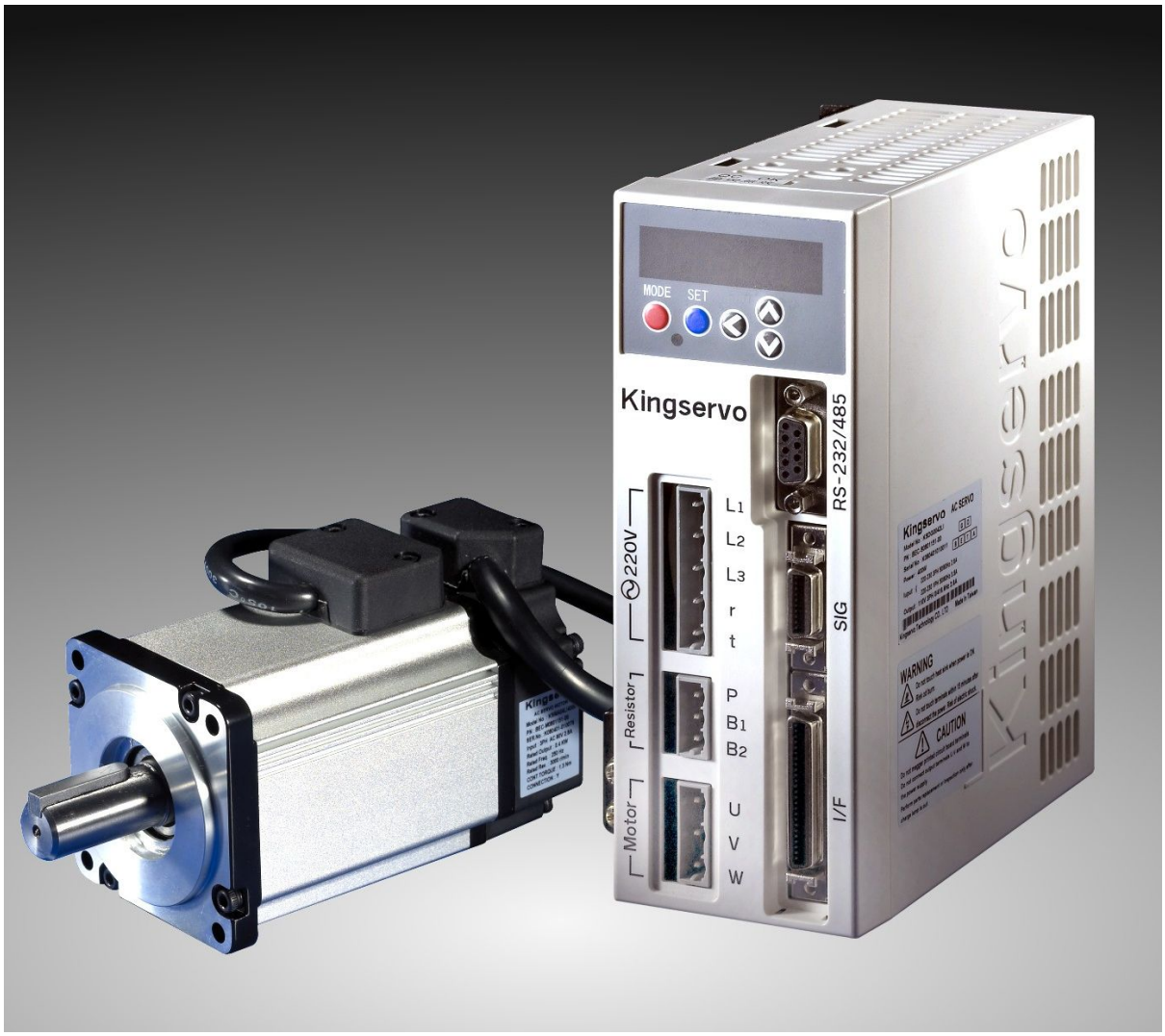
Kingservo

Manual

AC Servo MotorKSMA

Servo Driver KSDG Series



20090219(Ver.4)

Content

Chapter 1: Identificaiotns of Products 5
1-1Safety Sign 5
1-3 Indentification of AC Servo Driver Type 7
1-3-1 Name-plate of Driver 7
1-3-2 Identifications of Driver Type 7
1-4 AC Encoding Principles of Servo 8
1-4-1 Name-plate of Servo Motor 8
1-5 Name of Parts 9
1-5-1Driver 9
1-5-2 Motor 10
1-6 Usage 11
Chapter 2: Connectionor and Wiring 13
2-1Controller and peripheral configuration map 13
2-2 Power Wiring Diagram 15
2-3 Defination of Connector Pin 17
2-3-1Cable of Encoder 17
2-3-2 Power Cable of Motor 18
2-4 Communication Line of RS-232 19
2-5 Wiring of Connector I/F 20
2-5-1 Pins of Connector I/F(SCSI II) 21
2-5-2Pin Signal ModeTable 22
Charpter 3: Setup with the Front Panel 27
3-1 Composition of Touch Panel and Display 27
3-2 Structure of Each Mode 28
3-3 Monitor Mode 29
3-4 Parameter Setup Mode 35
3-5 EEPROM Writing Mode 37
3-5-1 EEPROM Writing 37
3-5-2 Write in FactoryDefault Value in EEPROM 38
3-6 Stiffness setting mode 39
3-7 auxiliary function mode 40
3-7-1 Procedure for Trial Run 40
3-7-2 Alarm Clear Screen 42
3-7-3 Automatic Offset Adjustment 43
3-7-4 Alarm history clear finishes. 44
Charpter Parameters 45

4-1Setting of Parameters and Modes 45
4-1-1Introduction of Parameters 45
4-1-2 Setting Method 45
4-1-3 Connection Method 45
4-2 Instruction of Parameter Function 51
Chapter 5 Connection and setup of control mode 89
5-2-1Input Circuit 90
5-2-2 Output Circuit 92
5-3 Input Signal and Pin No. of the Connector,I/F 94
5-3-2 Input Signals (Pulse Train) and Their Functions 98
5-3-3 Input Signals (Analog Command) and Their Functions 100
5-3-4Output Signals (Common) and Their Functions 102
Chapter 6 Documenets 105
6-1 Dimensions 105
6-2 Timing Chart 109
6-3 Adjustment 113
6-4 Motor Characteristics (S-T Characteristics) 114
6-5 Overload protection time characteristics 114
6-6 Connector Kit for Motor/Encoder Connection 115
6-6-2 SCSI-II Interface Cable 115
6-6-3 Specification of Main Loop connector 115
6-7 Driver Specifications 116
6-7-1 Basic Specificaitons 116
6-7-2 Function 117

Chapter 1: Identificaiotns of Products

1-1Safety 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.

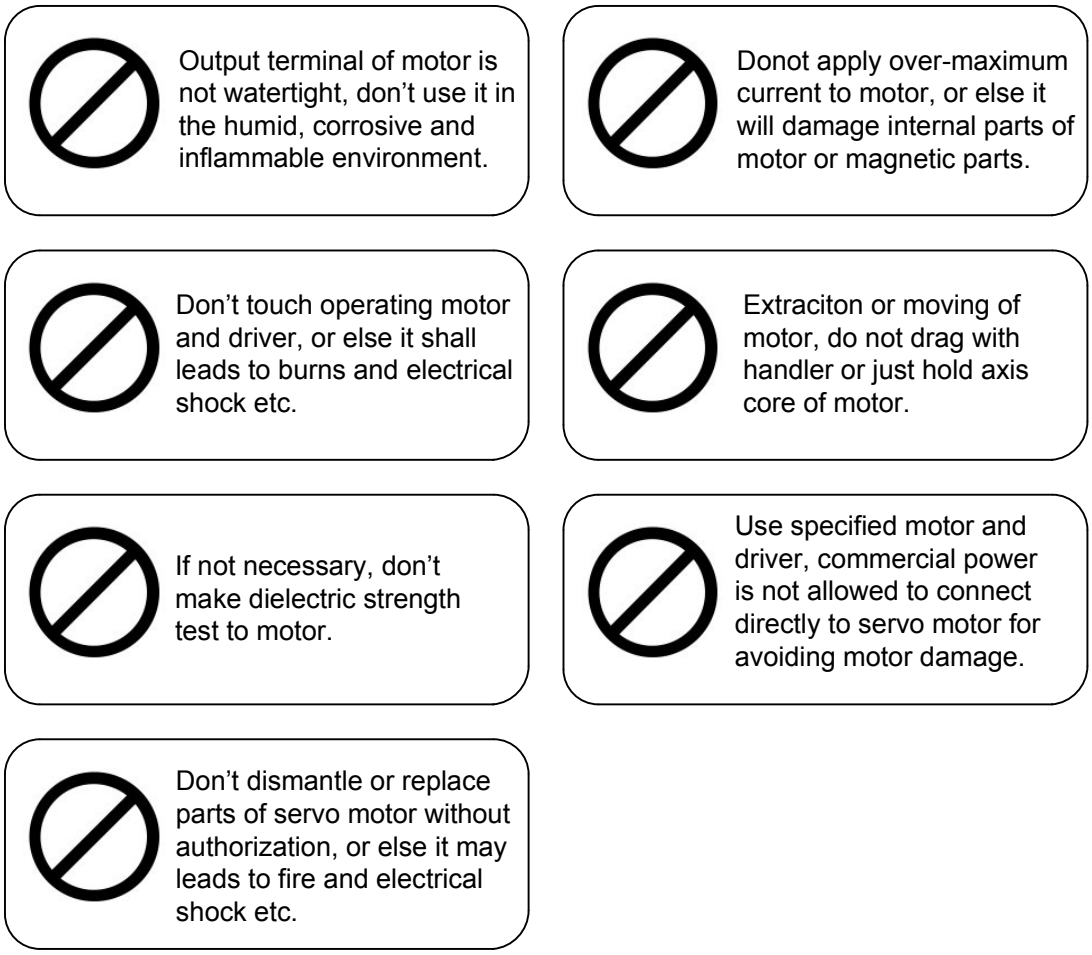
Electrical line and signal line shall be not connected to the same loop and separated for producing noise.

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



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?

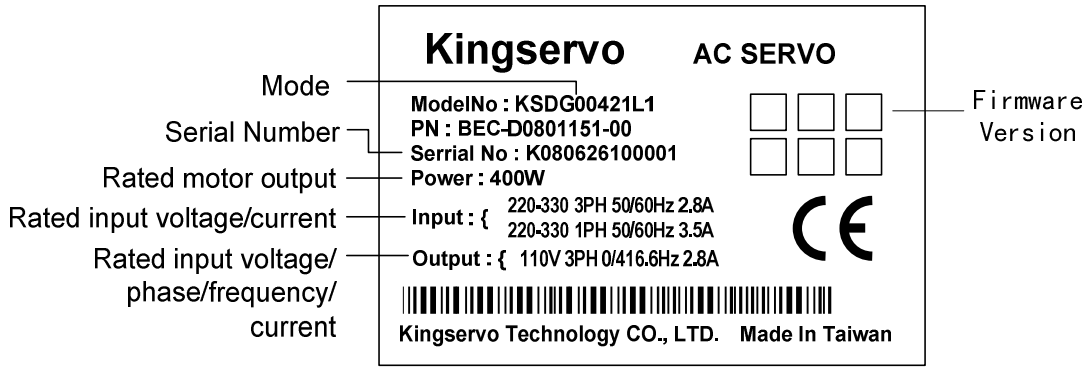
Verify whether driver motor controller and motor are the Kingservo Ac Servo series?

package contents:

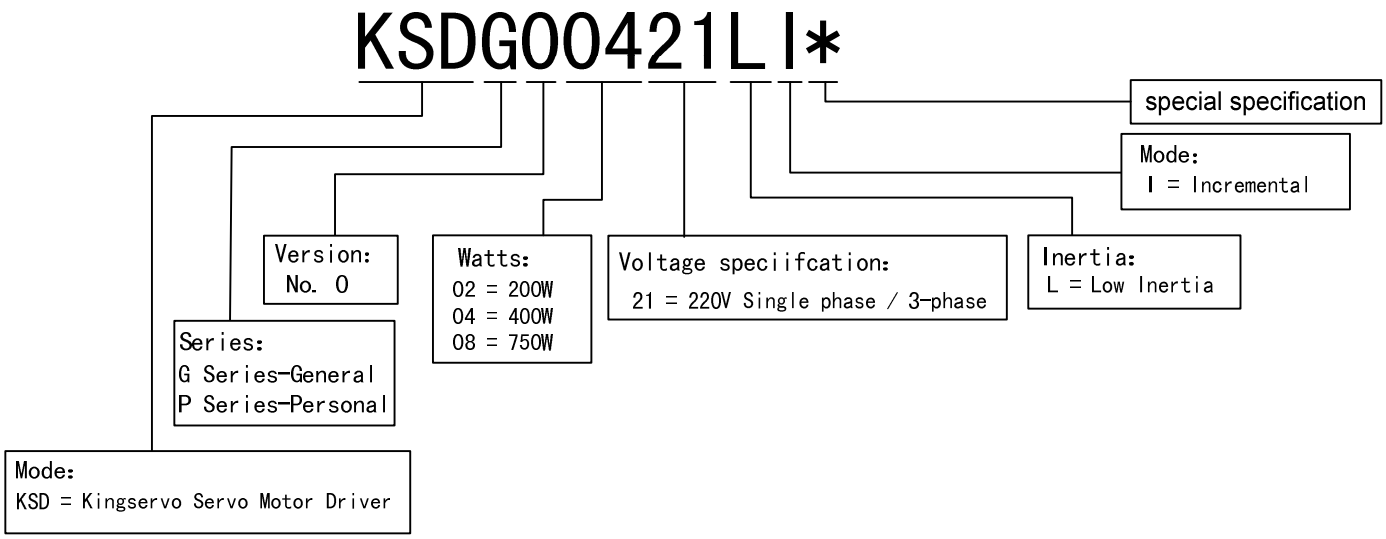
- motor
- key way
- encoding line
- power line
- controllor
- connector
- operation handle of connector

1-3 Indentification of AC Servo Driver Type

1-3-1 Name-plate of Driver

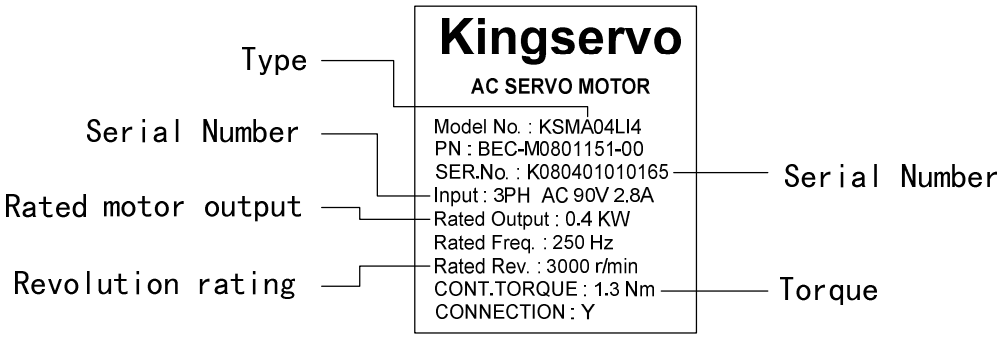


1-3-2 Identifications of Driver Type

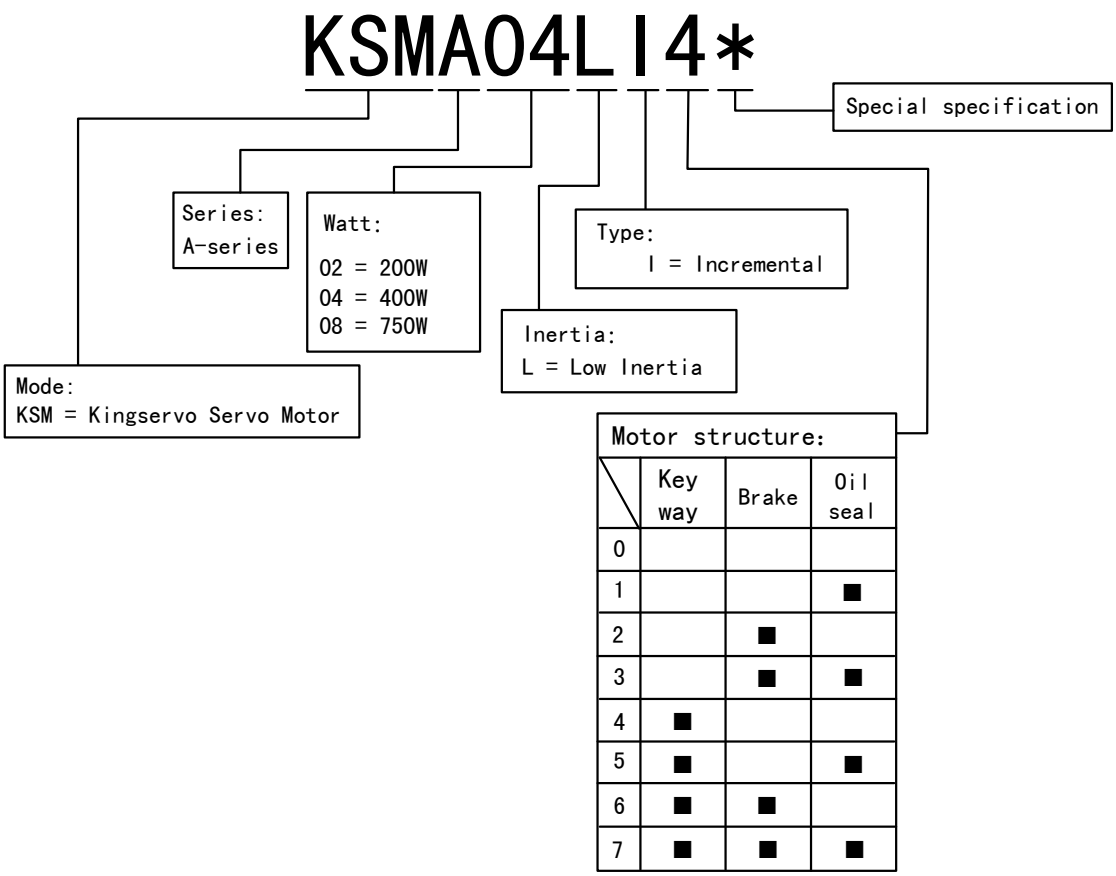


1-4 AC Encoding Principles of Servo

1-4-1 Name-plate of Servo Motor



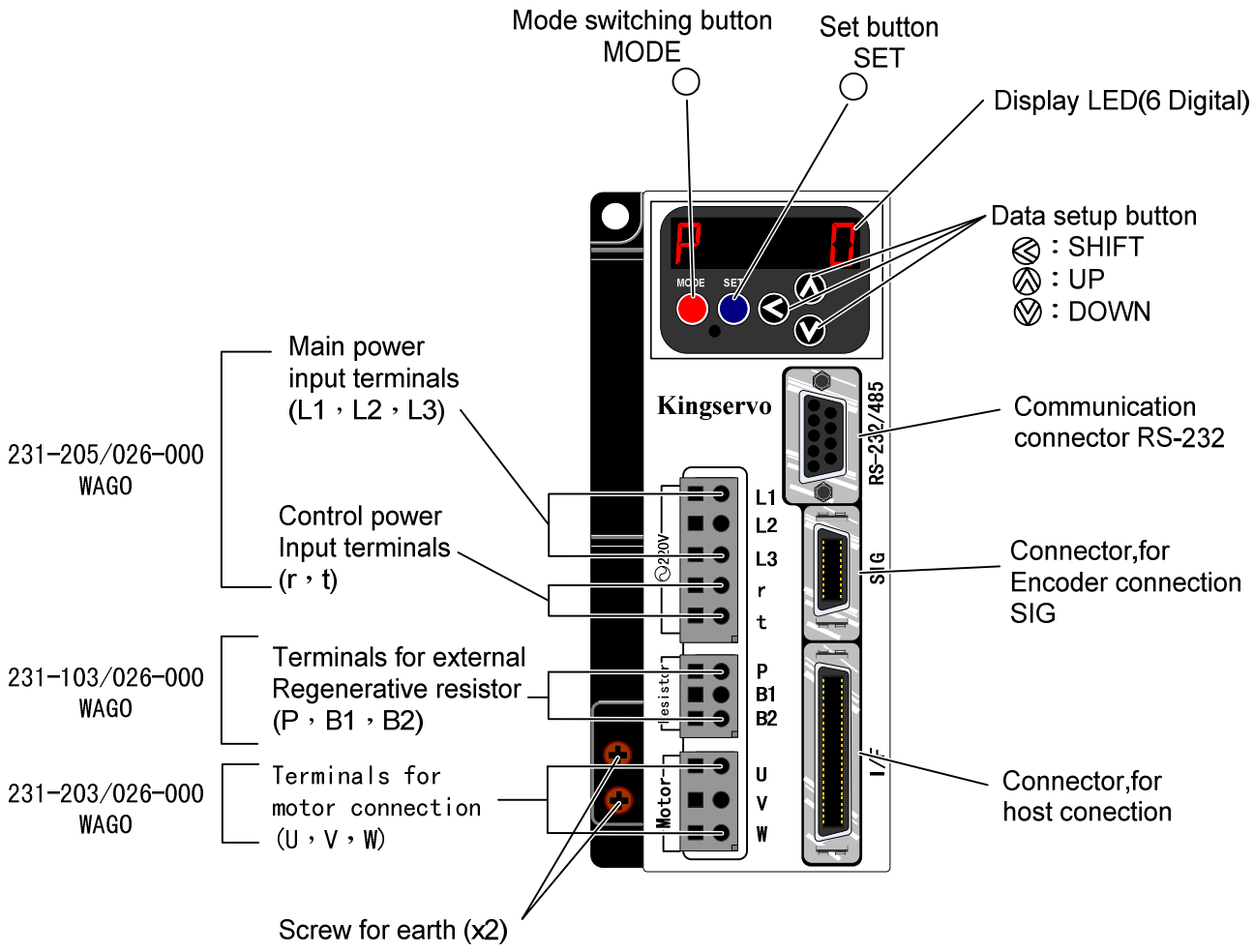
1-4-2 Identification of Servo Motor Type



1-5 Name of Parts

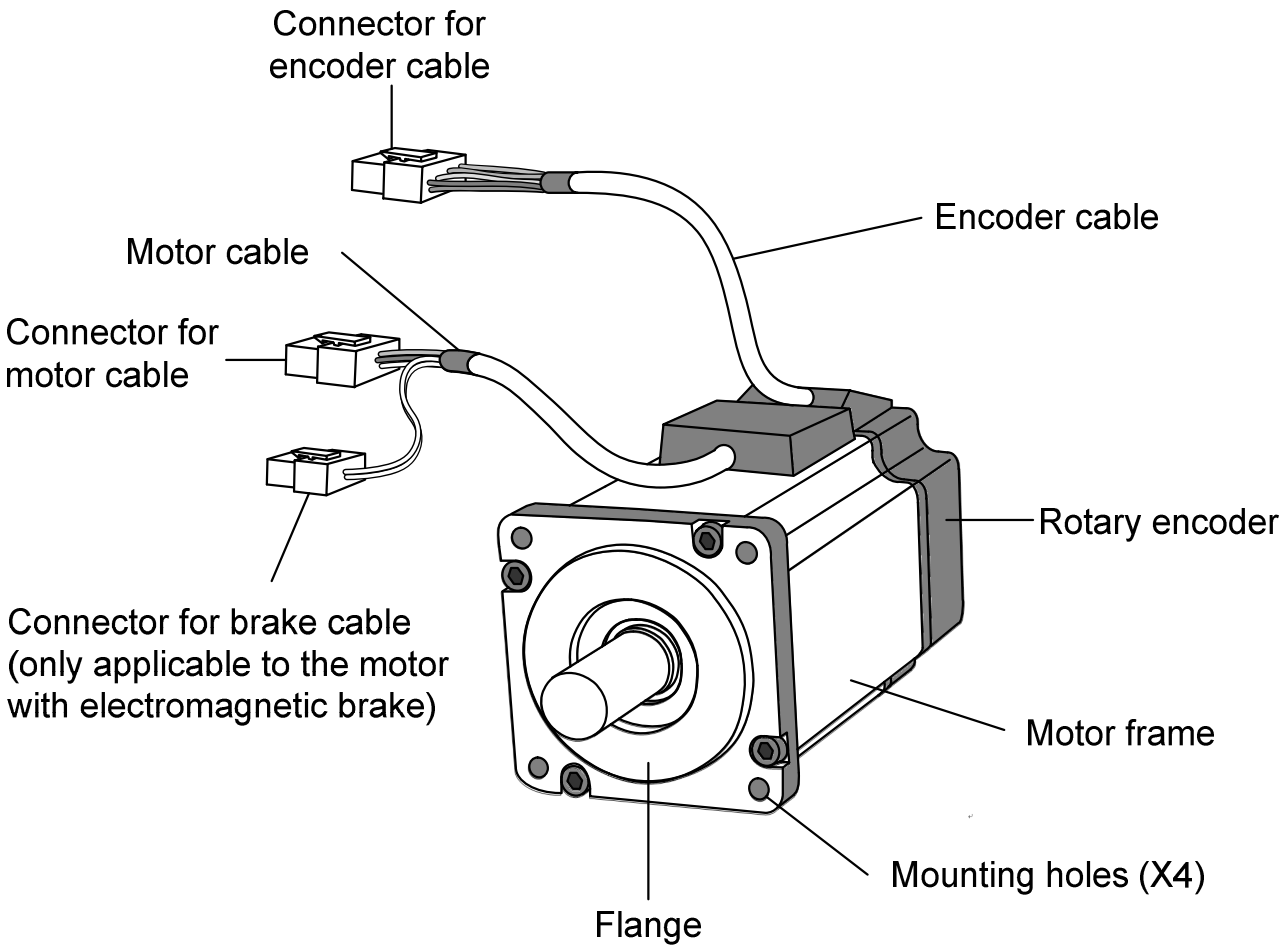
1-5-1Driver

- **KSDG 200W～3KW**



1-5-2 Motor

- **KSMA 200W～750W**



1-6 Usage

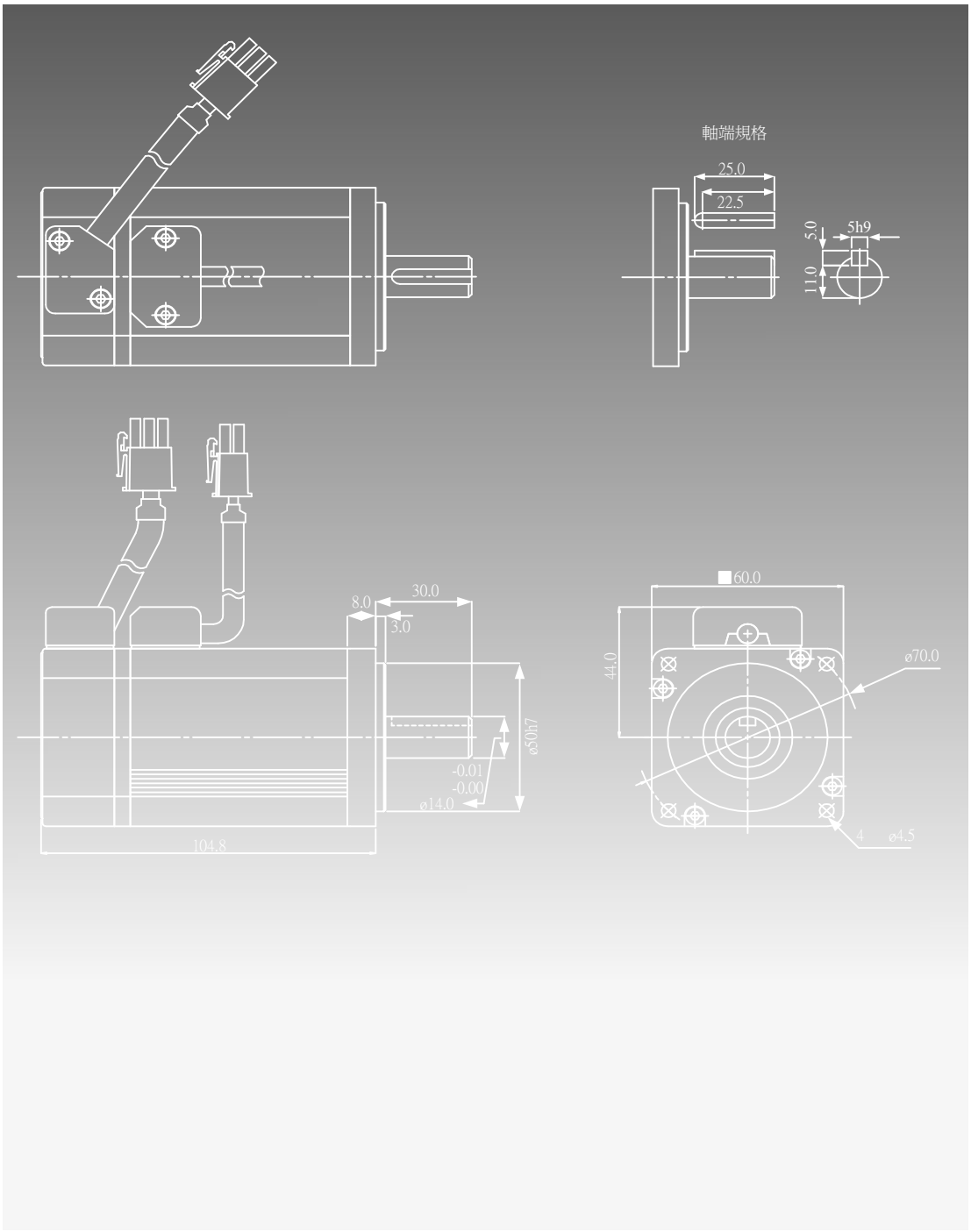
1. Usage Modes:

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

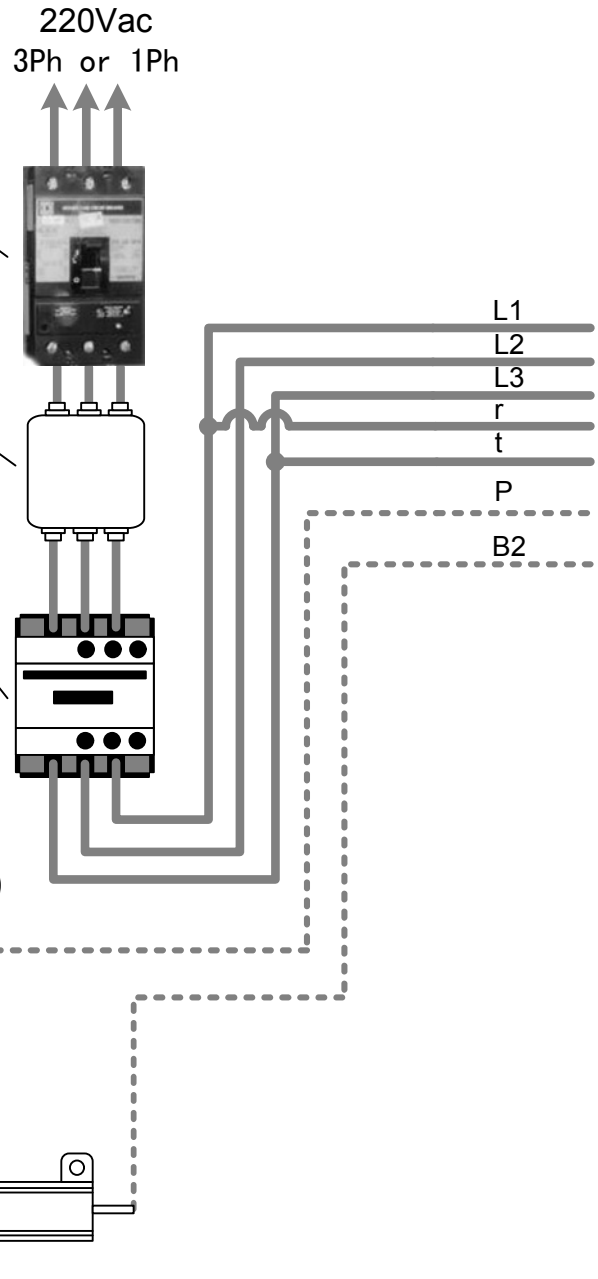
1. connect main power line(L1, L2, L3), control power(r, t), flyback resistor(P, B1, B2), connector of encoder line(SIG) and power line of motor(U, V, W) in accordance with connection of peripheral devices of controller and controller wiring diagram.
2. Increase I/F connector(MDR) wiring and connect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



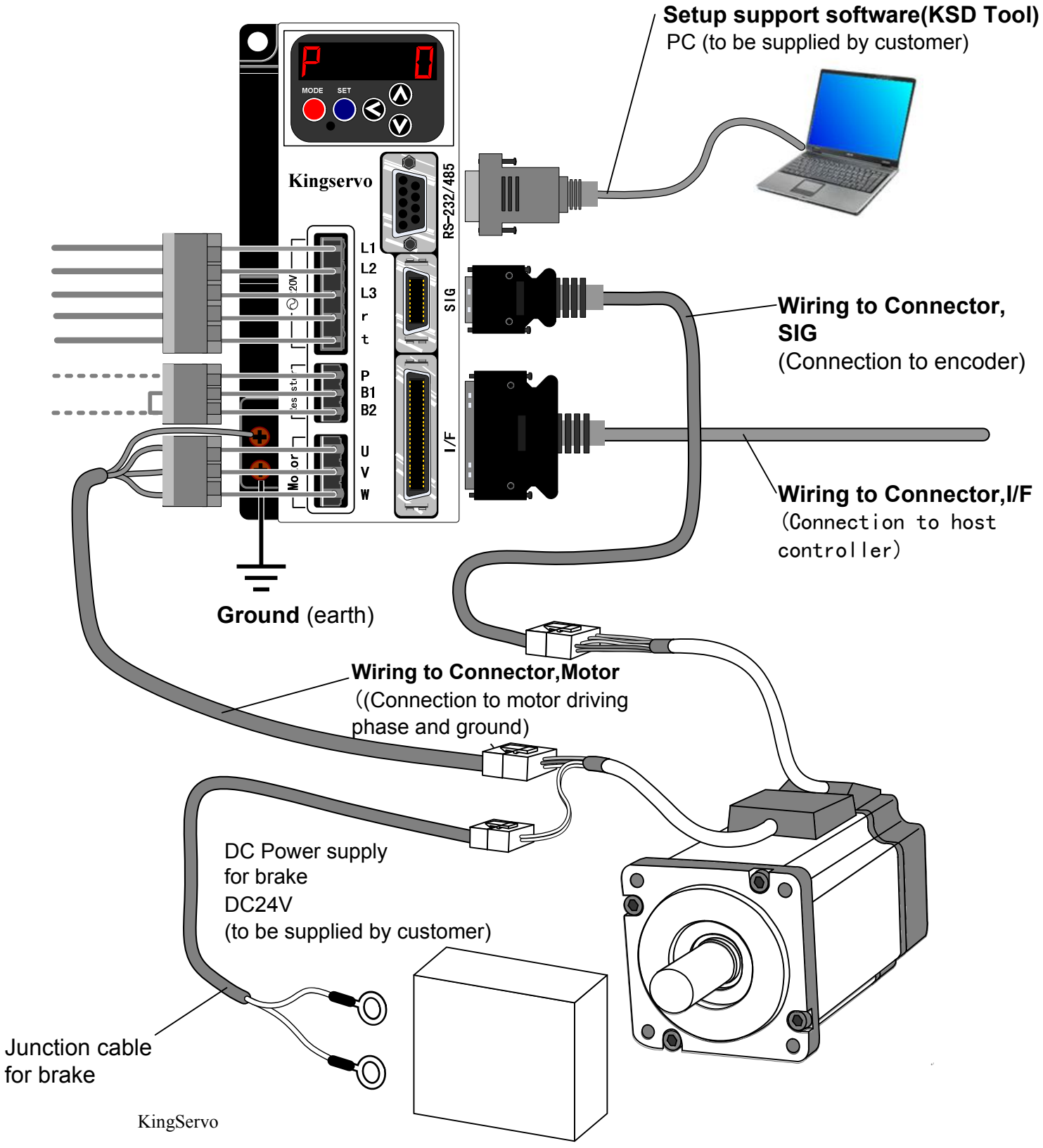
Circuit Breaker (NFB)
Use the circuit breaker matching capacity of the power source to protect the power lines.

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.

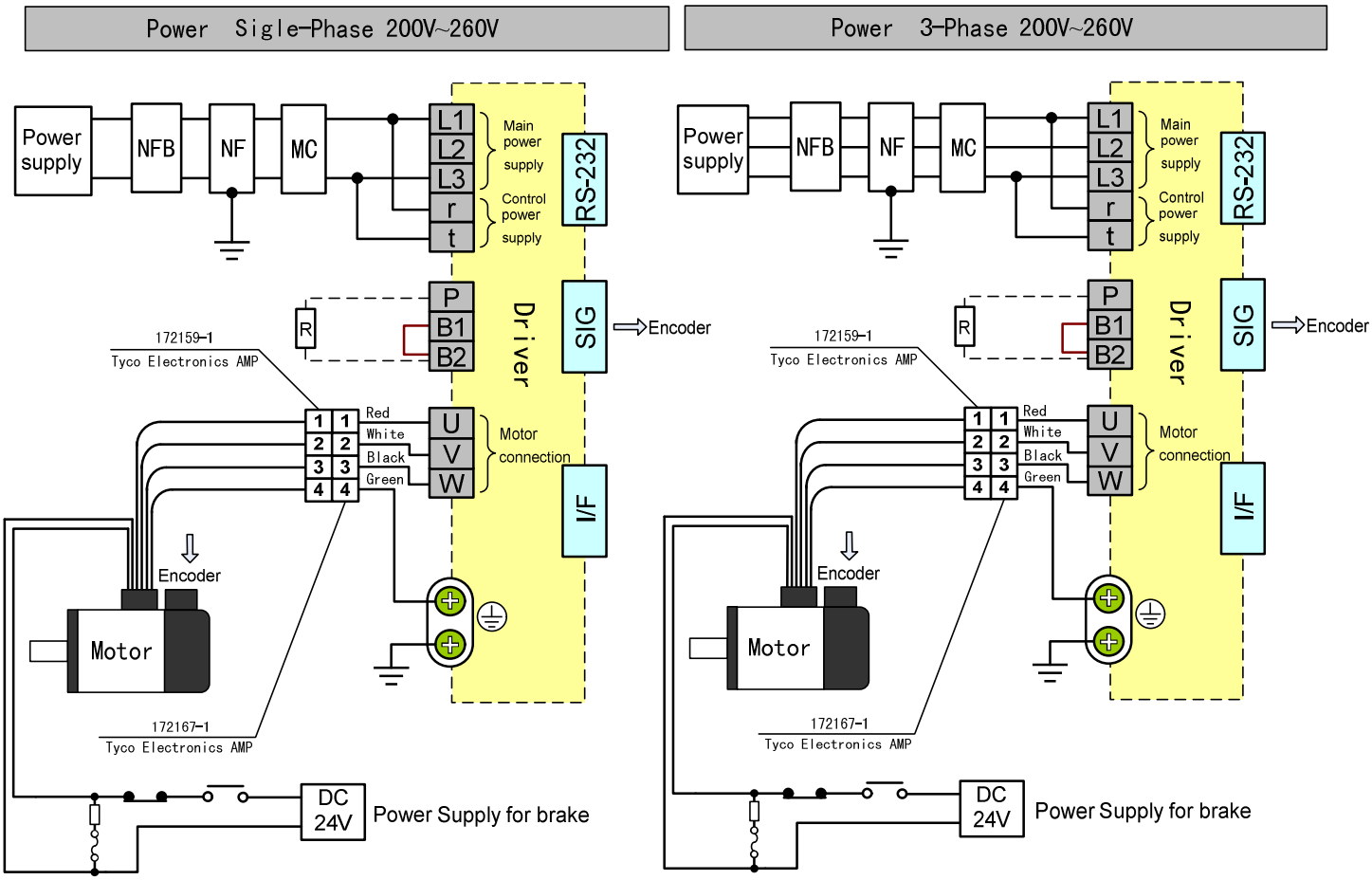
Pin RB1 (6-pin), RB2 (4-pin), and RB3 (5-pin)
•B1 and B2 to be kept shorted for normal operation.
• **When the capacity shortage of the regenerative resister is found, disconnect a shorting bar between B1 and B2**, then connect **the external regenerative resister** between P and B2.
• When you connect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

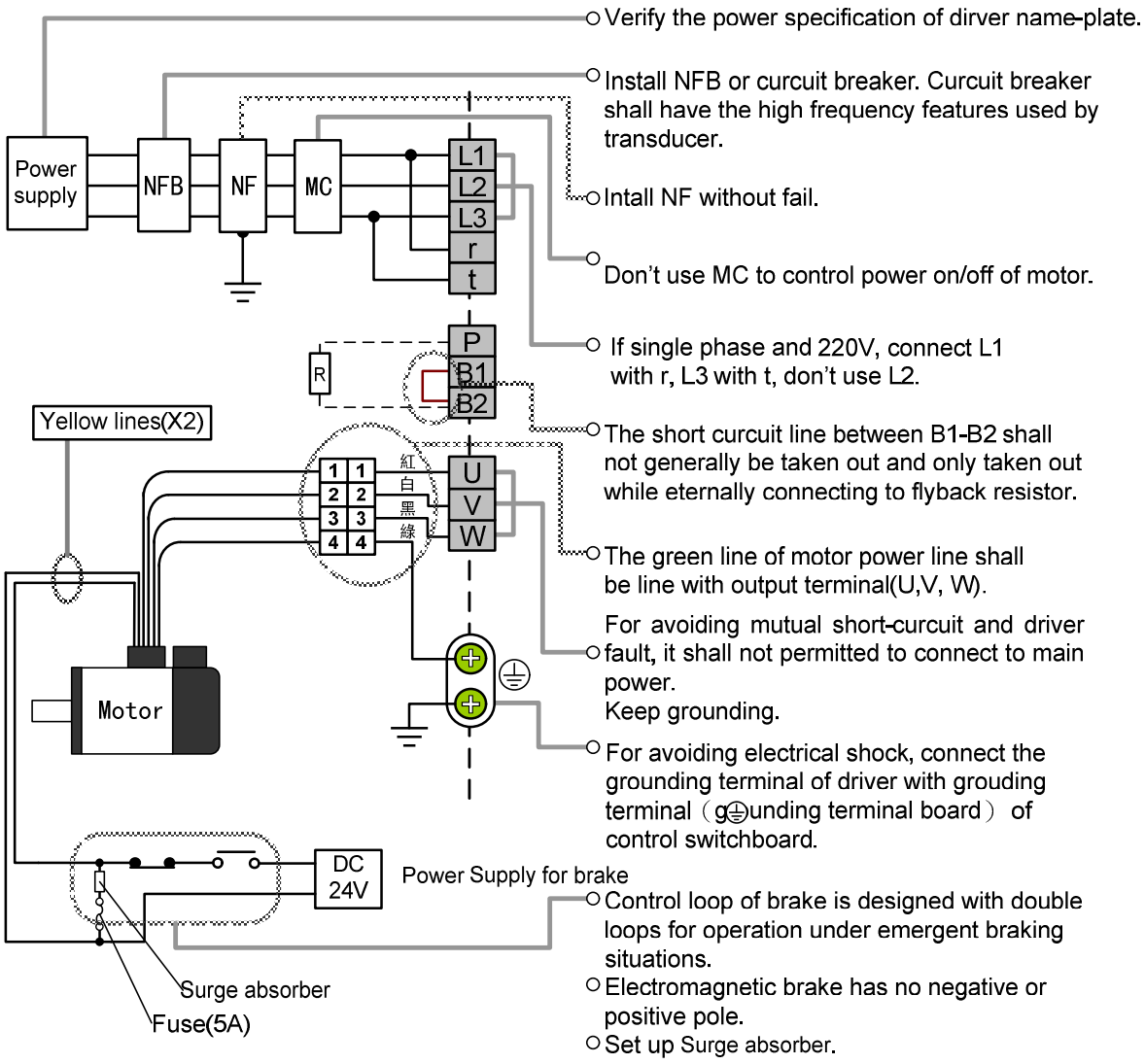
Regenerative resistor (optional)


Setup support software(KSD Tool)
PC (to be supplied by customer)
MODE
SET
Kingservo
RS-232/485
SIG
I/F
L1
L2
L3
r
t
P
B1
B2
U
V
W
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.





■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

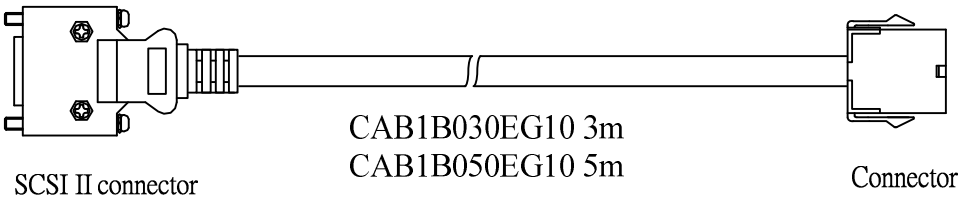
·Connect P and B2 to external flyback resistor(150Ω).

· Set Parameter Par 6C as 1.

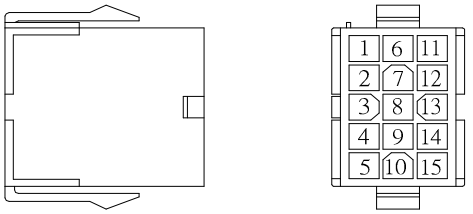
The power consumption of external resistor is limited to 10% duty, and set Par 6C as 2, (while Par 6C is set as 2, overheating-protection fuse shall be installed, or else it may cause overheating and burning-down of flyback resistor.).

2-3 Defination of Connector Pin

2-3-1Cable of Encoder



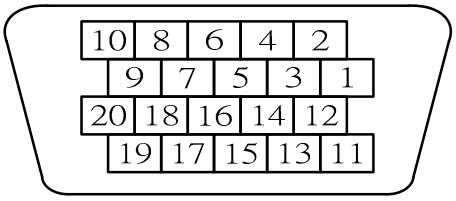
Connector



15 PIN

NO.	1	2	3	4	5	6	7-10	11	12	13	14	15
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

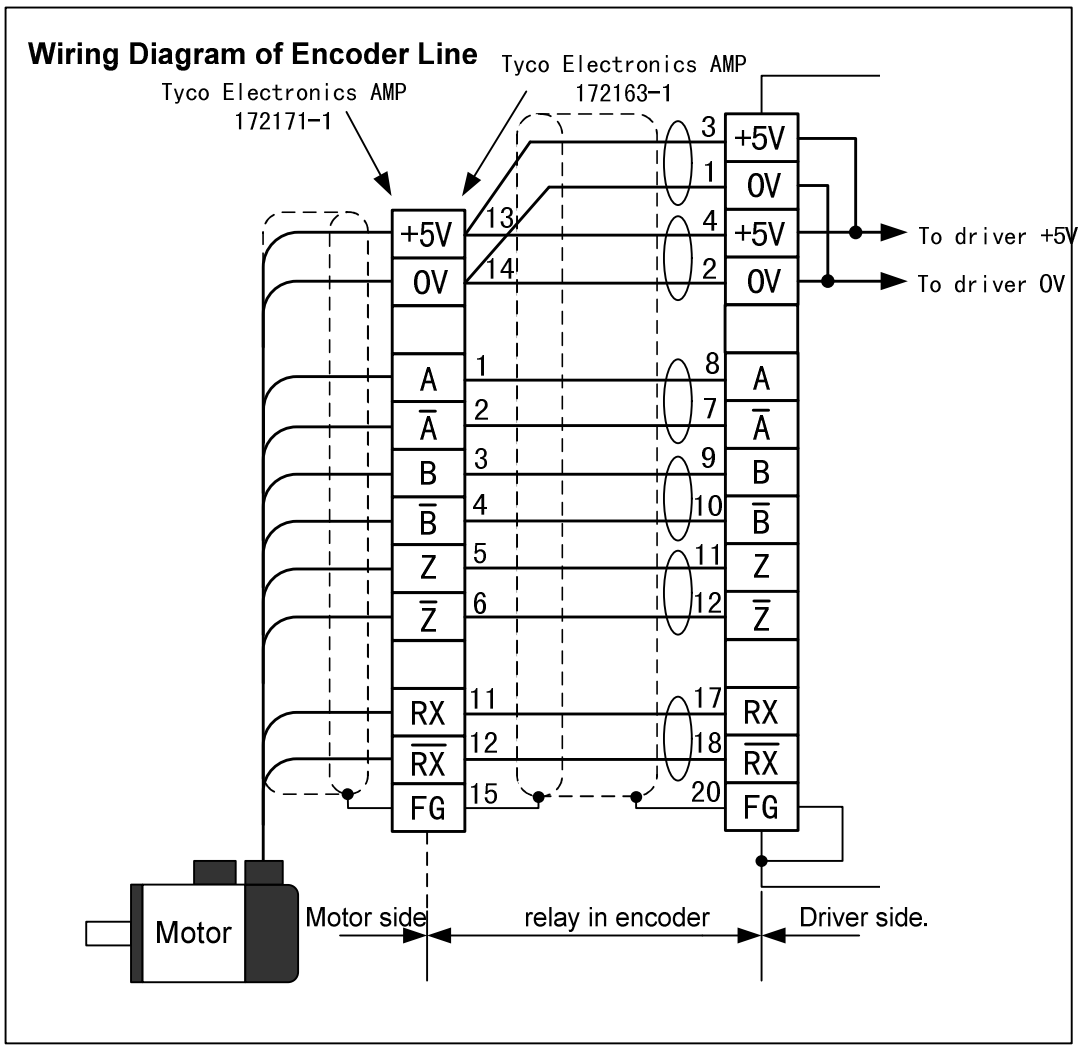


20 PIN

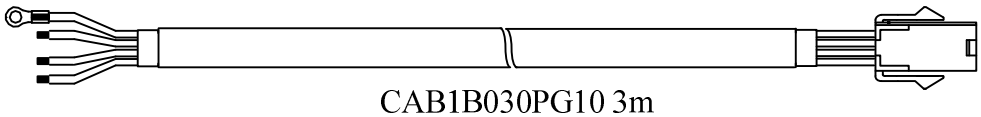
NO.	1	2	3	4	5-6	7	8	9	10
Pin Definition	GND	GND	VCC	VCC	NC	A	/A	B	/B
Color	Purple	Light Green	Brown	Pink		Red	Green	Black	White

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

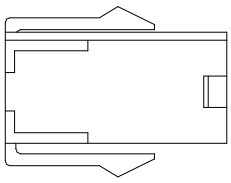


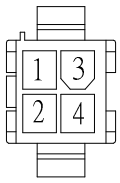
2-3-2 Power Cable of Motor



CAB1B030PG10 3m
CAB1B050PG10 5m

Connector

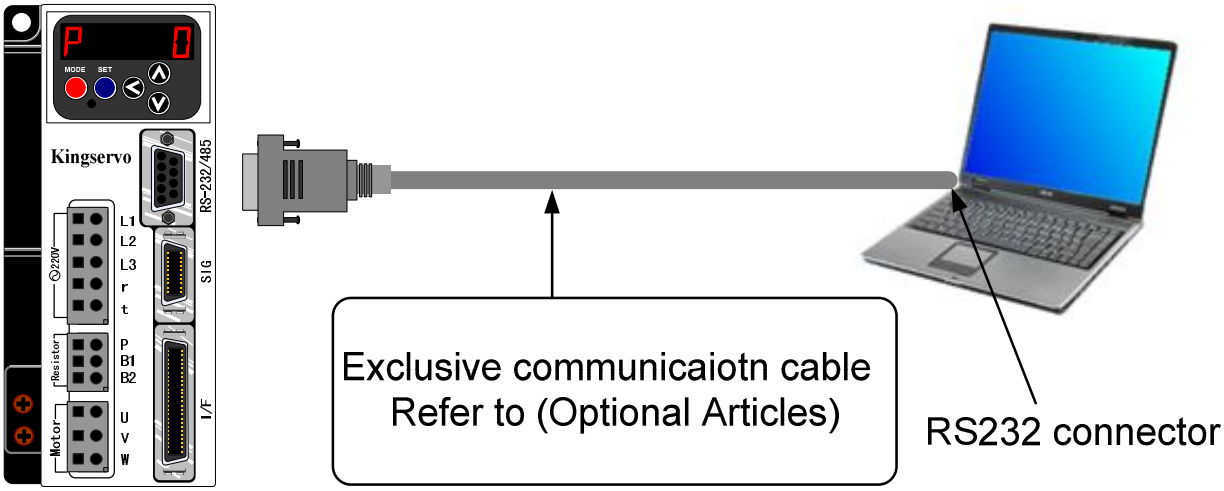


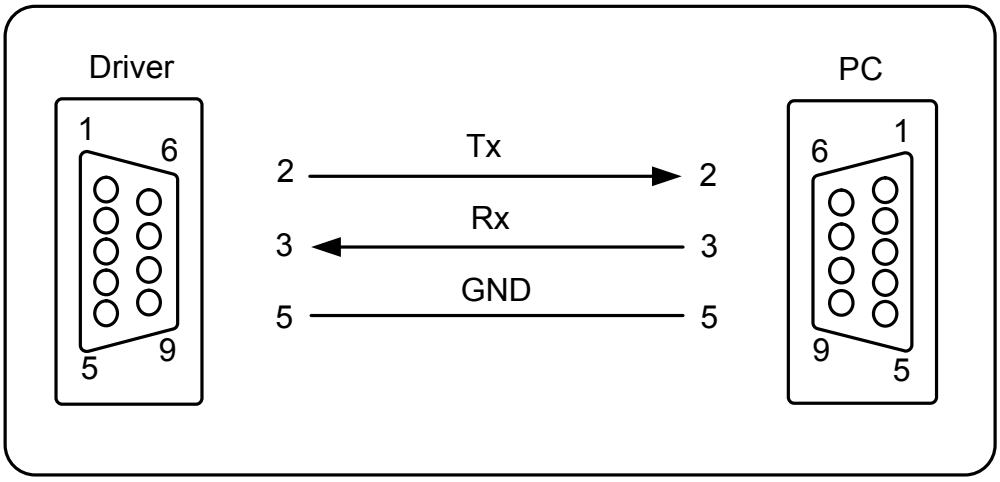


Pin NO.	Definition	Color
1	U	Red
2	V	White
3	W	Black
4	FG	Green

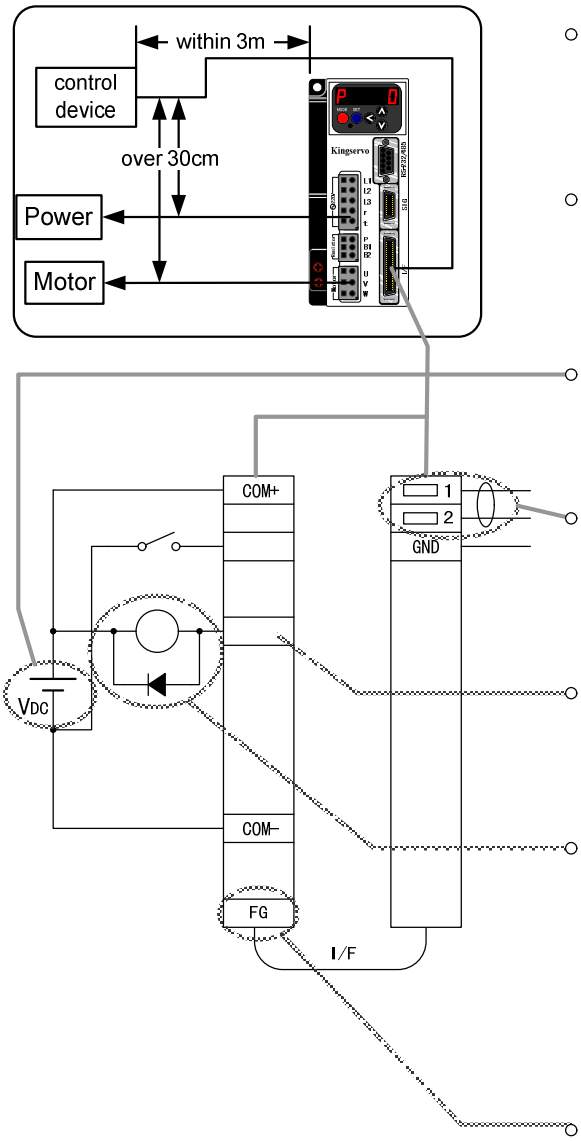
2-4 Communication Line of RS-232

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.



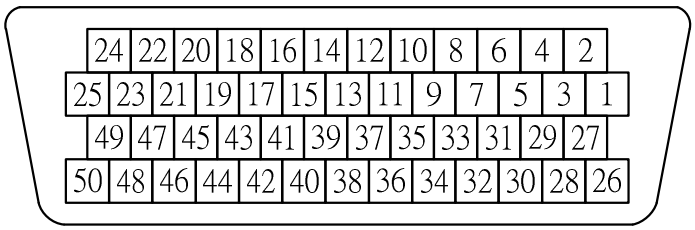


2-5 Wiring of Connector I/F



- 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)



Specification of Connector I/F

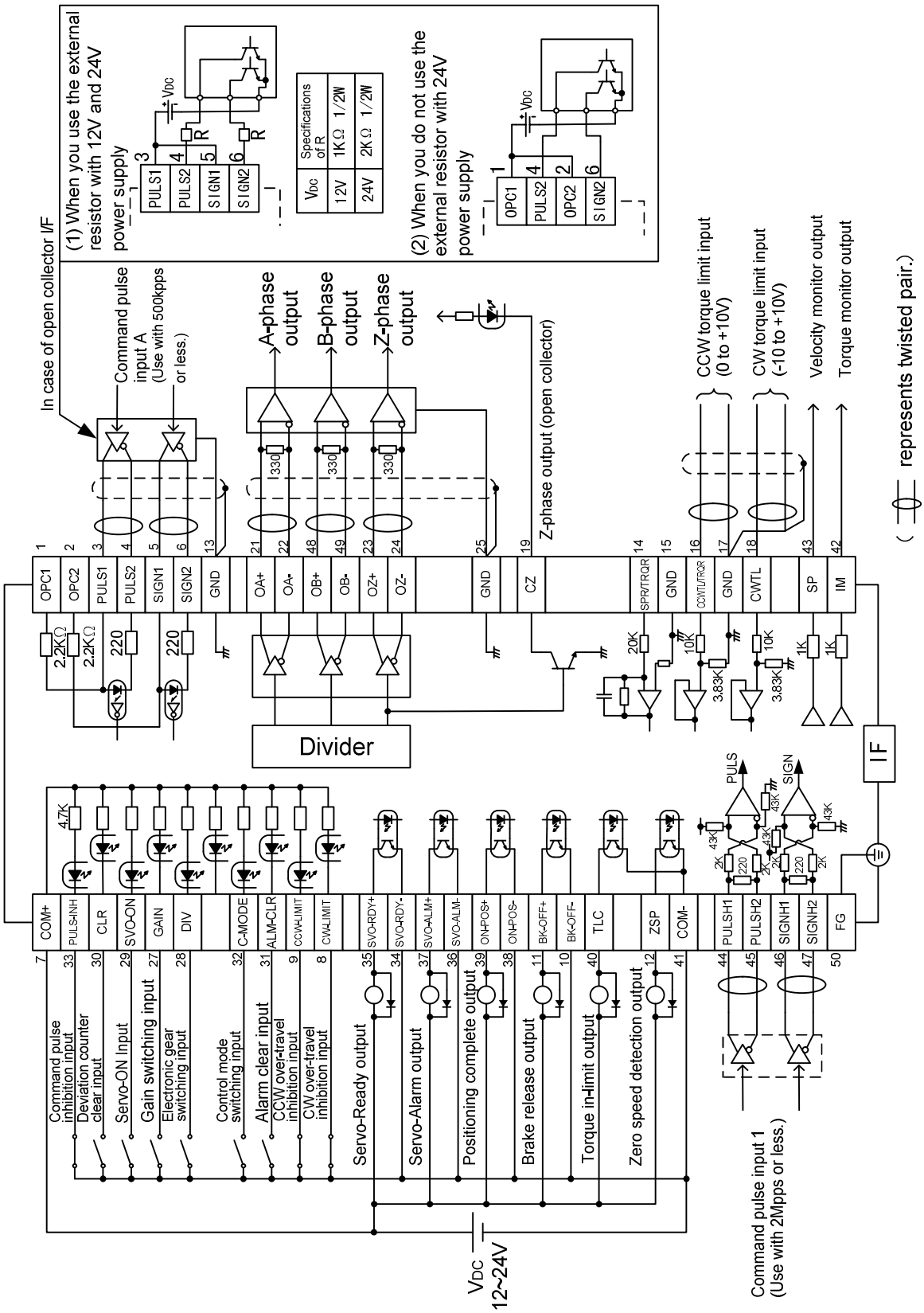
Side Connector of Driver	Connector Prepared by User		Manufacturer
	Name of Parts	Mode No.	
10250-52A2 PL	Connector(Welded)	54306-5011 or 54306-5019(leadfree)	Molex Inc.
	Shell of Connector	54331-0501	
	Connector(Welded)	10150-3000PE	Sumitomo 3M
	Shell of Connector	10350-52A0-008	

2-5-2Pin Signal ModeTable

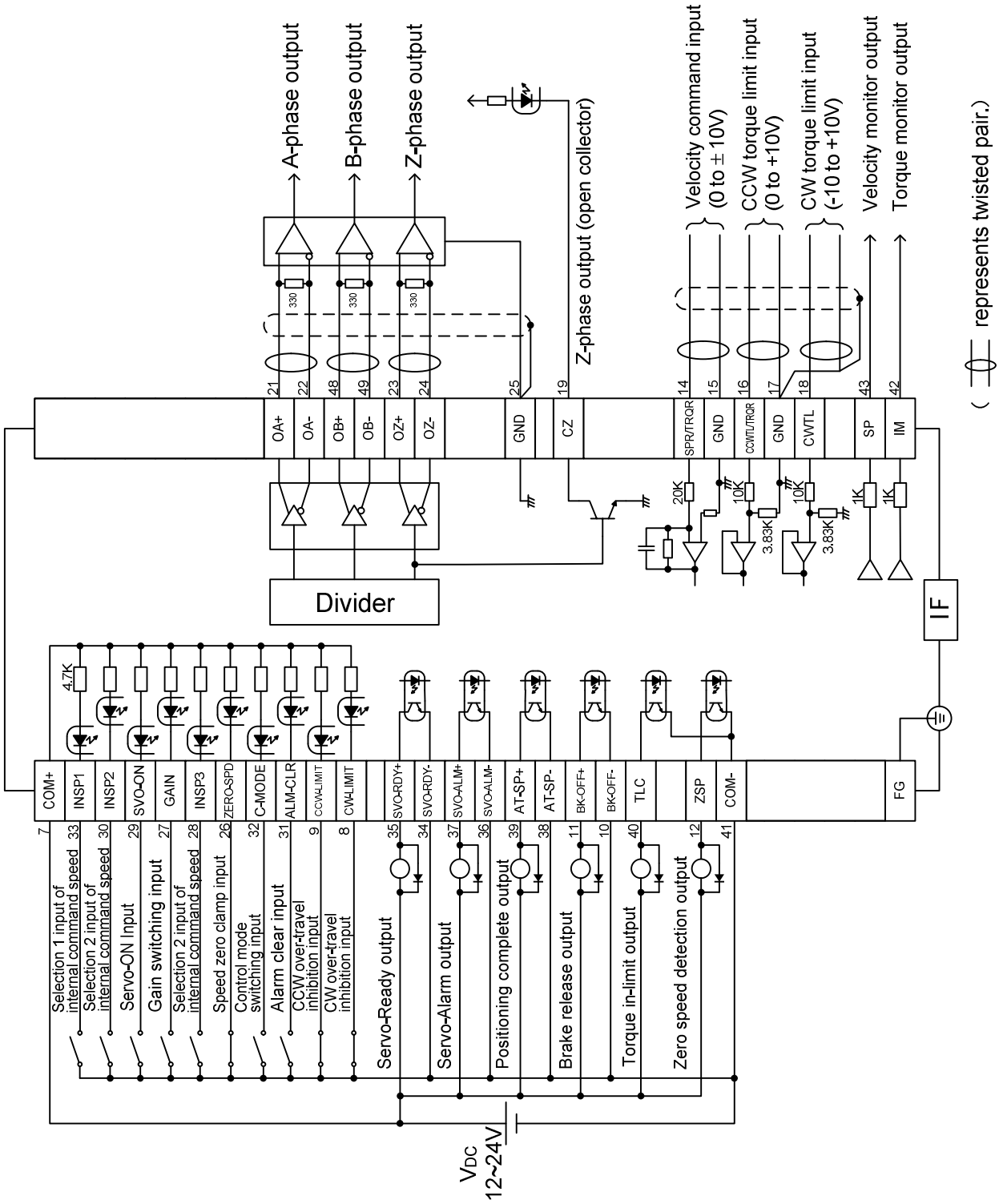
Pin No.	Position Mode	Function		Speed Mode	Function		Torque Mode	Function	
1	OPC1	Position command Pulse 1	input						
2	OPC2	Position command Pulse 2	input						
3	PULS1	Position command Pulse 2	input						
4	PULS2	Position command Pulse 2	input						
5	SIGN1	Position command Signal 2	input						
6	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/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	

2-5-3 Wiring Diagram of Control Mode

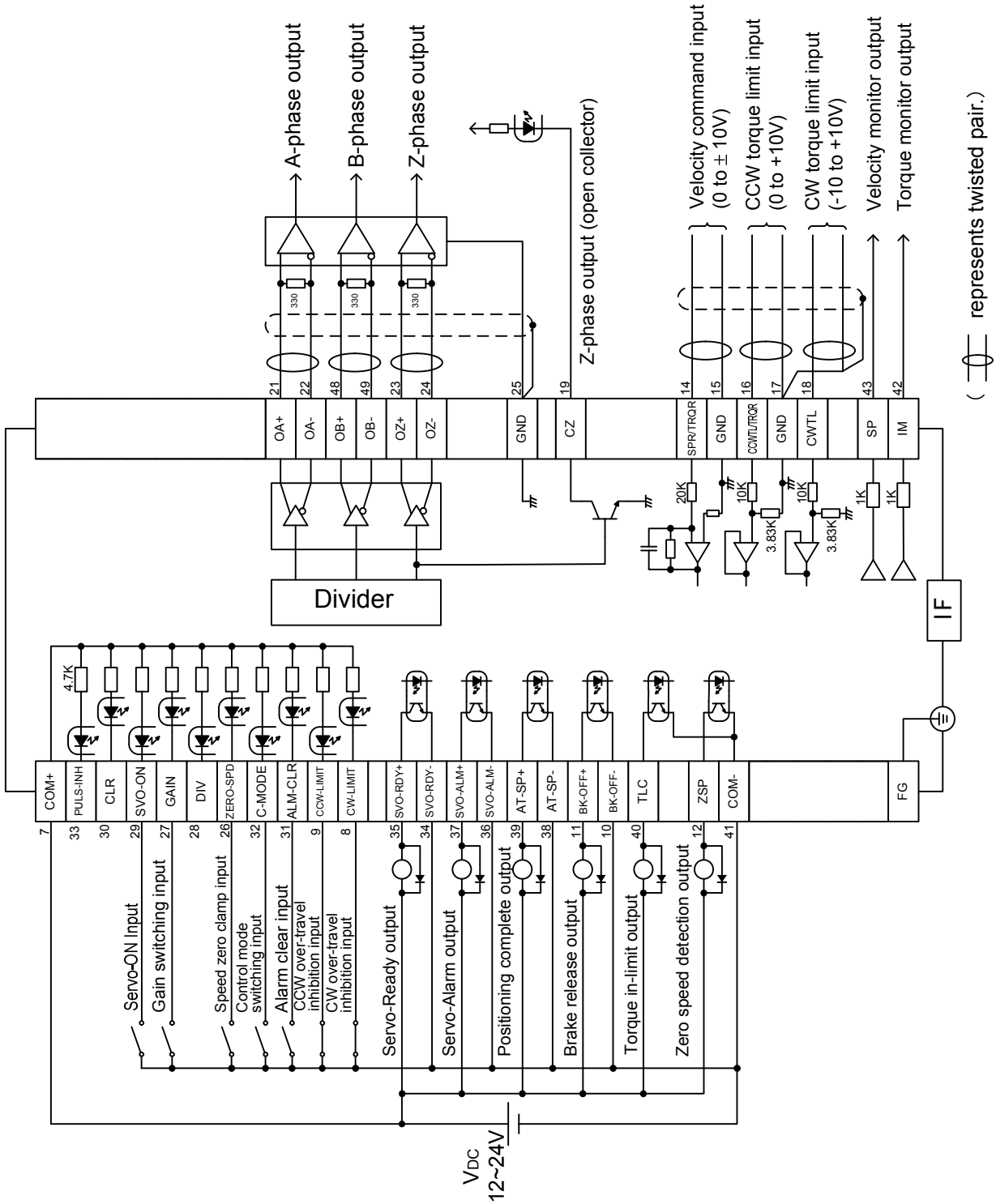
Position control mode

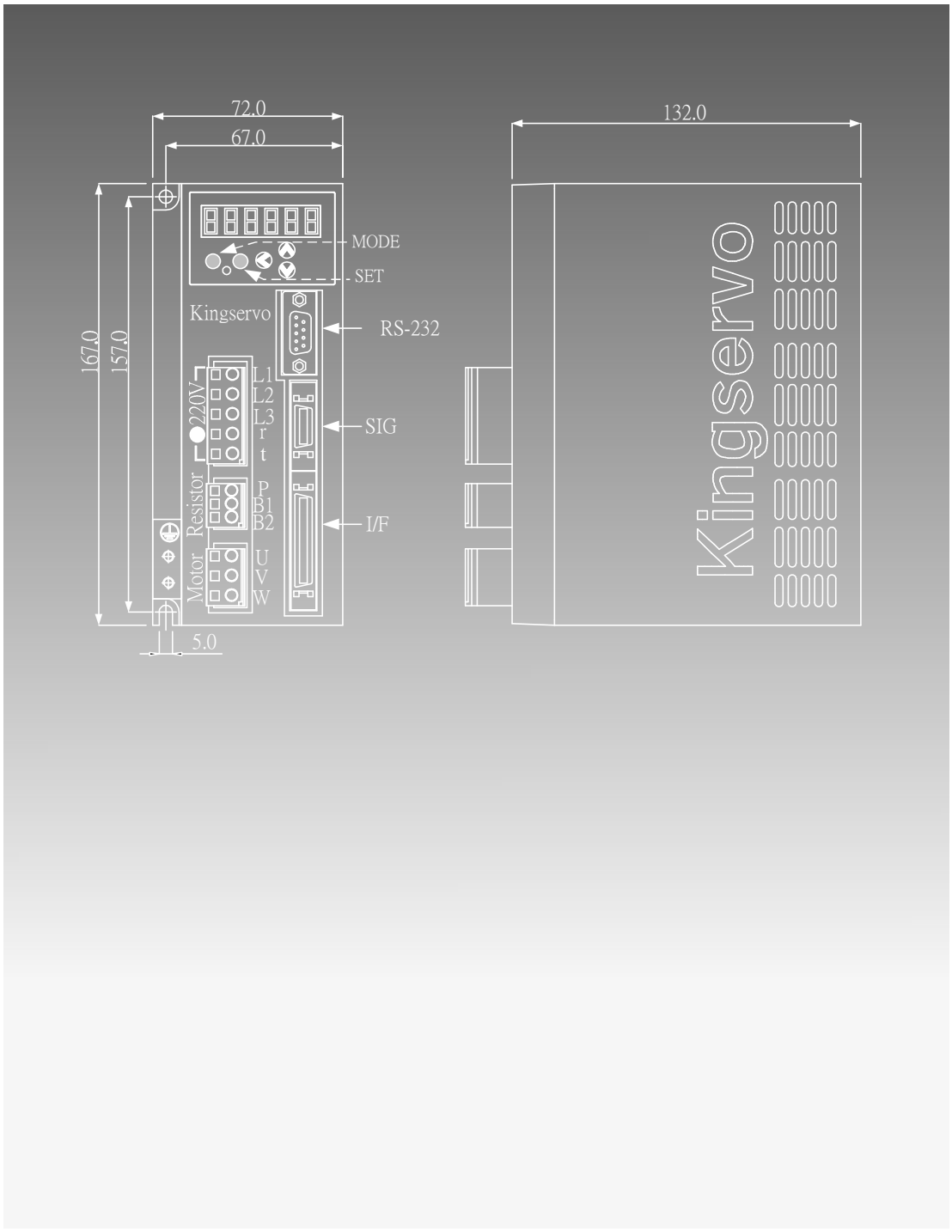


Velocity control mode



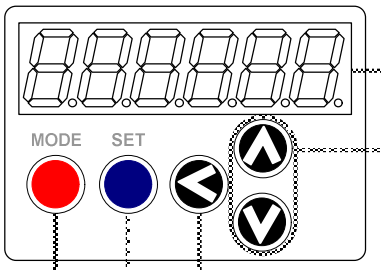
Torque control mode




72.0
67.0
167.0
157.0
MODE
SET
Kingservo
RS-232
SIG
I/F
220V
L1
L2
L3
r
t
Resistor
P
B1
B2
Motor
U
V
W
5.0
132.0
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.

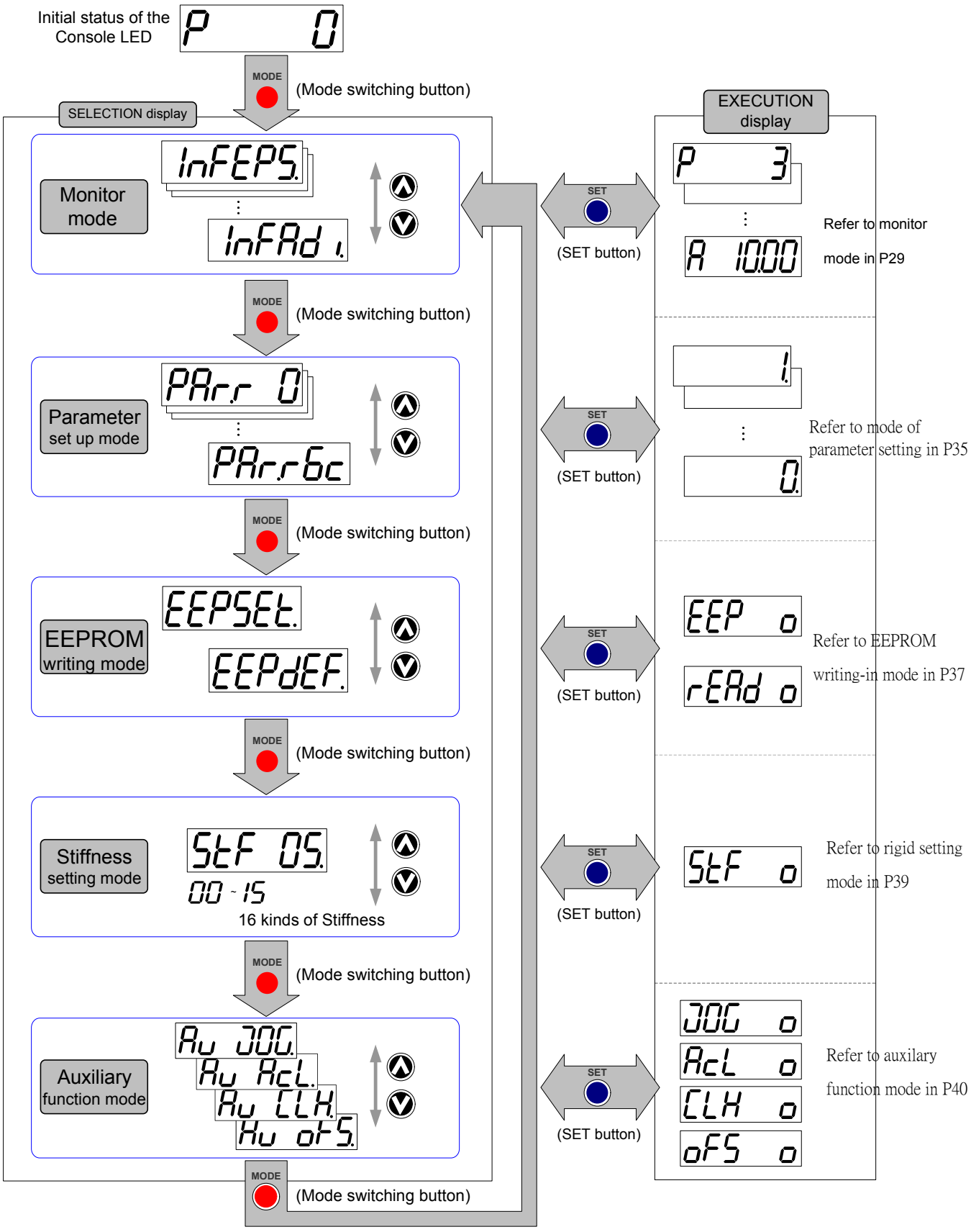
Press these to change display and data, select parameters and execute actions.
(Change/Selection/Execution is valid to the digit which decimal point flashes.)
Numerical value increases by pressing ▲,
decreases by pressing ▼.

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

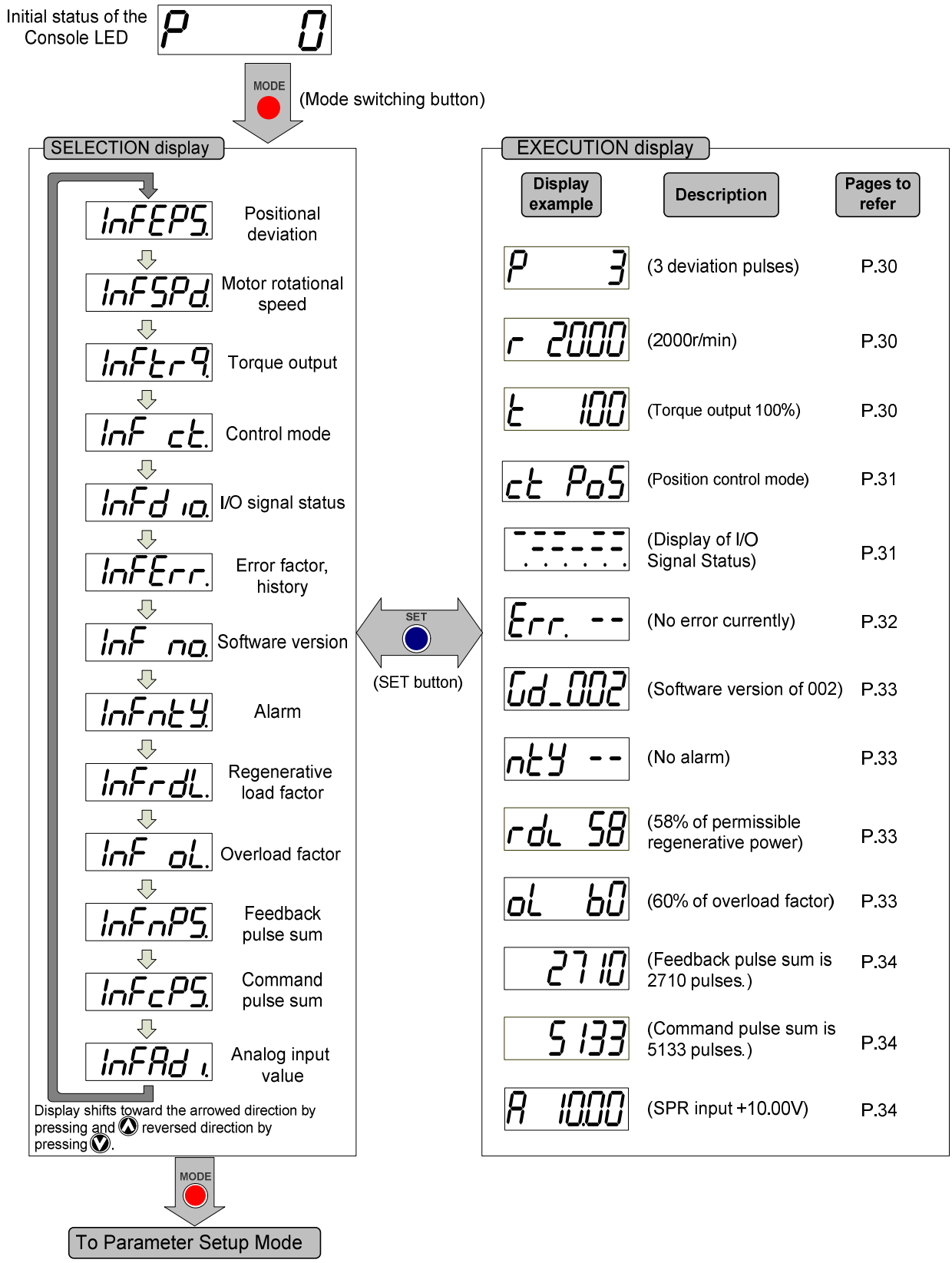
SET Button (valid at any time)
Press this to switch SELECTION and EXECUTTION display.

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



3-3 Monitor Mode



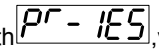
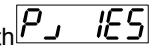
Instruction of state display：

.Positional deviation

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  ,value over upper limit is displayed with  ）

Unit：Pulse

.Rotary Speed of Motor

– display : CW rotation

no display : CCW rotation

Unit：rpm

.Torque Output

– display : CW rotation

no display : CCW rotation

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

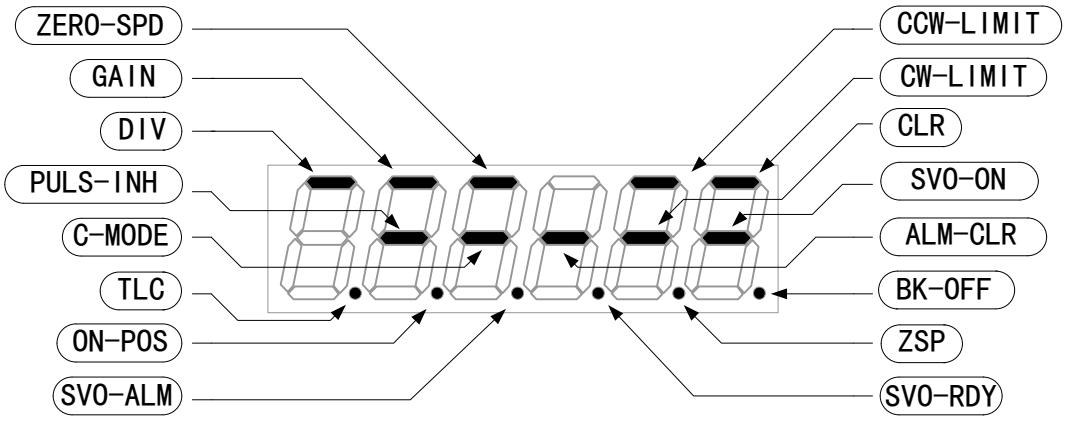
Unite：%

• 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.

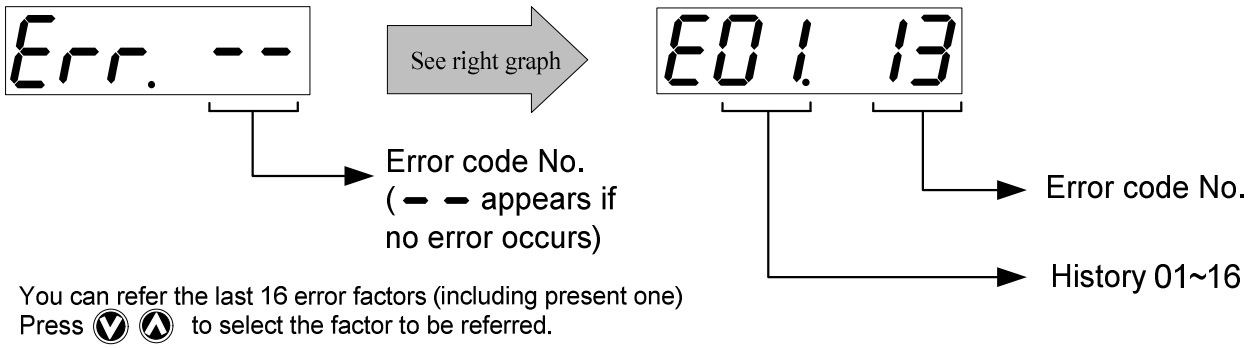


lights, it means that the signal input switch is on. lights, it means the signal input switch is off.

* 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.



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

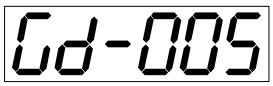
Error Code No.	Error content	Error Code No.	Error content
--	No fault	20	Encoder communication error protection
11	Under-voltage protection for control power	21	Encoder communication data error protection
12	Over-voltage protection	24	Excess positional deviation protection
13	Under-voltage protection for main power	26	Excess hybrid deviation error protection
14	Over-current protection(software)	36	EEPROM parameter error protection
15	Overheat protection	37	EEPROM parameter error protection
16	Overload protection	38	Run-inhibition input protection
18	Over-regenerative load protection	48	Encoder Z-phase error protection
99	Over-current protection(Hardware)		

※Following errors are not included in the history.Error Code No.11、13、36、37、38

Protective Function (Detail of Error Code)

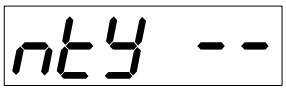
Error Code No.	Error content	Causes
11	Under-voltage protection for control power	While DSP is low voltage, inhibit process of EEPROM and display error.
12	Over-voltage protection	Occurs while voltage is over AC 260V.
13	Under-voltage protection for main power	Occurs while voltage is lower than AC 170V 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 48 21	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	Over-current protection(software) Over-current protection(Hardware)	Verify whether motor power(U,V,W) is short circuit or loose.

.Display of Software Version



To display the software version of driver.

.Alarm Display



-……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

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.

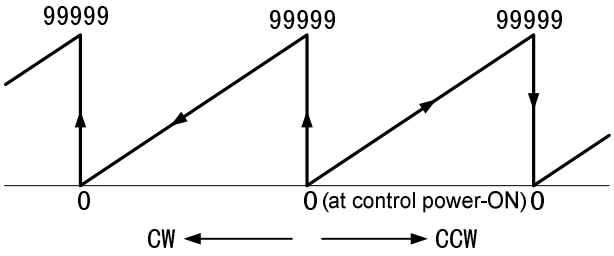
.Display of Over-load Factor

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

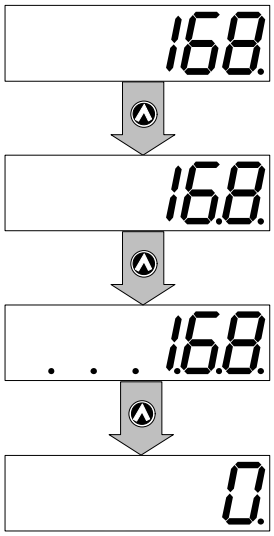
Scope：0～99999　Unit：Pules

Total sum of pulses after control power-ON.
Display overflows as the figures show.



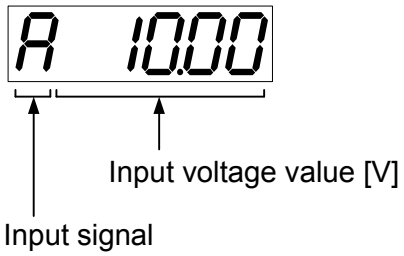
Keep pressing ▲ to shift the "•" as the right fig. shows.

[0-clear EXECUTION display]

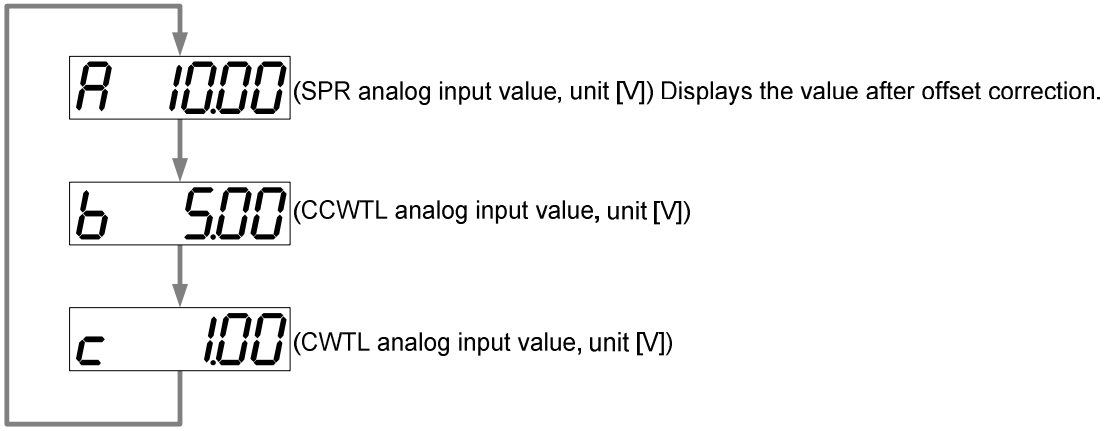


By pressing for approx. 3 sec. or longer on either one of screens of total sum of pulses display, you can clear feedback total sum, command pulse total sum or external scale feedback pulse total sum to " 0 " .

.Display of Analog Input Value



•Select the signal No. to be monitored by pressings ▲ ▼ .



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,

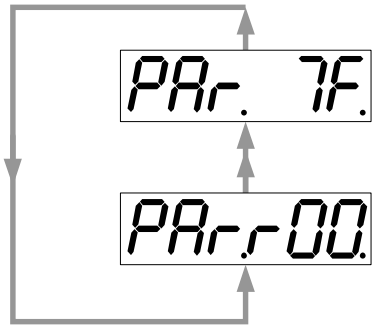
parameter setting mode

Parameter No. (Hexadecimal No.)

<Note>

For parameters which place is displayed with "r", 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.



Press ▲ to shift to arrowed direction.

Press ▼ to shift to reversed direction.

.Operation at EXECUTION display

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.

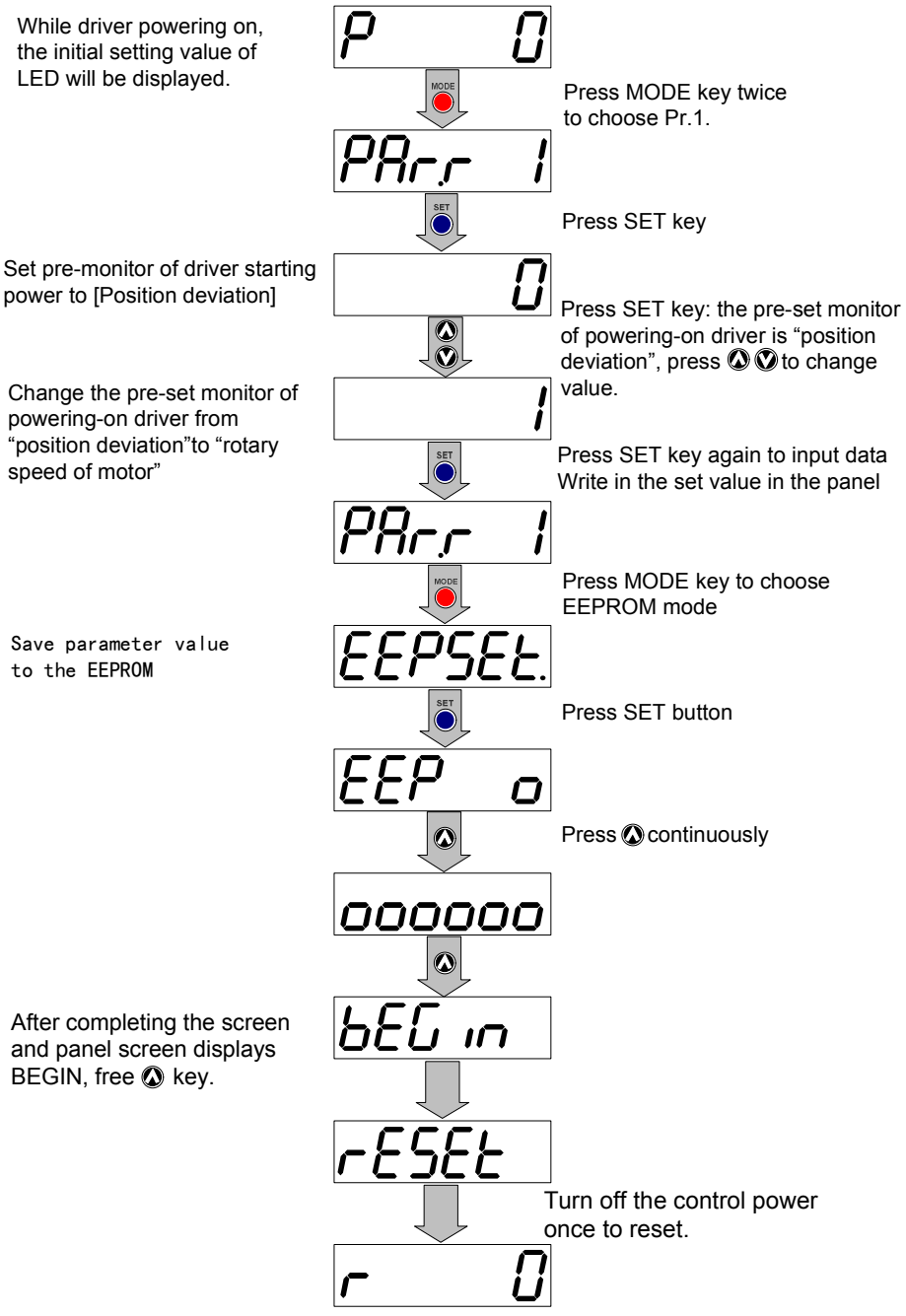
Value increases with ▲ decreases with ▼.

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



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.

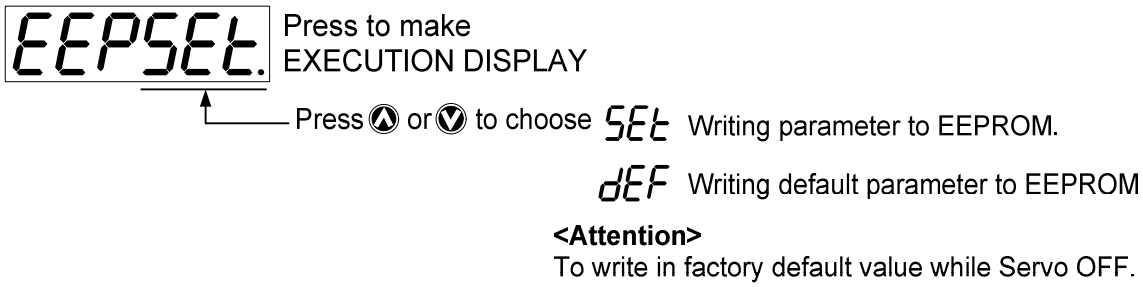
Note 2) Don't turn off the power during EEPROM writing. Incorrect data might be written. If this happens, set up all of parameters again, and re-write after checking the data.

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

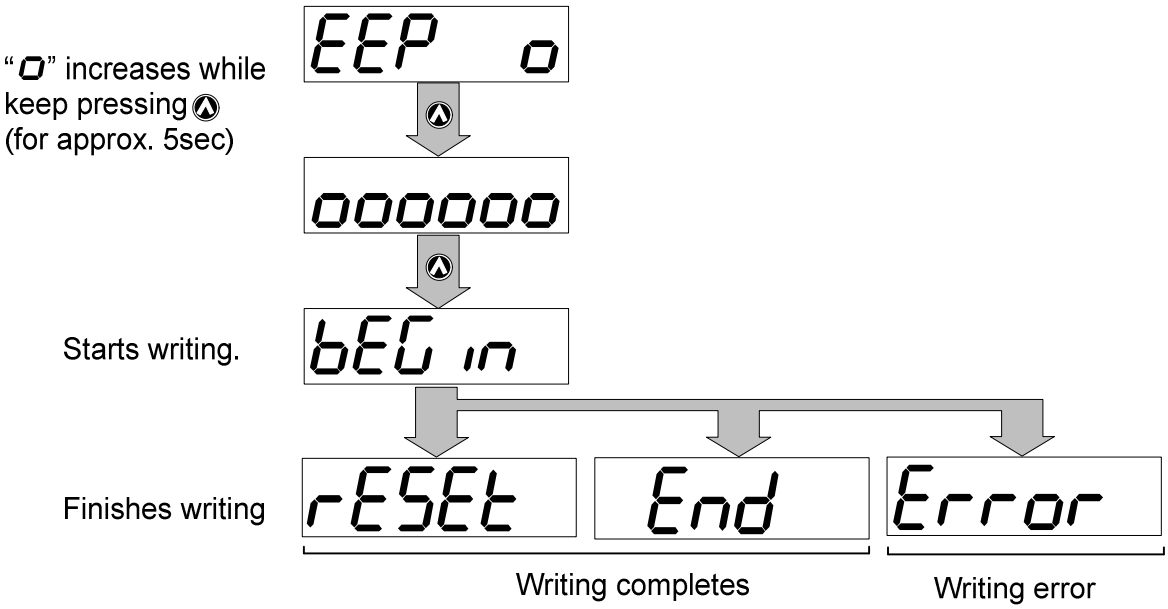


<Attention>
To write in factory default value while Servo OFF.

.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.



• 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.

Press to make
EXECUTION DISPLAY

Press ▲ or ▼ to choose SEt Writing parameter to EEPROM.

dEF Writing default parameter to EEPROM

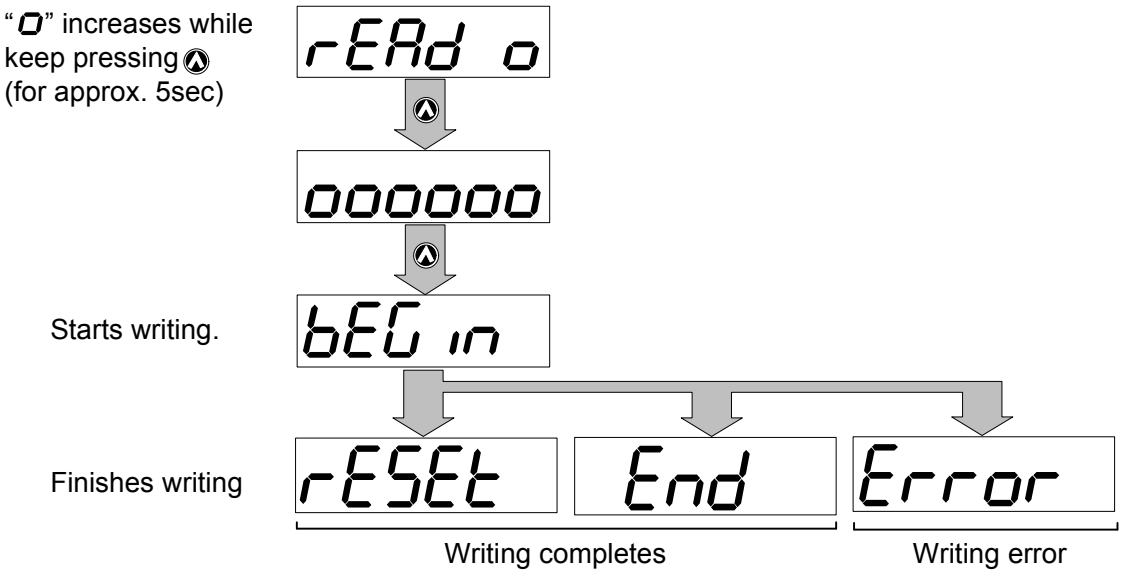
<Attention>
To write in factory default value while Servo OFF.

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.



• 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 Stiffness setting mode

.Stiffness setting and inertia adjustment

<Emphasis>

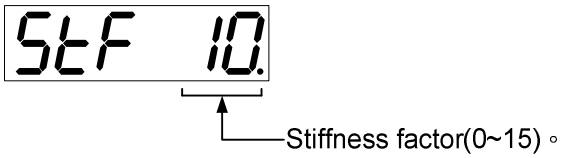
●While using rigid setting mode, internal control parameter of driver can be used to drive motor, it shall be set after load will not affect operation.

●Because of loads, after adjustment, it may cause shock or vibration, pay attention to safety and flexibly apply Pr14(time constant of torque filter) to prevent noise and Pr20(inertia rate) to reduce shock to make adjustment.

.Operation at SELECTION display

From the initial state of LED,

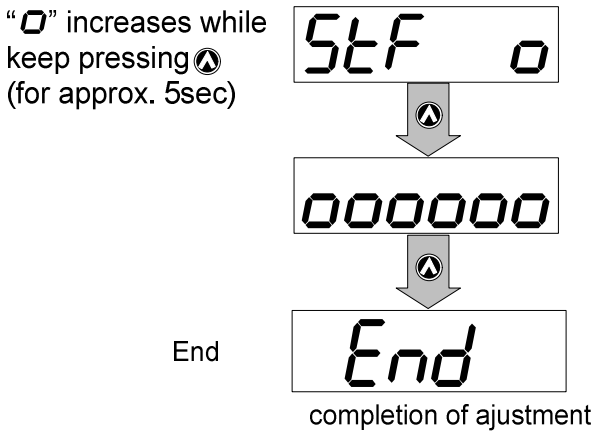
press MODE four times to enter into Stiffness setting mode.



Now press ▲ or ▼ to set mechanical stiffness factor(1~15).

.Operation at EXECUTION display

Press SET to display StF 0 execution screen。



<Attention>

For avoiding the lost of gain while closing power, write in setting value in the EEPROM.

While adustment is wrong, 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.

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>

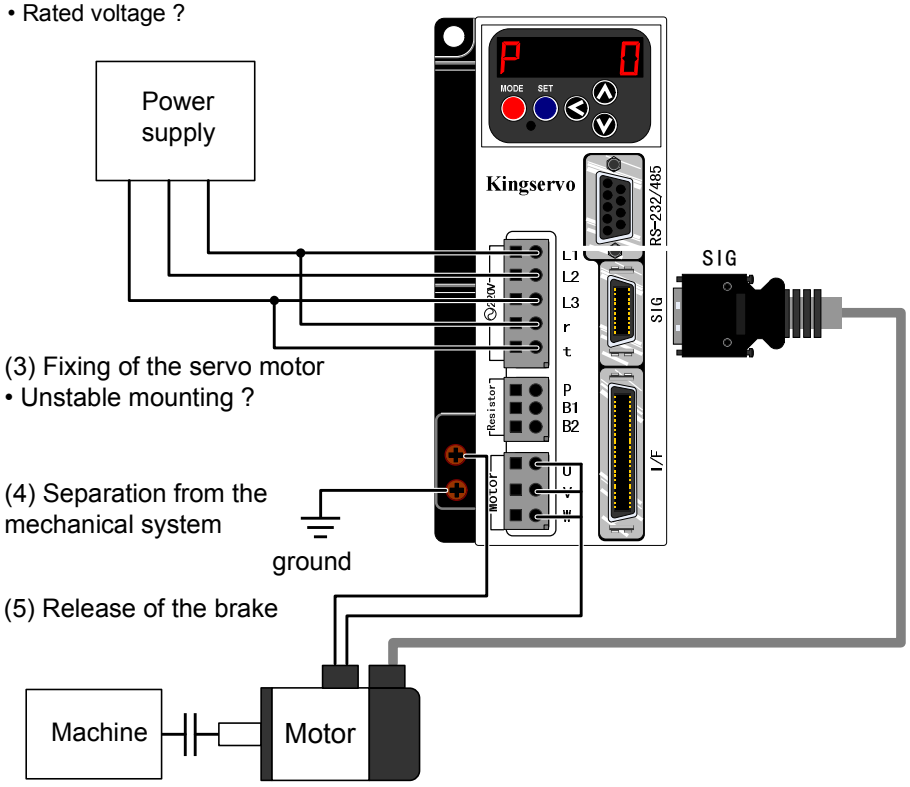
• Separate the motor from the load, detach the Connector, CN X5 before the trial run.

• 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 ?



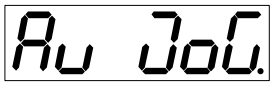
(6) Turn to Servo-OFF after finishing the trial run by pressing SET.

.Operation at SELECTION display

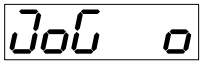
. auxiliary function mode

From the initial state of LED,

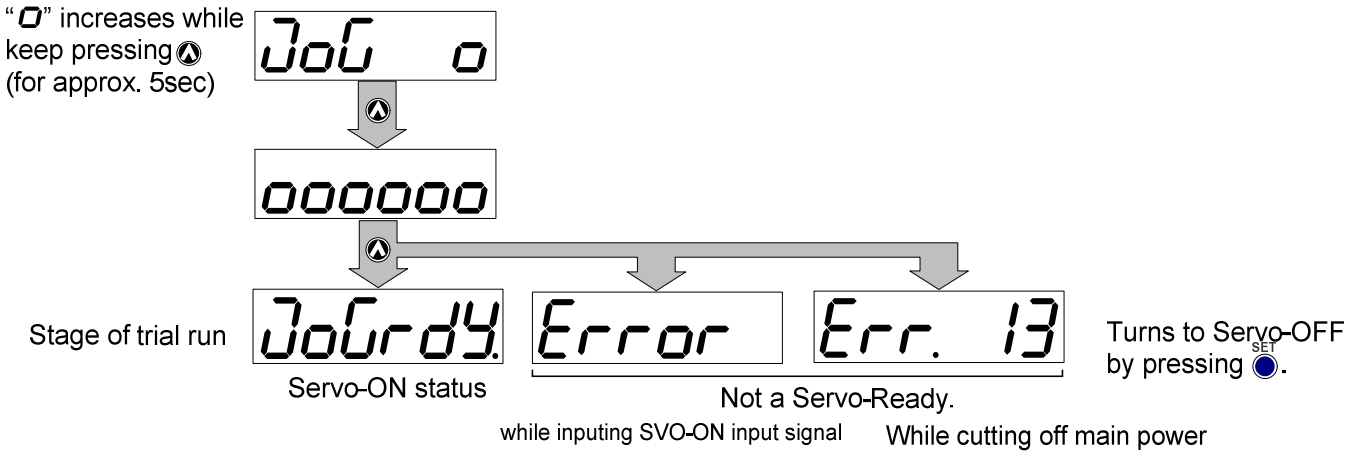
press MODE five times to enter into auxiliary function mode.

Press ▲▼,to display 

.Operation at EXECUTION display

Press SET to display 

execution screen.



Press ▲, motor rotates along CCW; press ▼, motor rotates along CW. Rotate motor with the speed set according to Pr57(JOG speed).

Free ▲▼, and the motor will cease at once.

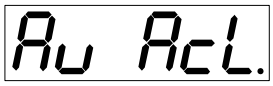
After testing run, refer to the structure of all modes in P28 and return to option screen.

3-7-2 Alarm Clear Screen

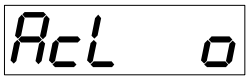
.Operation at SELECTION display

From the initial state of LED,

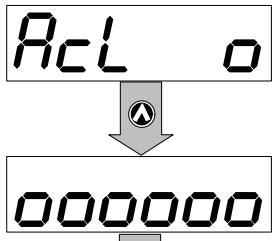
press MODE five times to enter into auxiliary function mode.

Press ▲▼,to display 

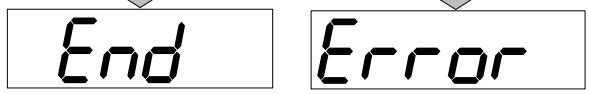
.Operation at EXECUTION display

Press SET to display 

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



End



Alarm clear completes

Clear is not finished.
Release the error by resetting the power.

3-7-3 Automatic Offset Adjustment

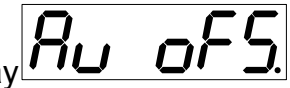
.Operation at SELECTION display

From the initial state of LED,

press MODE five times to enter into auxiliary function mode.

Press ▲▼,to display

.Operation at EXECUTION display

Press SET to display 

"0" increases while keep pressing ▲ (for approx. 5sec)

▲

▲

Adjustment finishes.

Automatic offset adjustment finishes.

Error occurs.
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.

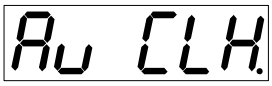
.Operation at SELECTION display

From the initial state of LED,

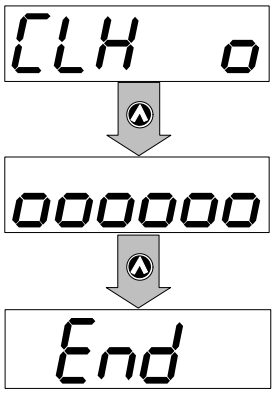
press MODE five times to enter into auxiliary function mode.

Press ▲▼,to display

.Operation at EXECUTION display

Press SET to display 

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



End

Alarm history clear finishes.

<Instruction>

The function can clear the abnormaly record.

Charpter 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:

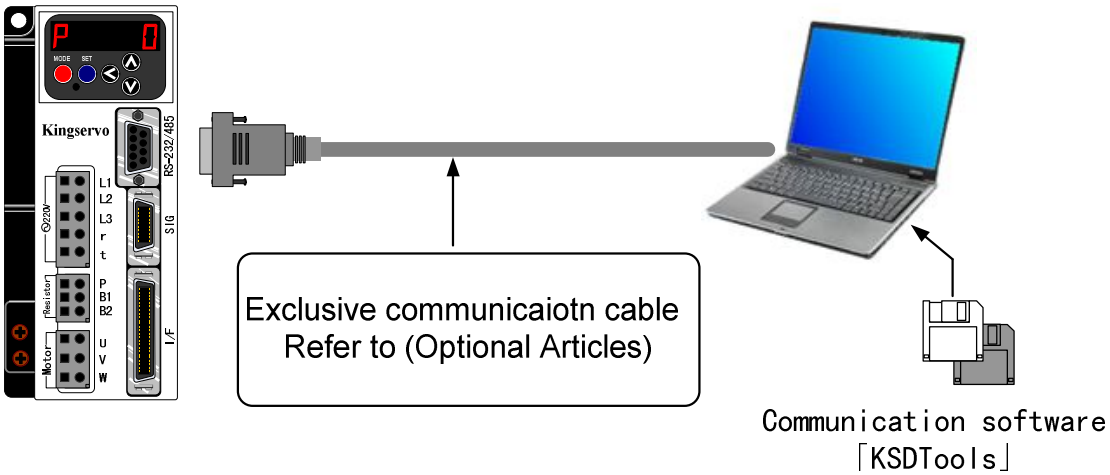
1.Front panel of machine

2.Set supporting software KSDTools by combining with computer.

<Instruction>

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

4-1-3 Connection Method



4-1-4Contents 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
Program	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	0~12	-	All
★02	Control mode setting	0	0~5	-	All
03	Invalid analog torque limit input	1	0~1	-	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	Notch filter frequency	1600	50~1600	Hz	All
1E	Notch filter width	4	0~4	-	All
20	Inertia ratio	0	0~10000	-	All
27	External noise detection	0	0~8	-	All
28	External noise detection filter	0	0~6400	0.01ms	All
2A	CCW torque control offset	0	-127~127	5mV	All
2B	CW torque control offset	0	-127~127	5mV	P，S

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 reversion	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	1	1~255	-	P
★45	Feedback pulse output logic RP	0	0~1	-	P
46	First instruction division multiple numerator	1	1~10000	-	P
47	Second instruction division multiple numerator	1	1~10000	-	P
★48	FIR smooth setting	0	0~3	-	P
49					
4A	Multiplication of instruction division multiplicaiotn numerator	0	0~17	-	P
4B	Instruction division multiplication denominator	1	1~10000	-	P
4C	Smooth filter setting	1	0~7	-	P
4D	Counter clearance input mode	1	0~2	-	P

● 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 reversion	1	0~1	-	S
52	Speed control offset	0	-2047~2047	0.3mV	S，T
53	First speed of speed setting	0	-10000~10000	rpm	S
54	Second speed of speed setting	0	-10000~10000	rpm	S
55	Third speed of speed setting	0	-10000~10000	rpm	S
56	Fourth speed of speed setting	0	-10000~10000	rpm	S，T
74	Fifth speed of speed setting	0	-10000~10000	rpm	S
75	Sixth speed of speed setting	0	-10000~10000	rpm	S
76	Seventh speed of speed setting	0	-10000~10000	rpm	S
77	Eighth speed 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	Speed-down time setting	0	0~10000	1ms/(1000rpm)	S
5A	S-shape speed-up/speed-down time setting	0	0~1000	2ms	S
5B	Torque command option	0	0~1	-	T
5C	Torque control input gain	30	10~100	0.1V/100%	T
5D	Torque control input reversion	0	0~1	-	T
5E	Torqeu limit setting	300	0~300	%	All

Parameters for Sequence

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 attainment	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	State during drive inhibition input	0	0~1	-	All
68	Sequence control while alarm souds	0	0~3	-	All
69	Sequence control while server is closed	0	0~7	-	All
6A	Mechanical brake action setting while machine ceases	0	0~200	ms	All
6B	Mechanical brake action setting while action	0	0~200	ms	All
★6C	Retrogradation resistance impressing option	0	0~2	-	All

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

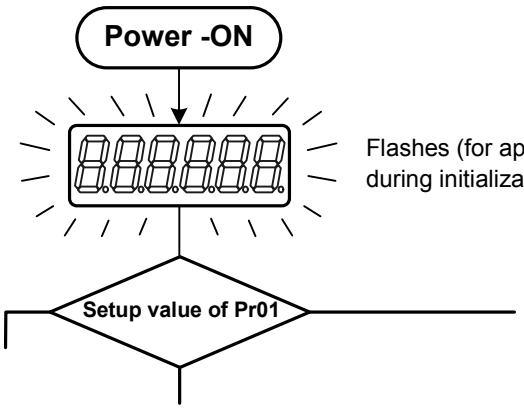
4-2 Instruction of Parameter Function

【】：represents factory default value

★：reprensents that power need be restarted while modifying parameters.

Pr01 |LED Initial Display ★

Initial Value：【0】
Setting Range：0~12
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	Sum of Feedback Pulse
11	Sum of Command Pulse
12	Analog Input Value

Pr02 |Setup of control mode ★

Initial Value：【0】

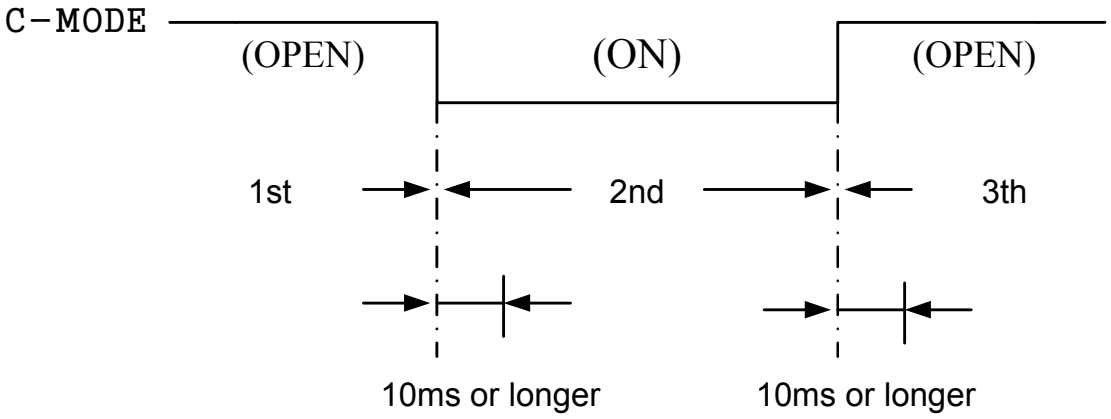
Setting Range：0~5

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.



＜**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：0~1

Unit：–

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

1: invalid input

0: valid input

If not using torque limit function, set Pr03 to “1”.

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

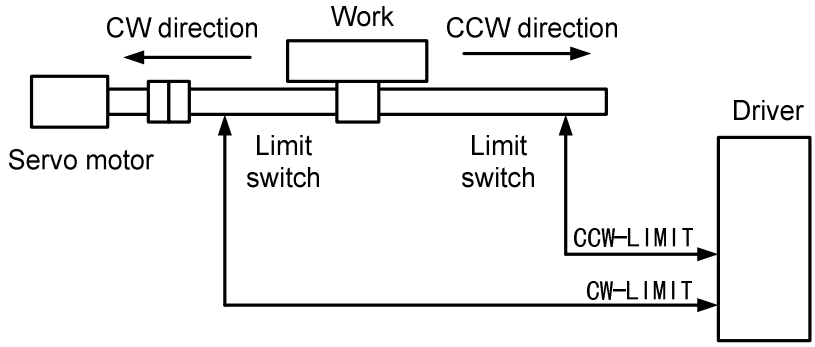
Pr04 | Drive Inhibition Input Invalidity ★

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(drive inhibition input protection) occurs.		

<Notes>

1. As Pr04 setting is 0 and drive inhibition input valid, program set by Pr66(drive inhibition time program) 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(drive inhibition input protection) will occur.
3. While used in the vertical axis and limit switch at the top of work piece acts, it may cause disappearance of upward torque and work piece to move downward. At the moment, donot use this function and use upper-level controller to process trip limit.

Pr05 | Speed setup,Internal/External switching

Initial Value：【1】

Setting Range：0~3

Unit：–

Function：set internal speed of simple execution speed control node.

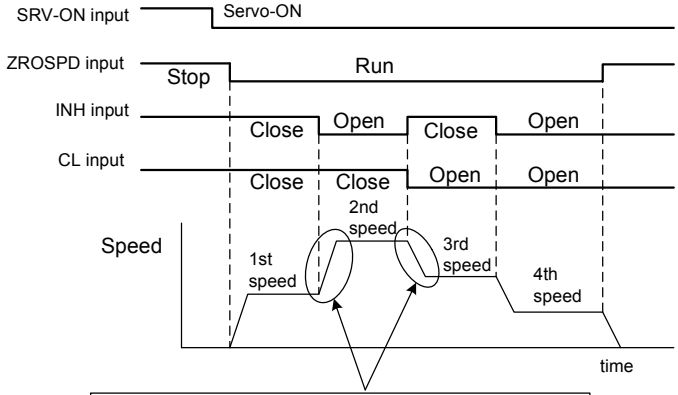
- Set the validity of internal speed setting.
- 8 types of internal speed. Their instruction data are setting to Pr53（1st speed）、Pr54（2nd speed）,Pr55（3rd speed）,Pr56（4th speed）,Pr74（5th speed）,Pr75（6th speed）,Pr76（7th speed）and Pr77（8th speed）.

- 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
  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 types of varying speed examples using internal speed instruction. Except CL/INH input, if expecting to control motor's drive and cease, 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	Remarks
0	Output during torque limit	TLC	About detail of functios of all output mark, refer to instruciton of CN I/F connectors's wiring.
1	Zero speed detection output	ZSP	
2	Warning signal output	WARN ALL	
3	Over-retrogradation warning output	WARN REG	
4	Overload warning output	WARN OL	

Pr0A | Selection of ZSP output

Initial Value：【0】

Setting Range：0~4

Unit：–

Function：Assign function of zero speed detection(ZSP:CN I/F PIN 12). Relation of 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.

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. Larger compesation 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 | External Noise Detection Filter

Initial Value：【500】

Setting Range：0~6400

Unit：0.01ms

Function：Set constant of one time delya filter of external torque noise detection compensation to improve resonance noise caused by Pr27 compensation.

Pr2A | CCW Torque Control Offset

Initial Value：【0】
Setting Range：-127~127
Unit：5mV
Function：This parameter is used to adjust OFFSET of external analog instruction system including upper-level device.

Pr2B | CW Torque Control Offset

Initial Value：【0】
Setting Range：-127~127
Unit：5mV
Function：Refer to Pr2A

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 3~8. set determinant level of first/second gain shift.

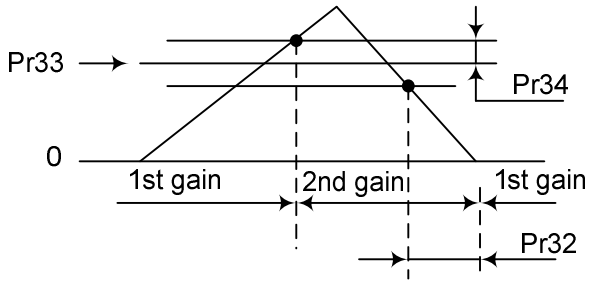
Pr34 | 1st hysteresis of control switching

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

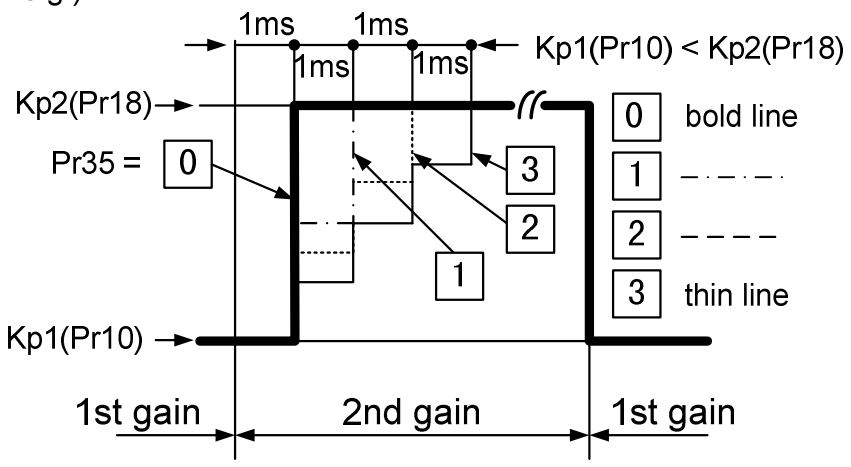
Initial Value：【4】

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 Pr37

Pr39 | 2nd hysteresis of control switching

Initial Value：【0】

Setting Range：0~10000

Unit：－

Function：Refer to Pr37

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 Pr30 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

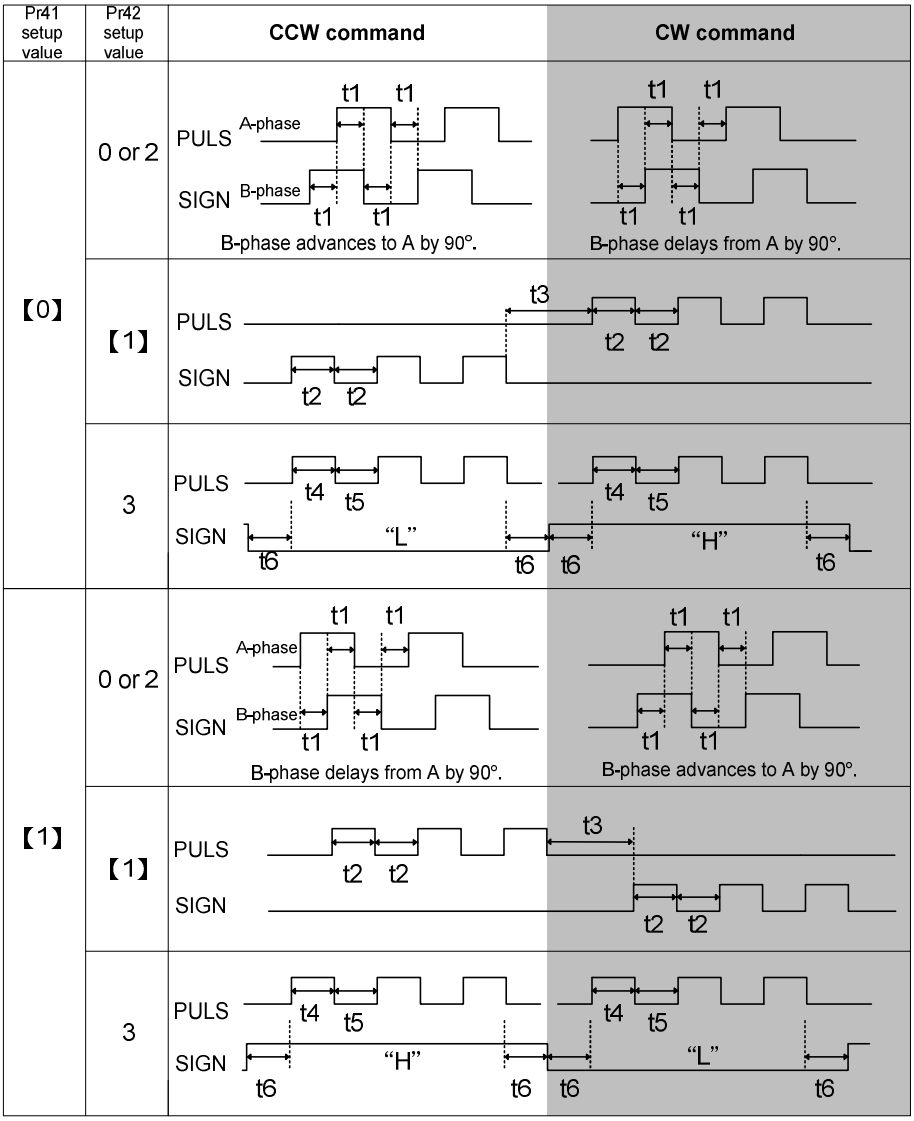
Pr41 | Command pulse rotational direction setup ★

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=0,

Pr42=0 or 2　Command pulse format is 90° phase difference 2-phase pulse(A + B-phase)

Pr42=1　Command pulse format is CW pulse train + CCW pulse train

Pr42=3　Command pulse format ispulse 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：【0】
Setting Range：0~3
Unit：－
Function：as same as Pr41

Pr43 | Invalidation of command pulse inhibit input

Initial Value：【0】
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：【1】
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.

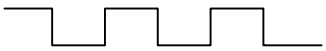
Pr45 | Reversal of pulse output logic ★

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

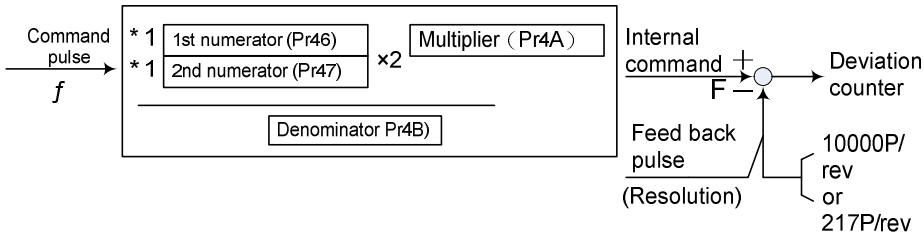
• Purpose of this function

(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≠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	$\frac{Pr46\ [1] \times 2^{Pr4A\ [17]}}{Pr4B\ [5000]}$	$\frac{Pr46\ [10000] \times 2^{Pr4A\ [0]}}{Pr4B\ [5000]}$
Example 2 when making the commandinput (f) as 40000 per onemotor revolution	$\frac{Pr46\ [10000] \times 2^{Pr4A\ [0]}}{Pr4B\ [5000]}$	$\frac{Pr46\ [2500] \times 2^{Pr4A\ [0]}}{Pr4B\ [10000]}$

Pr47 |2nd numerator ofelectronic 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 (X5 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】

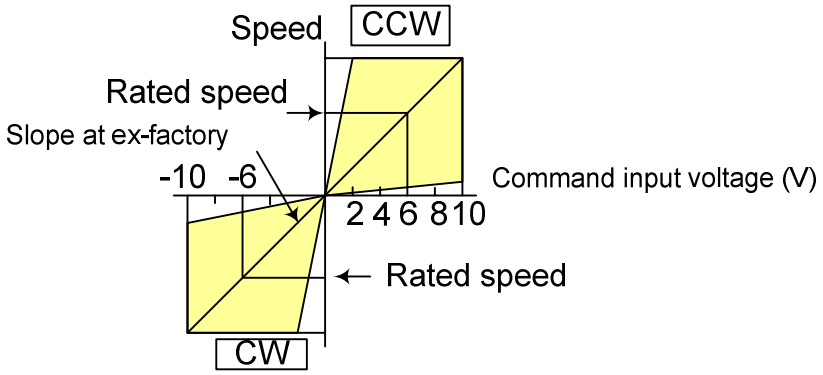
Setting Range：10~2000

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：【500】

Setting Range：10~2000

Unit：rpm/V

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]

<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 P.75, "Trial Run"of Preparation.

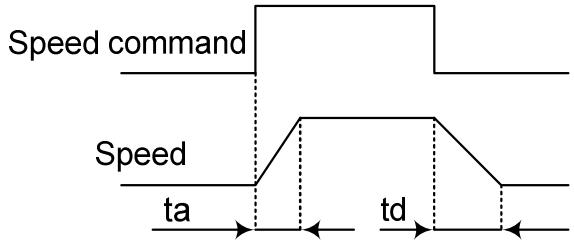
Pr58 | Acceleration time setup

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

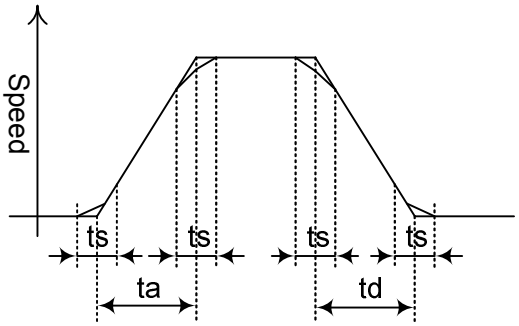
Pr5A | Sigmoid acceleration / deceleration time setup

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

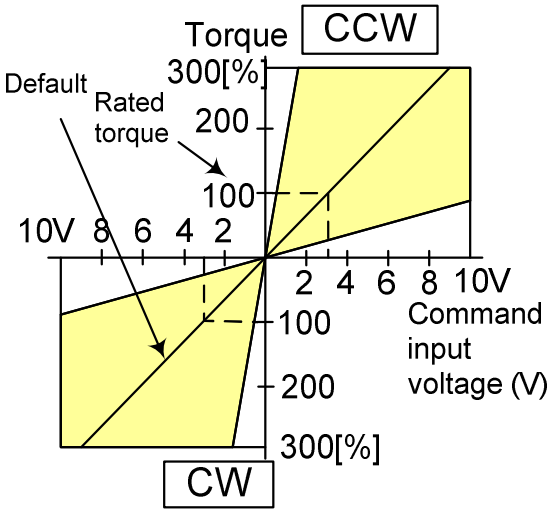
Pr5C | Input gain of torque command

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 |Torque limit setup

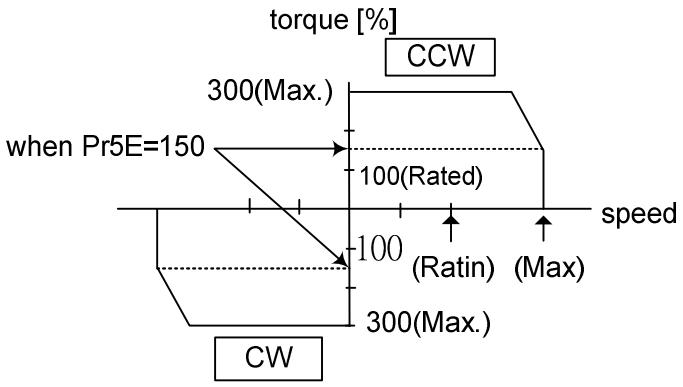
Initial Value：【300】

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.

Pr60 | Positioning complete(In-position) range

Initial Value：【10】

Setting Range：0~32767

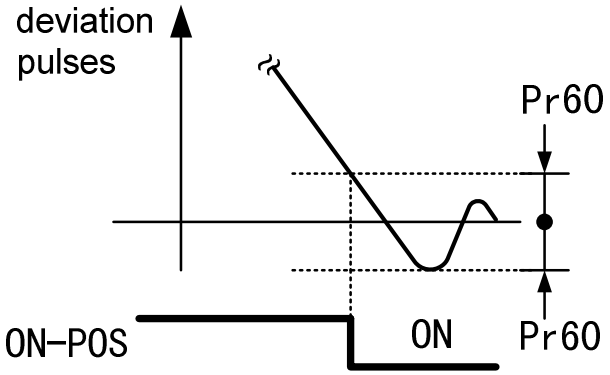
Unit：Pulse

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

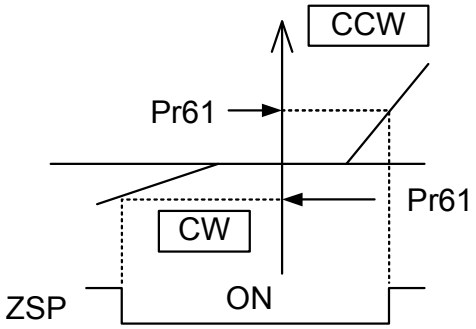
Initial Value：【50】

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)

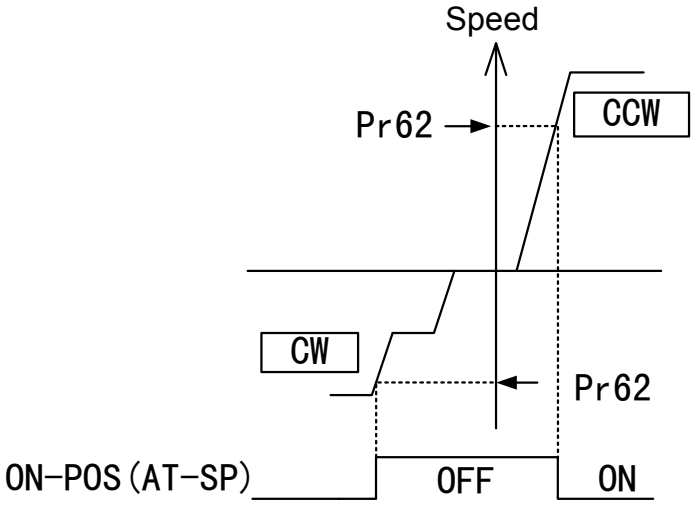
Initial Value：【1000】

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 P62 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: 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

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 P.110, "Timing Chart (When an error (alarm) occurs (at Servo-ON command status)" of Preparation.

Pr69 | Sequence at main power 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】

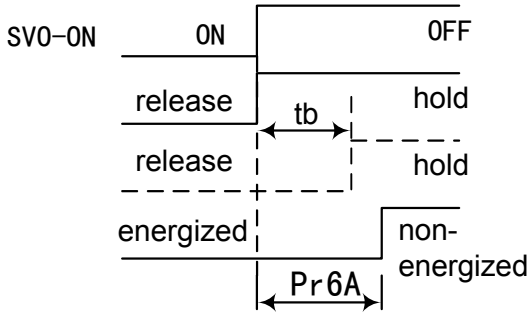
Setting Range：0~200

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 P.111, "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】

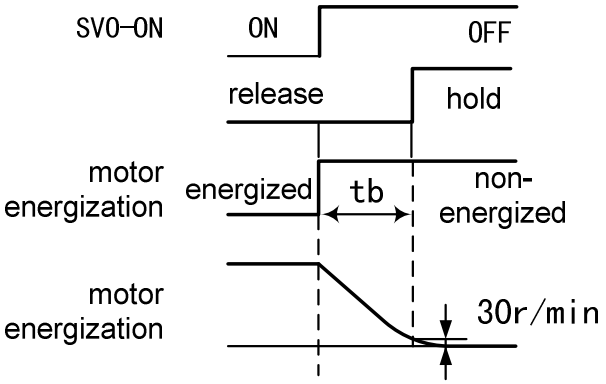
Setting Range：0~200

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 P.112, "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

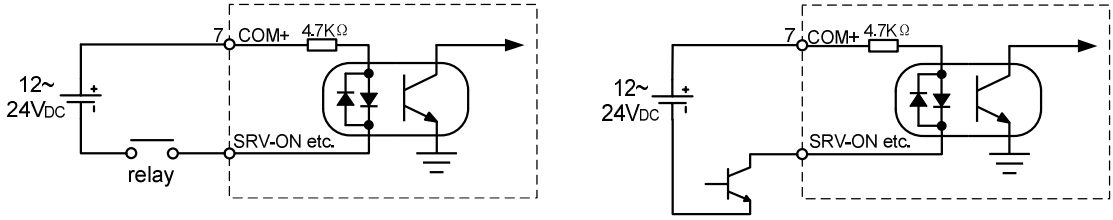
Chapter 5 Connection and setup of control mode

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	

5-2-1Input 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.

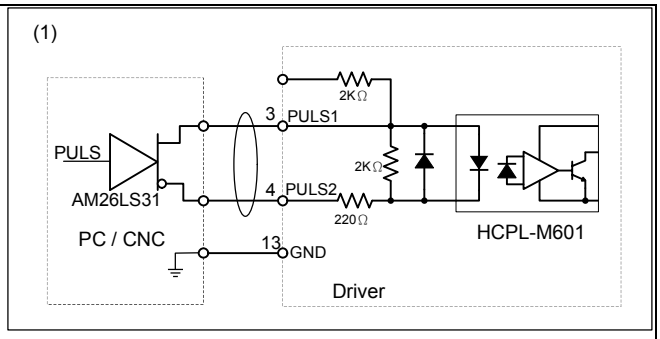
(2) Open collector I/F (Input pulse frequency : max. 200kpps)
- ■ The method which uses an external control signal power supply (VDC)
- ■ Current regulating resistor R corresponding to VDC is required in this case.
- ■ Connect the specified resister as below.

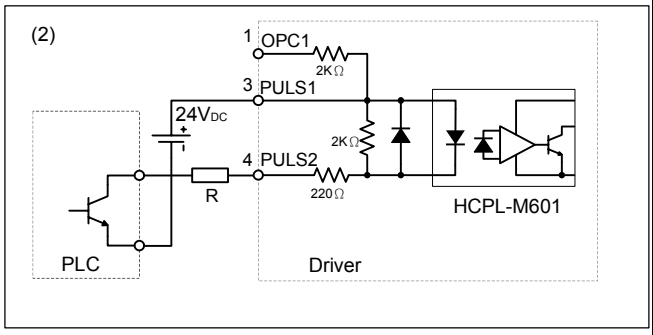
VDC	Specifications
12V	1KΩ 1/2W
24V	2KΩ 1/2W

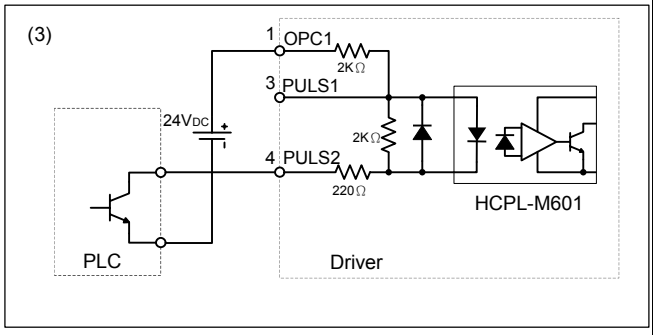
$$\frac{V_{DC} - 1.5}{R+220} \fallingdotseq 10mA$$

(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.

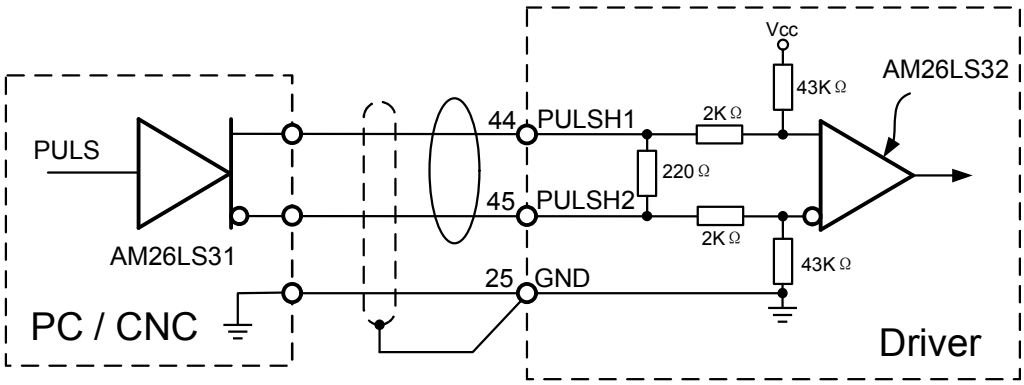






◆ Connection to sequence input signals (Pulse train interface exclusive to line driver)
- ■ Line driver I/F (Input pulse frequency : max. 2Mpps)

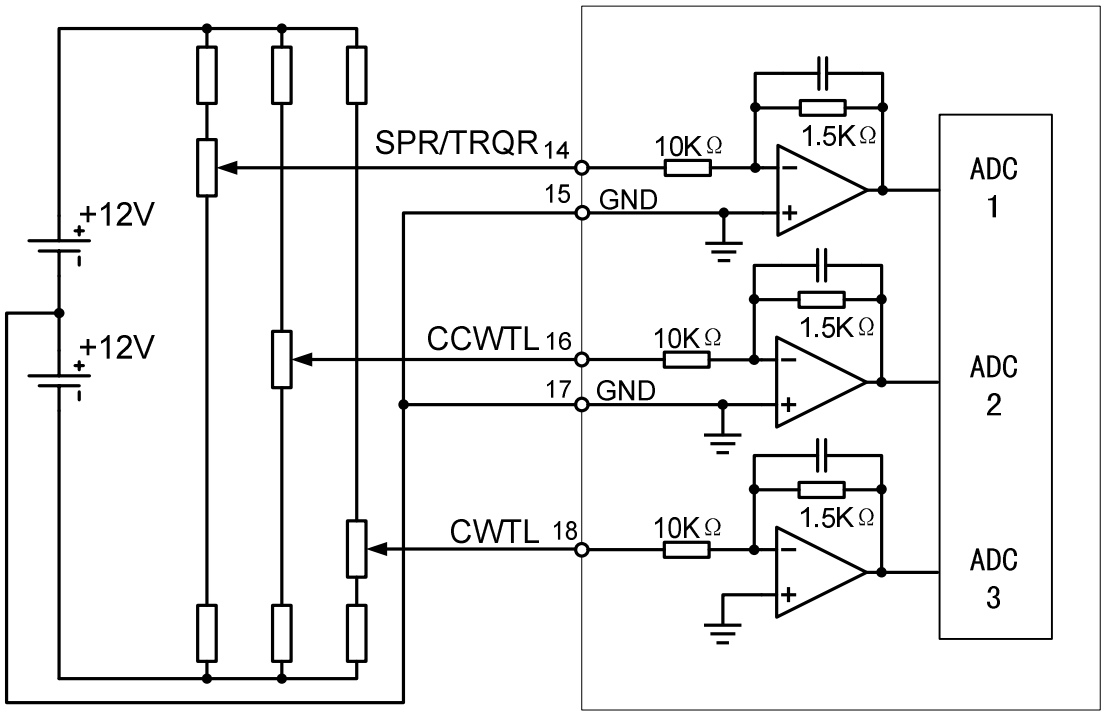
◆ This signal transmission method has better noise immunity. ¬We recommend this to secure the signal transmission.



represents twisted pair.

◆ Analog command input

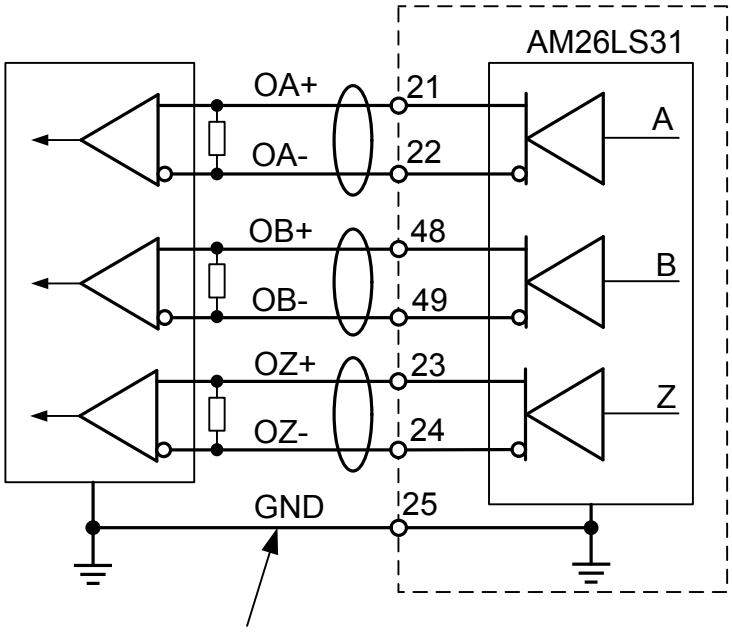
- The analog command input goes through 3 routes, SPR/TRQR(Pin-14), CCWTL (Pin-16) and CWTL (Pin-18).
- Max. permissible input voltage to each input is ±10V.
- All commands AD can be divided into 12bit about 5mV.



5-2-2 Output Circuit

◆ Line driver (Differential output) output

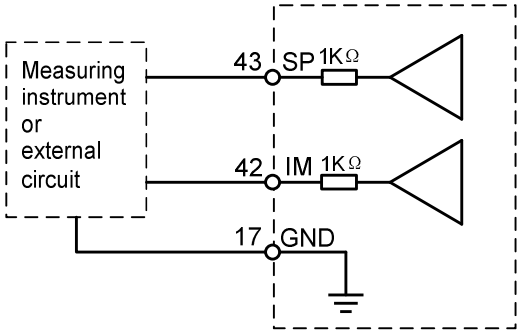
- Feeds out the divided encoder outputs (A, B and Z-phase) in differential through each line driver.
- At the host side, receive these in line receiver. Install a terminal resistor (approx. 330Ω) between line receiver inputs without fail.
- These outputs are not insulated.



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

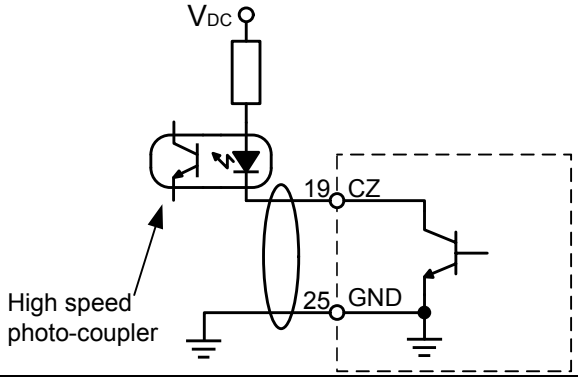
◆ Analog monitor output

- 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.



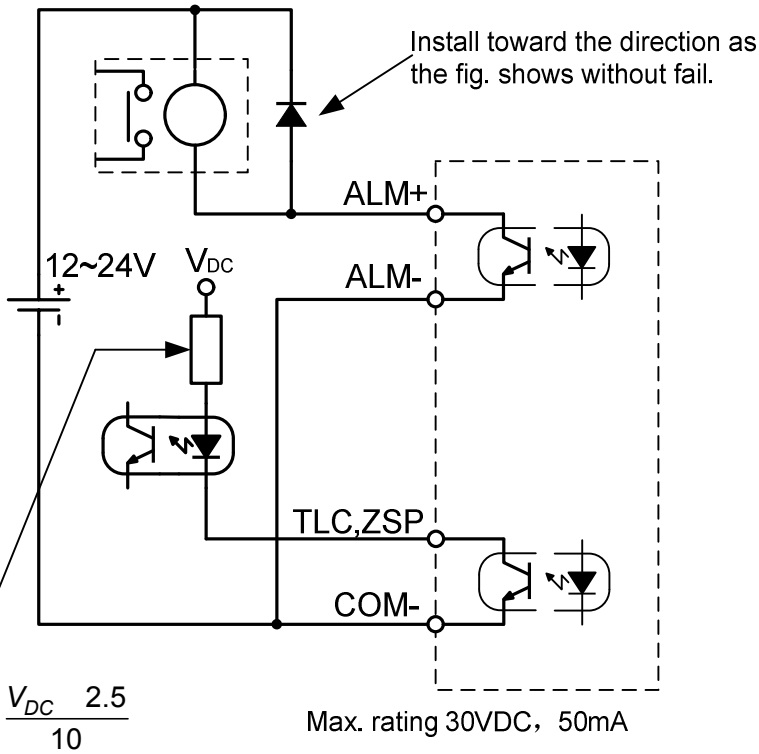
◆ Open collector output

- 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.



◆ 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.



5-3 Input Signal and Pin No. of the Connector,I/F

Input Signals (common) and Their Functions：

<table>
<tr><th>Title of signal</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>Power supply for control signal (+)</td><td>7</td><td>COM+</td><td>• Connect + of the external DC power supply (12 to 24V).
• Use the power supply voltage of 12V ± 5% – 24V ± 5%</td></tr>
<tr><td>Power supply for control signal (-)</td><td>41</td><td>COM-</td><td>• 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.</td></tr>
<tr><td>CW over-travel inhibit input</td><td>8</td><td>CW-LIMIT</td><td>• 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)</td></tr>
<tr><td>CCW over-travel inhibit input</td><td>9</td><td>CCW-LIMIT</td><td>• 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)</td></tr>
<tr><td>damping control switching input</td><td>26</td><td>ZERO-SPD</td><td>• Function varies depending on the control mode.
<table>
<tr><td>Velocity/ Torque control</td><td>• Becomes to a speed-zero clamp input (ZEROSPD).
<table>
<tr><th>Pr06</th><th>Connection to COM–</th><th>Content</th></tr>
<tr><td>0</td><td>—</td><td>ZEROSPD input is invalid.</td></tr>
<tr><td rowspan="2">1</td><td>open</td><td>Speed command is 0</td></tr>
<tr><td>Close</td><td>Normal action</td></tr>
<tr><td rowspan="2">2</td><td>open</td><td>Speed command is to CCW</td></tr>
<tr><td>Close</td><td>Speed command is to CW.</td></tr>
</table>
• In case Pr06 is 2 at torque control, ZERPSPD is invalid.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Title of signal</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
</table>

<table>
<tr>
<td>Gain switching input or Torque limit switching input</td>
<td>27</td>
<td>GAIN</td>
<td>
• Function varies depending on the setups of Pr30 (2nd gain setup) and Pr03 (Selection of torque limit).
<table>
<tr><th>Pr30</th><th>Connection to COM–</th><th>Content</th></tr>
<tr><td rowspan="2">0</td><td>Open</td><td>Velocity loop : PI (Proportion/Integration) action</td></tr>
<tr><td>Close</td><td>Velocity loop : P (Proportion) action</td></tr>
<tr><td rowspan="5">1</td><td colspan="2">when the setups of Pr31,Pr36 and 3A are 2</td></tr>
<tr><td>Open</td><td>1st gain selection (Pr10,11,12,13 and 14)</td></tr>
<tr><td>close</td><td>2nd gain selection (Pr18,19,1A,1B and 1C)</td></tr>
<tr><td colspan="2">when the setups of Pr31,Pr36 and 3A are 2</td></tr>
<tr><td colspan="2">invalid</td></tr>
</table>
</td>
</tr>
<tr>
<td>Electronic gear (division/multiplication) switching input</td>
<td>28</td>
<td>DIV</td>
<td>
• Function varies depending on the control mode.
<table>
<tr><td>Position</td><td>•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"</td></tr>
<tr><td>Velocity control</td><td>• Input of internal speed selection 3 (INTSP3)
•You can make up to 8-speed setups combining INH/INTSP1 and CL/INTSP2 inputs.</td></tr>
<tr><td>Torque control</td><td>• This input is invalid.</td></tr>
</table>
<Caution>
Do not enter the command pulse 10ms before/after switching.
</td>
</tr>
</table>

Numerator selection of electronic gear

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

Title of signal	**Pin No.**	**Symbol**	**Function**

<table>
<tr><td>Servo-ON input</td><td>29</td><td>SVO-ON</td><td>• 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.</td></tr>
<tr><td>Deviation counter clear input</td><td>30</td><td>CLR / INSP2</td><td>• Function varies depending on the control mode.
<table>
<tr><td>Position control</td><td>• 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).
<table>
<tr><th>Pr4D</th><th>Content</th></tr>
<tr><td>0</td><td>Clears the counter of positional deviation while CLR is connected to COM–.</td></tr>
<tr><td>1 [Default]</td><td>Clears the counter of positional deviation only once by connecting CLR to COM– from open status.</td></tr>
<tr><td>2</td><td>CLRis invalid.</td></tr>
</table></td></tr>
<tr><td>Velocity control</td><td>• Input of selection 2 of internal command speed (INTSP2)</td></tr>
<tr><td>Torque control</td><td>This input is invalid.</td></tr>
</table></td></tr>
<tr><td>Alarm clear input</td><td>31</td><td>ALM-CLR</td><td>• 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.</td></tr>
<tr><td>Control mode switching input</td><td>32</td><td>C-MODE</td><td>• You can switch the control mode as below by setting up Pr02 (Control mode setup) to 3-5.
<table>
<tr><th>Pr02 setup</th><th>Open (1st)</th><th>Connection to COM– (2nd)</th></tr>
<tr><td>3</td><td>Position control</td><td>Velocity control</td></tr>
<tr><td>4</td><td>Position control</td><td>Torque control</td></tr>
<tr><td>5</td><td>Velocity control</td><td>Torque control</td></tr>
</table>
<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.</td></tr>
</table>

Title of signal	Pin No.	Symbol	Function

<table>
<tr>
<td>Inhibition input of command pulse</td>
<td>33</td>
<td>PULS-INH / INSP1</td>
<td>
• Function varies depending on the control mode.
<table>
<tr>
<td>Position control</td>
<td>
• 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)
<table>
<tr><th>Pr43</th><th>Content</th></tr>
<tr><td>0</td><td>INH is valid</td></tr>
<tr><td>1(Default)</td><td>INH is invalid</td></tr>
</table>
</td>
</tr>
<tr>
<td>Velocity control</td>
<td>• Selection 1 input of internal command speed (INTSP1)</td>
</tr>
<tr>
<td>Torque control</td>
<td>• This input is invalid</td>
</tr>
</table>
</td>
</tr>
</table>

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.

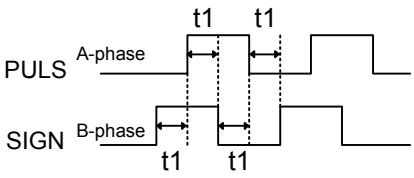
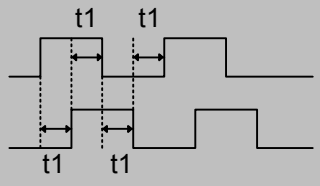
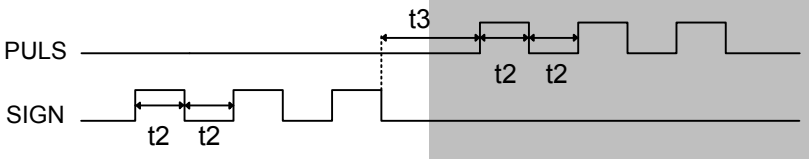
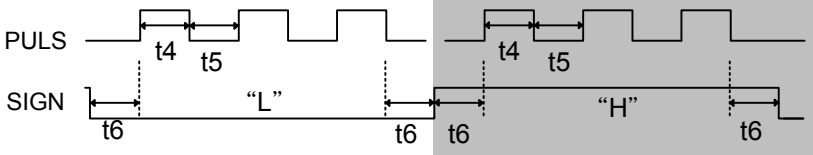
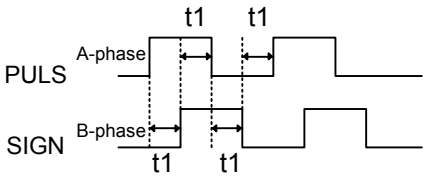
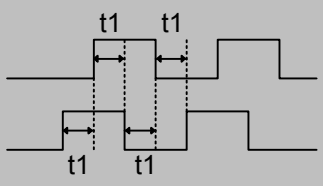
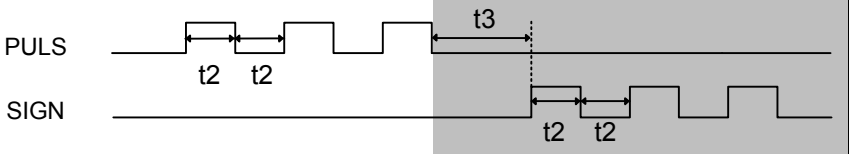
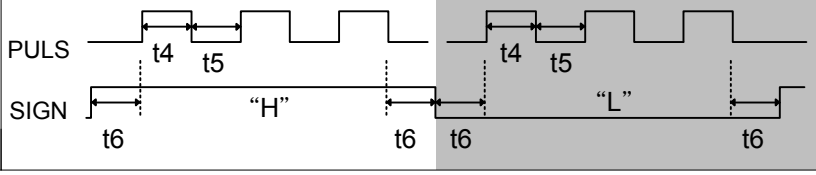
• Pulse train interface exclusive for line driver

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. • This input becomes invalid at such control mode as velocity control or torque control, where no position command is required. • 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".
	45	PLUSH2	
Command pulse sign input 1	46	SIGNH1	
	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. • This input becomes invalid at such control mode as the velocity control or torque control, where no position command is required. • Permissible max. input frequency is 500kpps at line driver input and 200kpps at open collector input. • 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".
	3	PULS1	
	4	PULS2	
Command pulse sign input 2	2	OPC2	
	5	SIGN1	
	6	SIGN2	

• Command pulse input format

Pr41 setup value	Pr42 setup value	CCW command	CW command
【0】	0 or 2	 B-phase advances to A by 90°.	 B-phase delays from A by 90°.
	【1】		
	3		
【1】	0 or 2	 B-phase delays from A by 90°.	 B-phase advances to A by 90°.
	【1】		
	3		

•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

<table>
<tr><th>Title of signal</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>Speed command input or Torque command input</td><td>14</td><td>SPR / TRQR</td><td>
• Function varies depending on control mode.
<table>
<tr><th>Pr02</th><th>Control mode</th><th>功能</th></tr>
<tr><td>3</td><td><u>Position/ Velocity</u></td><td>• 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)</td></tr>
<tr><td>4</td><td><u>Position/ Torque</u></td><td>• Function varies depending on Pr5B (Selection of torque command)
<table>
<tr><th>Pr5B</th><th>Content</th></tr>
<tr><td>0</td><td>• 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)</td></tr>
<tr><td>1</td><td>• 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)</td></tr>
</table></td></tr>
<tr><td>Others</td><td>Other control mode</td><td>• This input is invalid</td></tr>
</table>
•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]
</td></tr>
</table>

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

<Remark>_

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

<table>
<tr><th>Title of signal</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>CCW-Torque limit input</td><td>16</td><td>CCWTL / TRQR</td><td>• Function varies depending on Pr02 (Control mode setup).
<table>
<tr><th>Pr02</th><th>Control mode</th><th>content</th></tr>
<tr><td>2
4</td><td>Torque control
Position/Torque</td><td>• Function varies depending on Pr5B (Selection of torque command)
<table>
<tr><th>Pr5B</th><th>Content</th></tr>
<tr><td>0</td><td>This input becomes invalid.</td></tr>
<tr><td>1</td><td>• 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)</td></tr>
</table></td></tr>
<tr><td>5</td><td>Velocity/
Torque</td><td>• 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)</td></tr>
<tr><td>4
5
other</td><td>Position/Torque
Velocity/Torque
Other control mode</td><td>• 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.</td></tr>
</table>
•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]</td></tr>
<tr><td>CW-Torque limit input</td><td>18</td><td>CWTL</td><td>• Function varies depending on Pr02 (Control mode setup).
<table>
<tr><th>Pr02</th><th>Control mode</th><th>Content</th></tr>
<tr><td>2
4
5</td><td>Torque control
Position/Torque
Velocity/Torque</td><td>•This input becomes invalid when the torque control is selected.</td></tr>
<tr><td>4
5
other</td><td>Position/Torque
Velocity/Torque
Other control mode</td><td>• 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.</td></tr>
</table>
•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]</td></tr>
</table>

*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

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

<table>
<tr><th>Title of signal</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>External brake release signal</td><td>11
10</td><td>BK-OFF+
BK-OFF-</td><td>• 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.)</td></tr>
<tr><td>Servo-Ready output</td><td>35
34</td><td>SVO-RDY+
SVO-RDY-</td><td>• 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.</td></tr>
<tr><td>Servo-Alarm output</td><td>37
36</td><td>SVO-ALM+
SVO-ALM-</td><td>• 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.</td></tr>
<tr><td>Positioning complete (In-position)</td><td>39
38</td><td>ON-POS+
ON-POS-</td><td>• Function varies depending on the control mode.
<table>
<tr><td>Position control</td><td>• 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).</td></tr>
<tr><td>Velocity /Torque control</td><td>• 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).</td></tr>
</table></td></tr>
<tr><td>Zero-speed detection output signal</td><td>12
(41)</td><td>ZSP
(COM-)</td><td>• 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".</td></tr>
<tr><td>Torque in-limit signal output</td><td>40
(41)</td><td>TLC
(COM-)</td><td>• 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".</td></tr>
</table>

•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.	

<table>
<tr><th>Title of signal</th><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td rowspan="6">A-phase output

B-phase output

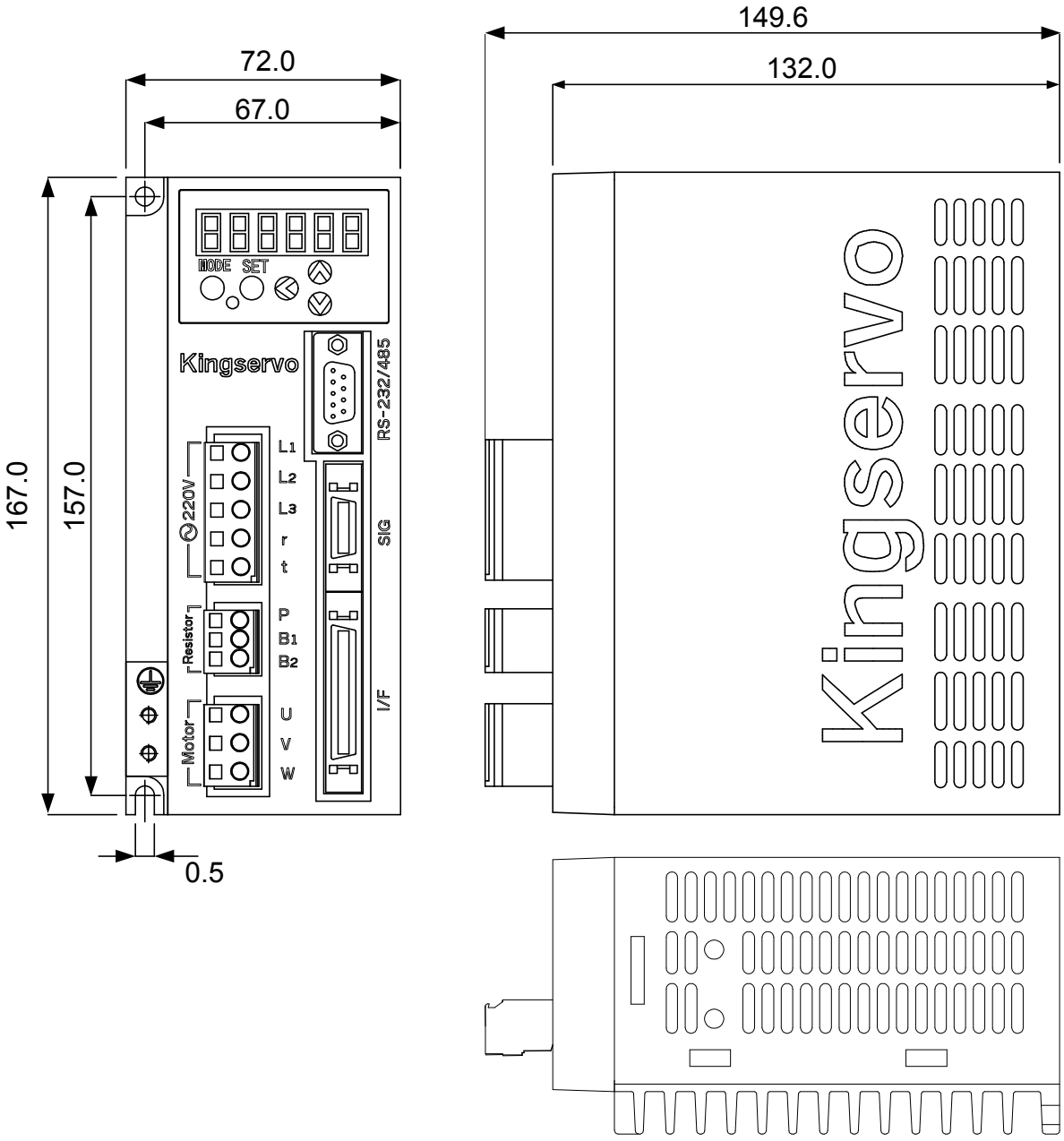
Z-phase output</td><td>21</td><td>OA+</td><td rowspan="6">• Feeds out the divided encoder signal or external scale signal (A, B, Zphase) in differential.
• You can set up the division ratio with Pr44 (Output Pulse Pre-division of Every Reversion)Pr4E(Numerator of pulse output division) and Pr4F(Denominator of pulse output division)
• You can select the logic relation between A-phase and B-phase, and the output source with Pr45 (Reversal of pulse output logic).
• Ground for line driver of output circuit is connected to signal ground (GND) and is not insulated.
• Max. output frequency is 4Mpps (after quadrupled)</td></tr>
<tr><td>22</td><td>OA-</td></tr>
<tr><td>48</td><td>OB+</td></tr>
<tr><td>49</td><td>OB-</td></tr>
<tr><td>23</td><td>OZ+</td></tr>
<tr><td>24</td><td>OZ-</td></tr>
<tr><td>Z-phase output</td><td>19</td><td>CZ</td><td>• 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.</td></tr>
<tr><td>Torque monitor signal output</td><td>42</td><td>IM</td><td>• The content of output signal varies depending on Pr08 (Torque monitor(IM) selection).
• You can set up the scaling with Pr08 value.
<table>
<tr><th>Pr08</th><th>Content of signal</th><th>Function</th></tr>
<tr><td>0-2</td><td>Torque command</td><td>• Feeds out the voltage in proportion to the motor torque command with polarity.
+ : generates CCW torque
– : generates CW torque</td></tr>
<tr><td>3-7</td><td>Positional deviation</td><td>• 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</td></tr>
</table></td></tr>
<tr><td>Speed monitor signal output</td><td>43</td><td>SPM</td><td>• The content of the output signal varies depending on Pr07 (Speed monitor (IM) selection).
• You can set up the scaling with Pr07 value.
<table>
<tr><th>Pr07</th><th>Control mode</th><th>Function</th></tr>
<tr><td>0-4</td><td>Motor speed</td><td>• Feeds out the voltage in proportion to the motor speed with polarity. + : rotates to CCW – : rotates to CW</td></tr>
<tr><td>5-9</td><td>Command speed</td><td>• Feeds out the voltage in proportion to the command speed with polarity.
+ : rotates to CCW – : rotates to CW</td></tr>
</table></td></tr>
<tr><td>Signal ground</td><td>13,15, 17,25</td><td>GND</td><td>• Signal ground
• This output is insulated from the control signal power (COM–) inside of thedriver.</td></tr>
<tr><td>Frame ground</td><td>50</td><td>FG</td><td>• This output is connected to the earth terminal inside of the driver.</td></tr>
</table>

MODE
SET
Kingservo
RS-232/485
SIG
I/F
220V
L1
L2
L3
r
t
Resistor
P
B1
B2
Motor
U
V
W

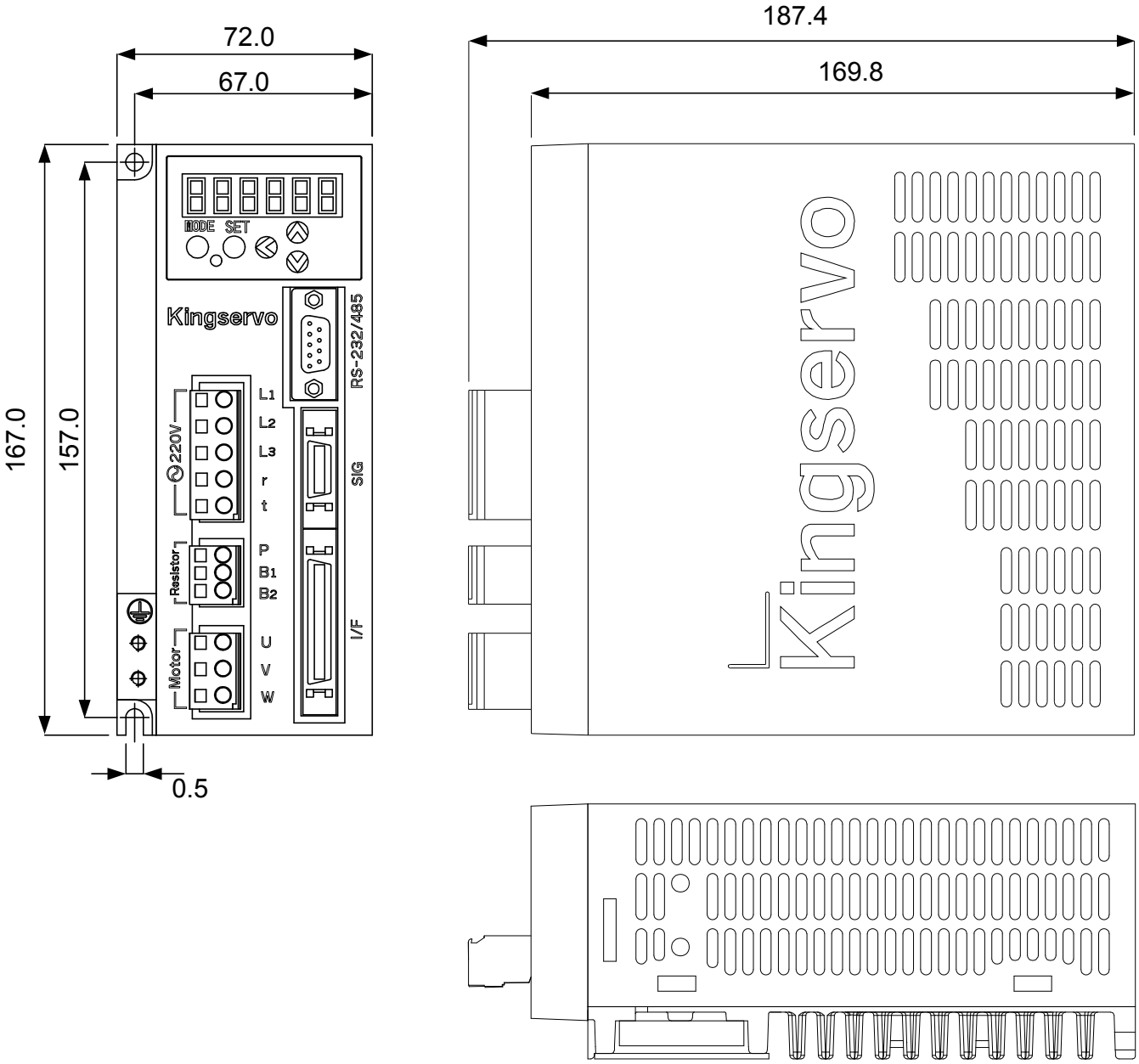
Chapter 6 Documenets

6-1 Dimensions

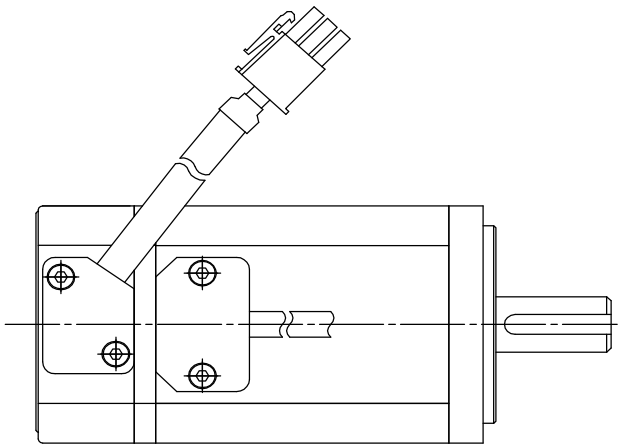
(Driver) KSDG 200W&400W

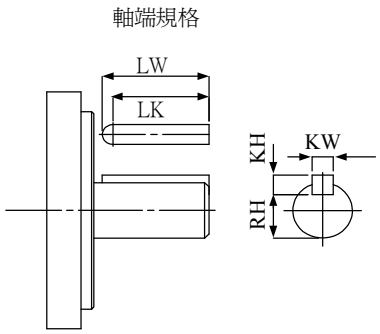


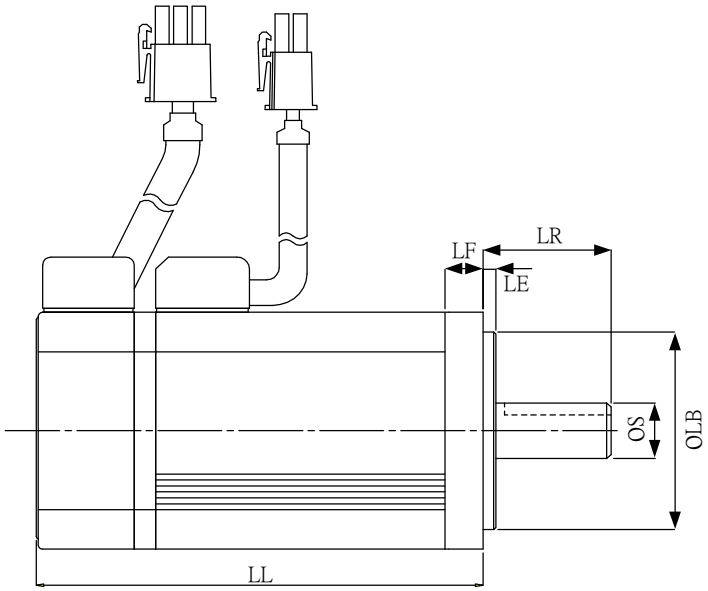
(Driver) KSDG 1KW&750W

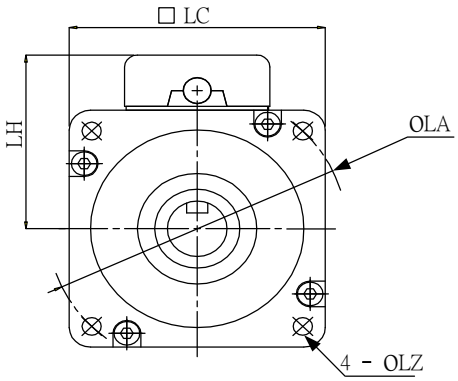


(Motor) KSMA 200W to750W







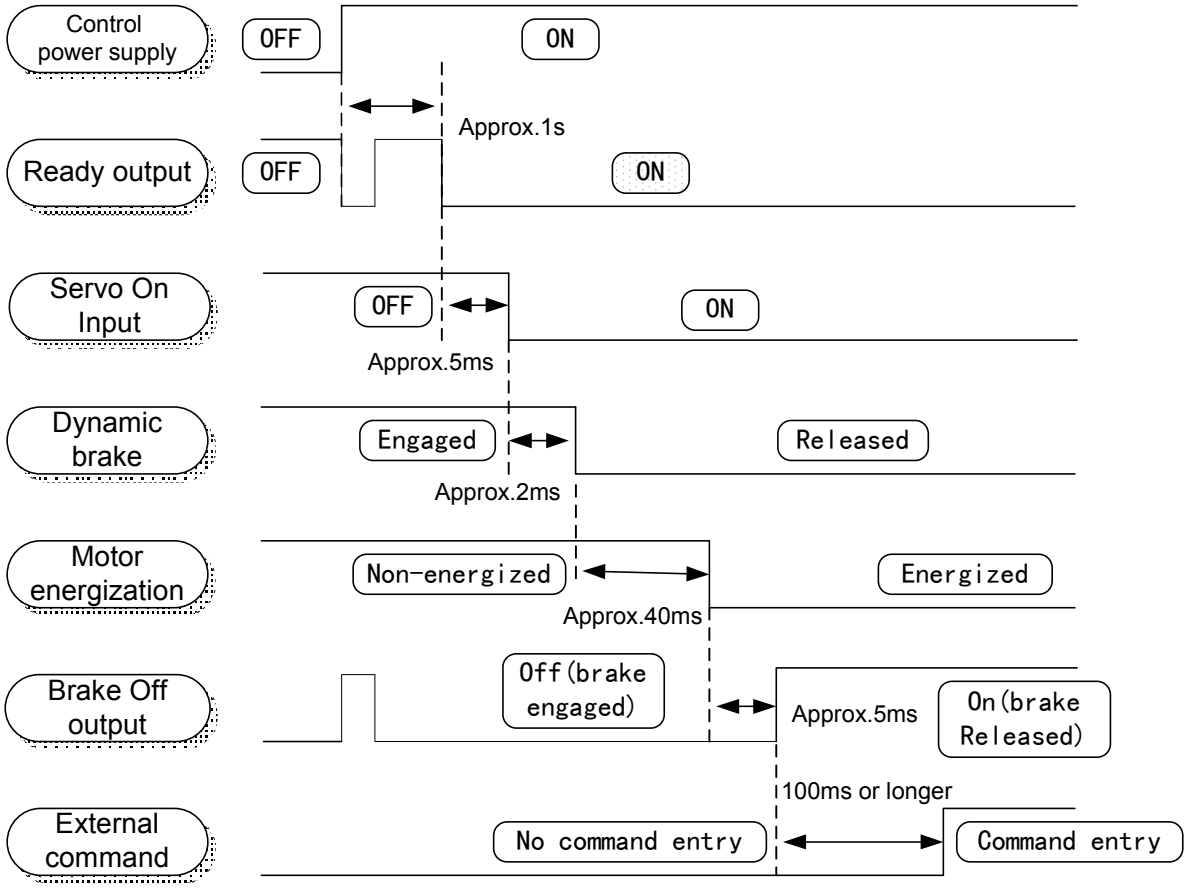


Dimensions table

Motor output		200W	400W	750W
LL	Without brake	82.4	104.8	108.6
	With brake	-	140.8	-
LF		8	8	8
LE		3	3	3
LR		30	30	38
LB		50h7	50h7	70h7
S		14h6	14h6	19h6
LH		44	44	53
LC		60	60	80
LA		70	70	90
LZ		4.5	4.5	6.6
Keyway dimensions	LW	25	25	25
	LK	22.5	22.5	22
	KW	5h9	5h9	6h9
	KH	5	5	6
	RH	11	11	15.5

6-2 Timing Chart

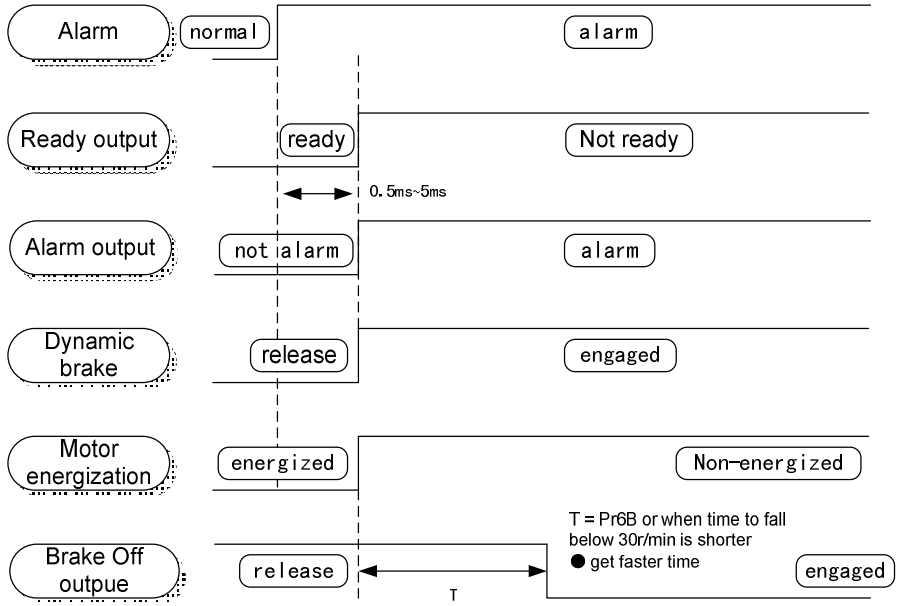
Servo ON signal process sequence as power-up



<Caution>

- Above charter represents the sequences from AC power starting to order inputing.
- Input Servo ON signal and external commands according to above sequences.

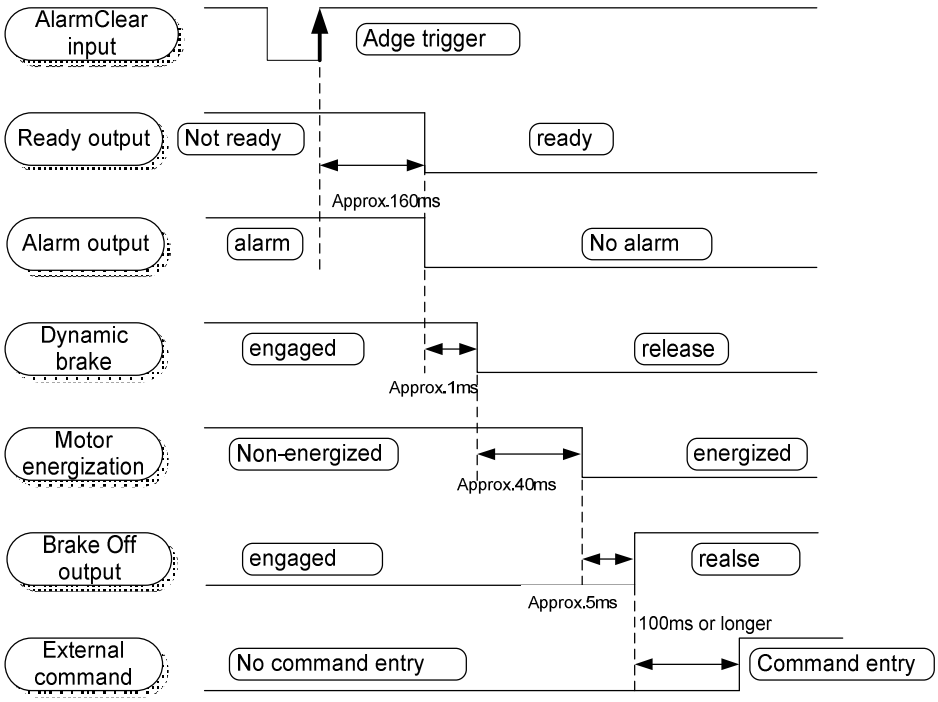
When an Error (Alarm) Has Occurred (at Servo-ON Command)



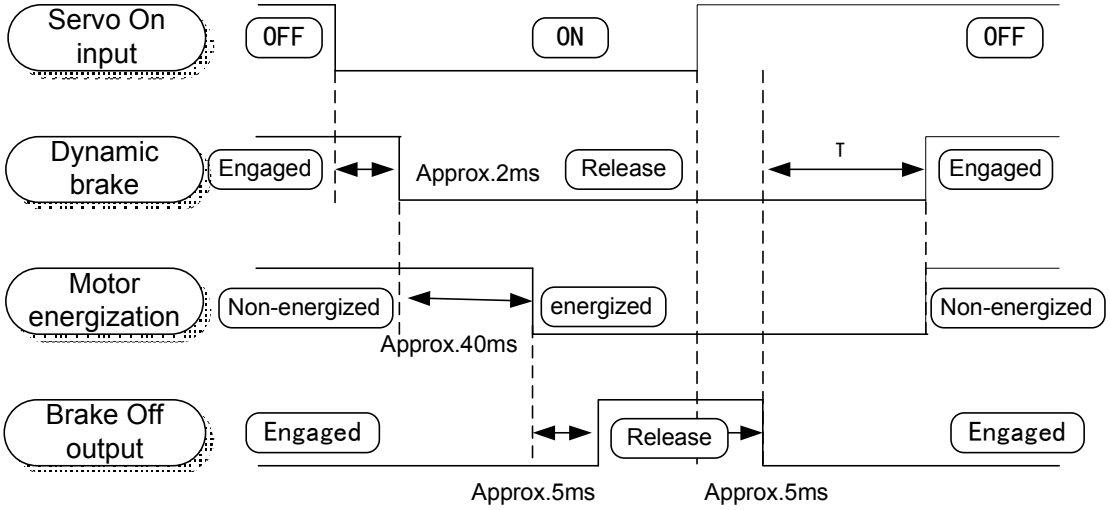
Related parameter:
Pr68 Sequence at alarm
Pr6B Setup of mechanical brake action at running

<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)



Servo-ON/OFF Action While the Motor Is at Stall (Servo-Lock)



Related parameter:
Pr69 Sequence at main power OFF
Pr6A Setup of mechanical brake action at stalling

<Cautions>

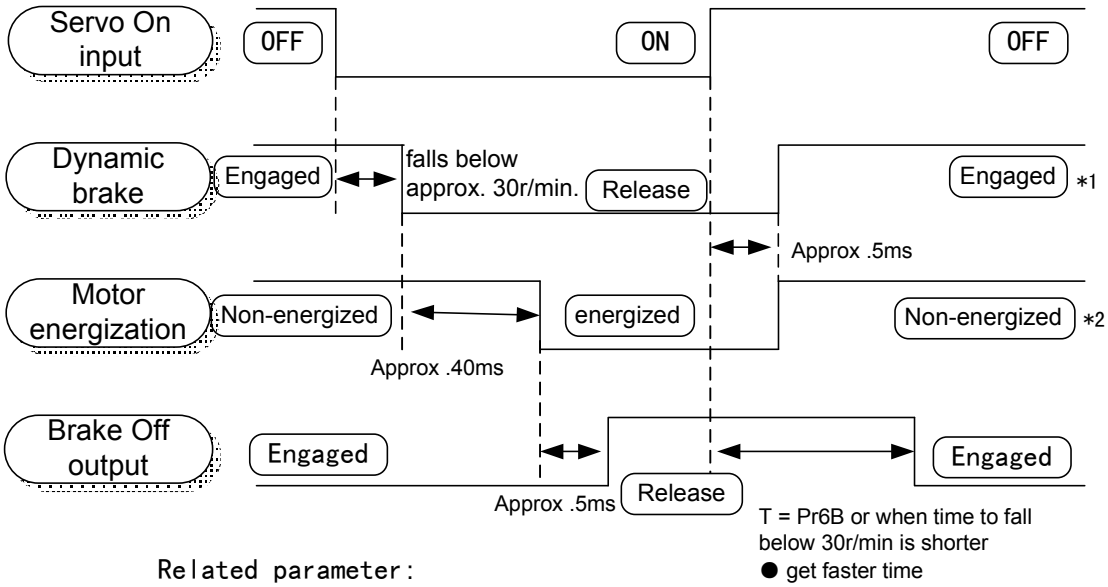
1.T will be determined by Pr6A setup value.

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.

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.)



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 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.

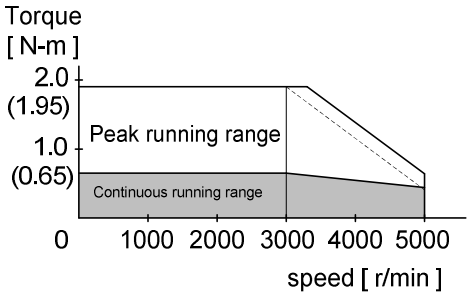
■Setup of speed limiting value

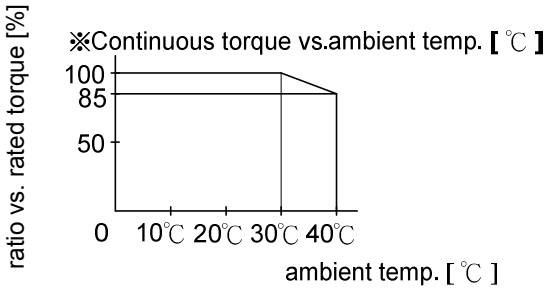
Setup the speed limiting value to the 4th speed of speed setup (Pr56) (when torque command selection (Pr5B) is 0.) or to the analog speed command input (SPR/TRQR/SPL) (when torque command selection (Pr5B) is 1).

- 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.

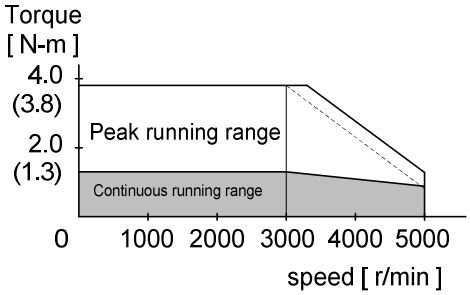
6-4 Motor Characteristics (S-T Characteristics)

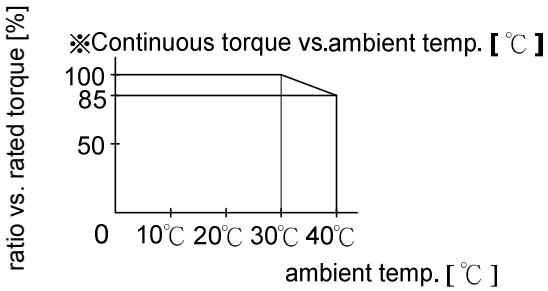
200W



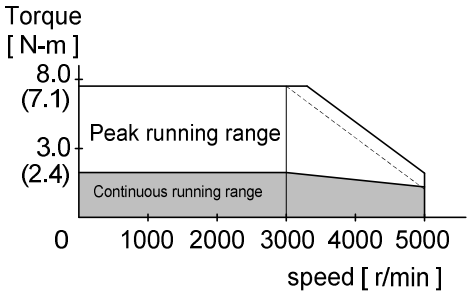


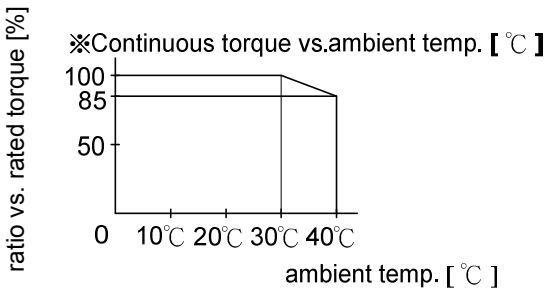
400W



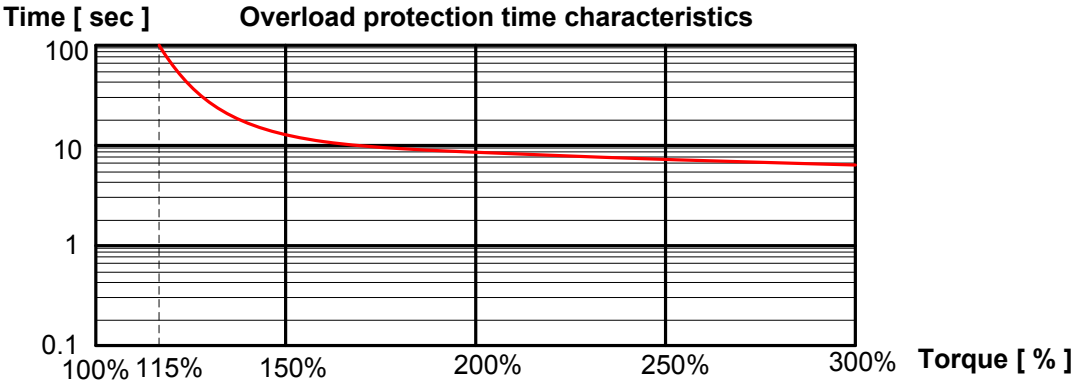


750W





6-5 Overload protection time characteristics



6-6 Connector Kit for Motor/Encoder Connection

6-6-1Connector and connector pin

Applicable motor models：KSMA 400W 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	

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)
Connetctor (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

6-7 Driver Specifications

6-7-1 Basic Specificaitons

Basic Specificaitons	Input power	Main circu	Single/3-phase，190~255V 50/60Hz
		Control circuit	Single Phase，190~255V 50/60Hz
	Environment	Temperature	Operating : 0 to 55°C, Storage : –20 to +80°C
		Humidity	Both operating and storage : 90%RH or less (free from condensation)
		Altitude	1000m or lower
		Vibration	5.88m/s2 or less, 10 to 60Hz (No continuous use at resonance frequency)
	Control method		IGBT PWM Sinusoidal wave drive
	Encoder feedback		2500P/r (10000 resolution) incremental encoder
	Control signal	Input	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.
		Output	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.
	Analog signal	Input	3 inputs(A/D)
		Output	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.)
	Pulse signal	Input	4 inputs ,Select the exclusive input for line driver or photo-coupler input with parameter.
		Output	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.
	Communication function	RS232	1 : 1 communication to a host with RS23 interface is enabled.
	Front panel		(1) 5 keys (MODE, SET, UP, DOWN, SHIFT), (2) LED (6-digit)
	Regeneration		Built-in regenerative resistor (50W) ◦
	Dynamic brake		Setup of action sequence at Power-OFF, Servo-OFF, at protective function activation and over-travel inhibit input is enabled.
	Control mode		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

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 $\times \frac{(1 \text{ to } 10000) \times 2^{(0 \text{ to } 17)}}{1 \text{ to } 10000}$
			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	Soft error	Over-voltage, under-voltage, over-speed over-load, over-heat, over-current and encoder error etc.
			Hard error	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 MODE SET △ ▽ ◁
			Setup support software	KSDTools

KINGSERVO TECHNOLOGY CO.,LTD.