Panasonic

REFERENCE SPECIFICATIONS

MODEL

Product Name: AC servo driver
Part Number : MINAS-A6 series

(RS485/232 Communication type)

Issued on   Nov. 1, 2015
Revised on   Sept. 14, 2016

REVISIONS

Date	Page	Rev.	Description	Signed
Nov. 1, 2015	-		NEWLY ISSUED	-
Sept. 8,2016	P1	1.0	UPDATE THE MODEL DESIGNATION CODE	-
	P1		CHANGED THE NAME OF COMPANY	
	P1, P3,P53, P65		ADDED THE MODEL OF MEDLN93SG	
	P4, P5		ADDED THE FUNCTIONS	
	P14		CORRECT THE CONNECTOR PIN NO. OF RS485 SIGNAL	
	P56		ADDED THE HARMONIC SUPPRESSION MEASURES	
	P63～65		CORRECT THE INRUSH CURRENTS AT CONTROL POWER SUPPLY	

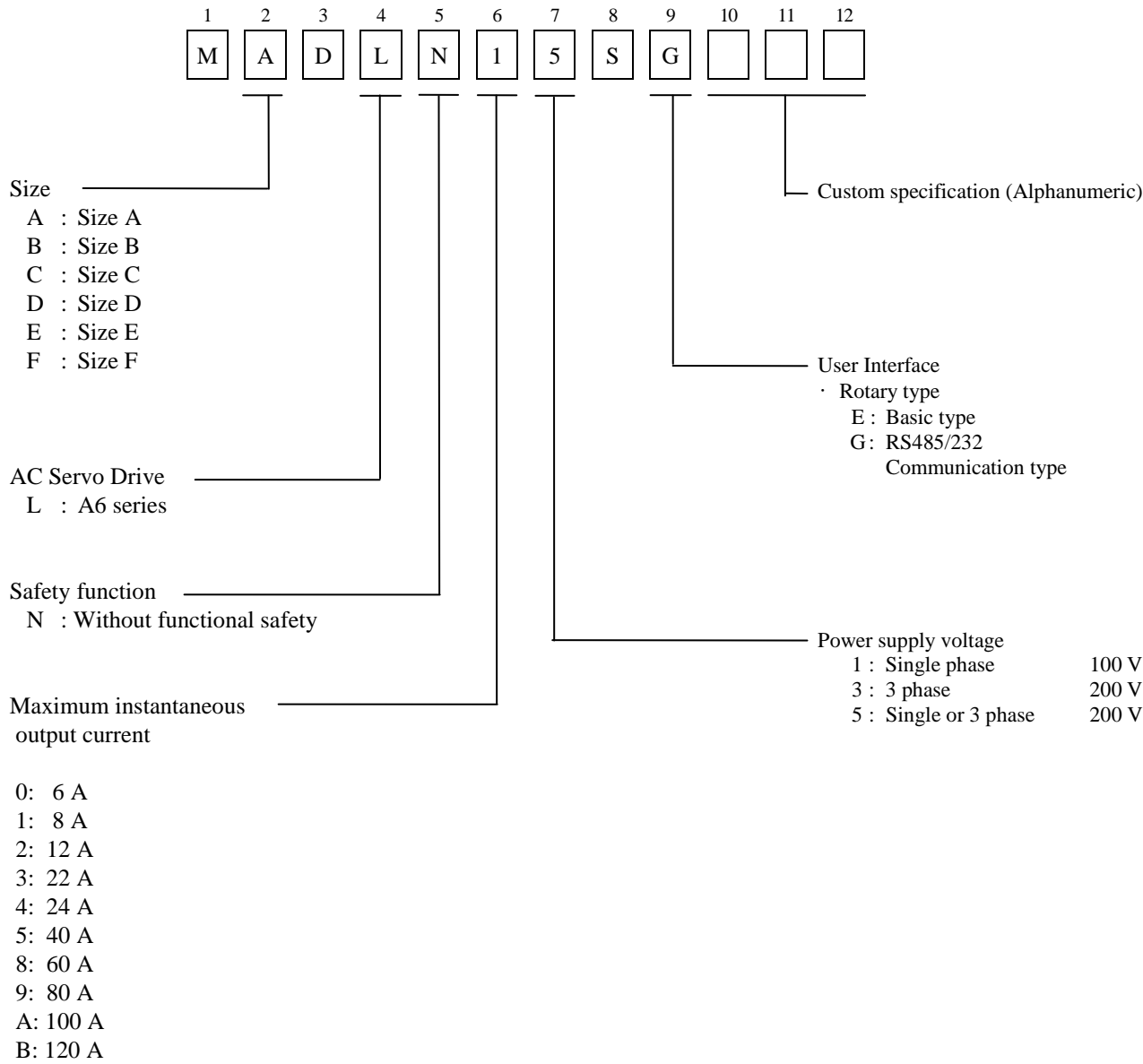Contents

1. Scope

These specifications relate to the servo driver for the AC servo system that is comprised of the AC servo motor manufactured and supplied by Motor Business Unit, Electromechanical Control Business Division, Automotive & Industrial amplifier Systems Company, Panasonic Corporation.

2. Model designation code

Notation of the machine designation code is as follows:

1	2	3	4	5	6	7	8	9	10	11	12
M	A	D	L	N	1	5	S	G			

Size
  A : Size A
  B : Size B
  C : Size C
  D : Size D
  E : Size E
  F : Size F

AC Servo Drive
  L : A6 series

Safety function
  N : Without functional safety

Maximum instantaneous
output current

 0: 6 A
 1: 8 A
 2: 12 A
 3: 22 A
 4: 24 A
 5: 40 A
 8: 60 A
 9: 80 A
 A: 100 A
 B: 120 A

Custom specification (Alphanumeric)

User Interface
 · Rotary type
   E : Basic type
   G : RS485/232
       Communication type

Power supply voltage
  1 : Single phase   100 V
  3 : 3 phase   200 V
  5 : Single or 3 phase   200 V

3. Product line-up

Servo driver			Motor used				
Model	Size	Power supply input	Model	Voltage specification	Rated output	Rated speed	Encoder specification
MADLN01SG	A	Single 100 V	MSMF5AZL1□□	100 V	50 W	3000 r/min	7 cores, 23 bits
			MHMF5AZL1□□	100 V	50 W	3000 r/min	7 cores, 23 bits
MADLN11SG	A	Single 100 V	MSMF011L1□□	100 V	100 W	3000 r/min	7 cores, 23 bits
			MQMF011L1□□	100 V	100 W	3000 r/min	7 cores, 23 bits
			MHMF011L1□□	100 V	100 W	3000 r/min	7 cores, 23 bits
MADLN05SG	A	Single / 3 phase 200 V	MSMF5AZL1□□	200 V	50 W	3000 r/min	7 cores, 23 bits
			MHMF5AZL1□□	200 V	50 W	3000 r/min	7 cores, 23 bits
			MSMF012L1□□	200 V	100 W	3000 r/min	7 cores, 23 bits
			MQMF012L1□□	200 V	100 W	3000 r/min	7 cores, 23 bits
			MHMF012L1□□	200 V	100 W	3000 r/min	7 cores, 23 bits
MADLN15SG	A	Single / 3 phase 200 V	MSMF022L1□□	200 V	200 W	3000 r/min	7 cores, 23 bits
			MQMF022L1□□	200 V	200 W	3000 r/min	7 cores, 23 bits
			MHMF022L1□□	200 V	200 W	3000 r/min	7 cores, 23 bits
MBDLN21SG	B	Single 100 V	MSMF021L1□□	100 V	200 W	3000 r/min	7 cores, 23 bits
			MQMF021L1□□	100 V	200 W	3000 r/min	7 cores, 23 bits
			MHMF021L1□□	100 V	200 W	3000 r/min	7 cores, 23 bits
MBDLN25SG	B	Single / 3 phase 200 V	MSMF042L1□□	200 V	400 W	3000 r/min	7 cores, 23 bits
			MQMF042L1□□	200 V	400 W	3000 r/min	7 cores, 23 bits
			MHMF042L1□□	200 V	400 W	3000 r/min	7 cores, 23 bits
MCDLN31SG	C	Single 100 V	MSMF041L1□□	100 V	400 W	3000 r/min	7 cores, 23 bits
			MQMF041L1□□	100 V	400 W	3000 r/min	7 cores, 23 bits
			MHMF041L1□□	100 V	400 W	3000 r/min	7 cores, 23 bits
MCDLN35SG	C	Single / 3 phase 200 V	MSMF082L1□□	200 V	750 W	3000 r/min	7 cores, 23 bits
			MHMF082L1□□	200 V	750 W	3000 r/min	7 cores, 23 bits
MDDLN45SG	D	Single / 3 phase 200 V	MGMF092L1□□	200 V	850 W	1500 r/min	7 cores, 23 bits
			MSMF092L1□□	200 V	1.0 kW	3000 r/min	7 cores, 23 bits
			MSMF092L1□□	200 V	1.0 kW	3000 r/min	7 cores, 23 bits
			MDMF102L1□□	200 V	1.0 kW	2000 r/min	7 cores, 23 bits
			MHMF102L1□□	200 V	1.0 kW	2000 r/min	7 cores, 23 bits
MDDLN55SG	D	Single / 3 phase 200 V	MHMF092L1□□	200 V	1.0 kW	3000 r/min	7 cores, 23 bits
			MSMF102L1□□	200 V	1.0 kW	3000 r/min	7 cores, 23 bits
			MGMF132L1□□	200 V	1.3 kW	1500 r/min	7 cores, 23 bits
			MSMF152L1□□	200 V	1.5 kW	3000 r/min	7 cores, 23 bits
			MDMF152L1□□	200 V	1.5 kW	2000 r/min	7 cores, 23 bits
			MHMF152L1□□	200 V	1.5 kW	2000 r/min	7 cores, 23 bits

Servo driver			Motor used				
Model	Size	Power supply input	Model	Voltage specification	Rated output	Rated speed	Encoder specification
MEDLN83SG	E	3 phase 200 V	MGMF182L1□□	200 V	1.8 kW	1500 r/min	7 cores, 23 bits
			MSMF202L1□□	200 V	2.0 kW	3000 r/min	7 cores, 23 bits
			MDMF202L1□□	200 V	2.0 kW	2000 r/min	7 cores, 23 bits
			MHMF202L1□□	200 V	2.0 kW	2000 r/min	7 cores, 23 bits
MEDLN93SG	E	3 phase 200 V	MGMF242L1**	200 V	2.4 kW	1500 r/min	7 cores, 23 bits
MFDLNA3SG	F	3 phase 200 V	MSMF302L1□□	200 V	3.0 kW	3000 r/min	7 cores, 23 bits
			MDMF302L1□□	200 V	3.0 kW	2000 r/min	7 cores, 23 bits
			MHMF302L1□□	200 V	3.0 kW	2000 r/min	7 cores, 23 bits
MFDLNB3SG	F	3 phase 200 V	MGMF292L1□□	200 V	2.9 kW	1500 r/min	7 cores, 23 bits
			MSMF402L1□□	200 V	4.0 kW	3000 r/min	7 cores, 23 bits
			MDMF402L1□□	200 V	4.0 kW	2000 r/min	7 cores, 23 bits
			MHMF402L1□□	200 V	4.0 kW	2000 r/min	7 cores, 23 bits
			MGMF442L1□□	200 V	4.4 kW	1500 r/min	7 cores, 23 bits
			MSMF502L1□□	200 V	5.0 kW	3000 r/min	7 cores, 23 bits
			MDMF502L1□□	200 V	5.0 kW	2000 r/min	7 cores, 23 bits
			MHMF502L1□□	200 V	5.0 kW	2000 r/min	7 cores, 23 bits

4. General specifications
4-1 General specification

Basic specifications	Input power supply	100 V	Main circuit power		Single phase 100 - 120 V $^{+10\%}_{-15\%}$ 50/60 Hz
			Control circuit power		Single phase 100 - 120 V $^{+10\%}_{-15\%}$ 50/60 Hz
		200 V	Main circuit power	A - D	Single/3 phase 200 - 240 V $^{+10\%}_{-15\%}$ 50/60 Hz
				E - F	3 phase 200 - 240 V $^{+10\%}_{-15\%}$ 50/60 Hz
			Control circuit power	A - D	Single phase 200 - 240 V $^{+10\%}_{-15\%}$ 50/60 Hz
				E - F	Single phase 200 - 240 V $^{+10\%}_{-15\%}$ 50/60 Hz
	Operation conditions		Temperature		Operation temperature: 0 - 55 degrees C (no freezing) Storage temperature: -20 – 65 degrees C (Max.temperature guarantee : 80 degrees C for 72 hours no condensation*)
			Humidity		Operation and storage humidity 20 - 85 %RH or less (no condensation*)
			Height above the sea		Height above the sea level: 1000 meters or less
			Vibration		5. 88 m/s^2 or less, 10 – 60 Hz
	Insulation voltage				Resistant to 1500 V AC between primary power supply and ground for a minute (Sensed current: 20 mA)
	Control method				IGBT PWM method, sinusoidal drive
	Encoder feedback				23Bit(resolution:8388608) 7cores-serial absolute encoder
	Control signal		Input		Multi-function input x 10 Function of each multi-function input is assigned by the parameter.
			Output		Multi-function output x 5 + dedicated output x 1 (alarm output) Function of each multi-function output is assigned by the parameter.
	Analogue signal		Output		2 outputs for analog monitor
	Pulse signal		Input		2 inputs Both open collector and line driver interface can be connected. High speed line driver interface can be connected.
			Output		4 outputs Line driver output for encoder pulses (A/B/Z signal) or external feedback pulses (EXA/EXB/EXZ signal) open collector output also available for Z or EXZ signal
	Communication		USB		USB interface to connect to computers for parameter setting or status monitoring.
			RS232		1:1 communication
			RS485		1: n communication (max 31)
			Modbus-RTU		1: n communication with superior controller is possible.
	Front panel				5 key switches, 6-digit 7-segment LED
	Regeneration				Size A, B: External regen resistor only Size C - F: Built-in regen resistor (External regen is also available)
	Dynamic brake				Size A - F: Built-in
	Control mode				Selectable from the following 3 modes by parameter: [1]position control [2]velocity control [3]position/velocity control

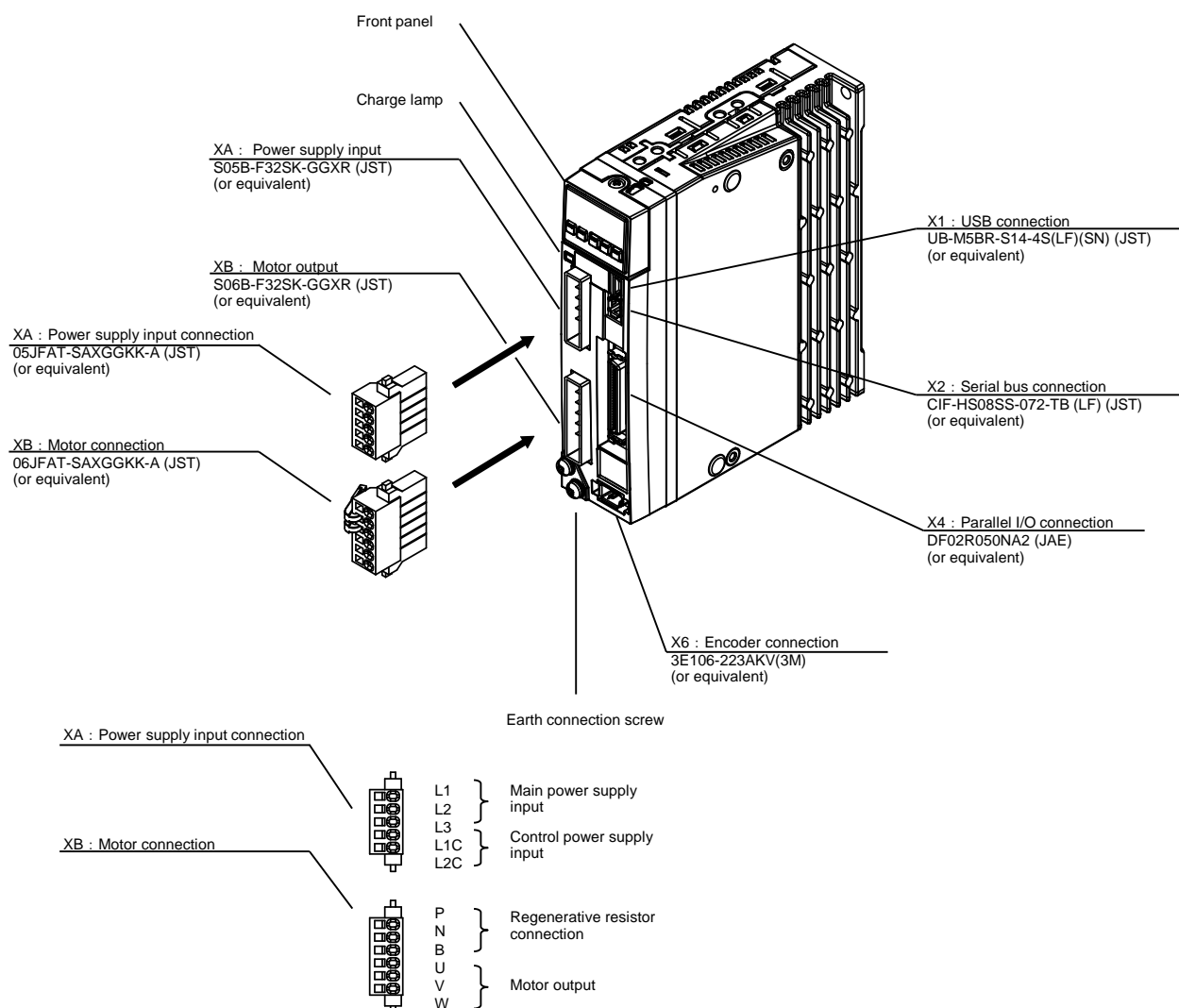● Please note that condensation tend to occur when temperature fall.

Function	Position control	Control input		Deviation counter clear, command pulse input inhibition, command division/multiplication switching, vibration suppression control switching, etc.
		Control output		Positioning completion, etc.
		Pulse input	Max command pulse frequency	500 K[pulse/s] (when using the photo coupler input) 8 M[pulse/s] (when using the line receiver input of A-phase /B-phase)
			Command pulse input mode	Differential input. Differential input can be selected by parameters. ((1) Positive direction/ negative direction, (2) A-phase/B-phase (3) Command/ direction)
			Command pulse scaling (Electronic gear)	1/1000 to 8000 times Although electronic gear ratio of the encoder resolution (numerator) and command number of pulses per revolution of the motor (denominator) can be arbitrarily set in the range of 1 to 223 for the numerator and in the range of 1 to 223 for the denominator, this product should be used within the aforementioned range.
			Smoothing Filter	Primary delay filter or FIR filter is selectable for command input.
		Vibration suppression control		Maximum of 3 may be used simultaneously
		Model type vibration damping filter		Maximum of 2 may be used simultaneously
		2 degrees of freedom control		Available
		Load fluctuation suppression control		Available
		Position compare output function		Available [Condition] Block operation valid setting Return to origin completed state in increment mode (when block operation origin return invalidation setting is set to invalid)
		Block operation		Available
	Velocity control	Control input		Internal command velocity selection 1, Internal command velocity selection 2, Internal command velocity selection 3, speed zero clamp, etc.
		Control output		Speed arrival, etc.
		Internal velocity command		It is possible to switch 8 speeds of internal velocity with control input.
		Soft start/down function		0 to 10s/1000 r/min r/min Setting is possible for acceleration and deceleration respectively. S shaped acceleration/deceleration is possible.
		Speed zero clamp		Internal velocity command can be clamped to 0 with speed zero clamp input.
		Velocity command filter		Available
		2 degrees of freedom control		Available
		Load fluctuation suppression control		Available
		Position compare output function		Not available
		Block operation		Not available
	Common	Auto-tuning		This function identifies the load inertia real-time and automatically sets up the gain that meets the stiffness setting when the motor is running with host and internal driver operation commands.
		Pulse signal output division function		Number of pulses can be arbitrarily set. (However, the number of encoder pulses is the maximum number.)
		Protection function		Overvoltage, undervoltage, overspeed, overload, overheat, overcurrent, encoder failure, positional overdeviation, command pulse division, EEPROM failure, etc.
		Alarm data trace back function		Reference of history of alarm data is available.
		Infinite rotation absolute function		Available
		Deterioration diagnosis function		Available

4-2 Specifications by model
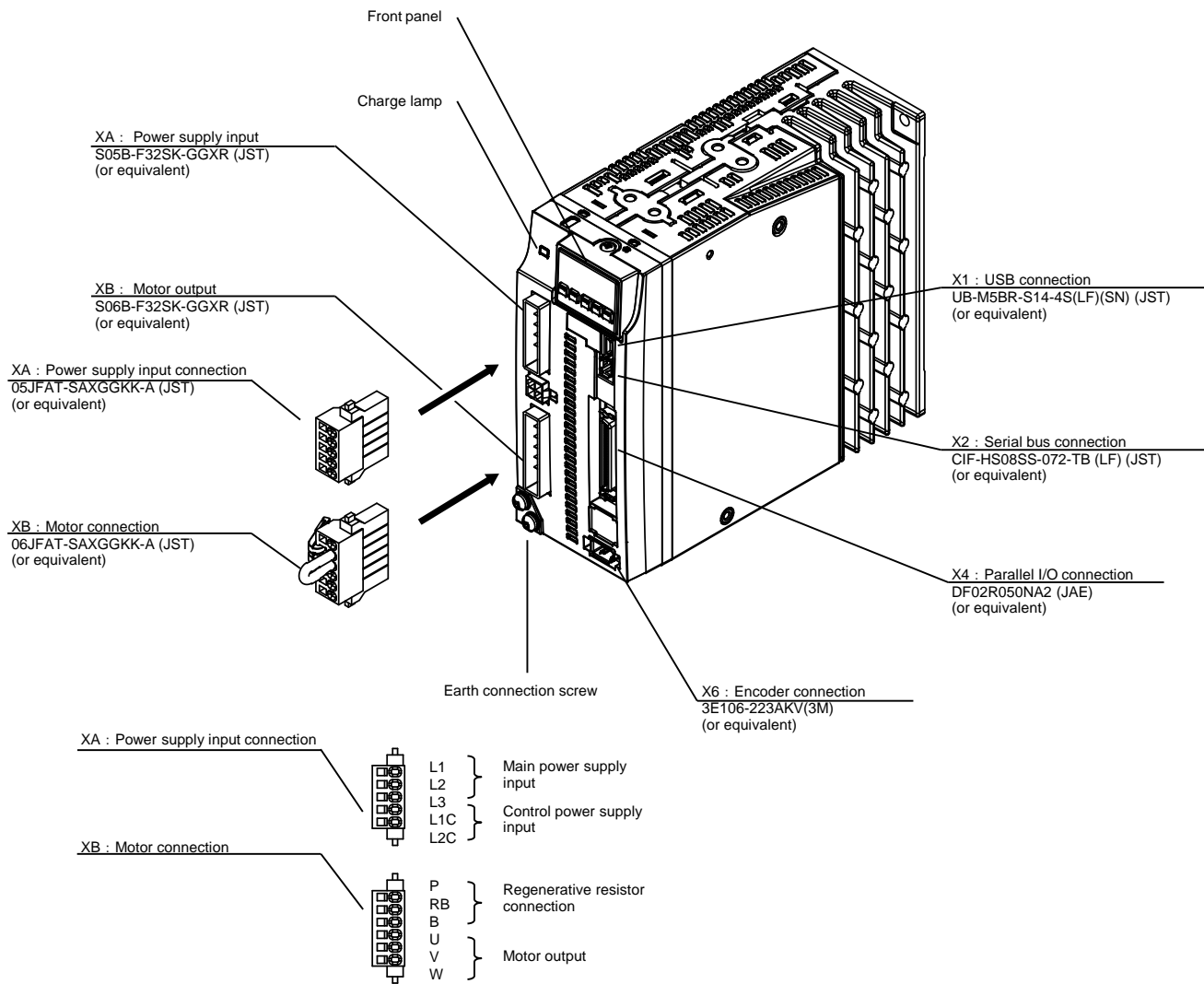
Refer to specification for each model.
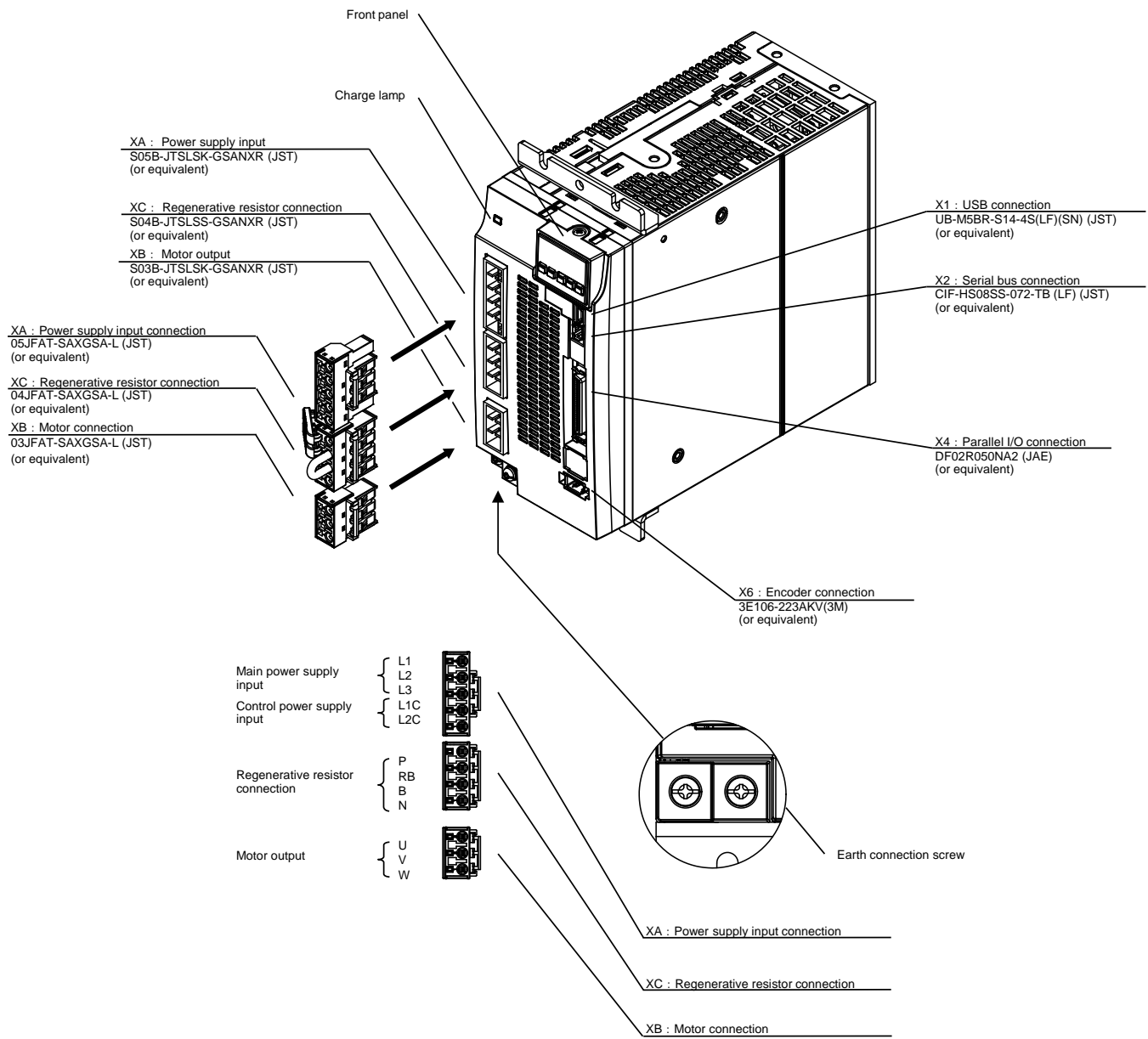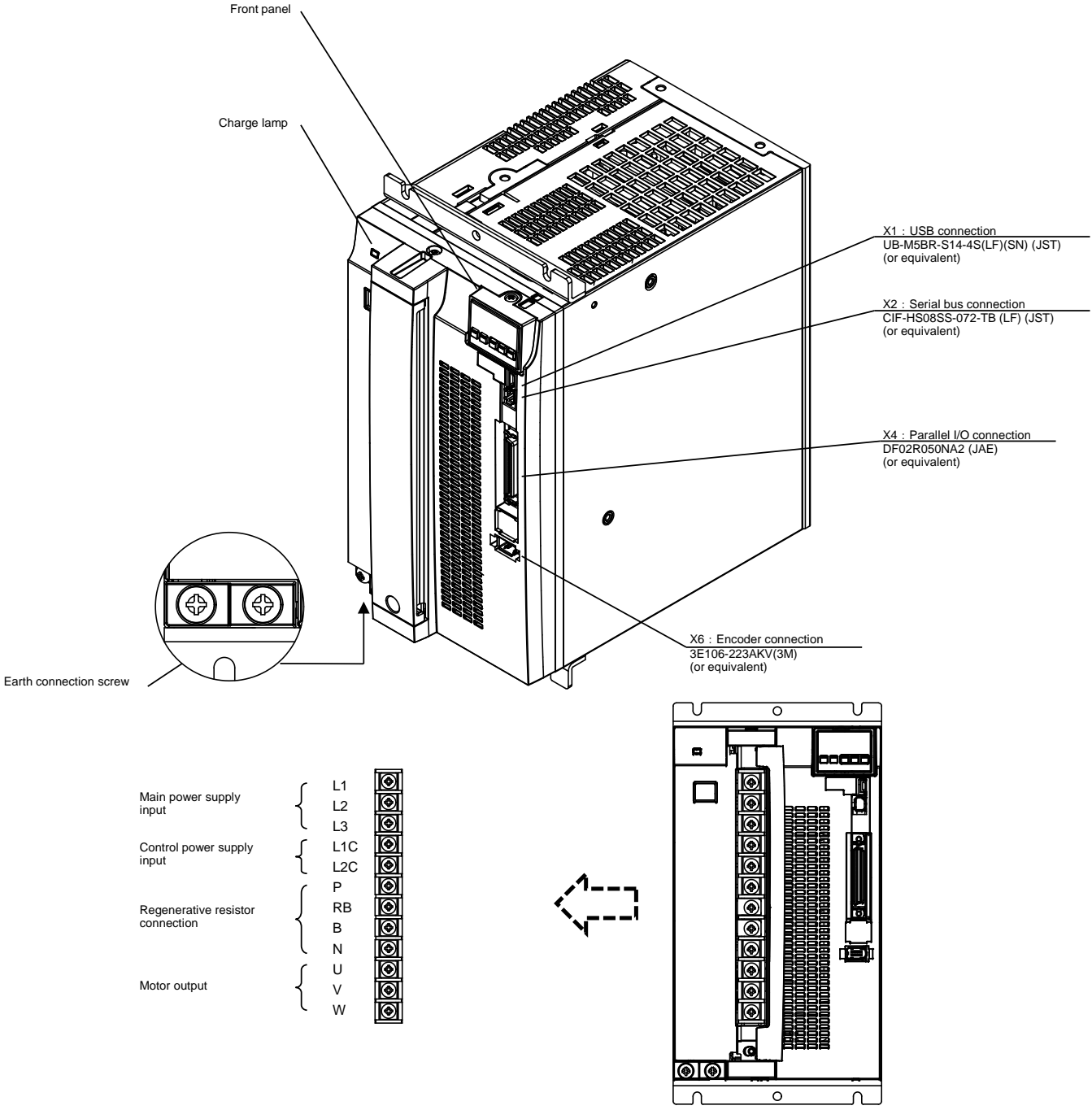
5. Appearance and part names

100 V,200 V size A, B

Front panel

Charge lamp

XA : Power supply input
S05B-F32SK-GGXR (JST)
(or equivalent)

XB : Motor output
S06B-F32SK-GGXR (JST)
(or equivalent)

XA : Power supply input connection
05JFAT-SAXGGKK-A (JST)
(or equivalent)

XB : Motor connection
06JFAT-SAXGGKK-A (JST)
(or equivalent)

X1 : USB connection
UB-M5BR-S14-4S(LF)(SN) (JST)
(or equivalent)

X2 : Serial bus connection
CIF-HS08SS-072-TB (LF) (JST)
(or equivalent)

X4 : Parallel I/O connection
DF02R050NA2 (JAE)
(or equivalent)

X6 : Encoder connection
3E106-223AKV(3M)
(or equivalent)

Earth connection screw

XA : Power supply input connection

XB : Motor connection

L1
L2 } Main power supply input
L3
L1C } Control power supply
L2C } input

P
N } Regenerative resistor connection
B
U
V } Motor output
W

Motor Business Unit, Panasonic Corporation

100 V,200 V size C, D

Front panel

Charge lamp

XA : Power supply input
S05B-F32SK-GGXR (JST)
(or equivalent)

XB : Motor output
S06B-F32SK-GGXR (JST)
(or equivalent)

XA : Power supply input connection
05JFAT-SAXGGKK-A (JST)
(or equivalent)

XB : Motor connection
06JFAT-SAXGGKK-A (JST)
(or equivalent)

X1 : USB connection
UB-M5BR-S14-4S(LF)(SN) (JST)
(or equivalent)

X2 : Serial bus connection
CIF-HS08SS-072-TB (LF) (JST)
(or equivalent)

X4 : Parallel I/O connection
DF02R050NA2 (JAE)
(or equivalent)

Earth connection screw

X6 : Encoder connection
3E106-223AKV(3M)
(or equivalent)

XA : Power supply input connection

L1
L2
L3   } Main power supply input
L1C
L2C } Control power supply input

XB : Motor connection

P
RB   } Regenerative resistor connection
B
U
V   } Motor output
W

Motor Business Unit, Panasonic Corporation

200 V size E

Front panel

Charge lamp

XA : Power supply input
S05B-JTSLSK-GSANXR (JST)
(or equivalent)

XC : Regenerative resistor connection
S04B-JTSLSS-GSANXR (JST)
(or equivalent)

XB : Motor output
S03B-JTSLSK-GSANXR (JST)
(or equivalent)

XA : Power supply input connection
05JFAT-SAXGSA-L (JST)
(or equivalent)

XC : Regenerative resistor connection
04JFAT-SAXGSA-L (JST)
(or equivalent)

XB : Motor connection
03JFAT-SAXGSA-L (JST)
(or equivalent)

X1 : USB connection
UB-M5BR-S14-4S(LF)(SN) (JST)
(or equivalent)

X2 : Serial bus connection
CIF-HS08SS-072-TB (LF) (JST)
(or equivalent)

X4 : Parallel I/O connection
DF02R050NA2 (JAE)
(or equivalent)

X6 : Encoder connection
3E106-223AKV(3M)
(or equivalent)

Main power supply input { L1 L2 L3

Control power supply input { L1C L2C

Regenerative resistor connection { P RB B N

Motor output { U V W

Earth connection screw

XA : Power supply input connection

XC : Regenerative resistor connection

XB : Motor connection

Motor Business Unit, Panasonic Corporation

200 V size F

Front panel

Charge lamp

X1：USB connection
UB-M5BR-S14-4S(LF)(SN) (JST)
(or equivalent)

X2：Serial bus connection
CIF-HS08SS-072-TB (LF) (JST)
(or equivalent)

X4：Parallel I/O connection
DF02R050NA2 (JAE)
(or equivalent)

X6：Encoder connection
3E106-223AKV(3M)
(or equivalent)

Earth connection screw

Main power supply
input { L1
L2
L3

Control power supply
input { L1C
L2C

Regenerative resistor
connection { P
RB
B
N

Motor output { U
V
W

Name plate

Model number

Serial Number
e.g.):
P 1 5 0 7 0 0 0 1 N

Lot number

Month of production

Year of production
(Lower 2 digit of AD year)

Input/output voltage

Number of phase

Rated input/output current

Input/output frequency

Rated output of applicable motor

Panasonic   AC SERVO DRIVER

Model No.	MADLN15SE		
Serial No.	P15070001		
	INPUT	OUTPUT	
Voltage	200-240 V	0-240 V	
Phase	1φ/3φ	3φ	
F.L.C	2.0 A/1.1 A	1.6 A	
Freq.	50/60 Hz	0-541.7 Hz	
Power	200 W		

Panasonic Corporation   20150701   Made in China

CE   10   (合格)

KCC-REM-FAN-M-D   TÜV SÜD EMC LISTED   c (UL) us LISTED   IND. CONT. EQ. 7Z45

QR code

Standard mark

Country of origin

Manufacture date
e.g.):
2 0 1 5 0 7 0 1

Manufacture date

Manufacture month

Manufacture year

6. Configuration of connectors and terminal blocks

6-1 Power connector XA , XB , XC , XD and terminal block

[1] Size A, B of 100 V and 200 V system

	Connector pin No.	Terminal symbol	Name	Description			
XA	5	L1	Main power supply input	100 V	Single phase 100-120 V	+ 10 % - 15 %	50/60 Hz input
					Use L1 and L3 terminal for single phase input		
	4	L2		200 V	Single or 3 phase 200-240 V	+ 10 % - 15 %	50/60 Hz input
	3	L3			Use L1 and L3 terminal for single phase input		
	2	L1C	Control power supply input	100 V	Single phase 100-120 V	+ 10 % - 15 %	50/60 Hz input
	1	L2C		200 V	Single phase 200-240 V	+ 10 % - 15 %	50/60 Hz input
XB	6	P	Regen resistor connection	· When a trip happens due to a regenerative load protection error, connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for the parameter Pr0.16. · Do not connect N terminal.			
	5	N					
	4	B					
	3	U	Motor connection	Connect each phase of the motor winding. U: U phase V: V phase W: W phase			
	2	V					
	1	W					
	⏚	⏚	Earth	Earth terminal for grounding			

  * Tighten the earth screws M4 with the 0.7-0.8 Nm torque respectively.

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[2] Size C, D of 100 V and 200 V system

	Connector pin No.	Terminal symbol	Name	Description		
XA	5	L1	Main power supply input	100 V	Single phase 100-120 V + 10 % - 15 % 50/60 Hz input Use L1 and L3 terminal for single phase input	
	4	L2		200 V	Single or 3 phase 200 – 240 V + 10 % - 15 % 50/60 Hz input Use L1 and L3 terminal for single phase input	
	3	L3				
	2	L1C	Control power supply input	100 V	Single phase 100-120 V	+ 10 % - 15 % 50/60 Hz input
	1	L2C		200 V	Single phase 200 – 240 V	+ 10 % - 15 % 50/60 Hz input
XC	4	N	-	• Do not connect.		
	3					
	2	P				
	1					
XB	6	P	Regen resistor connection	• Normally, short out the circuit between B and RB. (Sizes C, D) • When a trip happens due to a regenerative load protection error, open the circuit between B and RB and connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for the parameter Pr0. 16.		
	5	RB				
	4	B				
	3	U	Motor connection	Connect each phase of the motor winding. U: U phase V: V phase W: W phase		
	2	V				
	1	W				
	⏚	⏚	Earth	Earth terminal for grounding		

* Tighten the earth screws M4 with the 0.7-0.8 Nm torque respectively.

[3] Size E of 200 V system

	Connector pin No.	Terminal symbol	Name	Description				
XA	5	L1	Main power supply input	200 V	3 phase 200 - 240 V	+ 10 % - 15 %	50/60 Hz input	
	4	L2						
	3	L3						
	2	L1C	Control power supply input	200 V	Single phase 200 - 240 V	+ 10 % - 15 %	50/60 Hz input	
	1	L2C						
XC	4	P	Regen resistor connection	· Normally, short out the circuit between RB and B. · When a trip happens due to a regenerative load protection error, open the circuit between RB and B and connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for parameter Pr0. 16. · Do not connect N terminal.				
	3	RB						
	2	B						
	1	N						
XB	3	U	Motor connection	Connect each phase of the motor winding. U: U phase V: V phase W: W phase				
	2	V						
	1	W						
	⏚	⏚	Earth	Earth terminal for grounding				

* Tighten the earth screws M4 with the 0.7-0.8 Nm torque respectively.

[4] Size F of 200V system

Terminal block is used instead of connector.

	Terminal No. (Upper to bottom)	Terminal symbol	Name	Description			
Terminal Block	1	L1	Main power supply input	3 phase	200 - 240 V	+ 10 % - 15 %	50/60 Hz input
	2	L2					
	3	L3					
	4	L1C	Control power supply input	Single phase	200 - 240 V	+ 10 % - 15 %	50/60 Hz input
	5	L2C					
	6	P	Regen resistor connection	· Normally, short out the circuit between RB and B. · When a trip happens due to a regenerative load protection error, open the circuit between RB and B and connect an external regenerative resistor (prepared by customer) between P and B. Then, specify the external regenerative resistor for parameter Pr0. 16. · Do not connect N terminal.			
	7	RB					
	8	B					
	9	N					
	10	U	Motor connection	Connect each phase of the motor winding. U: U phase V: V phase W: W phase			
	11	V					
	12	W					
	⏚	⏚	Earth	Earth terminal for grounding			

* Tighten the earth screws M5 with the 1.4 -1.6 Nm torques respectively.
* Tighten the terminal block screws M5 with the 1.0-1.7 Nm torques respectively.
* Tighten the fixing screw M3 for the terminal block cover with the 0.2 Nm torque.
* If the maximum value of tightening torque is exceeded, the terminal block could be damaged.

6-2 USB connector X1

By connecting to a computer or a controller via USB interface, the following operations are available
parameter reference / change parameter save / load monitoring of status checking alarm status or alarm history

Name	Symbol	Connector pin No	Description
USB signal	VBUS	1	・ Communicate with a computer or a controller
	D-	2	
	D+	3	
For manufacturer use	–	4	・ Do not connect
Signal ground	GND	5	・ Signal ground

6-3 Serial bus connector X2

Name	Symbol	Connector pin No	Description
Signal ground	GND	1	・ Signal ground (*Note 1)
NC	-	2	・ Do not connect
RS232 signal	TXD	3	・ Serial bus transmission and reception data (RS232)
	RXD	4	
RS485 signal	485 -	5	・ Serial bus transmission and reception data (RS485)
		7	
	485+	6	
		8	
Frame ground	FG	shell	・ Frame ground

Note 1)   The signal ground GND is connected with the control circuit ground connected with the connector X4 .

6-4 Parallel I/O connector, X4

Common digital inputs

Name	Symbol	Con-nector pin No.	Description	Circuit
Power supply input	COM+	7	・Connect to the + terminal of an external DC power supply (12 to 24 V) ・Use a 12 V (±5 %) to 24 V (±5 %) power supply ・Insulation is needed against the primary side power supply. Please do not connect them with the same power supply.	――
Multi-function input 1	SI1	8		
Multi-function input 2	SI2	9		
Multi-function input 3	SI3	26		
Multi-function input 4	SI4	27		
Multi-function input 5	SI5	28	・The function changes according to the parameter settings. See below.	i-1
Multi-function input 6	SI6	29		
Multi-function input 7	SI7	30		
Multi-function input 8	SI8	31		
Multi-function input 9	SI9	32		
Multi-function input 10	SI10	33		

Functions allocatable to multi-function inputs

Name	Symbol	Description
Servo ON	SRV-ON	・When turned ON, the servo is turned on (power is supplied to the motor). ・When turned OFF, the servo is turned off and the motor power is turned off.
Control mode switch	C-MODE	・Switches the control modes.
Positive overtravel limit	POT	・Positive overtravel limit. ・Make sure to connect this so that the contact point will be opened when the movable module positively exceeded the movable range. ・When this input is OFF, a positive torque does not occur.
Negative overtravel limit	NOT	・Negative overtravel limit. ・Make sure to wire this input to be activated as the work over travels the limit in the negative direction. ・When this input is OFF, a negative torque does not occur.
Deviation counter clear	CL	・Clears the position deviation counter.
Command pulse inhibition	INH	・Ignores the position command pulse.
Preset velocity 1	INTSPD1	・Preset speed.
Preset velocity 2	INTSPD2	・Allows you to set up to 8 internal velocities by combining INTSPDs 1 - 3.
Preset velocity 3	INTSPD3	
Speed zero clamp	ZEROSPD	・Sets the speed command to zero.
Anti-vibration switch 1	VS-SEL1	・Switches the applied frequencies for anti-vibration control.
Anti-vibration switch 2	VS-SEL2	
Gain switch	GAIN	・Input to switch the gains.
Torque limit switch	TL-SEL	・Switches the torque limits.
Alarm clear	A-CLR	・Digital input to clear the alarm.
Command scaling switch	VC-SIGN	・Specifies the sign of the speed command during the speed control.
Torque command sign	TC-SIGN	・Specifies the sign of the torque command during the torque control.
Command scaling switch 1	DIV1	・Switches the scaling numerators of the command pulse.
Command scaling switch 2	DIV2	・Allows you to switch up to 4 numerators by combining DIVs 1, 2.
Forced alarm input	E-STOP	・Generates Err87. 0 "Abnormal forced alarm input."
Inertia ratio switch	J-SEL	・Switches the inertia ratios.

Input signals (command pulse train) and their functions

A suitable interface can be chosen from two kind of interface based on the specification of command pulses.

A. Pulse train interface with line driver

Name	Symbol	Con-nector pin No.	Description	Circuit
Command pulse input 1	PULSH1	44	· Input terminal for the position command pulse. It can be selected by setting corresponding parameters. · Disabled in such control modes as the speed control or the torque control, which does not require position commands. · The maximum allowable input frequency is 8 Mpps.	Di-2
	PULSH2	45		
Command direction input 1	SIGNH1	46		
	SIGNH2	47		

B. Pulse train interface with optocoupler

Name	Symbol	Con-nector pin No.	Description	Circuit
Command pulse input 2	OPC1	1	· Input terminal for the position command pulse. It can be selected by setting corresponding parameters. · Disabled in such control modes as the speed control or the torque control, which does not require position commands. · The maximum allowable input frequency is 500 kpps for line driver input, and 200 kpps for open collector input.	Di-1
	PULS1	3		
	PULS2	4		
Command direction input 2	OPC2	2		
	SIGN1	5		
	SIGN2	6		

Output signals (common) and their functions

Name	Symbol	Con-nector pin No.	Description	Circuit
Multi-function output 1	SO1- SO1+	10 11		
Multi-function output 2	SO2- SO2+	34 35	・ The function changes according to the parameter settings. See below.	o-1
Multi-function output 4	SO4- SO4+	38 39		
Servo alarm	ALM- ALM+	36 37	・ Digital output to indicate alarm status.	
Multi-function output 5	SO5	12	・ The function changes according to the parameter settings. See below.	o-3
Multi-function output 6	SO6	40		
Power supply input	COM-	41	・ Connect to the - terminal of an external DC power supply (12 to 24 V) ・ The power capacity varies depending on a composition of I/O circuit.0.5A or more is recommended. ・ Insulation is needed against the primary side power supply Please do not connect them with the same power supply.	———

Functions allocatable to multi-function outputs

Name	Symbol	Description
Servo Alarm	ALM	・ Digital output to indicate the driver is in alarm status..
Servo ready	S-RDY	・ Digital output to indicate the driver is ready to be enabled.
Motor holding break release	BRK-OFF	・ Digital output to provide the timing signal to control the motor holding brake.
Zero speed	ZSP	・ Outputs the zero speed detection signals.
Torque limited	TLC	・ Outputs the torque limit signal.
In-position	INP	・ Outputs the positioning completion signal.
Positioning completion 2	INP2	・ Outputs the positioning completion signal 2.
At speed	AT-SPD	・ Outputs the at-speed signal.
V-COIN	V-COIN	・ Outputs the speed coincidence signal.
Warning output 1	WARN1	・ Outputs the warning output signal configured in Pr4. 40 "Warning output selection 1".
Warning output 2	WARN2	・ Outputs the warning output signal configured in Pr4. 41 "Warning output selection 2".
Position command ON/OFF	P-CMD	・ Outputs meaning positional command applied.
Speed in –limit output	V-LIMIT	・ Outputs meaning the speed is limited at torque control mode.
Alarm attribute output	ALM-ATB	・ Outputs meaning occur an alarm that can be cleared.
Speed command ON/OFF	V-CMD	・ Turns on output transistor when the speed command is applied while the speed is controlled.
Servo on status output	SRV-ST	・ Turn on output transistor when servo is on.

Output signals (pulse output) and its function

Name	Symbol	Connector pin No.	Description	Circuit
A phase output	OA+	21	• Scaling processed encoder signal or external scale signal (A/B/Z-phase) is output in differential mode. (RS422 equivalent) • Scaling ratio can be set by parameters. • The ground pin of the line driver on the output circuit is not insulated and is connected to signal ground (GND). • The maximum output frequency is 8 Mpps (after quadrature).	Do-1
	OA-	22		
B phase output	OB+	48		
	OB-	49		
Z phase output	OZ+	23		
	OZ-	24		
Z phase output	CZ	19	• Open collector output of Z-phase signal. • Ground of line driver of the output circuit is connected to signal ground (GND); not insulated.	Do-2

Analog monitor signals and their functions

Name	Symbol	Connector pin No.	Description	Circuit
Analog monitor output	IM	42	• Analog signal output for monitoring • Monitoring object changes according to the parameter setting.	Ao-1
	SP	43		

Others

Name	Symbol	Connector pin No.	Description	Circuit
Frame ground	FG	50, shell	• Internally connected to the earth terminal.	——
Signal ground	GND	13,15, 17,25	• Signal ground • Internally insulated from the control signal power supply (COM-).	——
–	–	20	• Do not connect	——

6-5 Encoder connector X6

Name	Connector pin No.	Description
Encoder power supply output	1	E5V
	2	E0V (*Note 1)
―	3	Do not connect.
	4	Do not connect.
Encoder signal I/O (serial signal)	5	PS
	6	/PS
Frame ground	shell	FG

*Note 1) The E0V of the encoder power supply output is connected with the control circuit ground of the connector X4 .

Input and output interface

i - 1

V_{DC}
12 to 24 V

or

V_{DC}
12 to 24 V

4.7 k
1000 p
1 k
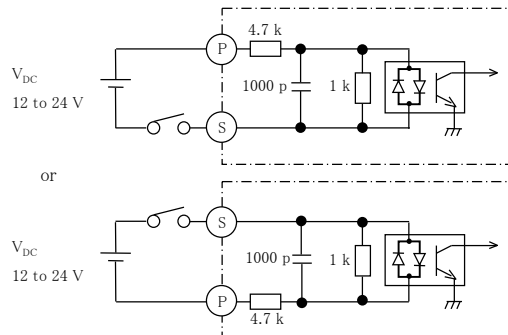
Pins;
S : (X4) 8, 9, 26, 27, 28, 29, 30, 31, 32, 33
P : (X4) 7

o - 1

V_{DC}
12 to 24 V

R
50 mA or less
10
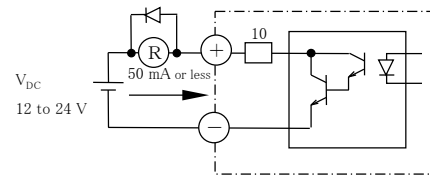
Pins;
　+ : (X4) 11, 35, 37, 39　　　　- : (X4) 10, 34, 36, 38

Note) To directly run the relay, attach a diode in
Parallel with the relay and in the direction
shown in the figure above.
VCE sat = 1.2 V

Ao - 1

Twisted pair
1 k
GND
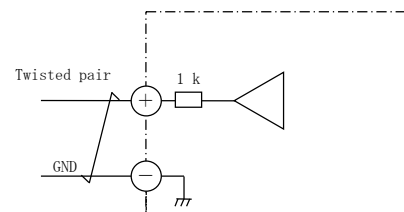
Pins;
　+ : (X4) 42, 43
　- : (X4) 13, 17, 25
Note) Outputting signal amplitude is ±10 V

Di - 1

＜Line Driver＞

Twisted pair
H/L
3,5
2.2 k
1000 p
4,6
220
13　GND

H/L
PULS
SIGN
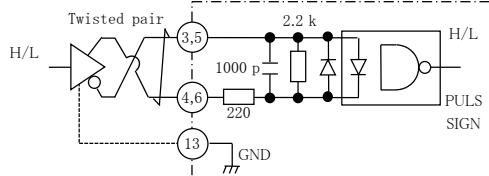
＜Open Collector＞
①12-24 V Powersupply with external resistor

$$\frac{Vp-1.5}{R+220} \fallingdotseq 10\ mA$$

1,2　2.2 k
3,5
2.2 k
R
1000 p
4,6
220
10 mA
13　GND

Vp
12 to 24 V
ON/OFF

L/H
PULS
SIGN
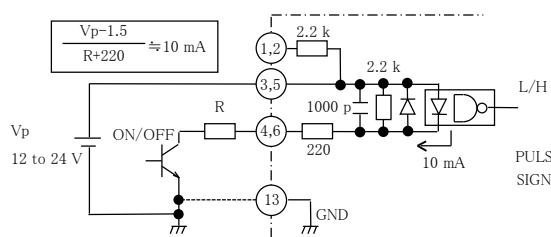
②24 V Power supply without external resistor

1,2　2.2 k
3,5
2.2 k
1000 p
4,6
220
13　GND

24 V
ON/OFF

L/H
PULS
SIGN

Do - 1

Twisted pair
Equivalent of
AM26C31
GND
13

Pins;
　+ : 21, 23, 48
　- : 22, 24, 49

Do - 2

V_{DD}
30 V MAX
CZ
19
10
50 mA MAX
GND
17

Di - 2

H/L

Twisted pair

44
46

47
45

120

2 k

2 k

20 k

20 k

Equivalent of
AM26C32

H/L

PULS

SIGN

13 GND

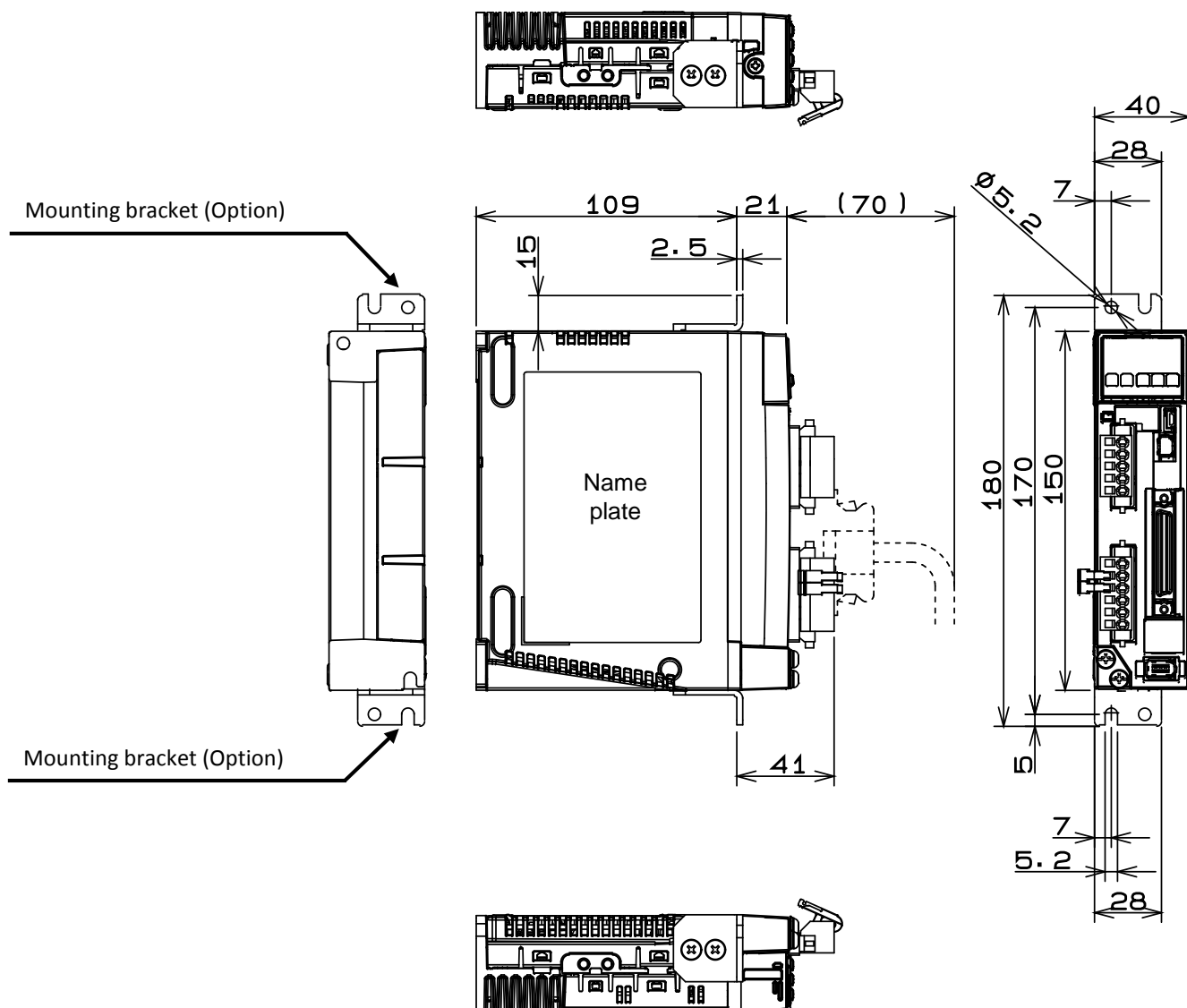## o －2

V_{DC}
12 to 24 V

R

50 mA or less

+

10

41
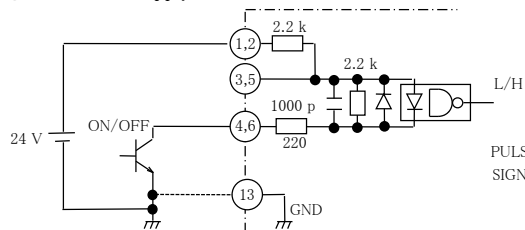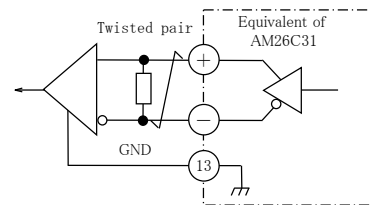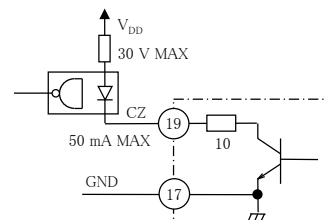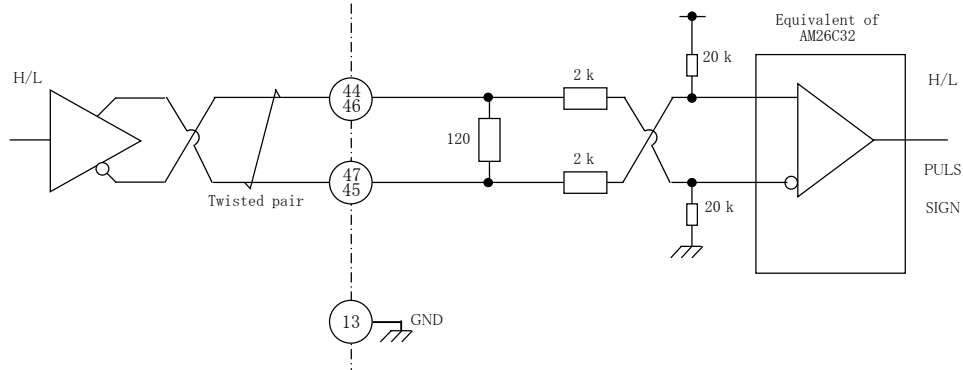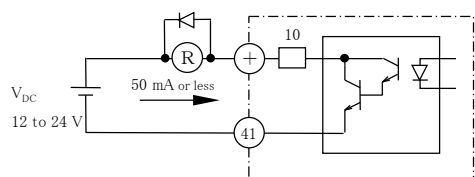
Pins;
 ＋ : 40, 12
 Note) To directly run the relay, attach a diode in
      Parallel with the relay and in the direction
      shown in the figure above.

7. Dimensions

External dimension size A
  [Base-mounting TYPE (Standard: Mounting on the back)]

2-M4 Effective screw depth 7

14

4

90

10

150

130

(70)

40

Ø5.2

140

Name
plate

150

5

5.2

28

6

4

14

90

10

2-M4 Effective screw depth 7

*Please do not use the screw holes of no description of the size value.

[Rack-mounting TYPE (Option: Mounted on the front)]

Mounting bracket (Option)

Name plate

Mounting bracket (Option)

109   21   (70)

15   2.5

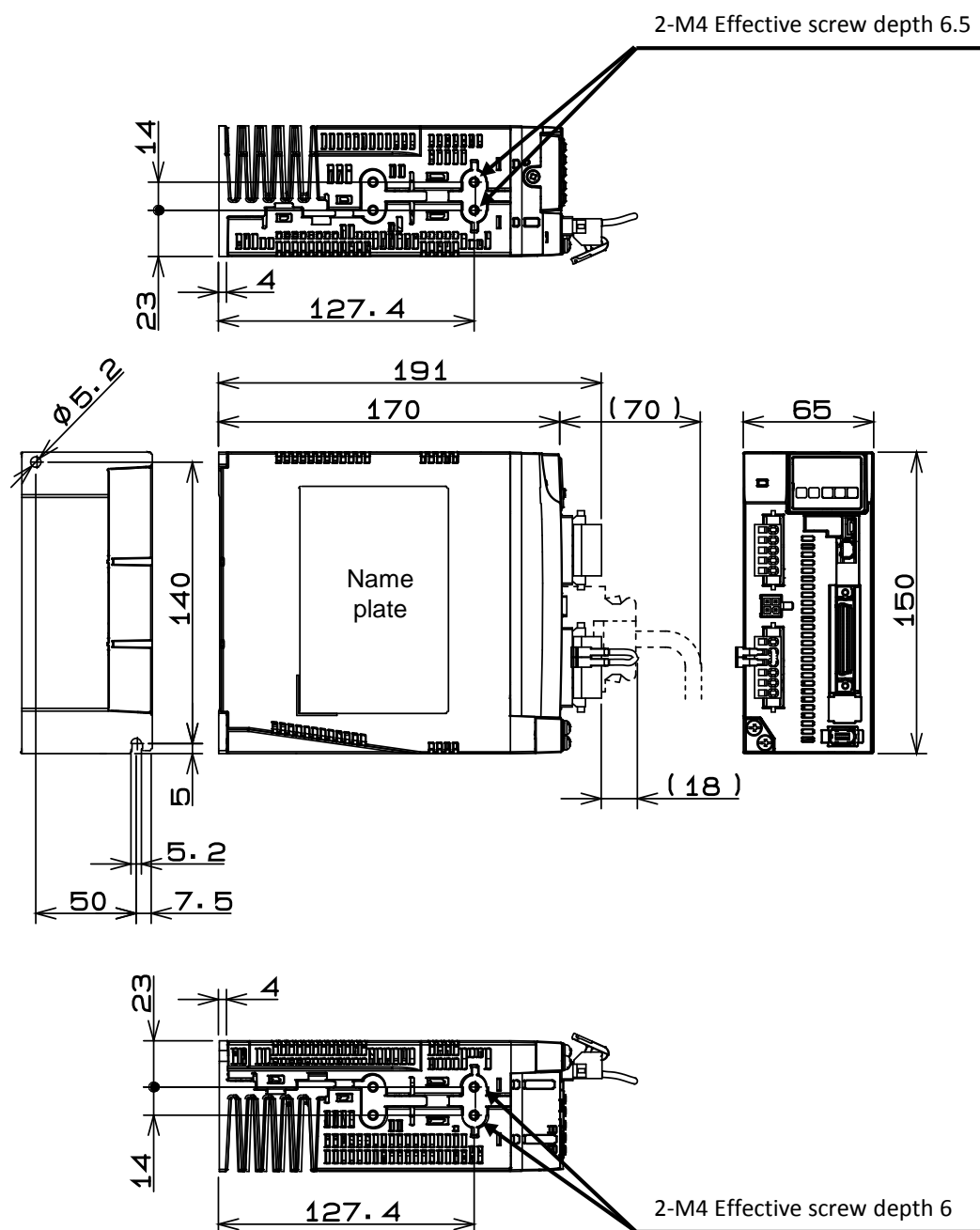41

40
28
7
ø5.2
180   170   150
5
7
5.2
28

*Please do not use the screw holes of no description of the size value.
*Mounting bracket is optional parts. Mounting bracket does not shipped with the product.
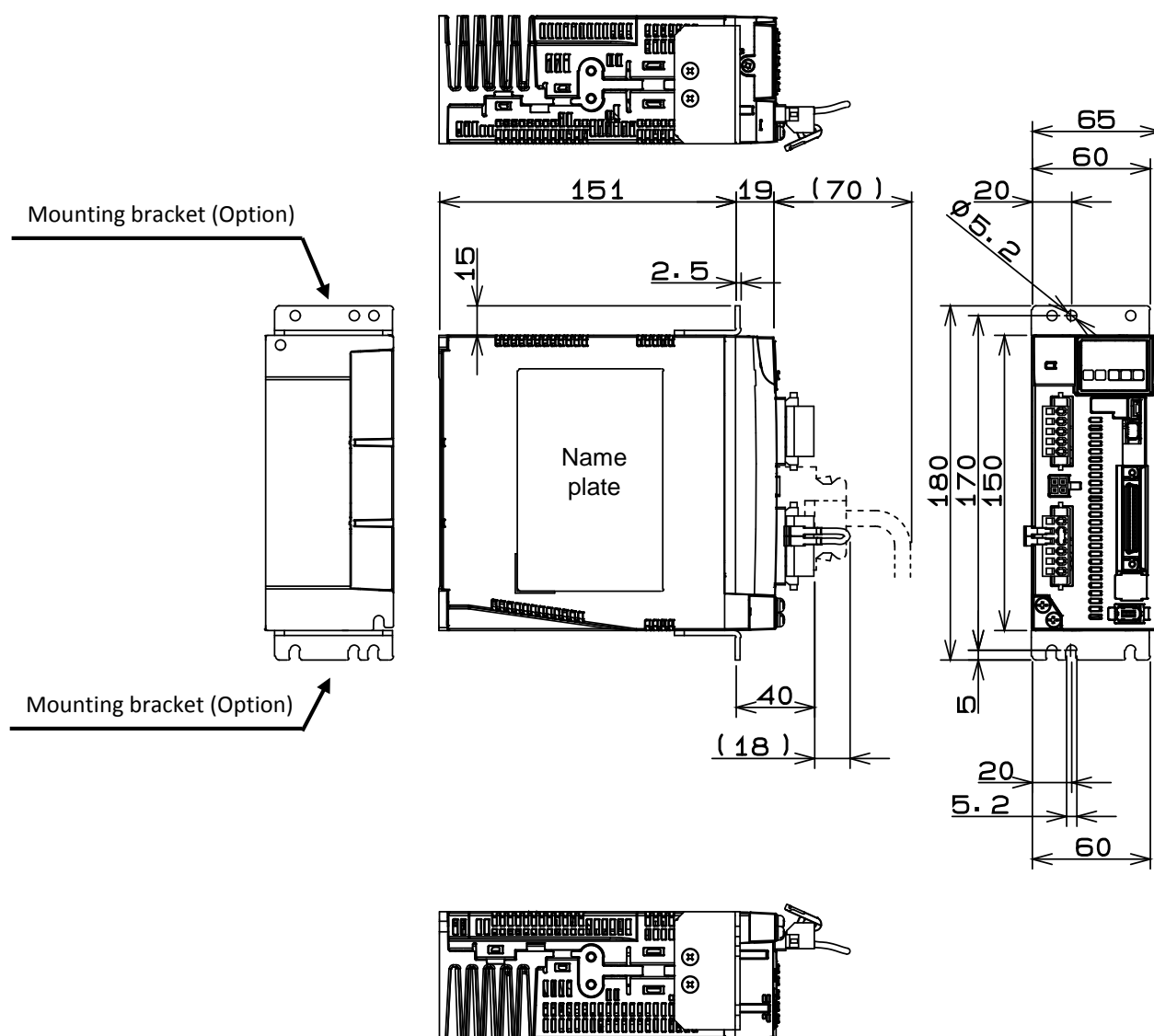
External dimension size B

[Base-mounting TYPE (Standard: Mounting on the back)]
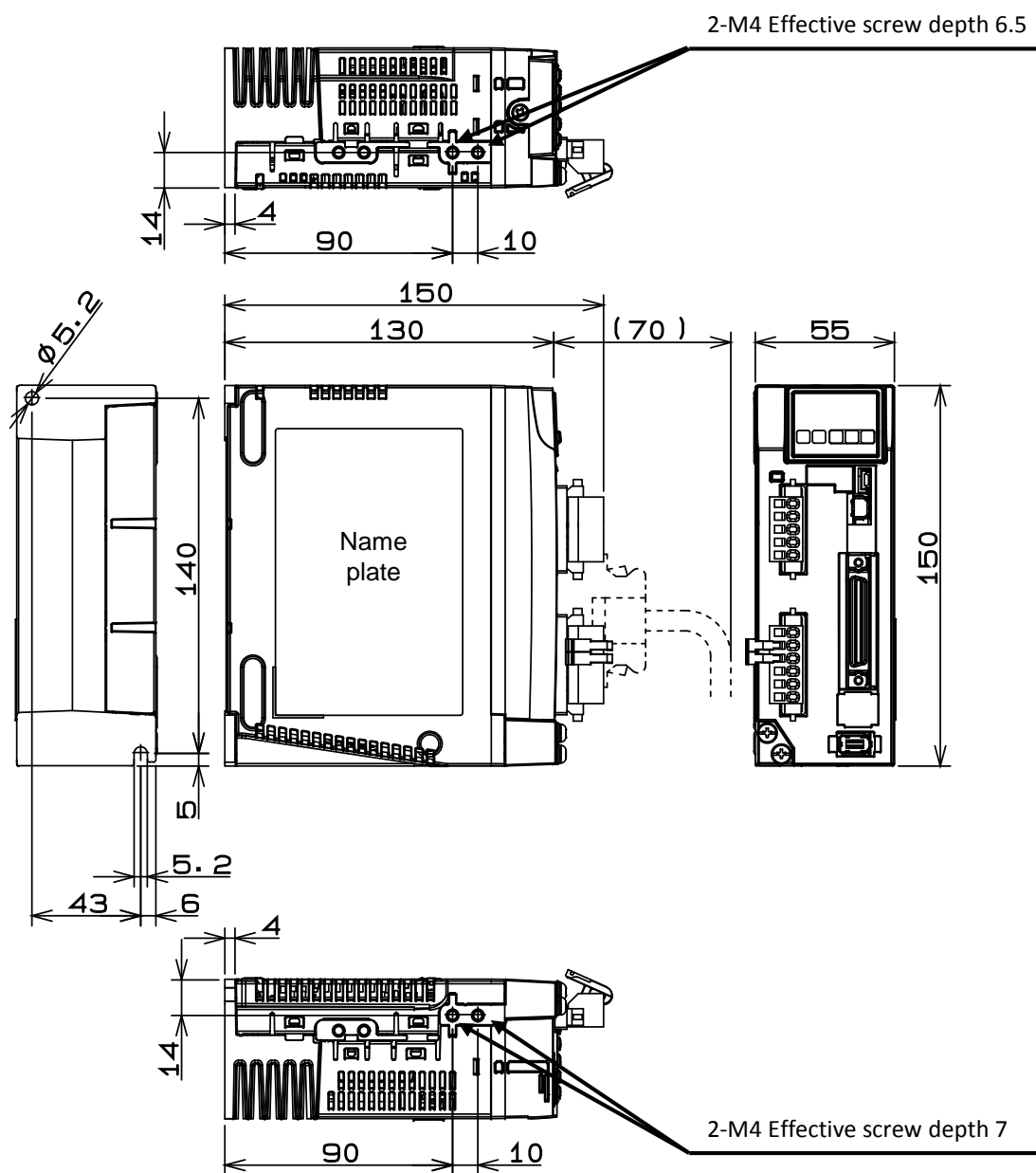
2-M4 Effective screw depth 6.5

14

4

90

10

Ø5.2

150

130

(70)

55

140

Name plate

150

5

5.2

43

6

4

14

90

10

2-M4 Effective screw depth 7

*Please do not use the screw holes of no description of the size value.

[Rack-mounting TYPE (Option: Mounted on the front)]

Mounting bracket (Option)

Mounting bracket (Option)

Name
plate

109
21
(70)
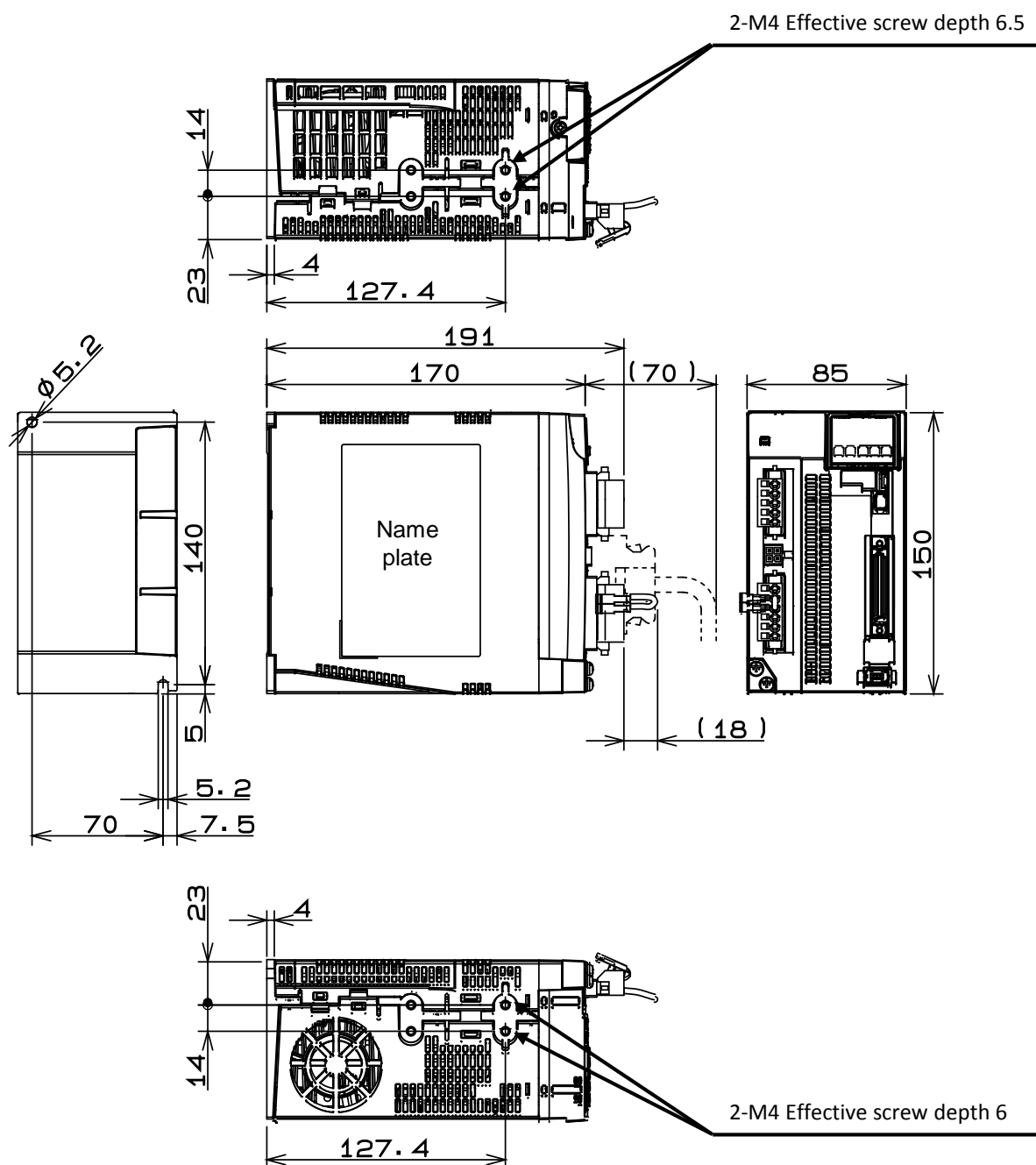15
2.5
41

55
28
ø5.2
7
180
170
150
5
7
5.2
28
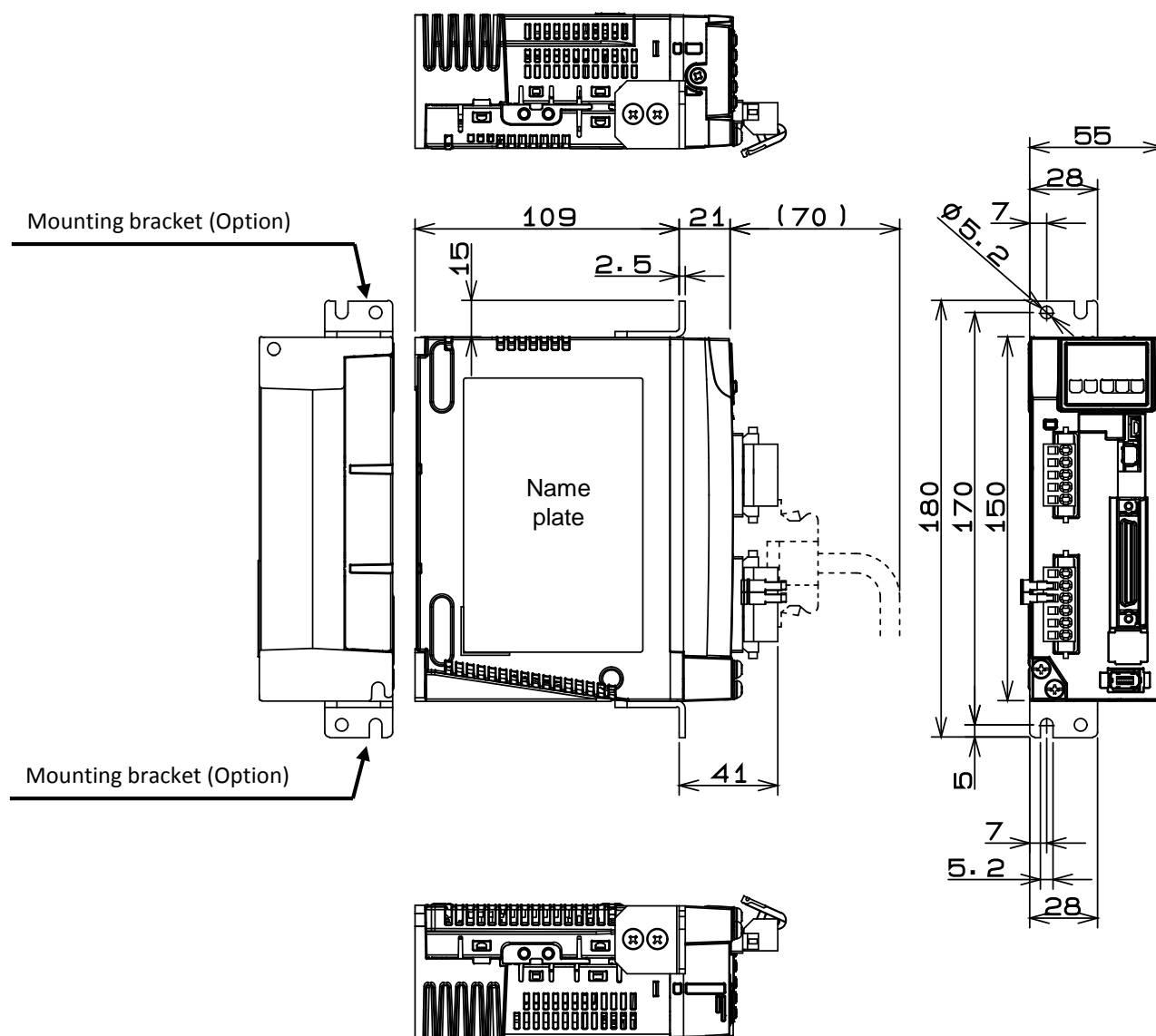
*Please do not use the screw holes of no description of the size value.
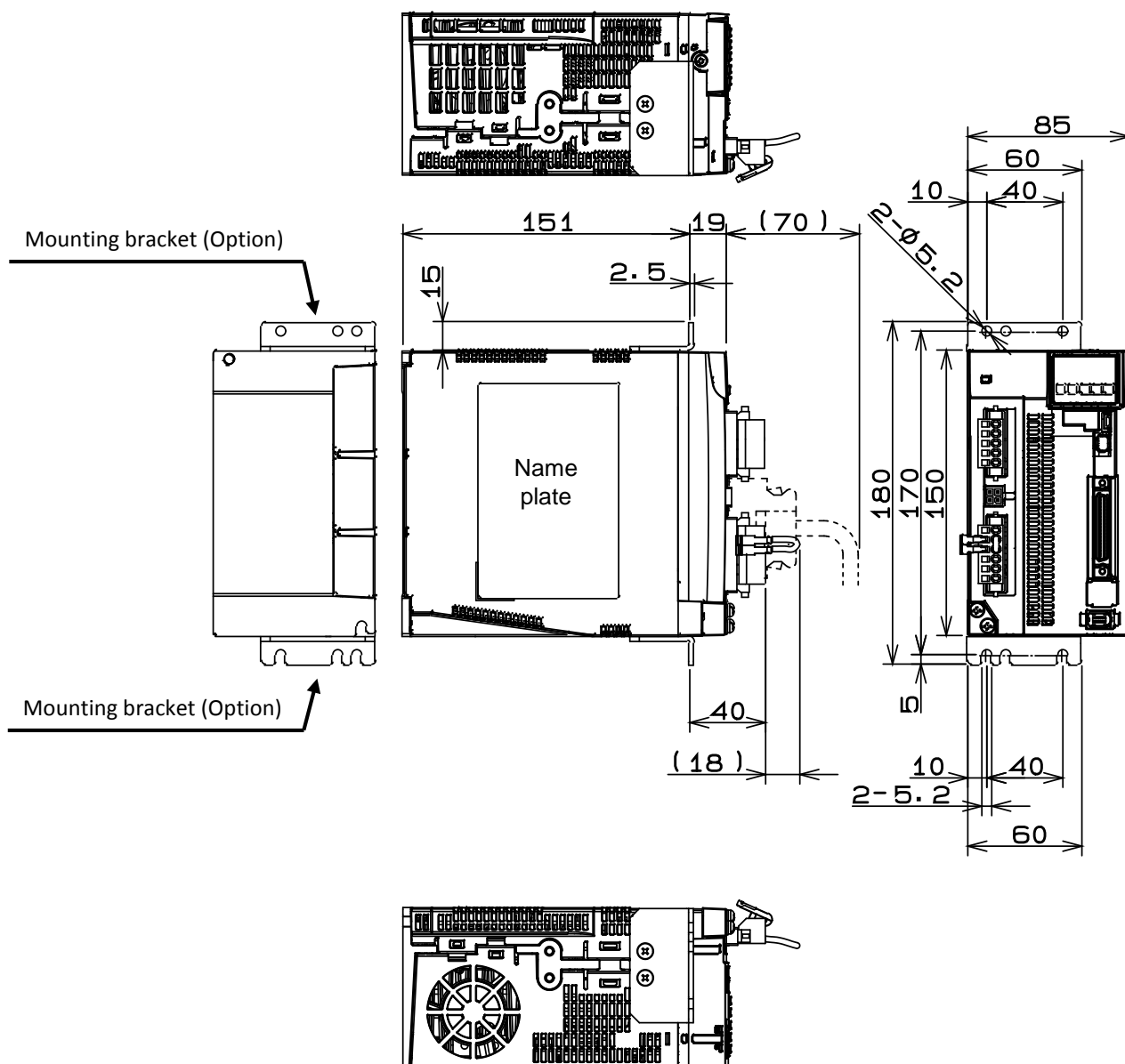*Mounting bracket is optional parts. Mounting bracket does not shipped with the product.

External dimension size C
[Base-mounting TYPE (Standard: Mounting on the back)]

2-M4 Effective screw depth 6.5

14

23

4

127.4

∅5.2

191

170

(70)

65

140

Name
plate

150

5

5.2

50

7.5

(18)

23

4

14

127.4

2-M4 Effective screw depth 6

*Please do not use the screw holes of no description of the size value.

[Rack-mounting TYPE (Option: Mounted on the front)]

Mounting bracket (Option)

Mounting bracket (Option)

151   19   (70)

15

2.5

Name
plate

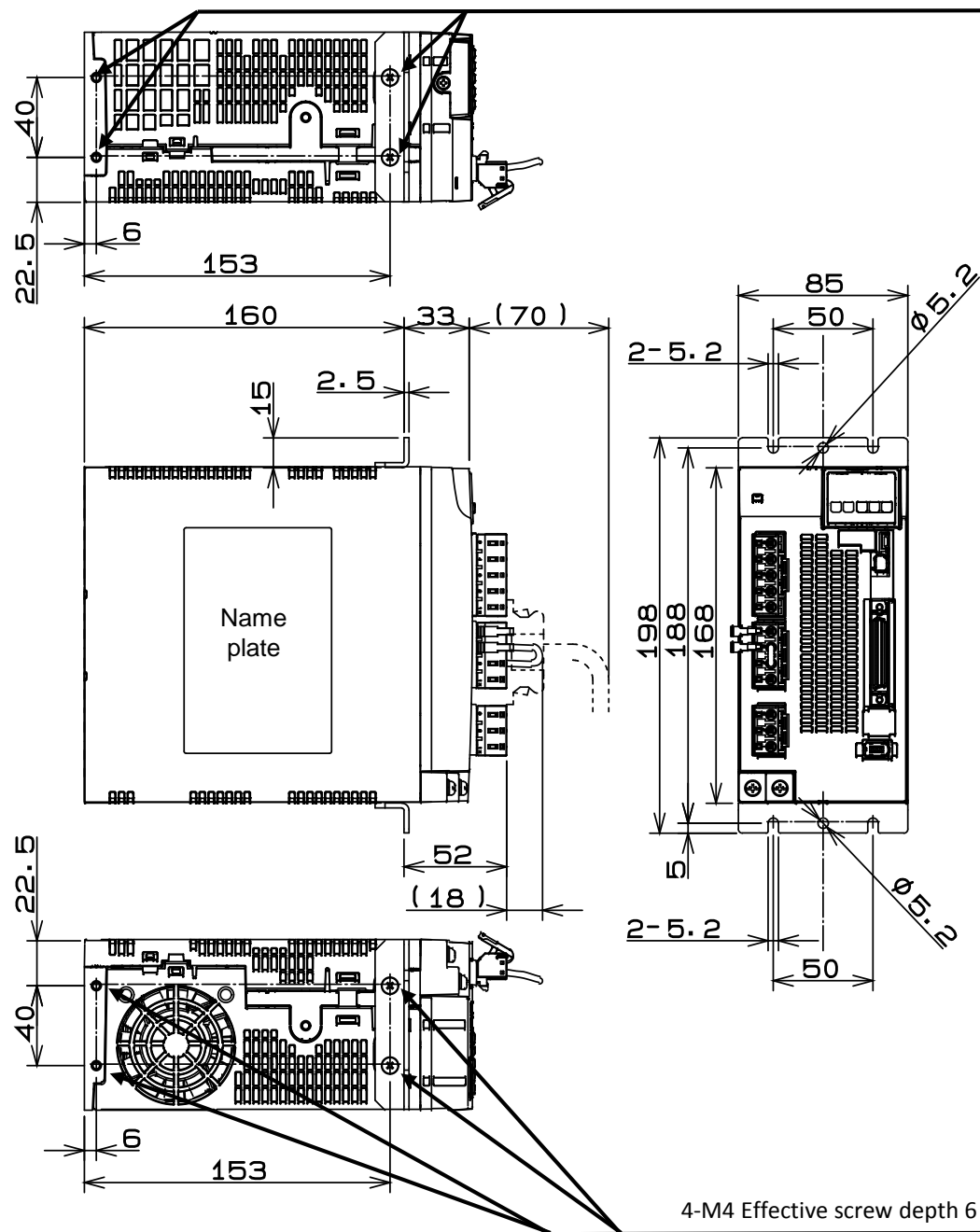180   170   150

5

40

(18)

65

60

20

ø5.2

20

5.2

60

*Please do not use the screw holes of no description of the size value.
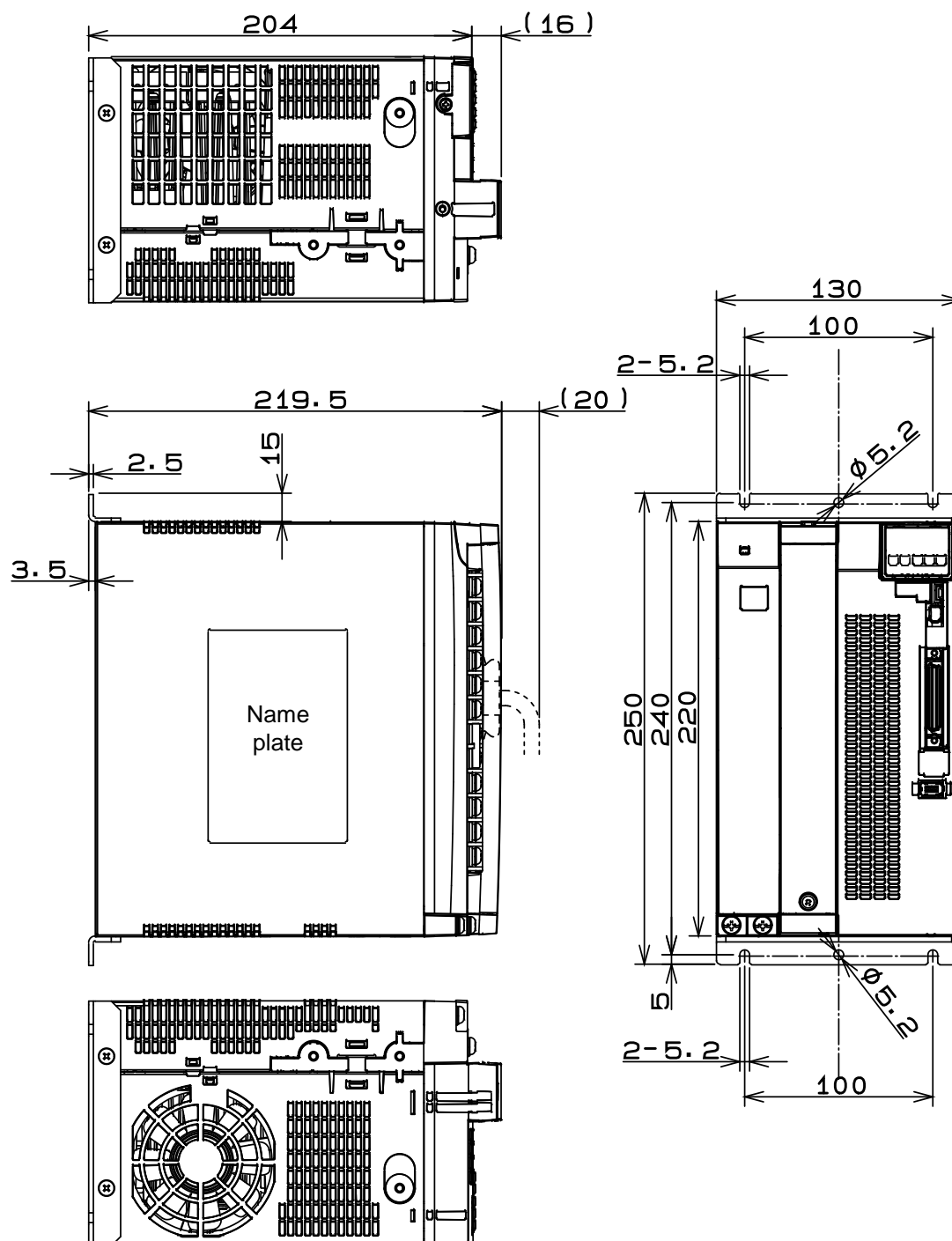*Mounting bracket is optional parts. Mounting bracket does not shipped with the product.

External dimension size D 200V

[Base-mounting TYPE (Standard: Mounting on the back)]

2-M4 Effective screw depth 6.5

14

23

4

127.4

ø5.2

191

170

(70)

85

140

Name plate

150

5

5.2

70

7.5

(18)

23

4

14

127.4

2-M4 Effective screw depth 6

*Please do not use the screw holes of no description of the size value.

[Rack-mounting TYPE (Option: Mounted on the front)]

Mounting bracket (Option)

Mounting bracket (Option)

151   19   (70)

15   2.5

Name plate

40

(18)

85
60
10   40

2-ø5.2

180   170   150

5

10   40
2-5.2
60

*Please do not use the screw holes of no description of the size value.
*Mounting bracket is optional parts. Mounting bracket does not shipped with the product.

Motor Business Unit, Panasonic Corporation

External dimension size E 200V
[Rack-mounting TYPE (Standard)]

4-M4 Effective screw depth 6

40

22.5

6

153

160

33

(70)

15

2.5

Name
plate

52

(18)

85

50

ø5.2

2-5.2

198

188

168

5

2-5.2

50

ø5.2

22.5

40

6

153

4-M4 Effective screw depth 6

[Base-mounting TYPE (Change from standard)]

Name
plate

External dimension size F 200V
[Rack-mounting TYPE (Standard)]

4-M4 Effective screw depth 9

31 (16)

70

30

6

162

169   47   (20)

15

2.5

Name
plate

130

100

2-5.2

φ5.2

250   240   220

5

2-5.2

φ5.2

100

30

70

6

162

4-M4 Effective screw depth 9

Motor Business Unit, Panasonic Corporation

[Base-mounting TYPE (Change from standard)]

204   (16)

219.5   (20)

2.5   15

3.5

Name plate

130

100

2-5.2

φ5.2

250   240   220

5

2-5.2

φ5.2

100

8. Wiring

8-1 Used cables and maximum cable lengths

Name	Symbol	Maximum cable length	Used cable
Main power supply	L1, L2, L3	——	Refer to specification
Control power supply	L1C, L2C	——	Refer to specification
Motor connection	U, V, W,	20m	Refer to specification
Earth cable	⏚	——	Refer to specification
Encoder connection	X6	20m	Batch twisted shielded pair
I/O connection	X4	3m	Core cable: 0. 18mm^2 or more

8-2 Various connectors

Connector symbol	Part name	Part number	Manufacturer
X2	Connector	2040008-1	Tyco electronics
X4	Solder plug (soldering type)	DF02P050F22A1	JAE
	Shell kit	DF02D050B22A	
X6	Connector	3E306-3200-008	3M Company

Please use the above part number connector, or equivalent connector.
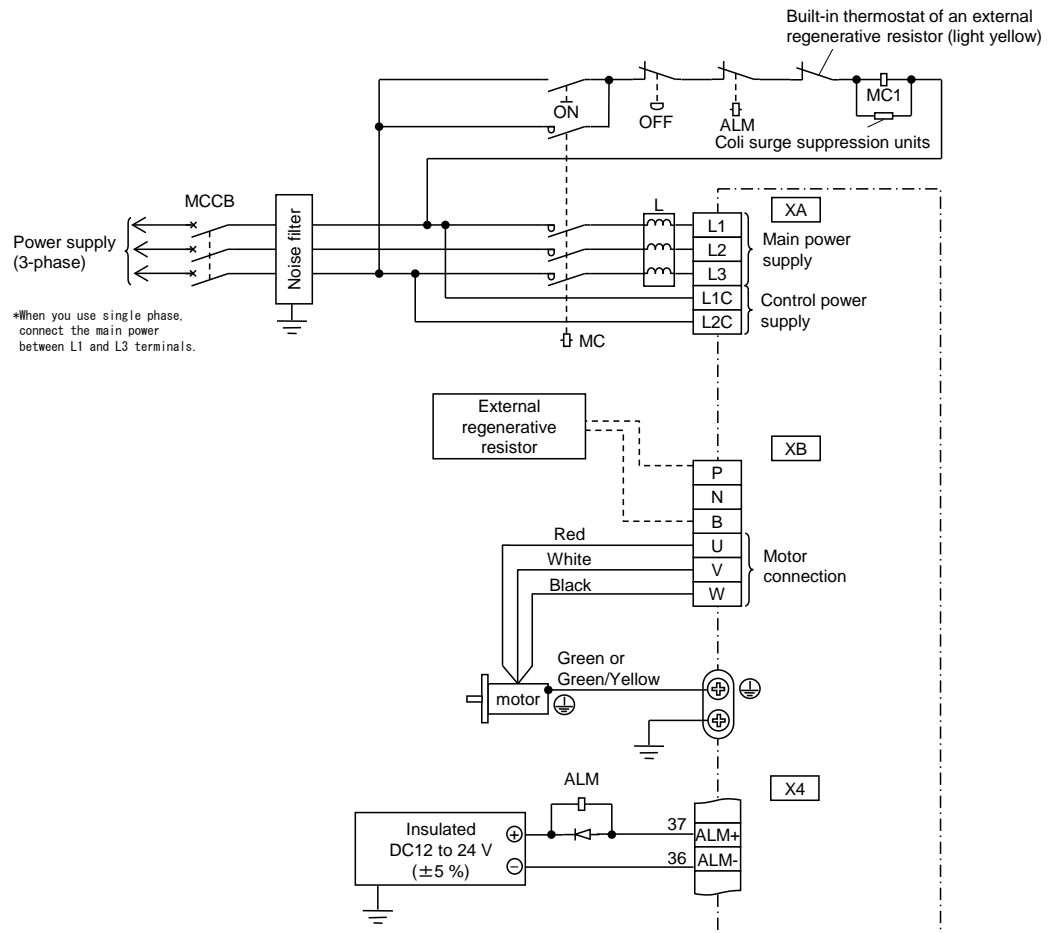
8-3 Precautions for wiring

(1) Wiring to power connector and terminal block

100/ 200 V sizes A - B

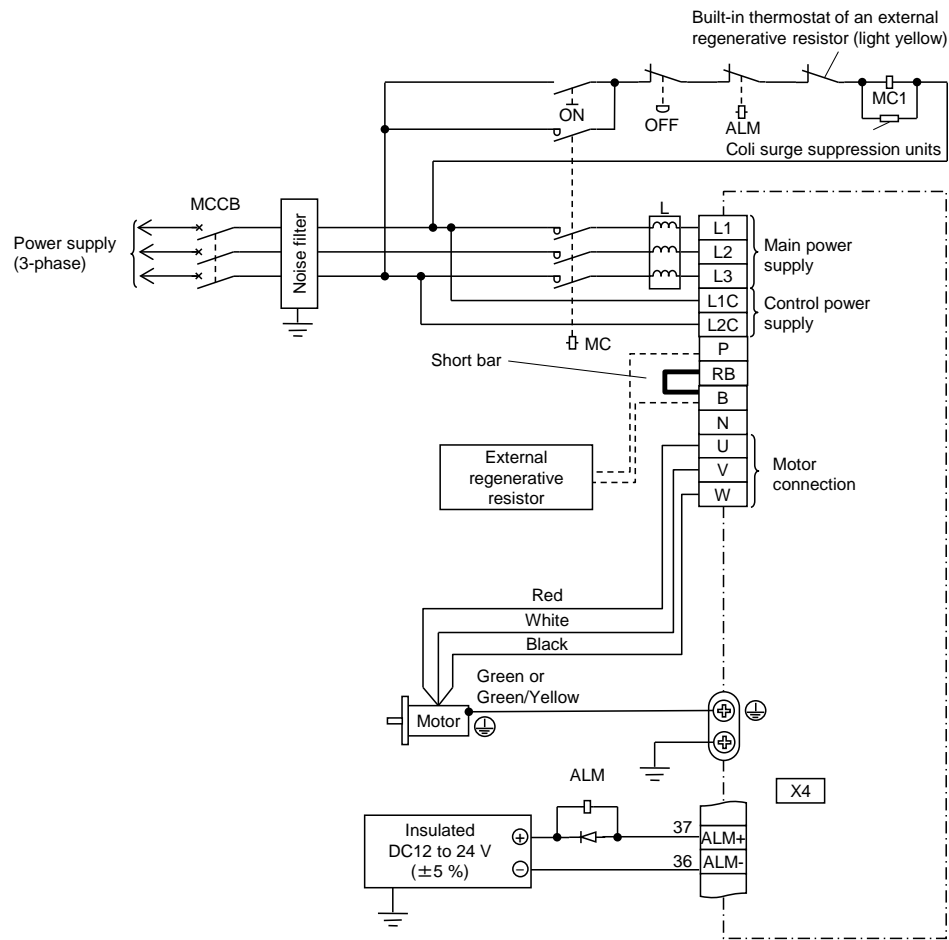■Connection of regenerative resistor

Size	Shorting cable (Accessories)	Internal regenerative resistor	Connection of the connector XB	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
A B	Not attached	Not installed	Between P and B: Connect the external regenerative resistor.	Between P and B: Keep open

- The circuit connected to terminal X1 – X6 are secondary circuits.

Insulation is needed against the primary side power supply (power supply of the motor brake).

Please do not connect them with the same power supply.

100/ 200 V sizes C - D

■Connection of regenerative resistor

Size	Shorting cable (Accessories)	Internal regenerative resistor	Connection of the connector XB	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
C D	Supplied	Installed	Between RB and B: Disconnect the short cable Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the shorting cable

- The circuit connected to terminal X1 – X6 are secondary circuits.

Insulation is needed against the primary side power supply (power supply of the motor brake).

Please do not connect them with the same power supply.

200 V size E

Built-in thermostat of an external regenerative resistor (light yellow)

MC1

Coli surge suppression units

ON OFF ALM

MCCB

Power supply (3-phase)

Noise filter

L

	XA
L1	Main power supply
L2	
L3	
L1C	Control power supply
L2C	

MC

Short cable

	XC
P	
RB	
B	
N	

External regenerative resistor

Red
White
Black

	XB
U	Motor connection
V	
W	

Green or Green/Yellow

motor

ALM

	X4
37	ALM+
36	ALM-

Insulated DC12 to 24 V (±5 %)

■Connection of regenerative resistor

Size	Shorting cable (Accessories)	Internal regenerative resistor	Connection of the connector XC	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
E	Supplied	Installed	Between RB and B: Disconnect the short cable Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the shorting cable

- The circuit connected to terminal X1 – X6 are secondary circuits.
  Insulation is needed against the primary side power supply (power supply of the motor brake).
  Please do not connect them with the same power supply.

200 V size F

■Connection of regenerative resistor

Size	Short bar (Accessories)	Internal regenerative resistor	Connection of the connector XC	
			In case of using the external regenerative resistor	In case of not using the external regenerative resistor
F	Supplied	Installed	Between RB and B: Disconnect the short bar Between P and B: Connect the external regenerative resistor	Between RB and B: Connect the short bar

-The standard of the ability of the built-in dynamic brake resistor is up

 to continuousness three times in the stop from the allowance and maximum inertia and the rated speed.

 Resistor is damaged and the dynamic brake might not work when using it under more critical operating condition.

- The circuit connected to terminal X1 – X6 are secondary circuits.

 Insulation is needed against the primary side power supply (power supply of the motor brake).

  Please do not connect them with the same power supply.

[1] When the servo driver uses single phase power supply for sizes A - D, connect the servo driver to the terminals L1, L3 of main power supply input. Do not connect anything to the terminal L2.

[2] Surely insert the connector into place until it clicks.

[3] Make sure to use an insulation coated crimp terminal when connecting to each terminal on the terminal block.

[4] Terminal block cover is fixed with screws. When wiring to the terminal block, unscrew these screws to uncover the cover. Tighten the cover fixing screw with the torque of 0.2 Nm or less.

[5] To not use an external regenerative resistor, short out the circuit between terminals RB and B. (For sizes C, D, E, F)When a trip occurs due to the regenerative load protection error No.18.0, externally install a regenerative resistor.

To externally install a regenerative resistor, remove a connection cable between terminals RB, B and then connect the regenerative resistor between terminals P, B.

The products (Sizes A, B) supporting only the external regenerative resistor, connect an external regenerative resistor if necessary.

To use an external regenerative resistor, set Pr.0.16 (external regenerative resistor selection) to 1 or 2.

[6] Apply the power supply of the voltage indicated on the nameplate.

[7] Do not reverse-connect the power input terminals (L1, L2, and L3) and the motor output terminals (U, V, and W).

[8] Do not connect the motor output terminals (U, V, and W) to ground or short out them.

[9] Because high voltage is applied to the power connectors $\boxed{XA}$, $\boxed{XB}$, $\boxed{XC}$, and $\boxed{XD}$, and the terminal block, never touch them on any account. It may cause electric shock.

[10] Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, below the maximum input voltage of the product.

[11] An AC servomotor, unlike an induction motor, cannot change the rotation direction by exchanging three phases.

Make sure to coincide the motor output terminals (U, V, and W) of the servo driver with the colors (pin number for cannon plugs) of the motor output cables.

[12] Surely connect the ground terminals of the motor and the servo driver and earth the ground terminal as well as that of the noise filter. In addition, earth the equipment unit. To earth them, ground resistance should be 100 ohm or less for grounding.

When the power supply voltage is over 300 V ground resistance should be 10ohm or less.

Please tight the earth screws by appropriate torque and use correct size earth cable decided in the specifications.

In order to avoid the impact of electrolytic corrosion, do not immediately have any contact between aluminum and copper.

[13] Attach the serge absorbing circuits for preventing noises to an electromagnetic contactor placed around the servo driver, a coil between relay contact points, and a brake winding of motor with a brake.

[14] Attach the no fuse breaker. In case of emergency, make sure to power off outside the servo driver. To use an earth leakage circuit breaker, use that in which a high frequency wave countermeasure is taken.

[15] In order to reduce the terminal noise voltage, install a noise filter.

[16] Customer is responsible for the power supply of the brake attached to a motor.

[17] Turn ON the power after the wiring was finished.

* As for external regenerative resistor, we recommend the resistors below:

Size	Input Power Voltage	
	Single phase 100 V	Single/3 phase 200 V
A	DV0P4280	DV0P4281 (100 W or less), DV0P4283 (200 W)
B	DV0P4283	DV0P4283
C	DV0P4282	DV0P4283
D		DV0P4284
E	-	DV0P4284 x 2 in parallel or DV0P4285 x 1
F		DV0P4285 x 2 in parallel

Manufacturer by Iwaki Musen Kenkyusho

Part number	Manu-facturer's model	Specification			Built-in thermal protector operational temperature
		Resis-tance value	Rated power (for reference) *		
			Free air	Fan used (1 m/s)	
		Ω	[W]	[W]	
DV0P4280	RF70M	50	10	25	140 ± 5 deg. Celsius
DV0P4281	RF70M	100	10	25	Contact point B
DV0P4282	RF180B	25	17	50	Open/close capacity (resistance load)
DV0P4283	RF180B	50	17	50	1 A 125 VAC, 6000 times
DV0P4284	RF240	30	40	100	0. 5 A 250 VAC, 10000 times
DV0P4285	RH450F	20	52	130	

* Electric power available without running the built-in thermal protector.

For safety, a temperature fuse and a thermal protector are built in.

Configure the circuit so as to turn off the power supply when the thermal protector is running.

The built-in temperature fuse can break according to the radiation condition, the used temperature range, the power supply voltage, and the load change.

Make sure that the surface temperature of regenerative resistor is being kept 100 deg. Celsius or less under bad conditions (high power supply voltage, large load inertia, short deceleration time, etc.) subject to regeneration by embedding the regenerative resistor in equipments and running the equipments.

Attach the regenerative resistor on the incombustibles such as metal.

Install the regenerative resistor so that people can not directly touch it, such as the incombustible to cover it.

Keep the temperature of places, which people can directly touch, below 70 deg. Celsius.

*) Dynamic brake

　Servo driver(size A-F) has built-in dynamic brake function to stop motor in an emergency.

　Dynamic brake can be operated in the following cases

　　1. The main power off

　　2. The servo off

　　3. Protection action

　　4. Connector X4 driving ban importation (POT, NOT) action

　On the above 1~4 cases, valid or invalid of dynamic brake can be determined by the parameters.

　However, when the control power off, dynamic brake of size A-F keep valid condition.

　Dynamic brake shall be using in rated short time for emergency stop using. Please note the following points.

　　1. Do not start / stop the motor by the servo signal (SRV-ON) . Built-in dynamic brake circuit may be damaged.

　　2. Do not drive the motor with external torque. Motor generates electricity by external torque.

　　　Dynamic brake circuit will be damaged and it is possible that short-circuit current cause smoke or combustion.

　　3. Allow approx. 10 minutes pause when the dynamic brake is activated during high-speed running.

　　　Resistor is damaged and the dynamic brake might not work when using it under more critical operating condition.

*) Mounting direction and spacing

　-To perform effective cooling, allow sufficient ambient space.

　-Provide a fan so as to make uniform the temperature in the control panel.

　-Each of Sizes D to F is equipped with a cooling fan on the bottom.

　-Adhere to environmental conditions for the environment in the control panel.

		d
Sizes A-F		10 mm or more
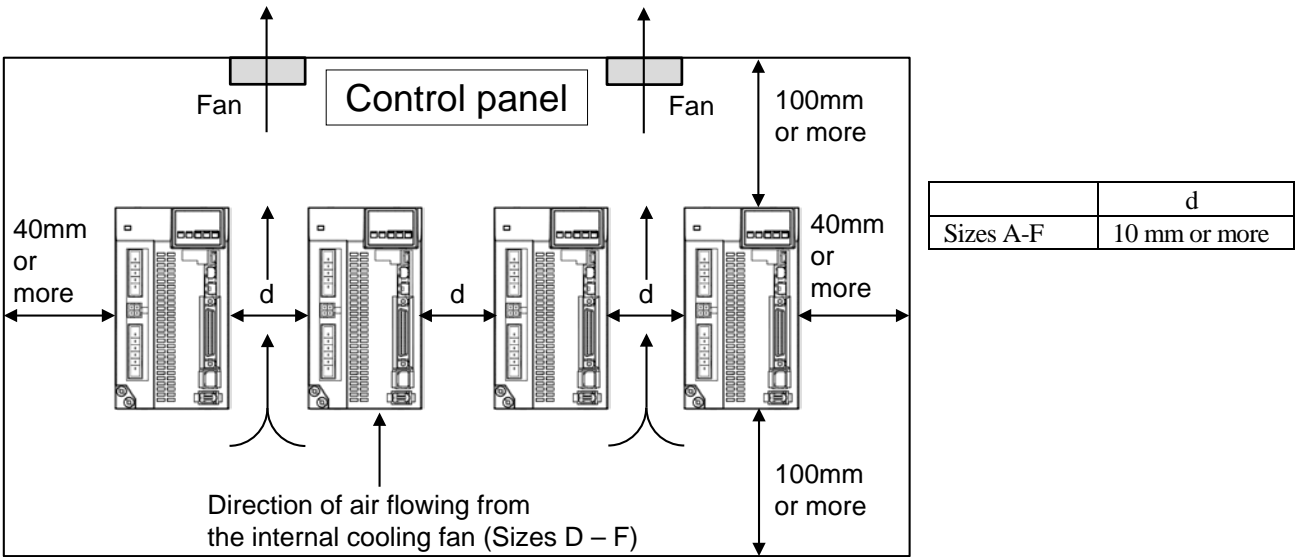
　In case the portion to receive a fan is coated, peeling off the coating before installing a fan or using homebuilt brackets with conductive plating provides effective anti-noise measures.

(2) Wiring to connector X4

[1] Customer is responsible for the control signal power supply at 12-24 VDC for external control connected between COM+ and COM-.Insulation is needed against the primary side power supply (power supply of the motor brake).
Please do not connect them with the same power supply.

[2] Place the servo driver and its peripheral device as nearly as possible (up to 3 m) so as to shorten the wiring.

[3] Wire the wiring as far away as possible (30 cm or more) from the power lines (L1, L2, L3, L1C, L2C, U, V, W, ⏚). Do not put them in the same duct or bind them together.

Digital input

Signal	Pin	Terminal
	7	COM+
Command pulse Inhibition input	33	INH
Deviation counter clear input	30	CL
Servo-ON input	29	SRV-ON
Gain switching input	27	GAIN
Electronic gear switching input 1	28	DIV1
Damping control switching input 1	26	VS-SEL1
Control mode switching input	32	C-MODE
Alarm clear input	31	A-CLR
Positive direction over-travel inhibition input	9	POT
Negative direction over-travel inhibition input	8	NOT

V_{DC} 12 to 24 V

4.7 kΩ

The functions of pins 8, 9, 26-33 are allocatable with parameters. The figure above shows the default setting.

[4]   Be aware of the polarity of the power supply for control signals. The polarity connection contrary to the figure shown above can damage the servo driver.

[5]   To directly drive the relay with each output signal, make sure to attach a diode in parallel to the relay and in the direction as shown in the figure below. The servo driver can be damaged if the diode is not attached or the diode is attached in the opposite direction.

[6]   When a logic circuit such as a gate receives each output signal, take care so that a noise does not impact on the circuit.

[7]   Apply 50 mA or less of current to each output.

Digital output
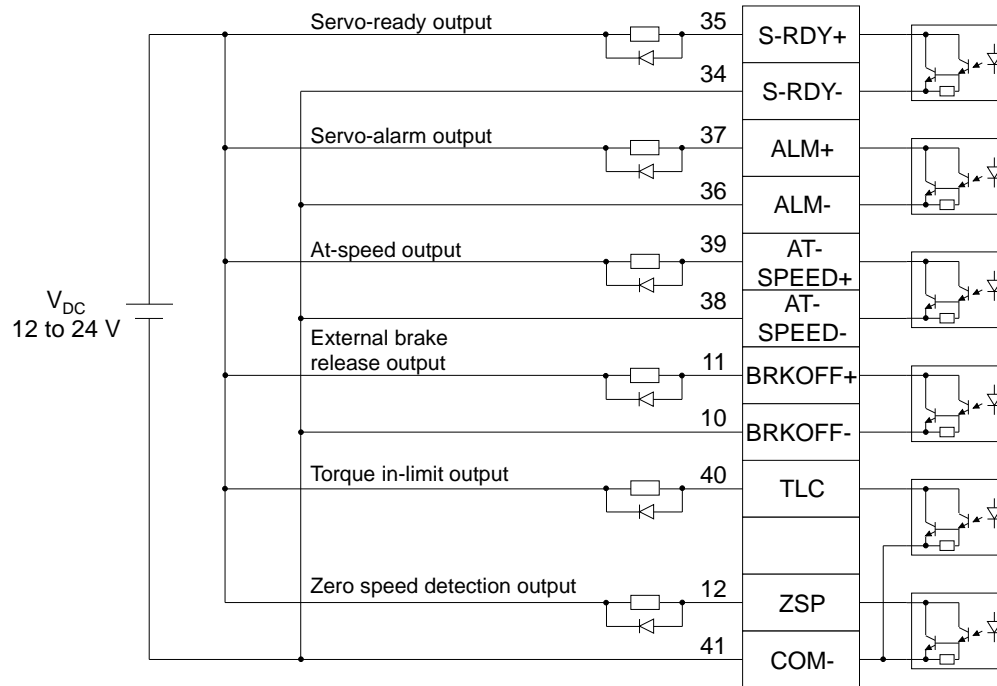
The functions of pins 10, 11, 34, 35, 38, 39 are allocatable with parameters. The figure above shows the default setting.

Pulse train command

A. Pulse train interface exclusively for line driver

44

2 kΩ   20 kΩ

120 Ω

45

2 kΩ   20 kΩ

PULS

46

2 kΩ   20 kΩ

120 Ω

47

2 kΩ   20 kΩ

SIGN

13

represents twisted pair
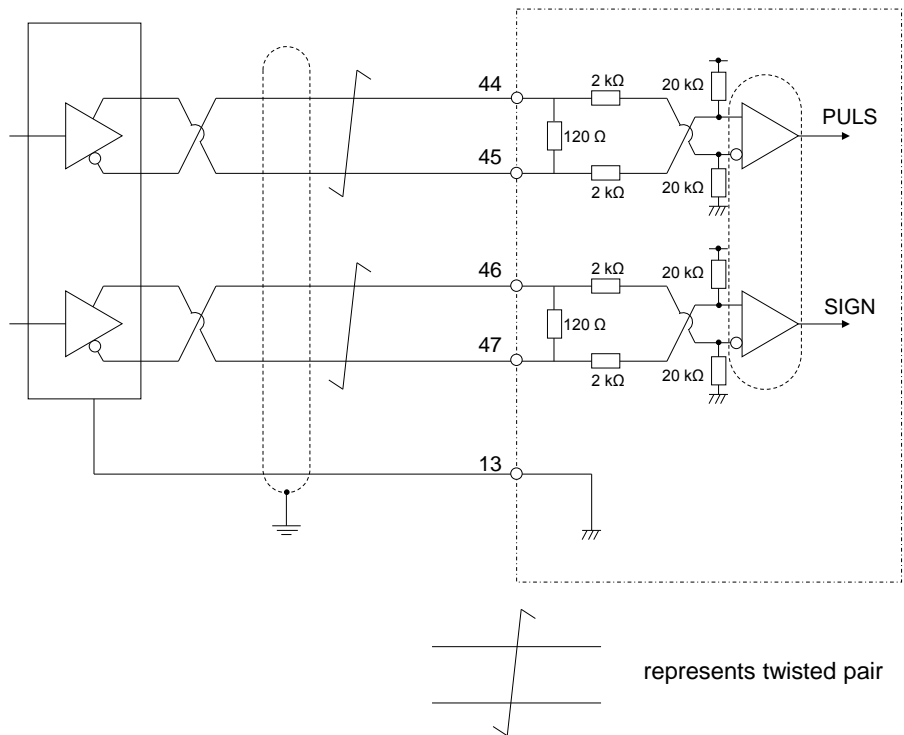
B. Pulse train interface

The pulse train command input can support both line driver and open collector interfaces, but in order to increase the certainty of signal transmissions, we recommend you to use the pulse train command input as an line driver interface as shown in the figure below.

Be aware that the line driver and open collector interfaces differ from each other in the connection to the servo driver.

● Line driver interface

3   PULS1   2.2 kΩ

4   PULS2

220 Ω

5   SIGN1   2.2 kΩ

6   SIGN2

220 Ω

13

represents twisted pair

Motor Business Unit, Panasonic Corporation

● Open collector interface

$$\frac{V_{DC} - 1.5}{R + 220} \fallingdotseq 10 \text{ mA}$$

represents twisted pair

represents twisted pair
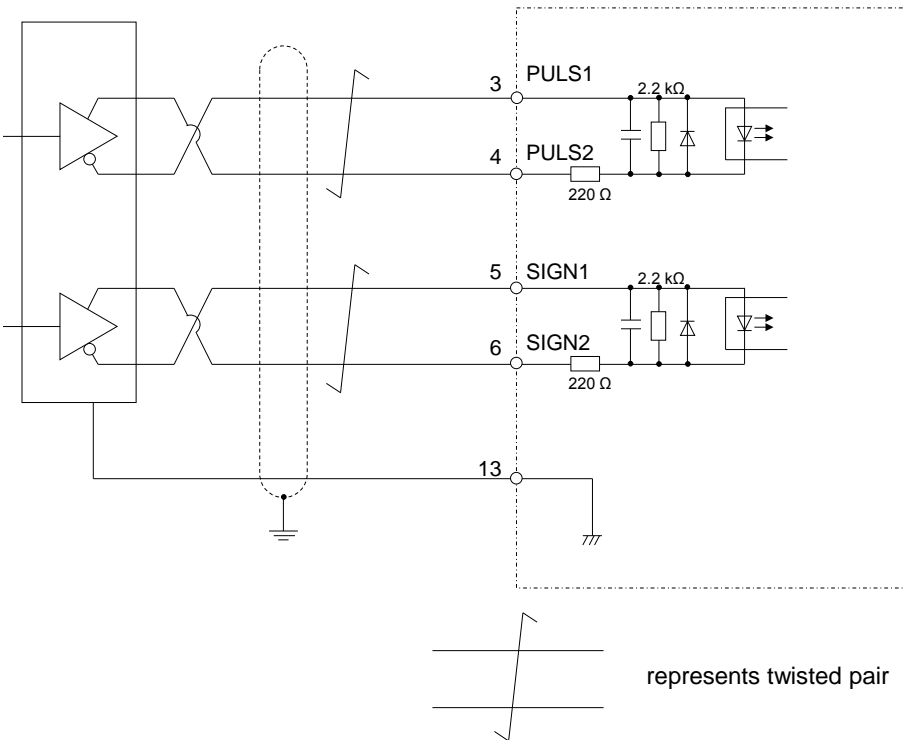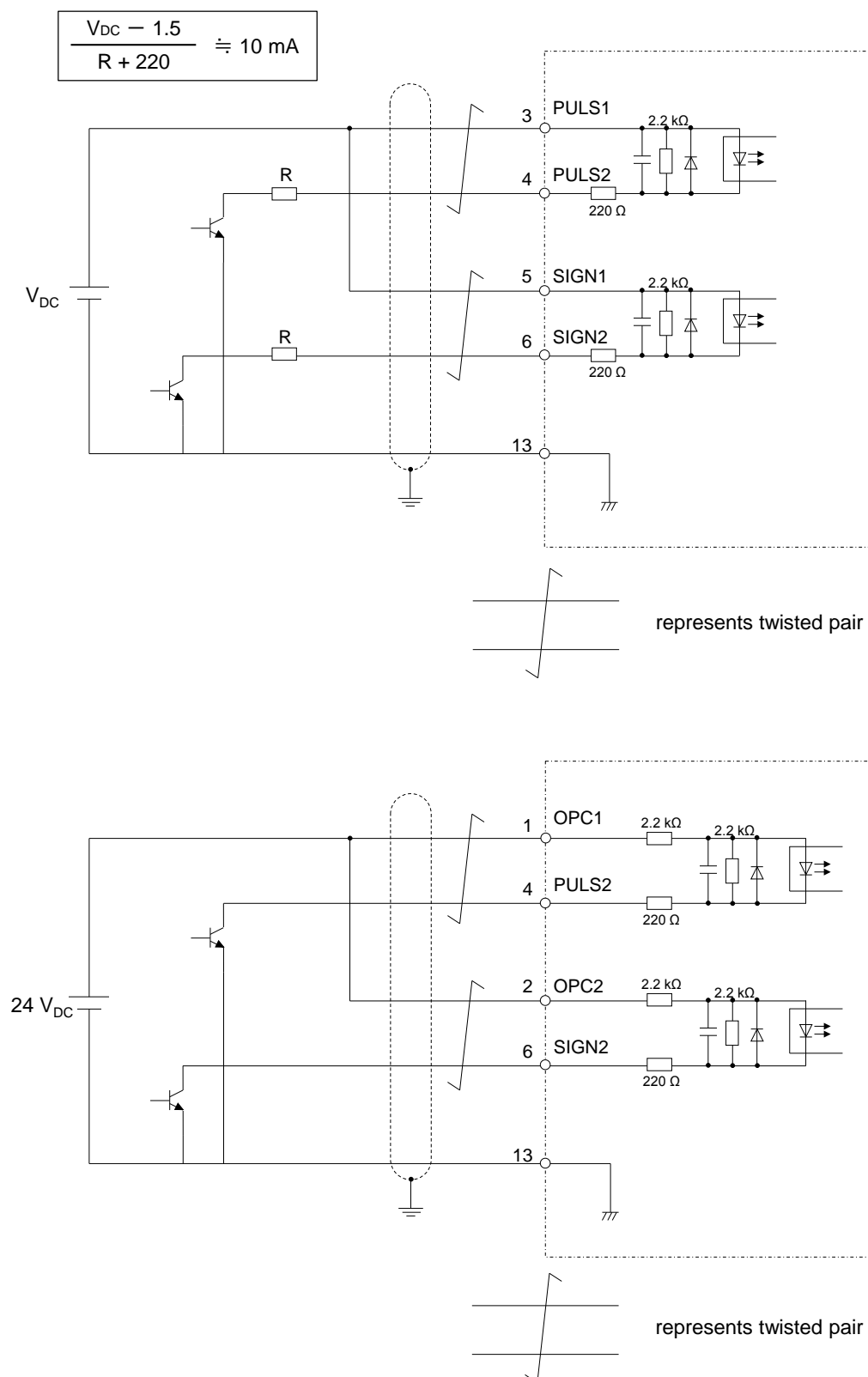
Note: Precautions for using the command pulse input as an open collector interface

・Shorten the wire length (up to 1 m).
・Be aware that the maximum pulse frequency of the open collector interface is small (200 kpps)
  compared with that (500 kpps) of the line driver interface.

Feedback pulse of rotary encoder

AM26LS32 (or equivalent)

AM26LS31 (or equivalent)

OA+	21	A
OA-	22	
OB+	48	B
OB-	49	
OZ+	23	Z
OZ-	24	
GND	25	

Max. rating 30 V, 50 mA

19 CZ

25 GND

High speed photo-coupler TLP554 (or equivalent)

Connect signal ground of the host and the driver without fail.

represents twisted pair
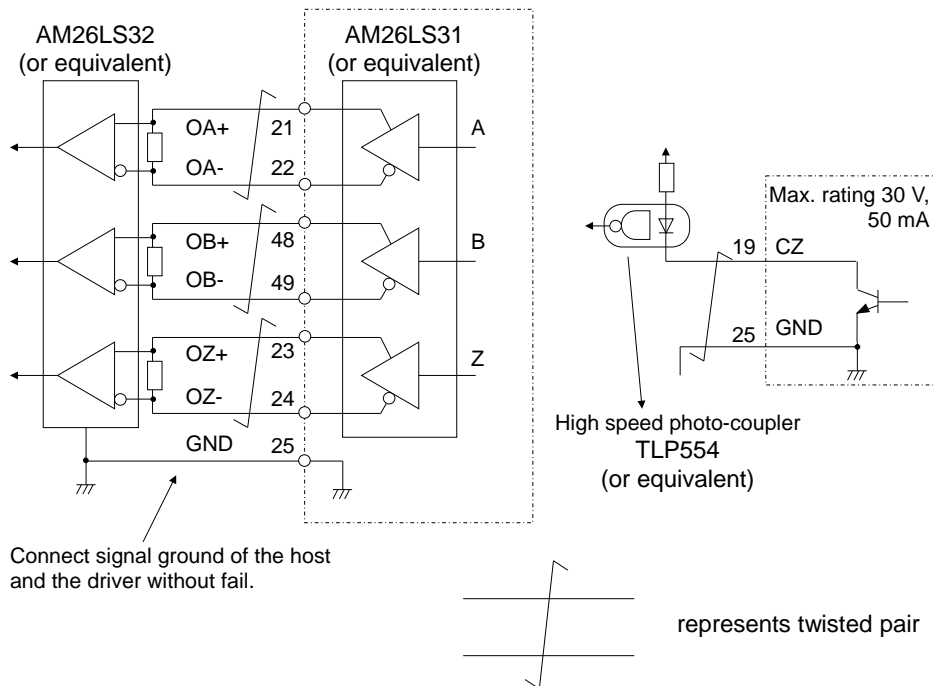
Note:
  [1] As well as being output in the line driver, only the Z-phase signals are output to the pin 19 (CZ) in the open collector. When using this CZ signal, be careful not to be subject to the noise impact.
  [2] Use a line receiver (AM26C32 or equivalent) for receiving the output pulses. Then, attach appropriate terminating resistor between inputs of the line receiver.
  [3] In the Z-phase signal output, be aware that the logic of line driver output (OZ) is the reverse of that of the open collector output (CZ).
  [4] Use the pulses at less than or equal to the maximum output frequency 4 Mpps (after quad edge valuation).

(3) Wiring to connector X6

[1] As for the encoder cable, use the batch shielded twisted wire pairs whose core is 0.18 mm^2 or more.

[2] The cable length should be up to 20 m. When the wiring is long, we recommend you to use the double wiring for the 5 V power supply in order to reduce the impact of voltage drop.

[3] Connect the coat of shielded cable at the motor side to the shield of shielded cable from the encoder.
Make sure to connect the coat of shielded cable at the servo driver side to the shell (FG) of X6 .

[4] Wire the wiring as far away as possible (30 cm or more) from the power lines (L1, L2, L3, L1C, L2C, U, V, W, ⏚).
Do not put them in the same duct or bind them together.

[5] Do not connect anything to the empty pins of X6 .

In case of using as singleturn encoder

In case of lead wire type:

Motor lead	Motor side pin	Pin No.	Encoder cable pin No.	Driver side	
White	E5V	7	1	E5V	+5 V
Black	E0V	8	2	E0V	0 V
Red	BAT+	1	3		
Pink	BAT-	2	4		
Cyan	PS	4	5	PS	
Purple	$\overline{PS}$	5	6	$\overline{PS}$	
Yellow/Green	FG	3		Shell (FG)	

172169-1 **Tyco Electronics** (or equivalent)
172161-1 **Tyco Electronics** (or equivalent)

Motor   Motor side   Encoder cable   Driver side

In case of canon plug type:

Motor side pin	Pin	Encoder cable pin No.	Driver side	
E5V	H	1	E5V	+5 V
E0V	G	2	E0V	0 V
BAT+	T	3		
BAT-	S	4		
PS	K	5	PS	
$\overline{PS}$	L	6	$\overline{PS}$	
FG	J		Shell (FG)	

JL10-2A20-29P **JAE** (or equivalent)
JL10-6A20-29S-EB N/M3057-12A **JAE** (or equivalent)

Motor   Encoder cable   Driver side

In case of using as multiturn encoder

In case of lead wire type:
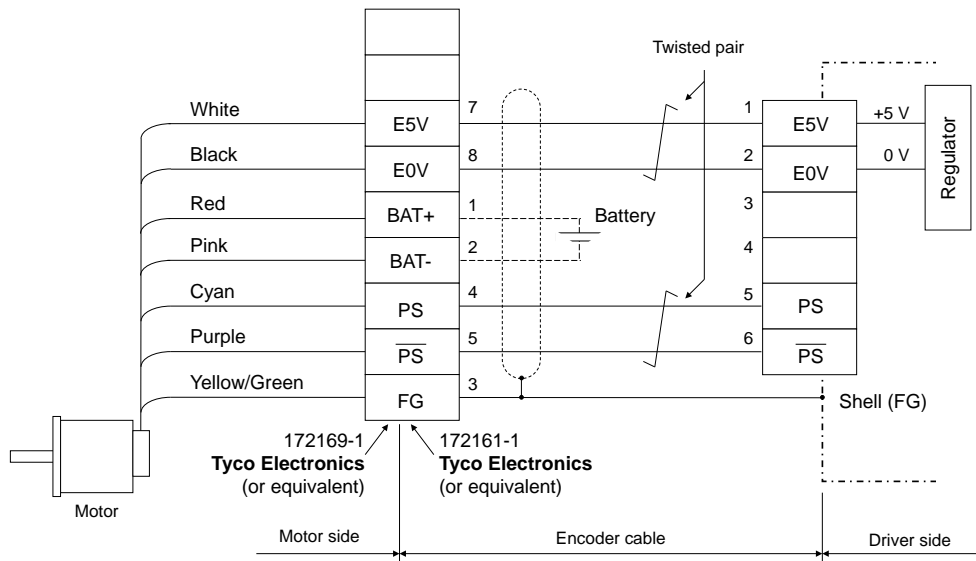
Connect the battery for absolute encoder to the relay connector between **1P** and **2P** (above figure).
As for the battery holder and the battery connection cable, customer can use the optional cable or prepare them.

In case of canon plug type:
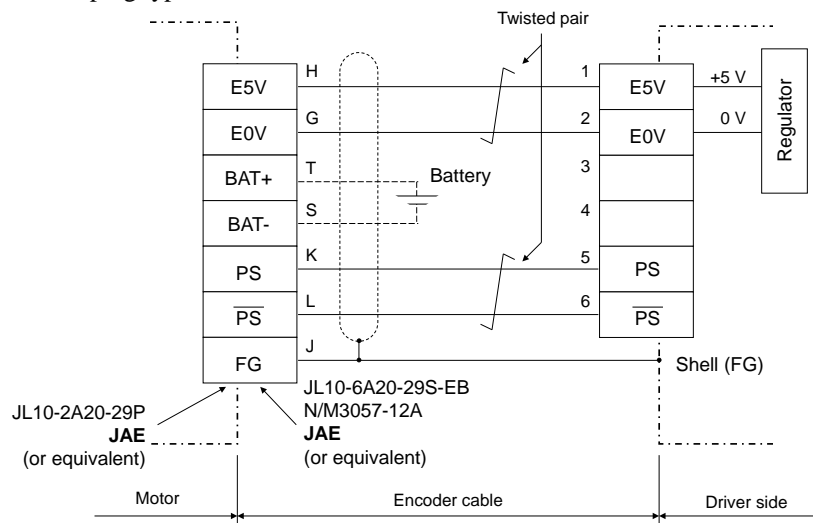
Connect the battery for absolute encoder to the relay connector between **T-pin** and **S-pin** (above figure).
As for the battery holder and the battery connection cable, customer can use the optional cable or prepare them.

9. Compliance with global standards
  9-1 Conforming standards

European EC directive	EMC directive	EN55011 EN61000-6-2 EN61000-6-4 EN61800-3
	Low voltage directive	EN61800-5-1 EN50178
UL standard		UL508C (File No. E164620)
CSA standard		C22. 2 No. 14
KC		KN11 KN61000-4-2,3,4,5,6,8,11

    IEC : International Electrotechnical Commission
    EN : Europaischen Norman
    EMC : Electromagnetic Compatibility
    UL : Under writers Laboratoris
    CSA : Canadian Standards Association
    KC : Radio Waves Act(South Korea)

  9-2 European EC directive

  Our products, in order to make it easy for the embedded equipments and devices to be compliant with EC directive, provide the compliance with the standards associated with low voltage directive.

  9-2-1 Compliance with EMC directive
    Our servo system determines the model (conditions) such as the installed distance and the wiring of the servo driver and the servomotor and makes the model compliant with the standards associated with EMC directive. When equipments and devices are embedded in practice, wiring and grounding conditions, etc. may be not the same as the model. Thus, it is necessary to measure how the final equipments and devices where the servo driver and the servo motor are embedded are compliant (especially unnecessary radiation noise, noise terminal voltage) with EMC directive.

9-3 Peripheral device configuration

9-3-1 Installation environment

Use the servo driver under the environment of pollution level 2 or 1 defined in IEC60664-1.

(Example: Installed in the IP54 control panel.)

100 V/200 V type
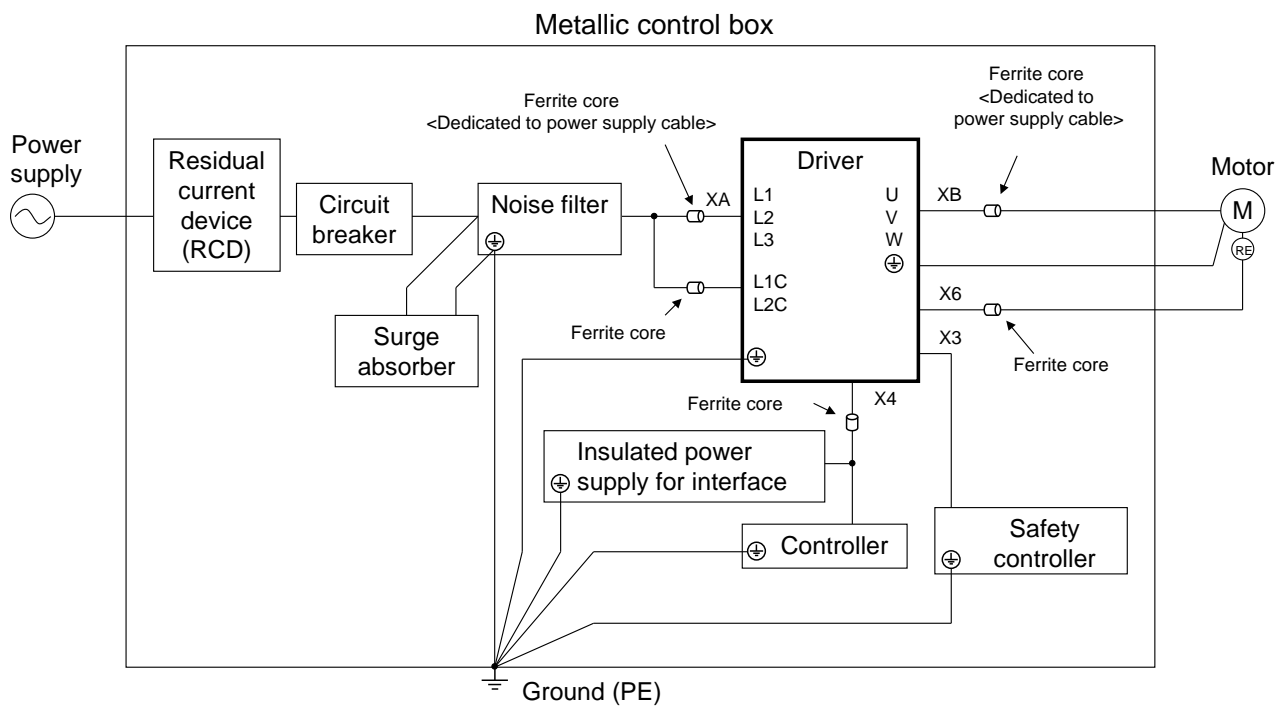
9-3-2 Power supply

100 V system:	Single phase 100 V - 120 V $^{+10\ \%}_{-15\%}$	50/60 Hz
200 V system (Sizes A-D):	Single / 3 phase 200 V - 240 V $^{+10\ \%}_{-15\%}$	50/60 Hz
200 V system (Sizes E-F):	3 phase 200 V - 240 V $^{+10\ \%}_{-15\%}$	50/60 Hz

(1) Use it under the environment of overvoltage category III defined in IEC60664-1.
(2) As for the parallel I/O power supply, use the CE marking conforming product or the 12-24 VDC power supply of insulation type compliant with EN standard (EN60950).

9-3-3 Power supply

Make sure to connect a circuit breaker compliant with IEC standard and UL certification (marked with LISTED, (U_L)) between the power supply and the noise filter.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

9-3-4 Noise filter

To install one noise filter as a whole in the power unit when multiple servo drivers are used, consult the noise filter manufacturer.

9-3-5 Surge absorber

Install the surge absorber in the primary side of the noise filter.

- Please!

To carry out a pressure test of equipments and devices, make sure to detach the surge absorber.

Otherwise, the surge absorber can be damaged.

9-3-6 Ferrite core

Install the noise filters for signal lines in all cables (power supply, motor, encoder, and interface cables).

9-3-7 Grounding

(1) In order to avoid an electric shock, make sure to connect a protection ground terminal (⏚) of the servo driver and the protection ground (PE) of the control panel.

(2) Do not tighten the connection to the protection ground terminal (⏚) along with other parts. The servo driver has two protection ground terminals.

9-4 List of peripheral devices applicable to servo driver

Servo driver	Voltage spec	Power capacity (Rated current)	Electromagnetic contactor (Rated current/ Released heat current)	Circuit breaker (Rated current)	Noise filter	Surge absorber	Noise filter for signals	
							Power cable	Motor cable
MADL*01**	Single phase 100V	Approx. 0.4 kVA	20 A	10 A	DV0P4170 (for single phase) / DV0PM20042 / RTHN-5010	DV0P4190 (for single phase) / DV0P1450 (for 3 phase)	DV0P 1460	DV0P 1460
MADL*11**								
MADL*05**	Single/ 3 phase 200V	Approx. 0.5 kVA						
MADL*15**								
MBDL*21**	Single phase 100V	Approx. 0.5 kVA						
MBDL*25**	Single/ 3 phase 200V	Approx. 0.9 kVA						
MCDL*31**	Single phase 100V	Approx. 0.9 kVA		15 A	DV0PM20042 / RTHN-5010			
MCDL*35**	Single/ 3 phase 200V	Approx. 1.3 kVA						
MDDL*45**	Single/ 3 phase 200V	Approx. 1.8 kVA	30 A	20 A	DV0P4220 / RTHN-5030			
MDDL*55**		Approx. 2.3 kVA						
MEDL*83**	3 phase 200V	Approx. 3.8 kVA	60 A	30 A	DV0PM20043 / RTHN-5050	DV0P1450	RJ8035	
MEDL*93**								
MFDL*A3**		Approx. 4.5 kVA	100 A	50 A	DV0P3410 / RTHN-5050			
MFDL*B3**		Approx. 7.5 kVA						

● Select the specification common to single/ 3 phase 200 V according to the power supply.
● To become compliant with European EC directive, make sure to connect a circuit breaker compliant with IEC standard and UL certification (marked with LISTED) between the power supply and the noise filter.

- Please!
・ Select a circuit breaker and a noise filter with the capacity comparable to the power capacity (by taking into account the load condition).
・ Terminal block and earth terminal
For wiring, use the copper conductor cable of the temperature rating 75deg. Celsius or more.
For the protection earth terminal, use M4 for Sizes A-E, M5 for Sizes F.
The terminal block can be damaged if the screw tightening torque exceeds the maximum value.
(see the page for explanation of terminal blocks.)

- Use earth cable having a cross section area of 2.0 mm^2 (AWG 14) or more for an output of 50 W to 2.5 kW, 3.5 mm^2 (AWG 12) or more for an output of 3.0 kW to 5.0 kW, 13.3 mm^2 (AWG 6) or more for an output of 6.0 kW to 11.0 kW, or 21.1 mm^2 (AWG 4) or more for an output of 15 kW.
- For Sizes A - E, use the dedicated connector which came with the product.
  In this case, the stripped cable length should be 8-9 mm.
- The tightening torque of connector (X4) with the upper controller should be 0.3 - 0.35 Nm.
  The torque which exceeds 0.35 Nm can damage the driver's connector.

	Optional part number	Part number of manufacturer	Manufacturer
Absorber	DV0P1450	R·A·V-781BXZ-4	Okaya Electric Industries
	DV0P4190	R·A·V-781BWZ-4	
	DV0PM20050	R·A·V-801BXZ-4	
Ferrite core	DV0P1460	ZCAT3035-1330	TDK
	—	RJ8035	Konno Kogyousho
Noise filter	DV0P4170	SUP-EK5-ER-6	Okaya Electric Industries
	DV0P4220	3SUP-HU30-ER-6	
	DV0P3410	3SUP-HL50-ER-6B	
	DV0PM20042	3SUP-HU10-ER-6	
	DV0PM20043	3SUP-HU50-ER-6	
	—	FN258L-16-07(29)	Schaffner
	—	FN258L-30-07(33)	
	—	FS5559-60-34	
	—	FS5559-80-34	
	—	FN258-42-07(33)	
	—	RTHN-5010	TDK

9-5 Compliance with UL standard

Certified by the UL508C (file No. E164620) standard by observing the installation conditions 1, 2 below.

[1] Installation environment

Use the servo driver under the environment of pollution level 2 or 1 defined in IEC60664-1.

(Example: Installed in the IP54 control panel.)

Make sure to connect a circuit breaker or fuse compliant with UL certification (marked with LISTED, Ⓤ)

between the power supply and the noise filter.

For information about rated current of the circuit breaker/ fuse, refer to "9-4 List of peripheral devices

applicable to servo driver".

For wiring, use the copper conductor cable of the temperature rating 75deg.Celsius or more.

The terminal block can be damaged if the screw tightening torque exceeds the maximum value.

(see the page for explanation of terminal blocks.)

[2] Short Circuit Current Ratings (SCCR)

This servo driver compiles with the power of the following conditions.

- The power supply voltage is less than the maximum input voltage of the product.

- Symmetrical short current of the power supply is less than 5000A.

[3] Protection of branch circuit

Protection of branch circuit, please follow the NEC(National Electrical Code) and standard regional.

[4] Overload protection, overheat protection

The overload protection function of the servo driver works when the effective current will be 115 % or more of

the rated current based on the time property. Check that the effective current of the servo driver does not exceed

the rated current. Set up the maximum instantaneous allowable current at the Pr0. 13 (first torque limit) and

Pr5.22 (second torque limit).

There is no overheat protection in the servo motor. If you need to conform to the NEC, please implement the

overheating protection measures.

9-6 Radio waves act (South Korea) precautions

This servo driver is a Class A commercial electromagnetic radio wave generator not designed for home use. The user and distributor should be aware of this fact.

A 급 기기 (업무용 방송통신기자재)

이 기기는 업무용(A 급) 전자파적합기기로서 판매자

또는 사용자는 이 점을 주의하시기 바라며, 가정외의

지역에서 사용하는 것을 목적으로 합니다.

(대상기종 : Servo Driver)

9-7 Compliance with SEMI F47 instantaneous stop standard

- ・ This function corresponds to the F47 power supply instantaneous stop standard in the SEMI standard during no/ light load condition.
- ・ Useful when used in the semiconductor manufacturing equipment.

  -Warning:
  [1] Not applicable to the driver which has a single phase 100V specification and a 24 VDC specification for control power input.
  [2] Make sure to evaluate and confirm the compliance with F47 power supply instantaneous stop standard with an actual device.

9-8 Harmonic suppression measures

- ・ Harmonic suppression measures will vary by the country.
  Please install in accordance with the regulations of each country.

⚠ SAFETY PRECAUTIONS

10. Safety precautions

■ Danger and damage caused when the safety precautions are ignored are described in the following categories and signs:

⚠ **DANGER**	Description of this sign indicates "urgent danger that may cause death or serious injury. "
⚠ **ATTENTION**	Description of this sign indicates "danger that may cause injury or property damage. "

■ Rules to keep are categorized and described with the following graphics.

🚫	This graphic indicates "Prohibited" acts that are not permitted.
❗	This graphic indicates "Mandatory" acts that must be performed forcibly.

⚠ DANGER

🚫

(1) Be sure not to store or use the equipment under conditions subjected to vibrations (5. 88 m/s^2 or heavier) or an impact shock, foreign matters such as dust, metal particles oil mist, liquids such as water, oil and polishing liquid, near flammable objects, in an atmosphere of corrosive gas (such as H_2S, SO_2, NO_2, Cl_2) or in an atmosphere of flammable gas.

(2) Do not place any flammable objects near a motor, a driver, or a regenerative resistor.

(3) Do not driver the motor with external torque. Motor generates electricity by external torque.
 Dynamic brake circuit will be damaged and it is possible that short-circuit current cause smoke or combustion.

(4) Do not damage or strain the cable, or do not apply excessive stress. Do not place a heavy item on the cable or do not pinch the cable.

(5) Do not use the equipment with the cable soaked in oil or water.

(6) Do not install the equipment near a heating object such as a heater or a large wire-wound resistor.
 (Install a thermal shield, etc. to avoid the influences of heating object.)

(7) Do not connect the motor directly with a commercial power.

(8) Do not use the equipment under conditions subject to strong vibrations or an impact shock.Please attach the anti-vibration equipment to servo driver mounting surface If you install the servo driver in the vicinity of the vibration source.

(9) Be sure not to touch a rotating part of a motor during operation.

(10) Do not touch the key flutes of motor output shaft with bare hands.

(11) Be sure not to touch inside a servo driver.

(12) Motor drive heat sink and peripheral device become very hot. Do not touch them.

(13) Do not carry out wiring or do not operate the equipment with wet hands.

⚠ SAFETY PRECAUTIONS

(14) Wiringwork is strictly allowed only for an engineer specializing electrical work.

(15) A motor other than specified is not provided with a protection device. Protect a motor with an overcurrent protection device, a ground-fault interrupter, overheating protection device, and emergency stop device,etc.

(16) When operating the driver after an earthquake, inspect installation conditions of the driver and the motor and safety of the equipment to make sure that no fault exists.

(17) After turning off the power, the inside circuit remains charged at a high voltage for a while. When moving, wiring or inspection the equipment, completely shut off the power supply input outside the driver and leave for 15 minutes or longer before working.

(18) Install and mount the equipment securely to prevent personal injury caused by poor installation or mounting on an earthquake.

(19) Install an external emergency shutoff circuit to stop operation and interrupt power immediately upon emergency. Emission of smoke or dust may occur due to a fault of a motor or a driver used in combination.For example, if the system is energized with the regenerative control power transistor shorted by failure,overheating of a regenerative resistor installed outside the driver may occur and it may emit smoke and dust. If a regenerative resistor is connected outside a driver, provide a means of detecting overheating such as a thermal protector to shut off power upon detecting abnormal heating.

(20) Mount the motor, the driver and the peripheral devices on a noncombustible material such as metal.

(21) Provide correct and secure wiring. Insecure wiring or incorrect wiring may cause runaway or burning of a motor. During wiring work, avoid entry of conductive dust such as wire chippings in an driver.

(22) Connect cables securely and provide secure insulation on current-carrying parts using insulation aterial.

(23) Be sure to install a fuseless breaker in a power supply. Be sure to connect grounding terminals and grounding wires. To prevent an electric shock and malfunction, type D grounding (grounding resistance at 100 Ω or lower) or higher grade is recommended.

(24) Tighten the screws on the terminal block and earth terminal securely at appropriate torque shown in the specifications.

(25) When building a system by using the safety feature, design it by fully understanding and being compliant with the related safety standards and items described in our operation manual or technical reference.

⚠ ATTENTION

(26) Do not hold cables or motor shaft when carrying the equipment.

(27) Do not adjust or change drive gains extremely, and do not make operations of the machine instable.

(28) The equipment may suddenly restart after recovery from shutdown upon a power failure. Keep away from the equipment. Specify settings of the equipment to secure safety for human against such restart operations.

(29) When the equipment is energized, keep away from the motor and mechanism driven by the motor in case of malfunction.

(30) Avoid a strong shock to the motor shaft.

(31) Avoid a strong shock to the product.

(32) Be sure not to use the electromagnetic contactor installed on the main power supply to start or stop the motor.

(33) Avoid frequent switching on and off the main power supply of the driver.

(34) The built-in brake of the motor is used for holding only. Do not use the brake to stop (braking) for securing safety of the equipment.

⚠ SAFETY PRECAUTIONS

<table>
<tr>
<td rowspan="7">🚫</td>
<td>(35)</td>
<td>Do not fall or topple over the equipment when carrying or installing.</td>
</tr>
<tr>
<td>(36)</td>
<td>Do not climb the motor or do not place a heavy item on the motor.</td>
</tr>
<tr>
<td>(37)</td>
<td>Do not block radiation slits of the driver and do not put a foreign matter into the driver.</td>
</tr>
<tr>
<td>(38)</td>
<td>Do not use the equipment under direct sunlight. When storing the equipment, avoid direct sunlight and store under conditions of operating temperatures and humidity.</td>
</tr>
<tr>
<td>(39)</td>
<td>Be sure not to disassemble or modify the equipment. Disassembling and repair is allowed only for the manufacturer or sales agency authorized by the manufacturer.</td>
</tr>
<tr>
<td>(40)</td>
<td>Do not start / stop the motor by the servo signal (SRV-ON). Built-in dynamic brake circuit may be damaged.</td>
</tr>
<tr>
<td>(41)</td>
<td>Use a motor and a driver in combination specified by the manufacturer. A customer shall be responsible for verifying performances and safety of combination with other driver.</td>
</tr>
<tr>
<td rowspan="17">❗</td>
<td>(42)</td>
<td>A failure of a motor or a combined driver may cause burning of motor, or emission of smoke and dust. Take this into consideration when the application of the machine is clean room related.</td>
</tr>
<tr>
<td>(43)</td>
<td>Install the equipment adequately in consideration of output and main unit weight.</td>
</tr>
<tr>
<td>(44)</td>
<td>Keep the ambient conditions of an installed motor within a range of allowable ambient temperatures and of allowable humidity.</td>
</tr>
<tr>
<td>(45)</td>
<td>Install the equipment by specified procedures and in specified orientation.</td>
</tr>
<tr>
<td>(46)</td>
<td>Install the devices by keeping specified distances between a driver and inside control panel or other devices.</td>
</tr>
<tr>
<td>(47)</td>
<td>If a motor has an eyebolt, use the eyebolt to carry the motor only. Do not use the eyebolt to carry equipment.</td>
</tr>
<tr>
<td>(48)</td>
<td>Connect a relay breaking upon emergency stop in series with a brake control relay.</td>
</tr>
<tr>
<td>(49)</td>
<td>For a test run, hold down a motor and disconnect from a mechanical system to verify operations before installing on the equipment.
(A motor must run smoothly at 30 r/min driven with an driver.)</td>
</tr>
<tr>
<td>(50)</td>
<td>Verify that an input power supply voltage satisfies the driver specifications before turning on the power and start operation.
An input voltage higher than rated may cause ignition and smoking in the driver, which may cause runaway or burning of a motor in some cases.</td>
</tr>
<tr>
<td>(51)</td>
<td>When an alarm status occurs, remove a cause of the problem before restarting.
Careless restarting without removing a cause of problem may cause malfunction or burning of a motor.</td>
</tr>
<tr>
<td>(52)</td>
<td>The built-in brake of the motor may not be able to hold due to expiring useful life or a mechanical structure.Install a braking device on the equipment to secure safety.</td>
</tr>
<tr>
<td>(53)</td>
<td>Pay attention to heat radiation. The driver generates heat by operating a motor. A driver used in a sealed control box may cause an extreme rise of temperature.
Consider cooling so that an ambient temperature around the driver satisfies an operating range.</td>
</tr>
<tr>
<td>(54)</td>
<td>Maintenance and inspection is allowed only for a specializing person.</td>
</tr>
<tr>
<td>(55)</td>
<td>Turn off the power when the equipment is not used for a long term.</td>
</tr>
<tr>
<td>(56)</td>
<td>The cooling fan in the top side of size H stops for energy saving when driver is servo off. It is not abnormal.</td>
</tr>
<tr>
<td>(57)</td>
<td>Allow approx. 10 minutes pause when the dynamic brake is activated during high-speed running.</td>
</tr>
<tr>
<td>(58)</td>
<td>Resistor is damaged and the dynamic brake might not work when using it under more critical operating condition.</td>
</tr>
</table>

- Capacitance of the capacitors of power supply rectifier circuit drops over time. To avoid a secondary problem due to a failure, replacement of capacitors is recommended at an interval of Abt imately 5 years. Commission the manufacturer or sales agency authorized by the manufacturer to replace the parts.

- Be sure to read operating manual (safety guide) that shipped with product before use.
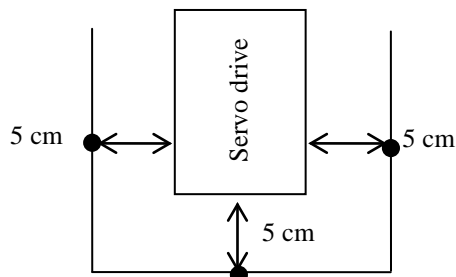
⚠ SAFETY PRECAUTIONS

Servo driver's ambient temperature

The driver's service life significantly depends on the
ambient temperature.
Make sure that the driver's ambient temperature
(at 5 cm distant from the driver) does not exceed the
operating temperature range.

5 cm ●←→ | Servo drive | ←→● 5 cm

↕ 5 cm

Operating temperature range: 0 to 55 °C

We have made the best efforts to ensure quality of this product. However, application of external
noise(include radiation) or static electricity, or a defect of the input power supply, wiring or components may
cause the servo driver to operate beyond the preset conditions. Therefore, you should exercise thorough
caution to ensure safety against an unexpected operation.

11. Life and warranty

11-1 Life expectancy of the driver

The driver has 28000 hours of life expectancy when used continuously under the following conditions,

Definition of the life:　　　Life end shall be defined as the capacitance of the electrolytic capacitor is reduced by 20 % from the ex-factory status.

Condition

Input power	:	Single phase 100 VAC 50/60 Hz
		3 phase 200 VAC 50/60 Hz
Working temperature.	:	55 degrees C
Output thrust	:	Constant thrust at rating
Speed	:	Constant speed at rating

Note that the life varies due to the working conditions.

11-2 Typical life

[1] In-rush current prevention relay

Replace the in-rush current prevention relay when it is activated typically 20000 times. Note that the criteria may vary depending on the environmental and working condition.

[2] Cooling fan

Replace the cooling fan in 10000 to 30000 hours. Note that the criteria may vary depending on the environmental and working condition.

11-3 Warranty period

(1) Warranty period shall be 12 months from the ex-factory date or 18 months from the date of manufacturing. This Warranty shall be exempted in the following cases,

[1] defects resulting from misuse and/or repair or modification by the customer

[2] defects resulting from drop of the Product or damage during transportation

[3] defects resulting from improper usage of the Product beyond the Specifications

[4] defects resulting from fire, earthquake, lightening, flood, damage from salt, abnormal voltage or other Act of God, or other disaster.

[5] defects resulting from the intrusion of foreign material to the Product, such as water, oil or metallic particles. This Warranty shall be exempted when the life of the components described in 7-2 exceeds its typical life.

(2) Warranty scope

Panasonic warrants the replacement of the defected parts of the Product or repair of them when the defects of the Product occur during the Warranty Period, and when the defects are under Panasonic responsibility.This Warranty only covers the Product itself and does not cover any damage incurred by such defects.

12. Others

・ Precautions for export of this product and the equipment incorporating this product
  If the end user or end purpose of this product relates to military affairs, armament and so on, this product may
  be subject to the export regulations prescribed in "Foreign Exchange and Foreign Trade Control Law".To
  export this product, take thorough examination, and follow the required export procedure.

・ We cannot warrant this product, if it is used beyond the specified operating conditions.

・ Compliance with the relevant standards should be considered by the user.

・ The final decision on the compatibility with the installations and components at the user's site, in terms of
  structure, dimensions, characteristics and other conditions, should be made by the user.

・ When using this product in your equipment, be careful about the compatibility with the servomotor and the
  servo driver to be used together.

・ For performance improvement or other reasons, some components of this product may be modified in a range
  that satisfies the specifications given in this document.

・ Any specification change shall be based on our authorized specifications or the documents presented by the
  user. If a specification change may affect the functions and characteristics of this product, we will produce a
  trial product, and conduct examination in advance.Note that the produce price may be changed with a change
  in its specifications.

・ We have made the best efforts to ensure the product quality. However, complete equipment at customer's site
  may malfunction due to a failure of this product. Therefore, take precautions by providing fail-safe design at
  customer's site, and ensure safety within the operating range of the work place.

・ Failure of this product depending on its content, may generate smoke of about one cigarette.
  Take this into consideration when the application of the machine is clean room related.

・ When the equipment runs without connecting the servomotor's shaft electrically to ground, electrolytic
  corrosion may occur on the motor bearing and the bearing noise may get louder depending on the equipment
  and installing environment. So, customer is responsible to check and verify it.

・ A customer must verify and inspect the equipment. Please be careful when using in an environment with high
  concentrations of sulphur or sulphuric gases, as sulpharation can lead to disconnection from the chip resistor
  or a poor contact connection.

・ Do not use benzene, thinner, alcohol, and acid or alkaline detergent, because they can discolor and damage the
  packaging chassis.

・ Apply adequate tightening torque to the product mounting screw by taking into consideration strength of the
  screw and the characteristics of material to which the product is installed. Over-tightening can damage the
  screw and/or material; under-tightening can result in loosening.Example) Steel screw(M5) into steel
  section:2.7-3.3Nm.

・ Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply
  of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or
  a fire and other trouble.

・ When discard batteries, provide insulation using a tape, etc. and discard the batteries abiding by a municipal
  law.

・ When discarding the equipment, process the item as an industrial waste.

13. Specification for each model

Model	MADLN01SG	MADLN11SG	MADLN05SG	MADLN15SG
Power supply input	Single phase 100 V	Single phase 100 V	Single phase/ 3 phase 200 V	Single phase/ 3 phase 200 V
Maximum current rating	6 A	8 A	6 A	8 A
Rotary encoder feedback signal	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative discharge resistor	Externally connected	Externally connected	Externally connected	Externally connected
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available [NOTE]	Available [NOTE]	Available [NOTE]	Available [NOTE]
Ambient temperature main power supply cable	0 – 55 °C	0 – 55 °C	0 – 55 °C	0 – 55 °C
Control power cable	HVSF 0.75 mm^2	HVSF 0.75 mm^2	HVSF 0.75 mm^2	HVSF 0.75 mm^2
	AWG18	AWG18	AWG18	AWG18
Main power supply cable	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2
	AWG14 - 18	AWG14 - 18	AWG14 - 18	AWG14 - 18
Ground cable	HVSF 2.0 mm^2	HVSF 2.0 mm^2	HVSF 2.0 mm^2	HVSF 2.0 mm^2
	AWG14	AWG14	AWG14	AWG14
Motor cable	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2
	AWG14 - 18	AWG14 - 18	AWG14 - 18	AWG14 - 18
Inrush current (Main power supply) (*1)	Max. 7 A	Max. 7 A	Max. 14 A	Max. 14 A
Inrush current (Control power supply) (*1)	Max. 7 A	Max. 7 A	Max. 14 A	Max. 14 A
Weight	Approx 0.8 kg	Approx 0.8 kg	Approx 0.8 kg	Approx 0.8 kg
Dimensions	Size A	Size A	Size A	Size A

(*1) Current values were calculated on the basis of the power supply input described above, assuming a voltage of 100 V or 200 V.

(Note) The absolute encoder backup battery is externally connected.

   <Caution>
   The lithium-metal battery is used as a backup battery.
   There are restrictions for transportation of the lithium-metal batteries by an international transport rule
   of dangerous goods etc.
   Please inquire in detail through the purchase shop.

Model	MBDLN21SG	MBDLN25SG	MCDLN31SG	MCDLN35SG
Power supply input	Single phase 100 V	Single phase/ 3 phase 200 V	Single phase 100 V	Single phase/ 3 phase 200 V
Maximum current rating	12 A	12 A	22 A	22 A
Rotary encoder feedback signal	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative discharge resistor	Externally connected	Externally connected	Built-in	Built-in
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available NOTE)	Available NOTE)	Available NOTE)	Available NOTE)
Ambient temperature main power supply cable	0 – 55 ℃	0 – 55 ℃	0 – 55 ℃	0 – 55 ℃
Control power cable	HVSF 0.75 mm^2	HVSF 0.75 mm^2	HVSF 0.75 mm^2	HVSF 0.75 mm^2
	AWG18	AWG18	AWG18	AWG18
Main power supply cable	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2
	AWG14 - 18	AWG14 - 18	AWG14 - 18	AWG14 - 18
Ground cable	HVSF 2.0 mm^2	HVSF 2.0 mm^2	HVSF 2.0 mm^2	HVSF 2.0 mm^2
	AWG14	AWG14	AWG14	AWG14
Motor cable	HVSF 0.75 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2	HVSF 0. 5 - 2.0 mm^2	HVSF 0.75 - 2.0 mm^2
	AWG14 - 18	AWG14 - 18	AWG14 - 18	AWG14 - 18
Inrush current (Main power supply) (*1)	Max. 7 A	Max. 14 A	Max. 15 A	Max. 29 A
Inrush current (Control power supply) (*1)	Max. 7 A	Max. 14 A	Max. 7 A	Max. 14 A
Weight	Approx 1.0 kg	Approx 1.0 kg	Approx 1.6 kg	Approx 1.6 kg
Dimensions	Size B	Size B	Size C	Size C

 (*1) Current values were calculated on the basis of the power supply input described above, assuming a voltage of
     100 V or 200 V.
(Note) The absolute encoder backup battery is externally connected.
      <Caution>
      The lithium-metal battery is used as a backup battery.
      There are restrictions for transportation of the lithium-metal batteries by an international transport rule
      of dangerous goods etc.
      Please inquire in detail through the purchase shop.

Model	MDDLN45SG	MDDLN55SG	MEDLN83SG	MEDLN93SG
Power supply input	Single phase/ 3 phase 200 V	Single phase/ 3 phase 200 V	3 phase 200V	3 phase 200V
Maximum current rating	24 A	40 A	60 A	80 A
Rotary encoder feedback signal	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative discharge resistor	Built-in	Built-in	Built-in	Built-in
Auto gain tuning function	Provided	Provided	Provided	Provided
Dynamic brake function	Provided	Provided	Provided	Provided
Absolute system	Available NOTE)	Available NOTE)	Available NOTE)	Available NOTE)
Ambient temperature main power supply cable	0 – 55 °C	0 – 55 °C	0 – 55 °C	0 – 55 °C
Control power cable	HVSF 0.75 mm^2 AWG18	HVSF 0.75 mm^2 AWG18	HVSF 0.75 mm^2 AWG18	HVSF 0.75 mm^2 AWG18
Main power supply cable	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14
Ground cable	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14
Motor cable	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14	HVSF 2.0 mm^2 AWG14	HVSF 3.5 mm^2 AWG12
Inrush current (Main power supply) (*1)	Max. 29 A	Max. 29 A	Max. 29 A	Max. 29 A
Inrush current (Control power supply) (*1)	Max. 14 A	Max. 14 A	Max. 14 A	Max. 14 A
Weight	Approx 1.8 kg	Approx 1.8 kg	Approx 2.7 kg	Approx 2.5 kg
Dimensions	Size D	Size D	Size E	Size E

(*1) Current values were calculated on the basis of the power supply input described above, assuming a voltage of 200 V.

(Note) The absolute encoder backup battery is externally connected.

<Caution>
The lithium-metal battery is used as a backup battery.
There are restrictions for transportation of the lithium-metal batteries by an international transport rule of dangerous goods etc.
Please inquire in detail through the purchase shop.

Model	MFDLNA3SG	MFDLNB3SG
Power supply input	3 phase 200 V	3 phase 200 V
Maximum current rating	100 A	120 A
Rotary encoder feedback signal	Resolution: 8388608 P/r	Resolution: 8388608 P/r
Regenerative discharge resistor	Built-in	Built-in
Auto gain tuning function	Provided	Provided
Dynamic brake function	Provided	Provided
Absolute system	Available NOTE)	Available NOTE)
Ambient temperature main power supply cable	0 – 55 °C	0 – 55 °C
Control power cable	HVSF 0.75 mm²	HVSF 0.75 mm²
	AWG18	AWG18
Main power supply cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Ground cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Motor cable	HVSF 3.5 mm²	HVSF 3.5 mm²
	AWG12	AWG12
Inrush current (Main power supply) (*1)	Max. 22 A	Max. 22 A
Inrush current (Control power supply) (*1)	Max. 14 A	Max. 14 A
Weight	Approx 4.8 kg	Approx 4.8 kg
Dimensions	Size F	Size F

(*1) Current values were calculated on the basis of the power supply input described above, assuming a voltage of 200 V.

(Note) The absolute encoder backup battery is externally connected.

      <Caution>

    The lithium-metal battery is used as a backup battery.

    There are restrictions for transportation of the lithium-metal batteries by an international transport rule of dangerous goods etc.

    Please inquire in detail through the purchase shop.