

MITSUBISHI

MAGNETIC MOTOR STARTERS AND MAGNETIC CONTACTORS

MS-Nseries

Performance with a refined new design and functional beauty



(Note) This mark indicates EC Directive Compliance. Products with the CE mark can be used for European destinations.

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001 (standards for quality assurance management systems)



Substantial safety and functionality realized with a full lineup

Incorporation of CAN terminal for simple wiring

By adopting a CAN terminal, there is no need to remove the screws, and losing of the terminal screw is prevented by the integrated screw holder and terminal screw. The terminal screw is set in a plastic screw holder. When each pole is moved and the screw loosened, the screw is naturally set in the screw holder. This is Mitsubishi's original CAN terminal. (Patented) (S-N10CX~N35CX, SD-N11CX~N35CX, SR/SRD-N4CX)

Unified design for N series

The design has been unified for the MS-N series. The front face of the product is a bright white color, making the inside of the panel brighter and providing a clean image.

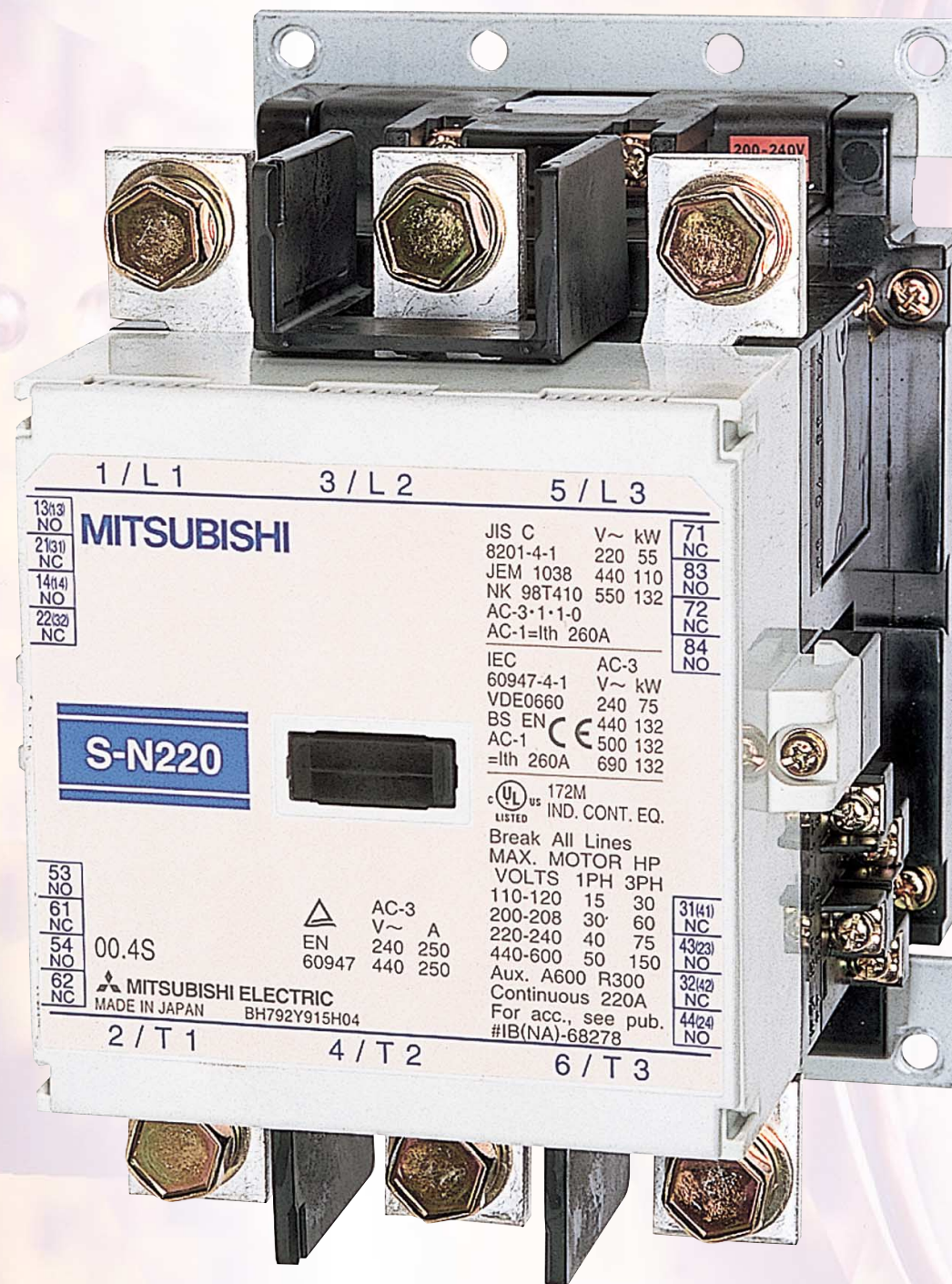
Arc space reduced to approx. one-third!

By adopting the new extinguishing mechanism, the arc space has been reduced to approx. 1/3 (Mitsubishi comparison).

Compatible with International Standards

Most of Mitsubishi's standard products comply with International Standards.

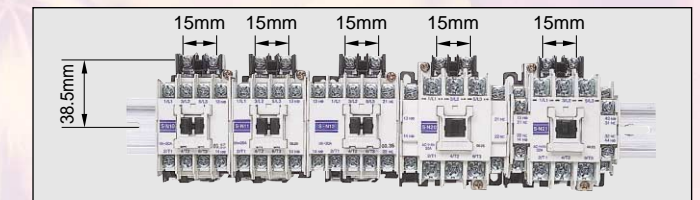
Applicable standards: JIS, JEM, IEC, EN, VDE, BS
Approved standards: UL, CSA, LR, BV, NK, KR, TÜV



Small-Sized Models S-N10~N35

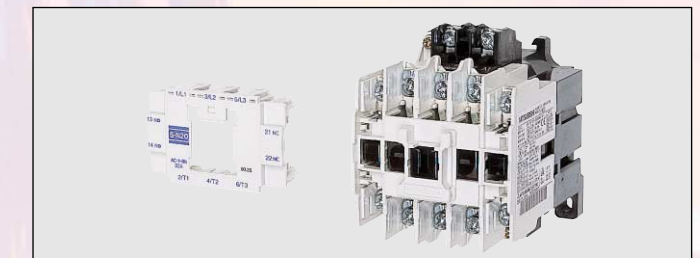
Simple installation and wiring

The MS-N series contactors, starters and relays can be installed on a mounting rail (35mm width). The terminals of these coils are arranged on the contactor with simple wiring. Furthermore, the distance between the center of the rail and the coil terminals is unified at 38.5mm. (S-N10 to N21, MSO-N10 to N21 and SR-N4)



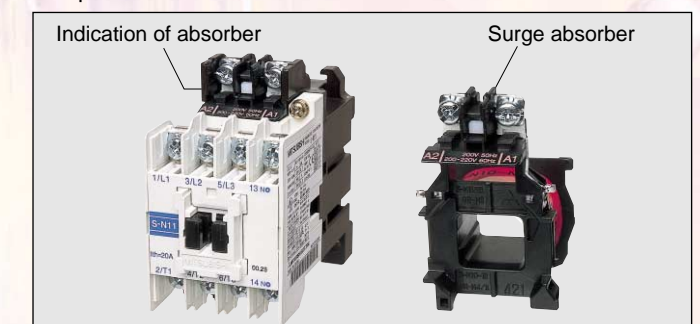
Simple inspections

The contactor can be inspected easily by removing the arc cover.



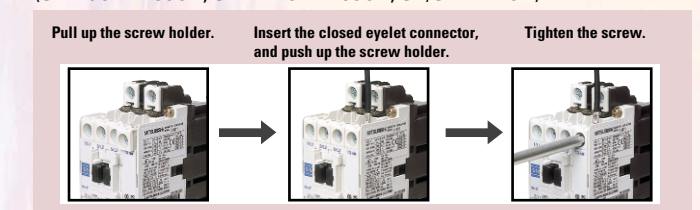
Built-in surge absorber

The model with built-in surge absorber for coils is obtainable as an option.



CAN terminal realizes safety and speedy

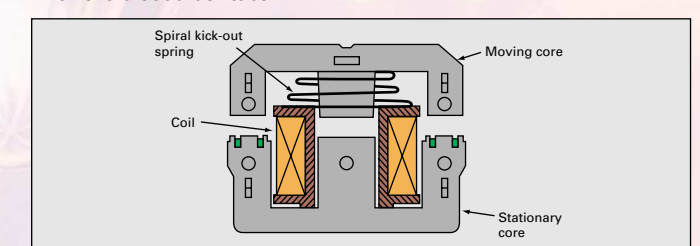
The models with finger protection are safer and speedier even if the lug of a closed type eyelet (ring) terminal plate is used. (S-N10CX~N35CX, SD-N11CX~N35CX, SR/SRD-N4CX)



Stronger barrier strength is improved with the thermoplastic mold.

Improved magnet

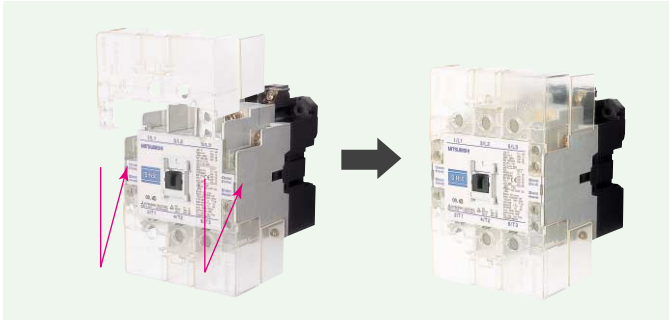
By using a spiral kick-out spring, the dynamic balance of the moving parts is improved, bouncing is reduced, and the core life is extended. Furthermore, the core movement is generally stabilized. The efficient magnet has been achieved through modern technology of the magnet section using a computer. The contactor has a performance to withstand a voltage drop to 35% with the closed contact.



Medium-and Large-Sized Models: S-N50~S-N800

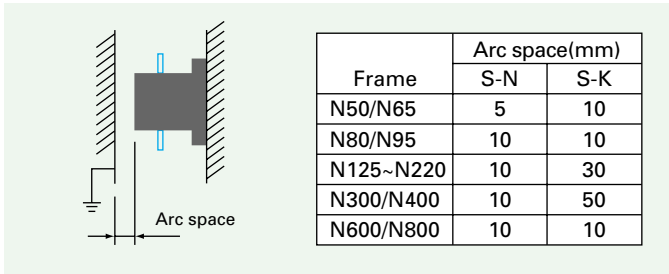
Finger Protection Compatible

An easy-to-install terminal cover, which lays importance on further safety and is compatible with finger protection, has been prepared.



The arc blowoff direction has been changed to further improve safety and space conservation

A new extinguishing structure, which eliminates the blow off of hot gas (arc) to the front (direction to door of control panel) when the current is cutoff has been incorporated.



In addition to improved safety, the freedom of panel design has been increased allowing space to be saved.

DC Electromagnet with AC Operation (Patented)

Lower Power Consumption

Coil power consumption is greatly low so MS-N Series contactors can be controlled by almost any type of relay, even small output relays of programmable controllers.

Less Noise nor Surge from Coil

When switching a coil, the energy will be desipated within internal circuit of electromagnet

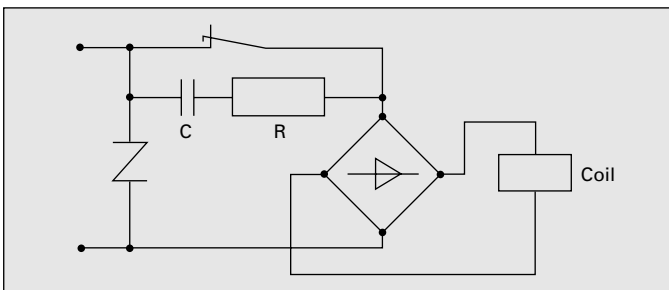
Humming Completely Eliminated

DC excitation does not cause humming so operation is quiet.

Contactors Coils Have Ultra-Wide Range of Ratings

The number of coil types has been cut by two-thirds and there is no need to re-wire for different frequencies. The coil also withstands large voltage drops.

Internal circuit of the electromagnet



MATCH WITH ELECTRONIC CONTROL FOR FACTORY AUTOMATION

One-touch surge absorber

If the magnetic relay coil is opened and closed near an electronic circuit, malfunctioning of the electronic circuit could be induced by a surge voltage. The UN-SA type surge absorber suppresses the surge voltage when this coil is opened and closed. In



addition to the general varistor type and the CR type that lays importance on suppressing the induction voltage when starting, the type with operating indicator (varistor type), and the varistor type with CR are available.

Auxiliary contact unit with low level contact

This is an auxiliary contact unit with low level contact, capable of opening and closing the low voltage and minute current of the electronic control circuit. It can be installed with one touch onto the magnetic contactor or magnetic relay that opens and closes the power of the motor, etc. The junction relay for opening and closing the low voltage and minute current is not needed, so this unit is suitable for opening and closing electronic input circuits in programmable logic controllers, etc. A compact microswitch is used for the low level contact, so the unit will not malfunction due to fields and surge voltages from the main circuit current and coil of the magnetic contactor.



A 1NO+1NC low level contacts and 1NO+1NC standard contacts are built-in, so the opening and closing of 200VAC and 24VDC can be handled with one unit.

Interface unit

◆2 types of inputs

The long life no-contact output type (UN-SY21, SY31) and contact output type (UN-SY22, SY32) are available.

◆One touch installation

The UN-SY21, SY22, SY31 and SY32 types can be mounted with one touch onto the coil terminal. Post-installation work is easy.



◆Single standalone unit

A single unit installation type (UN-SY11, SY12) is available for the S-KR11 and S-N80 to N400 magnetic contactor.

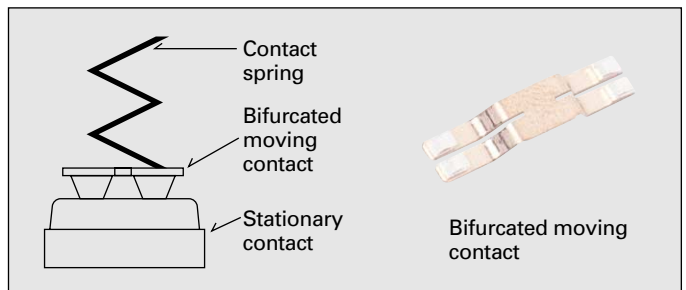
Direct installation is possible on the following units:

S-N series (Magnetic contactor) 65A frame or less

SR-N series (Magnetic relay) 4-pole, 5-pole and 8-poles types

Even Greater Contact Reliability

Contact reliability has been greatly improved by the bifurcated auxiliary moving contact



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TYPE REFERENCE LIST

Type	Description	Ref. Page
B(D)-A <input type="checkbox"/> / N <input type="checkbox"/>	NC main contact contactors	50
CD- <input type="checkbox"/>	Heavy-duty clapper-type contactors	52
DU(D)- <input type="checkbox"/>	DC contactors	43
ET-N <input type="checkbox"/>	Electronic motor protection relays	40
EYD(O)-N <input type="checkbox"/>	Star-delta starters	70
MS-N <input type="checkbox"/>	General purpose enclosed type motor starters	20
MS-N <input type="checkbox"/> PM	Enclosed non-reversing motor starters with pushbutton	21
MSO(D)-N <input type="checkbox"/>	General purpose open type motor starters	8,18,32
MSO-N <input type="checkbox"/> DL	Delay open type magnetic contactors	54
MSO(D)-2XN <input type="checkbox"/>	General purpose open and reversing type motor starters	9,19,32
PF- <input type="checkbox"/>	Plug-in sockets for UA-DL2	66
S-N <input type="checkbox"/> 8	Compact 3-pole contactors	49
S(D)-N <input type="checkbox"/>	General purpose contactors	2~
SD-M <input type="checkbox"/>	DC interface contactors	56
S-N <input type="checkbox"/> DL	Delay open type magnetic contactors	54
S(D)-2XN <input type="checkbox"/>	General purpose reversing contactors	26
SH(L)(D)-V <input type="checkbox"/>	Medium voltage vacuum contactors	46
SH(L)(D)-2XV <input type="checkbox"/>	Medium voltage reversing vacuum contactors	46
SL(D)-N <input type="checkbox"/>	Mechanically latched contactors	16
SL(D)-2XN <input type="checkbox"/>	Mechanically latched reversing contactors	17
SLXS-N <input type="checkbox"/>	Mechanically latched and normal reversing contactors	17
SR(D)-N <input type="checkbox"/>	Contactors relays	59
SRE- <input type="checkbox"/>	Voltage detection relays	63
SRS-H <input type="checkbox"/>	Solid state time delay relays	67
SRT(D)-N <input type="checkbox"/>	Pneumatic time delay relays	68
TH-N <input type="checkbox"/>	Thermal overload relays	34
THR- <input type="checkbox"/>	Saturable reactors for TH-N	38
UA-AXVV <input type="checkbox"/>	Auxiliary contact blocks for SH-V	48
UA-DL2	Re-starting relay	65
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1. GENERAL PURPOSE CONTACTORS & STARTERS

Series MS-N

1.1 Conformity to International Standards

Mitsubishi magnetic motor starters and contactors are designed to conform to the relevant IEC recommendations and to the standards of as many countries as possible. Specifically, they conform to the following:

IEC60947-4-1 International
EN60947-4-1 Europe

VDE0660 Germany
NEMA-ICS U.S.A

Table 1.1

Type	Model Name	Europe		North America / UL				Marine				
		CE Mark 	TÜV 	Listing		Recognition		U.K. 	France 	Korea 	Japan 	
				U.S.A. 	Canada 	U.S.A. 	Canada 					
AC Operated Contactor	S-N10(CX)	◎	◎ (*2)	◎	◎	◎	◎ ()	○	○	○	◎	
	S-N11(CX)/N12(CX)											
	S-N18(CX)											
	S-N20(CX)/N21(CX)											
	S-N25(CX)											
	S-N35(CX)											
	S-N28(CX)											
	S-N38(CX)											
	S-N48(CX)											
	S-N50											
	S-N65											
	S-N80											
	S-N95											
	S-N125											
	S-N150											
	S-N180											
S-N220												
S-N300												
S-N400												
S-N600												
S-N800												
Overload Relay	TH-N12(CX)KP	◎	○ (*2)	◎	◎	◎	◎ ()	○	○	—	—	
	TH-N18(CX)KP											
	TH-N20(TA)(CX)KP											
	TH-N60(TA)KP											
	TH-N120(TA)KP											
	TH-N220RHKP/HZKP											
	TH-N400RHKP/HZKP											
DC Operated Contactor	SD-N11(CX)/N12(CX)	◎	◎ (*2)	◎	◎	◎	◎ ()	○	○	—	◎	
	SD-N21(CX)											
	SD-N35(CX)											
	SD-N50											
	SD-N65											
	SD-N80											
	SD-N95											
	SD-N125											
	SD-N150											
	SD-N220											
	SD-N300											
	SD-N400											
	SD-N600											
SD-N800												
AC Operated Contactor Relay	SR-N4(CX)	◎	● (*2)	◎	◎	◎	()	()	○	○	—	—
DC Operated Contactor Relay	SRD-N4(CX)	◎	● (*2)	◎	◎	◎	()	()	○	○	—	—
Auxiliary Contact Block	UN-AX2(CX)	◎	○ (*2)	◎	◎	◎	◎ ()	◎ ()	○	○	—	—
	UN-AX4(CX)											
	UN-AX11(CX)											
	UN-AX80											
	UN-AX150											

Notes: 1. ◎ : CE Mark (Manufacturer's Declaration) == Standard model applicable, marking on the product.

UL, TÜV == Standard model applicable, marking on the product.

NK == Standard model applicable, Certificate No. on the product.

● : Standard model applicable, no marking on the product. If marking required, order model name followed by suffix "DZ".

○ : Standard model applicable, no marking on the product.

☆ : Special model applicable, marking on the product. Order model name followed by suffix "UL".

— : Not applicable to the Standard or not approved.

2. Finger protection type is certified according to DIN VDE I0106 part 100. For finger protection type, order model name followed by suffix "CX".

3. For each certificate conditions, see next three pages.

1.1.1 List of C€ Marked Type



Table 1.1.1

Standard Contactors Non-reversing	A.C. operated	S-N10, S-N11, S-N12, S-N18, S-N20, S-N21, S-N25, S-N28, S-N35, S-N38, S-N48, S-N50, S-N65, S-N80, S-N95, S-N125, S-N150, S-N180, S-N220, S-N300, S-N400, S-N600, S-N800
	D.C. operated	SD-N11, SD-N12, SD-N21, SD-N35, SD-N50, SD-N65, SD-N80, SD-N95, SD-N125, SD-N150, SD-N220, SD-N300, SD-N400, SD-N600, SD-N800
Standard Contactors Reversing	A.C. operated	S-2XN10, S-2XN11, S-2XN20, S-2XN21, S-2XN25, S-2XN35, S-2XN50, S-2XN65, S-2XN80, S-2XN95, S-2XN125, S-2XN150, S-2XN180, S-2XN220, S-2XN300, S-2XN400, S-2XN600, S-2XN800
	D.C. operated	SD-2XN11, SD-2XN21, SD-2XN35, SD-2XN50, SD-2XN65, SD-2XN80, SD-2XN95, SD-2XN125, SD-2XN150, SD-2XN220, SD-2XN300, SD-2XN400, SD-2XN600, SD-2XN800
Additional Auxiliary Contact Blocks		UN-AX2, UN-AX4, UN-AX11, UN-AX80, UN-AX150
Mechanical Interlocks ³		UN-ML11, UN-ML21, UN-ML80, UN-ML150, UN-ML220
Thermal Overload Relays		TH-N12KP, TH-N18KP, TH-N20KP, TH-N20TAKP, TH-N60KP, TH-N60TAKP, TH-N120KP, TH-N120TAKP, TH-N220RHKP, TH-N220HZKP, TH-N400RHKP, TH-N400HZKP, TH-N600KP
Contactor Relays	A.C. operated	SR-N4
	D.C. operated	SRD-N4
D.C. Interface Contactors	Non-reversing	SD-M11, SD-M12, SD-M19
	Reversing	SD-MR12, SD-MR19

Notes: 1. Listed types are representatives and contains standard models.

2. Applicable product standards

Contactors : EN60947-1, EN60947-4-1, EN60947-5-1

Thermal overload relays : EN60947-1, EN60947-4-1, EN60947-5-1

Aux. contact blocks : EN60947-1, EN60947-5-1

Mechanical interlocks : EN60947-1, EN60947-4-1, EN60947-5-1

3. For mechanical interlocks,

no marking on the product.

Mechanical interlocks are applicable when used in reversing contactors.

1.1.2 TÜV Certified Type



TÜV Rheinland

Table 1.1.2 (1)

■ Contactor

Model Name	Applicable standard	Certificate No.
S-N10(CX)(SA)	EN60947-4-1	R9551340
S-N11(CX)(SA)		
S-N12(CX)(SA)		
S-N20(CX)(SA)	EN60947-4-1	R9551336
S-N21(CX)(SA)		
S-N25(CX)(SA)		
S-N35(CX)(SA)	EN60947-4-1	R9651190
S-N18(CX)(SA)		
S-N28(CX)(SA)		
S-N38(CX)(SA)	EN60947-4-1	R9651189
S-N48(CX)(SA)		
S-N50/S-N65		
S-N80/S-N95	EN60947-4-1	R9851170
S-N125	EN60947-4-1	R9851138
S-N150	EN60947-4-1	R9851169
S-N180/S-N220	EN60947-4-1	R9851167
S-N300/S-N400	EN60947-4-1	R9851164
SD-N11(CX)(SA)	EN60947-4-1	R9851171
SD-N12(CX)(SA)		
SD-N21(CX)(SA)		
SD-N35(CX)(SA)	EN60947-4-1	R9551340
SD-N50/SD-N65	EN60947-4-1	R9551336
SD-N80/SD-N95	EN60947-4-1	R9651190
SD-N125	EN60947-4-1	R9851170
SD-N150	EN60947-4-1	R9851138
SD-N220	EN60947-4-1	R9851169
SD-N300/SD-N400	EN60947-4-1	R9851167
	EN60947-4-1	R9851164
	EN60947-4-1	R9851171

Notes: 1. Standard models are applicable under following conditions.

Main circuits : AC-3 rated current at 440V AC max.

(Main contacts) and rated continuous current.

Auxiliary contacts : AC-15 rated current at 550V AC max.

and rated continuous current.

Operation coil : AC coil designation

N10~N12, N18~N48 and SR-N4 ; AC12V~AC440V

N20~N35 ; AC12V~AC380V

N50~N150 ; AC24V~AC500V

N180~N400 ; AC48V~AC500V

DC coil designation DC12V~DC220V

2. For contactors, standard models are with TÜV mark on the product.

For other products, standard models are with no TÜV mark on the product.

For contactor relays, order model name followed by suffix "DZ" if TÜV mark on the product is required.

3. Finger protection type is certified according to DIN VDE 0106 part 100. For finger protection type, order model name followed by suffix "CX".

4. Models with built-in surge absorber (model name followed by "SA") are also certified.

■ Overload Relay

Table 1.1.2 (2)

Model Name	Applicable standard	Registration No.
TH-N12(CX)KP	EN60947-4-1	J9551338
TH-N18(CX)KP	EN60947-4-1	J9551338
TH-N20(TA)(CX)KP	EN60947-4-1	J9551341
TH-N60(TA)KP	EN60947-4-1	J9851140
TH-N120(TA)KP	EN60947-4-1	J9851168
TH-N220RHKP/HZKP	EN60947-4-1	J9851166
TH-N400RHKP/HZKP	EN60947-4-1	J9851172

■ Contactor Relay

Table 1.1.2 (3)

Model Name	Applicable standard	Certificate No.
SR-N4(CX)(SA)	EN60947-5-1	R9551339
SRD-N4(CX)(SA)	EN60947-5-1	R9551339

■ Auxiliary Contact Block

Table 1.1.2 (4)

Model Name	Applicable standard	Registration No.
UN-AX2(CX)	EN60947-5-1	J9551337
UN-AX4(CX)		
UN-AX11(CX)		
UN-AX80	EN60947-5-1	R9851225
UN-AX150		

1.1.3 UL Approval for U.S.A. and Canada



■ Contactor and Motor Starter

Table 1.1.3 (1)

Mark	cUL US																	cUL US		
	Model Name	S-N10(CX)	S(D)-N11(CX) S(D)-N12(CX)	S-N18(CX)	S-N20(CX) S(D)-N21(CX)	S-N25(CX)	S(D)-N35(CX)	S(D)-N50 ²	S(D)-N65 ²	S(D)-N80 ²	S(D)-N95 ²	S(D)-N125 ²	S(D)-N150 ²	S-N180 ²	S(D)-N220 ²	S(D)-N300 ²	S(D)-N400 ²	S-N600 ²	S-N800UR ²	
Contactor (open)	Continuous current rating A open	13	20	30	30	35	40	80	95	100	100	125	150	220	220	300	400	680	910	
	Horsepower rating Single phase	120V HP	1/2	1/2	1	1	2	2	3	3	5	7-1/2	10	15	15	—	—	—	—	
		240V HP	1-1/2	1-1/2	3	3	3	5	7-1/2	10	15	15	20	25	30	40	—	—	—	—
	Three phase	208V HP	3	3	5	5	7-1/2	10	15	15	20	25	40	40	60	60	100	125	150	250
240V HP		3	3	5	5	7-1/2	10	15	15	20	25	40	40	60	60	100	150	200	300	
480V HP		5	7-1/2	10	10	15	20	30	40	50	60	75	100	125	150	200	300	400	600	
600V HP		5	7-1/2	10	10	15	20	30	40	50	60	75	100	125	150	200	300	400	600	
Starter (open)	Mark	cUL US																	—	
	Model Name	MSO-N10KP(CX)	MSO-N11KP(CX) N12KP(CX)	MSO-N18KP(CX)	MSO-N20KP(CX) N21KP(CX)	MSO-N25KP(CX)	MSO-N35KP(CX)	MSO-N50KP ²	MSO-N65KP ²	MSO-N80KP ²	MSO-N95KP ²	MSO-N125KP ²	MSO-N150KP ²	MSO-N180KP ²	MSO-N220KP ²	MSO-N300KP ²	MSO-N400KP ²	—	—	
Horsepower rating Three phase	208V HP	3	3	5	5	7-1/2	10	15	15	20	25	40	40	60	60	100	125	—	—	
	240V HP	3	3	5	5	7-1/2	10	15	20	25	30	40	50	60	75	100	150	—	—	
	480V HP	5	7-1/2	10	10	15	20	30	40	50	60	75	100	125	150	200	300	—	—	
	600V HP	5	7-1/2	10	10	15	20	30	40	50	60	75	100	125	150	200	300	—	—	
Max. rating of short circuit protection device	Fuse class K5	30	30	70	70	100	125	250	250	300	225	350	350	500	500	600 ³	500 ³	800 ⁴	1200 ⁴	
	Circuit breaker	—	—	—	—	100	125	—	—	300	225	350	350	500	500	600	1000	—	—	

- Notes: 1. UL listed types for S-N600 and S-N800 require suffix letters "UL" (eg. S-N800UL).
 2. Types S-N50 to S-N800 and MSO-N50KP to N400KP with IIsco lugs are also listed as type name with suffix letters "UL" (eg. S-N50UL).
 3. Time delay fuse
 4. Class L fuse

■ Thermal Overload Relay



Table 1.1.3 (2)

Model Name	Heater designation (Rated current [A])	Contactor to be coupled	Auxiliary Contact
TH-N12(CX)KP☆ TH-N12(CX)☆*1 TH-N12(CX)HZKP★*2 TH-N12(CX)HZ★*1	0.12A(0.1-0.16), 0.17(0.14-0.22), 0.24A(0.2-0.32), 0.35A(0.28-0.42), 0.5A(0.4-0.6), 0.7A(0.55-0.85), 0.9A(0.7-1.1), 1.3A(1-1.6), 1.7A(1.4-2), 2.1A(1.7-2.5), 2.5A(2-3), 3.6A(2.8-4.4), 5A(4-6), 6.6A(5.2-8), 9A(7-11), 11A(9-13)	S-N10 S-N11 S-N12	Rated /C600 Code /AC600Vmax Make 1800VA(15A max)
TH-N18(CX)KP☆ TH-N18(CX)☆*1	1.3A(1-1.6), 1.7(1.4-2), 2.1A(1.7-2.5), 2.5A(2-3), 3.6A(2.8-4.4), 5A(4-6), 6.6A(5.2-8), 9A(7-11), 11A(9-13), 15A(12-18)	S-N18	Break 180VA(1.5A max)
TH-N20(CX)KP TH-N20(CX)*1 TH-N20CXHZKP★ TH-N20CXHZ★*1	0.24A(0.2-0.32), 0.35A(0.28-0.42), 0.5A(0.4-0.6), 0.7A(0.55-0.85), 0.9A(0.7-1.1), 1.3A(1-1.6), 1.7A(1.4-2), 2.1A(1.7-2.5), 2.5A(2-3), 3.6A(2.8-4.4), 5A(4-6), 6.6A(5.2-8), 9A(7-11), 11A(9-13), 15A(12-18)	S-N20 S-N21 S-N25 S-N35	Rated /B600 Code /AC600Vmax Make 3600VA(30A max) Break 360VA(3A max)
TH-N20TAKP☆ TH-N20TA☆*1	22A(18-26) 29A(24-34)	S-N25,N35 S-N35	
TH-N60KP TH-N60TAKP☆	15A(12-18), 22A(18-26), 29A(24-34), 35A(30-40), 42A(34-50) 54A(43-65) 67A(54-80) 82A(65-100)	S-N50,N65,N80,N95 S-N65,N80,N95 S-N80,N95 S-N95	Rated /B600 Code /AC600Vmax Make 3600VA(30A max) Break 360VA(3A max)
TH-N120KP TH-N120TAKP☆	42A(34-50), 54A(43-65), 67A(54-80), 82A(65-100) 105A(85-125) 125A(100-150)	S-N125,N150 S-N125,N150 S-N150	
TH-N220RHKP☆ TH-N220HZKP★	82A(65-100), 105A(85-125), 125A(100-150), 150A(120-180) 180A(140-220)	S-N180,N220 S-N220	
TH-N400RHKP☆ TH-N400HZKP★	105A(85-125), 125A(100-150), 150A(120-180), 180A(140-220), 250A(200-300) 330A(260-400)	S-N300,N400 S-N400	


- Notes: 1. ☆ is to be coupled with contactor and can not be mounted separately from contactor. ★ is only for separate mounting.
 2. Suffix "KP" ; Overload and phase failure protection type with three heater elements.
 3. *1 ; TH-N12(CX), N12(CX)HZ, N18(CX), N20(CX), N20CXHZ and N20TA are recognized (RU) for single phase motors.
 4. *2 is to be coupled with TH-N12(CX)KP (cUL US) and UN-HZ12 (RU).

■ Contactor Relay and Auxiliary Contact Block

Table 1.1.3 (3)

Type Model Name	Ratings	
Contactor Relay SR(D)-N4	Rated Code ; A600	Rated Code ; R300
Auxiliary Contact Block UN-AX2(CX) UN-AX4(CX) UN-AX11(CX)	AC600V max Make 7200VA Break 720VA	DC250V max Make 28VA Break 28VA
UN-AX80 UN-AX150		

1.1.4 Approved Marine Standards

■ Lloyd's Register of Shipping (LR) 

■ Bureau Veritas (BV) 

Table 1.1.4 (1)

Type	Model Name	BV Certificate No.	LR Certificate No.	Note
Contactor	S-N10, N11, N12, N20, N21(CX)	06139	95/10008	AC-3 Maximum 550V Standard model can be applied.
	SD-N11, N12, N21(CX)(SA)	2634/6987	96/10035	
	S-N18, N25, N28, N35(CX)(SA)/SD-N35(CX)(SA)	2634/6988	96/10034	
	S/SD-N50, N65, N80, N95	2634/07905	98/10016	
	S/SD-N125, N150, N220, N300, N400, S-N180	2634/07905	98/10016	
	S/SD-N600, N800	2634/07905	98/10016	
Thermal Overload Relay	TH-N12 (CX)(KP), N20(CX)(KP)	06139	95/10009	Maximum 550V Standard model can be applied.
	TH-N18(CX)(KP), N20TA(CX)(KP)	2634/6988	96/10033	
	TH-N60(KP), N60TA(KP), N120(KP), N120TA(KP), N220(KP), N400(KP)	2634/07905	98/10017	
	TH-N600(KP)	2634/07905	98/10017	
Contactor Relay	SR-N4(CX)	06139	95/10010	AC-15 Maximum 550V Standard model can be applied.
	SRD-N4(CX)	2634/6987	96/10035	
Auxiliary Contact Block	UN-AX2, AX4, AX11(CX)	06139	95/10010	Standard model can be applied.
	UN-AX80, AX150, AX600	2634/07905	98/10016	

■ Korean Register of Shipping (KR) 

Table 1.1.4 (2)

Contactor Model Name	Certificate No.	Contactor Model Name	Certificate No.	Contactor Model Name	Certificate No.
S-N10(CX)	KOB02571-EL020	S-N21(CX)	KOB02571-EL024	S-N95	KOB02571-EL028
—	—	S-N25(CX)(SA)	KOB02571-EL025	S-N125	KOB02571-EL028
S-N11(CX)	KOB02571-EL021	S-N35(CX)(SA)	KOB02571-EL026	S-N150	KOB02571-EL028
S-N12(CX)	KOB02571-EL022	S-N50	KOB02571-EL028	S-N220	KOB02571-EL028
S-N18(CX)(SA)	KOB02571-EL027	S-N65	KOB02571-EL028	S-N300	KOB02571-EL028
S-N20(CX)	KOB02571-EL023	S-N80	KOB02571-EL028	S-N400	KOB02571-EL028

Note: 1. Standard models are applicable. (AC3 Max. 440V according to JEM standard.)

■ Nippon Kaiji Kyokai (NK) 

Table 1.1.4 (3)

Contactor Model Name	Certificate No.	Contactor Model Name	Certificate No.	Contactor Model Name	Certificate No.		
S-N10(CX)	—	94T415	S-N125	SD-N125	98T407	SL(D)-N21NK	95T401
S-KR11	—	85T405	S-N150	SD-N150	98T408	SL(D)-N35NK	96T401
S-N11(CX)	SD-N11(CX)	94T416	S-N180	—	98T409	SL(D)-N50NK	98T413
S-N12(CX)	SD-N12(CX)	94T417	S-N220	SD-N220	98T410	SL(D)-N65NK	98T414
S-N18(CX)(SA)	—	95T404	S-N300	SD-N300	98T411	SL(D)-N80NK	98T415
S-N20(CX)	—	94T418	S-N400	SD-N400	98T412	SL(D)-N95NK	98T416
S-N21(CX)	SD-N21(CX)	94T419	S-N600	SD-N600	85T406	SL(D)-N125NK	98T417
S-N25(CX)(SA)	—	95T402	S-N800	SD-N800	85T407	SL(D)-N150NK	98T418
S-N35(CX)(SA)	SD-N35(CX)(SA)	95T403 96T401	S-N38(CX)(SA)	—	96T402	SL(D)-N220NK	98T419
S-N50	SD-N50	98T403	S-N48(CX)(SA)	—	96T403	SL(D)-N300NK	98T420
S-N65	SD-N65	98T404	B-N20	BD-N20	96T404	SL(D)-N400NK	98T421
S-N80	SD-N80	98T405	B-A65	BD-A65	81T420	SL(D)-N600NK	85T408
S-N95	SD-N95	98T406	B-A100	BD-A100	81T421	SL(D)-N800NK	85T409

Note: 1. Standard models are applicable. (AC3 Max. 440V according to JEM standard.)

1.2 Selection Guide



S-N11CX



S-2xN11



MSO-N12



S-N21CX



MSO-N35

Three-phase motor ratings IEC category AC-3 kW(hp)	220-240V	2.5(3-1/4)	3.5(4-1/2)	3.5(4-1/2)	4.5(6)	5.5(7-1/2)	5.5(7-1/2)	7.5(10)	11(15)
	380-440V	4(5-1/2)	5.5(7-1/2)	5.5(7-1/2)	7.5(10)	11(15)	11(15)	15(20)	18.5(25)
	500V	4(5-1/2)	5.5(7-1/2)	5.5(7-1/2)	7.5(10)	11(15)	11(15)	15(20)	18.5(25)
	660V	4(5-1/2)	5.5(7-1/2)	5.5(7-1/2)	7.5(10)	7.5(10)	7.5(10)	11(15)	15(20)
Conventional free air thermal current Ith A		20	20	20	25	32	32	50	60
Auxiliary contacts ¹	(standard)	1NO	1NO	1NO+1NC	— ²	1NO+1NC	2NO+2NC	2NO+2NC	2NO+2NC
	(special)	1NC	1NC	2NO	—	2NO	—	—	—
Number of additional auxiliary contact block for ³	1NO + 1NC (front)	1	1	1	1	1	1	1	1
	1NO + 1NC (side)	2	2	—	—	2	2	2	2
	2NO + 2NC (front)	1	1	1	1	1	1	1	1
	Low level signal (front) [1NO+1NC (+Standard 1NO + 1NC)]	1	1	1	1	1	1	1	1

Notes: 1. Number of auxiliary contact shows that for non-reversing type. Twice of the auxiliary contacts are provided on reversing type.
 2. (2NO + 2NC) × 2 auxiliary contacts are provided on reversing type and no additional contact can be mounted.
 3. Front clip-on and side clip-on block should not be mounted both.

Contactors

AC operated models	Non-reversing	S-N10(CX)	S-N11(CX)	S-N12(CX)	S-N18(CX)	S-N20(CX)	S-N21(CX)	S-N25(CX)	S-N35(CX)
	Reversing	S-2xN10(CX)	S-2xN11(CX)	—	S-2xN18(CX)	S-2xN20(CX)	S-2xN21(CX)	S-2xN25(CX)	S-2xN35(CX)
DC operated models		—	SD-N11(CX)	SD-N12(CX)	—	—	SD-N21(CX)	—	SD-N35(CX)

Note: 1. Products which model names are provided with suffix “CX” are provided with finger protection. (N10~N65)
 Especially N10~N35 with suffix “CX” are provided with CAN terminals.

Stators (AC operated)

Enclosed type (IP20)	MS-N10 (KP)	MS-N11 (KP)	MS-N12 (KP)	—	MS-N20 (KP)	MS-N21 (KP)	MS-N25 (KP)	MS-N35 (KP)
Open type (IP00)	MSO-N10 (KP)(CX)	MSO-N11 (KP)(CX)	MSO-N12 (KP)(CX)	MSO-N18 (KP)(CX)	MSO-N20 (KP)(CX)	MSO-N21 (KP)(CX)	MSO-N25 (KP)(CX)	MSO-N35 (KP)(CX)

Thermal Overload Relays¹

Three heater type with phase failure protection	TH-N12KP(CX)	TH-N18KP(CX)	TH-N20KP(CX)	TH-N20TAKP(CX)
Two heater type	TH-N12(CX)	TH-N18(CX)	TH-N20(CX)	TH-N20TA(CX)
Heater setting range A (Ordering designation)	0.1~0.16(0.12A) 0.14~0.22(0.17A) 0.2~0.32(0.24A) 0.28~0.42(0.35A) 0.4~0.6(0.5A) 0.55~0.85(0.7A) 0.7~1.1(0.9A) 1~1.6(1.3A) 1.4~2(1.7A)	1.7~2.5(2.1A) 2~3(2.5A) 2.8~4.4(3.6A) 4~6(5A) 5.2~8(6.6A) 7~11(9A) 9~13(11A) ²	1~1.6(1.3A) 1.4~2(1.7A) 1.7~2.5(2.1A) 2~3(2.5A) 2.8~4.4(3.6A) 4~6(5A) 5.2~8(6.6A) 7~11(9A) 9~13(11A) 12~18(15A)	0.2~0.32(0.24A) 0.28~0.42(0.35A) 0.4~0.6(0.5A) 0.55~0.85(0.7A) 0.7~1.1(0.9A) 1~1.6(1.3A) 1.4~2(1.7A) 1.7~2.5(2.1A)
			2~3(2.5A) 2.8~4.4(3.6A) 4~6(5A) 5.2~8(6.6A) 7~11(9A) 9~13(11A) 12~18(15A) ³	18~26(22A) 24~34(29A) 30~40(35A) ⁴

Notes: 1. Saturable reactors for thermal overload relays are available as a kit or equipped with the relay. The suffix “SR” following the model name of the relay indicates “with saturable reactor”. (ex. TH-N20KPSR*5A) (Except for type TH-N12KP, TH-N18 and TH-N18KP)
 2. Except for size N10. 3. For size N20 & N21 only. 4. For size N35 only.



S-N65



S-N125



S-N400



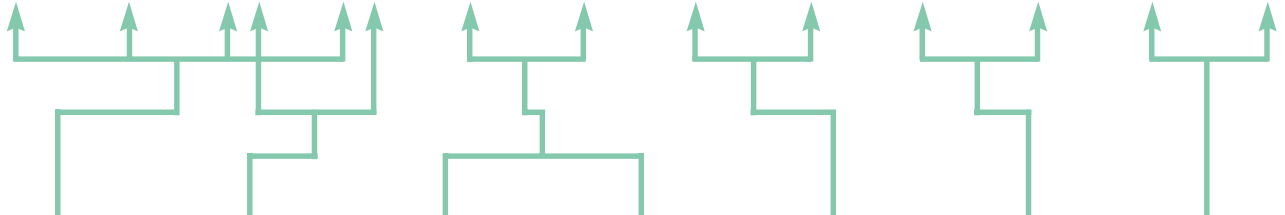
S-N800

Table 1.2.1

15(20)	18.5(25)	22(30)	30(40)	37(50)	45(60)	55(75)	75(100)	90(125)	125(170)	190(250)	220(300)
22(30)	30(40)	45(60)	55(75)	60(80)	75(100)	90(125)	132(180)	160(210)	220(300)	330(450)	440(600)
25(34)	37(50)	45(60)	55(75)	60(80)	90(125)	110(150)	132(180)	160(210)	225(330)	330(450)	500(670)
22(30)	30(40)	45(60)	55(75)	60(80)	90(125)	110(150)	132(180)	200(270)	250(330)	330(450)	500(670)
80	100	135	150	150	200	260	260	350	450	800	1000
2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC	2NO+2NC
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	2	2	2	2	2	2	2	2	—	—
1	1	—	—	—	—	—	—	—	—	1	1
—	—	—	—	—	—	—	—	—	—	—	—

S-N50(CX)	S-N65(CX)	S-N80	S-N95	S-N125	S-N150	S-N180	S-N220	S-N300	S-N400	S-N600	S-N800
S-2×N50(CX)	S-2×N65(CX)	S-2×N80	S-2×N95	S-2×N125	S-2×N150	S-2×N180	S-2×N220	S-2×N300	S-2×N400	S-2×N600	S-2×N800
SD-N50	SD-N65	SD-N80	SD-N95	SD-N125	SD-N150	—	SD-N220	SD-N300	SD-N400	SD-N600	SD-N800

MS-N50 (KP)	MS-N65 (KP)	MS-N80 (KP)	MS-N95 (KP)	MS-N125 (KP)	MS-N150 (KP)	MS-N180 (KP)	MS-N220 (KP)	MS-N300 (KP)	MS-N400 (KP)	—	—
MSO-N50 (KP)(CX)	MSO-N65 (KP)(CX)	MSO-N80 (KP)	MSO-N95 (KP)	MSO-N125 (KP)	MSO-N150 (KP)	MSO-N180 (KP)	MSO-N220 (KP)	MSO-N300 (KP)	MSO-N400 (KP)	—	—



TH-N60KP(CX)	TH-N60TAKP	TH-N120KP	TH-N120TAKP	TH-N220RHKP	TH-N400RHKP	TH-N600KP ⁹
TH-N60(CX)	TH-N60TA	TH-N120	TH-N120TA	TH-N220RH	TH-N400RH	TH-N600 ⁹
12-18(15A) 18-26(22A) 24-34(29A) 30-40(35A) 34-50(42A) 43-65(54A)	54-80 (67A) 65-100(82A) 85-105(95A) ⁵	34-50 (42A) 43-65 (54A) 54-80 (67A) 65-100(82A)	85-125 (105A) 100-150(125A) ⁶	65-100 (82A) 85-125 (105A) 100-150(125A) 120-180(150A) 140-220(180A) ⁷ 170-250(210A) ⁷	85-125 (105A) 100-150(125A) 120-180(150A) 140-220(180A) 200-300(250A) 260-400(330A) ⁸	200-300(250A) 260-400(330A) 400-600(500A) 520-800(660A) ¹⁰

5. For size N95 only.

6. For size N150 only.

7. For size N220 only.

8. For size N400 only.

9. TH-N600(KP) must be used with the current transformers (to be supplied by the customer.) See Table 2.1.2.

10. For size N800 only.

1.3 The Overview (Type designation breakdown)

1.3.1 Non-Reversing Types

Table 1.3.1

Frame Size		N10	N11	N12	N18	N20	N21	N25	N35	N50	N65	N80	N95	N125	N150	N180	N220	N300	N400	N600	N800			
Spec	Rated capacity	220-240V	2.5	3.5	3.5	4.5	5.5	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	125	190	220		
	Category AC-3(kW)	380-440V	4	5.5	5.5	7.5	11	11	15	18.5	22	30	45	55	60	75	90	132	160	220	330	440		
Spec	Number of aux. contacts	Standard	1NO	1NO	1NO1NC	—	1NO1NC	← 2NO2NC →																
		Special	1NC	1NC	2NO	—	2NO	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
ACCESSORIES	Additional aux. contact blocks	Front-on ¹	← 2P or 4P →										—	—	—	—	—	—	—	—	—	—		
		Side-on	← 1NO1NC×2(max.) →		—	← 1NO1NC×2(max.) →															2NO2NC×1(max.)			
	Surge absorber ³	← Attachable →										← Provided as a standard →												
	Mechanical interlock unit	← Attachable →		—	← Attachable →															—	—			
CONTACTORS	Open	AC operated	S-□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
		DC operated	SD-□	—	○	○	—	—	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Finger protected	S-□CX	○	○	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	—	—
			SD-□CX	—	○	○	—	—	○	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—
	Mechanically latched	SL(D)-□	—	—	—	—	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
STARTERS	Open	AC operated	MSO-□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
		DC operated	MSOD-□	—	○	○	—	—	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	
		With phase failure protection	MSO-□KP	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Enclosed Class IP20	Slow trip type with saturable reactor	MSO-□SR	○	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Quick-trip type with 2 heater elements	MSO-□FS	—	—	—	—	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—
			with phase failure protection	MSO-□KF	○	○	○	—	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—
Enclosed Class IP20	Standard type	MS-□	○	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	With push button	MS-□PM	○	○	—	—	○	○	○	○	○	○	○	○	—	—	—	—	—	—	—	—	—	
	With phase failure protection	MS-□KP	○	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	Mounting on 35mm rail	← Available →										—	—	—	—	—	—	—	—	—	—	—		

Notes: 1. Additional head-on type aux. contact blocks cannot be attached to the enclosed type, mechanically latched type of size N50 & N65.
 2. Surge absorber is provided as a standard on ac operated contactors and starters of sizes N50 to N800.

1.3.2 Reversing Type

Table 1.3.2

Frame Size		2x N10	2x N11	2x N18	2x N20	2x N21	2x N25	2x N35	2x N50	2x N65	2x N80	2x N95	2x N125	2x N150	2x N180	2x N220	2x N300	2x N400	2x N600	2x N800			
Spec	Rated capacity	220-240V	2.5	3.5	4.5	5.5	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	125	190	220		
	Category AC-3(kW)	380-440V	4	5.5	7.5	11	11	15	18.5	22	30	45	55	60	75	90	132	160	220	330	440		
Spec	Number of aux. contacts	Standard	← 1NO1NC×2 →		2NO2NC×2	1NO1NC×2	← 2NO2NC×2 →										← 3NO3NC×2 →			← 4NO4NC ×2 →			
		Special	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
ACCESSORIES	Additional aux. contact blocks	Front-on ¹	← 4P×2 / 2P×2 →		—	← 4P×2 / 2P×2 →										—	—	—	—	—	—	—	
		Side-on	← 1NO1NC×2 →		—	← 1NO1NC×2 →										—	—	—	—	—	—	—	
	Surge absorber ²	← Attachable →										← Provided as a standard →											
CONTACTORS	Open	AC operated	S-□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
		DC operated	SD-□	—	○	—	—	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Finger protected	S-□CX	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Mechanically latched	SL(D)-□	—	—	—	—	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		AC operated	MSO-□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
STARTERS	Open	DC operated	MSOD-□	—	○	—	—	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	
		With phase failure protection	MSO-□KP	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Slow trip type	MSO-□SR	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Quick-trip type	MSO-□FS	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		with 2 heater elements	MSO-□FS	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		with phase failure protection	MSO-□KF	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		Standard type	MS-□	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
With phase failure protection	MS-□KP	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Mounting on 35mm rail		← Available ³ →										—	—	—	—	—	—	—	—	—			

Notes: 1. Additional head-on type aux. contact blocks cannot be attached to the enclosed type, mechanically latched type of size N50 & N65.
 2. Surge absorber is provided as a standard on ac operated contactors and starters of sizes 2xN50 to 2xN800.
 3. Remove a mounting plate for mounting on 35mm rail of sizes 2xN25 to 2xN65.

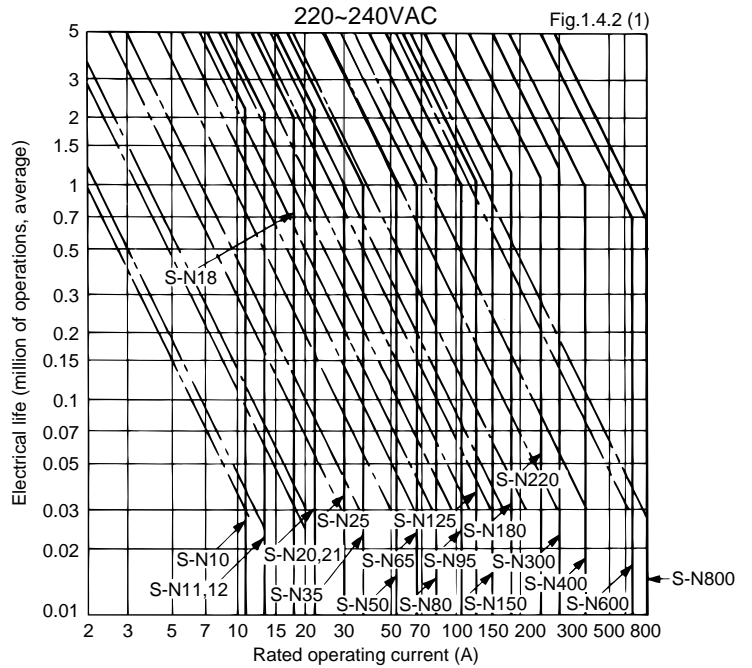
1.4.2 Performance of Series S-N Contactors

Electrical Life

The electrical life of the main contacts of a contactor is determined mainly by the circuit-opening duty it will perform. The relationship between electrical life and rated current of Mitsubishi contactors under normal and jogging duties of squirrel-cage motors is shown in Fig. 1.4.2(1) and 1.4.2(2). In the case of a mixture of normal and jogging duties, the expected contactor life can be determined as follows:

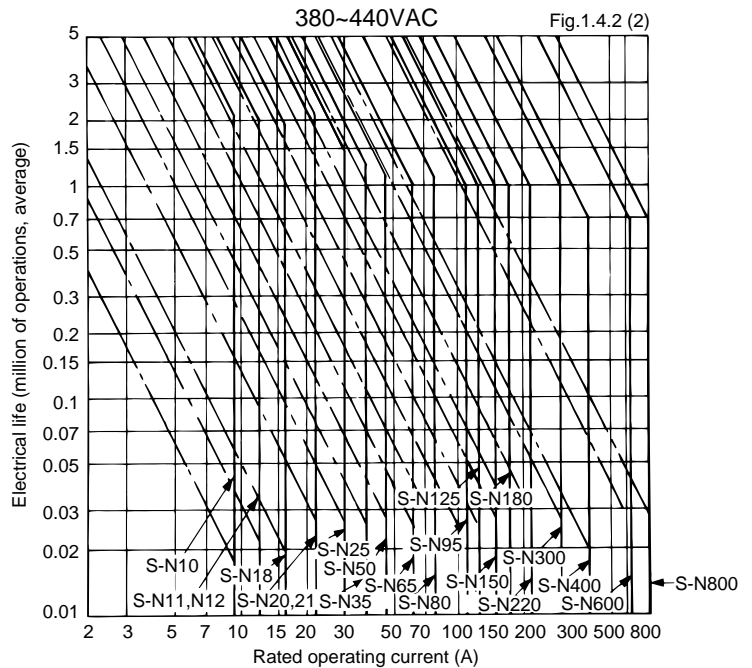
$$N = Nr/1 + \frac{\alpha}{100} (Nr/Ni - 1) \dots\dots\dots \text{Eq.1.1}$$

- where
- N : Life in the case of $\alpha\%$ jogging duty
 - Nr : Life in the case of normal duty
 - Ni : Life in the case of 100% jogging duty
 - α : Percentage of jogging duty



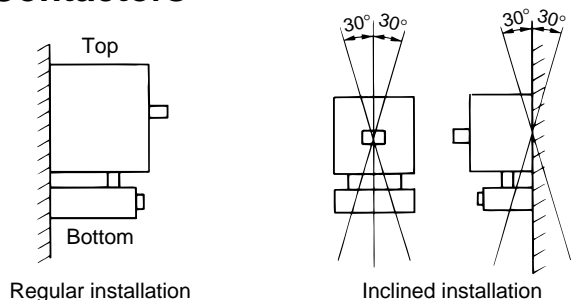
Electrical life versus rated operating current

- Normal duty, 6le on, 1e off, on-load factor 40%, 1200 operations/hour (AC3)
- - - Jogging duty, 6le on, 6le off, on-load factor 7%, 600 operations/hour (AC4)-S-N10~S-N300
300 operations/hour (AC4)-S-N400~S-N600
150 operations/hour (AC4)-S-N800



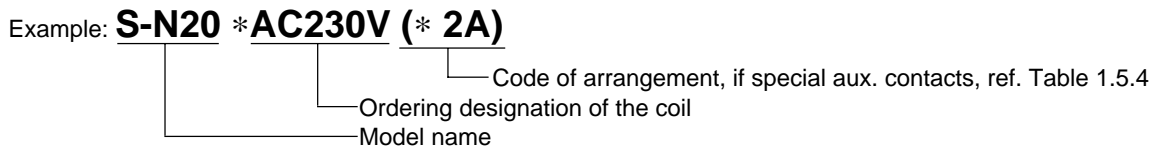
1.4.3 Mounting Attitude of Starters and Contactors

To assure proper performance, Mitsubishi magnetic motor starters and contactors should be mounted on a vertical supporting surface with the line terminals upwards and the load terminals downwards. The supporting surface may have a maximum inclination of 30° from the vertical in any direction.

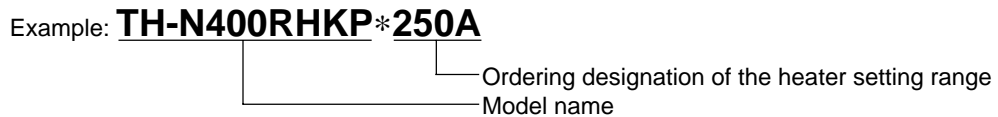


1.5 When Ordering

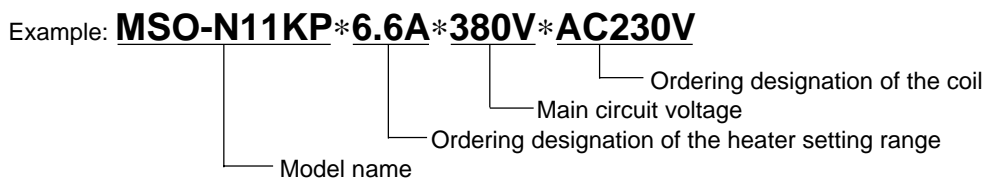
Contactors, indicate the model name and the ordering designation of the coil.



Overload relays, indicate the model name and the ordering designation of the heater setting range.



Motor starters, indicate the model name, heater setting range, main circuit voltage, coil designation.



Note: Mark * indicates a blank space.

Coil Ratings and Ordering Designations for S-N10(CX), -N11(CX), -N12(CX), -N18(CX), -N20(CX), -N21(CX), -N25(CX), -N35(CX) and SR-N(CX)

Table 1.5.1

Rated voltage (VAC)		Ordering designation
50Hz	60Hz	
24	24	AC24V
48~50	48~50	AC48V
100	100~110	AC100V
110~120	115~120	AC120V
125~127	127	AC127V
200	200~220	AC200V
208~220	220	AC220V
220~240	230~240	AC230V
240~260	260~280	AC260V
346~380	380	AC380V
380~415	400~440	AC400V
415~440	460~480	AC440V
500	500~550	AC500V

for S-N50(CX)~N800

Table 1.5.2

Rated voltage (50/60Hz)	Ordering designation
100~127V	AC100V
200~240V	AC200V
260~350V	AC300V
380~440V	AC400V
460~550V	AC500V

AC24V, AC48V are available for S-N50(CX)~N150

for SD-N, SRD-N

Table 1.5.3

Rated voltage (VDC)	Ordering designation
24	DC24V
48	DC48V
100	DC100V
110	DC110V
120~125	DC125V
200	DC200V
220	DC220V

Code of arrangement for special aux. Contacts

Table 1.5.4

Arrangement	Code
1NC	1B
2NO	2A

A : Normally Open

B : Normally Closed

1.6 Selection Table of Contactors

1.6.1 Non-Reversing Contactors

Type **S-N□**, **SD-N□**

Ordering Designation

Model name S-N10
 Coil designation (See page 13) AC400V
 If required special aux. contact (never specify for standard). 1B
 Complete type designation S-N10*AC400V*1B

Note: Mark*indicates a blank space.

Table 1.6.1

Rated operational current AC-3	Rated motor capacity 3-phase AC-2 & AC-3				Model name		Standard aux. contacts	Finger protection terminal cover	Additional auxiliary contact block								
	220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)			AC operated	DC operated	UN-AX2(CX)	UN-AX4(CX)	UN-AX11(CX)	UN-AX80	UN-AX150	UN-AX600	
11	9	2.5	4	4	4	S-N10 S-N10CX* S-N10(1B) S-N10CX*(1B)	—	—	1	—	—	—	—	—	—	—	—
13	12	3.5	5.5	5.5	5.5	S-N11 S-N11CX* S-N11(1B) S-N11CX*(1B)	SD-N11 SD-N11CX* SD-N11(1B) SD-N11CX*(1B)	—	1	—	—	2	—	—	—	—	—
13	12	3.5	5.5	5.5	5.5	S-N12 S-N12CX* S-N12(2A) S-N12CX*(2A)	SD-N12 SD-N12CX* SD-N12(2A) SD-N12CX*(2A)	—	1	1	—	—	—	—	—	—	—
18	16	4.5	7.5	7.5	7.5	S-N18 S-N18CX*	—	—	—	—	—	—	—	—	—	—	—
22	22	5.5	11	11	7.5	S-N20 S-N20CX* S-N20(2A) S-N20CX*(2A)	—	—	1	1	—	—	—	—	—	—	—
22	22	5.5	11	11	7.5	S-N21 S-N21CX*	SD-N21 SD-N21CX*	—	2	2	—	—	—	—	—	—	—
30	30	7.5	15	15	11	S-N25 S-N25CX*	—	—	2	2	—	—	—	—	—	—	—
40	40	11	18.5	18.5	15	S-N35 S-N35CX*	SD-N35 SD-N35CX*	—	2	2	—	—	—	—	—	—	—
55	50	15	22	22	22	S-N50 S-N50CX*	SD-N50	—	2	2	—	—	—	—	—	—	—
65	62	18.5	30	37	30	S-N65 S-N65CX*	SD-N65	—	2	2	—	—	—	—	—	—	—
85	85	22	45	45	45	S-N80	SD-N80	—	2	2	—	—	—	—	—	—	—
105	105	30	55	55	55	S-N95	SD-N95	—	2	2	—	—	—	—	Max. 2	—	—
125	120	37	60	60	60	S-N125	SD-N125	—	2	2	—	—	—	—	—	—	—
150	150	45	75	90	90	S-N150	SD-N150	—	2	2	—	—	—	—	—	—	—
180	180	55	90	110	110	S-N180	—	—	2	2	—	—	—	—	—	—	—
250	250	75	132	132	132	S-N220	SD-N220	—	2	2	—	—	—	—	Max. 2	—	—
300	300	90	160	160	200	S-N300	SD-N300	—	2	2	—	—	—	—	—	—	—
400	400	125	220	225	250	S-N400	SD-N400	—	2	2	—	—	—	—	—	—	—
630	630	190	330	330	330	S-N600	SD-N600	—	2	2	—	—	—	—	—	—	—
800	800	220	440	500	500	S-N800	SD-N800	—	2	2	—	—	—	—	—	—	1

Note: 1 "CX" denotes with finger protection terminal covers.



S-N10CX



S-N21



SD-N65



S-N220



SD-N400



S-N800

1.6.2 Reversing Contactors

Type **S-2xN□**, **SD-2xN□**

Ordering Designation

Model name S-2xN95
 Coil designation (See page 13) AC400V
 Complete type designation S-2xN95*AC400V

Note: Mark*indicates a blank space.

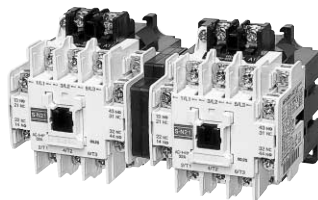
Table 1.6.2

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name		Standard aux. contacts		Additional auxiliary contact block(max).				
220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)	AC operated	DC operated	NO	NC	UN- AX2(CX)	UN- AX4(CX)	UN- AX11(CX)	UN- AX80	UN- AX150
11	9	2.5	4	4	4	S-2xN10 S-2xN10CX ¹	—	2	2	2	2	2	—	—
13	12	3.5	5.5	5.5	5.5	S-2xN11 S-2xN11CX ¹	SD-2xN11 SD-2xN11CX ¹	2	2	—	—	—	—	—
18	16	4.5	7.5	7.5	7.5	S-2xN18 S-2xN18CX ¹	—	4	4	—	—	—	—	—
22	22	5.5	11	11	7.5	S-2xN20 S-2xN20CX ¹	—	2	2	—	—	—	—	—
22	22	5.5	11	11	7.5	S-2xN21 S-2xN21CX ¹	SD-2xN21 SD-2xN21CX ¹	4	4	—	—	—	—	—
30	30	7.5	15	15	11	S-2xN25 S-2xN25CX ¹	—	4	4	2	2	2	—	—
40	40	11	18.5	18.5	15	S-2xN35 S-2xN35CX ¹	SD-2xN35 SD-2xN35CX ¹	4	4	—	—	—	—	—
55	50	15	22	22	22	S-2xN50 S-2xN50CX ¹	SD-2xN50	4	4	—	—	—	—	—
65	62	18.5	30	37	30	S-2xN65 S-2xN65CX ¹	SD-2xN65	4	4	—	—	—	—	—
85	85	22	45	45	45	S-2xN80	SD-2xN80	4	4	—	—	—	2	—
105	105	30	55	55	55	S-2xN95	SD-2xN95	4	4	—	—	—	—	—
125	120	37	60	60	60	S-2xN125	SD-2xN125	4	4	—	—	—	—	—
150	150	45	75	90	90	S-2xN150	SD-2xN150	6	6	—	—	—	—	—
180	180	55	90	110	110	S-2xN180	—	6	6	—	—	—	—	—
250	250	75	132	132	132	S-2xN220	SD-2xN220	6	6	—	—	—	—	2
300	300	90	160	160	200	S-2xN300	SD-2xN300	6	6	—	—	—	—	—
400	400	125	220	225	250	S-2xN400	SD-2xN400	6	6	—	—	—	—	—
630	630	190	330	330	330	S-2xN600	SD-2xN600	8	8	—	—	—	—	—
800	800	220	440	500	500	S-2xN800	SD-2xN800	8	8	—	—	—	—	—

Note: 1 "CX" denotes with finger protection terminal covers.



S-2xN11



S-2xN21



S-2xN150

1.6.3 Non-Reversing Mechanically Latched Contactors



Type **SL-N□**, **SLD-N□**

Ordering Designation

Model name SL-N35
 Closing coil designation¹ AC200V
 Tripping coil designation¹ DC100V
 Complete type designation SL-N35*MC-AC200V*MT-DC100V

Note: Mark*indicates a blank space.
 1. See Table 1.6.3 (2).

Table 1.6.3 (1)

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name		Standard free aux. contacts		Additional auxiliary contact block			
220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)	AC operated (closing coil)	DC operated (closing coil)			UN- AX11	UN- AX80	UN- AX150	UN- AX600
22	22	5.5	11	11	7.5	SL-N21	SLD-N21	2	2	Max.2	—	—	—
40	40	11	18.5	18.5	15	SL-N35	SLD-N35	2	2				
55	50	15	22	22	22	SL-N50	SLD-N50	2	2				
65	62	18.5	30	37	30	SL-N65	SLD-N65	2	2				
85	85	22	45	45	45	SL-N80	SLD-N80	1	2	—	Max.2	—	—
105	105	30	55	55	55	SL-N95	SLD-N95	1	2				
125	120	37	60	60	60	SL-N125	SLD-N125	1	2	—	—	Max.2	—
150	150	45	75	90	90	SL-N150	SLD-N150	1	2				
250	250	75	132	132	132	SL-N220	SLD-N220	1	2				
300	300	90	160	160	200	SL-N300	SLD-N300	1	2				
400	400	125	220	225	250	SL-N400	SLD-N400	1	2	—	—	—	1
630	630	190	330	330	330	SL-N600	SLD-N600	1	2				
800	800	220	440	500	500	SL-N800	SLD-N800	1	2				

• Coil Ratings (Closing & Tripping)

Table 1.6.3 (2)

Ordering designation	Applicable voltage
AC100V	100-127VAC 50/60Hz
AC200V	200-240VAC 50/60Hz
AC300V	260-350VAC 50/60Hz
AC400V	380-440VAC 50/60Hz
AC500V	460-550VAC 50/60Hz
DC24V	24VDC
DC48V	48VDC
DC100V	100-110VDC
DC125V	120-125VDC
DC200V	200-220VDC

• Precautions

- Minimum energising time, both for closing and tripping must be set longer than the followings.
 SL(D)-N21 to N220 : 0.3 sec.
 SL(D)-N300 to N800 : 0.5 sec.
- Make sure never to over lap the energising time for closing and tripping.



SL-N35



SL-N150

1.6.4 Reversing Mechanically Latched Contactors

(Components for Automatic Transfer Switches)

Type **SL-2xN□**, **SLD-2xN□**, **SLxS-N□**

Ordering Designation

• Mechanically latched & mechanically latched contactor	
Model name	SL-2xN35
Closing coil designation in normal left side ¹	AC200V
Tripping coil designation in normal left side ¹	DC100V
Closing coil designation in standby right side ¹	DC100V
Tripping coil designation in standby right side ¹	AC200V
Complete type designation	SL-2xN35*MC1-AC200V*MT1-DC100V*MC2-DC100V*MT2-AC200V
• Mechanically latched & normal contactor	
Model name	SLxS-N150
Closing coil designation in normal left side ¹	AC200V
Tripping coil designation in normal left side ¹	AC100V
Coil designation in standby right side ²	AC100V
Complete type designation	SLxS-N150*MC1-AC200V*MT1-AC100V*AC100V

Notes: Mark*indicates a blank space.

1. See Table 1.6.3(2) 2. See Table 1.5.2

Table 1.6.4

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name mechanically latched & mechanically latched			Mechanically latched & normal			Additional auxiliary contact block		
220	380	220	380			AC operated	DC operated	AC operated	UN-AX11	UA-AX80	UA-AX150			
-240V	-440V	-240V	-440V	500V	690V	(closing coil)	(closing coil)	(closing coil)						
(A)	(A)	(kW)	(kW)	(kW)	(kW)									
22	22	5.5	11	11	7.5	SL-2xN21	SLD-2xN21	—	Max.2	—	—			
40	40	11	18.5	18.5	15	SL-2xN35	SLD-2xN35	—						
55	50	15	22	22	22	SL-2xN50	SLD-2xN50	—						
65	62	18.5	30	37	30	SL-2xN65	SLD-2xN65	SLxS-N65						
85	85	22	45	45	45	SL-2xN80	SLD-2xN80	—	—	Max.2	—			
105	105	30	55	55	55	SL-2xN95	SLD-2xN95	—						
125	120	37	60	60	60	SL-2xN125	SLD-2xN125	SLxS-N125						
150	150	45	75	90	90	SL-2xN150	SLD-2xN150	SLxS-N150	—	—	Max.2			
250	250	75	132	132	132	SL-2xN220	SLD-2xN220	SLxS-N220						
300	300	90	160	160	200	SL-2xN300	SLD-2xN300	SLxS-N300						
400	400	125	220	225	250	SL-2xN400	SLD-2xN400	SLxS-N400						
630	630	190	330	330	330	SL-2xN600	SLD-2xN600	—	—	—	—			
800	800	220	440	500	500	SL-2xN800	SLD-2xN800	—						

• Precautions

- Minimum energising time both for closing and tripping must be set longer than the followings.

SL(D)-2xN21 to N220, SLxS-N65 to N220 : 0.3 sec.

SL(D)-2xN300 to N800, SLxS-N300 and N400 : 0.5 sec.

Make sure never to overlap the energising time for closing and tripping.



SL-2xN35

1.7 Selection Table of Direct-On-Line Motor Starters

1.7.1 Non-Reversing Motor Starters without Enclosure (IP 00)

Type MSO-N□

Ordering Designation

Model name MSO-N50KP
 Heater designation of overload relay 42A
 Main circuit voltage 440VAC
 Coil designation (See page 13) AC200V

Complete type designation MSO-N50KP*42A*440V*AC200V

Note: Mark*indicates a blank space.

Table 1.7.1

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name		Aux. contacts	Heater designation of overload relay (ordering designation)		
220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)	Phase failure protection type	Two heater type				
11	9	2.5	4	4	4	MSO-N10KP MSO-N10CXKP ¹	MSO-N10	1 —	0.12A, 0.17A, 0.24A, 0.35A, 0.5A, 0.7A 0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A 6.6A, 9A		
13	12	3.5	5.5	5.5	5.5	MSO-N11KP MSO-N11CXKP ¹	MSO-N11	1 —		11A	
13	12	3.5	5.5	5.5	5.5	MSO-N12KP MSO-N12CXKP ¹	MSO-N12	1 1	0.24A, 0.35, 0.5A, 0.7A, 0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A, 6.6A, 9A, 11A, 15A		
18	16	4.5	7.5	7.5	7.5	MSO-N18KP MSO-N18CXKP ¹	MSO-N18	— —		15A	
22	22	5.5	11	11	7.5	MSO-N20KP MSO-N20CXKP ¹	MSO-N20	1 1	19A		
22	22	5.5	11	11	7.5	MSO-N21KP MSO-N21CXKP ¹	MSO-N21	2 2			
30	30	7.5	15	15	11	MSO-N25KP MSO-N25CXKP ¹	MSO-N25	2 2	22A 29A 35A		
40	40	11	18.5	18.5	15	MSO-N35KP MSO-N35CXKP ¹	MSO-N35	2 2			
55	50	15	22	22	22	MSO-N50KP MSO-N50CXKP ¹	MSO-N50	2 2	15A, 22A, 29A, 35A, 42A, 54A		
65	62	18.5	30	37	30	MSO-N65KP MSO-N65CXKP ¹	MSO-N65	2 2			
85	85	22	45	45	45	MSO-N80KP	MSO-N80	2 2	67A 82A 95A		
105	105	30	55	55	55	MSO-N95KP	MSO-N95	2 2			
125	120	37	60	60	60	MSO-N125KP	MSO-N125	2 2	42A, 54A, 67A, 82A, 105A		
150	150	45	75	90	90	MSO-N150KP	MSO-N150	2 2			
180	180	55	90	110	110	MSO-N180KP	MSO-N180	2 2	82A, 105A, 125A, 150A		
250	250	75	132	132	132	MSO-N220KP	MSO-N220	2 2			
300	300	90	160	160	200	MSO-N300KP	MSO-N300	2 2	180A, 210A		
400	400	125	220	225	250	MSO-N400KP	MSO-N400	2 2			
										105A, 125A, 150A, 180A, 250A	330A

Note: 1. "CX" denotes with finger protection terminal covers.



MSO-N11CXKP



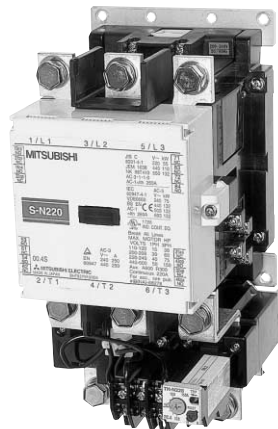
MSO-N18KP



MSO-N50



MSO-N125KP



MSO-N220

1.7.2 Reversing Motor Starters without Enclosure (IP 00)

Type MSO-2xN□

Ordering Designation

Model name MSO-2xN35KP
 Heater designation of overload relay 29A
 Main circuit voltage 440VAC
 Coil designation (See page 13) AC200V

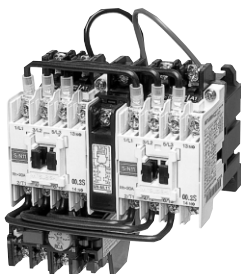
Complete type designation MSO-2xN35KP*29A*440V*AC200V

Note: Mark*indicates a blank space.

Table 1.7.2

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name		Free aux. contacts	Heater designation of overload relay
220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)	Phase failure protection type	Two heater type		(ordering designation)
11	9	2.5	4	4	4	MSO-2xN10KP MSO-2xN10CXKP ¹	MSO-2xN10	2 —	0.12A, 0.17A, 0.24A, 0.35A, 0.5A, 0.7A
13	12	3.5	5.5	5.5	5.5	MSO-2xN11KP MSO-2xN11CXKP ¹	MSO-2xN11	2 —	0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A
18	16	4.5	7.5	7.5	7.5	MSO-2xN18KP MSO-2xN18CXKP ¹	MSO-2xN18	4 2	6.6A, 9A, 11A
22	22	5.5	11	11	7.5	MSO-2xN20KP MSO-2xN20CXKP ¹	MSO-2xN20	2 —	0.24A, 0.35A, 0.5A, 0.7A, 0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A, 6.6A, 9A, 11A, 15A
22	22	5.5	11	11	7.5	MSO-2xN21KP MSO-2xN21CXKP ¹	MSO-2xN21	4 2	
30	30	7.5	15	15	11	MSO-2xN25KP MSO-2xN25CXKP ¹	MSO-2xN25	4 2	22A 29A 35A
40	40	11	18.5	18.5	15	MSO-2xN35KP MSO-2xN35CXKP ¹	MSO-2xN35	4 2	
55	50	15	22	22	22	MSO-2xN50KP MSO-2xN50CXKP ¹	MSO-2xN50	4 2	15A, 22A, 29A, 35A, 42A, 54A
65	62	18.5	30	37	30	MSO-2xN65KP MSO-2xN65CXKP ¹	MSO-2xN65	4 2	
85	85	22	45	45	45	MSO-2xN80KP	MSO-2xN80	4 2	67A
105	105	30	55	55	55	MSO-2xN95KP	MSO-2xN95	4 2	82A 95A
125	120	37	60	60	60	MSO-2xN125KP	MSO-2xN125	4 2	42A, 54A, 67A, 82A, 105A
150	150	45	75	90	90	MSO-2xN150KP	MSO-2xN150	6 4	
180	180	55	90	110	110	MSO-2xN180KP	MSO-2xN180	6 4	82A, 105A, 125A, 150A
250	250	75	132	132	132	MSO-2xN220KP	MSO-2xN220	6 4	
300	300	90	160	160	200	MSO-2xN300KP	MSO-2xN300	6 4	180A, 210A
400	400	125	220	225	250	MSO-2xN400KP	MSO-2xN400	6 4	

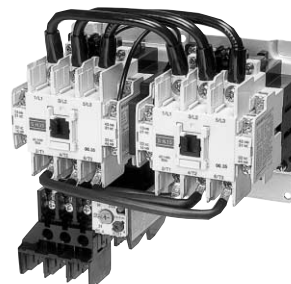
Note:1. "CX" denotes with finger protection terminal covers.



MSO-2xN11KP



MSO-2xN18



MSO-2xN35



MSO-2xN150KP

1.7.3 Enclosed Non-Reversing Motor Starters (IP 20)

Type **MS-N**□

Ordering Designation

Model name MS-N21KP
 Heater designation of overload relay 15A
 Main circuit voltage 220VAC
 Coil designation (See page 13) AC230V

Complete type designation MS-N21KP*15A*220V*AC230V

*Note: Mark*indicates a blank space.*

Table 1.7.3

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name		Free aux. contacts	Heater designation of overload relay
220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)	Phase failure protection type	Two heater type	(ordering designation)	
11	9	2.5	4	4	4	MS-N10KP	MS-N10	0.24A, 0.35A, 0.5A, 0.7A, 0.9A, 1.3A	
13	12	3.5	5.5	5.5	5.5	MS-N11KP	MS-N11	1.7A, 2.1A, 2.5A, 3.6A, 5A, 6.6A, 9A	
13	12	3.5	5.5	5.5	5.5	MS-N12KP	MS-N12	11A	
22	22	5.5	11	11	7.5	MS-N20KP	MS-N20	19A	
22	22	5.5	11	11	7.5	MS-N21KP	MS-N21	0.24A, 0.35A, 0.5A, 0.7A, 0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A, 6.6A, 9A, 11A, 15A	
30	30	7.5	15	15	11	MS-N25KP	MS-N25	22A	
40	40	11	18.5	18.5	15	MS-N35KP	MS-N35	29A	
55	50	15	22	22	22	MS-N50KP	MS-N50	35A	
65	62	18.5	30	37	30	MS-N65KP	MS-N65	15A, 22A, 29A, 35A, 42A, 54A	
85	85	22	45	45	45	MS-N80KP	MS-N80	67A	
105	105	30	55	55	55	MS-N95KP	MS-N95	82A	
125	120	37	60	60	60	MS-N125KP	MS-N125	95A	
150	150	45	75	90	90	MS-N150KP	MS-N150	42A, 54A, 67A, 82A, 105A	
180	180	55	90	110	110	MS-N180KP	MS-N180	125A	
250	250	75	132	132	132	MS-N220KP	MS-N220	82A, 105A, 125A, 150A	
300	300	90	160	160	200	MS-N300KP	MS-N300	180A, 210A	
400	400	125	220	225	250	MS-N400KP	MS-N400	105A, 125A, 150A, 180A, 250A	
								330A	

Note: 1. Models with finger protection terminal covers are not available.



MS-N10



MS-N21



MS-N65



MS-N220KP

1.7.4 Enclosed Non-Reversing Motor Starters with Pushbutton Switch (IP 20)

Type **MS-N□PM**

When the thermal overload relay is tripped, type MS-N/K□PM enclosed direct-on-line motor starters can be easily reset by pushing the OFF button on the enclosure (MS-N10 KPPM and -N11 KPPM can be reset by pushing the RESET button).

Ordering Designation

Model name MS-N21KPPM
 Heater designation of overload relay 15A
 Main circuit voltage 220VAC
 Coil designation (See page 13) AC200V

Complete type designation MS-N21KPPM*15A*220V*AC200V

*Note: Mark*indicates a blank space.*

Table 1.7.4

Rated operational current AC-3		Rated motor capacity 3-phase AC-2 & AC-3				Model name		Free aux. contacts		Heater designation of overload relay			
220 -240V (A)	380 -440V (A)	220 -240V (kW)	380 -440V (kW)	500V (kW)	690V (kW)	Phase failure protection type	Two heater type	1	2	(ordering designation)			
11	9	2.5	4	4	4	MS-N10KPPM	MS-N10PM	1	—	0.24A, 0.35A, 0.5A, 0.7A, 0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A, 6.6A, 9A			
13	12	3.5	5.5	5.5	5.5	MS-N11KPPM	MS-N11PM	1	—	11A			
22	22	5.5	11	11	7.5	MS-N20KPPM	MS-N20PM	—	1	0.24A, 0.35A, 0.5A, 0.7A, 0.9A, 1.3A, 1.7A, 2.1A, 2.5A, 3.6A, 5A, 6.6A, 9A, 11A, 15A			
22	22	5.5	11	11	7.5	MS-N21KPPM	MS-N21PM	1	2	19A			
30	30	7.5	15	15	11	MS-N25KPPM	MS-N25PM	1	2	22A			
40	40	11	18.5	18.5	15	MS-N35KPPM	MS-N35PM	1	2	29A 35A			
55	50	15	22	22	22	MS-N50KPPM	MS-N50PM	1	2	15A, 22A, 29A, 35A, 42A, 54A			
65	62	18.5	30	37	30	MS-N65KPPM	MS-N65PM	1	2				
85	85	22	45	45	45	MS-N80KPPM	MS-N80PM	1	2			67A	
105	105	30	55	55	55	MS-N95KPPM	MS-N95PM	1	2			82A 95A	



MS-N11PM



MS-N80PMKP

1.8 Optional Parts and Accessories for Contactors

1.8.1 Replacement Coils

Table 1.8.1

AC operated coils				DC operated coils			
Contactors(s)	Part number*		Mass(kg)	Contactors(s)	Part number*		Mass(kg)
S-N10, S-N11, S-N12,	S-N10-COIL	AC □□□V	0.06	SD-N11, SD-N12,	SD-N11-COIL	DC □□□V	0.23
S-N18, SR-N4	SR-N4-COIL	AC □□□V		SRD-N4			
S-N20, S-N21	S-N21-COIL	AC □□□V	0.08	SD-N21	SD-N21-COIL	DC □□□V	0.24
S-N25, S-N35	S-N35-COIL	AC □□□V	0.08	SD-N35	SD-N35-COIL	DC □□□V	0.23
S-N50, S-N65	S-N50-COIL	AC □□□V	0.27	SD-N50, SD-N65	SD-N50-COIL	DC □□□V	0.8
S-N80, S-N95	S-N80-COIL	AC □□□V	0.6	SD-N80, SD-N95	SD-N80-COIL	DC □□□V	0.6
S-N125, S-N150	S-N125-COIL	AC □□□V	0.46	SD-N125, SD-N150	SD-N125-COIL	DC □□□V	0.9
S-N180, S-N220	S-N180-COIL	AC □□□V	0.6	SD-N220	SD-N220-COIL	DC □□□V	1.4
S-N300, S-N400	S-N300-COIL	AC □□□V	0.9	SD-N300, SD-N400	SD-N300-COIL	DC □□□V	2.0
S-N600, S-N800	S-N600-COIL	AC □□□V	2.0	SD-N600, SD-N800	SD-N600-COIL	DC □□□V	6.0

Note: When ordering, please specify the operating voltage according to Table 1.5.1~3.

1.8.2 Replacement Contact Kits

Table 1.8.2 (1)





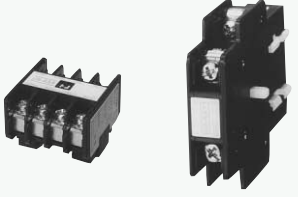

Kits of main contacts for contactors	Contactor	Part number	Mass(kg)
 <p>PARTS BH739N300</p>	Kit consists of 3 moving contacts and 6 stationary contacts (include springs and spring supports also).	S-N10(CX)*, -N11(CX), -N12(CX)	PARTS BH719N300 0.03
		SD-N11(CX), -N12(CX)	PARTS BH729N300 0.05
 <p>BH769N300</p>		S-N18(CX)	PARTS BH739N300 0.05
		S-N20(CX), -N21(CX), SD-N21(CX)	PARTS BH749N300 0.07
 <p>B799N300</p>		S-N25(CX)	PARTS BH749N301 0.07
		S-N35(CX)	PARTS BH749N303 0.07
		SD-N35(CX)	PARTS BH759N300 0.11
		S-N50(CX)	PARTS BH759N302 0.11
		SD-N50	PARTS BH759N303 0.11
		S-N65(CX)	PARTS BH759N303 0.11
		SD-N65	PARTS BH769N300 0.1
		S-N80	PARTS BH769N302 0.1
		SD-N80	PARTS BH769N303 0.1
		S-N95	PARTS BH779N300 0.1
		SD-N95	PARTS BH779N301 0.1
		S-N125	PARTS BH789N300 0.2
		SD-N125	PARTS BH799N300 0.4
		S(D)-N150	PARTS BH799N301 0.4
		S-N180	PARTS BH609N300 0.8
		S(D)-N220	PARTS BH609N301 0.8
		S(D)-N300	PARTS BH619N300 2.5
		S(D)-N400	PARTS BH619N301 2.5
		S(D)-N600	
		S(D)-N800	

Table 1.8.2 (2)

Kits of auxiliary contacts for contactors	Contactor	For arrangement	Part number	Mass(kg)
 <p>PARTS BH729N310</p>	Kit consists of 1 bifurcated moving contact and 2 stationary contacts.	S-N10(CX), N11(CX), SD-N11(CX)	1NO PARTS BH719N310	0.01
			1NC PARTS BH719N311	0.01
	Kit consists of 2 bifurcated moving contacts and 4 stationary contacts.	S-N12(CX), SD-N12(CX)	1NO+1NC PARTS BH729N310	0.01
		S-N20(CX)	1NO+1NC PARTS BH739N310	0.02
	Kit consists of 4 bifurcated moving contacts and 8 stationary contacts.	S-N21(CX) to S-N35(CX),	2NO+2NC PARTS BH739N311	0.03
		SD-N21(CX) to SD-N35(CX),		
		S-N50(CX) to N95	2NO+2NC PARTS BH539N315	0.02
		SD-N50 to N95		
		S-N125, SD-N125	2NO+2NC PARTS BH579N312	0.02
		S-N150 to N800	(Use auxiliary contact blocks, see 1.8.3 "Auxiliary Contact Blocks.")	
		SD-N150 to N800		

1.8.3 Auxiliary Contact Blocks

Table 1.8.3

	Mounting	Contactor/Relay	Type for	Contact arrangement	Part Number				
 <p>UN-AX4 UN-AX11</p>	Front clip-on ^{1,2}	S-N10(CX), -N11(CX), -N12(CX), -N20(CX), -N21(CX), -N25(CX), -N35(CX), -N18(CX), -N28(CX), -N38(CX), -N48(CX), -N50(CX), -N65(CX) SD-N11(CX), -N12(CX), -N21(CX), -N35(CX), -N50, -N65 SR-N4(CX) SRD-N4(CX)	Standard	2NO	UN-AX2(CX)2A				
				1NO+1NC	UN-AX2(CX)1A1B				
				2NC	UN-AX2(CX)2B				
				4NO	UN-AX4(CX)4A				
				3NO+1NC	UN-AX4(CX)3A1B				
				2NO+2NC	UN-AX4(CX)2A2B				
				Low level signal (5Vdc 5mA)	1NO+1NC (low level)	UN-LL22(CX)			
					1NO+1NC (standard)				
				 <p>UN-AX150</p>	Side clip-on ^{1,3}	S-N10(CX), -N11(CX), -N20(CX), -N21(CX), -N25(CX), -N35(CX) -N50(CX), -N65(CX) SD-N11(CX), -N21(CX), -N35(CX) -N50, -N65 SR-N4(CX), SRD-N4(CX)	Standard	1NO+1NC	UN-AX11(CX)
								Side clip-on ³	S(D)-N80, -N95, -N125
S(D)-N150, -N180, -N220, -N300, -N400	1NO+1NC	UN-AX150							
S(D)-N600, -N800	2NO+2NC	UN-AX600							

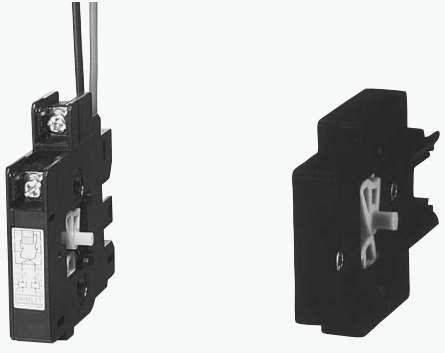
Notes: 1 Front clip-on and side clip-on should not be mounted both.

2 Maximum 1 piece of aux. contact block can be mounted on a Contactor / Relay.

3 Maximum 2 pieces of aux. contact block can be mounted on a Contactor / Relay.


1.8.4 Mechanical Interlocks

Table 1.8.4

	Contactor	Part Number
 <p>UN-ML11 UN-ML21</p>	S-N10(CX), -N11(CX), SD-N11(CX)	UN-ML11(CX)
	S-N20(CX), -N21(CX), -N25(CX), -N35(CX), -N18(CX), -N28(CX), -N38(CX), -N48(CX), -N50(CX), -N65(CX)	UN-ML21
	SD-N21(CX), -N35(CX), -N50, -N65	
	S(D)-N80, -N95, -N125	UN-ML80
	S(D)-N150	UN-ML150
	S-N180, S(D)-N220, -N300, -N400	UN-ML220


1.8.5 Connecting Bar Kits

Table 1.8.5

	For connecting reversing contactors	Contactor	Part Number
 <p>UN-SD50</p>	Kit consists of 3 connecting bars or wires each for source and load side.	S-2×N10(CX), -2×N11(CX)	UN-SD10CX
		S-2×N18	UN-SD18CX
		S-2×N18CX	UN-SD18CX
		S-2×N20, -2×N21	UN-SD21CX
		S-2×N20CX, N2×N21CX	UN-SD21CX
		S-2×N25, -2×N35	UN-SD35CX
		S-2×N25CX, -2×N35CX	UN-SD35CX
		S-2×N50(CX), -2×N65(CX)	UN-SD50
		S-2×N80, -2×N95	UN-SD80
		S-2×N125	UN-SD125
		S-2×N150	UN-SD150
		S-2×N180, -2×N220	UN-SD220
		S-2×N300, -2×N400	UN-SD300
S-2×N600, -2×N800	UN-SD600		

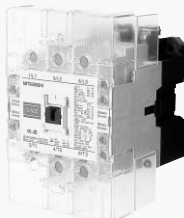
1.8.6 Surge Absorbers

Table 1.8.6

	Contactor/Relay	Applicable control voltage	Part Number
 <p>UN-SA13</p>	Varistor type	S-N10, -N11, -N12, -N18, -N20, -N21, -N25, -N35, -N28, -N38, -N48 SD-N11, -N12, -N21, -N35, SR(D)-N4	AC24-240V/DC24-250V UN-SA21 AC200V AC200-480V UN-SA21 AC400V
	Varistor type with operating indicator (LED)	S-N10, -N11, -N12, -N18, -N20, -N21, -N25, -N35, -N28, -N38, -N48 SD-N11, -N12, -N21, -N35, SR(D)-N4	AC50-240V UN-SA22 AC200V DC60-250V
	Varistor and CR type	S-N10, -N11, -N18, -N20, -N21, -N25, -N35, -N28, -N38, -N48 SD-N11, -N12, -N21, -N35 SR(D)-N4	AC24-127V DC24-125V AC100-240V DC100-250V
CR type	S-N10, -N11, -N12, -N18, -N20, -N21, -N25, -N35, -N28, -N38, -N48, SR-N4 SD-N11, -N12, -N21, -N35, SRD-N4	AC24-240V DC24-250V	UN-SA23 AC200V UN-SA13 DC200V

1.8.7 Terminal Covers

Table 1.8.7

For contactors	Contactor	Part Number	For starters	Starter (loadside)	Part Number
 <p>S-N50 with 2pcs of UN-CZ500</p>	S(D)-N50, -N65 ³	UN-CZ500¹		MSO(D)-N50, -N65 ³	UN-CZ501² (+CZ500)
	S(D)-N80, -N95	UN-CZ800¹		MSO(D)-N80, -N95	UN-CZ801² (+CZ800)
	S(D)-N125	UN-CZ1250¹		MSO(D)-N125	UN-CZ1251² (+CZ1250)
	S(D)-N150	UN-CZ1500¹		MSO(D)-N150	UN-CZ1501² (+CZ1500)
	S-N180, S(D)-N220	UN-CZ2200¹		MSO-N180, MSO(D)-N220	UN-CZ2201² (+CZ2200)
	S(D)-N300, -N400	UN-CZ3000¹		MSO(D)-N300, -N400	UN-CZ3001² (+CZ3000)
	S(D)-2×N50, N65	UN-CZ502		MSO(D)-2×N50, N65	UN-CZ504
	S(D)-2×N80, N95	UN-CZ802		MSO(D)-2×N80, N95	UN-CZ804
	S(D)-2×N125	UN-CZ1252		MSO(D)-2×N125	UN-CZ1254
	S(D)-2×N150	UN-CZ1502		MSO(D)-2×N150	UN-CZ1504
	S-2×N180, S(D)-2×N220	UN-CZ2202		MSO-2×N180, MSO(D)-2×N220	UN-CZ2204
	S(D)-2×N300, N400	UN-CZ3002		MSO(D)-2×N300, N400	UN-CZ3004

Notes : 1. 2pcs are required for one contactor

2. For line side another cover (for contactor) is required.

3. Terminal covers should not be mounted for type S-N50CX, S-N65CX, MSO-N50(KP)CX and MSO-N65(KP)CX.

1.8.8 Pneumatic Time Delay Modules

Table 1.8.8


Contactor/Relay	On delay
 <p>UN-TR4AN</p>	UN-TR4AN(CX)
	S-N10(CX)
	S-N11(CX)
	S-N12(CX)
	S-N18(CX)
	SR-N4(CX)
	SD-N11(CX)
SD-N12(CX)	
SRD-N4(CX)	

For detail see item 4.6.

Note : UN-AX11(CX) (Table 1.8.3) can not be combined to a Contactor / Relay together with UN-TR4AN (CX).

1.8.9 DC Interface Modules

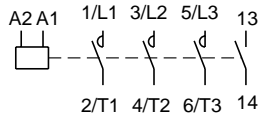
Table 1.8.9

Direct mounting to contactor	Contactor/Relay	Solid state	Relay
 <p>UN-SY21</p>	S-N10(CX), -N11(CX), -N12(CX), -N18(CX), -N20(CX), -N21(CX), -N25(CX), -N35(CX), -N28(CX), -N38(CX), -N48(CX) SR-N4(CX)	UN-SY21(CX)	UN-SY22(CX)
	S-N50	UN-SY31	UN-SY32
	S-N65		
	S-N80 to N400	UN-SY11	UN-SY12

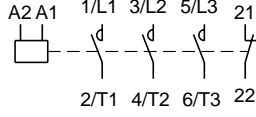
For detail see item 3.8.

1.9 Connections and Contact Arrangement

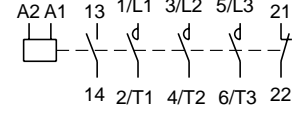
1.9.1 S, SD-N □



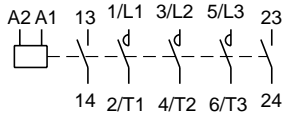
**S-N10, N11(1NO)
SD-N11(1NO)**



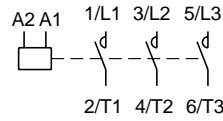
**S-N10, N11(1NC)
SD-N11(1NC)**



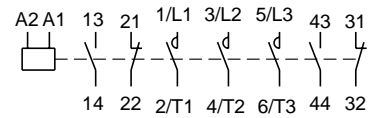
**S-N12, N20
SD-N12**



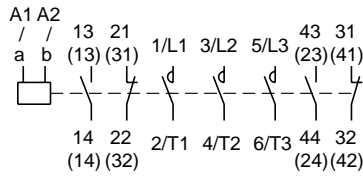
**S-N12(2NO)
S-N20(2NO)**



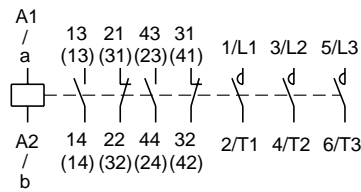
S-N18



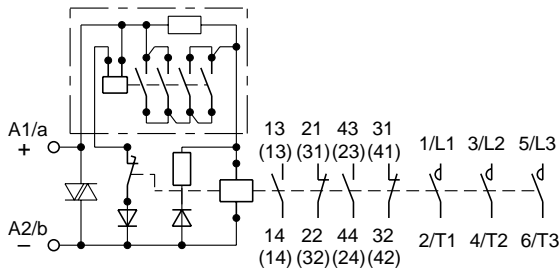
**S-N21, N25, N35
SD-N21, N35**



**S-N50~N400
SD-N50~N400**

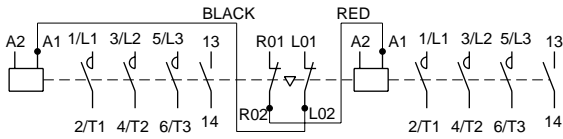


S-N600, N800

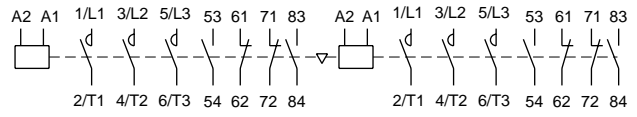


SD-N600, N800

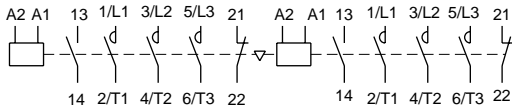
1.9.2 S, SD-2xN □



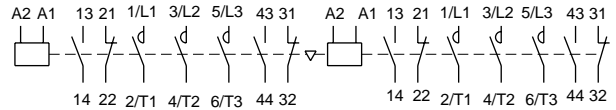
S-2xN10, N11
SD-2xN11



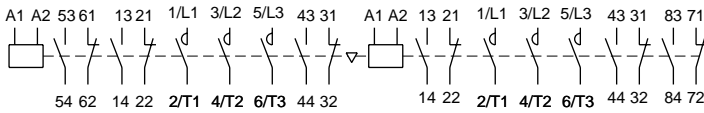
S-2xN18



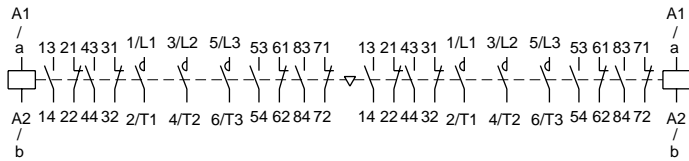
S-2xN20



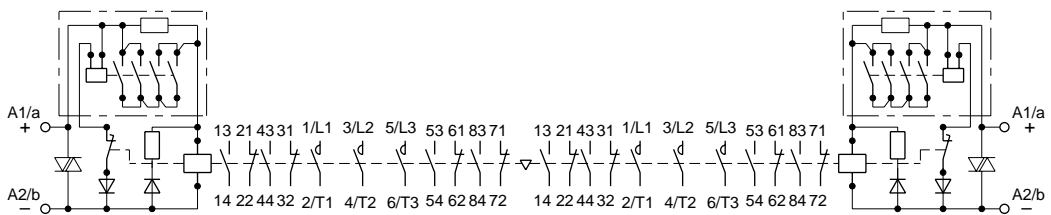
S-2xN21~N35
SD-2xN21, N35



S-2xN50~N400
SD-2xN50~N150, N220~N400

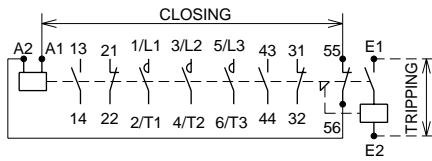


S-2xN600, N800

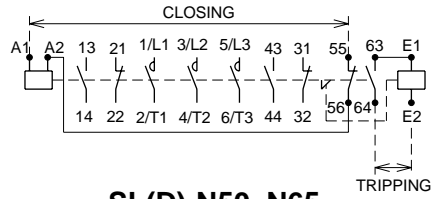


SD-2xN600, N800

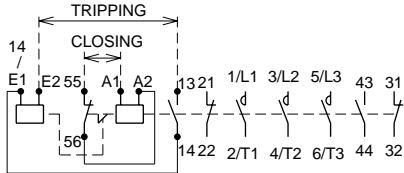
1.9.3 SL, SLD-(2x)N □



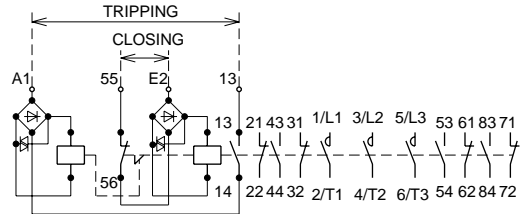
SL(D)-N21, N35



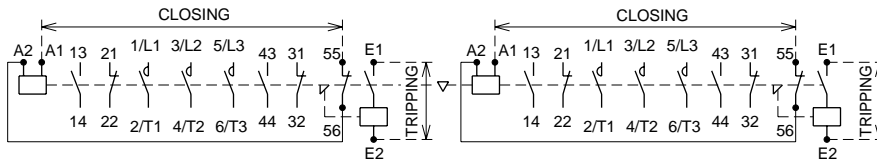
SL(D)-N50, N65



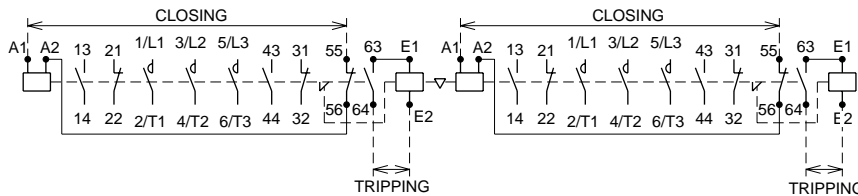
SL(D)-N80~N400



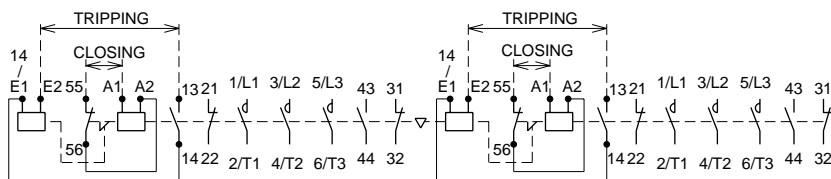
SL(D)-N600, N800



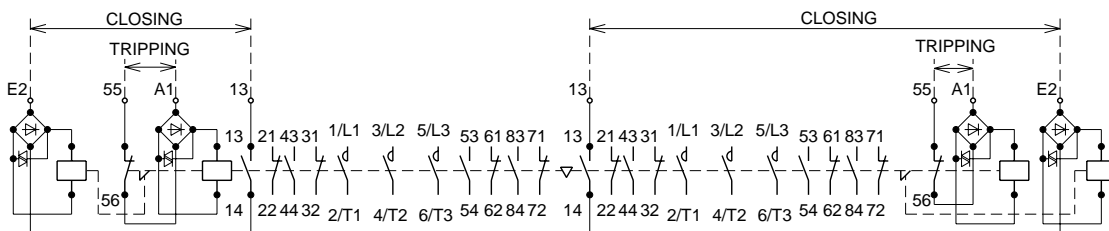
SL(D)-2xN21, N35



SL(D)-2xN50, N65

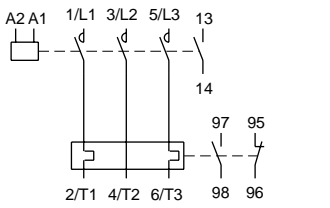


SL(D)-2xN80~N400

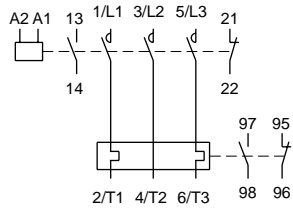


SL(D)-2xN600, N800

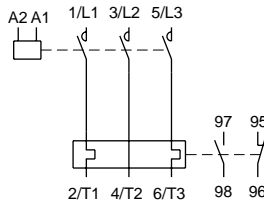
1.9.4 MSO-(2x)N □



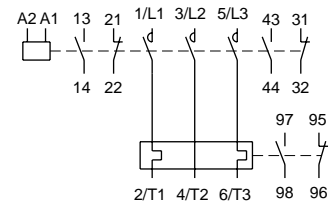
MSO-N10, N11



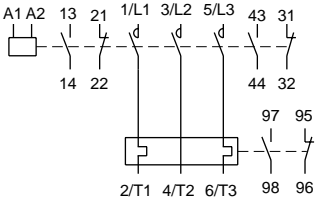
MSO-N12, N20



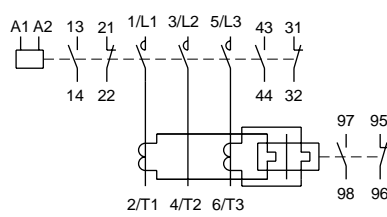
MSO-N18



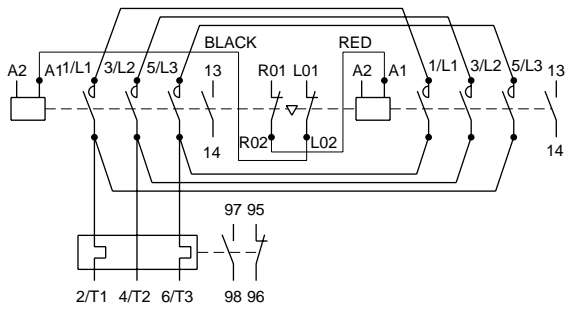
MSO-N21~N35



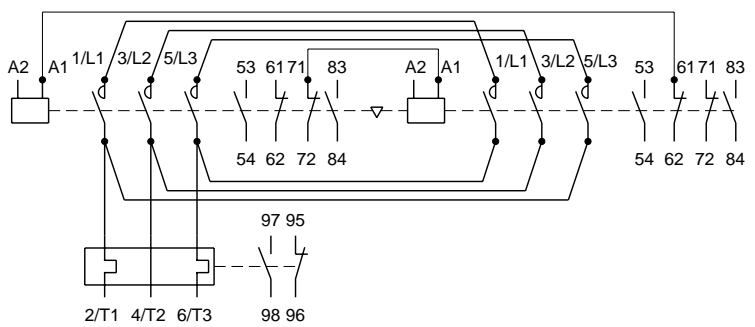
MSO-N50~N150



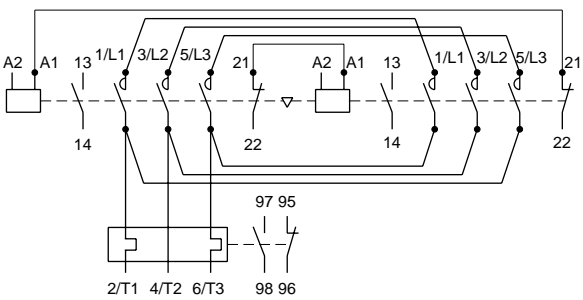
MSO-N180~N400



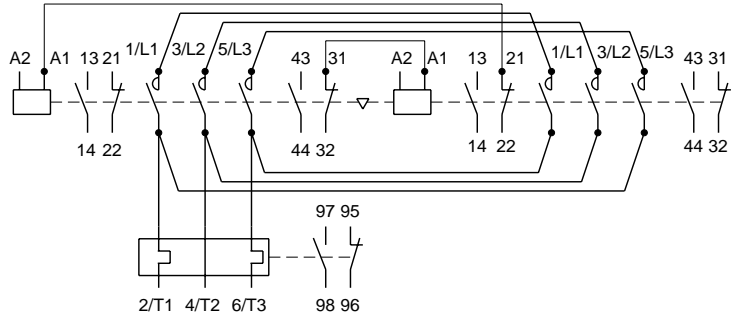
MSO-2xN10, N11



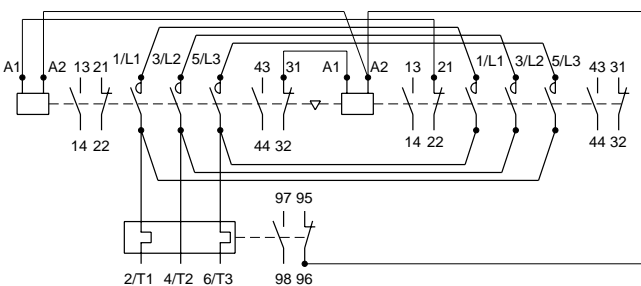
MSO-2xN18



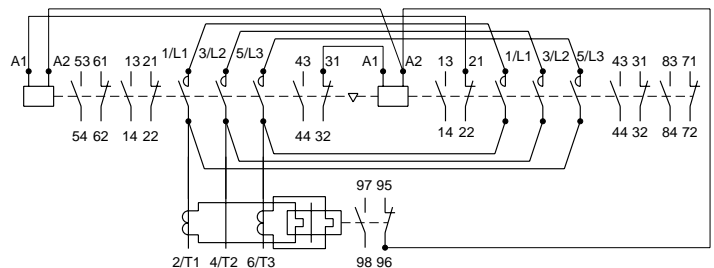
MSO-2xN20



MSO-2xN21~N35

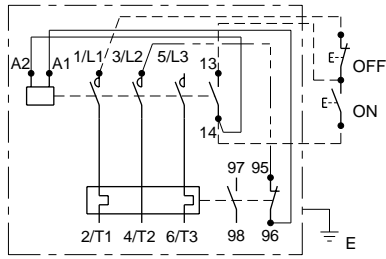


MSO-2xN50~N150

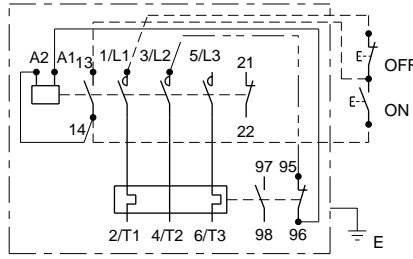


MSO-2xN180~N400

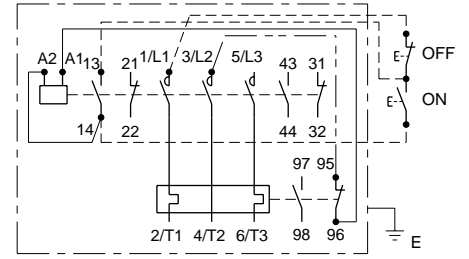
1.9.5 MS-N□



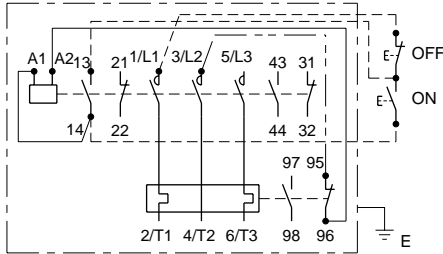
MS-N10, N11



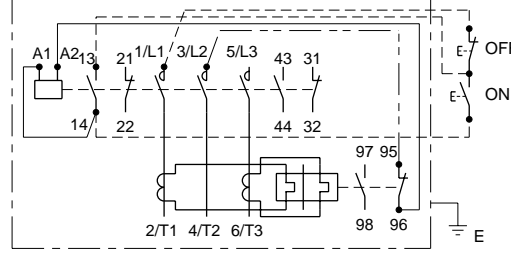
MS-N12, N20



MS-N21, N35



MS-N50~N150

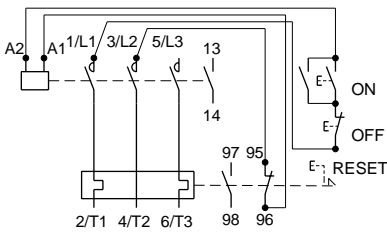


MS-N180~N400

- Notes: 1. When separate control, wire — is not provided.
2. Wire — and push buttons are not provided.

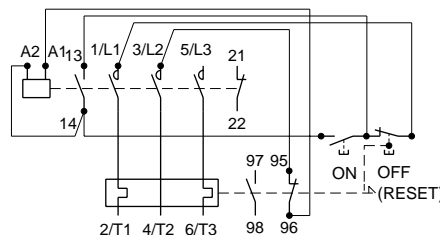
1.9.6 MS-N□PM

common control



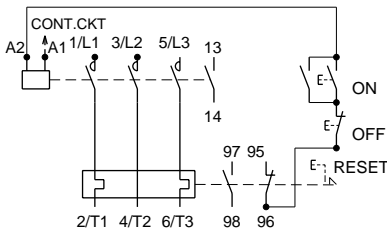
MS-N10, N11PM

common control

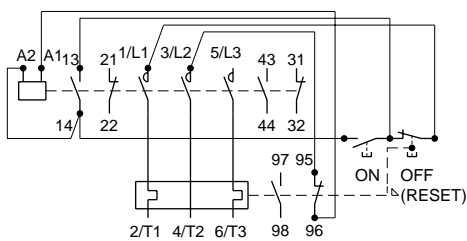


MS-N20PM

separate control

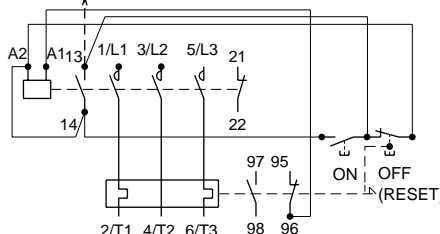


common control

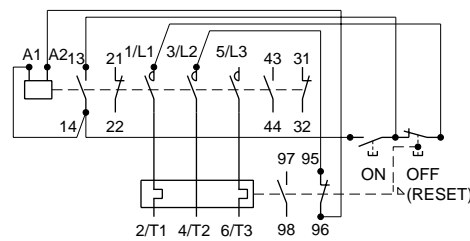


MS-N21~N35PM

separate control

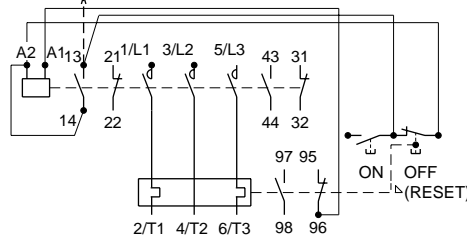


common control

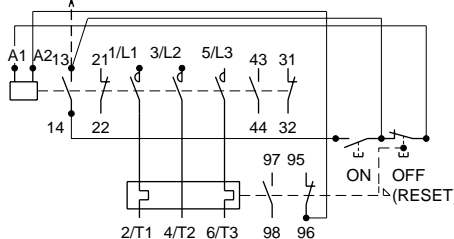


MS-N50~N95PM

CONT. CKT

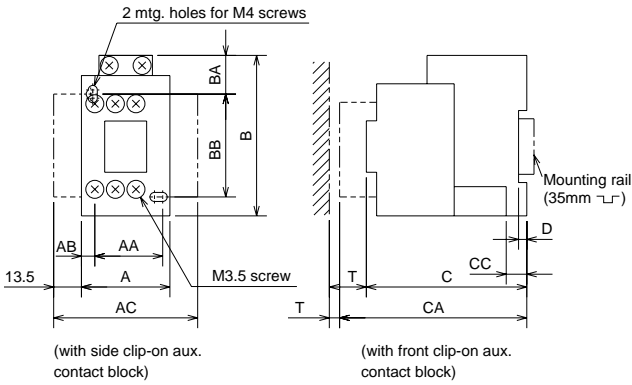


CONT. CKT



1.10 Outline Dimensions

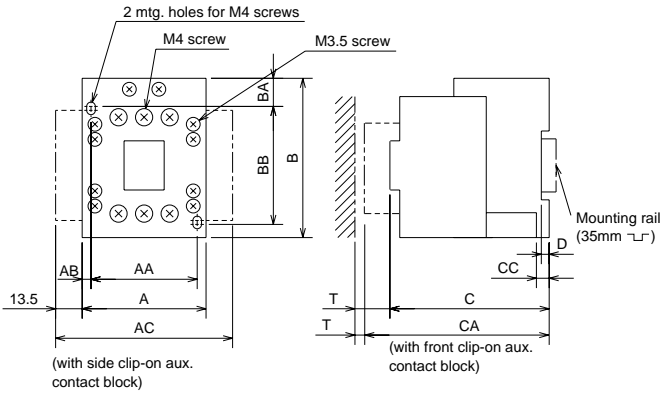
1.10.1 Outline Dimensions of Non-Reversing Contactors



• Dimensions

Type	A	B	C	AA	AB	AC	BB	BA	CC	CA	D	Mass(kg)	T
S-N10(CX),-N11(CX)	43	78	78	35	4.5	70	50	19	10	106	4	0.3	5
S-N12(CX)	53	78	78	40	4.5	—	50	19	10	106	4	0.32	5
S-N18(CX)	43	79	81	30	6	—	60	13	10	109	4	0.33	5
SD-N11(CX)	43	78	110	35	4.5	70	50	19	10	138	4	0.62	5
SD-N12(CX)	53	78	110	40	4.5	—	50	19	10	138	4	0.64	5

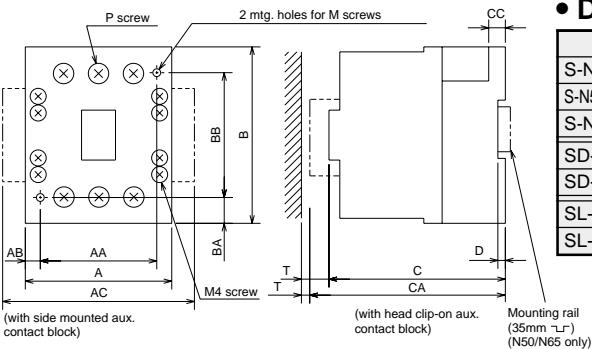
Note: Front clip-on and side clip-on aux. contact blocks should not be mounted both.



• Dimensions

Type	A	B	C	AA	AB	AC	BB	BA	CC	CA	D	Mass(kg)	T
S-N20(CX),-21(CX)	63	81	81	54	4.5	90	60	14	6.5	109	4	0.4	5
S-N25(CX),-N35(CX)	75	89	91	65	5	102	70	13	6.5	119	4	0.52	5
SD-N21(CX)	63	81	113	54	4.5	90	60	14	6.5	141	4	0.72	5
SD-N35(CX)	75	89	123	65	5	102	70	13	6.5	151	4	0.85	5
SLD-N21	63	81	137	54	4.5	90	60	14	6.5	—	4	0.55	5
SLD-N35	75	89	147	65	5	102	70	13	6.5	—	4	0.67	5

Note: Front clip-on and side clip-on aux. contact blocks should not be mounted both.

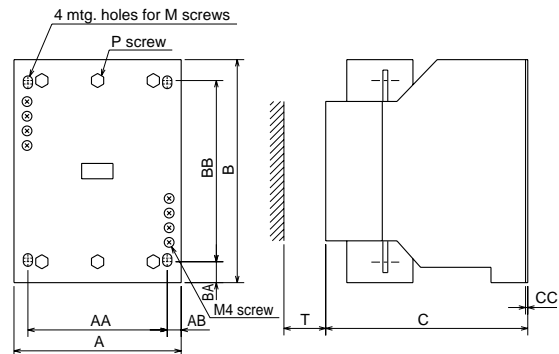


• Dimensions

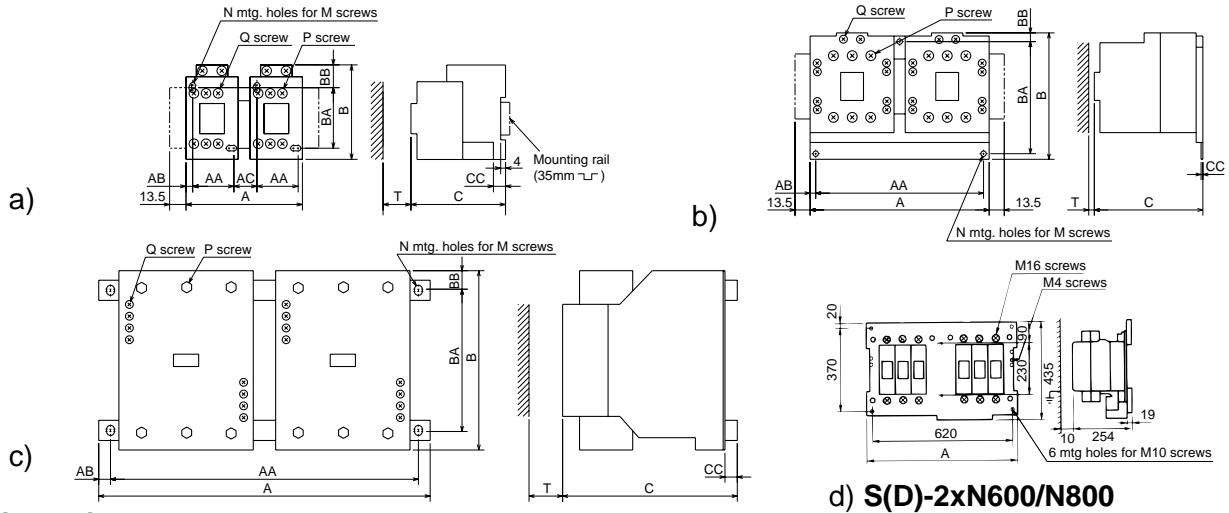
Type	A	B	C	AA	AB	AC	BB	BA	CC	CA	D	M	P	Mass(kg)	T
S-N50,-N65	88	106	106	70	9	—	75	15.5	10	135	4.5	M4	M6	0.75	10
S-N50CX,-N65CX	88	108	106	70	9	—	75	15.5	10	135	4.5	M4	M6	0.77	10
S-N80,-N95	100	124	127	80	10	128	110	7	12	—	—	M5	M6	1.8	10
SD-N50,-N65	88	107.5	133	70	9	—	75	15.5	10	—	—	M4	M6	2.1	10
SD-N80,-N95	100	134	157	80	10	128	110	7	12	—	—	M5	M6	3.3	10
SL-N50,-N65	88	106	135.5	70	9	—	75	15.5	10	—	—	M4	M6	1.3	10
SL-N80,-N95	100	172	127	80	10	128	110	7	12	—	—	M5	M6	2.1	10

• Dimensions

Type	A	B	C	AA	AB	BB	BA	CC	CA	D	M	P	Mass(kg)	T
S-N125	100	150	137	90	5	125	12.5	1.6	—	—	M4	M8	2.5	10
S-N150	120	160	145	100	10	125	17.5	1.6	—	—	M5	M8	3.2	10
S-N180,-N220	138	204	175	120	9	190	7	1.6	—	—	M6	M10	5.5	10
S-N300,-N400	163	243	195	145	9	225	9	2.3	—	—	M8	M12	9.5	10
S-N600,-N800	290	310	235	250	20	250	30	10.5	—	—	M10	M16	27	10
SD-N125	102	150	162	90	5	125	12.5	1.6	—	—	M4	M8	4.3	30
SD-N150	120	160	169.5	100	10	125	17.5	1.6	—	—	M5	M8	4.3	30
SD-N220	138	204	200.5	120	9	190	7	2.0	—	—	M6	M10	7.5	30
SD-N300,-N400	163	243	221	145	9	225	9	2.3	—	—	M8	M12	13.5	50
SD-N600,-N800	375	310	235	250	20	250	30	10.5	—	—	M10	M16	28	10
SL(D)-N125	100	191	137	90	5	125	12.5	1.6	—	—	M4	M8	3.0	30
SL(D)-N150	120	201	145	100	10	125	17.5	1.6	—	—	M5	M8	3.6	30
SL(D)-N220	138	224	175	120	9	190	7	1.6	—	—	M6	M10	6.0	30
SL(D)-N300,-N400	163	259	195	145	9	225	9	2.3	—	—	M8	M12	10	50
SL(D)-N600,-N800	290	390	235	250	20	250	30	10.5	—	—	M10	M16	27	10



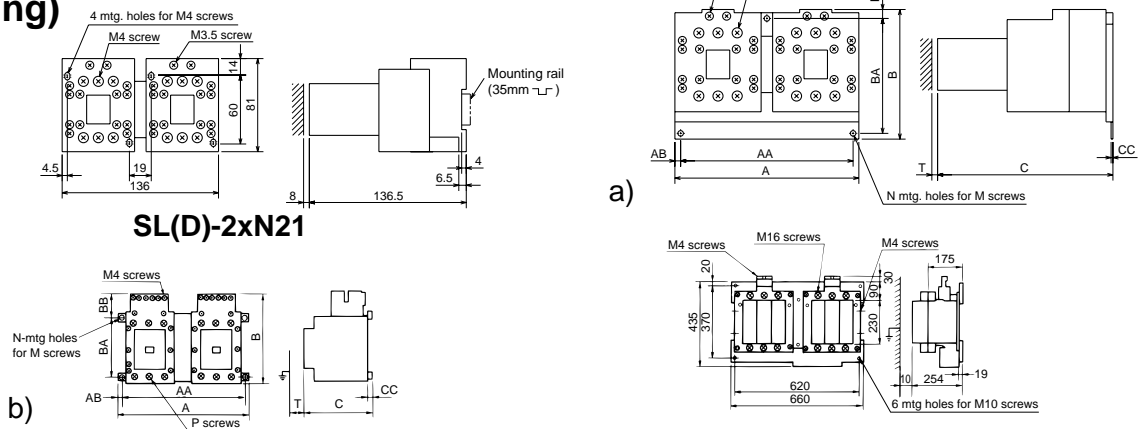
1.10.2 Outline Dimensions of Reversing Contactors



• Dimensions

Type	Fig.	A	B	C	AA	AB	AC	BA	BB	CC	N	M	P	Q	Mass(kg)	T
S-2xN10/N11	a	99	78	78	35	4.5	21	50	19	10	4	M4	M3.5	M3.5	0.64	5
S-2xN18	a	96	79	109	30	3.5	23	60	13	10	4	M4	M4	M3.5	0.75	5
S-2xN20/N21	a	136	81	81	54	4.5	19	60	14	6.5	4	M4	M4	M3.5	0.8	5
S-2xN25/N35	b	160	110	97	150	15	—	100	8	1.6	3	M4	M5	M3.5	1.3	5
S-2xN50/N65	b	216	115	112	204	6	—	100	8	2	3	M5	M6	M4	2.6	10
S-2xN80/N95	b	270	140	137	247	11.5	—	100	32	10	3	M6	M6	M4	4.3	10
S-2xN125	c	276	150	148	255	10.5	—	125	12.5	1.6	4	M6	M8	M4	5.7	30
S-2xN150	c	296	160	156	275	10.5	—	125	17.5	1.6	4	M6	M8	M4	7.2	30
S-2xN180/220	c	370	215	189	340	15	—	190	12.5	1.6	4	M8	M10	M4	12	30
S-2xN300/N400	c	395	250	209	365	15	—	225	12.5	2.3	4	M8	M12	M4	20.5	50
S-2xN600/N800	d	660	—	—	—	—	—	—	—	—	—	—	—	—	54	—
SD-2xN11	a	99	78	110	35	4.5	21	50	19	10	4	M4	M3.5	M3.5	1.3	5
SD-2xN21	b	160	100	119	150	5	—	90	5	2	3	M4	M4	M3.5	1.7	5
SD-2xN35	b	160	113	129	150	5	—	100	8	1.6	3	M4	M5	M3.5	2.0	5
SD-2xN50/N65	b	216	116.5	133	204	6	—	100	8	2	3	M5	M6	M4	4.5	10
SD-2xN80/N95	b	270	140	167	247	11.5	—	100	32	10	3	M6	M6	M4	6.4	10
SD-2xN125	c	276	150	173	255	10.5	—	125	12.5	1.6	4	M6	M8	M4	9.2	30
SD-2xN150	c	296	160	180.5	275	10.5	—	125	17.5	1.6	4	M6	M8	M4	10	30
SD-2xN220	c	370	215	214.5	340	15	—	190	12.5	1.6	4	M8	M10	M4	17	30
SD-2xN300/N400	c	395	250	235	365	15	—	225	12.5	2.3	4	M8	M12	M4	29	50
SD-2xN600/N800	d	800	—	—	—	—	—	—	—	—	—	—	—	—	64	—

Latched Contactors (Reversing)

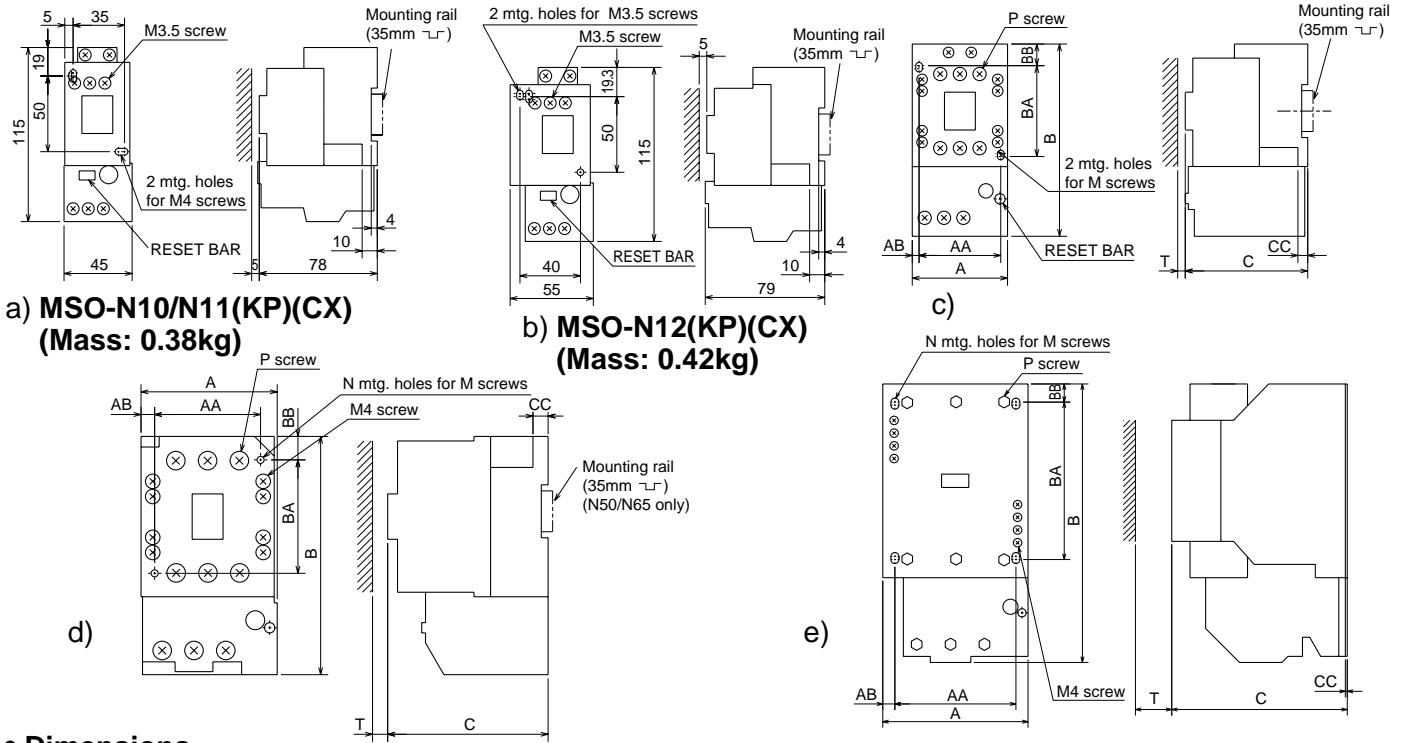


• Dimensions

Type	Fig.	A	B	C	AA	AB	BA(BC)	BB	CC	N	M	P	Q	Mass(kg)	T
SL(D)-2xN35	a	160	113	153	150	5	100	8	1.6	3	M4	M5	M3.5	2.2	5
SL(D)-2xN50/N65	a	216	115	141.5	204	6	100	8	2	3	M5	M6	M4	3.2	10
SL(D)-2xN80/N95	b	270	184	137	247	11.5	100	74	10	3	M6	M6	M4	5.3	10
SL(D)-2xN125	b	276	191	148	255	10.5	125	53.5	11	4	M6	M8	M4	6.7	30
SL(D)-2xN150	b	296	201	156	275	10.5	125	58.5	11	4	M8	M8	M4	8.8	30
SL(D)-2xN220	b	370	230	189	340	15	190	27	14	4	M8	M10	M4	13	30
SL(D)-2xN300/N400	b	395	263	209	365	15	225	25	14	4	M8	M12	M4	21.5	50

1.10.3 Outline Dimensions of Open Type Starters

■ Nonreversing Starters without Enclosures

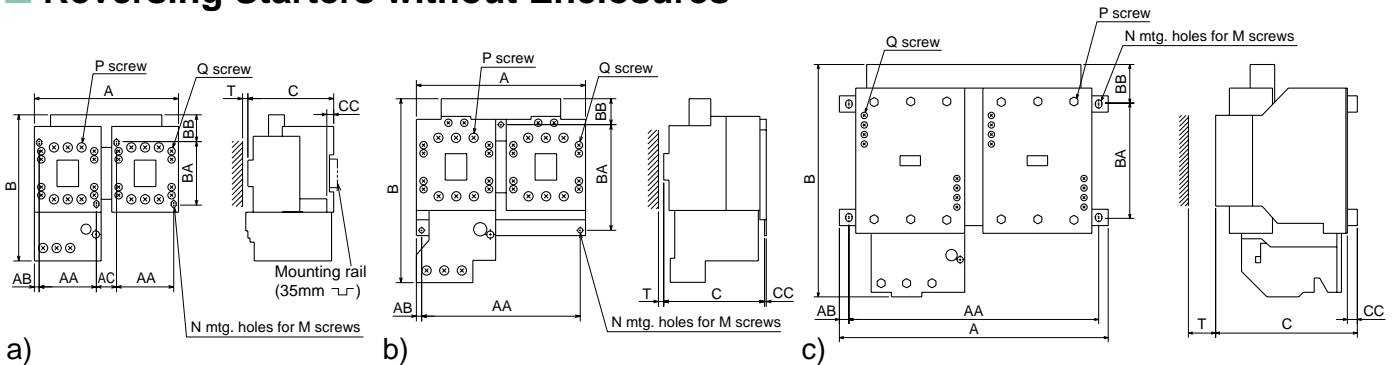


• Dimensions

Type	Fig.	A	B	C	AA	AB	BA	BB	CC	N	M	P ¹	Mass(kg)	T
MSO-N18(CX)(KP)	c	54	122	81	30	7	60	13	10	2	M4	M4(M3.5)	0.5	5
MSO-N20(CX)(KP)	c	63	127	81	54	4.5	60	14	6.5	2	M4	M4(M3.5)	0.6	5
MSO-N21(CX)(KP)	c	63	127	81	54	4.5	60	14	6.5	2	M4	M4(M3.5)	0.6	5
MSO-N25/N35(CX)(KP)	c	75	157	91	65	5	70	13	6.5	2	M4	M5(M3.5)	0.8	5
MSO-N50/N65(KP)	d	90	158	106	70	9	75	16	10	2	M4	M6	2.2	10
MSO-N50/N65(CX)(KP)	d	92	160	106	70	9	75	18	10	2	M4	M6	2.3	10
MSO-N80/N95(KP)	d	100	196	127	80	10	110	7	12	2	M5	M6	3.2	10
MSO-N125(KP)	e	112	239	137	90	14	125	12.5	1.6	4	M4	M8	4.2	30
MSO-N150(KP)	e	120	250	145	100	10	125	17.5	1.6	4	M5	M8	7.7	30
MSO-N180/N220(KP)	e	144	282	180.5	120	12	190	7	1.6	4	M6	M10	7.7	30
MSO-N300/N400(KP)	e	163	358	195	145	9	225	9	2.3	4	M8	M12	12.5	50

Note: 1. Value in parenthesis shows terminal screw of coil and auxiliary contact.

■ Reversing Starters without Enclosures

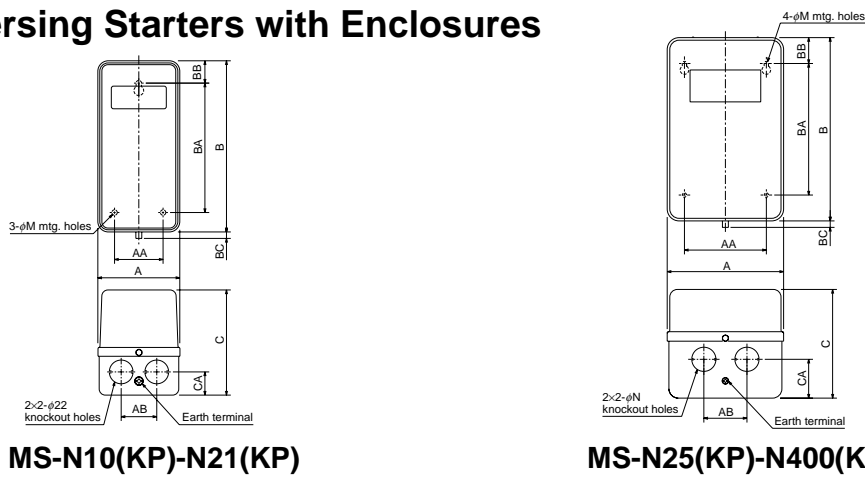


• Dimensions

Type	Fig.	A	B	C	AA	AB	AC	BA	BB	CC	N	M	P	Q	Mass(kg)	T
MSO-2xN10/N11(CX)(KP)	a	99	125	79	35	4.5	21	50	19	10	4	M4	M3.5	M3.5	0.76	5
MSO-2xN18(CX)(KP)	a	97	134	109	30	6.5	23	60	13	10	4	M4	M4	M3.5	0.9	5
MSO-2xN20/N21(CX)(KP)	a	136	138	81	54	4.5	19	60	14	6.5	4	M4	M4	M3.5	1.0	5
MSO-2xN25/N35(CX)(KP)	b	160	159	97	150	5	—	100	8	1.6	3	M4	M5	M3.5	1.3	5
MSO-2xN50/N60(CX)(KP)	b	216	169	112	204	6	—	100	17	2	3	M5	M6	M4	2.9	10
MSO-2xN80/N95(KP)	b	270	213	137	247	11.5	—	100	45.5	10	3	M6	M6	M4	4.6	10
MSO-2xN125(KP)	c	276	251	148	255	10.5	—	125	24.5	11	4	M6	M8	M4	6.6	30
MSO-2xN150(KP)	c	296	276	156	275	10.5	—	125	43.5	11	4	M6	M8	M4	8.5	30
MSO-2xN180/N220(KP)	c	370	304	194.5	340	15	—	190	28.5	14	4	M8	M10	M4	14.5	30
MSO-2xN300/N400(KP)	c	395	392	209	365	15	—	225	42.5	14	4	M8	M12	M4	24.5	50

1.10.4 Outline Dimensions of Enclosed Motor Starters

■ Nonreversing Starters with Enclosures



MS-N10(KP)-N21(KP)

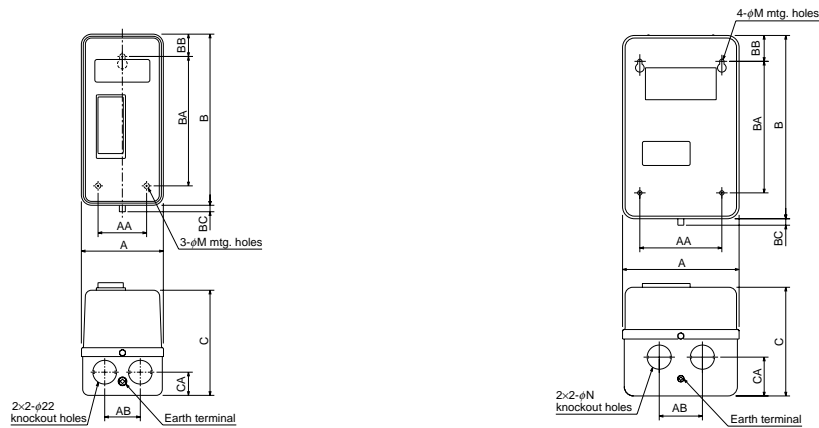
MS-N25(KP)-N400(KP)

• Dimensions

Type	A	AA	AB	B	BA	BB	BC	C	CA	M	N	Mass(kg)
MS-N10/K11(KP)	76	45	33	159	120	21	6	97.5	21.5	4	22	0.8
MS-N12(KP)	76	45	33	159	120	21	6	97.5	21.5	5	22	0.9
MS-N20(KP)/N21(KP)	104	76	50	170	140	15	6	110	30	6	22	1.1
MS-N25(KP)/N35(KP)	135	95	50	225	165	30	6	126	45	6	28	2.0
MS-N50(KP)	160	120	80	270	220	25	12	145	45	6	22 × 35	3.2
MS-N65(KP)	160	120	80	270	220	25	12	145	45	6	22 × 35	3.2
MS-N80/N95(KP)	190	150	100	300	260	20	12	163	67	7	22 × 35	4.0
MS-N125(KP)	230	170	90	384	330	29	12	190	80	9	44 × 50	8.0
MS-N150(KP)	270	200	120	484	400	44	12	209	85	9	44 × 50	12.8
MS-N180/N220(KP)	270	200	120	484	400	44	12	209	85	9	44 × 50	16.2
MS-N300/N400(KP)	440	320	160	590	480	55	12	220	140/90*	11	62 × 78	28

* Left value is for power-supply side, right for load side.

■ Enclosed Type Nonreversing Starters with Pushbuttons



MS-N10PM(KP)-N21PM(KP)

MS-N25PM(KP)-N95PM(KP)

• Dimensions

Type	A	AA	AB	B	BA	BB	BC	C	CA	M	N	Mass(kg)
MS-N10/N11PM(KP)	76	45	33	159	120	21	6	114	22	4	22	0.9
MS-N20PM(KP) MS-N21PM(KP)	104	76	50	170	140	15	6	114	30	6	22	1.3
MS-N25/N35PM(KP)	135	95	50	225	165	30	6	130	45	6	28	2.1
MS-N50/N65PM(KP)	160	120	80	270	220	25	12	149	45	6	22 × 35	3.3
MS-N80/N95PM(KP)	190	150	100	300	260	20	12	167	67	7	22 × 35	4.1

2. MOTOR PROTECTION RELAYS

2.1 Thermal Overload Relays

TH-N Series Thermal Overload Relays Will Make a Convenience and Safer Systems.



TH-N12



TH-N20



TH-N12CX

A Selection of Relays for Optimum Motor Protection Characteristics

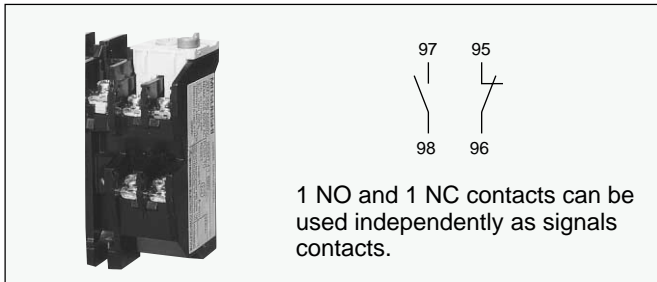
The thermal relay line-up includes two-element units as well as the phase failure protection type models (three-element relays), all with the same external dimensions.

This array of protection characteristics allows you to choose the units best suited to your motor protection needs.

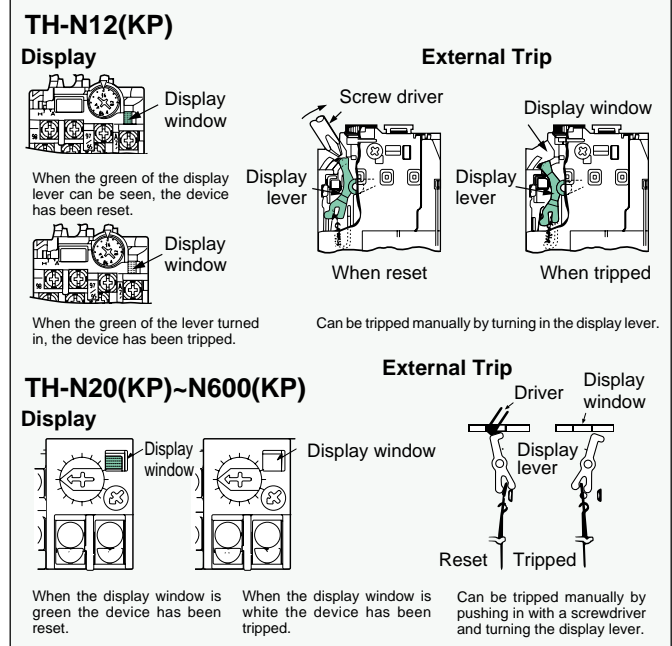
Maintenance and Inspection Are Easy

An operation indicator makes maintenance and inspection easy. Checks can be performed using manual operations.

1NO + 1NC Contacts



• Display and External Trip Mechanism



Rated Current Can Be Set Easily

The value of the rated current is displayed on a dial. Simply adjust the dial to the full-load current of the motor and motor protection is assured.

Finger Protectors

Models with finger protectors that conform to DIN VDE 0106 Part 100 (TH-N□CX) are also available.

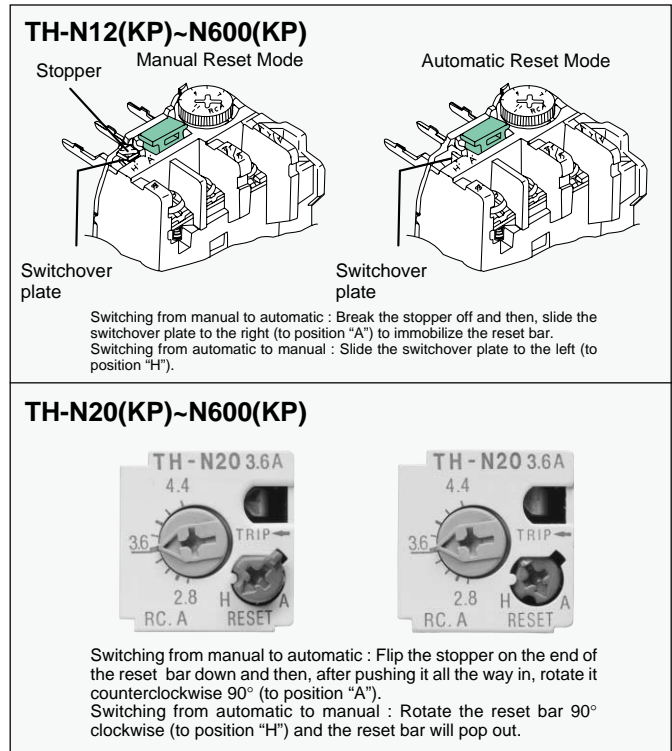
Various Accessories

- Independent mount adaptor for TH-N12(CX) : UN-HZ12(CX)
- Reset release : UN-RR□□□
- Trip indicating LED : UN-TL□□

Trip-Free Reset Bar

Choose between automatic and manual reset. Also features tripfree reset bar mechanism.

• Switching Between Automatic and Manual Reset



2.1.1 Selection Guide of Thermal Overload Relays

Table 2.1.1

Max. Fuse Rating (660Vac) IEC 269-1 (A)			Overload Relay			Motor Capacity [kW, (hp)] (Three phase 50/60Hz, based on four poles)			
aM	gG	gM	Heater designation	Setting range (A)	Model (TH-)	AC220-240V	AC380V	AC400-440V	AC500V
0.5	0.5	—	0.12A	0.1-0.16	N12	—	—	—	—
0.5	1	—	0.17A	0.14-0.22		—	—	—	—
1	2	—	0.24A	0.2-0.32		0.03(1/24)	0.06(1/12)	0.06(1/12)	0.09(1/8)
1	2	—	0.35A	0.28-0.42		0.05(1/16)	0.09(1/8)	0.09(1/8)	0.12(1/6)
1	2	—	0.5A	0.4-0.6		0.06(1/12)	0.12(1.6)	0.12(1.6)	0.18(1/4)
2	4	—	0.7A	0.55-0.85		0.09(1/8)	0.18(1/4)	0.18(1/4)	0.25(1/3)
2	4	—	0.9A	0.7-1.1		0.12(1/6)	0.25(1/3)	0.25(1/3)	0.37(1/2)
2	4	—	1.3A	1.0-1.6		0.18(1/4)	0.37(1/2)	0.37(1/2) 0.55(3/4)	0.55(3/4)
4	6	—	1.7A	1.4-2.0		0.25(1/3)	0.55(3/4)	0.75(1)	0.75(1)
4	6	—	2.1A	1.7-2.5		0.37(1/2)	0.75(1)	—	1.1(1-1/2)
6	10	—	2.5A	2.0-3.0		0.55(3/4)	1.1(1-1/2)	1.1(1-1/2)	1.5(2)
6	10	—	3.6A	2.8-4.4		0.75(1)	1.5(2)	1.5(2)	2.2(3)
8	16	—	5A	4.0-6.0		1.1(1-1/2)	2.2(3)	2.2(3)	3(4)
12	20	—	6.6A	5.2-8.0		1.5(2)	3(4)	3.3,7(4.5)	3.7(5)
12	20	—	9A	7.0-11		2.2(3)	3.7(5) 4(5-1/2)	3(4) 3.7(5)	5.5(7-1/2)
16	25	32M35	11A	9.0-13		3(4)	5.5(7-1/2)	5.5(7-1/2)	7.5(10)
20	32	32M50	15A	12-18		3.7(5)	7.5(10)	7.5(10) 9(12.5)	9(12/5)
25	40	32M63	19A ¹	16-22		5.5(7-1/2)	11(15)	11(15)	11(15)
40	63	32M63	22A	18-26	5.5(7-1/2)	11(15)	11(15)	15(20)	
50	80	63M80	29A	24-34	7.5(10)	15(20)	15(20)	18.5(25)	
63	80	63M80	35A ²	30-40	9(12.5)	18.5(25)	18.5(25)	22(30)	
63	100	100M100	42A	34-50	11(15)	22(30)	22(30)	30(40)	
80	125	100M125	54A	43-65	15(20)	30(40)	30(40)	37(50)	
100	160	100M160	67A	54-80	18.5(25)	37(50)	37(50)	45(60)	
125	200	100M200	82A	65-100	22(30)	45(50)	45(60)	55(75)	
—	200	100M200	95A ³	85-105	30(40)	55(75)	55(75)	—	
—	250	200M250	105A	85-125	30(40)	55(75)	55(75)	75(100)	
—	250	200M250	125A	100-150	37(50)	75(100)	75(100)	90(125)	
—	315	200M315	150A	120-180	45(60)	90(125)	90(125)	110(150)	
—	400	—	180A	140-220	55(75)	110(150)	110(150)	132(175)	
—	500	—	210A ⁴	170-250	75(100)	132(180)	132(180)	—	
—	630	—	250A	200-300	75(100)	132(180) 160(220)	132(180) 160(220)	160(220)	
—	630	—	330A	260-400	90(125) 110(150)	200(270)	200(270)	220(300) 250(340)	
—	800	—	500A	400-600	132(180) 160(220)	220(300) 250(340) 300(400)	220(300) 250(340) 300(400)	400(530)	
—	1000	—	660A	520-800	200(270) 220(300)	400(530)	400(530)	500(670)	

Notes: 1. For starter size N20, N21 only. 2. For starter size N35 only. 3. For starter size N95 only. 4. For starter size N220 only. 5. Selection by mounting

Mounting	W/o F/P (2)	TH-N12(KP)	TH-N18(KP)	TH-N20(KP)	TH-N20TA(KP)	TH-N60(KP)	TH-N60TA(KP)	TH-N120(KP)	TH-N120TA(KP)	TH-N220RH(KP)	TH-N400RH(KP)	—
Contactor mounting	With F/P (3)	TH-N12CXKP	TH-N18CXKP	TH-N20CXKP	TH-N20TAKPCX	TH-N60CXKP	—	—	—	—	—	—
Independent mounting	W/o F/P (2)	TH-N12(KP) + UN-HZ12 ⁽⁴⁾	—	TH-N20(KP)	—	TH-N60(KP)	—	TH-N120(KP)	TH-N120TAHZ(KP)	TH-N220HZ(KP)	TH-N400HZ(KP)	TH-N600(KP) + CT
	With F/P (3)	TH-N12CXKP ⁽⁴⁾ + UN-HZ12CX	—	TH-N20CXHZKP	—	TH-N60CXKP	—	—	—	—	—	—

Notes: 1. Use "Connecting parts" when couple with contactor (see Table 2.1.6(3)). 2. W/o F/P: Without Finger Protection. 3. With F/P: With Finger Protection. 4. UN-HZ12(CX) is shipped separately from TH-N12(CX)(KP). 5. CT should be supplied by customer.

2.1.2 Selection Guide of the Current Transformers for TH-N600KP

Table 2.1.2

Current Transformer for TH-N600KP	Heater Designation(A)		250	330	500	660
	Setting Range(A)		200~300	260~400	400~600	520~800
	Current Transformer Ratio		400/5A	500/5A	750/5A	1,000/5A
	Current Transformer Capacity		At least 15VA			
	Recommended MITSUBISHI Current Transformer Model Number		Cable wiring	CW-15L 400/5A 15VA	CW-15L 500/5A 15VA	CW-15L 750/5A 15VA
		Bus bar wiring	CW-15LM 400/5A 15VA	CW-15LM 500/5A 15VA	CW-15LM 750/5A 15VA	CW-40LM 1000/5A 40VA

* Current transformer to be supplied by customer.

2.1.3 Technical Data

Table 2.1.3

Three heater type Two heater type	TH- TH-	N12(CX)KP N12(CX)	N18(CX)KP N18(CX)	N20(CX)KP N20(CX)	N20TA(CX)KP N20TA(CX)	N60(CX)KP N60(CX)	N60TAKP N60TA	N120KP N120	N120TAKP N120TA	N220RHKP N220RH	N400RHKP N400RH	N600KP N600								
Max. setting current	A	13	18	22	40	65	105	100	150	220	400	800								
Range of setting current	A	0.1-13	2.8-18	0.2-22	18-44	12-65	54-105	34-100	85-150	65-250	85-400	200-800								
Rated insulation voltage	V	690	690	690	690	690	690	690	690	1000	1000	690								
Permissible ambient temperature	°C	-25 to +55																		
Single phase protection	Types TH-N/K □□□ KP provide the protection.																			
Bimetal heating	Direct										Via CTs		Via CTs ¹							
Max. heater dissipation per current path	W	0.8	0.9	0.8	1.4	1.7	2.4	2.5	3.2	2.5	2.5	2.5								
Min. setting	W	1.8	2.2	2.2	3.5	4.9	5.2	7.1	8.6	6.0	6.0	6.0								
Max. setting	W	1.8	2.2	2.2	3.5	4.9	5.2	7.1	8.6	6.0	6.0	6.0								
Auxiliary contact	1NO + 1NC																			
Rated operating current of aux. contacts	—																			
Category	NO	2		—		—		2		—		—								
AC-15	contact	120V	A	1		—		1		—		—								
		240V	A	1		—		1		—		—								
		500V	A	0.5		—		0.5		—		—								
NC	contact	120V	A	2		—		3		—		—								
		240V	A	1		—		2		—		—								
		500V	A	0.5		—		1		—		—								
Category	48V	A	0.4		—		0.5		—		—									
DC-13	contact	110V	A	0.2		—		0.2		—		—								
		220V	A	0.1		—		0.1		—		—								
		220V	A	0.1		—		0.1		—		—								
Main terminal screw size	—																			
Line side	mm	—		M4	M4	M6	M6	M8	M8	—	—	M4								
	mm	M3.5	M4	M4	M5	M6	M6	M8	M8	M10	M12	M4								
Load side	mm	M3.5	M4	M4	M5	M6	M6	M8	M8	M10	M12	M4								
Standard wire sizes recommended	—																			
Heater designation-wire size (mm ²)	0.24A-2		3.6A-2		0.24A-2		22A-5.5		15A-3.5		67A-22		42A-14		105A-60		—		—	
	11A-2		11A-2		11A-2		29/35A-8		29/35A-8		82/95A-38		54/67A-22		125A-60		82A-38		—	
Max. conductor size	(2.5) ²		—		6		—		25		—		38		60		—		—	
	2.5		6		6		16		25		38		38		60		150		240	
Busbar width	—		—		—		—		15		—		20		20		—		—	
	—		—		—		—		15		20		20		20		25		30	
Aux. contacts	mm ²		2.5		4		4		4		4		4		4		4		4	

Notes: 1. Used with current transformer (to be supplied by the customer). See Table 2.1.2.
2. When used with UN-HZ 12(CX) adaptor.

2.1.4 Selection Guide of Quick Trip Thermal Overload Relay

Table 2.1.4

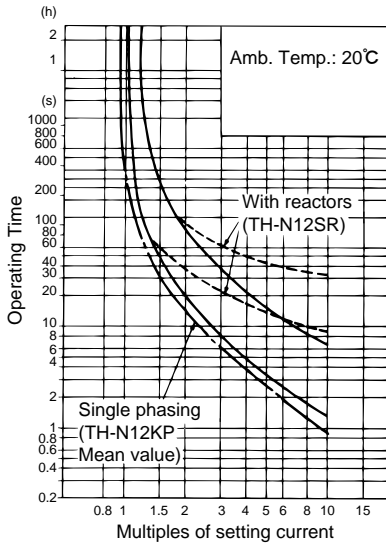
Applicable contactor	S-N10 S-N11 S-N12	S-N20 S-N21 S-N25 S-N35	S-N25 S-N35	S-N50 S-N65 S-N80 S-N95	S-N80 S-N95
Three heater type with phase failure protection	TH-N12KF	TH-N20KF	TH-N20TAKF	TH-N60KF	TH-N60TAKF
Two heater type	—	TH-N20FS	TH-N20TAFS	TH-N60FS	TH-N60TAFS
Heater setting range (Ordering designation)	1.7~2.5(2.1A) 2.8~4.4(3.6A) 4~6(5A) 5.2~8(6.6A) 7~11(9A) 9~13(11A)	1.7~2.5(2.1A) 2.8~4.4(3.6A) 4~6(5A) 5.2~8(6.6A) 7~11(9A) 9~13(11A) 12~18(15A)	18~26(22A) 24~34(29A) 30~40(35A) ¹	34~50(42A) 43~65(54A)	54~80(67A) 65~93(82A) ²

Notes: *1. Only for S-N35.
*2. Only for S-N95.

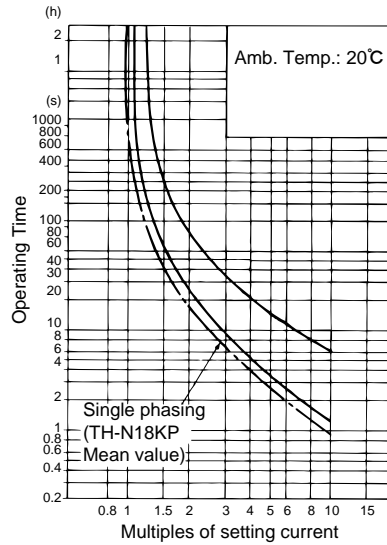
2.1.5 Operating Characteristics of Thermal Overload Relays

(Connecting wire size: Refer to "standard wire size" of Table 2.1.3)

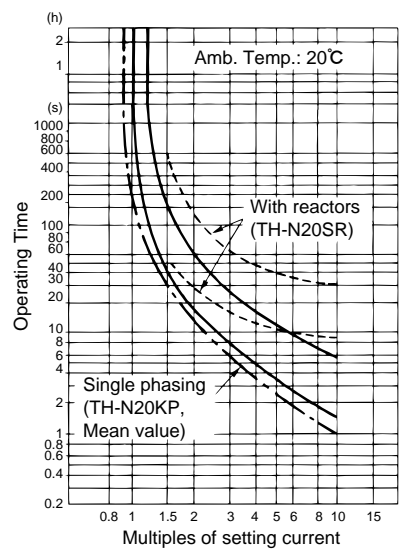
TH-N12
TH-N12KP-TH-N12SR



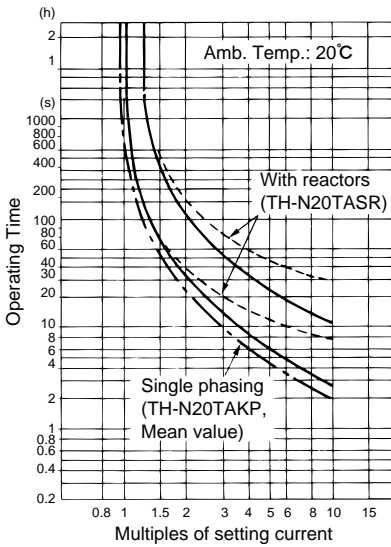
TH-N18
TH-N18KP



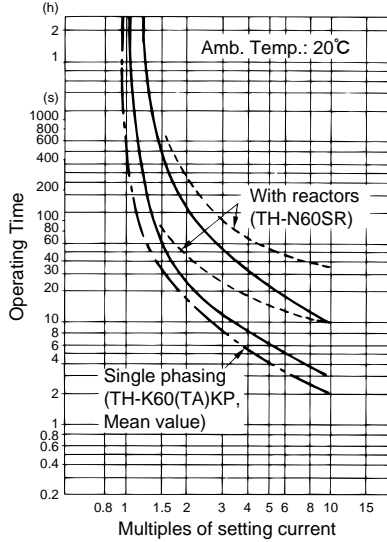
TH-N20-TH-N20KP
TH-N20SR-TH-N20KPSR



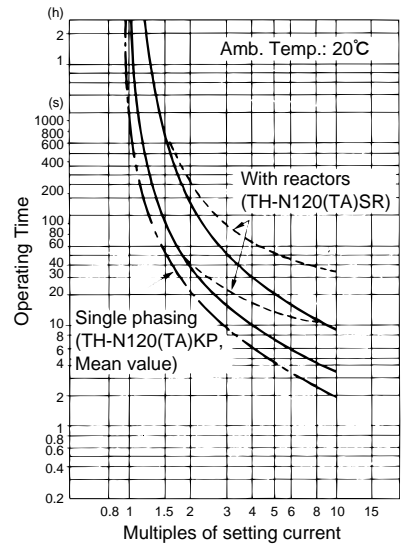
TH-N20TA-TH-N20TAKP
TH-N20TASR-TH-N20TAKPSR



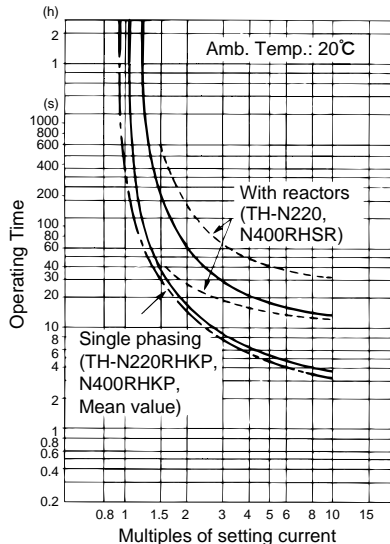
TH-N60-TH-N60TA
TH-N60KP-TH-N60TAKP
TH-N60SR-TH-N60TASR
TH-N60KPSR-TH-N60TAKPSR



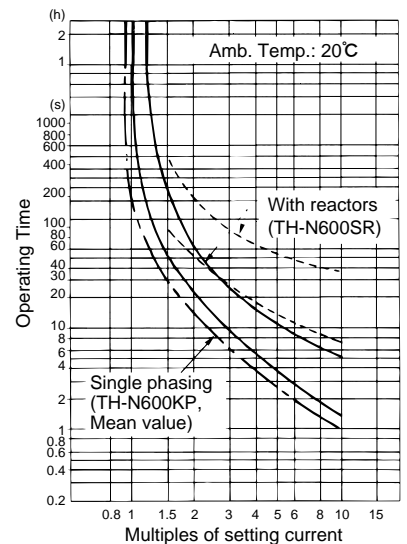
TH-N120-TH-N120KP
TH-N120SR-TH-N120KPSR
TH-N120TA-TH-N120TAKP
TH-N120TASR-TH-N120TAKPSR



TH-N220RH
TH-N220RHKP
TH-N220RHRSR
TH-N220RHKPSR
TH-N400RH
TH-N400RHKP
TH-N400RHRSR
TH-N400RHKPSR



TH-N600
TH-N600KP
TH-N600SR
TH-N600KPSR



2.1.6 Optional Parts and Accessories

Saturable Reactors for Slow Tripping

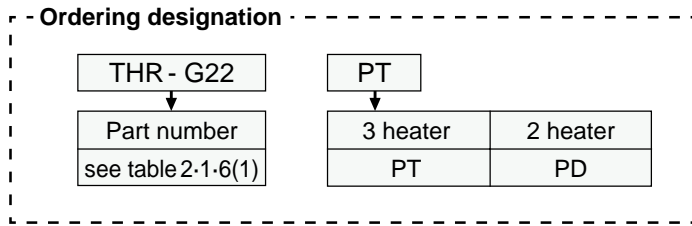


Table 2.1.6 (1)

Heater Designation	Part number						
	TH-N12 ¹	TH-N20(KP)	TH-N20TA(KP)	TH-N60(KP) TH-N60TA(KP)	TH-N120(KP) TH-N120TA(KP)	TH-N220□□(KP) TH-N400□□(KP)	TH-N600(KP)
0.24A	TSR-A0Y	TSR-C0Y	—	—	—	—	—
0.35A	TSR-A0Y	TSR-C0Y	—	—	—	—	—
0.5A	TSR-A01	TSR-C0Y	—	—	—	—	—
0.7A	TSR-A03	TSR-C03	—	—	—	—	—
0.9A	TSR-A05	TSR-C03	—	—	—	—	—
1.3A	TSR-A09	TSR-C07	—	—	—	—	—
1.7A	TSR-A11	TSR-C09	—	—	—	—	—
2.1A	TSR-A12	TSR-C10	—	—	—	—	—
2.5A	TSR-A13	TSR-C12	—	—	—	—	—
3.6A	TSR-A15	TSR-C15	—	—	—	—	—
5A	TSR-A18	TSR-C17	—	—	—	—	—
6.6A	TSR-A21	TSR-C20	—	—	—	—	—
9A	TSR-A23	TSR-C23	—	—	—	—	—
11A	TSR-A25	TSR-C25	—	—	—	—	—
15A	—	TSR-C26	—	THR-G22	—	—	—
19A	—	TSR-C29	—	—	—	—	—
22A	—	—	TSR-D28	THR-G24	—	—	—
29A	—	—	TSR-D29	THR-G26	—	—	—
35A	—	—	TSR-D28	THR-G27	—	—	—
41A	—	—	—	THR-G27	THR-H41	—	—
54A	—	—	—	THR-G29	THR-H42	—	—
67A	—	—	—	THR-G29	THR-H43	—	—
82A	—	—	—	THR-G30	THR-H43	THR-F10	—
95A	—	—	—	THR-G30	—	—	—
105A	—	—	—	—	THR-H44	THR-F13	—
125A	—	—	—	—	THR-H45	THR-F13	—
150A	—	—	—	—	—	THR-F15	—
180A	—	—	—	—	—	THR-F16	—
210A	—	—	—	—	—	THR-F17	—
250A	—	—	—	—	—	THR-F18	THR-E13
330A	—	—	—	—	—	THR-F19	THR-E13
500A	—	—	—	—	—	—	THR-E13
660A	—	—	—	—	—	—	THR-E13

Note: 1. Saturable reactors can be adopted only for the two heater type TH-N12


Table 2.1.6 (2)

Trip indicator	Thermal overload relay	Voltage(50/60Hz)	Part number
	TH-N12(CX)(KP)	AC 24/DC24V	UN-TL15DC24V
	TH-N18(CX)(KP)	AC 100-127V AC 200-240V	UN-TL15AC100V UN-TL15AC200V
Reset release	Thermal overload relay	Part number	Length (mm)
	TH-N12(CX)(KP)	UN-RR205	200
	TH-N18(CX)(KP)	UN-RR405 UN-RR555 UN-RR705	400 550 700
Separate mounting adaptor	Thermal overload relay	Part number	
	TH-N12(TP/KP)	UN-HZ12	
	TH-N12CX(TP/KP)	UN-HZ12CX	

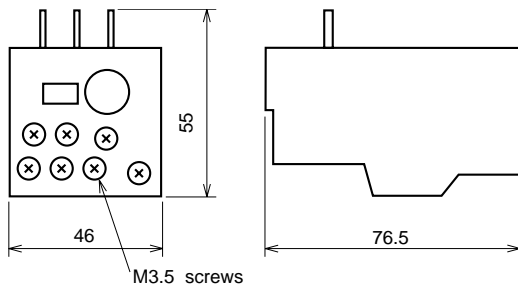
Note: 1. Except for type TH-N60CX and TH-N60CXKP.

• Connecting Parts for Contactors to Thermal Overload Relays

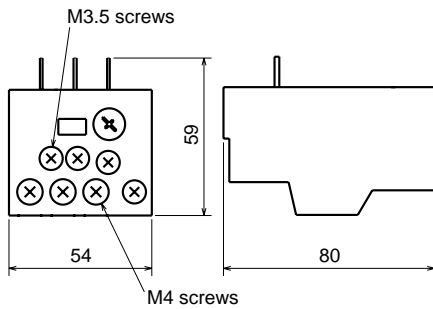
Table 2.1.6 (3)

	For connection between contactor (non-reversing type) and thermal overload relay		Overload relay	Contactor	Part number	Mass(kg)
				TH-N20(CX)(KP)	S-N20(CX), S(D)-N21(CX)	UN-TH20
			TH-N20(CX)(KP), -N20TA(CX)(KP)	S-N25(CX), S(D)-N35(CX)	UN-TH25(CX)	0.02
			TH-N60(CX)(KP)	S-N50(CX), -N65(CX) SD-N50, -N65	BH559N350	0.02
		* Connecting bars and mounting plate are included in the OLR of TH-N220RH(KP) and TH-N400RH(KP) for S-N180, -N220, -N300, -N400.	TH-N60(KP), -N60TA(KP)	S-N80, -N95 SD-N80, -N95	BH569N350 BH569N352	0.04 0.04
			TH-N120(KP), N120TA(KP)	S(D)-N125 S(D)-N150	BH579N355 BH589N355	0.36 0.36

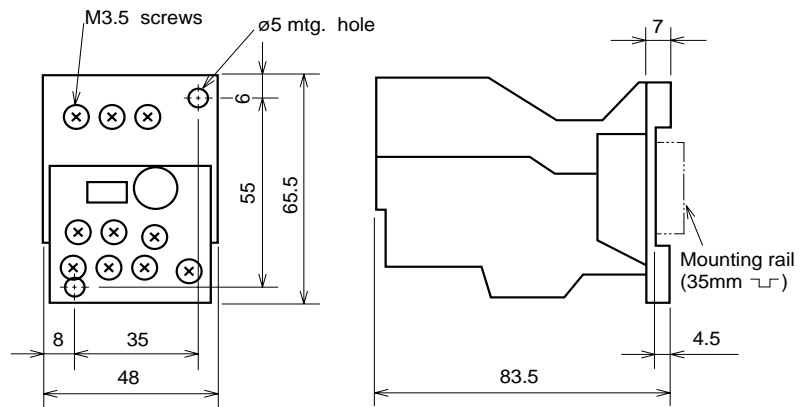
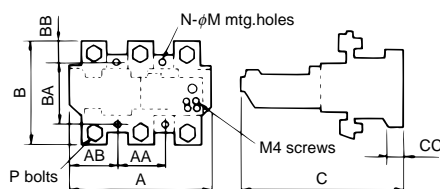
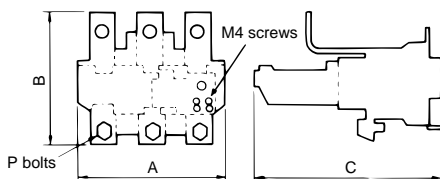
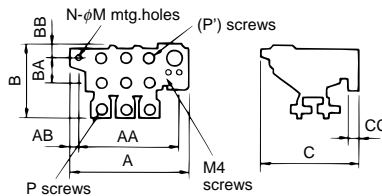
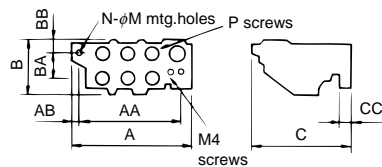
2.1.7 Outline Dimensions



TH-N12(CX)(KP) (Mass: 0.11kg)



TH-N18(CX)(KP) (Mass: 0.14kg)



TH-N12(CX)(KP) with mounting adapter UN-HZ12(CX)

Type	A	B	C	AA	AB	BA	BB	CC	N	M	P	Q	Mass (kg)
TH-N20(CX)(KP)	63	51	79	19	15	33	8.5	7	2	4.5	M4	M3.5	0.14
TH-N60(KP)	91.5	57	87	70	12	45	6	9	2	4.5	M6	M4	0.28
TH-N60CX(KP)	91.5	57	87	70	12	45	6	9	2	4.5	M6	M4	0.28
TH-N120(KP)	103	67	105	75	14	50	6	10	2	6	M8	M4	0.48
TH-N600(KP)	63	42	83.5	19	14	33	2	7	2	4.5	M4	M4	0.14

Type	A	B	C	AA	AB	BA	BB	CC	N	M	P(P')	Mass (kg)
TH-N20TA(CX)(KP)	74	72	83.5	—	—	—	—	—	—	—	M5 (M4)	0.2
TH-N60TA(KP)	89	73.5	83.5	—	—	—	—	—	—	—	M6 (M6)	0.32
TH-N120TA(KP)	112	87	105	—	—	—	—	—	—	—	M8 (M8)	0.75
TH-N120TAHZ(KP)	112	103	105	75	25	50	25	10	2	6	M8 (M8)	1.0

Type	A	B	C	AA	AB	BA	BB	CC	N	M	P	Mass (kg)
TH-N220RH(KP)	144	114	179.5	—	—	—	—	—	—	—	M10	2.5
TH-N400RH(KP)	144	160	193.5	—	—	—	—	—	—	—	M12	2.7

Type	A	B	C	AA	AB	BA	BB	CC	N	M	P	Mass (kg)
TH-N220HZ(KP)	144	104	166.5	47	48.5	62	21	18	4	6	M10	2.5
TH-N400HZ(KP)	144	173	166.5	47	48.5	62	55.5	18	4	6	M12	2.7

Note: Suffix "HZ" denotes separate mounting type.

2.2 Electronic Motor Protection Relays

Series ET-N

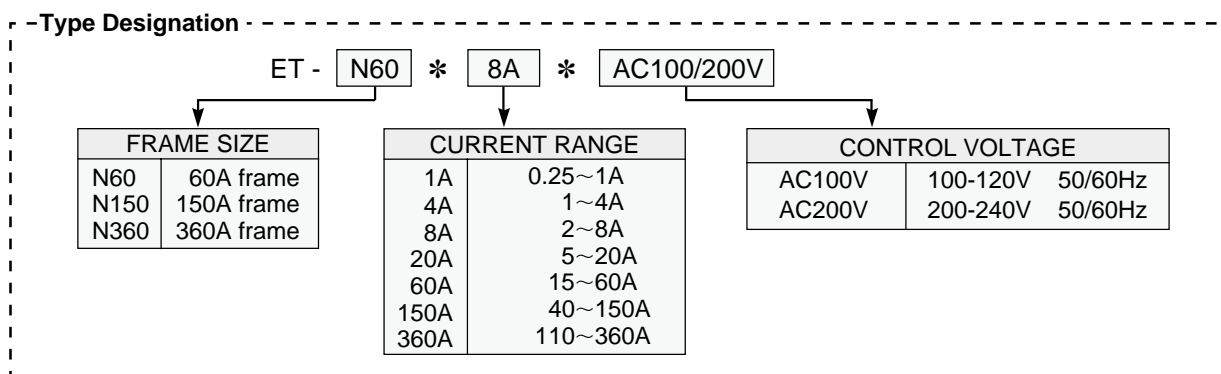


ET-N60 60A

The MITSUBISHI series ET-N relay is an excellent relay that can protect motors electrically. Those series ET-N relays have the following excellent features.

■ Features

- Selectable Protection Mode
 - Overload (including locked rotor condition)
 - Phase failure (including current unbalance)
 - Incorrect phase sequence
- Excellent Wide Current Range
- Easy Wiring
- Easy Setting and Maintainance
- Selectable Tripping Time at 600% of setting.
 - Quick trip (3s.)
 - Fast trip (5s.)
 - Medium trip (15s.)
 - Slow trip (30s.)
- Withstands High Overcurrent
- Fine Indication of Trip Mode
- Conformity to International Standards
- Can be mounted on 35mm rail (ET-N60)



■ Specifications

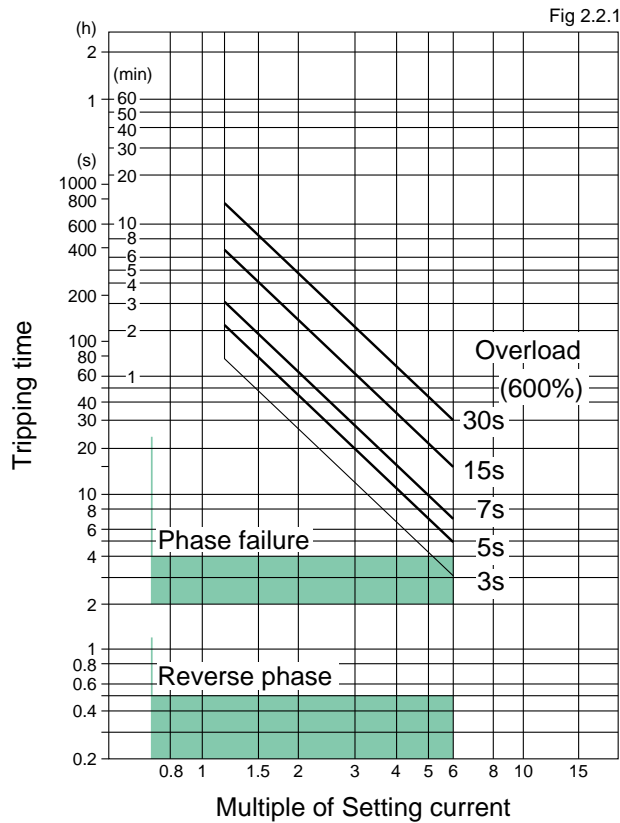
• Ratings and characteristics

Table 2.2.1

Frame size [Current range]		N60[1A]	N60[4A]	N60[8A]	N60[20A]	N60[60A]	N150[150A]	N360[360A]	
Rated insulation voltage	VAC	690							
Adjustable setting range	A	0.25-1	1-4	2-8	5-20	15-60	40-150	110-360	
Applicable motor capacity	200-240VAC	kW	0.03-0.2	0.2-0.75	0.4-1.5	1.5-4	3.7-11	11-37	30-90
	380-440VAC	kW	0.05-0.4	0.4-1.5	0.75-2.2	2.2-7.5	7.5-22	22-75	55-150
3-ph	200-240VAC	HP	1/16-1/4	1/4-1	1/2-2	2-5	5-15	15-50	40-125
	380-440VAC	HP	1/8-1/2	1/2-2	1-3	3-10	10-30	30-100	75-200
Rated operating current of aux. contacts	Category AC-15	120VAC	A	2					
	240VAC	A	1						
Rated operating current of aux. contacts	Category DC-13	24VDC	A	1					
	110VDC	A	0.2						
Permissible ambient temperature/humidity	°C/%RH	-10 to +55/45 to 85							
Control circuit consumption	VA	7.5 (AC100V)/15 (AC200V)							
Control voltage tolerance	times	0.85 to 1.1 (rated control voltage)							
Tripping time		See Fig. 2.2.1							
Tripping condition	Overload	%	[minimum tripping current] 110 to 120 (at setting current)						
	Phase failure	%	more than 70 (at setting current) [Tripping time : 2-4 sec.]						
	Reversal phase	%	more than 70 (at setting current) [Tripping time : less than 0.5 sec.]						
Withstand voltage	VAC	2500 [1 minute]							
Shock resistance	Vibration 10-55Hz	m/s ²	19.6						
	Sine wave pulse	m/s ²	49						
Conductor size	Main terminals	mm ²	2-14			3.5-22	5.5-60	14-200	
	Control terminals	mm ²	1.25-2						

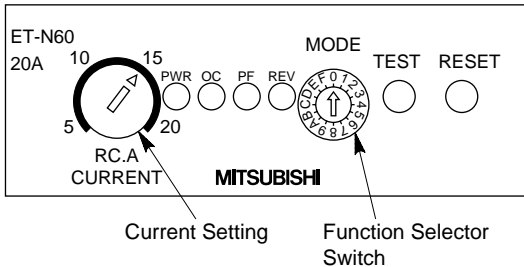
Note: ET-N relay cannot be used on DC circuit

• **Characteristic Curves**



• **Selection of Protection Mode & Tripping Time**

Table 2.2.2



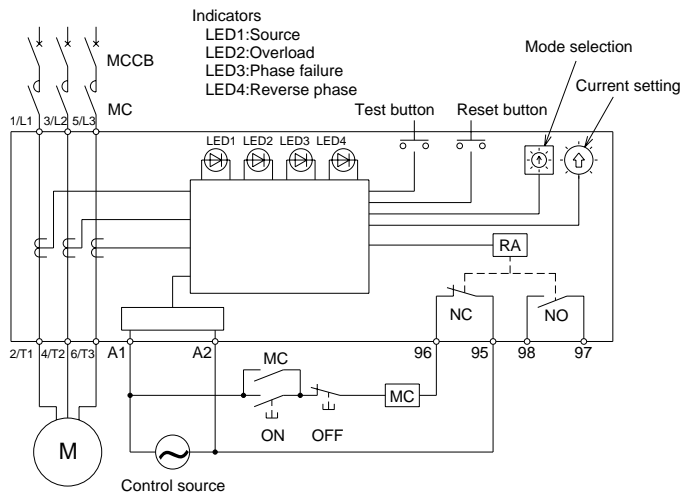
The selector switch is set at position “7” (overload and phase failure protection mode; standard trip type) when shipping. So please reset the position of the changeover switch according to Table 2.2.2 before installation.

Protection mode	Overload tripping time at 600% of setting(s)	Symbol on changeover switch
Overload, phase failure and reversal phase [3E]	3	0
	5	1
	7	2
	15	3
	30	4
Overload and phase failure [2E]	3	5
	5	6
	7	7
	15	8
Overload only [1E]	30	9
	3	A
	5	B
	7	C
	15	D
	30	E

• **Application to High Voltage or Big Motor Circuit**

The high voltage current transformer (secondary current: smaller than 5A; capacity: more than 5VA) should be connected to ET-N60*8A in the star connection, when the load is high voltage or big AC motor.

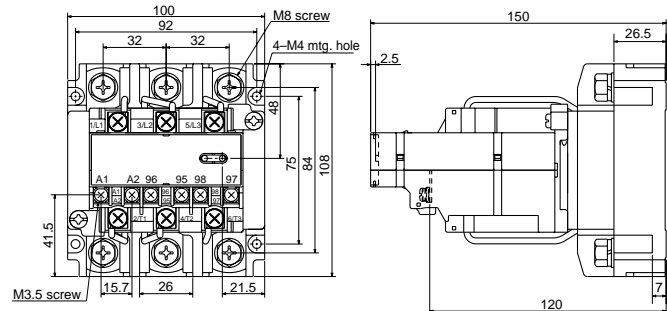
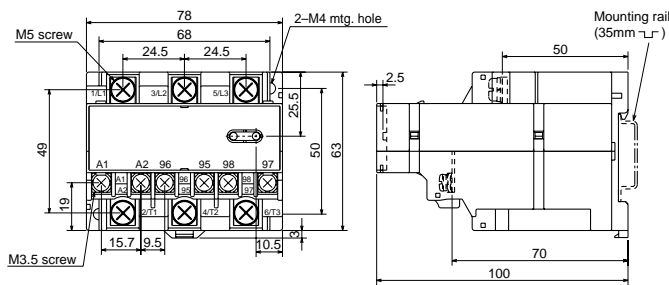
■ Wiring Precautions



- The control source should be wired in the same phases as the contactor control source.
- When the load is a single phase motor, use 1/ L1-2/T1 and 5/L3-6/T3 phases. And re-set the position of changeover switch to "A" to "E".

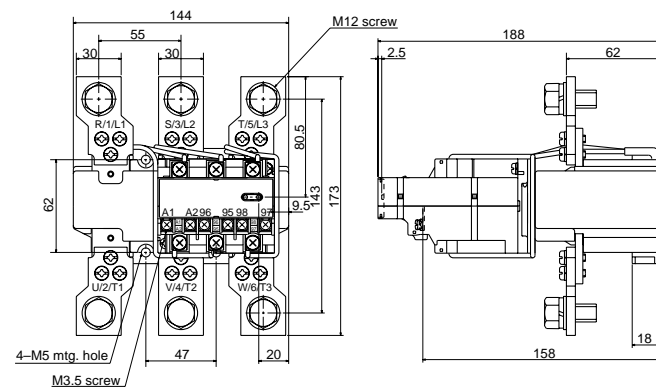
- If capacitors are used to correct the power factor, connect the capacitor in the power source side of the ET-N relay.

■ Outline Dimensions



ET-N60(1-60A) (Mass: 0.3kg)

ET-N150 (Mass: 1.6kg)



ET-N360 (Mass: 2.5kg)

3. DEFINITE PURPOSE CONTACTORS & STARTERS

3.1 DC Contactors

Series DU




DU-A60

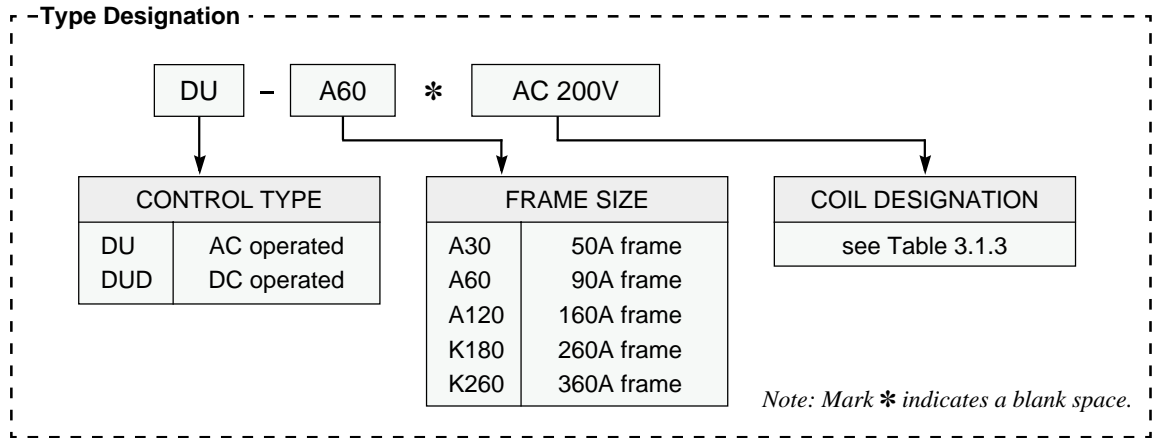


DU-K180

The MITSUBISHI series DU contactors are designed for DC circuits, that is the variable-speed drive-control circuits (SCR switching circuit) and DC motor control circuits.

Features

- Compact design
- High break capacity
- CSA certified models are also available on AC operated type, add suffix "UR" immediately after the Frame size.
- Double break contacts
- UL recognized component (If  marking is required add suffix "UR" immediately after the Frame size).
- Long Life

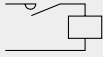



Specifications

- Number of main contacts type DU : 2NO1NC, type DUD : 2NO
Number of auxiliary contacts type DU & DUD : 2NO2NC

Ratings

Table 3.1.1

Frame size			A30	A60	A120	K180	K260	
Conventional free air thermal current			50	90	160	260	360	
Rated operating current for SCR switching circuit*	NO contact	110VDC	A	40	80	160	260	360
		240VDC	A	40	80	160	260	360
		440VDC	A	15	30	60	90	130
		500VDC	A	15	30	60	90	130
1-pole 	NC contact	110VDC	A	120	240	480	720	1.040
		240VDC	A	120	240	480	720	1.040
		440VDC	A	120	240	480	720	1.040
		500VDC	A	120	240	480	720	1.040
Rated operating current for SCR switching circuit	NO contact	110VDC	A	50	90	160	260	360
		240VDC	A	50	90	160	260	360
		440VDC	A	40	80	160	260	360
		500VDC	A	40	80	160	260	360
Rated operating current category DC 2 & 4	NO contact	110VDC	A	30	60	120	180	260
		240VDC	A	20	40	80	120	175
		440VDC	A	7.5	15	30	—	—
1-pole 	NC contact	110VDC	A	20	40	80	100	150
		240VDC	A	15	30	60	75	100
		440VDC	A	7.5	15	25	—	—
Rated operating current category DC2 & 4	NO contact	110VDC	A	40	80	160	240	350
		240VDC	A	30	60	120	180	260
		440VDC	A	20	40	80	120	175
Rated operating current of aux. contacts	Category AC11	110VAC	A	6				
	Category AC11	240VAC	A	5				
Rated operating current of aux. contacts	Category DC11	110VDC	A	1.2				
	Category DC11	240VDC	A	0.2				

Note: For SCR switching, making current of NO contacts is 2 times the rated operating current and making current of NC contact is 1 times, the rated operating current which means the peak value at making. In this application NO and NC contacts do not break any current.

• Characteristics

Table 3.1.2

Frame size		A30	A60	A120	K180	K260	
Mechanical life	operations	2.5 million					
Electrical life	operations	0.5 million					
Permissible ambient temperature		°C					
		-10 to 55					
Coil voltage tolerance		times					
		0.85 to 1.1 (rated coil voltage)					
Coil consumption	Inrush	240	520	1260	480	480	
	Sealed	28	47	100	44	54	
	Watts	7 (26)	13 (35)	25 (50)	5(41)	7.3(55)	
Operating time	Make	NO contacts ON	15 (60)	20 (100)	20 (140)	30(150)	40(180)
		NC contact OFF	12	13	13	26	37
	Break	NO contacts OFF	6(18)	11 (27)	11 (37)	110(25)	125(30)
		NC contact ON	12	18	18	112	135
Make and break capacity		tmes					
Category DC2 & DC4		times					
		4 (at the rated operating current)					
		4 (at the rated operating current)					
Permissible switching frequency		operations/hour					
		1,200					
Vibration resistance	10-55Hz	m/s ²					
Shock resistance	10 msec half sine wave	m/s ²					
		19.6					
		49					
Conductor size	Main terminals	2-25	2-35	6-70	10-150	16-185	
	Control terminals	mm ²			1-4		
					1-2.5		

Note: Parenthesized data is for type DUD, DC operated contactors.

• Coil designation

Table 3.1.3

Coils for type DU-A			Coils for type DU-K		Coils for type DUD	
Coil designation	Applicable voltage		Coil designation	Applicable voltage	Coil designation	Applicable voltage
	50Hz	60Hz				
AC100V	100VAC	100-110VAC	AC100V	100-127VAC 50/60Hz	DC24V	24VDC
AC120V	110-120VAC	115-120VAC	AC200V	200-240VAC 50/60Hz	DC48V	48VDC
AC200V	200VAC	200-220VAC	AC300V	260-350VAC 50/60Hz	DC100V	100VDC
AC230V	220-240VAC	230-240VAC	AC400V	380-440VAC 50/60Hz	DC110V	110VDC
AC400V	380-415VAC	400-440VAC	AC500V	460-550VAC 50/60Hz	DC120V¹	120VDC
AC440V	415-440VAC	460-480VAC			DC125V	120-125VDC ²
AC500V	500VAC	500-550VAC			DC200V	200VDC
					DC220V	220VDC

Notes: 1. Only for type DUD-A60
2. 125V DC for type DUD-A60

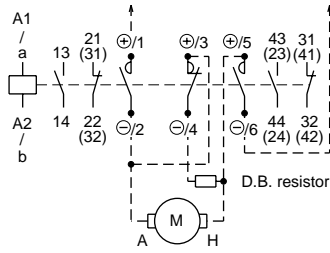
■ Spare parts

Table 3.1.4

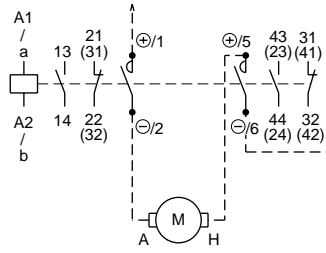
Spare parts	Ordering designation
Main contact kits for DU-□ ¹	MAIN KIT DU-□
Main contact kits for DUD-□ ²	MAIN KIT DUD-□
Auxiliary contact kits for DU(D)-A□ ³	Z926783G30
Auxiliary contact Units for DU(D)-K□ ⁴	UN-AX150
Coils for DU-□ ⁵	DU-□-COIL AC-V
Coils for DUD-□ ⁶	DUD-□-COIL DC-V

Notes: 1. Contact kit of type DU consists of three moving contacts and six stationary contacts.
2. Contact kit of type DUD consists of two moving contacts and four stationary contacts.
3. Aux. contact kits of type DU(D)-A□ are all the same.
4. Aux. contact units of type DU(D)-K□, UN-AX 150 are the same as those of the standard series S-N contactors.
5. Coils for DU-K 180/K 260 are the same as S-N220/N300 each.
6. Coil for DUD-A30 includes only one coil. Other DC operated coils of type DUD include two coils.

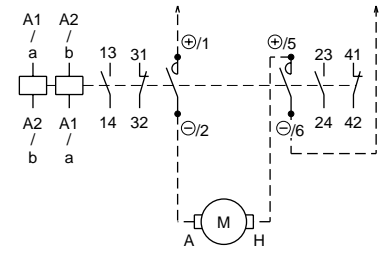
Contact Arrangements



DU-A30, DU-A60, DU-A120
DU-K180, DU-K260



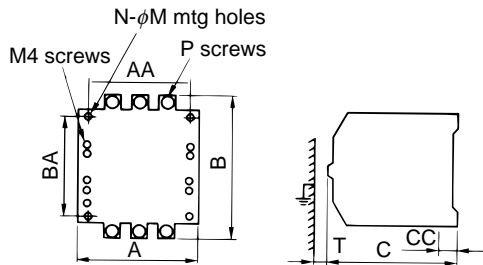
DUD-A30, DUD-A60
DUD-K180, DUD-K260



DUD-A120

Note: Values in parenthesis are shown on auxiliary terminals of DU-A or DUD-A .

Outline Dimensions



Type	A	AA	B	BA	C	CC	N	M	P	Mass(kg)	T
DU-A30	100	86	118	90	105.5	12.5	3	5	6	1.2	10
DU-A60	120	100	144	100	128.5	16	3	5	6	2.0	10
DU-A120	162	130	160	140	162	2.3	4	6	10	4.1	10
DU-K180	138	120	204	190	174	1.6	4	6	10	5.5	30
DU-K260	163	145	243	225	195	2.3	4	8	12	10	50
DUD-A30	101	86	108	90	135.5	3.2	3	5	6	2.1	10
DUD-A60	120	100	144	100	161.5	2	3	5	6	3.5	10
DUD-A120	162	130	160	140	187	2.3	4	6	10	7.1	10
DUD-K180	138	120	204	190	200	1.6	4	6	10	7.5	30
DUD-K260	163	145	243	225	220	2.3	4	8	12	13.5	50

3.2 Medium Voltage Vacuum Contactors

Series SH-V



SH-V160

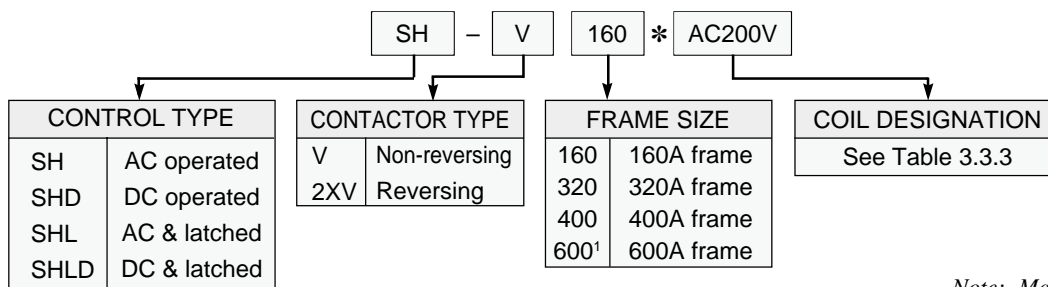
The MITSUBISHI series SH-V contactors are specially designed for the areas of mining, pumping, sawing and other applications where voltage above 1500VAC are frequently used.

Features

- Compact design
- Lightweight
- Long service life
- Easy inspection & maintenance
- Applications over a wide range of voltage
- High insulation strength



Type Designation



Note: Mark * indicates a blank space.

Note: 1. Only AC operated non-reversing type is available for Frame size 600.
SH-V600 is not presently certified by CSA.

Specifications

• Ratings

Table 3.2.1

Frame size		V160	V320	V400	V600	
Rated insulation voltage		V	1,500	1,500	1,500	
Rated operating capacity	Three phase motor category AC3	240V	55(180)	90(320)	115(400)	160(630)
		440V	110(180)	200(320)	250(400)	300(630)
	1,000V	660V	160(180)	315(320)	400(400)	600(600)
		1,500V	225(160)	450(320)	550(400)	750(600)
Resistance load rating category AC-1	Three phase capacitor	240V	50(150)	75(250)	100(300)	200(580)
		440V	100(150)	150(250)	200(300)	400(580)
	1,000V	1,000V	250(150)	300(200)	300(200)	-
		1,500V	350(150)	500(200)	500(200)	-
Conventional free air thermal current		A	200	350	450	750
Short circuit interrupting current		A	4,000			5,040
Withstand current for short time	for 2 seconds	kA	4			6
	for 10 milliseconds	kA	33			
Rated operating current of aux. contacts	Category AC-15	240VAC	5			
		480VAC	3			
	Category DC-13	660VAC	3			
		110VAC	1.2			
	220VAC	0.2				

Note: A surge absorber is required for motors less than 5.5kW only.

● Characteristics

Table 3.2.2

Frame size		V160	V320	V400	V600
Mechanical life ^{1,2} .	operations	2.5 million			
Electrical life ^{3,4} . (category AC3)	operations	0.5 million			
Permissible ambient temperature	°C	-10 to +55			
Coil voltage tolerance	times	0.85 to 1.1 (rated coil voltage)			
Coil consumption	AC operated Inrush Sealed Watts	VA VA W	550 45 5.2		1150 55 7.3
	DC operated Inrush Sealed	VA VA	500 40		— —
	Mechanically latched Inrush	VA	550		—
Operating time (approx.)	Make Break	msec	40		65
		msec	130		80
Make and break current capacity	Make Break	times	10 (at AC3 rated operating current)		
		times	8 (at AC3 rated operating current)		
Permissible switching frequency	operations/hour	1,200			
Vibration resistance	10-55Hz	m/s ²		19.6	
Shock resistance	Sine wave pulse	m/s ²		49	
Conductor size	Main terminals	mm ²	5.5-100	14-200	70-325
	Control terminals	mm ²	1-2.5		

- Notes: 1. Mechanical life of the latched type is 0.25 million operations.
 2. Mechanical life of vacuum tube is 1 million.
 3. When the load is three phase capacitors, electrical life is 0.1 million operations.
 4. Electrical life of the latched type is 0.25 million operations.

● Coil Designation

Table 3.2.3

Coil designation	Rated voltage
AC100V	100~127V 50/60Hz
AC200V	200~240V 50/60Hz
AC300V	260~350V 50/60Hz
AC400V	380~440V 50/60Hz
AC500V	460~550V 50/60Hz
DC100V	100-110 VDC
DC200V	200-220 VDC

Note: When ordering the latched type contactor, specify the coil designation of the closing coil and the tripping coil. Place "MC" before the closing coil designation and place "MT" before the tripping coil designation.

■ Spare Parts & Accessories

Table 3.2.4

Contactor Catalog Number	Coil Part Number ¹	Main Contact Part Number	Auxiliary Contacts Number		Vacuum Tube Gauge Part Number
			Replacement(1NO 1NC)	Add-on(2NO 2NC)	
SH-V160	SH-V160COIL AC V	SH-V160TUBES ²	UA-AXVV1	UA-AXVV2 ³	SH-V160 GAUGE
SH-V320		SH-V320TUBES ²			
SH-V400		SH-V400TUBES ²			
SH-V600	SH-V600COIL AC V	SH-V600TUBES ²		UA-AXVV4	SH-V600 GAUGE

- Notes: 1. See Table 3.3.3 for Coil Designation.
 2. Set of three vacuum bottles supplied.
 3. Consists of two UA-AXVV1 contact blocks on the mounting plate. Mounts on left side of contactor.

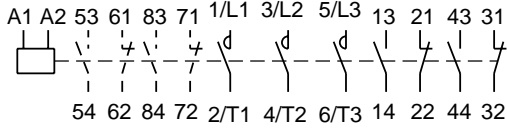
● Surge absorber

Table 3.2.5

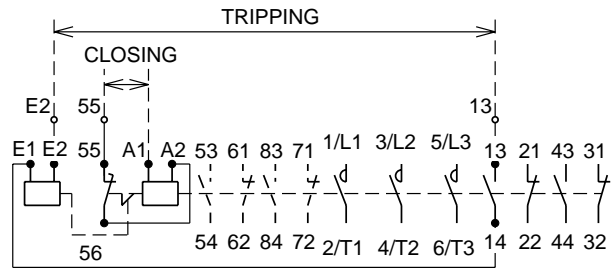
As the vacuum tubes of SH-V use a special contact material, the surge voltage by current chopping is very small. Surge absorbers are required only for motors smaller than 5.5kW.

Applicable voltage	Ordering designation
up to 440VAC	UA-SU4
up to 550VAC	UA-SU5
up to 660VAC	UA-SU6
up to 1,000VAC	UA-SU10
up to 1,500VAC	UA-SU15

Contact Arrangement

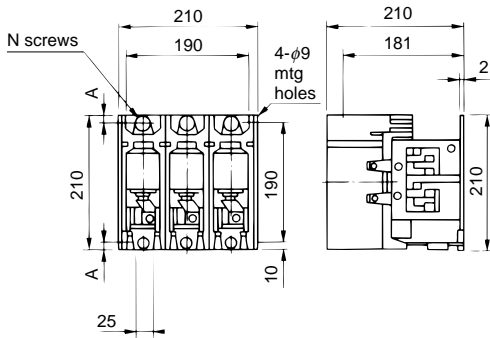


SH-V□



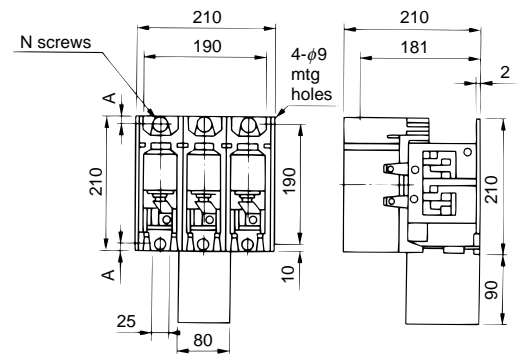
SHL-V□
SHLD-V□

Outline Dimensions

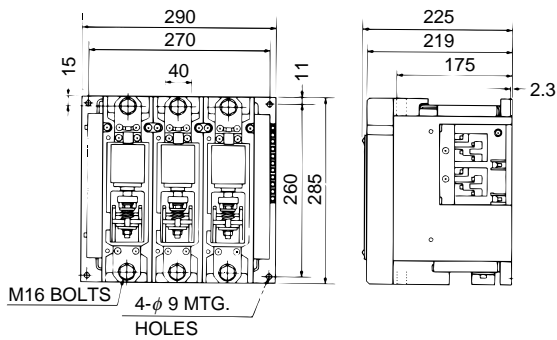


SH-V160, V320, V400 (Mass:12.5kg)

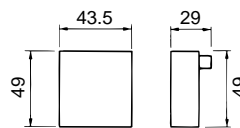
KEYS	N	A
SH-V160	M8	10
SH-V320	M10	12.5
SH-V400	M10	12.5
SHL(D)-V160	M8	10
SHL(D)-V320	M10	12.5
SHL(D)-V400	M10	12.5



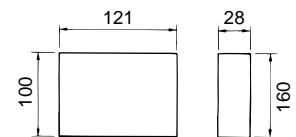
SHL-V160, V320, V400 (Mass:14kg)
SHLD-V160, V320, V400



SH-V600(Mass:22kg)



UA-AXVV1(Mass:0.2kg)



UA-AXVV2 (Mass:0.5kg)

3.3 Compact 3-Pole Contactors

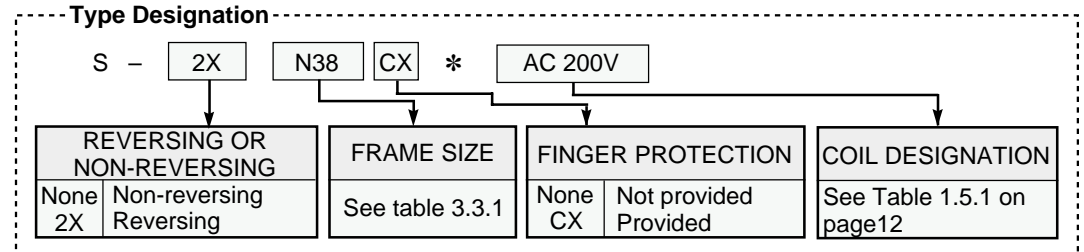
The MITSUBISHI series S-N□8 compact 3-pole contactors are designed for limited panel space applications such as machine control panels.



S-N48

Features

- Compact design—Very limited required mounting space.
- Front clip-on type auxiliary contact block can be added.
- Coil surge absorbers are available. • Can be mounted on 35mm rail.



Note: Mark * indicates a blank space

Specifications

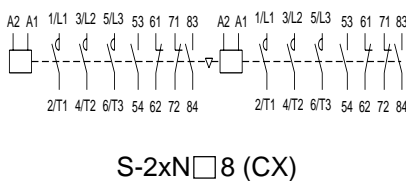
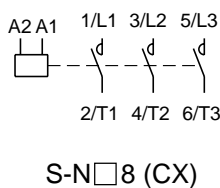
Rating and characteristics

Table 3.3.1

Type			S-N18 (CX)	S-N28 (CX)	S-N38 (CX)	S-N48 (CX)
Rated insulation voltage	V		AC690			
Rated operational current	220-240V	A(kW)	18(4.5)	26(7.5)	39(11)	50(15)
	380-440V	A(kW)	16(7.5)	17(7.5)	32(15)	40(18.5)
3-ph, category AC-3	500V	A(kW)	13(7.5)	13(7.5)	24(15)	32(18.5)
	690V	A(kW)	9(7.5)	9(7.5)	12(11)	17(15)
Conventional free air thermal current	A		25	30	60	80
Electrical life	operations (million)		1			
Mechanical life			10	5		
Rated making current for 100,000 cycle operations	A		200	300	500	670
Peak let through time 0.5ms						
Switching frequency(AC3)	operations/hour		1800	1800	1800	1200
Coil consumption (at rated coil voltage)	Inrush	VA	60			110
	Sealed	VA	10			13
	Watts	W	3			4.5
Terminal screw size	Main terminal		M4	M4	M5	M5
	Control terminal		M3.5	M3.5	M3.5	M3.5
Conductor size (Compression terminal size)	Main terminal		1-6			2-16
	Control terminal		1-2.5			1-2.5
Additional auxiliary contact block			UN-AX2 or UN-AX4			

Note: 1. For finger protection type, order model name followed by suffix "CX".

Contact Arrangement



Outline Dimensions

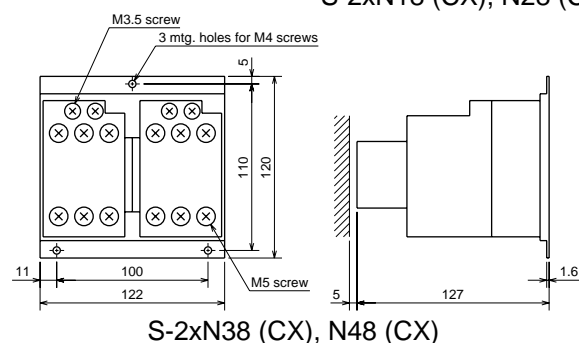
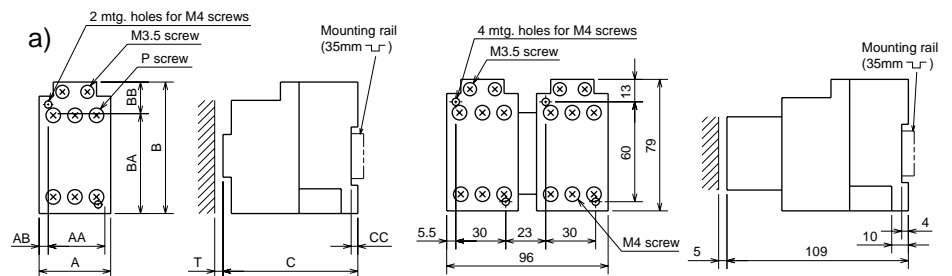


	Fig.	A	B	C	AA	AB	BB	BA	CC	CA	D	P	Q	Mass(kg)	T
S-N18 (CX), N28 (CX)	a	43	79	81	30	7	60	6	10	109	4	M4	M3.5	0.33	5
S-N38 (CX), N48 (CX)	a	54	90	93	40	7	80	6	7	121	4	M5	M3.5	0.4	5

3.4 NC Main Contact Contactors



B-N20

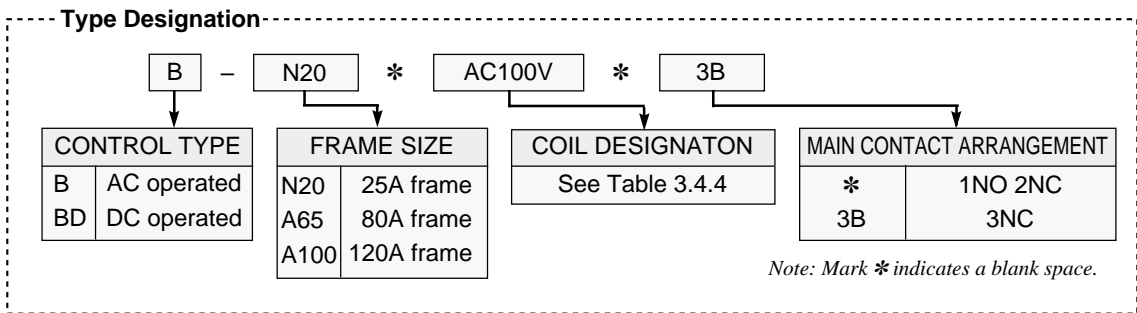


B-A65

The MITSUBISHI series B-N/A contactors are specially designed for the dynamic braking circuit of motors, switching motor-starting resistors and switching of emergency lighting.

Features

- 2 or 3 NC main contacts.
- Suitable for a variety of loads.
- Compact design
- Both AC operated models & DC operated models



Specifications

- Number of main contacts: Special arrangement 3 NC can be supplied only with type B-N20/A65. aux. contacts: 2NO fixed.

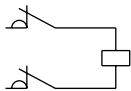
Ratings

Table 3.4.1

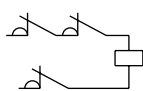
FRAME SIZE			N20	A65	A100	
Conventional free air thermal current	lth	A	25	80	120	
Rated operating current category AC-3	200-240VAC	A	18	50	80	
	380-440VAC	A	13	35	55	
Rated operating current category AC-1	max 500VAC	A	25	80	120	
Rated operating current category DC-2 & DC-4	2NC ¹	110VDC	A	8	20	30
		220VDC	A	1	3	5
	3NC ²	110VDC	A	15	50	—
		220VDC	A	5	20	—
Rated operating current category DC-1	2NC ¹	110VDC	A	15	30	40
		220VDC	A	5	10	20
	3NC ²	110VDC	A	20	65	—
		220VDC	A	10	30	—

- Notes: 1. At 2NC series connection
2. At 3NC series connection

Notes: 1. At 2NC series connection



2. At 3NC series connection



Characteristics

Table 3.4.3

FRAME SIZE			N20	A65	A100
Mechanical life		Operations	5 million		
Electrical life		Operations	0.5 million		
Coil consumption	Inrush	VA	90 (-)	400 (-)	880 (-)
	Sealed	VA	15 (-)	40 (-)	76 (-)
	Watts	W	4 (16)	10.5(40)	19(45)
Coil voltage tolerance		times	0.85 to 1.1(at rated coil voltage)		
Operating time	Coil off → NC on	msec	20(50)	19(35)	18(35)
	Coil on → NC off	msec	20(50)	17(75)	19(125)
Make and break current capacity	AC-3	times	10(rated operating current)		
	DC-2 & DC-4	times	4(rated operating current L/R ≤ 15 msec)		
Conductor size	Main terminals	mm ²	1-6	2-25	2-70
	Control terminals	mm ²	1-2.5		

Note: Parenthesized data if for type BD-□ DC operated contactors.

Rated operating current of aux. contacts.

Table 3.4.2

Category	Rated voltage	A
AC-15	120VAC	6
	240VAC	5
	440VAC	3
	500VAC	3
DC-13	48VDC	3
	110VDC	1.5
	220VDC	0.5

Coil Designation

Table 3.4.4

Coil designation	Applicable voltage
AC100V	100V/50Hz, 100-110V/60Hz
AC200V	200V/50Hz, 200-220V/60Hz
AC400V	400V/50Hz, 440V/60Hz
DC100V	100VDC
DC110V	110VDC
DC200V	200VDC

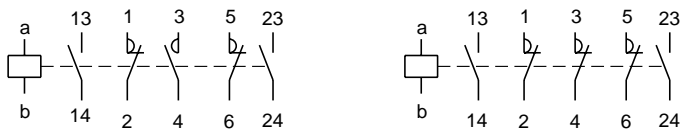
Coils for B(D)-N20 is same as one of S(D)-N21, refer to Table 1.8.1 of Page 18.

Spare Parts

Table 3.4.5

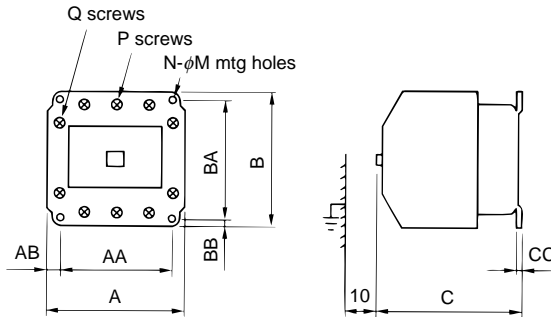
Spare parts	Ordering designation
Main contact kits for B(D)-N20 1NO2NC for B-N20 3NC for B(D)-A65 1NO2NC for B-A65 3NC for B(D)-A100	PARTS MAIN KIT B(D)-N20 1A2B BH739N301 B-N20 3B BH739N302 B(D)-A65 1A2B Z936083G10 B-A65 3B Z936084G10 B(D)-A100 Z936085G10
Auxiliary contact kits for B(D)-N20 for B(D)-A65/A100	PARTS AUX KIT B(D)-N20 BH739N312 B(D)-A65 Z936083G30
Coils for B-N20 or B-A □ AC operation for BD-N20 or BD-A □ DC operation	B-N20-COIL AC....V, B-A □ -COIL AC....V BD-N20-COIL DC....V, BD-A □ -COIL DC....V

Contact Arrangements



Note: 1. 3NC is available for B-N20 and B-A65 only.

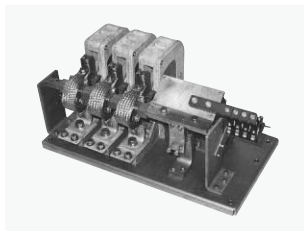
Outline Dimensions



Type	A	B	C	AA	AB	BA	BB	CC	N	M	P	Q	Mass(kg)
B-N20	63	81	81	54	4.5	60	7	6.5	2	4.8	M4	M3.5	0.4
B-A65	120	116	128.5	100	10	100	8	16	3	5.8	M6	M4	2.0
B-A100	140	140	144.5	114	13	125	7.5	2	4	7	M8	M4	2.8
BD-N20	63	81	113	54	4.5	60	7	6.5	2	4.8	M4	M3.5	0.7
BD-A65	120	116	161	100	10	100	8	2	3	6	M6	M4	3.5
BD-A100	140	140	177.5	114	13	125	7.5	2	4	7	M8	M4	5.0

3.5 Heavy-Duty Clapper-Type Contactors

Series CD



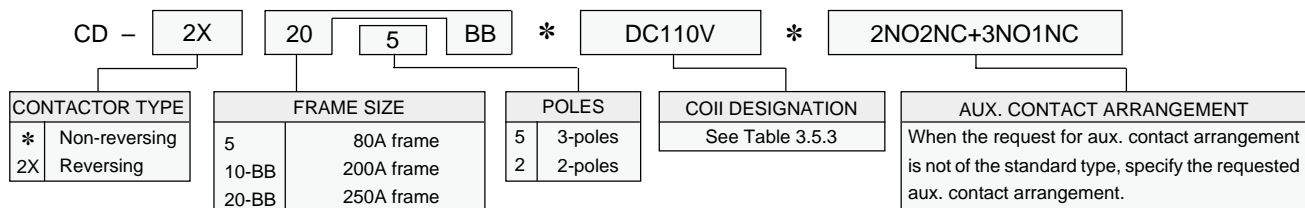
CD-205BB

The MITSUBISHI series CD, heavy-duty clapper-type contactors are specially designed for the crane control or for the rolling mill control, where checking and maintenance are very important.

Features

- Long life under high switching-frequency operation
- Stable operation and high reliability
- Easy checking, maintenance and replacement
- Versatile construction of aux. Contacts
- Standardised mounting hole dimensions

Type Designation



- Notes: 1. Max. auxiliary contacts is 4 for frame size 5 to 80, 3 for frame size 120.
 2. Standard aux. Contact arrangements are 2NO2NC fixed for frame size 5 & 10-BB, 2NO2NC for frame size 20-BB to 80, and 2NO1NC for frame size 120.
 3. Rectifier equipped type for AC control circuit is also available.

Specifications

• Ratings

Table 3.5.1

Frame size	3-poles		CD-55	CD-105BB	CD-205BB	CD-405	CD-605	CD-805	CD-1205	
	2-poles		CD-52	CD-102BB	CD-202BB	CD-402	CD-602	CD-802	CD-1202	
Rated insulation voltage	660									
Conventional free air thermal current	A		80	200	250	400	600	800	1200	
Rated operating Current	Category AC-3	200-220VAC	A	80	200	250	400	600	800	1000
		380-440VAC	A	65	150	200	320	480	750	1000
		500-550VAC	A	50	80	140	280	420	600	1000
	Category AC-2	200-220VAC	A	80	200	250	400	600	800	1200
		380-440VAC	A	65	150	200	400	600	800	1200
		500-550VAC	A	65	100	200	400	600	800	1200
Category AC-1	Max.550VAC	A	70	110	220	400	600	800	1200	
Rated operating Current	Category AC-3	200-220VAC	KW	19	50	60	100	150	200	300
		380-440VAC	KW	30	70	100	150	250	400	500
		500-550VAC	KW	30	50	90	150	250	400	500
	Category AC-2	200-220VAC	KW	19	50	60	100	150	200	300
		380-440VAC	KW	30	70	100	200	300	400	600
		500-550VAC	KW	39	50	100	200	300	400	600
Rated operating Current	Category DC-4	100-110VDC	A	50	100	200	400	600	-	-
	Category DC-1	200-220VDC	A	(50)	(100)	(200)	(400)	(600)	-	-
Rated operating Current	Category DC-4	100-110VDC	A	65	100	200	400	600	-	-
	Category DC-1	200-220VDC	A	(65)	(100)	(200)	(400)	(600)	-	-

Note: 1. Parenthesized data is applicable for 2 or 3 poles connections. Not for the single-pole application.

• Rated Operating Current of Aux. Contacts.

Table 3.5.2

Category	Rated voltage	A
AC-15	220VAC	10
	440VAC	6
	550VAC	5
DC-13	48VDC	5
	110VDC	3
	220VDC	1

• Coil Designation

Table 3.5.3

Coil designation	Applicable voltage
DC100V	100VDC
DC110V	110VDC
DC200V	200VDC
DC220V	220VDC

● Characteristics

Table 3.5.4

Item	Frame size	3-poles	CD-55	CD-105BB	CD-205BB	CD-405	CD-605	CD-805	CD-1205
		2-poles	CD-52	CD-102BB	CD-202BB	CD-402	CD-602	CD-802	CD-1202
Mechanical life	operations	10 million			0.5 million			0.25 million	
Electrical life	operations	0.5 million						0.25 million	0.25 million
Coil consumption	w	50	50	60	110	120	120	260	
Coil voltage tolerance	times	0.85 to 1.1(rated coil voltage)							
Operating time ³	Close ¹	msec	110(105)	190(175)	210(200)	260(240)	390(340)	390(340)	170(120)
	Open ²	msec	20(30)	40(50)	50(60)	40(60)	35(50)	35(50)	20(40)
Make and break capacity	AC ratings Make Break	times times	10(category AC-3) 8(category AC-3)						4 (category AC-2)
	DC ratings Make & Break	times	4(category DC-2 & DC-4)						-
Permissible switching frequency	operations/hour	1200							600
Category conformed to	AC ratings	—	AC-3		AC-3		AC-3	AC-2	
	DC ratings	—	DC-3		DC-3		-	-	

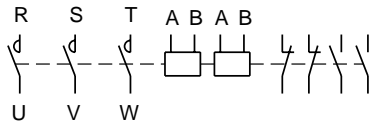
Notes: 1 Time from coil ON to main contact ON.

2 Time from coil OFF to main contact OFF.

3 Parenthesized data is for the 2-poles types.

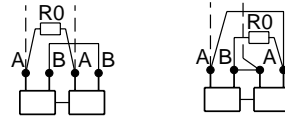
■ Contact Arrangements & Coil Connection Diagrams

● Contact arrangements



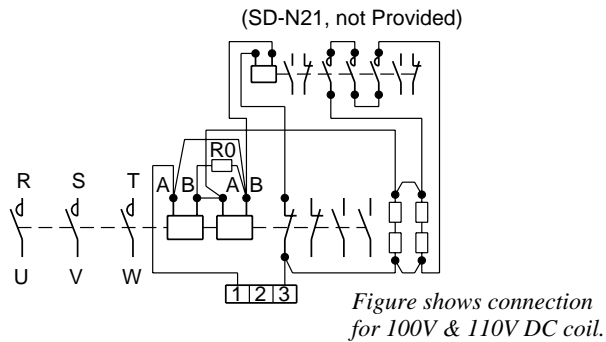
CD-55 ~ 805

● Connection of coils for CD-55 ~ 1205

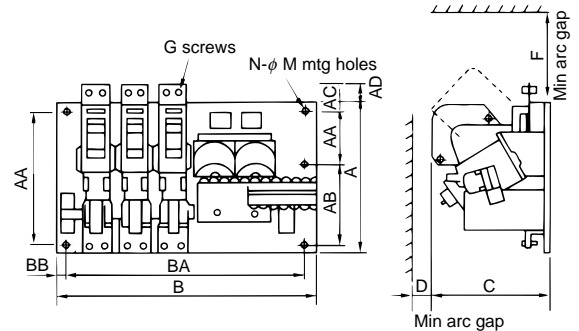


200VDC &
220VDC

100VDC &
110VDC



CD-1205



■ Outline Dimensions

Table 3.5.5

Type	A	AA	AB	AC	AD	B	BA	BB	C	D	E	F	G	N-M	Mass(kg)
CD-52	190	150	0	20	10	310	250	20	146	50	28	40	M6	3-11.5	8
CD-55	190	150	0	20	10	360	300	20	146	50	28	40	M6	3-11.5	9
CD-102BB	230	200	0	15	20	380	350	15	180	70	37	60	M8	4-11.5	16
CD-105BB	230	200	0	15	20	440	400	20	180	70	37	60	M8	4-11.5	18
CD-202BB	270	200	0	50	30	410	350	30	204	80	25	60	M10	4-11.5	24
CD-205BB	270	200	0	50	30	480	450	15	204	80	25	60	M10	4-11.5	29
CD-402	303	100	150	28	37	540	500	20	298	100	45	100	M12	5-11.5	45
CD-405	303	100	150	28	37	640	600	20	298	100	45	100	M12	5-11.5	54
CD-602,-802	365	100	200	40	35	600	550	25	327	150	47	140	M12	6-11.5	67
CD-605,-805	365	100	200	40	35	700	650	25	327	150	47	140	M12	6-11.5	79
CD-1202	400	150	150	75	-	700	650	25	327	170	55	170	M12	6-11.5	86
CD-1205	400	150	150	75	-	800	750	25	327	170	55	170	M12	6-11.5	106

3.6 Delay Open Type Magnetic Starters & Contactors

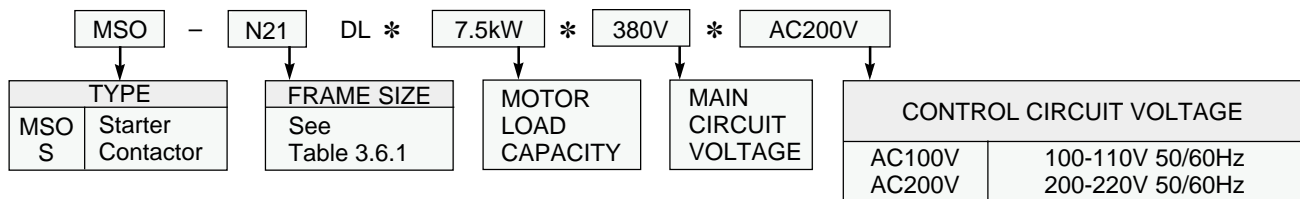
Series S/MSO-N□DL



MSO-N□DL

The MITSUBISHI series MSO-N□DL starters and S-N□DL contactors are specially designed to prevent instantaneous “drop-out” when connected to motors, resulting from momentary voltage drop or power interruption caused by lightning or similar. A capacitor connected in parallel with the operating coil of the contactor discharges so that the starter or contactor will remain closed for 1 to 4 seconds.

Type Designation



Note: Mark * indicates a blank space.

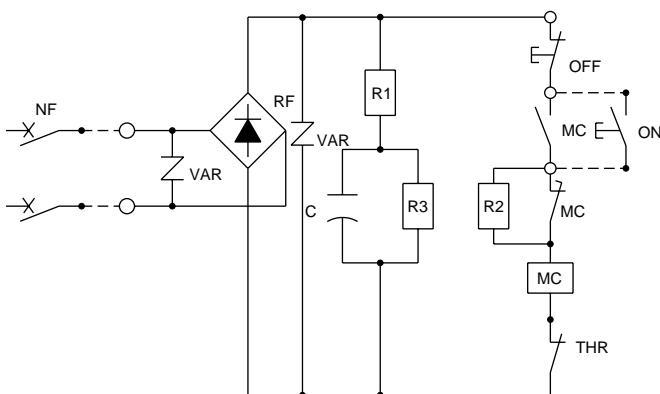
Specifications

• Ratings and Characteristics

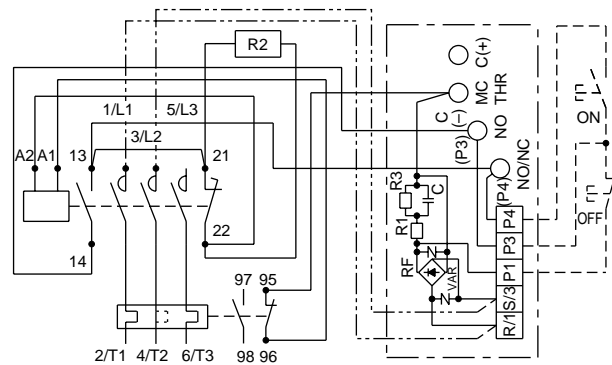
Table 3.6.1

Frame size			N12	N21	N35	N50	N65	N80	N95	N150	N220	N300	N400
Three phase motor	220-240VAC	kW	3.5	5.5	11	15	18.5	22	30	45	75	90	125
	380-440VAC	kW	5.5	11	18.5	22	30	45	55	75	132	160	220
	500-550VAC	kW	5.5	11	18.5	22	30	45	55	90	132	160	225
Category AC-3	220-240VAC	A	13	22	40	55	65	85	105	150	250	300	400
	380-440VAC	A	12	22	40	50	62	85	105	150	250	300	400
	500-550VAC	A	9	17	32	33	45	75	85	140	200	250	350
Conventional free air thermal current	I _{th}	A	20	32	60	80	100	135	135	200	260	350	450
Available aux. contacts			1NO1NC										
Holding time		sec.	2 ⁺² ₋₁										
Control circuit power consumption	Inrush	VA	21	40	44	55	55	66	66	76	100	140	140
	Sealed	VA	13	18	19	26	26	27	27	55	66	85	85

• Diagrams Circuit



• Typical Wiring Diagram

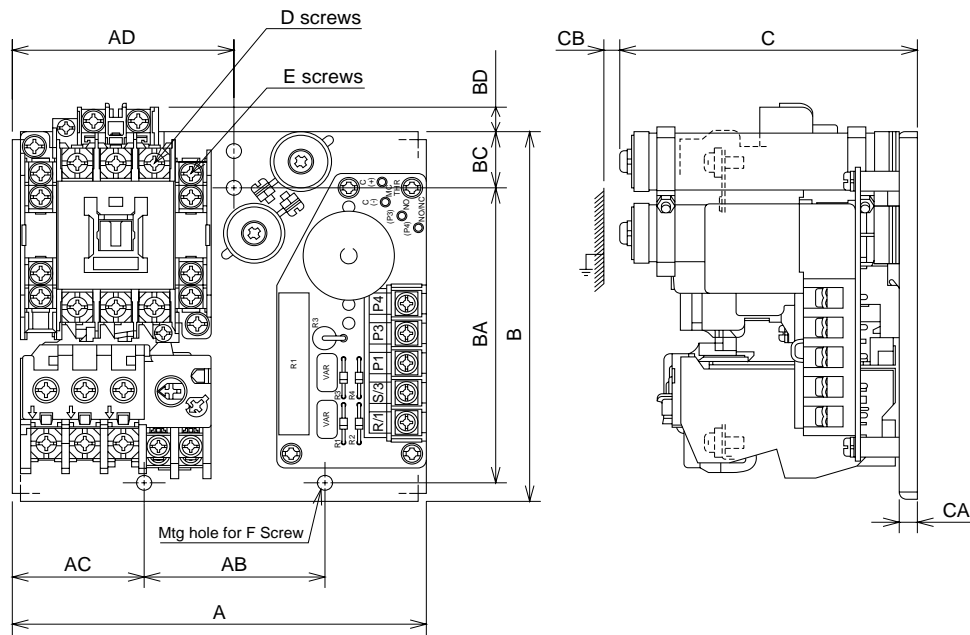


Note: R/1-R/1 & S/3-S/3 (---) wiring is omitted if the control circuit voltage is 100VAC or the main circuit voltage differs from the control circuit voltage.

● **Caution**

- When the circuit breaker (NF) is made (ON) and disconnected (OFF) repeatedly within a short time interval [eg: when the instantaneous power failure occurs within a short time interval], electrical parts might be damaged or specified holding time might not be assured.
Causes; 1) Overload occurs by frequent inrush current to RF and R1.
2) Enough electricity is not charged into the capacitor (C).
- Even after the power is turned off (after the NF is disconnected), current might remain in the capacitor (C). So please take care to avoid the electrical shock, when you check or repair the system.

■ **Outline Dimensions**



■ **Dimensions**

Table 3.6.2

Dimension / Model	A	AB	AC	AD	B	BA	BC	BD	C	CA	CB	D	E	F
MSO-N12DL	132	40	49	69	110	100	5	12.5	98	6	5	M3.5	M3.5	3-M4
MSO-N21DL	137	60	43	73	125	100	19	11	98	6	5	M4	M3.5	3-M4
MSO-N35DL	134	50	42	67	162	150	6	23	114	8	5	M5	M3.5	3-M4
MSO-N50/65DL	150	50	56	81	168	150	9	26.5	141	8	10	M6	M4	3-M5
MSO-N80/95DL	170	100	35	85	220	200	10	39.5	165	8	10	M6	M4	3-M6
MSO-N150DL	210	140	26	105	270	250	10	33	177.5	8	30	M8	M4	3-M8
MSO-N220DL	230	140	20	90	290	250	12	21	208.5	8	30	M10	M4	3-M8
MSO-N300/400DL	300	200	10	-	361.5	200	25	30	229	8	50	M12	M4	4-M8

Notes: 1. Dimensions CB is the arc clearance.

2. Outline dimensions of S-N□DL are the same as those of MSO-N□DL, except for S-N300/N400DL. Dimension B of S-N300/N400DL is 250mm.

3.7 DC Interface Contactors

Series **SD-M**



The MITSUBISHI series SD-M contactors are specially designed to be directly driven by the transistor output (DC24V) of a programmable sequence controller, etc.

■ Features

- Low coil power consumption: By combining an electromagnet with permanent magnet, coil operating current is reduced to DC24V 60mA (1.5W) for SD-M11, M12 and 75mA (1.8W) for SD-M19.
- Compact construction: Width 45mm, Height 48mm, Depth 61mm in Type SD-M11
- Can be mounted on 35mm rail
- Operating indicator (LED)
- Coil surge absorber
- Bifurcated auxiliary moving contacts having high contact reliability
- Safety clear terminal cover
- Easy wiring: All terminals are in the same plane
- Integrated reversing contactor with mechanical and electrical interlock

Type Designation

• Non-reversing types

SD - M 11 * DC24V * *

FRAME SIZE	
11	With 1 auxiliary contact
12	With 2 auxiliary contacts
19	With 2 auxiliary contacts

• Reversing type

SD - MR12 * DC24V
SD - MR19 * DC24V

AUXILIARY CONTACT ARRANGEMENT	
*	Standard type: SD-M11 with 1NO, SD-M12/M19 with 1NO1NC
1B	Special type: SD-M11 with 1NC
2A	Special type: SD-M12/M19 with 2NO

Note: Mark * indicates a blank space.

■ Specifications

• Ratings & characteristics

Table 3.7.1

Type	SD	M11,M12,MR12	M19,MR19
Rated insulation voltage	V	660	660
Conventional free air thermal current	A	15	20
Rated operating current	Category AC3 200-240VAC	A	12
	380-440VAC	A	9
Rated 3ph motor capacity	Category AC1 200-440VAC	A	15
	200-240VAC	kW	3
	380-440VAC	kW	4
Coil voltage tolerance	%	85-110	85-110
Coil consumption	W	1.5	1.8
Coil current	mA	60	75
Operating times	Make	mS	<50
	Break	mS	<20
Mechanical life	operations	10 million	10 million
	Category AC3	operations	1 million
Electrical life	operations	0.5 million	0.5 million
	Category AC1	operations	0.5 million
Permissible ambient temperature	°C	-10 to 55	-10 to 55
Switching frequency	operations/hour	1800	1800
Conductor size	mm ²	1 to 2.5	1 to 6 (Main) 1 to 2.5 (Control)

• Ratings of auxiliary contacts

Table 3.7.2

Rated insulation voltage	V	660	
Rated continuous current	A	6	
Rated operating current	Category AC11 220VAC	A	2
	440VAC	A	1
	Small coil load(L/R=40mS) 24VDC	A	2
	Resistive load 24VDC	A	3
Mechanical Endurance	operations	10 million	
Electrical Endurance	operations	0.5 million	

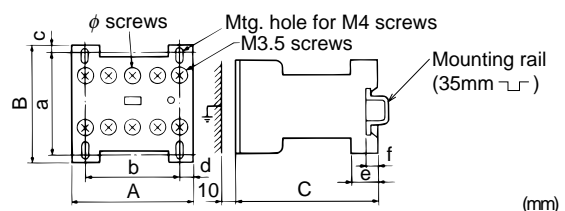
■ Contact Arrangement & Wiring Diagram

Table 3.7.3

	Type	Standard	Special
Non-reversing	SD-M11	Aux. 1NO 	Aux. 1NC
		SD-M12 SD-M19	Aux. 1NO1NC
Reversing	SD-MR12	AUX. 1NO1NC x 2 	
	SD-MR19	AUX. 1NO1NC x 2 	

Note: Coil terminal have polarity.

■ Outline Dimensions



	A	B	C	a	b	c	d	e	f	P	Mass(kg)
SD-M11	45	48	61	40	35	4	5	9	3	M3.5	0.2
SD-M12	54	48	61	40	35	4	5	9	3	M3.5	0.2
SD-MR12	109	63	62	50	86	6.5	11.5	5.5	4	M3.5	0.45
SD-M19	66	58	77	50	55	4	5.5	9	3	M4	0.34
SD-MR19	133	80	78	50	110	22	11.5	9	3	M4	0.73

3.8 DC Interface Modules



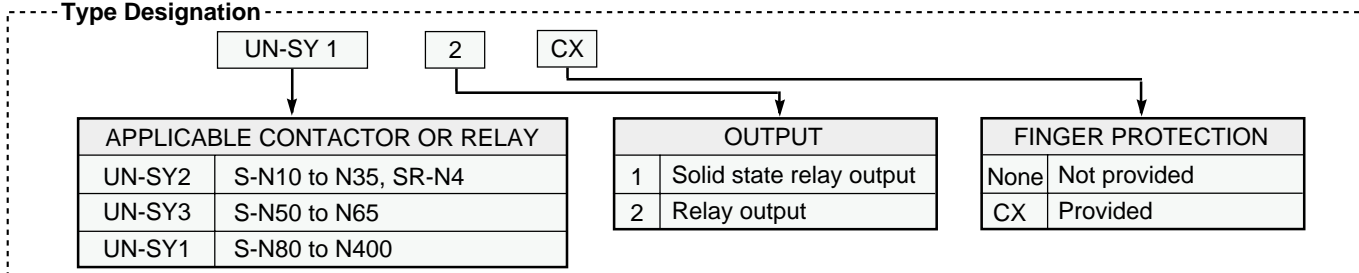
S-N21CX+UN-SY21CX

The MITSUBISHI type UN-SY interface module is an optional unit for S-N series contactors or SR-N series relays, controlled by the transistor output of a programmable controller.

■ Features

- Easy mounting on the Type S-N10 to S-N65 contactors and SR-N series relays.
- Separate mounting type for the Type S-N80 to S-N400 contactors.
- Relay or solid state output versions are available.

Type Designation



Note: Suffix "CX" is available only for UN-SY21 or SY22.

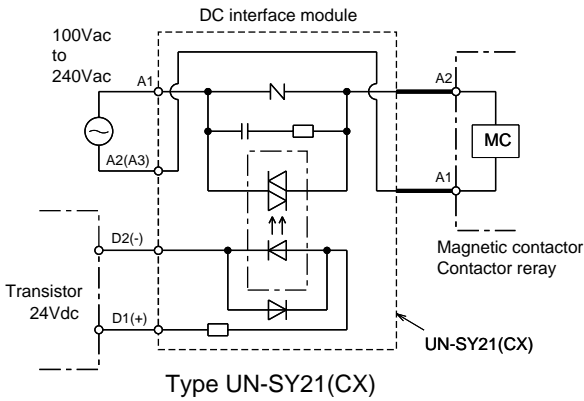
■ Specifications

Table 3.8.1

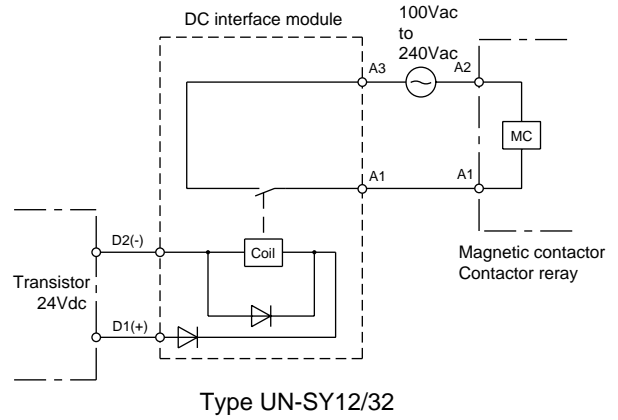
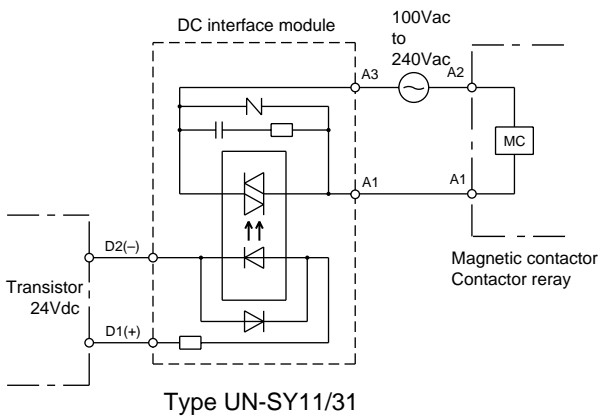
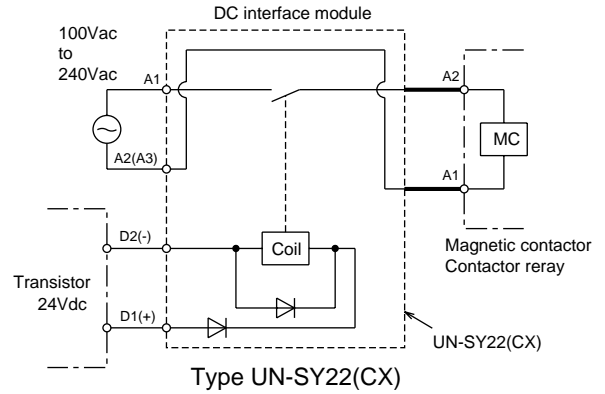
Type		UN-SY21(CX)	UN-SY31	UN-SY11	UN-SY22(CX)	UN-SY32	UN-SY12
Output		Solid state relay			Relay		
Applicable Type of contactor or relay	Direct mounting to contactor or relay	S-N10 to N35 S-N18, N28, N38, N48	S-N50, N65	–	S-N10 to N35 S-N18, N28, N38, N48	S-N50, N65	–
	Separate mounting	–	–	S-N80 to N400	–	–	S-N80 to N400
Input	Rated control voltage	24Vdc			24Vdc		
	Permissible voltage tolerance	80% to 110% of rated control voltage					
	Min. working voltage	18Vdc			18Vdc		
	Max. breaking voltage	4Vdc			1Vdc		
	Power consumption	0.4W			0.24W		
Output	Rated voltage	100Vac to 240Vac 50/60Hz					
	Rated operating current	0.5A (category AC11)					
	Response time	11ms or less			10ms or less		
	OFF-state leakage current	3mA/240Vac			–		
	Mechanical life	–			5 million operations		
	Electrical life	–			1 million operations		
Ambient temperature		–10 to 55°C					

■ Connection

(1) Solid State Output



(2) Relay Output



■ Mounting

- Direct mounting – Type S-N10 to S-N65 and SR-N4
Remove the coil terminal screw from the contactor or relay, then slide the tab on the interface module to the groove on the contactor or relay. Fasten the connecting conductor with the coil terminal screw.
- Separate mounting – Type S-N80 to S-N400
Mount the interface module (UN-SY11/12) with screw on a panel as follows.

■ Outline Dimensions

Type Number	UN-SY21/22(CX)	UN-SY-31/32	UN-SY11/12	
Module Outline dimensions				
Overall Mounting dimensions	Coupling outline			Mtg. hole layout for separate mounting
	<p>S-N10 S-N11 SR-N4 SR-N8 (S-N18) (S-N28)</p>	<p>S-N20 S-N21 (S-N25) (S-N35) (S-N38) (S-N48)</p>	<p>S-N12 SR-N5</p>	

4. RELAYS

4.1 Contactor Relays



SR-N4

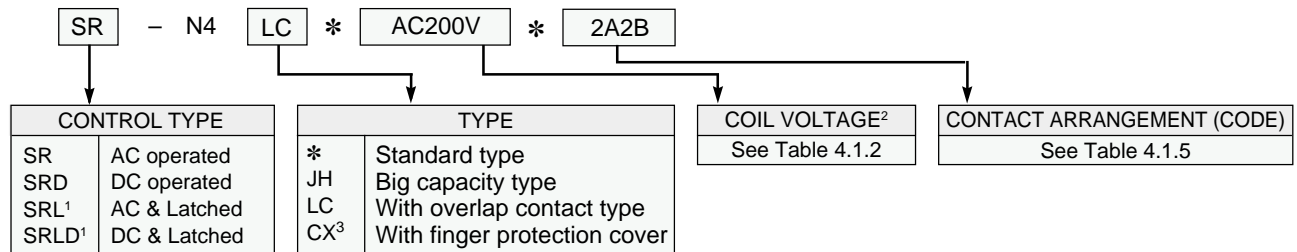
The MITSUBISHI series SR-N contactor relays are specially designed for use in low voltage control applications. Series SR-N have many superior features.

■ Features

- High reliability: By adopting bifurcated moving contacts and by improving the shape of the contacts, contact performance has been made more reliable than ever.
- Long life
- Easily visible coil ratings
- Various accessories common with the series S-N contactors (Head-and side clip-on type additional aux. contact blocks, surge absorbers, safety covers)
- Finger protected types are available (DIN 57106/VDE 0106 Part 100)
- Can be mounted on 35mm rail
- Dust-proof construction
- Easy wiring (self-rising terminal screws)

---Type Designation---

● Standard types



Notes: 1. For latched type relays, JH and LC types cannot be available.

2. When ordering the latched type relays, please specify the closing coil and tripping coil voltage.

ex: SRL-N4 *MC-AC200V *MT-AC100V *4A
 closing coil tripping coil

3. Only suffix "CX" is admitted to make any combination with other tabulated suffixes.

Note: Mark * indicates a blank space.

4.1.1 Specifications

Rating and characteristics

Table 4.1.1 (1)

Type	SR-SRD-	N4 (CX)	N4JH (CX)	N4LC (CX)		
Available contact arrangements (code)		4NO (4A) 3NO+1NC (3A1B) 2NO+2NC (2A2B)	4NO (4A) 2NO+2NC (2A2B)	4NO (4A) 2NO+2NC (2A2B)		
Rated insulation voltage		V				
Conventional free air thermal current		16	20	16		
Rated operating current	Category AC-15 (coil load)	110VAC	A	6	10	6 (3) ²
		230VAC	A	5	10	5 (3) ²
		440VAC	A	3	5	3 (3) ²
		550VAC	A	3	4	3 (3) ²
	Category AC-12 (resistive load)	110VAC	A	16	20	16
		230VAC	A	12	16	12
		440VAC	A	5	10	5
		550VAC	A	5	10	5
	Category DC-13 (large coil load)	24VDC	A	5		3
		48VDC	A	3		2
		110VDC	A	0.8(2) ¹		0.5
		220VDC	A	0.2(0.8) ¹		0.1
	Category DC-14	24VDC	A	8		5
		48VDC	A	3		2
		110VDC	A	2(4) ¹		1
		220VDC	A	0.4(1) ¹		0.2
	Category DC-12 (resistive load)	24VDC	A	10		8
		48VDC	A	8		5
110VDC		A	5(8) ¹		3	
220VDC		A	1(3) ¹		0.5	
Mechanical life	Operations	10 million (latched type 1 million)				
Electrical life	Operations	0.5 million				
Permissible ambient temperature/humidity		°C/%RH			-25 to +55/45 to 85	
Coil consumption	Ac-operated	Inrush	VA	60		
		Sealed	VA	10		
	DC-operated	Watts	W	3		
		Watts	W	7		
Coil voltage tolerance		times	0.85 to 1.1 (rated coil voltage)			
Operating time (average)	Make	ms	15 (AC)	50 (DC)		
	Break	ms	10 (operated)	10 (operated)		
Switching frequency		operations /hour	1,800			
Vibration resistance	10-55Hz	m/s ²	19.6			
Shock resistance	10 msec. half sine wave	m/s ²	49			
Conductor size		mm ²	1.0 to 2.5			

Notes: 1. Parenthesized rated operating current is for switching the load in 2-pole series connection.

2. Parenthesized rated operating current is for switching of NC contact.

Coil voltage

Table 4.1.1 (2)

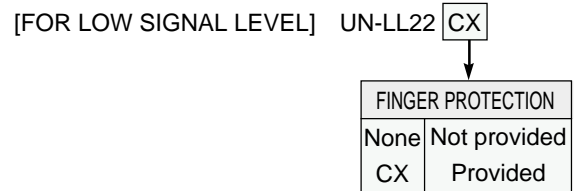
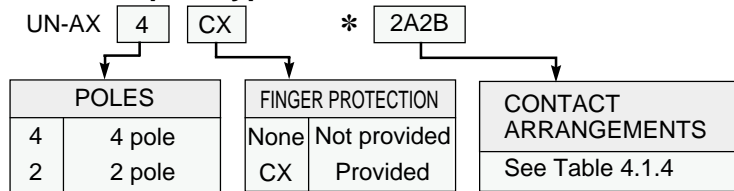
Coil designation	Rated voltage (AC)		Coil designation	Rated voltage (AC)		Coil designation	Rated voltage (DC)
	50Hz	60Hz		50Hz	60Hz		
AC12V	12V	12V	AC220V	208-220V	220V	DC24V	24VDC
AC24V	24V	24V	AC230V	220-240V	230-240V	DC48V	48VDC
AC48V	48-50V	48-50V	AC260V	240-260V	260-280V	DC100V	100VDC
AC100V	100V	100-110V	AC380V	346-380V	380V	DC110V	110VDC
AC120V	110-120V	115-120V	AC400V	380-415V	400-440V	DC125V	120-125VDC
AC127V	125-127V	127V	AC440V	415-440V	460-480V	DC200V	200VDC
AC200V	200V	200-220V	AC500V	500V	500-550V	DC220V	220VDC

Note: AC operated coils are the same as those of S-N10 etc., and DC operated coils are the same as those of SD-N11 etc.

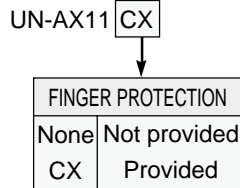
4.1.2 Auxiliary Contact Blocks

Type Designation

● Front clip-on types



● Side clip-on types



Note: Mark * indicates a blank space.

■ Ratings and characteristics

Table 4.1.2 (1)

Type	UN-	AX2 (CX)	AX4 (CX)	AX11(CX)	LL22 (CX)	
Applicable contact arrangements		2NO 1NO+1NC 2NC	4NO 3NO+1NC 2NO+2NC	1NO+1NC	1NO+1NC [Standard]	1NO+1NC' [Low level]
Rated insulation voltage	V	690				250
Conventional free air thermal current	lth	A	16		1	
Rated operating current	Category AC-15 (coil load)	110VAC 220VAC 440VAC	A A A	6 5 3	240VAC 20mA ($\cos\phi \geq 0.95$) 48VDC 100mA ($L/R \leq 1\text{msec}$) Minimum operating current 5VDC 5mA	
	Category DC-13 (large coil load)	48VDC 110VDC 220VDC	A A A	3 0.8 0.2		
Mechanical life	operations	10 million		2.5 million		
Electrical life	operations	0.5 million		0.5 million		
Permissible ambient temperature/humidity	°C/%RH	-25 to +55/45 to 85				
Switching frequency	operations /hour	1,800				
Conductor size	mm ²	1.0 to 2.5				

Note: 1. Contact reliability may be decreased if it is operated more than 1 million operations

■ Selection guide & contact arrangements

Table 4.1.2 (2)

Front clip-on types	UN-AX2 2A		UN-AX2 1A1B		UN-AX2 2B		UN-LL22	
	UN-AX4 4A		UN-AX4 3A1B		UN-AX4 2A2B			
	UN-AX11							
Side clip-on types	When mount on left side		When mount on right side					

Note: Front clip-on types and side clip-on contact block should not be mounted both.

4.1.3 Contact Arrangements of Contactor Relay

Table 4.1.3

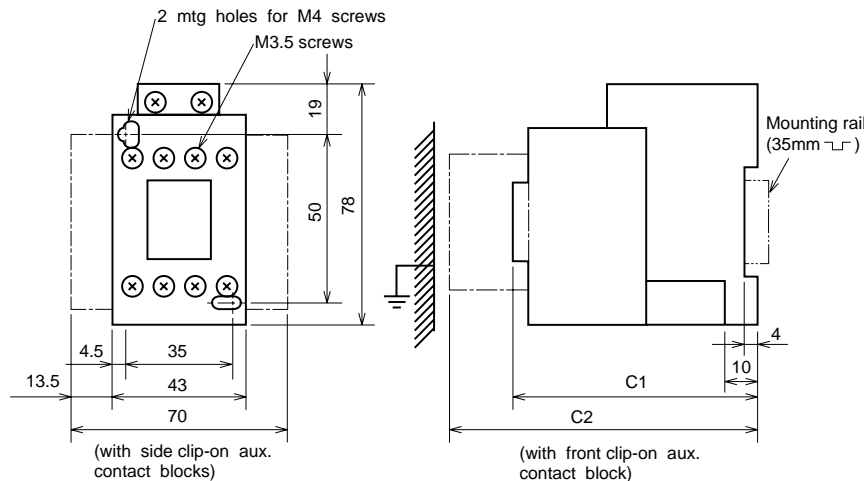
With standard contacts		
<p>4NO</p> <p>SR-N4(CX)AC.....V 4A SRD-N4(CX)DC.....V 4A</p>	<p>3NO + 1NC</p> <p>SR-N4(CX)AC.....V 3A1B SRD-N4(CX)DC.....V 3A1B</p>	<p>2NO + 2NC</p> <p>SR-N4(CX)AC.....V 2A2B SRD-N4(CX)DC.....V 2A2B</p>
With big capacity contacts		
<p>4NO</p> <p>SR-N4JH(CX)AC.....V 4A SRD-N4JH(CX)DC.....V 4A</p>	/	<p>2NO + 2NC</p> <p>SR-N4JH(CX)AC.....V 2A2B SRD-N4JH(CX)DC.....V 2A2B</p>
With late break contacts		
/	<p>3NO + 1NC (late break)</p> <p>SR-N4LC(CX)AC.....V 3A1B SRD-N4LC(CX)DC.....V 3A1B</p>	<p>2NO + 2NC (late break)</p> <p>SR-N4LC(CX)AC.....V 2A2B SRD-N4LC(CX)DC.....V 2A2B</p>
With mechanical latching		
<p>4NO</p> <p>SRL-N4 AC.....V 4A SRLD-N4 DC.....V 4A</p>	<p>3NO + 1NC</p> <p>SRL-N4 AC.....V 3A1B SRLD-N4 DC.....V 3A1B</p>	<p>2NO + 2NC</p> <p>SRL-N4 AC.....V 2A2B SRLD-N4 DC.....V 2A2B</p>

4.1.4 Spare Coils & Accessories

Spare coils and accessories are common with the series S-N contactors.

- Spare coils See Table 1.8.1 (except for Type SRL(D) latched relays)
- Surge absorbers (suppressors) See Table 1.8.6

4.1.5 Outline Dimensions



• Key to Dimensions

Model	C1	C2	Mass (kg)
SR-N4(CX)	78	106	0.3
SRD-N4(CX)	110	138	0.62
SRL-N4(CX) SRLD-N4(CX)	134	-	0.45

Note: Front clip-on and side clip-on contact block should not be mounted both.

4.2 Voltage Detection Relays



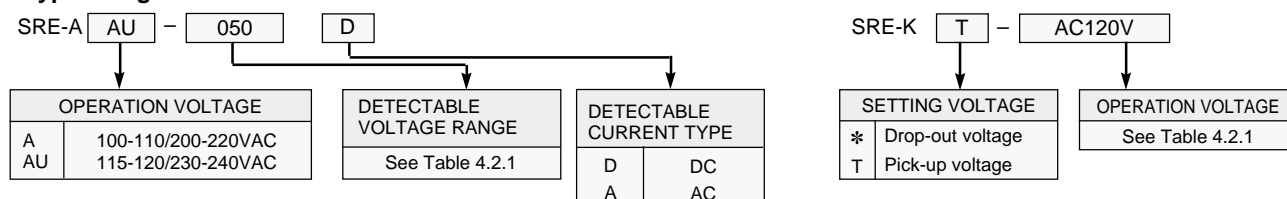
SRE-AA

The MITSUBISHI series SRE relays are specially designed for voltage sensing. The type SRE-A is specially designed for the detection of undervoltage or overvoltage conditions. The type SRE-K is particularly useful for the switching of automatic transfer panels. The type SRE-K can detect undervoltage by simply connecting to the power-source terminals.

Features

- High sensibility
- High reliability
- Easy wiring
- High surge tolerance
- Wide detective voltage range

Type Designation



Specifications

Selection table

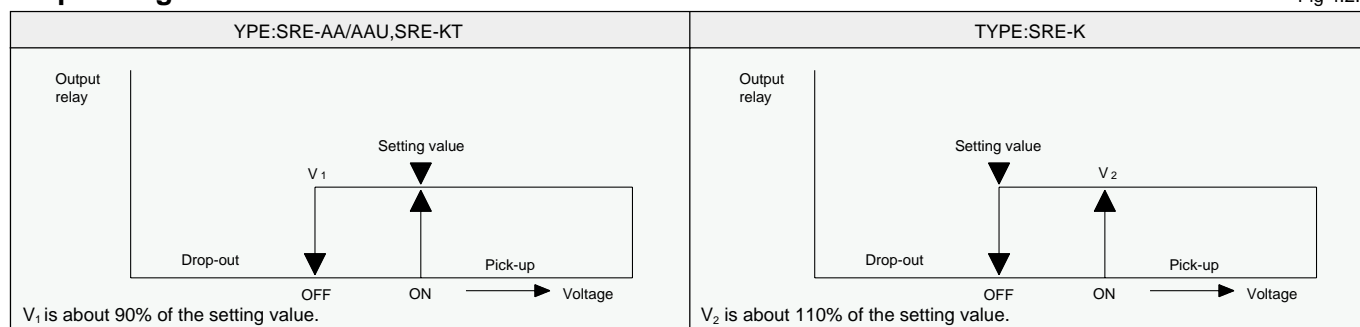
Table 4.2.1

Type		Detectable voltage range	Permissible input voltage (continuous)	Input impedance	Operation voltage	
SRE-AA SRE-AAU	0P5D	0.1-0.5VDC	± 100VDC	20KΩ	Type SRE-AA 100-110V 50/60Hz 200-220V	
	1P5D	0.3-1.5VDC	± 100VDC	50KΩ		
	005D	1- 5VDC	± 150VDC	100KΩ		
	015D	3-15VDC	± 150VDC	100KΩ		
	050D	10-50VDC	± 200VDC	500KΩ		
	150D	30-150VDC	± 300VDC	800KΩ		
	250D	50-250VDC	± 300VDC	800KΩ		
	015A	3-15VAC	150VAC	100KΩ		Type SRE-AAU 115-120V 50/60Hz 230-240V
	050A	10-50VAC	200VAC	500KΩ		
150A	30-150VAC	300VAC	800KΩ			
250A	50-250VAC	300VAC	800KΩ			
SRE-K	AC100V	75-105VAC	120VAC	Input 1.8VA	100-110V,50/60Hz	
	AC120V	90-125VAC	132VAC		115-120V,50/60Hz	
	AC200V	150-210VAC	240VAC		200-220V,50/60Hz	
	AC240V	180-250VAC	264VAC		230-240V,50/60Hz	
	DC 12V	9-12.5VDC	14VDC	Input 1.7W	12VDC	
	DC 24V	18-25VDC	28VDC		24VDC	
SRE-KT	DC100V	75-105VDC	120VDC	Input 1.8VA	100VDC	
	AC100V	80-115VAC	120VAC		100-110V,50/60Hz	
	AC120V	95-130VAC	132VAC		115-120V,50/60Hz	
	AC200V	160-230VAC	240VAC		200-220V,50/60Hz	
	AC240V	190-260VAC	264VAC	230-240V,50/60Hz		
	DC 12V	10-14VDC	14VDC	Input 1.7W	12VDC	
	DC 24V	20-28VDC	28VDC		24VDC	
DC100V	80-115VDC	120VDC		100VDC		

Note: The type SRE-A □ D, for DC detection can be used for full-wave rectification voltage.

Operating Condition

Fig 4.2.1



● Ratings and characteristics

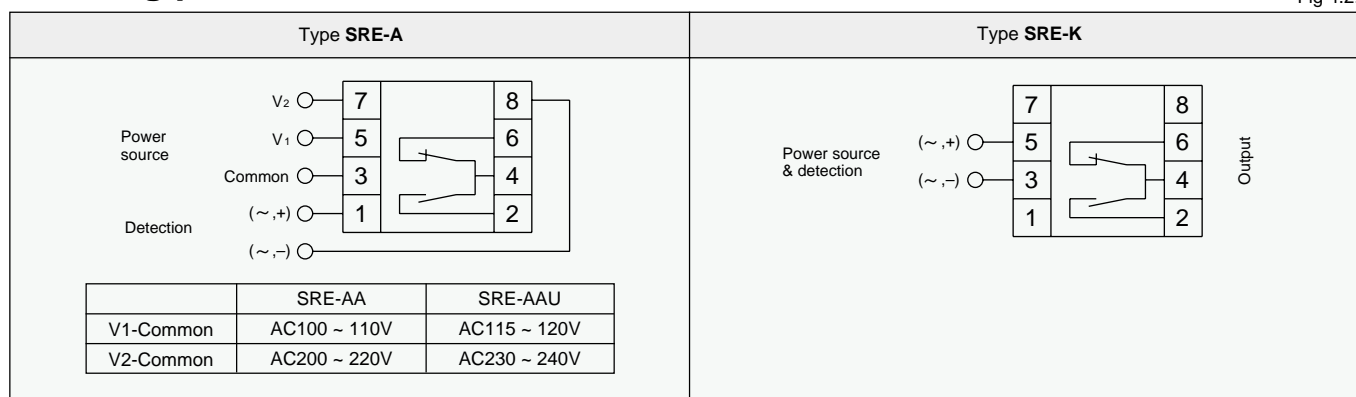
Table 4.2.2

Type		SRE-A	SRE-K
Output contact arrangement		1 changeover	
Conventional free air thermal current		Ith	A
		3	
Rated operating current of output contact	Category AC-15	110VAC	A
		220VAC	A
	Category DC-13	24VDC	A
		110VDC	A
Accuracy	Repetitive operation ¹		%
	Control voltage fluctuation		%
	Ambient temperature change		%
Response time(at 150% of the rated voltage)		msec	100 to 200
Mechanical life		operations	10 million
Electrical life		operations	0.25 million
Permissible ambient temperature/humidity		°C/ %RH	-10 to +55/max. 85
Power consumption		VA	2
Operation voltage tolerance (ambient temperature 40°C)		%	85 to 110
Withstand voltage		VAC	1500 [1 minute]
Insulation resistance (500VDC insulation tester)		MΩ	min. 100
Vibration resistance		10 to 55Hz	m/s ²
Shock resistance		10msec half sine wave	m/s ²
			19.6
			98

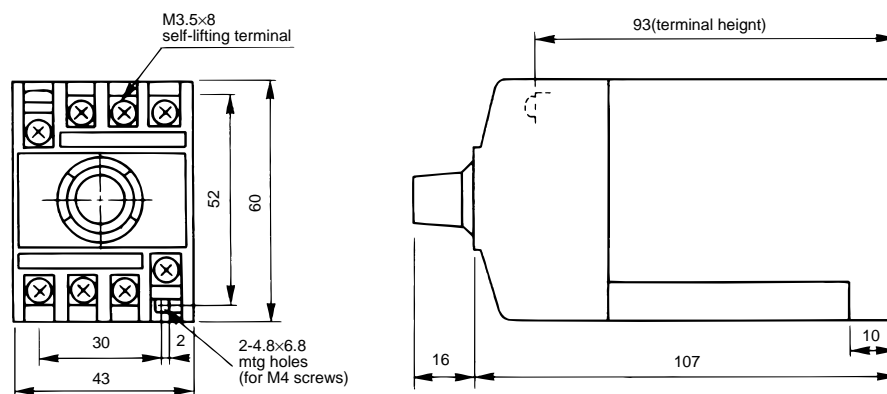
Note: 1. Repetitive operation accuracy (%) = $\pm \frac{1}{2} \times \frac{\text{max. measurement} - \text{min. measurement}}{\text{max. scale value}} \times 100$.

■ Wiring precautions

Fig 4.2.2



■ Outline dimensions



4.3 Re-Starting Relay



UA-DL2 with PF-08RM

The MITSUBISHI series UA-DL re-starting relays are specially designed for automatic re-starting. When the power recovers from an instantaneous power failure or voltage drop the UA-DL re-starts the stopped equipment or machines.

■ Features

- Easy installation and easy wiring
- Compact design
- Versatility of the control voltage (100VAC & 200VAC)
- Indicator lamp is provided.
- Selectable permissible max. power failure time (1sec. & 2sec.).

--- Type Designation ---

UA-DL2 * AC100/200V

SOCKETS type: PF-08RM/08TM

See page 66

CONTROL VOLTAGE	
Ordering designation	Rated control voltage (50/60Hz)
AC100/200V	100-110/200-220VAC
AC100V	100-110/110-120VAC
AC200V	200-220/220-240VAC

Notes: 1. DC control voltage type is not available.
2. Mark * indicates a blank space.

■ Specifications

● Ratings & characteristics

Table 4.3.1

Output contact arrangement				1 NO
Rated operating current of output contact	Category	110VAC	A	1.5
	AC-15	220VAC	A	1.0
Selection of permissible max. power failure time		sec.		1 and 2
Accuracy	Set permissible power failure time	%		-20 to +50
	Control voltage fluctuation	%		±35
	Ambient temperature change	%		±25
Minimum energizing time		sec.		1
Electrical life		operations		0.5 million
Permissible ambient temperature/humidity		°C/ %RH		-10 to +55/max. 85
Control voltage tolerance		%		85 to 110 (rated control voltage)
Power consumption		VA		3
Vibration resistance		10 to 55Hz	m/s ²	19.6
Shock resistance		10 msec. half sine wave	m/s ²	98
Withstand voltage		VAC		2000 (50/60Hz 1min.)
Insulation resistance		MΩ		min. 100

Note: 1. When shipping, permissible power failure is set to 2 secs.

When the required re-setting time is 1 sec., please turn the time setting dial to left until it stops.

When you want the permissible power failure time longer than 2 sec., please consult with MITSUBISHI.

● Connection diagrams

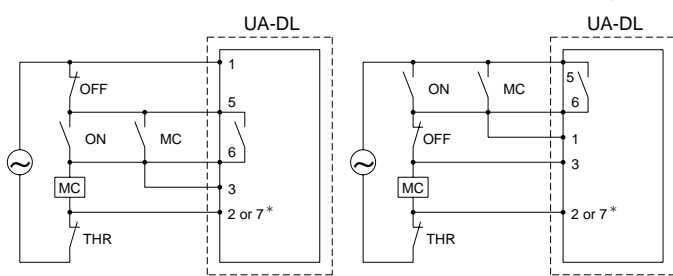


Fig. 4.3.1

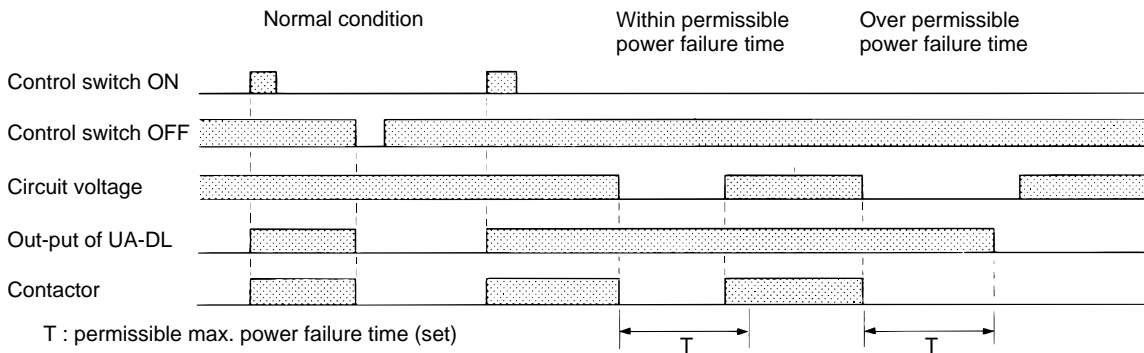
* Selection table of terminals

Control voltage	AC100/200V	AC100V	AC200V
Terminal No.			
2	100-110VAC	100-110VAC	200-220VAC
7	200-220VAC	110-120VAC	220-240VAC

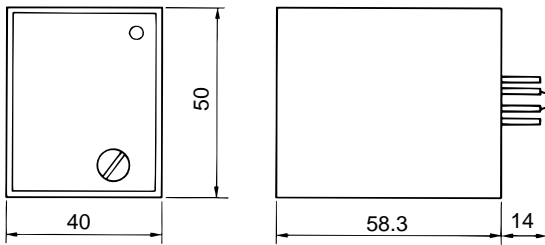
Connection of control switch differs in the above 2 connection diagrams.

● Operation characteristics

Fig. 4.3.2

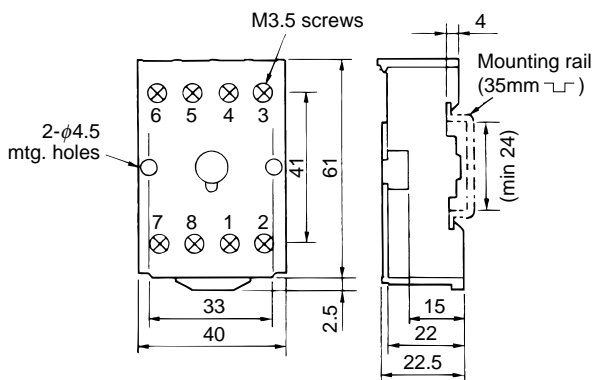


■ Outline Dimensions

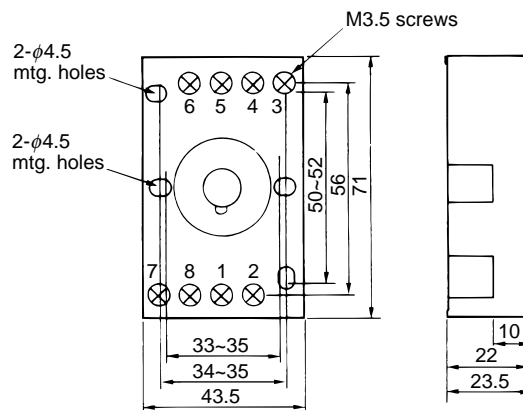


UA-DL2 (Mass: 0.1kg)

Note: 2 pcs of locking springs are enclosed in the each package of UA-DL.



PF-08RM (Mass: 0.05kg)



PF-08TM (Mass: 0.05kg)

4.4 Solid State Time Delay Relays

Series SRS-H



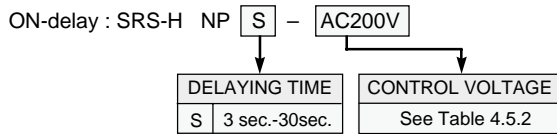
SRS-HNPS

The MITSUBISHI series SRS-H solid state time delay relays are specially designed for high accuracy and easy mounting.

Features

- High accuracy
- Compact design
- High reliability
- Easy mounting (for direct panel mounting or mounting on 35mm rail)
- With finger protection (terminal cover) model is available
- 1 delayed & 1 instantaneous changeover contact for ON-delay relay.

Type Designation



Specifications

Time delay selection

Table 4.5.1

Relay type		Adjustable time range	Contacts
ON-delay	SRS-HNPS	3 sec. - 30 sec.	1 delayed and 1 instantaneous changeover

Control voltages

Table 4.5.2

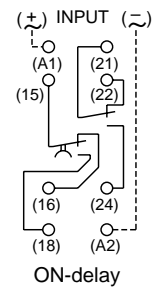
Ordering designation	Rated voltage
AC100V	100-120V 50/60Hz
AC200V	200-240V 50/60Hz
AC400V	380-440V 50/60Hz

Rating & characteristics

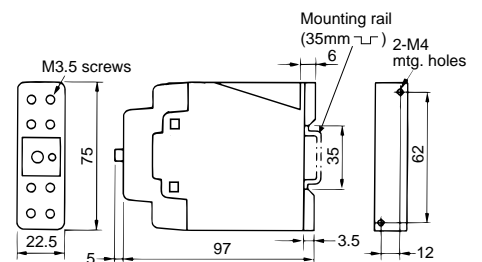
Table 4.5.3

Type		ON-delay		
Conventional free air thermal current		A	2	
Rated operating current	Category	120VAC	A	
	AC-15	240VAC	A	
		440VAC	A	
Accuracy	Repetitive operation	%	±0.5	
	Control voltage fluctuation	%	±1	
	Ambient temperature change	%	±5	
Minimum pause time		msec.	100	
Mechanical life		operations	10 million	
Electrical life		operations	0.1 million	
Permissible ambient temperature		°C	-10 to 55	
Permissible ambient relative humidity		%RH	45 to 80	
Control voltage tolerance		%	85 to 110 (rated control voltage)	
Power consumption	Control voltage	AC	VA	5 (AC100V/AC200V)
				10 (AC400V)
Vibration resistance		10-55Hz	m/s ²	19.6
Shock resistance		10msec half sine wave	m/s ²	49
Withstand voltage		[live parts to ground]	VAC	2000 (1 min.)

Internal wiring



Outline Dimensions



SRS-HNPS (Mass: 0.15kg)

4.5 Pneumatic Time Delay Relays

Series SRT-N

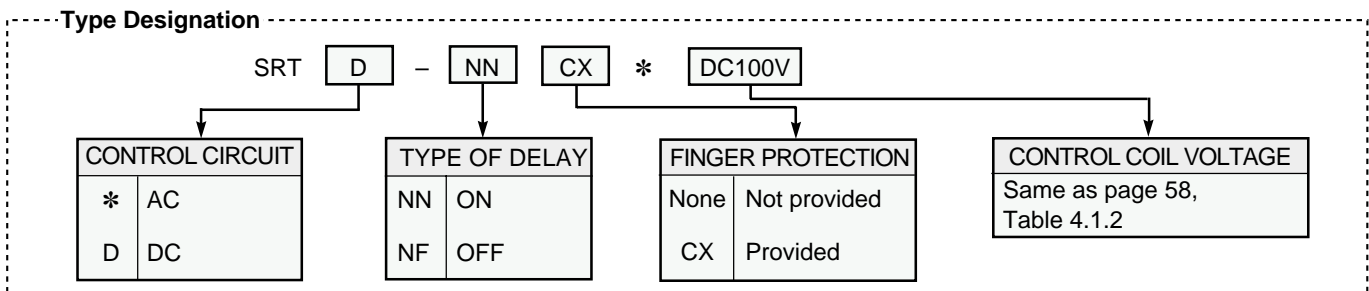


The MITSUBISHI series SRT pneumatic time delay relays are designed for general purpose time delaying, such as star-delta starters and transfer panels.

■ Features

- Easy delaying time adjustment
- Can be mounted on 35mm rail
- High contact reliability: By using bifurcated moving contacts, contact performance has been made more reliable than ever.
- Finger protected types are available
- Manual testing
- 2 delayed contacts (1NO1NC) & 4 instantaneous contacts (2NO2NC)

SRT-NN



Note: Mark * indicates a blank space.

■ Specifications

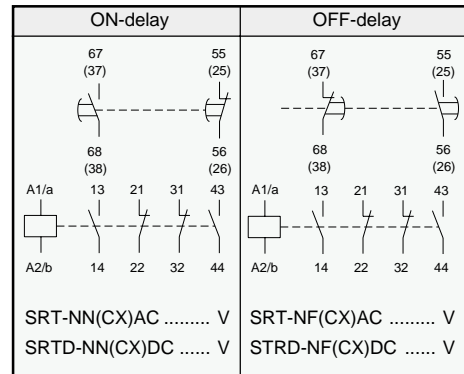
● Ratings & characteristics

Table 4.6.1

Adjustable delay time range		sec.	0.1 to 60	
Type of contacts		-	Delayed	Instantaneous
Conventional free air thermal current I _{th}		A	10	16
Rated operating current	category	110VAC	5	6
		220VAC	3	5
	AC-15	440VAC	1	3
		550VAC	1	3
	category	110VAC	6	16
		220VAC	4	12
AC-12	440VAC	1.5	5	
	550VAC	1.5	5	
category	24VDC	A	1	5
	48VDC	A	0.5	3
	110VDC	A	0.3	0.8
DC-13	220VDC	A	0.15	0.2
	category	24VDC	A	2
DC-12	48VDC	A	1	8
	110VDC	A	0.6	5
	220VDC	A	0.3	1
Rated insulation voltage		VAC	660	
Mechanical life		operations	1 million	
Electrical life		operations	1 million	0.5 million
Repeat accuracy		%	±10	
Min. pause time		msec.	500	
Min. energizing time	AC operated	msec.	15	
	DC operated	msec.	30	
Permissible ambient temperature		°C	-5 to 55	
Control coil voltage tolerance		%	85 to 110	
Make and break capacity (at rated operating current)	AC	times	11	
	DC	times	2	
Average operating times	AC operated	Make	msec.	11
		Break	msec.	10
	DC operated	Make	msec.	45
		Break	msec.	10
Coil consumption	AC operated	Inrush	VA	50
		Sealed	VA	10
	DC operated	W	7	
Switching frequency		operations /hour	1,800	
Vibration resistance		10-55Hz	m/s ²	19.6
Shock resistance 10msec. half sine wave			m/s ²	49
Conductor size			mm ²	1.0 to 2.5

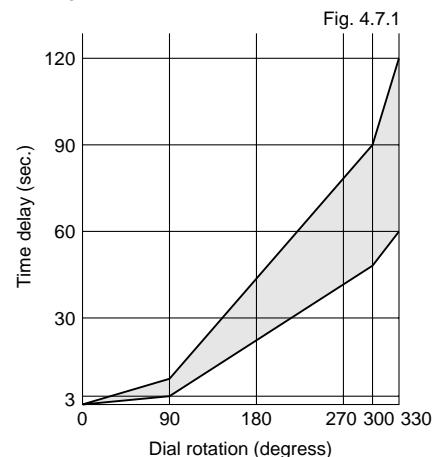
■ Contact arrangement

Table 4.6.2



- Notes: 1. 13-14,43-44 Instantaneous NO contacts
 23-24,33-34 Instantaneous NC contacts
 55-56,65-66 Delayed NC contacts
 57-58,67-68 Delayed NO contacts
 2. Aux. contact block should not be mounted.

● Delay time characteristics

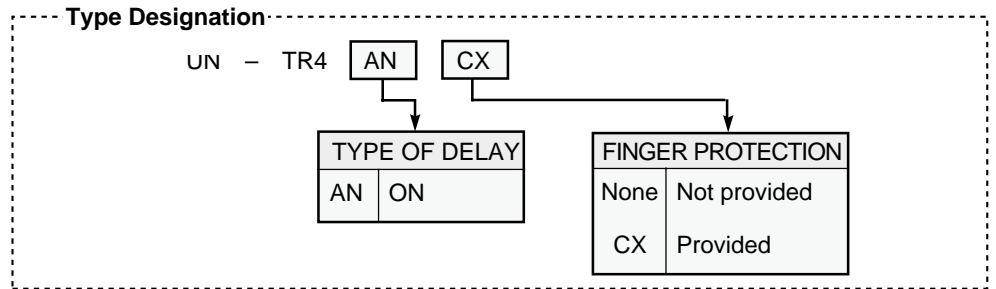


Pneumatic Time Delay Modules



UN-TR4AN

Type UA-TR pneumatic time delay modules are designed for attachment to series S-K contactors and SR-K contactor relays.



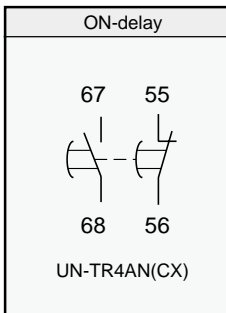
Applicable contactor and relay selection

Table 4.6.3

Type	Type of delay	Applicable contactors and relays	
UN-TR4AN(CX)	ON delay	AC operated	S-N10(CX),N11(CX),N18(CX) SR-N4(□□)(CX)
		DC operated	SD-N11(CX) SRD-N4(□□)(CX)

Note: When this module is mounted, aux. contact block should not be mounted.

Contact arrangement



Note: 55-56 Delayed NC contacts
67-68 Delayed NO contacts

Ratings & characteristics

..... See delayed contacts of Table 4.7.1

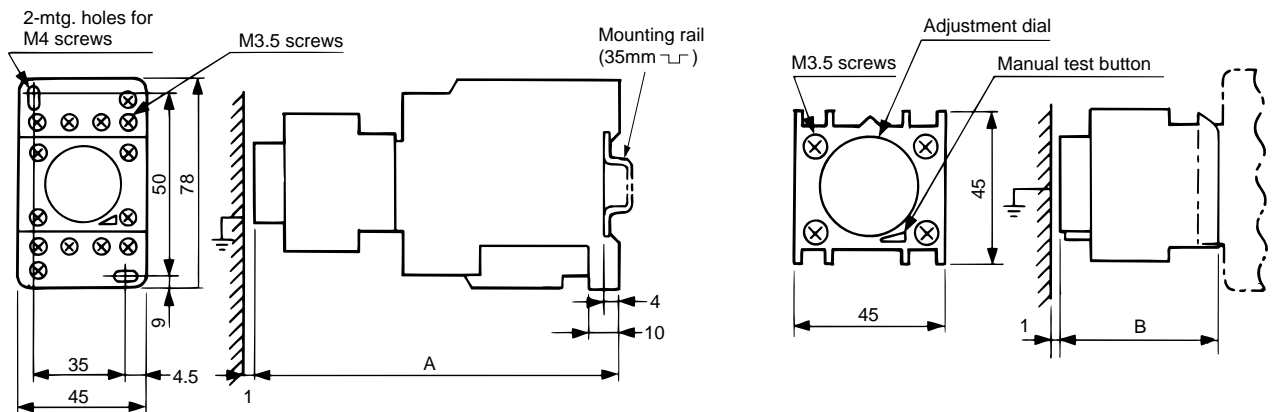
Delay time characteristics

..... See Fig.4.7.1

Key to Dimensions

Type	A	B	Mass(kg)
SRT-NN(CX), -NF(CX)	121.5	-	0.36
SRTD-NN(CX), -NF(CX)	153.5	-	0.68
UN-TR4AN(CX)	-	48.5	0.06

Outline Dimensions



5. STAR-DELTA STARTERS

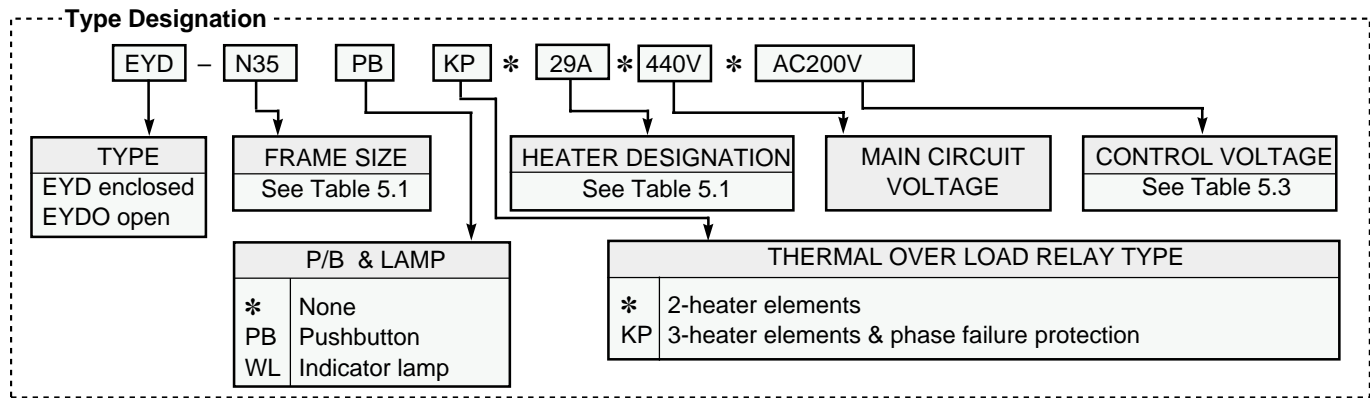
Series EYD-N



EYD-N35

The MITSUBISHI series EYD-N star-delta starters are generally suitable for squirrel-cage motors of 4kW to 250kW which can be started at no-load or reduced load. During starting, the motor is star-connected, reducing current and torque to 1/3 of direct-on-line starting values.

So the voltage drop, due to starting current, can be reduced. Series EYD-N star-delta starters are the simplest and cheapest methods of all reduced-voltage starting methods. Series EYD-N star-delta starters comprise three contactors (for running, delta operation and star operation), one thermal overload relay and one time-delay relay (series SRS-H, solid-state time delay relay). The star-delta changeover time is set to 10 sec when shipped, but is easily adjustable from 3 sec. to 30 sec. The O.L.R. heater is set at the heater designation value (following) when shipped, and be sure to re-set to suit the motor full-load current in the field.



Note: Mark * indicates a blank space

5.1 Selection Table

Table 5.1

Rated 3-phase motor capacity				Star-delta starter Type EYD(O)-	Heater designation A	Setting range A	Components ¹		
220-240VAC		380-440VAC					Running & delta contactors	Star contactor	Thermal O.L.R
kW	HP	kW	HP						
11	15	18.5	25	N20(KP)	35	30~40	S-N20	S-N20	TH-N60(KP)
18.5	25	30	40	N35(KP)	54	43~65	S-N35	S-N20	TH-N60(KP)
22	30	45	60	N50(KP)	82	65~100	S-N50	S-N20	TH-N120(KP)
30	40	55	75	N65(KP)	105	85~125	S-N65	S-N25	TH-N120TA(KP)
45	60	75	100	N80(KP)	125	100~150	S-N80	S-N25	TH-N120TA(KP)
-	-	90	125	N95(KP)	150	120~180	S-N95	S-N35	TH-N220HZ(KP)
55	75	-	-		180	140~220			
62	85	110	150	N125(KP)	180	140~220	S-N125	S-N50	TH-N220HZ(KP)
75	100	132	180	N150(KP)	210	170~250	S-N150	S-N50	TH-N220HZ(KP)
110	150	220	300	N220(KP)	330	260~400	S-N220	S-N65	TH-N400HZ(KP)
160	220	250	340	N300(KP)	500	400~600	S-N300	S-N125	TH-N600(KP) ²

Notes: 1. Time delay relays are all SRS-HNPS.

2. TH-N600(KP) and current transformer, CW-15L or CW-15LM (by MITSUBISHI).

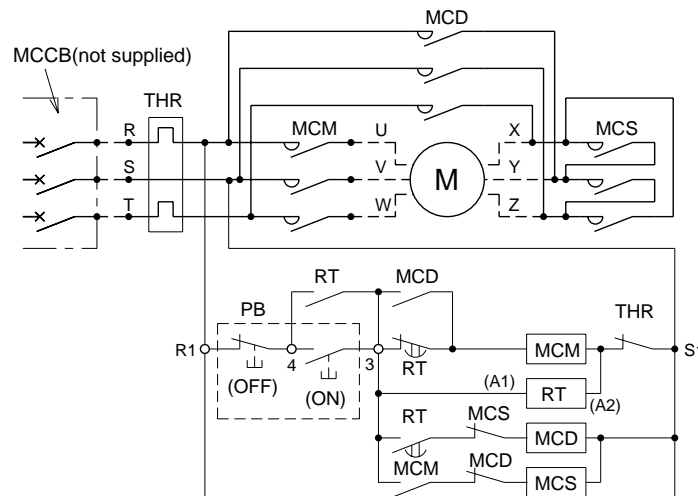
5.2 Specifications

• Characteristics

Table 5.2

Item	Frame size	N20	N35	N50	N65	N80	N95	N125	N150	N220	N300
Mechanical life	operations	1 million									
Electrical life	operations	0.25 million									
Permissible and temp.	°C	-25 to 55									
Coil consumption											
At star connection	VA	35	33	35		40		48	66	85	
At delta connection	VA	35	31	39		49		57	93	113	
Coil voltage tolerance	%	85 to 110(rated coil voltage)									
Conductor size											
Line side	mm ²	4-16	4-25	6-35	10-50	10-70	16-95	16-120	16-150	16-210	70-300
Motor side	mm ²	2.5-6	2.5-10	4-25	4-25	6-35	6-35	10-70	16-95	16-150	35-200
Control terminal	mm ²	1-2.5	1-2.5	1-2.5	1-2.5	1-2.5	1-2.5	1-2.5	1-2.5	1-2.5	1-2.5

• Connection



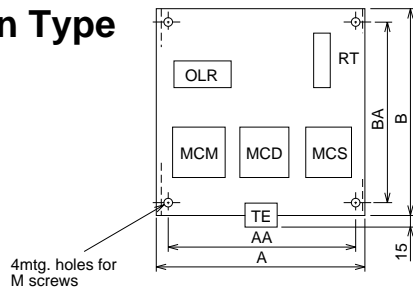
• Control Voltage

Table 5.3

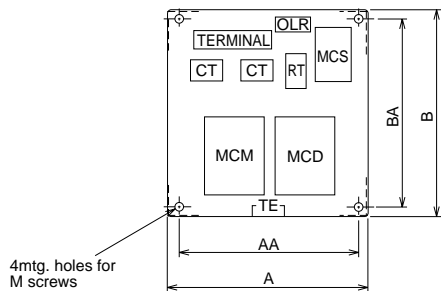
Control voltage designation	EYD(O)-N20(KP)to N95(KP)		EYD(O)-N125(KP)to N300(KP)	
	Rated voltage		Control voltage designation	Rated voltage 50Hz/60Hz
	50Hz	60Hz		
AC100V	100V	100-110V	AC100V	100-120V
AC120V	110-120V	115-120V	AC200V	200-240V
AC220V	208-220V	220V	AC400V	380-440V
AC230V	220-240V	230-240V		
AC380V	380V	380V		
AC400V	380-415V	400-440V		
AC415V	380-415V	400-440V		
AC440V	415-440V	460-480V		

5.3 Outline Dimensions

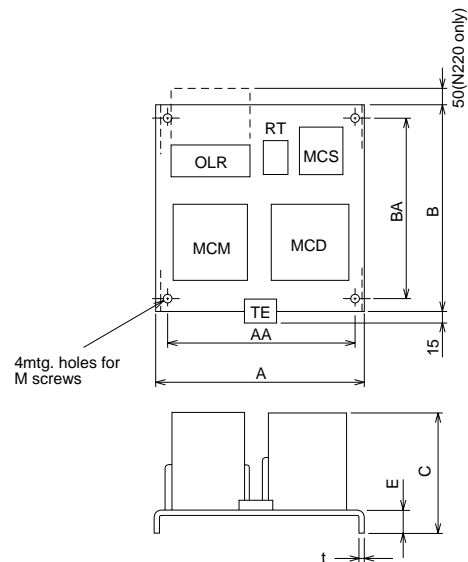
5.3.1 Open Type



Type EYDO-N20, N35



Type EYDO-N300, N400



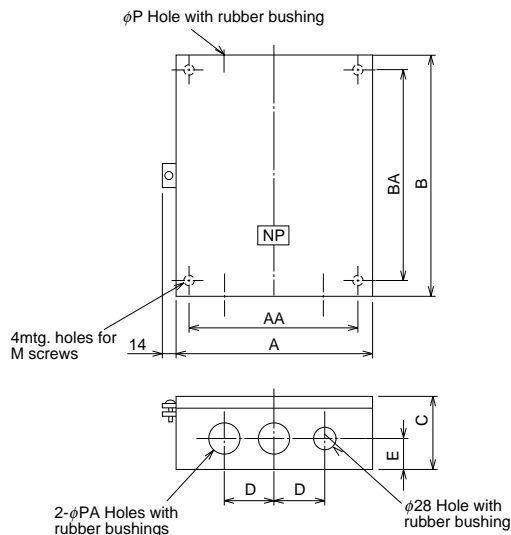
Type EYDO-N50~N220

● Dimensions

Table 5.4

Type	A	B	C	AA	BA	E	M	t	Mass (kg)
EYDO-N20	230	220	114	200	200	12	M6	2.3	4
EYDO-N35	270	270	114	250	250	12	M6	2.3	5
EYDO-N50	270	270	118	250	250	12	M6	2.3	5.5
EYDO-N65	270	270	118	250	250	12	M6	2.3	5.5
EYDO-N80	270	270	140	250	250	12	M6	2.3	7
EYDO-N95	380	430	180	350	400	15	M8	3.2	11
EYDO-N125	380	430	180	350	400	15	M8	3.2	13
EYDO-N150	380	430	189	350	400	15	M8	3.2	14
EYDO-N220	380	430	189	350	400	15	M8	3.2	21
EYDO-N300	600	600	210	550	550	15	M12	3.2	42
EYDO-N400	600	600	210	550	550	15	M12	3.2	42

5.3.2 Enclosed Type

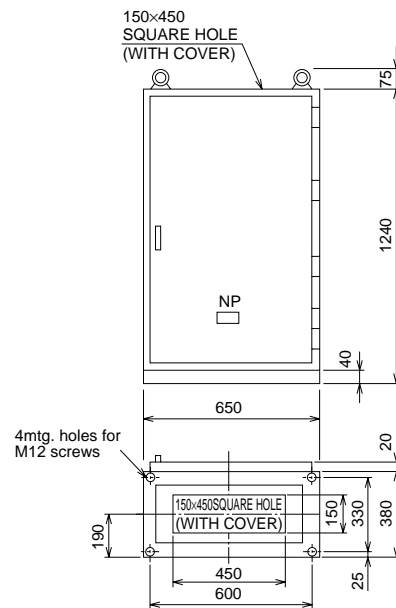


Type EYD-N20~N220

● Dimensions

Table 5.5

Type	A	B	C	AA	BA	D	E	M	P	PA	Mass (kg)
EYD-N20	260	360	165	200	300	75	60	M6	40	28	7
EYD-N35	310	460	165	250	400	75	60	M8	52	40	9
EYD-N50	310	460	165	250	400	75	60	M8	52	40	10
EYD-N65	310	460	165	250	400	75	60	M8	52	40	10
EYD-N80	310	460	165	250	400	75	60	M8	52	40	12
EYD-N95	460	660	225	400	600	125	80	M12	78	62	24
EYD-N125	460	660	225	400	600	125	80	M12	78	62	26
EYD-N150	460	660	225	400	600	125	80	M12	78	62	28
EYD-N220	460	660	225	400	600	125	80	M12	78	62	34



Type EYD-N300, N400 (Mass 120kg)

6. SOLID STATE CONTACTORS

Series **US-K**



6.1 Features

Ideal for heavy duty applications

The contactor contains no moving parts, so its reliability and long life are assured even in high cycling applications.

Silent operation

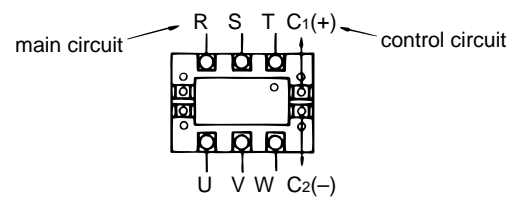
Since the contactor has no moving part, noise is eliminated.

Completely insulated power circuit

The power circuit elements are electrically insulated from the heatsink. No insulation of the heatsink is required.

Easy connection

Up-front wiring.



Built-in surge absorber

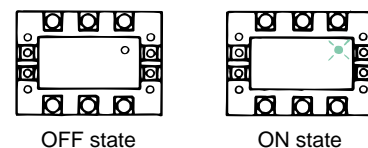
Surge absorbers are built-in for protection of the power circuit elements from line surges.

Indicator lamp shows operating condition









Front-mounted for clear indication of operational state.

Compact size

The contactor consists of a small size body and heatsink.



6.2 Product Scope.

	Item		Kinds and Ratings					
	Rated operational current (AC-1)		5	8	15	20		30
200Vac Class (100 to 240Vac)	Heater capacity(kw)	1 ϕ 200V	1	1.6	3	4	4	6
		3 ϕ 200V	1.7	2.7	5.2	6.9	6.9	10.3
	Maximum motor capacity(kw)		0.4	0.4	1.5	2.2	2.2	3.7
	Three phase control type							
	Individual high power control type							
400Vac Class 200 to 440Vac	Rated operational current (AC-1)						20	30
	Heater capacity(kw)	1 ϕ 400V					8	12
		3 ϕ 400V					13.8	20.7
	Maximum motor capacity(kw)						3.7	7.5
	Three phase control type							
Individual high power control type								
Options	Driving unit				UA-DR15 <input type="checkbox"/> UA-DR1 <input type="checkbox"/>			
	Driving unit with aux,output		UA-SH8 <input type="checkbox"/>		UA-SH15 <input type="checkbox"/> UA-SH1 <input type="checkbox"/>			
	Aux. output unit							
	Reversing unit							
	Fault detecting unit							
	Power control unit							
Mounting on 35mm rail								





	Item		Kinds and Ratings					
	Rated operational current (AC-1)		5	8			20	30
200Vac Class 100 to 240Vac	Heater capacity(kw)	1 ϕ 200V	1	1.6			4	6
		3 ϕ 200V	1.7	2.7			6.9	10.3
	Individual low power control type							
Option	Power control unit		UA-PC <input type="checkbox"/>					
Mounting on 35mm rail								

Table 6.1

























Kinds and Ratings							
40	50	70	80	100	120	150	200
8	10	14	16	20	24	30	40
13.8	17.3	24.2* ¹	27.7	34.6* ¹	41.5	52* ¹	69* ¹
5.5	5.5	11* ¹	11	15* ¹	15	18.5* ¹	22* ¹
							
US-K40SS US-K40SSTE	US-K50SS US-K50SSTE	US-K70NS US-K70NSTE	US-K80NS US-K80NSTE	US-K100TE	US-K120TE	US-K150TE	
							
		US-K70		US-K100		US-K150	US-K200
40	50	70	80	100	120	150	200
16	20	28	32	40	48	60	80
27.7	34.6	48.5* ¹	55.4	69.3* ¹	83	103.9* ¹	138.5* ¹
7.5	15	22* ¹	22	30* ¹	30	37* ¹	45* ¹
							
US-KH40SS US-KH40SSTE	US-KH50NS US-KH50NSTE	US-KH70NS US-KH70NSTE	US-KH80NS US-KH80NSTE	US-KH100TE	US-KH120TE	US-KH150TE	
							
		US-KH70		US-KH100		US-KH150	US-KH200
UA-DR1 <input type="checkbox"/>							
UA-SH1 <input type="checkbox"/>							
UA-AXUS							
UA-RE <input type="checkbox"/>							
UN-FD* ² · UN-FD4* ³							
UA-PC <input type="checkbox"/>							

Table 6-2

Kinds and Ratings	
40	50
8	10
13.8	17.3
	
US-K40DD US-K40DDTE	US-K50DD US-K50DDTE
UA-PC <input type="checkbox"/>	

Notes: 1. It shows the capacity in condition of combined two or three contactors for three phase circuits.

2. Applicable main circuit voltage is 200 to 240 Vac only.

3. Applicable main circuit voltage is 380 to 440 Vac.

MITSUBISHI ELECTRIC WORLDWIDE SALES NETWORK

Country/Region	Company name and address	Telephone
Australia	Mitsubishi Electric Australia Pty., Ltd., 348 Victoria Road, P.O. Box 11, Rydalmere NSW 2166, Australia	612-9684-7245
Belgium	Emac S.A., Industrialaan 1, 1702 Groot-Bijgaarden, Belgium	32-2-4810211
Chile	Rhona S.A., Vte. Agua Santa 4211 Casilla (P.O. Box) 30-D Viña Del Mar, Chile	032-610896
China	Setsuyo Auschina Electric Co. Ltd., Innobation Center Bldg., Room No. 406A Guiping Road, Shanghai, China	021-6495-6611
	Ryoden International Ltd., (Shanghai), Flat G, H, J, 4F Jin Ming Bldg., Block 2.8, Zun Yi Road South, Shanghai, China	021-6275-8377
Colombia	Proelectrico Ltda., Carrera 43G No. 27-12, P.O. Box 4346, Medellin, Colombia	2322300
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Egypt	Cairo Electrical Group 9, Rostoum Street, Appt #5 Garden City, P.O. Box 165-11516, MAGLIS AL-SHAAB, Cairo, Egypt	20-2-7961337
Germany	Mitsubishi Electric Europe B.V., German Branch, Gother Strasse 8, 40880 Ratingen, Germany	49-2102-4860
Greece	Drepanias Anton S.A., Lenormanman Str. 193, 104 42 Athens, Greece	30-15-141910
Hong Kong	Ryoden international Ltd., 10/F Manulife Tower, 169 Electric Road, North Point, Hong Kong	28878870
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Italy	Carpaneto 10090 Cascine Vica-Rivoli (To), Via Ferrero, 10-Ang. Pavia 6 Italy	39-11-9590111
Korea	STC Techno Seoul Co., Ltd. (Setsuyo), 2Fl. Dong Seo Game Channel Bldg. 660-11, Deungchon-Dong, Kanguseo-Gu, Seoul, Korea	02-3664-8333
Kuwait	Salem M Al-Nisf Electrical Co. W.L.L., P.O. Box 871, Safat, Kuwait	710036
Lao PDR	Societe Lao Import-Export, 43-47 Lane Xang Road, P.O. Box 2789, VT Vientiane, Lao PDR	21-215043, 21-215110
Lebanon	Comptoir d'Electricite Generate-Liban, Cebaco Center-Block A, Autostrade Dora, P.O. Box 11-2597, Beirut, Lebanon	961-1-240445
Myanmar	Peace Myanmar Electric Co., Ltd., No. 216, Bo Aung Gyaw Street, Botataung 11161, Yangon, Myanmar	951-295426
Nepal	Wait & Vol1 House Co., Ltd., KHA 2-65, Volt House Dilli Bazar, P.O. Box 2108, Kathmandu, Nepal	977-1-411330
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New Zealand	Melco Sales (N.Z.) Ltd., 1 Parliament Street, Lower Hut1, New Zealand	644-569-7350
Norway	SCANELECAS, 5074 Godvik Leirvikasen 43B, Norway	47-55-506000
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Poland	MPL Technology Sp Zo.o., Ul, Wroclawska 53, 30011 Krakow, Poland	48-12-322885
Saudi Arabia	Center of Electrical Goods, Al-Nabhaniya Street-4th Crossing Al-Hassa Road, P.O. Box 15955, Riyadh 11454, Saudi Arabia	966-1-4770149
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Sweden	Euro Energy Components AB, Energigatan 15 S-43422 Kungsbacka Sweden	(0)300-51800
Switzerland	Trietec A G., Mühlenstrasse 136, 8200 Schaffhausen, Switzerland	41-52-6258425
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U.S.A	Mitsubishi Electric Automation, Inc., 500 corporate Woods Parkway	847-478-2100
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Venezuela	Adesco C.A., Apartado de Correos 78034 Caracas 1074A, Venezuela	2422348
Vietnam	Sa Giang Techno Co., Ltd. (Setsuyo), 207 Nguyen Van Thu St., Dist 1 HCMC, Vietnam	848-821-5450

Safety tip: Be sure to read the instruction manual thoroughly before using these products.

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