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Industrial Automation Headquarters

Delta Electronics, Inc.
Taoyuan Technology Center
No.18, Xinglong Rd., Taoyuan District,
Taoyuan City 33068, Taiwan
TEL: 886-3-362-6301 / FAX: 886-3-371-6301

Asia

Delta Electronics (Shanghai) Co., Ltd.
No.182 Minyu Rd., Pudong Shanghai, P.R.C.
Post code : 201209
TEL: 86-21-6872-3988 / FAX: 86-21-6872-3996
Customer Service: 400-820-9595

Delta Electronics (Japan), Inc.
Tokyo Office
Industrial Automation Sales Department
2-1-14 Shibadaimon, Minato-ku
Tokyo, Japan 105-0012
TEL: 81-3-5733-1155 / FAX: 81-3-5733-1255

Delta Electronics (Korea), Inc.
Seoul Office
1511, 219, Gasan Digital 1-Ro., Geumcheon-gu,
Seoul, 08501 South Korea
TEL: 82-2-515-5305 / FAX: 82-2-515-5302

Delta Energy Systems (Singapore) Pte Ltd.
4 Kaki Bukit Avenue 1, #05-04, Singapore 417939
TEL: 65-6747-5155 / FAX: 65-6744-9228

Delta Electronics (India) Pvt. Ltd.
Plot No.43, Sector 35, HSIIDC Gurgaon,
PIN 122001, Haryana, India
TEL: 91-124-4874900 / FAX : 91-124-4874945

Delta Electronics (Thailand) PCL.
909 Soi 9, Moo 4, Bangpoo Industrial Estate (E.P.Z),
Pattana 1 Rd., T.Phraksa, A.Muang,
Samutprakarn 10280, Thailand
TEL: 66-2709-2800 / FAX : 662-709-2827

Delta Energy Systems (Australia) Pty Ltd.
Unit 20-21/45 Normanby Rd., Notting Hill Vic 3168, Australia
TEL: 61-3-9543-3720

Americas

Delta Electronics (Americas) Ltd.
Raleigh Office
P.O. Box 12173, 5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3813 / FAX: 1-919-767-3969

Delta Greentech (Brasil) S/A
São Paulo Office
Rua Itapeva, 26 – 3˚ Andar - Bela Vista
CEP: 01332-000 – São Paulo – SP - Brasil
TEL: 55-11-3530-8642 / 55-11-3530-8640

Delta Electronics International Mexico S.A. de C.V.
Mexico Office
Vía Dr. Gustavo Baz No. 2160, Colonia La Loma,
54060 Tlalnepantla Estado de Mexico
TEL: 52-55-2628-3015 #3050/3052

EMEA

Headquarters: Delta Electronics (Netherlands) B.V.
Sales: Sales.IA.EMEA@deltaww.com
Marketing: Maketing.IA.EMEA@deltaww.com
Technical Support: iatechnicalsupport@deltaww.com
Customer Support: Customer-Support@deltaww.com
Service: Service.IA.emea@deltaww.com
TEL: +31(0)40 800 3800

BENELUX: Delta Electronics (Netherlands) B.V.
De Witbogt 20, 5652 AG Eindhoven, The Netherlands
Mail: Sales.IA.Benelux@deltaww.com
TEL: +31(0)40 800 3800

DACH: Delta Electronics (Netherlands) B.V.
Coesterweg 45, D-59494 Soest, Germany
Mail: Sales.IA.DACH@deltaww.com
TEL: +49(0)2921 987 0

France: Delta Electronics (France) S.A.
ZI du bois Challand 2, 15 rue des Pyrénées,
Lisses, 91090 Evry Cedex, France
Mail: Sales.IA.FR@deltaww.com
TEL: +33(0)1 69 77 82 60

Iberia: Delta Electronics Solutions (Spain) S.L.U
Ctra. De Villaverde a Vallecas, 265 1º Dcha Ed.
Hormigueras – P.I. de Vallecas 28031 Madrid
TEL: +34(0)91 223 74 20

C/Llull, 321-329 (Edifici CINC) | 22@Barcrelona, 08019 Barcelona
Mail: Sales.IA.Iberia@deltaww.com
TEL: +34 93 303 00 60

Italy: Delta Electronics (Italy) S.r.l.
Ufficio di Milano Via Senigallia 18/2 20161 Milano (MI)
Piazza Grazioli 18 00186 Roma Italy
Mail: Sales.IA.Italy@deltaww.com
TEL: +39 02 64672538

Russia: Delta Energy System LLC
Vereyskaya Plaza II, office 112 Vereyskaya str.
17 121357 Moscow Russia
Mail: Sales.IA.RU@deltaww.com
TEL: +7 495 644 3240

Turkey: Delta Greentech Elektronik San. Ltd. Sti. (Turkey)
Şerifali Mah. Hendem Cad. Kule Sok. No:16-A
34775 Ümraniye – İstanbul
Mail: Sales.IA.Turkey@deltaww.com
TEL: + 90 216 499 9910

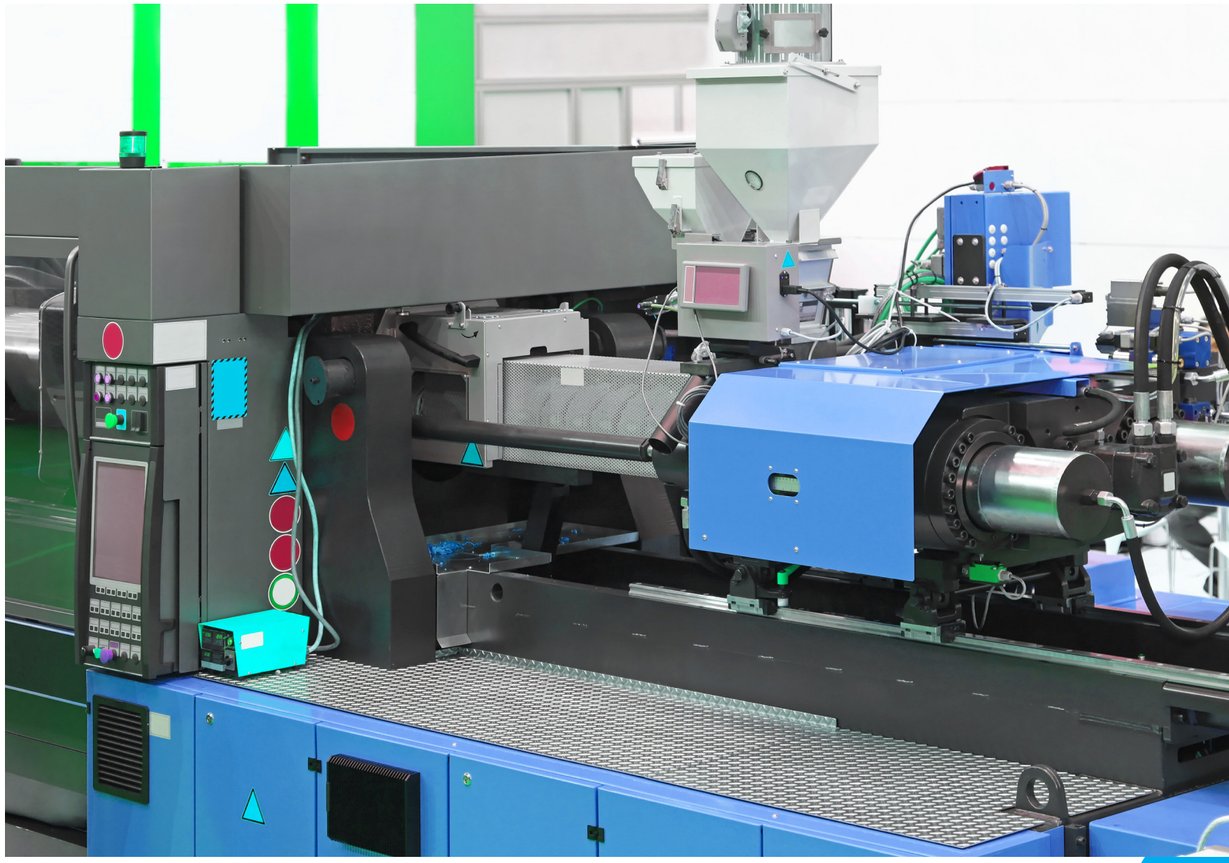
GCC: Delta Energy Systems AG (Dubai BR)
P.O. Box 185668, Gate 7, 3rd Floor, Hamarain Centre
Dubai, United Arab Emirates
Mail: Sales.IA.MEA@deltaww.com
TEL: +971(0)4 2690148

Egypt + North Africa: Delta Electronics
511 Cairo Business Plaza, North 90 street,
New Cairo, Cairo, Egypt
Mail: Sales.IA.MEA@deltaww.com

*We reserve the right to change the information in this manual without prior notice.

DELTA_IA-MDS_VFD-VJ-C_UM_EN_20190805

Delta Hybrid Servo Drive VFD-VJ Series - Air Cooled & Oil Cooled User Manual



Delta Hybrid Servo Drive VFD-VJ Series - Air Cooled & Oil Cooled User Manual

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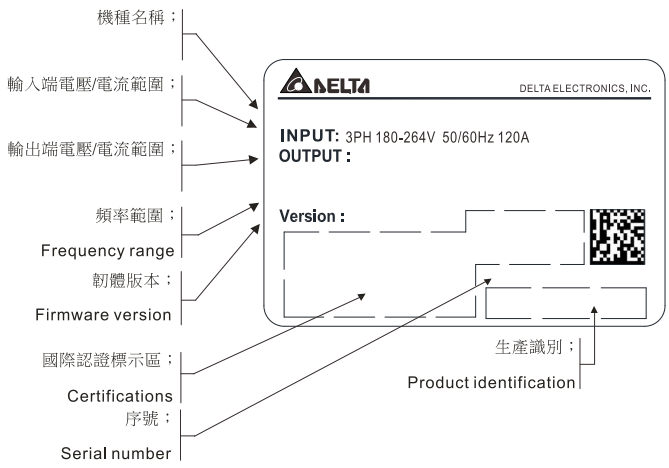
Preface

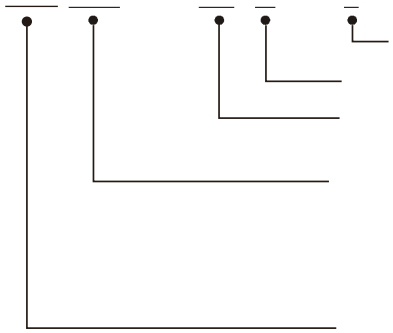
CAUTION

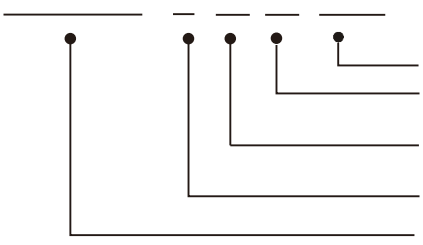
Table of Contents

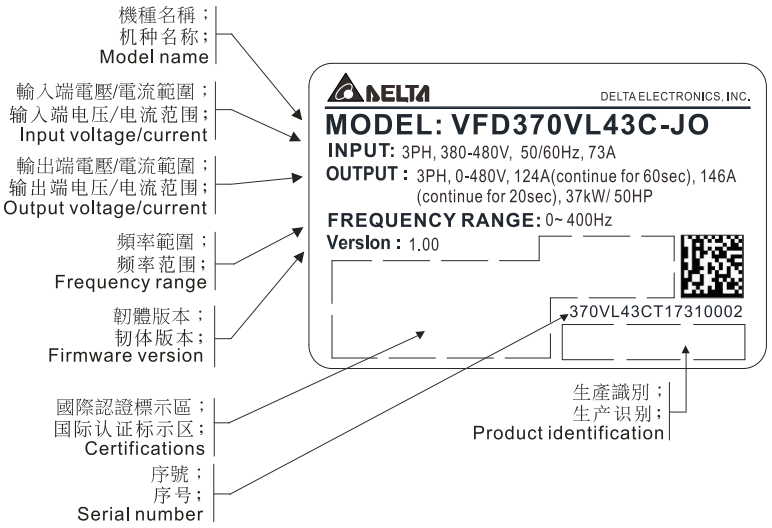
1. Description of Hybrid Servo Drives

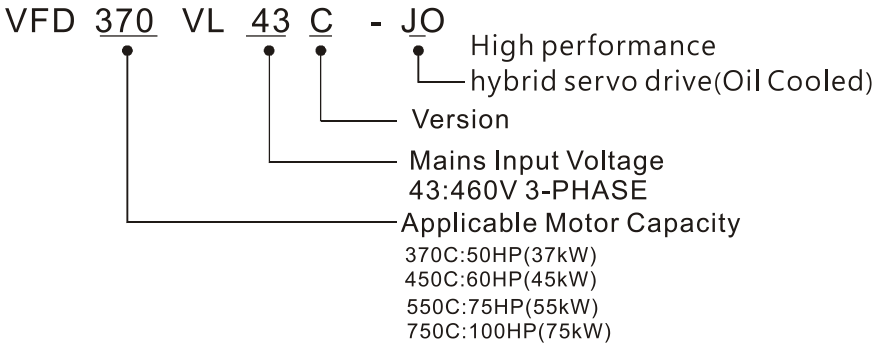
1-1 Receiving and Inspection

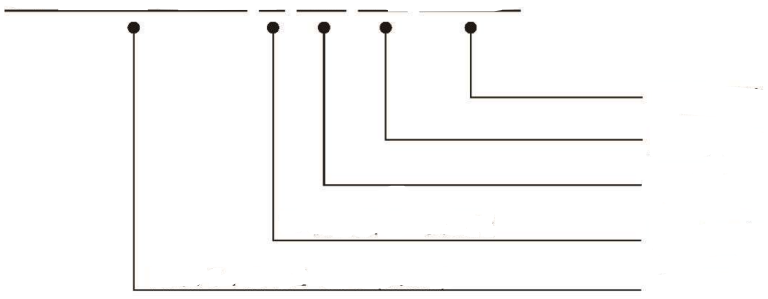







機種名稱；
机种名称；
Model name
輸入端電壓/電流範圍；
输入端电压/电流范围；
Input voltage/current
輸出端電壓/電流範圍；
输出端电压/电流范围；
Output voltage/current
頻率範圍；
频率范围；
Frequency range
韌體版本；
韧体版本；
Firmware version
國際認證標示區；
国际认证标示区；
Certifications
序號；
序号；
Serial number
DELTA ELECTRONICS, INC.
MODEL: VFD370VL43C-JO
INPUT: 3PH, 380-480V, 50/60Hz, 73A
OUTPUT : 3PH, 0-480V, 124A(continue for 60sec), 146A
(continue for 20sec), 37kW/ 50HP
FREQUENCY RANGE: 0~ 400Hz
Version : 1.00
370VL43CT17310002
生產識別；
生产识别；
Product identification


VFD 370 VL 43 C - JO
High performance
hybrid servo drive(Oil Cooled)
Version
Mains Input Voltage
43:460V 3-PHASE
Applicable Motor Capacity
370C:50HP(37kW)
450C:60HP(45kW)
550C:75HP(55kW)
750C:100HP(75kW)



1-2 Product Specifications

Air Cooled VFD-VJ-C 230 series

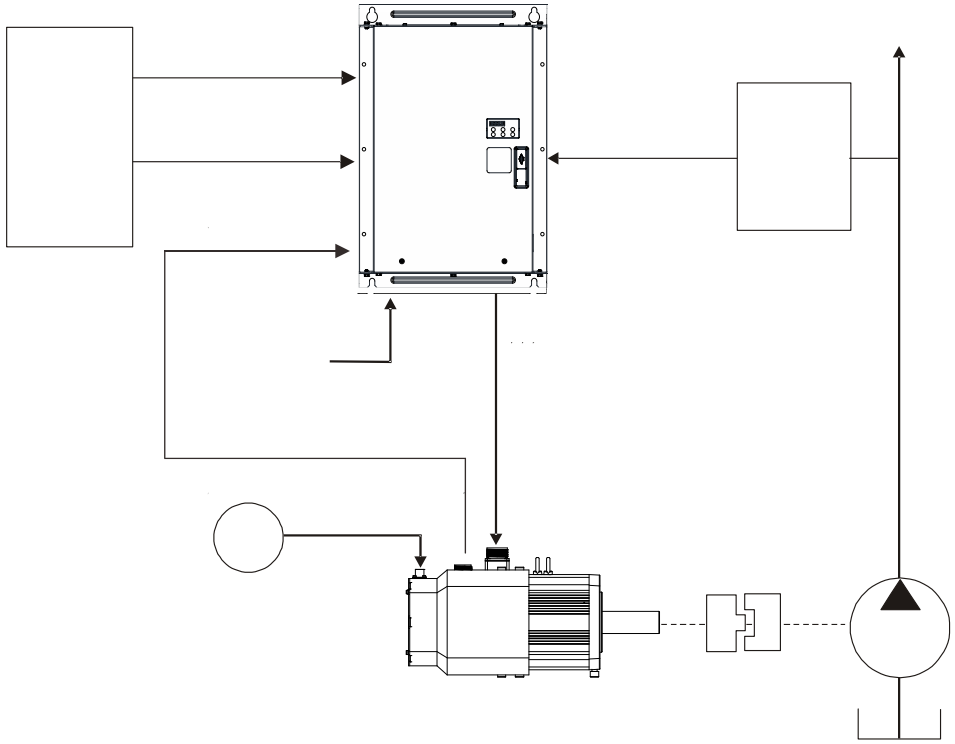
Air Cooled VFD-VJ-C 460V series

General Specifications

		2 channels: 1ch DC 0 ~ 10V and 1ch DC -10 ~ 10V, max. load: 2mA
		CE

We have applied for UL certification and will pass the certification sometime in 2019.

1-3 Overview of Hybrid Servo Systems



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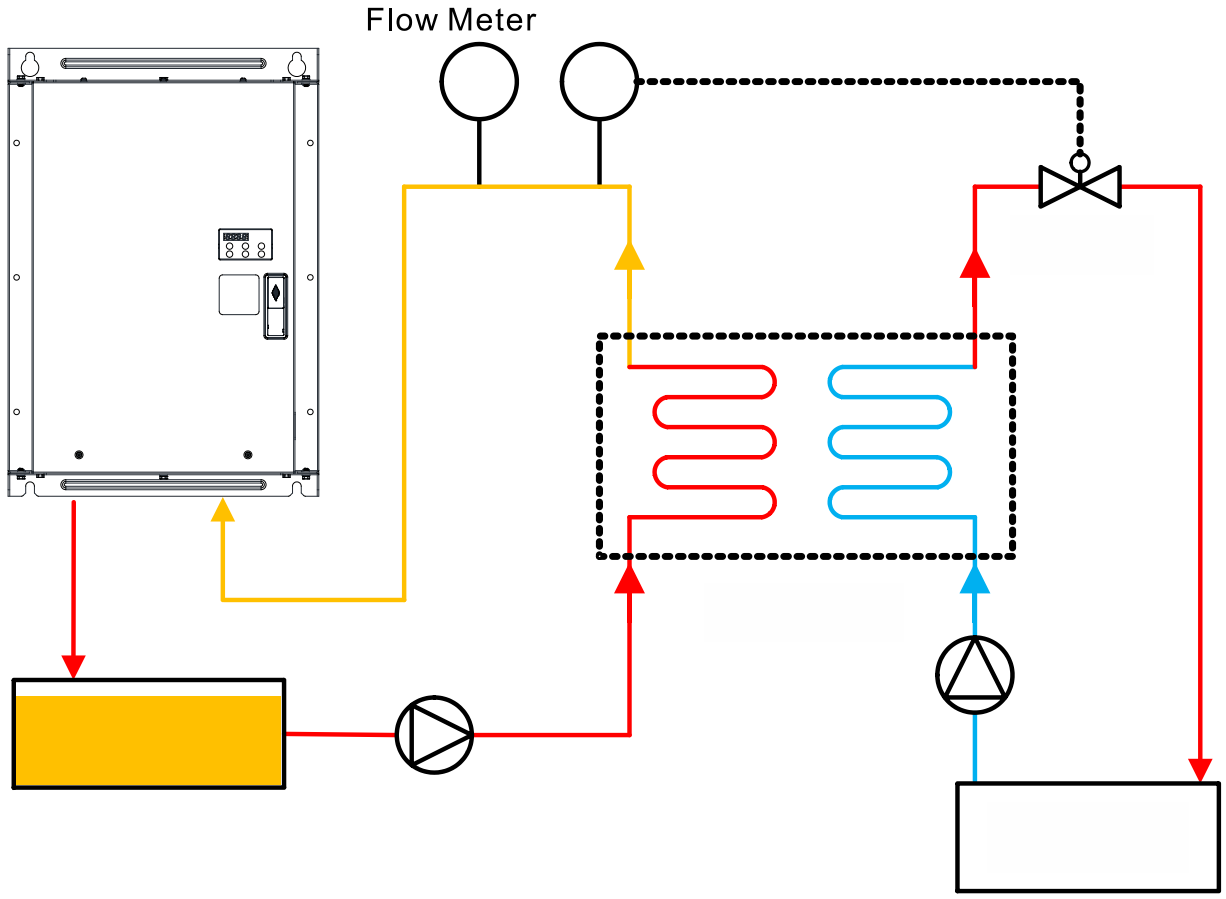
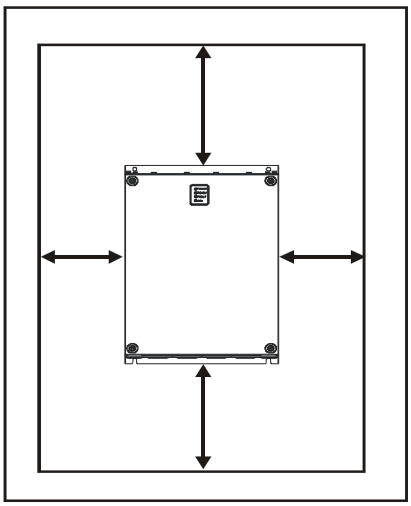
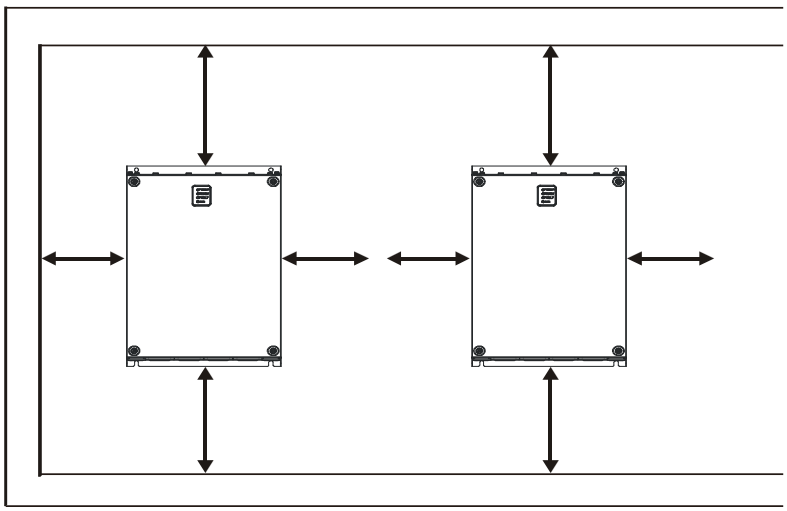
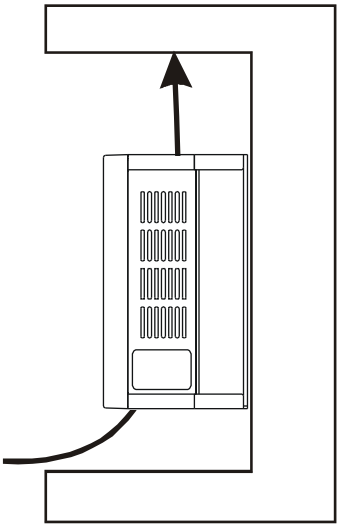
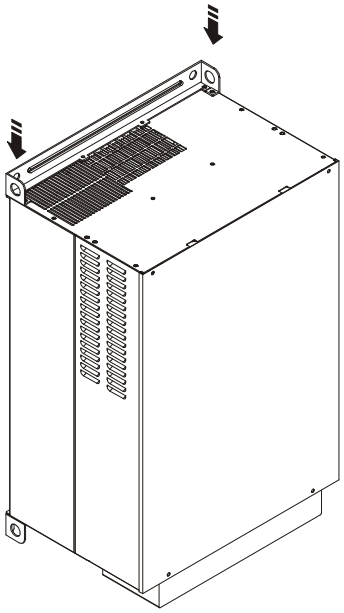
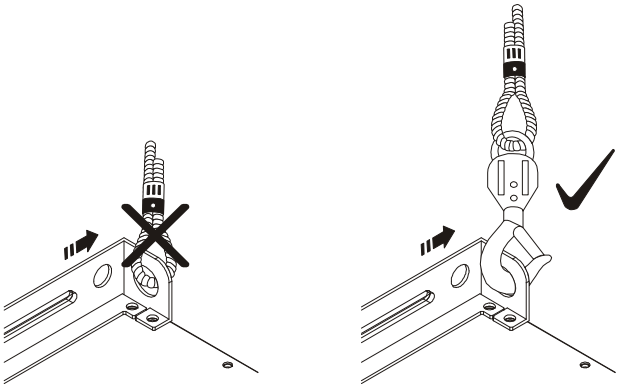


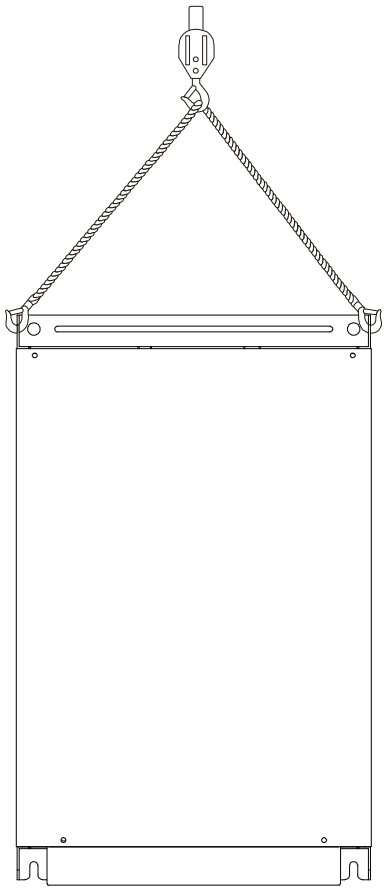


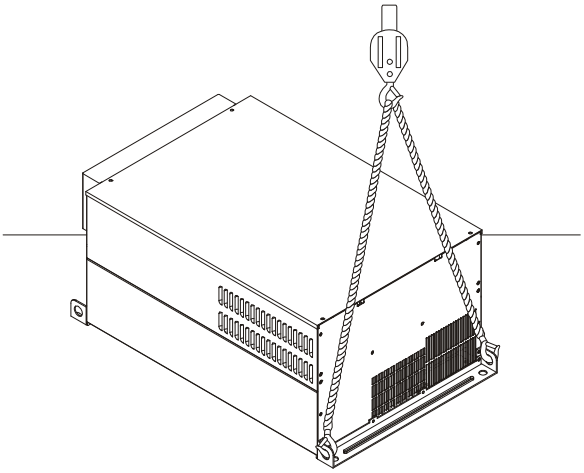


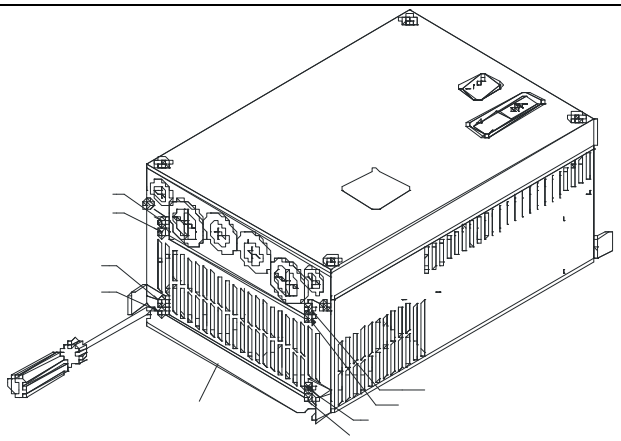


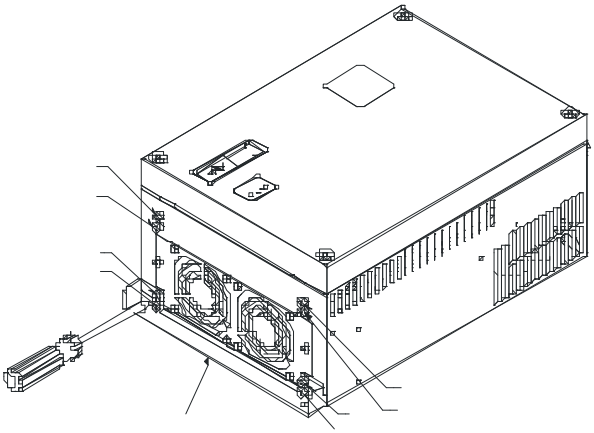


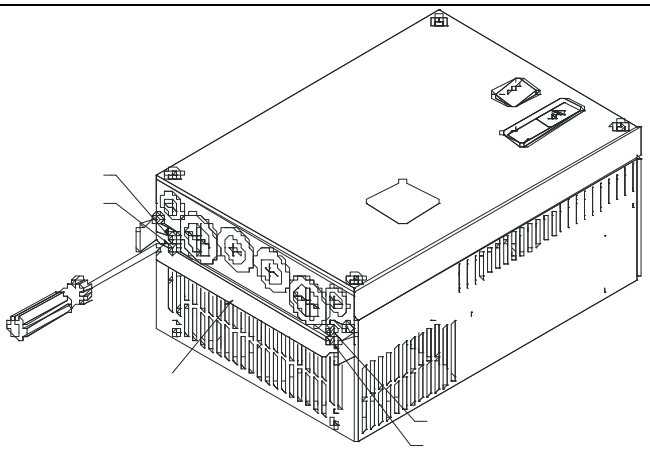


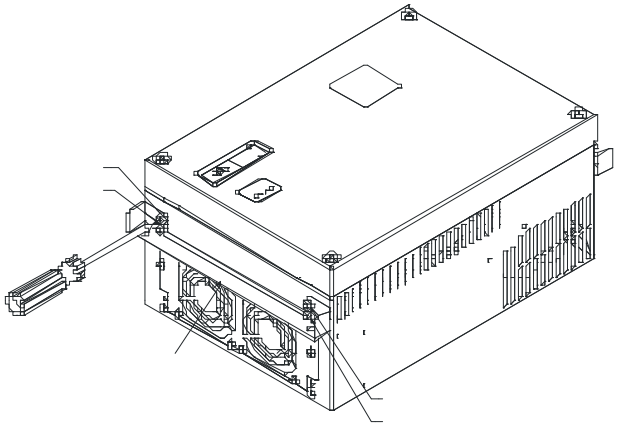


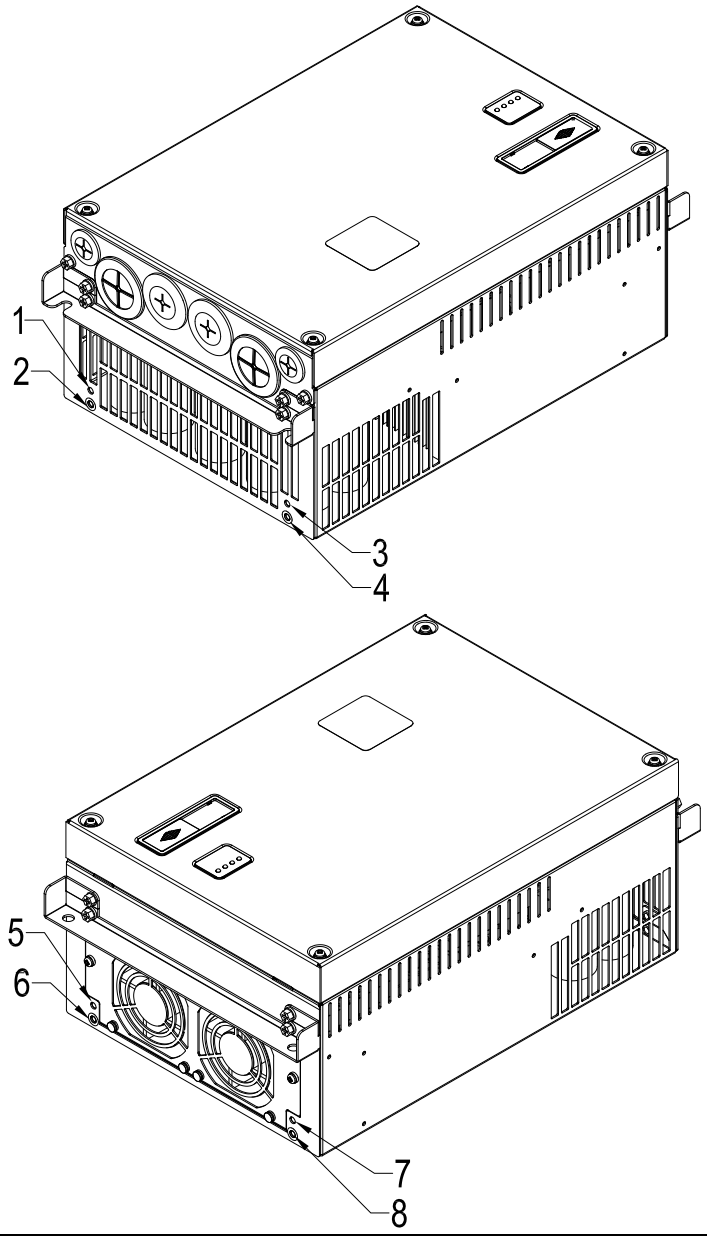




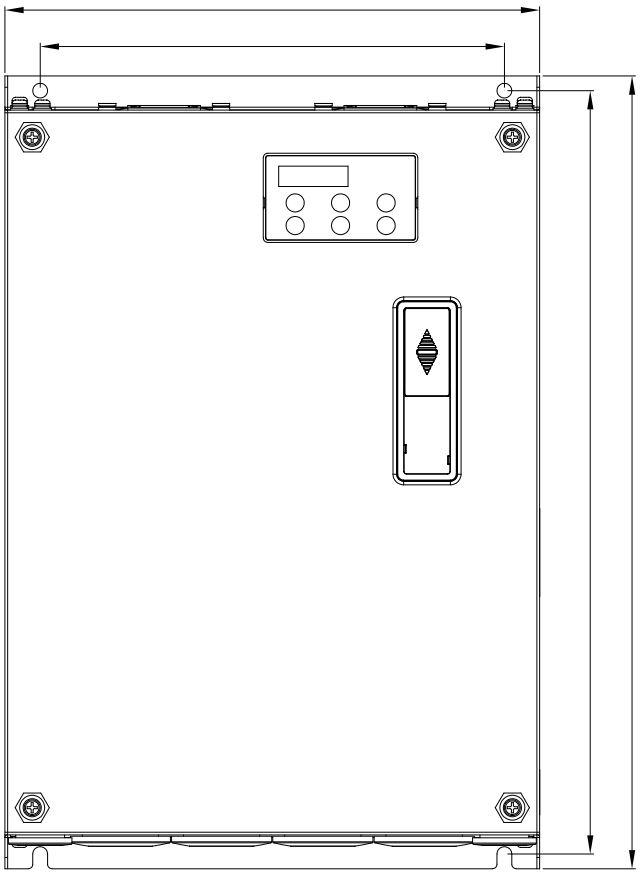


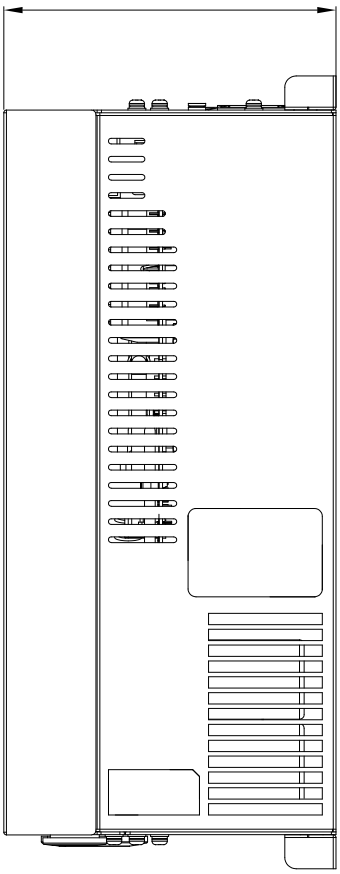


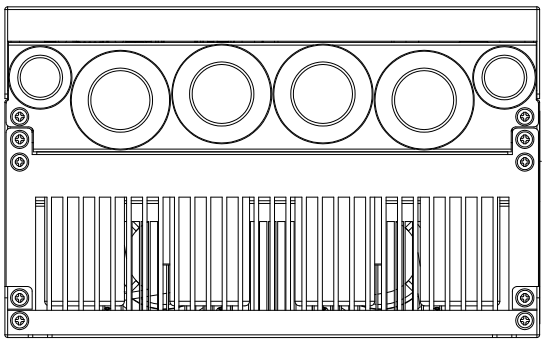


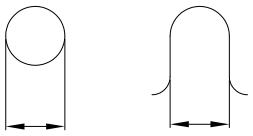

1
2
3
4
5
6
7
8

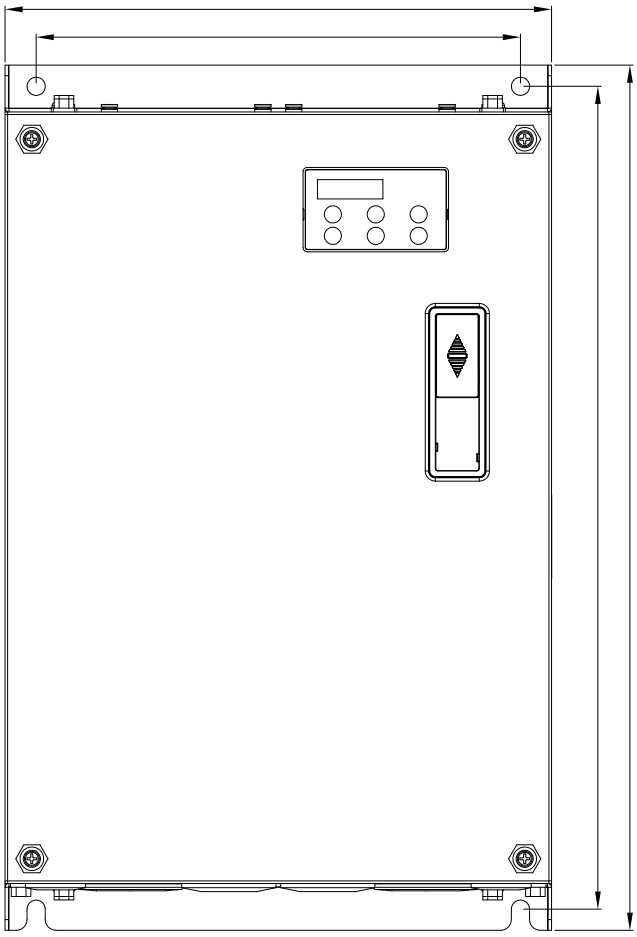
1-5 Product Dimensions

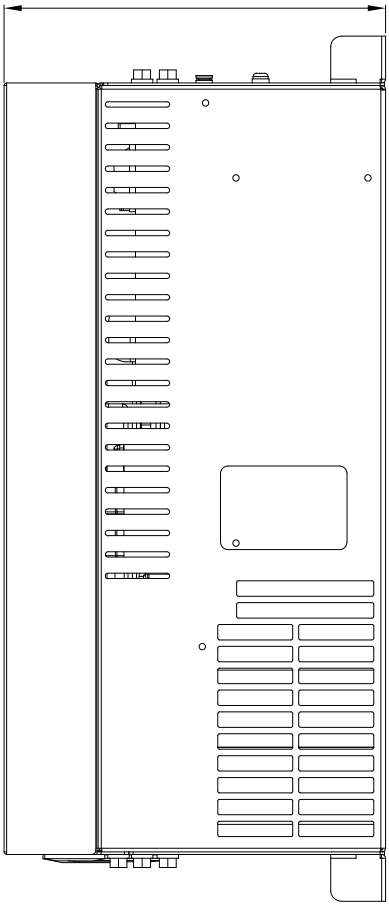


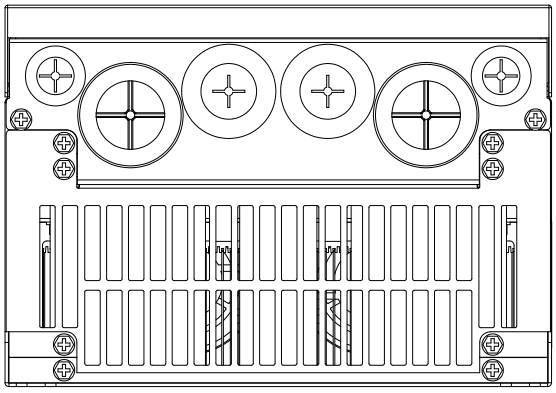


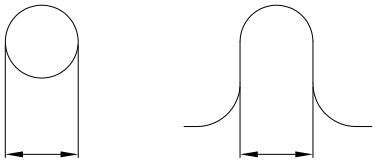


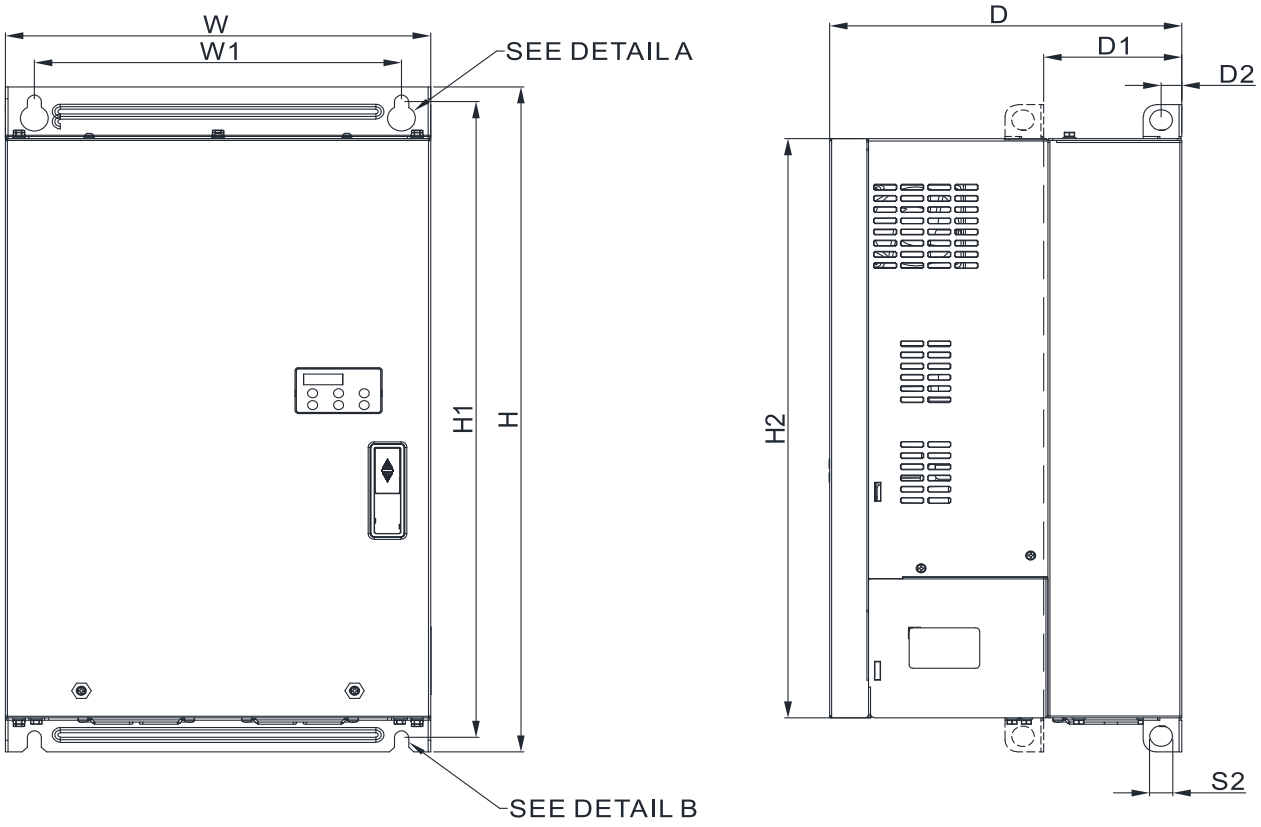


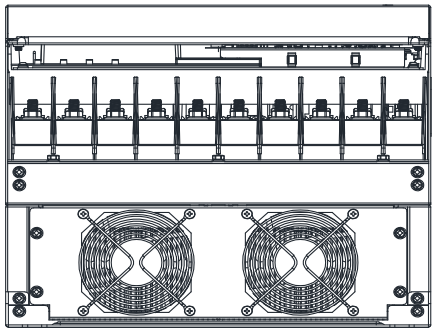


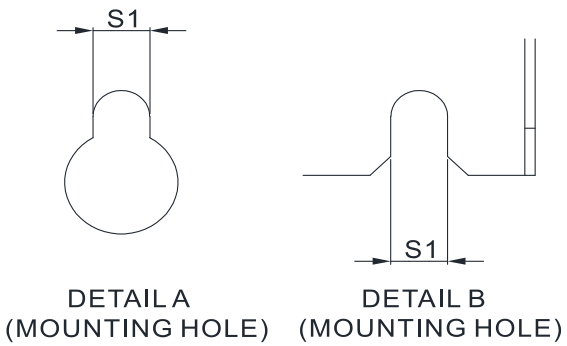


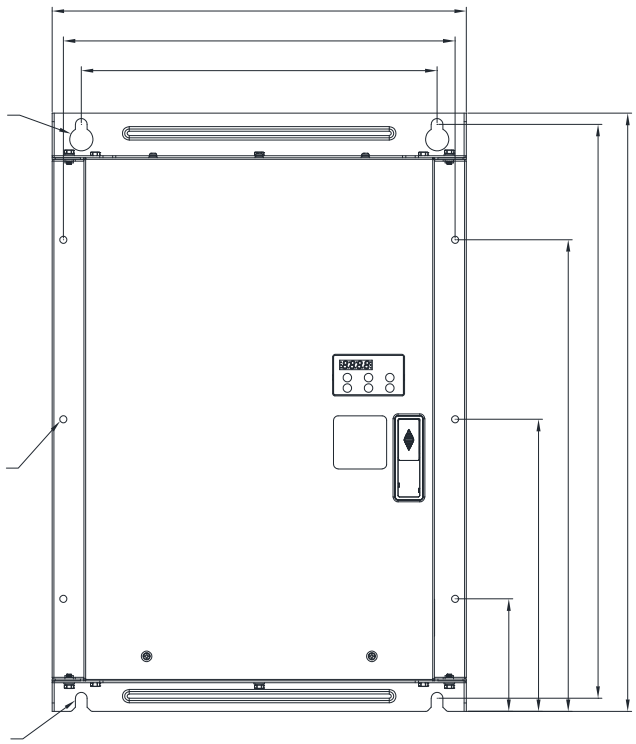


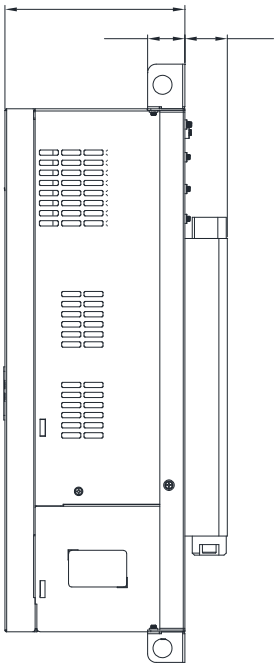


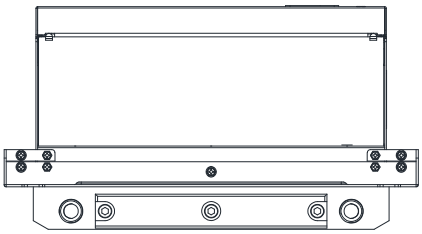

W
W1
SEE DETAIL A
H1
H
SEE DETAIL B
D
D1
D2
H2
S2

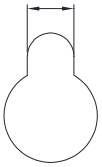


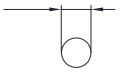

S1
S1
DETAIL A
(MOUNTING HOLE)
DETAIL B
(MOUNTING HOLE)





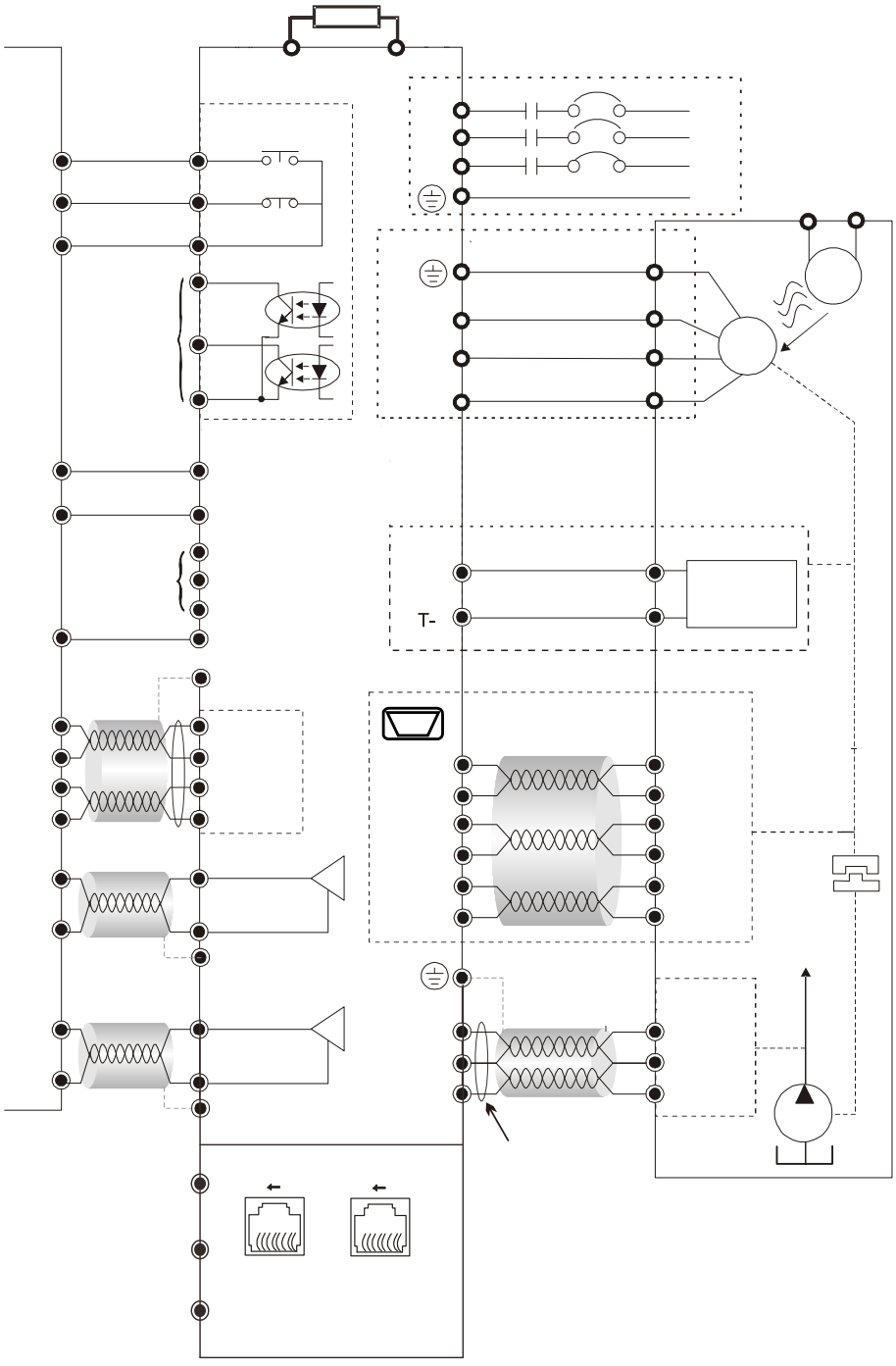


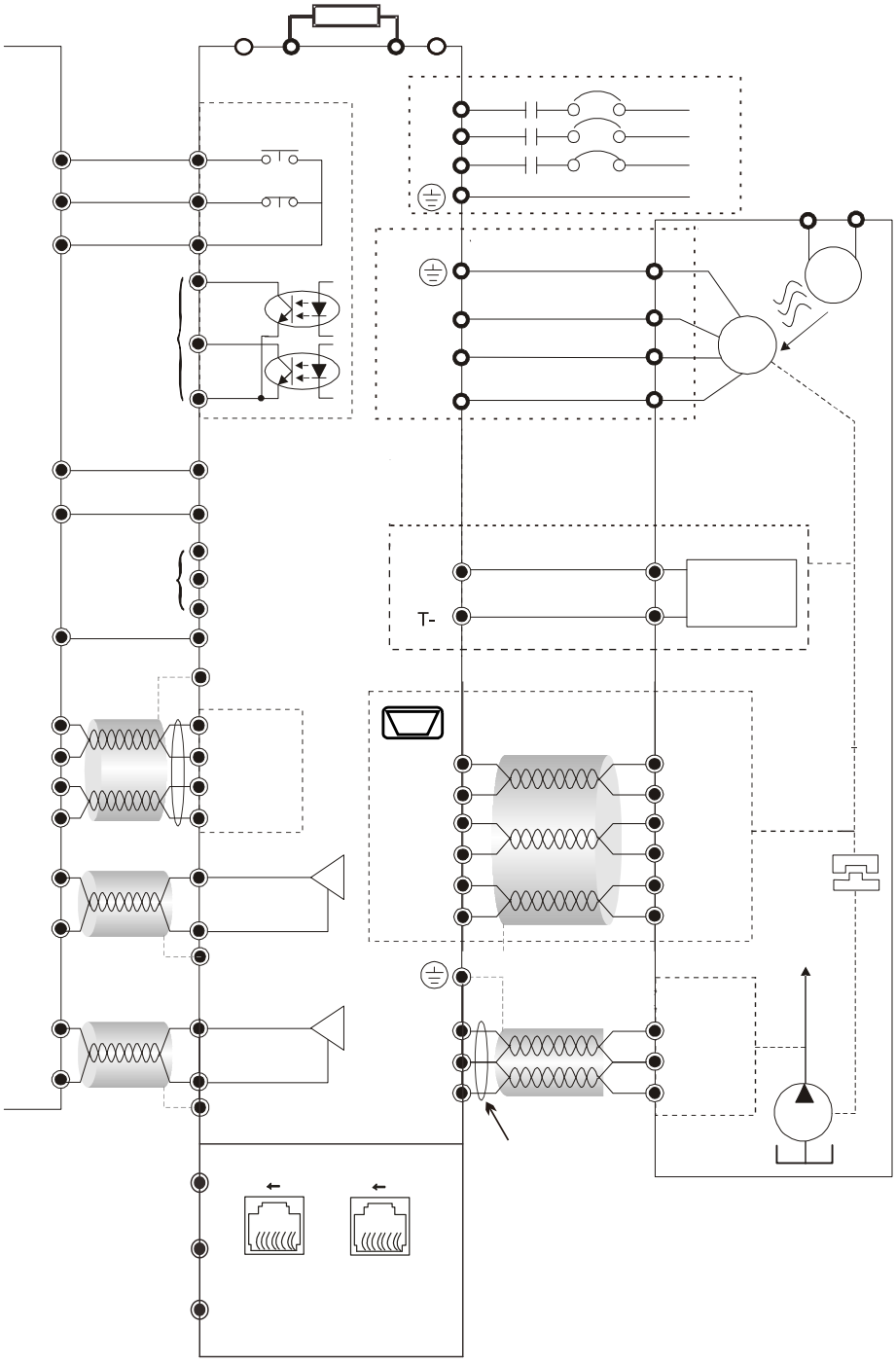




2. Wiring

2-1 Description of Wiring

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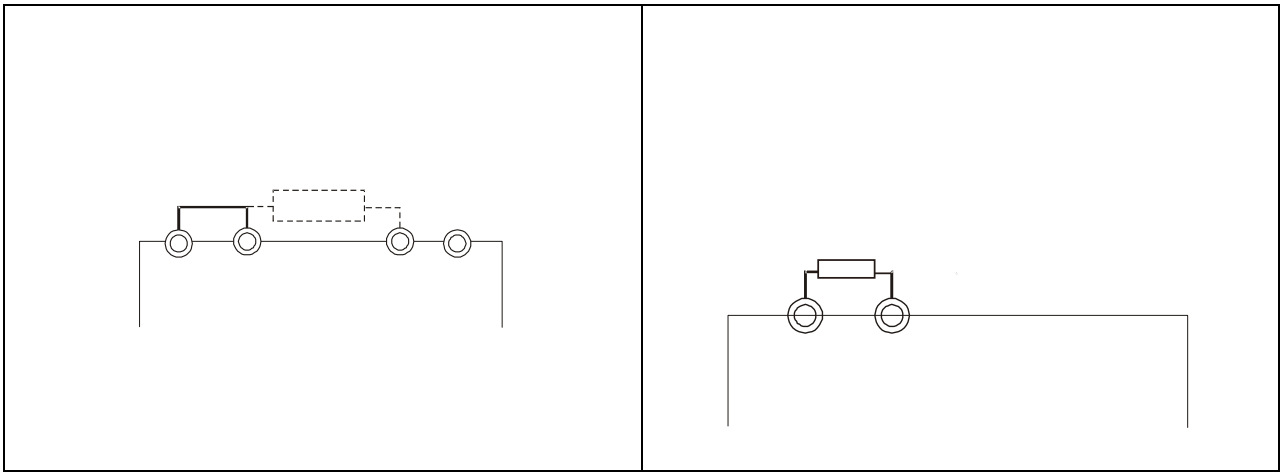

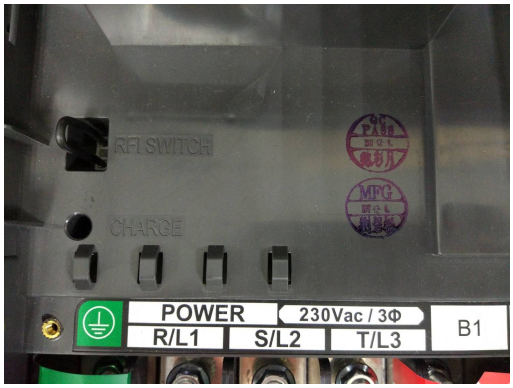

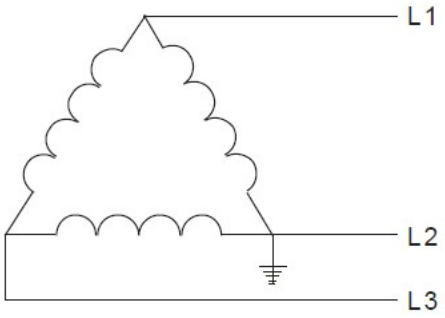
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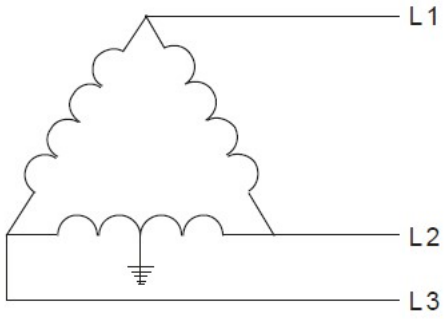
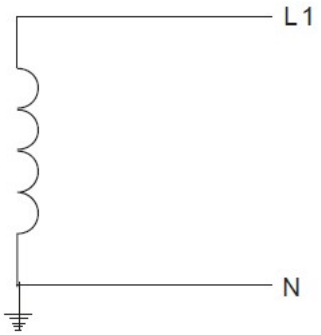
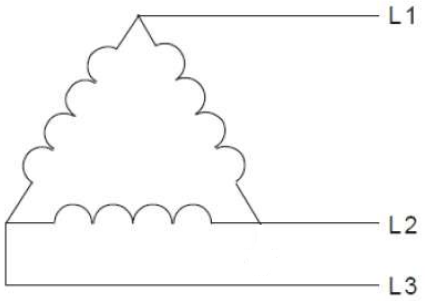
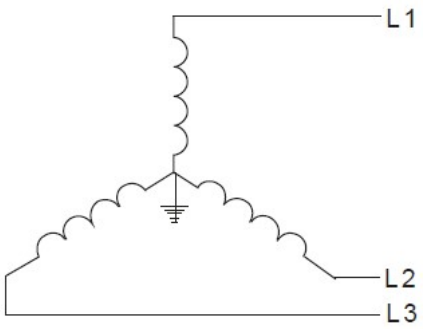
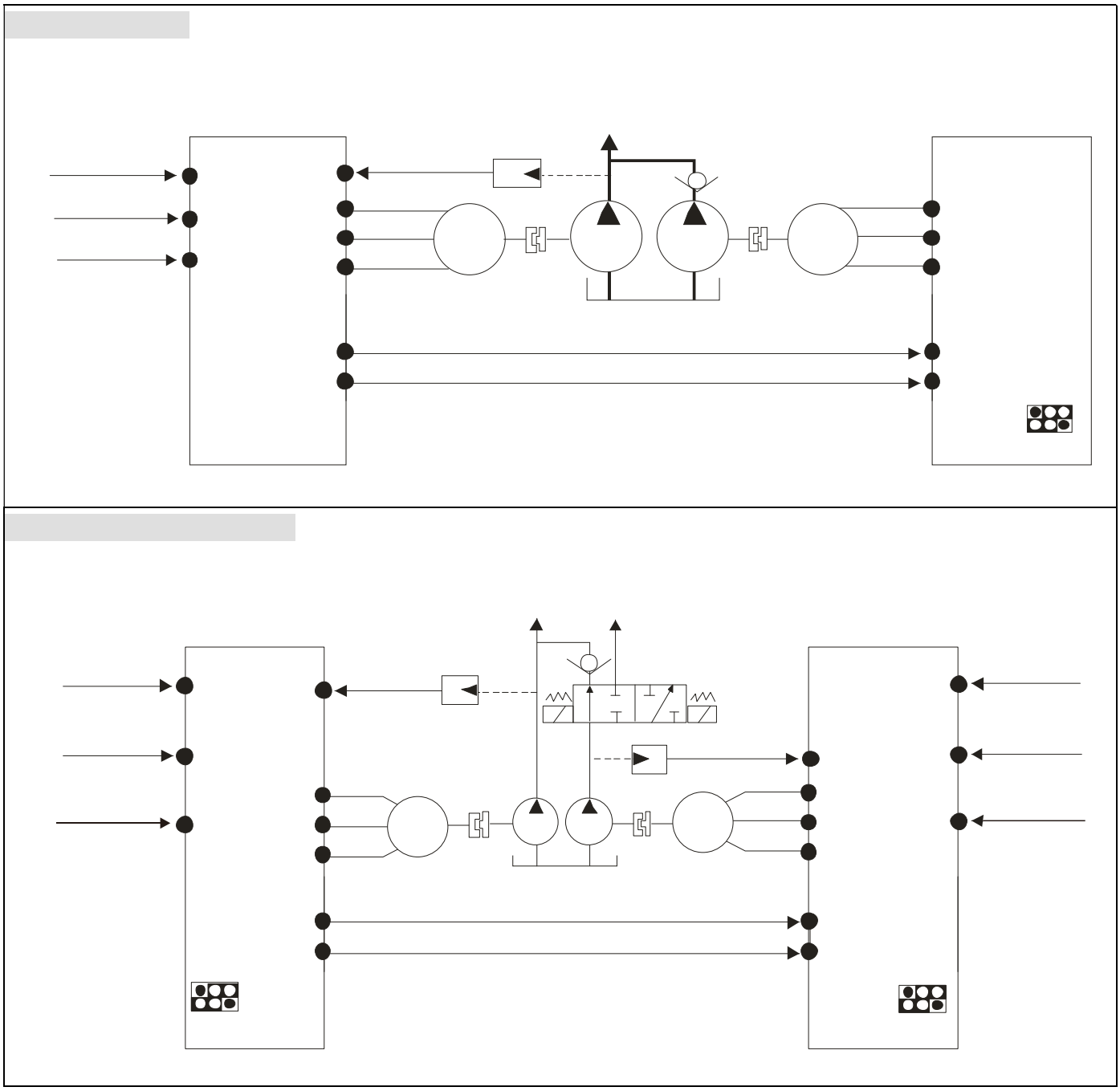
L2
L3

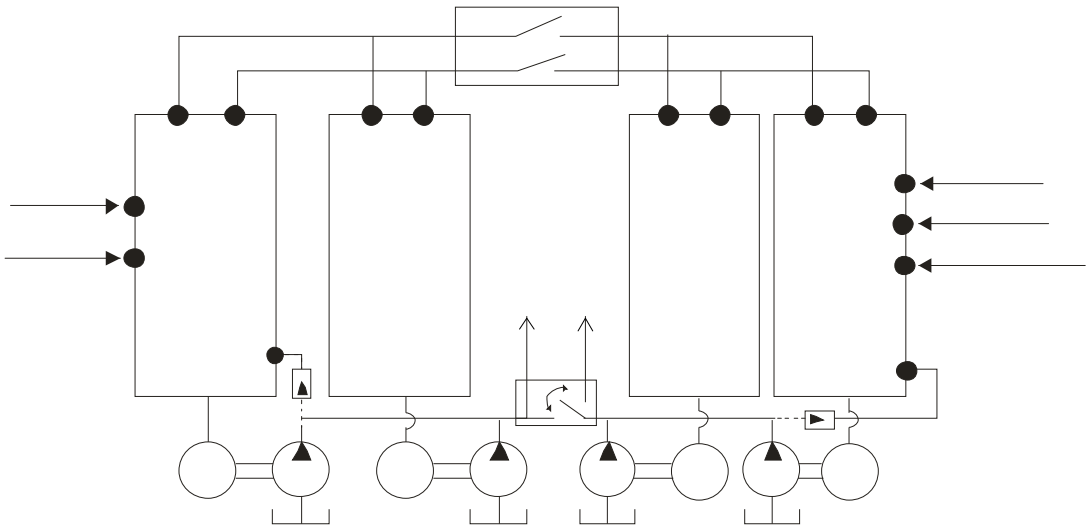

L1
L2
L3


L1
N

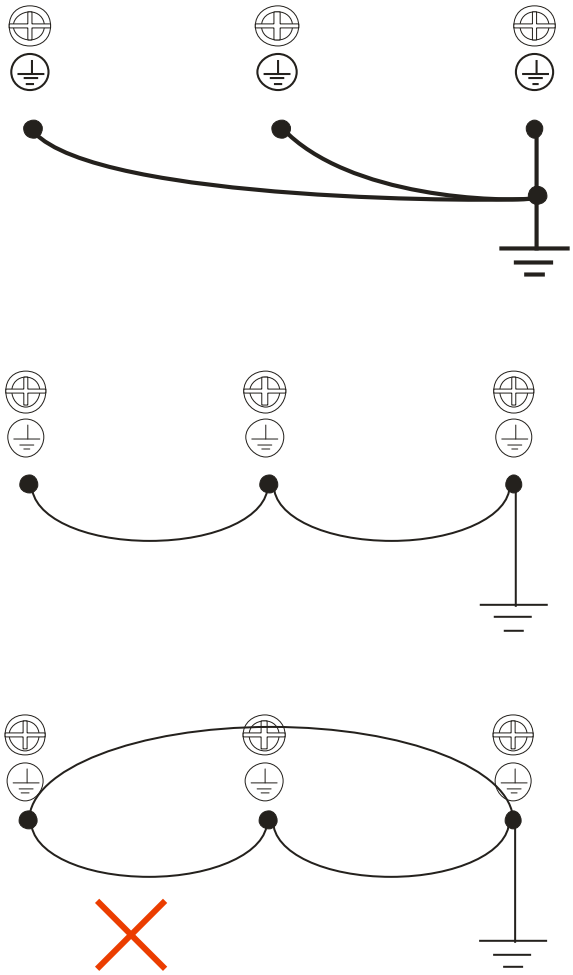

L1
L2
L3

	 L1 L2 L3

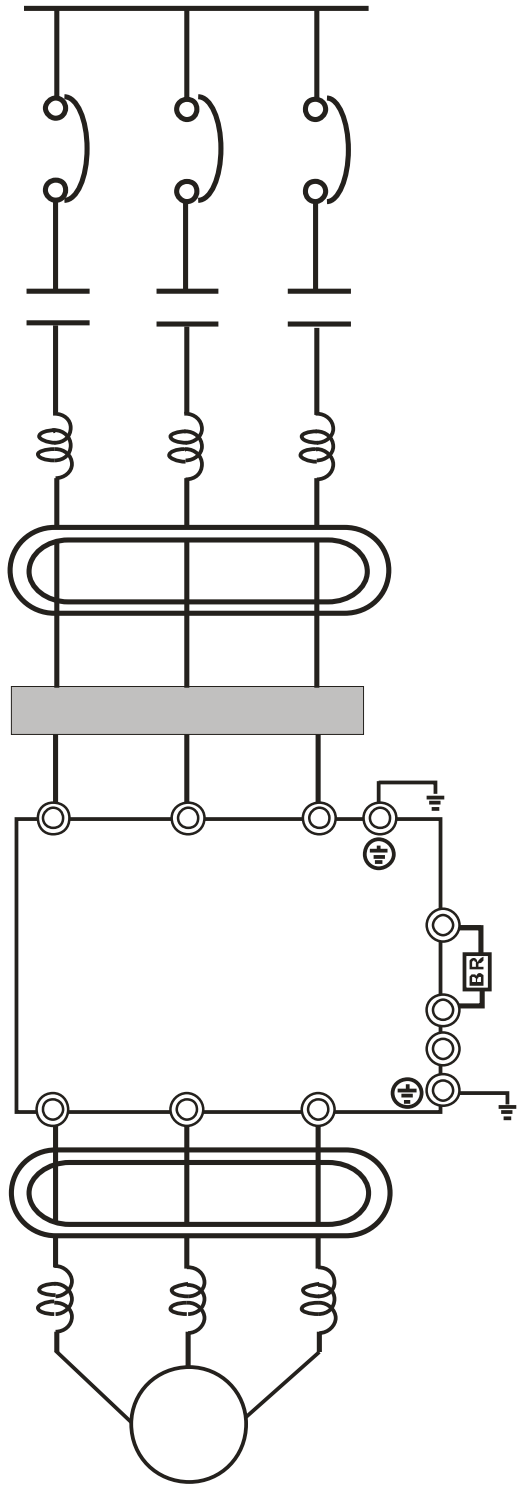




CAUTION

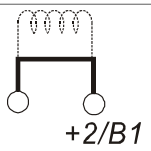


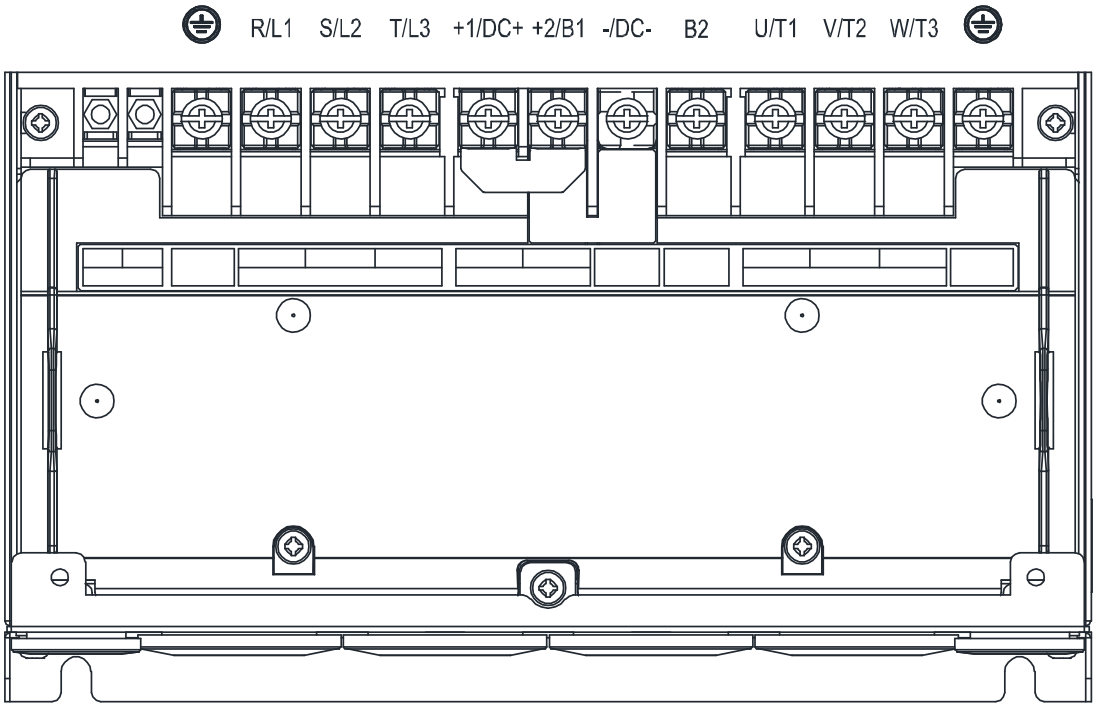
2-2 Description of Terminals on Main Circuit



⏚	

CAUTION


+2/B1


R/L1 S/L2 T/L3 +1/DC+ +2/B1 -/DC- B2 U/T1 V/T2 W/T3

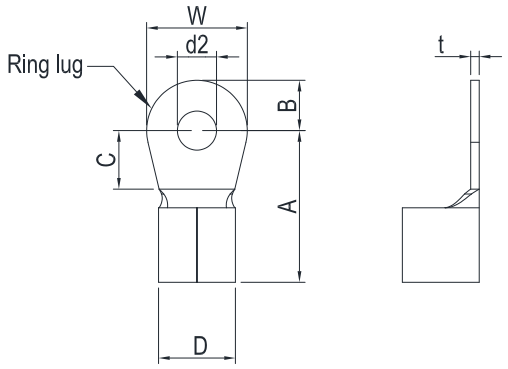


Figure 1.

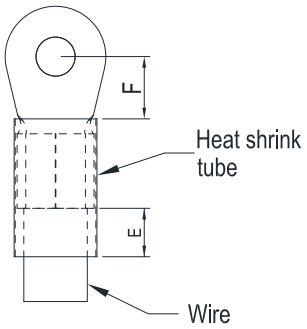
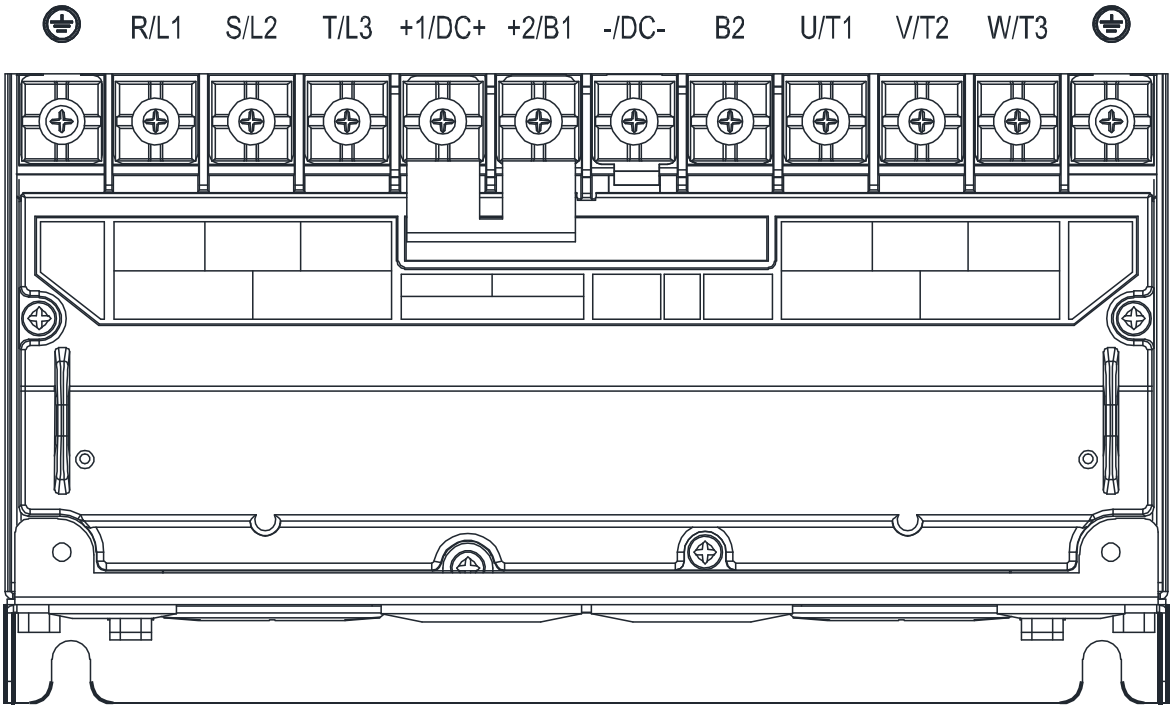


Figure 2.


R/L1
S/L2
T/L3
+1/DC+
+2/B1
-/DC-
B2
U/T1
V/T2
W/T3

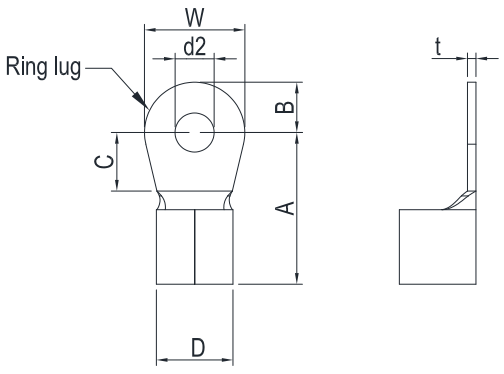


Figure 1.

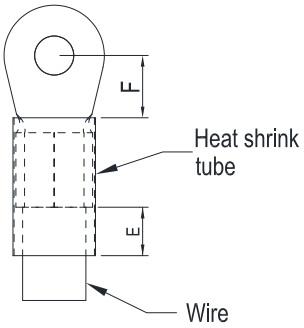
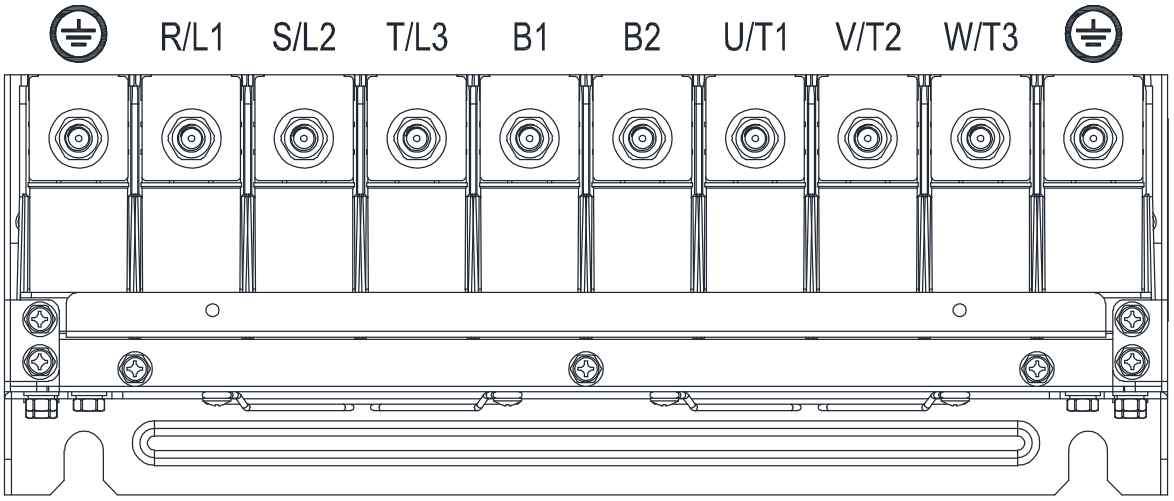


Figure 2.


R/L1
S/L2
T/L3
B1
B2
U/T1
V/T2
W/T3

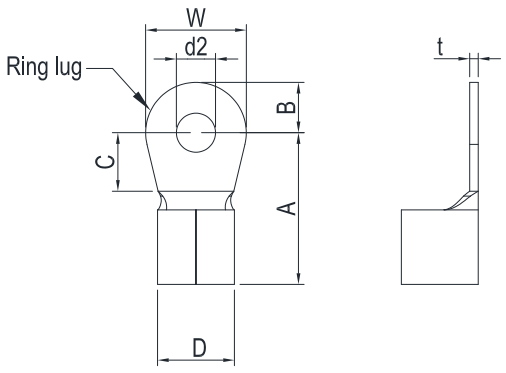


Figure 1.

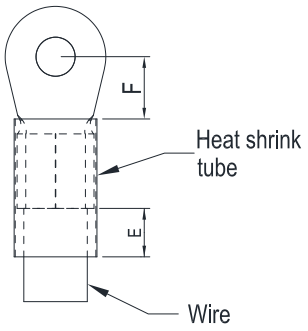
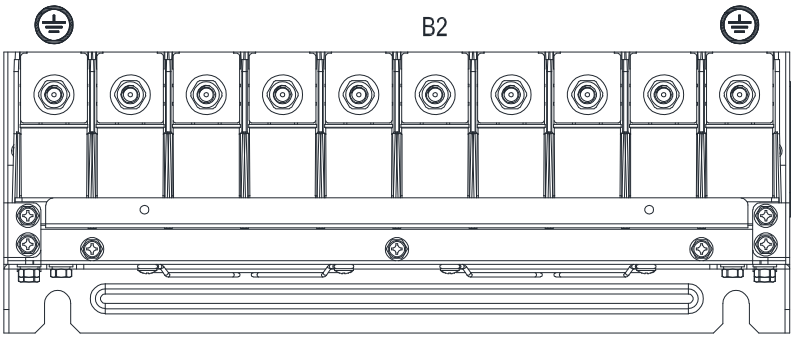
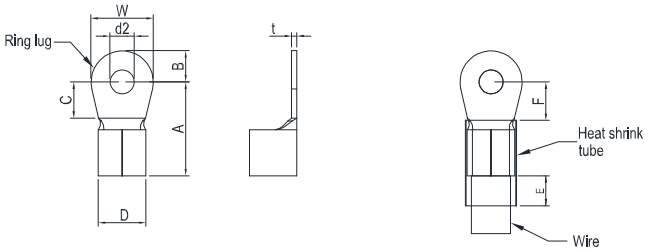


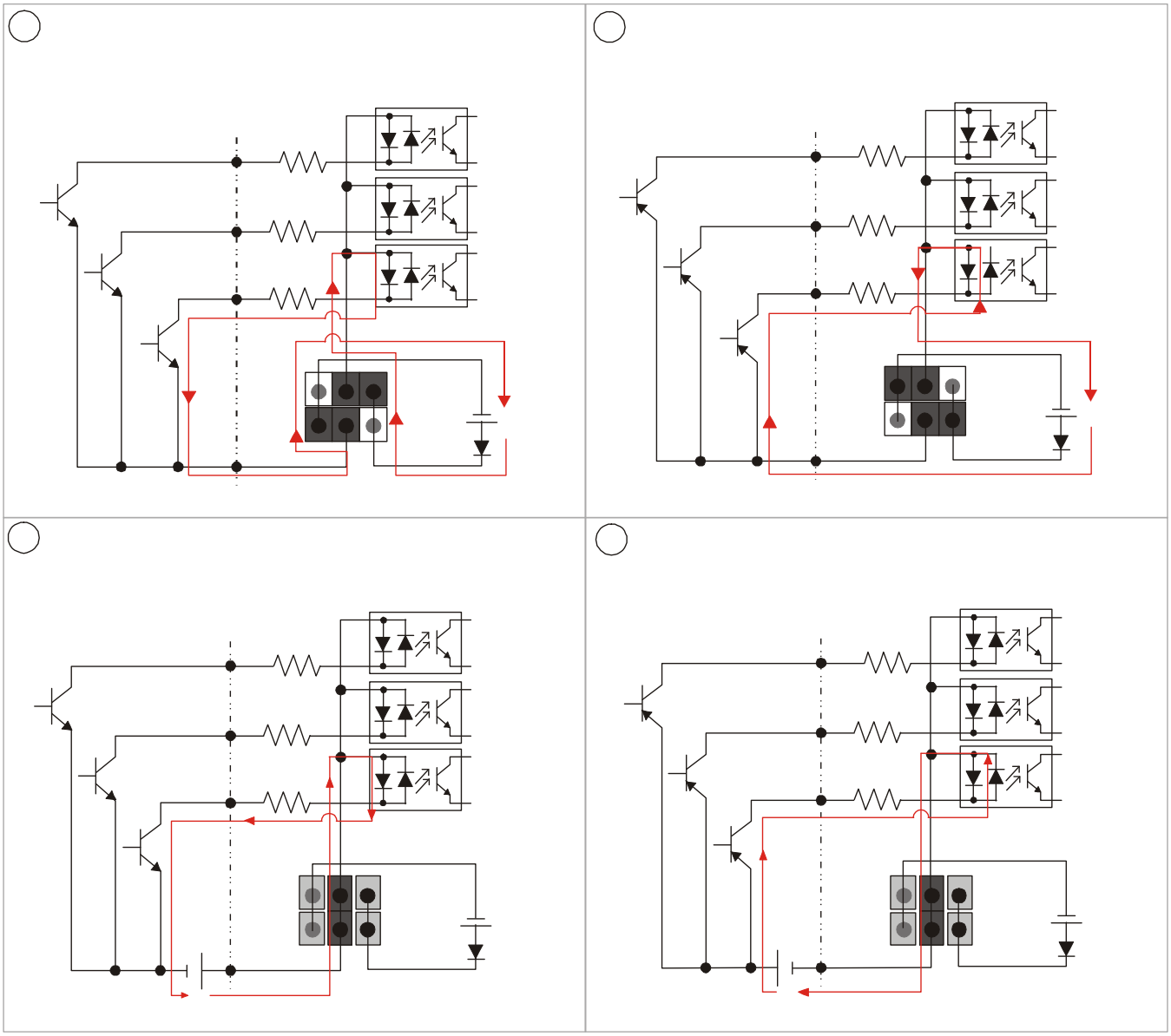
Figure 2.



FRAME-SIZE	AWG	VENDOR	P/N	A (MAX.)	B (MAX.)	C (MIN.)	D (MAX.)	d2 (MIN.)	E (MIN.)	F (MIN.)	W (MAX.)	t (MAX.)
E	4	K.S.T	RNB22-8	50.0	16.0	10.0	27.0	8.3	13.0	14.0	28.0	6.0
	2	K.S.T	RNBS38-8									
	1/0	K.S.T	RNB60-8									
	2/0	K.S.T	RNB70-8									
	3/0	K.S.T	RNB80-8									
	4/0	K.S.T	SQNBS100-8									


W
d2
Ring lug
B
C
A
D
t
F
Heat shrink
tube
E
Wire

2-3 Description of Terminals on Control Circuit



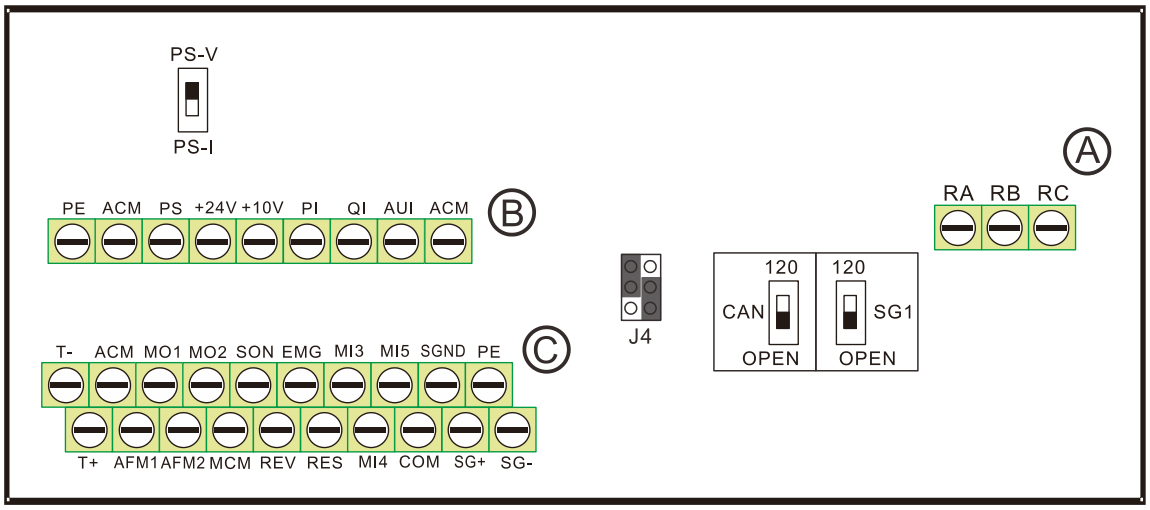
External:

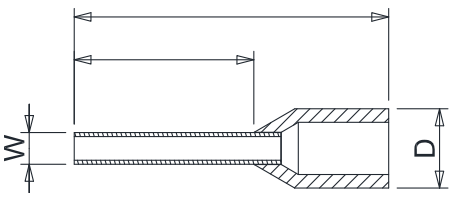
SINK: 4-3
6-5
SOURCE: 4-3
6-5

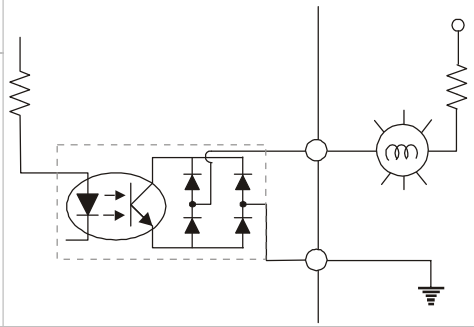
INPWR
SINK: 1-3
4-6

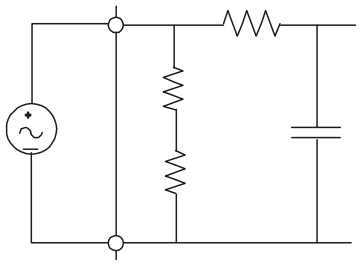
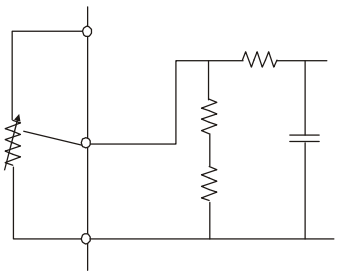
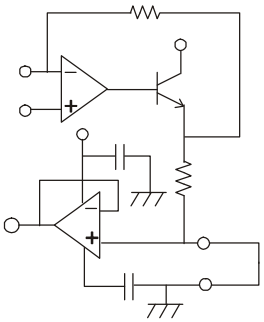
Internal:

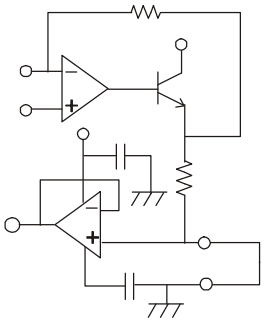
SOURCE: 2-4
3-6

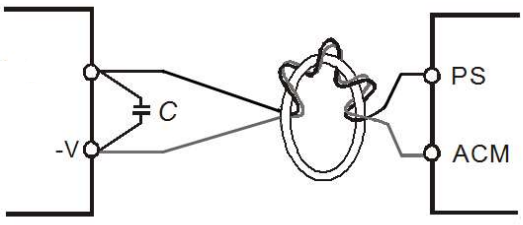


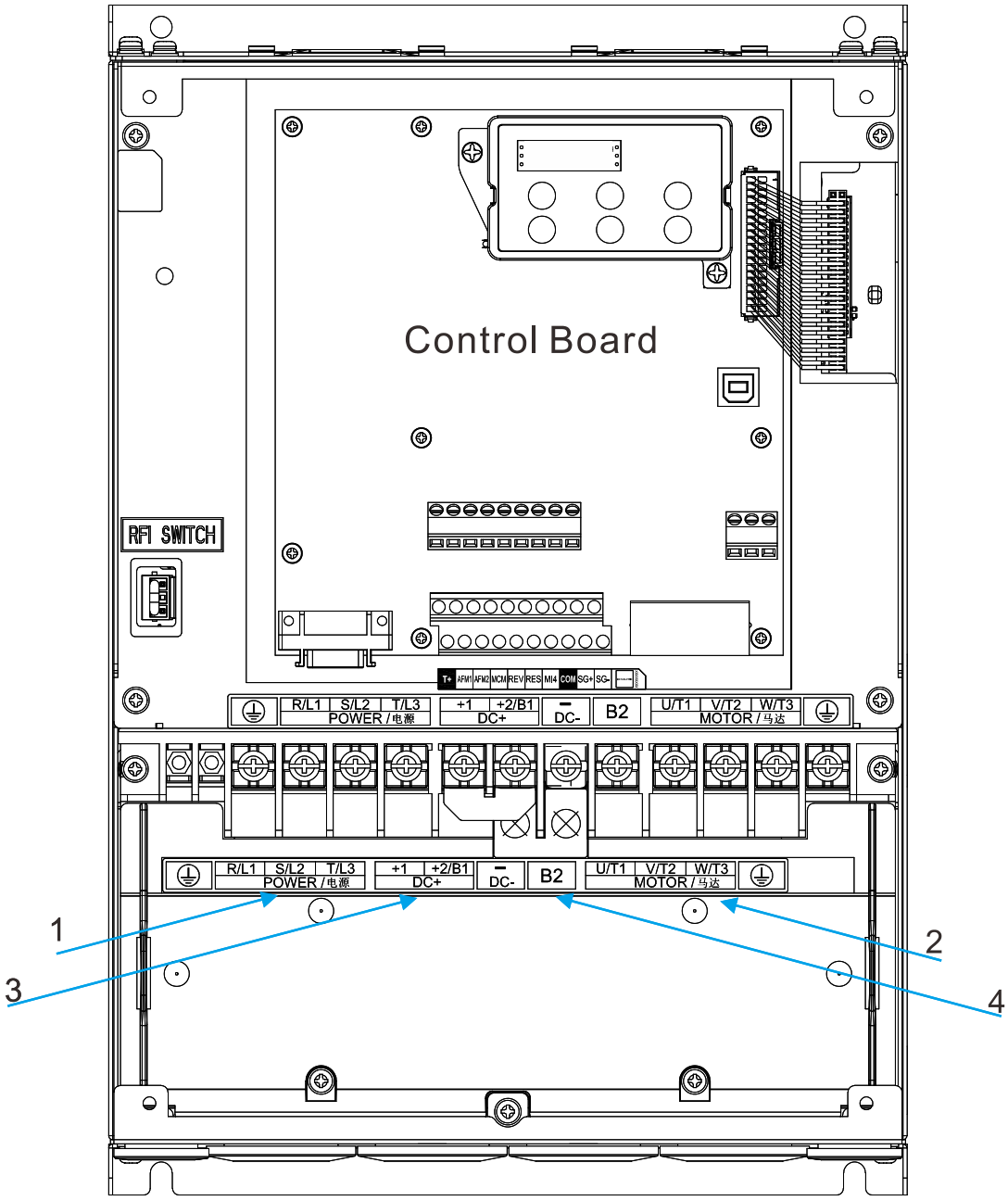


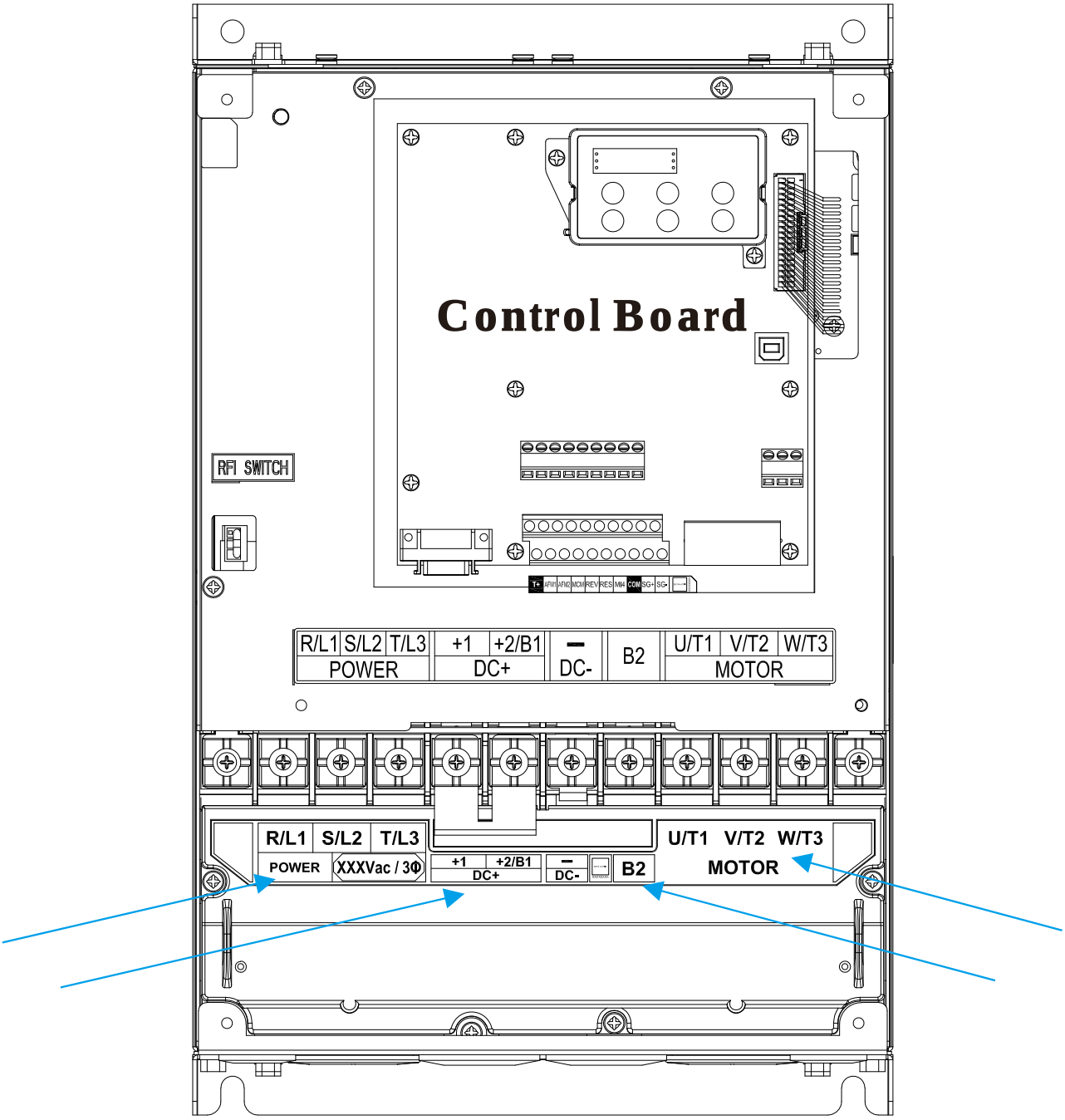
			

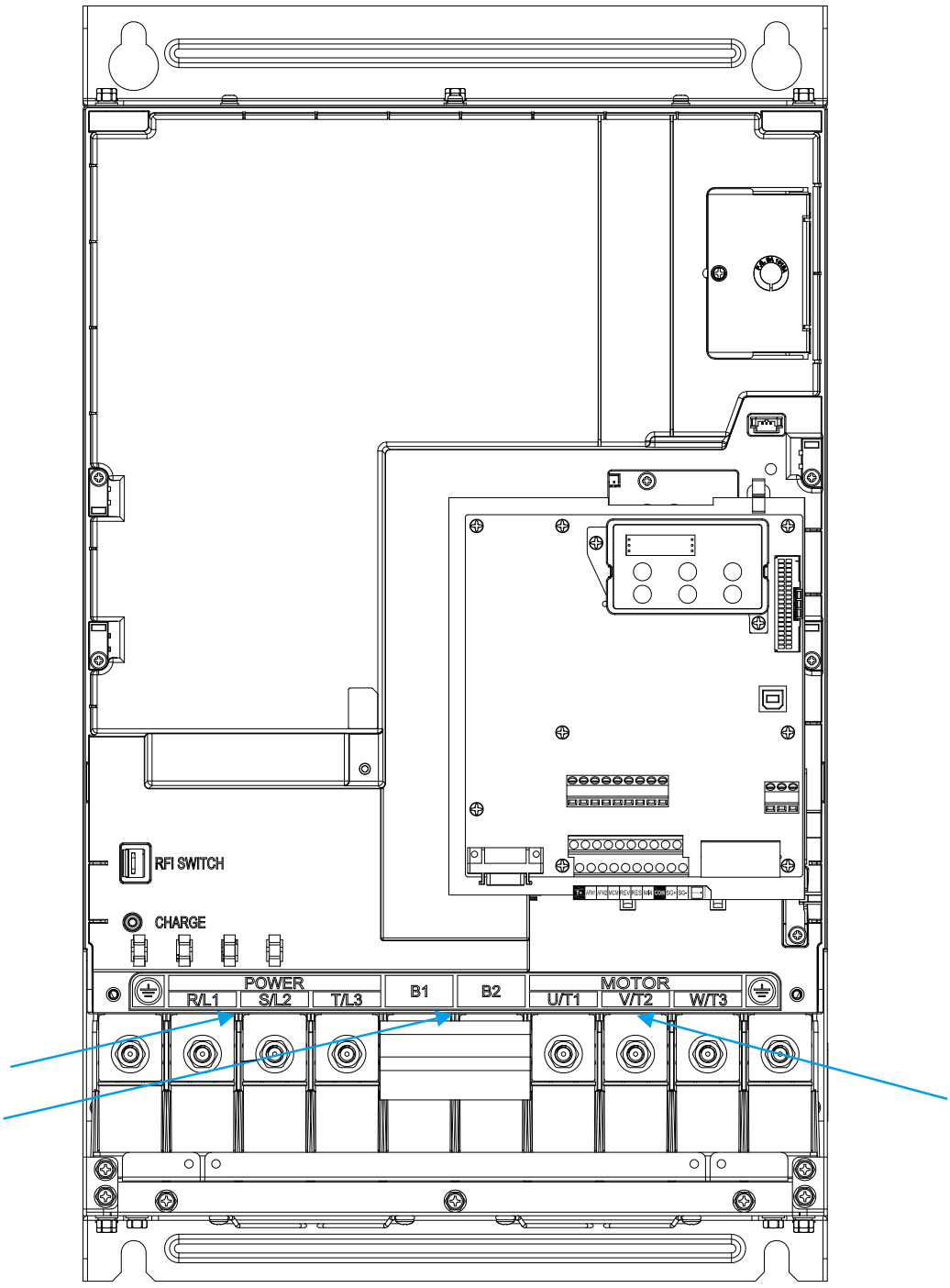
			
			
			


C
-V
PS
ACM


Control Board
RFI SWITCH
R/L1 S/L2 T/L3
POWER / 电源
+1 +2/B1
DC+
DC-
B2
U/T1 V/T2 W/T3
MOTOR / 马达
1
2
3
4

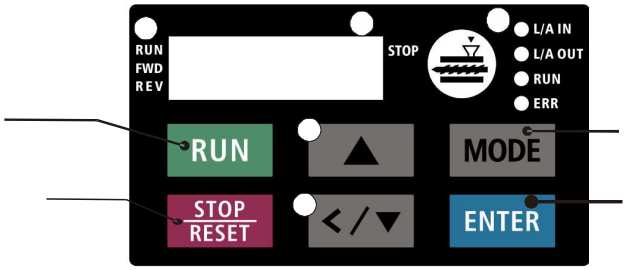

Control Board
RFI SWITCH
R/L1 S/L2 T/L3
POWER
+1 +2/B1
DC+
DC-
B2
U/T1 V/T2 W/T3
MOTOR
XXXVac / 3Φ


RFI SWITCH
CHARGE
POWER
R/L1
S/L2
T/L3
B1
B2
MOTOR
U/T1
V/T2
W/T3

3. Machine Adjustment Procedure

 CAUTION	⏚
 WARNING	

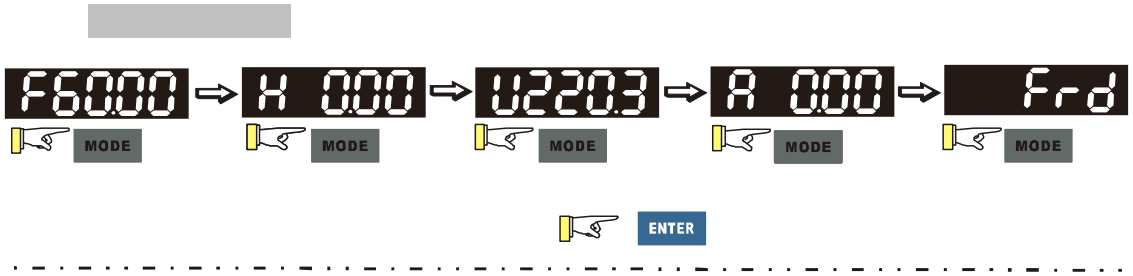
3-1 Description of Control Panel

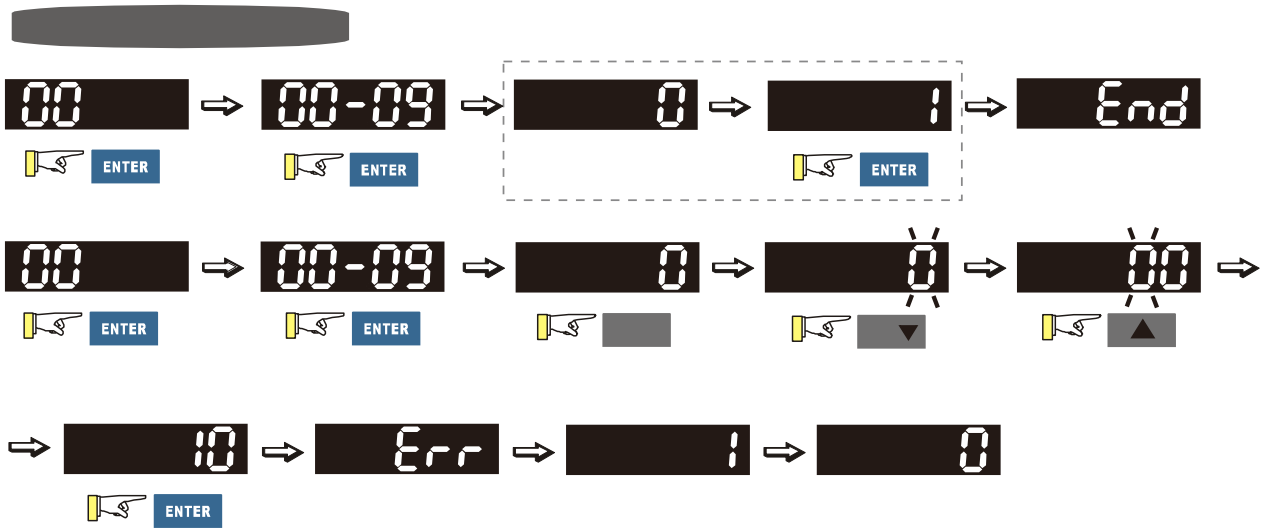


-
-
-
-
-

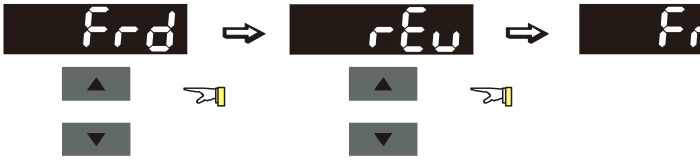
RUN FWD REV F60.00 STOP	
RUN FWD REV H50.00 STOP	
RUN FWD REV b120.0 STOP	
RUN FWD REV A 5.00 STOP	
RUN FWD REV Frd STOP	
RUN FWD REV rEv STOP	
RUN FWD REV 01-00 STOP	
RUN FWD REV 10 STOP	
RUN FWD REV EF STOP	

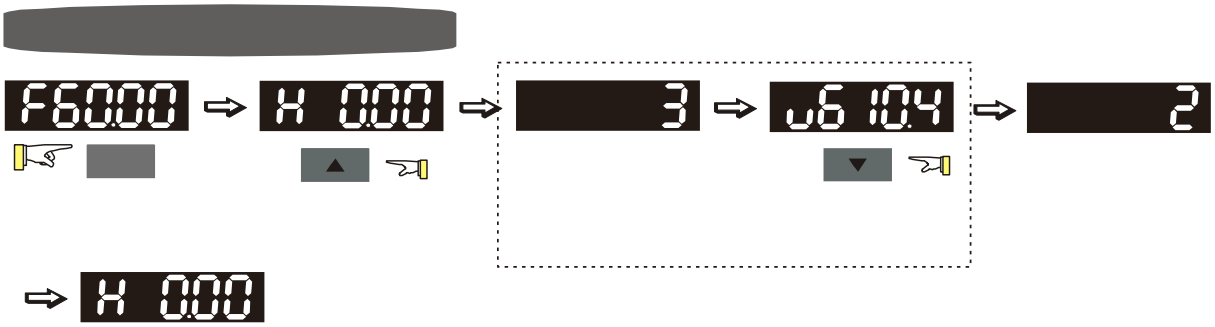
 RUN FWD REV End STOP	
 RUN FWD REV Err STOP	

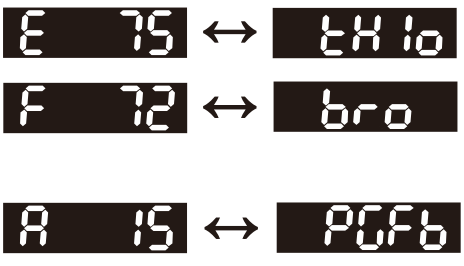

F60.00
H 0.00
U220.3
A 0.00
Frd
MODE
MODE
MODE
MODE
MODE
ENTER

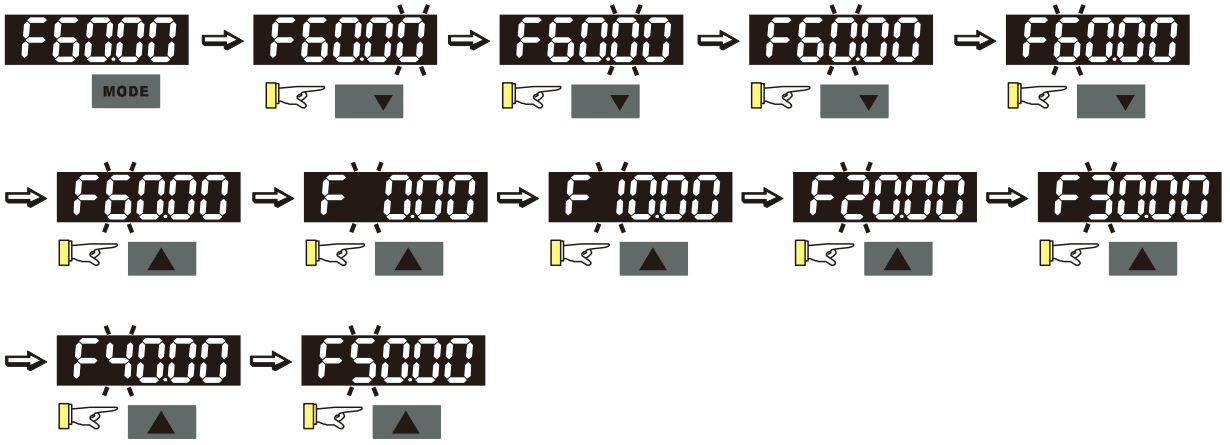

00
00-09
0
1
End
ENTER
ENTER
ENTER
00
00-09
0
0
00
ENTER
ENTER
10
Err
1
0
ENTER

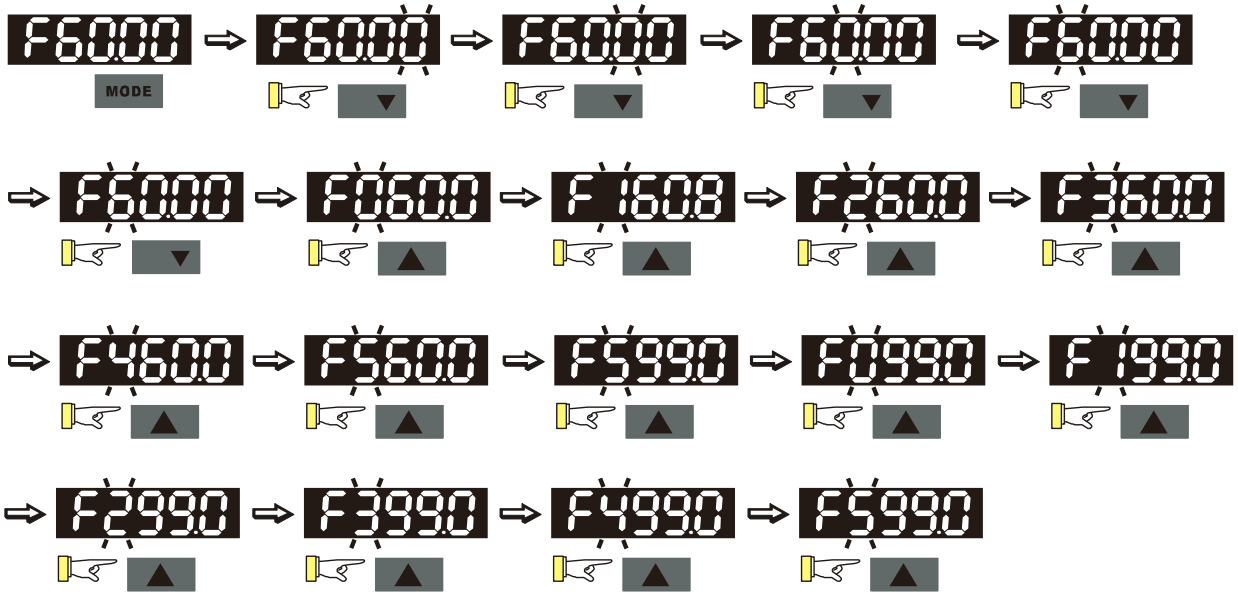

F60.00
F59.99
F60.00

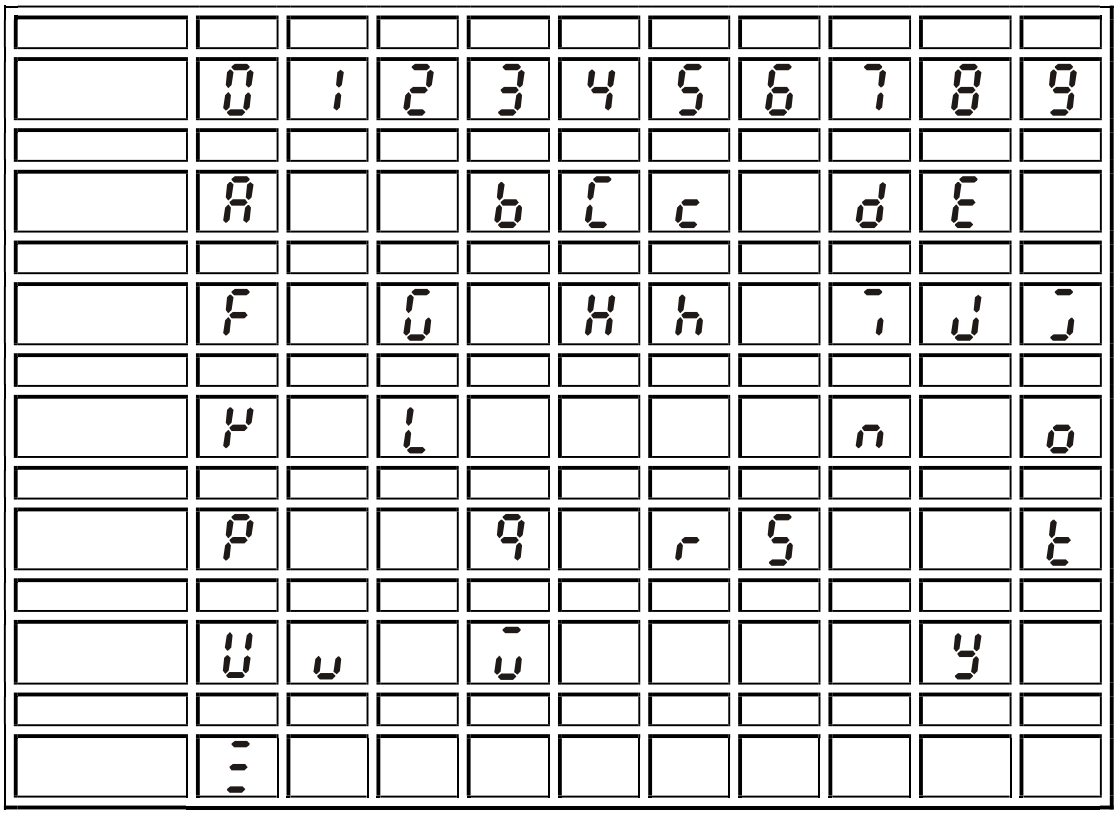

Frd
rEv
Frd


F60.00
H 0.00
3
v6 10.4
2
H 0.00

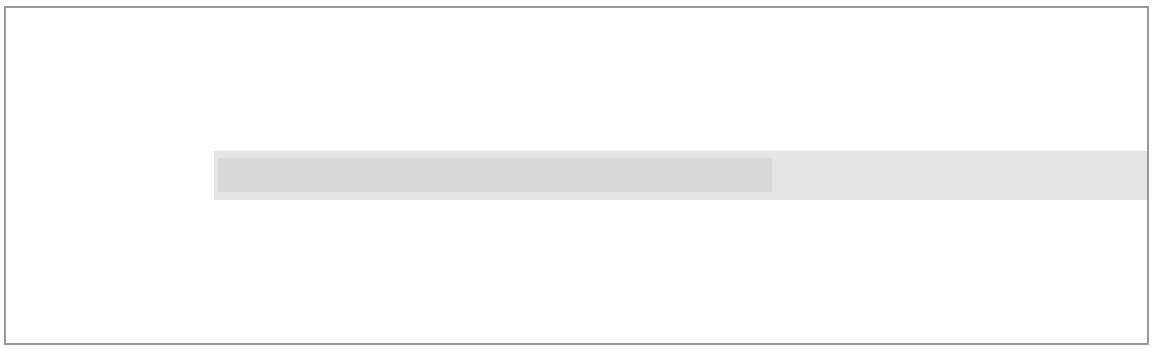

E 75
tX Io
F 72
bro
A 15
PCFb

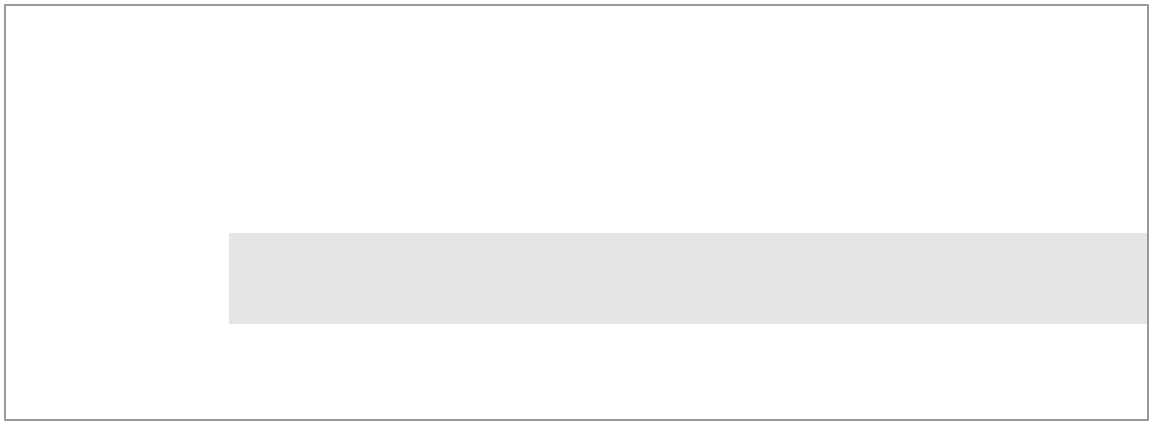

F60.00
MODE
F60.00
F60.00
F60.00
F60.00
F60.00
F60.00
F 10.00
F 10.00
F20.00
F30.00
F40.00
F50.00

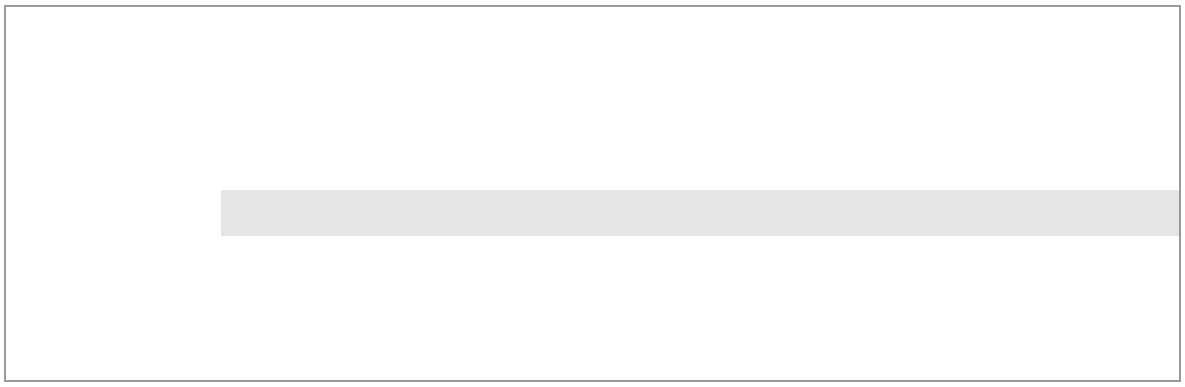

F60.00
MODE
F60.00
F60.00
F60.00
F60.00
F60.00
F60.00
F 1608
F2600
F3600
F4600
F5600
F5990
F0990
F 1990
F2990
F3990
F4990
F5990

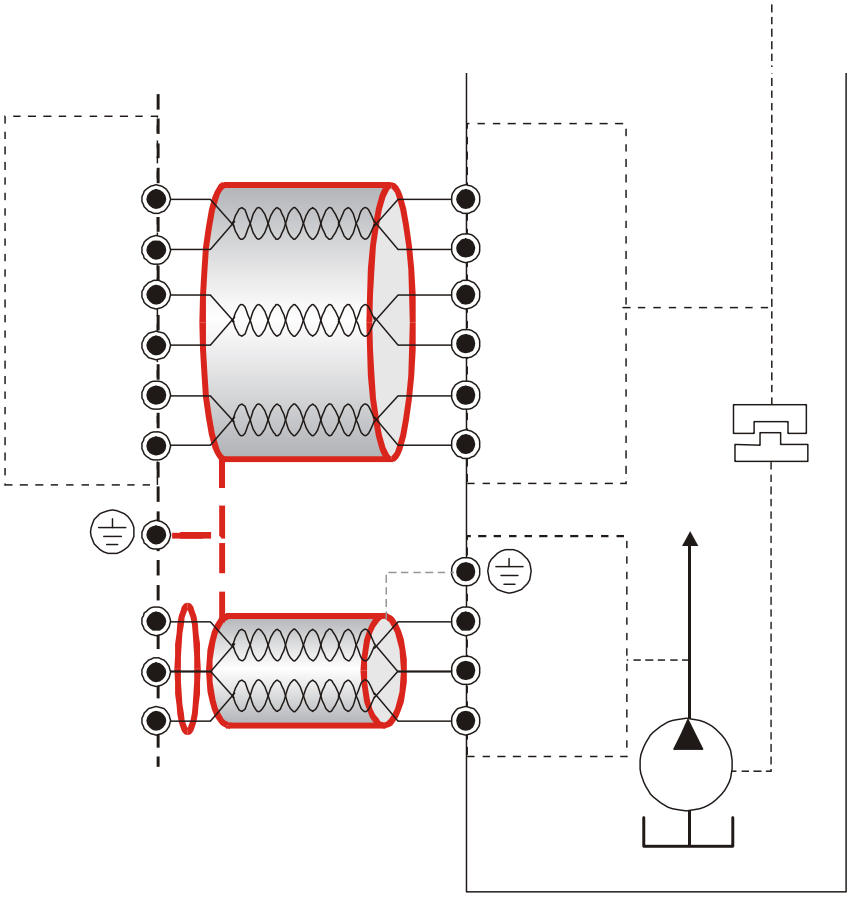


3-2 Machine Adjustment Procedure

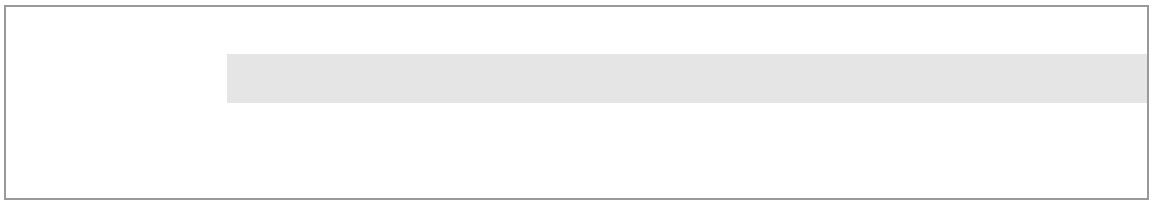




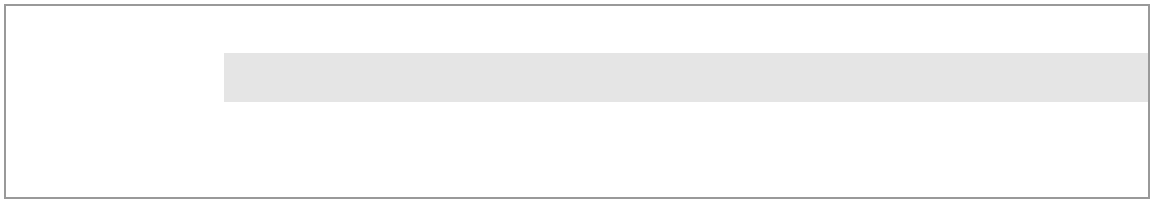


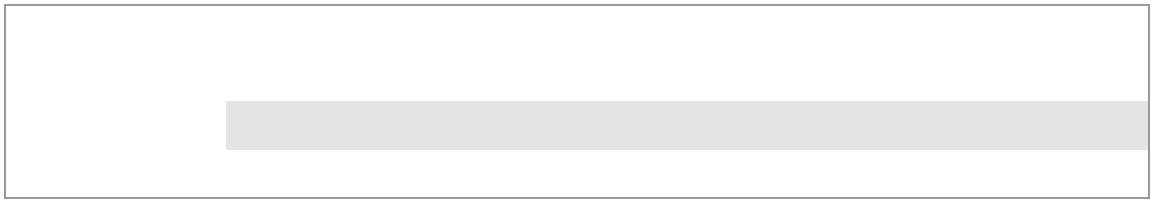


Confluence Machine Tuning Procedure

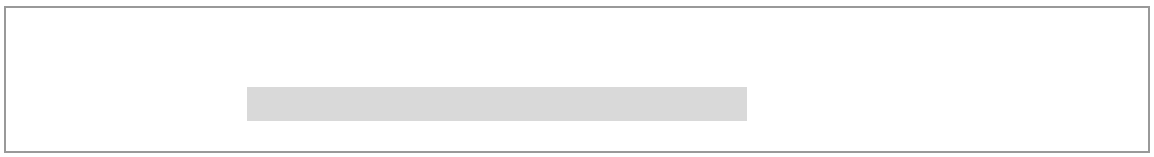


[redacted]





Confluence/Diversion Mode Adjustment Procedure



4. Description of Parameters

4-1 Summary of Parameters

Parameter	Explanation	Settings	Factory Setting	VF	FOCPG	FOCPM
00-09	Pressure control mode	0: Disable (Speed control) 1: Enable (Pressure control)	0	○	○	○
00-10	Speed bandwidth	0~40Hz	20		○	○
00-11	Pressure feedback filtering time	0.000~1.000 second	0.000	○	○	○
00-12	Pressure command filtering time	0.000~1.000 second	0.000	○	○	○
00-13	Flow command filtering time	0.000~1.000 second	0.000	○	○	○
00-14	Percentage for the pressure command value (Max)	0.0~100.0%	56.0	○	○	○
00-15	Percentage for the pressure command value (Mid)	0.0~100.0%	28.0	○	○	○
00-16	Percentage for the pressure command value (Min)	0.0~100.0%	0.0	○	○	○
00-17	Percentage for the flow command value (Max)	0.0~100.0%	100.0	○	○	○
00-18	Percentage for the flow command value (Mid)	0.0~100.0%	50.0	○	○	○
00-19	Percentage for the flow command value (Min)	0.0~100.0%	0.0	○	○	○
00-20	P gain 1	0.0~1000.0	50.0	○	○	○
00-21	I integration time 1	0.00~500.00 seconds	2.00	○	○	○
00-22	P gain 2	0.0~1000.0	50.0	○	○	○
00-23	I integration time 2	0.00~500.00 seconds	2.00	○	○	○
00-24	P gain 3	0.0~1000.0	50.0	○	○	○
00-25	I integration time 3	0.00~500.00 seconds	2.00	○	○	○
00-26	Pressure stable zone	0~100%	25	○	○	○
00-27	Minimum pressure	0.0~100.0%	0.1	○	○	○
00-28	Depressurization speed	0~100%	25	○	○	○
00-29	Ramp up rate of pressure command	0~1000ms	0	○	○	○
00-30	Ramp down rate of pressure command	0~1000ms	100	○	○	○

02 Protection Parameters

You can set this parameter during operation.

Parameter	Explanation	Settings	Factory Setting	VF	FOCPG	FOCPM
02-00	Software brake level	230V series: 350.0~450.0V 460V series: 700.0~900.0V	380.0 760.0	○	○	○
02-01	Fault record 1	0: No error record	0	○	○	○
02-02	Fault record 2	1: Over-current during acceleration (ocA)	0	○	○	○
02-03	Fault record 3	2: Over-current during deceleration (ocd)	0	○	○	○
02-04	Fault record 4	3: Over-current during constant speed (ocn)	0	○	○	○
02-05	Fault record 5	4: Ground fault (GFF)	0	○	○	○
02-06	Fault record 6	5: IGBT short-circuit (occ)	0	○	○	○
		6: Over-current at stop (ocS)		○	○	○
		7: Over-voltage during acceleration (ovA)		○	○	○
		8: Over-voltage during deceleration (ovd)		○	○	○
		9: Over-voltage during constant speed (ovn)		○	○	○
		10: Over-voltage at stop (ovS)		○	○	○
		11: Low-voltage during acceleration (LvA)		○	○	○
		12: Low-voltage during deceleration (Lvd)		○	○	○
		13: Low-voltage during constant speed (Lvn)		○	○	○
		14: Low-voltage at stop (LvS)		○	○	○
		15: Phase loss protection (orP)		○	○	○
		16: IGBT over-heat (oH1)		○	○	○
		17: Heat sink over-heat for 40HP and above (oH2)		○	○	○
		18: TH1 open: IGBT over-heat protection circuit error (tH1o)		○	○	○
		19: TH2 open: heat sink over-heat protection circuit error (tH2o)		○	○	○
		20: IGBT over heated and unusual fan function (oHF)		○	○	○
		21: Hybrid servo drive overload (oL)		○	○	○
		22: Motor over-load (EoL1)		○	○	○
		23: Reserved				
		24: Motor over-heat (oH3)		○	○	○
		25: Reserved				
		26: Reserved		○	○	○
		27: Reserved		○	○	○
		28: Reserved		○	○	○
		29: Reserved		○	○	○
		30: Memory write error (cF1)		○	○	○
		31: Memory read error (cF2)		○	○	○

Parameter	Explanation	Settings	Factory Setting	VF	FOCPG	FOCPM
		32: Isum current detection error (cd0)		○	○	○
		33: U-phase current detection error (cd1)		○	○	○
		34: V-phase current detection error (cd2)		○	○	○
		35: W-phase current detection error (cd3)		○	○	○
		36: Clamp current detection error (Hd0)		○	○	○
		37: Over-current detection error (Hd1)		○	○	○
		38: Over-voltage detection error (Hd2)		○	○	○
		39: Ground current detection error (Hd3)		○	○	○
		40: Auto tuning error (AuE)			○	○
		41: Reserved		○	○	○
		42: PG feedback error (PGF1)			○	○
		43: PG feedback loss (PGF2)			○	○
		44: PG feedback stall (PGF3)			○	○
		45: PG slip error (PGF4)			○	○
		46: Reserved		○	○	○
		47: Reserved		○	○	○
		48: Reserved				
		49: External fault input (EF)		○	○	○
		50: Emergency stop (EF1)		○	○	○
		51: Reserved				
		52: Password error(Pcod)		○	○	○
		53: CPU error (ccod)		○	○	○
		54: Communication error (wrong command)(cE1)		○	○	○
		55: Communication error (wrong data address) (cE2)		○	○	○
		56: Communication error (wrong data value) (cE3)		○	○	○
		57: Communication error (wrong data written address) (cE4)		○	○	○
		58: RS-485 Communication time out (cE10)		○	○	○
		59: Reserved		○	○	○
		60: Braking transistor error (bF)		○	○	○
		61~63: Reserved		○	○	○
		64: Reserved		○	○	○
		65: PG card information error (PGF5)				○
		66: Overpressure (ovP)		○	○	○
		67: Pressure feedback fault (PfbF)		○	○	○
		68: Oil pump runs reversely (Prev)				

Parameter	Explanation	Settings	Factory Setting	VF	FOCPG	FOCPM
		69: Oil shortage (noil)				
		70: Reserved				
		71: Over current at Braking chopper (ocbs)				
		72: Braking resistor is open-circuit (bro)				
		73: Resistance of braking resistor is too small (brF)				
		74: Braking chopper overheated (oH4)				
		75: Error occurred on Brake chopper's thermal protection line (tH4o)				
		76~81: Reserved				
		82: Output Phase Loss on Phase U (oPL1)				
		83: Output Phase Loss on Phase V (oPL2)				
		84: Output Phase Loss on Phase W (oPL3)				
		85, 86, 88~100: Reserved				
		87: Hybrid motor drive overloading while running at low frequency (oL3)				
		101: Software error 1 occurred on CANopen (CGdE)				
		102: Software error 2 occurred on CANopen (CHbE)				
		103: Reserved				
		104: Hardware error occurred on CANopen (CbFE)				
		105: Index setting error occurred on CANopen (CIdE)				
		106: Slave # setting error occurred on CANopen (CAdE)				
		107: CANopen index is out of range (CFrE)				
02-07	Low voltage level	160.0~220.0V 320.0~440.0V	180.0 360.0	○	○	○
02-08	PTC action selection	0: Warn and keep operation 1: Warn and ramp to stop 2: Warn and coast to stop	1	○	○	○
02-09	PTC level	0.0~150.0°C	130	○	○	○
02-10	Reserved					
02-11	PTC type	0: Not assigned 1: KTY84-130 2: PTC130 3: Switch (N.C. model)	0	○	○	○

4-2 Description of Parameter Settings

00-00

00-01

00-02

00-03

00-04

A 2.00

H 2.30

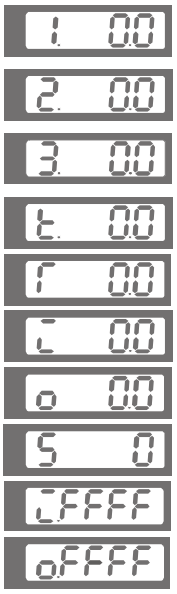
U3 10.3

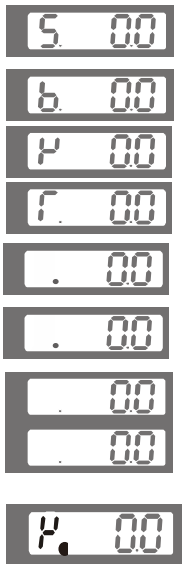
E22.03

n 0.0

P0.00


r 00
- 00
t 00
- 00
C 00


1. 00
2. 00
3. 00
t. 00
r 00
C 00
o 00
S 0
CFFFF
oFFFF


S. 00
b. 00
P 00
r. 00
. 00
. 00
. 00
. 00
P. 00

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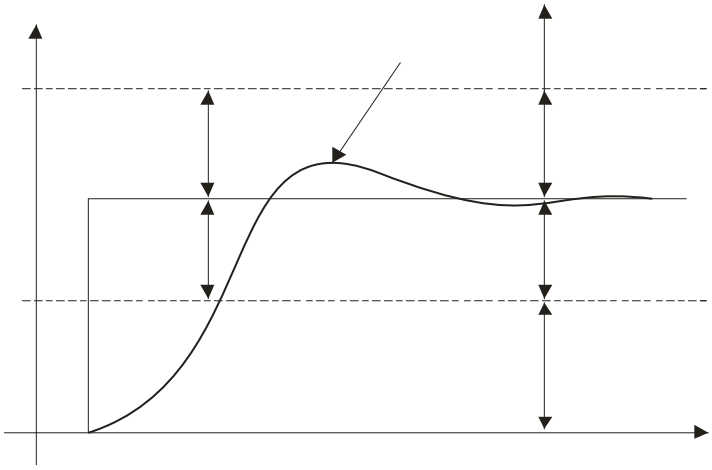

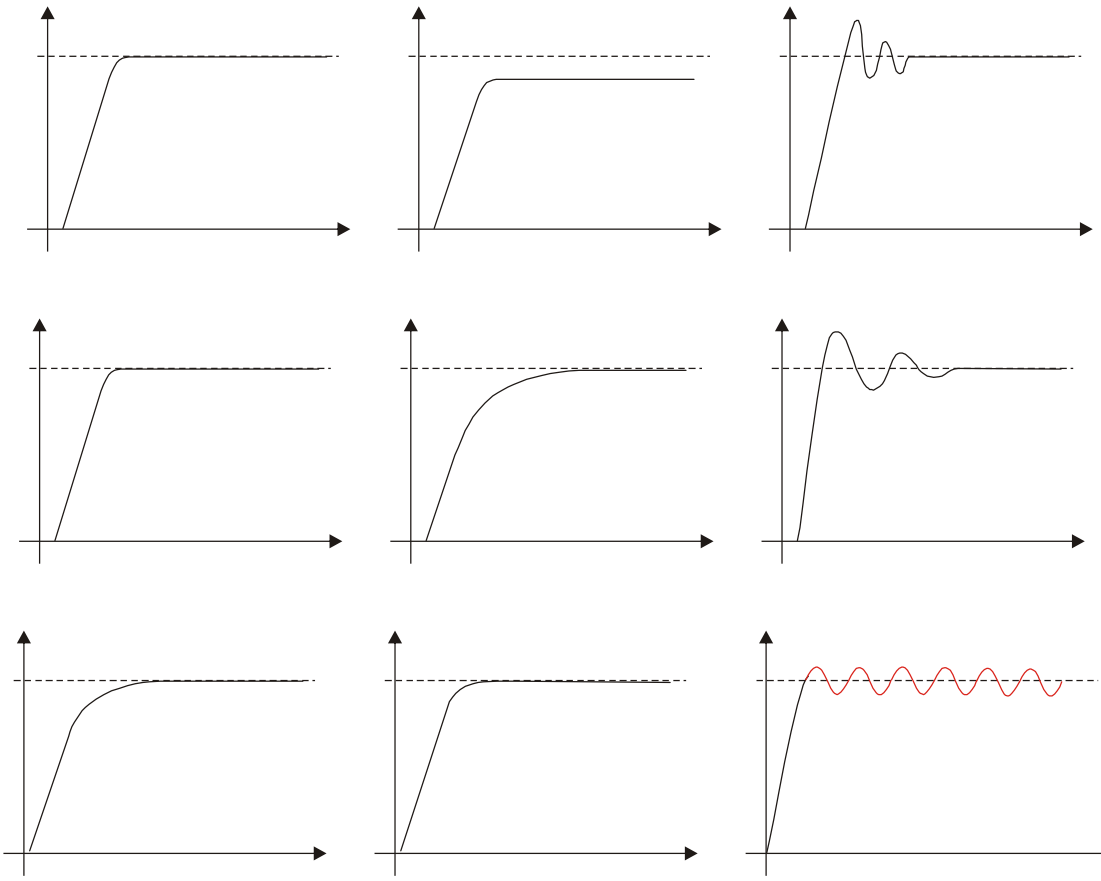

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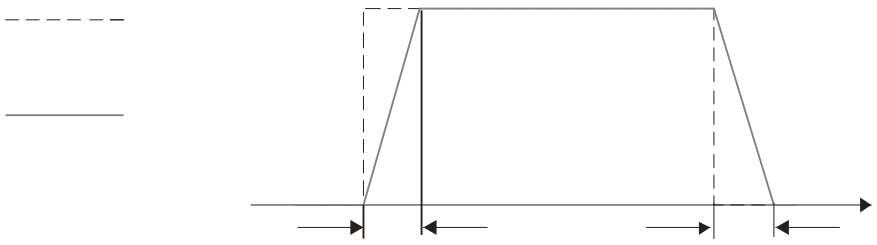

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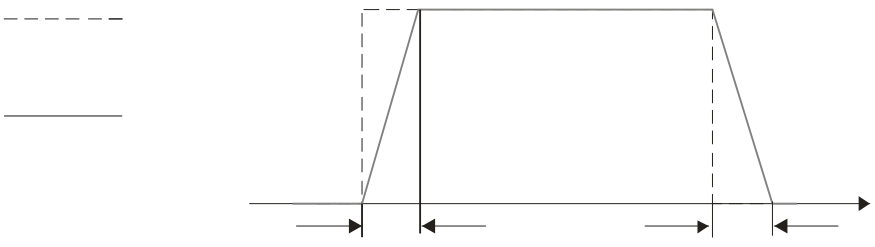

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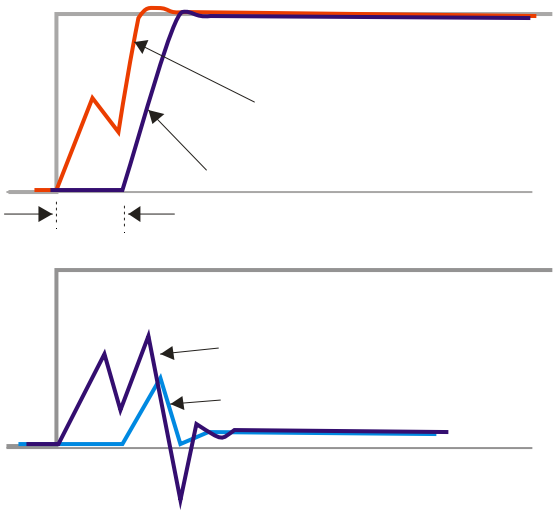

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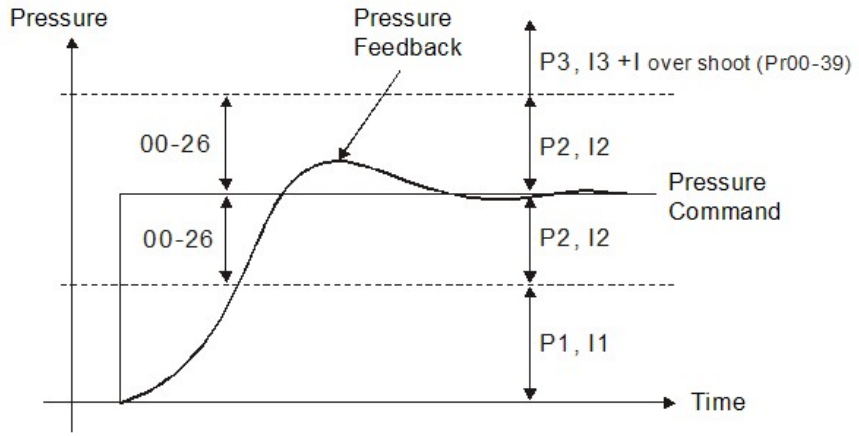
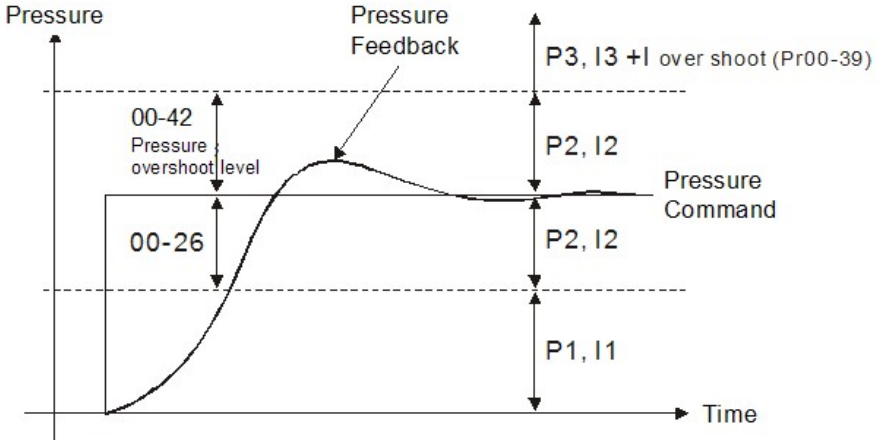
Set Pr00-42=0



Set Pr00-42≠0



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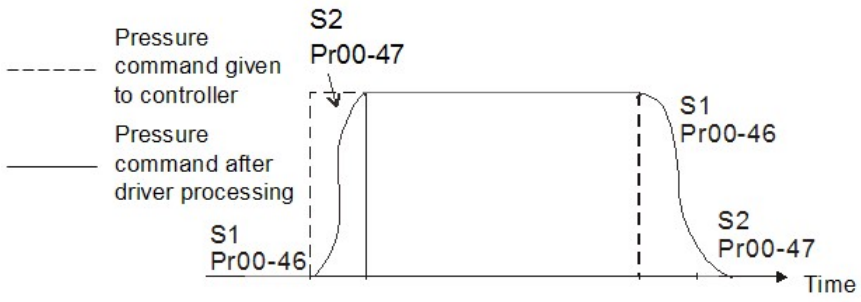

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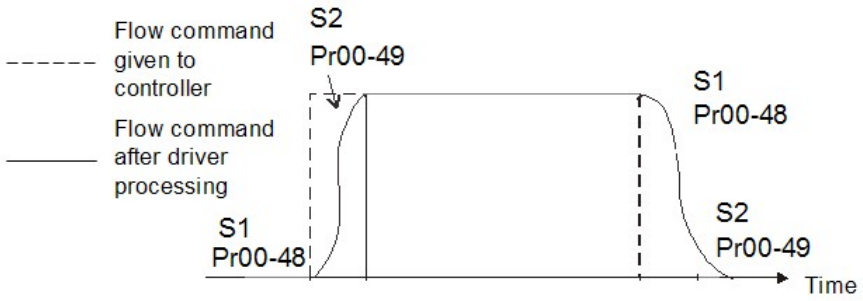

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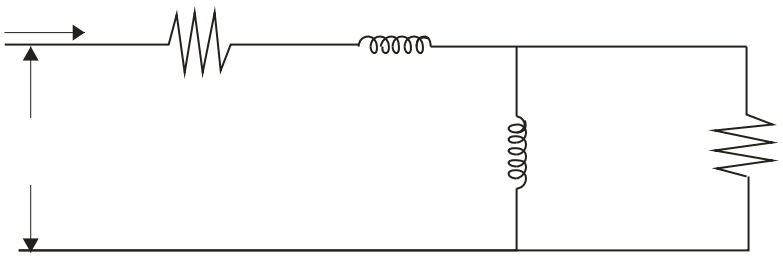

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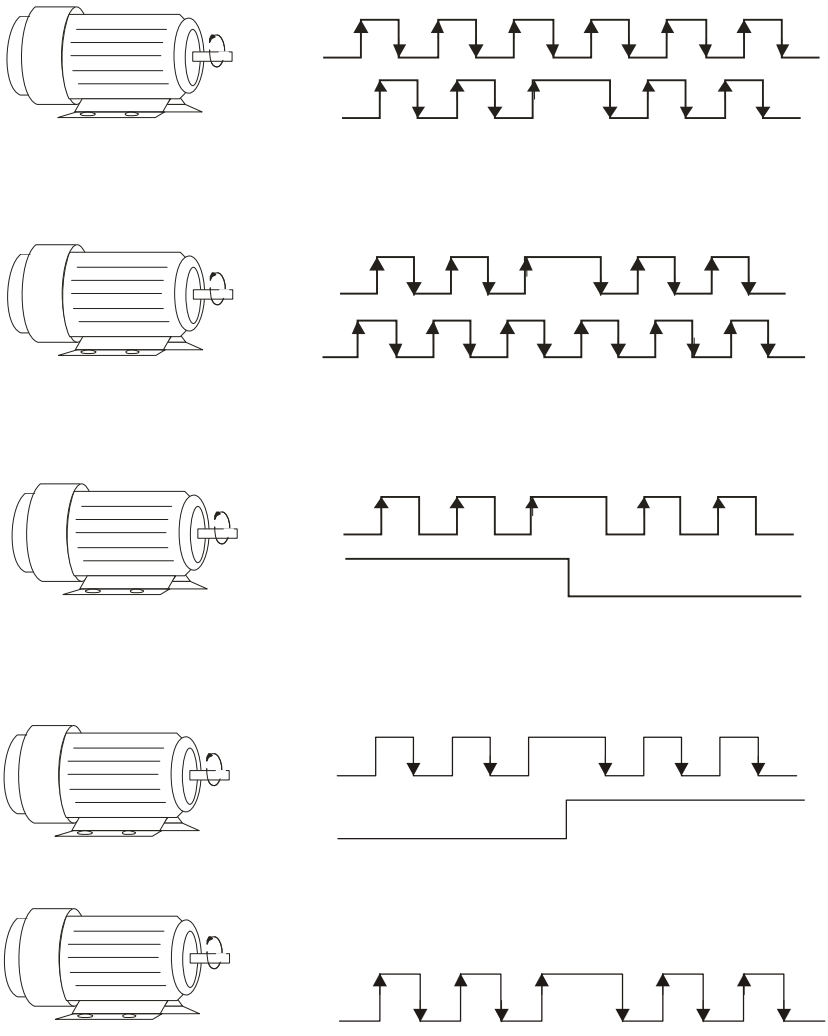

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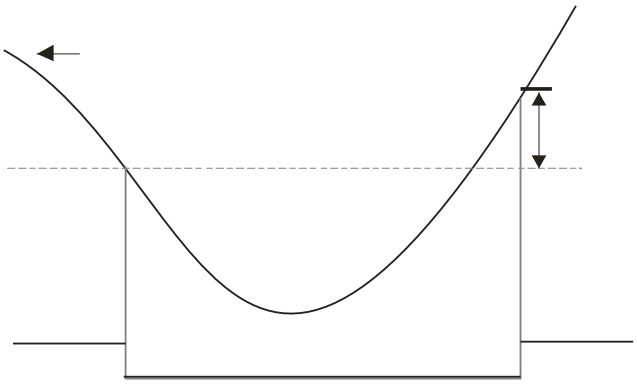

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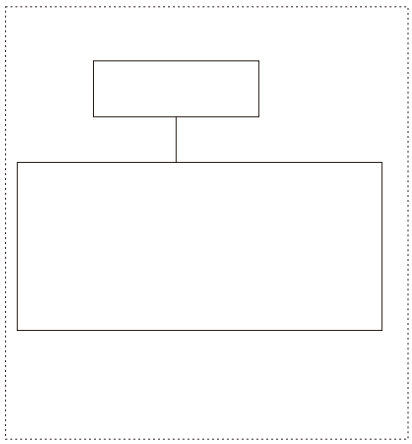

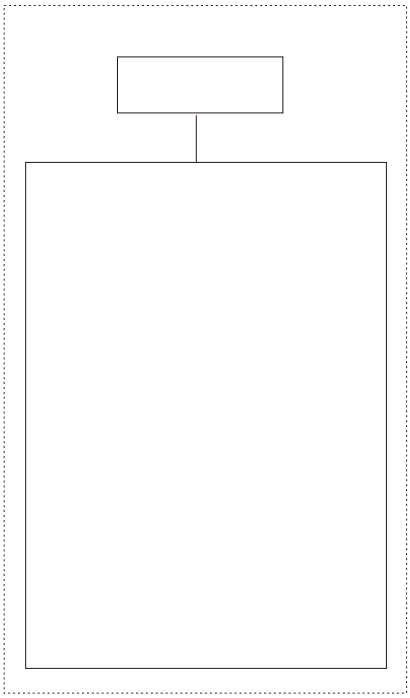

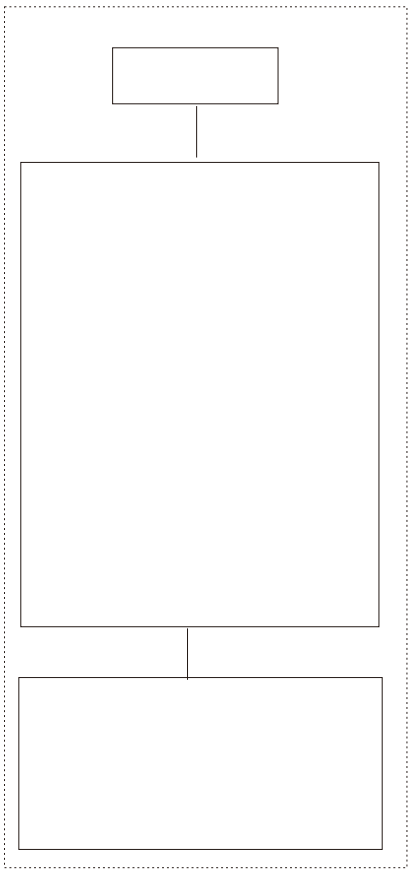

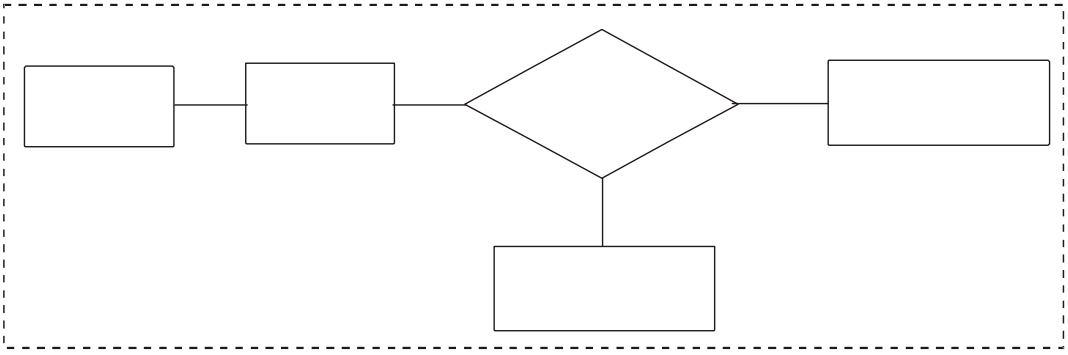


03-00
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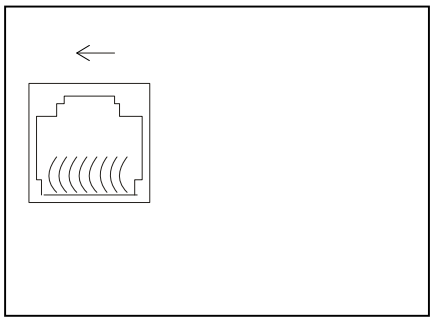

04-00

04-01

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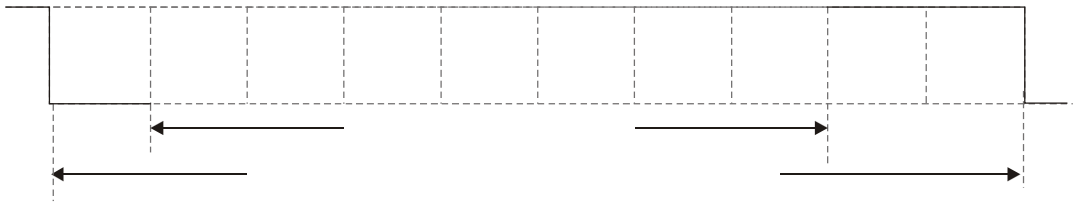
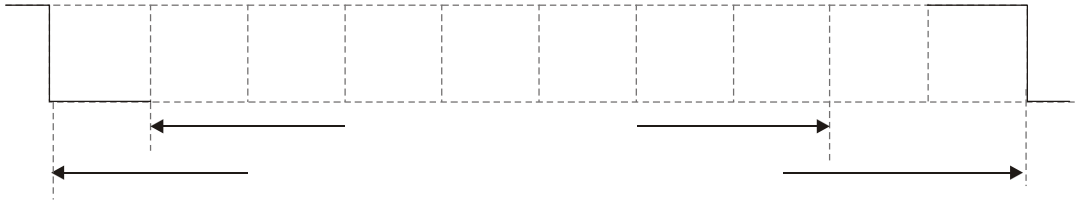
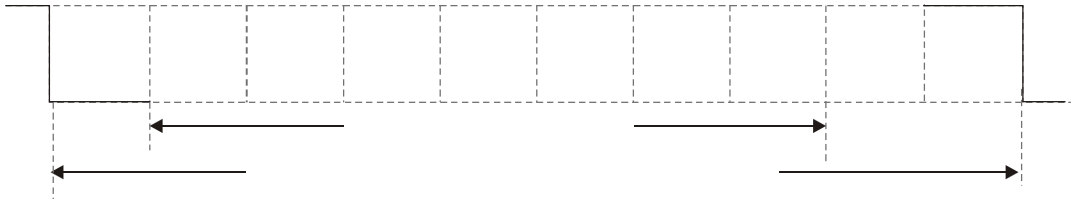
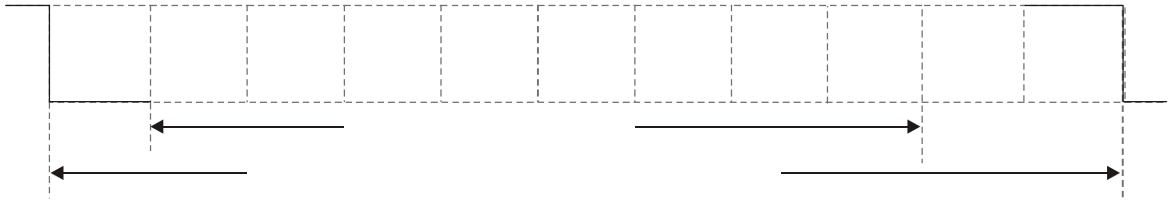
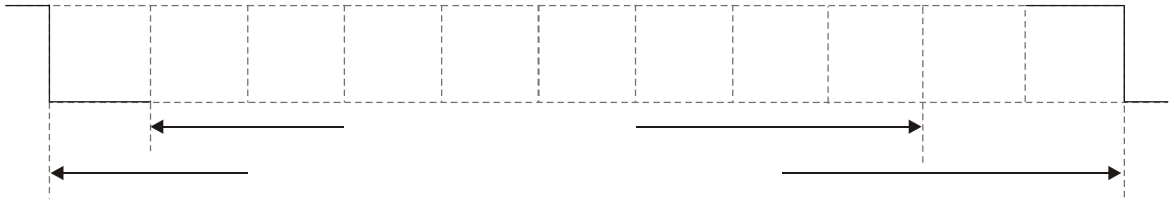
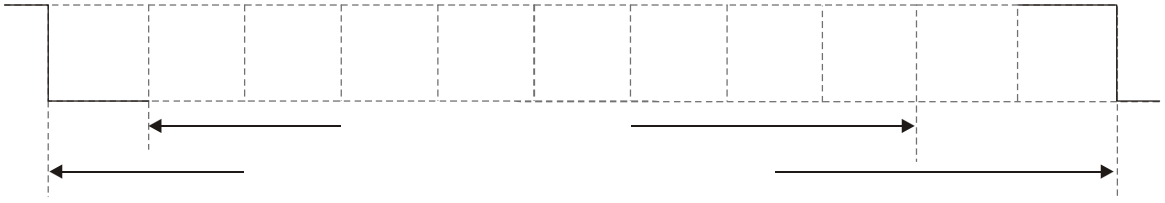












ASCII mode:

Command Message:

STX	':'
Address	'0'
	'1'
Function	'0'
	'3'
Starting register	'2'
	'1'
	'0'
	'2'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
LRC Check	'D'
	'7'
END	CR
	LF

Response Message

STX	':'
Address	'0'
	'1'
Function	'0'
	'3'
Number of register (count by byte)	'0'
	'4'
Content of starting register 2102H	'1'
	'7'
	'7'
	'0'
Content of register 2103H	'0'
	'0'
	'0'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

RTU mode:

Command Message:

Address	01H
Function	03H
Starting data register	21H
	02H
Number of register (count by world)	00H
	02H
CRC CHK Low	6FH
CRC CHK High	F7H

Response Message

Address	01H
Function	03H
Number of register (count by byte)	04H
Content of register address 2102H	17H
	70H
Content of register address 2103H	00H
	00H
CRC CHK Low	FEH
CRC CHK High	5CH

06H: single write, write single data to register.

Example: writing data 6000 (1770H) to register 0100H. AMD address is 01H.

ASCII mode:

Command Message:

STX	':'
Address	'0'
	'1'
Function	'0'
	'6'
Target register	'0'
	'1'
	'0'
	'0'
Register content	'1'
	'7'
	'7'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

Response Message

STX	':'
Address	'0'
	'1'
Function	'0'
	'6'
Target register	'0'
	'1'
	'0'
	'0'
Register content	'1'
	'7'
	'7'
	'0'
LRC Check	'7'
	'1'
END	CR
	LF

RTU mode:

Command Message:

Address	01H
Function	06H
Target register	01H
	00H
Register content	17H
	70H
CRC CHK Low	86H
CRC CHK High	22H

Response Message

Address	01H
Function	06H
Target register	01H
	00H
Register content	17H
	70H
CRC CHK Low	86H
CRC CHK High	22H

10H: write multiple registers (write multiple data to registers) (at most 20 sets of data can be written simultaneously)

Example: Set the multi-stage speed of hybrid servo drive (address is 01H):

Pr. 04-00 = 50.00 (1388H), Pr. 04-01 = 40.00 (0FA0H)

ASCII Mode

Command Message:

STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Target register	'0'
	'5'
	'0'
	'0'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
Number of register (count by Byte)	'0'
	'4'
The first data content	'1'
	'3'
	'8'
	'8'
The second data content	'0'
	'F'
	'A'
	'0'
LRC Check	'9'
	'A'
END	CR
	LF

Response Message

STX	':'
ADR 1	'0'
ADR 0	'1'
CMD 1	'1'
CMD 0	'0'
Target register	'0'
	'5'
	'0'
	'0'
Number of register (count by word)	'0'
	'0'
	'0'
	'2'
LRC Check	'E'
	'8'
END	CR
	LF

RTU mode:

Command Message:

ADR	01H
CMD	10H
Target register	05H
	00H
Number of register (Count by word)	00H
	02H
Quantity of data (Byte)	04
The first data content	13H
	88H
The second data content	0FH
	A0H
CRC Check Low	'9'
CRC Check High	'A'

Response Message:

ADR	01H
CMD 1	10H
Target register	05H
	00H
Number of register (Count by word)	00H
	02H
CRC Check Low	41H
CRC Check High	04H

Check sum

ASCII mode:

LRC (Longitudinal Redundancy Check) is calculated by summing up, module 256 and the values of the bytes from ADR1 to last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example:

01H + 03H + 21H + 02H + 00H + 02H = 29H, the 2's-complement negation of 29H is D7H.

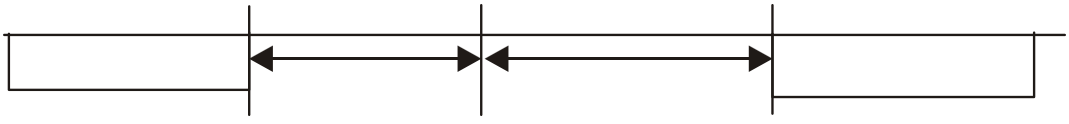
RTU mode:

CRC (Cyclical Redundancy Check) is calculated by the following steps:

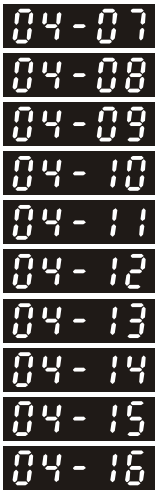
4. Address list

Content	Register	Function	
Hybrid servo drive parameters	GGnnH	GG means parameter group, nn means parameter number, for example, the address of Pr. 04-01 is 0401H.	
Command write only	2000H	bit 1~0	00B: No function
			01B: Stop
			10B: Run
			11B: Enable JOG
		bit 3~2	Reserved
		bit 5~4	00B: No function
			01B: FWD
			10B: REV
			11B: Change direction
		bit 14~13	00B: No function
			01B: Operated by digital keypad
			10B: Operated by Pr00-21
			11B: Change source of operation command
		bit 15	Reserved
	2001H	Frequency command(Set Pr00-06=0, Input XXX.XX Hz)	
	2002H	bit 0	1: EF (external fault) on
		bit 1	1: Reset
		bit 2	1: B.B ON
		bit 15~3	Reserved
Status monitor read only	2100H	High byte: Warn code Low Byte: Error code	
	2101H	bit 1~0	Hybrid servo drive operation status 00B: Drive stops 01B: Drive decelerating 10B: Drive standby 11B: Drive in operation
		bit 2	1: Reserved
		bit 4~3	Operation direction 00B: FWD run 01B: From REV run to FWD run 10B: From FWD run to REV run 11B: REV run
		bit 8	1: Master frequency controlled by communication interface
		bit 9	1: Master frequency controlled by analog signal or external input terminals.
		bit 10	1: Operation command controlled by communication interface
		bit 11	1: Parameter locked
		bit 12~15	Reserved
	2102H	Frequency command (XXX.XX Hz)	
	2103H	Output frequency (XXX.XX Hz)	
	2104H	Output current (XX.XX A).	
	2105H	DC-BUS voltage (XXX.X V)	
	2106H	Output voltage (XXX.X V)	
	2107H	Reserved	
	2108H	Reserved	
	2116H	Multi-function display (Pr00-04)	
	2200H	Display output current (A)	
	2201H	Reserved	
	2202H	Actual output frequency (XXX.XX Hz)	
	2203H	DC-BUS voltage (XXX.X V)	
	2204H	Output voltage (XXX.X V)	
	2205H	Power angle (XXX.X)	
	2206H	Display actual motor speed kW of U, V, W (XXXXX kW)	
	2207H	Display motor speed in rpm estimated by the drive or encoder feedback (XXXXX rpm) (Pr00-04 #7)	
	2208H	Display positive / negative output torque in %, estimated by the motor drive (t0.0: positive torque, -0.0: negative torque) (XXX.X %)	

04-05



04-06


04-07
04-08
04-09
04-10
04-11
04-12
04-13
04-14
04-15
04-16


04-17


04-18


04-19

04-20

04-21

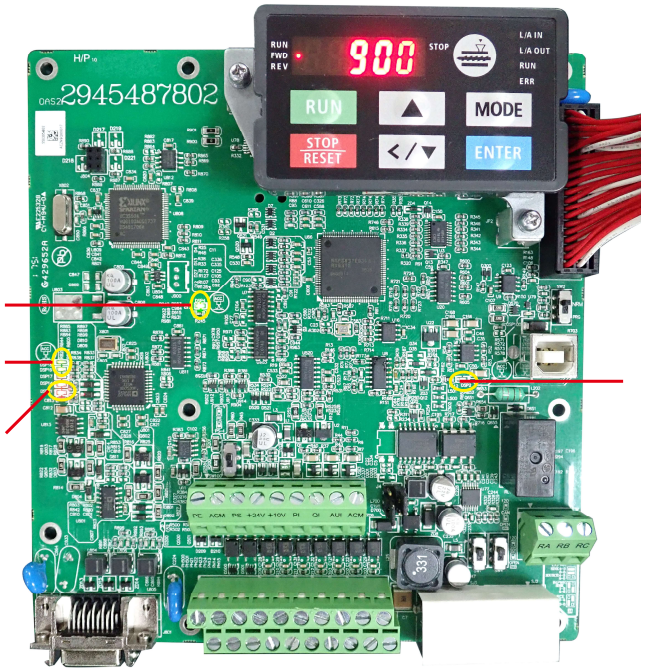
04-22

04-23

04-24

5. Methods of Anomaly Diagnosis

5-1 Unusual Signal



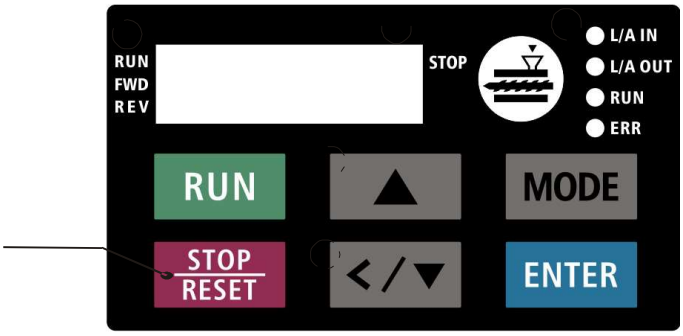
			
			
			
			
			
			
			
			

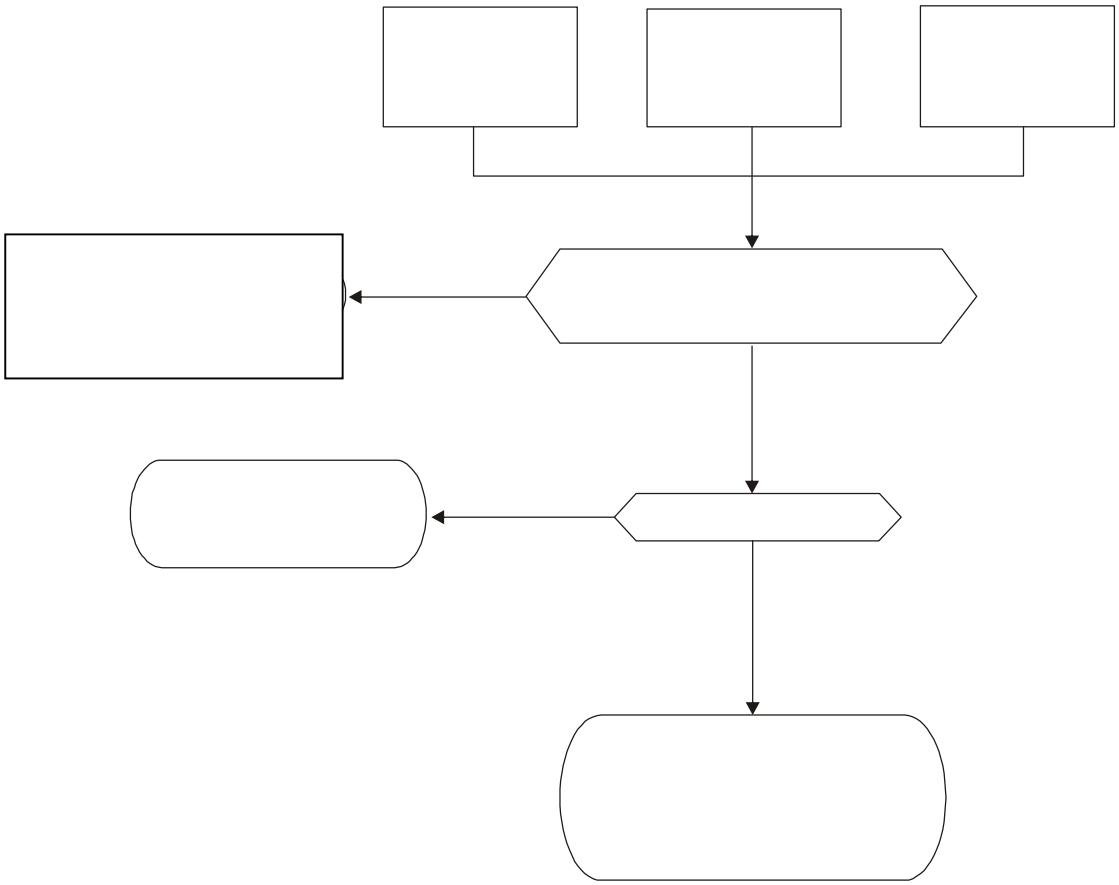
			
			
			
			
			
			



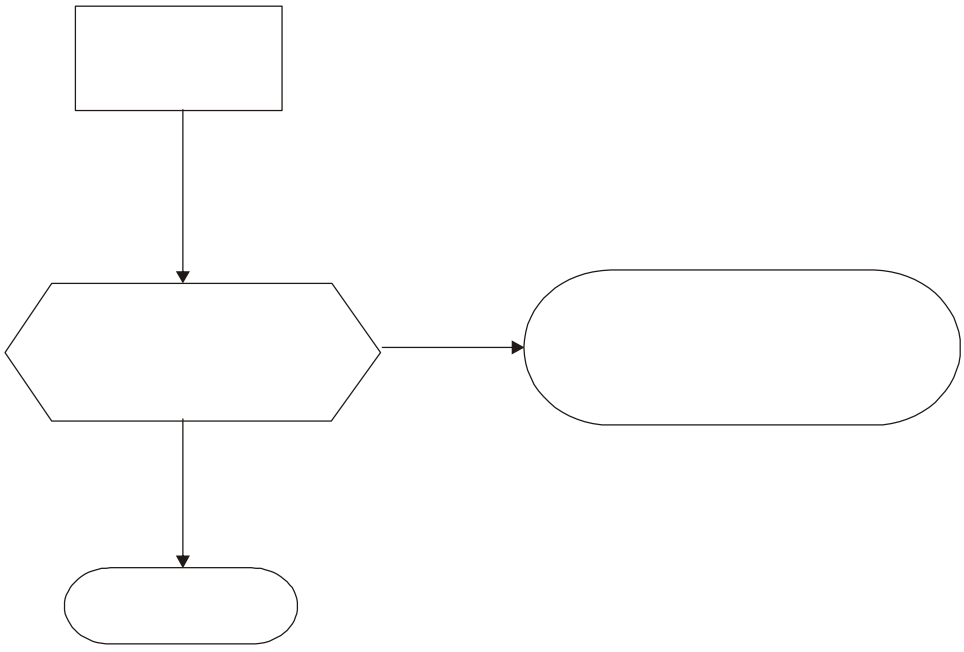
	6	

	6	
	CLOn	

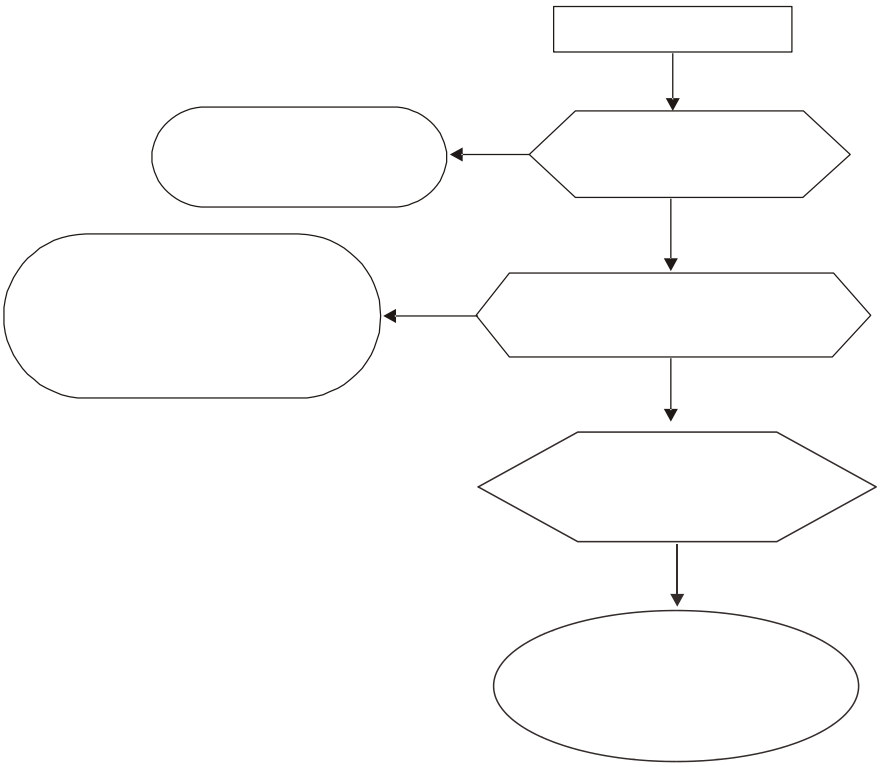
5-2 Over Current (oc)



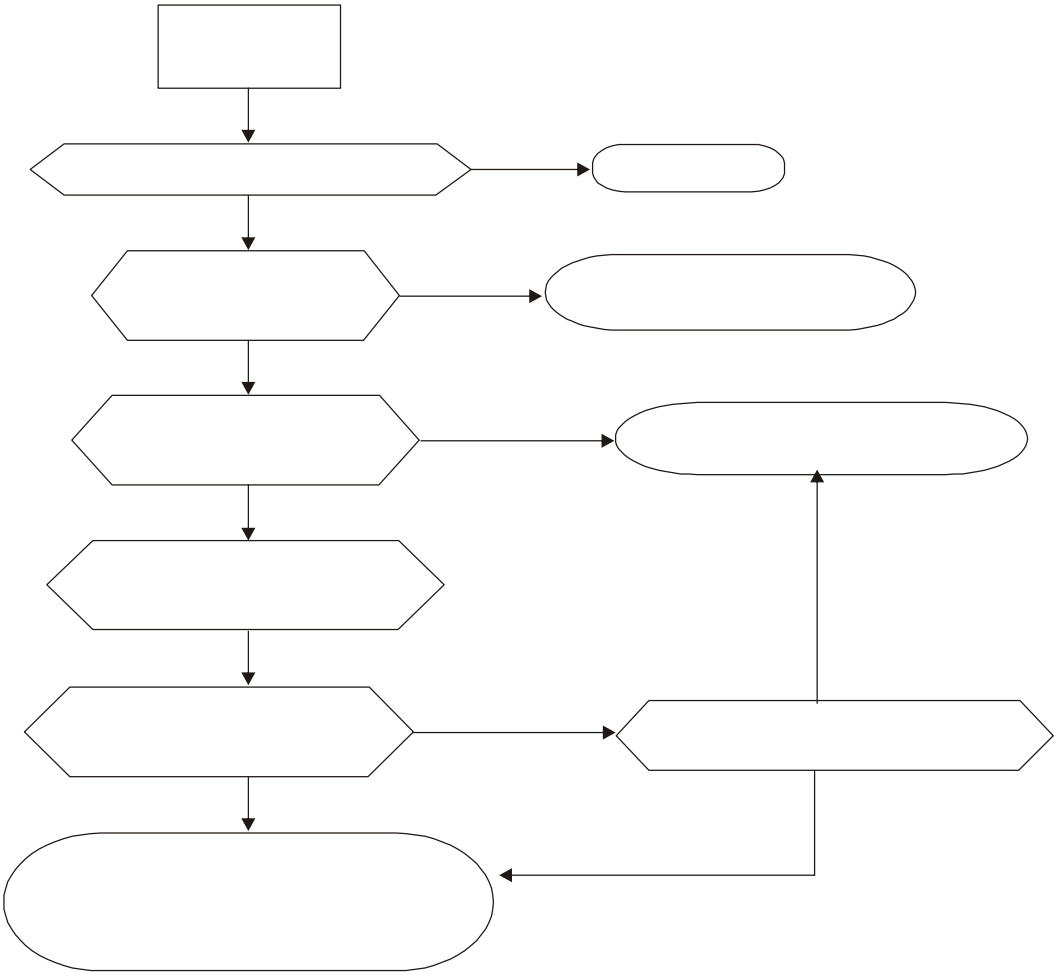
5-3 Ground Fault (GFF)



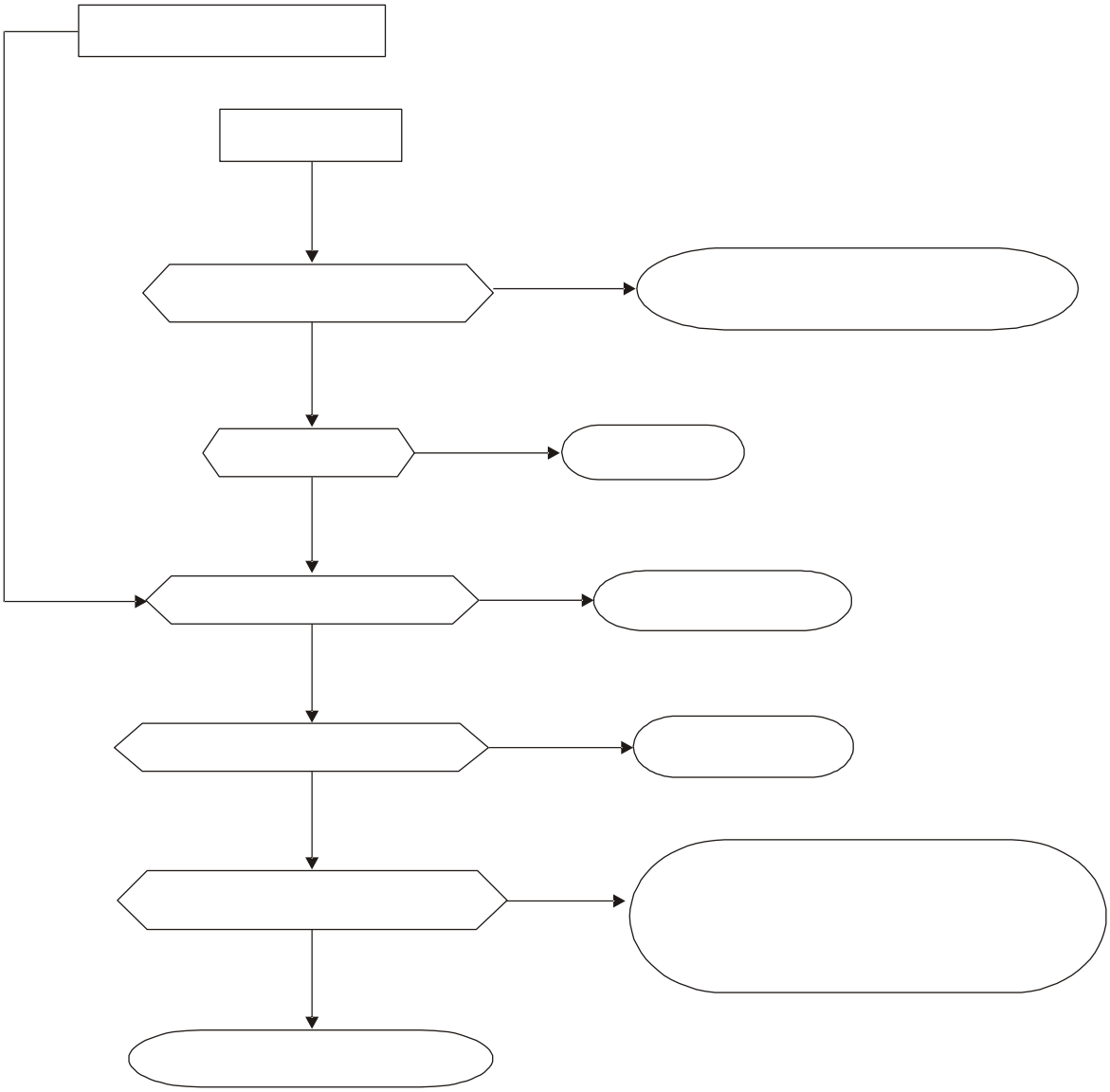
5-4 Over Voltage (ov)



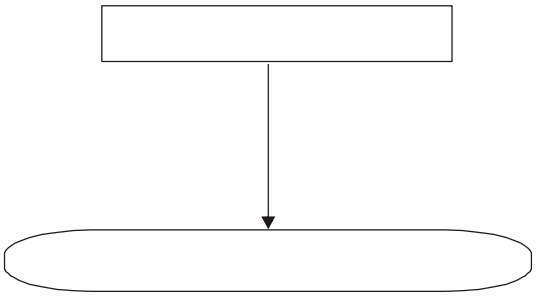
5-5 Low Voltage (Lv)



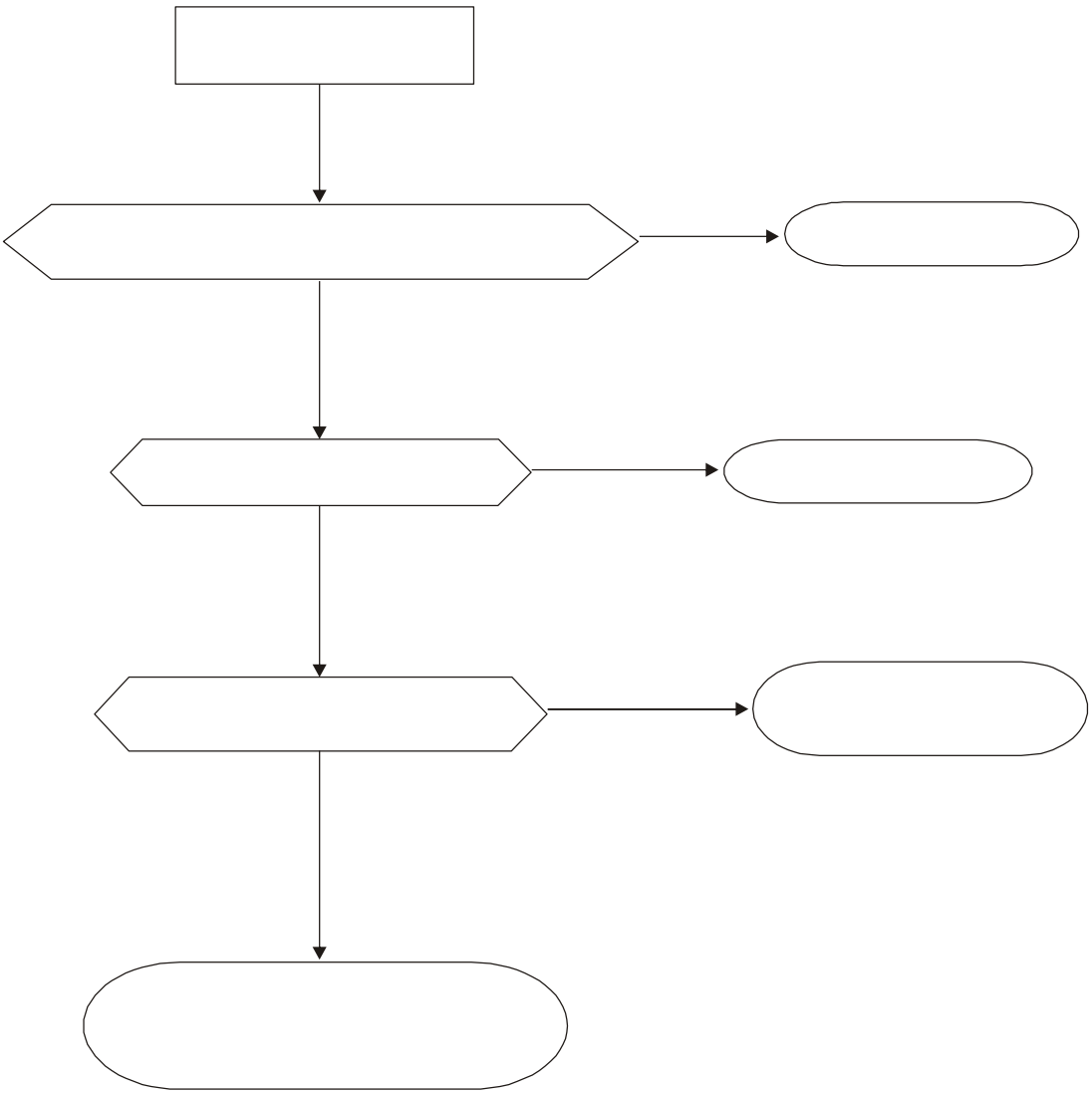
5-6 Over Heat (oH1)



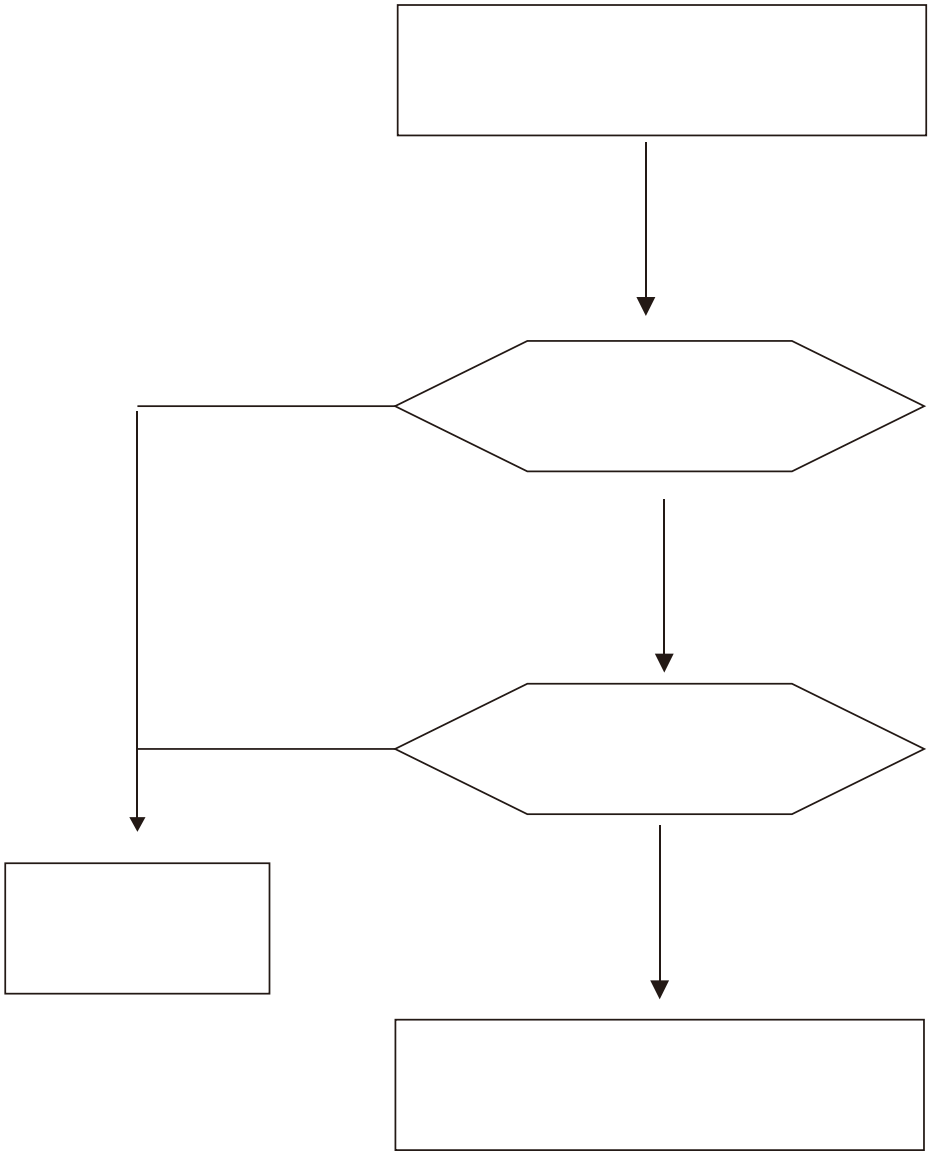
5-7 Overload (oL)



5-8 Phase Loss (PHL)



5-9 Hybrid servo drive overloading when running at low frequency (oL3)



5-10 Electromagnetic/Induction Noise

5-11 Environment and Facilities for Installation

6. Suggestions and Error Corrections for Hybrid Servo Drives

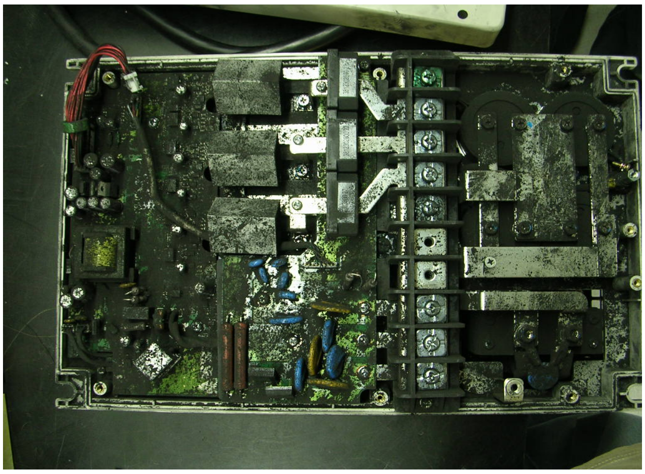
6-2 Greasy Dirt Problem

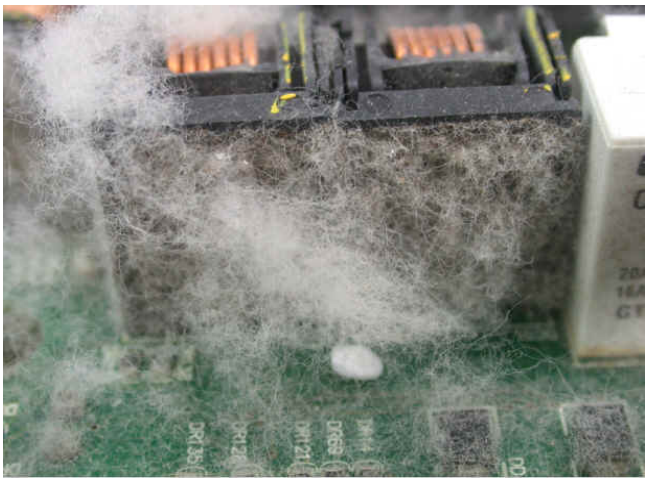
Serious greasy dirt problems generally occur in processing industries such as machine tools, punching machines and so on. Please be aware of the possible damages that greasy oil may cause to your drive:

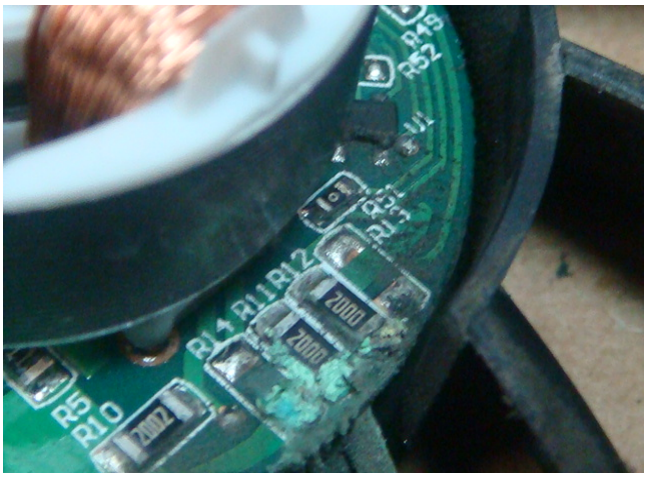
1. **Electronic components that silt up with greasy oil may cause the drive to burn out or even explode.**
2. **Most greasy dirt contains corrosive substances that may damage the drive.**

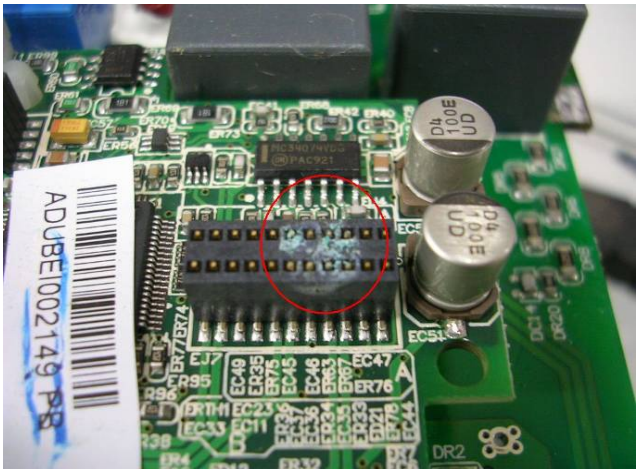
Solution:

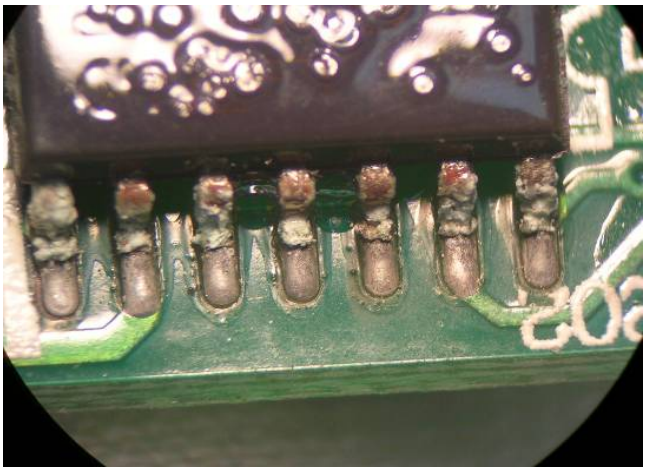
Install the hybrid servo drive in a standard cabinet to keep it away from dirt. Clean and remove greasy dirt regularly to prevent damage of the drive.

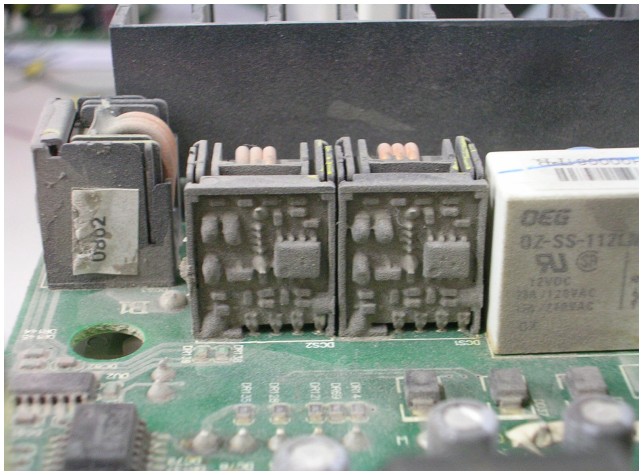


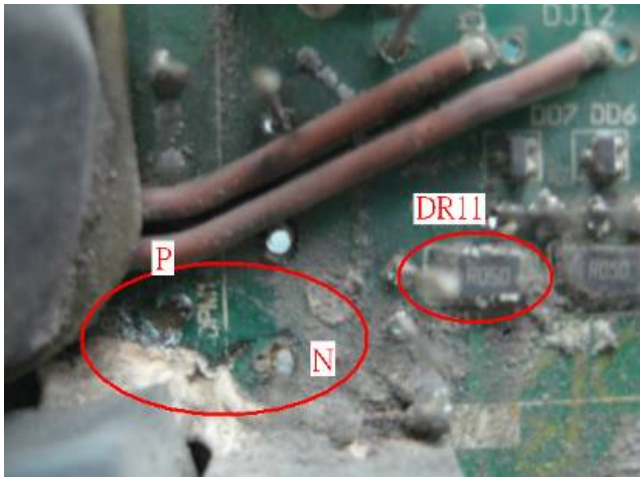


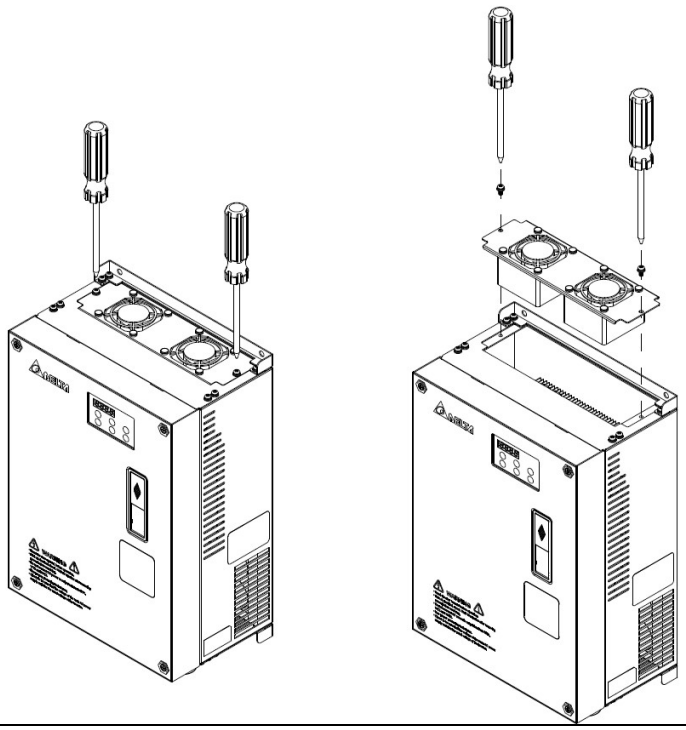
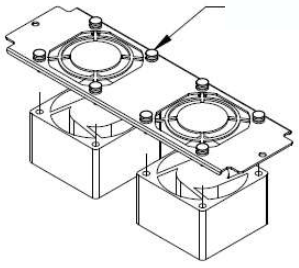
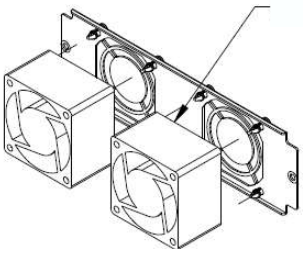

R5
R10
2002
2000
2000

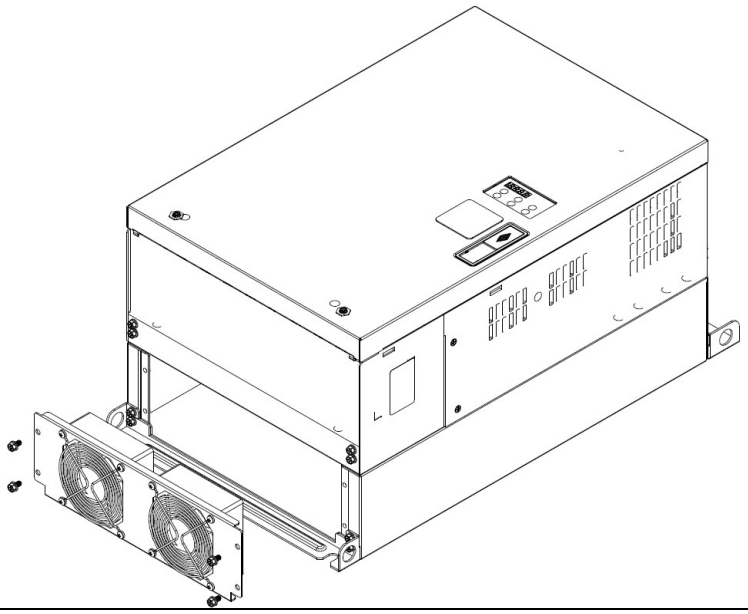

ADUBEI002149 PB
D4
100E
UD
D4
100E
UD
DR2

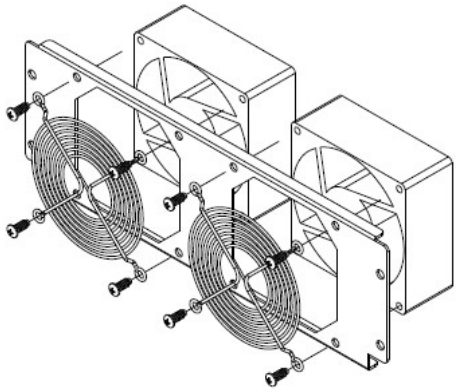


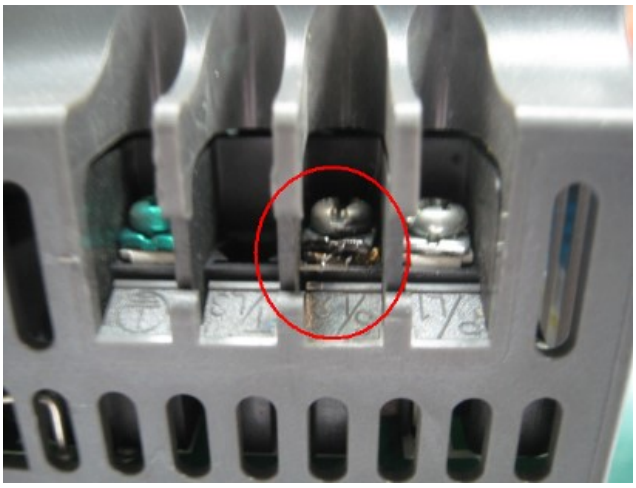


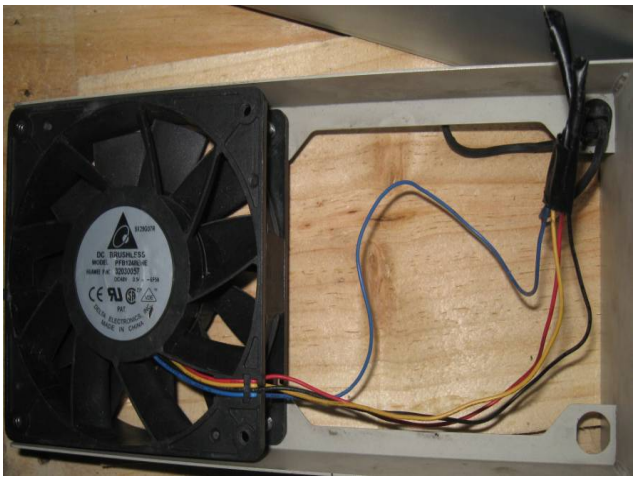


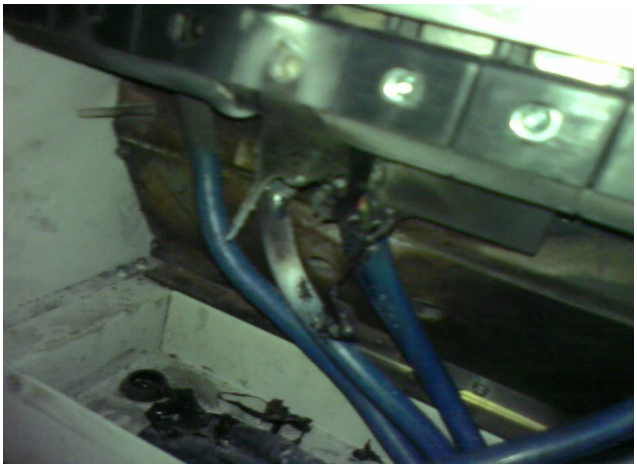
  

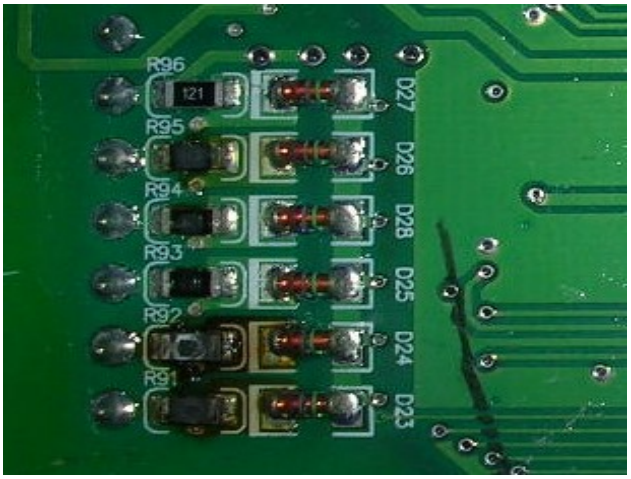


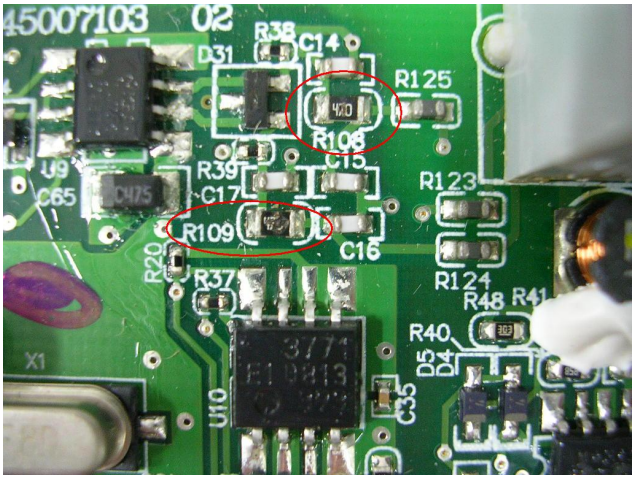


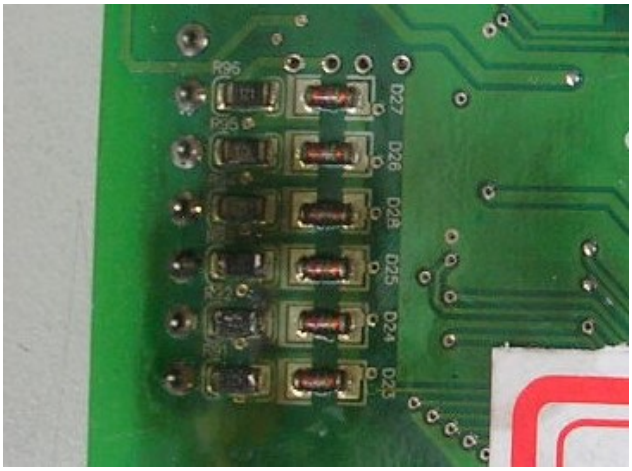



DC BRUSHLESS



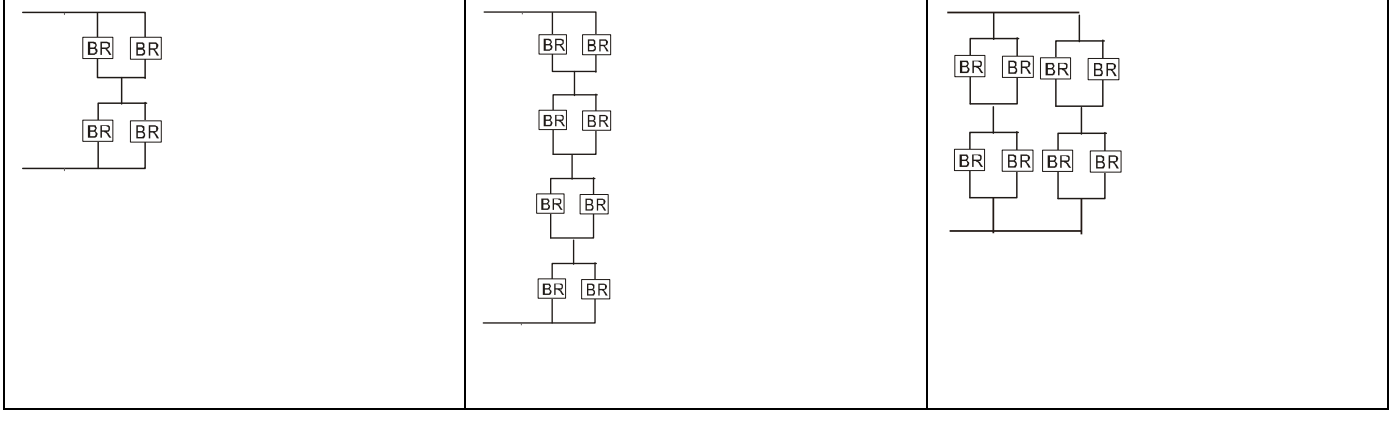

R96
R95
R94
R93
R92
R91
D27
D26
D28
D25
D24
D23

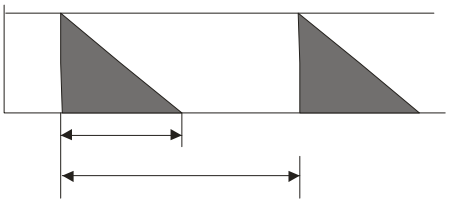

45007103 02
R38
C14
D31
R125
R108
C15
U9
C65
R39
C17
R123
R109
C16
R20
R37
R124
R48
R41
R40
D5
D4
X1
U10
C35

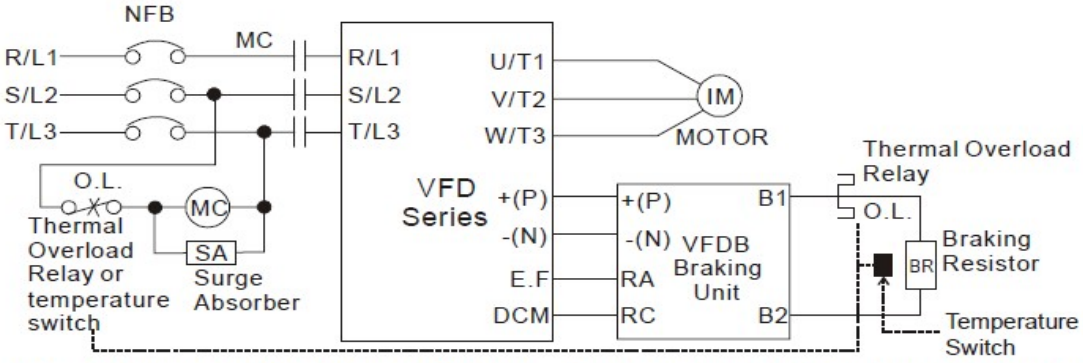

R96
R95
D27
D26
D28
D25
D24
D23

Appendix A: Optional Accessories

A-1 Braking Resistor Selection Chart

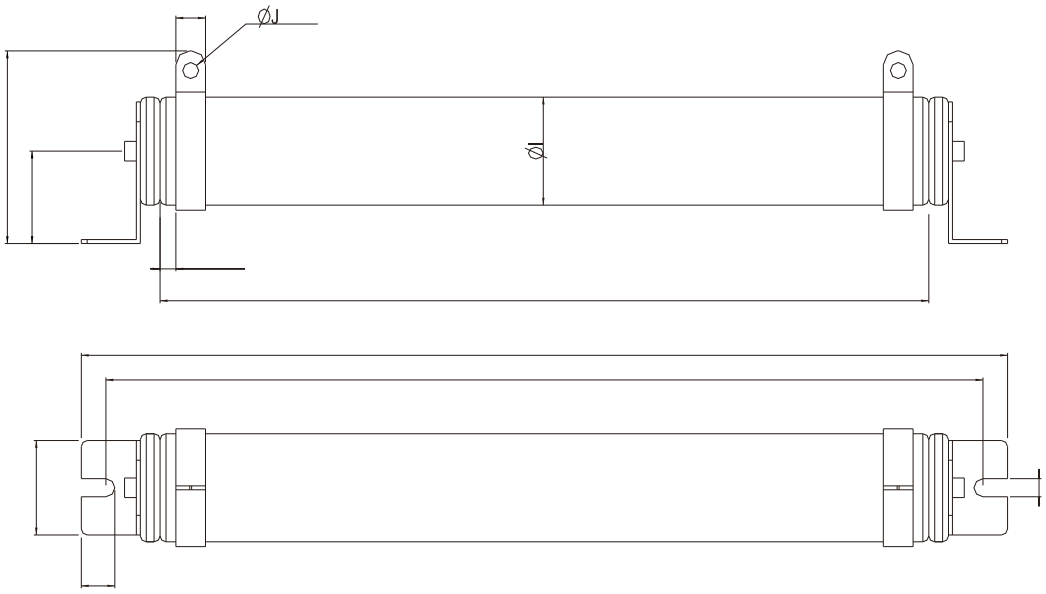

BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR
BR

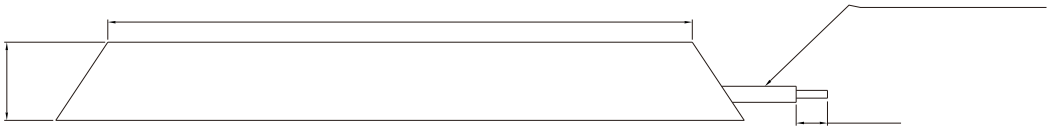




Note1: When using the AC drive with DC reactor, please refer to wiring diagram in the AC drive user manual for the wiring of terminal +(P) of Braking unit.

Note2: **Do NOT** wire terminal -(N) to the neutral point of power system.

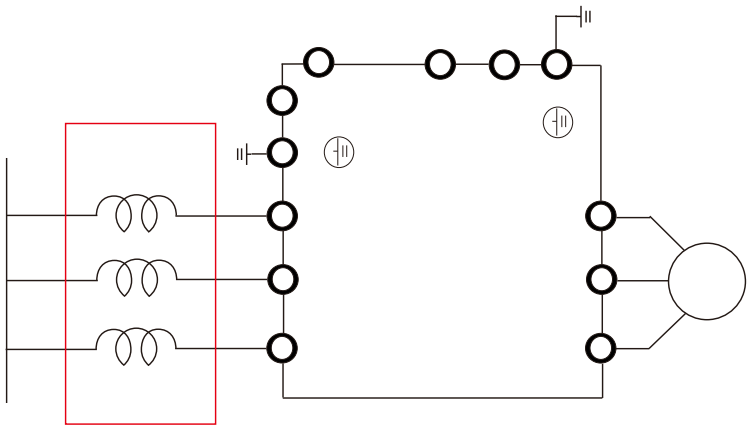

ØJ
Ø1

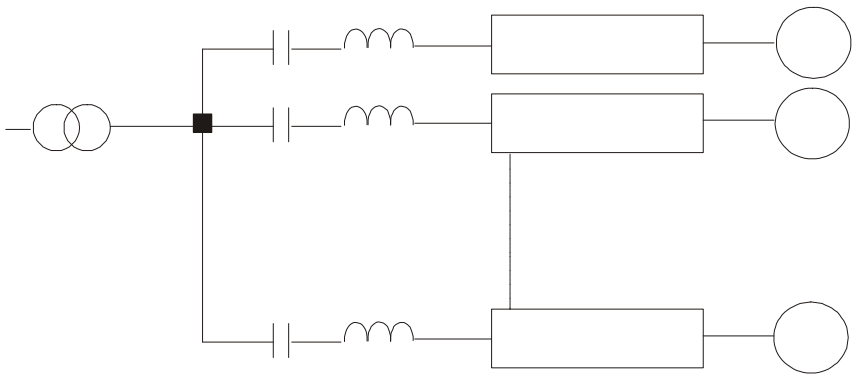


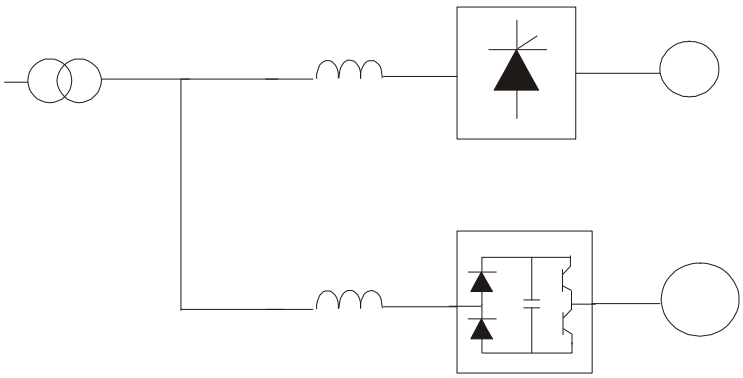
A-2 Non-Fuse Circuit Breaker

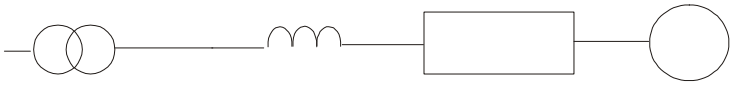
A-3 Fuse

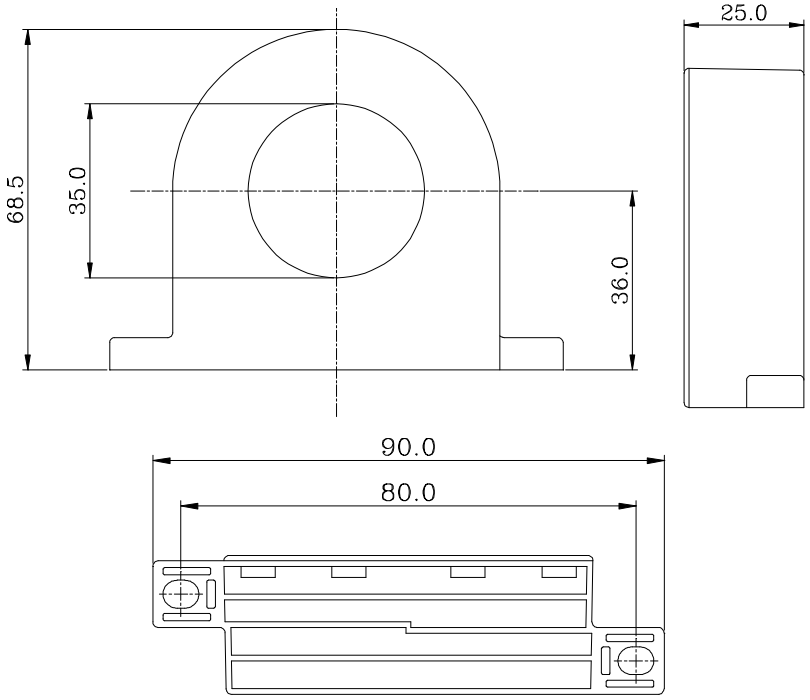
A-4 Reactor

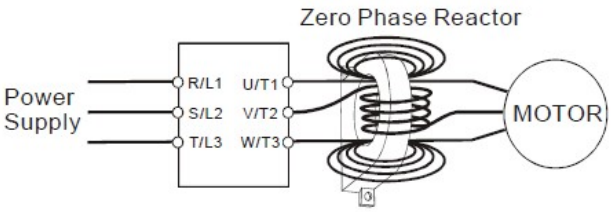


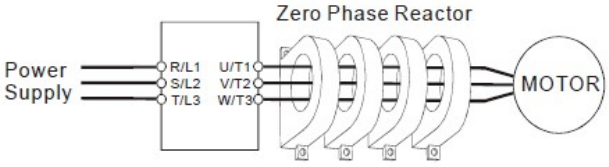




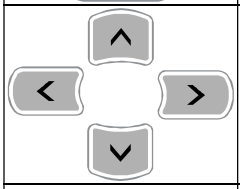



25.0
68.5
35.0
36.0
90.0
80.0


Zero Phase Reactor
Power Supply
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
MOTOR


Zero Phase Reactor
Power Supply
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
MOTOR

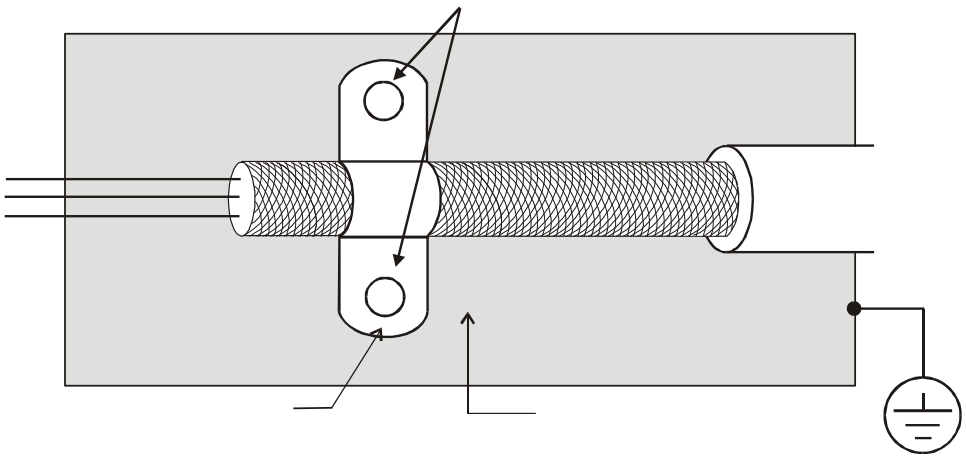
A-5 Digital Keypad KPC-CC01

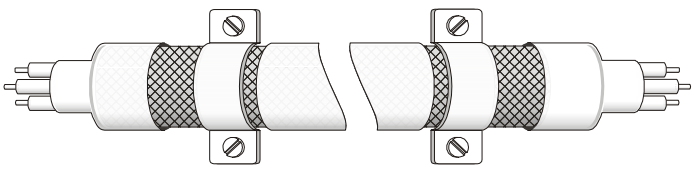
 RUN	
 STOP RESET	
 FWD REV	
 ENTER	
 ESC	
 MENU	
	
 F1 F2 F3 F4	
 HAND	
 AUTO	

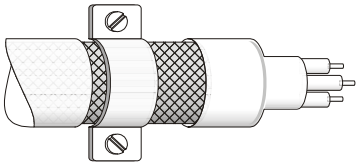
	
	
	

	0	1	2	3	4	5	6	7	8	9
	A	b	C c	d	E	F	G	H h	I	J J
	P	L	n	O o	P	q	r	S	Tt	U
	v	y	=							

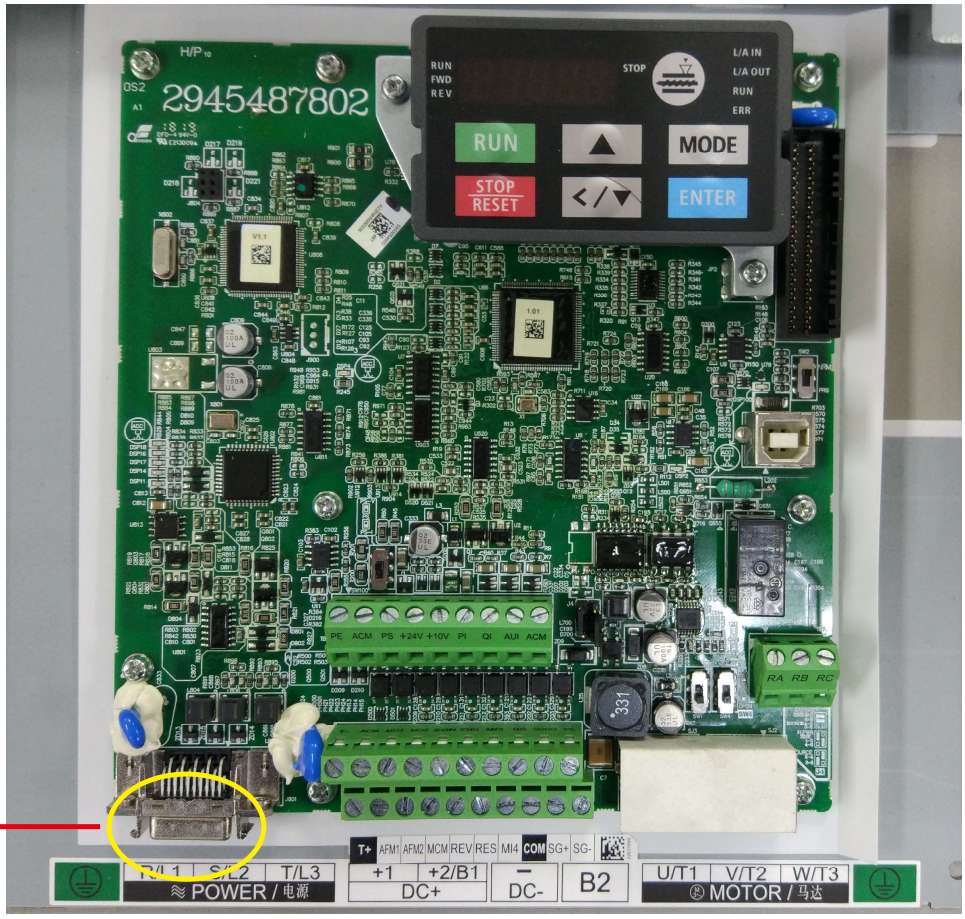
A-6 EMI Filter

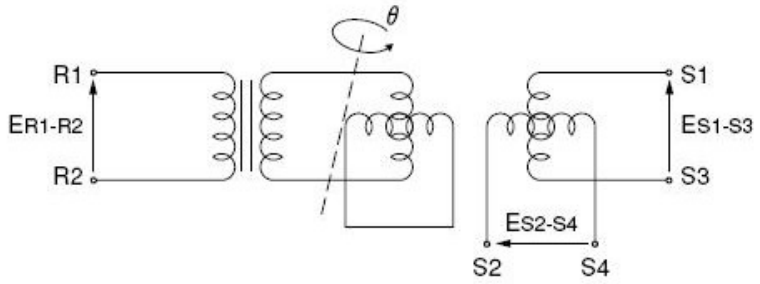


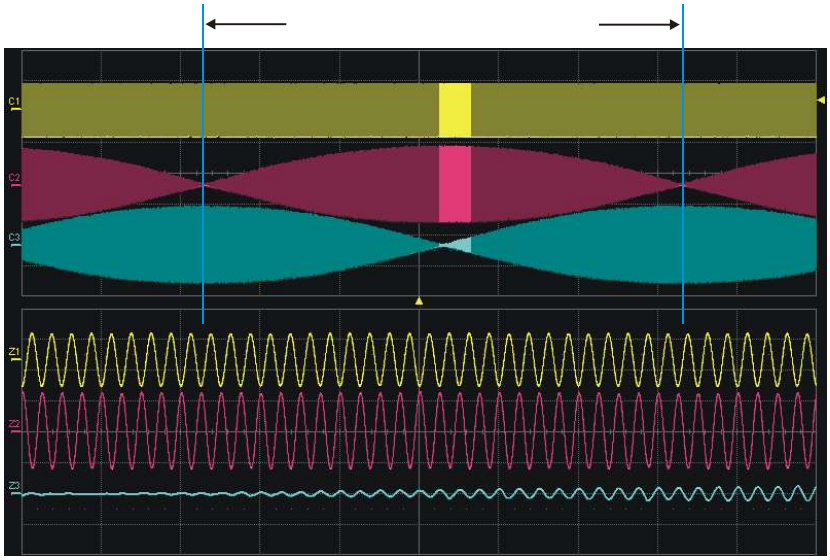


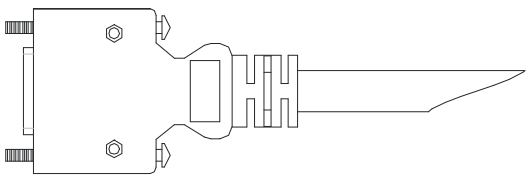


A-7 Speed Feedback Encoder

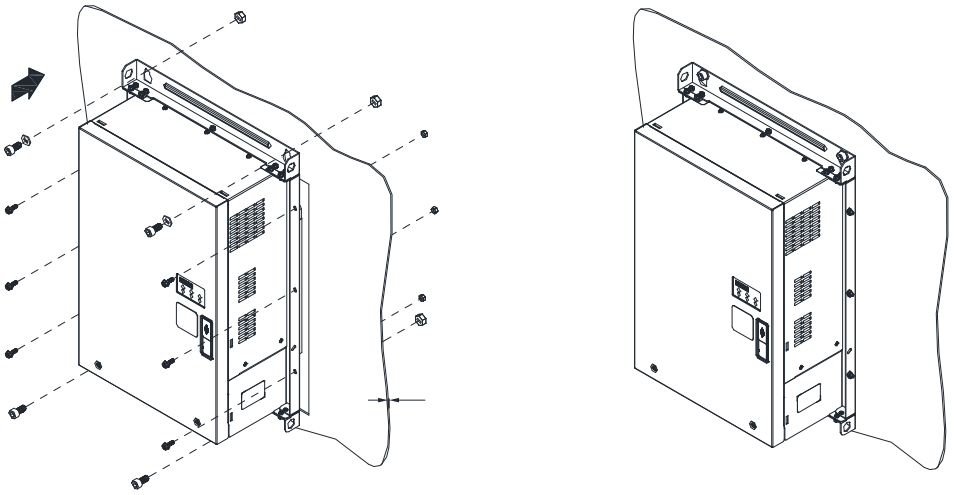


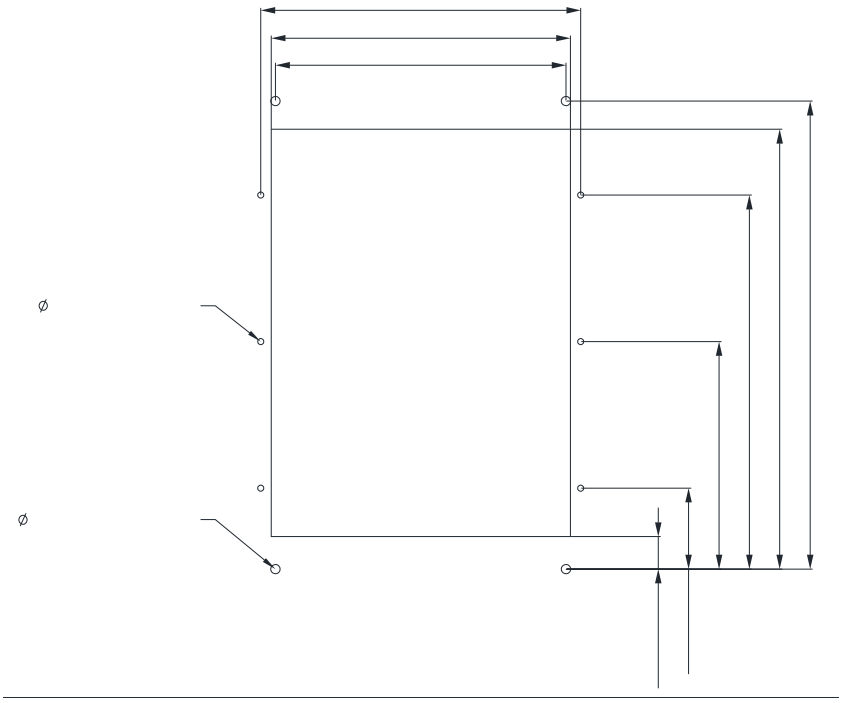

θ
R1
ER1-R2
R2
S1
ES1-S3
S3
ES2-S4
S2
S4



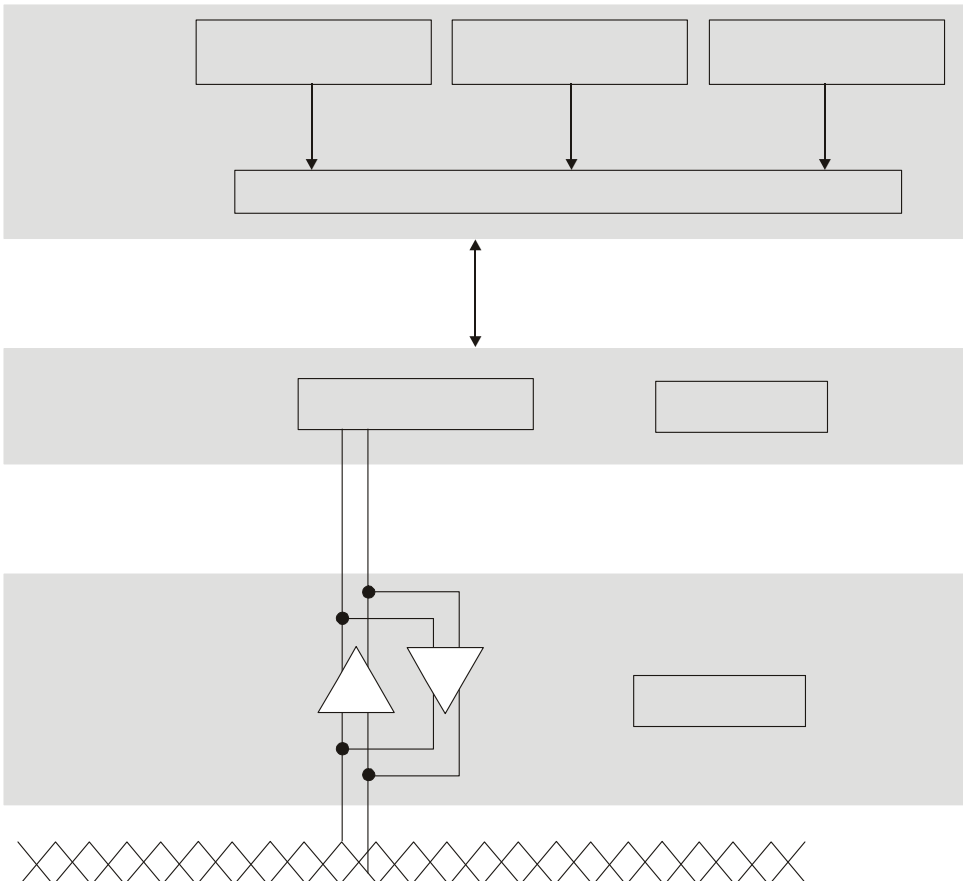


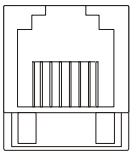
A-8 Wall-Mounted Installation

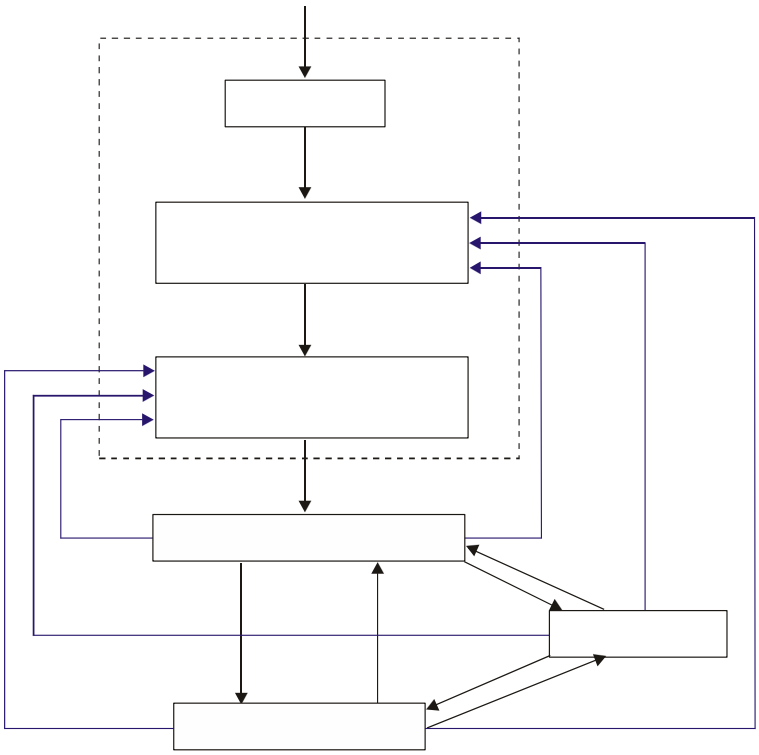


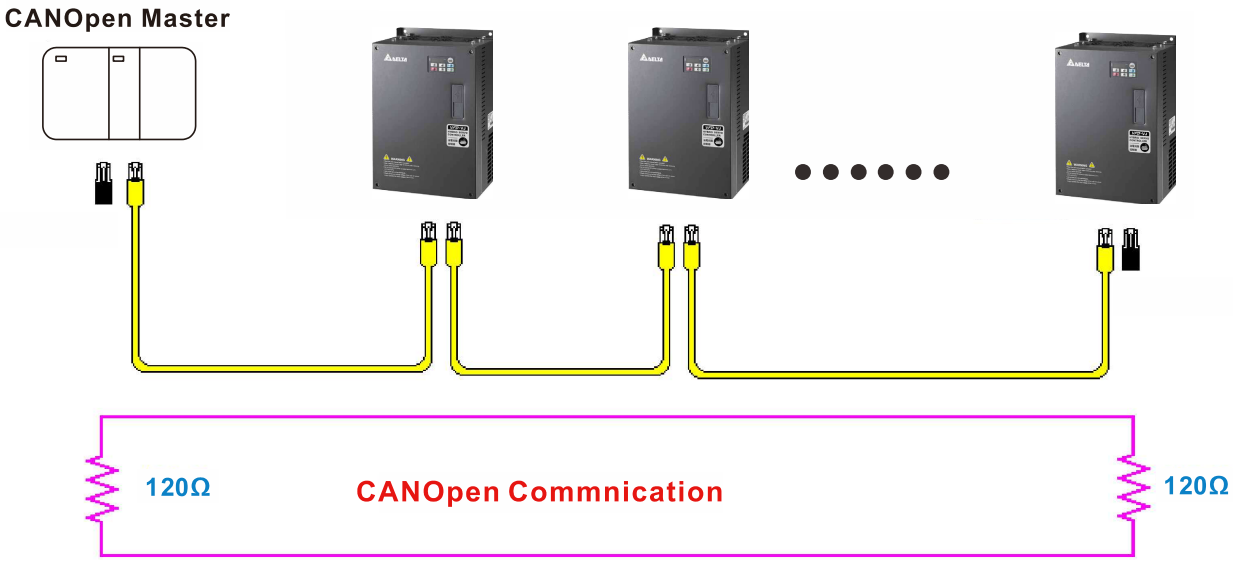


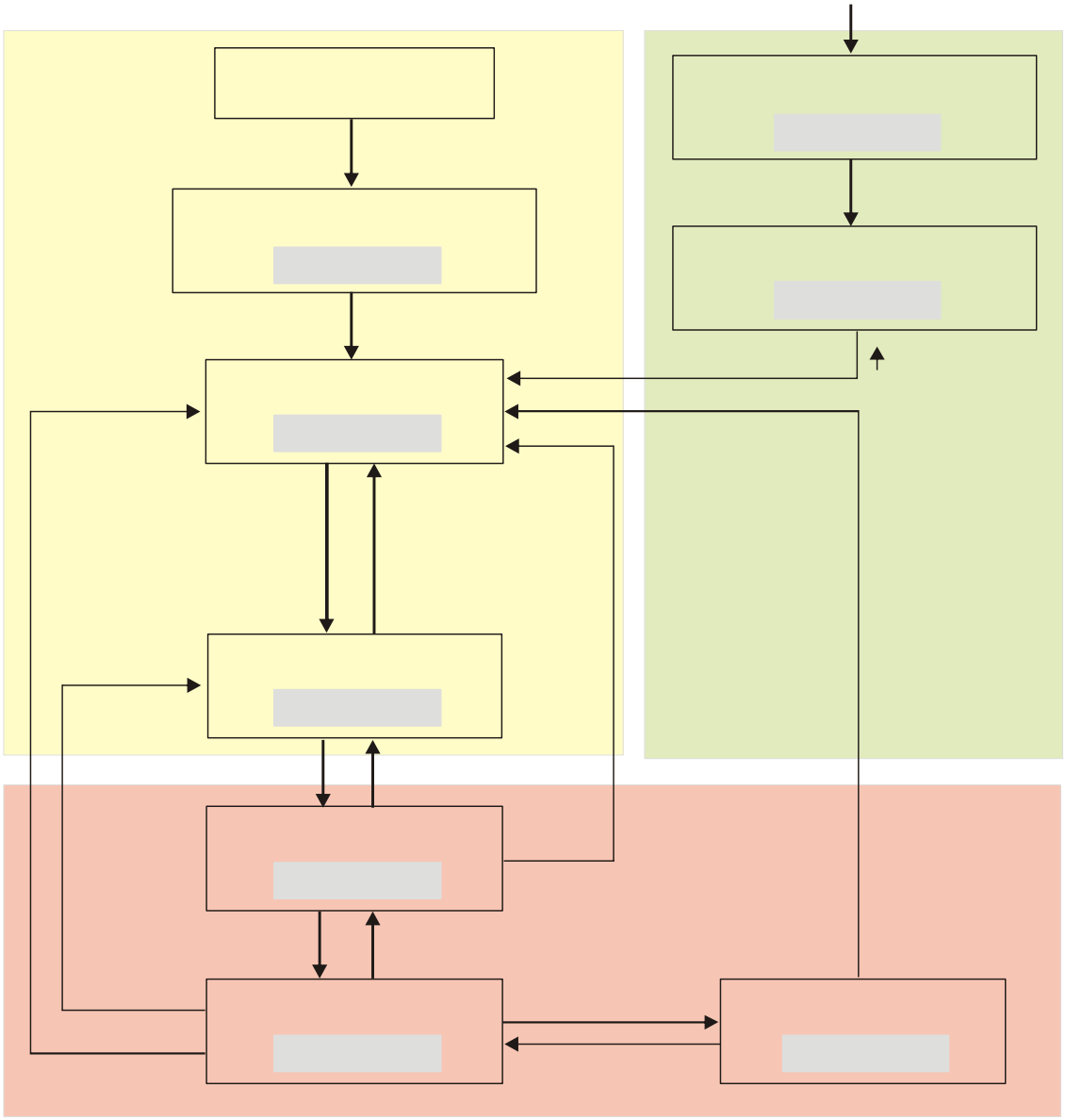
Appendix B: CANopen Overview

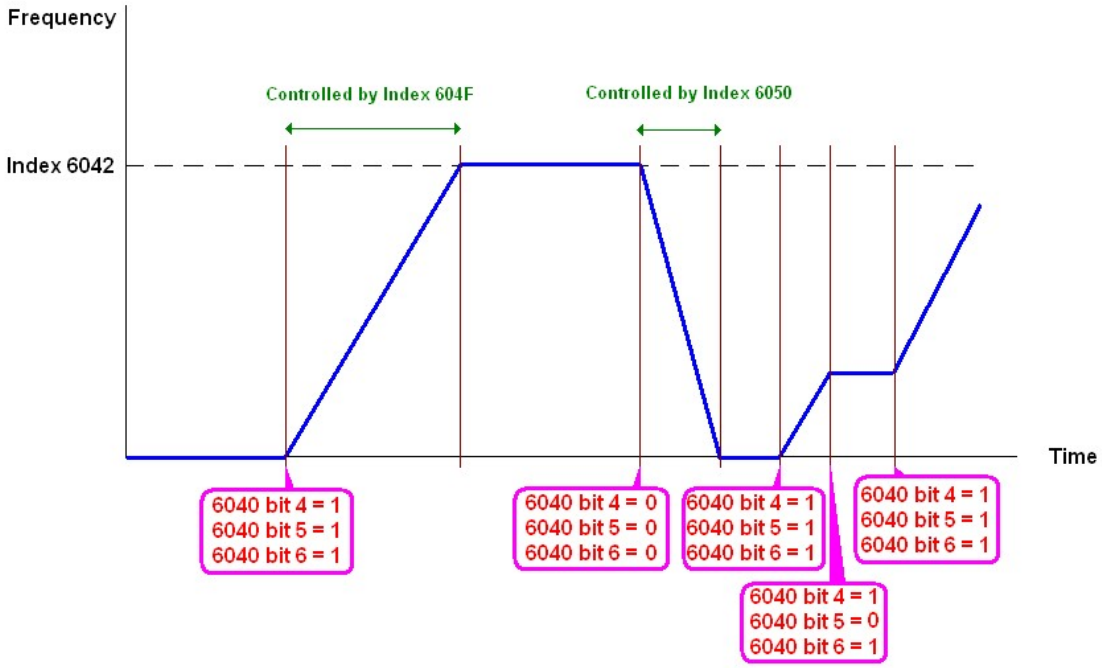


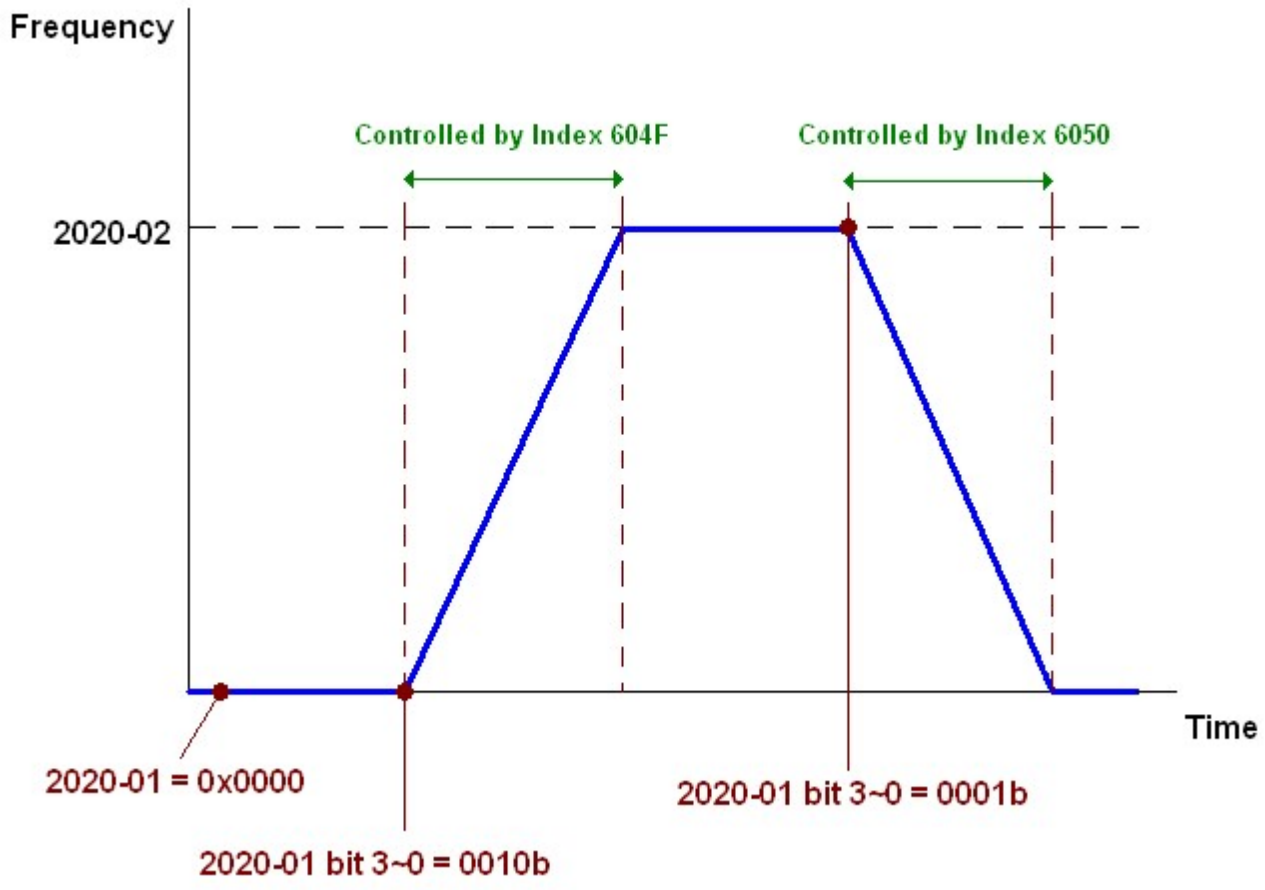


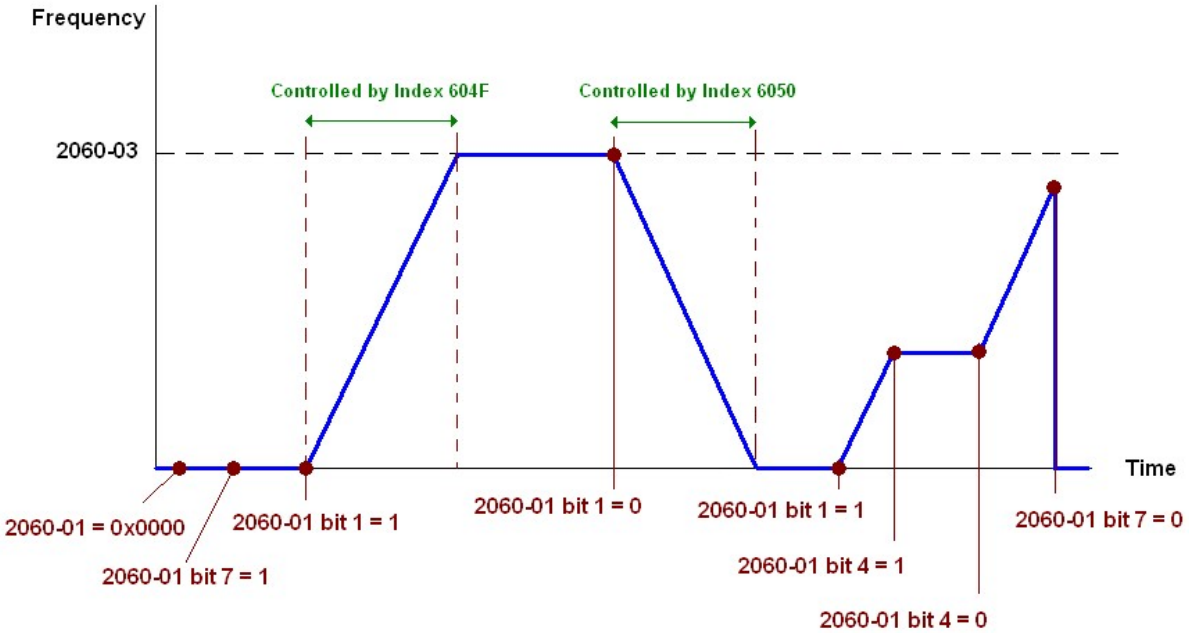



CANOpen Master
120Ω
CANOpen Commnication
120Ω




Frequency
Controlled by Index 604F
Controlled by Index 6050
Index 6042
Time
6040 bit 4 = 1
6040 bit 5 = 1
6040 bit 6 = 1
6040 bit 4 = 0
6040 bit 5 = 0
6040 bit 6 = 0
6040 bit 4 = 1
6040 bit 5 = 1
6040 bit 6 = 1
6040 bit 4 = 1
6040 bit 5 = 0
6040 bit 6 = 1
6040 bit 4 = 1
6040 bit 5 = 1
6040 bit 6 = 1


Frequency
Controlled by Index 604F
Controlled by Index 6050
2020-02
Time
2020-01 = 0x0000
2020-01 bit 3~0 = 0010b
2020-01 bit 3~0 = 0001b


Frequency
Controlled by Index 604F
Controlled by Index 6050
2060-03
Time
2060-01 = 0x0000
2060-01 bit 7 = 1
2060-01 bit 1 = 1
2060-01 bit 1 = 0
2060-01 bit 1 = 1
2060-01 bit 4 = 1
2060-01 bit 4 = 0
2060-01 bit 7 = 0

B-4 CANopen Supporting Index

VJ Index:

The parameter index corresponds as shown in this example:

Index	sub-Index
2000H + Group	member+1

For example:

Pr.01-01 (Source of operation command)

Group		member
01(01H)	-	01(01H)

Index = 2000H + 01H = 2001
Sub Index = 01H + 1H = 2H

VJ Control Index:

Delta Standard Mode (Old definition)

Index	Sub	Definition	Factory Setting	R/W	Size	Note	
2000H	2D	Pressure Cmmand	0	RW	U16		
	2E	Flow Command	0	RW	U16		
2020H	0	Number	3	R	U8		
	1	Control word	0	RW	U16	Bit 1–0	00B:Disable
							01B:Stop
							10B:Disable
							11B: JOG Enable
						Bit3–2	Reserved
						Bit5–4	00B:Disable
							01B: Direction forward
							10B: Direction reverse
							11B: Switch direction
						Bit7–6	Reserved
						Bit11–8	Reserved
						Bit12	Reserved
						Bit14–13	00B: No function
							01B: Operation command by the digital keypad
							10B: Operation command according to Pr.01-01 setting
							11B: Switch the source of operation command
						Bit 15	Reserved
	2	Freq. command (XXX.XX Hz)	0	RW	U16		
	3	Other trigger	0	RW	U16	Bit0	1: E.F. ON
						Bit1	1: Reset
						Bit15–3	Reserved
2021H	0	Number	10	R	U8		
	1	Error code	0	R	U16		High byte: Warn Code Low Byte: Error Code
	2	AC motor drive status	0	R	U16	Bit 1–0	00B: Stop
							01B: Decelerate to stop
							10B: Waiting for operation command
							11B: In operation
						Bit 2	Reserved
						Bit 4–3	00B: Run forward
							01B: Switch from run in reverse

Index	Sub	Definition	Factory Setting	R/W	Size	Note	
							to run forward
							10B: Switch from run forward to run in reverse
							11B: Run in reverse
						Bit 7–5	Reserved
						Bit 8	1: Master Frequency command controlled by communication interface
						Bit 9	1: Master Frequency command controlled by analog / external terminal signal input
						Bit 10	1: Operation command controlled by communication interface
						Bit 11	1: Parameter lock
						Bit 12	Reserved
						Bit 15–13	Reserved
	3	Frequency command (XXX.XXHz)	0	R	U16		
	4	Output freq. (XXX.XX Hz)	0	R	U16		
	5	Output current (XXX.XX A)	0	R	U16		
	6	DC BUS voltage (XXX.X V)	0	R	U16		
	7	Output voltage (XXX.X V)	0	R	U16		
	8	Reserved	0	R	U16		
	9	Reserved	0	R	U16		
	A	Reserved	0	R	U16		
	B	Reserved	0	R	U16		
	C	Reserved	0	R	U16		
	D	Reserved	0	R	U16		
	E	Reserved	0	R	U16		
	F	Reserved	0	R	U16		
	10	Reserved	0	R	U16		
	17	Multi-function display (Pr.00-04)	0	R	U16		
2022H	0	Reserved	0	R	U16		
	1	Display output current (XX.XXA)	0	R	U16		
	2	Display counter value	0	R	U16		
	3	Display actual output frequency(XXX.XX Hz)	0	R	U16		
	4	Display DC-BUS voltage (XXX.X V)	0	R	U16		
	5	Display output voltage (XXX.X V)	0	R	U16		
	6	Display output power angle (XXX.X°)	0	R	U16		
	7	Display output power by U, V, W in kW (XX.XXX kW)	0	R	U16		
	8	Display actual motor speed (XXXXX rpm)	0	R	U16		
	9	Display estimate output torque (XXX.X%)	0	R	U16		
	A	Display PG feedback	0	R	U16		
	B	Reserved	0	R	U16		
	C	Display signal for PS analog	0	R	U16		

Delta Standard Mode (New definition)

Index	sub	R/W	Size	Descriptions			Speed Mode
				bit	Definition	Priority	
2060h	00h	R	U8				
	01h	RW	U16	0	Ack	4	0: fcmd =0 1: fcmd = Fset(Fpid)
				1	Dir	4	0: FWD run command 1: REV run command
				2			
				3	Halt	3	0: Drive runs until target speed is reached 1: Drive stops by declaration setting
				4	Hold	4	0: Drive runs until target speed is reached 1: Frequency stop at current frequency
				5	JOG	4	0:JOG OFF Pulse 1:JOG RUN
				6	QStop	2	Quick Stop
				7	Power	1	0: Power OFF 1: Power ON
				8	Ext_Cmd2	4	0 1: Clear the absolute position.
				14–8			
				15	RST	4	Pulse 1: Fault code cleared
	02h	RW	U16		Mode Cmd		0: Speed Mode
	03h	RW	U16				Speed command (unsigned decimal)
	04h	RW	U16				
	05h	RW	S32				
	06h	RW					
	07h	RW	S16				
	08h	RW	U16				
2061h	01h	R	U16	0	Arrive		Frequency reached
				1	Dir		0: Motor FWD run 1: Motor REV run
				2	Warn		Warning
				3	Error		Error detected
				4			
				5	JOG		JOG
				6	QStop		Quick stop
				7	Power ON		Switch ON
				15–8			
	02h	R					
	03h	R	U16				Actual output frequency
	04h	R					
	05h	R	S32				Actual position (absolute)
	06h	R					
	07h	R	S16				Actual torque

DS402 Standard

Index	Sub	Definition	Factory Setting	R/W	Size	Unit	PDO Map	Mode	Note
6007h	0	Abort connection option code	2	RW	S16		Yes		0: No action 2: Disable voltage 3: Quick Stop
603Fh	0	Error code	0	R0	U16		Yes		
6040h	0	Control word	0	RW	U16		Yes		
6041h	0	Status word	0	R0	U16		Yes		
6042h	0	vl target velocity	0	RW	S16	rpm	Yes	vl	
6043h	0	vl velocity demand	0	RO	S16	rpm	Yes	vl	
6044h	0	vl control effort	0	RO	S16	rpm	Yes	vl	
604Fh	0	vl ramp function time	10000	RW	U32	1ms	Yes	vl	Unit must be 100 ms, and check if the setting is 0.
6050h	0	vl slow down time	10000	RW	U32	1ms	Yes	vl	
6051h	0	vl quick stop time	1000	RW	U32	1ms	Yes	vl	
605Ah	0	Quick stop option code	2	RW	S16		No		0: Disable drive function 1: Slow down on slow down ramp 2: Slow down on quick stop ramp 5: Slow down on slow down ramp and stay in QUICK STOP 6: Slow down on quick stop ramp and stay in QUICK STOP
605Ch	0	Disable operation option code	1	RW	S16		No		0: Disable drive function 1: Slow down with slow down ramp; disable the drive function
6060h	0	Mode of operation	2	RW	S8		Yes		2: Velocity mode
6061h	0	Mode of operation display	2	RO	S8		Yes		Same as above

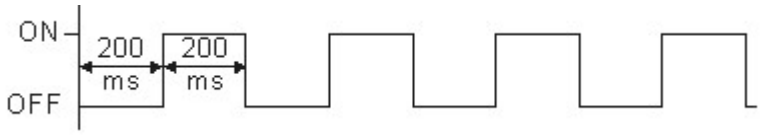
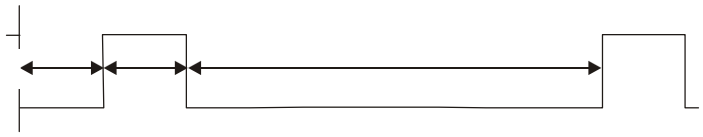
					
					
					
					
					
					
					
					
					
					
					
					
					

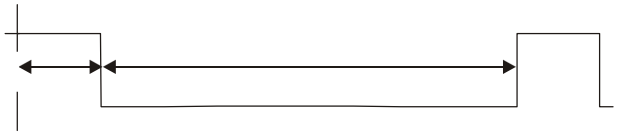
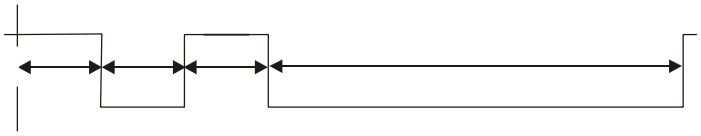
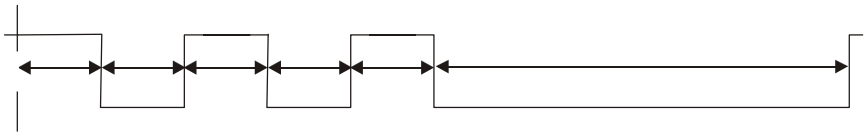
					
					
					
					
					
					
					
					
					
					
					
					
					
					
					

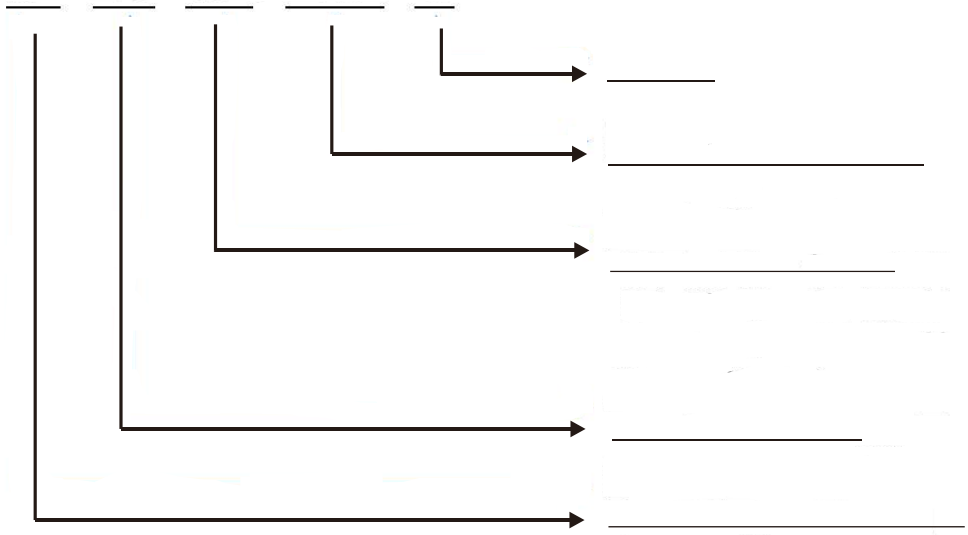
					
					
					
					
					
					
					
					
					
					
					
					
					
					
					
					

Appendix C: MSJ 220V & 380V Hybrid Servo Motor

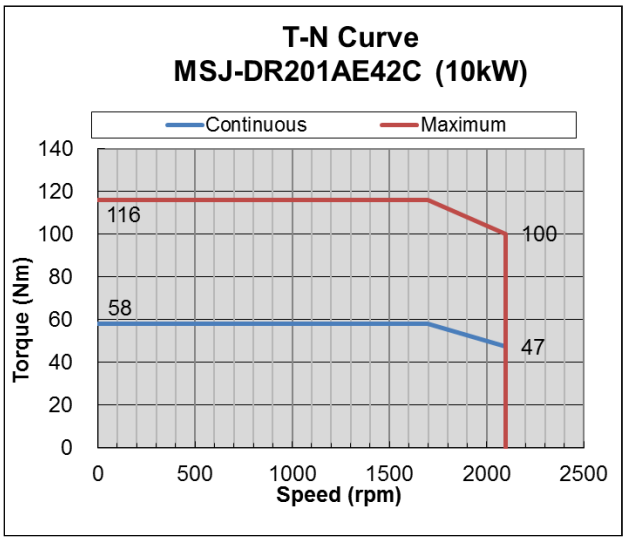


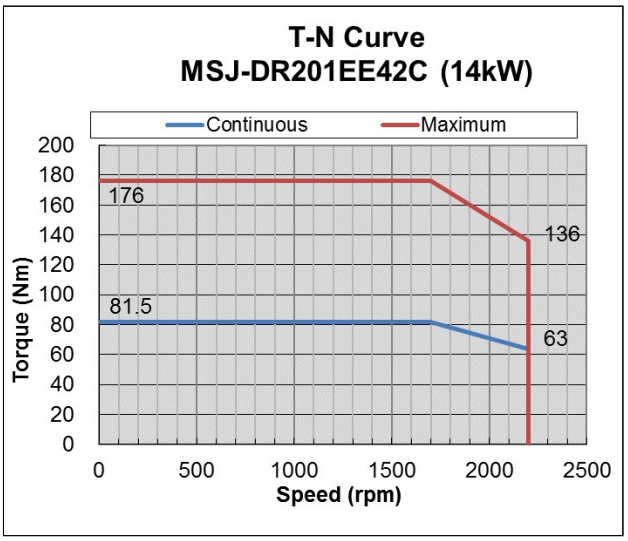
C-3 Motor Specifications

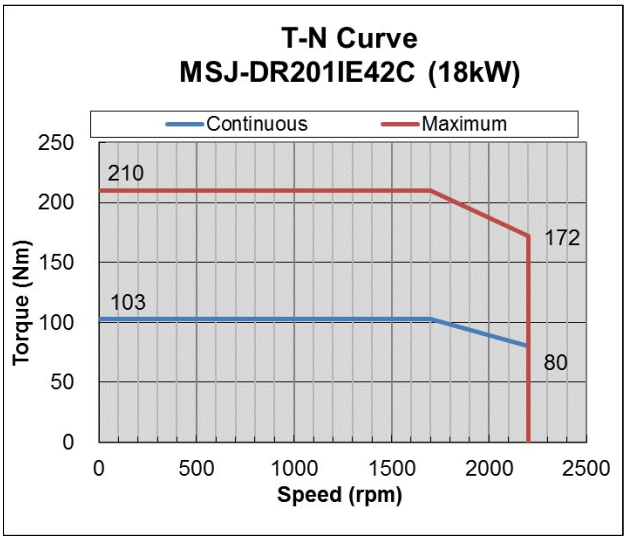
220V:

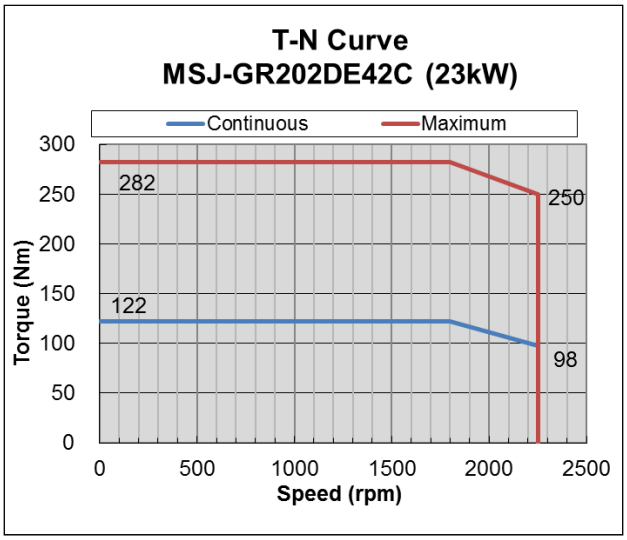
Model		MSJ-______________C				
		DR201AE42	DR201EE42	DR201IE42	GR202DE42	DR202HE42
Pr01-35 Motor ID#		216	218	220	222	224
Voltage		220V				
Rated Output Power	kW	10	14	18	23	27
No. of Poles		8				
Rated Torque	Nm	58	81.5	103	122	154
Maximum Torque	Nm	116	176	210	282	308
Rated Speed	rpm	1700	1700	1700	1800	1700
Maximum Speed*	rpm	2100	2200	2200	2250	2200
Rated Current	A	38	53	69	87	101
Torque Constant	Nm/A	1.52	1.54	1.49	1.47	1.52
Voltage Constant	V/krpm	100	95	96.5	90	95
Phase Resistance	ohm	0.239	0.145	0.110	0.064	0.060
Inductance	mH	2.740	1.791	1.438	0.939	0.864
Rotor Moment of Inertia	kg-m	6.8 x10	9.0 x10	11.7 x10	13.3 x10	17.5 x10
Weight	kg	46	53	59.5	67.5	83.6
Frame	mm	200 x 200				
Insulation Class						
Protection Class						
Efficiency Class						
Cooling Method						
Encoder						
Motor Temperature Protection						
Operating Environment						
Installation Method						
Certifications						

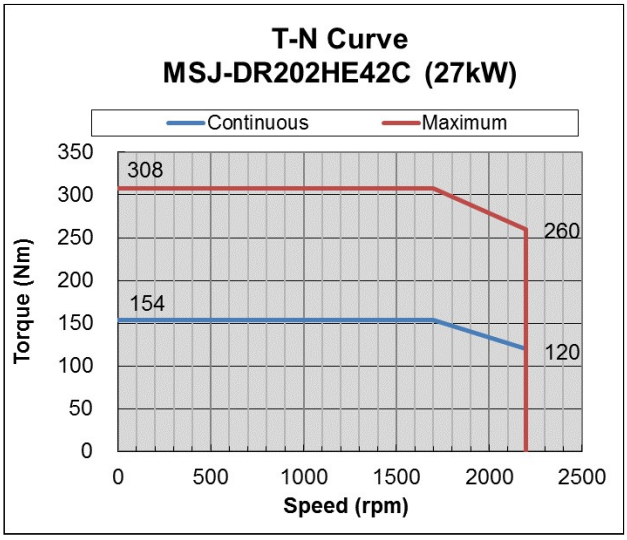
380V:

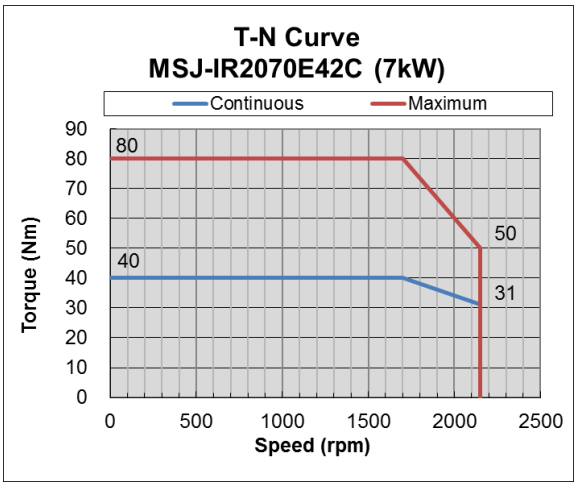

T-N Curve
MSJ-DR201AE42C (10kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
116
100
58
47
0
20
40
60
80
100
120
140
0
500
1000
1500
2000
2500

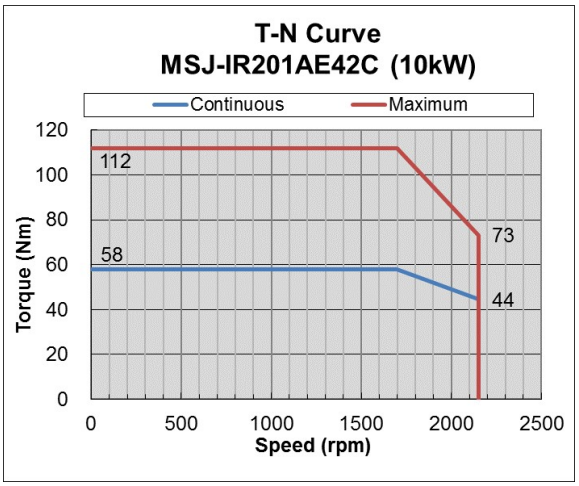

T-N Curve
MSJ-DR201EE42C (14kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
176
136
81.5
63
0
20
40
60
80
100
120
140
160
180
200
0
500
1000
1500
2000
2500

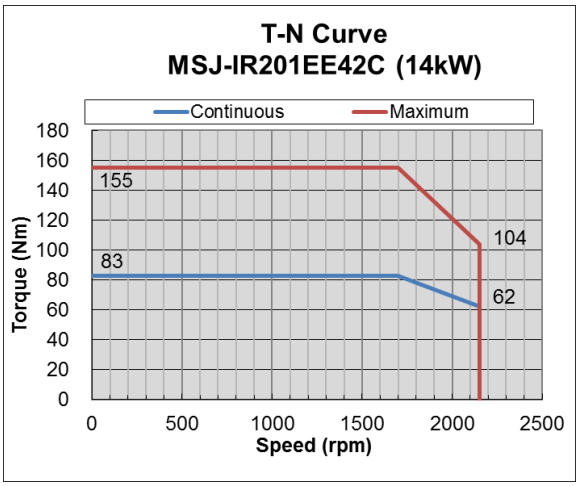

T-N Curve
MSJ-DR201IE42C (18kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
210
172
103
80
0
50
100
150
200
250
0
500
1000
1500
2000
2500

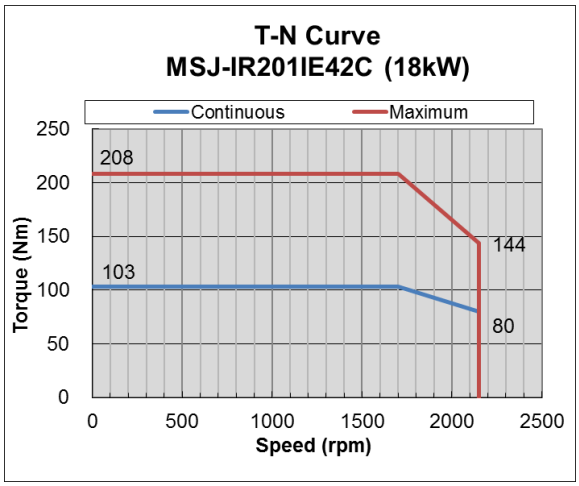

T-N Curve
MSJ-GR202DE42C (23kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
282
250
122
98
0
50
100
150
200
250
300
0
500
1000
1500
2000
2500

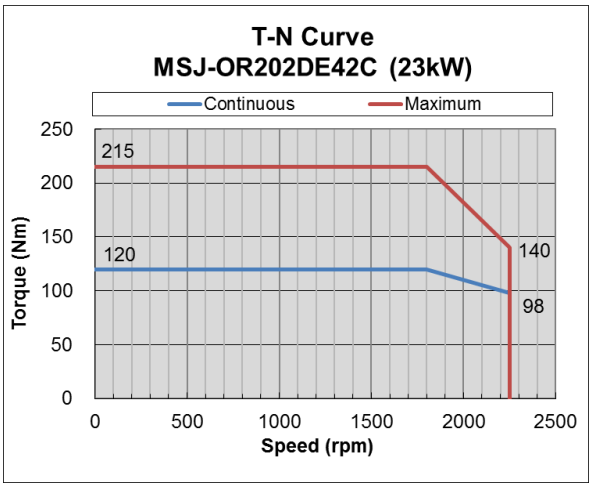

T-N Curve
MSJ-DR202HE42C (27kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
308
260
154
120
0
50
100
150
200
250
300
350
0
500
1000
1500
2000
2500

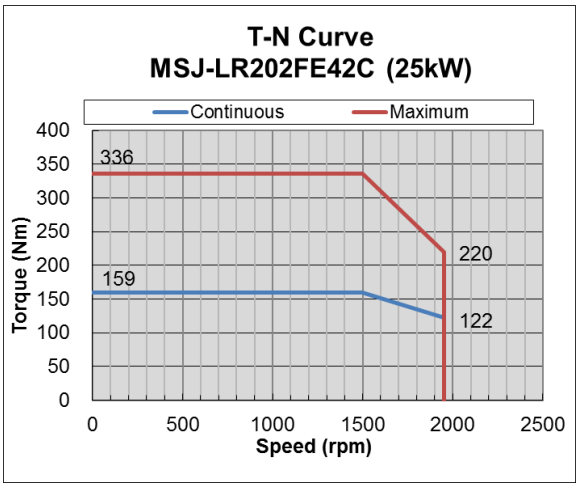

T-N Curve
MSJ-IR2070E42C (7kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
80
40
50
31
0
10
20
30
40
50
60
70
80
90
0
500
1000
1500
2000
2500

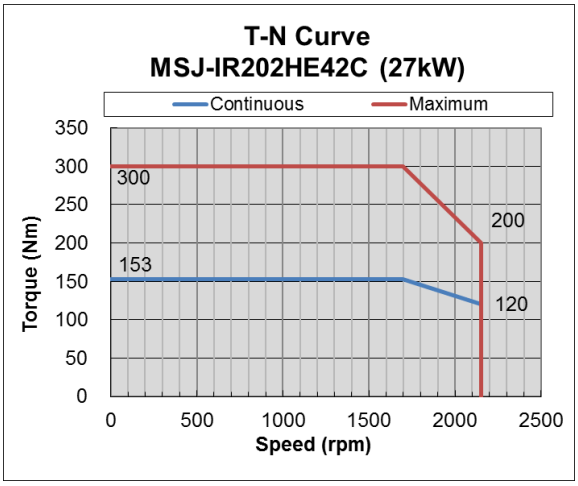

T-N Curve
MSJ-IR201AE42C (10kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
112
58
73
44
0
20
40
60
80
100
120
0
500
1000
1500
2000
2500

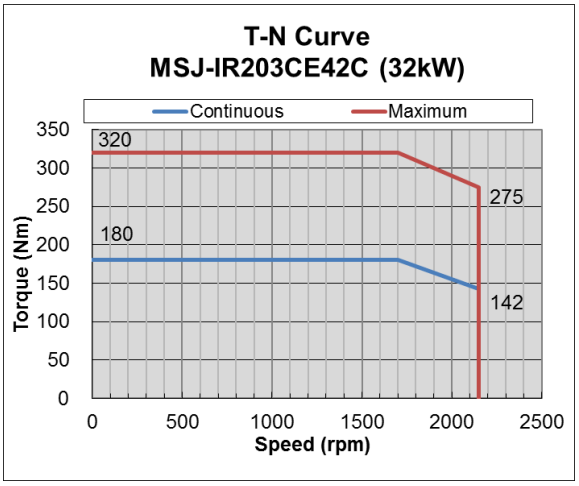

T-N Curve
MSJ-IR201EE42C (14kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
155
83
104
62
0
20
40
60
80
100
120
140
160
180
0
500
1000
1500
2000
2500

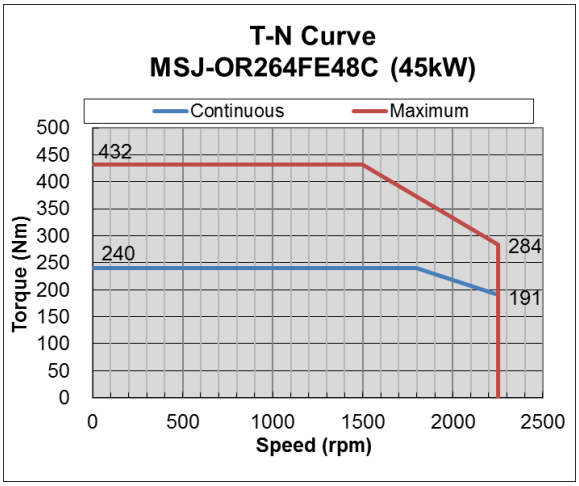

T-N Curve
MSJ-IR201IE42C (18kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
208
103
144
80
0
50
100
150
200
250
0
500
1000
1500
2000
2500

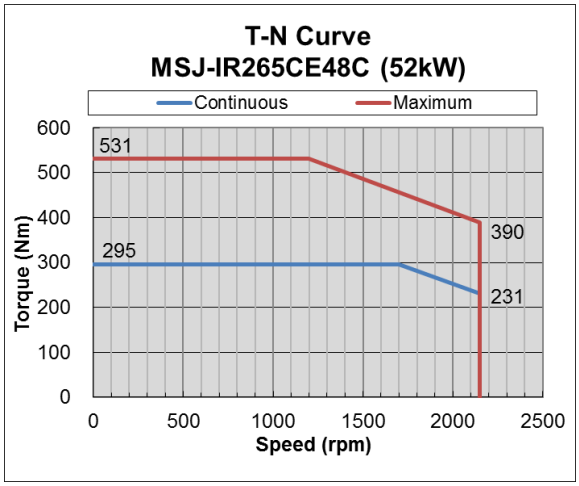

T-N Curve
MSJ-OR202DE42C (23kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
215
120
140
98
0
50
100
150
200
250
0
500
1000
1500
2000
2500

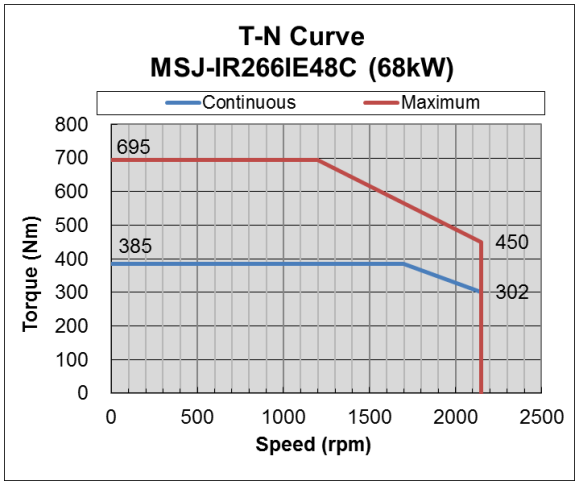

T-N Curve
MSJ-LR202FE42C (25kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
336
159
220
122
0
50
100
150
200
250
300
350
400
0
500
1000
1500
2000
2500

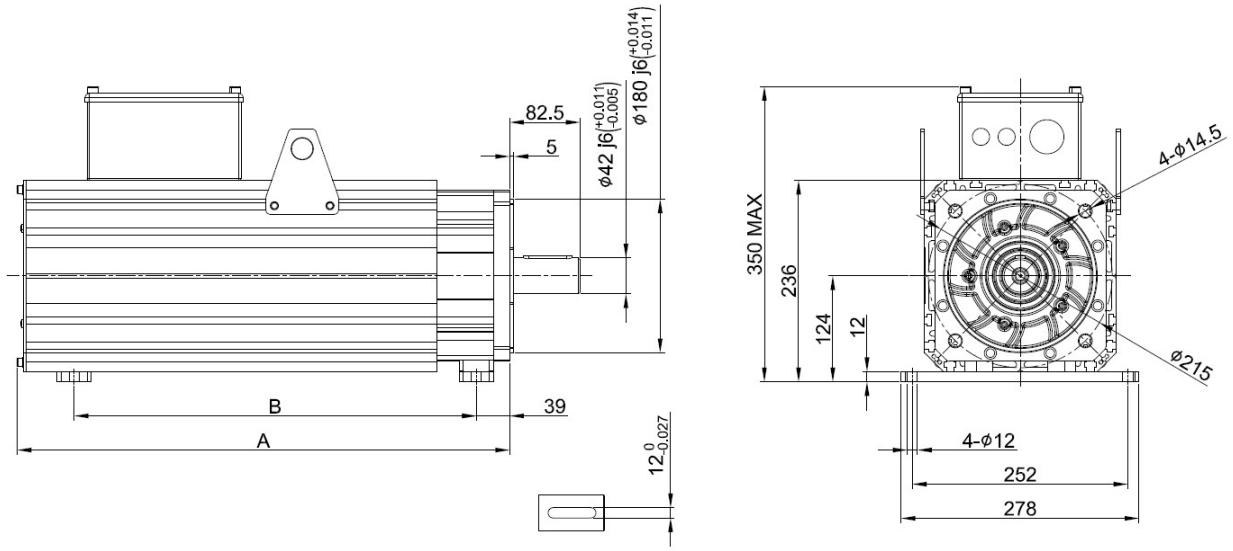

T-N Curve
MSJ-IR202HE42C (27kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
300
200
153
120

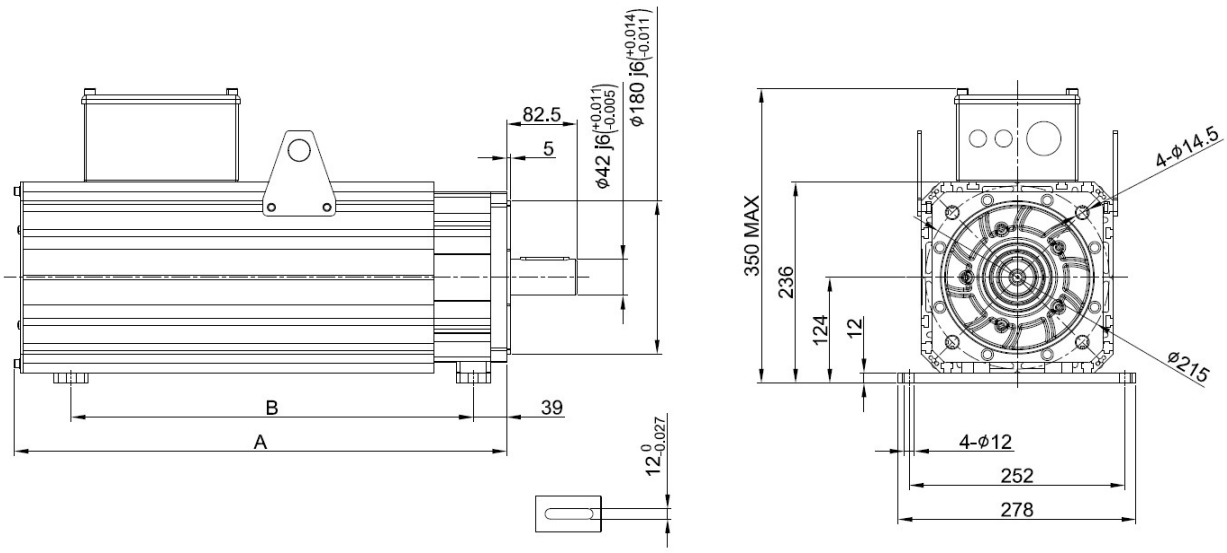

T-N Curve
MSJ-IR203CE42C (32kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
320
275
180
142

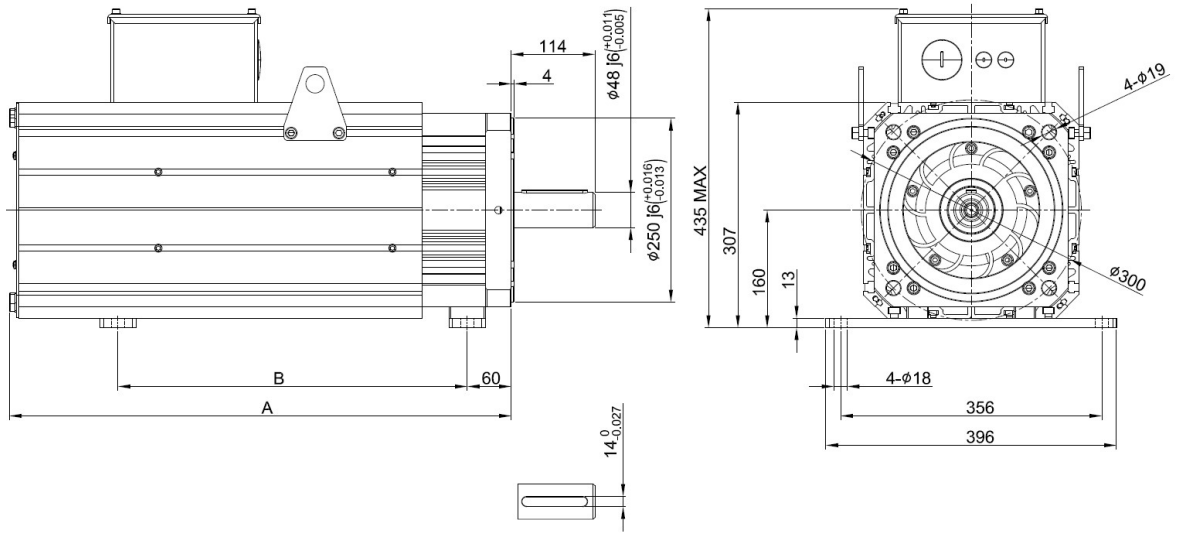

T-N Curve
MSJ-OR264FE48C (45kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
432
284
240
191

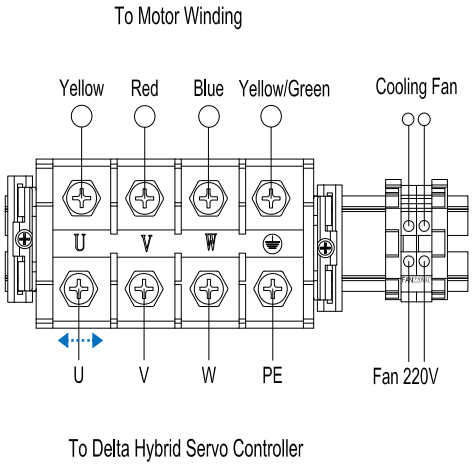

T-N Curve
MSJ-IR265CE48C (52kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
531
390
295
231

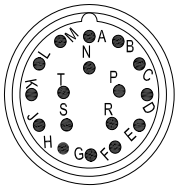

T-N Curve
MSJ-IR266IE48C (68kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
695
450
385
302


82.5
5
φ42 j6(+0.011 -0.005)
φ180 j6(+0.014 -0.011)
B
A
39
12 0 -0.027
350 MAX
236
124
12
4-φ14.5
φ215
4-φ12
252
278

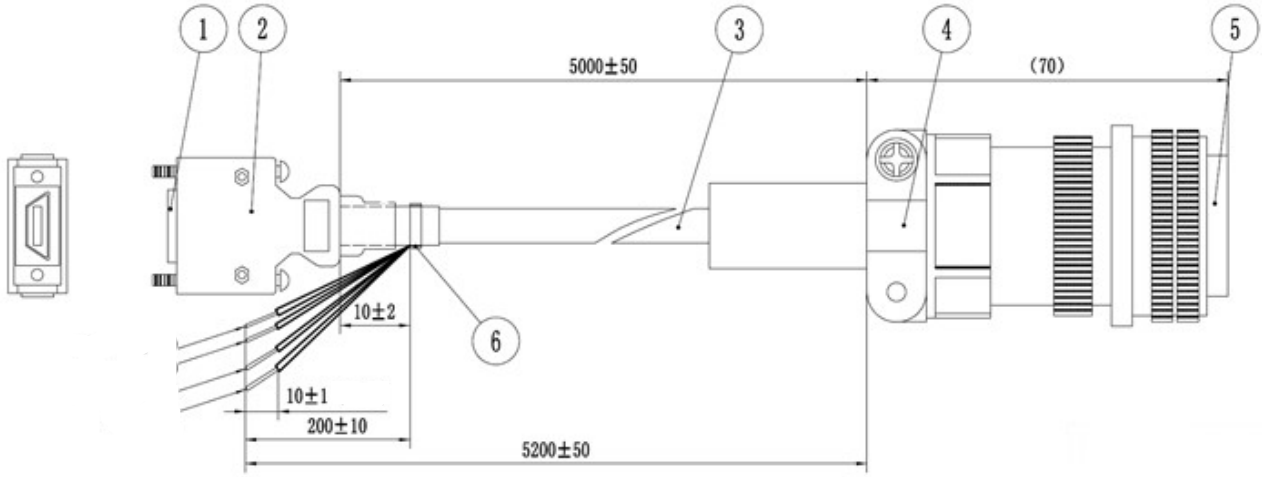

82.5
5
φ42 j6(+0.011 -0.005)
φ180 j6(+0.014 -0.011)
B
39
A
12 0 -0.027
350 MAX
236
124
12
4-φ14.5
φ215
4-φ12
252
278


114
4
φ48 j6(+0.011 -0.005)
φ250 j6(+0.016 -0.013)
B
60
A
14 0 -0.027
435 MAX
307
160
13
4-φ19
φ300
4-φ18
356
396

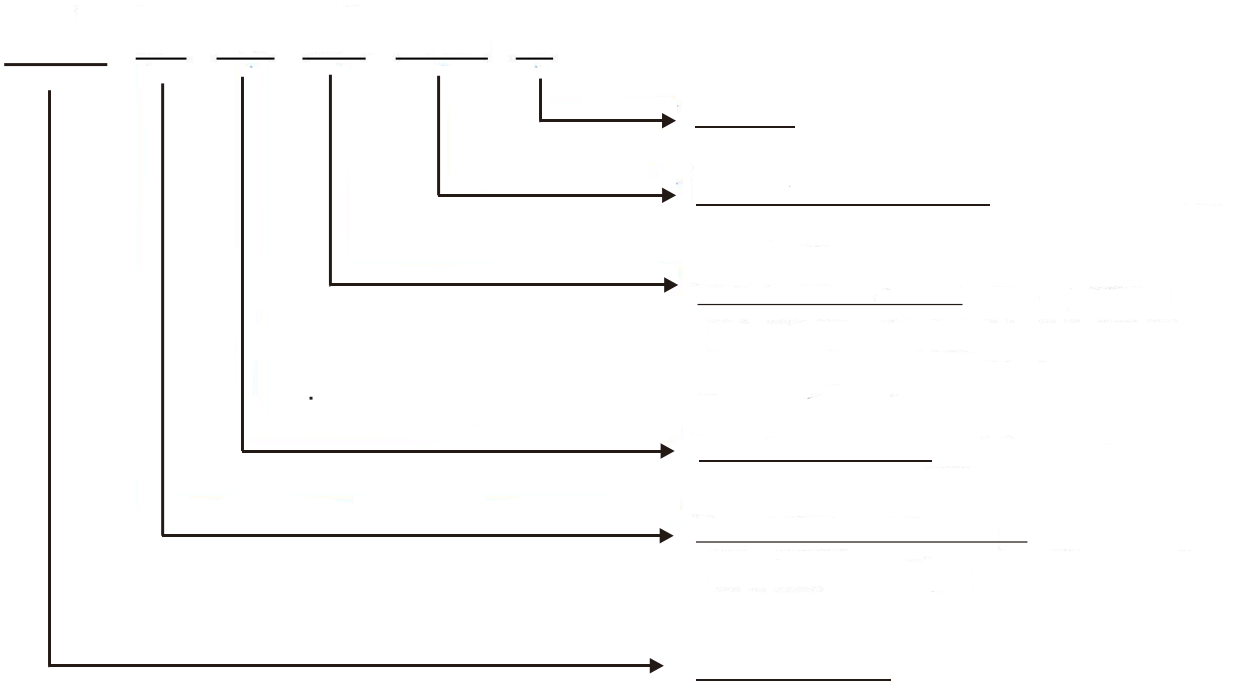




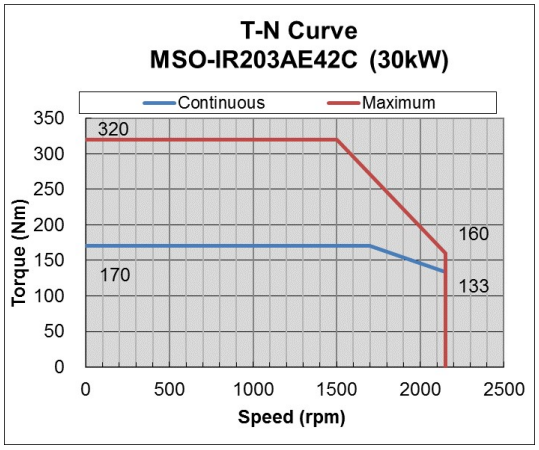
Connector Pin Definition			
PIN	Signal/ Color	PIN	Signal/ Color
A		K	KTY/ Brown
B	Sin / Blue	L	
C	Cos+/ Red	M	
D	Cos-/ Black	N	
E		P	
F		R	Resex-/ Ylw Wht
G	PTC/ Light Blue	S	Resex+/ Red Wht
H	PTC/ Light Blue	T	
J	KTY/ White		

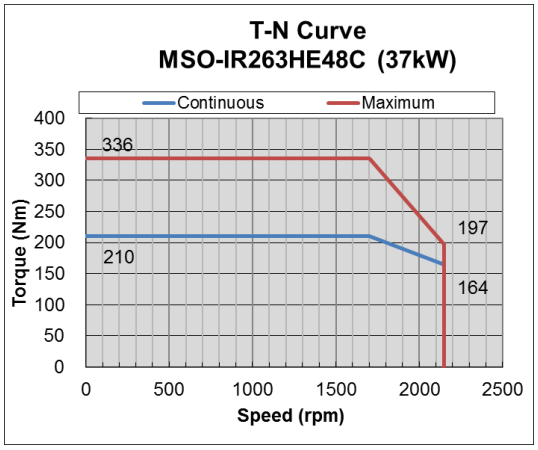

1
2
3
4
5
5000±50
(70)
6
10±2
10±1
200±10
5200±50

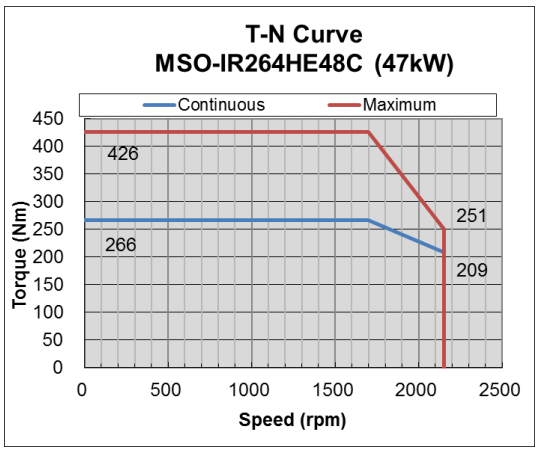
Appendix D: MSO 380V Oil Cooled Hybrid Servo Motor

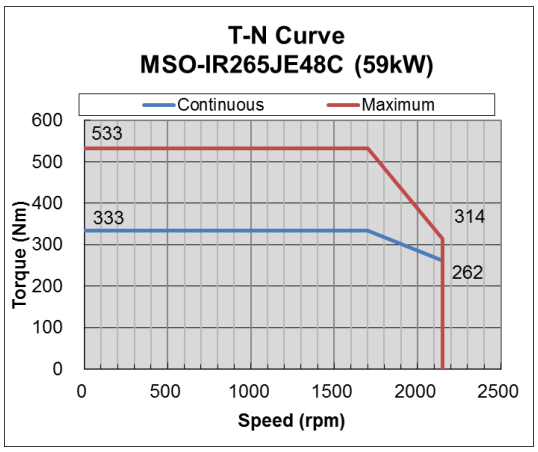


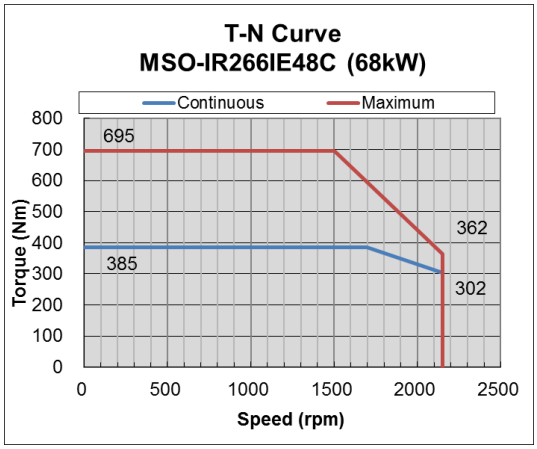
D-3 Motor Specifications

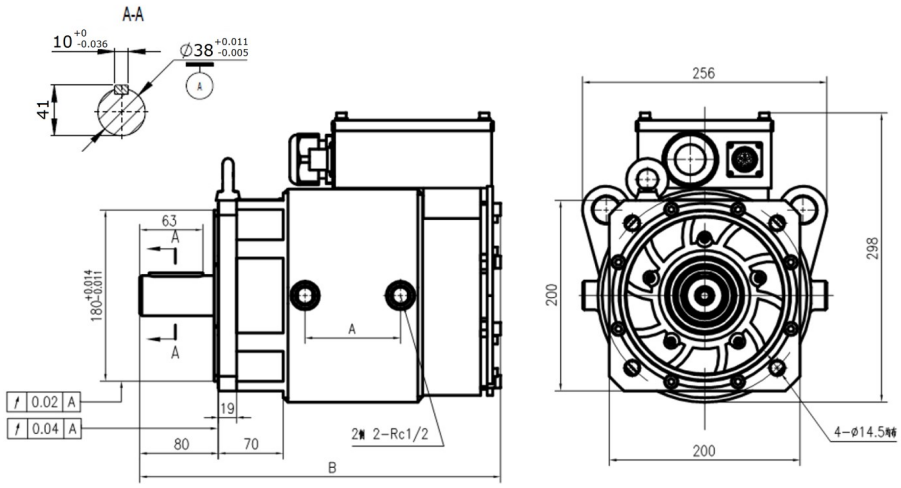

T-N Curve
MSO-IR203AE42C (30kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
320
160
170
133
0
50
100
150
200
250
300
350
0
500
1000
1500
2000
2500

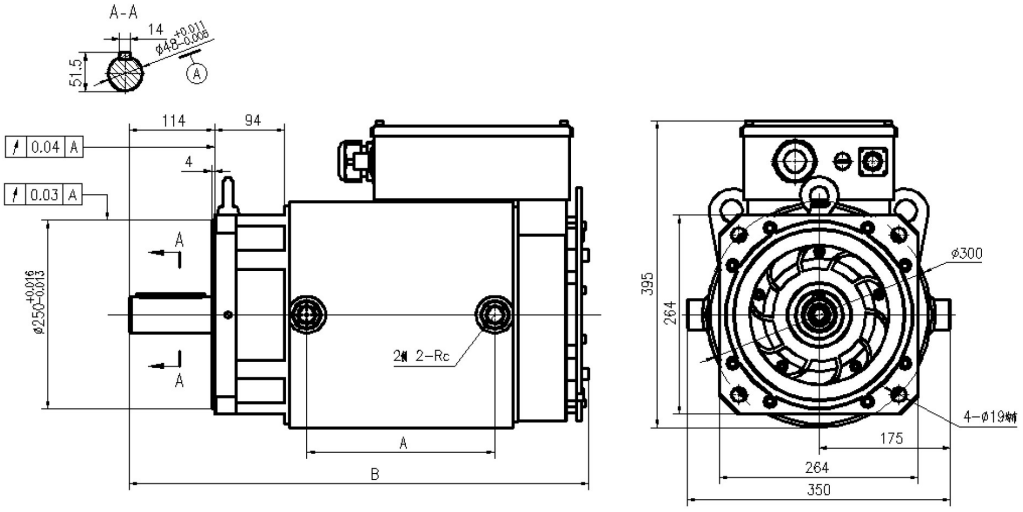

T-N Curve
MSO-IR263HE48C (37kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
336
197
210
164
0
50
100
150
200
250
300
350
400
0
500
1000
1500
2000
2500

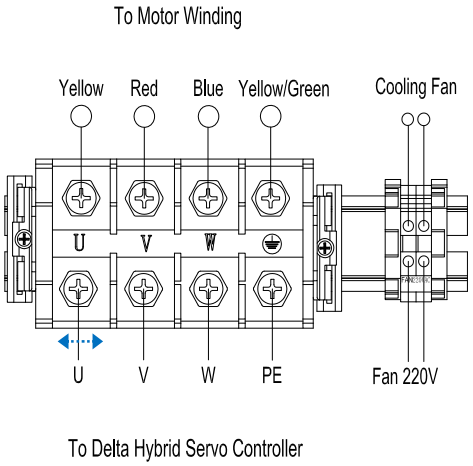

T-N Curve
MSO-IR264HE48C (47kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
426
251
266
209
0
50
100
150
200
250
300
350
400
450
0
500
1000
1500
2000
2500

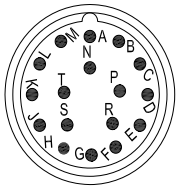

T-N Curve
MSO-IR265JE48C (59kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
533
314
333
262
0
100
200
300
400
500
600
0
500
1000
1500
2000
2500


T-N Curve
MSO-IR266IE48C (68kW)
Continuous
Maximum
Torque (Nm)
Speed (rpm)
695
362
385
302
0
100
200
300
400
500
600
700
800
0
500
1000
1500
2000
2500

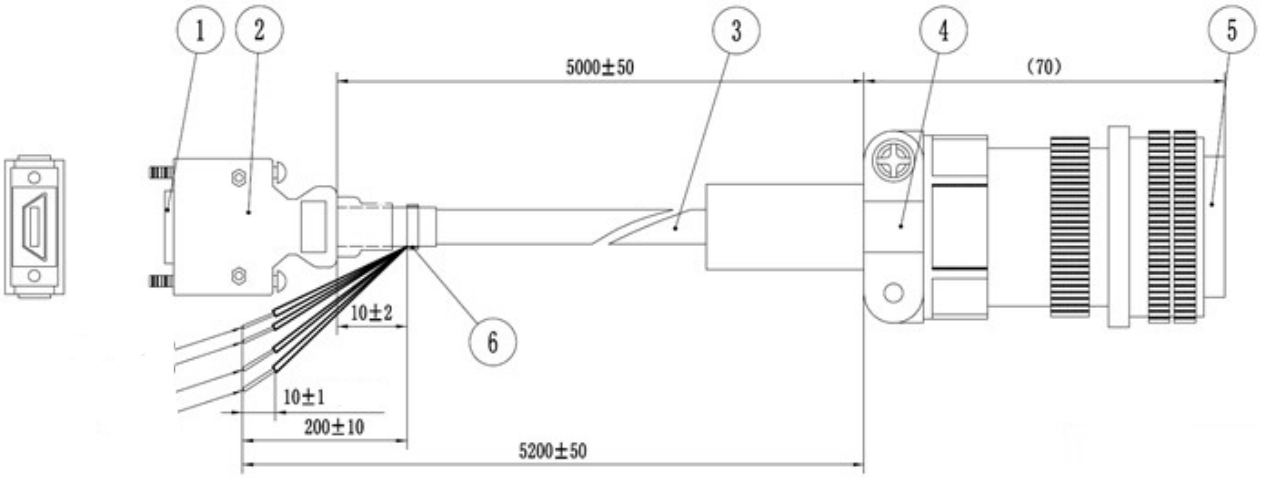

A-A
10 +0 -0.036
Ø38 +0.011 -0.005
41
63
180 +0.014 -0.011
A
0.02 A
0.04 A
19
80
70
2M 2-Rc1/2
B
256
200
298
200
4-Ø14.5


A-A
14
Ø48 +0.011 -0.006
51.5
114
94
4
0.04 A
0.03 A
Ø250 +0.016 -0.013
2M 2-Rc
A
B
395
264
Ø300
4-Ø19
175
264
350





Connector Pin Definition			
PIN	Signal/ Color	PIN	Signal/ Color
A		K	KTY/ Brown
B	Sin / Blue	L	
C	Cos+/ Red	M	
D	Cos-/ Black	N	
E		P	
F		R	Resex-/ Ylw Wht
G	PTC/ Light Blue	S	Resex+/ Red Wht
H	PTC/ Light Blue	T	
J	KTY/ White		


1
2
3
4
5
5000±50
(70)
6
10±2
10±1
200±10
5200±50

Appendix E: Activate the Oil Pump, Step by Step