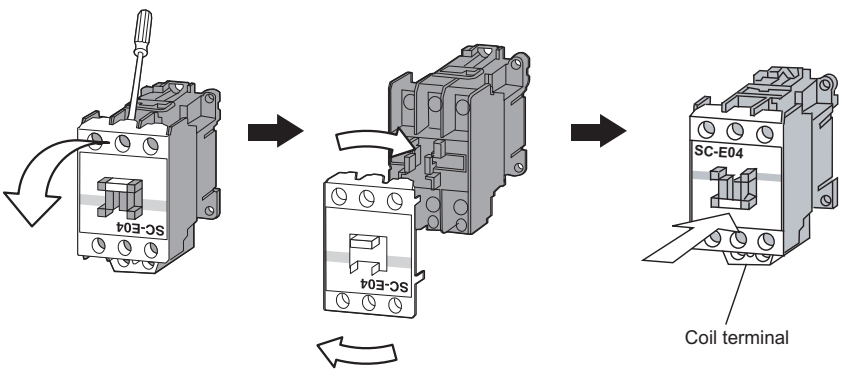
When the manual motor starter and magnetic contactor are configured as a combination starter, the contactor nameplate ends up facing the wrong direction because the coil terminal of the magnetic contactor faces downward. Use the following procedure to turn the nameplate upside down.



SC-E2S

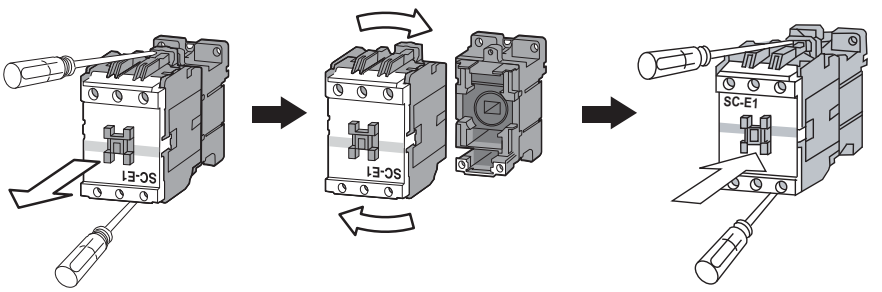
For SC-E02 to SC-E05-xxx contactors

- 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-xxx contactors

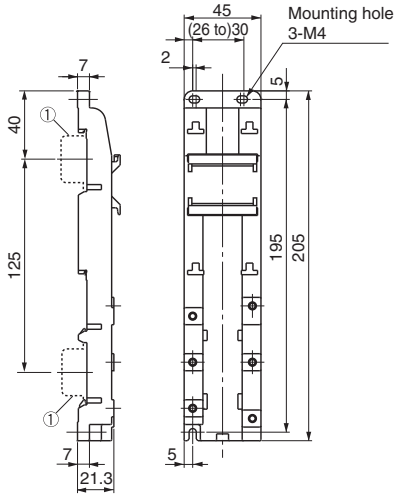
- Use a Phillips screwdriver to remove the two screws securing the front and back bodies.
- Remove the front body and turn it 180 degrees (top to bottom), then re-mount it with the screws.
- Make sure that no foreign matter enters the interior of the magnetic contactor during this removal/re-mounting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



Fuji Duo Series Combination Starters

Dimensions (mm)

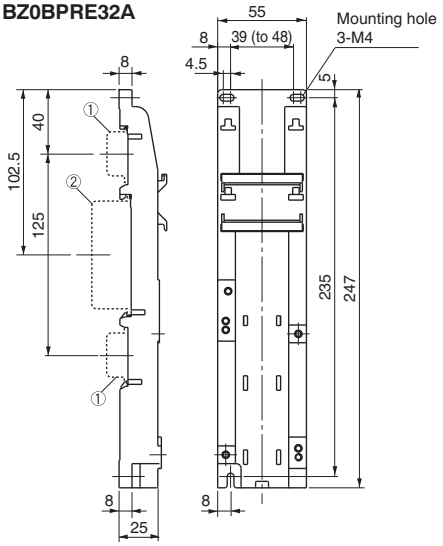
BZ0BPRE22A



①35mm wide rail (height 15mm) x 2

Base plate	MMS	Contactor
BZ0BPRE22A	BM3RHB-xxx	SC-E02, E03, E04, E05-xxx E02G, E03G, E04G, E05G-xxx

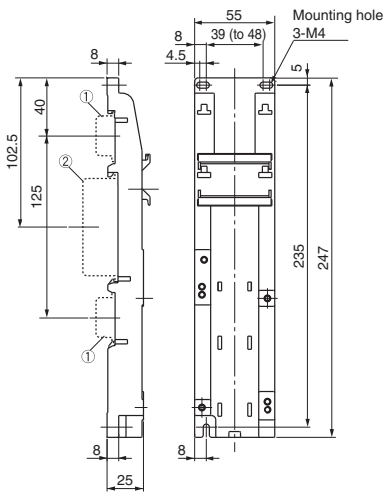
BZ0BPRE32A



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

Base plate	MMS	Contactor
BZ0BPRE32A	BM3RHB-xxx	SC-E1, E1G-xxx

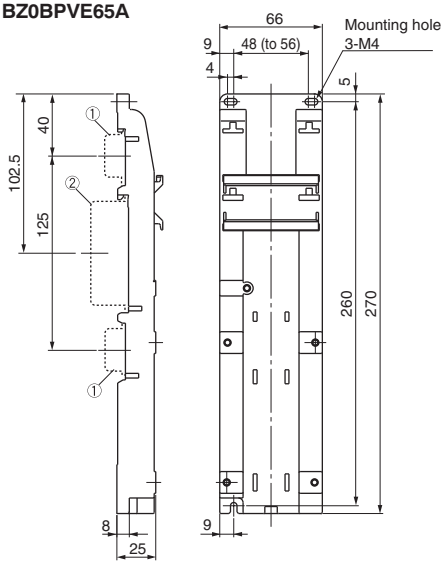
BZ0BPVE51A



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

Base plate	MMS	Contactor
BZ0BPVE51A	BM3VHB-xxx	SC-E1, E2, E2S-xxx E1G, E2G, E2SG-xxx

BZ0BPVE65A



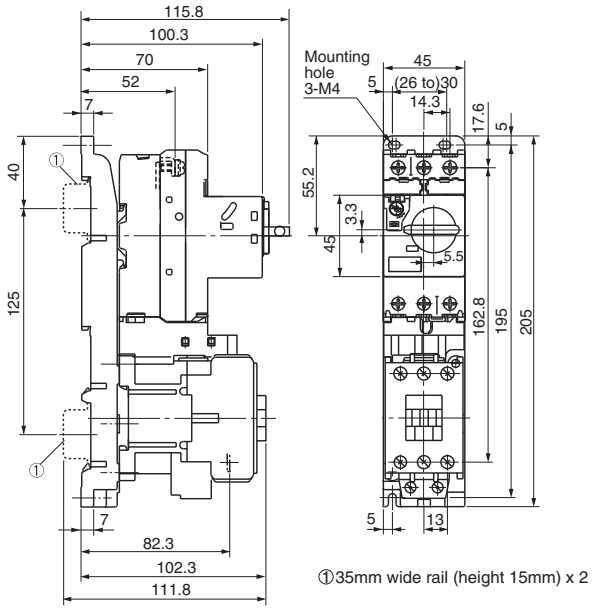
①35mm wide rail (height 15mm) x 2
②75mm wide rail (height 25mm) x 1

Base plate	MMS	Contactor
BZ0BPVE65A	BM3VHB-xxx	SC-E3, E3G-xxx

Fuji Duo Series Combination Starters

Dimensions (mm)

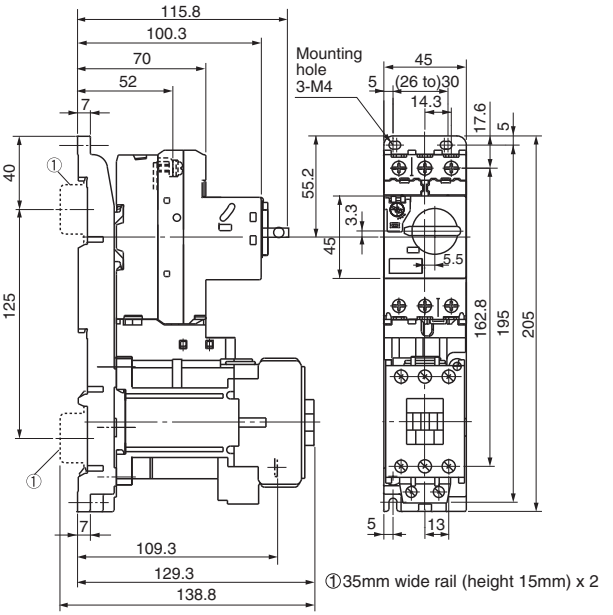
BM3RHB-xxx + SC-E02 to E05-xxx



①35mm wide rail (height 15mm) x 2

MMS	Contactors	Link module	Base plate
BM3RHB-xxx	SC-E02, E03, E04, E05-xxx	BZ0LRE22AA	BZ0BPRE22A

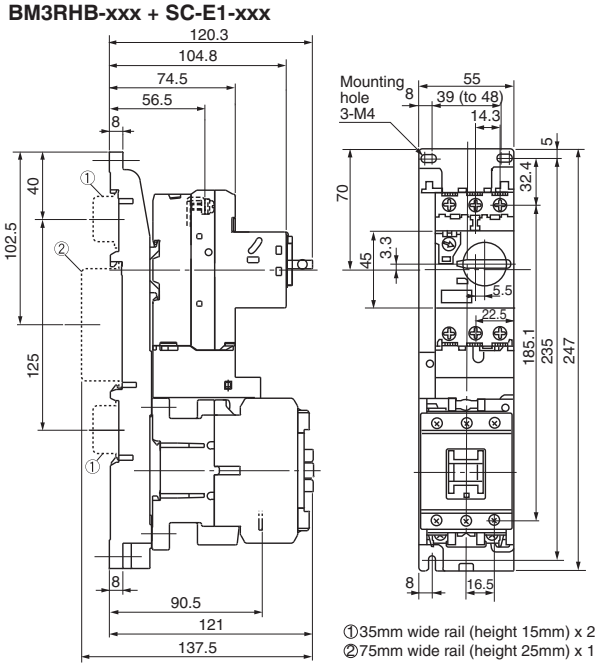
BM3RHB-xxx + SC-E02G to E05G-xxx



①35mm wide rail (height 15mm) x 2

MMS	Contactors	Link module	Base plate
BM3RHB-xxx	SC-E02G, E03G, E04G, E05G-xxx	BZ0LRE22GA	BZ0BPRE22A

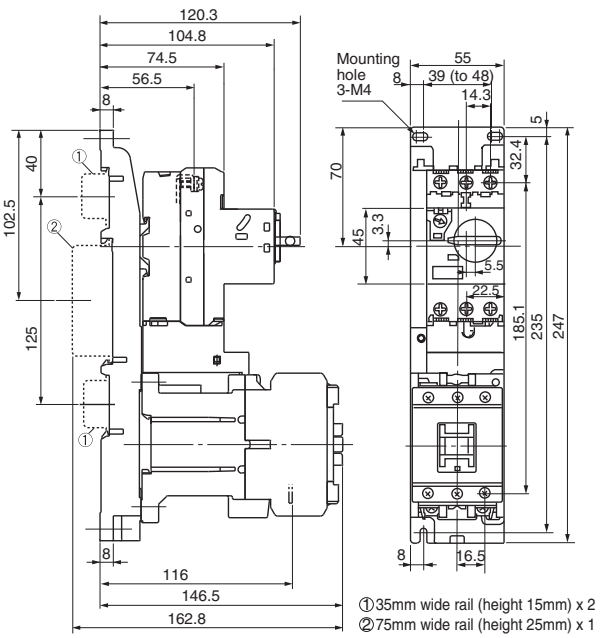
BM3RHB-xxx + SC-E1-xxx



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

MMS	Contactors	Link module	Base plate
BM3RHB-xxx	SC-E1-xxx	BZ0LRE32AA	BZ0BPRE32A

BM3RHB-xxx + SC-E1G-xxx



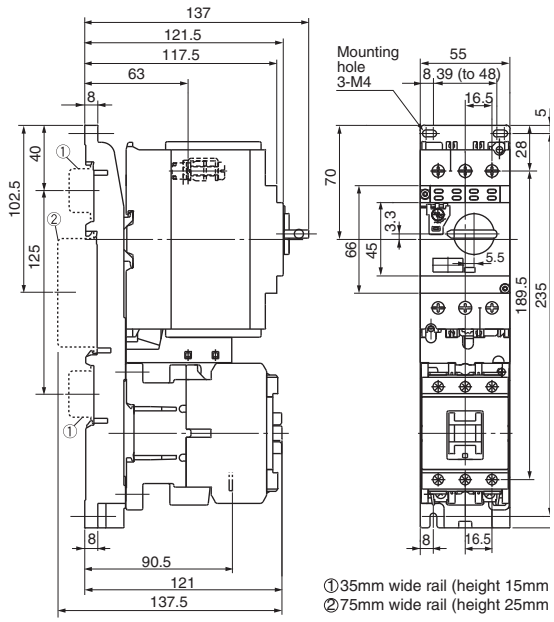
①35mm wide rail (height 15mm) x 2
②75mm wide rail (height 25mm) x 1

MMS	Contactors	Link module	Base plate
BM3RHB-xxx	SC-E1G-xxx	BZ0LRE32GA	BZ0BPRE32A

Fuji Duo Series Combination Starters

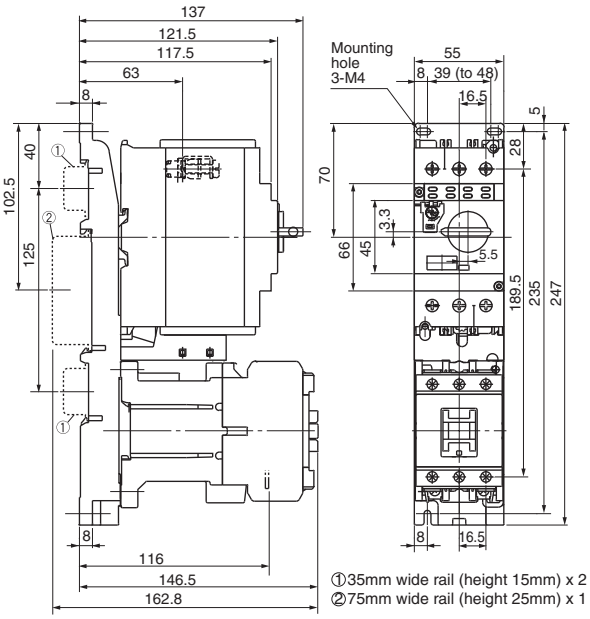
Dimensions (mm)

BM3VHB-xxx + SC-E1, E2, E2S-xxx



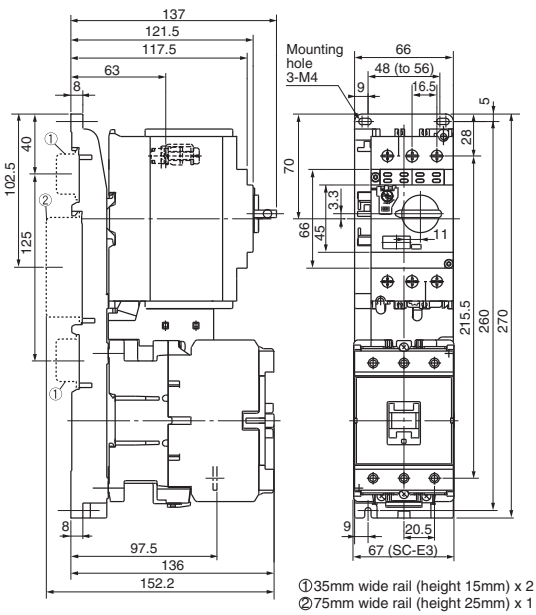
MMS	Contactors	Link module	Base plate
BM3VHB-xxx	SC-E1, E2, E2S-xxx	BZ0LVE51AA	BZ0BPVE51A

BM3VHB-xxx + SC-E1G, E2G, E2SG-xxx



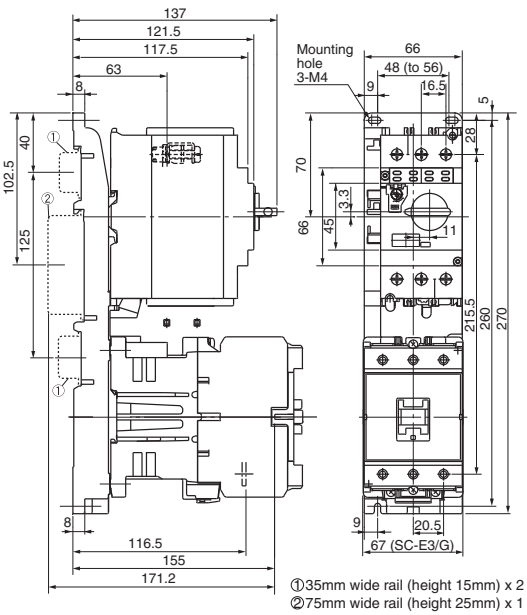
MMS	Contactors	Link module	Base plate
BM3VHB-xxx	SC-E1G, E2G, E2SG-xxx	BZ0LVE51GA	BZ0BPVE51A

BM3VHB-xxx + SC-E3-xxx



MMS	Contactors	Link module	Base plate
BM3VHB-xxx	SC-E3-xxx	BZ0LVE65AA	BZ0BPVE65A

BM3VHB-xxx + SCE3G-xxx



MMS	Contactors	Link module	Base plate
BM3VHB-xxx	SC-E3G-xxx	BZ0LVE65GA	BZ0BPVE65A

Fuji Odyssey Series 3N Contactors

Description

- 180 - 361A rating (AC3)
- Provides higher current and horsepower capabilities than SC-E series. Designed for reliable use in applications requiring constant switching, reduced coil energy-consumption, and increased horsepower capabilities.
- Available in 154 mm and 169 mm frame widths
- SUPERMAGNET™ for high operating reliability.
- Use with Odyssey 3N series overload relays.

Features

- Equipped with 2 N.O. and 2 N.C. auxiliary contacts
- Chatter-free operation eliminates contact welding and coil burning
- SUPERMAGNET™ coil operates on either AC or DC voltage
- Wire Terminal Connection Type: Crimp ring Terminal (See page 17-55 for specs)

Agency approvals

- UL listed file E42419, Standard UL508
- cUL listed file E42419, Standard CSA C22.2 No. 14
- CE: Meets LVD EN60947-4-1
- SEMI F47-0200

Optional accessories

- Replacement coils
- Terminal covers

3NC4H0122

Ecology

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

Odyssey 3N Series Contactors 180–361 Amps

Part Number	Fuji Type	Price	Coil Voltage	Rated Motor Capacity (HP)						Rated AC-3 Current (A) [note 1]	Rated AC-1 Thermal Current (A) [note 2]	Quantity of Auxiliary Contacts		SCCR Ratings (KA)	Frame Width (mm)
				3-Phase				1-Phase							
				200–208V	220–240V	440–480V	550–600V	100–120V	220–240V			NO	NC		
3NC4Q0E22	SC-N8	<--->	24–25VAC / 24VDC	60	60	150	150	N/A		180	260	2	2	10	138
3NC4Q0122		<--->	100–127VAC / 100–120VDC												
3NC4Q0222		<--->	200–250VAC / 200–240VDC												
3NC4Q0Q22		<--->	380–450VAC												
3NC4Q0422		<--->	460–575VAC												
3NC4H0E22	SC-N10	<--->	24–25VAC / 24VDC	75	75	150	200			221	260				
3NC4H0122		<--->	100–127VAC / 100–120VDC												
3NC4H0222		<--->	200–250VAC / 200–240VDC												
3NC4H0Q22		<--->	380–450VAC												
3NC4H0422		<--->	460–575VAC												
3NC5F0E22	SC-N11	<--->	24–25VAC / 24VDC	100	100	200	250			285	350			18	148
3NC5F0122		<--->	100–127VAC / 100–120VDC												
3NC5F0222		<--->	200–250VAC / 200–240VDC												
3NC5F0Q22		<--->	380–450VAC												
3NC5F0422		<--->	460–575VAC												
3NC5H0E22	SC-N12	<--->	24–25VAC / 24VDC	125	150	300	350			361	450				
3NC5H0122		<--->	100–127VAC / 100–120VDC												
3NC5H0222		<--->	200–250VAC / 200–240VDC												
3NC5H0Q22		<--->	380–450VAC												
3NC5H0422		<--->	460–575VAC												

Notes: 1. AC3 type loads consist of squirrel cage three-phase motors; occasional, limited jogging duty.
2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

Contactor Coil Characteristics - AC Input

Part Number	Power Consumption (VA)		Pick-up Voltage (V)	Drop-out Voltage (V)	Operating Time (ms)	
	Inrush	Sealed			Coil ON to Contact ON	Coil OFF to Contact OFF
3NC4Qxxxx, 3NC4Hxxxx	277	5.4	70-80	35-50	35-41	37-45
3NC5Fxxxx, 3NC5Hxxxx	265	5.9	70-80	35-50	40-47	36-43

NOTE: This data is based on 100-120V SUPERMAGNET™ coil, tested at 120VAC, 60Hz.

Fuji Odyssey Series 3N Contactors

Contactor Coil Characteristics - DC Input - 110VDC						
Part Number	Power Consumption (watts)		Pick-up Voltage (V)	Drop-out Voltage (V)	Operating Time (ms)	
	Inrush	Sealed			Coil ON to Contact ON	Coil OFF to Contact OFF
3NC4Qxxxx, 3NC4Hxxxx	324	4.1	77-88	28-44	35-41	37-45
3NC5Fxxxx, 3NC5Hxxxx	340	4.5	77-88	28-44	40-47	36-43
NOTE: This data is based on 100-120V SUPERMAGNET™ coil, tested at 110VDC.						

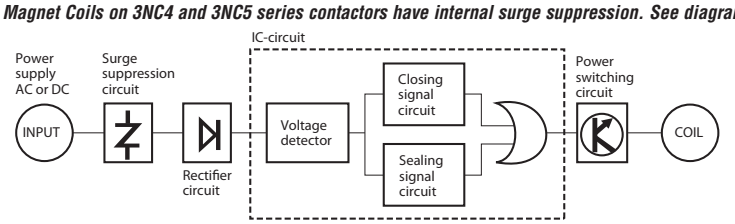
Contactor Coil Characteristics - DC Input - 24VDC						
Part Number	Power Consumption (watts)		Pick-up Voltage (V)	Drop-out Voltage (V)	Operating Time (ms)	
	Inrush	Sealed			Coil ON to Contact ON	Coil OFF to Contact OFF
3NC4Qxxxx, 3NC4Hxxxx	250	5.9	17-19.2	6-12	35-41	37-45
NOTE: This data is based on 100-120V SUPERMAGNET™ coil, tested at 110VDC.						

Contactor Auxiliary Contact Ratings				
NEMA ICS 5-2000 Ratings (note 1)				
AC Ratings			DC Ratings	
Designation	Making VA	Breaking VA	Designation	Making/Breaking VA
A600	7200	720	Q300	69
Note 1: NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 16-75.				

Contactor Terminal Tightening Torque Chart				
Part Number	Terminal Size	Cable Size Maximum	Applicable Max. Width for Ring Terminal	Tightening Torque
3NC4Q0XXX	M10	300MCM (152mm²)	36.5mm	133-177 in.lbs. 15-20 Nm
3NC4H0XXX	M10	300MCM (152mm²)	36.5mm	133-177 in.lbs. 15-20 Nm
3NC5F0XXX 3NC5H0XXX	M12	400MCM (203mm²)	44.5mm	310-399 in.lbs. 35-45 Nm

Contactor Life Expectancy Performance Data				
Model	Current Capacity Make/Break	Operating Cycles per Hour	Life Expectancy (million operations)	
			Electrical	Mechanical
3NC4Qxxxx through 3NC5Fxxxx	12xle/10xle	1200	1	5
3NC5Hxxxx	12xle/10xle	1200	0.5	5
Note: Rated operational current. Electrical life test: Conforming to IEC947-4-1, AC3. The endurance test complies with the requirements of international standard IEC, JIS and JEM.				

Note: Super Magnet Coils on 3NC4 and 3NC5 series contactors have internal surge suppression. See diagram below.



Optional accessories

Terminal covers

Prevent contact with electrified terminals.

SZ-N8T

SZ-N11T

Odyssey Series Contactor Terminal Covers			
Part Number	Price	Description	Applicable Contactors
SZ-N8T	<--->	Terminal cover for line or load side. Prevents contact with electrified contactor terminals.	3NC4Qxxxx, 3NC4Hxxxx contactors
SZ-N11T	<--->		3NC5Fxxxx, 3NC5Hxxxx contactors

Replacement contactor coils

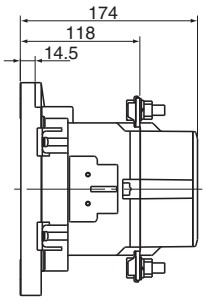
SZ-GSN11-100

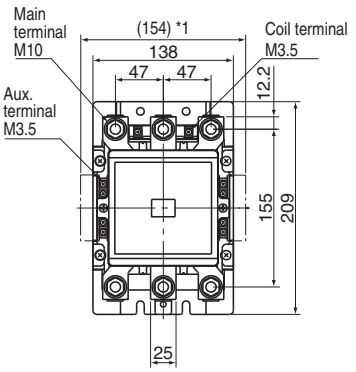
Odyssey Series Replacement Contactor Coils			
Part Number	Price	Applicable Contactors	Coil Voltage
SZ-GSN8-100	<--->	3NC4Q0122, 3NC4H0122	100-127VAC/100-120VDC
SZ-GSN11-100	<--->	3NC5F0122, 3NC5H0122	100-127VAC/100-120VDC
SZ-GSN8-200		3NC4Q0222, 3NC4H0222	200-250VAC/200-240VDC
SZ-GSN11-200		3NC5F0222, 3NC5H0222	200-250VAC/200-240VDC
SZ-GSN8-24	<--->	3NC4Q0E22, 3NC4H0E22	24-25VAC/24VDC
SZ-GSN11-24	<--->	3NC5F0E22, 3NC5H0E22	24-25VAC/24VDC
Replacement coils are not available for coil codes Q and 4 (380–450VAC and 460–575VAC).			

Fuji Odyssey Series 3N Contactors

Dimensions (mm)

3NC4Q0#22
3NC4H0#22

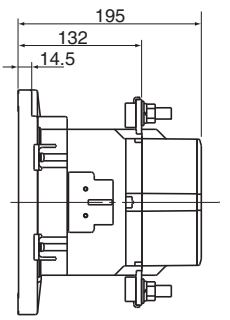


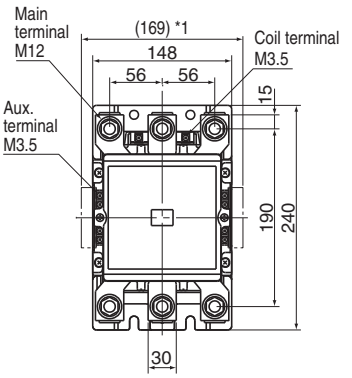


* 1 Aux. contact block (Side mounted)

Weight: 4.9kg

3NC5F0#22
3NC5H0#22

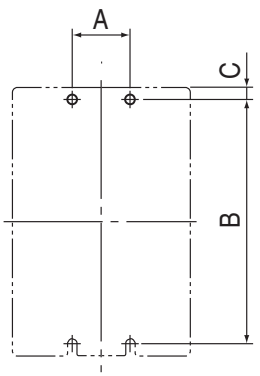




* 1 Aux. contact block (Side mounted)

Weight: 7.8kg

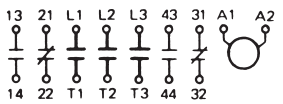
Mounting dimensions



Frame Size	*A*	*B*	*C*	*Screw Size*
3NC4Qxxxx	45	190	9.5	4-M6
3NC4Hxxxx	45	190	9.5	4-M6
3NC5Fxxxx	60	220	10	4-M8
3NC5Hxxxx	60	220	10	4-M8

Wiring diagrams

Non-reversing Contactors



Fuji Odyssey Series 3N Overload Relays

General information

- Use with Odyssey 3N series contactors.
- Protects motor windings from burning due to overloads, locked rotor currents, or open phases.

Agency approvals:

- UL listed file E42419, Standard UL 508
- cUL listed file E42419, Standard CSA C22.2 No. 14
- CE: LVD EN60947-4-1

3NK4QK

3NK4HN

3NK5HQ

Odyssey Series Overload Relays					
Part Number	***Fuji Type***	***Price***	***Adjustable Current Range (A)***	***Frame Width***	***Compatible Contactor***
3NK4QK	***TK-N8***	<--->	65 - 95	119mm	3NC4Qxxxx
3NK4QL	***TK-N8***	<--->	85 - 125		
3NK4QN	***TK-N8***	<--->	110 - 160		
3NK4QP	***TK-N8***	<--->	125 - 185		
3NK4HL	***TK-N10***	<--->	85 - 125	138mm	3NC4Hxxxx
3NK4HN	***TK-N10***	<--->	110 - 160		
3NK4HP	***TK-N10***	<--->	125 - 185		
3NK4HQ	***TK-N10***	<--->	160 - 240		
3NK5HN	***TK-N12***	<--->	110 - 160	142mm	3NC5Fxxxx 3NC5Hxxxx
3NK5HP	***TK-N12***	<--->	125 - 185		
3NK5HQ	***TK-N12***	<--->	160 - 240		
3NK5HR	***TK-N12***	<--->	200 - 300		
3NK5HS	***TK-N12***	<--->	240 - 360		3NC5Hxxxx
3NK5HT	***TK-N12***	<--->	300 - 450		

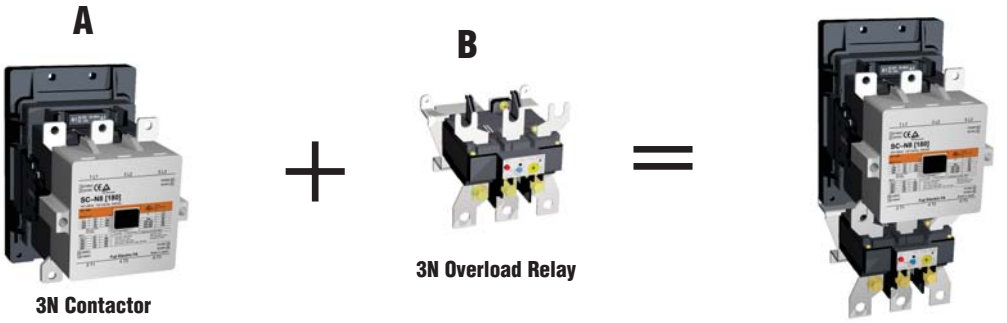
Specifications

Overload Relay Alarm Contact Ratings				
AC Ratings *(note 1)*			***DC Ratings*** *(note 1)*	
Designation	***Making VA***	***Breaking VA***	***Designation***	***Making/Breaking VA***
C600	1800	180	---	---

Notes:
1. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 16-75.

Wire Terminal Tightening Torque Chart					
Part Number	***Contactor or Starter***	***Terminal Size***	***Cable Size Maximum***	***Applicable Max. Width for Ring Terminal***	***Tightening Torque***
3NK4Qx	3NC4Q0	M10	300MCM (152mm2)	36.5mm	133-177 in.lbs., 15-20 Nm
3NK4Hx	3NC4H0	M10	300MCM (152mm2)	36.5mm	133-177 in.lbs., 15-20 Nm
3NK5Hx	3NC5F0	M12	400MCM (203mm2)	44.5mm	310-399 in.lbs., 35-45 Nm
	3NC5H0				

Fuji Odyssey Series 3N Overload Relays Selection Tables



Step 1. Select an Odyssey 3N contactor from Column A based on motor voltage and horsepower.

Step 2. Select an Odyssey 3N overload relay from Column B to work with the contactor selected in Step 1. The motor full load current (FLA) should be within the adjustable current range of the overload relay.

220-240V 3-Phase Motor (60 to 150 hp)

Motor Rating		A	B	
HP	Motor Full Load Amperage (FLA) (See Note 1)	Contactor	Overload Relay	
			Part Number	Adjustable Current Range
60	154	3NC4Q0x22	3NK4QN	110 to 160 Amps
75	192	3NC4H0x22	3NK4HQ	160 to 240 Amps
100	248	3NC5F0x22	3NK5HR	200 to 300 Amps
125	312	3NC5H0x22	3NK5HS	240 to 360 Amps
150	360	3NC5H0x22	3NK5HT	300 to 450 Amps
Note 1: Per NEC 2005 Table 430.250				

440-480V 3-Phase Motor (125 to 300 hp)

Motor Rating		A	B	
HP	Motor Full Load Amperage (FLA) (See Note 1)	Contactor	Overload Relay	
			Part Number	Adjustable Current Range
125	156	3NC4Q0x22	3NK4QP	125 to 185 Amps
150	180	3NC4H0x22	3NK4HQ	160 to 240 Amps
200	240	3NC5F0x22	3NK5HR	200 to 300 Amps
250	302	3NC5H0x22	3NK5HS	240 to 360 Amps
300	361	3NC5H0x22	3NK5HT	300 to 450 Amps
Note 1: Per NEC 2005 Table 430.250				

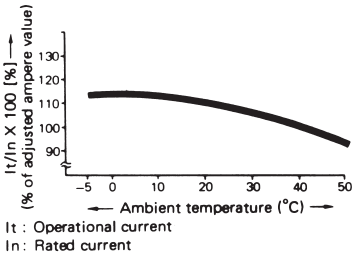
Fuji Odyssey Series 3N Overload Relays

Specifications

Ambient temperature compensator

Overload relays are provided with an ambient temperature compensator. Their characteristics limit current value changes to approximately 10% as the ambient temperature changes between –5°C and 40°C.

Compensation characteristics (Average value)

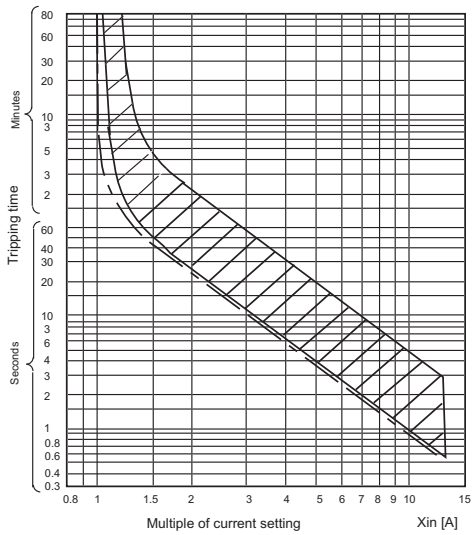


It : Operational current
In : Rated current

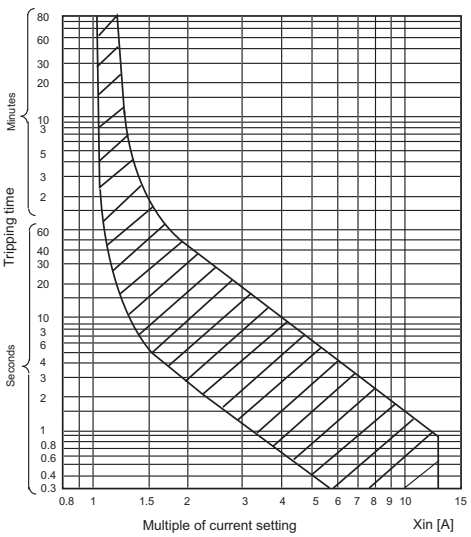
Open-phase protection

3NK4Qx

Cold start

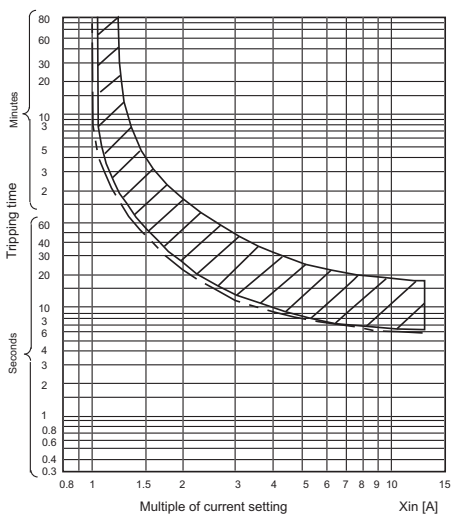


Hot start

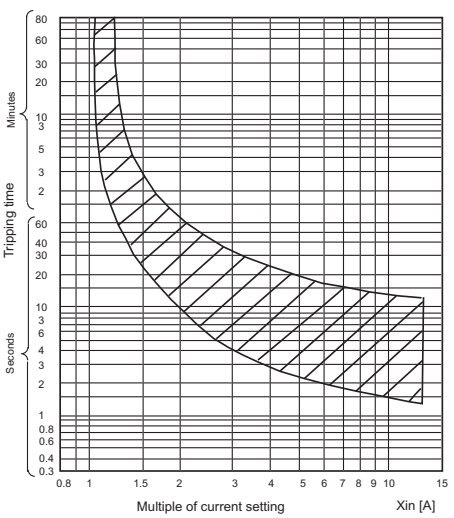


3NK4Hx, 3NK5Hx

Cold start



Hot start



Fuji Odyssey Series 3N Overload Relays

Optional accessories

Terminal covers

NOTE: Larger terminal covers may require some adjustment for proper fit.

SZ-WN8T

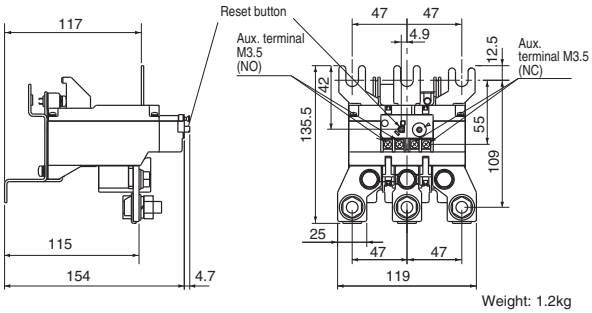
SZ-WN10T

SZ-WN11T

Odyssey Series Overload Relay Terminal Covers			
Part number	***Price***	***Description***	***Applicable Contactors, Overload Relays***
SZ-WN8T	<--->	Terminal cover for load side. Prevents contact with electrified contactor terminals.	3NK4Qx overload relays
SZ-WN10T	<--->		3NK4Hx overload relays
SZ-WN11T	<--->		3NK5Hx overload relays

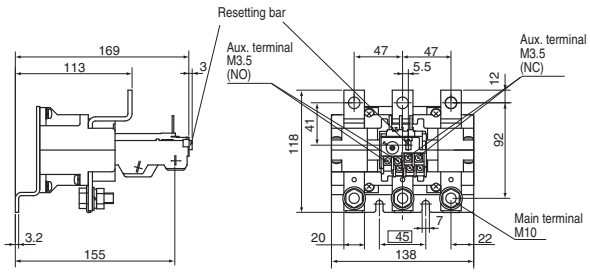
Dimensions (mm)

3NK4Qx



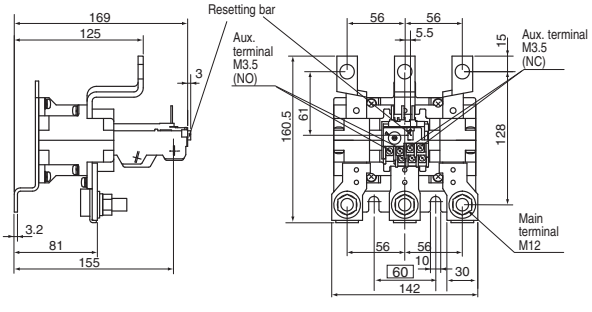
Weight: 1.2kg

3NK4Hx



Weight: 1.85kg

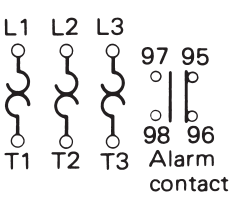
3NK5Hx



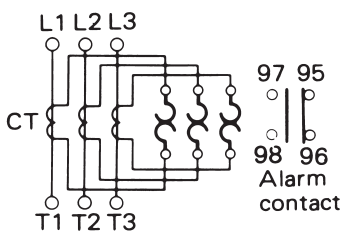
Weight: 2.3kg

Wiring diagrams

3NK4Qx



3NK4Hx, 3NK5Hx



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2004 Control Engineering Editors' Choice Award

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GH Series IEC Motor Controls

The GH series of IEC contactors and bi-metallic overload relays are manufactured by Europe's leading maritime contactor company. Contactors for ocean-going vessels are built to the most rigid specifications. This same design technology carries over to this line of industrial motor controls.

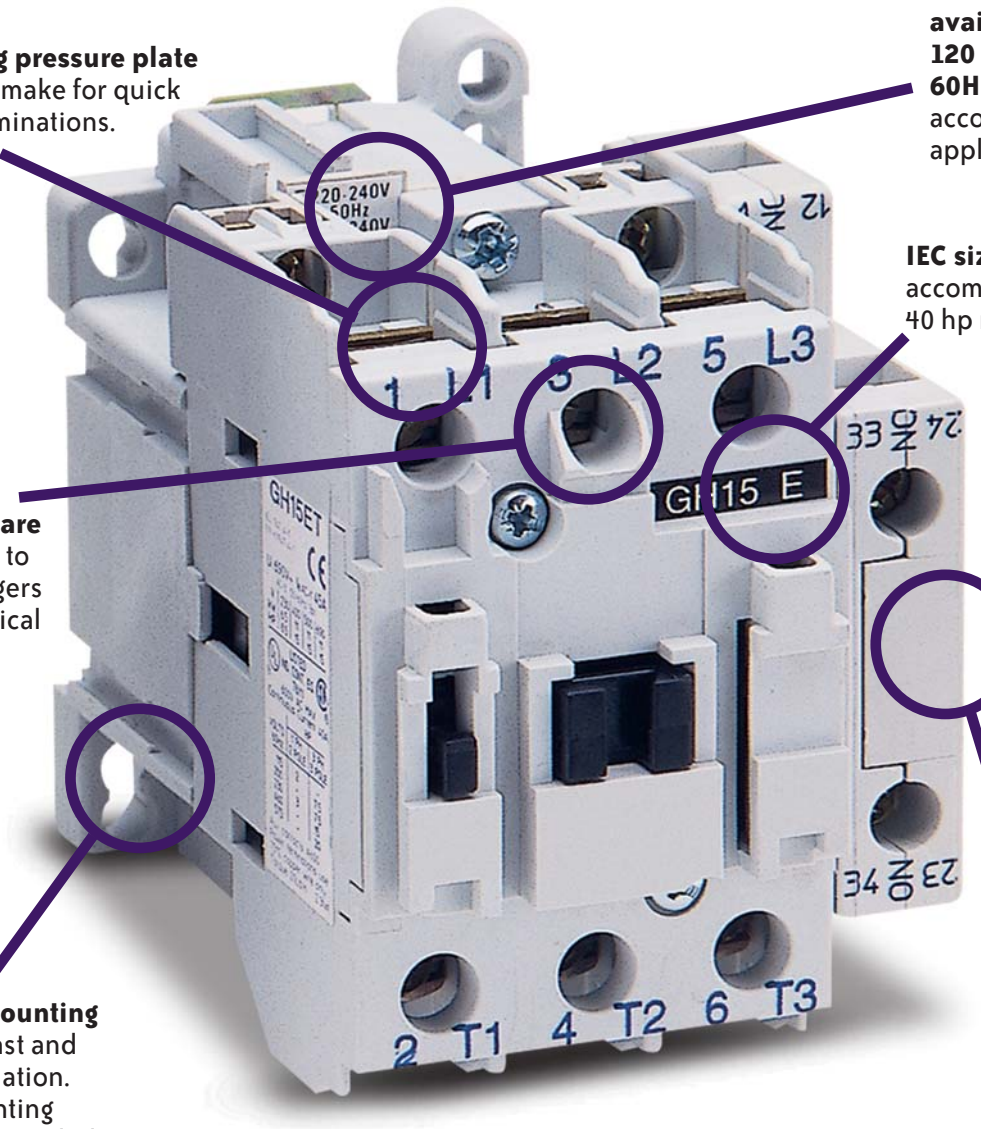
We offer individual components that allow you to use the contactor alone or to assemble your motor starter using our thermal overload relays. You can also combine a manual motor starter/protector for all-in-one protection.

Use contactors wherever you need a heavy-duty switching device with up to three poles. Add up to eight auxiliary contact blocks for interlocks and feedback. Or use the optional mechanical interlock to create an inexpensive reversing contactor.

Self-lifting pressure plate terminals make for quick wiring terminations.

Actuator coils, available in 120 and 220 VAC, 60Hz models, accommodate most applications.

IEC sizes B through J accommodate up to 40 hp motors.



Terminals are IP20 rated to protect fingers from electrical shock.

DIN-rail mounting provides fast and easy installation. Panel mounting holes are provided.

Top and side mounted auxiliary contacts offer versatility for space requirements.

GH Series Contactor Configurations

Contactor Part Numbers									
IEC FRAME SIZE	Contactor Model	Part Number	Price	Number of Contacts			Coil Voltage and Frequency	Additional Contacts	
				Main	Auxiliary Contacts Included			Maximum Contact Block Arrangement	Type of Additional Contact Block
					N.O	N.C.			
45 mm	GH15BN	GH15BN-3-10A	<--->	3	1		110-120VAC 50-60 Hz	Up to 8 auxiliary contacts may be added to the contactor by utilizing the side mount and top mount contact block assemblies.Though referred to as a top mount assembly, the GH15T mounts to the front of the contactor. ***Note: If using the BM0H mechanical interlock, the use of auxiliary contacts are prohibited on that side of each contactor. This does not pertain to the auxilliary contact built into the GH15BN, GH15CN and GH15DN contactors.***	Top mount GH15T11 (1 N0 & 1 NC) GH15T40 (4 N0) GH15T31 (3 N0 & 1 NC) GH15T22 (2 N0 & 2 NC) Side mount GH15S11 (1 N0 & 1 NC) ***Note: Auxiliary contact blocks work with all frame sizes.***
		GH15BN-3-01A	<--->	3		1	110-120VAC 50-60 Hz		
		GH15BN-3-10B	<--->	3	1		220-240VAC 50-60 Hz		
		GH15BN-3-01B	<--->	3		1	220-240VAC 50-60 Hz		
	GH15CN	GH15CN-3-10A	<--->	3	1		110-120VAC 50-60 Hz		
		GH15CN-3-01A	<--->	3		1	110-120VAC 50-60 Hz		
		GH15CN-3-10B	<--->	3	1		220-240VAC 50-60 Hz		
		GH15CN-3-01B	<--->	3		1	220-240VAC 50-60 Hz		
	GH15DN	GH15DN-3-10A	<--->	3	1		110-120VAC 50-60 Hz		
		GH15DN-3-01A	<--->	3		1	110-120VAC 50-60 Hz		
		GH15DN-3-10B	<--->	3	1		220-240VAC 50-60 Hz		
		GH15DN-3-01B	<--->	3		1	220-240VAC 50-60 Hz		
	GH15ET	GH15ET-3-00A	<--->	3			110-120VAC 50-60 Hz		
		GH15ET-3-00B	<--->	3			220-240VAC 50-60 Hz		
	GH15FT	GH15FT-3-00A	<--->	3			110-120VAC 50-60 Hz		
		GH15FT-3-00B	<--->	3			220-240VAC 50-60 Hz		
60 mm	GH15GT	GH15GT-3-00A	<--->	3			120VAC 60 Hz		
		GH15GT-3-00B	<--->	3			240VAC 60 Hz		
	GH15HT	GH15HT-3-00A	<--->	3			120VAC 60 Hz		
		GH15HT-3-00B	<--->	3			240VAC 60 Hz		
	GH15JT	GH15JT-3-00A	<--->	3			120VAC 60 Hz		
		GH15JT-3-00B	<--->	3			240VAC 60 Hz		

GH Series 45 mm Contactor Specifications

45 mm Contactor Specification Guide							
Contactor Model			***GH15BN***	***GH15CN***	***GH15DN***	***GH15ET***	***GH15FT***
Insulation Voltage	AC	(V)	600 Volts AC				
Ampere Rating	Max. UL Amps (AC3) note 1	(A)	9	12	16	25	32
	AC1 Thermal Current (600V) note 2	(A)	30	30	40	45	50
Maximum Power (hp) of Three-Phase Motors	200V	(hp)	2	3	3	7.5	7.5
	230/240V	(hp)	3	3	5	7.5	10
	460/480V	(hp)	5	7.5	10	15	20
	575V	(hp)	7.5	10	15	20	25
Maximum Power (hp) of Single-Phase Motors	115V	(hp)	5	5	1	2	2
	230/240V	(hp)	1	2	3	3	5
Maximum Power (kW) of Three-Phase Motors AC3 Category *note 1*	230/240V	(kW)	2.2	3	4	6.5	7.5
	400V	(kW)	4	5.5	7.5	11	15
	440/480V	(kW)	4.7	6.4	9	12.5	16.5
	500V	(kW)	5.5	7.5	10	11	15
	690V	(kW)	5.5	7.5	7.5	11	15
Short Circuit Protection Fuses Class J UL Rated Fuses	Type 2 Coordination note 3	(A)	20	25	32	40	50
SCCR Rating (kA)		kA	5	5	5	5	5
Auxiliary Contacts Electrical Capacity			A600 *note 4*				
Coil Voltage Operating Limits			A.C. Pick-up 85-110% rated control voltage / A.C. Drop-out 20-75% rated control voltage				
Average Coil Power Requirements / Coil current (A) = VA/Coil Voltage			A.C. Pick-Up (VA) 80-100 / A.C. Sealed (VA) 9-12				
Power Factor			Pick-up .65 / Sealed .35				
Coil Operating Time at Rated Coil Voltage			Pick-up (ms) 10-25 / Drop-out (ms) 6-18				
Maximum Operating Frequency (No-Load Operation)			3000 operations / hour				
Mechanical Durability			10,000,000 operations				
Electrical Durability			1,000,000 operations				
Operating Ambient Temperature			-25 to +55C (-13 to +131F)				
Electrical Protection Degree			IP20 (IP10 for power entry cables)				
Mounting			Screw or 35mm DIN rail				
Wire Sizes	Line / Load		10 AWG			8 AWG	
	Control & Auxiliary Contacts		#12-#14 AWG (stranded recommended)				

Notes:

1. AC3 type loads consist of squirrel cage three-phase motors.

2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

3. Type 2 coordination is a protection category for IEC 60947-4-1. Section 8.2.5.1 specifies that Type 2 coordination requires that, under short circuit conditions, the contactor or starter shall cause no danger to persons or installation and shall be suitable for further use. The risk of minor contact welding is possible.

4. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 17-77.

GH Series 60 mm Contactor Specifications

60 mm Contactor Specification Guide					
Contactor Model			***GH15GT***	***GH15HT***	***GH15JT***
Insulation Voltage	AC	(V)	600 Volts AC		
Ampere Rating	Max. UL Amps (AC3) note 1	(A)	40	50	63
	AC1 Thermal Current (600V) note 2	(A)	63	80	100
Maximum Power (hp) of Three-Phase Motors	200V	(hp)	10	15	15
	230/240V	(hp)	10	15	20
	460/480V	(hp)	25	30	40
	575V	(hp)	30	40	50
Maximum Power (hp) of Single-Phase Motors	115V	(hp)	3	3	5
	230/240V	(hp)	5	7.5	10
Maximum Power (kW) of Three-Phase Motors AC3 Category note 1	230/240V	(kW)	11	12.5	18.5
	400V	(kW)	18.5	22	30
	440/480V	(kW)	21	25	33
	500V	(kW)	18.5	22	30
	690V	(kW)	18.5	22	30
Short Circuit Protection Fuses Class J UL Rated Fuses	Type 2 Coordination note 3	(A)	63	80	100
SCCR Rating (kA)		kA	5	5	5
Auxiliary Contacts Electrical Capacity			A600 note 4		
Coil Voltage Operating Limits			A.C.Pick-up 85-110% rated control voltage / A.C. Drop-Out 20-75% rated control voltage		
Average Coil Power Requirements / Coil current (A) = VA/Coil Voltage			A.C. Pick-up (VA) 250 / A.C. Sealed (VA) 18		
Power Factor			Pick-up .54 / Sealed .35		
Coil Operating Time at Rated Coil Voltage			Pick-up (ms) 12-30 / Drop-out (ms) 6-15		
Maximum Operating Frequency (No-Load Operation)			3000 operations / hour		
Mechanical Durability			10,000,000 operations		
Electrical Durability			1,000,000 operations		
Operating Ambient Temperature			-25 to +55C (- 13 to +131F)		
Electrical Protection Degree			IP20 (IP10 for power entry cables)		
Mounting			Screw or 35mm DIN rail		
Wire Sizes	Line / Load		#3-#12 stranded		
	Control & Auxiliary Contacts		#12 - #16 AWG (stranded recommended)		

Notes

1. AC3 type loads consist of squirrel cage three phase motors.

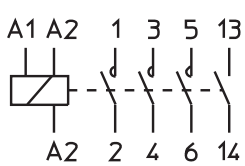
2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

3. Type 2 coordination is a protection category for IEC 60947-4-1. Section 8.2.5.1 specifies that Type 2 coordination requires that, under short circuit conditions, the contactor or starter shall cause no danger to persons or installations, and shall be suitable for further use. The risk of minor contact welding is possible.

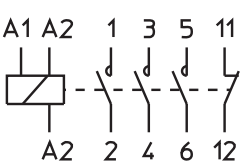
4. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 17-77.

Contactors

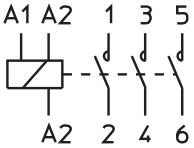
GH15BN3-10
GH15CN3-10
GH15DN3-10



GH15BN3-01
GH15CN3-01
GH15DN3-01



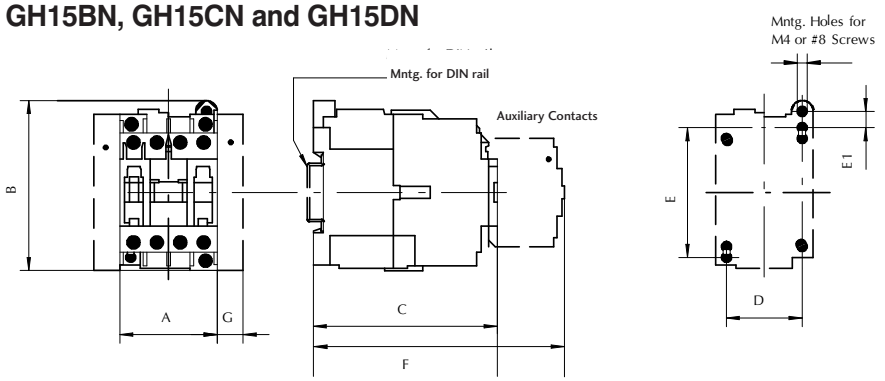
GH15ET3-00
GH15FT3-00
GH15GT3-00 (1)
GH15HT3-00 (1)
GH15JT3-00 (1)



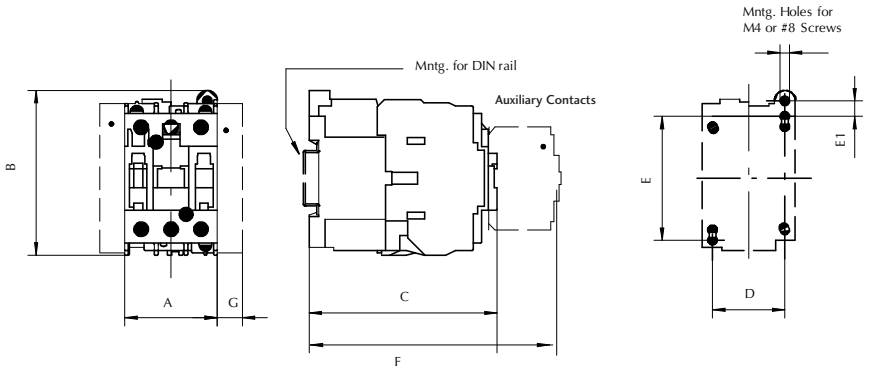
GH Series Contactor Dimensions

Dimensions (Inches)										
Product	IEC Size	Contactor Type								
		Wide	High	Deep	Mounting					Shipment Weight in Pounds
		A	B	C	D	E	E1	F	G	
Contactors	BN-DN	1.77	3.15	3.35	1.38	2.36	.3	4.57	.47	1.3
	ET-FT	1.77	3.15	3.58	1.38	2.36	.3	4.8	.47	1.4
	GT, HT, JT	2.36	4.49	4.29	1.97	3.94	—	5.51	.47	2.0

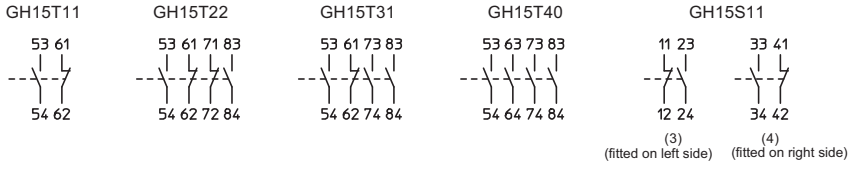
GH15BN, GH15CN and GH15DN



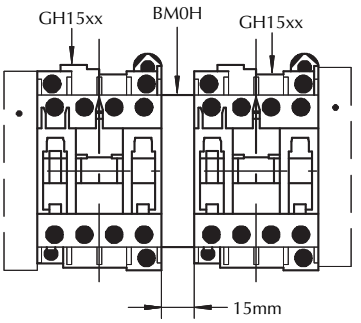
GH15ET, GH15FT, GH15GT, GH15HT and GH15JT



Auxiliary Contact Blocks



BM0H



Contactor accessories

Auxiliary contacts

Auxiliary contacts are designed for installation on the GH series contactors. The snap-on design makes them quick and easy to install.

The bifurcated contact blocks feature silver nickel alloy contacts.

Auxiliary Contacts			
Part Number	Price	Description	Mounting
GH15T11	<--->	1 NO 1 NC	Top
GH15T22	<--->	2 NO 2 NC	Top
GH15T31	<--->	3 NO 1 NC	Top
GH15T40	<--->	4 NO	Top
GH15S11	<--->	1 NO 1 NC	Side

Contacts rated A600 per NEMA ICS 5-2000. For more info, refer to Control Circuit Contact Electrical Ratings, page 17-77.

Replacement coils (for 45 mm frame only)

Replacement coils for the 110/120V and 220/240V units are available

Replacement Coils		
Part Number	Price	Description
B01-A-120	<--->	110/120V 50/60 Hz
B01-B-240	<--->	220/240V 50/60 Hz

Note: These coils do not work with GH15GT, GH15HT and GH15JT.

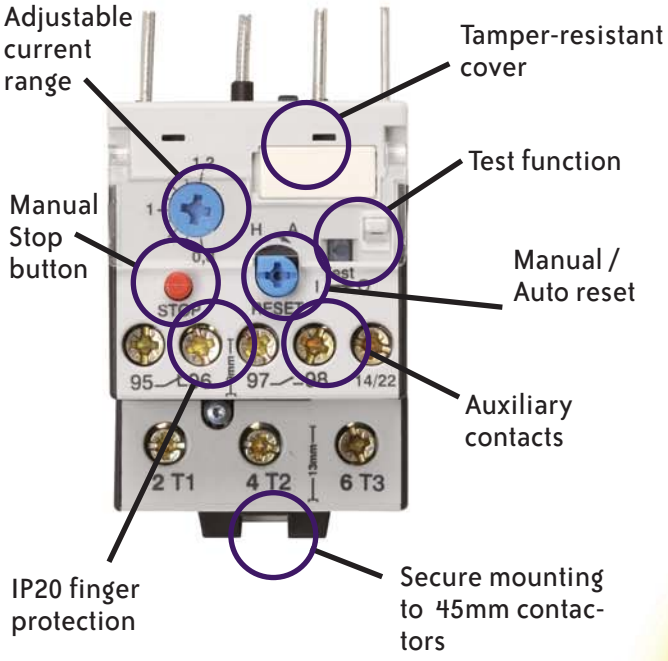
Mechanical interlock

Mechanical interlocks connect two contactors horizontally. When one contactor is energized, the other contactor is mechanically prohibited from making, even though it may be energized. The mechanical interlocks work with 45 and 60 mm contactors.

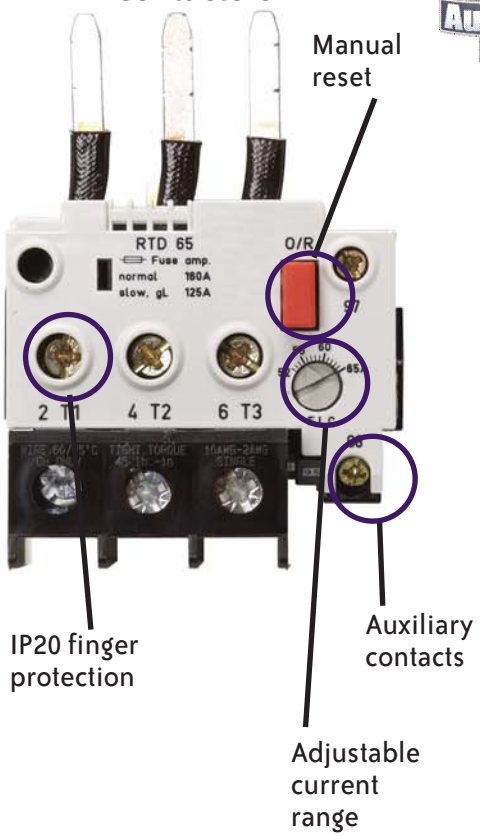
Mechanical interlock			
Part Number	Price	Description	Mounting
BM0H	<--->	Mechanical interlock	Side

Adjustable Overloads for GH Series Contactors

RTD32 for 45 mm Contactors



RTD65 for 60 mm Contactors



Adjustable overload relays for 45 mm and 60 mm contactors

The RTD32 and RTD65 adjustable motor overload relays are designed to attach directly to the GH Series 45 mm and 60 mm contactors. By combining the contactor with an overload relay, you have a motor starter solution at a fraction of the cost of the competition.

RTD65 overload relay for 60 mm contactors

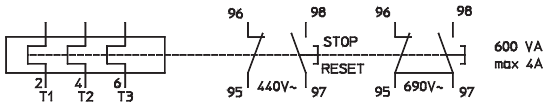
- Four sizes for motor currents from 20 to 65 amps
- Units come with N.O. and N.C. auxiliary contacts
- Mount directly to 60 mm contactors
- Class 10 trip curve
- UL/CUL listed, CE

RTD32 overload relay for 45 mm contactors

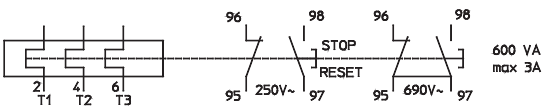
- 16 sizes for motor currents from 0.4 to 32 amps
- Units come with N.O. and N.C. auxiliary contacts
- Mount directly to 45 mm contactors
- Class 10 trip curve
- UL/CUL listed, CE

Overload Dimensions for GH Series Contactors

IEC terminal designations

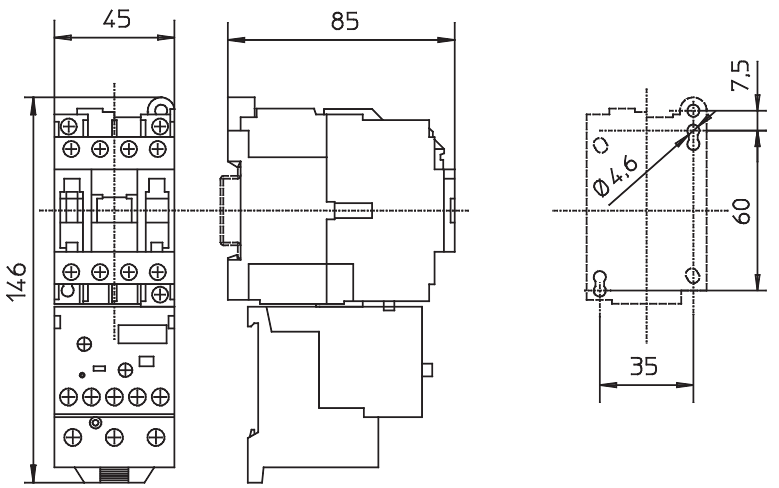


RTD32 (Manual - Auto Reset)



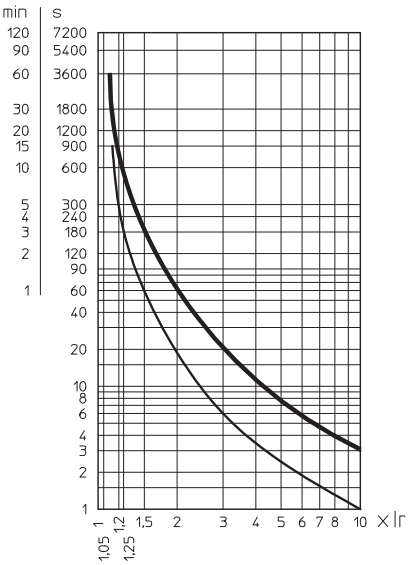
RTD65 (Manual - Auto Reset)

45 mm contactor and overload dimensions (mm)



GH15BN...FT + RTD32

Trip curve for 45 and 60 mm overloads

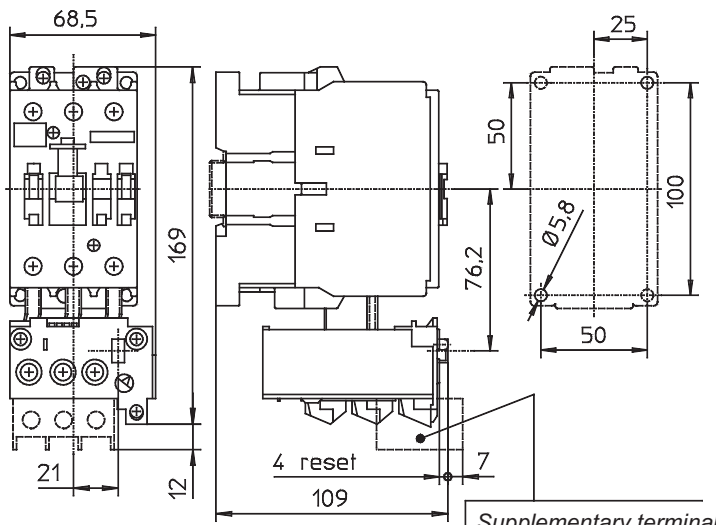


Note: Curves show tripping time (average value) versus multiples of setting current Ir.

Tripping starting from cold

Tripping starting from hot

60 mm contactor and overload dimensions (mm)



GH15GT ... JT + RTD65

Supplementary terminal block for 40-52A, 52-65A range only

GH Series Contactor/Overload Selection Guide

Step 1 Select your motor's FLA (Full Load Amperage) from column A.

Step 2 Follow across to column B to find your contactor size. Check the maximum amperage rating for that contactor. Ranges overlap and you may have to go to the next larger size.

Step 3 After selecting your contactor, follow across to Column C to find your overload relay model number.

Step 4 Order the contactor and overload relay, any desired auxiliary contacts, then assemble and install your motor starter.

Motor Contactor and Overload Relay Selection Guide (When Motor FLA is Known)				
A	***B***	***C***	***Price***	***IEC Contactor Frame Size***
Current Range Motor FLA	***Contactor Model***	***Overload Relay***		
0.4 to 0.6A	GH15BN up to maximum FLA of 9A	RTD32-60	<--->	45 mm frame size
0.6 to 0.9A		RTD32-90	<--->	
0.8 to 1.2A		RTD32-120	<--->	
1.2 to 1.8A		RTD32-180	<--->	
1.8 to 2.7A		RTD32-270	<--->	
2.7 to 4.0A		RTD32-400	<--->	
4.0 to 6.0A		RTD32-600	<--->	
6.0 to 9.0A		RTD32-900	<--->	
8.0 to 11.0A	GH15CN up to 12A FLA	RTD32-1100	<--->	
10.0 to 14.0A		RTD32-1400	<--->	
10.0 to 14.0A	GH15DN up to 16A FLA	RTD32-1400	<--->	
13.0 to 18.0A		RTD32-1800	<--->	
13.0 to 18.0A	GH15ET up to 25A FLA	RTD32-1800	<--->	
17.0 to 24.0A		RTD32-2400	<--->	
22.0 to 32.0A		RTD32-3200	<--->	
22.0 to 32.0A	GH15FT up to 32A FLA	RTD32-3200	<--->	
20.0 to 28.0A	GH15GT up to 40A FLA	RTD65-2800	<--->	60 mm frame size
28.0 to 42.0A		RTD65-4200	<--->	
28.0 to 42.0A	GH15HT up to 50A FLA	RTD65-4200	<--->	
40.0 to 52.0A		RTD65-5200	<--->	
40.0 to 52.0A	GH15JT up to 63A FLA	RTD65-5200	<--->	
52.0 to 65.0A		RTD65-6500	<--->	

MS Series Motor Starter/Protector Specifications

Specifications		
General		
Standards		IEC 947, EN 60947, VDE 0660, EN 60204, VDE 0113
Approvals		UL
Impact Resistance at 20 ms Duration		20g
Ambient Temperature		-25 to 50 °C (open) -25 to 40 °C (enclosed)
Climactic Class		IEC 68-2-3, IEC 68-2-30
Weight		0.55 lb (250g)
Protection Degree		IP 20
Main Circuits		
Insulation Voltage		690V
Insulation Impulse Voltage		6kV
Thermal Current		25A
Utilization Category		AC3
Wire Size Maximum		14-10 AWG
Terminal Torque Specification		2 N·m
Auxiliary Contact		
Insulation Voltage		500V
Thermal Current		6A
Operational Current:	***230V***	3.5A
	400V	2A
	500V	1.5A
Maximum Fuse Size		6A
Wire Size Maximum		18-14 AWG
Note: Phase loss protection only works under load. The phase loss protection is a product of the thermal overload protection circuitry.		

Dimensions and installation data for these products are available on our website, listed under Tech Support/technical and application notes/motor controls/contactors and starters/ Application Data for MS25 manual starter.

Shunt release

Shunt releases are used for electrically tripping the MSP. These units are easily installed inside the MSP and are offered in 120 and 220/240 volt AC versions.

Undervoltage release

Undervoltage releases are also installed inside the MSP and trip the device when the monitored voltage drops below a specified level. This is to protect the motor from damage when a low voltage situation occurs. Undervoltage releases may be wired to monitor voltage at point, but are typically wired to two of the incoming lines to the motor circuit. Undervoltage releases are not to be confused with the MSP's internal phase loss protection.

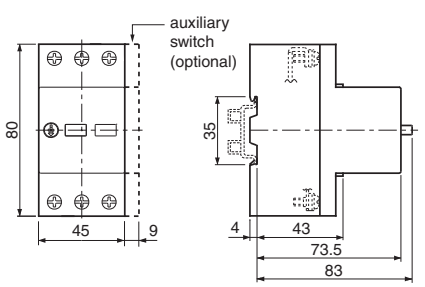
Note: A shunt release and undervoltage release cannot be installed in the same MSP.

Phase loss protection

Phase loss protection is integral to the MSP overload protection system. Phase loss protection works by detecting unequal current in each of the phases. A mechanical device senses the difference in the position of the bi-metallic overload strips and trips the MSP when this occurs. For proper phase loss detection, the MSP must be sized and adjusted to the motor it is protecting. The phase loss protection works only when the motor is running, and is a product of the thermal overload protection circuitry.

Note: The MSP provides magnetic short circuit protection as well as thermal overload protection under IEC 60947 requirements. NEC 430 may require a short circuit protection device upstream from the MSP. It is the responsibility of the user to comply with applicable codes and requirements.

Dimensions (mm)



Motor starter/protector combination consisting of a contactor, MSP with optional MS25-PS11 auxiliary contact and a UMP45 adapter plate. Components are sold separately.

MS Series MSP Selection Guide

Choose your motor starter/protector according to the FLA rating on your motor data plate. Refer to the charts on the following page.

Accessories

To complete your motor starter/ protector, there are several accessories that may be used. The Auxiliary Switch (contact) has one normally open contact and one normally closed contact. The Shunt Release trips when voltage is applied (120V or 220V). With the Undervoltage Release, your motor is protected from a low voltage situation.

Motor Starter/Protector and Accessories		
Part Number	**Price**	**Description**
MS25-16	<--->	Motor starter protector with thermal overload release, setting range from 0.1 to 0.16A
MS25-25	<--->	Motor starter protector with thermal overload release, setting range from 0.16 to 0.25A
MS25-40	<--->	Motor starter protector with thermal overload release, setting range from 0.25 to 0.4A
MS25-63	<--->	Motor starter protector with thermal overload release, setting range from 0.4 to 0.63A
MS25-100	<--->	Motor starter protector with thermal overload release, setting range from 0.63 to 1A
MS25-160	<--->	Motor starter protector with thermal overload release, setting range from 1 to 1.6A
MS25-250	<--->	Motor starter protector with thermal overload release, setting range from 1.6 to 2.5A
MS25-400	<--->	Motor starter protector with thermal overload release, setting range from 2.5 to 4A
MS25-630	<--->	Motor starter protector with thermal overload release, setting range from 4 to 6.3A
MS25-1000	<--->	Motor starter protector with thermal overload release, setting range from 6.3 to 10A
MS25-1600	<--->	Motor starter protector with thermal overload release, setting range from 10 to 16A
MS25-2000	<--->	Motor starter protector with thermal overload release, setting range from 16 to 20A
MS25-2500	<--->	Motor starter protector with thermal overload release, setting range from 20 to 25A
MS25-PS11	<--->	Auxiliary Switch, 1 N.O. contact, 1 N.C. contact
MS25-A120	<--->	120V/60Hz Shunt Release
MS25-A220	Discontinued	220V/60Hz Shunt Release
MS25-U220	<--->	220V/60Hz UnderVoltage Release
MS25-U440	<--->	440V/60Hz UnderVoltage Release
UMP45	<--->	Din Rail Adapter Plate

MS25 Series Motor Starter/Protector Short Circuit Instantaneous Trip Current and Backup Fuse Recommendations									
Manual Starter/ Protector Part Number	**Short Circuit Trip Current [1]**	**Short Circuit Breaking Capacity (kA)**				**Max Back-Up Fuses Class CC or Class J [2]**			
		220/240VAC	**460/480VAC**	**500 VAC**	**690 VAC**	**230 VAC**	**400 VAC**	**500 VAC**	**690 VAC**
MS25-16	2	50	50	50	50	*	*	*	*
MS25-25	3	50	50	50	50	*	*	*	*
MS25-40	5	50	50	50	50	*	*	*	*
MS25-63	8	50	50	50	50	*	*	*	*
MS25-100	12	50	50	50	50	*	*	*	*
MS25-160	20	50	50	50	50	*	*	*	*
MS25-250	33	50	50	3	2.5	*	*	25	20
MS25-400	44	50	50	3	2.5	*	*	35	25
MS25-630	75	50	50	3	2.5	*	*	50	35
MS25-1000	120	50	6	3	2.5	*	80	50	35
MS25-1600	160	6	4	2.5	2	63	80	63	35
MS25-2000	230	6	4	2.5	2	63	80	63	50
MS25-2500	270	6	4	2.5	2	63	80	63	50

***Note 1:** The short-circuit trip is the current at which the device will instantly trip via the electromagnetic trip circuitry within the MSP. The short circuit breaking capacity is the total branch circuit supply current that the device can safely protect. Fields marked with an asterisk indicate that the device can safely handle any supply current with output fusing.*

***Note 2:** The trip currents and back-up fuses are per IEC 60947. Local codes and regulations may require additional short circuit protection. Consult codes applicable to your application.*

GH Series Contactor/MSP Selection Guide

Step 1: Select your motor FLA (full load amperage) from column A.

Step 2: Go to column B to find your contactor model. Check the maximum amperage rating for that contactor. Ranges overlap and you may have to go to the next larger size.

Step 3: After selecting your contactor, go to column C to find your motor starter/protector.

Step 4: Order the motor starter/protector, contactor or any other accessories.

Motor Contactor and Motor Starter/Protector (MSP) Selection Guide (when motor FLA is known)				
A	**B**	**C**	**IEC Frame Size**	**Special Assembly Note**
Current Range Motor FLA	**Contactor Model**	**Motor Starter/Protector Part Number**		
0.1 to 0.16 A	GH15BN Up to 9A FLA	MS25-16	45 mm frame size	Note: A DIN rail adapter plate is needed for assembly of the contactor and motor starter/protector. This plate allows two DIN rail devices to be mounted together as an assembly to one piece of DIN rail. The part number is UMP45.
0.16 to 0.25 A		MS25-25		
0.25 to 0.4 A		MS25-40		
0.4 to 0.63 A		MS25-63		
0.63 to 1 A		MS25-100		
0.1 to 1.6 A		MS25-160		
1.6 to 2.5 A		MS25-250		
2.5 to 4 A		MS25-400		
4 to 6.3 A		MS25-630		
6.3 to 10 A		MS25-1000		
10.0 to 16 A	GH15CN Up to 12 A FLA	MS25-1600		
10.0 to 16.0 A	GH15DN Up to 16A FLA	MS25-1600		
16.0 to 20.0 A	GH15ET Up to 25A FLA	MS25-2000		
20.0 to 25.0 A		MS25-2500		

The following charts are to be used as a guideline only. Motor control devices should be sized using the motor FLA (full load amperage) rating. It is the user's responsibility to size the motor starter/protector properly.

Step 1: Select your motor horsepower rating in column A based on the rating from the motor data plate or spec. sheet.

Step 2: Go to column B to find your contactor model. Check the maximum amperage rating for that contactor. Ranges overlap and you may need to go to the next larger size.

Step 3: After selecting your contactor, go to column C to find your motor starter/protector.

Motor Contactor and MSP Selection Guide for 440-480 Volt Three-Phase Motor Control				
A	**B**	**C**	**IEC Frame Size**	**Special Assembly Note**
Motor Horsepower	**Contactor Model**	**Motor Starter/Protector Part Number**		
1/2	GH15BN Up to 9A FLA	MS25-160	45 mm frame size	Note: A DIN rail adapter plate is needed for assembly of the contactor and motor starter/protector. This plate allows two DIN rail devices to be mounted together as an assembly to one piece of DIN rail. The part number is UMP45.
3/4		MS25-160		
1		MS25-250		
1 1/2		MS25-400		
2		MS25-400		
3		MS25-630		
5		MS25-1000		
7 1/2	GH15CN Up to 12A FLA	MS25-1600		
10	GH15DN Up to 16A FLA	MS25-1600		
15	GH15ET Up to 25A FLA	MS25-2500		

Motor Contactor and MSP Selection Guide for 230-240 Volt Three-Phase Motor Control				
A	**B**	**C**	**IEC Frame Size**	**Special Assembly Note**
Motor Horsepower	**Contactor Model**	**Motor Starter/Protector art Number**		
1/2	GH15BN Up to 9A FLA	MS25-250	45 mm frame size	Note: A DIN rail adapter plate is needed for assembly of the contactor and motor starter/protector. This plate allows two DIN rail devices to be mounted together as an assembly to one piece of DIN rail. The part number is UMP45
3/4		MS25-400		
1		MS25-400		
1 1/2		MS25-630		
2		MS25-1000		
3	GH15CN Up to 12A FLA	MS25-1000		
5	GH15DN Up to 16A FLA	MS25-1600		
7 1/2	GH15ET Up to 25A FLA	MS25-2500		

Starters and Contactors Overview

Cutler-Hammer's Freedom series of IEC contactors feature a compact space saving design.

Components that meet IEC 60947 are more reliable, of higher quality, and are better matched to their intended application.

Contactor overview

The Cutler-Hammer CE15 Freedom Series IEC contactors offer big contactor ratings in a compact frame. The 45 mm frame contactors can handle up to 20 hp at 460V. They are easily DIN-rail mountable in either the vertical or horizontal upright position. Note: There is not enough space to assemble two contactors into a reversing contactor.

Starter overview

The Cutler-Hammer AE16 Series IEC starters are full voltage magnetic starters used for starting polyphase induction motors. These starters also provide protection to the motor against running or stalled overcurrents.

The 45 mm frame starters can handle up to 20 hp at 460V. They are easily DIN-rail mountable in either the vertical or horizontal upright position.

Starters are comprised of a contactor, overload relay and heater packs (sold separately). The overload relays have FLA adjustable dials.

Starter/contactor features and specifications

- EN60947-4-1 IEC 947-4-1 compliance (international standard for low voltage switchgear and control devices)
- UL-listed and CSA-certified
- 45 mm frame rated maximum 20 hp at 460V; highest horsepower rating in a compact, space-saving design
- Long-life twin break, silver cadmium oxide contacts for excellent conductivity and superior resistance to welding and arc erosion
- 45 mm open contactors, sizes A-F, with DIN-rail or universal base mounting
- DIN rail release mechanism: conveniently located on line side of contactor
- Designed to 2,000,000 electrical and 20,000,000 mechanical operations at maximum hp ratings through 20 hp at 460V. Adequate for most general duty control applications.
- Contactor and terminal markings conform to CENELEC EN50011.
- Holding circuit contact(s) supplied standard
- Lugs supplied standard on sizes A-F
- Tape wound coil
- Straight-through wiring

Thermal Overload Relays Overview

Overload relays are provided to protect motors, motor control apparatus and motor-branch circuit conductors against excessive heating due to motor overloads and failure to start.

The C306 overload relay is designed for use with the Cutler-Hammer series non-reversing contactors.

Time-current characteristics

The time-current characteristics of an overload relay define its operating time at various multiples of its current setting. Underwriters Laboratory (UL) performs tests in accordance with NEMA Standards and the NEC as follows:

- When tested at 100 percent of its current rating, the overload relay shall trip ultimately.
- When tested at 200 percent of its current rating, the overload relay shall trip in not more that eight minutes.
- When tested at 600 percent of its current rating, the overload relay shall trip in not more that 10 or 20 seconds, depending on the class of the relay.

Definitions

Current rating: the minimum current at which the relay will trip. Per NEC, an overload must ultimately trip at 125% of FLA current (heater) setting for a 1.15 service factor motor, and 115% FLA for a 1.0 service factor motor. Current setting: the FLA (Full Load Amperage) of the motor and thus the overload heater pack setting.

Example: 600% of current rating is defined as 750% (600 X 1.25) of FLA current (heater) setting for a 1.15 service factor motor. A 10A heater setting must trip in 20 seconds or less at 75A motor current for a Class 20 relay.

Thermal overload relays feature:

- Selectable manual or automatic reset operations
- Interchangeable Class 20 heater packs ±24% to match motor FLA and calibrated for 1.0 and 1.15 service factors (ordered separately)
- Integral load lugs which allow field wiring prior to heater pack installation
- Single-phase protection
- Bimetallic, ambient compensated operation
- Trip-free mechanism
- Electrically-isolated N.O. or N.C. contacts
- Overload trip indication
- Fingerproof terminals to reduce possibility of shock
- UL-listed, CSA-certified, NEMA-compliant

Overload relay setting

FLA dial adjustment

For motors having a 1.15 service factor, rotate the FLA adjustment dial to correspond to the motor's FLA rating. Estimate the dial position when the motor FLA falls between two letter values, as shown in the example.

For motors having a 1.0 service factor, or to meet IEC 947 requirements, rotate the FLA dial one-half of a position counter-clockwise (CCW).

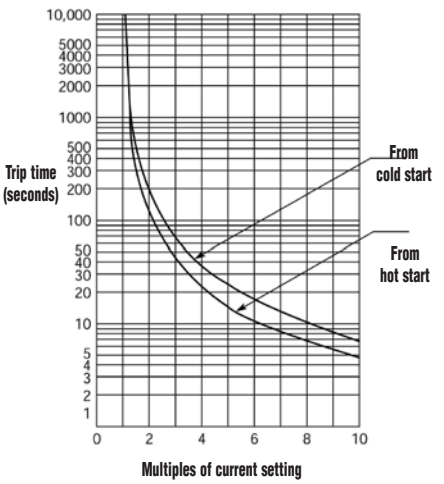
Manual/automatic reset

The overload relay is factory set at M for manual reset operation. For automatic reset operation, turn the reset adjustment dial to the A position, as shown in the illustration. Automatic reset is not intended for two-wire control devices.

Test for trip indication

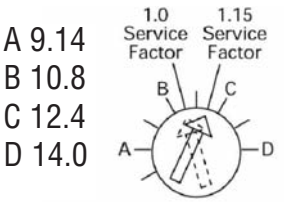
To test overload relay for trip indication when in manual reset, pull out the blue RESET button. An orange flag will appear indicating that the device has tripped. Push RESET button in to reset.

Class 20 overload relay 25ºC open rating

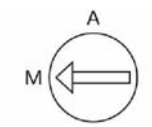


Thermal Overload Relays			
IEC	Max. Amps	No. of Poles	Open Type
A-F	32	3	C306DN3B

Price: <--->

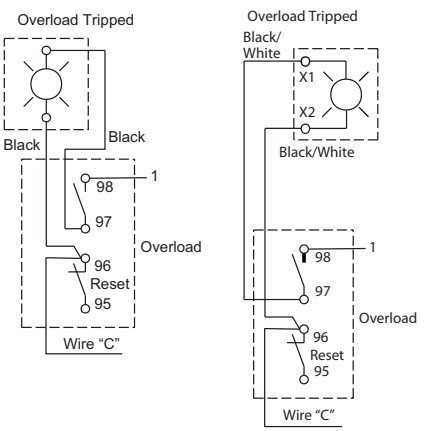


Example of 12.0 FLA setting for heater pack number H2011B showing position for 1.0 or 1.15 service factor motors.



Example of setting of manual reset.

Overload terminals 95/96 and 98/97



Warning: To provide continued protection against fire or shock hazard, the complete relay must be replaced if burnout of the heater element occurs.

Heater packs

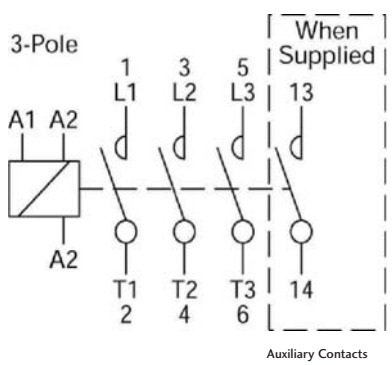
Heater packs are used with the C306DN3B overload relay. The load lugs are built into the overload base to allow load wiring prior to heater pack installation. Heater packs come in packs of three.

Standard Trip-Class 20 Heater Packs						
Part Number (Three heater packs)	Price	Max. Amps	Motor Full Load Ampere Rating Dial Position			
			A	B	C	D
H2001B-3	<--->	32	.254	.306	.359	.411
H2002B-3	<--->	32	.375	.452	.530	.607
H2003B-3	<--->	32	.560	.676	.791	.907
H2004B-3	<--->	32	.814	.983	1.15	1.32
H2005B-3	<--->	32	1.20	1.45	1.71	1.96
H2006B-3	<--->	32	1.79	2.16	2.53	2.90
H2007B-3	<--->	32	2.15	2.60	3.04	3.49
H2008B-3	<--->	32	3.23	3.90	4.56	5.23
H2009B-3	<--->	32	4.55	5.50	6.45	7.40
H2010B-3	<--->	32	6.75	8.17	9.58	11.0
H2011B-3	<--->	32	9.14	10.8	12.4	14.0
H2012B-3	<--->	32	14.0	16.9	19.9	22.8
H2013B-3	<--->	32	18.7	22.7	26.7	30.7
H2014B-3	<--->	32	23.5	28.5	33.5	38.5

Auxiliary contacts

Auxiliary contacts are designed for installation on the Cutler-Hammer Freedom series contactors and starters. The snap-on design makes them quick and easy to install.

The bifurcated (i.e. contact is split into two fingers for redundant contact) design of the contact blocks features silver cadmium alloy contacts.



Auxiliary Contacts

Contactor terminal markings

Contactor terminals are identified by a two-digit number in accordance with international standards approved by CENELEC (European Committee for Electrotechnical Standardization). This distinctive number is marked on the top nameplate and designates the type and quantity of built-in auxiliary contacts. The first digit indicates the quantity of N.O. contacts and the second digit indicates the quantity of N.C. contacts. *Example:* 10E indicates a contactor with one N.O. and no N.C. auxiliary contacts (factory supplied). In addition, all terminals conform to both CENELEC and NEMA requirements. Auxiliary contact terminals use the first digit to indicate location and the second digit to indicate status (1-2 means N.C. and 3-4 means N.O.) *Example*: 13-14 indicates the first auxiliary contact and it is a N.O. See the diagram to the left for the contact label.

Auxiliary Contacts		
Part Number	Price	Description
C320KGS3	<--->	1 N.O. and 1 N.C.
C320KGS1	<--->	1 N.O.

Mounting adapters

DIN-rail and panel mounting adapters are required when overload relays need to be separately mounted due to space requirements. The terminal base adapter includes line terminals and connects with the overload relays.

Mounting Adapters		
Part Number	Price	Description
C306TB1	<--->	Mounting Adapter for 32 Amp Overload Relay

CE15 Contactor Specifications

45 mm Cutler-Hammer CE15 Contactor Specifications								
Contactor Model			**CE15AN**	**CE15BN**	**CE15CN**	**CE15DN**	**CE15EN**	**CE15FN**
Insulation Voltage	AC	(V)	690 Volts AC					
Ampere Rating	Max. UL Current (AC3) note 1	(A)	7	10	12	18	25	32
	AC1 Thermal Current (600V) note 2	(A)	20	20	20	32	32	32
Maximum Power (hp) of Three-Phase Motors	200V	(hp)	1.5	2	3	5	5	7.5
	230/240V	(hp)	1.5	2	3	5	7.5	10
	460/480V	(hp)	3	5	7.5	10	15	20
	575V	(hp)	5	7.5	10	15	20	25
Maximum Power (hp) of Single-Phase Motors	115V	(hp)	0.25	0.5	0.5	1	2	2
	230/240V	(hp)	0.5	1	2	3	3	5
Maximum Power (kw) of Three-Phase Motors AC3 Category note 1	230/240V	(kW)	1.1	1.5	2.2	4	5.5	7.5
	415/440V	(kW)	2.2	4	5.5	7.5	11	15
	500/550V	(kW)	2.2	4	5.5	7.5	11	15
	500V	(kW)	4	5.5	7.5	11	15	18.5
	600V	(kW)	1.5	2.2	4	5.5	7.5	10
Auxiliary Contacts Electrical Capacity			A600 note 4					
Coil Voltage Operating Limits			A.C.Pick-Up 85-110% Rated Control Voltage / A.C. Drop-Out 20-75% Rated Control Voltage					
Average Coil Power Requirements / Coil current (A) = VA/Coil Voltage			A.C. Pick-Up (VA) 80-100 / A.C. Sealed (VA) 9-12					
Power Factor			Pick-Up .65 / Sealed .35					
Coil Operating Time at Rated Coil Voltage			Pick-Up (ms) 10-25 / Drop-Out (ms) 6-18					
Maximum Operating Frequency (No-Load Operation)			3000 Operations / Hour					
Mechanical Durability			10,000,000 Operations					
Electrical Durability			1,000,000 Operations					
Operating Ambient Temperature			-25° to +55°C					
Electrical Protection Degree			IP20 (IP10 for GH15ET and GH15FT)					
Mounting			Screw or 35mm DIN Rail					
Wire Sizes	Line / Load		#10 - #14 AWG stranded recommended			#14 - #8 stranded recommended		
	Control & Auxiliary Contacts		#12 - #14 AWG (stranded recommended)					
Line/Load Tighting Torque	Nm (Inch Pounds)		7	7	7	15	15	15

Notes

1. AC3 type loads consist of squirrel cage three phase motors.

2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

3. Type 2 coordination is a protection category for IEC 60947-4-1. Section 8.2.5.1 specifies that Type 2 coordination requires that, under short circuit conditions, the contactor or starter shall cause no danger to persons or installations and shall be suitable for further use. The risk of minor contact welding is possible.

4. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 17-77.

Cutler-Hammer CE15 Series Contactor Part Numbers									
IEC FRAME SIZE	**Cutler-Hammer Contactor Model**	**Part Number**	**Price**	**Number of Contacts**			**Coil Voltage and Frequency**	**Additional Contacts**	
				Main	**Auxiliary Contacts Included**			**Maximum Contact Block Arrangement**	**Type of Additional Contact Block**
					N.O	N.C.			
45 mm	**CE15AN**	**CE15AN4AB**	<--->	4			110-120VAC 50-60Hz	Up to two auxiliary contact blocks may be added to CE15 contactors (one per side).	Side mount C320KGS3: 1 N.O. / 1 N.C. C320KGS1: 1 N.O. / 1 N.C.
		CE15AN4BB	<--->	4			220-240VAC 50-60Hz		
	CE15BN	**CE15BN4AB**	<--->	4			110-120VAC 50-60Hz		
		CE15BN4BB	<--->	4			220-240VAC 50-60Hz		
	CE15CN	**CE15CN4AB**	<--->	4			110-120VAC 50-60Hz		
		CE15CN4BB	<--->	4			220-240VAC 50-60Hz		
	CE15DN	**CE15DNS3AB**	<--->	3	1		110-120VAC 50-60Hz		
		CE15DNS3BB	<--->	3	1		220-240VAC 50-60Hz		
	CE15EN	**CE15ENS3AB**	<--->	3	1		110-120VAC 50-60Hz		
		CE15ENS3BB	<--->	3	1		220-240VAC 50-60Hz		
	CE15FN	**CE15FNS3AB**	<--->	3	1		110-120VAC 50-60Hz		
		CE15FNS3BB	<--->	3	1		220-240VAC 50-60Hz		

Note: Holding circuit contact(s) supplied standard: a N.O. auxiliary contact block is mounted on the right-hand side. (On Sizes A-C, contact occupies fourth power pole position - no increase in width.)

AE16 Starter Specifications

45 mm Cutler-Hammer AE16 Starter Specifications								
Starter Model			**AE16AN**	**AE16BN**	**AE16CN**	**AE16DN**	**AE16EN**	**AE16FN**
Insulation Voltage	AC	(V)	690 Volts AC					
Ampere Rating	Max. UL Current (AC3) note 1	(A)	7	10	12	18	25	32
	AC1 Thermal Current (600V) note 2	(A)	20	20	20	32	32	32
Maximum Power (hp) of Three-Phase Motors	200V	(hp)	1.5	2	3	5	5	7.5
	230/240V	(hp)	1.5	2	3	5	7.5	10
	460/480V	(hp)	3	5	7.5	10	15	20
	575V	(hp)	5	7.5	10	15	20	25
Maximum Power (hp) of Single-Phase Motors	115V	(hp)	0.25	0.5	0.5	1	2	2
	230/240V	(hp)	0.5	1	2	3	3	5
Maximum Power (kw) of Three-Phase Motors AC3 Category note 1	230/240V	(kW)	1.1	1.5	2.2	4	5.5	7.5
	415/440V	(kW)	2.2	4	5.5	7.5	11	15
	500/550V	(kW)	2.2	4	5.5	7.5	11	15
	500V	(kW)	4	5.5	7.5	11	15	18.5
	600V	(kW)	1.5	2.2	4	5.5	7.5	10
Auxiliary Contacts Electrical Capacity			A600 note 4					
Coil Voltage Operating Limits			A.C.Pick-Up 85-110% Rated Control Voltage / A.C. Drop-Out 45% Rated Control Voltage					
Average Coil Power Requirements / Coil current (A) = VA/Coil Voltage			A.C. Pick-Up (VA) 80-100 / A.C. Sealed (VA) 7.5-10					
Power Factor			Pick-Up .65 / Sealed .35					
Coil Operating Time at Rated Coil Voltage			Pick-Up (ms) 12 / Drop-Out (ms) 12					
Maximum Operating Frequency (No-Load Operation)			Pick-Up (ms) 12 / Drop-Out (ms) 12					
Mechanical Durability			10,000,000 Operations					
Electrical Durability in Operations (AC3) note 1			2,000,000	2,000,000	2,220,222	1,300,000	1,600,000	1,500,000
Operating Ambient Temperature			-25° to +55°C					
Electrical Protection Degree			IP20 (IP10 for AE16DN,AE16EN, AE15FN)					
Mounting			Screw or 35mm DIN Rail					
Wire Sizes	Line / Load		#12 - 16 AWG stranded recommended			#16 - #8 stranded recommended		
	Control & Auxiliary Contacts		#12 - #14 AWG (stranded recommended)					
Line/Load Tighting Torque	Nm (Inch Pounds)		7			15		

Notes

1. AC3 type loads consist of squirrel cage three phase motors.

2. AC1 non-inductive or slightly inductive loads. Typically resistive loads (i.e. furnaces, ovens, etc.)

3. Type 2 coordination is a protection category for IEC 60947-4-1. Section 8.2.5.1 specifies that type 2 coordination requires that, under short circuit conditions, the contactor or starter shall cause no danger to persons or installations and shall be suitable for further use. The risk of minor contact welding is possible.

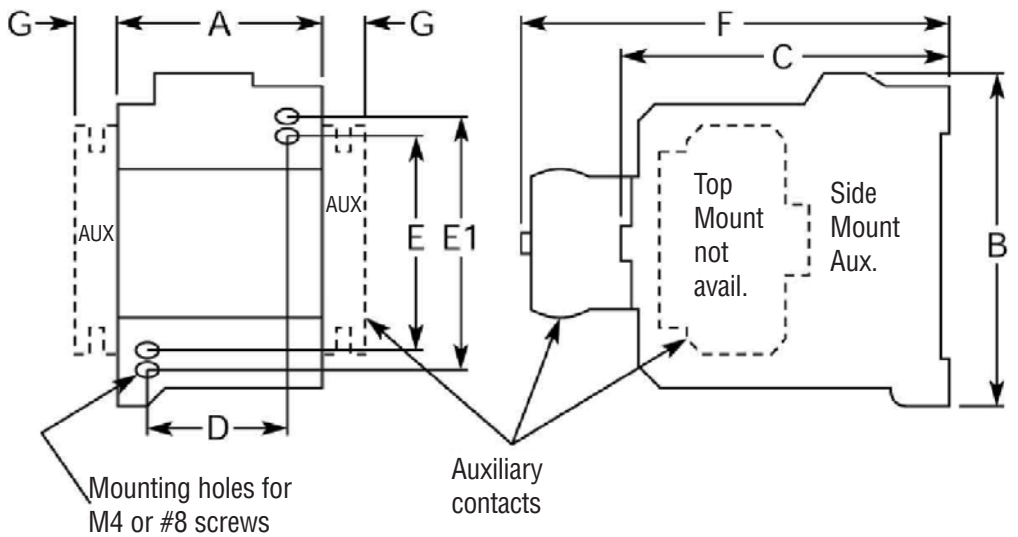
4. NEMA ICS 5-2000. For more information, refer to Control Circuit Contact Electrical Ratings, page 17-77.

Cutler-Hammer AE16 Series Starter Part Numbers									
IEC FRAME SIZE	**Cutler-Hammer Contactor Model**	**Part Number**	**Price**	**Number of Contacts**			**Coil Voltage and Frequency**	**Additional Contacts**	
				Main	**Auxiliary Contacts Included**			Maximum Contact Block Arrangement	Type of Additional Contact Block
					N.O	N.C.			
45 mm	**AE16AN**	**AE16ANS0AC**	<--->	3	1		110-120VAC 50-60Hz	Up to two auxiliary contact blocks may be added to AE16 contactors (one per side).	Side mount C320KGS3 (1 NO and 1 NC) C320KGS1 (1 NO and 1 NC)
		AE16ANS0BC	<--->	3	1		220-240VAC 50-60Hz		
	AE16BN	**AE16BNS0AC**	<--->	3	1		110-120VAC 50-60Hz		
		AE16BNS0BC	<--->	3	1		220-240VAC 50-60Hz		
	AE16CN	**AE16CNS0AC**	<--->	3	1		110-120VAC 50-60Hz		
		AE16CNS0BC	<--->	3	1		220-240VAC 50-60Hz		
	AE16DN	**AE16DNS0AC**	<--->	3	1		110-120VAC 50-60Hz		
		AE16DNS0BC	<--->	3	1		220-240VAC 50-60Hz		
	AE16EN	**AE16ENS0AC**	<--->	3	1		110-120VAC 50-60Hz		
		AE16ENS0BC	<--->	3	1		220-240VAC 50-60Hz		
	AE16FN	**AE16FNS0AC**	<--->	3	1		110-120VAC 50-60Hz		
		AE16FNS0BC	<--->	3	1		220-240VAC 50-60Hz		

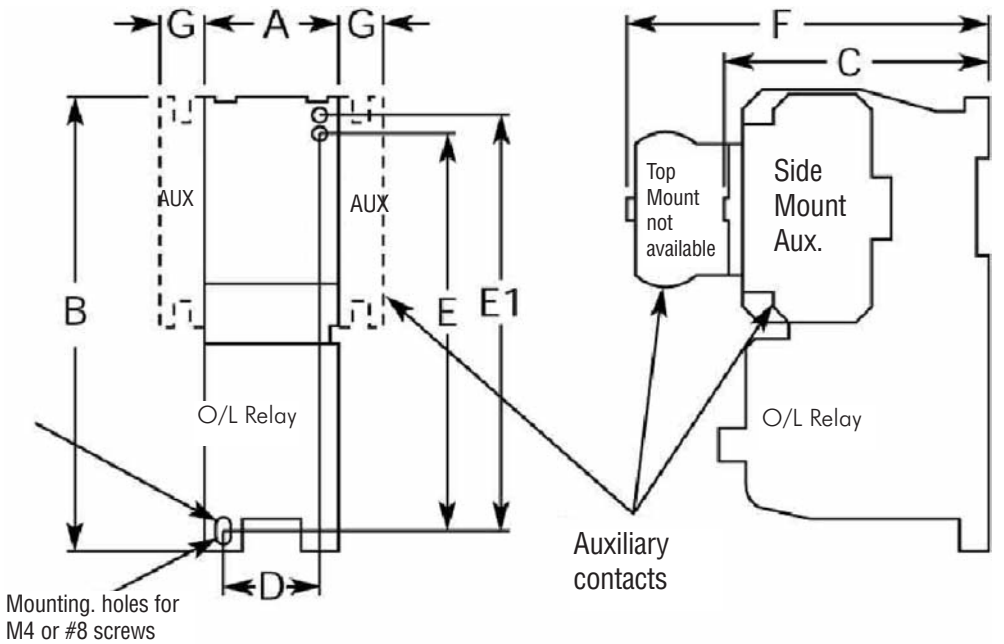
Note: Holding circuit contact(s) supplied standard: a N.O. auxiliary contact block is mounted on the right-hand side. (On Sizes A-C, contact occupies fourth power pole position-no increase in width.)

Size and Dimensions (Inches)										
Product	IEC Size	Contactor Type								Ship Weight in Pounds
		Wide	High	Deep	Mounting					
		A	B	C	D	E	E1	F	G	
Starters	A-F	1.80	5.86	3.28	1.36	5.19	5.39	-	54	1.75
Contactors	A-C	1.80	2.96	3.26	1.36	1.96	-	-	54	1.3
Contactors	D-F	1.80	2.96	3.26	1.36	1.96	-	-	54	1.4
Overload Relays	32 Amp	1.77	4.13	3.69	1.36	3.74	-	-	-	0.8

IEC contactor sizes A-F, CE15



IEC starter sizes A-F, AE16



Electrical Ratings Charts

Motor Current Ratings

Full Load Ampere (FLA) Rating for AC Induction Motors							
Motor HP	115 VAC		200 VAC		230 VAC		460 VAC
	1-Phase (A)	3-Phase (A)	1-Phase (A)	3-Phase (A)	1-Phase (A)	3-Phase (A)	3-Phase (A)
1/10	3.0	---	---	---	1.5	---	---
1/8	3.8	---	---	---	1.9	---	---
1/6	4.4	---	2.5	---	2.2	---	---
1/4	5.8	---	3.3	---	2.9	---	---
1/3	7.2	---	4.1	---	3.6	---	---
1/2	9.8	4.4	5.6	2.5	4.9	2.2	1.1
3/4	13.8	6.4	7.9	3.7	6.9	3.2	1.6
1	16.0	8.4	9.2	4.8	8.0	4.2	2.1
1 1/2	20.0	12.0	11.5	6.9	10	6.0	3.0
2	24.0	13.6	13.8	7.8	12	6.8	3.4
3	34.0	19.2	19.6	11.0	17	9.6	4.8
5	56.0	30.4	32.2	17.5	28	15.2	7.6
7 1/2	80.0	44.0	46.0	25.3	40	22	11
10	100.0	56.0	57.5	32.2	50	28	14
15	---	84.0	---	48.3	---	42	21
20	---	108.0	---	62.1	---	54	27
25	---	136.0	---	78.2	---	68	34
30	---	160.0	---	92	---	80	40
40	---	208.0	---	120	---	104	52
50	---	260.0	---	150	---	130	65
60	---	---	---	177	---	154	77
75	---	---	---	221	---	192	96
100	---	---	---	285	---	248	124

The motor currents are approximate and not guaranteed to be accurate. This chart is provided as a guideline only. Values were extrapolated from NEC Tables 430-148 and 430-150. Motor currents should be taken from the motor's nameplate. It is the user's responsibility to properly size their motor control devices.

Control Circuit Contact Electrical Ratings

NEMA Mechanical Switching Ratings and Test Values for DC Control Circuit Contacts					
Contact Rating Desig-nation	Thermal Continuous Test Current (A)	Maximum Make or Break DC Current (A)			Voltamperes
		125 Volts	250 Volts	301 to 600 Volts	
P300	5.0	1.1	0.55	---	138
P600	5.0	1.1	0.55	0.20	138
Q300	2.5	0.55	0.27	---	69
Q600	2.5	0.55	0.27	0.10	69
R300	1.0	0.22	0.11	---	28

This chart is provided as a guideline only, and the ratings and values are not guaranteed to be accurate. It is the users' responsibility to properly size their control circuit devices. The chart values are from NEMA Standard ICS 5-2000, Table 1-4-2.

NEMA Mechanical Switching Ratings and Test Values for AC Control Circuit Contacts											
Contact Rating Desig-nation	Thermal Continuous Test Current (A)	Maximum AC Current, 50/60Hz (A)								Voltamperes	
		120 Volts		240 Volts		480 Volts		600 Volts			
		Make	Break	Make	Break	Make	Break	Make	Break	Make	Break
A300	10	60	6.00	30	3.00	---	---	---	---	7200	720
A600	10	60	6.00	30	3.00	15	1.50	12	1.20	7200	720
B300	5	30	3.00	15	1.50	---	---	---	---	3600	360
B600	5	30	3.00	15	1.50	7.5	0.75	6	0.60	3600	360
C600	2.5	15	1.5	7.5	0.75	3.75	0.375	3.00	0.30	1800	180

This chart is provided as a guideline only, and the ratings and values are not guaranteed to be accurate. It is the users' responsibility to properly size their control circuit devices. The chart values are from NEMA Standard ICS 5-2000, Table 1-4-1.

IEC Utilization Categories

IEC Utilization Categories for Low Voltage Switchgear and Control Gear			
Current	***Category***	***Typical Applications***	***Relevant IEC Product Standard (3)***
AC	AC-1	Non inductive or slightly inductive loads, resistance furnaces, heaters	***60947-4***
	AC-2	Slip-ring motors: switching off	
	AC-3	Squirrel-cage motors: starting,switching off motors during running most typical industrial application	
	AC-4	Squirrel-cage motors: starting, plugging (1), inching (2)	
	AC-5a	Switching of electric discharge lamps	
	AC-5b	Switching of incandescent lamps	
	AC-6a	Switching of transformers	
	AC-6b	Switching of capacitor banks	
	AC-7a	Slightly inductive load in household appliances: mixers, blenders	
	AC-7b	Motor-loads for household applications: fans, central vacuum	
	AC-8a	Hermetic refrigerant compressor motor control with manual resetting overloads	
	AC-8b	Hermetic refrigerant compressor motor control with automatic resetting overloads	
	AC-12	Control of resistive loads and solid state loads with opto-coupler isolation	***60947-5***
	AC-13	Control of solid state loads with transformer isolation	
	AC-14	Control of small electromagnetic loads	
	AC-15	Control of AC electromagnetic loads	***60947-3***
	AC-20	Connecting and disconnecting under no-load conditions	
	AC-21	Switching of resistive loads, including moderate loads	
	AC-22	Switching of mixed resistive and inductive loads, including moderate overloads	
	AC-23	Switching of motor loads or other highly inductive loads	
AC and DC	A	Protection of circuits, with no rated short-time withstand current	***60947-2***
	B	Protection of circuits, with a rated short-time withstand current	
DC	DC-1	Non-Inductive or slightly inductive loads, resistance furnaces, heaters	***60947-4***
	DC-3	Shunt-motors, starting, plugging (1), inching (2), dynamic breaking of motors	
	DC-5	Series-motors, starting, plugging (1), inching (2), dynamic breaking of motors	
	DC-6	Switching of incandescent lamps	
	DC-12	Control of resistive loads and solid state loads with opto-coupler isolation	
	DC-13	Control of DC electromagnetics	***60947-5***
	DC-14	Control of D.C. electromagnetic loads having economy resistors in the circuit	
	DC-20	Connecting and disconnecting under no-load conditions	
	DC-21	Switching of resistive loads, including moderate overloads	***60947-3***
	DC-22	Switching of mixed resistive and inductive loads, including moderate overloads (i.e. shunt motors)	
	DC-23	Switching of highly inductive loads (i.e. series motors)	

(1) Plugging - Stopping a motor rapidly by reversing the primary power connections.

(2) Inching - Energizing a motor repeatedly for short periods to obtain small incremental movements.

(3) IEC Standards must be purchased from the International Electrotechnical Commission

BRYANT® Manual Motor Controllers / Disconnects

Overview

Bryant motor controllers are "suitable as motor disconnects," which means that a motor controller marked as such can also be used as a motor disconnect. From a safety perspective, this means a motor load can now be isolated and locked-out in one convenient location. By utilizing Bryant's compact motor controllers and disconnects, you benefit through the convenience of one device fulfilling two needs. A motor controller is simply used to activate a motor load "ON" or "OFF" and perform this function thousands of times. A motor disconnect, however, is designed and tested to withstand motor overloads and high short-circuit fault currents while maintaining the ability to disconnect the motor for service or maintenance.

According to the 2008 National Electric Code (NEC®) article 430.102, all motor controllers must have a disconnecting means located within the line of sight of the controller. Because the NEC® recognizes that a controller and disconnect can be the same unit (article 430.109), Bryant has designed a compact controller that will also meet the rigorous demands of a motor disconnect. Bryant's controllers are listed as "Suitable as Motor Disconnect" under UL Standard 508 – Industrial Control Equipment – qualifying them to perform both operations in one compact package.

TECH·SPEC®

Features and Benefits

- Thermoset body provides high resistance to electrical arc tracking.
- Silver alloy contacts for excellent conductivity and extended life
- Available NEMA 1, 3/3R and 4X enclosures
- Undrilled enclosures available for custom placement of entry positions
- Lockout / Tagout capability
- Switch sizes in 30, 40 and 60 Amps up to 600 VAC
- 2-pole and 3-pole switch configurations
- Use in indoor and outdoor environments
- Quick make, slow break design
- UL Listed as "Suitable as Motor Disconnect" under UL 508
- Wiring conduit knockouts on NEMA 1 and 3R controllers / disconnects
- Compact design

Applications

- Can be used locally at the motor
- "Suitable as a motor disconnect"
- Across-the-line motor starting
- Industrial machines
- Automation
- Switch contacts AC rated only (not DC rated).

Listings

- UL Listed and Recognized Catagory NLRV, UL file #E70402
- CSA Certified File 46186
- Flammability - UL94HB/V
- Standards
  - UL508
  - UL60947-1
  - CSA C22.2 No 14

BRYANT® Manual Motor Controllers / Disconnects

Quick Selection Guide

TECH·SPEC®

30002D

40003D

4002

60002D

30102D, 30103D

30322D, 30323D

30302D, 30303D

60302D, 60303D

664X33D

664X63D

Toggle Switch AC Motor Controllers / Disconnects

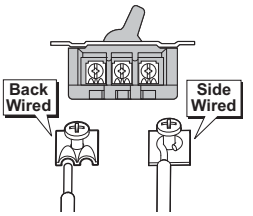
Part Number	Description	Amperage	Phase	Poles	Wired	Price
30002D	Switch only, 30A, 2-pole, 15 HP @ 600 VAC - Standard Toggle	30	1	2	Back and Side	<--->
30003D	Switch only, 30A, 3-pole, 20 HP @ 600 VAC - Standard Toggle	30	3	3	Back and Side	<--->
4002*	Switch only, 40A, 2-pole, 5 HP @ 600 VAC - Standard Toggle	40	1	2	Side	<--->
40002D	Switch only, 40A, 2-pole, 15 HP @ 600 VAC - Standard Toggle	40	1	2	Side	<--->
40003D	Switch only, 40A, 3-pole, 20 HP @ 600 VAC - Standard Toggle	40	3	3	Side	<--->
60002D	Switch only, 60A, 2-pole, 20 HP @ 600 VAC - Standard Toggle	60	1	2	Back	<--->
60003D	Switch only, 60A, 3-pole, 30 HP @ 600 VAC - Standard Toggle	60	3	3	Back	<--->

Motor controller only ("Not suitable as disconnect")

Toggle Switch AC Motor Controller Accessories

Part Number	Description	Price
30003FG	Finger Guards; red; for use with 30A and 40A Switches (Set of 2)	<--->
30100	NEMA 1 Enclosure without switch, use with 30002D and 30003D	<--->

Example
Back and Side Wired



Enclosed Toggle Switch AC Motor Controllers / Disconnects

Part Number	Description	Included Switch	Amperage	Phase	Poles	Enclosure	Price
30102D	Enclosed, 30A, 2-pole, NEMA 1	30002D Standard Toggle	30	1	2	NEMA 1 Metal	<--->
30103D	Enclosed, 30A, 3-pole,NEMA 1	30003D Standard Toggle	30	3	3		<--->
30302D	Enclosed, 30A, 2-pole, Aluminum	30002D Standard Toggle	30	1	2	NEMA 3R Metal	<--->
30303D	Enclosed, 30A, 3-pole, Aluminum	30003D Standard Toggle	30	3	3		<--->
30322D*	Enclosed, 30A, 2-pole, Plastic	30002DS Short Toggle	30	1	2	NEMA 3R Thermoplastic	<--->
30323D*	Enclosed, 30A, 3-pole, Plastic	30003DS Short Toggle	30	3	2		<--->
60302D*	Enclosed, 60A, 2-pole, Aluminum	60002FWD Standard Toggle	60	1	2	NEMA 3R Metal	<--->
60303D*	Enclosed, 60A, 3-pole, Aluminum	60003FWD Standard Toggle	60	3	3		<--->

Switch is not available as a separate item

NEMA 4X Enclosed Rotary Switch AC Motor Controllers / Disconnects

Part Number	Description	Included Switch	Amperage	Phase	Poles	Enclosure	Price
664X33D*	Enclosed, 30A, 3-pole, NEMA 4X	66033D Rotary	30	3	3	NEMA 4X Thermoplastic	<--->
664X63D*	Enclosed, 60A, 3-pole, NEMA 4X	66033D Rotary	60	3	3		<--->

Switch is not available as a separate item

NEMA 4X Enclosed Rotary Switch AC Motor Controller Accessories

Part Number	Description	Price
30003FG	Finger Guards; red; for use with 30A and 40A Switches (Set of 2)	<--->
660AC*	SPDT Auxiliary contact NO / NC; includes one contact for use with push-on terminals; use with 664X33D and 664X63D	<--->
6610MK	Rotary handle replacement kit, use with 664X33D and 664X63D. (Nema 1 rating) Must use gasket replacement kit 664XWP for NEMA 4X rating.	<--->
664XWP	NEMA 4X enclosure gasket replacement kit; includes 4 seals, neoprene bushing and 3 o-rings; use with 664X33D and 664X63D	<--->
664XFT	NEMA 4X enclosure mounting feet	<--->
6603N	NEMA 4X enclosure neutral buss connector	<--->

660AC Terminal is a quick connect terminal #250

BRYANT® Manual Motor Controllers / Disconnects

Toggle Switch

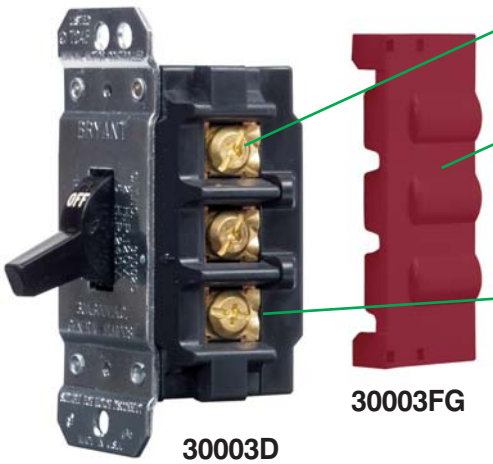
Toggle AC manual motor controllers can be integrated into your equiment design as a manual motor controller or as a motor disconnect. Quick-make and slow break operation provides reliability and long life. Each toggle switch controller has a 10,000 amp high fault short circuit withstand rating.

Toggle Switch Features

TECH·SPEC®

Thermoset Body

- Provides high resistance to electrical arc tracking
- Withstands high temperatures
- Excellent dimensional stability
- Superior dielectric strength



#10 brass terminal screw; clamping plate for back or side wiring

Optional side guard for close wall applications and finger safe environment

30003D

30003FG

Silver alloy contacts

- Four large contacts per pole
- Excellent conductivity
- Extended life

High Temperature thermoset body

Optional side guard for close wall applications and finger safe environment

30003FG

40002D

Steel screws and copper terminals

Recessed wiring wells for finger safe environments

60003D

BRYANT® Manual Motor Controllers / Disconnects

Toggle Switch

Toggle Switch AC Motor Controllers / Disconnects									
Part Number	Amperage	Phase	Poles	HP Ratings				Wired	Price
				120 VAC	240 VAC	480 VAC	600 VAC		
30002D	30	1	2	2	5	10	15	Back and Side	<--->
30003D	30	3	3	3	7.5	15	20	Back and Side	<--->
4002*	40	1	2	2	5	10	15	Side	<--->
40002D	40	1	2	2	5	10	15	Side	<--->
40003D	40	3	3	3	7.5	15	20	Side	<--->
60002D	60	1	2	–	10	15	20	Back	<--->
60003D	60	3	3	–	10	25	30	Back	<--->

Motor controller only ("Not suitable as disconnect")

Toggle Switch AC Motor Controller Accessories		
Part Number	Description	Price
30003FG	Finger Guards; red; for use with 30A and 40A Switches (Set of 2)	<--->
30100	NEMA 1 Enclosure without switch, use with 30002D and 30003D	<--->


30002D


40003D


4002


60002D

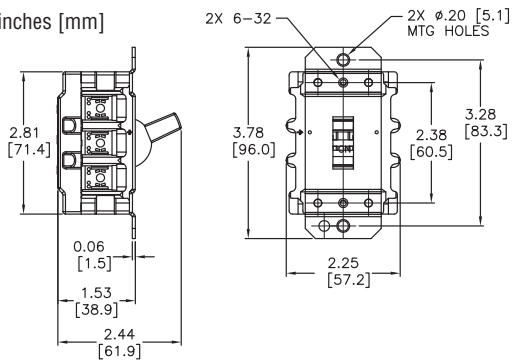
TECH·SPEC®


30003FG

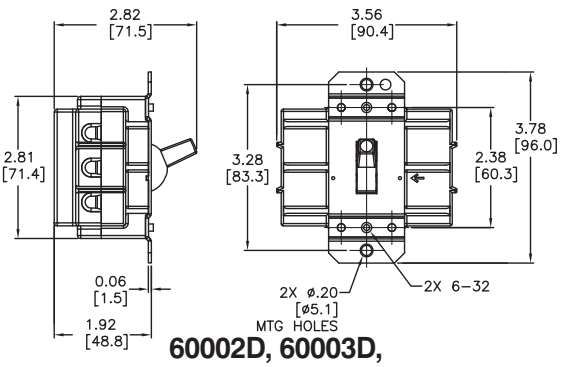

30100

Dimensions

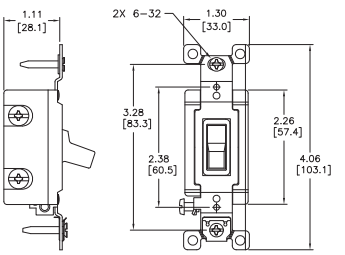
Units: inches [mm]



30002D, 30003D, 40002D, 40003D



60002D, 60003D,



4002

Dimensions are approximate
- Not for construction purposes

BRYANT® Manual Motor Controllers / Disconnects

Enclosed Toggle Switch

Enclosed toggle AC manual motor controllers feature NEMA 1 or NEMA 3R enclosures and can be used as motor controllers or disconnects. The NEMA 1 metal enclosed switches are ideal for use in indoor enviroments. The thermoplastic and metal NEMA 3R enclosed switches are raintight for use outdoors.

Enclosed Toggle Switch Features

NEMA 1 Motor Controllers / Disconnects

Wiring conduit knockouts

- 1/2 inch and 3/4 inch NPT
- Top, bottom or back wire entry points
- Surface mount control

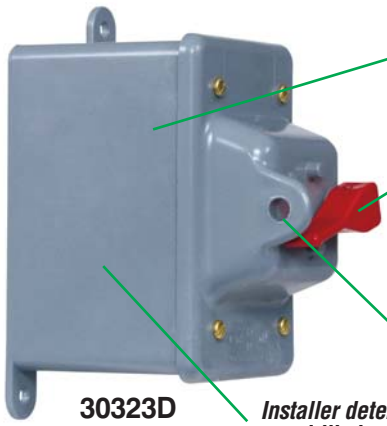
Lockout / Tagout capability

All aluminum cover and base; base is pre-drilled for rear surface mounting

30103D

NEMA 3 / 3R Motor Controllers / Disconnects

- Raintight enclosures
- Designed for surface mounting



Valox® enclosure; chemical and impact resistant

External activation lever switch

Lockout / Tagout capability

30323D

Installer determined wire entry; no pre-drilled openings or knockouts

TECH·SPEC®

Rain tight drip shield top; rolled seamless sides

All aluminum cover and base; base is pre-drilled for rear surface mounting

Wiring conduit knockouts; 1/2 inch NPT KO for 30 amp; bottom or back wire entry points

Lockout / Tagout capability

30303D

All aluminum cover and base; base is pre-drilled for rear surface mounting

Wiring conduit knockouts; 3/4 inch / 1 inch NPT KO for 60 amp; bottom or back wire entry points

60303D

Valox® is a registered trademark of SABIC Innovative Plastics.

BRYANT®

Manual Motor Controllers / Disconnects

Enclosed Toggle Switch

30102D, 30103D

30302D, 30303D

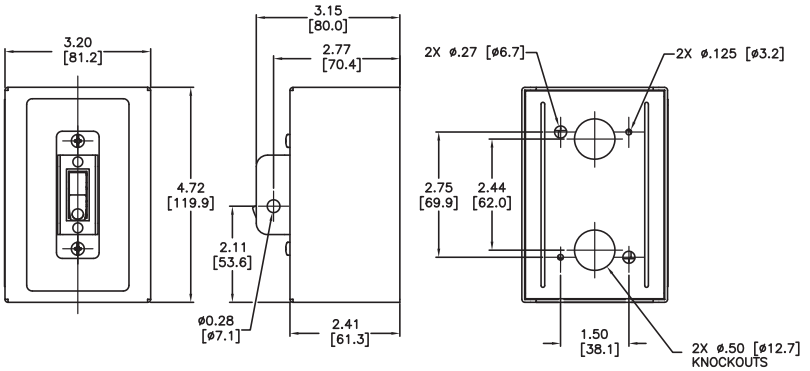
30322D, 30323D

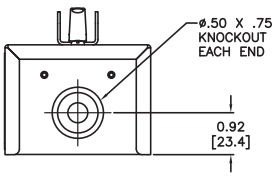
60302D, 60303D

TECH·SPEC®

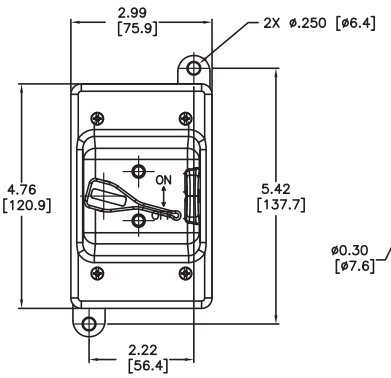
Enclosed Toggle Switch AC Motor Controllers / Disconnects									
Part Number	Amperage	Phase	Poles	HP Ratings				Enclosure	Price
				120 VAC	240 VAC	480 VAC	600 VAC		
30102D	30	1	2	2	5	10	15	NEMA 1 Metal	<--->
30103D	30	3	3	3	7.5	15	20		<--->
30302D	30	1	2	2	5	10	15	NEMA 3R Metal	<--->
30303D	30	3	3	3	7.5	15	20		<--->
30322D*	30	1	2	2	5	10	15	NEMA 3R Thermoplastic	<--->
30323D*	30	3	2	–	7.5	15	20		<--->
60302D*	60	1	2	–	10	15	20	NEMA 3R Metal	<--->
60303D*	60	3	3	–	10	25	30		<--->
*Switch is not available as a separate item									

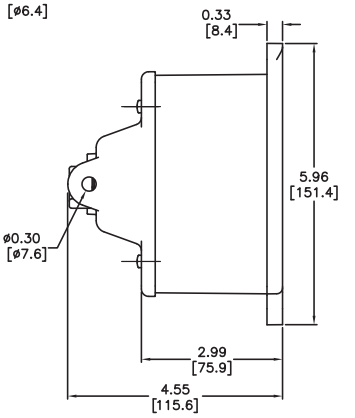
Dimensions Units: inches [mm]





30102D, 30103D





30322D, 30323D

Dimensions are approximate - Not for construction purposes

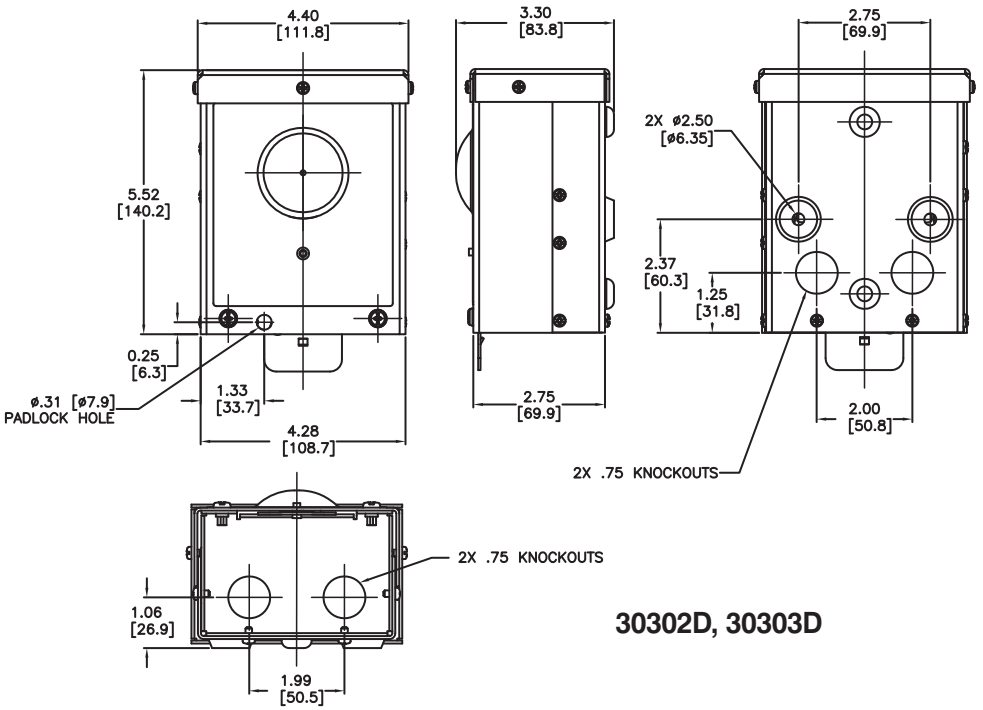
Manual Motor Controllers / Disconnects

Enclosed Toggle Switch

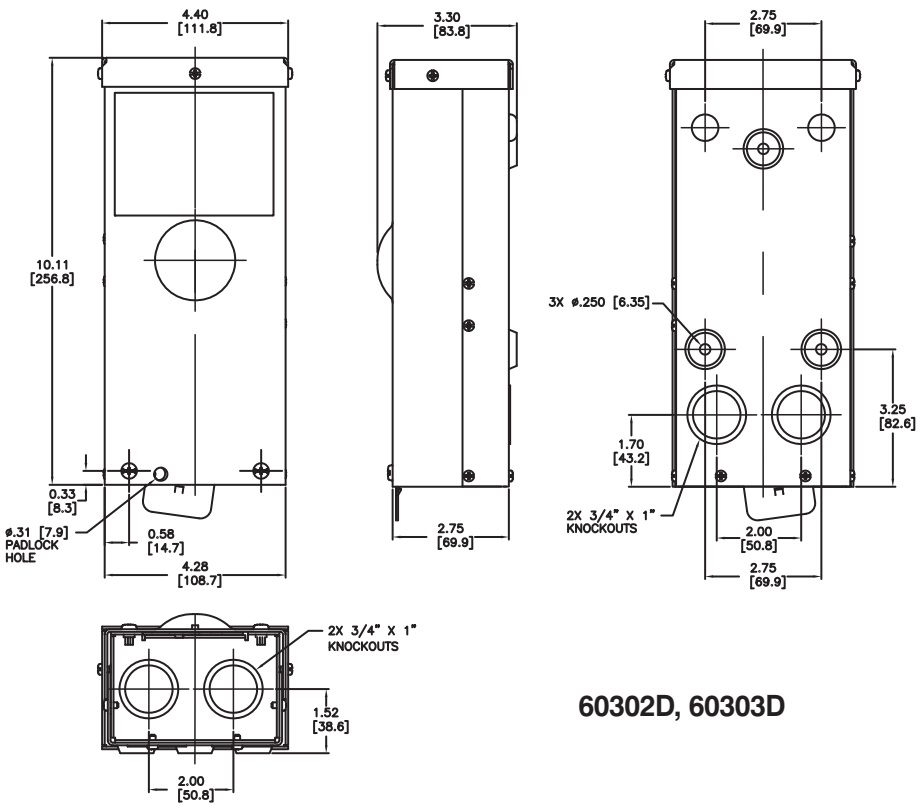
TECH·SPEC®

Dimensions

Units: inches [mm]



30302D, 30303D



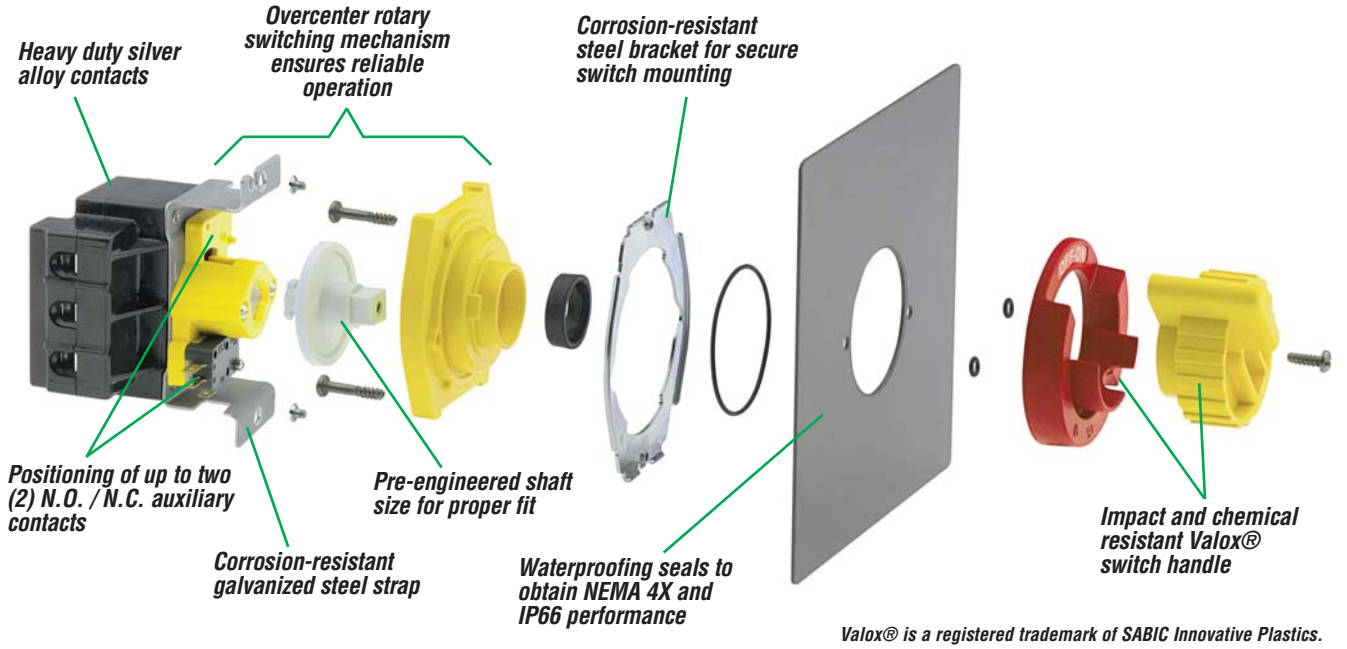
60302D, 60303D

NEMA 4X Enclosed Rotary Switch

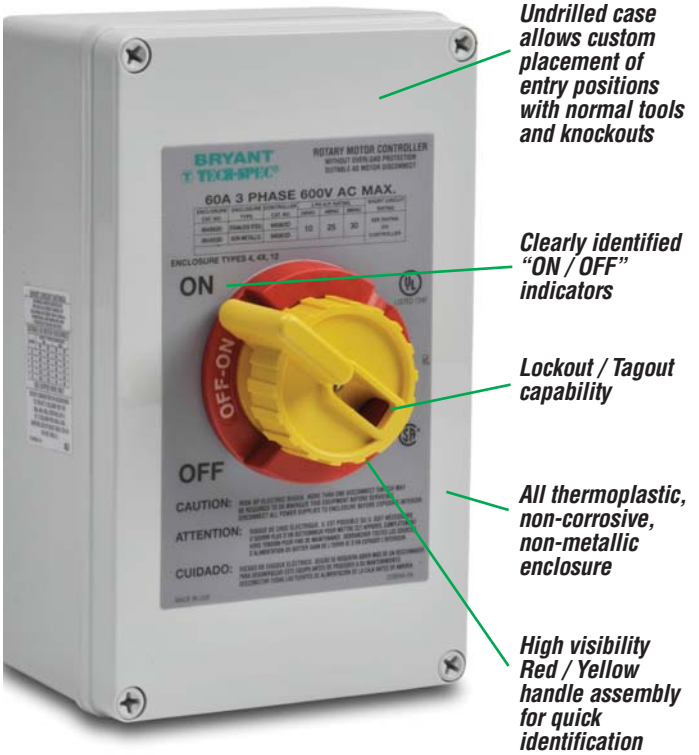
NEMA 4X enclosed toggle switch AC manual motor controllers are ideal for heavy wash down and corrosive environments. They feature thermoplastic bodies and can be used as a motor controller or disconnect.

TECH-SPEC®

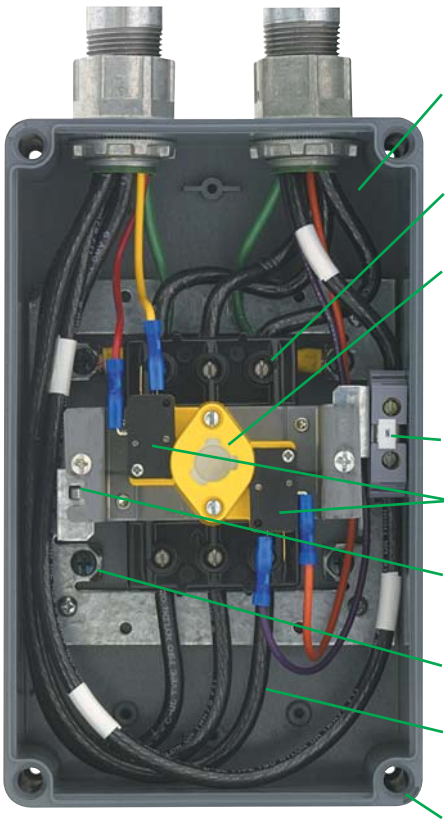
NEMA 4X Enclosed Rotary Switch Features



Valox® is a registered trademark of SABIC Innovative Plastics.



- Undrilled case allows custom placement of entry positions with normal tools and knockouts
- Clearly identified "ON / OFF" indicators
- Lockout / Tagout capability
- All thermoplastic, non-corrosive, non-metallic enclosure
- High visibility Red / Yellow handle assembly for quick identification



- Wire bending space for drip loops
- Accessible front wiring termination
- Interlocking shaft handle assembly prevents cover removal when in the "ON" position
- Neutral buss bar
- Two positions for auxiliary contacts
- Keyed one-way device mounting
- Four grounding screws
- Knuckle room for easy wiring
- Keyed base and cover

BRYANT® Manual Motor Controllers / Disconnects

NEMA 4X Enclosed Rotary Switch

NEMA 4X Enclosed Rotary Switch AC Motor Controllers									
Part Number	Amperage	Phase	Poles	HP Ratings				Enclosure	Price
				120 VAC	240 VAC	480 VAC	600 VAC		
664X33D*	30	3	3	3	7.5	15	20	NEMA 4X Thermoplastic	<--->
664X63D*	60	3	3	–	10	25	30		<--->
*Sold as a complete unit only									

NEMA 4X Enclosed Rotary Switch AC Motor Controller Accessories		
Part Number	Description	Price
30003FG	Finger Guards; red; for use with 30A and 40A Switches (Set of 2)	<--->
660AC*	SPDT Auxiliary contact NO / NC. includes one contact for use with push-on terminals, use with 664X33D and 664X63D	<--->
6610MK	Rotary handle replacement kit, use with 664X33D and 664X63D (Nema 1 rating) Must use gasket replacement kit 664XWP for NEMA 4X rating.	<--->
664XWP	NEMA 4X enclosure gasket replacement kit; includes 4 seals, neoprene bushing and 3 o-rings; use with 664X33D and 664X63D	<--->
664XFT	NEMA 4X enclosure mounting feet	<--->
6603N	NEMA 4X enclosure neutral buss connector	<--->
*660AC Terminal is a quick connect terminal #250		

664X33D

664X63D

30003FG

660AC

6610MK

664XWP

664XFT

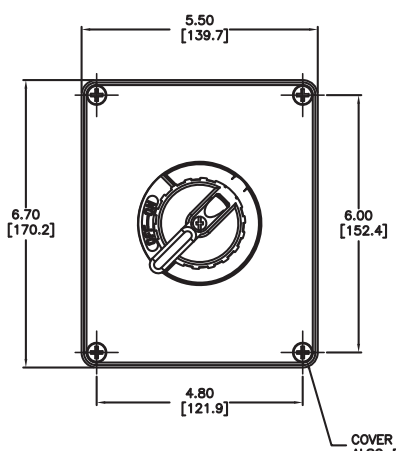
6603N

TECH·SPEC®

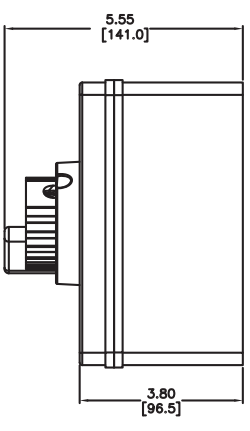
Dimensions

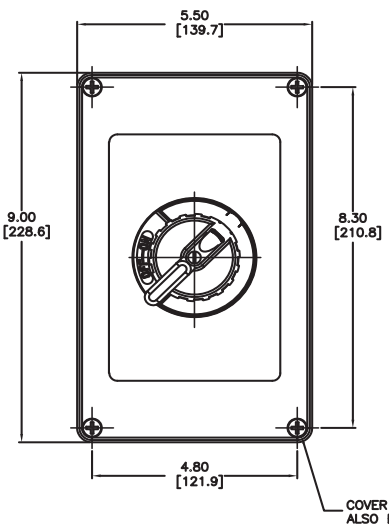
Units: inches [mm]

Dimensions are approximate
- Not for construction purposes

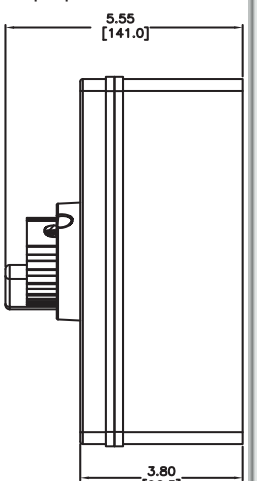


664X33D





664X63D

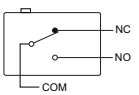


Manual Motor Controllers / Disconnects

Specifications

TECH·SPEC®

General Specifications								
Type	**Part Number**	**Weight**	**Short Circuit Withstand Rating**	**Dielectric Voltage**	**Electrical Life**	**Max Working Voltage**	**Mechanical Life**	**Operating Temperature**
Standard Toggle Switch	**30002D**	0.4 lbs (181 g)	10 kA 60A max J fuses or 125A max RK5 fuses	2,200V AC minimum for 1 minute	6,000 cycles at rated switch load	600 VAC RMS	10,000 minimum cycles	-40 °C (-40 °F) to 60 °C (140 °F)
	30003D	0.5 lbs (227 g)						
	4002	0.1 lbs (45 g)						
	40002D	0.4 lbs (181 g)						
	40003D	0.5 lbs (227 g)						
	60002D	0.7 lbs (318 g)	10 kA 80A max J fuses or 125A max RK5 fuses					
	60003D							
Enclosed Toggle Switch	**30102D**	1.0 lbs (454 g)	10 kA 60A max J fuses or 125A max RK5 fuses					
	30103D							
	30302D	1.3 lbs (590 g)						
	30303D							
	30322D	2.2 lbs (998 g)						
	30323D							
	60302D	1.9 lbs (861 g)	10 kA 80A max J fuses or 125A max RK5 fuses					
	60303D	2.0 lbs (907 g)						
Enclosed Rotary Switch	**664X33D**	2.5 lbs (1,134 g)						
	664X63D	3.0 lbs (1,361 g)						

NEMA 4X Enclosed Rotary Switch AC Motor Controller Accessory Specifications				
Part Number		**Switch Type**	**Load**	**Contact Material**
660AC		SPDT	15A @ 250 VAC Resistive, 10A @ 250 VAC Inductive 10A @ 30VDC Resistive and Inductive	Silver Alloy

Wiring Specifications					
Type	**Part Number**	**Cable Size**		**Tightening Torque**	
Toggle Switch	**30002D**	14 to 10 AWG	2.5 to 6 mm²	20 lb-in	2.3 Nm
	30003D				
	4002	14 to 8 AWG	2.5 to 10 mm²		
	40002D				
	40003D				
	60002D	14 to 6 AWG	2.5 to 16 mm²	25 lb-in	2.8 Nm
	60003D				
Enclosed Toggle Switch	**30102D**	14 to 10 AWG	2.5 to 6 mm²	20 lb-in	2.3 Nm
	30103D				
	30302D				
	30303D				
	30322D				
	30323D				
	60302D	14 to 6 AWG	2.5 to 16 mm²	25 lb-in	2.8 Nm
	60303D				
Enclose Rotary Switch	**664X33D**				
	664X63D				

Note: Bryant does not recommend the use of wire ferrules or crimping terminals. The wire gauges are specified above and in the installation instructions included with each manual motor controller.

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Prosense™ Phase Monitor Relays

PMRU

PMRR

PMRRL

Phase Monitor Relays

Phase monitor relays provide protection against premature equip ment failure caused by voltage faults on 3-Phase systems. All Prosense phase monitor relays are designed to be compatible with typical Wye or Delta systems. Phase monitor relays protect against single phasing regardless of any regenerative voltages.

PMRU Series

The PMRU Series phase monitor relays utilize a microprocessor-based design to provide protection against phase loss, phase reversal, phase unbalance, undervoltage and overvoltage. The PMRU is a universal voltage product that works on any 3-phase system voltage from 208 to 480V. These devices are designed to be compatible with typical Wye or Delta systems. In Wye systems, a connection to a neutral is not required. PMRU Series products protect against unbalanced voltages or single phasing regardless of any regenerative voltages.

The relay is energized when the phase sequence and all voltages are correct. Any one of five fault conditions will de-energize the relay. Re-energization is automatic upon correction of the fault condition. A manual reset option is available if a momentary N.C. switch is wired to the appropriate terminals (See "Manual Reset" wiring diagram on page 5). A multi-color LED indicates normal condition and also provides specific fault indication to simplify troubleshooting.

The PMRU Series offers a variety of user-adjustable settings. The percent phase unbalance is adjustable from 2 to 10% and also has a "Disable" setting for those applications where poor voltage conditions could cause nuisance tripping. The undervoltage drop-out can be set at 80 to 95% of operating voltage (overvoltage setting is fixed at 110% of nominal). The adjustable time delay drop-out on undervoltage (0.1 to 20 seconds) eliminates nuisance tripping caused by momentary voltage fluctuations. There is also an adjustable time delay (1 to 300 seconds) on both power up and restart after a fault has been cleared.

PMRR Series

The PMRR Series phase monitor relays provide protection against phase reversal in a compact low-cost design. One relay will work on any 3-phase system from 208V to 480V. This relay is designed to be compatible with most Wye or Delta systems. In Wye systems, a connection to a neutral is not required.

The relay is energized and the LED on when the sequence is correct. Any fault will de-energize the relay and turn off the LED. Re-energization is automatic upon correction of the fault condition.

PMRRL Series

The PMRRL Series phase monitor relays provide protection against phase loss, phase reversal and undervoltage. These relays are designed to be compatible with typical Wye or Delta systems. In Wye systems, a connection to a neutral is not required. Phase monitor relays protect against single phasing regardless of any regenerative voltages.

The relay is energized and the LED is on when all three phases are present in the correct sequence at a voltage level above the undervoltage setting. The undervoltage drop-out can be set at 75 to 95% of operating voltage. Any fault will instantaneously de-energize the relay and turn off the LED. Re-energization is automatic upon correction of the fault condition.

Reference Guide

The reference guide below provides general information on the different versions of Phase Monitor Relays offered by AutomationDirect.com (see Product Selection on the following pages for further details).

Series	Mounting Style	Phase Loss	Phase Reversal	Phase Unbalance	Under Voltage	Over Voltage	Time Delay on Undervoltage	Approvals*	See Page
PMRR	Plug-in*		✓					cURus	3
PMRRL	Plug-in*	✓	✓		✓ (adj.)		50 ms fixed	cURus	3
PMRU	Plug-in*	✓	✓	✓ (adj.)	✓ (adj.)	✓(fixed)	0.1-20 seconds	cURus, CE	3

**** In addition to the above approvals, all plug-in products are also UL Listed when used with the appropriate (70169-D) socket.***

ProSense™ Phase Monitor Relays

Features

PMRU

- Universal voltage range of 208 to 480VAC, 3-phase systems
- Protects against phase loss, phase reversal, phase unbalance, undervoltage and overvoltage
- Variety of user-selectable and adjustable settings for flexibility in 3-phase protection
- Automatic or Manual Reset
- Multi-Color LED indicates normal condition and provides fault indication to simplify troubleshooting
- Compact plug-in case utilizing industry-standard 8-pin octal socket
- 10A SPDT output contacts

PMRR

- Protects against phase reversal
- Works with 208-480V 3-phase systems
- LED indicates both normal and fault conditions
- Compact plug-in case utilizing industry-standard 8-pin octal socket
- 10A SPDT output contacts

PMRRL

- Protects against phase loss, phase reversal and undervoltage
- Undervoltage setting is adjustable from 75-95% of nominal
- LED indicates both normal and fault conditions
- Compact plug-in case utilizing industry-standard 8-pin octal socket
- 10A SPDT output contacts

Agency Approvals

- cURus, File number E191059
- UL Listed, File number E191059
- CE , EN60947-1, EN60947-5-1 (PMRU Series Only)
- RoHS

UL LISTED RoHS c UL us CE

(with appropriate socket 70169-D)

ProSense Series Phase Monitor Relays

Part Number	Description	Pcs/Pkg	Wt (lb)	Price	Use With
PMRU-1C-480A*	Phase monitor relay, provides protection against phase reversal, phase loss, phase unbalance, undervoltage, and overvoltage; 10A SPDT output contacts, 8-pin octal base. Works with 3-phase systems from 208V to 480V.	1	0.4	<--->	70169-D or 750-2C-SKT
PMRR-1C-480A*	Phase monitor relay, provides protection against phase reversal; 10A SPDT output contacts, 8-pin octal base. Works with 3-phase systems from 208V to 480V.	1	0.3	<--->	70169-D or 750-2C-SKT
PMRRL-1C-208A	Phase monitor relay, provides protection against phase reversal, phase loss and undervoltage; 10A SPDT output contacts, 8-pin octal base. Works with 208V 3-phase systems.	1	0.3	<--->	70169-D or 750-2C-SKT
PMRRL-1C-240A	Phase monitor relay, provides protection against phase reversal, phase loss and undervoltage; 10A SPDT output contacts, 8-pin octal base. Works with 240V 3-phase systems.	1	0.3	<--->	70169-D or 750-2C-SKT
PMRRL-1C-480A*	Phase monitor relay, provides protection against phase reversal, phase loss and undervoltage; 10A SPDT output contacts, 8-pin octal base. Works with 480V 3-phase systems.	1	0.3	<--->	70169-D or 750-2C-SKT
70169-D	Relay socket, 10A at 600V, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->	-----
750-2C-SKT	Relay socket, 5A at 600V, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->	-----

** Requires a 600V socket when used on system voltages greater than 300 volts, such as the 70169-D or 750-2C-SKT*

Technical Specifications

	PMRU-1C-480A	PMRR-1C-480A	PMRRL-1C-208A	PMRRL-1C-240A	PMRRL-1C-480A
Input Voltage Range**	208-480 VAC 50/60Hz (+/-20%)	208-480 VAC 50/60Hz (+10/-25%)	208 VAC 50/60Hz (+10/-25%)	240 VAC 50/60Hz (+10/-25%)	480 VAC 50/60Hz (+10/-25%)
Phase Loss	Unit trips on total loss of one or more of the three phases (A,B,C)	N/A	Unit trips on total loss of one or more of the three phases (A,B,C)		
Phase Reversal	Unit trips if sequence of the three phases is anything other than A-B-C	N/A	Unit trips if sequence of the three phases is anything other than A-B-C		
Phase Unbalance	Adjustable from 2 to 10%	N/A			
Undervoltage	Adjustable from 80 to 95%of nominal voltage	N/A	Unit trips when the average of all three line phases is less than the adjusted set point*		
Overvoltage	Fixed at 110% of Nominal	N/A	N/A	N/A	N/A
Output Contacts	SPDT: 10A at 240 VAC/30 VDC Max	SPDT: 10A at 240 VAC Max			
Life*	Mechanical: 10,000,000 Electrical: 100,000	Mechanical: 100,000 Electrical: 100,000			
Response Times	See table 2 on page e4	Pick-up: 50ms, Drop out: 50ms			
Power Consumption	3 VA				
Temperature	-28° to 65°C (-18 to 149°F)				
Mounting	8-pin octal socket requires a 600 V rated socket when used on system voltages greater than 300 V				
Indicator LED	See table 1 on page e4	Red LED on when all conditions are normal and off when a fault condition has occurred			
Reset	Standard reset is automatic upon correction of fault or when a momentary-contact N.C. switch is wired across the Manual Reset terminals (6 & 7), the unit switches to manual reset mode and remote manual reset is available	Standard reset is automatic upon correction of fault.			
Approvals	cURus, CE (PMRU series only), RoHS, (cULus when used with socket 70169-D)				

** Resistive load*

*** Fusing is not required by code but if fusing is used we recommend 2 Ampere MCL2 fuse between the phase monitor relay and the three phases.*

PMRU LED Indication

Table 1 - LED Indication	
PMRU Series LED Status*	***Indicator***
Green Steady	Normal/Relay ON
Green Flashing	Power Up/Restart Delay
Red Steady	Unbalance
Red Flashing	Undervoltage/Overvoltage
Amber Steady	Reversal
Amber Flashing	Loss
Green/Red Alternating	Undervoltage/Overvoltage Trip Pending
Red/Amber Alternating	NominalVoltage Set Error

Note: If LED does not remain illuminated or does not flash after a fault on PMRU unit, there is a loss situation of either Phase A or C. When Phase A or C is restored the LED functions normally.

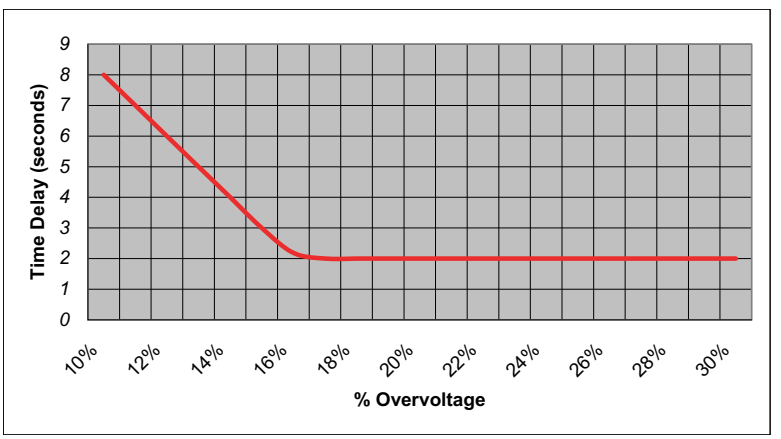
PMRU Response Time

Table 2 - Response Times	
Power up and restart after fault	1-300 seconds adjustable
Drop-out Due to Fault	
Phase Loss and Reversal	100ms fixed
Phase Unbalance	2 seconds fixed
Undervoltage	0.1 - 20 seconds adjustable
Overvoltage	Fixed time based on inverse time curve (See Chart 1 Below)

PMRRL Undervoltage

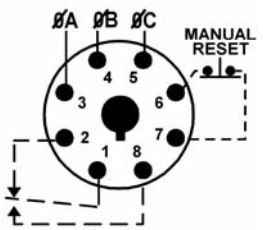
Table 3 - Undervoltage Rating	
PMRRL-1C-208A	156-198V
PMRRL-1C-240A	180-230V
PMRRL-1C-480A	360-460V

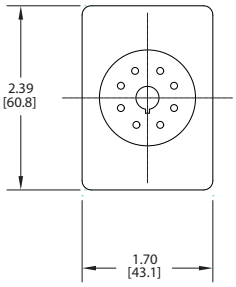
Chart 1 - Overvoltage Inverse Time Curve

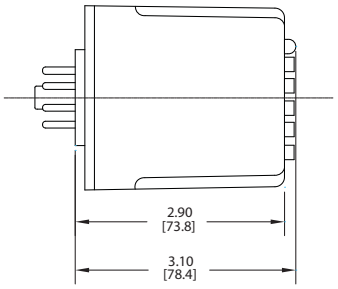


Wiring and Dimensions

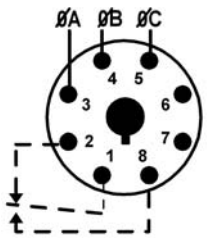
PMRU-1C-480A

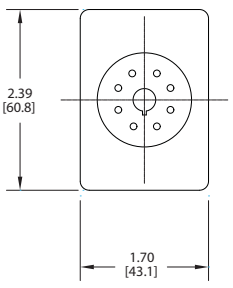


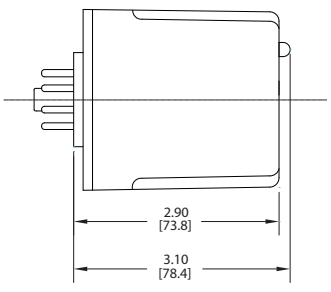




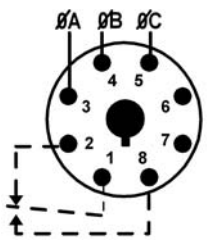
PMRR-1C-480A

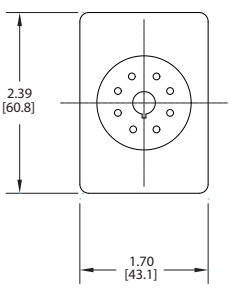


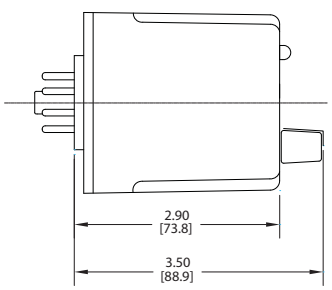




PMRRL-1C-208A, PMRRL-1C-240A, PMRRL-1C-480A







All Dimensions in Inches (Millimeters)

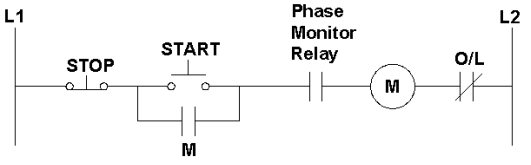
Protection

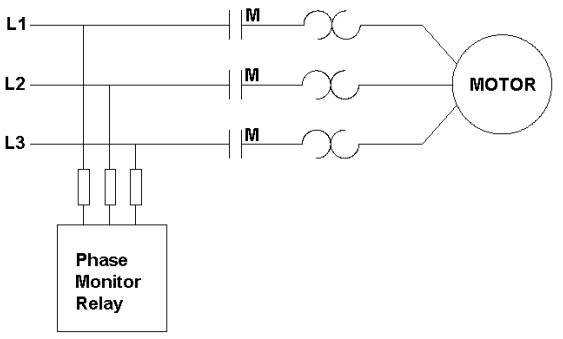
Depending on the unit selected, it will protect 3-phase equipment against:

- **Phase loss** - total loss of one or more of the three phases. Also known as "single phasing." Typically caused by a blown fuse, broken wire, or worn contacts. This condition would result in a motor drawing locked rotor current during start-up. In addition, a 3-phase motor will continue to run after losing a phase, resulting in possible motor burn-out.
- **Phase reversal** - reversing any two of the three phases will cause a 3-phase motor to run in the opposite direction. This may cause damage to driven machinery or injury to personnel. The condition usually occurs as a result of mistakes made during routine maintenance or when modifications are made to the circuit.
- **Phase unbalance** - unbalance of a 3-phase system occurs when single phase loads are connected such that one or two of the lines (phases) carry more or less of the load. This could cause motors to run at temperatures above published ratings.
- **Undervoltage** - when voltage in all three lines of a 3-phase system drop simultaneously.
- **Overvoltage** - when voltage in all three lines of a 3-phase system increase simultaneously.

Typical Connections

Line Side Monitoring

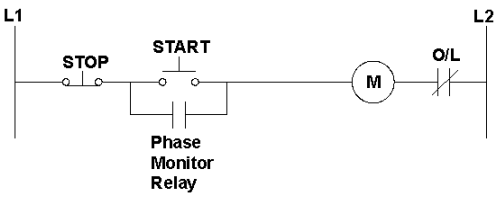


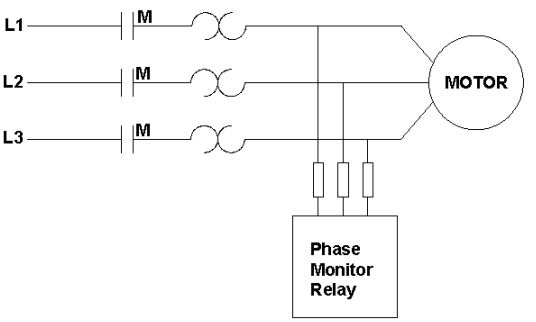


Line Side Monitoring

With the relay connected before the motor starter, the motor can be started in the reverse direction. However, the motor is unprotected against phase failures between the relay and the motor.

Load Side Monitoring





Load Side Monitoring

With the relay connected directly to the motor, the total feed lines are monitored. This connection should not be used with reversing motors.

Alternating Relays

AR

ARX

Alternating Relays

AR Series

Alternating relays are used in special applications where the optimization of load usage is required by equalizing the run time of two loads. The alternating action is initiated by a control switch, such as a float switch, manual switch, timing delay, pressure switch, or other isolated contact. Each time the initiating switch is opened, the output relay contacts will change state, thus alternating the two loads. Two LED indicators show which load to energize next.

The alternating relay can be used with one or two control switches and is available in the SPDT output configuration.

The AR Series Relays have a three-position selector switch. This allows the unit to alternate the two loads as normal, or lock the relay to one load or the other. By locking the alternating relay to one load, the other load can be removed for service without rewiring the first load for continuous operation. The selector switch has a low profile to prevent any accidental changes in status.

ARX Series

Alternating relays with DPDT cross-wired outputs are used in applications requiring both (a) the optimization of load usage by equalizing the run time of two loads and (b) additional capacity in case of excess load requirements. The alternating action is initiated by a control switch, such as a float switch, manual switch, timing relay, pressure switch, or other isolated contact. Each time the initiating switch is opened, the output relay contacts will change state, thus alternating the two loads. Two LED indicators show the load to energize first.

Alternating relays with DPDT cross-wired output configurations can be used with two or three control switches.

The ARX series relays have a three-position selector switch. This allows a DPDT cross-wired unit to alternate the two loads as normal, or lock the relay to always operate the same load first each time. In this manner, a load that has fewer hours of operation than the other load could be used more often in an effort to eventually balance the run time of both loads.

Features

AR

- For duplex loads
- 10A SPDT output configuration
- Can be used with one or two control switches
- 120 VAC Control voltage
- Compact plug-in design utilizing industry-standard 8-pin octal socket
- Low profile selector switch to lock in one sequence
- 2 LEDs indicate load to energize next

ARX

- For duplex loads
- 10A DPDT cross-wired output configuration
- Can be used with two or three control switches
- 120 VAC Control voltage
- Compact plug-in design utilizing industry-standard 8-pin octal socket
- Low profile selector switch to lock either load On first
- 2 LEDs indicate load to energize first

Agency Approvals

- cURus, File number E191059
- CSA, File number LR45565
- CE , EN60947-1, EN60947-5-1
- RoHS

(with appropriate socket 70169-D)

Alternating Relays

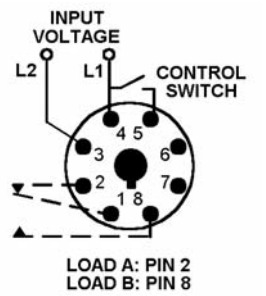
AR/ARX Series Alternating Relays					
Part Number	**Description**	**Pcs/Pkg**	**Wt (lb)**	**Price**	**Use With**
AR-1C-120A	Alternating relay, for use in applications requiring load usage optimization by equalizing the run time of two loads. 120 VAC coil voltage, SPDT, 10A contact rating, 8-pin octal base, selector swtich to select between load A, load B, or alternate loads. Two LEDs indicate load to energize next.	1	0.3	<--->	70169-D or 750-2C-SKT
ARX-2C-120A	Alternating relay, for use in applications requiring load usage optimization by equalizing the run time of two loads, accomodates additional capacity in case of excess load requirements. 120 VAC coil voltage, DPDT Cross Wired, 10A contact rating, 8-pin octal base, selector switch to select between load A, load B, or alternate loads. Two LEDs indicate load to energize first.	1	0.3	<--->	70169-D or 750-2C-SKT
70169-D	Relay socket, 10A at 600V, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->	-----
750-2C-SKT	Relay socket, 5A at 600V, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->	-----

Technical Specifications		
	AR-1C-120A	***ARX-2C-120A***
Voltage Tolerances	120 VAC 50/60Hz (+10%/-15%)	
Output Contacts	10A at 240 VAC/30 VDC Max	
Life*	Mechanical 10,000,000 operations; Electrical - Resistive: 100,000 operations	
Power Consumption	Less than 3 VA	
Temperature	-28 to 65°C (-18 to 149°F)	
Mounting	8-pin octal socket	
Indicator LED	2 LEDs marked LOAD A and LOAD B	
Selector Switch Settings	LOCK LOAD A ALTERNATE LOCK LOAD B	LOCK LOAD A (Always energizes first based on switch position) ALTERNATE LOCK LOAD B (Always energizes first based on switch position)
Approvals	cURus, CE, CSA (LR45565), RoHS, (cULus when used with socket 70169-D)	

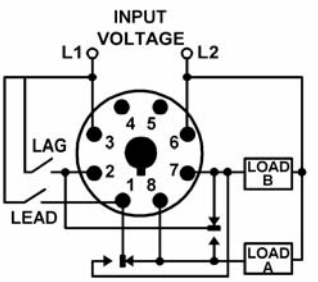
**** Resistive load***

Wiring

AR-1C-120A

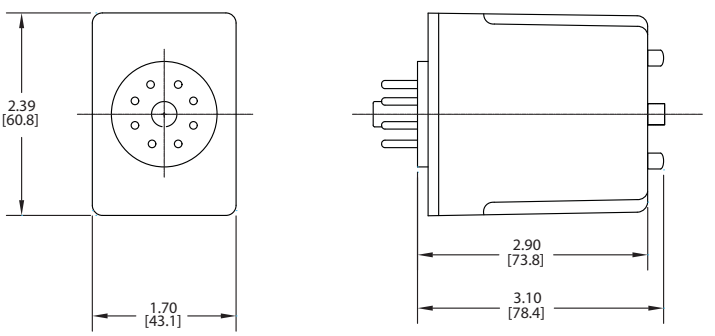


ARX-2C-120A



Dimensions

AR-1C-120A, ARX-2C-120A



All Dimensions in Inches (Millimeters)

Alternating Relays

Typical Installations

When using the AR series relay with the selector switch in the "Alternate" position in the initial off state (Figure A), the Control Switch is open, the Alternating Relay is in the "LOAD A" position, and both loads (M1 and M2) are off. The red LED marked "LOAD A" is ON. When the Control Switch closes, it energizes Load M1. As long as the Control Switch remains closed, Load M1 remains energized. When the Control Switch opens, Load M1 is turned off and the Alternating Relay toggles to the "LOAD B" position. The red LED marked "LOAD B" glows. When the Control Switch closes again, it energizes Load M2. When the Control Switch opens, Load M2 is turned off, the Alternating Relay toggles back to the "LOAD A" position, and the process can be repeated again. On relays with DPDT contacts, two pilot lights can be used for remote indication of "LOAD A" or "LOAD B" status.

To eliminate any bounce condition of the Control Switch, the addition of a second switch (OFF) along with two auxiliary contacts is recommended as shown (Figure B).

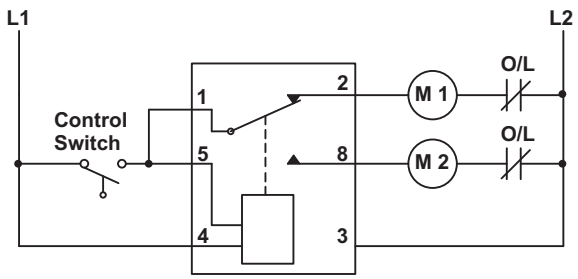


Figure A

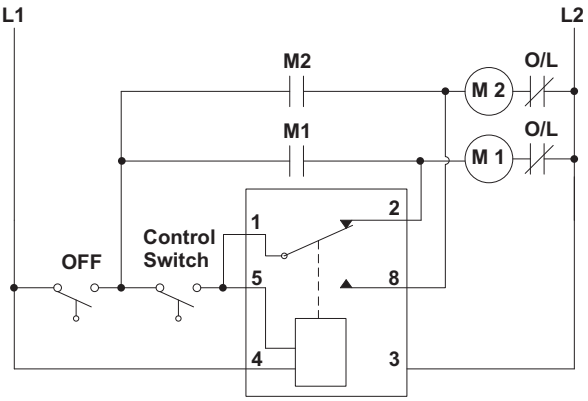


Figure B

When using the ARX series relay with the selector switch in the "Alternate" position in the initial off state (Figure C), both the LEAD Control Switch and the LAG Control Switch are open, the Alternating Relay is in the "LOAD A" position, and both loads are off. The red LED marked "LOAD A" is ON. When the LEAD Control Switch closes, it energizes Load M1. As long as the LEAD Control Switch remains closed, Load M1 remains energized. If the LAG Control Switch closes, it energizes Load M2. When the LAG Control Switch opens, Load M2 is turned off. When the LEAD Control Switch opens, Load M1 is turned off And the Alternating Relay toggles to the "LOAD B" position. The red LED marked "LOAD B" is ON. When the LEAD Control Switch closes, it turns on Load M2. If the LAG Control Switch closes, it will energize Load M1. When the LAG Control Switch opens, Load M1 is turned off. When the LEAD Control Switch opens, Load M2 is turned off, the Alternating Relay toggles back to the "LOAD A" position, and the process can be repeated again.

A type of operation known as "Sequence On - Simultaneously Off (S.O.S.O.)" where the two loads are energized sequentially, but remain on together until the OFF switch is opened (Figure D). In the initial OFF state, all three switches are open, the Alternating Relay is in the "LOAD A" position, and both loads are off. No action happens with the Alternating Relay or either load when the OFF Switch closes. When the LEAD Switch closes, Load M1 turns on. When the LAG Switch closes, Load M2 turns on. Both loads remain on as long as all three switches are closed. When the LAG Switch opens, Load M2 remains on because the OFF Switch is still closed. When the LEAD Switch opens, Load M1 remains on because the STOP Switch is still closed. When the OFF Switch opens, both Load M1 and Load M2 are turned off simultaneously. The Alternating Relay toggles to the "LOAD B" position. The entire cycle is then repeated, but with Load M2 energized first followed by Load M1.

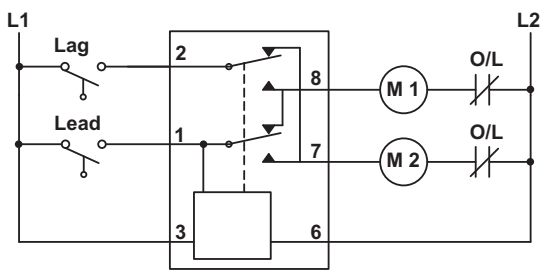


Figure C

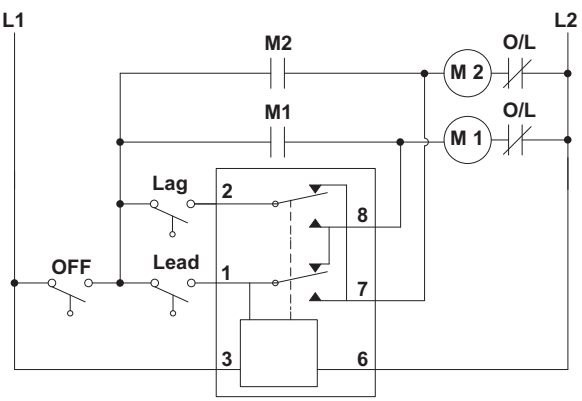


Figure D

Note: M1 and M2 reference in Figures A,B,C and D are coils.

ProSense™ Pump Seal Failure Relays

PSFR

PSFR-2C

Pump Seal Failure Relays

PSFR Series

PSFR series pump failure relays are designed to monitor the shaft seals of submersible pumps. A resistive-measuring probe is installed in the pump seal cavity provided by pump manufacturer. If the seal starts to leak, contaminating fluid enters the seal cavity provided by pump manufacturer, lowering the resistance between the internal probe and the common connection.

When the resistance drops below the user-adjustable sensitivity setpoint of the relay, the output relay energizes and the LED turns ON. The relay output can be used to give an alarm indication of a leaking seal. These products will automatically reset when the fault condition clears.

Two pump seal failure relays are available:

1.) 8-pin SPDT single channel relay

2.) 8-pin dual channel relay, with 2 SPNO contacts

Features

- Monitors submersible pump seals for leakage
- Single or dual channel for monitoring one or two pumps
- Adjustable sensitivity ranges (4.7K, 20K, 47K, 100K)
- Uses industry-standard 8-pin octal sockets

Agency Approvals

- cURus, File number E191059
- CE, EN60947-1, EN60947-5-1
- RoHS

(with appropriate socket 70169-D)

ProSense Pump Seal Failure Relays					
Part Number	***Description***	***Pcs/Pkg***	***Wt (lb)***	***Price***	***Use With***
PSFR-1C-120A	Pump seal failure relay, monitors shaft seals of submersible pumps. Single channel, adjustable sensitivity range from 4.7K, 20K, 47K, 100K, LED failure indication, one 10A single-pole double-throw output contacts, 8-pin octal base, 9 VDC probe voltage.	1	0.4	<--->	70169-D or 750-2C-SKT
PSFR-2C-120A	Pump seal failure relay, monitors shaft seals of submersible pumps. Dual channel, adjustable sensitivity range from 4.7K, 20K, 47K, 100K, LED failure indication, two 5A single-pole N.O. output contacts, 8-pin octal base, 9 VDC probe voltage.	1	0.4	<--->	70169-D or 750-2C-SKT
70169-D	Relay socket, 10A at 600 V rated, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->	-----
750-2C-SKT	Relay socket, 5A at 600 V rated, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->	-----

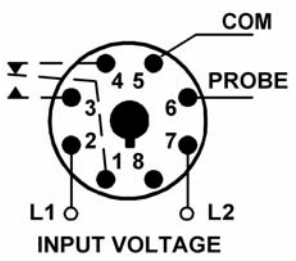
Technical Specifications		
	PSFR-1C-120A	***PSFR-2C-120A***
Voltage Tolerances	120 VAC 50/60Hz (+10%/-15%)	
Output Contacts	10A at 240 VAC/30 VDC Max	
Life*	Mechanical 10,000,000 operations; Electrical: 100,000 operations	
Probe Voltage	9 VDC	
Response Time	Pick-up: 10ms; Drop-out: 10ms	
Power Consumption	2 VA	
Temperature	-28 to 65°C (-18 to 149°F)	
Mounting	8-pin octal socket	
Indicator LED	Red ON when seal leak detected and relay energized	
Output Contacts	Single Channel Relays: 10A at 240 VAC/7A at 30 VDC Max Dual Channel Relays: (2) 5A at 240 VAC/5A at 30 VDC Max	
Insulation Voltage	2,000 volts	
Approvals	cURus (E191059), CE, RoHS, (cULus when used with socket 70169-D)	

**** Resistive load***

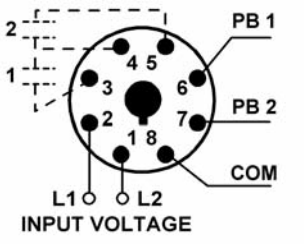
prosense™ Pump Seal Failure Relays

Wiring

PSFR-1C-120A

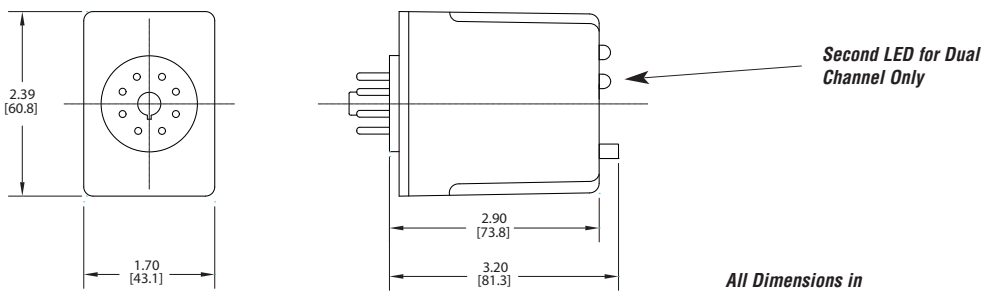


PSFR-2C-120A



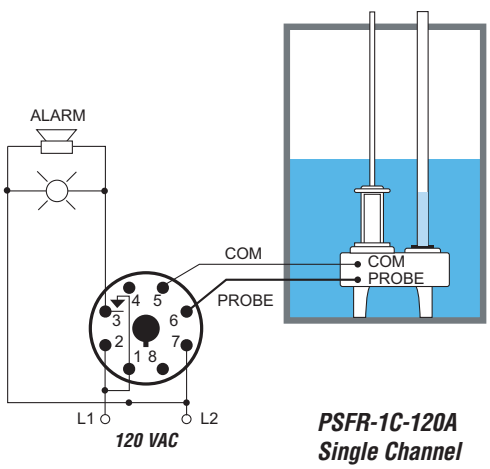
Dimensions

PSFR-1C-120A, PSFR-2C-120A

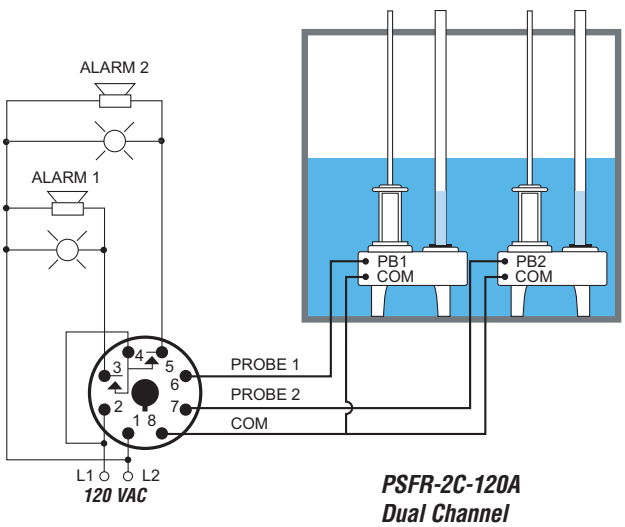


All Dimensions in Inches (Millimeters)

Typical Installations



PSFR-1C-120A
Single Channel



PSFR-2C-120A
Dual Channel

prosense™ 8-pin Octal Socket

70169-D

750-2C-SKT

Features

- 600V (Plug-in 3-phase monitor relays require a 600V-rated socket when used with system voltages greater than 300V)
- Mounts on 35mm DINrail
- Screw pressure wire clamp termination

Agency Approvals

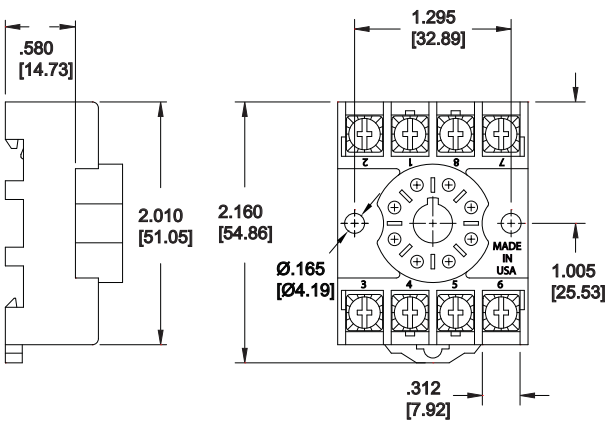
- cURus, File number E191059, E225080
- CE
- RoHS

Octal Sockets for Motor Monitor Relays				
Part Number	***Description***	***Pcs/Pkg***	***Wt (lb)***	***Price***
70169-D	Relay socket, works with all phase monitor relays, 10A at 600 V rated, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->
750-2C-SKT	Relay socket, works with all phase monitor relays, 5A at 600 V rated, 8-pin octal configuration. Can be mounted on 35mm DIN rail or directly mounted to the panel.	1	0.1	<--->

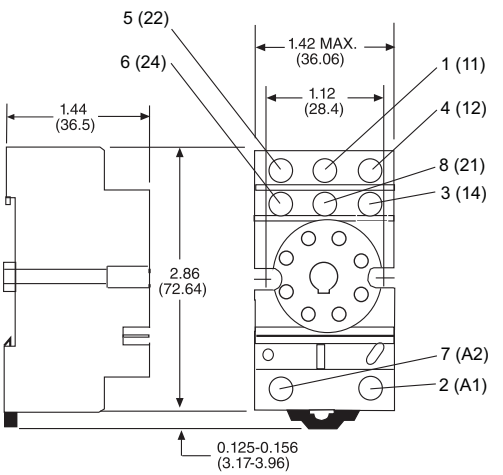
Technical Specifications						
Part Number	***Voltage***	***Current***	***Screw Size***	***Screw wire size (capacity)***	***Screw wire torque***	***Screw chassis mounting torque***
70169-D	600V	10A	6-32	1 or 2 #12-#22 AWB	6-7 Lb-in (12 Lb-in max)	7 Lb-in
750-2C-SKT	600V	5A	M3.5	(1) #12/ (2) #14 AWG	9 Lb-in	7Lb-in

Dimensions

70169-D



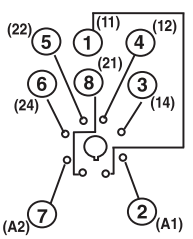
750-2C-SKT



Socket Pinouts

70169-D

750-2C-SKT



All Dimensions in Inches (Millimeters)