Kingservo

Manual

AC Servo Motor KSMA

Servo Driver KSDG Series

20110602(Ver.5)

Content

Chapter 1: Identificaiotns of Products

1-1 Safety Sign

⊘ caution   ⊘ Prohibit

Warning Sign ——————————————————————————

After unpackage, check whether machine type is same with the package information immediately.	Store servo motor in the dry, clean and non-corrosive air/liquid environment.
If storage of servo motor is over 6 months, check axis perodically core and add anti-rust grease every 3 months.	Connect wiring correctly. Confirm the correct connection of electrical line and signal line to provent faults and damage of motor.
Electrical line and signal line shall be not connected to the same loop and separated for producing noise.	For avoiding electrical shock, power off and wait for ten minutes before moving motor or wiring.
Keep motor's temperature within the specified scope.	Finding any abnormal smell, noise, smoke, heat or irregualr vibration, stop motor and power off.

Inhibition Sign ―――――――――――――――――――――――――――――――

⊘ Output terminal of motor is not watertight, don't use it in the humid, corrosive and inflammable environment.

⊘ Donot apply over-maximum current to motor, or else it will damage internal parts of motor or magnetic parts.

⊘ Don't touch operating motor and driver, or else it shall leads to burns and electrical shock etc.

⊘ Extraciton or moving of motor, do not drag with handler or just hold axis core of motor.

⊘ If not necessary, don't make dielectric strength test to motor.

⊘ Use specified motor and driver, commercial power is not allowed to connect directly to servo motor for avoiding motor damage.

⊘ Don't dismantle or replace parts of servo motor without authorization, or else it may leads to fire and electrical shock etc.

1-2 Check before Usage

After unpackage, verify:

・ Check whether the numbers of parts are as same as the specification?

・Check whether there is any damage to the appearance during transportation?

Verify whether driver motor controller and motor are the Kingservo Ac Servo series?

　　　package contents:

- ・ motor
- ・ key way
- ・ encoding line
- ・ power line
- ・ controllor
- ・ connector
- ・ operation handle of connector

1-3 Indentification of AC Servo Driver Type

1-3-1 Name-plate of Driver

Mode
Serial Number
Rated motor output
Rated input voltage/current
Rated input voltage/
phase/frequency/
current

Kingservo　　**AC SERVO**

ModelNo : KSDG00421L1
PN : BEC-D0801151-00
Serrial No : K080626100001
Power : 400W
Input : { 220-330 3PH 50/60Hz 2.8A
　　　　220-330 1PH 50/60Hz 3.5A
Output : { 110V 3PH 0/416.6Hz 2.8A

Firmware
Version

CE

Kingservo Technology CO., LTD.　Made In Taiwan
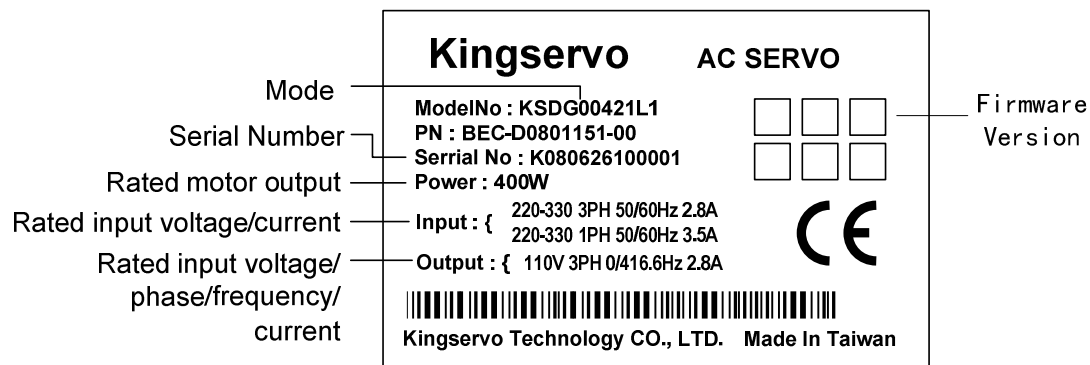
1-3-2 Identifications of Driver Type

KSDG00421LI*

special specification

Mode:
I = Incremental

Version:
No. 0

Watts:
01 = 100W
02 = 200W
04 = 400W
08 = 750W
10 = 1KW
15 = 1.5KW

Voltage speciifcation:
21 = 220V Single phase / 3-phase

Inertia:
L = Low Inertia

Series:
G Series-General
P Series-Personal
C Series-Communication

Mode:
KSD = Kingservo Servo Motor Driver
KSL = Kingservo Servo LinearMotor Driver
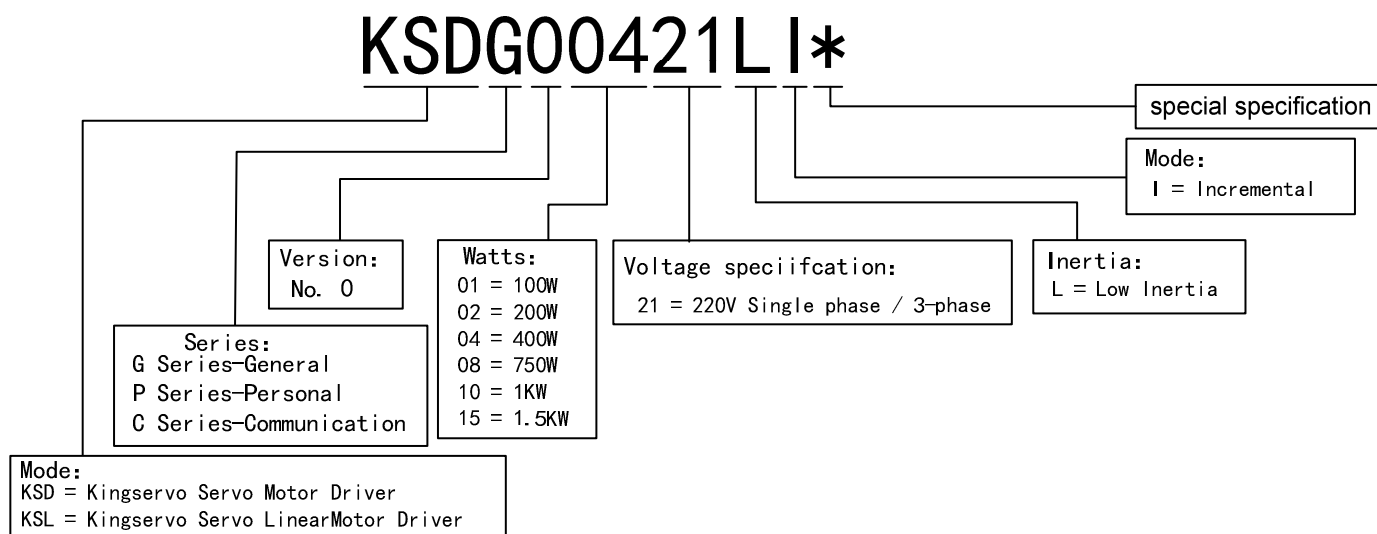
1-4 AC Encoding Principles of Servo

1-4-1 Name-plate of Servo Motor

Type ———

Serial Number ———

Rated motor output ———

Revolution rating ———

Kingservo

AC SERVO MOTOR

Model No. : KSMA04LI4
PN : BEC-M0801151-00
SER.No. : K080401010165 ——— Serial Number
Input : 3PH AC 90V 2.8A
Rated Output : 0.4 KW
Rated Freq. : 250 Hz
Rated Rev. : 3000 r/min
CONT.TORQUE : 1.3 Nm ——— Torque
CONNECTION : Y
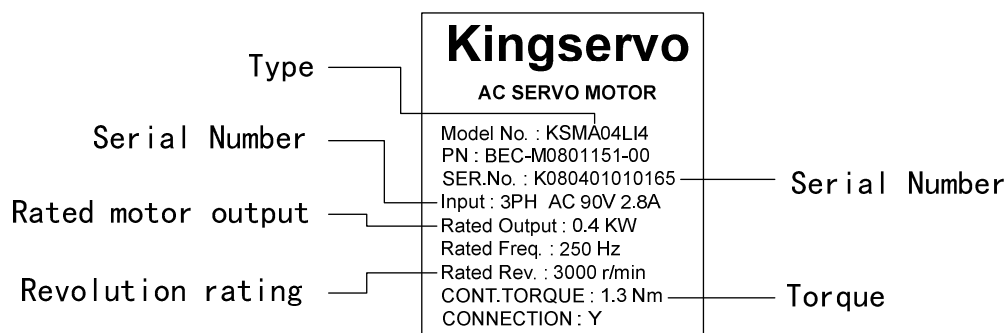
1-4-2 Identification of Servo Motor Type

KSMA04LI4*

Special specification

Series:
A-series

Watt:
01 = 100W
02 = 200W
04 = 400W
08 = 750W
10 = 1KW
15 = 1.5KW

Type:
I = Incremental

Inertia:
L = Low Inertia
M = Middle Inertia

Mode:
KSM = Kingservo Servo Motor

Motor structure			
\	Key way	Brake	Oil seal
0			
1			
2			
3			
4			
5			
6			
7			
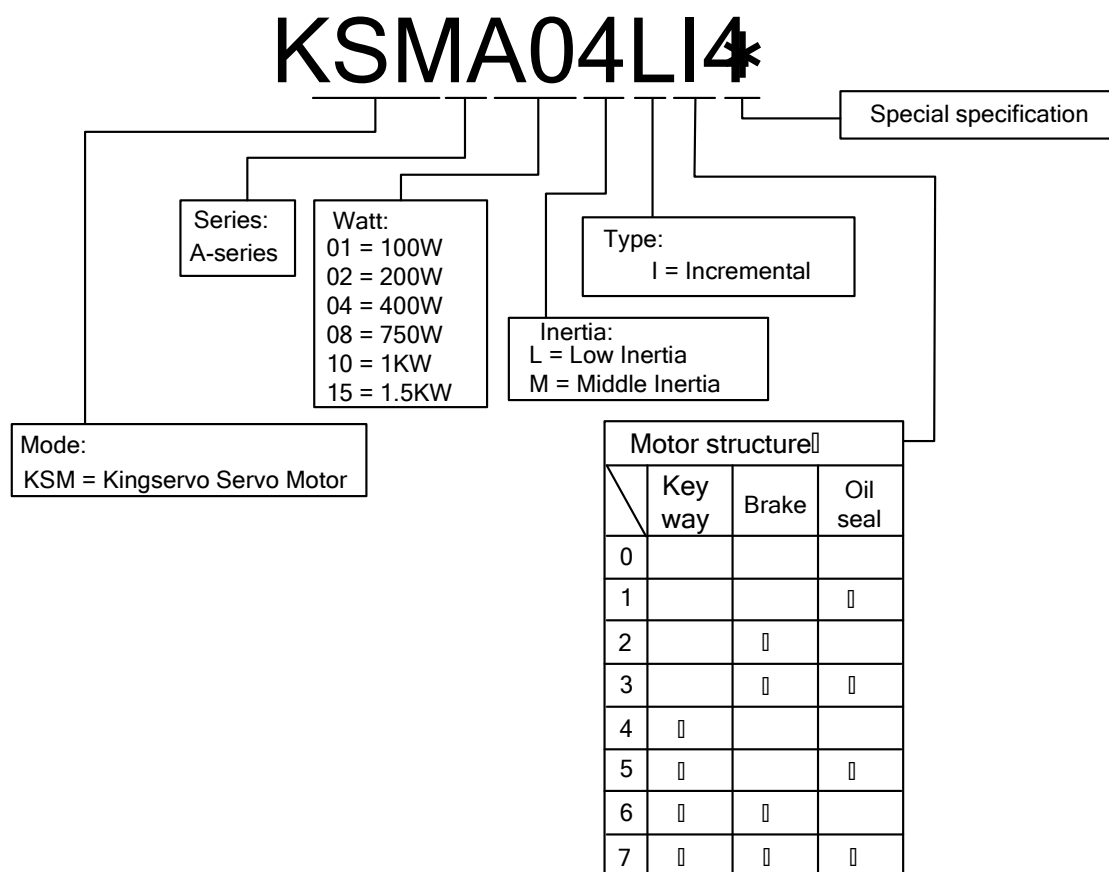
1-5 Name of Parts

1-5-1Driver

● KSDG 200W～3KW

Mode switching button
MODE

Set button
SET

Display LED(6 Digital)

Data setup button
◎ : SHIFT
⦿ : UP
⦿ : DOWN

231-205/026-000
WAGO

Main power
input terminals
(L1，L2，L3)

Control power
Input terminals
(r，t)

Kingservo

Communication
connector RS-232

Connector,for
Encoder connection
SIG

231-103/026-000
WAGO

Terminals for external
Regenerative resistor
(P，B1，B2)

231-203/026-000
WAGO

Terminals for
motor connection
(U，V，W)

Connector,for
host conection

Screw for earth (x2)

L1
L2
L3
r
t

P
B1
B2

U
V
W

RS-232/485

SIG

I/F

1-5-2 Motor

● **KSMA 200W～750W**

Connector for
encoder cable

Encoder cable

Motor cable

Connector for
motor cable

Rotary encoder

Connector for brake cable
(only applicable to the motor
with electromagnetic brake)

Motor frame

Mounting holes (X4)

Flange

●

KSMA 1000W～2000W

Motor
Connect

Encoder
Connect

Seal

Flange

Mounting holes(X4)

1-6 Installation

Please sure to install in the correct way to avoid the drive or motor failure or accident.

1-6-1 Driver

Installation
sites

(1) Put in the room to avoid the sun or easy to damp place.this motor driver is not waterproof construction.

(2) Do not set up in easily accessible to hydrogen sulfide, chlorine, ammonia, sulfur, chloride, sulfide, pH, chlorine and other corrosive gases, or to guide fire is gas, grinding oil, oil mist, iron, cutting powder and other places.

(3) well-ventilated dry place no dust

(4) Put in smooth no vibration place.

Environmental
conditions

Item	Condition
Ambient temperature	0°C to 55°C (free from freezing)_
Ambient humidity	Less than 90% RH (free from condensation)_
Storage temperature	−20°C to 80°C (free from freezing)_
Storage humidity	Less than 90% RH (free from condensation)_
Vibration	Lower than 5.9m/S2 (0.6G), 10 to 60Hz_
Storage humidity	Lower than 1000m

Installation

(1) Rack-mount. Install in vertical position，and reserve enough space around the servo driver for ventilation.

Mounting Direction and Spacing

• Reserve enough surrounding space for effective cooling.

• Install fans to provide uniform distribution of temperature in the control panel.

• Observe the environmental conditions of the control panel described in the next page.
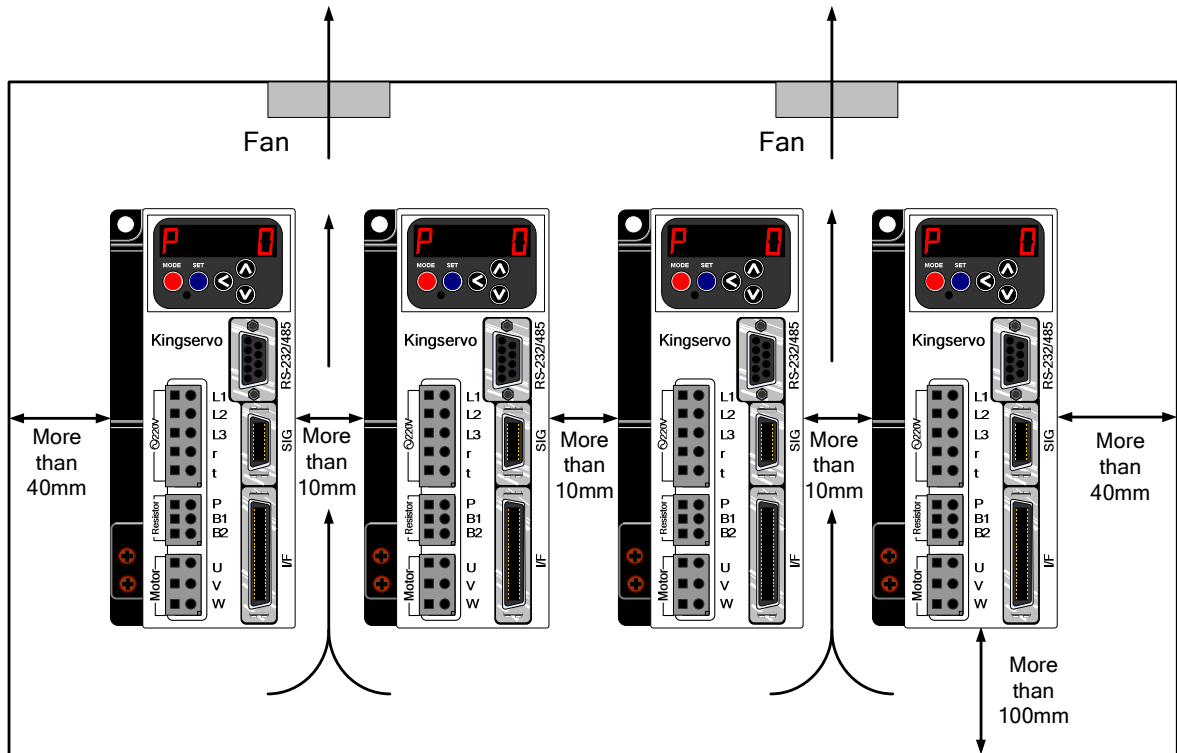
Notes on installation

We have been making the best effort to ensure the highest quality, however, application of exceptionally

large external noise disturbance and static electricity, or failure in input power, wiring and components may

result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety

in the operative range.

There might be a chance of smoke generation due to the failure of these products. Pay an extra attention

when you apply these products in a clean room environment.

1-6-2 Motor

Installation
sites

Since the conditions of location affect a lot to the motor life, please choose the installation
location meets the following conditions.
(1)　Installation in the room to avoid the sun, or easy to damp places.
(2)　Do not set up in easily accessible to hydrogen sulfide, chlorine, ammonia, sulfur,
　　　chloride, sulfide, pH, chlorine and other corrosive gases, or gas fire is guide the
　　　Department, or flammable material near use.
(3)　Where the motor is free from grinding oil, oil mist, iron powder or chips
(4)　Well-ventilated and humid and dust-free place, far apart from the heat source such as a
　　　furnace.
(5)　Easy-to-access place for inspection and cleaning.
(6)　Vibration-free place.
(7)　Avoid enclosed place. Motor may gets hot in those enclosure and shorten the motor
　　　life.

Environmental
conditions

Item		Condition
Ambient temperature		0℃ to 40℃ (free from freezing) *1
Ambient humidity		Less than 85% RH (free from condensation)
Storage temperature		−20℃ to 80℃ (free from freezi ng) *2
Storage humidity		Less than 85% RH (free from condensation)
Vibration	Motor only	Lower than 49m/s2 (5G) at running, 24.5m/s2 (2.5G) at stall
Impact	Motor only	Lower than 98m/s2 (10G)
Enclosure rating	Motor only	IP65 (except rotating portion of output shaft and lead wire end) These motors conform to the test conditions specified in EN standards (EN60529). Do not use these motors in application where water proof performance is required such as continuous wash-down operation.

*1 Ambient temperature to be measured at 5cm away from the motor.

*2 Permissible temperature for short duration such as transportation.

Installation

You can mount the motor either horizontally or vertically as long as you observe the
followings.
(1)　Horizontal mounting
　　●　Mount the motor with cable outlet facing downward for water/oil countermeasure.
(2)　Vertical mounting
　　●　Use the motor with oil seal (non-standard) when mounting the motor with gear
　　　　reducer to prevent thereducer oil/grease from entering to the motor.
(3)　For mounting dimensions, refer to "Dimensions".

Oil/Water Protection

Don't submerge the motor cable to water or oil.
(1) Install the motor with the cable outlet facing downward.
(2) Avoid a place where the motor is subjected to oil or water.
(3) Use the motor with an oil seal when used with the gear reducer, so thatthe oil may not enter to the motor through shaft.
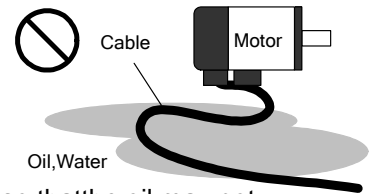
Cable using the instructions

(1) Avoid a stress application to the cable outlet and connecting portion by bending or self-weight.
(2) Especially in an application where the motor itself travels, fix the attached cable and contain the extension junction cable into the bearer so that the stress by bending can be minimized.
(3) Take the cable bending radius as large as possible. (Minimum R20mm)

Permissible Load to Output Shaft

(1) Design the mechanical system so that the applied radial load and/or thrust load tothe motor shaft at installation and at normal operation can meet the permissible value specified to each model.
(2) Pay an extra attention when you use a rigid coupling. (Excess bending load maydamage the shaft or deteriorate the bearing life.)
(3) Use a flexible coupling with high stiffness designed exclusively for servo applicationin order to make a radial thrust caused by micro misalignment smaller than the permissible value.

Notes on installation

(1) Do not apply direct impact to the shaft by hammer while taching/detaching a coupling to and from the motor shaft.
   ● may damage the encoder mounted on the other side of the shaft.
(2) Make a full alignment.
   ● incomplete alignment may cause vibration and damage the bearing.
(3) If the motor shaft is not electrically grounded, it may cause electrolytic corrosion to the bearing depending on the condition of the machine and its mounting environment, and may result in the bearing noise. Check and verification by customer is required.
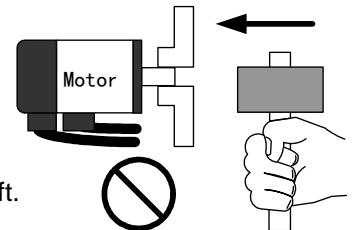
1-7 Usage

1. Usage Modes:

Choose one of following modes. Mode selection must be determined through I/F connector(MDR) wiring.

Mode	Mode Name
Single Mode	Position control
	Velocity control
	Torque control
Mixed Mode	Position/Velocity control
	Position/Torque control
	Velocity/Torque control

2. I/F Signal Connection Line

1. connect main power line(L1, L2, L3), control power(r, t), flyback resistor(P, B1, B2), connector of encoder line(SIG) and power line of motor(U, V, W) in accordance with connection of peripheral devices of controller and controller wiring diagram.

2. Increase I/F connector(MDR) wiring and connect them by

   ·connection of single mode

   ·connection of all signal pins

   Connecting another terminal of upper-level controller to set up parameters of control mode, and then operate.

   About the function definition of I/F pin mode, adjust parameter Pro2 to contol mode function of PIN14, 6, and 18.

   Speed and torque mode control use few pin. Wile single application, the numbers of I/F Pin Weld line.

3. While I/f connector(MDR) does not connect controller, the motor can be trial run.

軸端規格

25.0

22.5

5.0

5h9

11.0

ø4.5

8.0

30.0

3.0

ø50h7

-0.01
-0.00

ø14.0

104.8

■60.0

44.0

ø70.0

4 - ø4.5
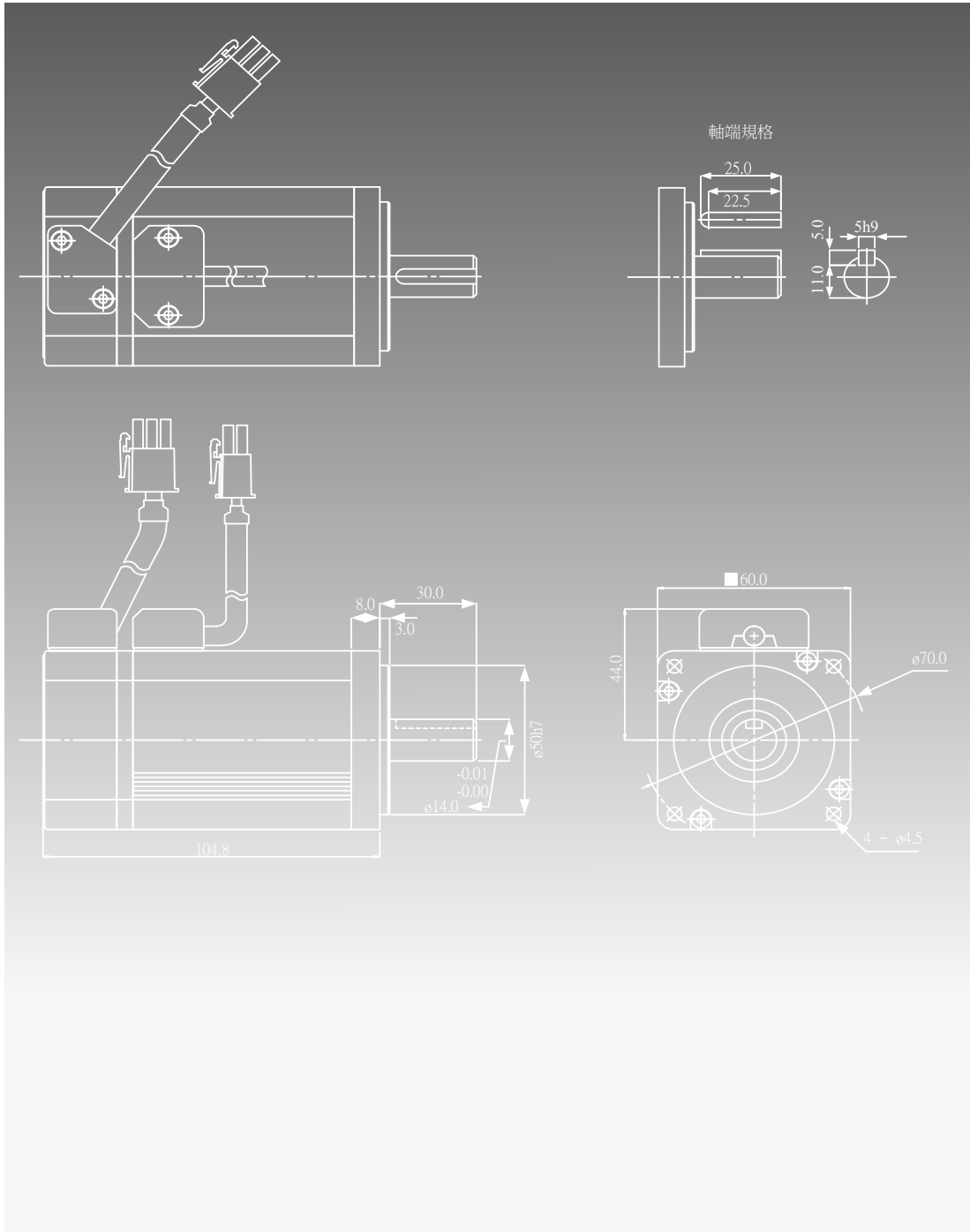
Chapter 2: Connectionor and Wiring

2-1Controller and peripheral configuration map

●**Wiring of the Main Circuit**

220Vac
3Ph or 1Ph

Circuit Breaker (NFB)
Use the circuit breaker matching capacity of the power source to protect the power lines.

L1
L2
L3
r
t

P

B2

Noise Filter (NF)
Prevents external noise from the power lines. And reduces an effect of the noise generated by the servo driver.

Magnetic Contactor (MC)
Turns on/off the main power of the servo driver. Use a surge absorber together with this.
• **Never start nor stop the servo motor with this Magnetic Contactor.**

Pin RB1 (6-pin), RB2 (4-pin), and RB3 (5-pin)
•B1 and B2 to be kept shorted for normal operation.
• **When the capacity shortage of the regenerative resister is found, disconnect a shorting bar between B1 and B2**, then connect **the external regenerative resister** between P and B2.
• When you connect an external regenerative resister, set up Parameter No. 6C to 1 or 2.

Regenerative resistor (optional)

Setup support software(KSD Tool)
PC (to be supplied by customer)

Kingservo

RS-232/485

L1
L2
L3
r
t

P
B1
B2

U
V
W

SIG

I/F

Motor

Wiring to Connector, SIG
(Connection to encoder)

Wiring to Connector,I/F
(Connection to host controller)

Ground (earth)

Wiring to Connector,Motor
（(Connection to motor driving phase and ground)

DC Power supply
for brake
DC24V
(to be supplied by customer)

Junction cable
for brake
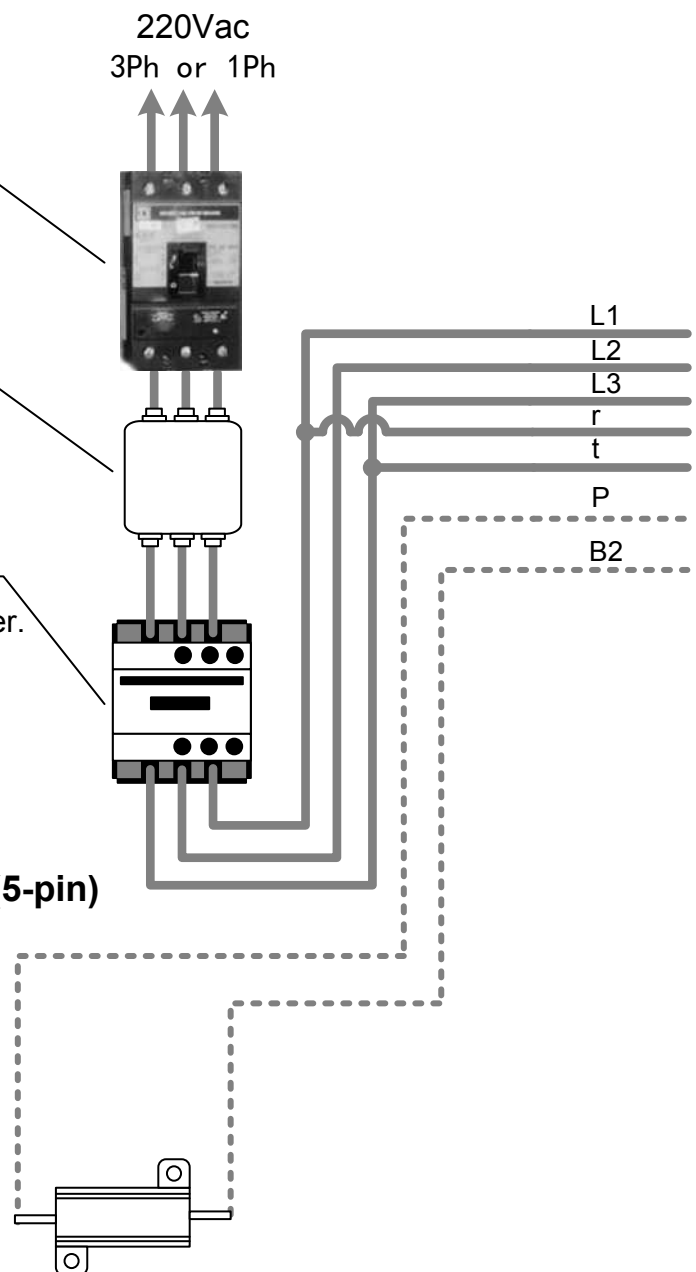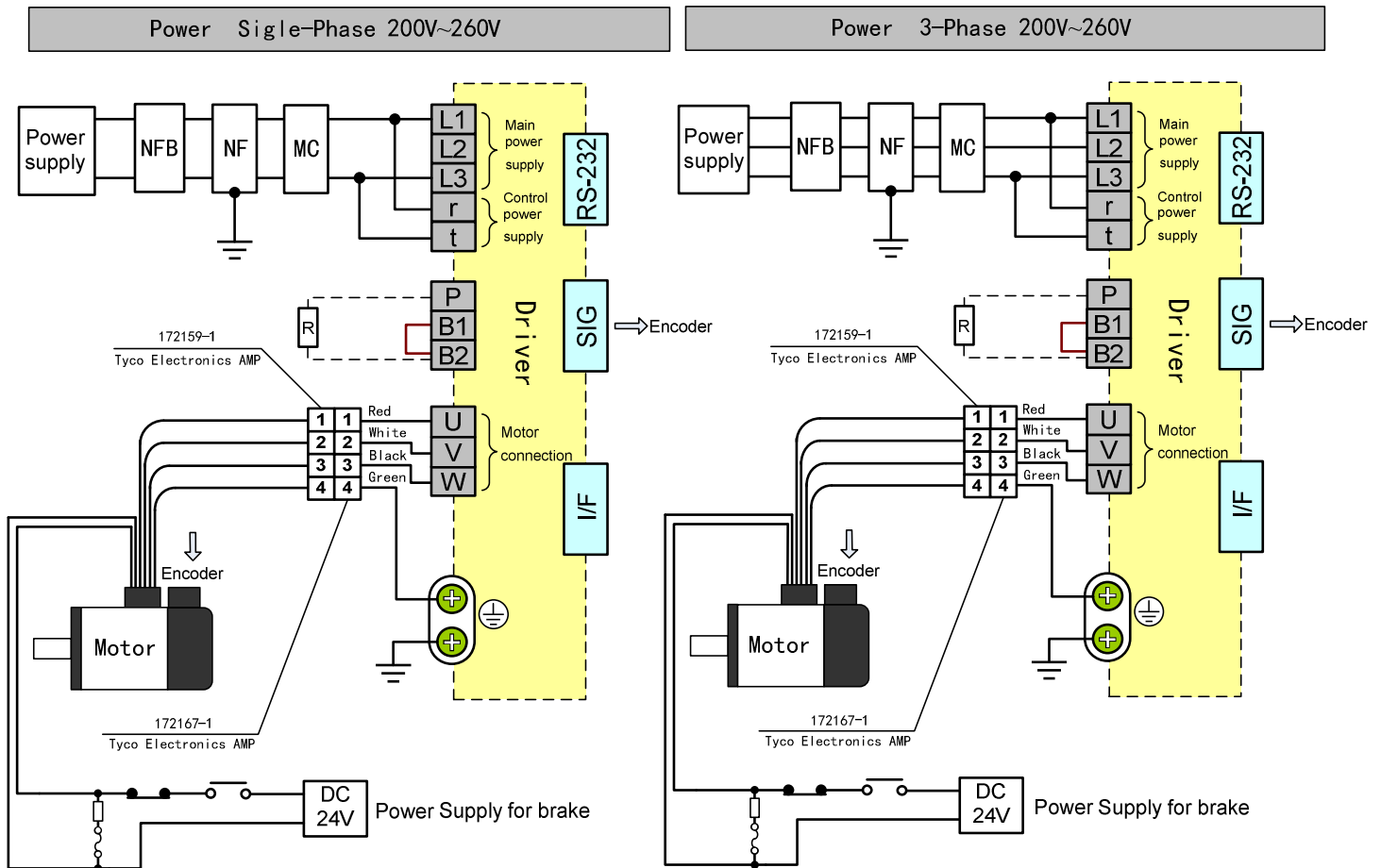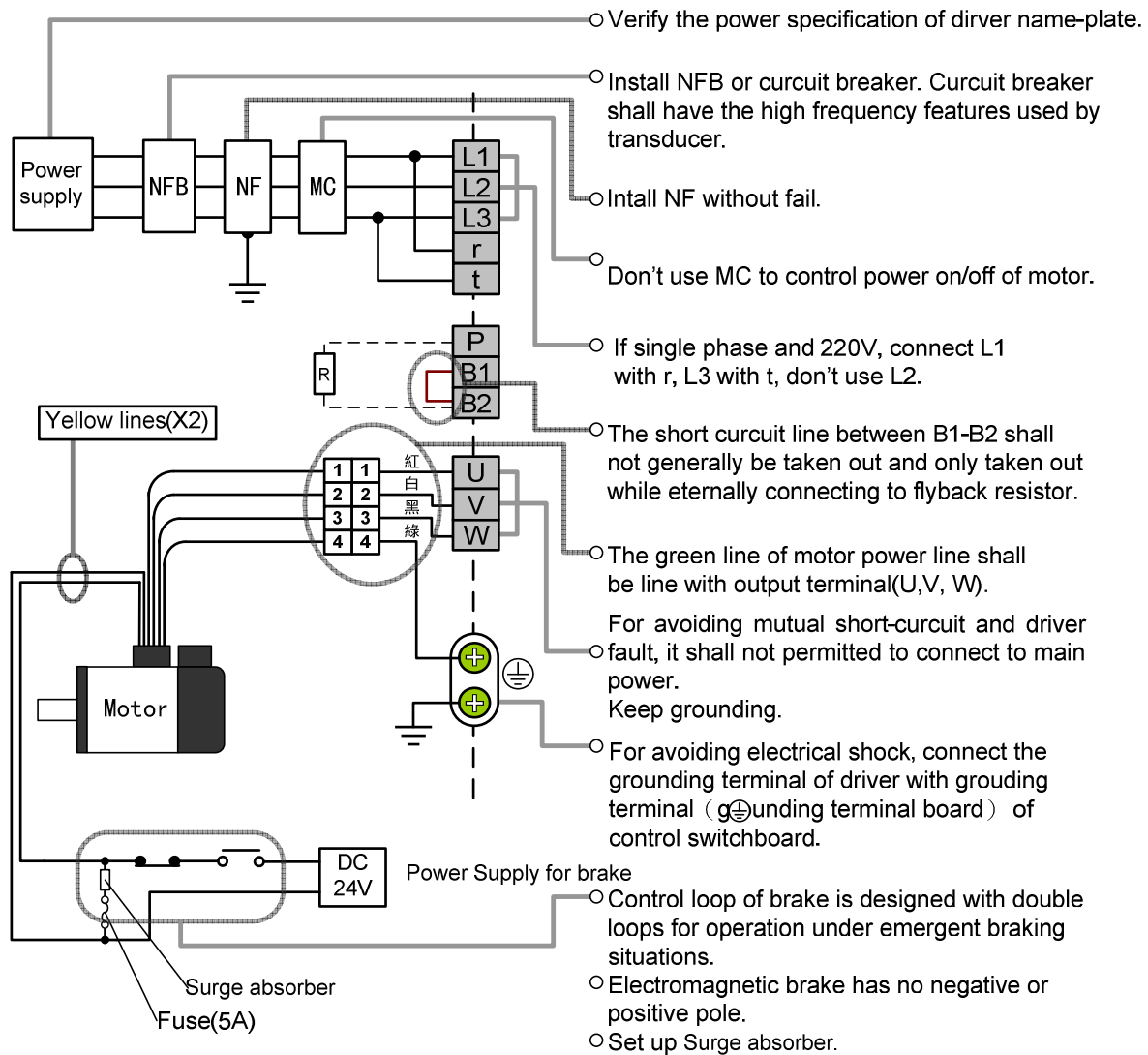
2-2 Power Wiring Diagram

While alarm system is activated, the main line power should be power off immediately.

Power Sigle-Phase 200V~260V	Power 3-Phase 200V~260V

Single-Phase diagram:

Power supply — NFB — NF — MC — L1, L2, L3 (Main power supply), r, t (Control power supply)

RS-232

Driver

P, B1, B2 — R

172159-1 Tyco Electronics AMP

1 1 Red
2 2 White
3 3 Black
4 4 Green

U, V, W (Motor connection)

SIG ⇒ Encoder

I/F

Motor — Encoder

172167-1 Tyco Electronics AMP

DC 24V — Power Supply for brake

3-Phase diagram:

Power supply — NFB — NF — MC — L1, L2, L3 (Main power supply), r, t (Control power supply)

RS-232

Driver

P, B1, B2 — R

172159-1 Tyco Electronics AMP

1 1 Red
2 2 White
3 3 Black
4 4 Green

U, V, W (Motor connection)

SIG ⇒ Encoder

I/F

Motor — Encoder

172167-1 Tyco Electronics AMP

DC 24V — Power Supply for brake

Verify the power specification of dirver name-plate.

Install NFB or curcuit breaker. Curcuit breaker shall have the high frequency features used by transducer.

Intall NF without fail.

Don't use MC to control power on/off of motor.

If single phase and 220V, connect L1 with r, L3 with t, don't use L2.

The short curcuit line between B1-B2 shall not generally be taken out and only taken out while eternally connecting to flyback resistor.

The green line of motor power line shall be line with output terminal(U,V, W).

For avoiding mutual short-curcuit and driver fault, it shall not permitted to connect to main power.
Keep grounding.

For avoiding electrical shock, connect the grounding terminal of driver with grouding terminal（g⏚unding terminal board） of control switchboard.

Control loop of brake is designed with double loops for operation under emergent braking situations.

Electromagnetic brake has no negative or positive pole.

Set up Surge absorber.

■**Function of Regenerative Resistor**

·While load with large inertia reducing speed, flyback energy leads to rising of driver's capacitor voltage, so the flyback resistor is used to absorb and consume the excessive energy and protect driver.

·While using vertical ascending (Z axis) mechanism, flyback problem shall be payed attention to.

·specification of built-in flyback resistor: 150Ωand 50W.

■**Application of Built-in Regenerative resistor**

·Keep short curicuit between B1 and B2.

·Set parameter Par 6C as 0 (default value is 0).

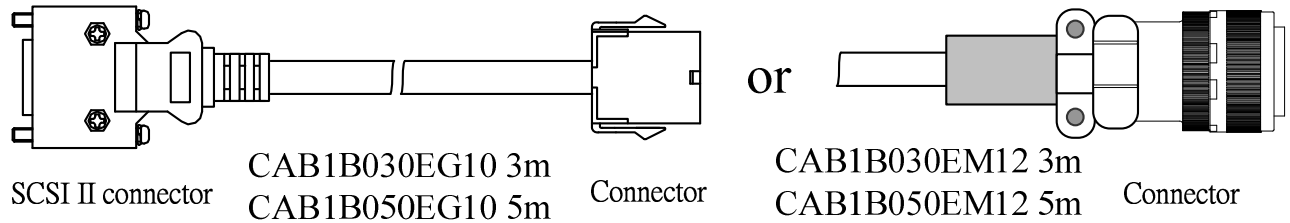■**Application of External Regenerative Resistor**

·Connect P and B2 to external flyback resistor(150Ω).
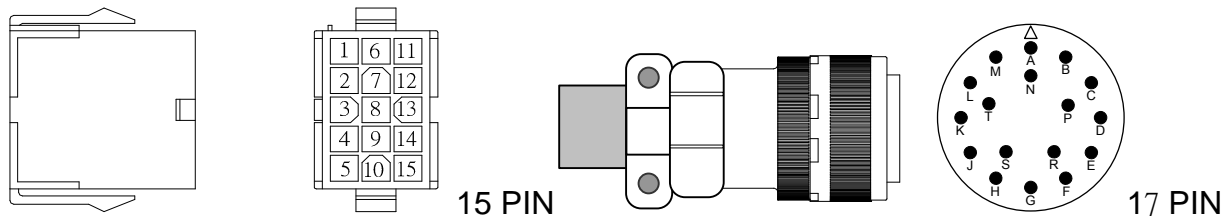
· Set Parameter Par 6C as 1.

The power consumption of external resistor is limited to 10% duty, and set Par 6C as 2, (while Par 6C is set as 2, overheating-protection fuse shall be installed, or else it may cause overheating and burning-down of flyback resistor.).

2-3 Defination of Connector Pin

2-3-1Cable of Encoder

CAB1B030EG10 3m
CAB1B050EG10 5m

SCSI II connector   Connector

CAB1B030EM12 3m
CAB1B050EM12 5m

or   Connector

Connector

15 PIN   17 PIN

15 Pin No.	1	2	3	4	5	6	7-10	11	12	13	14	15
17 Pin No	A	B	C	D	E	F	other	P	R	H	G	J
Pin Definition	A	/A	B	/B	Z	/Z	NC	RX	/RX	VCC	GND	FG
Color	Red	Green	Black	White	Yellow	Blue		Gray	Orange	Brown/ Light RED	Purple/ Ligth Green	Grounding Line of Isolation Net

SCSI II Connector
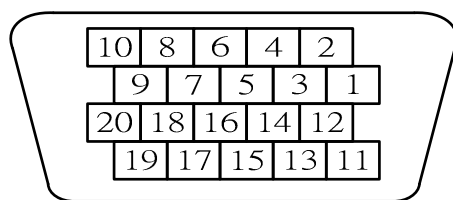
20 PIN

NO.	1	2	3	4	5-6	7	8	9	10
Pin Definition	GND	GND	VCC	VCC	NC	A	/A	B	/B
Color	Purple	Light Green	Brown	Pink		Red	Green	Black	White

NO.	11	12	13-16	17	18	19	20
Pin Definition	Z	/Z	NC	RX	/RX	NC	GND
Color	Yellow	Blue		Gray	Orange		Grounding line of Isolation Net

.Wiring Diagram of Encoder Line

Wiring Diagram of Encoder Line

Tyco Electronics AMP 172171-1
Tyco Electronics AMP 172163-1

| Motor side | relay in encoder | Driver side. |

2-3-2 Power Cable of Motor

CAB1B030PG10 /3
⇩
CAB1B050PG10 /5   connect

or

CAB1B030PM12
⇩
CAB1B050PM12 /5   connect
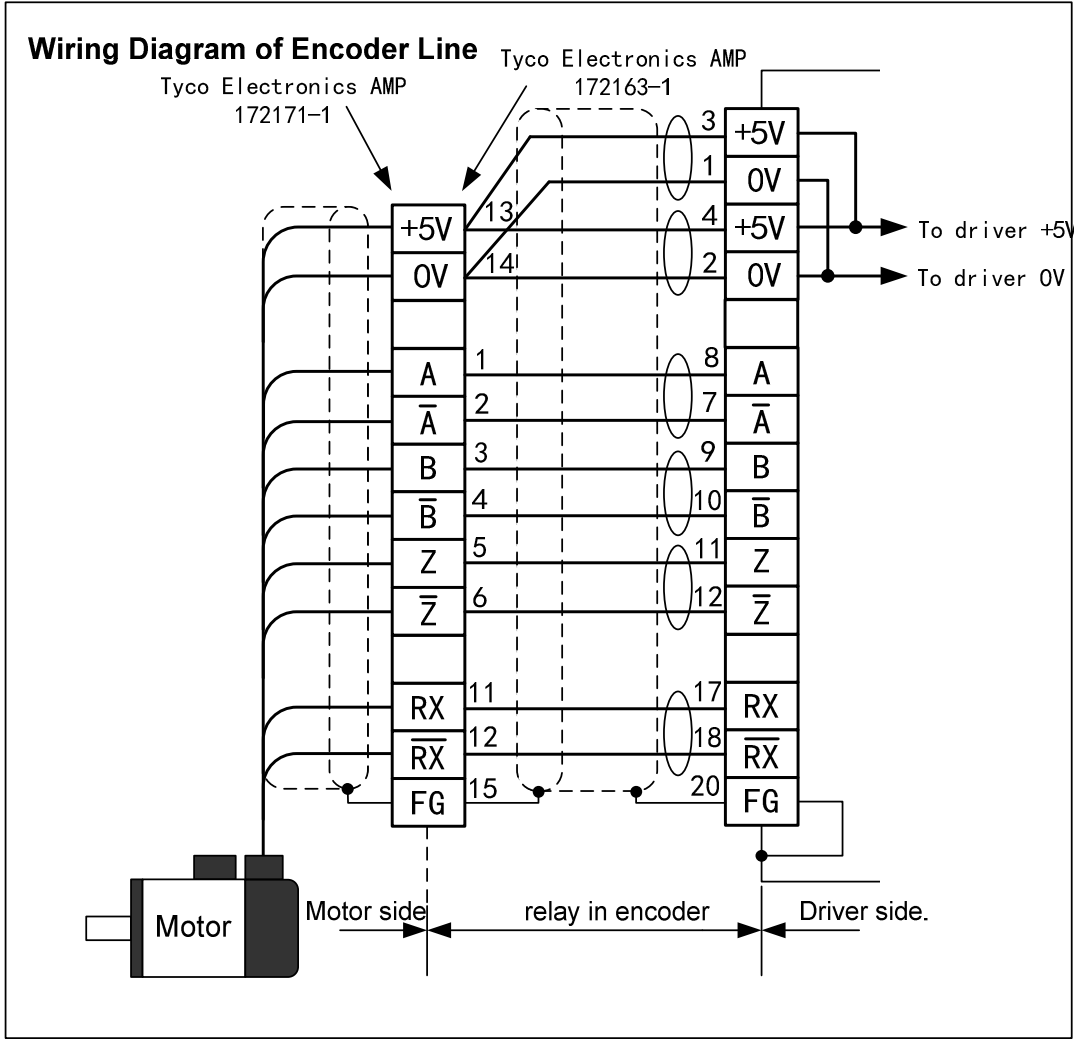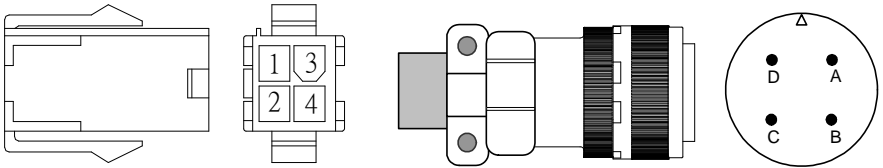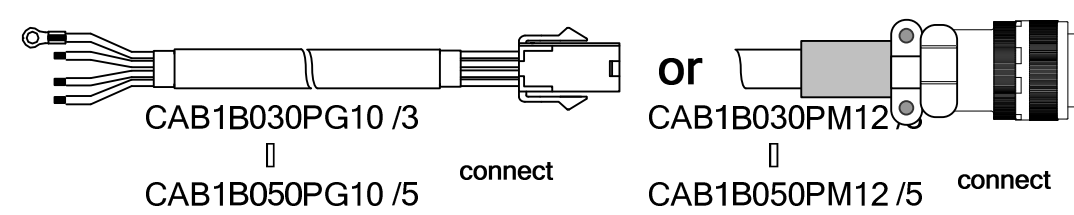
Pin NO.	Definition	Color
1	U	Red
2	V	White
3	W	Black
4	FG	Green

2-4 Communication Line of RS-232

While connecting computer and driver by RS-232, the communication software KSDTools can be set up. KSDTools provides many convenient functions such as to monitor the states of motor, set/modify parameters and so no.
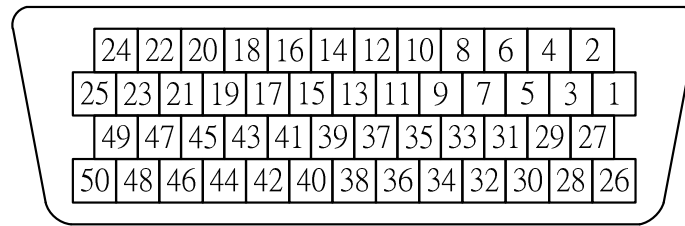

Exclusive communicaiotn cable
Refer to (Optional Articles)

RS232 connector
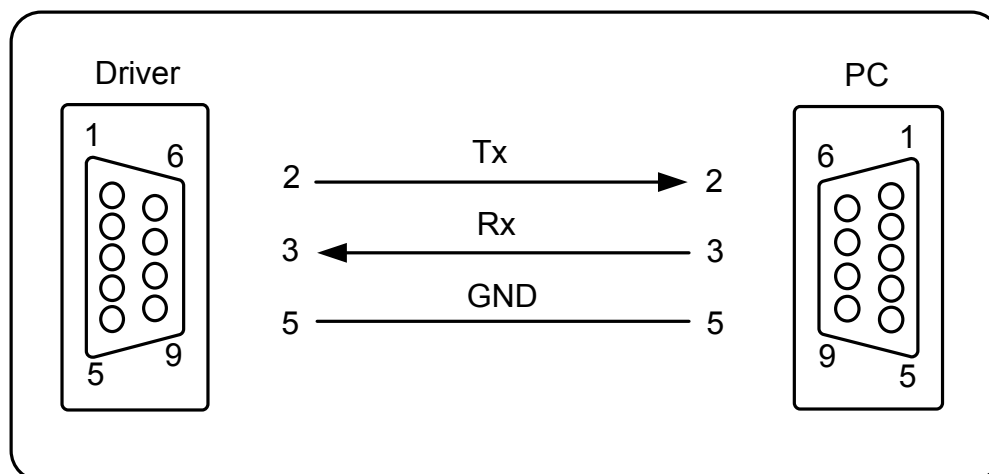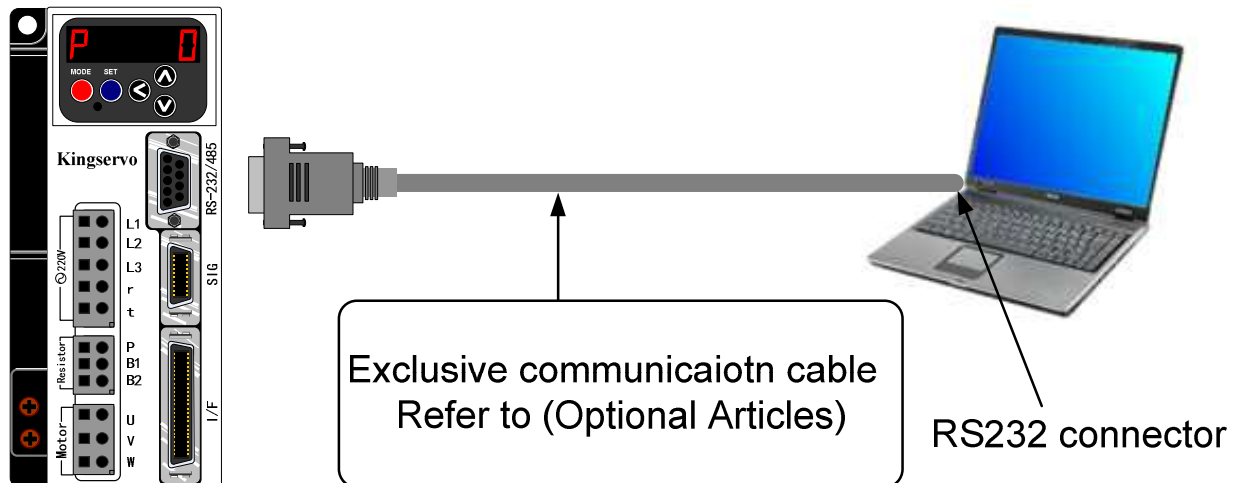
2-5 Wiring of Connector I/F
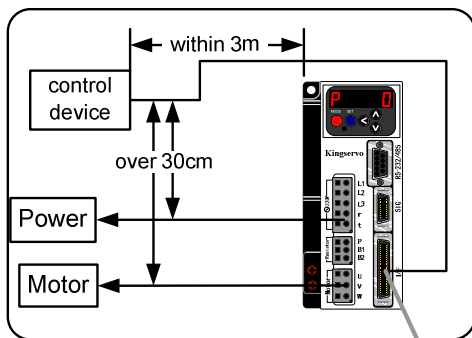
○ Wiring connecting to pheripheral devices such as upper-level controller shall be shorter than 3 meters.

○ Keep 30 cm with wiring of main line. Donot bind them together through the same groove.

○ Prepare the VDC between COM+~COM- by the user. The Voltage is DC +12~+24V.

○ Use shielded twisted pair as the wiring of command pulse input and signal output of encoder etc.

○ The voltage of output terminal of controlling signal shall not be over 24V or current of that shall not be over 50mA.

○ While using output of controlling signal directly to drive relay, a diode and relay shall be in parallel according to the direction of diagram. If a diode is not installed or installed in wrong direction, it would damage driver.

○ Earth terminal shall be connected with grounding line within the driver.

2-5-1 Pins of Connector I/F(SCSI II)

24	22	20	18	16	14	12	10	8	6	4	2
25	23	21	19	17	15	13	11	9	7	5	3	1
49	47	45	43	41	39	37	35	33	31	29	27
50	48	46	44	42	40	38	36	34	32	30	28	26

Specification of Connector I/F

Side Connector of Driver	Connector Prepared by User		Manufacturer
	Name of Parts	Mode No.	
10250-52A2 PL	Connector(Welded)	54306-5011 or 54306-5019(leadfree)	Molex Inc.
	Shell of Connector	54331-0501	
	Connector(Welded)	10150-3000PE	Sumitomo 3M
	Shell of Connector	10350-52A0-008	

2-5-2Pin Signal ModeTable

Pin No.	Position Mode	Function		Speed Mode	Function		Torque Mode	Function	
1	OPC1	Position command Pulse 1	input						
2	OPC2	Position command Pulse 2	input						
3	PULS1	Position command Pulse 2	input						
4	PULS2	Position command Pulse 2	input						
5	SIGN1	Position command Signal 2	input						
6	SIGN2	Position command Signal 2	input						
7	COM+	Signal Power (+)		COM+	Signal Power (+)		COM+	Signal Power (+)	
8	CW-LIMIT	CW-inhibition limit	input	CW-LIMIT	CW-inhibition limit	input	CW-LIMIT	CW-inhibition limit	input
9	CCW-LIMIT	CCW-inhibition limit	input	CCW-LIMIT	CCW-inhibition limit	input	CCW-LIMIT	CCW-inhibition limit	input
10	BK-OFF-	Brake release(-)	output	BK-OFF-	Brake release(-)	output	BK-OFF-	Brake release(-)	output
11	BK-OFF+	Brake release(+)	output	BK-OFF+	Brake release(+)	output	BK-OFF+	Brake release(+)	output
12	ZSP	Zero-speed detection	output	ZSP	Zero-speed detection	output	ZSP	Zero-speed detection	output
13	GND	Signal ground							
14				SPR	Speed command	input	SPR/TRQR	Torque command or speed command	input
15	GND	Signal ground		GND	Signal ground		GND	Signal ground	
16	CCWTL	CCW Torque Limit	input	CCWTL	CCW Torque Limit	input	CCWTL/TRQI	Torque command	input
17	GND	Signal ground		GND	Signal ground		GND	Signal ground	
18	CWTL	CW Torque limit	input	CWTL	CW Torque limit	input			
19	CZ	Z-phase output (OPC)	output	CZ	Z-phase output (OPC)	output	CZ	Z-phase output (OPC)	output
20									
21	OA+	A-phase output(+)	output	OA+	A-phase output(+)	output	OA+	A-phase output(+)	output
22	OA-	A-phase output(-)	output	OA-	A-phase output(-)	output	OA-	A-phase output(-)	output
23	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output
24	OZ-	Z-phase output(-)	output	OZ-	Z-phase output(-)	output	OZ-	Z-phase output(-)	output
25	GND	Signal ground		GND	Signal ground		GND	Signal ground	
26				ZERO-SPD	Speed zero clamp input	input	ZERO-SPD	Speed zero clamp input	input
27	GAIN	Gain switching input	input	GAIN	Gain switching input	input	GAIN	Gain switching input	input
28	DIV	Electronic gear selection	input	INSP3	internal speed selection 3	input			
29	SVO-ON	Servo-ON input	input	SVO-ON	Servo-ON input	input	SVO-ON	Servo-ON input	input
30	CLR	Deviation counter clear input	input	INSP2	internal speed selection 2	input			
31	ALM-CLR	Alarm clear input	input	ALM-CLR	Alarm clear input	input	ALM-CLR	Alarm clear input	input
32	C-MODE	Control mode switching input	input	C-MODE	Control mode switching input	input	C-MODE	Control mode switching input	input
33	PULS-INH	Inhibition input of command pulse	input	INSP1	internal speed selection 1	input			
34	SVO-RDY-	Servo-Ready output(-)	output	SVO-RDY-	Servo-Ready output(-)	output	SVO-RDY-	Servo-Ready output(-)	output
35	SVO-RDY+	Servo-Ready output(+)	output	SVO-RDY+	Servo-Ready output(+)	output	SVO-RDY+	Servo-Ready output(+)	output
36	SVO-ALM-	Servo-Alarm output(-)	output	SVO-ALM-	Servo-Alarm output(-)	output	SVO-ALM-	Servo-Alarm output(-)	output
37	SVO-ALM+	Servo-Alarm output(+)	output	SVO-ALM+	Servo-Alarm output(+)	output	SVO-ALM+	Servo-Alarm output(+)	output
38	ON-POS-	Positioning complete output	output	AT-SP-	Velocity complete output(-)	output	AT-SP-	Velocity complete output(-)	output
39	ON-POS+	Positioning complete output	output	AT-SP+	Velocity complete output(+)	output	AT-SP+	Velocity complete output(+)	output
40	TLC	Torque limit detection	output	TLC	Torque limit detection	output	TLC	Torque limit detection	output
41	COM-	Signal power(-)		COM-	Signal power(-)		COM-	Signal power(-)	
42	IM	Torque monitor	output	IM	Torque monitor	output	IM	Torque monitor	output
43	SPM	Speed monitor	output	SPM	Speed monitor	output	SPM	Speed monitor	output
44	PULSH1	Position command Pulse 1	input						
45	PULSH2	Position command Pulse 1	input						
46	SIGNH1	Position command Signal 2	input						
47	SIGNH2	Position command Signal 2	input						
48	OB+	B-phase output(+)	output	OB+	B-phase output(+)	output	OB+	B-phase output(+)	output
49	OB-	B-phase output(-)	output	OB-	B-phase output(-)	output	OB-	B-phase output(-)	output
50	FG	Frame ground		FG	Frame ground		FG	Frame ground	

2-5-3 Wiring Diagram of Control Mode

Position control mode
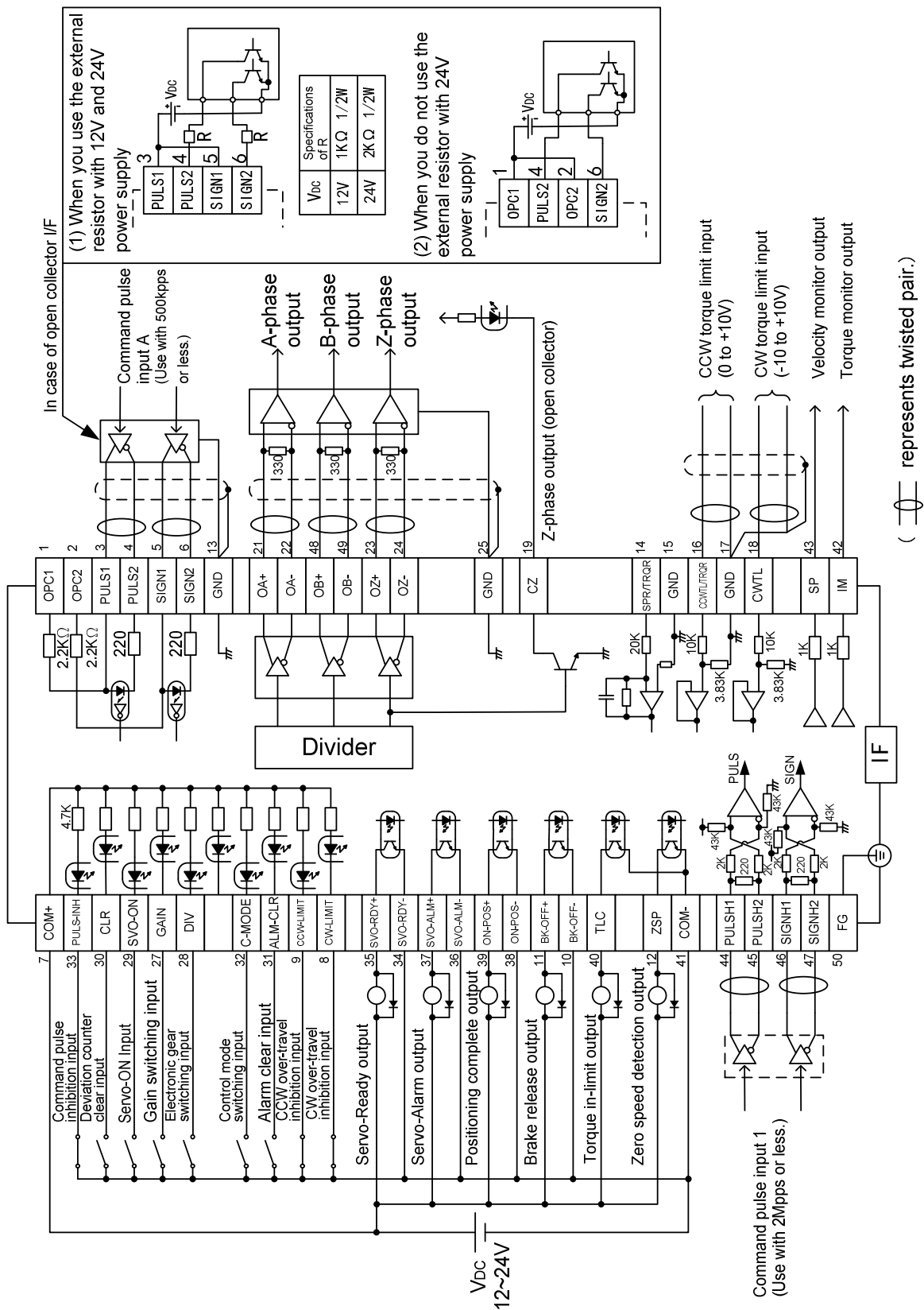
Velocity control mode

Torque control mode

72.0
67.0
167.0
157.0
5.0
132.0

MODE
SET
Kingservo
RS-232
220V
L1
L2
L3
r
t
Resistor
P
B1
B2
Motor
U
V
W
SIG
I/F

Kingservo
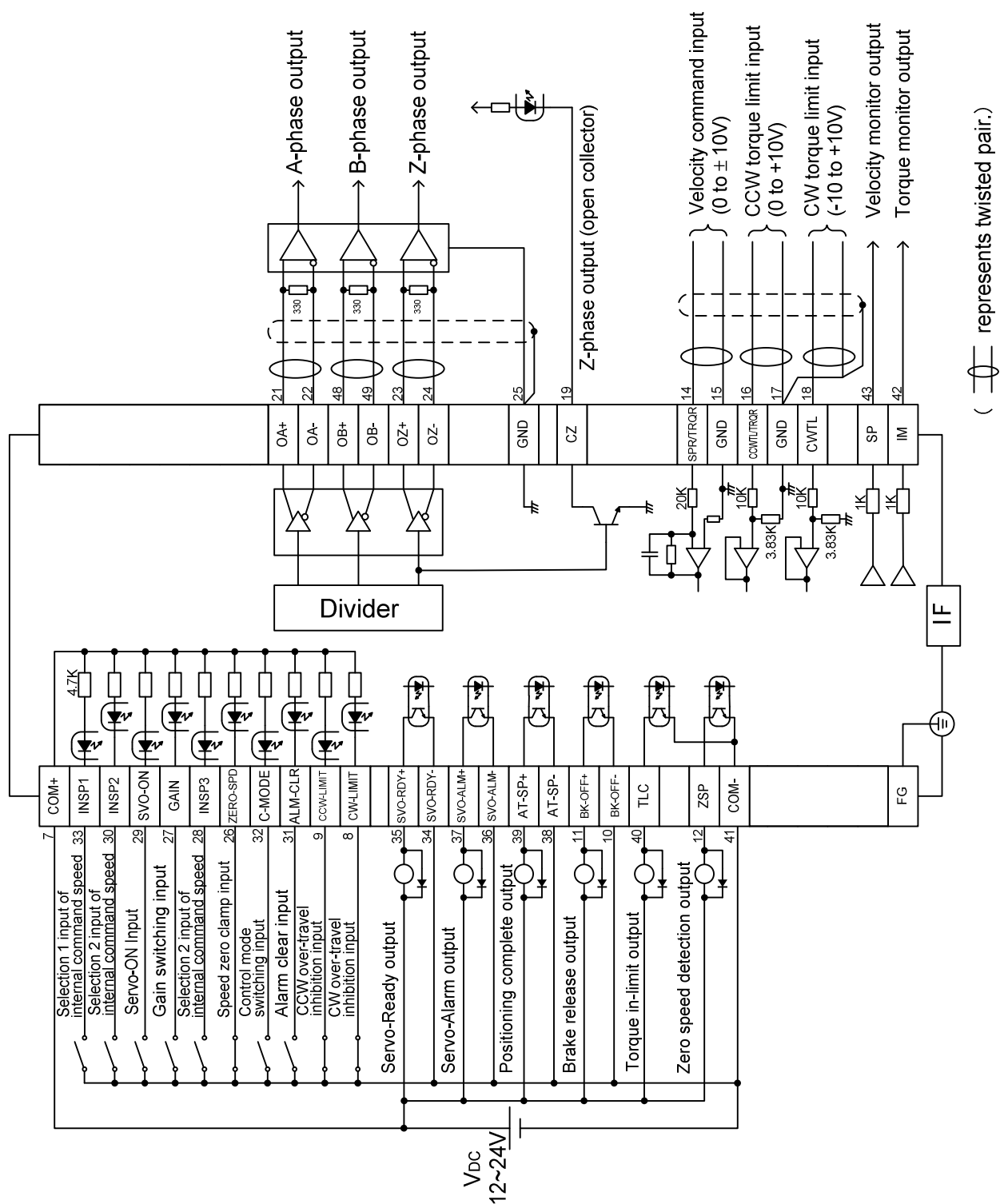
Charpter 3: Setup with the Front Panel

3-1 Composition of Touch Panel and Display

Display LED (6-digit)
All of LED will flash when error occurs,
and switch to error display screen.
All of LED will flash slowly when warning occurs.

Press these to change display and data, select
parameters and execute actions.
(Change/Selection/Execution is valid to the digit
which decimal point flashes.)
Numerical value increases by pressing ⊗,
decreases by pressing ⊗.

⊗ Shifting of the digit for data changing to higher digit.
(Valid to the digit whose decimal point flashes.)

SET Button (valid at any time)
Press this to switch SELECTION and
EXECUTTION display.

Mode switching button (valid at SELECTION display)
Press this to switch 5 kinds of mode.
1) Monitor Mode
2) Parameter Set up Mode
3) EEPROM Write Mode
4) Auto-Gain Tuning Mode
5) Auxiliary Function Mode

3-2 Structure of Each Mode

Initial status of the Console LED: `P    0`

MODE (MODE switching button)

SELECTION display

Execution

Monitor mode: `InFEPS.` ... `InFAd i.`

MODE (MODE switching button)

Parameter Set up mode: `PArr 0` ... `PArr6c`

MODE (MODE switching button)

EEPROM Writing mode: `EEPSEt.` `EEPdEF.`

MODE (MODE switching button)

Auto Gain: `AtGnOS.` `00 ~ 15`
16 kinds of Stiffness

MODE (MODE switching button)

Auxiliary Function mode: `Au JOG.` `Au AcL.` `Au CLH.` `Au ofS.`

MODE (MODE switching button)

SET (SET button)

Execution displays:
- `P    3` ... `A  10.00` — Refer to monitor mode in P33
- `I.` ... `0.` — Refer to mode of parameter setting in P39
- `EEP  o` `rEAd o` — Refer to EEPROM writing-in mode in P41
- `AtGn o` — Refer to rigid setting mode in P43
- `JOG  o` `AcL  o` `CLH  o` `ofS  o` — Refer to auxilary function mode in P44

3-3 Monitor Mode

Initial status of the Console LED | $P \quad 0$

MODE — MODE switching button

Selection display

InFEPS.	Position deviation	
InFSPd.	Motor rotation speed	
InFtrq.	Torque output	
InF ct.	Control mode	
InFd io.	I/O signal status	
InFErr.	Error history	
InF no.	Software version	
InFntY.	Alarm	
InFrdL.	Regenerative Load factor	
InFJrt.	Inertia ratio	
InF oL.	Overload factor	
InFnPS.	Feedback Pulse sum	
InFcPS.	Command Pulse sum	
InFAd i.	Analog input value	

SET — SET button

press ⊙ Display shift forward the arrowed direction by ⬇

press ⊙ Reversed direction by ⬇

EXECUTION display

Display example	Description	Page to refer
$P \quad 3$	3 deviation pulses	P34
$r \; 2000$	2000rpm	P34
$t \; 100.0$	Torque output 100%	P34
ct PoS	Position control mode	P35
--.--.--	Display of I/O Signal status	P35
Err. --	No error currently	P36
Gd_002	Software version of 002	P37
ntY --	No alarm	P37
rdL 58	58% of permissible Regenerative power	P37
J 156	156% inertia ratio	P37
oL 60	60% of overload factor	P37
2710	Feedback pulse sum Is 2710 pulses	P37
5133	Command pulse sum Is 5133 pulses	P38
A 10.00	SPR input +10.00V	P38

MODE

To parameter setup Mode

Instruction of state display：

• Positional deviation

```
P      3
```

Positional deviation (cumulative pulse counts of deviation counter)

   – display : generates rotational torque of CW direction (viewed from shaft end)

  no display : generates rotational torque of CCW direction (viewed from shaft end)

Display Scope：–9999 ~ 9999 （value less than low limit is displayed with `Pr - 1E5`, value over upper

limit is displayed with `PJ  1E5` ）

Unit：Pulse

. Rotary Speed of Motor

```
r   2000
```

   – display : CW rotation

  no display : CCW rotation

Unit：rpm

. Torque Output

```
t   100.0
```

   – display : CW rotation

  no display : CCW rotation

Scope：–300 ~ 300 (100% in rated torque)

Unite：%

• Display of Control Mode

Panel Display		Setting Value of Pr02
State of C-MODE pins（32Pin）of I/F joint		
Open	Short	
ct PoS	ct PoS	0 Position control mode
ct SPd	ct SPd	1 Velocity control mode
ct tr9	ct tr9	2 Torque control mode
ct PoS	ct SPd	3 Position/Velocity control mode
ct PoS	ct tr9	4 Position/Torque control mode
ct SPd	ct tr9	5 Velocity/Torque control mode

• Display of I/O Signal Status

It's used to display the state of input/output signal connecting to I/F.

It's can be used to test whether the wiring is correct or not.

ZERO-SPD   GAIN   DIV   PULS-INH   C-MODE   TLC   ON-POS   SVO-ALM

CCW-LIMIT   CW-LIMIT   CLR   SVO-ON   ALM-CLR   BK-OFF   ZSP   SVO-RDY
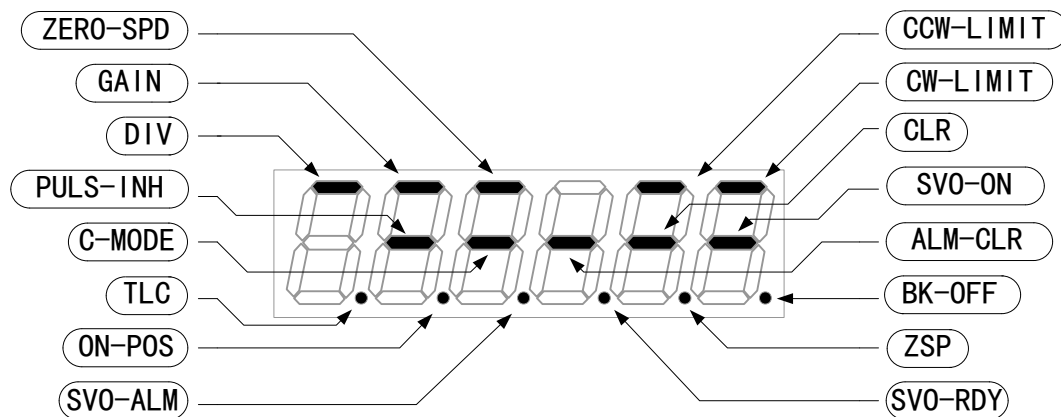
▬ lights, it means that the signal input switch is on. lights, it means the signal input switch is off.

* About the names and functions of all output signals, refer to the conneciton of all control modes.

* It's switch connecting CCW-LIMIT and CW-LIMIT, use B connection of usually closed switch.

• Display of Error factor, history

Including current one, it can trace back to causes of the last 16 alarms.

Error code No.
(– – appears if
no error occurs)

See right graph

Error code No.

History 01~16

You can refer the last 16 error factors (including present one)
Press ⓥ ⓐ to select the factor to be referred.
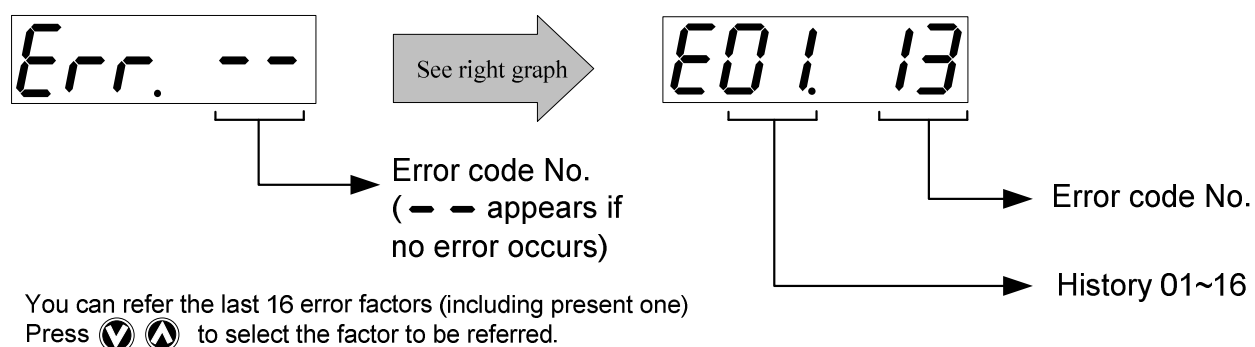
Error code No. and its content

Error Code No.	Error content	Error Code No.	Error content
– –	No fault	24	Excess positional deviation protection
11	Under-voltage protection for control power	26	Over-speed protection
12	Over-voltage protection	29	Deviation counter overflow protection
13	Under-voltage protection for main power	36	EEPROM parameter error protection
14	Over-current protection(software)	37	EEPROM parameter error protection
15	Overheat protection	38	Run-inhibition input protection
16	Overload protection	48	Encoder Z-phase error protection
18	Over-regenerative load protection	49	Encoder Z phase lose protection
20	Encoder A,B phase error protection	50	Encoder Z phase double signal.
21	Encoder communication error protection	99	Over-current protection(Hardware)
22	Encoder communication data error protection		

※Following errors are not included in the history.Error Code No.11、13

Protective Function (Detail of Error Code)

Error Code No.	Error content	Causes
11	Under-voltage protection for control power	While DSP is low voltage, inhibit process of EEPROM and display error.
12	Over-voltage protection	Occurs while voltage is over AC 260V.
13	Under-voltage protection for main power	Occurs while voltage is lower than AC 170V or connection of single phase power isnot correct.
18	Over-regenerative load protection	Occurs while DC-bus is over DC400V(AV283V), flyback rate is 100%, the bench-mark of flyback limit is DC 368V, 0%, and DC 395V, 85%.
20,21 22,48	Encoder communication error protection Encoder Z-phase error protection Encoder communication data error protection	Verify whether connector of SIG encoder correctly connect to driver. Verify connection of male and female connector of encoder cable is correct.
14,99 99	Over-current protection(software) Over-current protection(Hardware)	Verify whether motor power(U,V,W) is short circuit or loose.

.Display of Software Version

`Cd-005` display the software version of driVer.

.Alarm Display

`ntY --`   – ······no alarm 、 A ······Alarm occurrence

> **Over-regeneration alarm**：Turns on when regenerative load reaches more than 85% of alarm trigger level of regenerative load protection.

> **Overload alarm** : Turns on when the load reaches 85% or more of alarm trigger level of over-load protection.

Over 85%, the LED panel will keep on flickering.

.Display of Regenerative Load Factor

`rdL 58`

Display the ratio (%) against the alarm trigger level of regenerative protection.
This is valid when Pr6C (Selection of external regenerative resistor) is 0 or 1.

.Display of Over-load Factor

`oL 36`

Displays the ratio (%) against the rated load. Refer to Charpter 6, "Overload Protection Time Characteristics" of When in Trouble.

.Display of Feedback Pulse Sum, Command Pulse Sum

Scope：0～99999　Unit：Pules

Total sum of pulses after control power-ON.

Display overflows as the figures show.
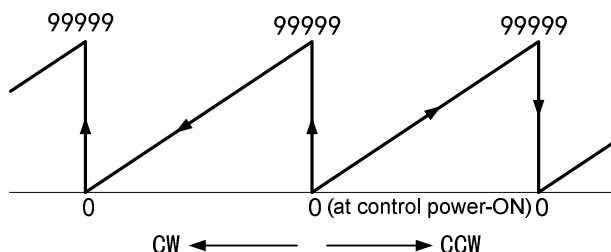
Keep pressing Ⓐ
to shift the "•" as
the right fig. shows.

By pressing for approx. 3 sec. or longer on either
one of screens of total sum of pulses display, you can
clear feedback total sum, command pulse total sum
or external scale feedback pulse total sum to "0".

.Display of Analog Input Value

Input voltage value [V]

Input signal

•Select the signal No. to be monitored by pressings Ⓐ Ⓥ .

(SPR analog input value, unit [V]) Displays the value after offset correction.

(CCWTL analog input value, unit [V])

(CWTL analog input value, unit [V])
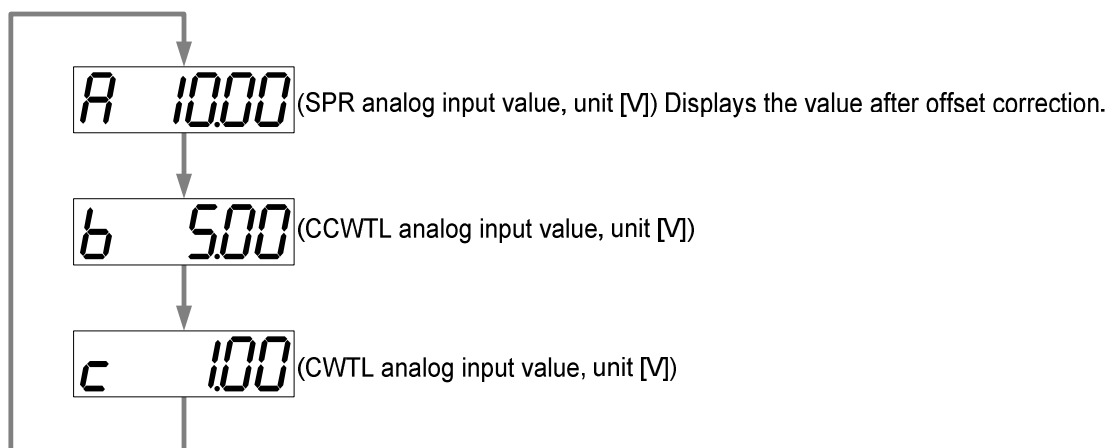
Note) Voltage exceeding ± 10V can not be displayed correctly.

3-4 Parameter Setup Mode

.Operation at SELECTION display

From the initial state of LED,
press ⬤ **MODE** twice,
parameter setting mode

`PArr00.`

Parameter No. (Hexadecimal No.)

<Note>
For parameters which place is displayed with "⌐", the content changed and written to EEPROM becomes valid after turning off the power once.

Press Ⓐor Ⓥ to select parameter No. to be referred/set.
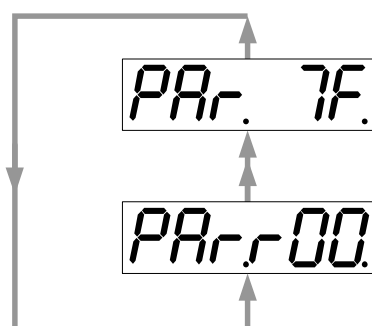
`PAr. 7F.`   Press Ⓐ to shift to arrowed direction.

`PArr00.`   Press Ⓥ to shift to reversed direction.

.Operation at EXECUTION display

`1000.`   Press ⬤ **SET** to change to EXECUTION display

You can change the value which digit has a flashing decimal point.

Parameter value

<Note> Each parameter has a limit in number of places for upper-shifting.

(1) You can change the decimal point with Ⓐ , then shift the digit for data change.

(2) Press Ⓥor Ⓐto set up the value of parameter.
Value increases with Ⓥ decreases with Ⓥ .

After setting up parameters, return to SELECT mode, referring to structure of each mode (P.28).

<Remarks>After changing the parameter value and pressing ⬤ **SET** , the content will be reflected in the control. Do not extremely change the parameter value which change might affect the motor movement very much (especially velocity loop or position loop gains).

.Instruction of Parameter Setting

Instruction of initial display example of PAr.r 1 LED

While driver powering on, the initial setting value of LED will be displayed.

P 0

Press MODE key twice to choose Pr.1.

PAr.r 1

Press SET key

Set pre-monitor of driver starting power to [Position deviation]

0

Press SET key: the pre-set monitor of powering-on driver is "position deviation", press ▲▼ to change value.

Change the pre-set monitor of powering-on driver from "position deviation" to "rotary speed of motor"

1

Press SET key again to input data Write in the set value in the panel

PAr.r 1

Press MODE key to choose EEPROM mode

Save parameter value to the EEPROM

EEPSEt.

Press SET button

EEP o

Press ▲ continuously

000000

After completing the screen and panel screen displays BEGIN, free ▲ key.

bEG in

rESEt

Turn off the control power once to reset.

r 0

The screen will display r0, which means the completion of setting.

• When you change the parameters which contents become valid after resetting, rESEt will be displayed after finishing wiring. Turn off the control power once to reset.

Note 1) When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

Note 2) Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

3-5 EEPROM Writing Mode

3-5-1 EEPROM Writing

.Operation at SELECTION display

Starting from the initial LED status,press ⬤ᴹᴼᴰᴱ then brings the display of

EEPROM Writing Mode

| EEPSEt. | Press to make EXECUTION DISPLAY |

Press Ⓐ or Ⓥ to choose SEt Writing parameter to EEPROM.

dEF Writing default parameter to EEPROM

<Attention>
To write in factory default value while Servo OFF.

.Operation at EXECUTION display

Under option screen of | EEPSEt. | , press ⬤ˢᴱᵀ to choose | EEP   o | execution display.

While executing writing-in, continuously press Ⓐ until | bEG in | is displayed.

"*O*" increases while keep pressing Ⓐ (for approx. 5sec)

| EEP   o |

Ⓐ

| 000000 |

Ⓐ

Starts writing. | bEG in |

Finishes writing | rESEt | | End | | Error |

Writing completes   Writing error

• When you change the parameters which contents become valid after resetting, | rESEt | will be displayed after finishing wiring. Turn off the control power once to reset.

Note 1) When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

Note 2) Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

3-5-2 Write in FactoryDefault Value in EEPROM

.Operation at SELECTION display

From the initial state of LED,

press 🔴 (MODE) three times to enter into EEPROM writing-in mode.

| EEPSEt. | Press to make EXECUTION DISPLAY |

Press ⓐ or ⓥ to choose **SEt** Writing parameter to EEPROM.

dEF Writing default parameter to EEPROM

<Attention>
To write in factory default value while Servo OFF.

Now press ⓐ or ⓥ to set writing-in parameters of EEPROM or writing-n factory defautl value of EEPROM.

.Operation at EXECUTION display

Under option screen of | EEPdEF. |, press 🔵 (SET) to choose | rEAd o | execution display.

While executing writing-in, continuously press ⓐ until | bEG in | is displayed.

"**0**" increases while keep pressing ⓐ (for approx. 5sec)
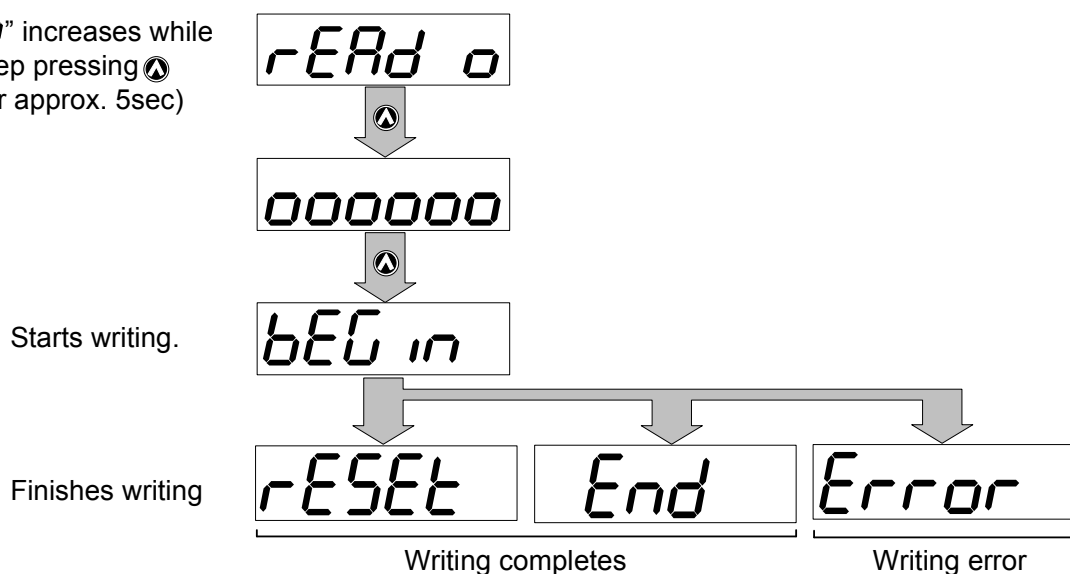
| rEAd o |

⬇ ⓐ

| 000000 |

⬇ ⓐ

Starts writing.

| bEG in |

Finishes writing

| rESEt | | End | | Error |

Writing completes   Writing error

• When you change the parameters which contents become valid after resetting, | rESEt | will be displayed after finishing wiring. Turn off the control power once to reset.

Note 1) When writing error occurs, make writing again. If the writing error repeats many times, this might be a failure.

Note 2) Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

3-6 AUTO-GAIN mode

.Off-line auto gain adjustment

<Emphasis>

●about in- line auto-gain , pleas reference chapter 6-3.

●The motor will be driven in a preset pattern by the driver in off-line auto-gain tuning mode. You can change this pattern with Pr25 (Setup of action at off-line auto-gain tuning), however, shift the load to where the operation in this pattern may not cause any trouble, then execute this tuning.

●Depending on the load, oscillation may occur after the tuning. In order to secure the safety, use Pr14 to eliminate the noise.

.Operation at SELECTION display

From the initial state of LED,

press ● (MODE) four times to enter into Auto-Gain setting mode.

AtGn 10. Display

Stiffness factor(0~15)
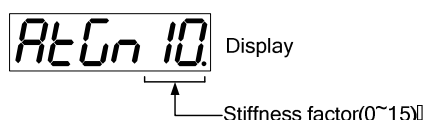
Now press ⊙ or ⊙ to set mechanical stiffness factor (1~15).

.Operation at EXECUTION display

Press ● (SET) to display AtGn o execution screen。

don't input the external command and servo on status
Keep press ⊙ (approx 5sec) Continued to increase

Start auto-gain process

End

Completed   Error: No Servo ON

<Attention>
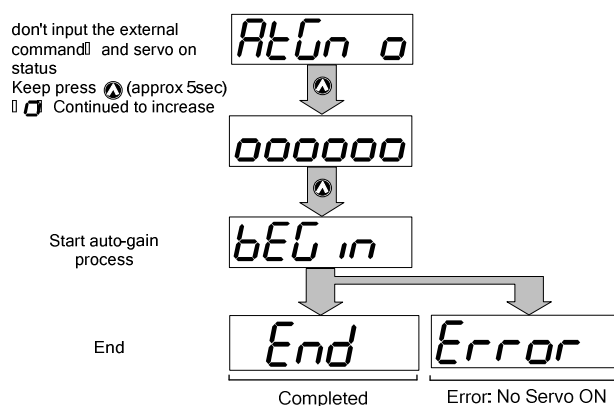
For avoiding loss of gain when closing power, please setting into the EEPROM.

When adjustment is wrong, please adjust the gain parameter back to the previous data. Except abnormality, servo motor will not cease.Moreover, as load difference.sometimes machine will produce vibration but not faults, so pay attention to the safety.

Error occurred,checking the motor Servo ON state.

3-7 auxiliary function mode

3-7-1 Procedure for Trial Run

You can make a trial run (JOG run) without connecting the Connector, I/F to the host controller such as PLC.

<Remarks>

• Separate the motor from the load, detach the Connector, CN X5 before the trial run.

• Bring the user parameter setups (especially Pr11-14 and 20) to defaults, to avoid oscillation or other failure.

• Inspection Before Trial Run

(1) Inspection on wiring
• Miswiring ?
(Especially power input and motor output)
• Short or grounded ?
• Loose connection ?

(2) Confirmation of power supply and voltage
• Rated voltage ?

(3) Fixing of the servo motor
• Unstable mounting ?

(4) Separation from the mechanical system

(5) Release of the brake
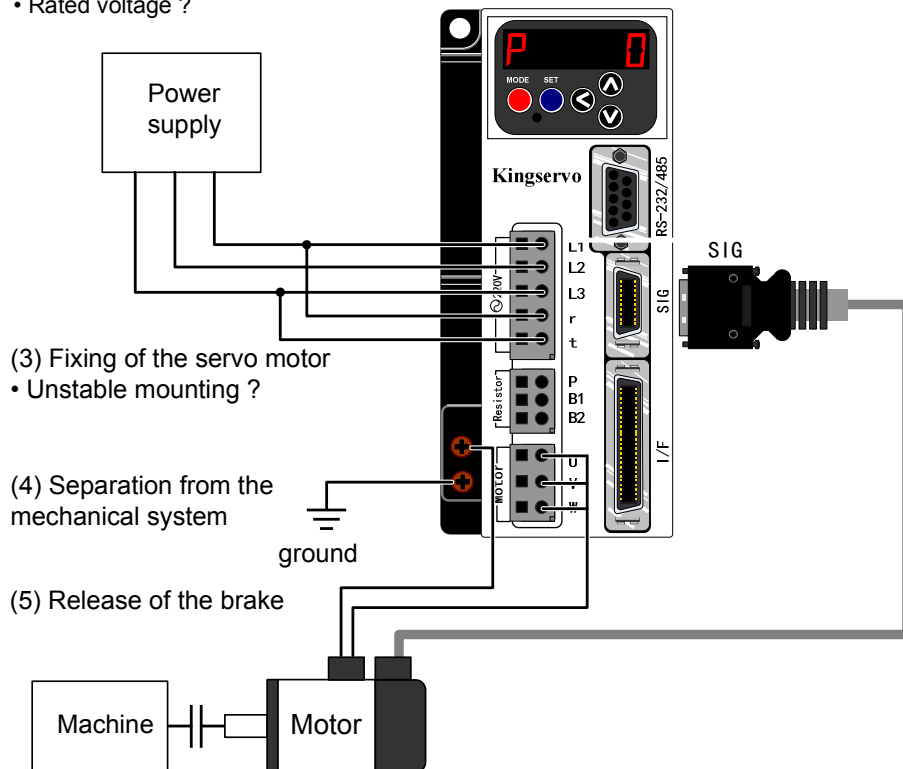
(6) Turn to Servo-OFF after finishing the trial run by pressing ⊙.

.Operation at SELECTION display
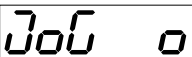
. auxiliary function mode

From the initial state of LED,

press ⊙ (MODE) five times to enter into auxiliary function mode.

Press ⊙ ⊙ ,to display `Au JoG.`

.Operation at EXECUTION display

Press ⊙ (SET) to display `JoG  o` execution screen.

" `o` " increases while keep pressing ⊙ (for approx. 5sec)

`JoG  o`

⊙

`000000`

⊙

Stage of trial run `JoGrdY.`   `Error`   `Err. 13`   Turns to Servo-OFF by pressing ⊙ (SET).

Servo-ON status   Not a Servo-Ready.

while inputing SVO-ON input signal   While cutting off main power
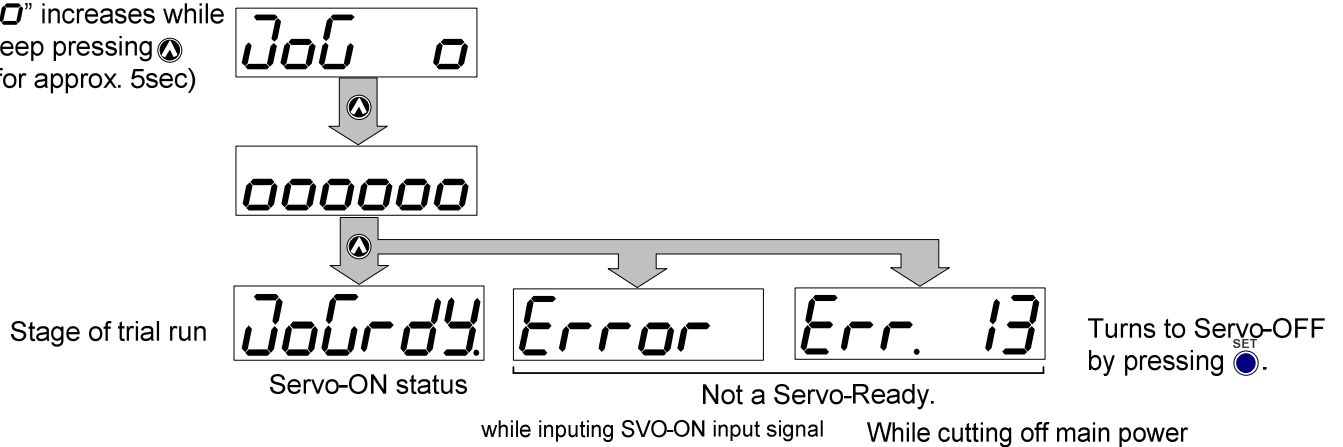
Press ⊙ , motor rotates along CCW; press ⊙ , motor rotates along CW. Rotate motor with the speed set according to Pr57(JOG speed) (Page84).

Free ⊙ ⊙ , and the motor will cease at once.
After testing run, refer to the structure of all modes in P32 and return to option screen.

3-7-2 Alarm Clear Screen

.Operation at SELECTION display
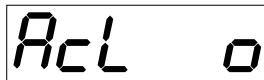
From the initial state of LED,

press ⦿ MODE five times to enter into auxiliary function mode.

Press ⓐ ⓥ ,to display $\boxed{\text{Au AcL.}}$

.Operation at EXECUTION display

Press ⦿ SET to display $\boxed{\text{AcL o}}$

" o " increases while keep pressing ⓐ (for approx. 5sec)

$\boxed{\text{AcL o}}$

ⓐ

$\boxed{\text{000000}}$

ⓐ

End

$\boxed{\text{End}}$ $\boxed{\text{Error}}$

Alarm clear completes   Clear is not finished.
Release the error by resetting the power.

3-7-3 Automatic Offset Adjustment

.Operation at SELECTION display

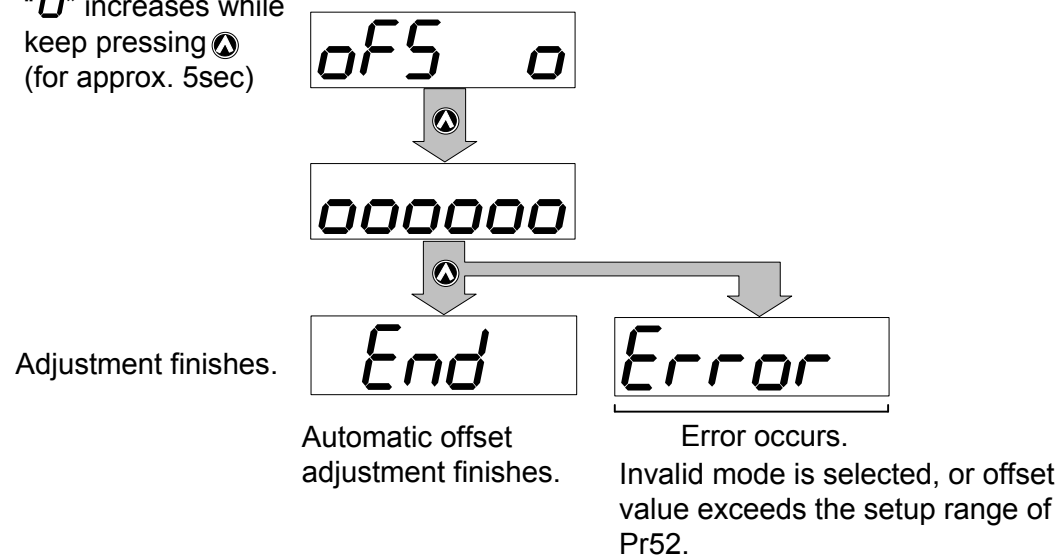From the initial state of LED,

press ⚫ (MODE) five times to enter into auxiliary function mode.

Press ⊙⊙ ,to display ┌─────────┐
│ Au oFS. │
└─────────┘

.Operation at EXECUTION display

Press ⚫ (SET) to display ┌─────────┐
│ Au oFS. │
└─────────┘

"□" increases while keep pressing ⊙ (for approx. 5sec)

┌─────────┐
│ oFS o │
└─────────┘

⊙

┌─────────┐
│ 000000 │
└─────────┘

⊙

Adjustment finishes.

┌─────────┐   ┌─────────┐
│ End   │   │ Error   │
└─────────┘   └─────────┘

Automatic offset   Error occurs.
adjustment finishes.   Invalid mode is selected, or offset
                          value exceeds the setup range of
                          Pr52.

<Notes>

This function is invalid at position control mode.

You cannot write the data only by executing automatic offset adjustment.

Execute a writing to EEPROM when you need to reflect the result afterward.

3-7-4 Alarm history clear finishes.

.Operation at SELECTION display
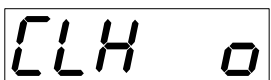
From the initial state of LED,

press ⬤ (MODE) five times to enter into auxiliary function mode.

Press ⓐⓥ ,to display `Au CLH.`

.Operation at EXECUTION display

Press ⬤ (SET) to display `Au CLH.`

" *□* " increases while
keep pressing ⓐ
(for approx. 5sec)

`CLH    □`

⬇ ⓐ

`□□□□□□`

⬇ ⓐ

End   `End`

Alarm history clear finishes.

<Instruction>

The function can clear the abnormaly record.

Charpter 4 Parameters

4-1Setting of Parameters and Modes

4-1-1Introduction of Parameters

Driver has parameters setting features and functions. The chapter will introduce the funciton of every parameter. Read it carefully and ajust parameters to the best operating condition before application.

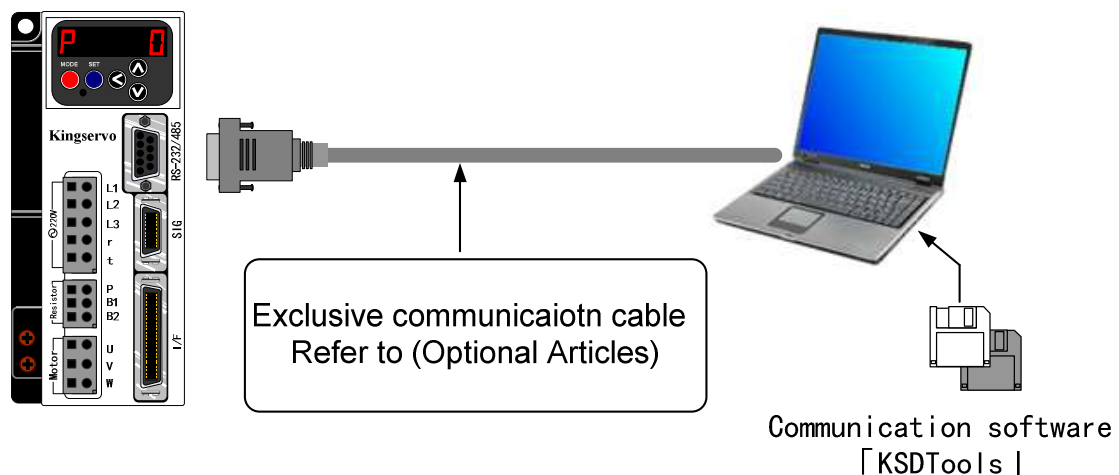### 4-1-2 Setting Method

The setting mothod of parameters is as following:

1. Front panel of machine
2. Set up supporting software KSDTools by computer.

<Instruction>

About the setting method of computer screen, refer to the munual of KSDTools.

4-1-3 Connection Method

Exclusive communicaiotn cable
Refer to (Optional Articles)

Communication software
「KSDTools」

4-1-4 Contents and List of parameters

Type	Parameter No. (Pr□□)	Abstract
Function Seletcion	00 to 0F	selection of control mode, designation of input/output signal, setting of communicaiton transition rate etc
Adjustment	10 to 20 27 to 2B	(first and second)servo gain of position, speed and integral tec or setting of time constant of all filters. External noise detector, CCW and CW torque control offset etc.
	30 to 3D	shift related setting of the first gain to the second gain.
Position Control	40 to 4D	setting of input form and direction of commnad pulse, setting of division of output pulse of encoder and setting of division rate of command pulse etc.
Speed/Torque Control	50 to 5A 74 to 77	nput gain setting, rotary limit setting and offset adjustment of speed commander, internal speed(1 to 4 level) setting and setting of accelerating/decelerating time etc.
	5B to 5E	input gain setting, rotary limit setting and offset adjustment of torque commander
Process	60 to 6C	setting of output signal detection condition of on-position, zero speed attainment etc. while main power off, alarm occurs and Servo OFF, speeddown operation or setting of release condition of differential counter.

More information, refer to the parameter setting of all control modes.

● The introduction of marks of all modes is as following.

Mark	Control Mode	Setting value of Pr02
P	positon control	0
S	speed control	1
T	torque contro	2

Mark	Control Mode	Setting value of Pr02
P/S	Positon(first)and speed(second) control	3＊
P/T	Positon(first)and torque(second) control	4＊
S/T	Speed(first)and torque(second) control	5＊

＊ if 3.,4and 5 complex modes are set, one of the first and second modes can be chosen according to control mode shift input(C-MODE).

While C-MODE is broken circuit, the first mode is chosen

While C-MODE is short circuit, the second mode is chosen.

Before and after 10ms of shift, don't input command.

Parameters for Functional Selection

Parameter No. (Pr□□)	Function	Pre-set value	Range	Unit	Applicable Mode
★00	(Used by Manufacturer)				
★01	LED initial display state	0	0~13	-	All
★02	Control mode setting	0	0~5	-	All
03	Invalid analog torque limit input	1	0~2	-	P，S
★04	Invalid drive inhibition input	1	0~2	-	All
05	Ixternal/external shift of speed setting	0	0~3	-	S
06	Invalid zero speed clamp	0	0~2	-	S，T
07	Speed monitor option	3	0~9	-	All
08	Torque monitor option	0	0~7	-	All
09	Output option during torque limit	0	0~4	-	All
0A	Output option of zero speed detection	1	0~4	-	All
★0C	Setting of RS232C communicaiton baud	3	0~3	-	All

● Modification of parameter No. marked with ★ will be effective only after control power is reset.

Parameters for Adjustment of Time Constants of Gains and Filters

Parameter No. (Pr□□)	Function	Pre-set value	Range	Unit	Applicable Mode
10	First position loop gain	47	1~2000	1/S	P
11	First speed loop gain	36	1~3500	Hz	All
12	Time constant of first speed loop integral	28	0~1000	0.01ms	All
13	First speed detection filter	0	0~5	-	All
14	Time constant of first torque filter	65	25~2500	0.01ms	All
15	Speed feed-forward	300	0~1500	0.1%	P
16	Time constant of speed feed-forward filter	50	0~6400	0.01ms	P
18	Second position loop gain	54	1~2000	1/S	P
19	Second speed loop gain	36	1~3500	Hz	All
1A	Time constant of second speed loop integral	130	0~1000	ms	All
1B	Second speed detection filter	0	0~5	-	All
1C	Time constant of second torque filter	65	25~2500	0.01ms	All
1D	First notch filter frequency	1600	50~1600	Hz	All
1E	First notch filter width	4	0~4	-	All
20	Inertia ratio	0	0~10000	-	All
21	Real-time Auto-gain	0	0~7	-	All
22	Real-time Auto-gain stiffness	4	0~15	-	All
25	Off-line Auto-gain	0	0~7	-	All
27	External noise detection	0	0~8	-	All
28	Second external noise filter	1600	100~1600	Hz	All
29	Second external noise filter width	2	0~4	-	All
2A	Second external noise filter depth	0	0~99	-	All

Parameters for Adjustment (2nd Gain Switching Function)

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
30	Second gain action setting	0	0~1	-	All
31	Position control shift mode	7	0~8	-	P
32	Position control shift delay time	5	0~10000	ms	P
33	Position control shift level	100	0~10000	-	P
34	Position control shift width	30	0~10000	-	P
35	Position gain shift time	4	0~10000	(set value+1)ms	P
36	Speed control shift mode	0	0~5	-	S
37	Speed control shift delay time	0	0~10000	ms	S
38	Speed control shift level	0	0~10000	-	S
39	Speed control shift width	0	0~10000	-	S
3A	Torque control shift mode	0	0~3	-	T
3B	Torque control shift delay time	0	0~10000	ms	T
3C	Torque control shift level	0	0~10000	-	T
3D	Torque control shift width	0	0~10000	-	T

Parameters for Position Control

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
★40	Command pulse input option	0	0~1	-	P
★41	Command pulse reverse	0	0~1	-	P
★42	Pulse input mode setting	1	0~3	-	P
43	Invalid input commnad pulse inhibition	1	0~1	-	P
★44	Output pulse pre-division of every reversion	0	1~255	-	P
★45	Feedback pulse output logic RP	0	0~1	-	P
46	First instruction electric gear numerator	1	1~10000	-	P
47	Second instruction electric gear numerator	1	1~10000	-	P
★48	FIR smooth setting	0	0~3	-	P
4A	Electric gear numerator rate	0	0~17	-	P
4B	Electric gear denominator	1	1~10000	-	P
4C	Smooth filter setting	1	0~7	-	P
4D	Counter clearance input mode	1	0~2	-	P
★4E	Numerator of pulse output division	10000	1~10000	-	All
★4F	Denominator of pulse output division	1	1~255	-	All

● Modification of parameter No. marked with ★ will be effective only after control power is reset.

Parameters for Velocity and Torque Control

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
50	Speed control input gain	500	10~2000	rpm/V	S，T
51	Speed control input reverse	1	0~1	-	S
52	Speed control offset	0	-2047~2047	0.3mV	S，T
53	First of speed setting	0	-10000~10000	rpm	S
54	Second of speed setting	0	-10000~10000	rpm	S
55	Third of speed setting	0	-10000~10000	rpm	S
56	Fourth of speed setting	0	-10000~10000	rpm	S，T
74	Fifth of speed setting	0	-10000~10000	rpm	S
75	Sixth of speed setting	0	-10000~10000	rpm	S
76	Seventh of speed setting	0	-10000~10000	rpm	S
77	Eighth of speed setting	0	-10000~10000	rpm	S
57	Jog speed setting	200	1~2000	rpm	All
58	Acceleration time setting	0	0~10000	1ms/(1000rpm)	S
59	Deceleration time setting	0	0~10000	1ms/(1000rpm)	S
5A	Sigmoid acceleration/ deceleration time setup	0	0~1000	2ms	S
5B	Torque command select	0	0~1	-	T
5C	Torque control input gain	30	10~100	0.1V/100%	T
5D	Torque control input reverse	0	0~1	-	T
5E	First torqeu limit setting	300	0~300	%	All
5F	Second torqeu limit setting	300	0~300	%	All

Parameter No.(Pr□□)	Function	Pre-set Value	Range	Unit	Applicable Mode
60	On-position range	10	0~32767	Pulse	P
61	Zero speed	50	10~10000	rpm	All
62	Speed arrival	1000	10~10000	rpm	S,T
63	Setting of excessive position deviation	20000	1~32000	Pulse	P
64	Invalid abnormality of excessive position deviation	0	0~1	-	P
65	On-position output setting	0	0~3	-	P
66	Sequence at driver inhibition input	0	0~1	-	All
67	Sequence at main power off	0	0~7	-	All
68	Sequence at alarm	0	0~3	-	All
69	Sequence at servo off	0	0~7	-	All
6A	Setup of mechanical brake action at stalling	0	0~500	ms	All
6B	Setup of mechanical brake action at running	0	0~500	ms	All
★6C	Selection of external regenerative resistor	0	0~2	-	All

●Modification of parameter No. marked with ★ will be effective only after control power is reset.
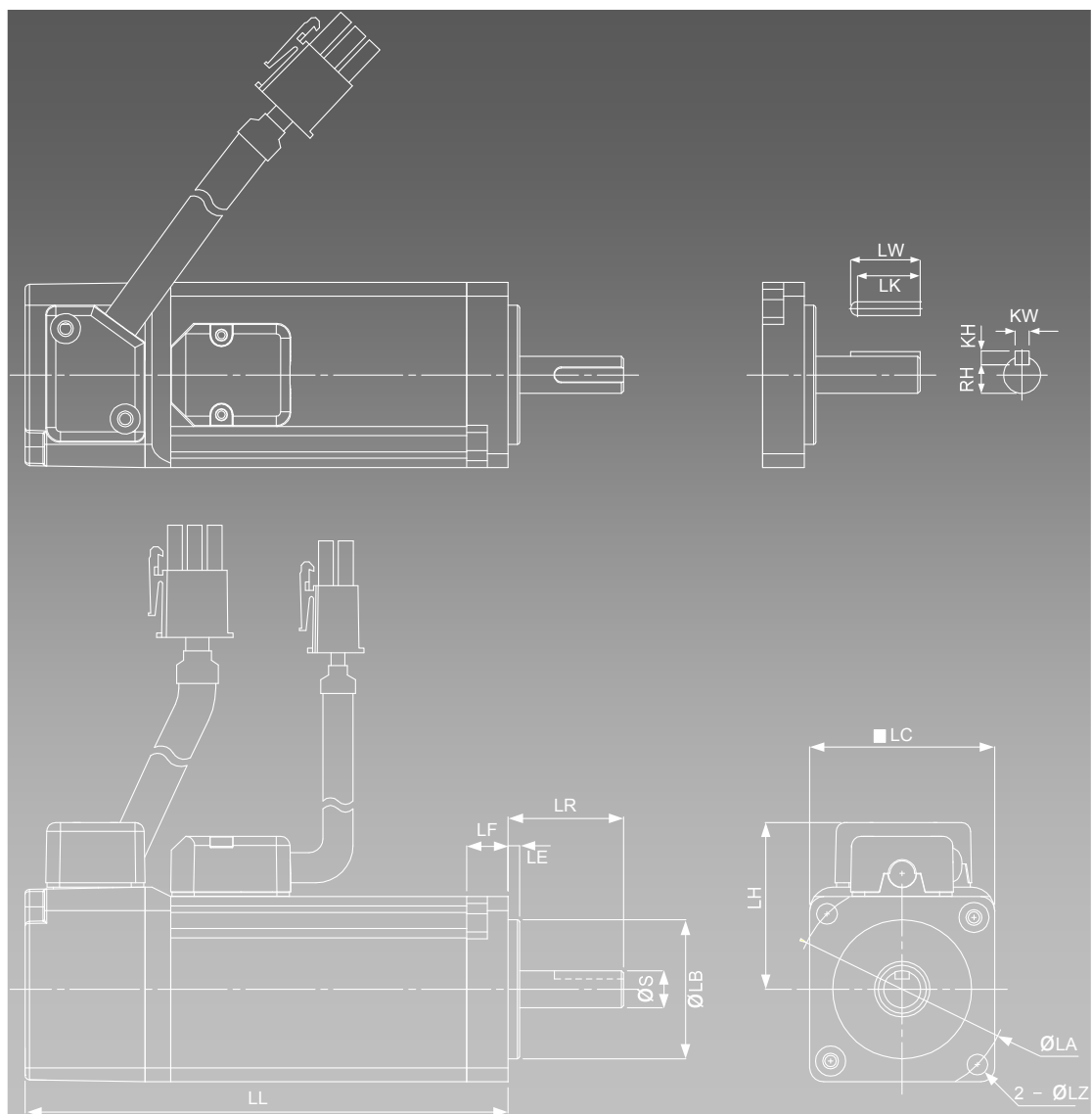
4-2 Instruction of Parameter Function

【 】：Factory default value

★：Control power need be restarted while modifying parameters.

Pr01 |LED Initial Display   ★

Initial Value：【0】
Setting Range：0~13
Unit：－
Function：You can select the type of data to be displayed on the front panel LED (7 segment) at the initial status after power-on.

Set Value	Contents
【0】	Position Deviation
1	Rotary Speed of Motor
2	Torque Output
3	Control Mode
4	I/O Signal State
5	Abnormality Record
6	Software Version
7	Warning Notice
8	Retrogradation Load Rate
9	Overload Load Rate
10	Inertia ratio
11	Sum of Feedback Pulse
12	Sum of Command Pulse
13	Analog Input Value
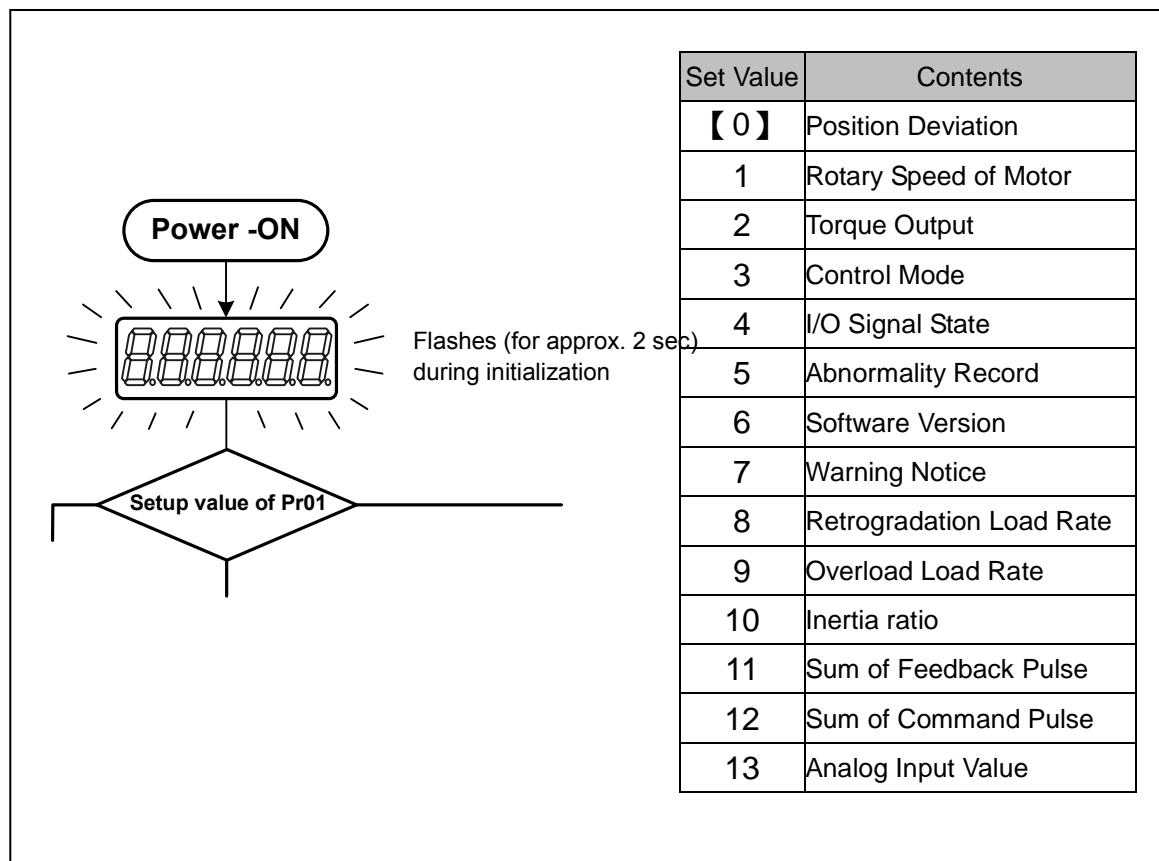
Pr02 |Setup of control mode ★

Initial Value：【0】

Setting Range：0~5

Unit：－

Function：You can set up the control mode to be used.

Setting Value	Control Mode	
	First Mode	Second Mode
【0】	Position	－
1	Speed	－
2	Torque	－
3	Position	Speed
4	Position	Torque
5	Speed	Torque

If setting is a complex mode (Pr02=3,4,5), control mode shift input (C-MODE) is used to make shift between first and second mode.

C－MODE (OPEN) (ON) (OPEN)

1st 2nd 3th

10ms or longer   10ms or longer
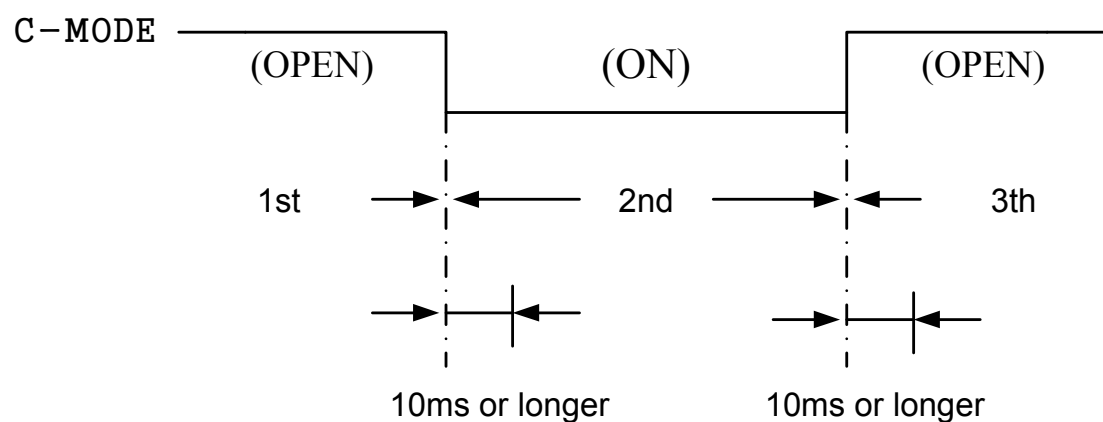
＜**Attention**＞

Don't enter commands 10ms before/after switching.

Position, speed and torque instruction are not allowed to input.

Pr03 | Analog Torque Limit Input Invalidity

Initial Value：【1】

Setting Range：0~2

Unit：–

Function： You can set up the torque limiting method for CCW/CW direction.

If not using torque limit function, set Pr03 to "1".
Use angle torque limit input (CCWTL：Pin16,CWTL：Pin18) CCWTL
and CWTL will be limited by Pr5E

設定值	CCW	CW
0	CCWTL：Pin16	CWTL：Pin18
【1】	CCW/CW 的扭力極限值皆由 Pr5E 設定	
2	由 Pr5E 設定	由 Pr5F 設定

This parameter is invalid in the torque control mode, CCW/CW
torque limit value will be set by Pr5E.

Pr04 | Drive Inhibition Input Invalidity ★

Initial Value：【1】

Setting Range：0~2

Unit：−

Function：In linear drive application, you can use this over-travel inhibiting function to inhibit the motor to run to the direction specified by limit switches which are installed at both ends of the axis, so that you can prevent the work load from damaging the machine due to the over-travel. With this input, you can set up the action of over-travel inhibit input.
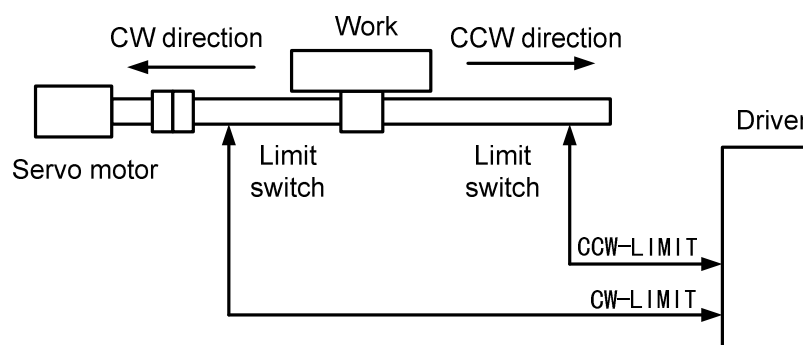
Set Value	CCW-LIMIT/ CW-LIMIT Input	Input	Connect COM-	Action
0	Valid	CCW-LIMIT (CN I/F,Pin-9)	Close	Close normal state of limit switch in the end of CCW
			Open	CCW is prohited、CW is permitted
		CW-LIMIT (CN I/F,Pin-8)	Close	Close normal state of limit switch in the end of CW
			Open	CW is prohited、CCW is permitted.
【1】	Invalid	Ignore CCW-LIMIT/CW-LIMIT input，drive inhibition funciton is invalid		
2	Valid	If one of CCW/CW inhibtion inputs is open circuit with COM-, Err38(Run-inhibition input protection) occurs.		

<Notes>

1. When Pr04 setting is 0 and drive inhibition input valid, program set by Pr66(Sequence at driver inhibition input) is used to make speed-down and cease. For detail, refer to instruction of Pr66.

2. If Pr04 setting is 0 and CCW-LIMIT and CW-LIMIT input is open meanwhile, driver is judged as abnormal state, Err38(Run-inhibition input protection) will occur.

3. When you turn off the limit switch on upper side of the work at vertical axis application,the work may repeat up/down movement because of the loosing of upward torque. In this case, set up Pr66 to 2, or limit with the host controller instead of using this function.

Pr05 | Speed setup,Internal/External switching

Initial Value：【0】

Setting Range：0~3

Unit：－

Function：This driver is equipped with internal speed setup function so that you can control the speed with contact inputs only.

- Set the validity of internal speed setting.
- 8 types of internal speed. Their instruction data are setting to Pr53（1st speed）、Pr54（2nd speed）,Pr55（3rd speed）,Pr56（4th speed）,Pr74（5th speed）,Pr75（6th speed）,Pr76（7th speed）and Pr77（8th speed）.

- As setting value is 1 or 2, shift of 4 internal speed commands is selected by 2 inputs.
  (1) PULS-INH（CN I/F，Pin-33）：Option input of first speed of speed setting
  (2) CLR（CN I/F，Pin-30）：Option input of 2nd speed of speed setting, ignore DIV input.

- As setting value is 3, shift of 8 internal speed commands is selected by 3 inputs.
  (1) PULS-INH（CN I/F，Pin-33）：Option input of first speed of speed setting
  (2) CLR（CN I/F，Pin-30）：Option input of second speed of speed setting
  (3) DIV（CN I/F，Pin-28）：Option input of third speed of speed setting

PULS-INH (Pin-33)	CLR (Pin-30)	DIV (Pin-28)	Pr05 Setting Value			
			0	1	2	3
OFF	OFF	OFF	Analog speed command (CN I/F，Pin-14)	1st speed of internal speed（Pr53）	1st speed of internal speed（Pr53）	1st speed of internal speed（Pr53）
ON	OFF	OFF	Analog speed command (CN I/F，Pin-14)	2nd speed of internal speed（Pr54）	2nd speed of internal speed（Pr54）	2nd speed of internal speed（Pr54）
OFF	ON	OFF	Analog speed command (CN I/F，Pin-14)	3rd speed of internal speed（Pr55）	3rd speed of internal speed（Pr55）	3rd speed of internal speed（Pr55）
ON	ON	OFF	Analog speed command (CN I/F，Pin-14)	4th speed of internal speed（Pr56）	Analog speed command (CN I/F，Pin-14)	4th speed of internal speed（Pr56）
OFF	OFF	ON	Analog speed command (CN I/F，Pin-14)	1st speed of internal speed（Pr53）	1st speed of internal speed（Pr53）	5th speed of internal speed（Pr74）
ON	OFF	ON	Analog speed command (CN I/F，Pin-14)	2nd speed of internal speed（Pr54）	2nd speed of internal speed（Pr54）	6th speed of internal speed（Pr75）
OFF	ON	ON	Analog speed command (CN I/F，Pin-14)	3rd speed of internal speed（Pr55）	3rd speed of internal speed（Pr55）	7th speed of internal speed（Pr76）
ON	ON	ON	Analog speed command (CN I/F，Pin-14)	4th speed of internal speed（Pr56）	Analog speed command (CN I/F，Pin-14)	8th speed of internal speed（Pr77）

· 4 speed examples using internal speed instruction. Except CL/INH input, if expecting to control motor's drive and stop, input zero speed clamp input (ZERO-SPD) and server on input (SVO-ON).
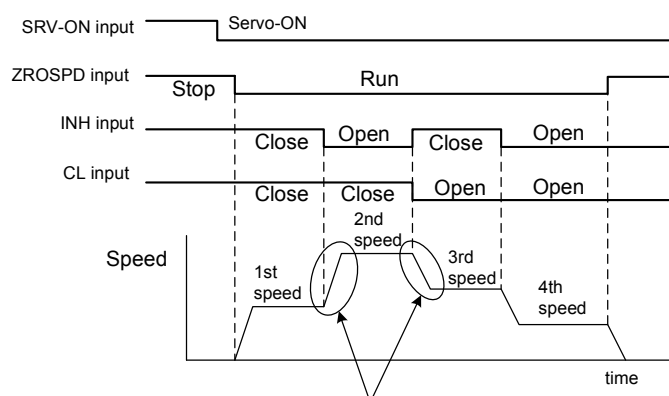
<Caution>
You can individually set up acceleration time,deceleration time, and sigmoid acceleration/deceleration time with parameter.Refer to
Pr58 : Acceleration time setup
Pr59 : Deceleration time setup
Pr5A : Sigmoid acceleration/deceleration time setup in this Chapter.

Pr06 | Selection of ZEROSPD input

Initial Value：【0】
Setting Range：0~2
Unit：–
Function：Set zero speed clamp input（ZERO-SPD：CN I/F PIN 26）.

Setting Value	ZERO-SPD Input（PIN 26）
【0】	Ignore ZERO-SPD input, non-zero speed clamp state.
1	Valid ZERO-SPD Input, if openning with COM-, speed command is 0.
2	If changing to direction sign and openning with COM-, speed command direction is CCW; if keeping short circuit with COM-, its direction is CW.

Pr07 | Selection of speed monitor (SP)

Initial Value：【3】
Setting Range：0~9
Unit：–
Function：Make choice and set the relation voltage output to speed monitor signal output (SPM:CN I/F PIN 43) and motor's actual speed and intruction speed.

Setting Value	SPM Signal	Relation Between Output Voltage Level and Speed
【0】	Motor speed	6V/375rpm
1		6V/750rpm
2		6V/1500rpm
3		6V/3000rpm
4		6V/6000rpm
5	Command speed	6V/375rpm
6		6V/750rpm
7		6V/1500rpm
8		6V/3000rpm
9		6V/6000rpm

Pr08 | Selection of torque monitor (IM)

Initial Value：【0】
Setting Range：0~7
Unit：－
Function：Set relation between output level of analog torque monitor signal(TM:CN I/F,PIN 42) and TM, or deviation pulse number.

Setting Value	TM Signal	Relation Between Output Level and TM, or Deviation Pulse Number
【0】	Torque	3V/100%
1		3V/200%
2		3V/300%
3	Position Deviation	3V/31p
4		3V/125p
5		3V/500p
6		3V/2000p
7		3V/8000p

Pr09 | Selection of TLC output

Initial Value：【0】
Setting Range：0~4
Unit：－
Function：Assign the functions of output during torque limit(TLC:CN I/F PIN 40).

Setting Value	Function	Mark of Signal	TLC output condiction
0	Output during torque limit	TLC	Torque command in Torque limit
1	Zero speed detection output	ZSP	Speed lower than Pr61
2	retrogradation Warning outpu	WARN ALL	Retrogradation higher or overload
3	Over-retrogradation warning output	WARN REG	Retrogradation more than 85%
4	Overload warning output	WARN OL	Load more than 85%

About detail of functios of all output mark, refer to instruciton of CN I/F connectors's wiring.

Pr0A | Selection of ZSP output

Initial Value：【0】
Setting Range：0~4
Unit：－
Function：Function of zero speed detection (ZSP:CN I/F PIN 12). Setting value of Pr0A and ZSP output function is same with TLC output option of above Pr09.

Pr0C | Baud rate setup of RS232 Communication　★

　　Initial Value：【3】

Setting Range：0~3

　　　　Unit：–

　　Function：You can set up the communication speed of RS232.

Setting Value	Baud
0	19200bps
1	38400bps
2	57600bps
3	115200bps

Pr10 | 1st gain of position loop

　　Initial Value：【47】

Setting Range：1~2000

　　　　Unit：1/S

　　Function：You can determine the response of the positional control system.Higher the gain of position loop you set, faster the positioning time you can obtain. Note that too high setup may cause oscillation.

Pr11 | 1st gain of velocity loop

　　Initial Value：【36】

Setting Range：1~3500

　　　　Unit：Hz

　　Function：You can determine the response of the velocity loop.In order to increase the response of overall servo system by setting high position loop gain, you need higher setup of this velocity loop gain as well. However, too high setup may cause oscillation.

　<Caution> When the inertia ratio of Pr20 is set correctly, the setup unit of Pr11 becomes (Hz).

Pr12 | 1st time constant ms of velocity loop integration

　　Initial Value：【28】

Setting Range：1~1000

　　　　Unit：ms

　　Function：You can set up the integration time constant of velocity loop.Smaller the setup, faster you can dog-in deviation at stall to 0.The integration will be maintained by setting to "999".The integration effect will be lost by setting to "1000".

Pr13 | 1st filter of speed detection

Initial Value：【0】
Setting Range：0~5
Unit：–
Function：You can set up the time constant of the low pass filter (LPF) after the speed detection, in 6 steps. Higher the setup, larger the time constant you can obtain so that you can decrease the motor noise, however, response becomes slow. Use with a default value of 0 in normal operation.

Pr14 | 1st time constant of torque filter

Initial Value：【65】
Setting Range：25~2500
Unit：0.01ms
Function：Set time constant of one time delay filter inserted into torque commander section.Effectively contain vibration caused by reversion resonance

Pr15 | Velocity feed forward

Initial Value：【300】
Setting Range：0~1500
Unit：0.1%
Function：You can set up the velocity feed forward volume at position control.Higher the setup, smaller positional deviation and better response you can obtain, however this might cause an overshoot.

Pr16 | Time constant of feed forward filter

Initial Value：【50】
Setting Range：0~6400
Unit：0.01ms
Function：You can set up the time constant of 1st delay filter inserted in velocity feed forward portion.You might expect to improve the overshoot or noise caused by larger setup of above velocity feed forward.

Pr18 | 2nd gain of position loop

Initial Value：【54】

Setting Range：1~2000

Unit：1/S

Function：Position loop, velocity loop, speed detection filter and torque command filter have their 2 pairs of gain or time constant (1st and 2nd).

The function and the content of each parameter is as same as that of the 1st gain and time constant.

Pr19 | 2nd gain of velocity loop

Initial Value：【36】

Setting Range：1~3500

Unit：Hz

Function：Refer to Pr18

Pr1A | 2nd time constant of velocity loop integration

Initial Value：【130】

Setting Range：1~1000

Unit：ms

Function：Refer to Pr18

Pr1B | 2nd filter of velocity detection

Initial Value：【0】

Setting Range：0~5

Unit：－

Function：Refer to Pr18

Pr1C | 2nd time constant of torque filter

Initial Value：【65】

Setting Range：25~2500

Unit：0.01ms

Function：Refer to Pr18

Pr1D | 1st notch frequency

Initial Value：【1600】

Setting Range：50~1600

Unit：Hz

Function：You can set up the frequency of the 1st resonance suppressing notch filter.The notch filter function will be invalidated by setting up this parameter to"1600".

Pr1E |1st notch width selection

Initial Value：【4】
Setting Range：0~4
Unit：－
Function：You can set up the notch filter width of the 1st resonance suppressing filter in 5 steps.Higher the setup, larger the notch width you can obtain.Use with default setup in normal operation.

Pr20 | Inertia ratio

Initial Value：【0】
Setting Range：0~10000
Unit：%
Function：You can set up the ratio of the load inertia against the rotor (of the motor) inertia.

Pr20=(load inertia/rotor inertia) X 100 [%]

<Caution> If the inertia ratio is correctly set, the setup unit of Pr11 and Pr19 becomes (Hz). When the inertia ratio of Pr20 is larger than the actual, the setup unit of the velocity loop gain becomes larger, and when the inertia ratio of Pr20 is smaller than the actual, the setup unit of the velocity loop gain becomes smaller.

Pr21 |Real-time auto-gain

Initial Value：【0】
Setting Range：0~7
Unit：－
Function：You can set up the action mode of the real-time auto-gain tuning. With higher setup such as 3 or 6, the driver respond quickly to the change of the inertia during operation, however it might cause an unstable operation. Use 1 or 4 for normal operation.For the vertical axis application,Use with the setup of 4 to 6.

Setting Value	Real-time auto-gain	Load inertia
【0】	Turn off	
1	Slower learning rate	Almost no change
2		
3	Normal learning rate	Change mitigation
4		
5		
6	Fast learning rate	Fast changes
7		

Setting is "0", it will turn off real-time auto-gain adjustment function.

Pr22 | Real-time auto-gain stiffness

Initial Value：【 0 】

Setting Range：0~10000

Unit：%

Function：You can set up the machine stiffness in 16 steps while the real-time autogain tuning is valid.

\<Caution\>
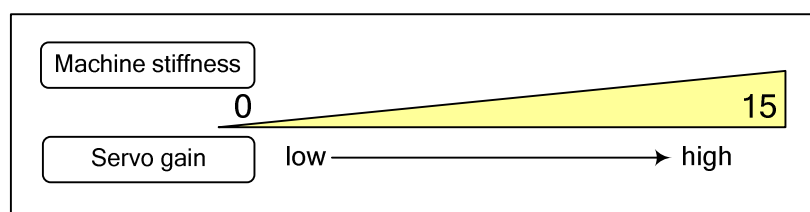
When you change the setup value rapidly, the gain changes rapidly as well, and this may damage to the machine. Increase the setup 0 to 15 gradually watching the movement of the machine until machine stable.

Pr25 | Off-line auto-gain

Initial Value：【 0 】

Setting Range：0~10000

Unit：%

Function：You can set up the action pattern at the off-line auto-gain tuning. When the setup is 0, the motor turns 2 revolutions to CCW after 2 revolutions to CW.，5 times of execution.

Setting Value	Rotational direction	Number of revolution
【 0 】	CCW → CW	2 revolution(CCW → CW)
1	CW → CCW	2 revolution(CW → CCW)
2	CCW →	2 revolution(only CCW)
3	CW →	2 revolution(only CW)
4	CCW → CW	1 revolution(CCW → CW)
5	CW → CCW	1 revolution(CW → CCW)
6	CCW →	1 revolution(only CCW)
7	CW →	1 revolution(only CW)

Pr27 | External Noise Observer

Initial Value：【0】
Setting Range：0~8
Unit：－
Function：Set compensation value of external torque noise observation to improve stability of speed loop.The high compensation value, faster response. However, large setting value easily cause resonance noise.

※If load mechanism is the mechanism with intensely changing inertia, this funciton is not suitable to be open and shall be set to 0.

Pr28 | Second external Noise Filter

Initial Value：【1600】
Setting Range：100~1600
Unit：Hz
Function：The second external Noise filter frequence setting.
You can setup the value to 1600 then close this function.

Pr29 | Second external Noise Filter width

Initial Value：【2】
Setting Range：0~4
Unit：-
Function：The second external Noise filter width 5 step setting.
Higher the setup, larger the notch width you can obtain. Use with default setup in normal operation.

Pr2A | Second external Noise Filter depth

Initial Value：【0】
Setting Range：0~99
Unit：-
Function：You can set up the second external Noise filter depth of the resonance suppressing filter. Higherthe setup, shallower the notch depth and smaller the phase delay you can obtain.

Pr30 | Setup of 2nd gain

Initial Value：【0】

Setting Range：0~1

Unit： –

Function：You can select the PI/P action switching of the velocity control or 1st/2nd gain switching.

Setting Value	Gain Option and shift
0	1st gain (PI/P switching enabled)
1	1st/2nd gain switching enabled

Switch the PI/P action with the gain switching input (Pin-27).

GAIN Input	Speed Loop Action
Open with COM-	PI Action
Connection wihtCOM-	P Action

Pr31 | 1st mode of control switching

Initial Value：【7】

Setting Range：0~8

Unit： –

Function：You can select the switching condition of 1st gain and 2nd

Setting Value	Gain Shift Condition
0	Fixed to the 1st gain.
1	Fixed to the 2nd gain.
2	2nd gain selection when the gain switching input is turned on. (Pr30 setup must be 1.)
3	2nd gain selection when the toque command variation is larger than the setups of Pr33 (1st level of control switching) and Pr34 (1st hysteresis of control switching).
4	Fixed to the 1st gain.
5	2nd gain selection when the command speed is larger than the setups of Pr33 (1st level of control switching) and Pr34 (1st hysteresis at control switching).
6	2nd gain selection when the positional deviation is larger than the setups of Pr33 (1st control switching level) and Pr34 (1st hysteresis of control switching).
7	2nd gain selection when more than one command pulse exist
8	2nd gain selection when the positional deviation counter value exceeds the setup of Pr60 (Positioning completer range).

Pr32 | 1st delay time of control switching

   Initial Value：【5】

  Setting Range：0~10000

     Unit：ms

   Function：You can set up the delay time when returning from the 2nd to the 1st gain,while Pr31 is set to 3、5、6、7、8.

Pr33 | 1st level of control switching

   Initial Value：【100】

  Setting Range：0~10000

     Unit：–

      Function：It is valid as Pr31 is set to 3, 5, 6, 7, 8. set determinant level of first/second gain shift.

Pr34 | 1st hysteresis of control switching

   Initial Value：【30】

  Setting Range：0~10000

     Unit：–

   Function：You can set up hysteresis width to be implemented above/below the judging level which is set up with Pr33. Unit varies depending on the setup of Pr31 (1st control switching mode). Definitions of Pr32 (Delay), Pr33 (Level) and Pr34 (Hysteresis) are explained in the fig. below.
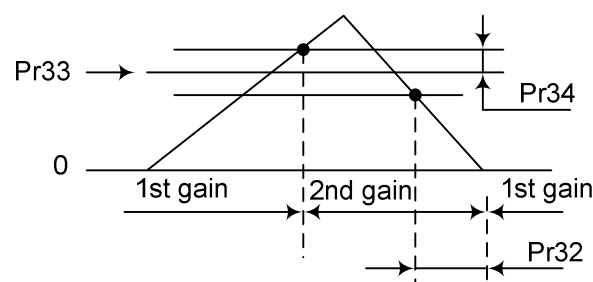
Pr35 | Switching time of position gain

Initial Value：【4】

Setting Range：0~10000

Unit：(setting value +1)ms

Function：You can setup the step-by-step switching time to the position loop gain only at gain switching while the 1st and the 2nd gain switching is valid.

e.g.)
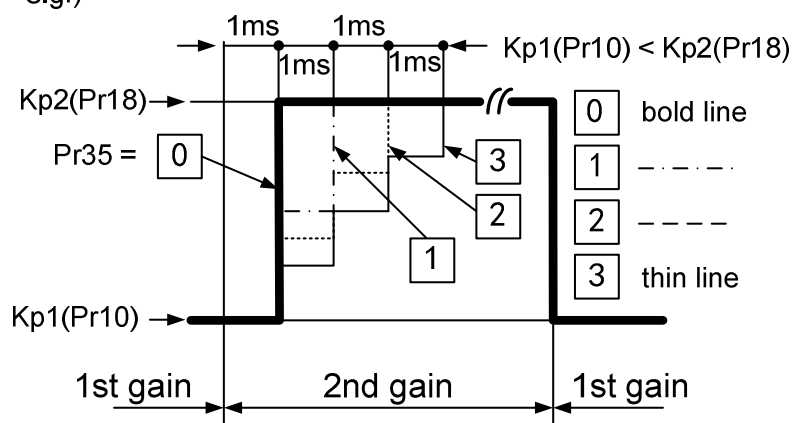
<Caution>The switching time isonly valid when switching from small position gain to large position gain.

Pr36 | Speed Control Shit Mode

Initial Value：【0】

Setting Range：0~5

Unit： –

Function：In speed control mode, make choice to the shift condition of first/second gain. It's the content that eliminates position control section in Pr31(Position control shift mode).

Setting Value	Gain Shift Condition
0	Fixation to First Gain
1	Fixation to Second Gain
2	As gain shift input（GAIN）is ON, select 2nd gain(Pr30 must be set to 1).
3	As torque instruction changes intensely, select second gain.
4	Fixation to First Gain
5	As instruction speed is big, select second gain.

Pr37 |2nd delay time of control switching

Initial Value：【0】

Setting Range：0~10000

Unit：ms

Function：The content is same with following ones in position control mode.

Pr32：Shift delay time

Pr33：Shift level

Pr34：Shift level width

Pr38 | 2nd level of control switching

Initial Value：【0】

Setting Range：0~10000

Unit： –

Function：Refer to Pr32 , Pr33 , Pr34

Pr39 | 2nd hysteresis of control switching

Initial Value：【0】

Setting Range：0~10000

Unit： –

Function：Refer to Pr32 , Pr33 , Pr34

Pr3A | 1st mode of control switching

Initial Value：【0】

Setting Range：0~3

Unit： –

Function：You can select the switching condition of 1st gain and 2nd gain while Pr31 is set to 1.

Setting Value	Gain Shift Condition
0	Fixation to First Gain
1	Fixation to Second Gain
2	As gain shift input（GAIN）is ON, select 2nd gain(Pr30 must be set to 1).
3	As torque instruction changes intensely, select second gain.

Pr3B | Torque Control Shift Delay Time

Initial Value：【0】

Setting Range：0~10000

Unit：ms

Function：The content is same with following ones in position control mode.

Pr32：Shift delay time

Pr33：Shift level

Pr34：Shift level width

Pr3C | Torque Control Shift Level

Initial Value：【0】

Setting Range：0~10000

Unit： –

Function：Refer to Pr3B

Pr3D | Torque Control Shift Level Width

Initial Value：【0】

Setting Range：0~10000

Unit：–

Function：Refer to Pr3B

Pr40 | Selection of command pulse input ★

Initial Value：【0】
Setting Range：0~1
Unit：－
Function：You can select either the photo-coupler input or the exclusive input for line driver as the command pulse input.

Setting Value	Content
【0】	Photo-coupler input (I/F PULS1:Pin-3, PULS2:Pin-4, SIGN1:Pin-5, SIGN2:Pin-6)
1	Exclusive input for line driver (I/FPULSH1:Pin-44, PULSH2:Pin-45, SIGNH1:Pin-46, SIGNH2:Pin-47)

※Photo-coupler input command frequency ≦500kpps
Exclusive input for line driver command frequency ≦2Mpps

Initial Value：【0】
Setting Range：0~1
Unit： −

Function：You can set up the rotational direction against the command pulse input, and the command pulse input format.

Pr41 setup value	Pr42 setup value	CCW command	CW command
【0】	0 or 2	A-phase PULS, B-phase SIGN — t1, t1 — B-phase advances to A by 90°.	t1, t1 — B-phase delays from A by 90°.
	【1】	PULS, SIGN — t2, t2, t3	t2, t2, t3
	3	PULS t4 t5, SIGN "L" t6, t6	PULS t4 t5, SIGN "H" t6, t6
【1】	0 or 2	A-phase PULS, B-phase SIGN — t1, t1 — B-phase delays from A by 90°.	t1, t1 — B-phase advances to A by 90°.
	【1】	PULS, SIGN — t2, t2, t3	t2, t2, t3
	3	PULS t4 t5, SIGN "H" t6, t6	PULS t4 t5, SIGN "L" t6, t6

Pr41=0,
Pr42=0 or 2   Command pulse format is 90°phase diff erence 2-phase pulse(A + B-phase)
Pr42=1   Command pulse format is CW pulse train + CCW pulse train
Pr42=3   Command pulse format is pulse train + Signal

・Permissible max. input frequency, and min. necessary time width of command pulse input signal.

Input I/F of PULS/SIGN signal		Permissible max. input frequency	Min. necessary time width					
			t1	t2	t3	t4	t5	t6
Pulse train interface exclusive to line driver		2Mpps	500ns	250ns	250ns	250ns	250ns	250ns
Pulse train interface	Line driver interface	500kpps	2µs	1µs	1µs	1µs	1µs	1µs
	Open collector interface	200kpps	5µs	2.5µs	2.5µs	2.5µs	2.5µs	2.5µs

Make the rising/falling time of the command pulse input signal to 0.1µs or smaller.

Pr42 |Setup of command pulse input mode ★

Initial Value：【1】
Setting Range：0~3
Unit： –
Function：as same as Pr41

Pr43 | Invalidation of command pulse inhibit input

Initial Value：【1】
Setting Range：0~1
Unit： –
Function：You can select either the validation or the invalidation of the command pulse inhibit input (INH : CN I/F Pin-33).

Setting Value	PULS-INH Input
0	Valid
1	Invalid

Command pulse input will be inhibited by opening the connection of INH input to COM.When you do not use INH input, set up Pr43 to 1 so that you may not need to connect INH (CN I/F Pin-33) and COM– (Pin-41) outside of the driver.

Pr44 |Output Pulse Pre-division of Every Reversion ★

Initial Value：【0】
Setting Range：0~225
Unit： –
Function：Set pre-division of one reversion pusle number of encoder pulse input to upper-level device.

$$\text{Pulse output resolution per one revolution} = \frac{\text{Encoder resolution}}{\text{Pr44}}$$

※Incremental encoder of Kingservo that resolution is 2500p/r.

When Pr44≠0，Pr4E、Pr4F setup is invalid.

Pr45 | Reversal of pulse output logic ★

Initial Value：【0】

Setting Range：0~1

Unit： –

Function：You can set up the B-phase logic and the output source of the pulse output (I/F OB+: Pin-48, OB– ： Pin-49). With this parameter, you can reverse the phase relation between the A-phase pulse and the B-phase pulse by reversing the B-phase logic.

Setup value	A-phase (OA)	at motor CCW rotation	at motor CW rotation
0	B-phase(OB) non-reversal		
1	B-phase(OB) reversal		

Pr46 | 1st numerator of electronic gear

Initial Value：【1】

Setting Range：1~10000

Unit： –

Function：Electronic gear (Command pulse division/multiplication) function

• Purpose of this function

  (1) You can set up any motor revolution and travel per input command unit.

  (2) You can increase the nominal command pulse frequency when you cannotobtain the required speed due to the limit of pulse generator of the host controller.

• Block diagram of electronic gear

  The upper limit of numeratro is 2621440. if setting value is over upper limit, then setting is invalid. More attention is that 2621440 will be numerator.
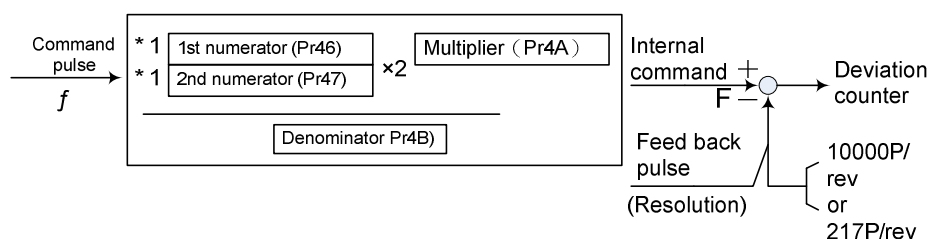
• "Numerator" selection of electronic gear

*1 : Select the 1st or the 2nd with the command electronic gear input switching (DIV : CN I/F, Pin-28)

DIV input open	Selection of 1st numerator（Pr46）
DIV input connect to COM–	Selection of 2nd numerator（Pr47）

<Setup example when numerator $\neq 0$>

• When division/multiplication ratio=1, it is essential to keep the relationship in which the motor turns one revolution with the command input (f) of the encoder resolution.Therefore, when the encoder resolution is 10000P/r, it is required to enter the input of f=5000Pulses in case of duplicate, f=40000Pulse in case of division of 1/4, in order to turn the motor by one revolution.

• Set up Pr46, 4A and 4B so that the internal command (F) after division / multiplication may equal to the encoder resolution (10000 or 2^{17}).

$$F = f \times \frac{Pr46 \times 2^{Pr4A}}{Pr4B} = 10000 \text{ or } 2^{17}$$

F：Internal command pulse counts per motor one revolution

f：Command pulse counts per one motor revolution.

Encoder resolution	$2^{17}(131072)$	10000(2500 P/r × 4)
Example 1 when making the commandinput (f) as 5000 per onemotor revolution	$\dfrac{Pr46 \boxed{1} \times 2^{Pr4A \boxed{17}}}{Pr4B \boxed{5000}}$	$\dfrac{Pr46 \boxed{10000} \times 2^{Pr4A \boxed{0}}}{Pr4B \boxed{5000}}$
Example 2 when making the commandinput (f) as 40000 per onemotor revolution	$\dfrac{Pr46 \boxed{10000} \times 2^{Pr4A \boxed{0}}}{Pr4B \boxed{5000}}$	$\dfrac{Pr46 \boxed{2500} \times 2^{Pr4A \boxed{0}}}{Pr4B \boxed{10000}}$

Pr47 | 2nd numerator of electronic gear

Initial Value：【1】
Setting Range：1~10000
Unit： –
Function：Refer to Pr46

Pr48 | Setup of FIR smoothing　　　　　　　　　★

Initial Value：【0】
Setting Range：0~3
Unit： –
Function：You can set up the moving average times of the FIR filter covering the command pulse. (Setup value + 1) become average travel times.

Pr4A | Multiplier of electronic gear numerator

Initial Value：【0】
Setting Range：0~17
Unit： –
Function：Refer to Pr46

Pr4B | Denominator of electronic gear

Initial Value：【1】
Setting Range：1~10000
Unit： –
Function：Refer to Pr46

Pr4C | Setup of primary delay smoothing

   Initial Value：【1】

Setting Range：0~7

      Unit： －

   Function：Smoothing filter is the filter for primary delay which is inserted after the electronic gear.

Purpose of smoothing filter

• Reduce the step motion of the motor while the command pulse is rough.

• Actual examples which cause rough command pulse are；

   (1) when you set up a high multiplier ratio (10 times or more).

   (2) when the command pulse frequency is low.

You can set the time constant of the smoothing filter in 8 steps with Pr4C.

Setup value	Time Constant
0	No filter function
1	Time constant small
↓	↓
7	Time constant large

Pr4D |Counter clear input mode

   Initial Value：【0】

Setting Range：0~2

      Unit： －

   Function：You can set up the clearing conditions of the counter clear input signal which clears the deviation counter.

Setting Value	Clearing condition
0	Clears the deviation counter at level (shorting for longer than 100⌠s)
1	Clears the deviation counter at falling edge (open-shorting for longer than 100⌠s)
2	Invalid

Pr4E |Numerator of pulse output division ★

Initial Value：【10000】

Setting Range：1~10000

Unit：-

Function：You can set up the pulse counts to be fed out from the pulse output (CN I/F 0A+：Pin-21, 0A-：Pin-22, 0B+：Pin-48, 0B-：Pin-49).

Pr44=<0> (Default)

The pulse output resolution per one revolution can be divided by any ration according to the formula below.

$$\text{Pulse output resolution per one revolution} = \frac{\text{Pr4E(Numerator of pulse output division)}}{\text{Pr4F(Denominator of pulse output division)}}$$

<Cautions>

•The encoder resolution is 10000 [P/r] for the 2500P/r incremental encoder.

• The pulse output resolution per one revolution cannot be greater than the encoder resolution.

(In the above setup, the pulse output resolution equals to the encoder resolution.)

• Z-phase is fed out once per one revolution of the motor.

•When Pr44≠0，Pr4E、Pr4F setup is invalid.

Pr4F |Denominator of pulse output division ★

Initial Value：【1】

Setting Range：1~255

Unit：-

Function：Refer to Pr4E

Pr50 | Input gain of speed command

Initial Value：【500】

Setting Range：10~2000

Unit：rpm/V

Function：You can set up the relation between the voltage applied to the speedcommand input (SPR：CN I/F, Pin-14) and the motor speed.

- You can set up a "slope" of the relation between the command input voltage and the motor speed, with Pr50.
- Default is set to Pr50=500 [r/min], hence input of 6V becomes 3000r/min.

<Cautions>
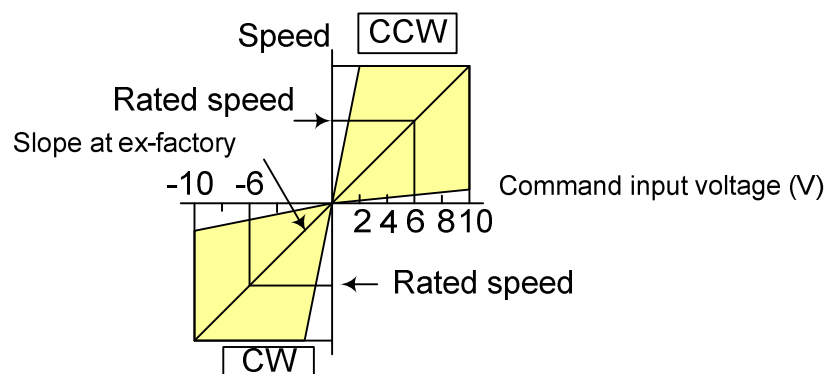
1. Do not apply more than ±10V to the speed command input (SPR).

2. When you compose a position loop outside of the driver while you use the driver in velocity control mode, the setup of Pr50 gives larger variance to the overall servo system. Pay an extra attention to oscillation caused by larger setup of Pr50.

Pr51 | Reversal of speed command input

Initial Value：【1】

Setting Range：0~1

Unit：-

Function：You can reverse the polarity of the speed command input signal (SPR:CN I/F, Pin-14). Use this function when you want to change the motor rotational direction without changing the polarity of the command signal from the host.

Setting Value	Rotation Direction of Motor
0	CCW direction with (+) command (viewed from the motor shaft end)
1	CW direction with (+) command (viewed from the motor shaft end)

<Notes>
• Default of this parameter is 1, and the motor turns to CW with (+) signal, this has compatibility to existing MINAS series driver.
• When Pr06 (ZEROSPD) is set to 2, this parameter becomes invalid.
<Caution>
When you compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

Pr52 |Speed command offset

Initial Value：【0】

Setting Range：-2047~2047

Unit：0.3mV

Function：• You can make an offset adjustment of analog speed command (SPR :CN I/F, Pin-14) with this parameter.• The offset volume is 0.3mV per setup value of "1".

• There are 2 offset methods, (1) Manual adjustment and (2) Automatic adjustment.

1) Manual adjustment

• When you make an offset adjustment with the driver alone,enter 0 V exactly to the speed command input (SPR/TRQR), (or connect to the signal ground), then set this parameter up so that the motor may not turn.

• when you compose a position loop with the host,

• Set this parameter up so that the deviation pulse may be reduced to 0 at the Servo-Lock status.

2) Automatic adjustment

• For the details of operation method at automatic offset adjustment mode, refer to P.43, "Auxiliary Function Mode" of Preparation.

• Result after the execution of the automatic offset function will bereflected in this parameter, Pr52.

Pr53 | 1st speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：When the internal speed setup is validated with parameter Pr05, "Switching of internal or external speed setup", you can set up 1st to 4th speed into Pr53 to 56, 5th to 8th speed into Pr74 to 77 in direct unit of [r/min] In torque control mode, Pr56 becomes the speed limit.

<Caution>

• The polarity of the setup value represents that of the internal command speed.

＋	Command to CCW (viewed from the motor shaft end)
－	Command to CW (viewed from the motor shaft end)

Pr54 | 2nd speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr55 | 3rd speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr56 | 4th speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr57 | JOG speed setup

nitial Value：【200】

Setting Range：1~2000

Unit：rpm

Function：You can setup the JOG speed.

Refer to Page.44, "Trial Run"of Preparation.

Pr58 | Acceleration time setup

Initial Value：【0】
Setting Range：0~10000
Unit：1ms/ (1000rpm)
Function：You can make the velocity control while adding acceleration and deceleration command to the speed command inside of the driver. With this function, you can make a soft-start when you enter the step-speed command and when you use with the internal speed setup.
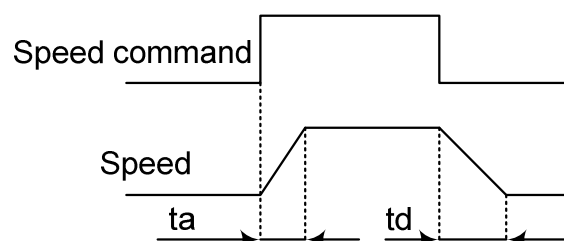
ta	Pr58	× 1ms/1000r/min
td	Pr59	× 1ms/1000r/min

<Caution>

Do not use these acceleration/deceleration time setup when you use the external position loop. (Set up both Pr58 and Pr59 to 0.)

Pr59 | Deceleration time setup

Initial Value：【0】
Setting Range：-0~10000
Unit：1ms/ (1000rpm)
Function：Refer to Pr58

Pr5A | Sigmoid acceleration / deceleration time setup

Initial Value：【0】
Setting Range：0~1000
Unit：2ms
Function：In order to obtain a smooth operation, you can set up the quasi sigmoid acceleration/deceleration in such application as linear acceleration/deceleration where acceleration variation is large at starting/stopping tocause a strong shock.
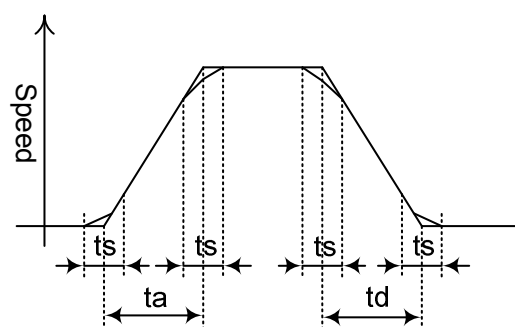
ta：Pr58　td：Pr59　ts：Pr5A

1. Set up acceleration/deceleration for basic linear portion with Pr58 and Pr59
2. Set up sigmoid time with time width centering the inflection point of linear acceleration/deceleration with Pr5A. (unit : 2ms)

Pr5B | Selection of torque command

Initial Value：【0】
Setting Range：0~1
Unit：－
Function：You can select the input of the torque command and the speed limit.

Pr5B	Torque command	Velocity limit
0	SPR/TRQR	Pr56
1	CCWTL/TRQR	SPR/TRQR

Pr5C | Input gain of torque command

Initial Value：【30】

Setting Range：10~100

Unit：0.1/100%

Function：You can set the relation between the voltage applied to the torque command input (SPR/TRQR : CN I/F, Pin-14 or CCWTL/TRQR : CN I/F, Pin-16) and the motor output torque.
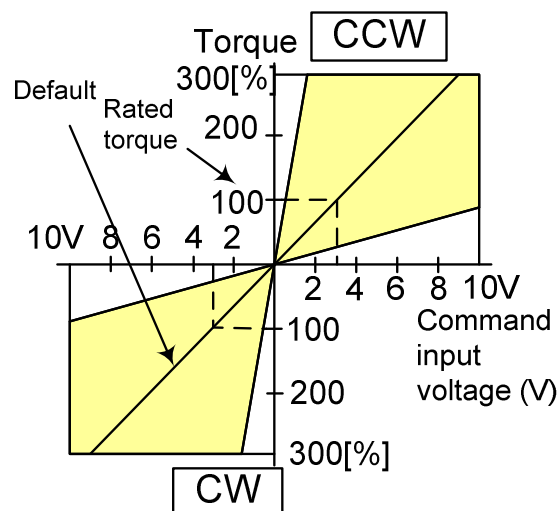
• Unit of the setup value is [0.1V/100%] and set up input voltage necessary to produce the rated torque.

• Default setup of 30 represents 3V/100%.

Pr5D |Input reversal of torque command

Initial Value：【0】

Setting Range：0~1

Unit：－

Function：You can reverse the polarity of the torque command input (SPR/TRQR : CN I/F, Pin-14 or CCWTL/TRQR : CN I/F, Pin-16)

Setup value	Direction of motor output torque
0	CCW direction (viewed from motor shaft) with (+) command
1	CW direction (viewed from motor shaft) with (+) command

Pr5E |First torque limit setup

Initial Value：【300】

Setting Range：0~300

Unit：%

Function：When Pr03=1 ,this parameter is valid.You can limit the max torque for both CCW and CW direction with Pr5E.

This torque limit function limits the max. motor torque with the parameter setup.In normal operation, this driver permits approx. 3 times larger torque than the rated torque instantaneously. If this 3 times bigger torque causes any trouble to the load (machine) strength, you can use this function to limit the max. torque.
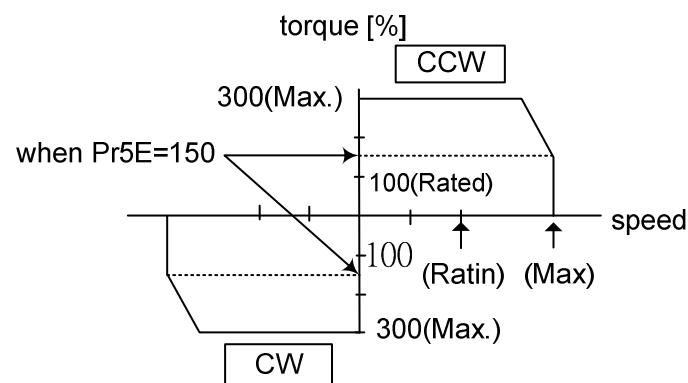
- Setup value is to be given in % against the rated torque.
- shows example of 150% setup with Pr03=1.
- Pr5E limits the max. torque for both CCW and CW directions.

Pr5F |Second torque limit setup

Initial Value：【300】

Setting Range：0~300

Unit：%

Function：Refer to Pr58. When Pr03=2 ,this parameter only limited CW torque.

Pr60 | Positioning complete(In-position) range

Initial Value：【10】

Setting Range：0~32767

Unit：Pulse

Function：You can set up the timing to feed out the positioning complete signal(ON-POS : CN I/F, Pin-39).

The positioning complete signal (ON-POS) will be fed out when the deviation counter pulse counts fall within ± (the setup value), after the command pulse entry is completed.

• Basic unit of deviation pulse is encoder "resolution", and varies per the encoder as below.

•2500P/r encoder : 4 X 2500 = 10000

<Cautions>
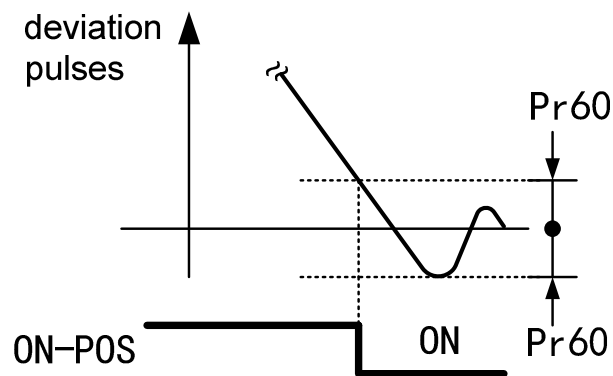
1. If you set up too small value to Pr60, the time until the ON-POS signal is fed might become longer, or cause chattering at output.

2. The setup of "Positioning complete range" does not give any effect to the final positioning accuracy.

Pr61 |Zero-speed

Initial Value：【50】

Setting Range：10~10000

Unit：rpm

Function：You can set up the timing to feed out the zero-speed detection output signal(ZSP : CN I/F, Pin-12 or TCL : CN I/F, Pin-40) in rotational speed [r/min].

The zero-speed detection signal (ZSP) will be fed out when the motor speed falls below the setup of this parameter, Pr61.
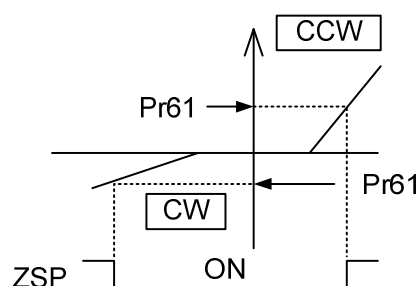
Pr62 | At-speed (Speed arrival)

Initial Value：【1000】

Setting Range：10~10000

Unit：rpm

Function：You can set up the timing to feed out the At-speed signal（AT-SP : CN I/F PIN 39）At-speed (Speed arrival) (ON-POS) will be fed out when the motor speed exceeds the setup speed of this parameter, Pr62

The setup of Pr62 is valid for both CCW and CW direction regardless of the motor rotational direction.
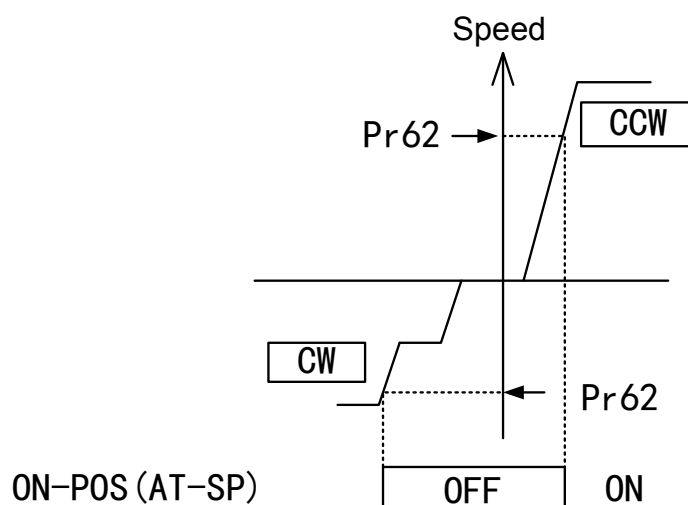
Pr63 | Setup of position deviation excess

Initial Value：【20000】

Setting Range：1~32000

Unit：Pulse

Function： You can set up the excess range of position deviation.

<Cautions>

Especially as setting of positon gain is too low and setting of Pr63 is too small, even not in the abnormality state, position deviaton excess protection may happen.

Pr64 | position deviation excess Invalidity

Initial Value：【0】

Setting Range：0~1

Unit： –

Function：This parameter can make "position deviation excess"function invalid.

Setting Value	position deviation excess
0	Valid
1	Invalid. As detaining pulses is over the determinant level set by Pr63, it will not be treated as abnormality and continue action.

Pr65 | Setup of positioning complete (on-pos) output

Initial Value：【0】

Setting Range：0~3

Unit： –

Function：You can set up the action of the positioning complete signal (ON-POS: CN I/F Pin-39) in combination with Pr60 (Positioning complete range).

Setup value	Action of positioning complete signal
0	The signal will turn on when the positional deviation is smaller than Pr60 (Positioning complete range)
1	The signal will turn on when there is no position command and the positional deviation is smaller than Pr60 (Positioning complete range).
2	The signal will turn on when there is no position command, the zero-speed detection signal is ON and the positional deviation is smaller than Pr60 (Positioning complete range).
3	The signal will turn on when there is no position command and the positional deviation is smaller than Pr60 (Positioning complete range).Then holds "ON" status until the next position command is entered.

Pr66 | Sequence at over-travel inhibit

Initial Value：【0】

Setting Range：0~1

Unit： －

Function：You can set up the running condition during deceleration or after stalling,while over-travel inhibit input （CCW-LIMIT：CN I/F PIN 9 or CW-LIMIT：CN I/F PIN 8）is valid.

Setting Value	Drive Condition		Deviation counter content
	During deceleration	After stalling	
0	DB	Free-run	Hold
1	Free-run	Free-run	Hold

Pr67 | Sequence at main power OFF

Initial Value：【0】

Setting Range：0~7

Unit： －

Function：Refer Pr69

Pr68 |Sequence at alarm

Initial Value：【0】

Setting Range：0~3

Unit： －

Function：You can set up the action during deceleration or after stalling when some error occurs while either one of the protective functions of the driver is triggered.

Setup value	Drive Condition		Deviation counter content
	During deceleration	After stalling	
0	DB	DB	Clear
1	Free-run	DB	Clear
2	DB	Free-run	Clear
3	Free-run	Free-run	Clear

(DB: Dynamic Brake action)

<Caution>

The content of the deviation counter will be cleared when clearing the alarm. Refer to "Timing Chart (When an error (alarm) occurs (at Servo-ON command status)" of Preparation.

Pr69 | Sequence at servo OFF

Initial Value：【0】

Setting Range：0~7

Unit： –

Function： When Pr65 (LV trip selection at main power OFF) is 0, you can set up.

1) the action during deceleration and after stalling

2) the clearing of deviation counter content after the main power is shut off.

Setup value	Drive Condition		Deviation counter content
	During deceleration	After stalling	
0	DB	DB	Clear
1	Free-run	DB	Clear
2	DB	Free-run	Clear
3	Free-run	Free-run	Clear
4	DB	DB	Hold
5	Free-run	DB	Hold
6	DB	Free-run	Hold
7	Free-run	Free-run	Hold

(DB: Dynamic Brake action)

Pr6A |Setup of mechanical brake action at stalling

Initial Value：【0】

Setting Range：0~200

Unit：ms

Function： You can set up the time from when the brake release signal (BRK-OFF：CN I/F, Pin-10 and 11) turns off to when the motor is de-energized (Servo-free), when the motor turns to Servo-OFF while the motor is at stall.

• Set up to prevent a micro-travel/drop of the motor (work) due to the action delay time (tb) of the brake.

• After setting up Pr6A >=tb , then compose the sequence so as the driver turns to Servo-OFF after the brake is actually activated.
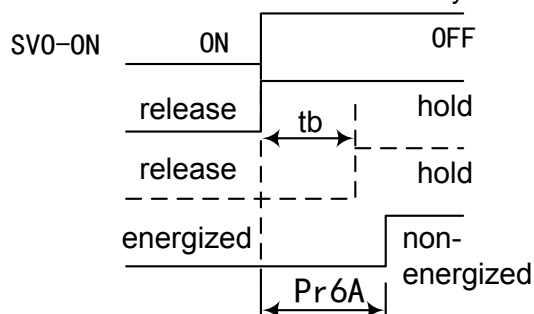
Refer to "Timing Chart"-Servo-ON/OFF Action While the Motor Is at Stall" of Preparation as well.

Pr6B | Setup of mechanical brake action at running

Initial Value：【0】

Setting Range：0~200

Unit：ms

Function：You can set up time from when detecting the off of Servo-ON input signal (SRV-ON：CN I/F, Pin-29) is to when external brake release signal (BRK-OFF：CN I/F, Pin-10 and 11) turns off, while the motor turns to servo off during the motor in motion.

• Set up to prevent the brake deterioration due to the motor running.

• At Servo-OFF during the motor is running, tb of the right fig. will be a shorter one of either Pr6B setup time, or time lapse till the motor speed falls below 30r/min.

Refer to "Timing Chart"-Servo-ON/OFF action while the motor is in motion" of Preparation as well.
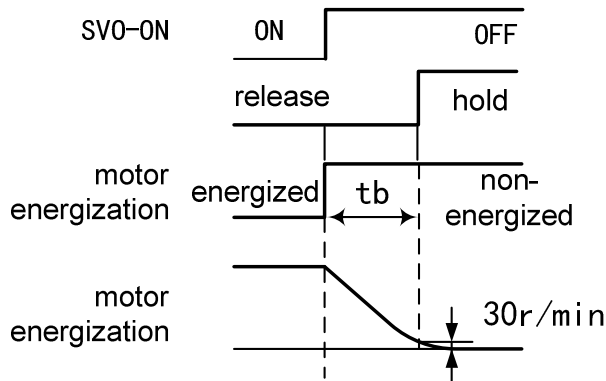
Pr6C |Selection of external regenerative resistor   ★

Initial Value：【0】

Setting Range：0~2

Unit：−

Function：With this parameter, you can select either to use the built-in regenerative resistor of the driver, or to separate this built-in regenerative resistor and externally install the regenerative resistor (between P1 and B2).

Setup value	Regenerative resistor to be used	Regenerative processing and regenerative resistor overload
0	Built-in resistor	Cooperate with internal resistance to make retrogradation resistance overload protection act.
1	External resistor	Taking action limit of impressing resistance as 10% DUTY, make it generate retrogradation resistance overload protection
2	External resistor	No protection

Pr74 |5th speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr75 |6th speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr76 |7th speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Pr77 |8th speed of speed setup

Initial Value：【0】

Setting Range：-10000~10000

Unit：rpm

Function：Refer to Pr53

Chapter 5 Connection and setup of control mode

5-1 Pin Table of Position, Speed and Torque Mode

Pin No.	Position Mode	Function		Speed Mode	Function		Torque Mode	Function	
1	OPC1	Position command Pulse 1	input						
2	OPC2	Position command Pulse 2	input						
3	PULS1	Position command Pulse 2	input						
4	PULS2	Position command Pulse 2	input						
5	SIGN1	Position command Signal 2	input						
6	SIGN2	Position command Signal 2	input						
7	COM+	Signal Power (+)		COM+	Signal Power (+)		COM+	Signal Power (+)	
8	CW-LIMIT	CW-inhibition limit	input	CW-LIMIT	CW-inhibition limit	input	CW-LIMIT	CW-inhibition limit	input
9	CCW-LIMIT	CCW-inhibition limit	input	CCW-LIMIT	CCW-inhibition limit	input	CCW-LIMIT	CCW-inhibition limit	input
10	BK-OFF-	Brake release(-)	output	BK-OFF-	Brake release(-)	output	BK-OFF-	Brake release(-)	output
11	BK-OFF+	Brake release(+)	output	BK-OFF+	Brake release(+)	output	BK-OFF+	Brake release(+)	output
12	ZSP	Zero-speed detection	output	ZSP	Zero-speed detection	output	ZSP	Zero-speed detection	output
13	GND	Signal ground							
14				SPR	Speed command	input	SPR/TRQR	Torque command or speed command	input
15	GND	Signal ground		GND	Signal ground		GND	Signal ground	
16	CCWTL	CCW Torque Limit	input	CCWTL	CCW Torque Limit	input	CCWTL/TRQR	Torque command	input
17	GND	Signal ground		GND	Signal ground		GND	Signal ground	
18	CWTL	CW Torque limit	input	CWTL	CW Torque limit	input			
19	CZ	Z-phase output (OPC)	output	CZ	Z-phase output (OPC)	output	CZ	Z-phase output (OPC)	output
20									
21	OA+	A-phase output(+)	output	OA+	A-phase output(+)	output	OA+	A-phase output(+)	output
22	OA-	A-phase output(-)	output	OA-	A-phase output(-)	output	OA-	A-phase output(-)	output
23	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output	OZ+	Z-phase output(+)	output
24	OZ-	Z-phase output(-)	output	OZ-	Z-phase output(-)	output	OZ-	Z-phase output(-)	output
25	GND	Signal ground		GND	Signal ground		GND	Signal ground	
26				ZERO-SPD	Speed zero clamp input	input	ZERO-SPD	Speed zero clamp input	input
27	GAIN	Gain switching input	input	GAIN	Gain switching input	input	GAIN	Gain switching input	input
28	DIV	Electronic gear selection	input	INSP3	internal speed selection 3	input			
29	SVO-ON	Servo-ON input	input	SVO-ON	Servo-ON input	input	SVO-ON	Servo-ON input	input
30	CLR	Deviation counter clear input	input	INSP2	internal speed selection 2	input			
31	ALM-CLR	Alarm clear input	input	ALM-CLR	Alarm clear input	input	ALM-CLR	Alarm clear input	input
32	C-MODE	Control mode switching input	input	C-MODE	Control mode switching input	input	C-MODE	Control mode switching input	input
33	PULS-INH	Inhibition input of command pulse	input	INSP1	internal speed selection 1	input			
34	SVO-RDY-	Servo-Ready output(-)	output	SVO-RDY-	Servo-Ready output(-)	output	SVO-RDY-	Servo-Ready output(-)	output
35	SVO-RDY+	Servo-Ready output(+)	output	SVO-RDY+	Servo-Ready output(+)	output	SVO-RDY+	Servo-Ready output(+)	output
36	SVO-ALM-	Servo-Alarm output(-)	output	SVO-ALM-	Servo-Alarm output(-)	output	SVO-ALM-	Servo-Alarm output(-)	output
37	SVO-ALM+	Servo-Alarm output(+)	output	SVO-ALM+	Servo-Alarm output(+)	output	SVO-ALM+	Servo-Alarm output(+)	output
38	ON-POS-	Positioning complete output(-)	output	AT-SP-	Velocity complete output(-)	output	AT-SP-	Velocity complete output(-)	output
39	ON-POS+	Positioning complete output(+)	output	AT-SP+	Velocity complete output(+)	output	AT-SP+	Velocity complete output(+)	output
40	TLC	Torque limit detection	output	TLC	Torque limit detection	output	TLC	Torque limit detection	output
41	COM-	Signal power(-)		COM-	Signal power(-)		COM-	Signal power(-)	
42	IM	Torque monitor	output	IM	Torque monitor	output	IM	Torque monitor	output
43	SPM	Speed monitor	output	SPM	Speed monitor	output	SPM	Speed monitor	output
44	PULSH1	Position command Pulse 1	input						
45	PULSH2	Position command Pulse 1	input						
46	SIGNH1	Position command Signal 2	input						
47	SIGNH2	Position command Signal 2	input						
48	OB+	B-phase output(+)	output	OB+	B-phase output(+)	output	OB+	B-phase output(+)	output
49	OB-	B-phase output(-)	output	OB-	B-phase output(-)	output	OB-	B-phase output(-)	output
50	FG	Frame ground		FG	Frame ground		FG	Frame ground	

5-2 Interface Circuit

5-2-1 Input Circuit

◆ Connection to sequence input signals
- ■ Connect to contacts of switches and relays, or open collector output transistors.
- ■ Make the lower limit voltage of the power supply (12 to 24V) as 11.4V or more in order to secure the primary current for photo-couplers.
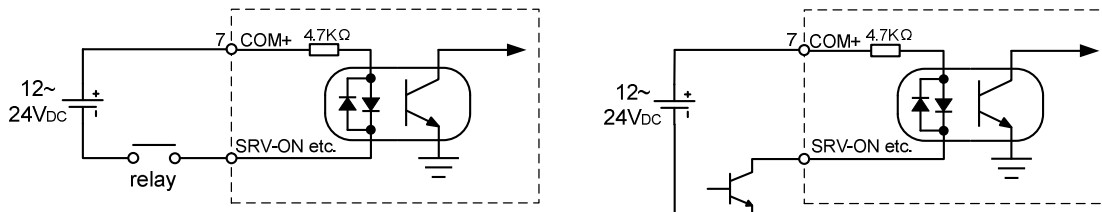
◆ Connection to sequence input signals (Pulse train interface)

(1) Line driver I/F (Input pulse frequency : max. 500kpps)
- ■ This signal transmission method has better noise immunity. We recommend this to secure the signal transmission.

(2) Open collector I/F (Input pulse frequency : max. 200kpps)
- ■ The method which uses an external control signal power supply (VDC)
- ■ Current regulating resistor R corresponding to VDC is required in this case.
- ■ Connect the specified resister as below.

V_{DC}	Specifications
12V	1KΩ 1/2W
24V	2KΩ 1/2W

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

(3) Open collector I/F (Input pulse frequency : max. 200kpps)
- ■ Connecting diagram when a current regulating resistor is not used with 24V power supply.

⊖ represents twisted pair.
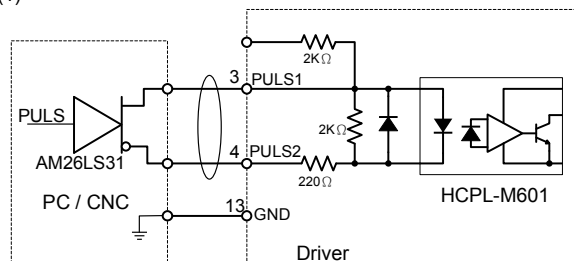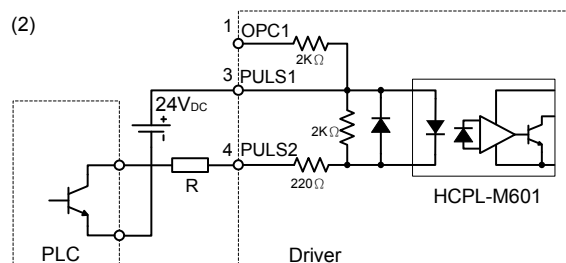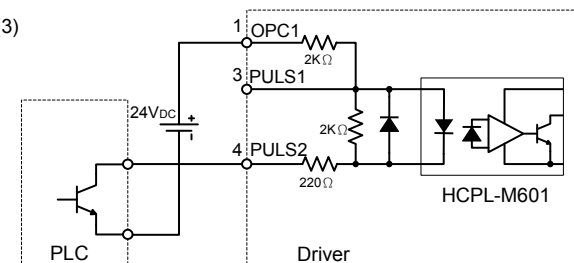
- Connection to sequence input signals (Pulse train interface exclusive to line driver)
    - Line driver I/F (Input pulse frequency : max. 2Mpps)
        - This signal transmission method has better noise immunity. ¬We recommend this to secure the signal transmission.

represents twisted pair.
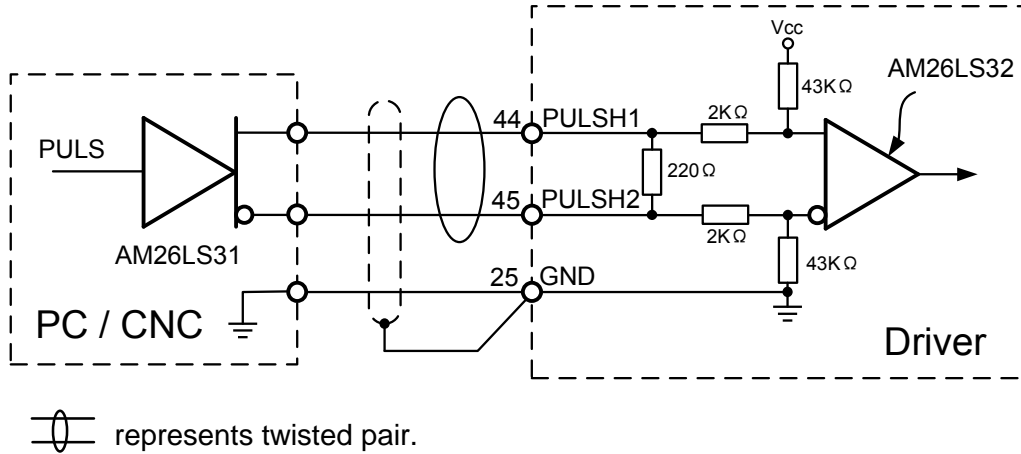
- Analog command input
    - The analog command input goes through 3 routes, SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
    - Max. permissible input voltage to each input is ±10V.
    - All commands AD can be divided into 12bit about 5mV.
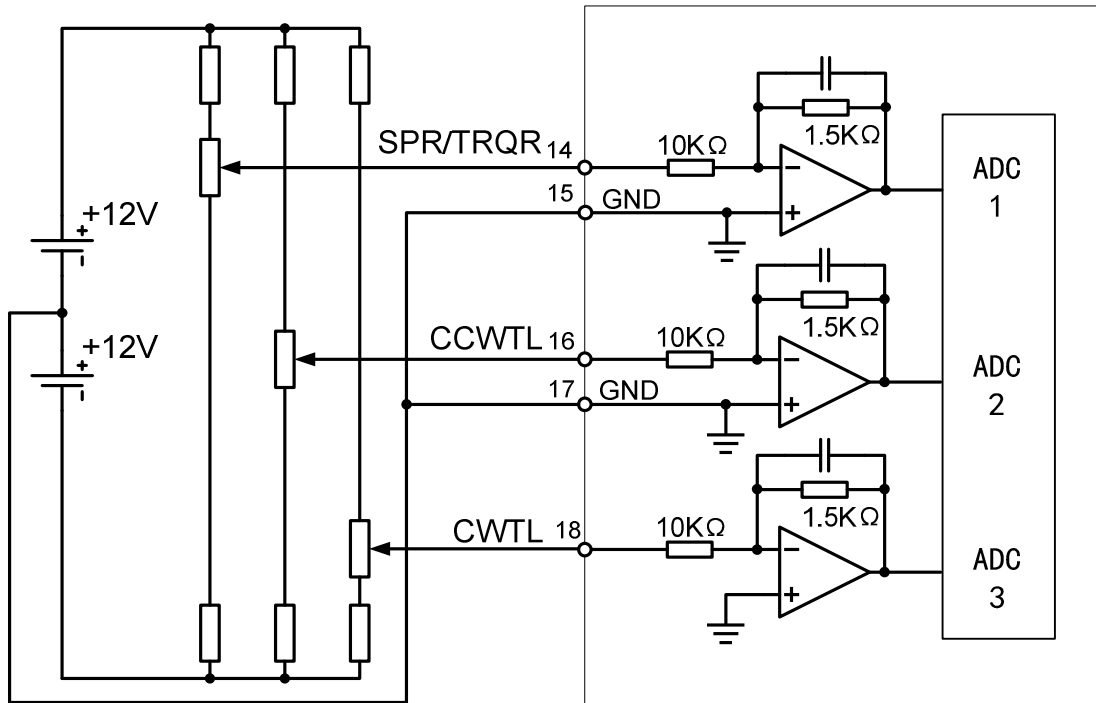
5-2-2 Output Circuit

◆ Line driver (Differential output) output
- Feeds out the divided encoder outputs (A, B and Z-phase) in differential through each line driver.
- At the host side, receive these in line receiver. Install a terminal resistor (approx. 330Ω) between line receiver inputs without fail.
- These outputs are not insulated.

```
                                    AM26LS31
                    OA+    21
                                        A
                    OA-    22
                    OB+    48
                                        B
                    OB-    49
                    OZ+    23
                                        Z
                    OZ-    24
                    GND    25
```
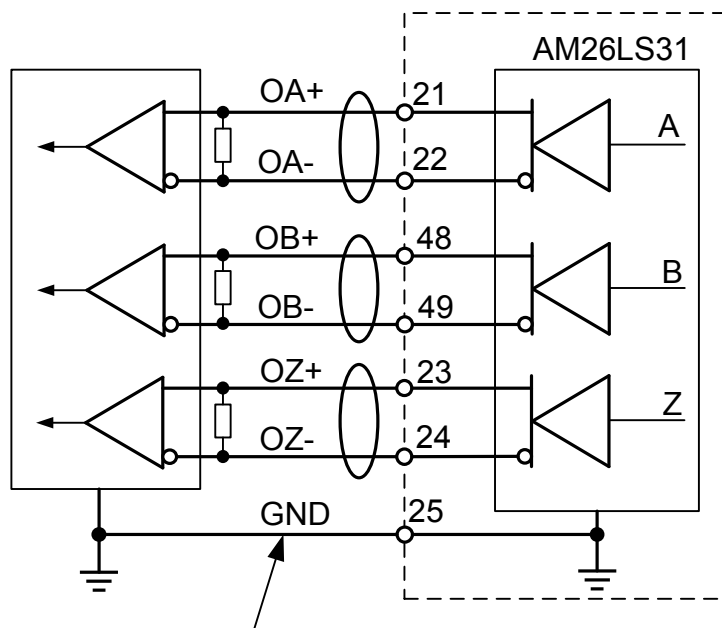
Connect signal ground of the host and the driver without fail.

◆ Analog monitor output
- There are two outputs, the speed monitor signal output (SP)and the torque monitor signal output (IM)
- Output signal width is ±10V.
- The output impedance is 1kΩ. Pay an attention to the input impedance of the measuring instrument or the external circuit to be connected.

```
Measuring        43   SP 1KΩ
instrument
or
external         42   IM 1KΩ
circuit
                 17   GND
```
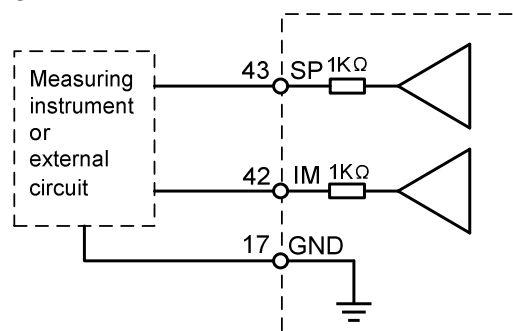
◆ Open collector output

■ Feeds out the Z-phase signal among the encoder signals in open collector. This output is not insulated.

■ Receive this output with high-speed photo couplers at the host side, since the pulse width of the Z-phase signal is narrow.

High speed photo-coupler
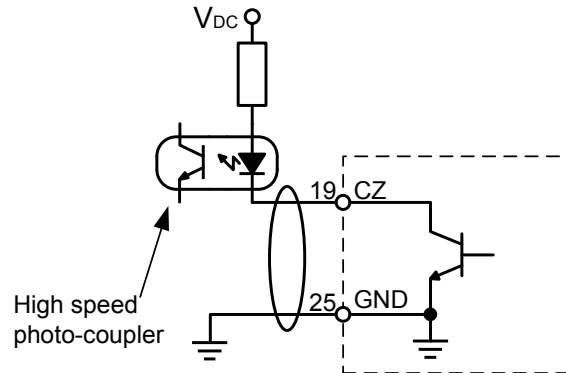
◆ Sequence output circuit

■ The output circuit is composed of open collector transistor outputs in the Darlington connection, and connect to relays or photo-couplers.

■ There exists collector to emitter voltage, VCE (SAT) of approx.1V at transistor-ON, due to the Darlington connection of the output or. Note that normal TTL IC cannot be directly connected since it does not meet VIL.

■ There are two types of output, one which emitter side of the output transistor is independent and is connectable individually,and the one which is common to – side of the control power supply (COM–).

■ If a recommended primary current value of the photo-coupler is 10mA, decide the resistor value using the formula to decide resistance value.

Install toward the direction as the fig. shows without fail.

ALM+
ALM-
12~24V V_{DC}
TLC,ZSP
COM-

$$R[K\Omega] = \frac{V_{DC} \quad 2.5}{10}$$

Max. rating 30VDC，50mA
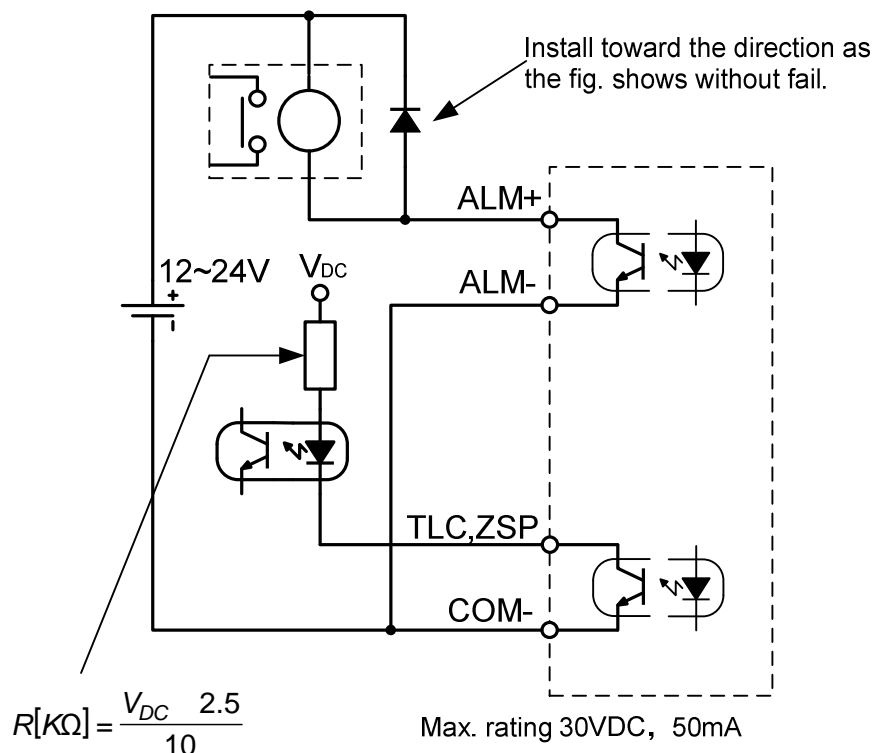
5-3 Input Signal and Pin No. of the Connector,I/F

5-3-1 Input Signals (common) and Their Functions：

Title of signal	Pin No.	Symbol	Function
Power supply for control signal (+)	7	COM+	• Connect + of the external DC power supply (12 to 24V). • Use the power supply voltage of 12V ± 5% − 24V ± 5%
Power supply for control signal (-)	41	COM-	• Connect − of the external DC power supply (12 to 24V). • The power capacity varies depending on a composition of I/O circuit. 0.5Aor more is recommended.
CW over-travel inhibit input	8	CW-LIMIT	• Use this input to inhibit a CW over-travel (CWL). • Connect this so as to make the connection to COM– open when the moving portion of the machine over-travels the movable range toward CW. • CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)". • You can select the action when the CWL input is validated with the setup of up Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)
CCW over-travel inhibit input	9	CCW-LIMIT	• Use this input to inhibit a CCW over-travel (CCWL). • Connect this so as to make the connection to COM– open when the moving portion of the machine over-travels the movable range toward CCW. • CWL input will be invalidated when you set up Pr04 (Setup of over-travel inhibit input) to 1.Default is "Invalid (1)". • You can select the action when the CCWL input is validated with the setup of Pr66 (Sequence at over-travel inhibit). Default is "Emergency stop with dynamic brake".(Pr66=0)
damping control switching input	26	ZERO-SPD	• Function varies depending on the control mode.

For pin 26 (ZERO-SPD), **Velocity/Torque control**:

• Becomes to a speed-zero clamp input (ZEROSPD).

Pr06	Connection to COM–	Content
0	—	ZEROSPD input is invalid.
1	open	Speed command is 0
1	Close	Normal action
2	open	Speed command is to CCW
2	Close	Speed command is to CW.

• In case Pr06 is 2 at torque control, ZERPSPD is invalid.

Title of signal	Pin No.	Symbol	Function
Gain switching input or Torque limit switching input	27	GAIN	· Function varies depending on the setups of Pr30 (2nd gain setup) and Pr03 (Selection of torque limit).
Electronic gear (division/multiplication) switching input	28	DIV	· Function varies depending on the control mode.

For pin 27 (GAIN):

Pr30	Connection to COM–	Content
0	Open	Velocity loop : PI (Proportion/Integration) action
0	Close	Velocity loop : P (Proportion) action
1	when the setups of Pr31,Pr36 and 3A are 2	
1	Open	1st gain selection (Pr10,11,12,13 and 14)
1	close	2nd gain selection (Pr18,19,1A,1B and 1C)
1	when the setups of Pr31,Pr36 and 3A are 2	
1		invalid

For pin 28 (DIV):

Position	•You can switch the numerator of electronic gear. By connecting to COM–, you can switch the numerator of electronic gear from Pr47 (1st numerator of electronic gear) to Pr48 (2nd numerator of electronic gear) • For the selection of command division/multiplication, referto the table of next page, "Numerator selection ofcommand scaling"
Velocity control	• Input of internal speed selection 3 (INTSP3) •You can make up to 8-speed setups combining INH/INTSP1 and CL/INTSP2 inputs.
Torque control	• This input is invalid.

<Caution>

Do not enter the command pulse 10ms before/after switching.

Numerator selection of electronic gear

CN X5 Pin-28 DIV	Setup of electronic gear
Open	$$\frac{\text{1st numerator of electronic gear (Pr46)} \times 2^{\text{Multiplier of command scaling (Pr4A)}}}{\text{Denominator of electronic gear (Pr4B)}}$$
Short	$$\frac{\text{2nd numerator of electronic gear (Pr46)} \times 2^{\text{Multiplier of command scaling (Pr4A)}}}{\text{Denominator of electronic gear (Pr4B)}}$$

Title of signal	Pin No.	Symbol	Function
Servo-ON input	29	SVO-ON	• Turns to Servo-ON status by connecting this input to COM–. • Turns to Servo-OFF status by opening connection to COM–, and current to the motor will be shut off. • You can select the dynamic brake action and the deviation counter clearing action at Servo-OFF with Pr69 (Sequence at Servo-OFF). **<Caution>** 1.Servo-ON input becomes valid approx.2 sec after power-on. (see P.109, "Timing Chart" of Preparation.) 2.Never run/stop the motor with Servo-ON/OFF. 3.After shifting to Servo-ON, allow 100ms or longer pause before enteringthe pulse command.
Deviation counter clear input	30	CLR / INSP2	• Function varies depending on the control mode.

Position control (CLR / INSP2):
• Input (CL) which clears the positional deviation counterand full-closed deviation counter.
• You can clear the counter of positional deviation by connecting this to COM–.
• You can select the clearing mode with Pr4E (Counter clear input mode).

Pr4D	Content
0	Clears the counter of positional deviation while CLR is connected to COM–.
1 [Default]	Clears the counter of positional deviation only once by connecting CLR to COM– from open status.
2	CLRis invalid.

Velocity control: • Input of selection 2 of internal command speed (INTSP2)

Torque control: This input is invalid.

Title of signal	Pin No.	Symbol	Function
Alarm clear input	31	ALM-CLR	• You can release the alarm status by connecting this to COM– for morethan 120ms. • The deviation counter will be cleared at alarm clear. • There are some alarms which cannot be released with this input.
Control mode switching input	32	C-MODE	• You can switch the control mode as below by setting up Pr02 (Control mode setup) to 3-5.

Pr02 setup	Open (1st)	Connection to COM– (2nd)
3	Position control	Velocity control
4	Position control	Torque control
5	Velocity control	Torque control

<Caution>
Depending on how the command is given at each control mode, the action might change rapidly when switching the control mode with C-MODE. Pay an extra attention.

Title of signal	Pin No.	Symbol	Function
Inhibition input of command pulse	33	PULS-INH / INSP1	・ Function varies depending on the control mode.

Position control	• Inhibition input of command pulse input (INH) • Ignores the position command pulse by opening the connection to COM– • You can invalidate this input with Pr43 (Invalidation of command pulse inhibition input)	
	Pr43	Content
	0	INH is valid
	1(Default)	INH is invalid
Velocity control	• Selection 1 input of internal command speed (INTSP1)	
Torque control	• This input is invalid	

5-3-2 Input Signals (Pulse Train) and Their Functions

You can select appropriate interface out of two kinds, depending on the command pulse specifications.

• Pulse train interface exclusive for line driver

Title of signal	Pin No.	Symbol	Function
Command pulse input 1	44	PLUSH1	• Input terminal for position command pulse. You can select by setting up Pr40 (Selection of command pulse input) to 1.
	45	PLUSH2	• This input becomes invalid at such control mode as velocity control or torque control, where no position command is required.
Command pulse sign input 1	46	SIGNH1	• Permissible max. input frequency is 2Mpps. • You can select up to 6 command pulse input formats with Pr41 (Setup of command pulse rotational direction) and Pr42 (Setup of command pulse input mode).For details, refer to the table below, "Command pulse input format".
	47	SIGNH2	

• Pulse train interface

Title of signal	Pin No.	Symbol	Function
Command pulse input 2	1	OPC1	• Input terminal for the position command. You can select by setting up Pr40 (Selection of command pulse input) to 0.
	3	PULS1	• This input becomes invalid at such control mode as the velocity control or torque control, where no position command is required.
	4	PULS2	
Command pulse sign input 2	2	OPC2	• Permissible max. input frequency is 500kpps at line driver input and 200kpps at open collector input.
	5	SIGN1	• You can select up to 6 command pulse input formats with Pr41 (Setup of command pulse rotational direction) and Pr42 (Setup of command pulse input mode). For details, refer to the table below, "Command pulse input format".
	6	SIGN2	

• Command pulse input format

Pr41 setup value	Pr42 setup value	CCW command	CW command
【0】	0 or 2	PULS A-phase / SIGN B-phase — t1, t1 B-phase advances to A by 90°.	PULS / SIGN — t1, t1 B-phase delays from A by 90°.
	【1】	PULS / SIGN — t2, t2	PULS — t3, t2, t2 / SIGN
	3	PULS t4 t5 / SIGN "L" t6 ... t6	PULS t4 t5 / SIGN "H" t6 ... t6
【1】	0 or 2	PULS A-phase / SIGN B-phase — t1, t1 B-phase delays from A by 90°.	PULS / SIGN — t1, t1 B-phase advances to A by 90°.
	【1】	PULS — t2, t2 / SIGN	PULS t3 / SIGN — t2, t2
	3	PULS t4 t5 / SIGN "H" t6 ... t6	PULS t4 t5 / SIGN "L" t6 ... t6

• PULS and SIGN represents the outputs of pulse train in put circuit.

• In case of CW pulse train + CCW pulse train and pulse train + sign, pulse train will be cap tured at the rising edge.

• In case of 2-phase pulse, pulse train will be captured at each edge.

・ Permissible max. input frequency of command pulse input signal and min. necessary time width

Input I/F of PULS/SIGN signal		Permissible max. input frequency	Min. necessary time width					
			t1	t2	t3	t4	t5	t6
Pulse train interface exclusive to line driver		2Mpps	500ns	250ns	250ns	250ns	250ns	250ns
Pulse train interface	Line driver interface	500kpps	2μs	1μs	1μs	1μs	1μs	1μs
	Open collector interface	200kpps	5μs	2.5μs	2.5μs	2.5μs	2.5μs	2.5μs

Make the rising/falling time of the command pulse input signal to 0.1μs or smaller.

5-3-3 Input Signals (Analog Command) and Their Functions

Title of signal	Pin No.	Symbol	Function		
Speed command input or Torque command input	14	SPR / TRQR	• Function varies depending on control mode.		
			Pr02	Control mode	功能
			3	**Position/ Velocity**	• Input of external speed command (SPR) when thevelocity control is selected. • Set up the gain, polarity, offset and filter of the Speed command with; Pr50 (Speed command input gain) Pr51 (Speed command input reversal) Pr52 (Speed command offset)
			4	**Position/ Torque**	• Function varies depending on Pr5B (Selection of torque command)

Within the Position/Torque section (Pr02 = 4), the following sub-table appears:

Pr5B	Content
0	• Torque command (TRQR) will be selected. • Set up the torque (TRQR) gain, polarity, Offset with: Pr5C (Torque command input gain) Pr5D（(Torque command input reversal) Pr52 (Speed command offset)
1	• Speed limit (SPL) will be selected. • Set up the speed limit (SPL) gain, offset and filter with Pr50 (Speed command input gain) Pr52（(Speed command offset)

Others	**Other control mode**	• This input is invalid

• The resolution of the A/D converter used in this input is 12 bit (including 1 bit for sign).
±2047[LSB]= ±10[V], 1[LSB]≒5.0[mV]

*Function becomes valid when the control mode with underline [   ] ／ [   ] .

<Remark>_

Do not apply voltage exceeding ±10V to analog command input of SPR/TRQR.

Title of signal	Pin No.	Symbol	Function

Title of signal	Pin No.	Symbol	Function
CCW-Torque limit input	16	CCWTL / TRQR	• Function varies depending on Pr02 (Control mode setup).

CCW-Torque limit input (Pin 16, CCWTL / TRQR):

• Function varies depending on Pr02 (Control mode setup).

Pr02	Control mode	content
2 4	Torque control Position/<u>Torque</u>	• Function varies depending on Pr5B (Selection of torque command)

Pr5B	Content
0	This input becomes invalid.
1	• Torque command input (TRQR) will be selected. • Set up the gain,polarity and offset of the command with: Pr5C (Torque command input gain) Pr5D(Torque command input reversal) Pr2A (CCW Torque Control Offset)

Pr02	Control mode	content
5	Velocity/<u>Torque</u>	• Becomes to the torque command input (TRQR). • Set up the gain,polarity and offset of the command with: Pr5C (Torque command input gain) Pr5D(Torque command input reversal) Pr2A (CCW Torque Control Offset)
4 5 other	<u>Position</u>/Torque <u>Velocity</u>/Torque Other control mode	• Becomes to the analog torque limit input to CCW(CCWTL). • Limit the CCW-torque by applying positive voltage(0 to +10V) (Approx.+3V/rated toque) • Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.

• The resolution of the A/D converter used in this input is 12 bit (including 1 bit for sign).
±2047[LSB]= ±10[V], 1[LSB]≒5.0[mV]

CW-Torque limit input (Pin 18, CWTL):

• Function varies depending on Pr02 (Control mode setup).

Pr02	Control mode	Content
2 4 5	Torque control Position/<u>Torque</u> Velocity/<u>Torque</u>	• This input becomes invalid when the torque control is selected.
4 5 other	<u>Position</u>/Torque <u>Velocity</u>/Torque Other control mode	• Becomes to the analog torque limit input to CW(CWTL). • Limit the CW-torque by applying negative voltage (0 to –10V) (Approx.+3V/rated toque). Invalidate this input by setting up Pr03 (Torque limit selection) to other than 0.

• The resolution of the A/D converter used in this input is 12 bit (including 1 bit for sign).
±2047[LSB]= ±10[V], 1[LSB]≒5.0[mV]

*Function becomes valid when the control mode with underline ([   ] ╱ [   ]) is selected while the switching mode is used in the control mode in table.

<Remark>Do not apply voltage exceeding ±10V to analog command input of CWTL and CCWTL

5-3-4 Output Signals (Common) and Their Functions

Title of signal	Pin No.	Symbol	Function
External brake release signal	11 10	BK-OFF+ BK-OFF-	• Feeds out the timing signal which activates the electromagnetic brake of the motor.•Turns the output transistor ON at the release timing of the electromagnetic brake.• You can set up the output timing of this signal with Pr6A (Setup of mechanical brake action at stall) and Pr6B (Setup of mechanical brake action at motion). For details, refer to P109, "Timing Chart" of Preparation.)
Servo-Ready output	35 34	SVO-RDY+ SVO-RDY-	• This signal shows that the driver is ready to be activated. • Output transistor turns ON when both control and main power are ON but not at alarm status.
Servo-Alarm output	37 36	SVO-ALM+ SVO-ALM-	• This signal shows that the driver is in alarm status.. • Output transistor turns ON when the driver is at normal status, and turns OFF at alarm status.
Positioning complete (In-position)	39 38	ON-POS+ ON-POS-	• Function varies depending on the control mode. *Position control*: • Output of positioning complete (ON-POS) • The output transistor will turn ON when the absolute value of the position deviation pulse becomes smaller than the setup value of Pr60 (Positioning complete range). *Velocity /Torque control*: • Output at-speed (speed arrival) (AT-SPEED) • The output transistor will turn ON when the actual motor speed exceeds the setup value of Pr62 (In-speed).
Zero-speed detection output signal	12 (41)	ZSP (COM-)	• Content of the output signal varies depending on Pr0A (Selection of ZSP output). • Default is 1, and feeds out the zero speed detection signal. • For details, see the table below, "Selection of TLC,ZSP output".
Torque in-limit signal output	40 (41)	TLC (COM-)	• Content of the output signal varies depending on Pr09 (Selection of TLC output). • Default is 0, and feeds out the torque in-limit signal. • For details, see the table below, "Selection of TLC,ZSP output".

•Selection of TCL and ZSP outputs

Value of Pr09 or Pr0A	I/F TLC : Output of Pin-40	I/F ZSP : Output of Pin-12
0	• Torque in-limit output (Default of I/F TLC Pr09)The output transistor turns ON when the torque command is limited by the torque limit during Servo-ON.	
1	• Zero-speed detection output (Default of I/F ZSP Pr0A)The output transistor turns ON when the motor speed falls under the preset value with Pr61.	
2	• Alarm signal output The output transistor turns ON when either one of the alarms is triggered, over-regeneration alarm, overload alarm.	
3	• Over-regeneration alarm The output transistor turns ON when the regeneration exceeds 85% of the alarm trigger level of the regenerative load protection.	
4	• Over-load alarmThe output transistor turns ON when the load exceeds 85% of the alarm trigger level of the overload alarm.	

Title of signal	Pin No.	Symbol	Function
A-phase output	21	OA+	• Feeds out the divided encoder signal or external scale signal (A, B, Zphase) in differential.
	22	OA-	• You can set up the division ratio with Pr44 (Output Pulse Pre-division of Every Reversion)Pr4E(Numerator of pulse output division) and Pr4F(Denominator of pulse output division)
B-phase output	48	OB+	• You can select the logic relation between A-phase and B-phase, and the output source with Pr45 (Reversal of pulse output logic).
	49	OB-	
Z-phase output	23	OZ+	• Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.
	24	OZ-	• Max. output frequency is 4Mpps (after quadrupled)
Z-phase output	19	CZ	• Open collector output of Z-phase signal • The emitter side of the transistor of the output circuit is connected to the signal ground (GND) and is not insulated.
Torque monitor signal output	42	IM	• The content of output signal varies depending on Pr08 (Torque monitor(IM) selection). • You can set up the scaling with Pr08 value.

Pr08	Content of signal	Function
0-2	Torque command	• Feeds out the voltage in proportion to the motor torque command with polarity. + : generates CCW torque – : generates CW torque
3-7	Positional deviation	• Feeds out the voltage in proportion to the positional deviation pulse counts with polarity.+ : positional command to CCW of motor position,– : positional command to CW of motor position

Title of signal	Pin No.	Symbol	Function
Speed monitor signal output	43	SPM	• The content of the output signal varies depending on Pr07 (Speed monitor (IM) selection). • You can set up the scaling with Pr07 value.

Pr07	Control mode	Function
0-4	Motor speed	• Feeds out the voltage in proportion to the motor speed with polarity. + : rotates to CCW – : rotates to CW
5-9	Command speed	• Feeds out the voltage in proportion to the command speed with polarity. + : rotates to CCW – : rotates to CW

Title of signal	Pin No.	Symbol	Function
Signal ground	13,15,17,25	GND	• Signal ground • This output is insulated from the control signal power (COM–) inside of thedriver.
Frame ground	50	FG	• This output is connected to the earth terminal inside of the driver.

Chapter 6 Documenets

6-1 Dimensions

(Driver) KSDG 100W&200W&400W
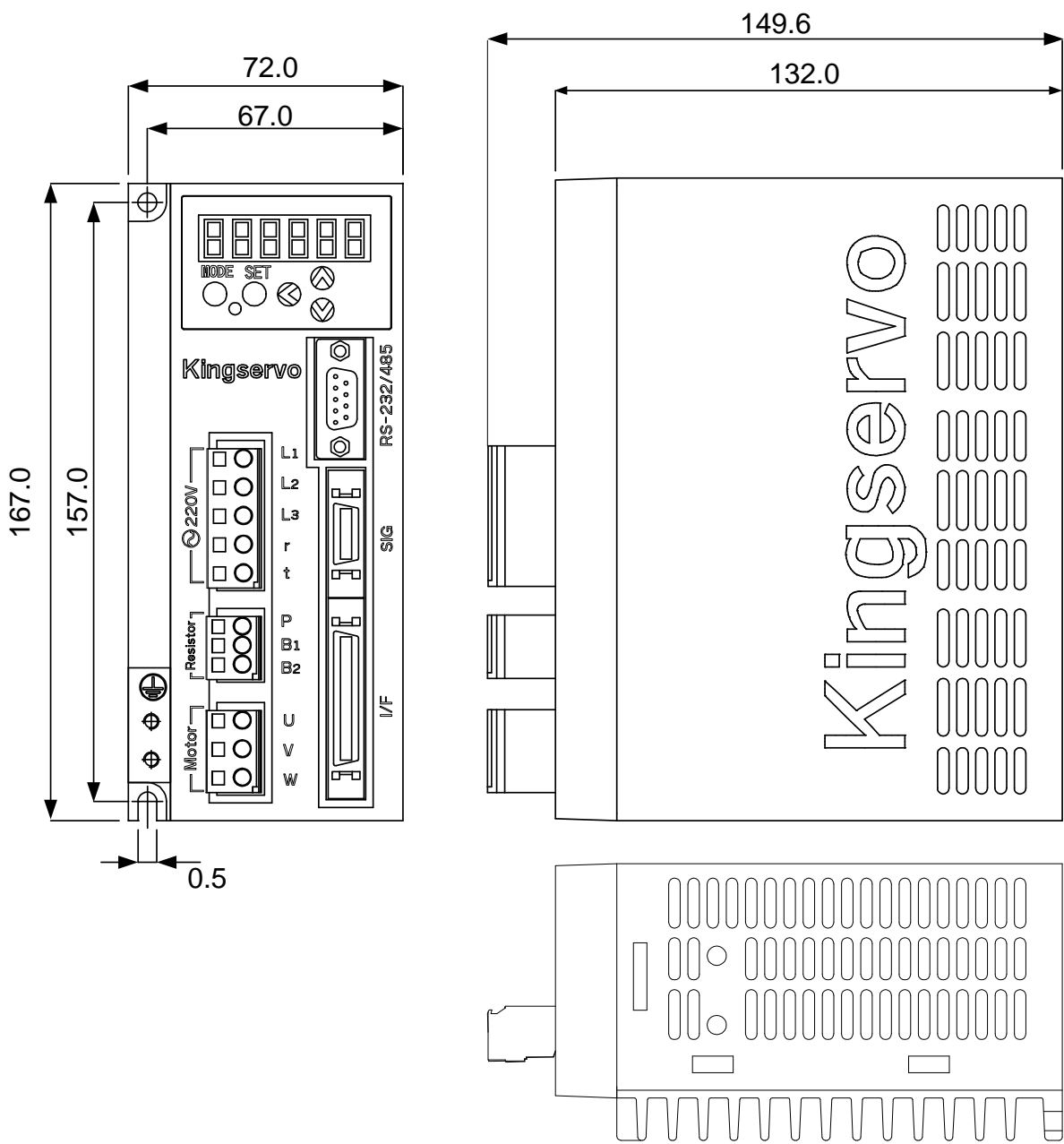
(Driver) KSDG 750W&1KW&1.5KW

72.0

67.0

167.0

157.0

0.5

Kingservo

RS-232/485

220V

L1
L2
L3
r
t

SIG

Resistor

P
B1
B2

Motor

U
V
W

I/F

187.4

169.8

Kingservo

Kingservo
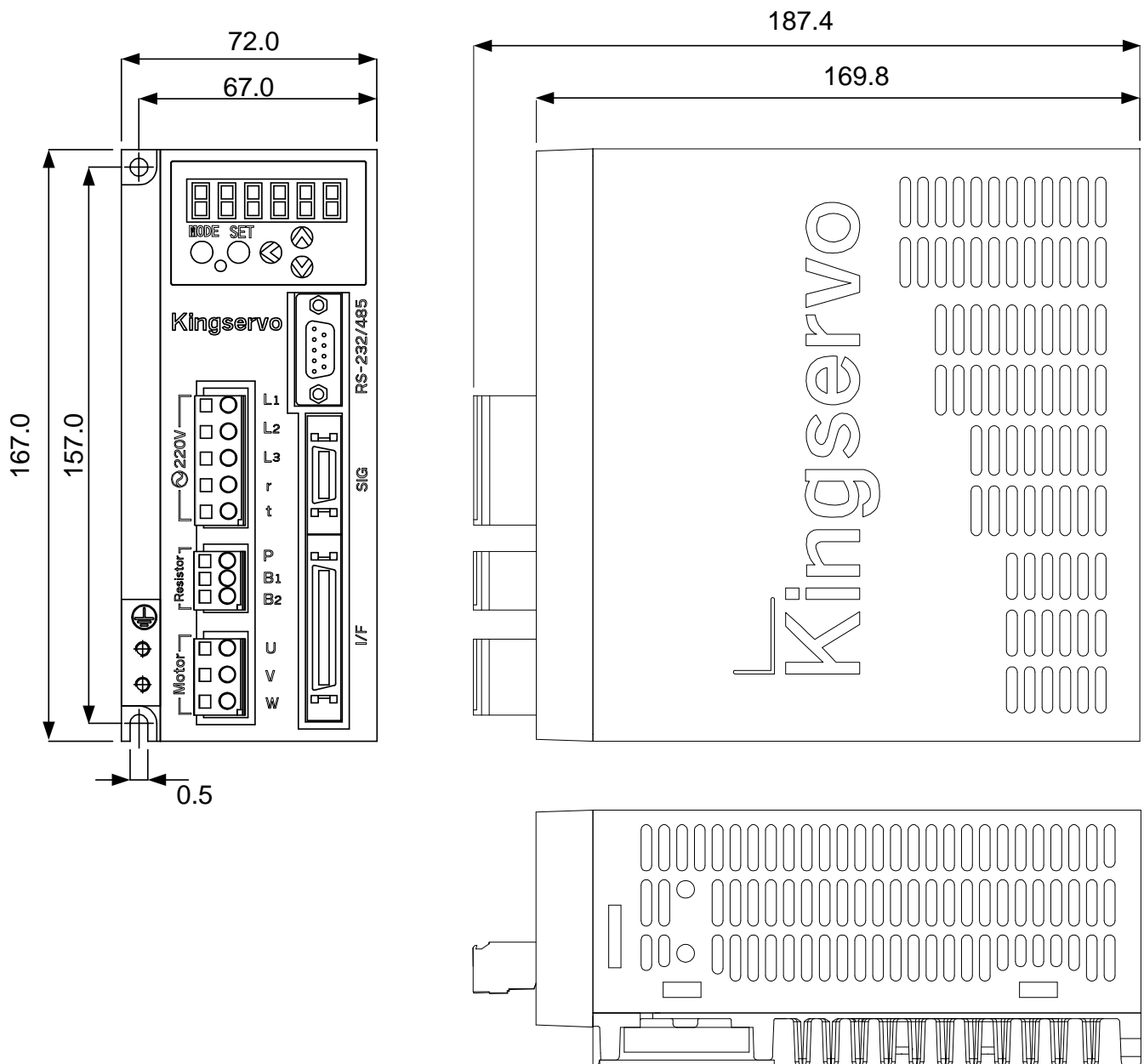
(Motor) KSMA 100W (and Smaller)

Shaft
Specifications

LW
LK

KW
RH KH

□LC

LH

LR
LF
LE

ØS
ØLB

ØLA

2 - ØLZ

LL

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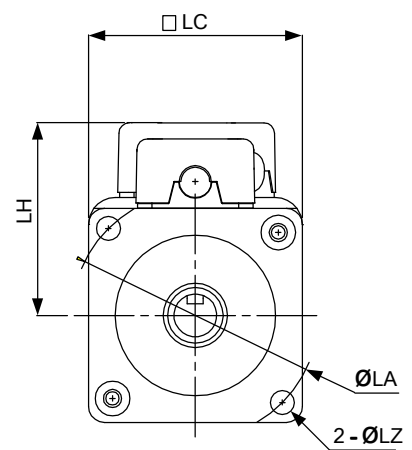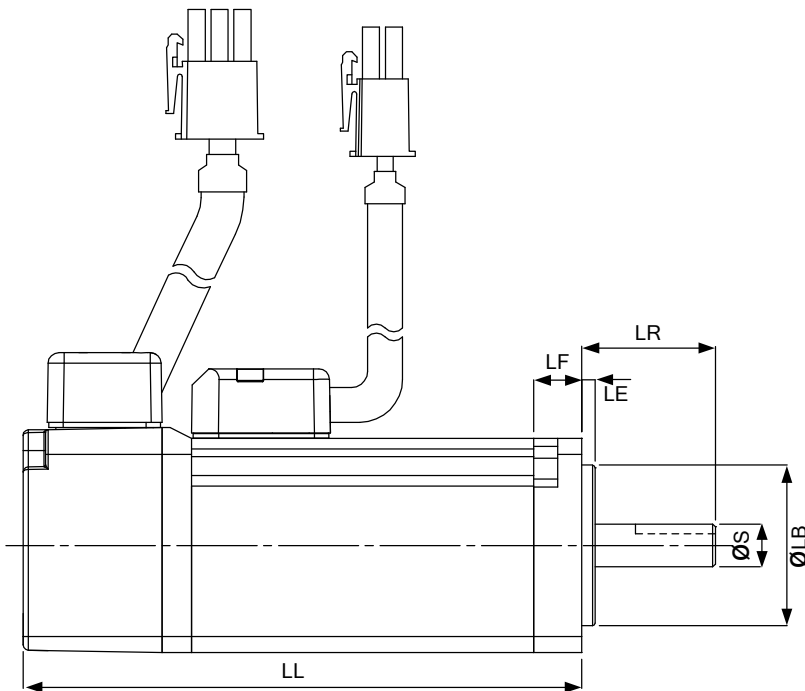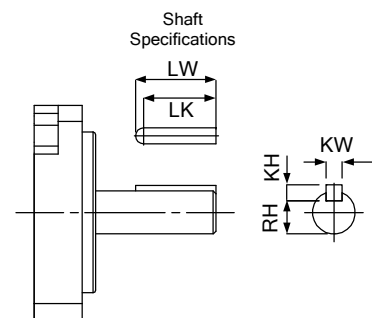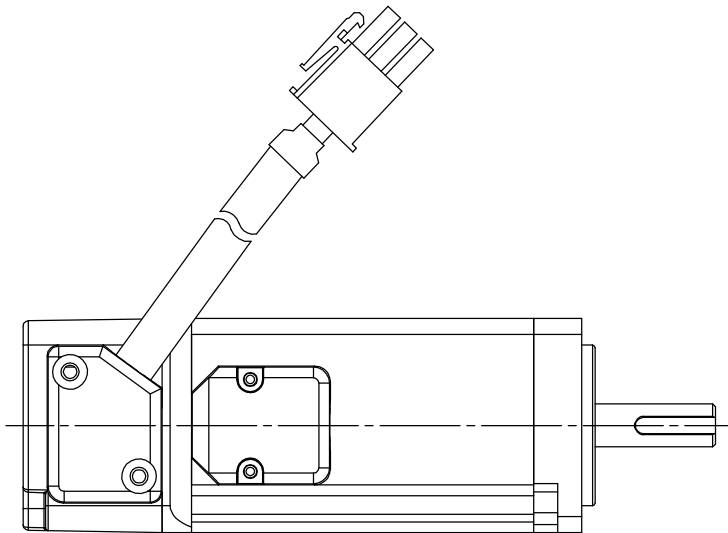
(Motor) KSMA 200W to750W

Shaft Specifications
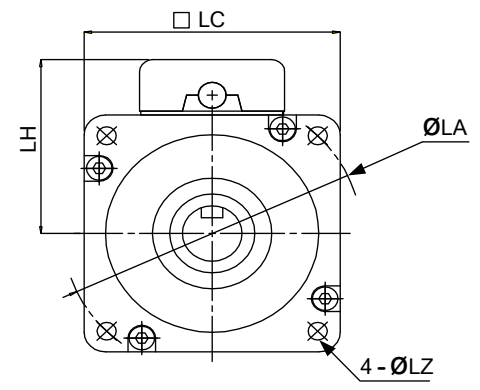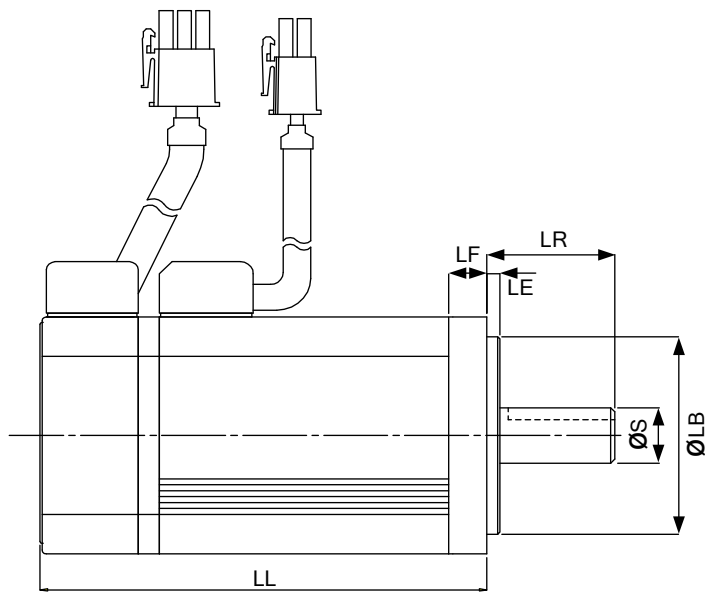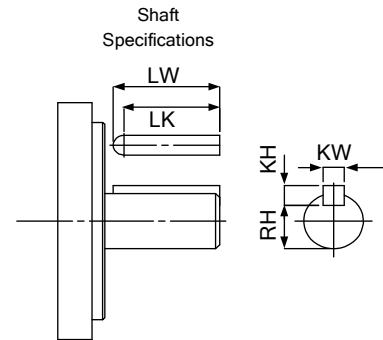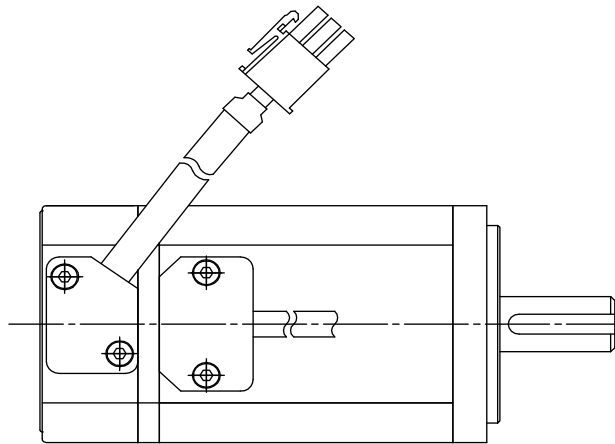
(Motor) KSMA 1KW&1.5KW (and bigger)

Shaft
Specifications

LW

LK

KW

RH KH

LR

LF

LE

ØS

ØLB

LL

☐ LC

LH

ØLA

4 - ØLZ

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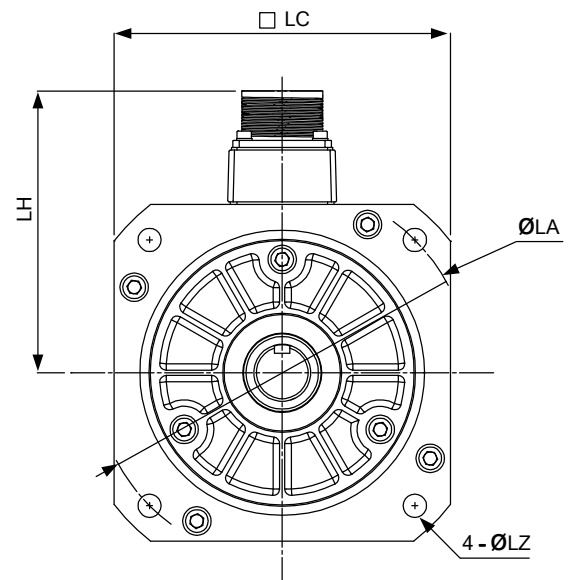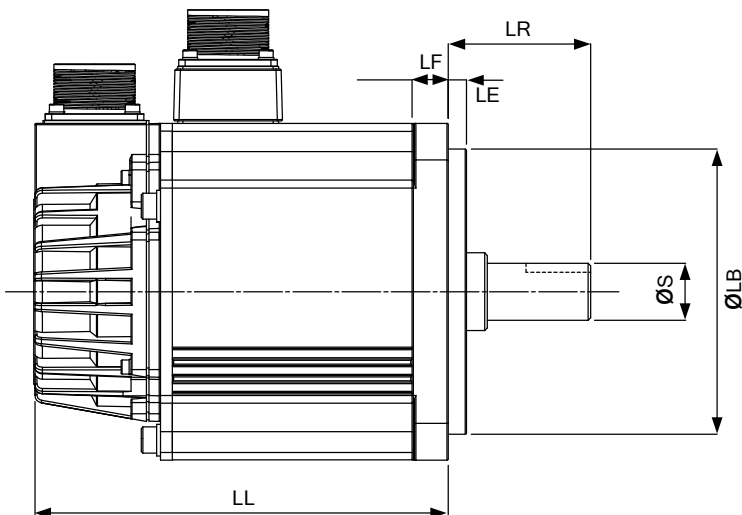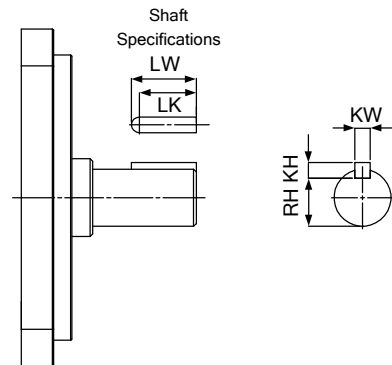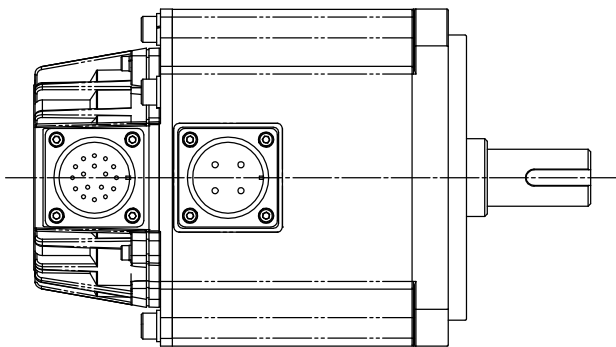
Dimensions table

馬達輸出		100W	200W	400W	750W	1kW	1.5kW	2kW
LL	無煞車	104.5	82.4	104.8	108.6	159.8	182.8	204.9
	有煞車		118.4	140.8				
LF		9	8	8	8	14	14	14
LE		2.5	3	3	3	7	7	7
LR		25	30	30	35	55.1	55.1	55.1
LB		30h7	50h7	50h7	70h7	110h7	110h7	110h7
S		8h6	14h6	14h6	19h6	22h6	22h6	22h6
LH		36	44	44	53	108.6	108.6	108.6
LC		40	60	60	80	130	130	130
LA		46	70	70	90	145	145	145
LZ		4.5	4.5	4.5	6.6	9	9	9
LW		15	25	25	25	25	25	25
LK		13.5	22.5	22.5	22	22	22	22
KW		3h9	5h9	5h9	6h9	6h9	6h9	6h9
KH		3	5	5	6	6	6	6
RH		6.2	11	11	15.5	18.5	18.5	18.5

6-2 Timing Chart

Servo ON signal process sequence as power-up

Control power supply	OFF	ON
Ready output	OFF	ON
		Approx.1s
Servo On Input	OFF	ON
	Approx.5ms	
Dynamic brake	Engaged	Released
	Approx.2ms	
Motor energization	Non-energized	Energized
	Approx.40ms	
Brake Off output	Off(brake engaged)	On(brake Released)
	Approx.5ms	
External command	No command entry	Command entry
	100ms or longer	

<Caution>
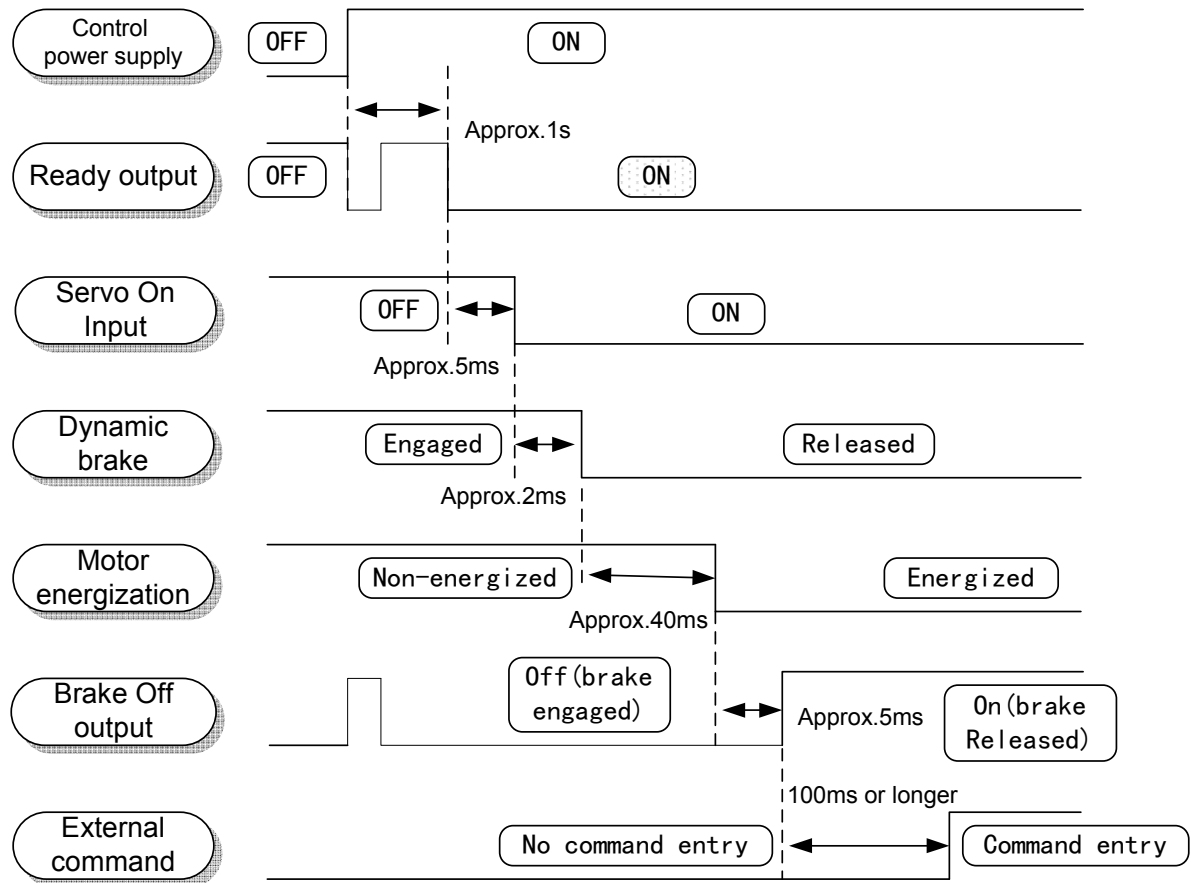
    a.   Above charter represents the sequences from AC power starting to order inputing.

    b.   Input Servo ON signal and external commands according to above sequences.

When an Error (Alarm) Has Occurred (at Servo-ON Command)

| Alarm | normal | | alarm |

| Ready output | ready | Not ready |

0.5ms~5ms

| Alarm output | not alarm | alarm |

| Dynamic brake | release | engaged |

| Motor energization | energized | Non-energized |

T = Pr6B or when time to fall
below 30r/min is shorter
● get faster time

| Brake Off outpue | release | T | engaged |
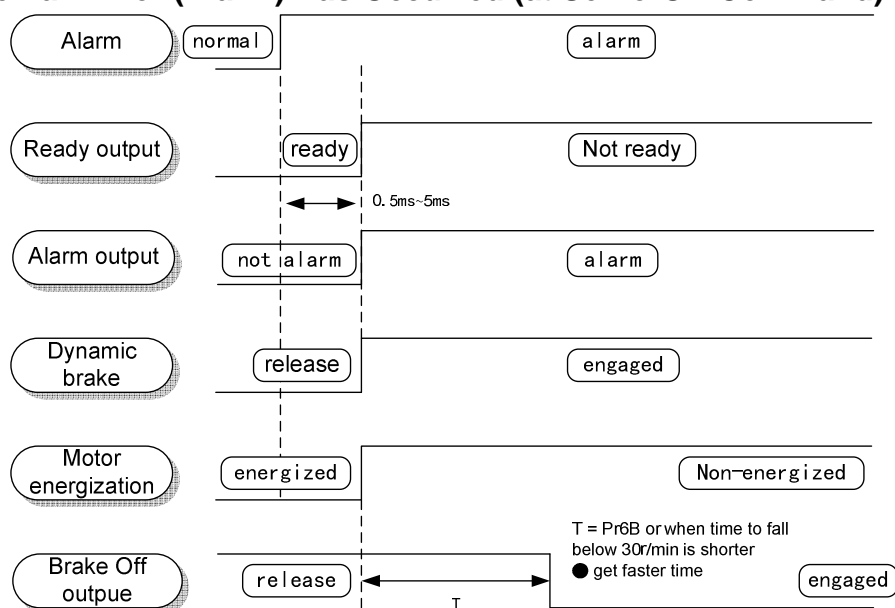
Related parameter:
Pr68 Sequence at alarm
Pr6B Setup of mechanical brake action at running

<Cautions>1.T will be a shorter time of either the setup value of Pr6B or elapsing time for the motor speed to fall below 30r/min. T will be 0 when the motor is in stall regardless of the setup pf Pr6A.2.For the action of dynamic brake at alarm occurrence, refer to an explanation of Pr68, "Sequence at alarm ("Parameter setup" at each control mode) as well.

When an Alarm Has Been Cleared (at Servo-ON Command)

| AlarmClear input | | Adge trigger |

| Ready output | Not ready | ready |

Approx.160ms

| Alarm output | alarm | No alarm |

| Dynamic brake | engaged | release |

Approx.1ms

| Motor energization | Non-energized | energized |

Approx.40ms

| Brake Off output | engaged | realse |

Approx.5ms

100ms or longer

| External command | No command entry | Command entry |
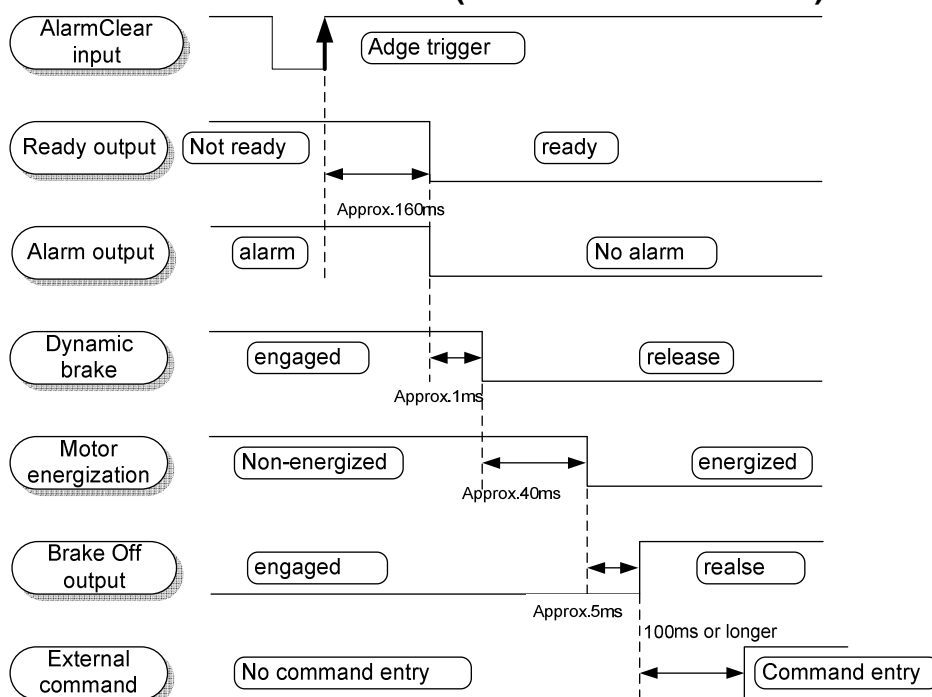
Servo-ON/OFF Action While the Motor Is at Stall (Servo-Lock)

Servo On input	OFF		ON		OFF

Dynamic brake: Engaged — Approx.2ms — Release — T — Engaged

Motor energization: Non-energized — Approx.40ms — energized — Non-energized

Brake Off output: Engaged — Approx.5ms — Release — Approx.5ms — Engaged
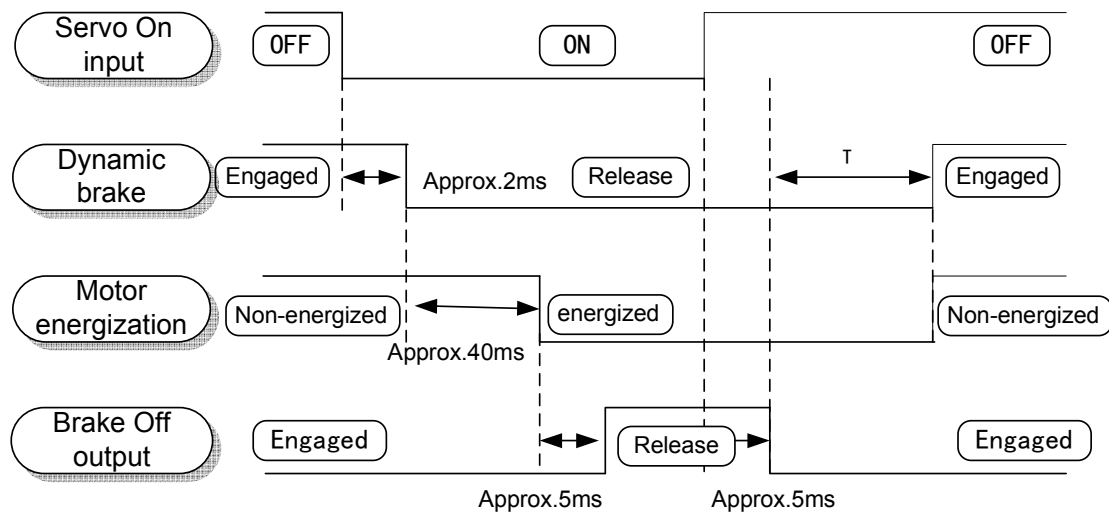
Related parameter:
Pr69 Sequence at main power OFF
Pr6A Setup of mechanical brake action at stalling

<Cautions>

1.T will be determined by Pr6A setup value.

2. For the dynamic brake action at Servo-OFF, refer to an explanation of Pr69, "Sequence at Servo-OFF ("Parameter setup" at each control mode) as well.

3. Servo-ON will not be activated until the motor speed falls below approx. 30r/min.

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Servo-ON/OFF Action While the Motor Is in Motion

(Timing at emergency stop or trip. Do not repeat this sequence. During the normal operation, stop the motor,then make Servo-ON/OFF action.)

Servo On input	OFF	ON	OFF

Dynamic brake — Engaged ←→ falls below approx. 30r/min. — Release — Engaged ☐*1 — Approx .5ms

Motor energization — Non-energized ←→ energized — Non-energized ☐*2 — Approx .40ms

Brake Off output — Engaged ←→ Release ←→ Engaged — Approx .5ms

T = Pr6B or when time to fall below 30r/min is shorter
● get faster time
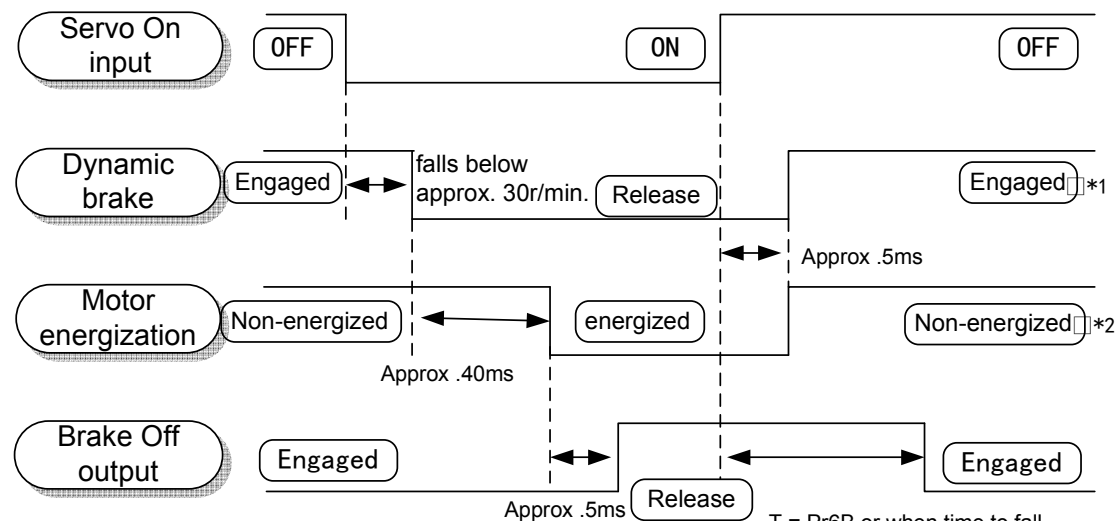
Related parameter:
    Pr69 Sequence at main power OFF
    Pr6B Setup of mechanical brake action at running

<Cautions>

1. T will be a shorter time of either the setup value of Pr6B or elapsing time for the motor speed to fall below 30r/min.

2. Even though the SRV-ON signal is turned on again during the motor deceleration, Servo-ON will not be activated until the motor stops.

3.Servo-ON will not be activated until the motor speed falls below approx. 30r/min.

*1*2 For the motor energization during deceleration at Servo-OFF, refer to an explanation of Pr69, "Sequence at Serve-OFF ("Parameter setup" at each control mode) as well.

6-3 Gain adjustment

6-3-1 Real-time Auto-gain

The driver estimates the load inertia of the machine in real time, and automatically sets up the optimum gain responding to the result. Also the driver automatically suppress the vibration caused by the resonance with an adaptive filter.

All drive control mode, can utilize the real-time auto-gain adjustment.
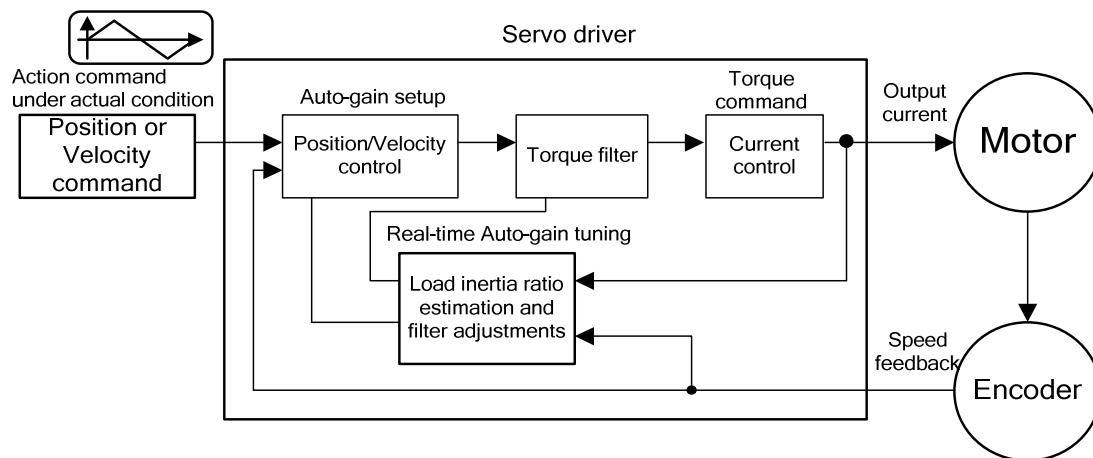
Methods of operation

1. Bring the motor to stall (Servo-OFF). (SVO-ON：CN I/F PIN 29)
2. Set up Pr21(Real-time auto-gain)，Set to a value other than 0. Usually begins from a number set by the small. The smaller the value, representing the learning rate is lower, for moderate changes in load inertia body. Higher learning rate, although you can quickly estimate the change in inertia, but because some motion curve may become unstable.
3. Pr22 set stiffness parameters, please start from the lower value set.
4. Then the motor can be ServoON, that is, the input signal (SVO-ON: CN I / F PIN 29) to ON, and operation of machinery in accordance with the general way to start.
5. In the mechanical operation, please also observe whether the normal functioning of institutions. When you want to improve the motor response, gradually increase the value of Pr22 to the appropriate stiffness. Adjust stiffness, if the occurrence of abnormal noise or mechanical earthquake, they should immediately reduce the stiffness values
6. Operation is completed, the results can be saved to EEPROM, for later re-use.

Setting Value	Real-time auto-gain	Load inertia
【0】	Turn off	
1	Slower learning rate	Almost no change
2		
3	Normal learning rate	Change mitigation
4		
5		
6	Fast learning rate	Fast changes
7		

Setting is "0", it will turn off real-time auto-gain adjustment function.

<Cautions>

The following conditions occurs, real-time auto-gain adjustment may not work, use off-line auto-gain or manually adjust the gain of the gain adjustment parameters.

- Rapid changes in load inertia ratio.
- Load inertia is too large, more than 20 times
- Mechanical stiffness is too low
- Gear gap phenomenon occurs

Automatically adjust the parameter list

On-line real-time auto-gain function is turned on, the following parameters will be automatically adjusted, but can not manually change the value.

Pr No.	Function
10	First position loop gain
11	First speed loop gain
12	Time constant of first speed loop integral
13	First speed detection filter
14	Time constant of first torque filter
15	Speed feed-forward
16	Time constant of speed feed-forward filter
18	Second position loop gain
19	Second speed loop gain
1A	Time constant of second speed loop integral
1B	Second speed detection filter
1C	Time constant of second torque filter
20	Inertia ratio
30	Second gain action setting

6-3-2 Off-line Auto-gain

Drive internal position command control motor movements. Run through the mechanical load torque and acceleration. estimate the load inertia ratio. Automatically adjusted to the appropriate gain.
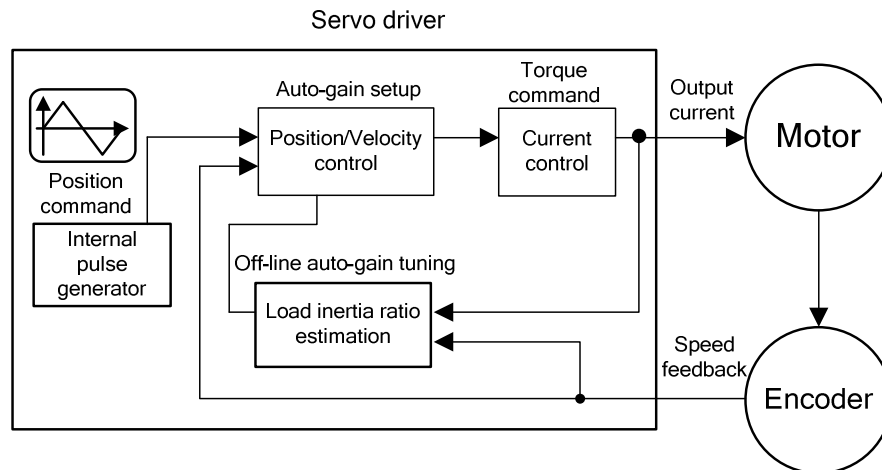
Methods of operation

1. Please accordance with the machinery of the actual situation，setting Pr25(off-line auto-gain）

   Select the operation mode of operation and scope rotated.

   Pr25 = 0, meaning the motor (facing shaft) from the starting point, first to the CCW direction of rotation 2 laps later, and then went to the CW direction of rotation 2 laps back to the original starting point, execution total five cycles.

2. According to the set operating range, the mechanical load to a safe location, be sure to disable all external command input to drive.

3. Motor Servo ON, that is, the input signal (SVO-ON: CN I / F PIN 29) is turned ON.

4. Choose the mechanical stiffness values requirement. You can start the off-line auto-gain adjustment,stiffness value setting, please begin by smaller. Mechanical function was normal, and then increase to the appropriate stiffness values, adjusted to no abnormal noise or vibration.

5. Operation is completed, the results can be saved to EEPROM, for later re-use.

<Cautions>

The following conditions occurs, off-line auto-gain adjustment may not work, use manually adjust the gain of the gain adjustment parameters.

- Load inertia is too large, more than 20 times
- Mechanical stiffness is too low
- Gear gap phenomenon occurs

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Setting Value	Rotational direction	Number of revolution
【0】	CCW → CW	2 revolution(CCW → CW)
1	CW → CCW	2 revolution(CW → CCW)
2	CCW →	2 revolution(only CCW)
3	CW →	2 revolution(only CW)
4	CCW → CW	1 revolution(CCW → CW)
5	CW → CCW	1 revolution(CW → CCW)
6	CCW →	1 revolution(only CCW)
7	CW →	1 revolution(only CW)

Automatically adjust the parameter list

Off-line auto-gain function is turned on, the following parameters will be automatically adjusted.

Pr No	Function	stiffness															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	First position loop gain	12	20	31	40	47	59	63	70	75	82	95	115	132	164	195	255
11	First speed loop gain	9	15	19	25	36	43	50	59	65	72	85	104	126	155	185	240
12	Time constant of first speed loop integral	62	50	38	31	28	26	24	22	21	19	18	17	16	15	15	9
13	First speed detection filter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Time constant of first torque filter	500	500	500	500	500	350	300	250	250	200	150	150	150	150	150	150
15	Speed feed-forward	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
16	Time constant of speed feed-forward filter	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
18	Second position loop gain	19	24	37	48	54	69	74	82	87	95	111	134	154	191	228	297
19	Second speed loop gain	9	15	19	25	36	43	50	59	65	72	85	104	126	155	185	240
1A	Time constant of second speed loop integral	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
1B	Second speed detection filter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1C	Time constant of second torque filter	500	500	500	500	500	350	300	250	250	200	150	150	150	150	150	150
20	Inertia ratio																
31	Position control shift mode	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
32	Position control shift delay time	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
33	Position control shift level	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
34	Position control shift width	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
35	Position gain shift time	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
36	Speed control shift mode	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3A	Torque control shift mode	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6-3-3 Manual Adjustment

Adjustment in Position Control Mode

Order	Parameter No.	Title of parameter	Standard value	How to adjust
1	Pr11	1st gain of velocity loop	36	Increase the value within the range where no abnormal noise and no vibration occur. If they occur, lower the value.
2	Pr14	1st time constant of torque filter	65	When vibration occurs by changing Pr11, change this value.Setup so as to make Pr11 x Pr14 becomes smaller than 10000. If you want to suppress vibration at stopping, setup larger value to Pr14 and smaller value to Pr11. If you experience too large vibration right before stopping, lower than value of Pr14.
3	Pr10	1st gain of position loop	47	Adjust this observing the positioning time. Larger the setup, faster the positioning time you can obtain, but too large setup may cause oscillation.
4	Pr12	1st time constant of velocity loop integration	28	Setup this value within the range where no problem occurs. If you setup smaller value, you can obtain a shorter positioning time, but too small value may cause oscillation. If you setup too large value, deviation pulses do not converge and will be remained.
5	Pr15	Velocity feed forward	300	Increase the value within the range where no abnormal noise occurs.Too large setup may result in overshoot or chattering of position complete signal, hence does not shorten the settling time. If the command pulse is not even,you can improve by setting up Pr16 (Feed forward filter) to larger value.

Adjustment in Velocity Control Mode

Except gain of position loop and Velocity feed forward, adjustments of velocity control are similar with above adjustment of position mode.

Adjustment in Torque Control Mode

Pr56 (4th speed of speed setting)or velocity control loop of SPR speed limit input is the base of torque control. The following explains the setting of speed limit value.

■Setup of speed limiting value

Setup the speed limiting value to the 4th speed of speed setup (Pr56) (when torque command selection (Pr5B) is 0.) or to the analog speed command input (SPR/TRQR/SPL) (when torque command selection (Pr5B) is 1).

- When the motor speed approaches to the speed limiting value, torque control following the analog torque command shifts to velocity control based on the speed limiting value which will be determined by the 4th speed of speed setup (Pr56) or the analog speed command input (SPR/TRQR/SPL).
- In order to stabilize the movement under the speed limiting, you are required to set up the parameters according to the above-mentioned "Adjustment in Velocity Control Mode".
- When the speed limiting value = 4th speed of speed setup (Pr56) , the analog speed command input is too low or the velocity loop gain is too low, or when the time constant of the velocity loop integration is 1000 (invalid), the input to the torque limiting portion of the above fig. becomes small and the output torque may not be generated as the analog torque command.

6-4 Motor Characteristics (S-T Characteristics)

100W

Torque [N-m]
1.0 (0.96)
0.5 (0.32)

Peak running range

continuous running range

0   100   200   300   400   500   Speed [r/min]
0   0   0   0   0

ratio vs. rated torque [%]

Continuous torque vs. ambient temp. [℃]

100
85
50

0   10   20   30   40   Ambient temp [℃]

750W

Torque [N-m]
8.0 (7.1)
3.0 (2.4)

Peak running range

continuous running range

0   100   200   300   400   500   Speed [r/min]
0   0   0   0   0

ratio vs. rated torque [%]

Continuous torque vs. ambient temp. [℃]

100
85
50

0   10   20   30   40   Ambient temp [℃]

200W

Torque [N-m]
2.0 (1.95)
1.0 (0.65)

Peak running range

continuous running range

0   100   200   300   400   500   Speed [r/min]
0   0   0   0   0

ratio vs. rated torque [%]

Continuous torque vs. ambient temp. [℃]

100
85
50

0   10   20   30   40   Ambient temp [℃]

1KW

Torque [N-m]
15 (14.4)
5.0 (4.8)

Peak running range

continuous running range

0   1000   2000   3000   Speed [r/min]

ratio vs. rated torque [%]

Continuous torque vs. ambient temp. [℃]

100
50

0   10   20   30   40   Ambient temp [℃]

400W

Torque [N-m]
4.0 (3.8)
2.0 (1.3)

Peak running range

continuous running range

0   100   200   300   400   500   Speed [r/min]
0   0   0   0   0

ratio vs. rated torque [%]

Continuous torque vs. ambient temp. [℃]

100
85
50

0   10   20   30   40   Ambient temp [℃]

1.5KW

Torque [N-m]
22.0 (21.6)
(7.2)
8.0

Peak running range

continuous running range

0   1000   2000   3000   Speed [r/min]

ratio vs. rated torque [%]

Continuous torque vs. ambient temp. [℃]

100
50

0   10   20   30   40   Ambient temp [℃]

6-5 Overload protection time characteristics

Time [sec]   **Overload protection time characteristics**

100

10

1

0.1

100%   115%   150%   200%   250%   300%   **Torque [%]**

6-6 Connector Kit for Motor/Encoder Connection

6-6-1Connector and connector pin

Applicable motor models：KSMA 100W ~ 750W

Item	Part No.	Number	Manufacturer	Note
Connector	172167-1	1	Tyco electronics	connector of motor side and power connection
Connector pin	170364-1	4	Tyco electronics	
Connector	172171-1	1	Tyco electronics	connector of motor side and encoder connection
Connector pin	170363-1	11	Tyco electronics	
Connector	172159-1	1	Tyco electronics	connector of motor power connection cable
Connector pin	170366-1	4	Tyco electronics	
Connector	172163-1	1	Tyco electronics	connector of encoder connection cable
Connector pin	170365-1	11	Tyco electronics	

Applicable motor models：KSMA 1000W ~ 2000W

項目	型號	數量	製造商	備註
Straight connector	AMS3106B 20-4S	1	PLT	connector of motor power connection cable
90 degree connector	AMS3108B 20-4S	1	PLT	
Straight connector	AMS3106B 20-29S	1	PLT	connector of encoder connection cable
90 degree connector	AMS3108B 20-29S	1	PLT	

※Above non-waterproof models,if the waterproof requirements, please purchase separately.

6-6-2 SCSI-II Interface Cable

Connector of diver side	Related connector prepard by user		Manufacturer
	Part No.	Type	
SIG	Connector(Welded)	10120-3000PE	Sumitomo 3M
	Shell of Connector	10320-52A0-008	
I/F	Connector(Welded)	10150-3000PE	Sumitomo 3M
	Shell of Connector	10350-52A0-008	

6-6-3 Specification of Main Loop connector

Item	Part No.	Number	Manufacturer	Note
Connector (Female)，5PIN，7.5mm	231-205/026-000	1	WAGO	connector used by main power(L1,L2, L3)and control power(r, t)
Connector (Female)，3PIN，5mm	231-103/026-000	1	WAGO	Connectors of flyback resistor (P, B1, B2)
Connectctor (Female)，3PIN，7.5mm	231-203/026-000	1	WAGO	Connector of motor power(U、V、V)
White lever	231-131	2	WAGO	Wiring tool

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6-7 Driver Specifications

6-7-1 Basic Specificaitons

<table>
<tr><td rowspan="22">Basic Specificaitons</td><td rowspan="2">Input power</td><td>Main circu</td><td>Single/3-phase，190~255V 50/60Hz</td></tr>
<tr><td>Control circuit</td><td>Single Phase，190~255V 50/60Hz</td></tr>
<tr><td rowspan="4">Environment</td><td>Temperature</td><td>Operating : 0 to 55℃, Storage : −20 to +80℃</td></tr>
<tr><td>Humidity</td><td>Both operating and storage : 90%RH or less (free from condensation)</td></tr>
<tr><td>Altitude</td><td>1000m or lower</td></tr>
<tr><td>Vibration</td><td>5.88m/s2 or less, 10 to 60Hz (No continuous use at resonance frequency)</td></tr>
<tr><td colspan="2">Control method</td><td>IGBT PWM Sinusoidal wave drive</td></tr>
<tr><td colspan="2">Encoder feedback</td><td>2500P/r (10000 resolution) incremental encoder</td></tr>
<tr><td rowspan="2">Control signal</td><td>Input</td><td>11 inputs
(1) Servo-ON, (2) Control mode switching, (3) Gain switching/Torque limit switching, (4) Alarm clear Other inputs vary depending on the control mode.</td></tr>
<tr><td>Output</td><td>6 outputs
(1) Servo alarm, (2) Servo ready, (3) Release signal of external brake (4) Zero speed detection,(5) Torque in-limit. Other outputs vary depending on the control mode.</td></tr>
<tr><td rowspan="2">Analog signal</td><td>Input</td><td>3 inputs(A/D)</td></tr>
<tr><td>Output</td><td>2 outputs (for monitoring)
(1) Velocity monitor (Monitoring of actual motor speed or command speed is enabled. Select the content and scale with parameter.), (2) Torque monitor (Monitoring of torque command,(approx.. 3V/rated torque)), deviation counter or full-closed deviation is enabled.Select the content or scale with parameter.)</td></tr>
<tr><td rowspan="2">Pulse signal</td><td>Input</td><td>4 inputs ,Select the exclusive input for line driver or photo-coupler input with parameter.</td></tr>
<tr><td>Output</td><td>4 outputs ,Feed out the encoder pulse (A, B and Z-phase) or external scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector.</td></tr>
<tr><td>Communication function</td><td>RS232</td><td>1 : 1 communication to a host with RS23 interface is enabled.</td></tr>
<tr><td colspan="2">Front panel</td><td>(1) 5 keys (MODE, SET, UP, DOWN, SHIFT), (2) LED (6-digit)</td></tr>
<tr><td colspan="2">Regeneration</td><td>Built-in regenerative resistor (50W)。</td></tr>
<tr><td colspan="2">Dynamic brake</td><td>Setup of action sequence at Power-OFF, Servo-OFF, at protective function activation and over-travel inhibit input is enabled.</td></tr>
<tr><td colspan="2">Control mode</td><td>Switching among the following 6 mode is enabled, (1) Position control, (2) Velocity control, (3) Toque control, (4) Position/Velocity control, (5) Position/Torque control, (6) Velocity/Torque control</td></tr>
</table>

6-7-2 Function

Function				
Control input				Inputs of 1) Servo-ON, 2) Alarm clear, 3) Gain switching, 4) Control mode switching, 5) CW over-travel inhibition and 6) CCW over-travel inhibition are common, and other inputs vary depending on the control mode.
Position	Control input			(1) Deviation counter clear, (2) Command pulse inhibition, (3) Damping control switching,(4) Gain switching or Torque limit switching
	Control output			Positioning complete (In-position)
	Pulse input	Max. command pulse freq		Exclusive interface for line driver : 2Mpps, Line driver : 500kpps, Open collector : 200kpps
		Input pulse signal format		Support (1) RS422 line drive signal and (2) Open collector signal from controller.
		Type of input pulse		1) CW/CCW pulse, (2) Pulse signal/rotational direction signal, (3) 90° phase difference signal
		Electronic gear (Division/Multiplication of command pulse)		Process the command pulse frequency $\times \dfrac{(1 \text{ to } 10000) \times 2^{(0 \text{ to } 17)}}{1 \text{ to } 10000}$
		Smoothing filter		Primary delay filter is adaptable to the command inputSelectable of (1) Position control for high stiffness machine and (2) FIR type filter for position control for low stiffness machine.
	Analog input	Torque limit command input		Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
Velocity	Control input			(1) Speed zero clamp, (2) Selection of internal velocity setup, (3) Gain switching or Torque limit switching input
	Control output			(1) Speed arrival (at-speed)
	Analog input	Velocity command input		Setup of scale and rotational direction of the motor against the command voltage is enabled with parameter, with the permissible max. voltage input = ±10V and 6V/rated speed (default setup)
		Torque limit command input		Individual torque limit for both CW and CCW direction is enabled. (3V/rated torque)
	Speed control range			1：5000
	Internal velocity command			8-speed with parameter setup
	Soft-start/down function			Individual setup of acceleration and deceleration is enabled, with 0 to 10s/1000r/min. Sigmoid acceleration/deceleration is also enabled.
	Zero-speed clam			0-clamp of internal velocity command with speed zero clamp input is enabled.

Function	Torque control		Control input	(1) CW over-travel inhibition, (2) CCW over-travel inhibition, (3) Speed zero clamp
			Control output	(1) Speed arrival (at-speed)
		Analog input	Velocity command input	Setup of scale and CW/CCW torque generating direction of the motor against the command voltage is enabled with parameter, with the permissible max. voltage input = ±10V and 3V/rated speed (default setup).
			Speed limit input	Speed limit input by analog voltage is enabled. Scale setup with parameter.
			Speed limit function	Speed limit value with parameter or analog input is enabled.
	Common		Masking of unnecessary input	Masking of the following input signal is enabled. (1) Over-travel inhibition, (2) Torque limit, (3) Command pulse inhibition, (4) Speed-zero clamp
			Division of encoder feedback pulse	Set up of any value is enabled (encoder pulses count is the max.).
		Protective function		Over-voltage, under-voltage, over-speed over-load, over-heat, over-current and encoder error etc.
				Excess position deviation, command pulse division error, EEPROM error etc.
			Traceability of alarm data	Traceable up to past 16 alarms including the present one.
		Setup	Manual	5push switches on front panel ▢ ▢ ▢ ▢ ◁
			Setup support software	

6-8 Error Code Description

Err.11 |Under-voltage protection for control power

Causes

- Control power (r、t) lower voltage.
- Momentary power failure occur the input control voltage.
- Insufficient power, result in the instant voltage drop on.

Solution

- ✓ Measurement control power (r, t) of the input voltage is correct.
- ✓ Increase the capacity of power supply.

Err.12 |Over-voltage protection

Causes

- Voltage exceeds permissible voltage range AC 260V.
- Regenerative resistor inappropriate, regenerative energy absorption is not complete.
- Regenerative resistor disconnected.

Solution

- ✓ Measurement main power (L1、L2、L3) of the input voltage is correct.
- ✓ Replaced by high power regenerative resistor.
- ✓ Measured P-B2 regenerative resistor values. If an open circuit, then replace the external resistor.

Err.13 |Under-voltage protection for main power

Causes

- Main power (L1、L2、L3) low voltage.
- Main power Instant power failure.
- Insufficient power, result in the instant voltage drop on.
- Lack of power phase.

Solution

- ✓ Measurement main power (L1、L2、L3) of the input voltage is correct.
- ✓ Increase the capacity of power supply.
- ✓ Properly connected to the main power. When using single-phase power connection L1, L3. When using the three-phase power, connect L1, L2, L3.

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Err.14 |Over-current protection (software)

Causes

- Driver output current exceeds the limit values.
- Servo motor power line contact is not completely, UVW between the short circuit or ground.
- Command input and ServoON the same time or earlier.
- Driver failure or motor failure.
- Often in the servo motor rotates, turn on or turn off the Servo ON, leading to destruction of the dynamic brake relay.
- Servo motor and drive specifications do not meet.

Solution

- ✓ Check servo motor UVW connector for loose or exposed wire and short circuit, poor insulation and green lines.
- ✓ Servo ON after waiting for more than 100ms is required,before they can input command.
- ✓ Please remove the servo motor power cable, then input the Servo ON test. If an exception occurs immediately after Servo ON, necessary to replace the drive.
- ✓ Measure the line resistance servo motor is balanced, if the resistance of imbalance need to replace the servo motor.
- ✓ Do not use Servo OFF / ON control servo motor to stop or running.
- ✓ According to label instructions, to confirm the servo motor drive models and capacities are matched with each other.

Err.15 |Over-heat protect

Causes

- Driver cooling, power components over the temperature exceeded the specified value.
- Load excessive.

Solution

- ✓ Reduce the temperature of the environment and enhance DRIVER cooling.
- ✓ Increase the deceleration time and lower operating speed.
- ✓ Choose a higher capacity drives and servo motors.

Err.16 |Over load protection

Causes

- Torque command values exceeded overload level (115%), the time limit will be based on overload characteristic curve, resulting in overload protection.

Time [sec]   **Overload protection time characteristics**
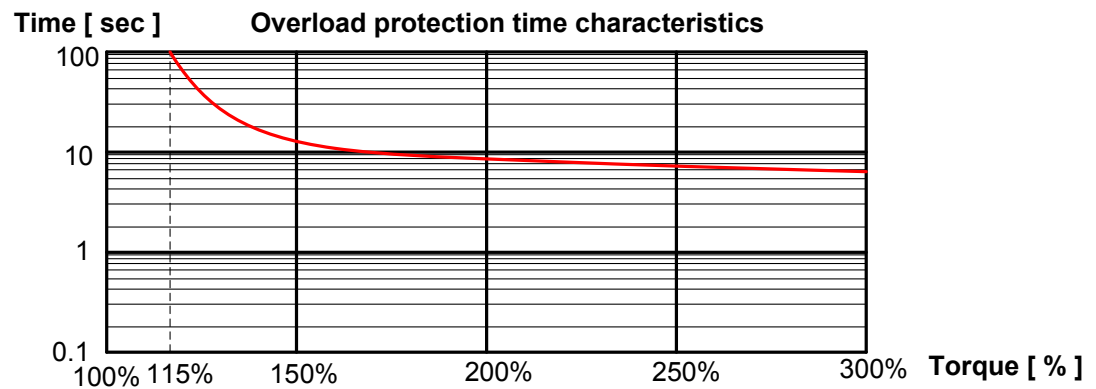
- Heavy load and makes the actual output torque exceeds the rated torque and continuous operation.
- Gain is adjusted properly, leading to mechanical vibration, shaking.
- Poor installation, cause the machine is not running smoothly.
- Motor operation, electromagnetic brake not released.

Solution

- ✓ Choose a higher capacity drives and servo motors.
- ✓ Increase the deceleration time and lower operating speed.
- ✓ Reduce the load.
- ✓ Re-adjust the gain parameter.
- ✓ Adjust machine so that machine running smoothly.
- ✓ Sure the electromagnetic brake of the terminal voltage (24V) is the normal brake release.

Err.18 |Over regenerative load protection

Causes

- Large load, the servo motor in the regenerative energy during deceleration, regenerative resistor exceeded the processing capacity, resulting in increased driver of the capacitor voltage.
- Servo motor in high speed operation, in a short deceleration time can not fully absorb the regenerative energy.
- External resistor consumption is limited to 10% duty.

Solution

- Observing the driver alert status and regenerative load ratio.
- Increase the deceleration time and lower operating speed.
- Choose a higher capacity drives and servo motors
- Use of external regenerative resistor. (Specifications for the built-in regenerative resistor 150Ω50W)。
- After using the external regenerative resistor, if still not fully absorb the regenerative energy，You can try to Pr6C = 2，And note that using this setting, be sure to set the temperature fuse protection to avoid damage resistance.

Err.20 |Encoder A,B phase error protection

Causes

- Encoder cable poor contact occurs, leading to A, B phase feedback signal or the differential voltage level is not correct.

Solution

- Check SIG encoder connector is properly connected driver.
- Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.

Err.21 |Encoder communication error protection

Causes

- Drive operation, to detect the driver and encoder communications interrupt too many times.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.
- ✓ encoder cable, motor cable, the power input line to keep their distance more than 30cm, please do not tie together by the same groove.

Err.22 |Encoder communication data error protection

Causes

- Drive operation, no breakdown in communications, but may be due to noise interference, and to detect the communication with the encoder information is incorrect.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.
- ✓ encoder cable, motor cable, the power input line to keep their distance more than 30cm, please do not tie together by the same groove.

Err.24 |Excess positional deviation protection

Causes

- Servo motor does not rotate to follow the command.
- Pulse position deviation exceeds Pr63.

Solution

- ✓ Check the servo motor to follow the position command input rotation.
- ✓ Check the servo motor wiring is correct UVW.
- ✓ Increase the gain setting.
- ✓ Extend motion controller acceleration and deceleration time and lower operating speed.
- ✓ Reduce the load.
- ✓ Increase Pr63, or set Pr64 = 1.

Err.26 |Over speed protection

Causes

- Servo motor rotation speed exceeds the maximum speed limit.
- Poor gain adjustment, resulting in Overshoot.

Solution

- ✓ Check the position command pulse frequency does not exceed the input limit.
- ✓ Check the input command electronic gear ratio is too large.
- ✓ Avoid fast speed command input.
- ✓ Re-adjust the gain settings to eliminate the Overshoot.

Err.29 |Deviation counter overflower protection

Causes

- Deviation counter value exceeds 2^{27} (134217728)

Solution

- ✓ Check the servo motor is rotating along with the input position command.
- ✓ Check the servo motor wiring is correct UVW.
- ✓ Increase the gain setting.

Err.36 |EEPROM parameter error protection

Causes

- Read data from the EEPROM, EEPROM data corruption parameters.

Solution

- ✓ Reset all the parameters, and stored in the EEPROM.
- ✓ The contents of the EEPROM restore to factory state.
- ✓ If repeated, shall replace the drive.

Err.37 |EEPROM parameter error protection

Causes

- Stored in the EEPROM data corruption of CRC.

Solution

- ✓ Reset all the parameters, and stored in the EEPROM.
- ✓ The contents of the EEPROM restore to factory state.
- ✓ If repeated, shall replace the drive.

Err.38 |Run inhibition input protection

Causes

- Pr04 = 0 时, CCW-LIMIT (CN I / F, Pin-9) and CW-LIMIT (CN I / F, Pin-8), both open to the COM-.
- Pr04 = 2, CCW-LIMIT and CW-LIMIT, one of which, with the COM-open.

Solution

- ✓ Check the pin CCW-LIMIT, CW-LIMIT and COM-connection of sensors, switches, power supplies and other wiring is abnormal.
- ✓ Check the I / F control signal power on sequencing.

Err.48 |Encoder Z phase error protection

Causes

- Encoder cable exposure is not good, resulting in the Z-phase feedback voltage level differential signal or incorrect.

Solution

- ✓ Check SIG encoder connector is properly connected driver.
- ✓ Check the encoder cable, male and female connectors really connected whether loose or loose metal pin.

Err.49 | Encoder Z phase lose protection

Causes

- Encoder one rotation, Z phase signal is not detected when a protective.

Solution

- ✓ Encoder components may fail, need to replace motor.

Err.50 | Encoder Z phase double signal

Causes

- Encoder rotating a circle, more than once detected the Z-phase signal to produce a protective

Solution

- ✓ The motor shaft may be subjected to hit, pulling and other external stress, resulting in breakage of glass plate, need to replace motor.

Err.99 |Over current protection (Hardware)

Causes

- Driver output current exceeds the limit values.
- Servo motor power line contact is not completely, UVW between the short circuit or ground.
- Command input and ServoON the same time or earlier.
- Driver failure or motor failure.
- Often in the servo motor rotates, turn on or turn off the Servo ON, leading to destruction of the dynamic brake relay.
- Servo motor and drive specifications do not meet.

Solution

- ✓ Check servo motor UVW connector for loose or exposed wire and short circuit, poor insulation and green lines.
- ✓ Servo ON after waiting for more than 100ms is required, before they can input command.
- ✓ Please remove the servo motor power cable, then input the Servo ON test. If an exception occurs immediately after Servo ON, necessary to replace the drive.
- ✓ Measure the line resistance servo motor is balanced, if the resistance of imbalance need to replace the servo motor.
- ✓ Do not use Servo OFF / ON control servo motor to stop or running.
- ✓ According to label instructions, to confirm the servo motor drive models and capacities are matched with each other.

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