Manual Version : [ver 3.3]

Software Version : Higher than 2.01

The first edition : 2002. 01. 02.

A revised edition : 2004. 05. 08.

Thank you for purchasing Metronix's AnyPack Series

Read this instruction manual thoroughly before installation, operation, maintenance or inspection of this product.

Symbols for Safe Operation

In this manual, NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION".

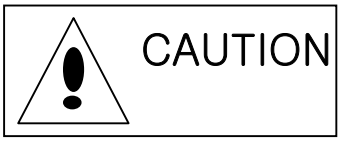
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

Indicates a potentially hazardous situation which, may result in minor or moderate injury to personnel, and possible damage to equipment if not avoided. It may also be used to alert against unsafe practices.

- Items described in Caution may also result in a vital accident in some situations. In cither case, follow these important notes.

Note for Safe Operation

◆ INSTALLATION



- Make sure to keep the install direction.
- Do not throw down and prevent from impact.
- Never use the equipment where it may be exposed to splashes of water, corrosive or flammable gases, or near flammable materials.(Failure to observe this warning may lead to electric shock or fire)

◆ WIRING

- For the input power supply of Servo drive, surely use AC200~230[V]
- Make sure to ground the ground terminal.
- Never connect the AC main circuit power supply to servo motor.
- Never connect the AC main circuit power supply to output terminals U,V and W.
- Use the compression terminal with insulated tube when wire the power terminal.
- Make sure that Power cable(U,V,W) and Encoder cable are separated when connected.
- Disconnect the power wires surely after the input power is off and “CHARGE” Lamp is completely OFF.
- Surely use Twist pair shield cable for pulse command signal (PF+, PF-, PR+, PR-), speed command signal(SPDCOM), torque limit signal(TRQLIM).

◆ OPERATION

- Before starting operation, check and adjust each menu.
- During operation, do not touch the shaft of motor.
- During operation, do not touch the heat sink.
- Do not connect or disconnect CN1,CN2,CN3 connectors while power is applied to the circuit.

◆ GENERAL PRECAUTIONS

- Specifications are subject to change for product modifications and improvements. In this case, we issue the manual on updated Version NO.

◆ Precaution at First Setup

- Make sure the Power Supply voltage (AC200~230[V]) and wiring before power is applied to the circuit.
- At first power apply, applied the power on Servo-OFF status.
- Verify the model No. of motor and the No. of Encoder pulse before power is applied to the circuit.
- Set the motor ID on menu[PE-201], number of Encoder Pulse on menu [PE-204]
- After finishing the above, set the operation mode of servo drive by linking upper motion controller on the menu [PE-601].
- Wire CN1 if servo drive according to each operation mode referring to “1.2 System Construction”(Refer to “5.5 Example of connecting to upper Controller”)
- The ON/OFF state of each CN1 input contacts can be verified at CN1 contacts state.

◆ MAINTENANCE AND INSPECTION

- After turning OFF Control power supply L1C, L2C, and main power supply L1, L2, L3 then wait enough time (Until the charge lamp is turned off), Proceed the maintenance and inspection. High voltage still remains in the internal condenser.
- Never touch the high-voltage terminals at first power apply.
- Do not repair, inspect, and replace the component except for authorized person.
- The alteration of products is not allowed in any case

Contents

3.Wiring

4.Detail Explanation of Program Menu

6. Communication Protocol

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7.2 Servo Drive

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8. Maintenance and Inspection

8.1 Maintenance and Inspection

8.2 Fault Diagnosis and Corrective Actions

[Appendix]

Chapter1

Product Configuration and Main Function

1.1 Product Configuration

1.2 System Configuration

1.3 Signal Explanation

1.1 Product Construction

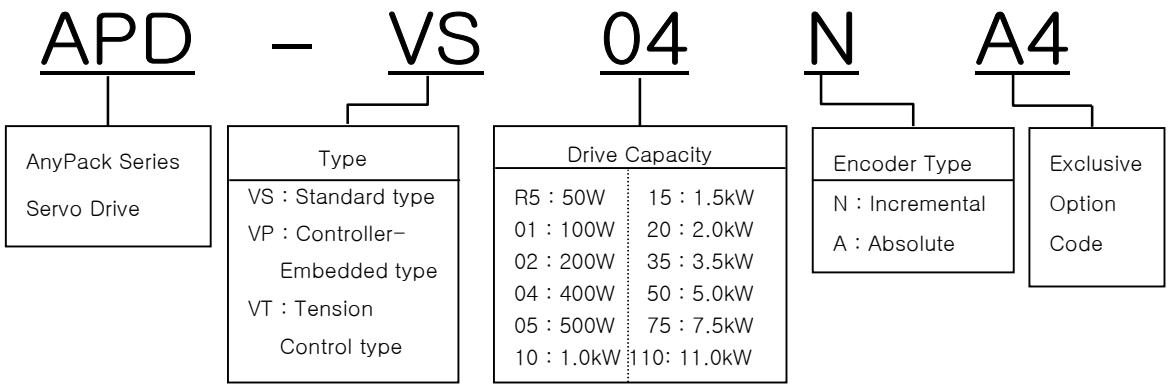
1.1.1 Checking Products

① Check if the products are the ones you ordered.
- Check the types marked in the nameplates of Servo Drive
- Check the types marked in the nameplates of Servo Motor

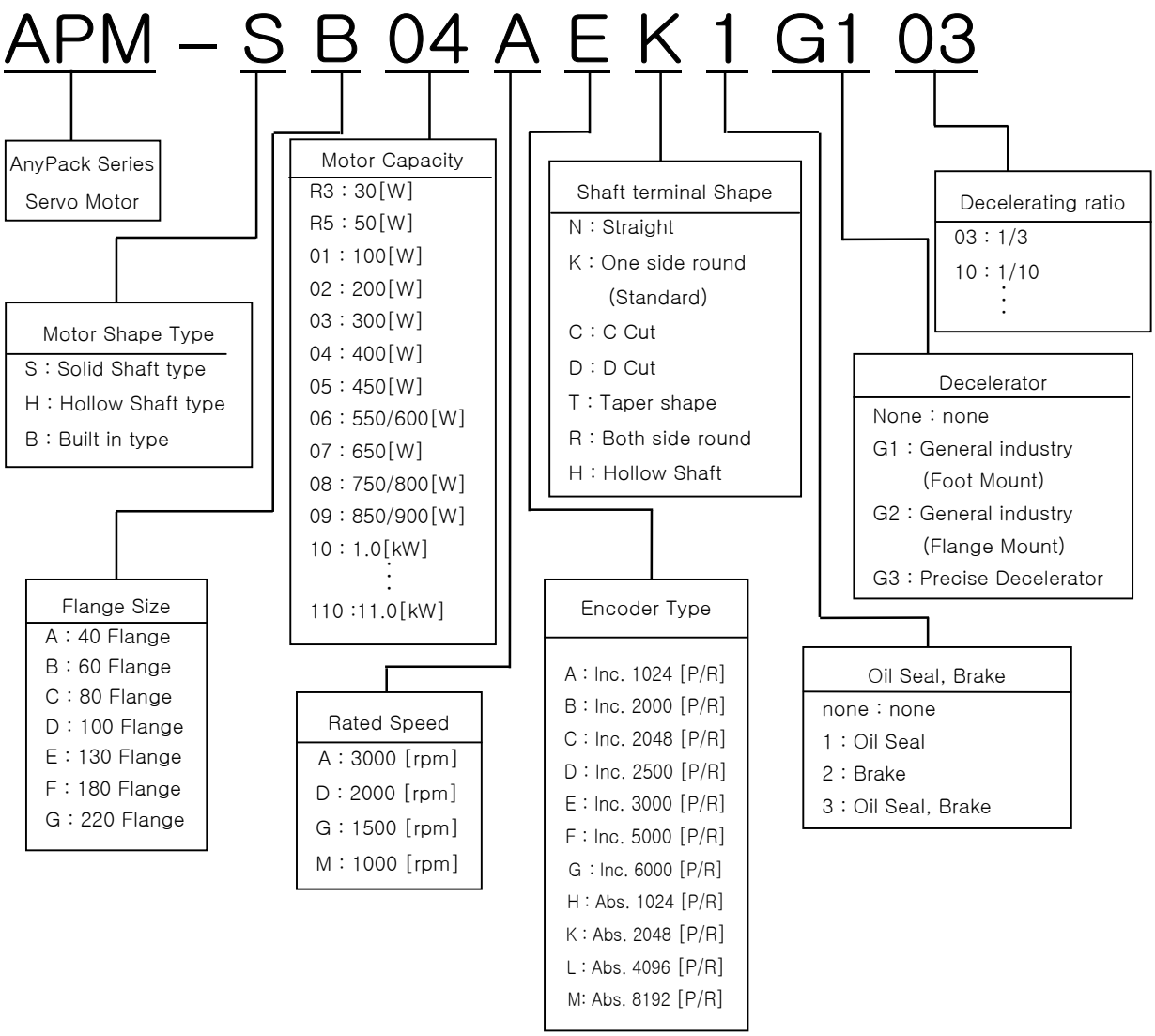
② Check Product and Option Items.
- Check if the cable types and length are right
- Check if the regenerative resistance is suitables for standard
- Check if the motor shaft is fine
- Check if the Oil Seal and Brake is fine
- Check if the decelerator and decelerating ratio is fine
- Check it the Encoder type is fine

③ Check the External Appearance
- Check if there is nodust or moisture
- Check if there is fading, contamination, damage, and disconnection
- Check screws for looseness
- Check if there is no noise or excessive friction at rotating

■ Servo drive Type Designation



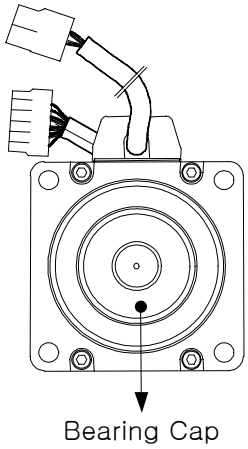
■ Servo Motor Product Type

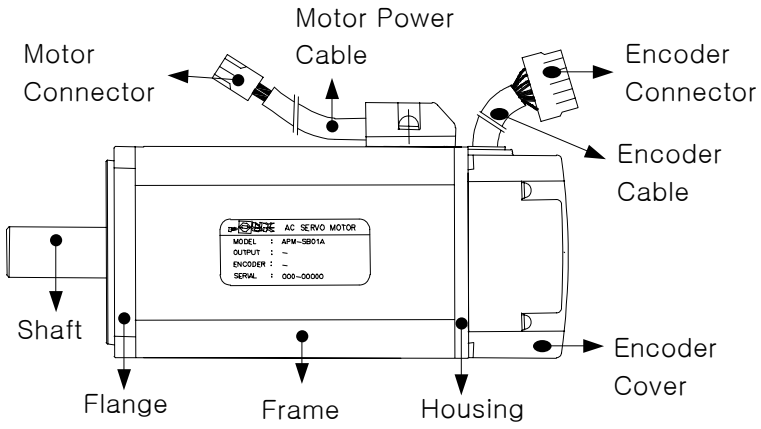


1.1.2 Identifying the Parts

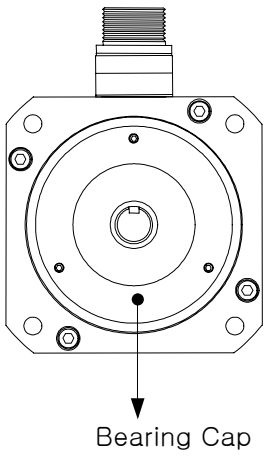
■ Servo Motor

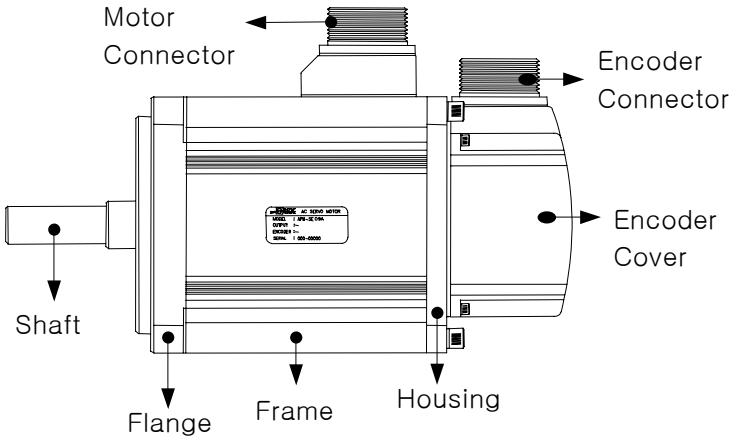
- Less than 80 Flange





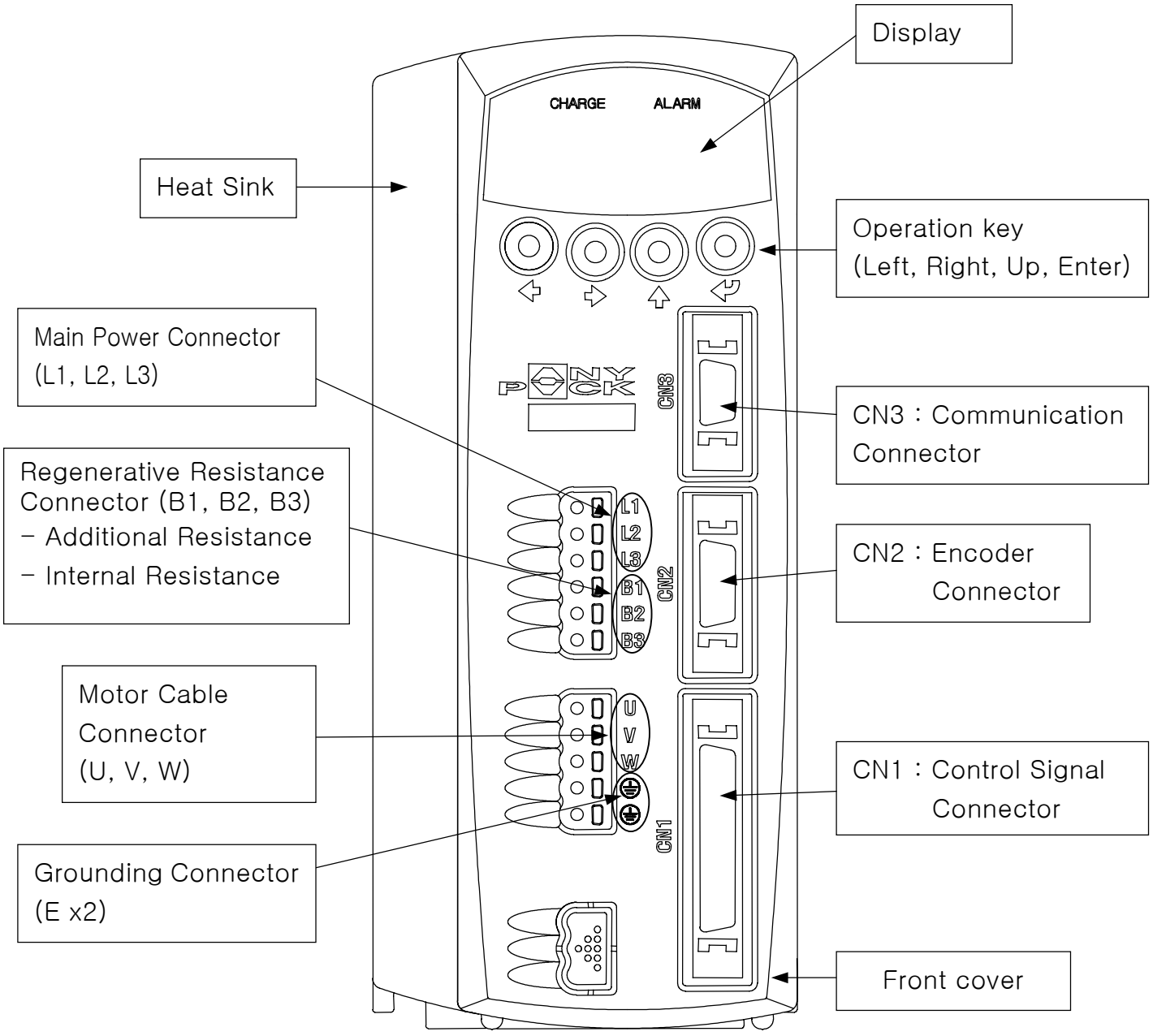
- More than 130 Flange



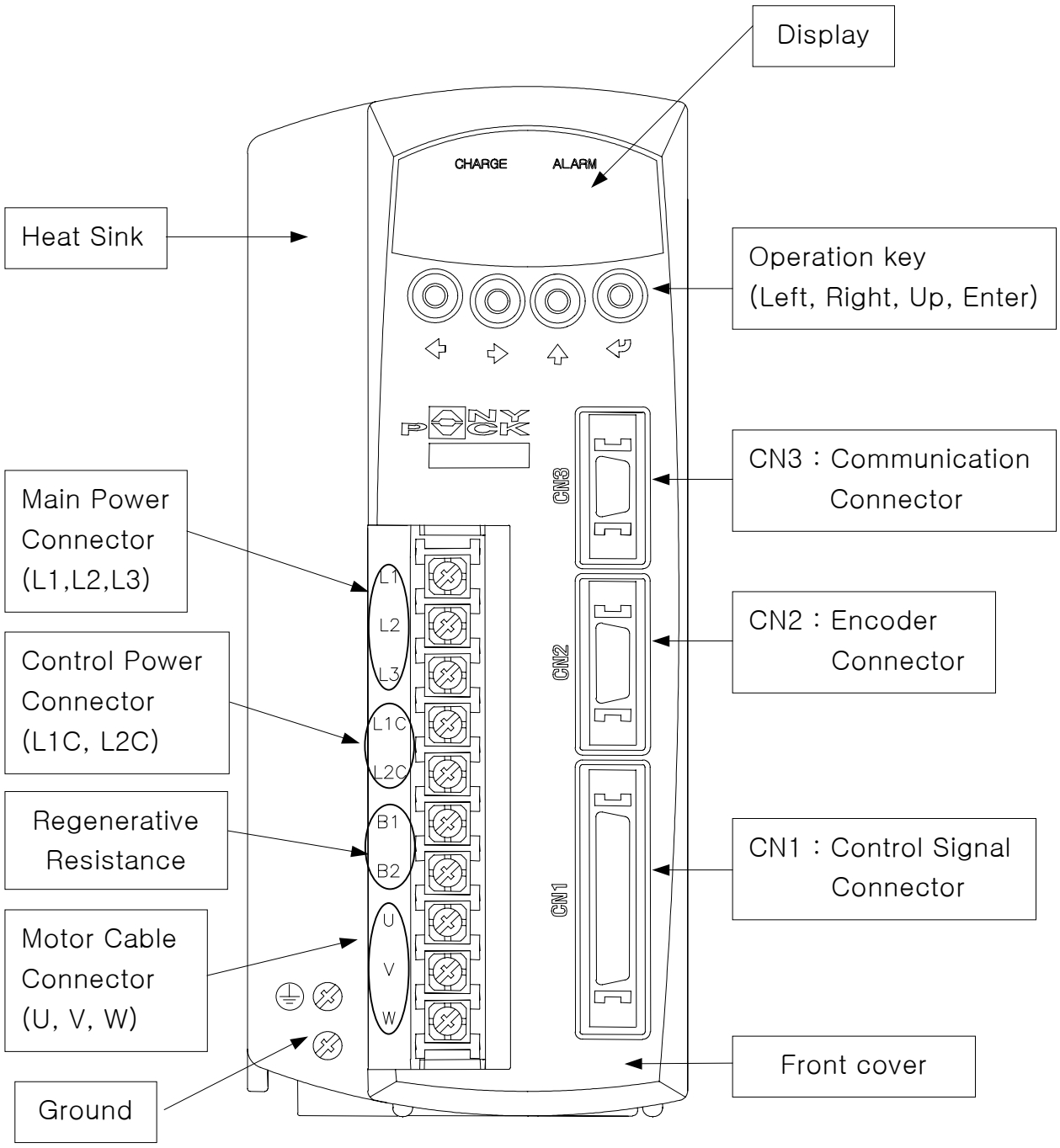


■ Servo Drive

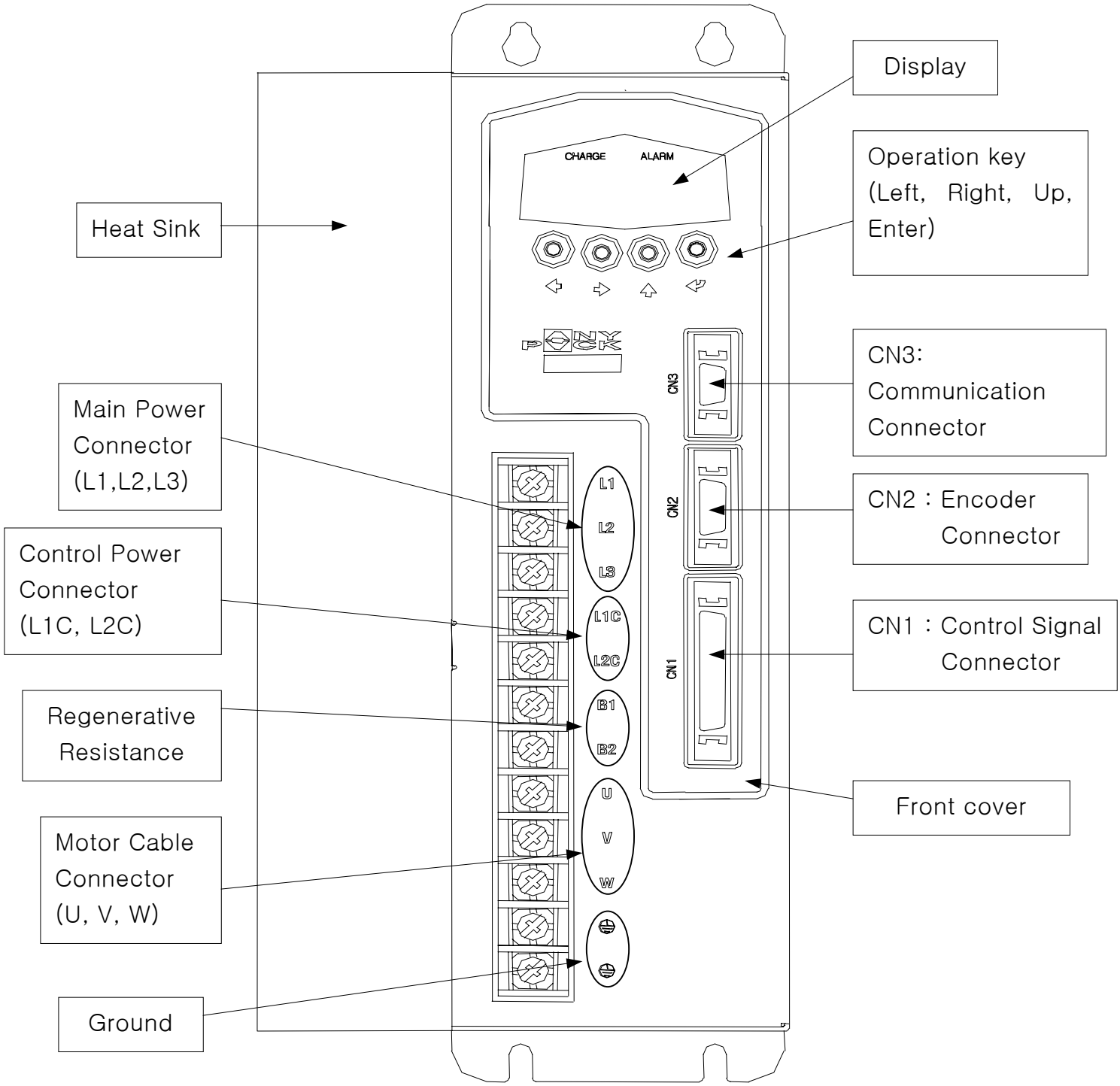
- Small Capacity (less than APD-VS04)



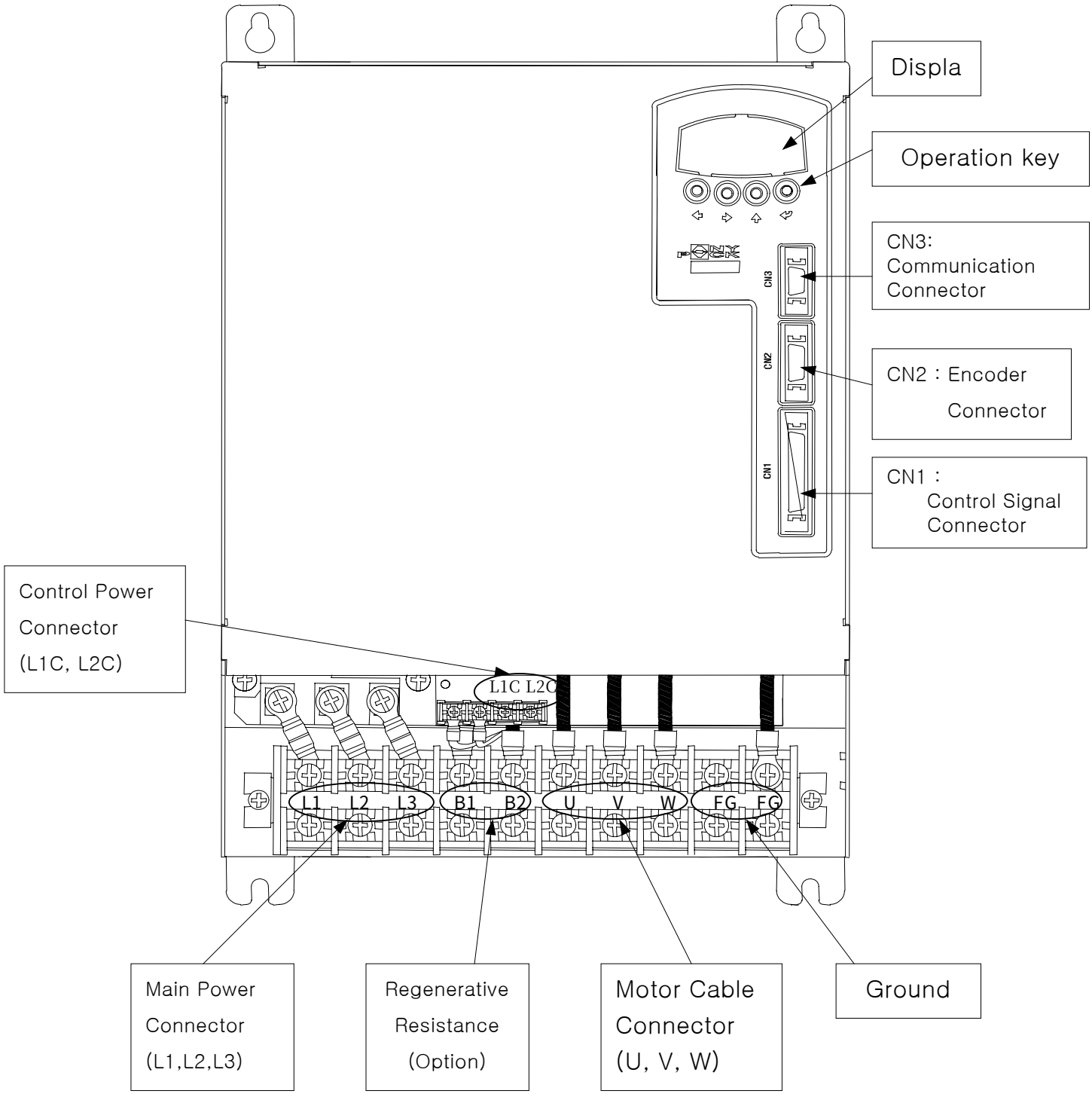
- Medium Capacity (APD-VS05 ~10)



- Large Capacity (APD-VS15 ~75)



- Special Large Capacity (APD-VS110)



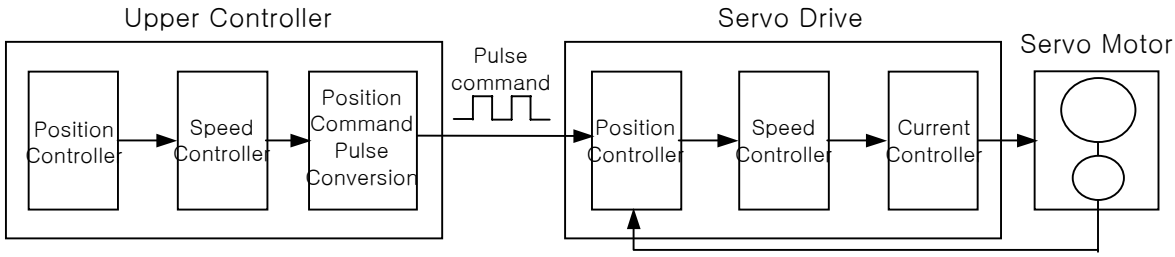
1.2 System Configuration

1.2.1 Summary

Servo System can be used variously by interface upper controller.

1) Position Operation System

Operation Servo by pulse command, that is operating position of servo motor by ration of encoder pulse compared to command pulse.



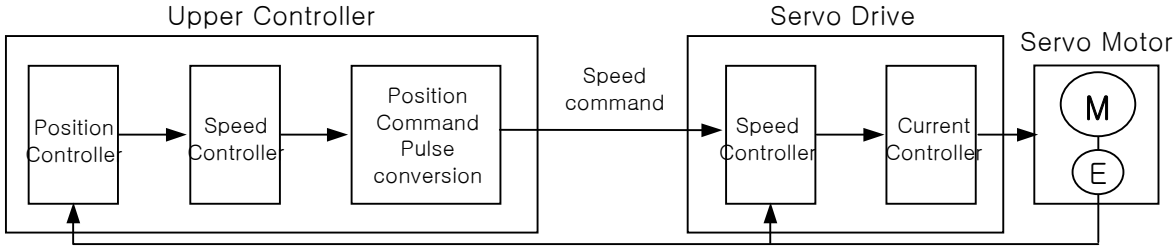
Strong point : Because of pulse input by transfer unit, upper controller is simple.

Weak point : High speed rotating is difficult at using precise transfer unit

Response characteristics are not good by using various step of control.

2) Speed Operation System

Operating servo by speed command that is analog or digital speed command.



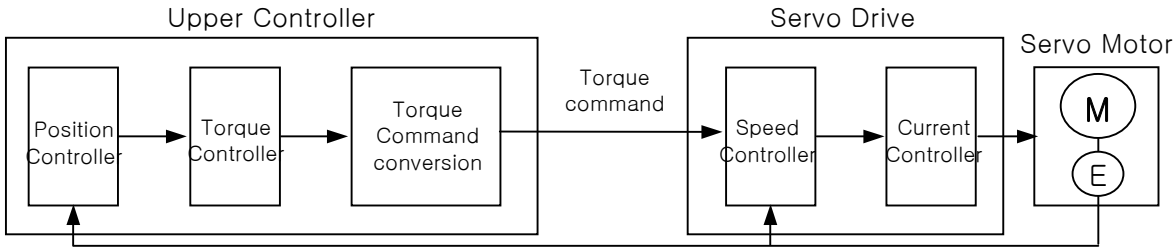
Strong point : Response of servo is fast.

Easy to control precisely

Weak point : Upper controller is complicate.

3) Torque Operation System

Operating Servo by torque command that is analog voltage.



Strong point : Response of servo is fast.
Easy to control precisely

Weak point : Upper controller is complicate

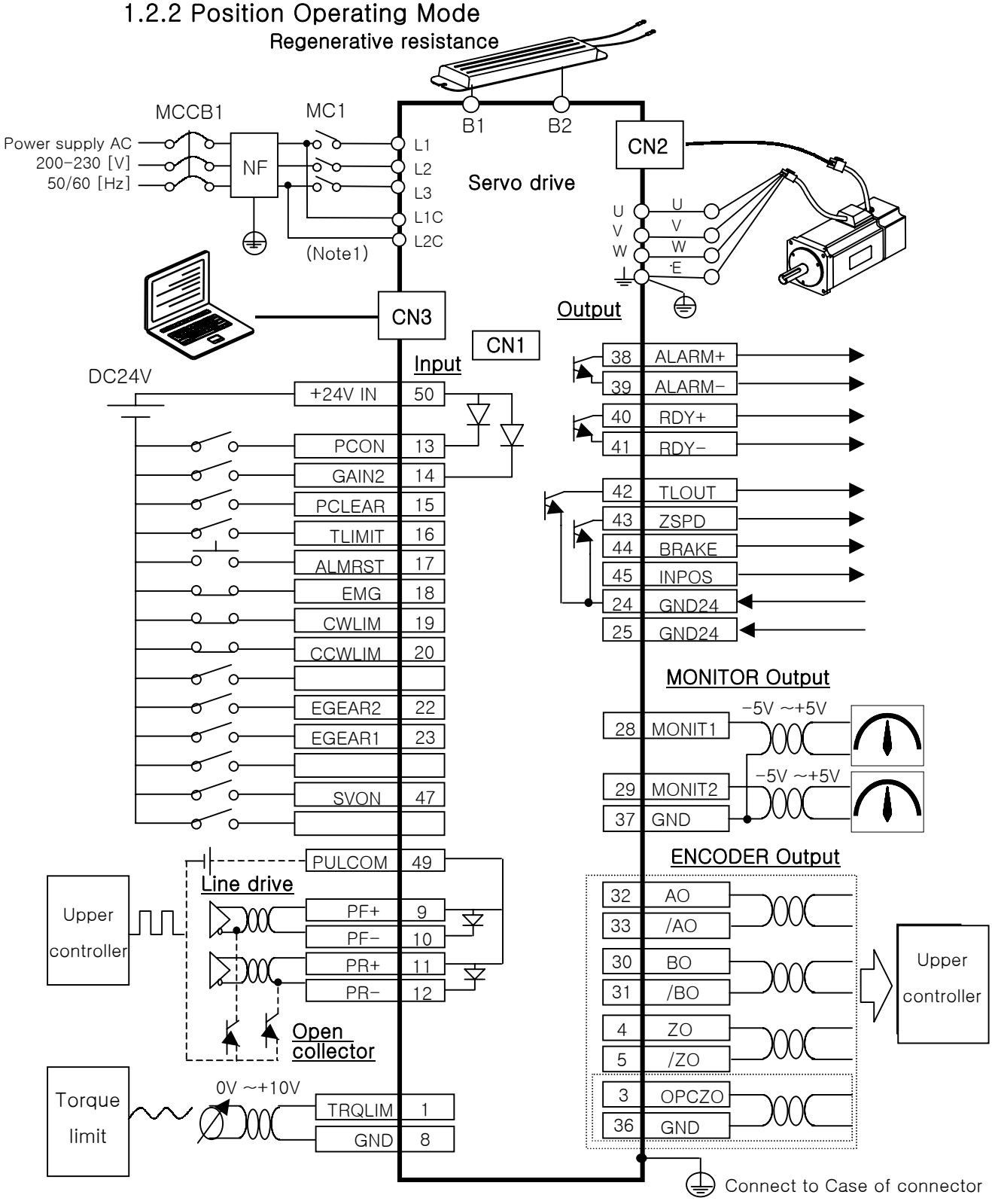
4) Operation mode

According to interface with upper controller, Operating mode is as below

Operation Mode	System
0	Operating Torque mode
1	Operating Speed mode
2	Operating Position mode
3	Operating Speed/Position mode by selecting connector
4	Operating Speed/Torque mode by selecting connector
5	Operating Position/Torque mode by selecting connector

* Operation mode is set up on menu [PE-601]

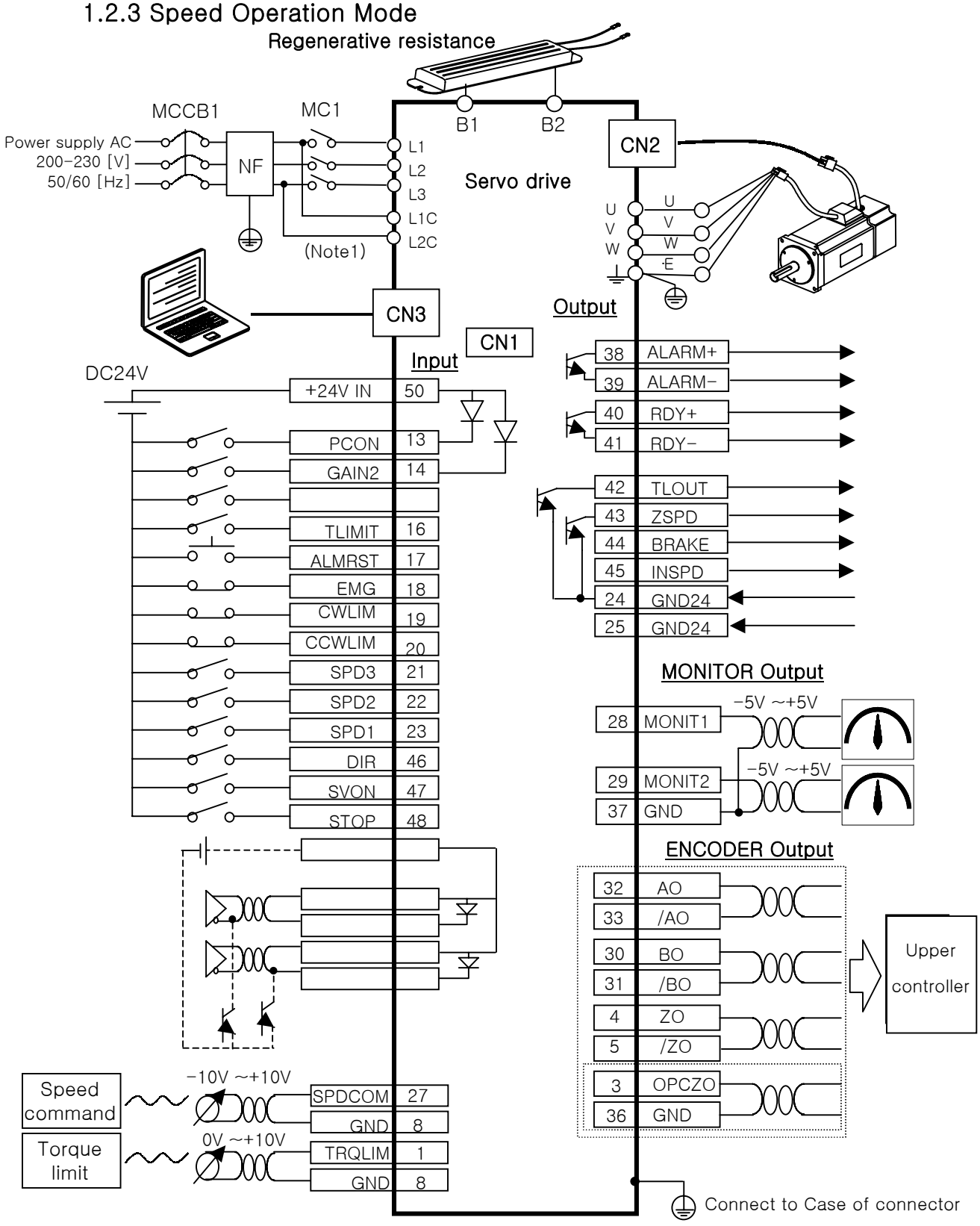
1.2.2 Position Operating Mode



Note1) The models that are higher than VS05 have a control power terminal(L1C, L2C)

Note2) Surely use Twist pair shield cable for pulse command signal (PF+, PF-, PR+, PR-) and torque limit signal(TRQLIM).

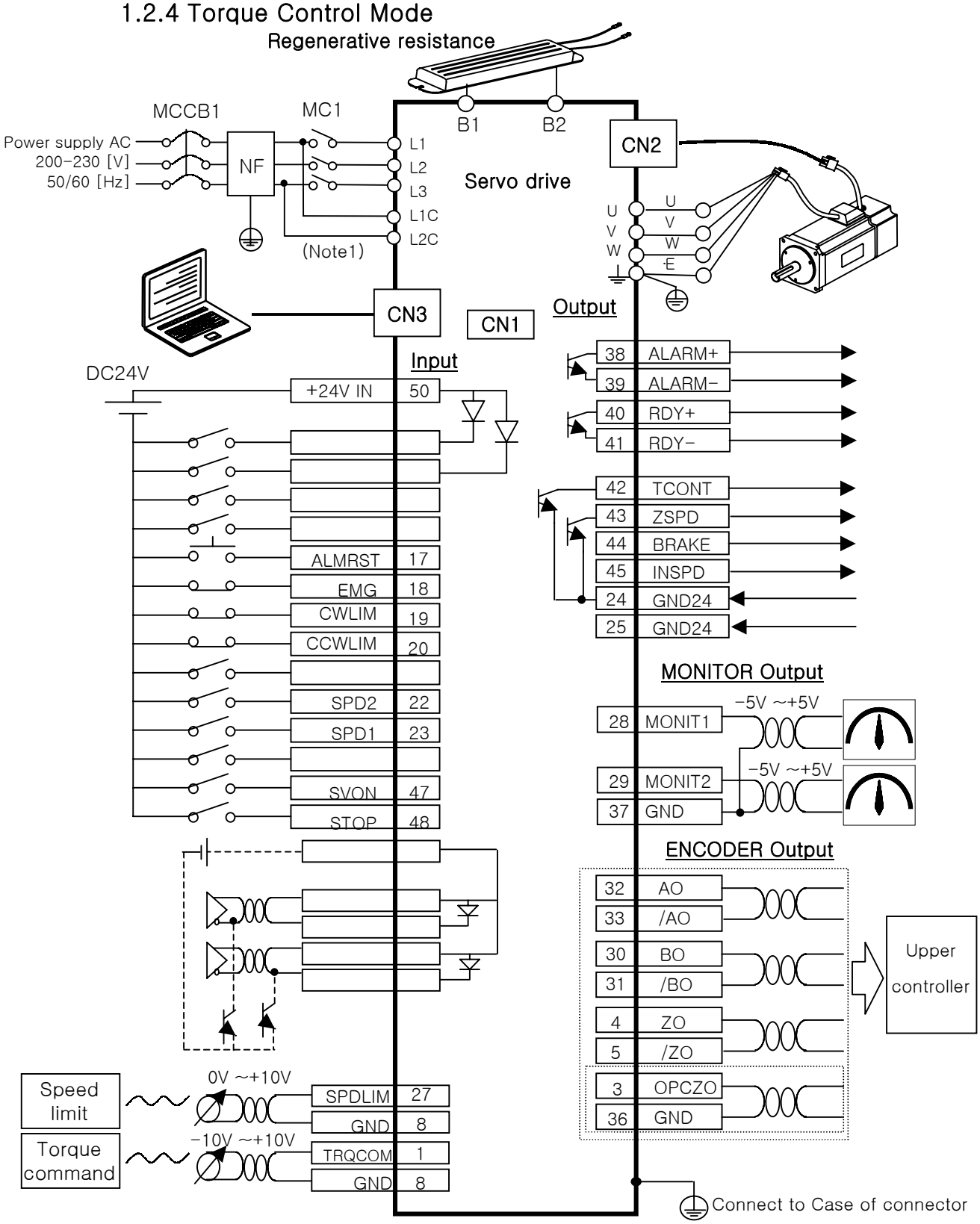
1.2.3 Speed Operation Mode



Note1) The models that are higher than VS05 have a control power terminal(L1C, L2C)

Note2) Surely use Twist Pair shield cable for SPDCOM, TRQLIM, GND.

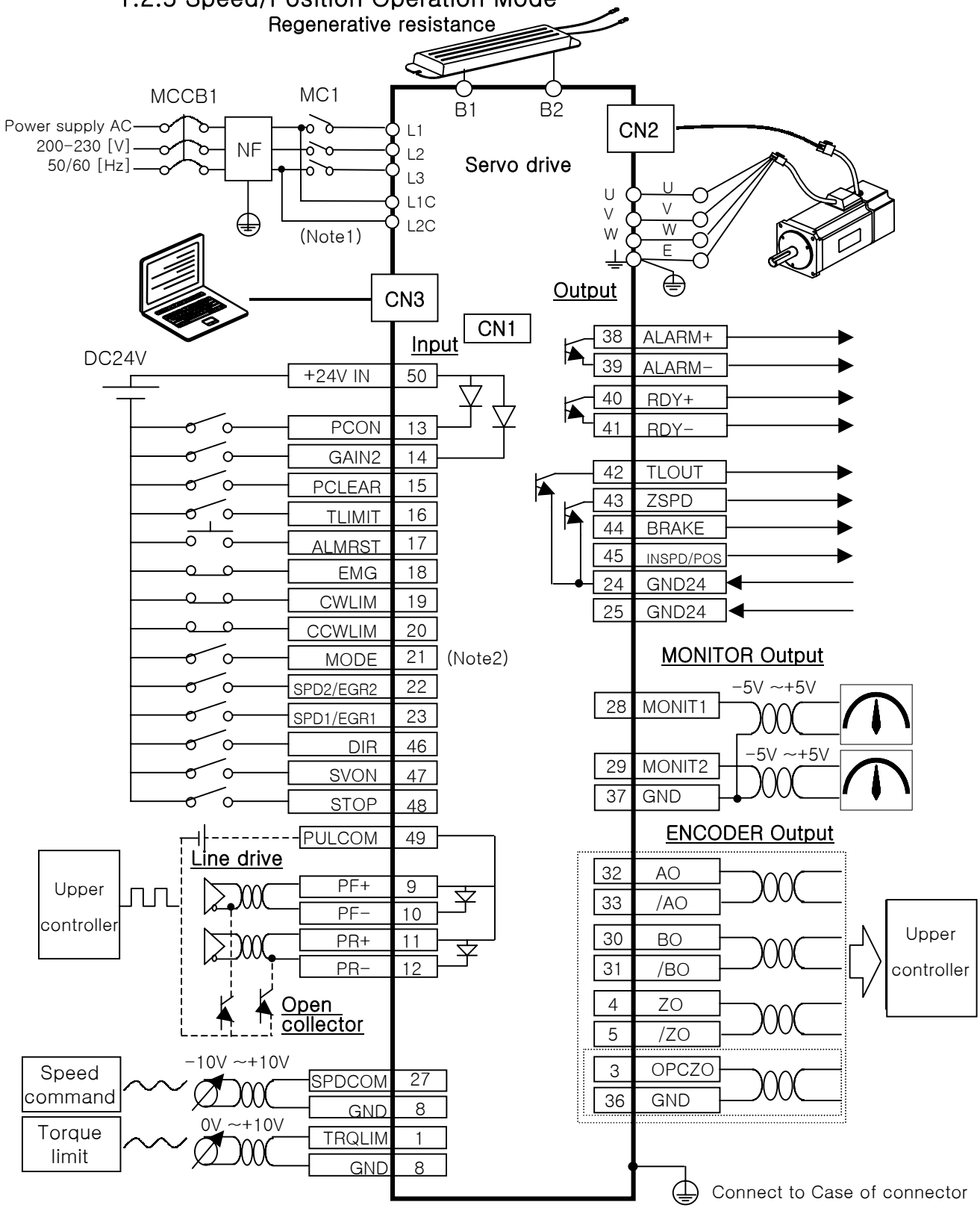
1.2.4 Torque Control Mode



Note1) The models that are higher than VS05 have a control power terminal(L1C, L2C)

Note2) Surely use Twist Pair shield cable for SPDCOM, TRQLIM, GND.

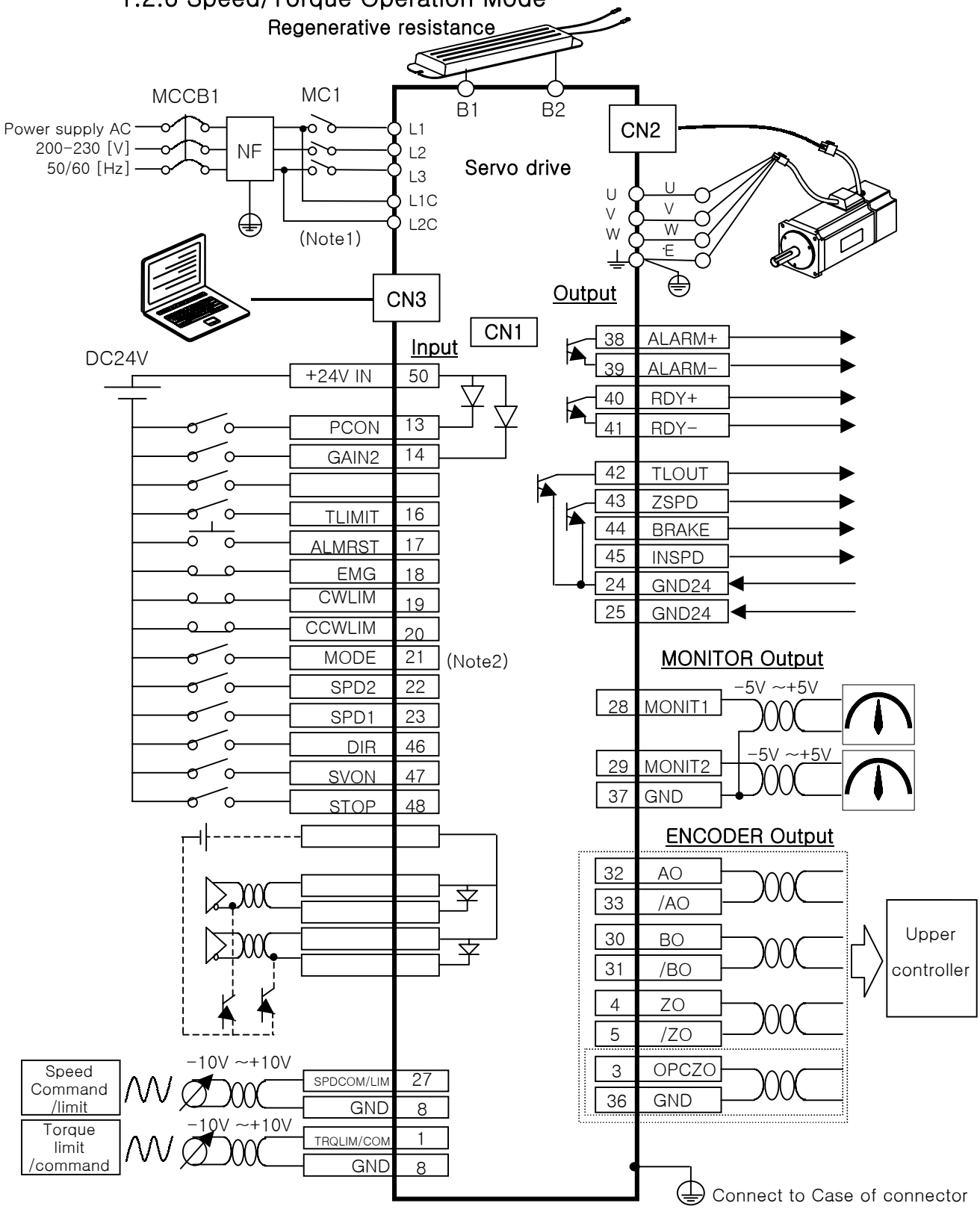
1.2.5 Speed/Position Operation Mode



Note1)The models that are higher than VS05 have a control power terminal(L1C, L2C)

Note2)Input contact MODE=ON:Speed control mode, MODE=OFF:Position control mode

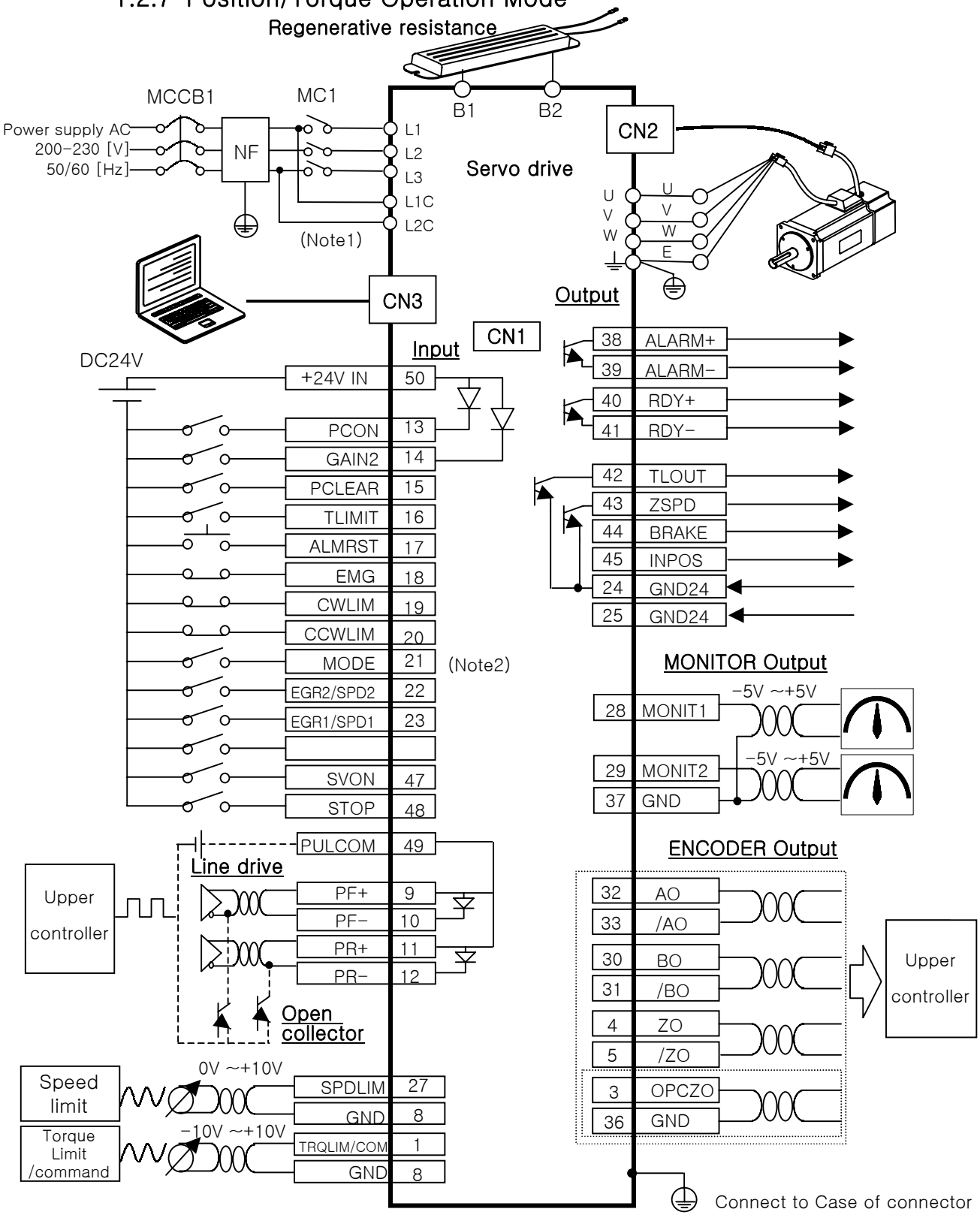
1.2.6 Speed/Torque Operation Mode



Note1) The models that are higher than VS05 have a control power terminal(L1C, L2C)

Note2) Input contact MODE=ON:Speed control mode, Mode=OFF:Torque control mode

1.2.7 Position/Torque Operation Mode



Mote1)The models that are higher than VS05 have a control power terminal(L1C, L2C)

Note2)Input contact MODE=ON:Position control mode, MODE=OFF:Torque control mode

1.3 Signal Explanation

1) Input contacts signal

Pin No.	Name	Function and Use	Application table on operation mode					
			P	S	T	S /P	S /T	P /T
50	+24V IN	Input contact +24[V] power supply	O	O	O	O	O	O
13	PCON	P control operating	O	O	X	O	O/X	O/X
14	GAIN2	Selecting gain2	O	O	X	O	O/X	O/X
15	PCLEAR	Input pulse clear	O	X	X	X/O	X	O/X
16	TLIMIT	ON : Torque limit by TRQLIM value OFF : Torque limit by parameter	O	O	X	O	O/X	O/X
17	ALMRST	RESET at ALARM	O	O	O	O	O	O
18	EMG	Emergency Stop	O	O	O	O	O	O
19	CWLIM	Prohibit CW rotating (reverse direction)	O	O	O	O	O	O
20	CCWLIM	Prohibit CWW rotating (forward direction)	O	O	O	O	O	O
21	SPD3	Selecting Speed3	X	O	X	X	X	X
	MODE	Switching control mode	X	X	X	O	O	O
22	SPD2	Selecting Speed2	X	O	O	O/X	O	X/O
	EGEAR2	Switching electronic gear ratio2	O	X	X	X/O	X	O/X
23	SPD1	Selecting Speed1	X	O	O	O/X	O	X/O
	EGEAR1	Switching electronic gear ratio1	O	X	X	X/O	X	O/X
46	DIR	Selecting rotating direction	X	O	X	O/X	O/X	X
47	SVON	Servo Operating	O	O	O	O	O	O
48	STOP	Motor Stop	X	O	O	O/X	O	X/O

Note1) P=Position, S=Speed, T=Torque

Note2) In case Speed operation, 'DIR' and 'STOP' contacts are operated as below by the menu [PE-514]

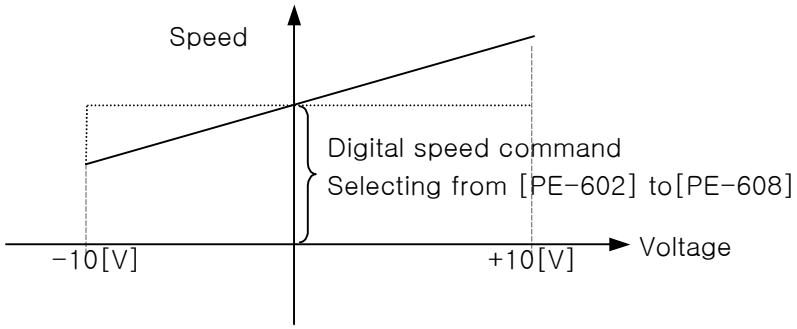
Set up [PE-514]	Operating Method					
	CCW		CW		Stop	
	DIR	STOP	DIR	STOP	DIR	STOP
0	OFF	OFF	ON	OFF	×	ON
1	OFF	ON	ON	OFF	ON	ON
					OFF	OFF

2) Analog Input Signal

Pin No.	Name	Function and Use	Application table on operation mode					
			P	S	T	S /P	S /T	P /T
27	SPDCOM	Analog speed command (-10~+10[V])	X	O	X	O/X	O/X	X
	SPDLIM	Analog speed limit input (0~+10[V])	X	X	O	X	X/O	X/O
1	TRQCOM	Analog torque command input (-10~+10[V])	X	X	O	X	X/O	X/O
	TRQLIM	Analog torque limit input (0~+10[V])	O	O	X	O	O/X	O/X
8	GND	Analog Signal ground	O	O	O	O	O	O

Note1) P=Position, S=Speed, T=Torque

* On Analog speed command, In case of override speed operation (set up as “1” on menu[PE-405]), operation is executed by speed command that is repeated on digital speed command.



3) Pulse Input Signal

Pin No.	Name	Function and Use	Application table on operation mode					
			P	S	T	S /P	S /T	P /T
9	PF+	Line drive(5V) : F+ pulse input Open collector(24V) : Not Used	O	X	X	X/O	X	O/X
10	PF-	Line drive(5V) : F- pulse input Open collector(24V) : F pulse input	O	X	X	X/O	X	O/X
11	PR+	Line drive(5V) : R+ pulse input Open collector(24V) : Not Used	O	X	X	X/O	X	O/X
12	PR-	Line drive(5V) : R- pulse input Open collector(24V) : R pulse input	O	X	X	X/O	X	O/X
49	PULCOM	Line drive(5V) : Not Used Open collector(24V) : +24V Power supply input	O	X	X	X/O	X	O/X

4) Output Contacts Signal

Pin No.	Name	Function and Use	Application table on operation mode					
			P	S	T	S /P	S /T	P /T
38 /39	ALARM+/-	ALARM state output ON : normal state OFF : ALARM state	O	O	O	O	O	O
40 /41	RDY+/-	ON at Complete operating ready state	O	O	O	O	O	O
42	TLOUT	Torque limit	O	O	O	O	O	O
43	ZSPD	Output at servo stop (speed is zero)	O	O	O	O	O	O
44	BRAKE	Brake operating signal output (ON at servo dirving)	O	O	O	O	O	O
45	INSPD	Output complete signal of target speed reaching	X	O	X	O/X	O/X	X
	INPOS	Output complete signal of target position reaching	O	X	X	X/O	X	O/X
24 25	GND24	Ground for operating power supply(24V) of I/O contacts	O	O	O	O	O	O

5) Monitor Output Signal and Output Power Supply

Pin No.	Name	Function and Use	Application table on operation mode					
			P	S	T	S /P	S /T	P /T
28	MONIT1	Analog monitor output1(-5~+5[V])	O	O	O	O	O	O
29	MONIT2	Analog monitor output2(-5~+5[V])	O	O	O	O	O	O
37	GND	Analog output signal ground	O	O	O	O	O	O
34	+15V	+15[V]Power supply output terminal	O	O	O	O	O	O
35	-15V	-15[V]Power supply output terminal	O	O	O	O	O	O

6) ENCODER Output Signal

Pin No.	Name	Function and Use	Application table on operation mode					
			P	S	T	S /P	S /T	P /T
32 33 30 31	AO /AO BO /BO	Divide the Encoder signal by set values of menu [PE-501] (5[V] Line drive type)	O	O	O	O	O	O
4 5	ZO /ZO	Encoder Z signal output by motor (5[V] Line drive type)	O	O	O	O	O	O
3 36	OPCZO GND	Encoder Z signal output by motor (Open collector type)	O	O	O	O	O	O

Chapter 2

Installation

2.1 Servo Motor

2.2 Servo Drive

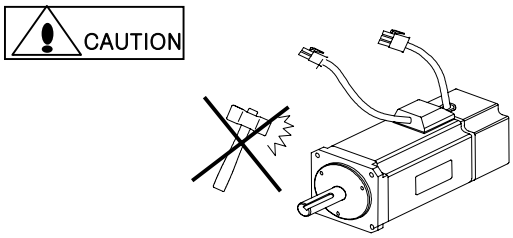
2.1 Servo motor

2.1.1 Operating Environment

Item	Environment	Remark
Temp.	0～40[℃]	In case of out of temp-range, inquire to Technical department and order separately
Humidity	Less than 80[%]RH	There should be no steam
External Vibration	Vibration Acceleration X, Y direction less19.6[㎨]	Excessive vibration might cause shortening of bearing duality

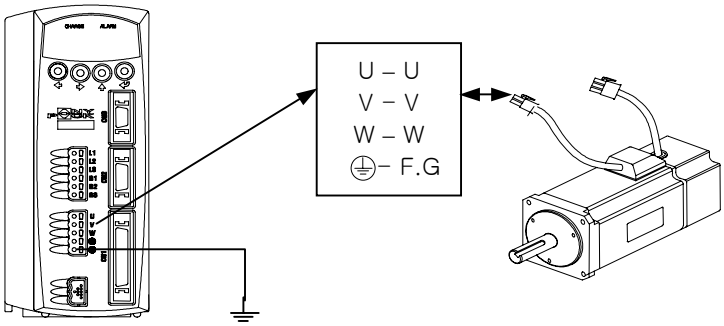
2.1.2 Preventing Excessive Impact

- Impacting the shaft when installation or dropping the motor might cause the damage of encoder.



2.1.3 Wiring

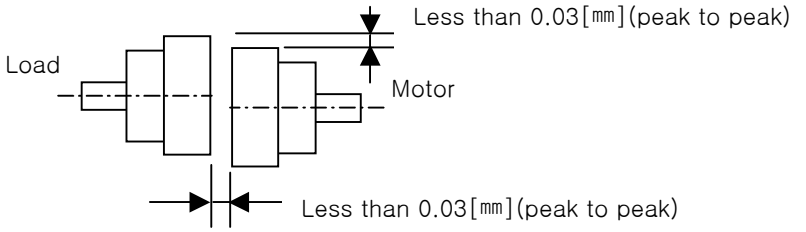
- Connecting commercial power supply directly to motor would cause damage of motor
  Certainly connect to designated drive
- Ground terminal of motor should be connected to one of ground terminals (two) in drive and another terminal should be connected to 3 class earth ground.



- Match the U, V and W terminals of the motor with those of the driver
- Check if there are out of placed pin or fault of connection
- In case of moisture or condensation on motor, Surely check if the insulation resistance is more than 10[㏁] and (500V), and then installation.

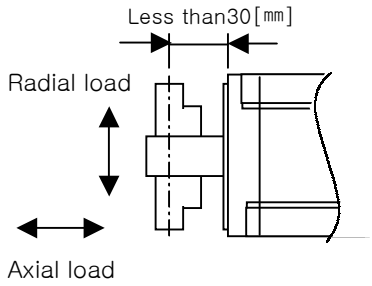
2.1.4 Assembling Load System

- Coupling assembling : Install motor shaft accurately match with load shaft within tolerance range.



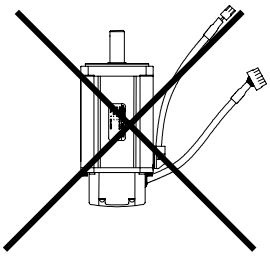
- Pulleys assembling :

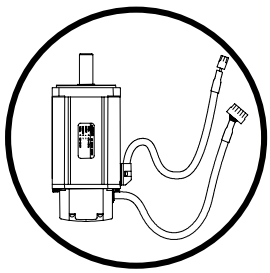
Flange	Radial load		Axial load		Reference diagram
	N	kgf	N	kgf	
40	148	15	39	4	
60	206	21	69	7	
80	255	26	98	10	
130	725	74	362	37	
180	1548	158	519	53	
220	1850	189	781	90	



2.1.5 Cable Installation

- In case of vertical Installation, care about oil or water that can be flowed into joint





- Prevent Cable from the stress or flaw
  Especially, while motor is moving, surely use the movable cable and cable should not be rolled.

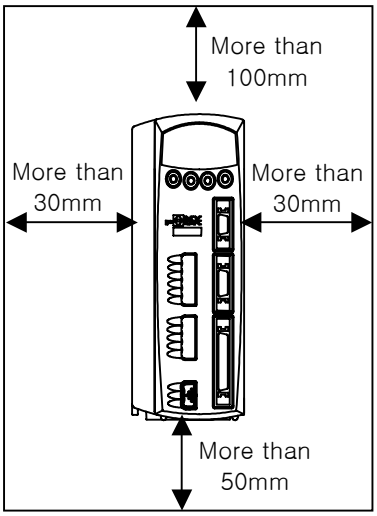
2.2 Servo Drive

2.2.1 Operating Environment

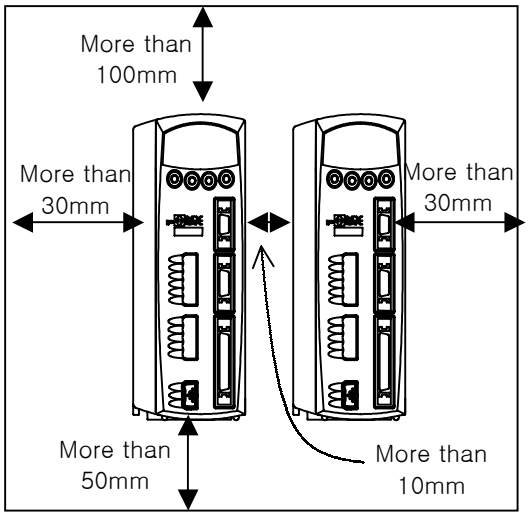
Items	Operating environment	Remarkable
Temp.	0～50[℃]	 Avoid heat by installing fans
Humidity	Less than 90[%]RH	 Stopping for long time, drive can be damaged by condensation or tree zing Therefore, operate after remove moisture of drive sufficiently.
External Vibration	Vibration Acceleration Less than 5.9[㎨]	Excessive vibration might cause shortening Durability and wrong operation
Environment	- Avoid direct sunlight - Avoid corrosive and flammable gas. - Avoid oil mist or dust. - Keep ventilation on closed place.	

2.2.2 Installing in a Control Board(Panel)

- Installation space is as below.



Install 1 drive



Install more than 2 drives

Note1) Install heat sources, such as regenerative resistance, away from the driver

주의

- Exercise caution to prevent chips produced by drilling from getting into the drive when drilling control panels.
- Take appropriate measures to prevent oils, water and metal powder from getting into the driver from openings in the control panels.
- If the drive is used in a place with large amount of toxic gases and dust, protect the drive with and air purge.

2.2.3 Wiring

- Check the input voltage, and keep it within range.

CAUTION	Drive may be damaged by over voltage.

- Connecting commercial power supply to the U,V,W terminals of drive may cause damage.
  (Certainly connect power supply to L1, L2, L3 terminals)
- Certainly use the standard resistance value for regenerative resistance that is to be connected to B1, B2 terminals of drive.

Model	Resistance	Standard Capacity	*Remarkable
VS02~VS04	50[Ω]	Internal 50[W]	CAUTION When expanding regenerative capacity, the resistance value should be referred to “7.3 Option and peripherals”
VS05~VS10	40[Ω]	External 140[W]	
VS15~VS20	23[Ω]	External 300[W]	
VS35~VS75	11.5[Ω]	External 300[W]×2	

- If there is additional control power supply (more than VS05), construct system in which control power supply (L1C, L2C) is supplied first and then main power supply (L1, L2, L3) is to be supplied.

- “High voltage” still remains for a while even after power is turned off.

CAUTION	To prevent electric shock, carry out wiring work after charge lamp is turned off

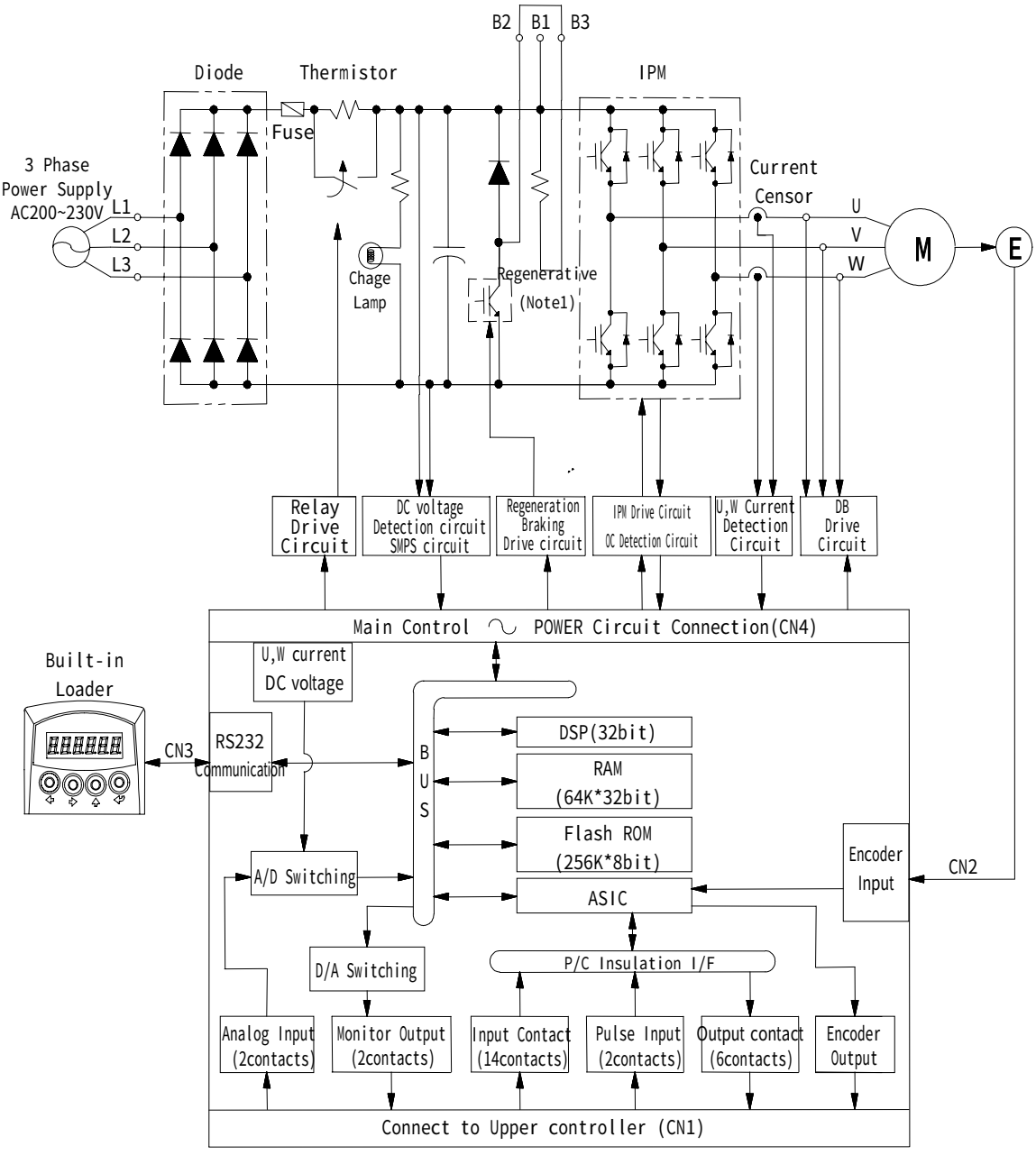
- Ground the terminals at the shortest distance
  Long ground distance can lead to wrong operation by noise effect.

Chapter 3

Wiring

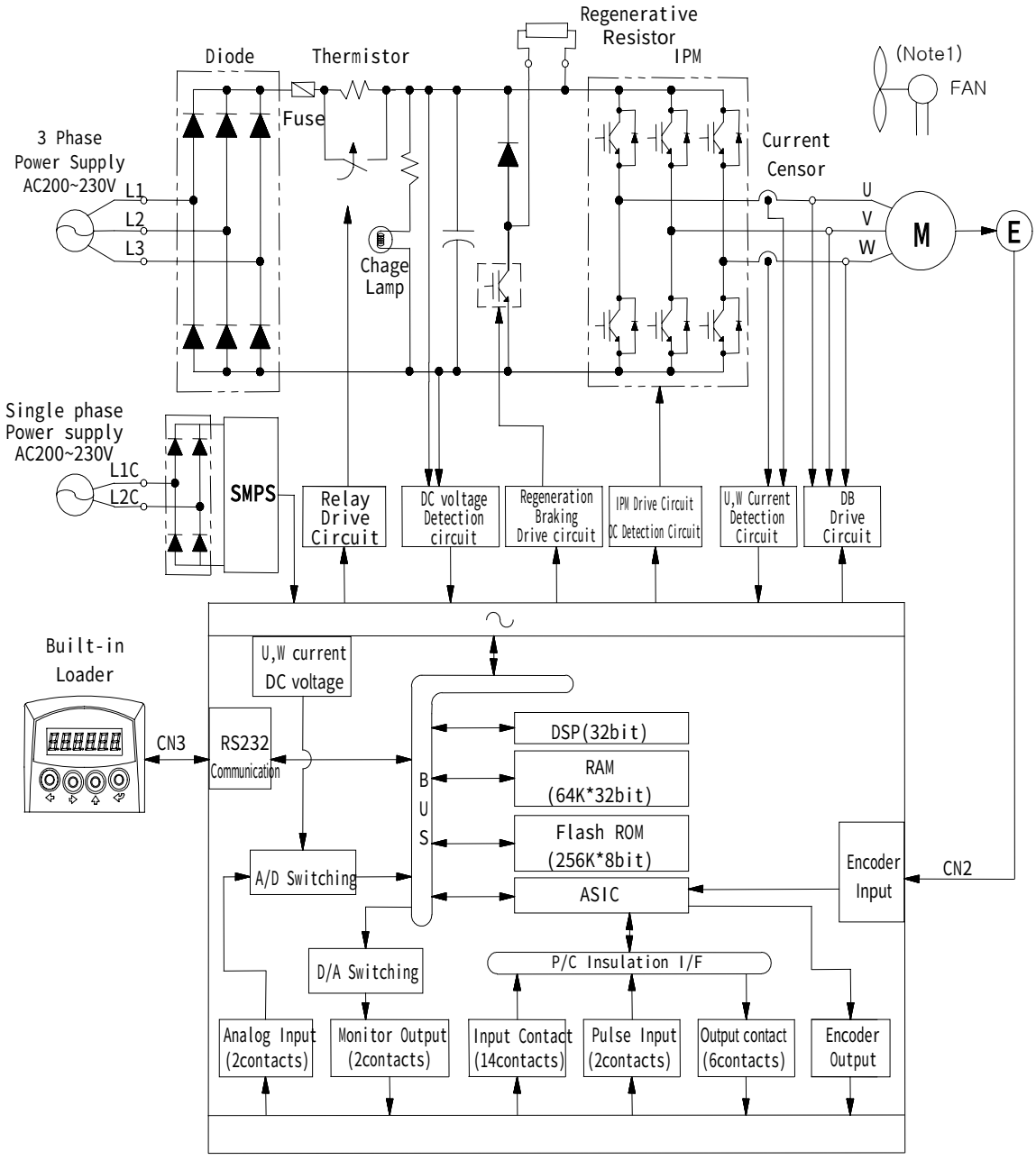
3.1 Internal Block Diagram

3.1.1 Block Diagram(Rated Output is less than 400[W]) [APD-VSR5 ~ APD-VS04]



(Note1) B2-B3 short pin and Regenerative resistor is installed in ONLY APD-VS02, VS04 Type

3.1.2 Block Diagram (Rated Output is from 0.5 to 11.0[kW]) [APD-VS05~APD-VS75]

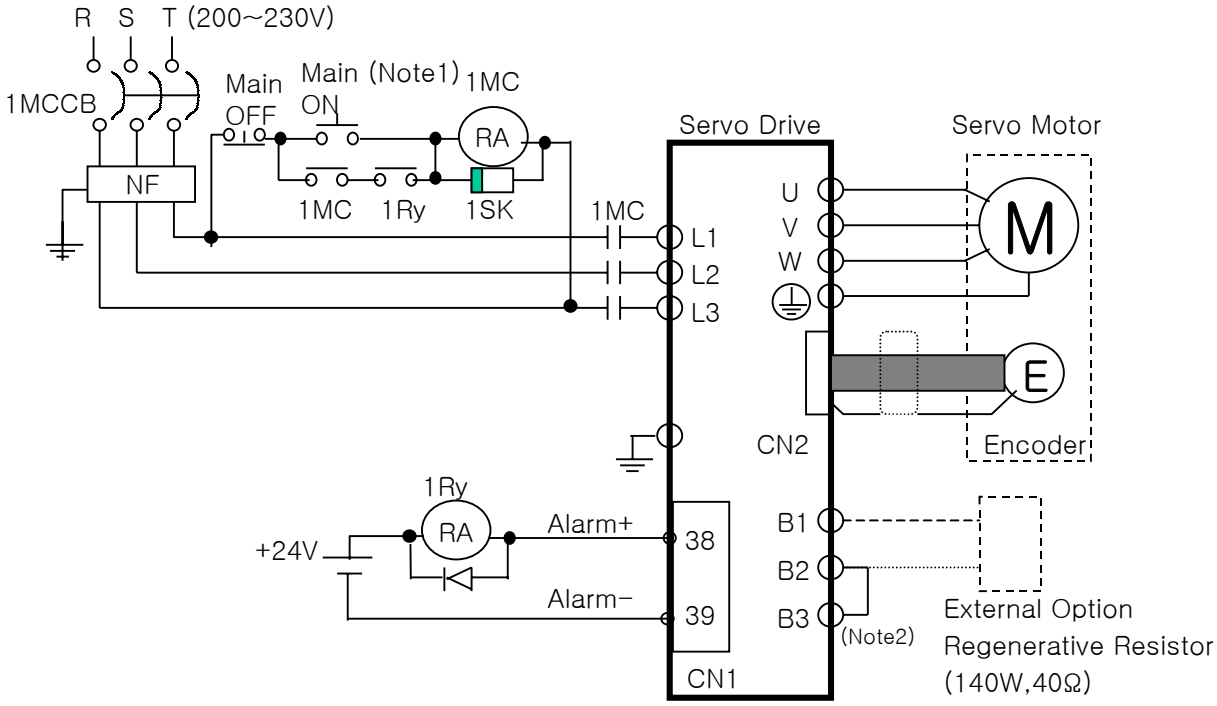


(Note1) APD-VS35, VS50, VS75 Type is cooled forcibly by DC24[V] cooling fan.
APD-VS110 Type is cooled forcibly by AC220[V] cooling fan.

3.2 Power Board Wiring

3.2.1 Wiring (Rated output is less than 400[W])

[APD-VSR5 ~ APD-VS04]

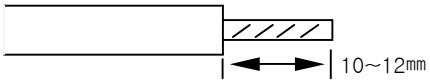


(note1) : It takes approximately 1~2 seconds before alarm signal is activated after power is connected. Press main power on switch for at least 2 seconds of longer.

(Note2) : B2-B3 short pin and regenerative resistor is installed in APD-VS02, VS04 Type (but, there are no regenerative circuit, and regenerative resistor in APD-VSR5~01 type)

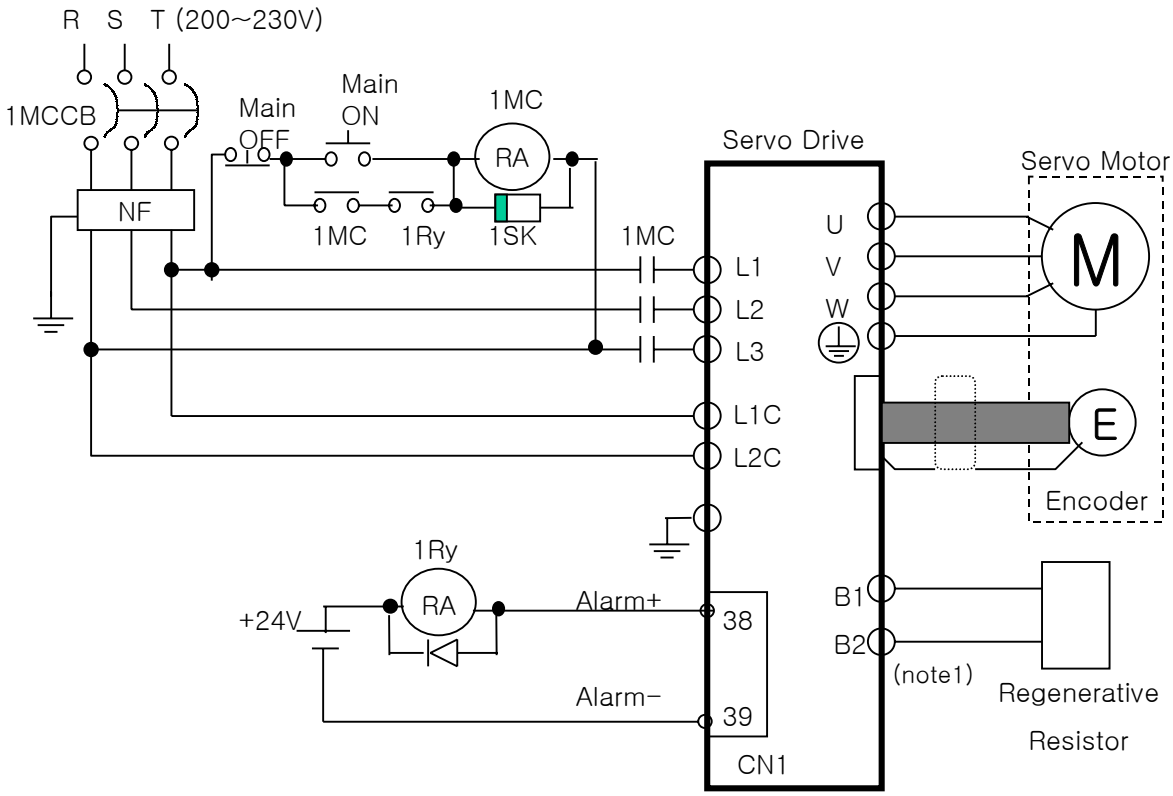
Open short pin(B2-B3), and connect external regenerative resistor to (B1-B2) in case of regenerative capacity is large due to frequent acceleration / deceleration At this time, Make sure optional Brake resistor is 140[W], 40[Ω].

(Note3) : For the electric wire that is to be used at Main circuit power board, strip the coating of wire about 10~12[㎜] as below and use the exclusive terminal which is Ferule UA-F1512 (Made by Suh-il Electronics).



(Note4) : Connect or remove the wiring of main circuit power board after press the button (▭) of terminal.

3.2.2 Wiring (Rated output is from 0.5 to 11.0[kW] [APD-VS05~APD-VS110]



(Note1) : If regenerative capacity is large due to frequent acceleration/deceleration, the same value of resistor and larger capacity of regenerative resistor than that of normal resistor provided should be used.

The resistor value of standard regenerative resistor for each capacity of drive is as below.

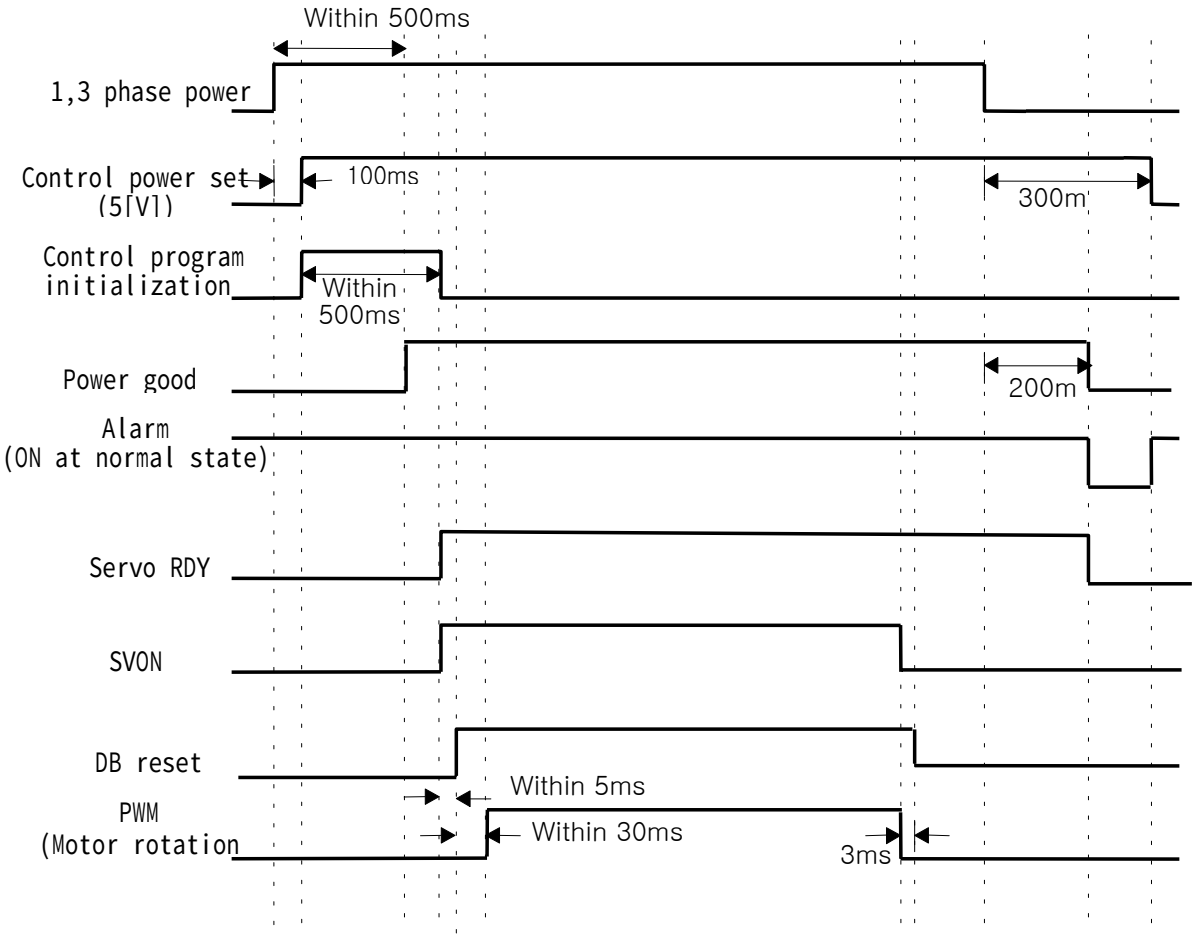
3.2.3 Power circuit part specification

Type	R5	01	02	04	05	10	15	20	35	50	75	110
NFB	SMC-10P				SMC-15P		20P	25P	35P	50P		75P
NF (NoiseFilter)	NFZ410S					415S		420S	4030	4040SG		4050SG
MC	GMC-32(26A) or equivalent				GMC-40(35A) or equivalent			GMC-50(50A) or equivalent				75A
Power Wire	AWG16 (1.25SQ)				AWG14 (2SQ)		AWG12 (3.5SQ)		AWG10 (5.5SQ)			AWG8 (8 SQ)
Compressed terminal	UA-F1512,SEOIL (10mm Strip&Twist)				GP110012 KET		GP110721 KET		GP110028 KET			GP140841 KET
Regenerative resistor (Provided)	-		Internal 50[Ω] (50[W])		40 [Ω] (140[W])		23 [Ω] (300[W])		11.5 [Ω] (300[W] x2P)			Option

3.3 Timing Diagram

3.3.1 Timing diagram at Supplying power

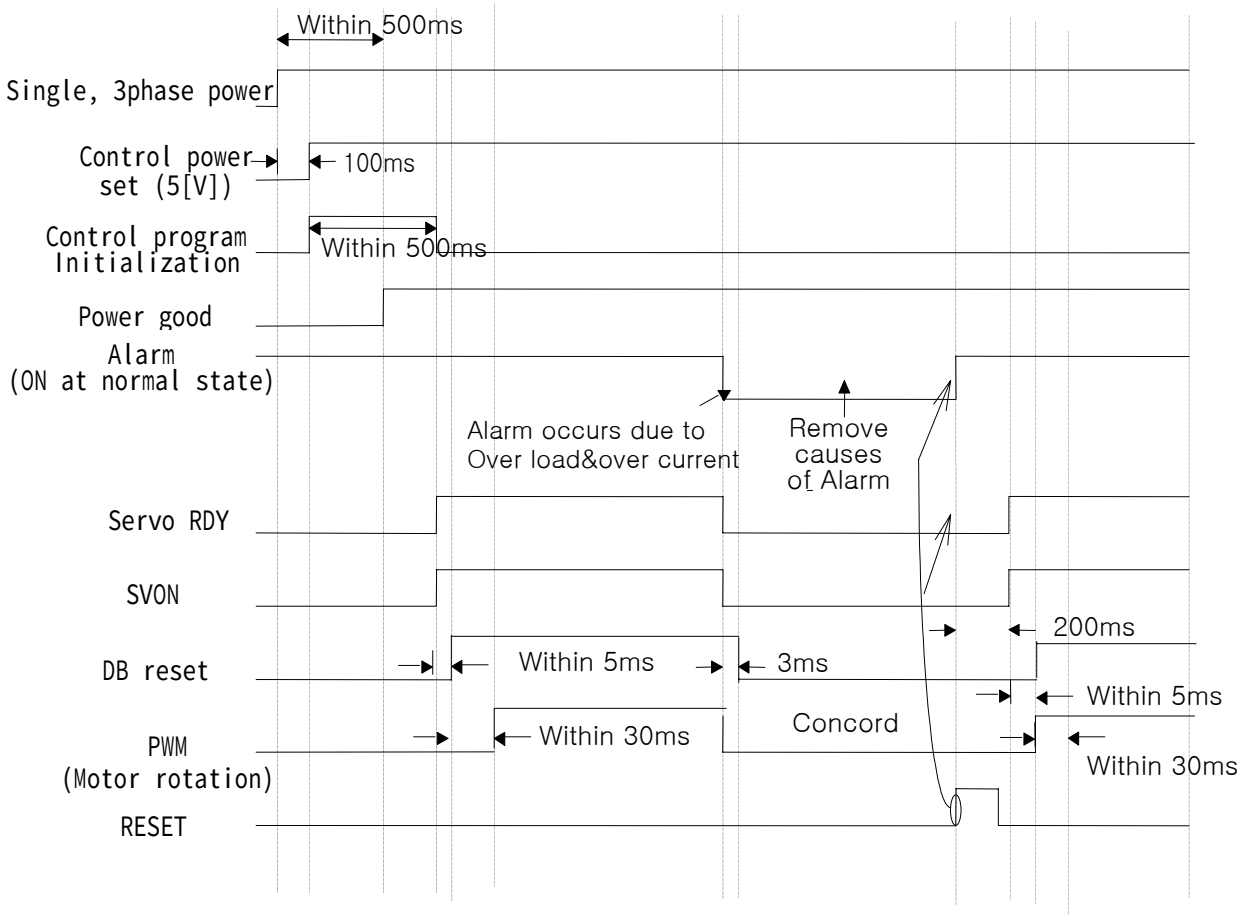
In the case of APD-VSR5~VS04, Power is supplied to the control circuit if 3-phase power is connected to the L1, L2, L3 terminals.
In the case of APD-VS05~VS110, Power is supplied to the control circuit if single-phase power is connected to the L1C, L2C terminals and 3-phase power is connected to the L1, L2, L3 terminals.
Servo becomes RDY after maximum 500[msec], the time required to initialize the inside of the drive system, and if the servo drive signal is turn on, operation starts 30[msec] later.



3.3.2 Timing diagram at Alarm

If Alarm occurs on the drive system, PWM is shut off and the motor stops.

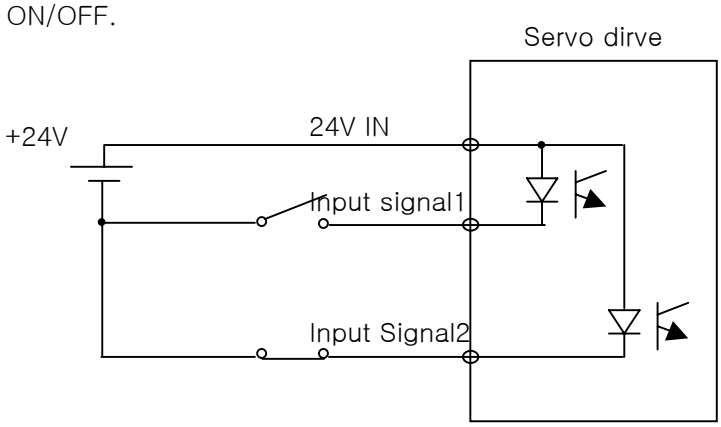
> CAUTION Check and remove causes of Alarm and turn off the servo motor drive command(SVON) before resetting Alarm.



3.4 Wiring of Control Signal

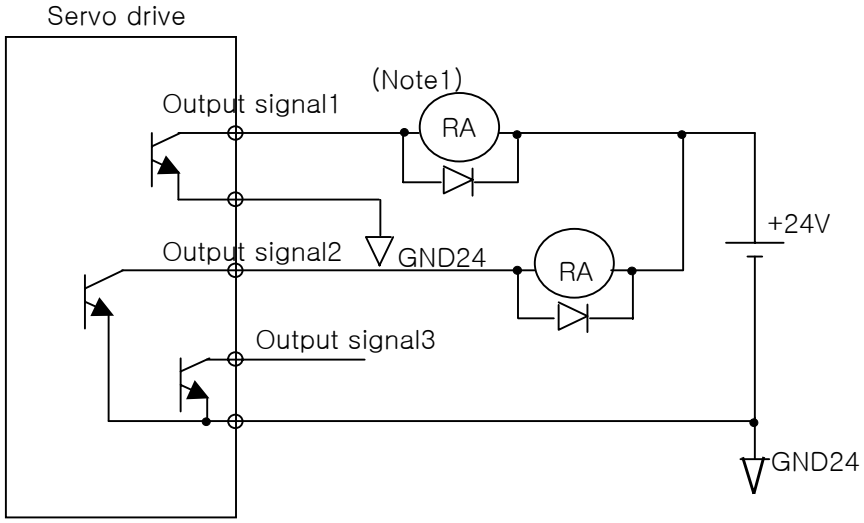
3.4.1 Input Contact Signal

CAUTION The input contacts are classified into A contact and B contact depending on the contact characteristics and can be reset by the menu [PC-807], And special caution is required because each contacts can forcibly be ON/OFF.



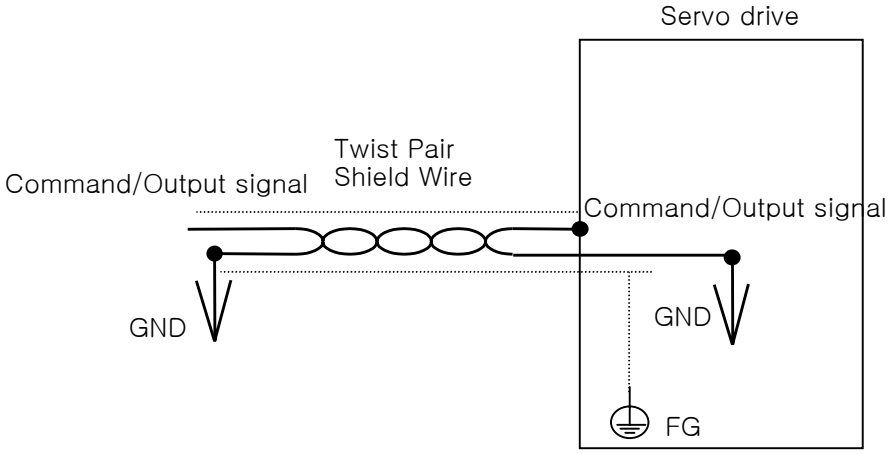
3.4.2 Output Contact Signal

CAUTION The output contact internally uses transistor switch. Take precaution because overvoltage of overcurrent may cause damage to the system.
- Power supply : DC24[V]±10%, 150[㎃]



(Note1) For the output signal of Alarm and Ready, the GND24 terminal is separated.

3.4.3 Analog I/O Signal



① GND terminal must be 0[V] of the control power supply.

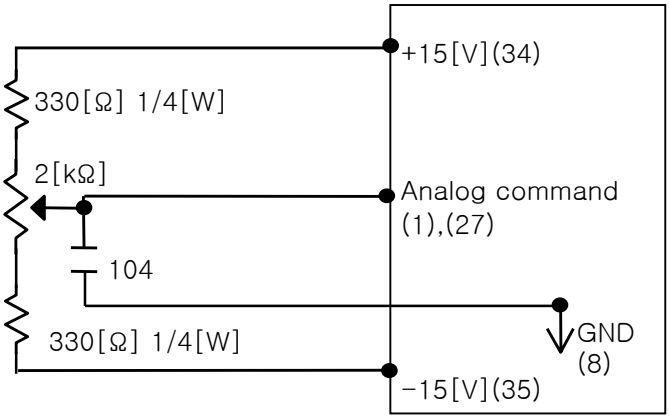
② Input signal command voltage is within ±10[V], and input impedance is 10[㏀].

③ Output signal voltage of Monitor1(No.28), Monitor2(No.29) is ±5[V].

Addition to this, when controlling analog input by variable resistance using offered power by drive, wiring is as under.

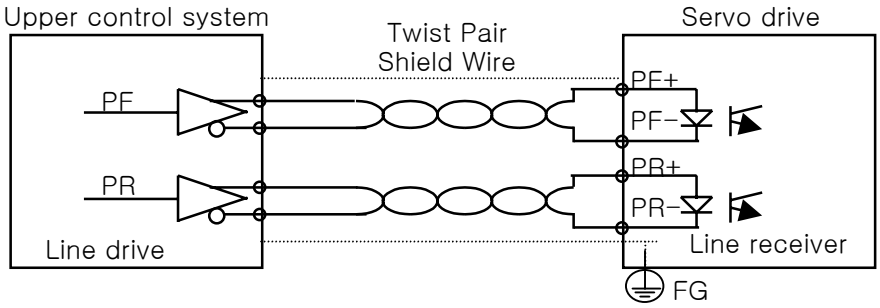
The output capacity of this power is 30[㎃] at maximum.

Do not exceed this capacity.

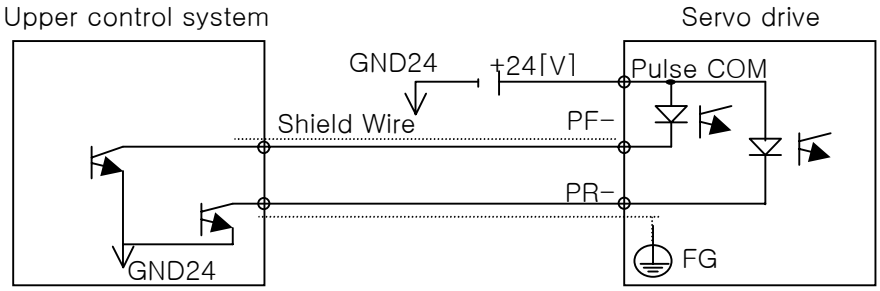


3.4.4 Pulse Input Signal

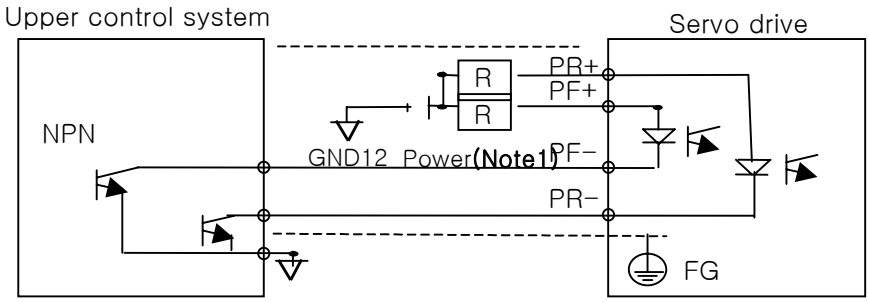
(1) Line drive(5[V]) Pulse input



(2) Open collector(24[V]) Pulse input

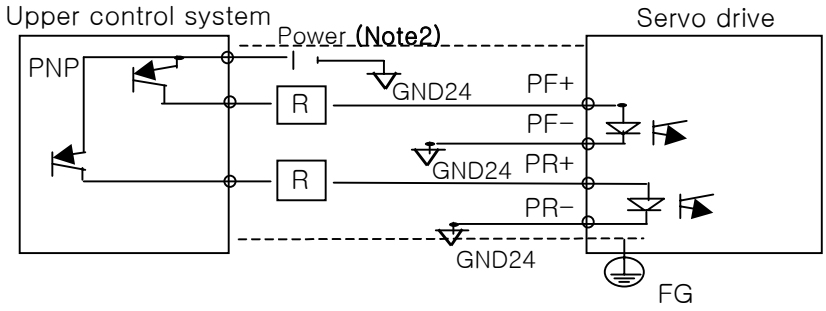


(3) 12[V] or 5[V] NPN Open Collector pulse command



(Note1) When the power supply12[V] is used : Resistance R=560~680[ohm]
When the power supply 5[V] is used : Resistance R=100~150[ohm]

(4) PNP Open Collector type pulse command

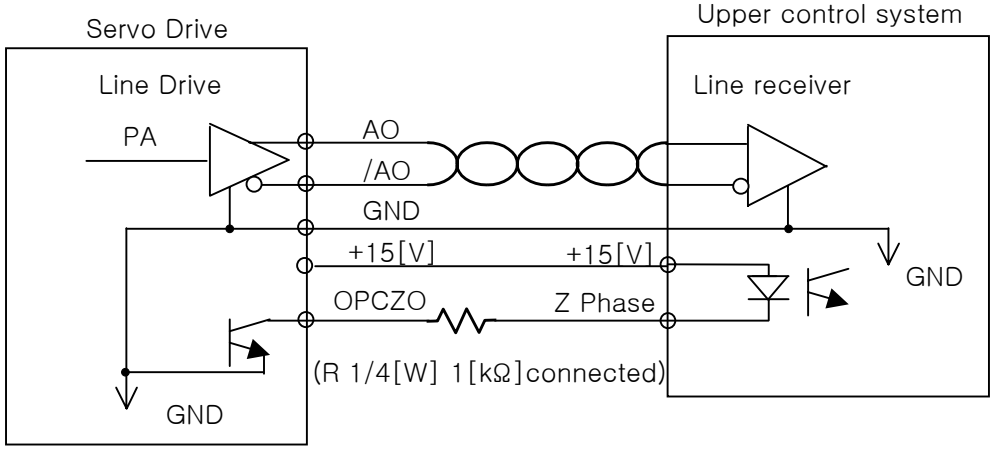


(Note2) When 24[V] is supplied : Resistance R=1.5[kilo ohm]
When the power supply 12[V] is used : Resistance R=560~680 [ohm]
When the power supply 5[V] is used : Resistance R=100~150[ohm]

CAUTION Inquire to our company for using open collector pulse input of DC5[V] or DC12[V]

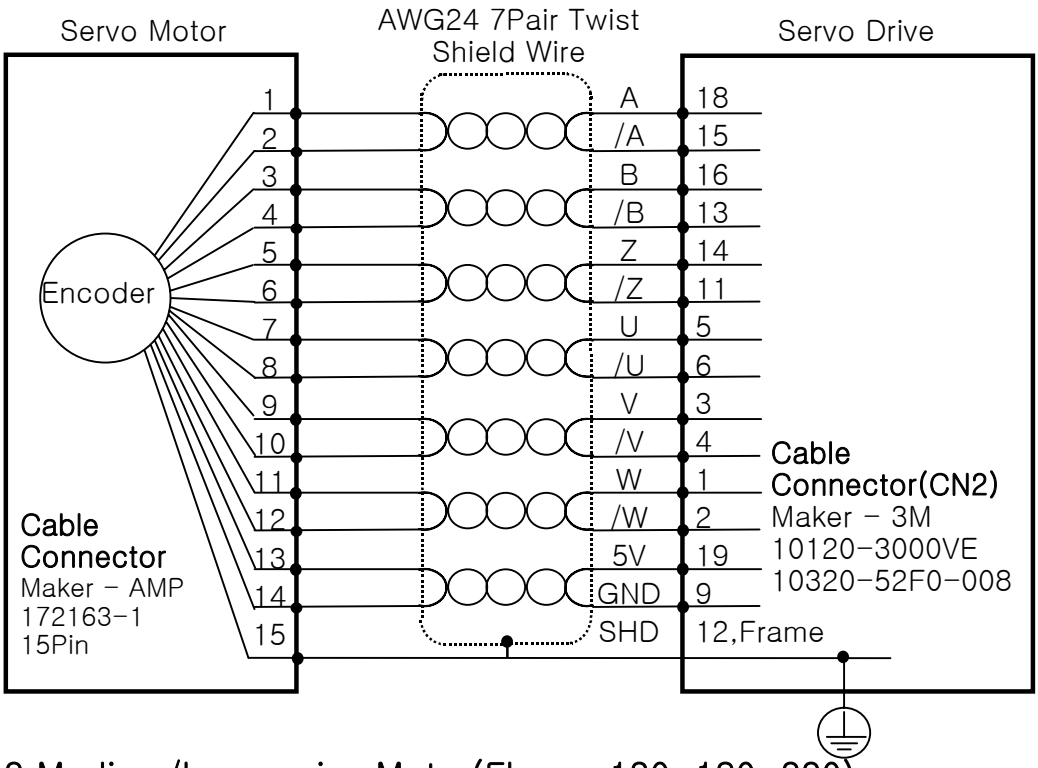
3.4.5 Encoder Output Signal

The encoder signal is produced based on 0[V](GND) of control power supply. Connect 0[V] terminal of the circuit which receives this signal from the upper control system to the 'GND' terminal of CN1. Encoder signal is produced in line drive system after the AC servo motor encoder signal received from CN2 is divided according to the frequency dividing ratio set by the menu [PE-510](Pulse Out Rate). Or in case of Z phase, there is also open collector output.

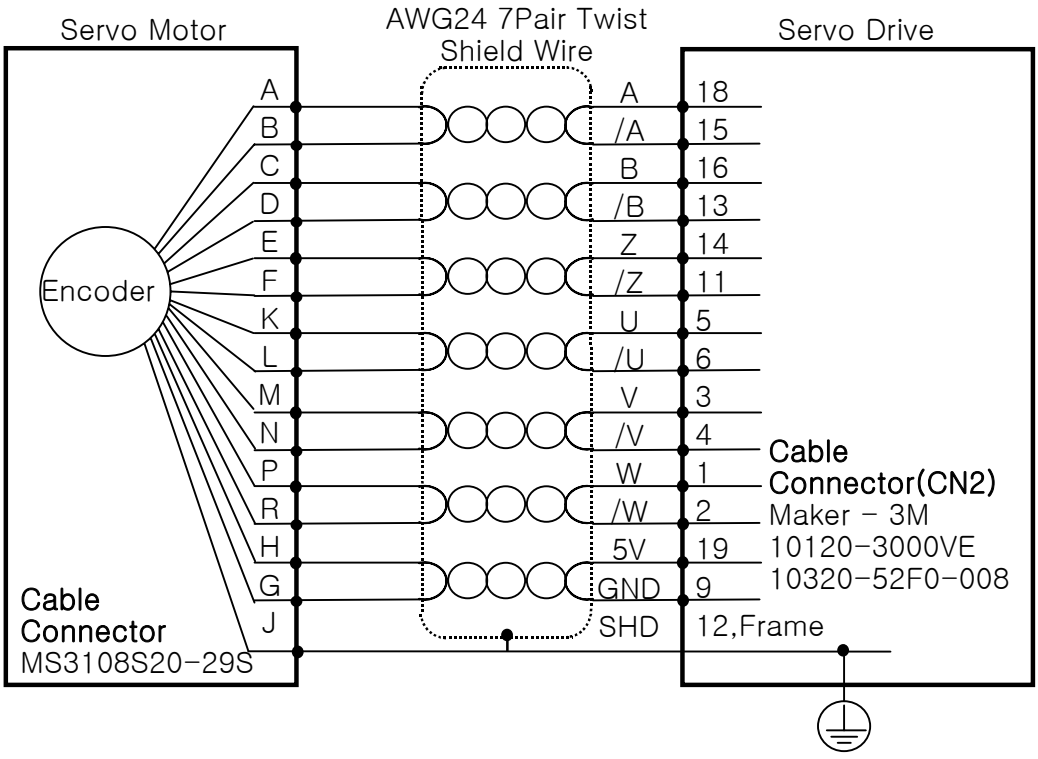


3.5 Wiring of Incremental Encoder Signal(CN2)

3.5.1 Small-size Motor(Flange 40, 60, 80)

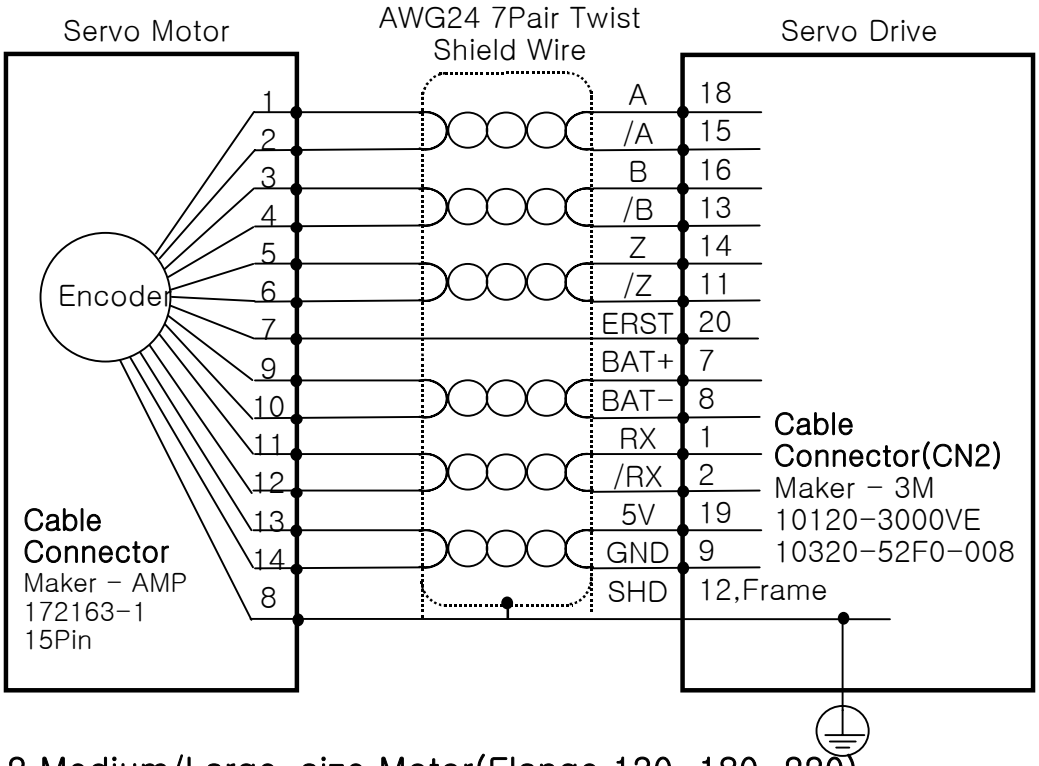


3.5.2 Medium/Large-size Motor(Flange 130, 180, 220)

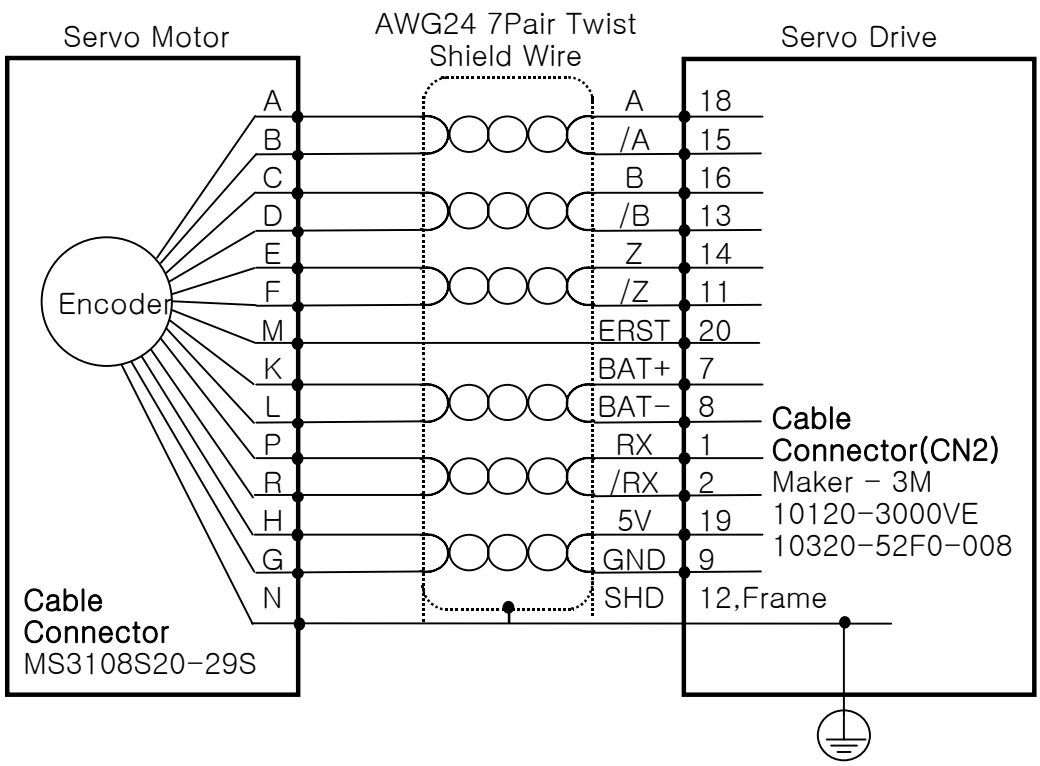


3.6 Wiring of Absolute Encoder signal(CN2)

3.6.1 Small-size Motor(Flange 40, 60, 80)



3.6.2 Medium/Large-size Motor(Flange 130, 180, 220)



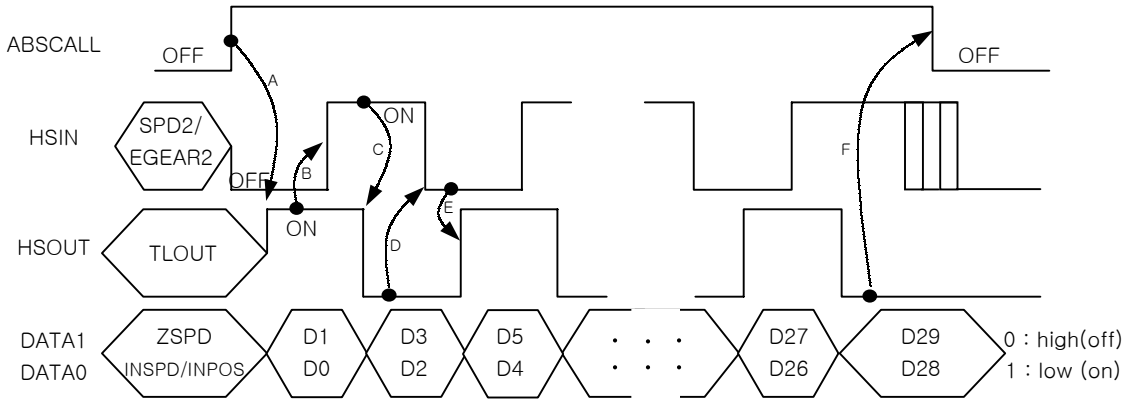
3.6.3 How to use Absolute Encoder

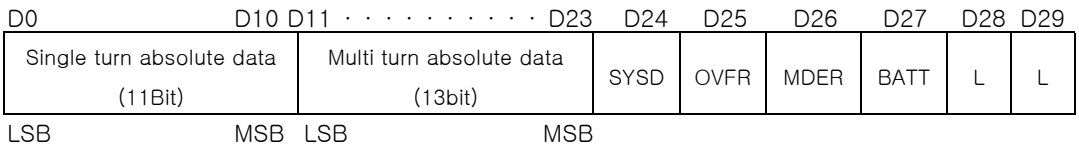
Set Encoder type[PE-203] to “6” when the absolute value Encoder is used. When Encoder type [PE-203] is set to “6”, the input contact ‘SPD3/MODE’ is automatically reset to the absolute position call(ABSCALL). Therefore, Switch operation mode “3, 4, 5” of Operation Mode [PE-601] and internal speed command “4, 5, 6, 7” used ‘SPD3’ at speed control servo are not possible to use.

(1) Absolute position data transmission by upper controller

The absolute position call (ABSCALL) must remain “ON” from the time absolute position transmission is requested to the time transmission is completed, and if the absolute position call(ABSCALL) is turned OFF during transmission, transmission stops and the mode return to initial state. To request absolute position transmission, change the absolute position call(ABSCALL) signal from OFF to ON when the servo is turned OFF. When the absolute position transmission starts based on the absolute position call(ABSCALL), the following I/O signals are reset to function pin for transmission.

If ABSCALL signal is turned OFF	If ABSCALL signal is turned ON
Rotation speed selection2 /Electric gear ratio selection2 (SPD2/EGEAR2)	Handshake Input (HSIN)
INSPD/INPOS ZSPD	Transmission data0 (DATA0) Transmission data1(DATA1)
TLOUT	Handshake Output (HSOUT)





Transmission data is “0” at electrically HIGH(contact OFF), and “1” at electrically LOW(contact ON)

(2) Sequence of Absolute position Data transmission with upper controller

① If ABSCALL is turned ON from Upper control like PLC, the servo drive reads the absolute value at this time, turns “ON” HSOUT, and displays 2 LSB Data (D0, D1) on DATA0 and DATA1, Servo “ON” is ignored until transmission is completed thereafter. (A)

② Upper controller(PLC) verifies HSOUT is turned “ON”, reads D0, D1, and turns “ON” HSIN. (B)

③ The servo drive verifies that HSIN has been turned “ON”, turns “OFF” HSOUT, and displays D2 and D3 on DATA0 and DATA1. (C)

④ Upper Controller(PLC) verifies HSOUT is turned “OFF”, reads D2 and D3, and turns “OFF” HSIN. (D)

⑤ The servo drive verifies that HSIN has been turned “OFF”, turns “ON” HSOUT, and displays D22 and D23 on DATA0 and DATA1. (E)

⑥ The upper controller(PLC) reads absolute value by repeating the process of item ① through ⑤ above, turns “OFF” ABSCALL, and completes absolute position Data transmission (F)

⑦ The functions of HSIN, HSOUT, DATA0 and DATA1 pins are automatically reset to the pins of original ‘SPD2/EGEAR2’, ‘TLOUT’, ‘INSPD/INPOS’ & ‘ZSPD’ respectively, and the servo can be turned ON.

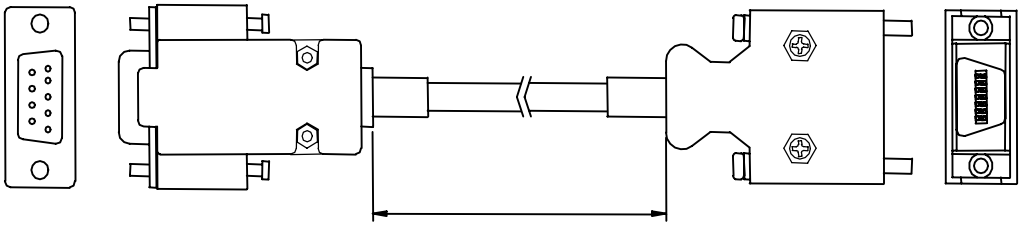
Note1) In case alarm occurs when attempting to transmit absolute position, reset alarm first and turn “ON” ABSCALL.

Note2) If ABSCALL is turned ON, the functions of ‘SPD2/EGEAR2’ are automatically reset to HSIN. If ‘SPD2/GEAR2’ pins are turned “ON” at this time, HSIN is recognized as being turned “ON”, and transmission error might occur.
Therefore, when ABSCALL is turned “ON”, turn “OFF” the ‘SPD2/EGEAR2’ (HSIN) pins.

3.7 Wiring of Communication (Option) Signal

3.7.1 PC-Communication (for RS232C)

This cable is for only PC-communication option cable to set servo drive menu by serial communicating of servo drive and PC.



[PC- Serial Port] [Servo Drive- CN3]

Content	PC-Serial Port	Servo Drive-CN3
Connector name	HDEB-9S	10114-3000VE
Case name	3600-09-G-L	10314-52A0-008
Wiring	NO.2(RXD)	NO.6(TXD)
	NO.3(TXD)	NO.5(RXD)
	NO.5(GND)	NO.11,NO.12(GND)
	×	Case(Shield)
Cable length	1,2,3,5[m]	

In Windows98, Serial Port(COM1) setting is as below.

(Setting > Control panel > System > Device manager > Port > Communication port(COM1) > Port setting)

Bps : 9600[bps] or 19200[bps] (same with menu [PE-202])

Data bit : 8

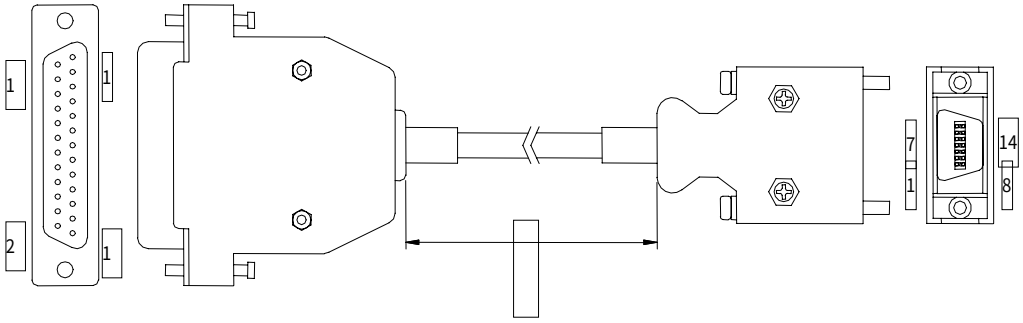
Parity : none

Stop bit : 1

Flow control : Xon/Xoff

3.7.2 Communication for only Servo (for O/S Download)

This cable is for only servo communication cable to upgrade O/S(Operating Software) by parallel communication of servo drive and PC.



[PC-Parallel Port]

[Servo Drive- CN3]

Contents	PC-Parallel Port	Servo Drive-CN3
Connector name	HDBB-25P	10114-3000VE
Case name	3600-25-G-L	10314-52A0-008
Wiring	NO.15(ERROR)	NO.1(DXO)
	NO.8(DATA6)	NO.2(FSRX)
	NO.7(DATA5)	NO.3(CLKRX)
	NO.9(DATA7)	NO.4(CLK)
	NO.16(INIT)	NO.8(RESET)
	NO.18(GND)	NO.9(INT2/3)
	NO.6(DATA4)	NO.10(DRO)
	NO.20(GND)	NO.11(GND)
	×	Case(Shield)
Cable length	1, 2, 3, 5[m]	

In Windows98, Parallel Port(LPT1) setting is as below.

(Setting > Control panel > System > Device manager > Port > Print port(LPT1) > resource)

Range of I/O : 0378 ~ 037B

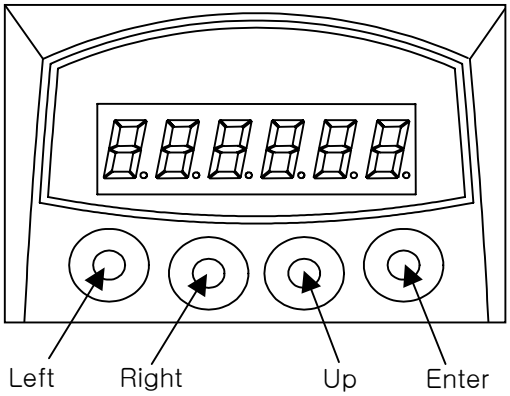
Request interrupt : 07

Chapter 4

Detailed Explanation of Program Menu

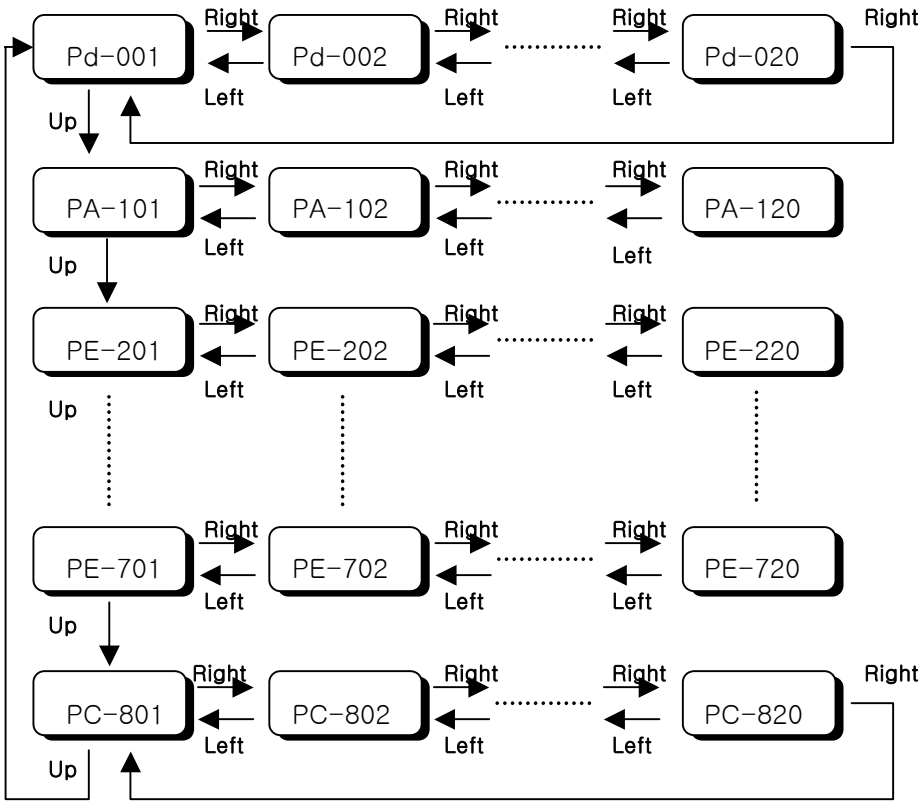
4.1 How to Operate Loader

4.1.1 External View

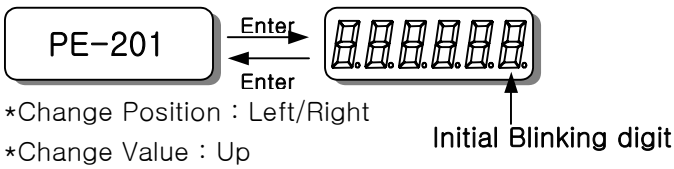


4.1.2 Menu Summary

① Move Menu



② Editing Menu



- Shift to the menu for editing in the same method of ①
- After above, press[Enter] Key, then data of menu is displayed " 13 "
  And, the last digit is blinking ; you can change the value where blink is located.
- For moving the blinking position, press [Left] or [Right].
- For changing value, press [Up] Key, then value is increased. At this time, the numerical value turns back to "0" when it exceeds "9".
- When editing is completed, press [Enter] Key, then value is saved and return to menu.

③ Error in menu editing

- Error is as below.

Display	Cause
notuSE	Menu that is used or impossible to set up
Err1	- In case of the menu is impossible to edit at Servo ON. - Error in editing Motor relative constant. - Input the value that does not have Motor ID. - In case of editing detailed constant on the state that Motor ID is not "0"
Err2	When setting the data that is out of range
Err3	Menu setting is locked. It should be unlocked.

④ Special handling function.

- In case of setting I/O state menu, the function of each key is handled as exclusive way. For a detailed, refer to chapter 5, Handling and Operating.
- Alarm Handling menu
- I/O setting menu
- Test operation menu
- Gain tuning menu
- Z position operation menu
- Absolute encoder reset
- Current offset compensation menu
- Menu Handling menu

4.2 Program Menu Summary

Menu consists of 9 menu group, and function of each menu is as below.

Comm. Code	Name of Menu Group	Function
Pd-001 ~ Pd-020	Status Menu	Indicates operation status information of Each Servo.
PA-101 ~ PA-120	Alarm Menu	Stores & Indicates records of Alarm that is Happened before.
PE-201 ~ PE-220	System Menu	Stores information of system construction
PE-301 ~ PE-320	Control Menu	Stores set variables that is related to control.
PE-401 ~ PE-420	Analog Menu	Stores set variables that is related to analog I/O.
PE-501 ~ PE-520	InOut Menu	Stores set variables that is related to I/O connection.
PE-601 ~ PE-620	Speed Operation Menu	Stores set variables that is related to Speed operation
PE-701 ~ PE-720	Pulse Operation Menu	Stores set variables that is related to position pulse operation
PC-801 ~ PC-820	Command Menu	Execute operation handling

From the below menu table, the abbreviation for each mode means ;

P : Used at Position control mode

S : Used at Speed control mode

T : Used at Torque control mode

1) Operation State Indicating Menu (Refer to chapter 4.3)

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
0	Pd-001	Current State	–	–	Indicates current operation status. (Normal : nor , Alarm : Alarm No.)	PST
			–	–		
1	Pd-002	Current Speed	r/min	0.0	Indicates current speed.	PST
			-9999.9	9999.9		
2	Pd-003	Command Speed	r/min	0.0	Indicates current command speed.	ST
			-9999.9	9999.9		
3	Pd-004	Current Pulse	–	0	Indicates cumulative value of position command Pulse that are input from external device.	P
			-99999	99999		
4	Pd-005	Feedback Pulse	–	0	Indicates feedback pulse when controlling position.	PST
			-99999	99999		
5	Pd-006	Pulse Error	–	0	Indicates remained position pulse that is to be operated.	P
			0	99999		
6	Pd-007	E-Gear N0	–	1000	Indicates numerator 0 of electronic gear ratio.	P
			1	99999		
7	Pd-008	Command Torque	[%]	0	Indicates current command torque at torque limit operation.	T
			-999.99	999.99		
8	Pd-009	Torque Limit	[%]	300	Indicates torque limit setting value.	PST
			0	300		
9	Pd-010	Current Load	[%]	0	Indicates current load ratio compared to rated.	PST
			-99999	99999		
10	Pd-011	Average Load	[%]	0	Indicates the average load ratio for 5 seconds Compared to rated.	PST
			0	99999		
11	Pd-012	Maximum Load	[%]	0	Indicates instantaneous max. load ratio compared to rated.	PST
			-99999	99999		
12	Pd-013	DC Link Voltage	Volt	0.0	Indicates DC Link voltage of current main power.	PST
			0.0	999.9		
13	Pd-014	CN1connection state I/O SET	–	–	Indicates contactsCN1 I/O status.	PST
			–	–		
14	Pd-015	Input EXT SET	–	–	Indicates input status that is handled forcibly by external(Handy Loader, PC) (refer to PC-808)	PST
			–	–		
15	Pd-016	I/O State	–	–	Indicates I/O status that is perceived last (It is perceived and indicated when A contact:ON, B contact:OFF)	PST
			–	–		
16	Pd-017	Input Logic Set	–	–	Menu that is related to communication.	PST
			–	–		
17	Pd-018	Input Logic Save	–	–		
			–	–		
18	Pd-019	Alarm bit	–	–		
			–	–		
19	Pd-020	Software Version	–	–	Indicates the Software Version.	PST
			–	–		

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

2) Alarm state indicating Menu

MENU			UNIT	INI	Description	App Mode
Comm. Code	CODE	NAME	MIN	MAX		
Alarm history 01 ~ 20			-	-	Indicates Alarm state that is happened before	PST
20 ~ 39	PA-101 ~ PA-120	Alarm History01 ~ Alarm History20	-	-		

Alarm code and details

CODE	Menu title	Cause	Checking Items
Nor-oF	Normal svoff	Servo OFF Normal condition	-
Nor-on	Normal svon	Servo ON Normal condition	-
L1.01	L1.01	RS232Comm.error, Control circuit operation error	Replace the drive
AL-01	Emergency Stop	EMG input contact turned OFF	Check external DC24V power supply
AL-02	Power Fail	Main power shut off during Servo ON status	Check the wiring of main power supply
AL-03	Line Fail	Motor and encoder miswriting	Check set values and CN2 wiring, U,V,W wiring.
AL-04	Motor Output	Error of Output (U.V.W) open phase	Check U,V,W wiring and IPM module damage
AL-05	Encoder Pulse	No. of encoder pulse set error	Check set value[PE-204] and CN2 wiring.
AL-06	Following Error	Position pulse following error	Check the [PE-502] position command pulse set value, wiring and Limit contact, gain set value
AL-07	Not Used	Not Used	-
AL-08	Over Current	Over current	Check the output terminal wiring motor・encoder set value, gain set, Replace drive if O.C. continues.
AL-09	Over Load	Over load	Check Load condition, Brake operating condition, wiring, motor・encoder set value.
AL-10	Over Voltage	Over voltage	Check input voltage, wiring If braking resistance, damage of braking resistance, excessive regenerative operation
AL-11	Over Speed	Over speed	Check encoder set value, encoder wiring, gain set
AL-12	Not Used	Not used	-
AL-13	Not Used	Not used	-
AL-14	ABS Data Error	Absolute encoder data transmission error	Check the initial reset [PC-811]
AL-15	ABS Battery Error	Absolute encoder battery error	Check the initial reset [PC-811] and if battery is discharged
AL-16	ABS Multi Error	Absolute encoder multi-rotation data transmission error	Check the initial reset [PC-811]
AL-17	ABS Read Fail	Absolute encoder reading error	Check encoder
AL-18	Not Used	Not used	-
AL-19	Not Used	Not used	-
AL-20	Flash Erase Fail	Deleting error of flash ROM data	Replace drive
AL-21	Flash Write Fail	Writing error of flash ROM data	Replace drive
AL-22	Data Init Error	Error of data initialization	Replace drive
AL-23	EPWR	Hardware error	[PE-203] set error
Err1	Error1	Input of parameters, which cannot be changed, is attempted during Servo ON	Turn OFF the servo and change the set value
Err2	Error2	Input of data which is out of set range	Input values within the set range
Err3	Error3	Change the menu which is locked by [PC-810](Menu Data Lock)	Change the menu [PC-810] with unlock condition

3) System variables setting menu (Refer to chapter 4.4.1)

Menus marked with "*" cannot be corrected during Servo-On

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
40	*PE-201	Motor ID	–	–	Sets Motor ID (Refer 4.4.1), When setting motor ID: Be set automatically from [PE-210] to [PE-217]	PST
			0	99		
41	*PE-202	RS232 Comm. speed	[bps]	0	Sets RS232 communication speed of CN3 0=9600[bps], 1=19200[bps] 2=38400[bps],3=57600[bps]	PST
		Baud Rate	0	1		
42	*PE-203	Encoder Type	–	0	Sets applied encoder type (0 : A phase lead, 1 : B phase lead, 6 : Absolute encoder)	PST
			0	9		
43	*PE-204	Encoder Pulse	[p/r]	3000	Sets the number of encoder pulse.	PST
			1	99999		
44	PE-205	CCW TRQ Limit	[%]	300	Sets torque limit value at CCW.	PST
			0	300		
45	PE-206	CW TRQ Limit	[%]	300	Sets torque limit value at CW.	PST
			0	300		
46	*PE-207	System ID	–	0	Sets drive ID on communication	PST
			0	99		
47	*PE-208	System Group ID	–	0	Sets drive group ID on communication	PST
			0	99		
48	PE-209	Start Menu No.	–	2	Sets the operation status display menu with [Pd-001]~[Pd-020] at power on.	PST
			1	20		
49	*PE-210	Inertia	$gf \cdot cm \cdot s^2$	ID	Sets inertia of motor. (Modification is possible when [PE-201] is "0")	PST
			0.01	999.99		
50	*PE-211	Trq Con	kgf·cm/A	ID	Sets torque constant of motor (Modification is possible then [PE-201] is "0")	PST
			0.01	999.99		
51	*PE-212	Phase Ls	mH	ID	Sets phase inductance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
52	*PE-213	Phase Rs	ohm	ID	Sets phase resistance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
53	*PE-214	Rated Is	A	ID	Sets rated current of motor (Modification is possible when [PE-201] is "0" .)	PST
			0.01	999.99		
54	*PE-215	Max Speed	r/min	ID	Sets max.speed of motor (Modification is possible when [PE-201] is "0")	PST
			0.0	9999.9		
55	*PE-216	Rated Speed	r/min	ID	Sets rated speed of motor (Modification is possible when [PE-201] is "0")	PST
			0.0	9999.9		
56	*PE-217	Pole Number	–	8	Sets pole number of motor (Modification is possible when [PE-201] is "0")	PST
			2	98		
57	PE-218	Not Used	–	–		
			–	–		
58	PE-219	Not Used	–	–		
			–	–		
59	PE-220	Not Used	–	–		
			–	–		

※ Communcation code is to be used for selecting the menu when using TOUCH or PC Communication.

Motor type and ID

Model	ID	Watt	Remark
SAR3A	1	30	
SAR5A	2	50	
SA01A	3	100	
SB01A	11	100	
SB02A	12	200	
SB04A	13	400	
SB03A	14	250	Customized type
HB02A	15	200	Hollow Shaft
HB04A	16	400	Hollow Shaft
SC04A	21	400	
SC06A	22	600	
SC08A	23	800	
SC10A	24	1000	
SC03D	25	300	
SC05D	26	450	
SC06D	27	550	
SC07D	28	650	
SC01M	29		
SC02M	30		
SC03M	31		
SC04M	32		
HC06H	33	600	Only S/T
SC05A	34	450	Only S/S
SC05H	35	500	Only S/S
SC08A	36	750	Only S/S
HB01A	37	100	Hollow Shaft
HC10A	38	1000	Hollow Shaft
HE30A	39	3000	Hollow Shaft
HB03H	40	250	Only Semiconductor

Model	ID	Watt	Remark
SE09A	61	900	
SE15A	62	1500	
SE22A	63	2200	
SE30A	64	3000	
SE06D	65	600	
SE11D	66	1100	
SE16D	67	1600	
SE22D	68	2200	
SE03M	69	300	
SE06M	70	600	
SE09M	71	900	
SE12M	72	1200	
SE05G	73	450	
SE09G	74	850	
SE13G	75	1300	
SE17G	76	1700	
HE09A	77	900	Hollow Shaft
HE15A	78	1500	Hollow Shaft
SE11M	79	1050	Customized type
SE07D	80	650	Customized type
SF30A	81	3000	
SF50A	82	5000	
SF22D	85	2200	
SF35D	86	3500	
SF55D	87	5500	
SF75D	88	7500	
SF12M	89	1200	
SF20M	90	2000	
SF30M	91	3000	
SF44M	92	4400	
SF20G	93	1800	
SF30G	94	2900	
SF44G	95	4400	
SF60G	96	6000	
HC05H	99	500	Customized type

Motor type and ID

Model	ID	Watt	Remark
SE35D	101	3500	Only DS
SE30D	102	3000	Customized type
SF44ML	103	4400	For LG Only
SF75G	104	7500	Customized type
SE35A	105	3500	Customized type
SF55G	106	5500	Customized type
SF60M	107	6000	Customized type
SG22D	111	2200	
SG35D	112	3500	
SG55D	113	5500	
SG75D	114	7500	
SG110D	115	11000	
SG12M	121	1200	
SG20M	122	2000	
SG30M	123	3000	
SG44M	124	4400	
SG60M	125	6000	
SG20G	131	1800	
SG30G	132	2900	
SG44G	133	4400	
SG60G	134	6000	
SG85G	135	8500	
SG110G	136	11000	
SG150G	137	15000	

Model명	ID	Watt	Remark

4) Control Variables Setting Menu (Refer to chapter 4.4.2)

Menus marked with "*" cannot be corrected during Servo-ON

MENU			UNIT	INI	Description	Appl. Mode
Comm Code	CODE	NAME	MIN	MAX		
60	PE-301	Inertia Ratio		2.0	Sets inertia ratio of load (Refer to chapter 4.4.2)	PST
			1.0	500.0		
61	PE-302	Position P Gain1	1/s	50	Sets position control proportional gain 1	P
			0	500		
62	PE-303	Position P Gain2	1/s	70	Sets position control proportional gain 2	P
			0	500		
63	PE-304	P Feedforward	[%]	0	Sets position feed-forward control ratio	P
			0	100		
64	PE-305	P FF FLT TC	msec	0	Sets the time-constant of position feed-forward control filter	P
			0	10000		
65	PE-306	P CMD FLT TC	msec	0	Sets the time-constant of position command filter	P
			0	10000		
66	PE-307	Speed P Gain1	rad/s		Sets speed proportional gain 1 (APD-VSR5~04:500, VS05~10:300, VS15~110:200)	PS
			0	5000		
67	PE-308	Speed P Gain2	rad/s	50	Set speed proportion gain 2. APD-VSR5~04:800,VS05~10:400,VS15~110:300)	PS
			0	5000		
68	PE-309	Speed I TC1	msec		Sets speed integral time constant 1 (APD-VSR5~04:20, VS05~10:30, VS15~110:50)	PS
			1	10000		
69	PE-310	Speed I TC2	msec		Sets speed integral time constant 2 (APD-VSR5~04:13, VS05~10:25, VS15~110:30)	PS
			1	10000		
70	PE-311	Speed IN FT	msec	0.0	Sets speed command filter	S
			0.0	100.0		
71	*PE-312	Speed FB FT	msec	0.5	Sets speed feed-back filter	PS
			0.0	100.0		
72	PE-313	Zero Speed Gain	r/min	0.0	Sets the speed range of zero speed gain	PS
			0.0	100.0		
73	PE-314	TORQ. CMD FLT	msec	0.0	Sets torque command filter	PST
			0.0	1000.0		
74	PE-315	DE-Resonance	-	0	Sets avoid resonance driving operation (0 : no operation, 1 : operation)	PST
			0	1		
75	PE-316	Notch Frequency	Hz	300	Sets avoid resonance driving frequency	PST
			0	1000		
76	PE-317	Notch Bandwidth	-	100	Sets avoid resonance band width	PST
			0	1000		
77	PE-318	Overload offset	-	1.1	Set the time of Oveload characteristic. (User is requested not to change it .)	PST
			1.0	3.0		
78	PE-319	Speed P Control	r/min	100.0	Sets the changed speed at PI-P control ('PCON' input)(P control is operated at less than set speed)	PS
			0.0	9999.9		
79	PE-320	Zero Speed Lock	-	1	Automatically switch from speed control to position control at 'STOP' input or command 0 voltage at [PE-403](SClamp Mode)=1,(0:not used, 1:operation)	PS
			0	1		

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

5) Analog I/O variables setting menu (Refer to chapter 4.4.3)

Menus marked with "*" cannot be corrected during Servo-On

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
80	*PE-401	Analog Speed	r/min 0.0	2000.0 max	Sets analog speed command at 10[V] -Max values is max speed of motor(Refer 4.4.3)	ST
81	PE-402	Speed Offset	mV -1000.0	0.0 1000.0	Sets the offset of speed command	S
82	PE-403	SClamp Mode	- 0	0 1	Sets zero speed clamp operation	S
83	PE-404	SClamp Volt	mV 0.0	0.0 2000.0	Sets zero speed clamp operating voltage	S
84	*PE-405	Speed Override	- 0	0 1	Sets speed override operation (0 : Not used, 1 : Override operation)	S
85	*PE-406	Analog Torque	[%] 0	100 300	Sets analog torque command at 10[V]	PST
86	PE-407	Torque Offset	mV -1000.0	0.0 1000.0	Sets the offset of torque command	T
87	PE-408	TClamp Mode	- 0	0 1	Sets zero torque clamp operation	T
88	PE-409	TClamp Volt	mV -1000.0	0.0 1000.0	Sets zero torque clamp operation voltage	T
89	PE-410	Monitor Type1	- 0	1 10	Sets type of analog output1 for monitoring	PST
90	PE-411	Monitor Mode1	- 0	0 1	Sets mode of analog output1 for monitoring (0:mark direction sorting,1:mark absolute value without direction sort)	PST
91	PE-412	Monitor Scale1	- 0.1	1.0 9999.0	Sets scale of analog output1 for monitoring	PST
92	PE-413	Monitor Offset1	mV -100.0	0.0 100.0	Sets offset of analog output1 for monitoring	PST
93	PE-414	Monitor Type2	- 0	3 10	Sets type of analog output2 for monitoring	PST
94	PE-415	Monitor Mode2	- 0	0 1	Sets mode of analog output2 for monitoring (0:mark direction sorting, 1:mark absolute value without direction sort)	PST
95	PE-416	Monitor Scale2	- 0.1	1.0 9999.0	Sets scale of analog output2 for momitoring	PST
96	PE-417	Monitor Offset2	mV -100.0	0.0 100.0	Sets offset of analog output2 for monitoring	PST
97	PE-418	Torque Com Dir	- 0	0 1	At Torque control operation, Set the motor rotating direction for torque command voltage at torque control operation. (0 : forward direction at + voltage, 1 : forward direction at – voltage)	T
98	PE-419	Not Used	- -	- -		
99	PE-420	Not Used	- -	- -		

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

6) I/O Contacts Variables Setting Menu (Refer to chapter 4.4.4)

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
100	PE-501	Inposition	Pulse 0	100 99999	Sets the output range of position operation finishing signal (Refer to chapter 4.4.4)	P
101	PE-502	Follow Error	Pulse 0	90000 999999	Sets the output range of position operation follow error signal	P
102	PE-503	0 Speed RNG	r/min 0.0	10.0 9999.9	Sets the output range of zero speed signal	PST
103	PE-504	Inspeed	r/min 0.0	100.0 9999.9	Sets the output range of speed reaching signal	S
104	PE-505	Brake SPD	r/min 0.0	50.0 9999.9	Sets brake output speed	PST
105	PE-506	Brake Time	msec 0	10 10000	Sets brake output delay time	PST
106	PE-507	PowerFail Mode	- 0	Per each model 1	Sets operation reset mode of main power error [0 : less than VS041(reset by hand), 1 : more than VS05(automatic reset)]	PST
107	PE-508	DB Control	- 0	1 1	Sets generating brake control operation 0:SVOFFat stop,less than [PE-503](zerospeed):Free-run 1:SVOFF at stop, generating brake function is always operated	PST
108	PE-509	Pulse Clear Mode	- 0	2 2	Sets position pulse clear operating mode 0 : Edge operating 1 : Level operation(response instantly) 2 : Level operation(filter operating)	P
109	PE-510	Pulse Out Rate	- 1	1 16	Sets divide ratio of encoder signal output -Divide ratio : 1,2,3.....16	PST
110	PE-511	Not Used	- -	- -		
111	PE-512	ESTOP Reset	- 0	1 1	Automatically Cancel after ESTOP operation (0:reset by hand, 1 : automatic rest)	PST
112	PE-513	Not Used	- -	- -		
113	PE-514	Dir Select Mode	- 0	0 1	0: DIR→Switching direction, STOP→stop 1: DIR→CW operation, STOP→CCW operation	S
114	PE-515	Output Logic	- 0	30 63	Sets Logic of output contacts. (30=ZSPD output, 26=TGON signal output)	PST
115	PE-516	PWM off Delay	msec 10	0 1000	Sets the delayed time(PWM-off) when command SV-off	PST
116 ~ 117	PE-517 ~ PE-518	Not Used	- -	- -		
118	PE-519	ZSPD Gain Rate	[%] 1.0	50.0 100.0	Set zero speed gain ratio that are to be applied to the speed range that is below the value which were set in PE-313.	S
119	PE-520	Gain Conv Mode 0	-	0	Set Gain1, Gain 2 switching mode. 0: Use Gain1 only.	

			0	3	1: Input contact. When Gain2 is OFF, use Gain1. When Gain 2 is ON, use Gain2. 2: If speed command[PE-503] is higher than zero speed, Gain 1 is to be switched to Gain 2. 3: If Position pulse error[PE-501] gets bigger than inpos value, Switching Gain1→Gain2.	

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

7) Speed operation variables setting menu(Refer to chapter 4.4.5)

Menus marked with "*" cannot be corrected during Servo-On

MENU			UNIT	INI	Description	Appl. Mode
Comm Code	CODE	NAME	MIN	MAX		
120	*PE-601	Operation Mode	–	1	Sets operation mode (Refer to chapter 4.4.5) 0 : torque control mode 1 : speed control mode 2 : position control mode 3 : speed/position control mode ('MODE' contact=OFF: position mode) 4 : speed/torque control mode ('MODE' contact=OFF: torque mode) 5 : position/torque control mode ('MODE' contact=OFF: torque mode) **(Surely set '0' for [PE-320] when using the operation mode 3 & 4)**	PST
			0	5		
121	PE-602	Speed Command1	r/min	10.0	Be selected as per the status of speed command input contact [SPD1][SPD2][SPD3] [X]: OFF, [O]: ON [X][X][X] : Analog speed command [O][X][X] : Internal speed command 1 [X][O][X] : Internal speed command 2 [O][O][X] : Internal speed command 3 [X][X][O] : Internal speed command 4 [O][X][O] : Internal speed command 5 [X][O][O] : Internal speed command 6 [O][O][O] : Internal speed command 7	ST
			-Max	+Max		
122	PE-603	Speed Command2	r/min	200.0		ST
			-Max	+Max		
123	PE-604	Speed Command3	r/min	500.0		ST
			-Max	+Max		
124	PE-605	Speed Command4	r/min	1000.0		S
			-Max	+Max		
125	PE-606	Speed Command5	r/min	1500.0		S
			-Max	+Max		
126	PE-607	Speed Command6	r/min	2000.0		S
			-Max	+Max		
127	PE-608	Speed Command7	r/min	3000.0		S
			-Max	+Max		
128	PE-609	Accel Time	msec	0	Sets the accelerating time	S
			0	100000		
129	PE-610	Decel Time	msec	0	Sets the decelerating time	S
			0	100000		
130	*PE-611	S Type Control	–	0	Sets S type control on speed control (0 : Linear Accel/Decel , 1 : S type Accel/Decel)	S
			0	1		
131	PE-612	Test Run Speed0	r/min	100.0	Sets speed 0 at continuous test operation	PST
			-Max	+Max		
132	PE-613	Test Run Speed1	r/min	-500.0	Sets speed 1 at continuous test operation	PST
			-Max	+Max		
133	PE-614	Test Run Speed2	r/min	1000.0	Sets speed 2 at continuous test operation	PST
			-Max	+Max		
134	PE-615	Test Run Speed3	r/min	-2000.0	Sets speed 3 at continuous test operation	PST
			-Max	+Max		
135	PE-616	Test Run Time0	sec	5	Sets time 0 at continuous test operation	PST
			1	50000		

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
136	PE-617	Test Run Time1	sec 1	5 50000	Sets time 1 at continuous test operation	PST
137	PE-618	Test Run Time2	sec 1	5 50000	Sets time 2 at continuous test operation	PST
138	PE-619	Test Run Time3	sec 1	5 50000	Sets time 3 at continuous test operation	PST
139	PE-620	Not Used	– –	– –		

※ Communication mode is to be used for selecting the menu when using TOUCH or PC Communication.

8) Position preration variables setting menu (Refer to chapter 4.4.5)

Menu marked with "*" cannot be corrected during Servo-ON

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
140	*PE-701	Pulse Logic	–	1	Sets the input pulse logic of position operation (Refer to chapter 4.4.6)	P
			0	5		
141	*PE-702	Electric Gear N0	–	1000	Sets numerator 0 or electronic gear ratio	P
			1	99999		
142	*PE-703	Electric Gear D0	–	1000	Sets denominator 0 or electronic gear ratio	P
			1	99999		
143	*PE-704	Electric Gear N1	–	1000	Sets numerator 1 or electronic gear ratio	P
			1	99999		
144	*PE-705	Electric Gear D1	–	2000	Sets denominator 1 or electronic gear ratio	P
			1	99999		
145	*PE-706	Electric Gear N2	–	1000	Sets numerator 2 or electronic gear ratio	P
			1	99999		
146	*PE-707	Electric Gear D2	–	3000	Sets denominator 2 or electronic gear ratio	P
			1	99999		
147	*PE-708	Electric Gear N3	–	1000	Sets numerator 3 or electronic gear ratio	P
			1	99999		
148	*PE-709	Electric Gear D3	–	4000	Sets denominator 3 or electronic gear ratio	P
			1	99999		
149	*PE-710	Backlash	Pulse	0	Sets backlash compensation in position operation (Standard : 4 interpolation pulse)	P
			0	10000		
150	PE-711	E-Gear Mode	–	0	0:electronic gear ratio 0~3 selecting 1:Offset value override function to numerator 0 of electronic gear ratio	P
			0	1		
151	PE-712	E-Gear offset	–	0	Directly setting numerator 0 of offset value on menu of EGEAR1 contact ON→increase, EGEAR2 contact ON→decrease	P
			-99999	99999		
152	*PE-713	Position Pulse Direction Pulse Dir	–	0	Converts the direction by pulse in position operation 0 : Operating in the direction of command 1 : Operating in the counter direction of command	
			0	1		
153	PE-714	Not Used	–	–		
			–	–		
154	PE-715	Not Used	–	–		
			–	–		
155	PE-716	Not Used	–	–		
			–	–		
156	PE-717	Not Used	–	–		
			–	–		
157	PE-718	Not Used	–	–		
			–	–		
158	PE-719	ABS Multi Turn	–	–	Absolute encoder's Multi Turn Data. Menu display is not possible as this is for Communication only.	P
			–	–		
159	PE-720	ABS Single Turn	–	–	Absolute encoder's Single Turn Data. Menu display is not possible as this is for communication only.	P
			–	–		

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.

9) Operation handling menu (Refer to chapter 5)

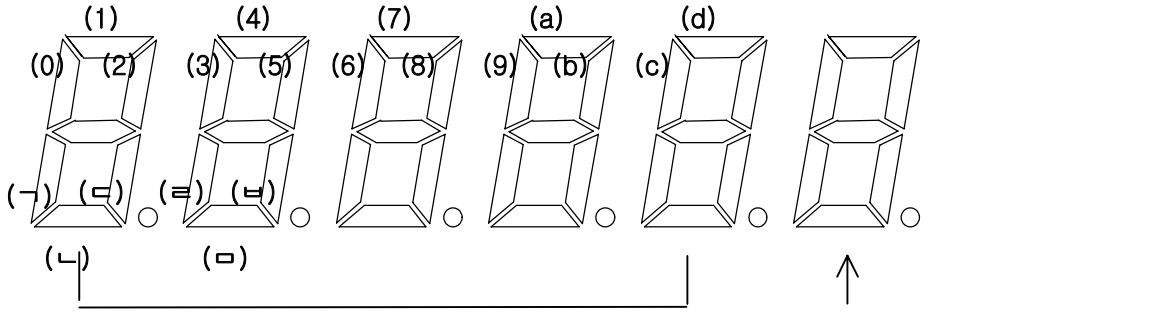
Menu marked with "*" cannot be corrected during Servo-ON

MENU			UNIT	INI	Description
Comm Code	CODE	NAME	MIN	MAX	
160	PC-801	Alarm Reset	-	-	Reset current alarm (Refer to chapter 5)
			-	-	
161	PC-802	Alarm His Clear	-	-	Clear alarm history
			-	-	
162	PC-803	Manual Test Run	-	-	Execute test operation by hand [Left] : forward rotating [Right] : reverse rotating [Up] : test operation speed changing ([PE-602]~[PE-608]) [Enter] : End Operating is not related to input status of CN1
			-	-	
163	PC-804	Auto Test Run	-	-	Continuous operation by speed and time that are set on menu, press [Enter] for end Operating is not related to input status of CN1
			-	-	
164	PC-805	Gain Tune Run	-	1	Sets automatic tuning operation of load inertia. 0: no auto tuning operation 1: auto tuning within 1~5 of inertia range 2: auto tuning within 5~10 of inertia range 3: auto tuning within 10~25 of inertia range 4: auto tuning within 25~50 of inertia range 5: auto tuning within 50~100 of inertia range (Procedure) ①sets the range with[Left], [Right] key ②execute forward/reverse operation about 10 times at 1000[r/min] ③Press [Enter] key, then auto tuning result is saved at [PE-301], [PE-307], [PE-309], and set as "0" automatically
			1	5	
165	PC-806	Z POS Search	-	-	Press [Enter] key, then motor rotate as forward Direction, and search for Z phase of encoder for stop
			-	-	
166	PC-807	IN Logic Set	-	-	After setting the input contact number(0~d) with [Left], [Right] key, press [Up]key, then the status of input contact is changed. Segment "Off" : Normal – A contact Segment "On" : Normal – B contact
			-	-	
167	PC-808	EXT Input Set	-	-	After setting the input contact number (0~d) with [Left], [Right] key, press [Up] key, then input contact is "ON" forcibly. Segment "Off" : Switch status of CN1 Segment "On" : Make "On" forcibly. All contacts are OFF at power off
			-	-	
168	*PC-809	Menu data Init	-	-	Press [Enter] key, then data of menu are changed to initial value automatically But, system menu data of [PE-201]~[PE-220] is not changed (It will be applied when the Power is supplied again.)
			-	-	
169	PC-810	Menu data Lock	-	-	Press [Enter] key, then Lock/unlock functions of menu data is operated as toggle. If data is changed at menu Lock status, then "Err3" would be displayed
			-	-	

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.

MENU			UNIT	INI	Description
Comm Code	CODE	NAME	MIN	MAX	
170	PC-811	ABS Encoder set	–	–	Press [Enter] key at using absolute encoder,then reset absolute encoder for 5 seconds.
171	PC-812	Current Offset	–	–	Compensates current offset of Hall-CT [Left] key : display current offset value of U phase [Right] key : display current offset value of W phase [Up] key : save existing current offset value In case of downloading servo soft, surely turn power ON/OFF 3~5 times, after that press[Up] Key and save current offset value.
172 ~ 173	PC-813 ~ PC-814	Not Used	–	–	
174	PC-815	Peak Load	%	0	Display instantaneous max. load ratio for the rated. [Right] Key : Display forward direction instantaneous max.load ratio. [Left] Key : Display reverse direction instantaneous max.load ratio. [Up] Key : Reset instantaneous max. load ratio
			-9999	9999	
175	PC-816	Following position pulse펄스 Feedback Pulse	Pulse	0	Display the amount of encoder pulse that motor is rotated. [Up] Key : Reset encoder pulse amount
			9.9.9.9.9.9	999999	
176 ~ 179	PC-817 - PC-820	Not Used	–	–	

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.



[Input contact : upper]

(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SVON	SPD1/ EGEAR1	SPD2/ EGEAR2	SPD3/ MODE	DIR	PCON	CCWLIM	CWLIM	TLIMIT	EMG
(a)	(b)	(c)	(d)						
STOP	ALMRST	GAIN2	PCLEAR						

[Output contact : lower]

(ㄱ)	(ㄴ)	(ㄷ)	(ㄹ)	(ㅁ)	(ㅂ)
BRAKE	INSPD/INPOS	ZSPD	READY	TLOUT	ALARM

4.3 Display Operation State

4.3.1 Display State[Pd-001] (Application Mode : PST)

- Display current operation state.
  * nor : normal operation state.
  * AL-XX : Display pertinent code at alarm
- Remove the source of alarm, and display data of menu on basis of [PE-209] when alarm is canceled by reset key
- At this time, Of handling is conducted between menu, display with no changing

4.3.2. Display Speed (Application Mode : PST, ST)

- Display Current Speed [Pd-002] and current speed command [Pd-003] as [r/min]
- Maximum range is –9999.9 ~ 9999.9

4.3.3 Display Position

① Position command pulse [Pd-004] (Application Mode : P)
Display Counter value of position command pulse that is inputted after Servo ON.

② Position following pulse [Pd-005] (Application Mode : PST)
Display counter value

③ Position Pulse remainder [Pd-006] (Application Mode : P)
Difference between command pulse and following pulse, and it displays pulse counter value for the position where Servo will drive on.

④ Electronic gear ratio numerator [Pd-007] (Application Mode : P)
Where deceleration ratio is being changed due to abration of machine, the Offset settlement [PE-712] can be set to be compensated by electronic gear ratio and the information of offset value is displayed.

4.3.4 Display Torque and Load

① Current command torque [Pd –008] (Application Mode : T)
Display the inside torque command that is operated from servo control algorithm compared to rated torque at percentage.

② Torque Limit [Pd –009] (Application Mode : PST)
Display maximum torque that servo motor can generate compared to rated torque at percentage.

③ Current load ratio [Pd-010] (Application Mode : PST)

Display energy (load) that servo motor currently generates compared to rated output at percentage

④ Average Load ratio [Pd -011] (Application Mode : PST)

Display average energy (load) value for 5 seconds that servo motor generates compared to rated output at percentage.

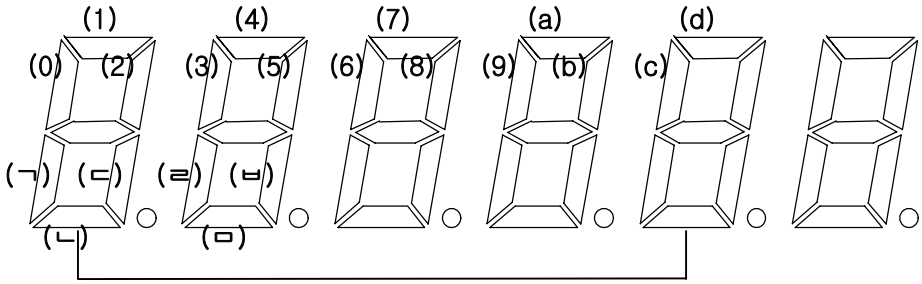
⑤ Maximum instantaneous Load rated [Pd -012] (Application Mode : PST)

Display maximum (peak) load value from the time when it started control up to now after servo ON compared to rated output at percentage.

⑥ Condenser DC Link Voltage [Pd -013] (Application Mode : PST)

- Display servo drive condenser voltage due to regenerative energy from servo motor.
- The maximum DC Link voltage is 405V at standard drive(220V)
- If DC Link voltage exceeded the limit due to that regenerative energy is large or the capacity of regenerative resistance is small, then over Voltage alarm occurs.
- Proper values are less than 395[V] on regenerative region.

4.3.5 Display I/O State



Display Input contact logic

[Input contact : Upper]

(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SVON	SPD1/ EGEAR1	SPD2/ EGEAR2	SPD3/ MODE	DIR	PCON	CCWLIM	CWLIM	TLIMIT	EMG
(a)	(b)	(c)	(d)						
STOP	ALMRST	GAIN2	PCLEAR						

[Output contact : Lower]

(ㄱ)	(ㄴ)	(ㄷ)	(ㄹ)	(ㅁ)	(ㅂ)
BRAKE	INSPD/INPOS	ZSPD	READY	TLOUT	ALARM

① CN1 I/O contact state [Pd-014] (Application Mode : PST)

CN1 Connector is ON (Shout) : Lamp ON

CN1 Connector is OFF (Open) : Lamp OFF

② External handling Input state [Pd-015] (Application Mode : PST)

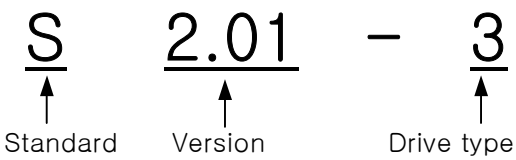
- Display state when handling the contact state by using external device (PC communication and the like), not in case of using CN1 connector.
- Since the external handling input state con not be stored at servo drive ROM, it can be automatically reset when power is turned OFF.

③ I/O contact state [Pd-016] (Application Mode : PST)

Display I/O state by compounding ① and ②

(When normal-A contact : ON, and normal-B contact : OFF, it is recognized and displayed)

4.3.6 Display Software version (Application Mode : PST)



●Software type is “S” in this Manual.

No.	Drive type
0	VSR5
1	VS01
2	VS02
3	VS04
4	VS05
5	VS10
6	VS15
7	VS20
8	VS35
9	VS50
A	VS75
b	VS110
c	VS110 Special type(300A)

4.4 Setting Up Menu

4.4.1 Setting System Variables

① Setting motor constant (Application Mode : PST)

- Setting motor constant by ID.
  Input ID number to ID menu [PE-201], then motor constant can be automatically set. ID for each model Motor is as below.

Motor type and ID

Model No.	ID	Watt	Remark
SAR3A	1	30	
SAR5A	2	50	
SA01A	3	100	
SB01A	11	100	
SB02A	12	200	
SB04A	13	400	
SB03A	14	250	Customized type
HB02A	15	200	Hollow Shaft
HB04A	16	400	Hollow Shaft
SC04A	21	400	
SC06A	22	600	
SC08A	23	800	
SC10A	24	1000	
SC03D	25	300	
SC05D	26	450	
SC06D	27	550	
SC07D	28	650	
SC01M	29		
SC02M	30		
SC03M	31		
SC04M	32		
HC06H	33	600	S/T only
SC05A	34	450	S/S only
SC05H	35	500	S/S only
SC08A	36	750	S/S only
HB01A	37	100	Hollow Shaft
HC10A	38	1000	Hollow Shaft
HE30A	39	3000	Hollow Shaft

Model No.	ID	Watt	Remark
SE09A	61	900	
SE15A	62	1500	
SE22A	63	2200	
SE30A	64	3000	
SE06D	65	600	
SE11D	66	1100	
SE16D	67	1600	
SE22D	68	2200	
SE03M	69	300	
SE06M	70	600	
SE09M	71	900	
SE12M	72	1200	
SE05G	73	450	
SE09G	74	850	
SE13G	75	1300	
SE17G	76	1700	
HE09A	77	900	Hollow Shaft
HE15A	78	1500	Hollow Shaft
SE11M	79	1050	Customized type
SE07D	80	650	Customized type
SF30A	81	3000	
SF50A	82	5000	
SF22D	85	2200	
SF35D	86	3500	
SF55D	87	5500	
SF75D	88	7500	

Motor type and ID

Model No.	ID	Watt	Remark
SF12M	89	1200	
SF20M	90	2000	
SF30M	91	3000	
SF44M	92	4400	
SF20G	93	1800	
SF30G	94	2900	
SF44G	95	4400	
SF60G	96	6000	
HC05H	99	500	Customized type
SE35D	101	3500	Only DS
SE30D	102	3000	Customized type
SF44ML	103	4400	For LG Only
SF75G	104	7500	Customized type
SE35A	105	3500	Customized type
SF55G	106	5500	Customized type
SF60M	107	6000	Customized type

Model No.	ID	Watt	Remark
SG22D	111	2200	
SG35D	112	3500	
SG55D	113	5500	
SG75D	114	7500	
SG110D	115	11000	
SG12M	121	1200	
SG20M	122	2000	
SG30M	123	3000	
SG44M	124	4400	
SG60M	125	6000	
SG20G	131	1800	
SG30G	132	2900	
SG44G	133	4400	
SG60G	134	6000	
SG85G	135	8500	
SG110G	136	11000	
SG150G	137	15000	

- Setting each motor constant

For setting motor constant individually, individually, input “0” to motor ID menu [PE-201]

Motor constant is as below

MENU			UNIT	INI	Explanation
Comm Code	CODE	NAME	MIN	MAX	
40	*PE-201	Motor ID	–	–	Sets motor ID : set automatically from [PE-210]to[PE-217]
			0	99	
49	*PE-210	Inertia	$gf \cdot cm \cdot s^2$	ID	Sets inertia of motor. (Modification is possible when [PE-201] is “0”)
			0.01	999.99	
50	*PE-211	Trq Con	kgf·cm/A	ID	Sets torque constant of motor.(Modification is possible when [PE-201] is “0”)
			0.01	999.99	
51	*PE-212	Phase Ls	mH	ID	Sets phase inductance of motor.(Modification Is possible when [PE-201] is ”0”)
			0.001	99.999	
52	*PE-213	Phase Rs	ohm	ID	Sets phase resistance of motor. (Modification is possible when[PE-201] is “0”)
			0.001	99.999	
53	*PE-214	Rated Is	A	ID	Sets rated current of motor. (Modification is possible when [PE-201] is “0”)
			0.01	999.99	
54	*PE-215	Max Speed	r/min	ID	Sets Max. speed of motor. (Modification is possible when [PE-201] is “0”)
			0.0	9999.9	
55	*PE-216	Rated Speed	r/min	ID	Sets rated speed of motor. (Modification is possible when [PE-201] is “0”)
			0.0	9999.9	
56	*PE-217	Pole Number	–	8	Sets pole number of motor. (Modification is possible when [PE-201] is “0”)
			2	98	

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.

② Setting encoder

- Encoder type [PE-203] (Application Mode : PST)

No.	Transmission	Signal method	Signal type	Remark
0	Parallel	A Phase lead at CCW	A,B,Z,U,V,W	Standard
1	Parallel	B Phase lead at CCW	A,B,Z,U,V,W	
6	Serial	Absolute value 11/13 bit	A,B,Z,RX	

- Encoder pulse [*PE-204]

  When encoder signal method uses A,B Signal, set number of pulse per single turn for signal.

  In this case, the pulse number of A phase & B phase is same.

③ Setting torque limit (Application Mode : PST)

Can set max. torque limit at CCW[PE-205] and CW[PE-206] respectively

It is displayed at percentage, compared to rated torque and the standard is 300[%]

④ Setting System ID (Application Mode : PST)

When communicating with servo using Bus communication, gives ID to servo.

At this time Option is needed for communication

- System ID [*PE-207]

  Give inherent ID to servo, and communicate with servo respectively.

- System group ID[*PE-208]

  In case of communication with several servos as a group, sets group ID

- Setting communication speed [*PE-202]

  Can use it by selecting the Baud Rate between 9600/19200[bps] that are the communication speed of RS232.

⑤ Setting state display at start [PE-209] (Application Mode : PST)

Can set applicable menu at servo ON.

Set value is sorted from [Pd-001]to[Pd-020]

4.4.2 Setting Control Variables

① Setting Inertia Ratio[PE-301] (Application Mode : PST)

The inertia ratio is set by calculating the load inertia as per the machinery system and calculating rotor inertia ratio as per the motor specification table.

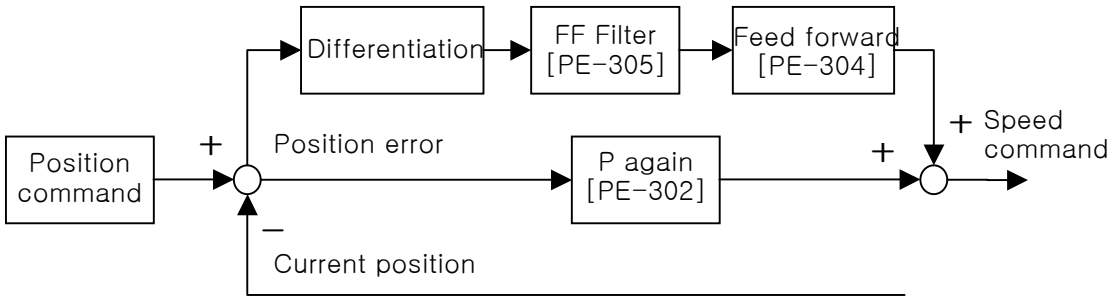
Setting the inertia ratio for load is a very important control variable for the Servo operation. So, The accurate setting of inertia ratio would be required for the best operation of servo.

■ Followings and the recommended values of control gain that are adequate to the load inertia ratio

Motor Flange	Inertia Ratio		Gain setting range		
	Section	[Inertia]	[Position Pos P Gain]	[Speed Proportional Gain]	[Speed Integral Gain]
40 ~ 80	Low inertia	1 ~ 5	40 ~ 90	400 ~ 1000	10 ~ 40
	Medium inertia	5 ~ 20	20 ~ 70	200 ~ 500	20 ~ 60
	High inertia	20 ~ 50	10 ~ 40	100 ~ 300	50 ~ 100
100 ~ 130	Low inertia	1 ~ 3	40 ~ 80	300 ~ 600	10 ~ 50
	Medium inertia	3 ~ 10	20 ~ 60	100 ~ 400	20 ~ 80
	High inertia	10 ~ 20	10 ~ 40	50 ~ 200	50 ~ 150
180 ~ 220	Low inertia	1 ~ 3	30 ~ 70	150 ~ 400	20 ~ 60
	Medium inertia	3~ 5	15 ~ 50	80 ~ 300	30 ~ 100
	High inertia	5 ~ 10	5 ~ 30	50 ~ 200	50 ~ 150

* If the calculation of inertia ratio is difficult, then Auto tuning the inertia ratio could be possible at trial operation. Refer to chapter “5.3.1 Gain Tuning”

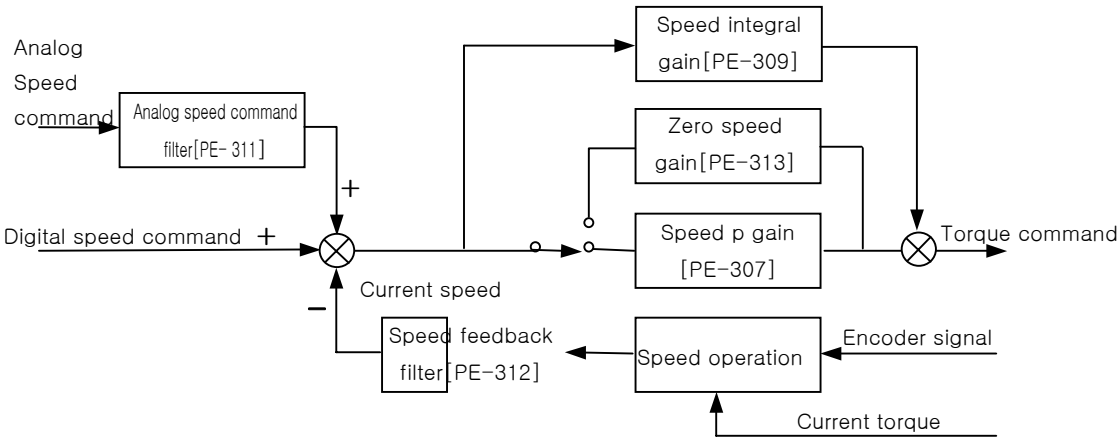
② Position control gain (Application Mode : P)



- Position command : Count the position command pulse from external. And convert it to position command value, and it pass through 1st order filter.
- Current position : Count the pulse signal from encoder, and convert it to current position by using electrical gear ratio setting.
- Position proportional gain [PE-302][PE-303] : multiply position proportional gain by difference between position command and current position and convert it to position command.

  * Recommend setting value = speed proportional gain[PE-307] / 10
- Feed forward Gain[PE-304] : Find the slope of position command by differentiation, and shortening the position decision time by adding the speed command to it. If this value is too large, overshoot may be occurred on position control or position control may be unstable, therefore set proper value by increasing from small value watching initial operation state.
- Feed forward filter [PE-305] : If position command is changed suddenly, control is unstable. In that case, remove vibration by setting filter value

③ speed control gain (Application Mode : PST, PS, S)

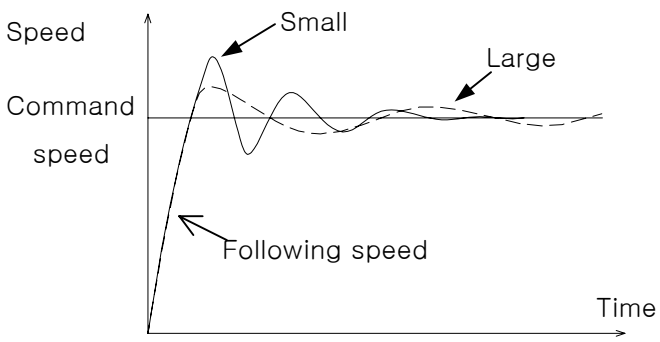


- Speed command : Use analog speed signal which is inputted from external passed through analog speed command filter [PE-311] as speed command or use digital speed command by [r/min] unit which is set on internal menu

- Current speed : Operate speed by counting encoder signal, and filtering it for current speed. At this time, use an algorithm that follows speed by using current torque & inertia in order to compensate the speed operation error at low speed

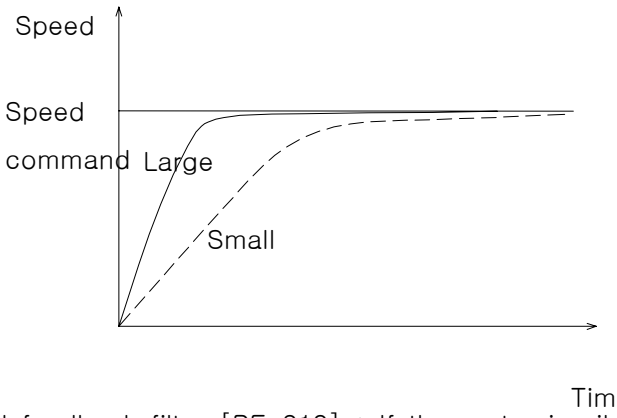
- Speed integral gain[PE-309] : Find the integral value of speed error that is the difference between command & current speed and convert it to torque command by multiplying it by integral. If we reduced integral gain, speed following characteristic can be improved as excessive response characteristic is improved. But, if it is too small, overshoot would be occurred. And if it is too large, the excessive response characteristic would be bad, then it is operated by the proportional control characteristic.

  * Recommend setting value = 10000 / speed proportional gain [PE-307]



- Speed proportional gain[PE-307] : convert to torque command by multiplying speed error by proportional gain

  Large value could lead good speed response, but too large value could lead vibration. On the other hand small value could lead bad speed response



- Speed feedback filter [PE-312] : If the motor is vibrated by the vibration of operating system and vibration occurred by the gain at applying the load that has too large inertia, the vibration can be controlled by applying filter to speed feedback. But, at this time, if you put too big gain value, the speed response would be dropped and the control function is also downed.

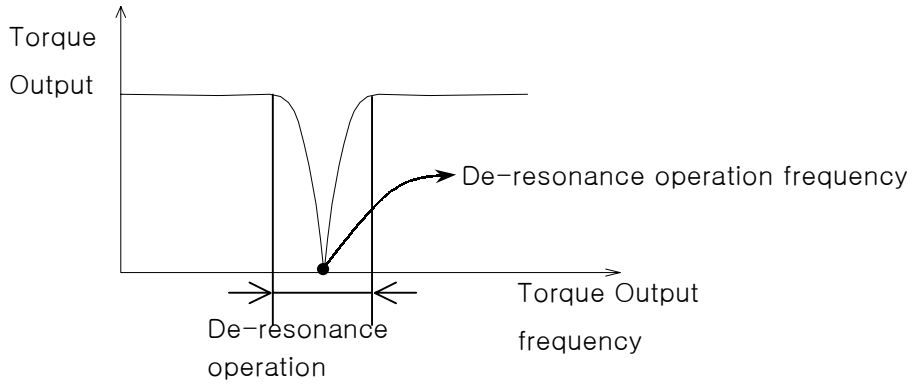
- Zero speed gain ratio[PE-313] : If user use the speed feedback filter and control the vibration, the system could often be unstable. At this time, Set the speed range for applying zero speed gain and adjust the gain within that speed range. Then, the vibration can be controlled.

- Zero speed gain ratio[PE-519] : Set the zero speed gain ratio that is to be applied to the speed range which are below the speed range that are set in [PE-313].

④ Setting torque command filter[PE-314] (Application Mode : PST)

By setting the digital filter for analog torque command voltage, the stability of command pulse con be improved. At this time, excessively large value could lead to bad response. So , set the proper value according to the system.

⑤ Setting De-resonance operation (Application Mode : PST)



- When vibration occurs due to mechanical resonance from specific frequency, the vibration caused by resonant can be controlled by limiting torque output for this frequency range.
- De-resonance operation [PE-315] : It is not operated at “0”. But, operated at “1”.

⑥ P control operating setting [PE-319] (Application Mode : PST)

- When switching P control by using P control contact (‘PCON’), P control could be operated under setting speed.
- After PI control operation by using this function, apply the stop function of P control operation. And it can improve position operating characteristics.

⑦ Zero speed torque improvement [PE-320] (Application Mode : PST)

- Set whether or not to operate by applying stop torque improvement algorithm at servo OFF

  “0” : Not used.

  “1” : Operated.
- STOP operation is “STOP” contact “ON” or speed command from analog is “0”

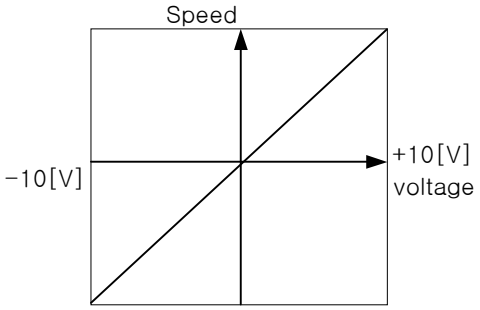
4.4.3 Setting Analog I/O Variables

① Setting Analog speed command (Application Mode : ST, S)

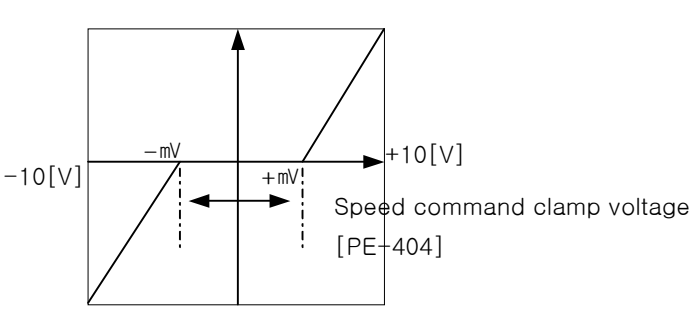
- Analog speed command [PE-401] : Set the speed command value by [r/min] unit at 10 [V]. At this time, maximum set value is maximum speed of motor.

- Speed command offset [PE-402] : There could be some voltage remained even at "0" torque command on analog signal interface circuit. At his time, set offset with the voltage value and compensate it. Unit is [㎷].

- Setting Speed command clamp



Speed command clamp mode "0"
[PE-403]



Speed command clamp mode "1"
[PE-403]

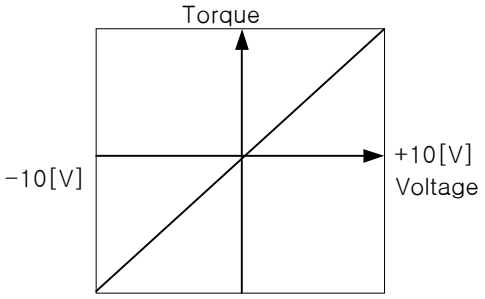
- Speed override operation [PE-405] : Operate speed command operation by overriding the analog speed command to digital speed command.
  "0" : Not operated.
  "1" : Override operation

② Setting analog torque command (Application Mode : PST, T)

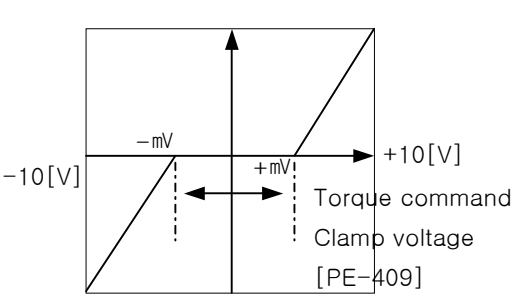
- Analog torque command [PE-406] : Set the torque command value at percentage to rated at 10[V]. At this time, setting value is within torque limit range in [PE-205] [PE-206]

- Torque command offset [PE-407] : There could be some voltage remained even at "0" torque command due to some problems on analog circuit. At this time, set offset with the voltage value and compensate it. Unit is [㎷].

- Torque command clamp



Torque command clamp mode “0”
[PE-408]



Torque command clamp mode “1”
[PE-408]

③ Setting analog output

Two of output form can be used for analog output. And it is outputted by the data value in period of 400[μsec] respectively.

- Analog output form [PE-410], [PE-414]

Form	Data content	Form	Data content
0	Command speed	4	Command pulse frequency
1	Current speed	5	Error pulse
2	Command torque		
3	Current torque		

- Analog output mode [PE-411], [PE-415]

Mode	Output method
0	Output as -5 ~ +5[V]
1	Output as 0 ~ +5[V]

- Analog output magnification [PE-412], [PE-416]

If the output value is too much large or small, then magnify or retrench output properly. Standard magnification of each output data is as below

Data item	Magnification
Speed	Max. speed of motor [PE-215]
Torque	Max. torque of motor [300%]
Command pulse frequency	500[Kpps]
Error pulse	Position error excessive output [PE-502]

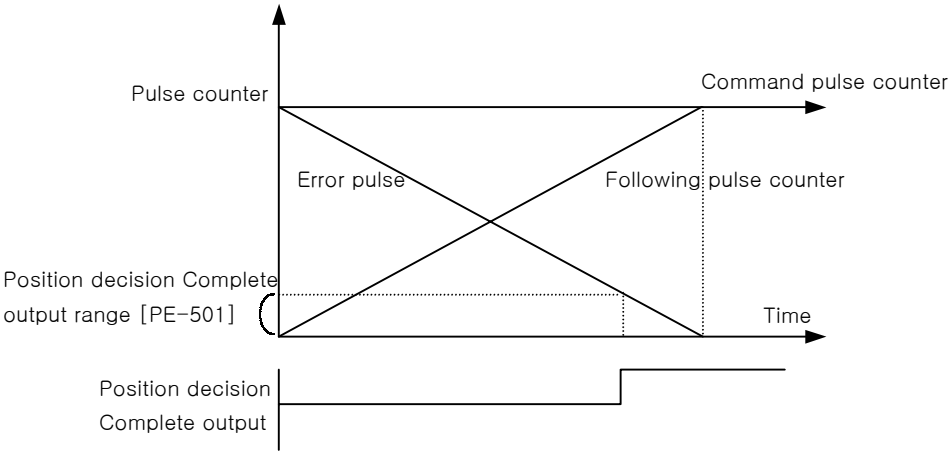
- Analog output offset [PE-413], [PE-417]

There could be some voltage generated at “0” value output due to problems of Analog circuit. At this time, set offset with the voltage value and compensate it. Unit is [㎷]

4.4.4 Setting I/O contact Variables

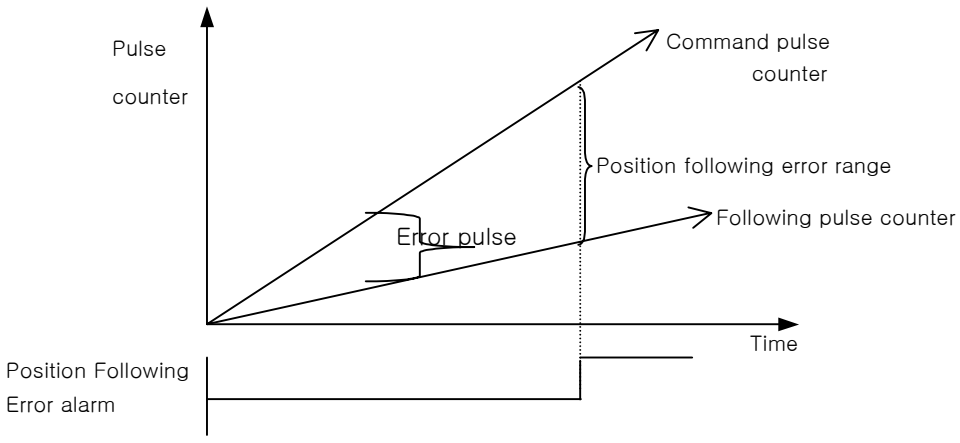
① Setting position operation variables (Application Mode : P)

- Position decision complete output range [PE-501] : If error pulse value which is the difference between command position pulse and following position pulse is within setting range, position decision complete signal is come out



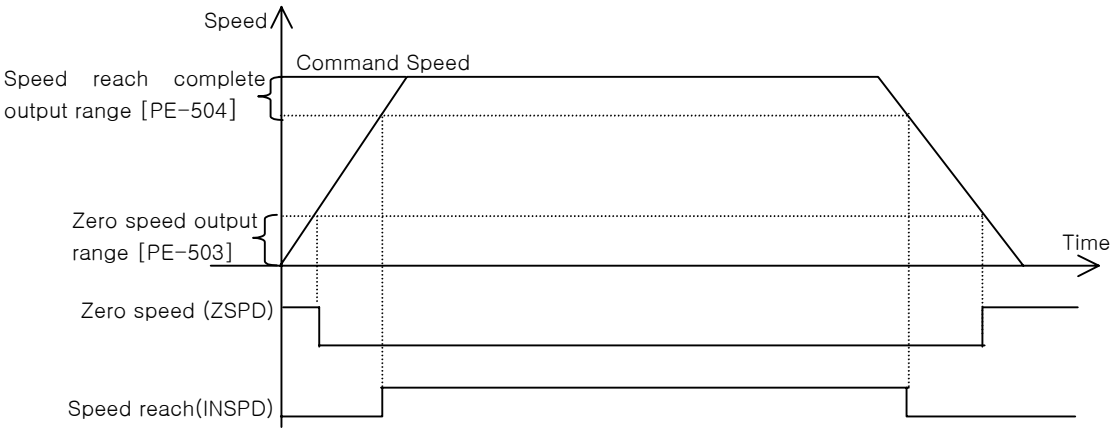
If setting value is excessively high, position decision complete signal could be occurred during operation according to position command pulse. Therefore set the value properly

- Position operation following error range [PE-502]



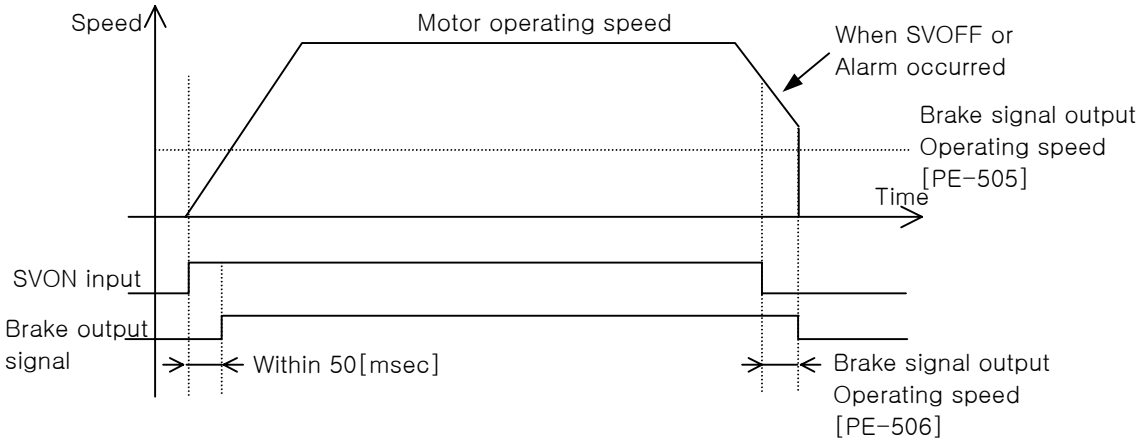
If the error pulse is larger than following error range set value, Position following error alarm would be occurred.

② Setting speed operation variables (Application Mode : PST, S)



- Zero speed output range [PE-503] : If current speed is less than set speed, zero speed signal is come out.
- Speed reach complete output range [PE-504] : Speed reach complete signal is come out.

③ Setting brake signal output variables (Application Mode : PST)



- Brake signal output operating speed [PE-505], Brake signal output delay time [PE-506] ; The Servo motor brake that is installed inside is used when a servo drive controls a vertical axis. In other words, a servo motor with brake prevents the movable part from shifting due to the force of gravity when system power goes OFF. When alarm is occurred during operation or when decelerated by SVOFF, the brake signal “OFF” is to be occurred by the signal that satisfies the operation first out of ‘brake signal output operating speed [PE-505]’ or ‘brake signal output delay time [PE-506] parameter.
  Then it prevents the vertical axis from dropping (shifting).

④ Generating brake operation [PE-508] (Application Mode : PST)

: Set the generating brake operation from VSR5 to VS04 drive.

"0" : Free Run on less than zero speed range at SVOFF

"1" : Always generating brake operation at SVOFF

⑤ Position pulse clear operation [PE-509] (Application Mode : P)

: Set the operation method of position pulsed clear at position operating mode.

Setting	Operation method
0	Can only be operated at the edge where the contact off->on. (Not operated on the off or on status.)
1	Contact On : Operated as Level (Instant response)
2	Contact is On and maintained for more than 0.8[msec] : Operated as Level

⑥ Encoder pulse division output [PE-510] (Application Mode : PST)

: When encoder signal comes out from servo, divided output pulse by set division ratio and output.

Division ratio is set by the integral numbers ("1~16")

EX) In case of the Encoder 3,000[P/R]

Encoder pulse output at setting the division ratio "1" : 3,000[P/R]×1=3,000[P/R]

Encoder pulse output at setting the division ratio "2" : 3,000[P/R]×1/2=1,500[P/R] ···

⑦ ESTOP automatic reset [PE-512] (Application Mode : PST)

: When returning to the contacts after ESTOP operation, proceed the alarm cancel operation automatically and return to the normal operation ready state.

"0" : alarm reset by hand.

"1" : automatic alarm reset.

⑧ Operating direction setting mode [PE-514] (Application Mode : S)

: Set the operating method of changing switch for the operating direction.

Set	Operating method					
	Forward(CCW)		Reverse(CW)		Stop	
	DIR	STOP	DIR	STOP	DIR	STOP
0	OFF	OFF	ON	OFF	No concern.	ON
1	OFF	ON	ON	OFF	ON	ON
					OFF	OFF

⑨ Output contact Logic setting[PE-515] (Applicable mode : PST) : Can change the output condition of Current output contact to Normal-A or Normal-B.
Setting range : 0~63, Initial value 30

(Example)

	2^5	2^4	2^3	2^2	2^1	2^0	= Setting value
	ALARM	TLOUT	RDY	ZSPD	INSPD	BRAKE	
Init.value (Current output condition)	0	1	1	1	1	0	= 30
If change ZSPD->TGON (RUN output)	0	1	1	0	1	0	= 26

⑩ PWM off delayed time setting[PE-516] (Applicable mode : PST) : Set the delayed time that is the real PWM-off when SV-off command is given. That means, when operating the motor with the output contact "BRAKE" signal, there is some time delayed to operate the motor brake("BREAK" signal : off). In order to prevent the motor from dropping in the vertical axis during this delayed time, the real PWM-off(delayed time) needs to be set.
Setting range : 0~1000[msec], Initial value 0

⑪ Zero speed gain ratio[PE-519] : Set the zero speed gain ratio that is to be applied to the speed range which are below the speed range that are set in [PE-313].

⑫ Gain 1, Gain 2 Switching Mode[PE-520]

Setting	Operation method
0	Only Gain 1 can be used.
1	Input contact When Gain 2 is off : Gain 1 is to be used, When Gain 2 is on : Gain 2 is to be used.
2	Gain 2 is to be used when speed command [PE-503] is higher than "zero speed" at speed controller.(Use 50% of Hysteresis)
3	Gain 2 is to be used when pulse error[PE-501] is higher than "inposition value at position controller. (Use 50% of Hysteresis)

※ If the value of Gain 2[PE-303] is smaller than the value of Gain 1 [PE-302][PE-307][PE-309], it will be applied as Gain 1.

4.4.5 Setting Speed operation Variables

① Setting operation mode [PE-601] (Application Mode : PST)

: set the servo operation mode.

Operation mode	Operation method
0	Torque control operation
1	Speed control operation
2	Position control operation
3 (Note1)	MODE contact ON : Speed control operation MODE contact OFF : Position control operation
4(Note1)	MODE contact ON : Speed control operation MODE contact OFF : Torque control operation
5	MODE contact ON : Position control operation MODE contact OFF : Torque control operation

Note1) When using the operation mode 2 or 4, Surely set the Zero speed torque improvement [PE-320] to “0”.

② Speed command [PE-602]~[PE-608] (Application Mode : ST, S)

: Set the operation speed with [r/min] unit.

According to speed command input contact, speed is selected.

SPD1	SPD2	SPD3/MODE	Speed selection
X	X	X	Analog speed command
O	X	X	Digital speed command 1
X	O	X	Digital speed command 2
O	O	X	Digital speed command 3
X	X	O	Digital speed command 4
O	X	O	Digital speed command 5
X	O	O	Digital speed command 6
O	O	O	Digital speed command 7

(Note1) O : “ON”, X : “OFF”

(Note2) In case of operating mode is “3,4,5”, ‘SPD3’ is used as ‘MODE’ therefore. Digital speed command can be used within 1~3.

③ Acceleration/deceleration time (Application Mode : S)

- Acceleration time [PE-609] : set the time taken for accelerating from the stopped to rated speed of motor as [msec] unit.
- Deceleration time [PE-610] : set the time taken for stopping during operation at rated speed of motor as [msec] unit.

④ S-shape operation [PE-611] (Application Mode : S) : In order to have a smooth acceleration/ deceleration, set the acceleration/deceleration as S-shape.

"0" : Linear acceleration/deceleration operation

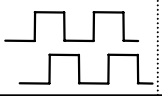
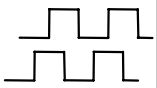
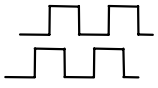
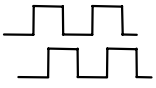
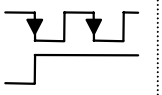
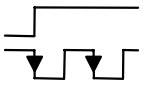
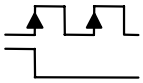
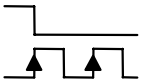
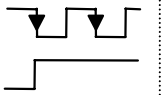
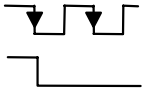
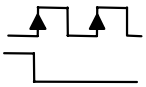
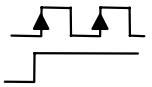
"1" : S-shape acceleration/deceleration operation

⑤ Manual test operation [PC-803] (Application Mode : PST) : Change the speed of manual test operation by pressing [Up] Key to the order of [PE-602] ~ [PE-608], then press [Right] Key for forward rotation, or press [Left] Key for reverse rotation. At this time, the state of input contact by CN1 is ignored.

⑥ Continuous test operation [PC-804] (Application Mode : PST) : Test operation is operated repeatedly from Step1 to Step4. Set operation speed([PE-612] ~ [PE-615]) and operation time ([PE-616] ~ [PE-619]) at each Step.

4.4.6 Setting Position Operation Variables

① Input pulse logic [PE-701] (Application Mode : P) : set the form of position command input pulse and rotating method for each logic.

PF +PR		N-logic			P-logic	
		Forward rotation	Reverse rotation		Forward rotation	Reverse rotation
A phase +B phase	"0"			"3"		
CCW or CW Pulse	"1"			"4"		
Pulse + direction	"2"			"5"		

② Electronic gear ratio[*PE-702]~ [*PE-709] (Application Mode : P) : Set the relation between 'position command input pulse' and 'encoder pulse' that is used at position control of motor as numerator/denominator. And it prevents error from occurring at position operation.

- Electronic gear ratio = transferred distance per input pulse × number of pulse per motor rotation/ transferred distance per motor rotation

Example) When deceleration ratio is 1/2 on 1[㎛] unit per 1 pulse, ball screw lead is 10[㎜], and encoder pulse is 3000pulse,

1) Transferred distance per input pulse = 1×10^{-3}=0.001[㎜]

2) Number of pulse per a motor rotation = encoder pulse number×4=3000×4= 12000

3) transferred distance per a motor rotation = 10 × 1/2=5[㎜]

∴ 4) electronic gear ratio = $12000\times10^{-3}/5=12/5$

Therefore, the numerator of electrical gear ratio is "12", denominator is "5".

Note1) In A, B phase encoder signal method, the signal is multiplied by 4 times and controlled. Therefore 3000 pulse encoder is 12000 pulses per a rotation.

Note2) At this time motor speed ([r/min]) is

Motor speed = 60 × electronic gear ratio × input pulse frequency / No.of pulse per a motor rotation

③ Backlash compensation [PE-710] (Application Mode : P) : Set the backlash amount that is converted to number of pulse when the location is deviated by backlash occurred at position operation.

④ Electronic gear ratio offset adjustment (Application Mode : P) : If the operation distance per 1 rotation is changed due to mechanical friction at 'position pulse command operation', adjust the changed distance caused by friction with offset and use it.

- Electronic gear ratio setting mode [PE-711]

"0" : use electronic gear ratio 0~3

"1" : use electrical gear ratio 0. And override the offset setting value to numerator of electronic gear ratio.

- Setting numerator offset of electronic gear ratio.

In above example, input the "12000" for numerator and "5000" for denominator. And on [PE-712] menu, turn "ON" the 'EGEAR1' contact, then numerator is increased by 1, on the other hand, turn "ON" the 'EGEAR2' contact, and then numerator is decreased by 1. Therefore if offset value is "2", electronic gear ratio is applied from 12000/5000 to "12002/5000". Or, if offset value is "–2", electronic gear ratio is applied from "12000/5000" to "11998/5000".

⑤ **Switching position pulse direction[*PE-713]** : Switch the operating direction of command pulse.

"0" : Operated with command pulse direction.

"1" : Operated with reverse direction of command pulse.

Chapter 5

Handling and Operating

5.1 Check Point before Operation

Improper handling of the drive may lead to unexpected accident or damage. The following are important points in operating the drive

5.1.1 Check Wiring

(1) Check if the input power is right voltage (AC200[V])

(2) Check if the connection (U,V,W GND) of drive and motor is O.K

(3) Check if control signal is correctly connected to 24[V]

(4) Check of the regenerative resistor is a correct model for the capacity and connection is O.K

(5) Check if wiring cable is not bent severely or it is under pressure

(6) Check if the GND and shield is O.K

5.1.2 Check wiring of operating signal (CN1)

Make sure that the wiring and contact state of operating signal is as below.

Pin NO.	Pin name	Contact state	Pin No.	Pin name	Contact state
18	EMG	ON	19	CWLIM	ON
47	SVON	OFF	20	CCWLIM	ON
48	STOP	OFF	13	PCON	OFF

Note) Signal name con be different by operation mode.

5.1.3 Check operating Environment

Check if there is no metal powder or moisture.

5.1.4 Check State of Machine

(1) Check if there is no problem on coupling of motor

(2) Check of there is no slackness or breakaway at joint bolt.

(3) Check of there is no obstacle on operation region.

5.1.5 Check menu variables

(1) Check if setting motor ID[PE-201] is OK

(2) Check if setting encoder [PE-204] is OK

(3) Check if control gain is set to proper value

5.2 Handling

5.2.1 Alarm Reset

- Alarm Reset : If 'ALMRST' of CN1 (Operating signal) is turned "ON", alarm is reset and it is steady state.
- Operation Menu Reset : Press [Enter] on Alarm Reset [PC-801], then "CLEAr" would be displayed, and alarm would be reset, and then it is steady state.

※ If alarm is sustained after alarm reset, check the alarm cause and operate servo after removing that cause

5.2.2 Alarm History Clear

Press [Enter] on the alarm history clear menu [PC-802], than "CLEAr" would be displayed, and alarm history is cleared.

(Note) Alarm history information is saved from the alarm occurred the very recently upto total 20 of alarm history [PA-101]~[PA-120] is regular sequence

5.2.3 Menu Initialization

When pressing [Up]key right after [Enter]key from the menu[PC-809], all the data of variables are to be changed to the initial value of Ex-factory status except from the variables [PE-201]~[PE-220] that are related to the system.

(Note) Surely Power OFF before the data is changed to the initial value.

5.2.4 Prohibiting Menu handling

Press [Enter] on the [PC-810] menu, then "Lock" is displayed and "Err3" is displayed at handling menu data and then operation is prohibited. For canceling this, go back to the [PC-810] menu, and press [Enter]again, then "unLock" is displayed and Lock setting is cancelled.

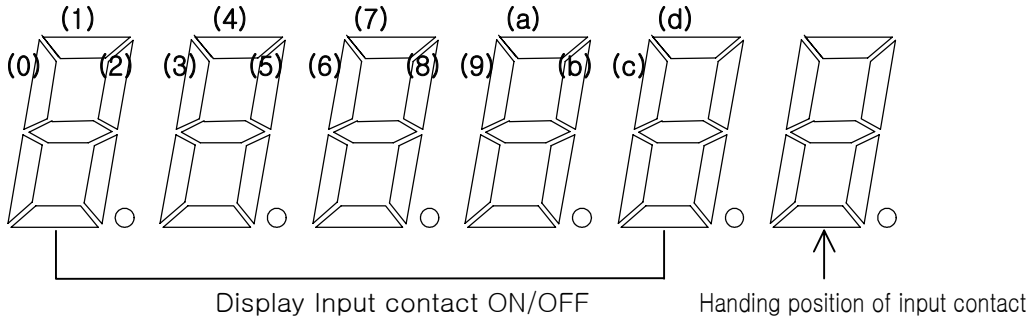
5.2.5 Absolute Encoder Reset

Press [Enter] on the [PC-811] menu, then "reset" is displayed for 5 seconds, and multi turn data and other error information of absolute encoder is cleared.

(Note) It is available only if wiring of absolute encoder is O.K

5.2.6 Setting Input Contact logic

Press [Enter] on [PC-807] menu, then



NO	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Name of contact	SVON	SPD1/ EGEAR1	SPD2/ EGEAR2	SPD3/ MODE	DIR	PCON	CCW LIM	CWLIM	TLIMIT	EMG

NO	(a)	(b)	(c)	(d)
Name of contact	STOP	ALMRST	GAIN2	PCLEAR

is displayed.

No. is selected by handling [Left] and [Right] key.

Press [Up] key, and Lamp on the location of No. is to be turned ON/OFF.

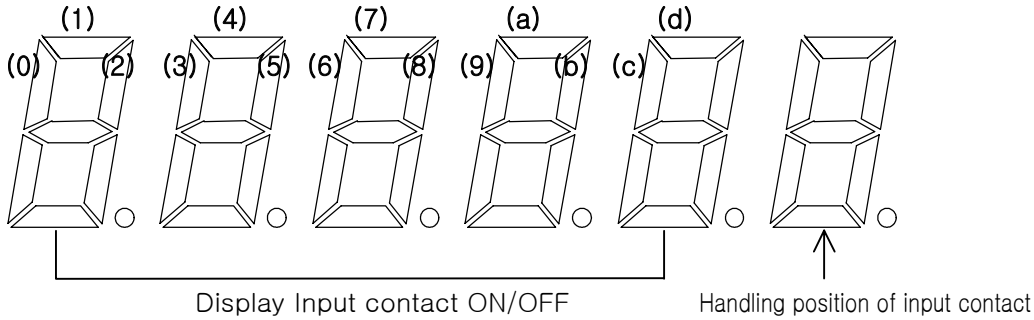
· ON : CN1 Control signal is operated by Normal B contact

· OFF : CN2 Control signal is operated by Normal A contact

Note) Even if the power on /off is repeated, the status of all the input contacts that is set are to be remained same.

5.2.7 Compulsory Handing Input Contact

Press [Enter] on [PC-808] menu, then



No	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Name of contact	SVON	SPD1/ EGEAR1	SPD2/ EGEAR2	SPD3/ MODE	DIR	PCON	CCW LIM	CWLIM	TLIMIT	EMG

No	(a)	(b)	(c)	(d)
Name of contact	STOP	ALMRST	GAIN2	PCLEAR

is displayed.

NO. is selected by handling [Left] and [Right] key.

Press [UP] key, and Lamp on the location of No. is to be turned ON/OFF.

· ON : ON state of the contact.

· OFF : OFF state of the contact.

Note) When the power is on/off, the status of all the contacts that are set is to be returned to the initial status(No.6,7 & 9 : on, Others : off) automatically.

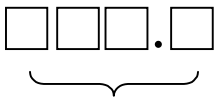
※ CN1 Operating signal and Compulsory handling of input contact is operated by OR logic

CN1 operating signal	Input contact Compulsory signal	Operating
OFF	OFF	OFF
ON	OFF	ON
OFF	ON	ON
ON	ON	ON

5.3 Adjustment

5.3.1 Gain Tuning

Press [Enter] on the menu[PC-805], and followings are displayed then Automatic gain tuning operation can be conducted.



① Inertia ratio range is automatically changed from 1 to 50.
② When pressing [Up] key, the Auto gain tuning operation is started with the operation speed 100[r/min].
③ When keep pressing [Up] key, the operation speed is increased 100->300 ->500[r/min]. Increased by 200[r/min]. Tuning time is quicker as per the speed.
④ When pressing [Right] key, the operating distance is increased. but, when pressing [Left] key, the operating distance is decreased.
⑤ If the tuning value is fixed and not changed, the tuning is completed.
⑥ If the inertia that was tuned reached "50", customers are requested to ask our technical dept. and set it by manual.
⑦ Press [Enter] key and the gain that was tuned are saved at [PE-301].[PE-307],[PE-309] automatically and returned to the menu.

Or Keep pressing [Enter]key on the menu[PC-805] and doing operation/stop or forward/reverse operation by contacts. Then the inertia ratio can continuously adjusted during the operation.

5.3.2 Current Offset Tuning

- Compensate offset of current sensor in servo drive. Wrong compensation lead to unstable control of servo.
- This offset value is already adjusted at ex-factory. If possible, do not adjust it.
- If downloads done for Software Upgrade or change, surely set the offset.
- Offset adjustment.

① Turn "ON" the servo.
② Turn "On" servo and operate 'operation/stop' or 'forward rotation/reverse rotation' for approximately 10 seconds at low speed.
③ Turn "OFF" the servo, and turn "ON' servo again.
④ press [Enter] on the [PC-812] menu, then offset value is displayed.
⑤ Press [Up]key for saving offset value
⑥ Repeat ②~⑤(about 5 times)
⑦ Every time when you press the [Left]key, the offset value of U phase current is displayed by the saved value and tuning value alternately, and everytime when you press the [Right]key, the offset value of W phase current is displayed by the saved value and tuning value alternately.
⑧ Press [Enter], then go back to the menu screen

5.4 Test Operation

5.4.1 Manual Test Operation

① Press [Enter] on the [PC-803] menu

② All alarm is cancelled, test operation speed is displayed, and servo is on the state of operation. At this time if alarm is not cancelled, check the wiring of servo or the other causes of alarm occurred, and retry.

③ Press [Up] key, then test operation speed is changed.
Test operation speed is displayed at [PE-602]~[PE-608] in regular sequence.

④ Press [Left] key, then current speed would be displayed, and motor is rotated reversal.

⑤ Press [Enter] key, then test operation is completed, and back to the menu screen.

⑥ Press [Enter] Key, then test operation is completed, and go back to the menu screen.

5.4.2 Continuous Test operation

① Press [Enter] on the [PC-804] menu.

② All alarm is cancelled, test operation speed is displayed, and servo is on state of operation. At this time if alarm is not cancelled, check the wiring of servo or the other causes of alarm occurred. And retry.

③ When operation step is continuously operated by repeating 4 steps (0~3), the operation speed and time is set by following menu.

Step	Speed	Time
0	[PE-612]	[PE-616]
1	[PE-613]	[PE-617]
2	[PE-614]	[PE-618]
3	[PE-615]	[PE-619]

5.4.3 Operation at Z position

① Press [Enter] on the [PC-806]

② All alarm is cancelled, and motor is rotated to Z phase position

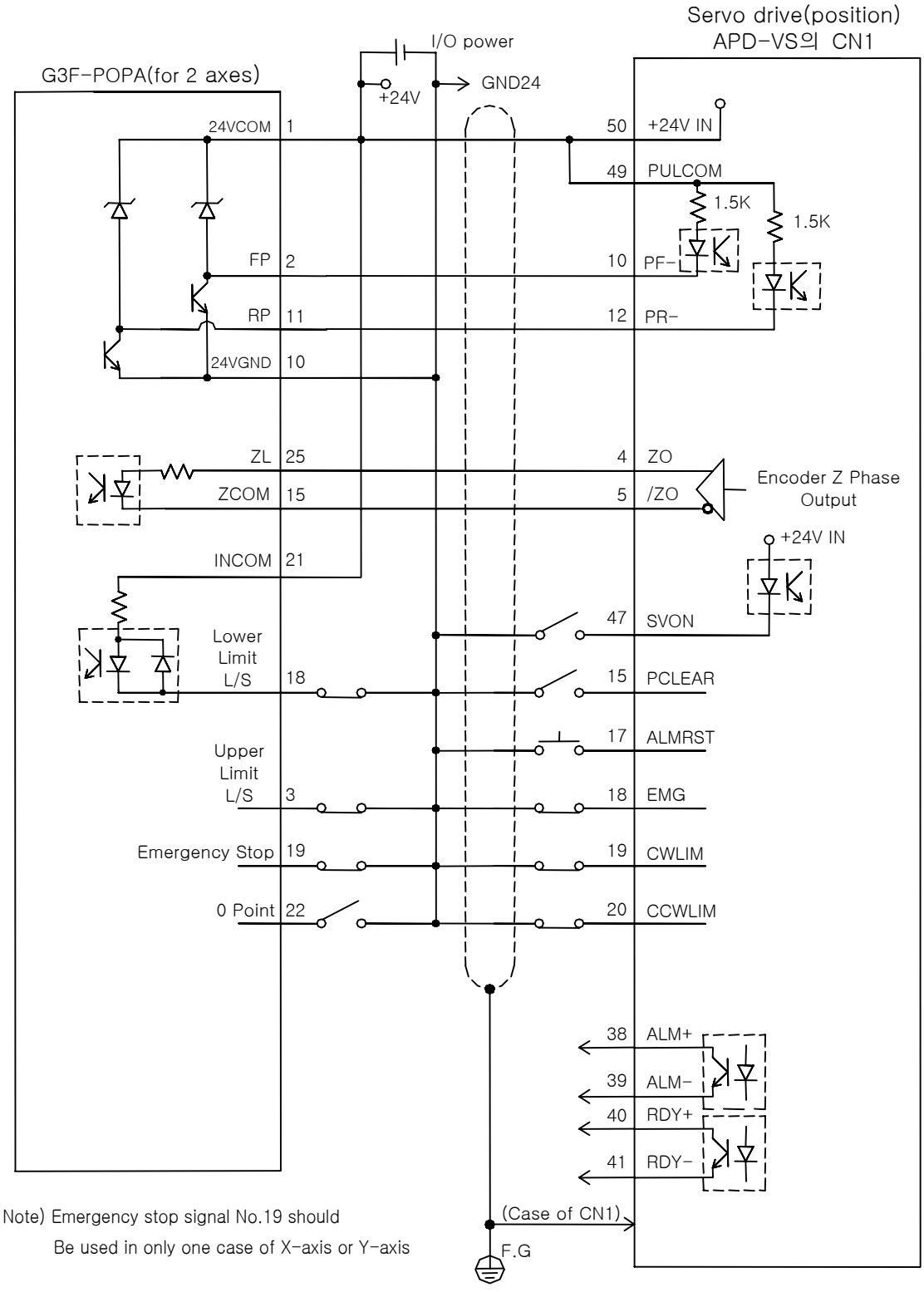
③ Press [Enter], then go back to menu.

※ This function is convenient to assemble it with a certain standard for finding Z phase position at assembling machinery.

5.5 Example of connecting to upper controller.

①The following diagram shows an example of connecting to the Unit G3F-POPA

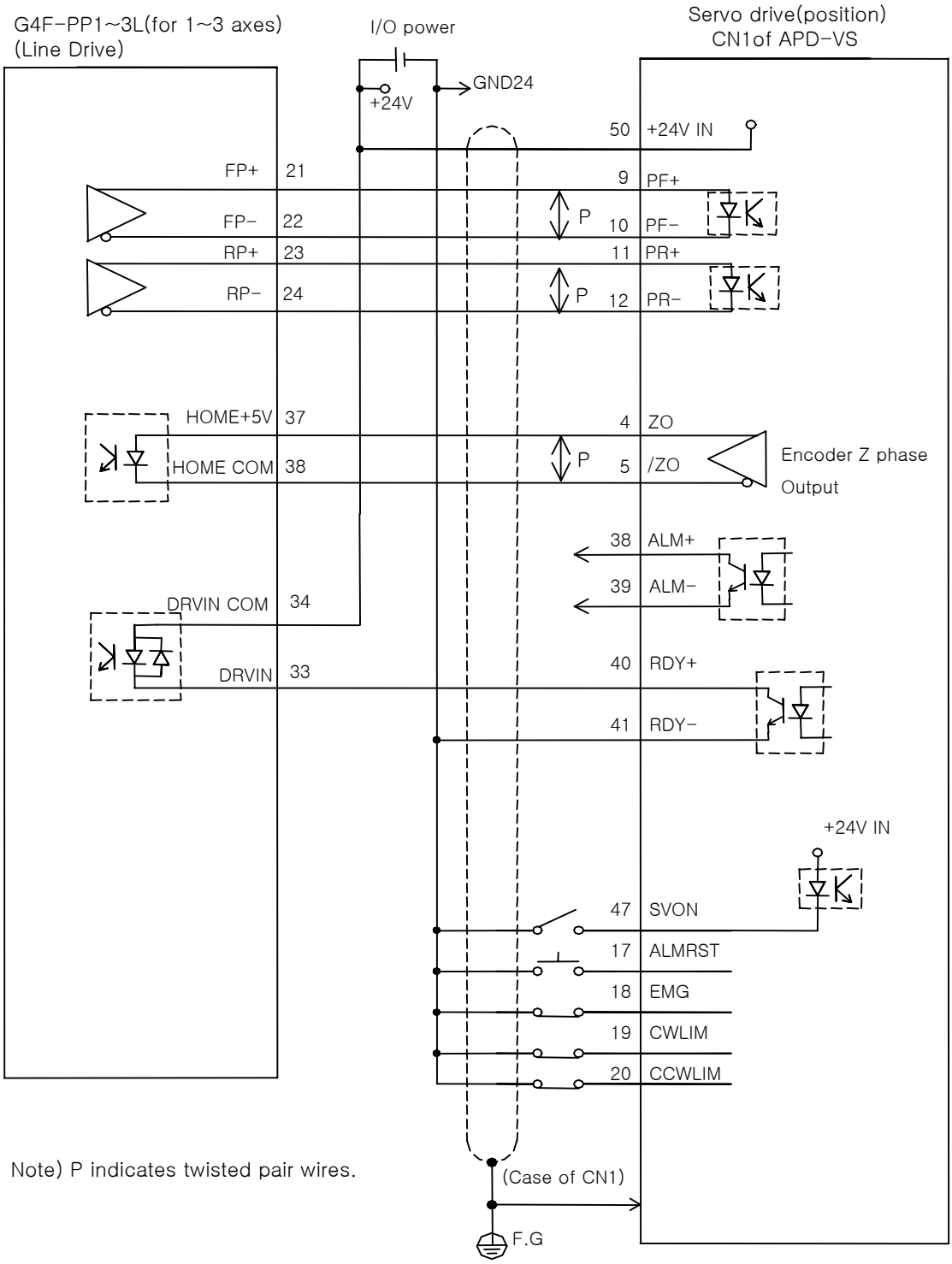
(Position Control for 2 axes) of GLODFA PLC GM3 Series (Made by LG Industrial systems)



Note) Emergency stop signal No.19 should
Be used in only one case of X-axis or Y-axis

② The following diagram shows an example of connecting to Unit G4F-PP1~3L

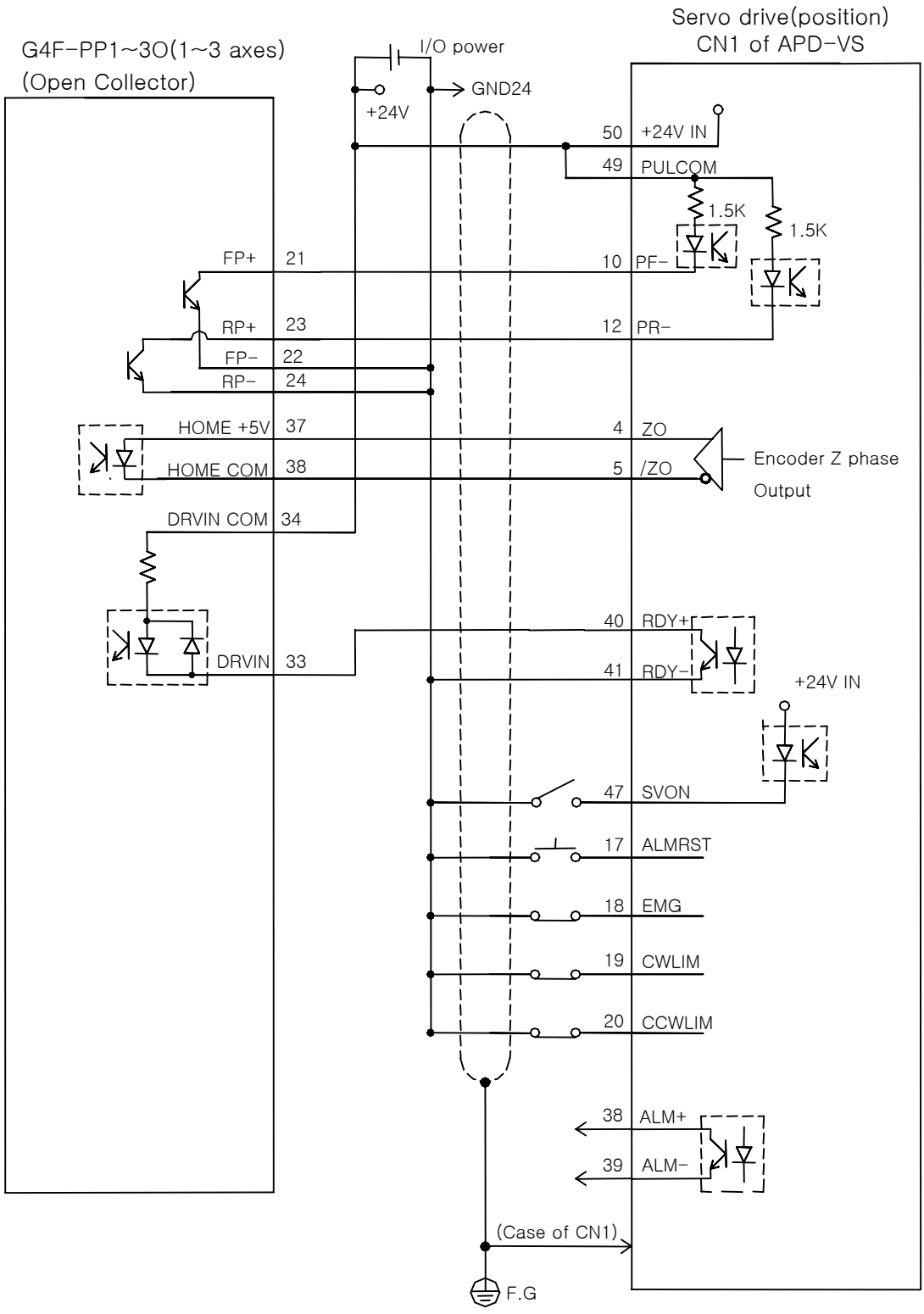
(Position Control for 1~3 axes) of GLOFA PLC GM4 Series(Made by LG Industrial Systems)



Note) P indicates twisted pair wires.

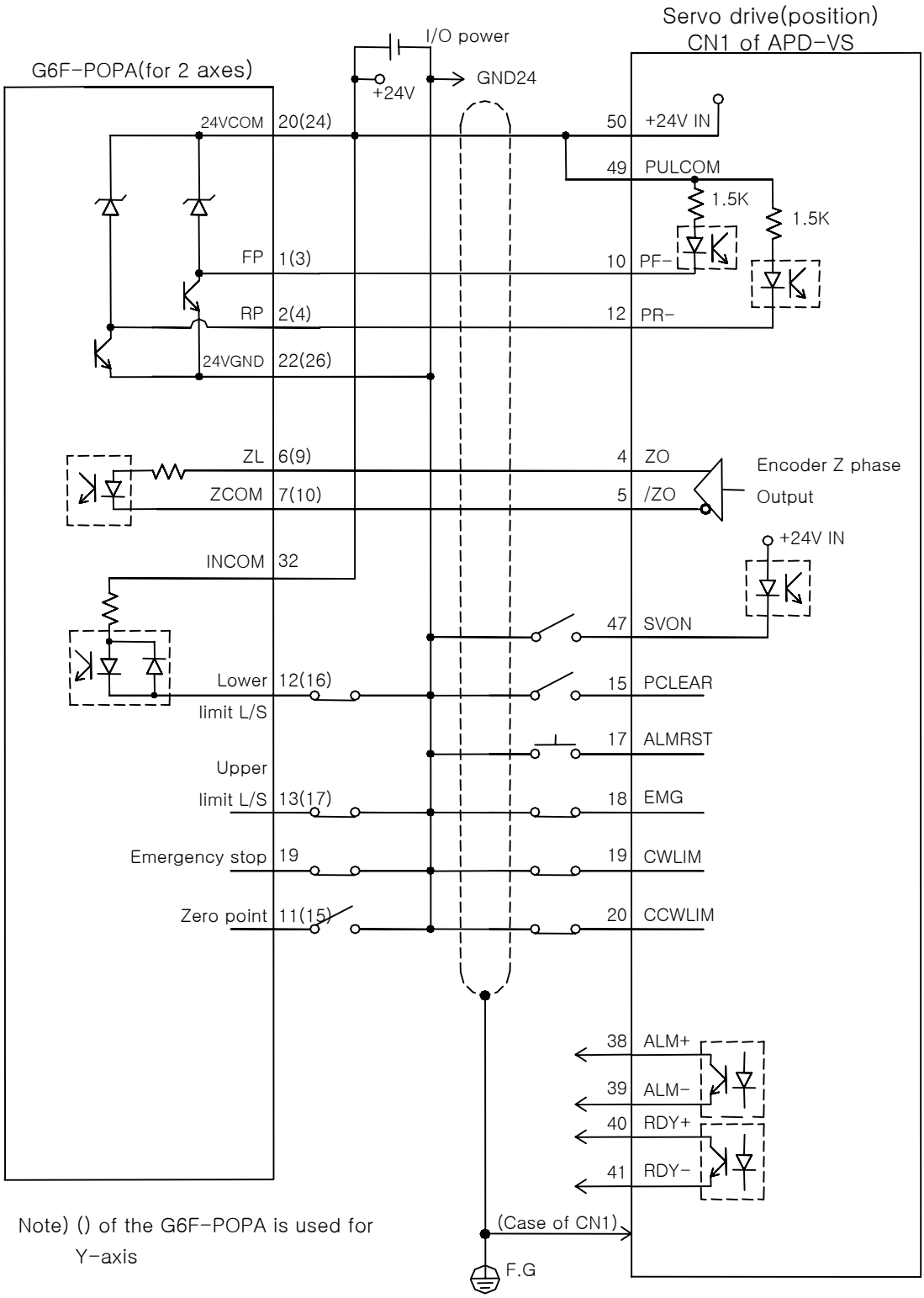
③ The following diagram shows an example of connecting to the Unit G4F-PP1~3O

(Position Control for 1~3 axes) of GLOFA PLC GM4 Series(Made by LG Industrial Systems)



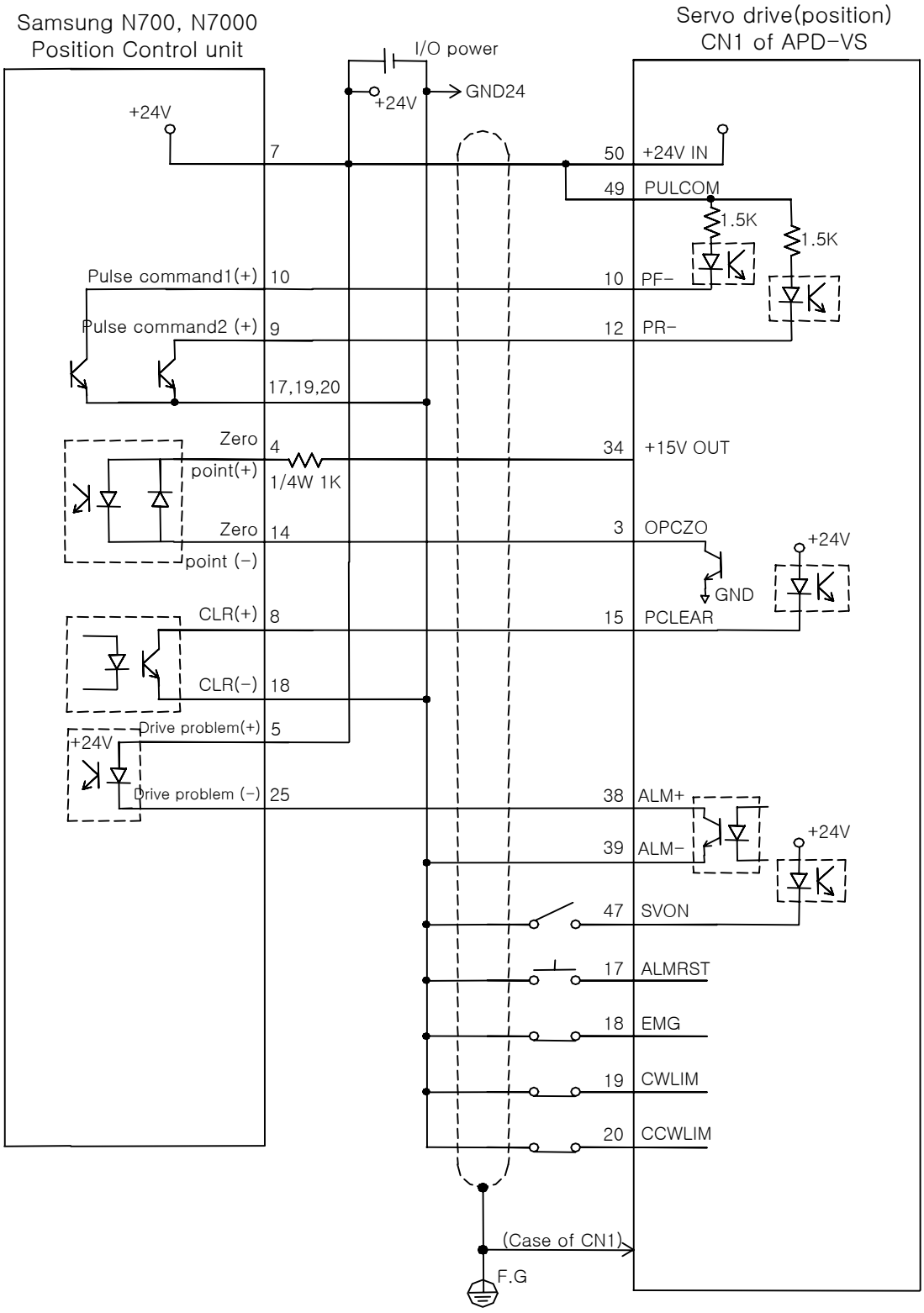
④ The following diagram shows an example of connecting to the Unit G6F-POPA

(Position Control for 2axes) of GLOFA PLC GM6 Series(Made by LG Industrial Systems)

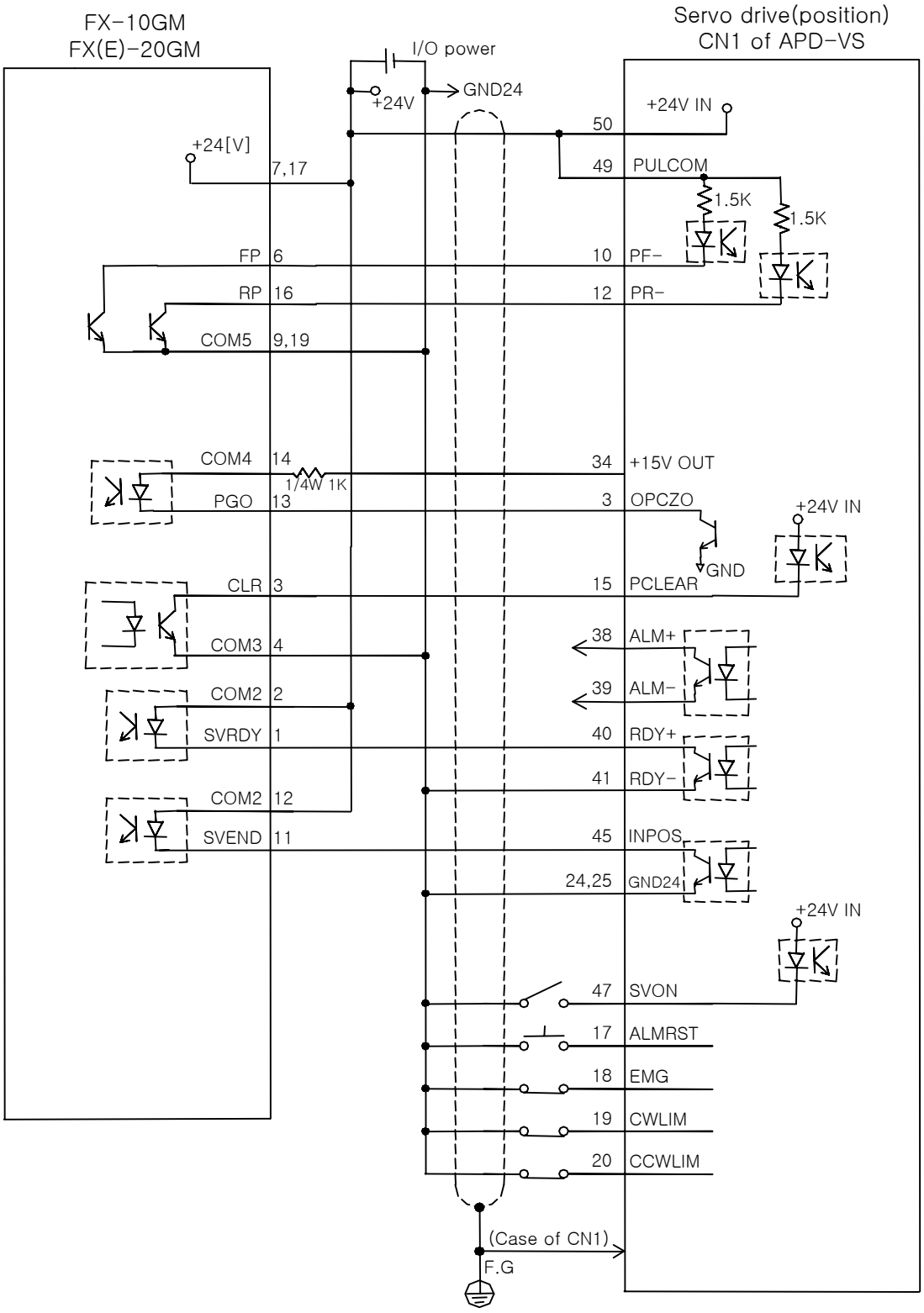


Note) () of the G6F-POPA is used for Y-axis

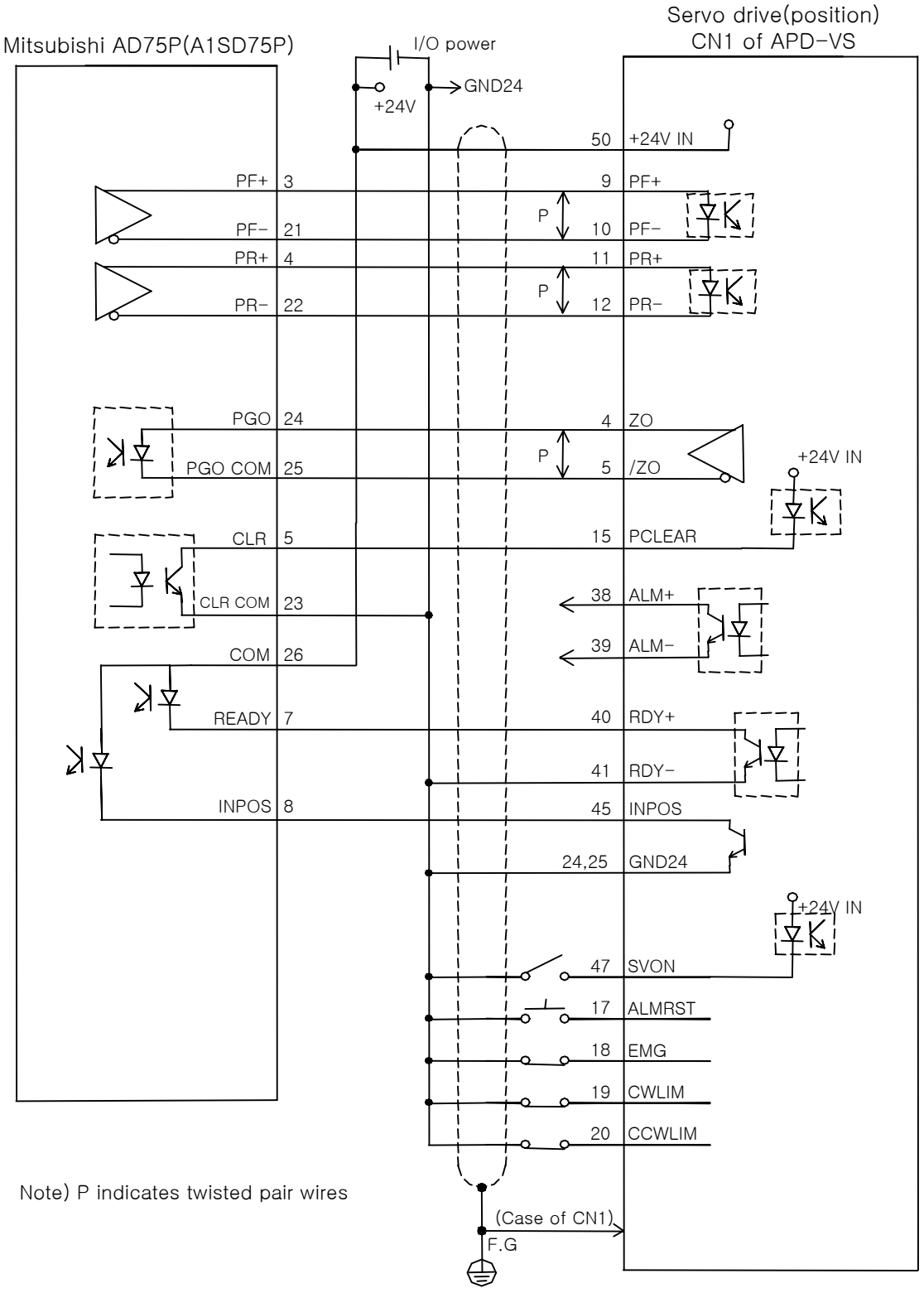
⑤ The following diagram shows an example of connecting to the Position Control Unit for SAMSUNG PLC N700, N7000.



⑥ The following diagram shows an example of connecting to the MITSUBISHI FX-10GM, FX(E)-20GM Position Unit

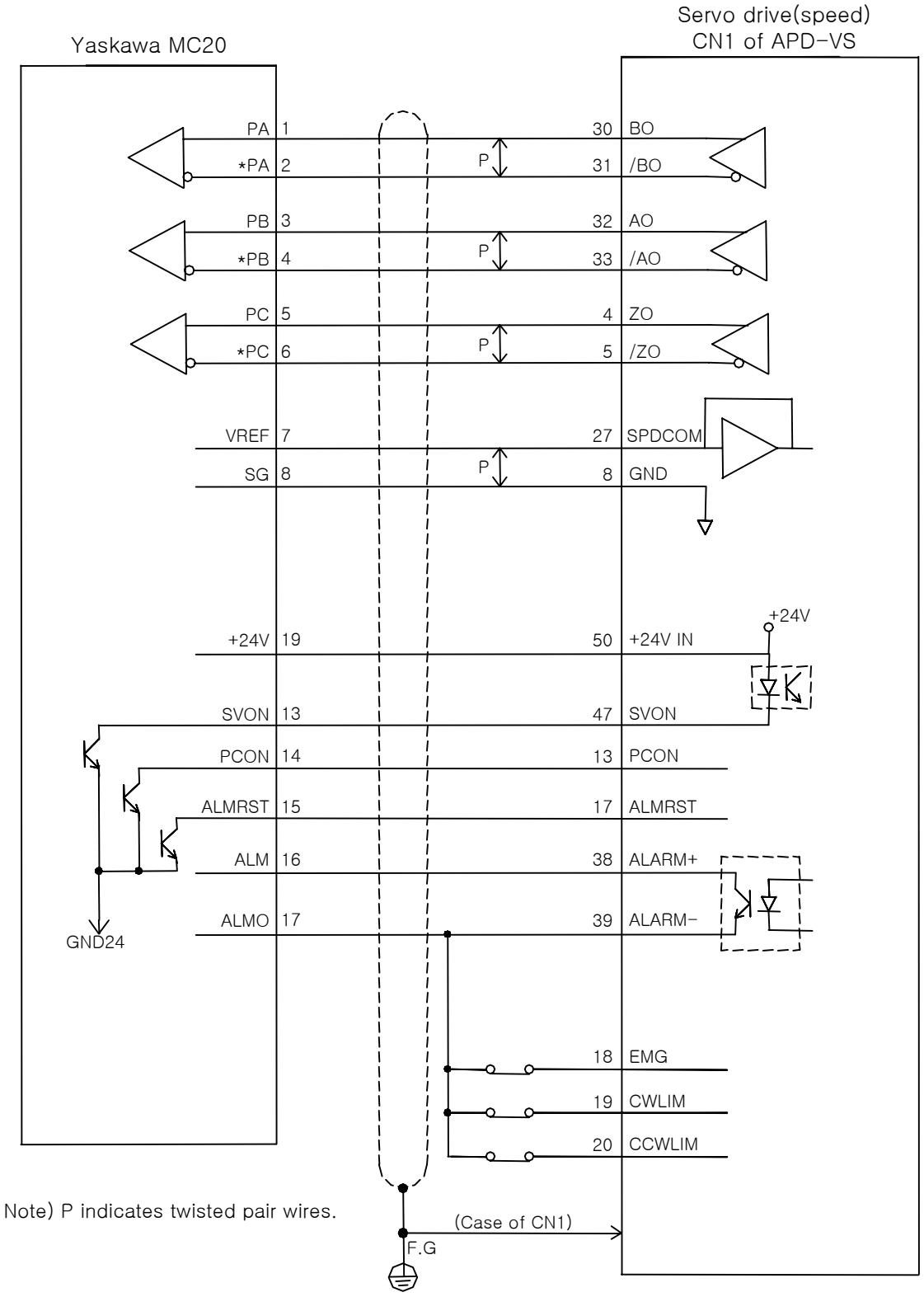


⑦ The following diagram shows an example of connecting to the MITSUBISHI AP75P (A1SD75P) Positioning Unit.



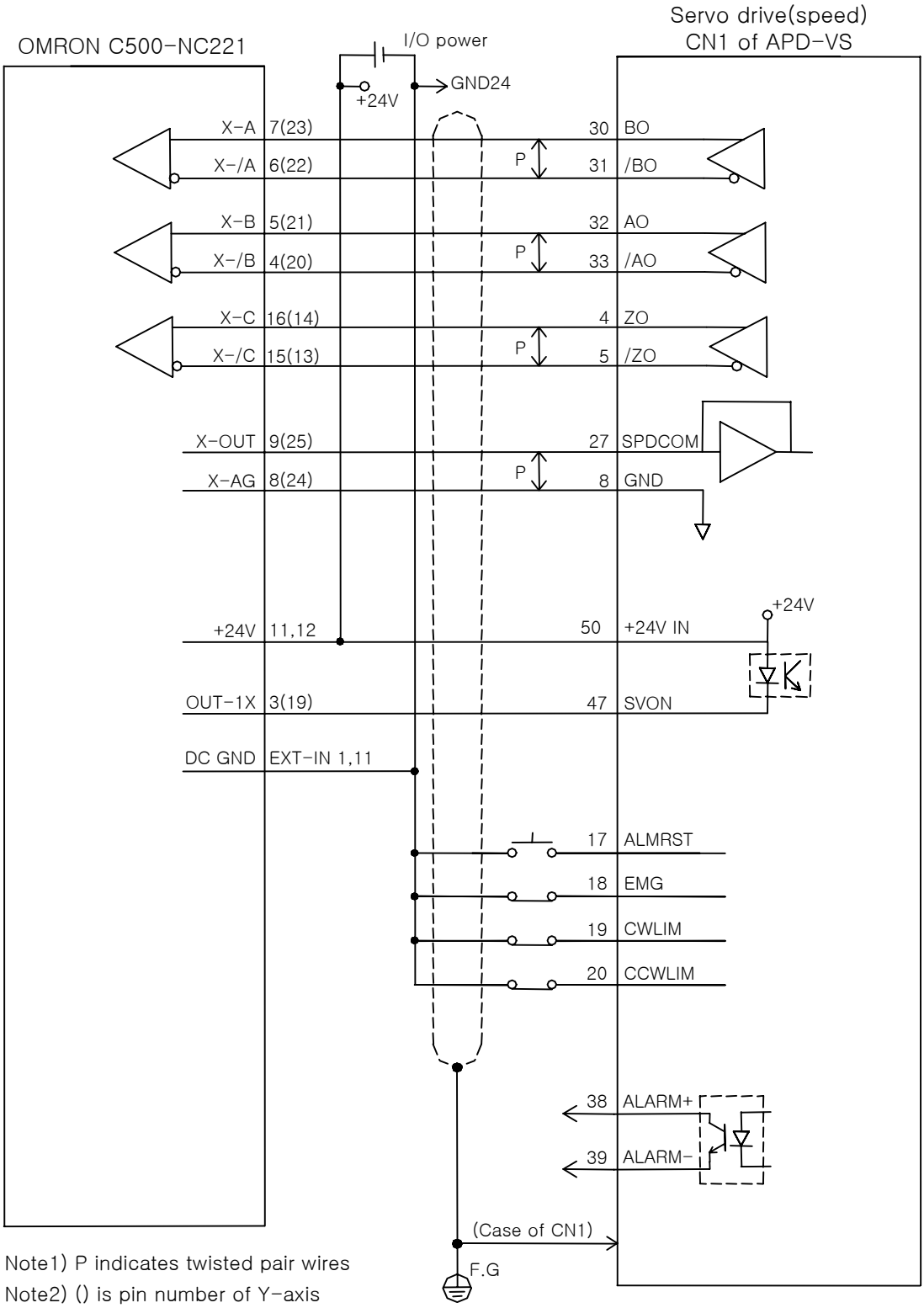
Note) P indicates twisted pair wires

⑧ The following diagram shows an example of connecting to the YASKAWA GL- series MC20 Motion Unit.



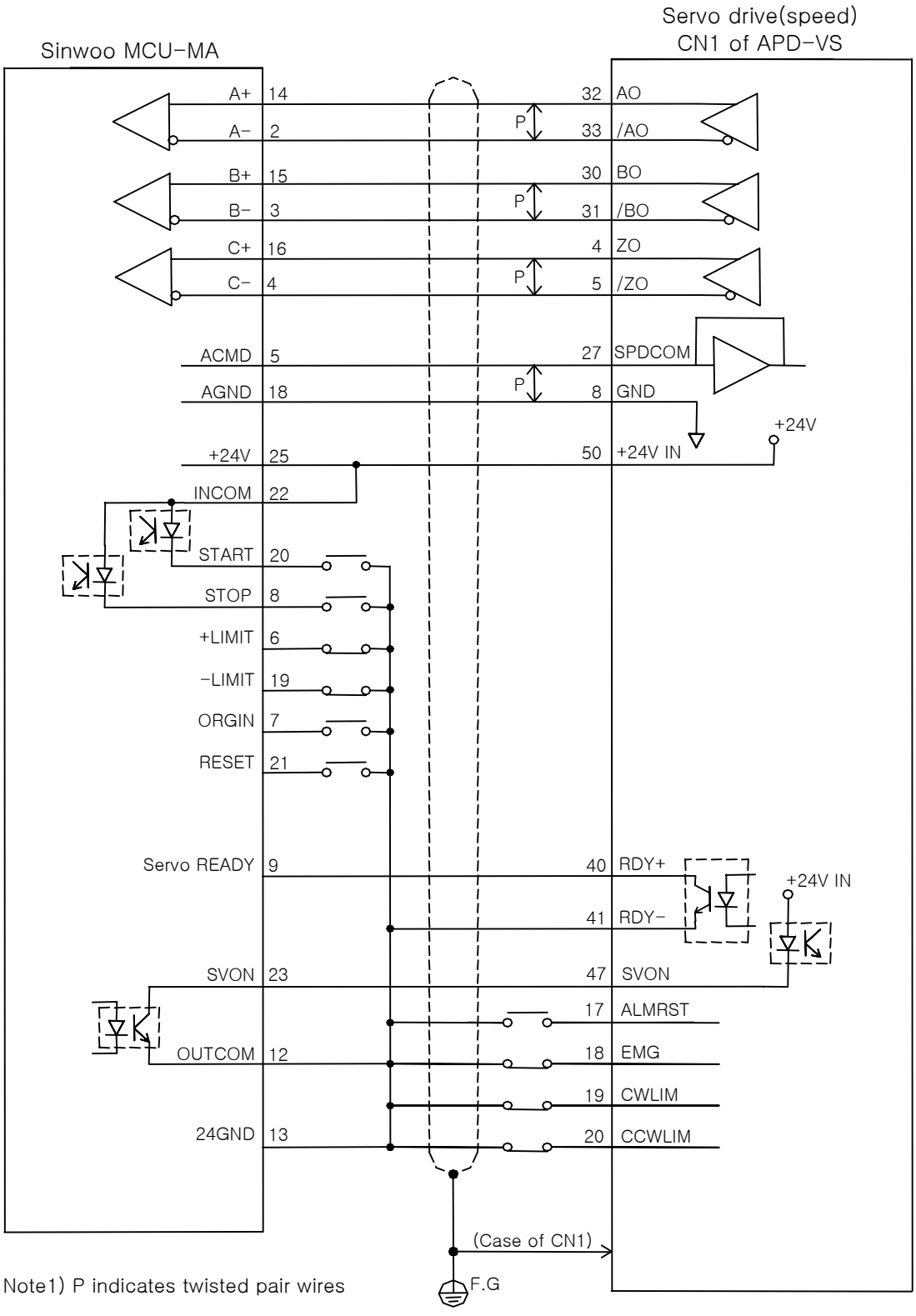
Note) P indicates twisted pair wires.

⑨ The following diagram shows an example of connecting to the OMPON's C500-NC221 Position Control Unit.



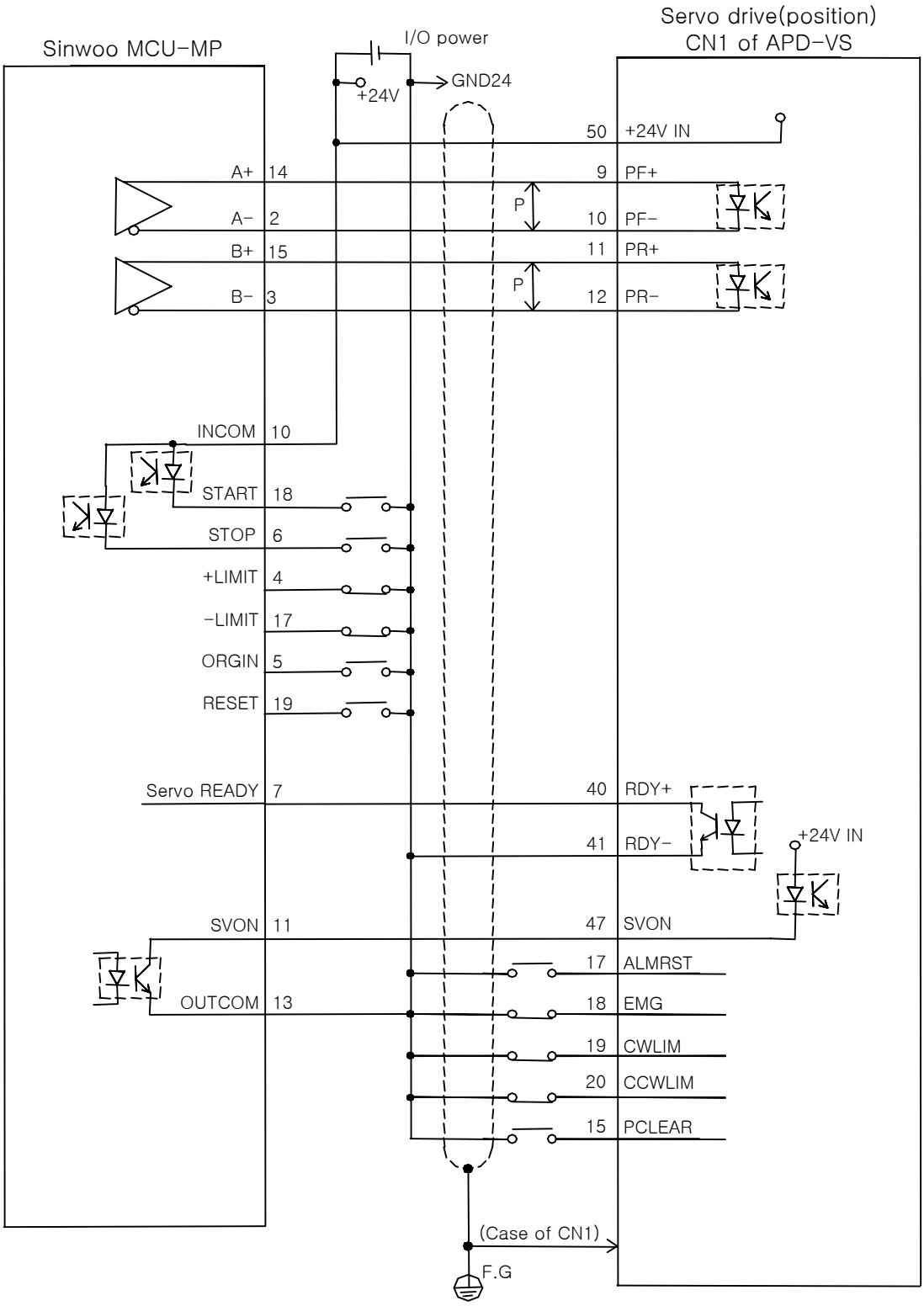
Note1) P indicates twisted pair wires
Note2) () is pin number of Y-axis

⑩ The following diagram shows an example of connecting to the SINWOO AUTOMATION TECH's MCU-MA Motion Unit.

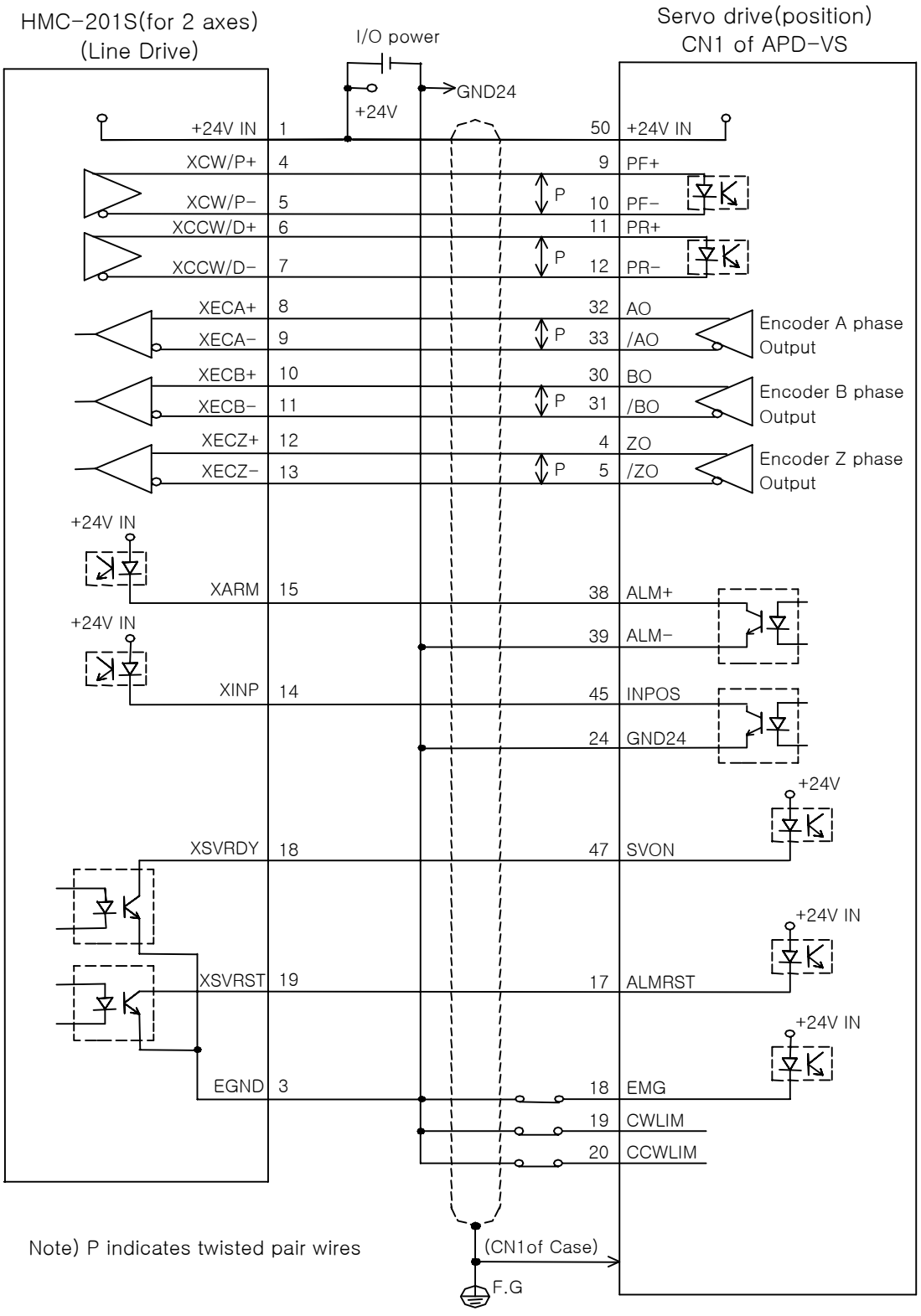


Note1) P indicates twisted pair wires

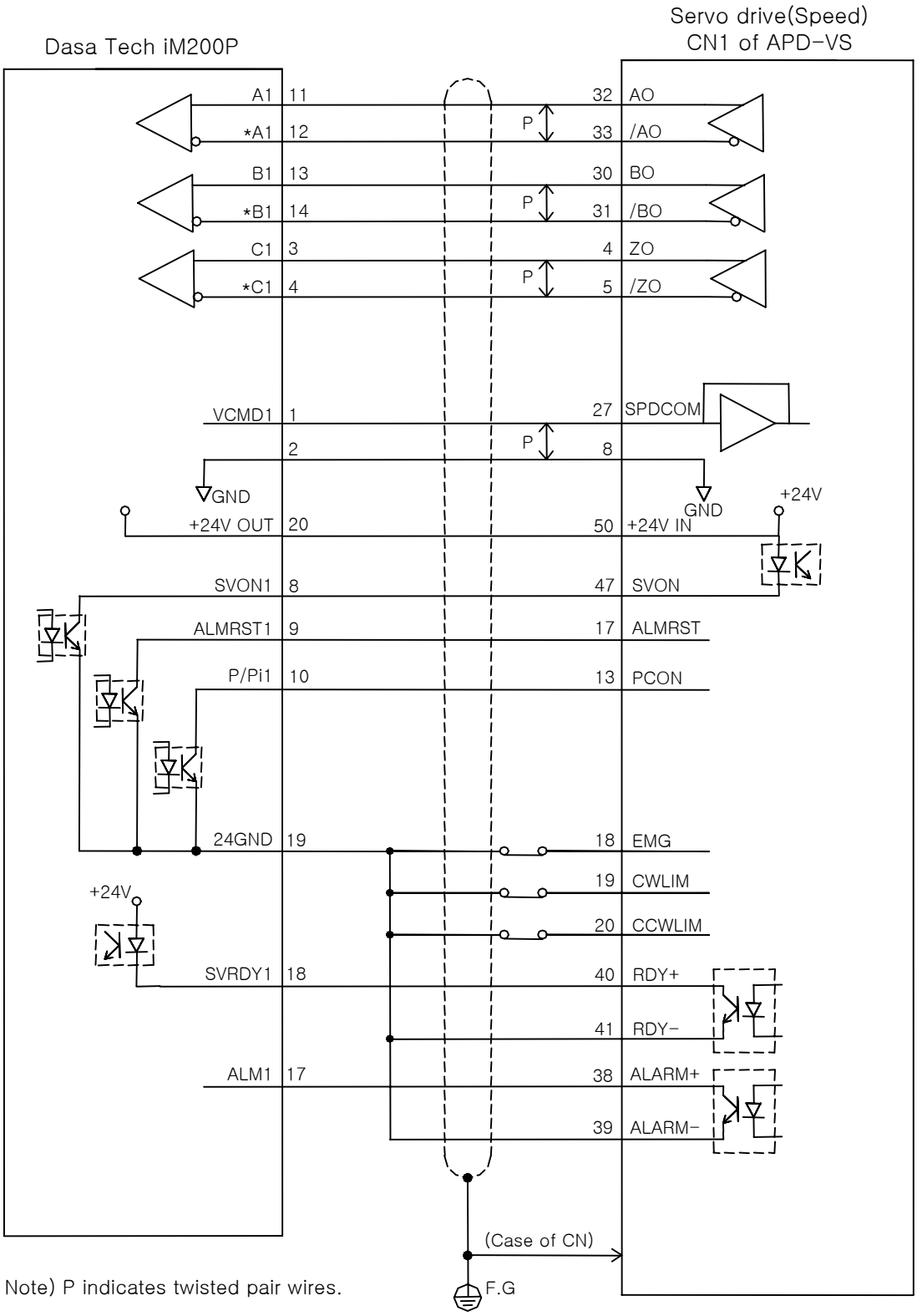
⑪ The following diagram shows an example of connecting to the SINWOO AUTOMATION TECH's MCU-MP Motion Unit.



⑫ The following diagram shows an ezample of connecting to HANMI's - 2 AXIS Motion Controller HMC-201S

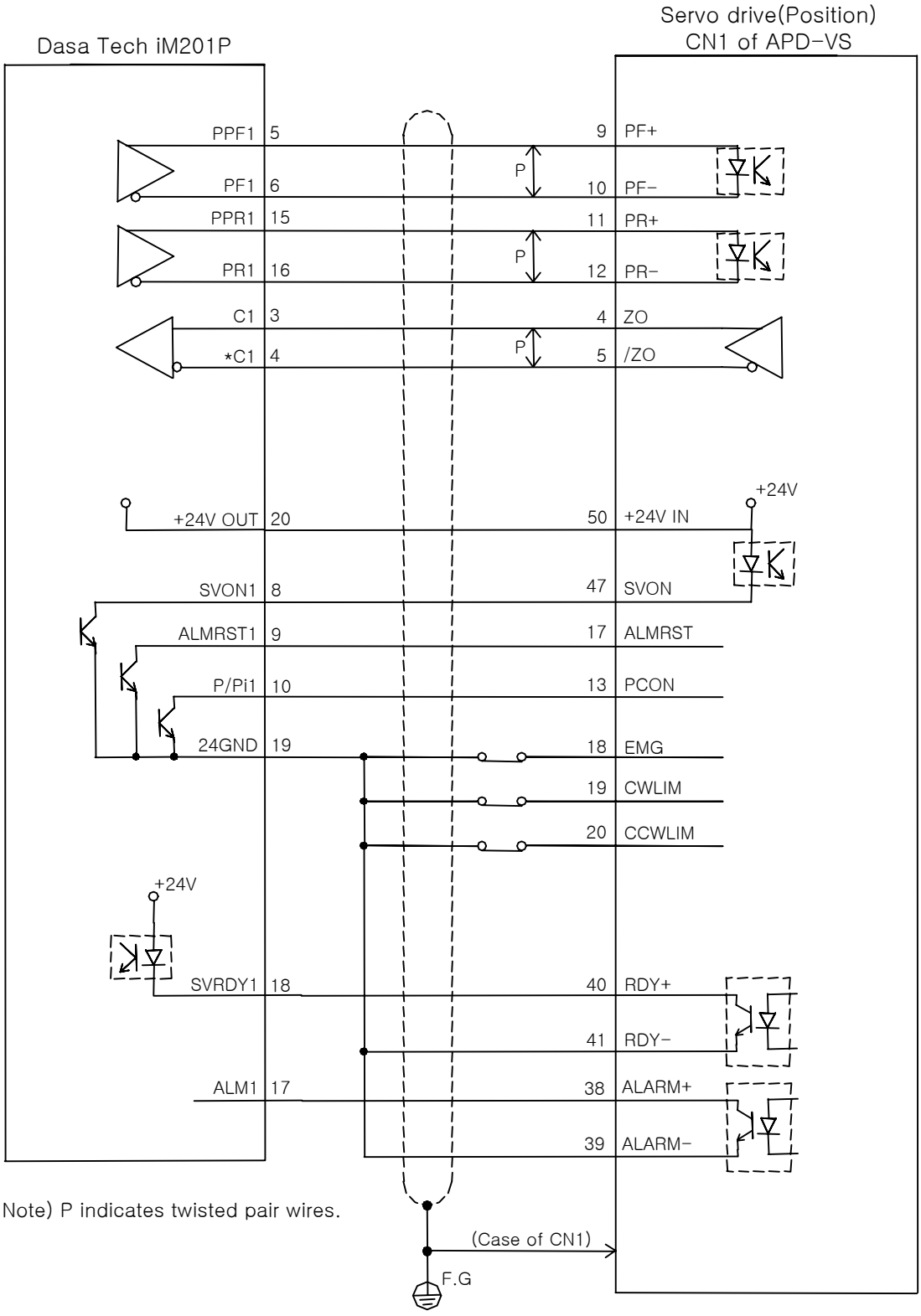


⑬ The following diagram shows an example of connecting to the DASA TECH's iM200P Motion Controller.



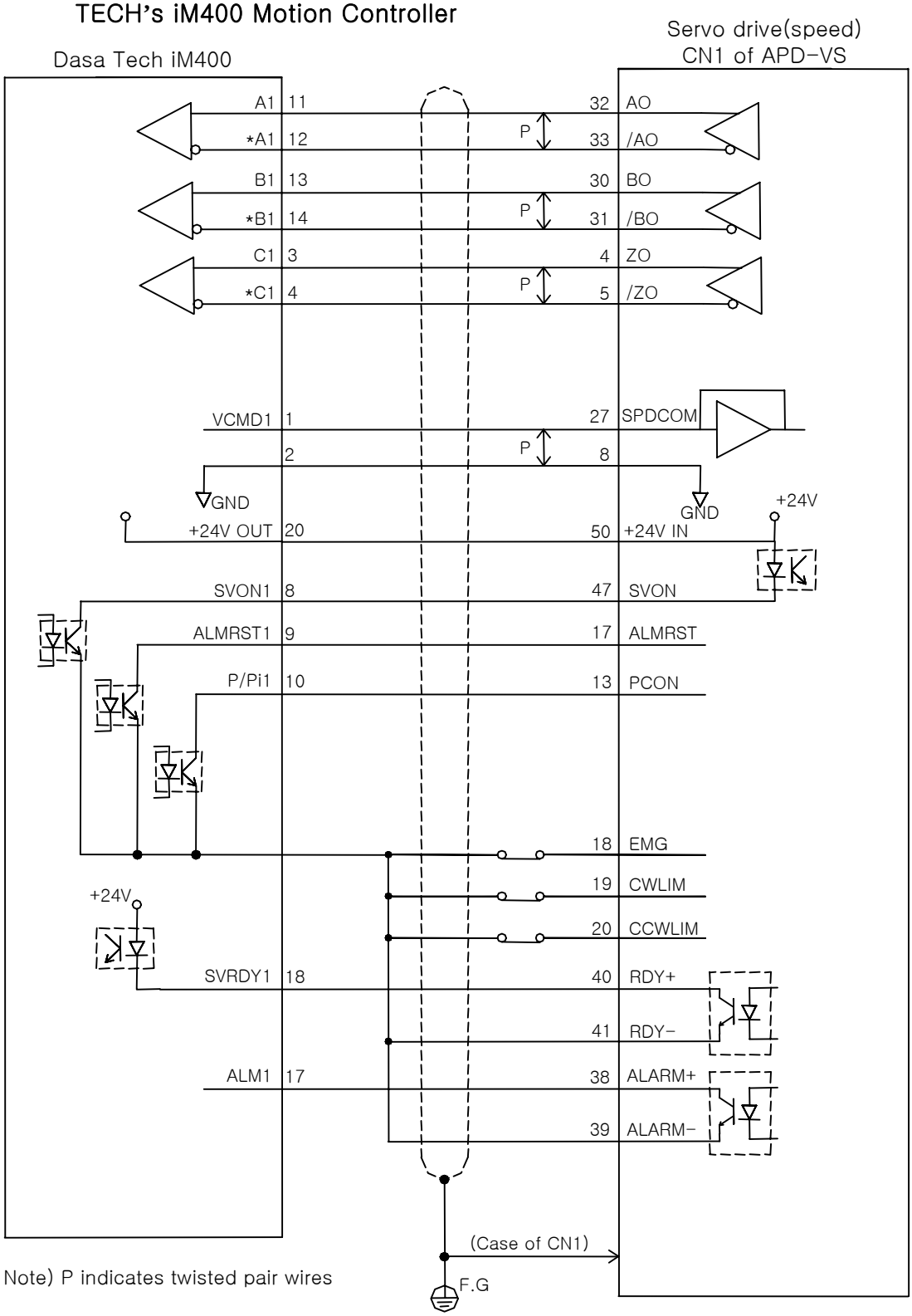
Note) P indicates twisted pair wires.

⑭ The following diagram shows an example of connecting to the DASA TECH's iM201P Motion Controller.



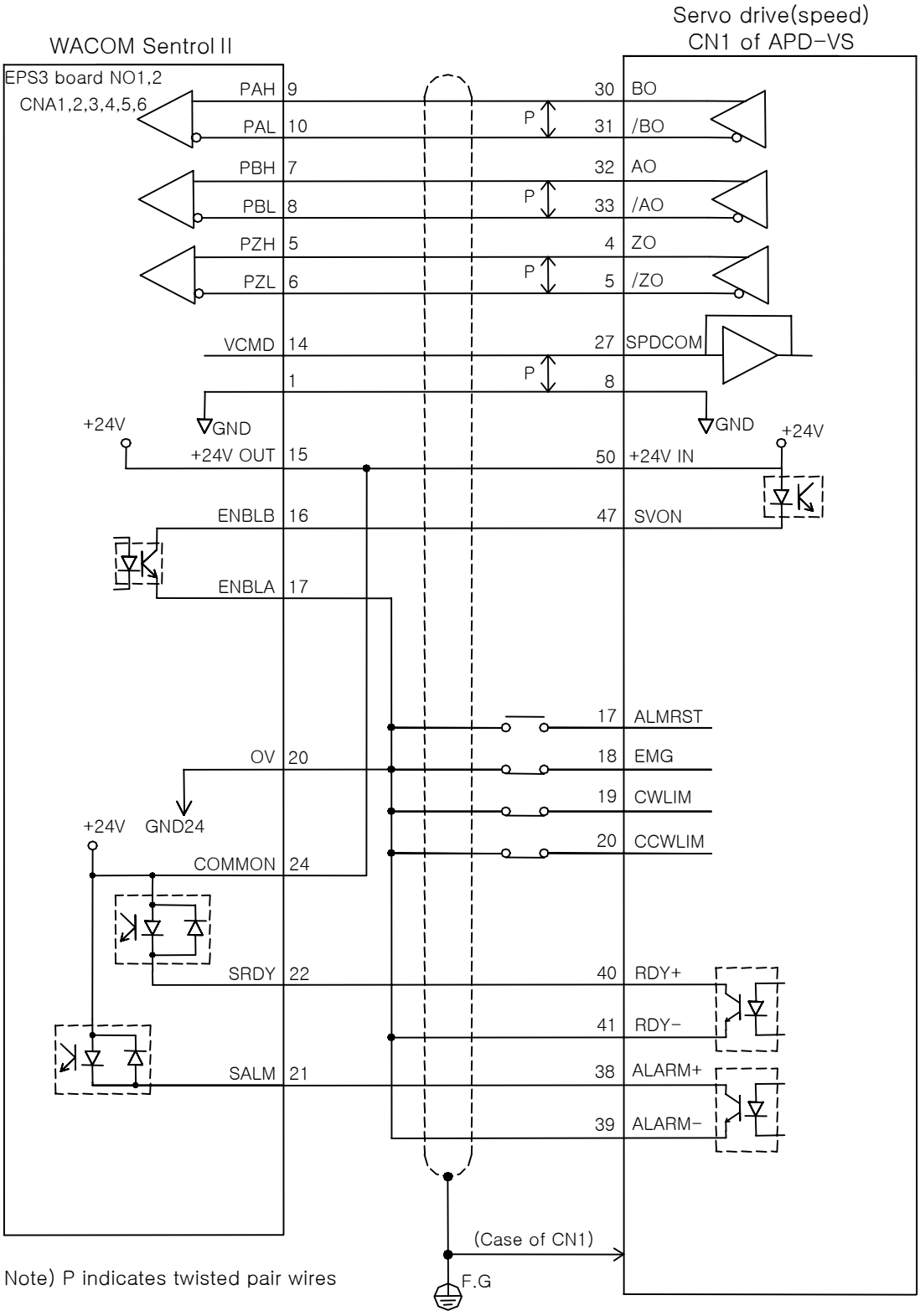
Note) P indicates twisted pair wires.

⑮ The following diagram shows an example of connecting to the DASA TECH's iM400 Motion Controller



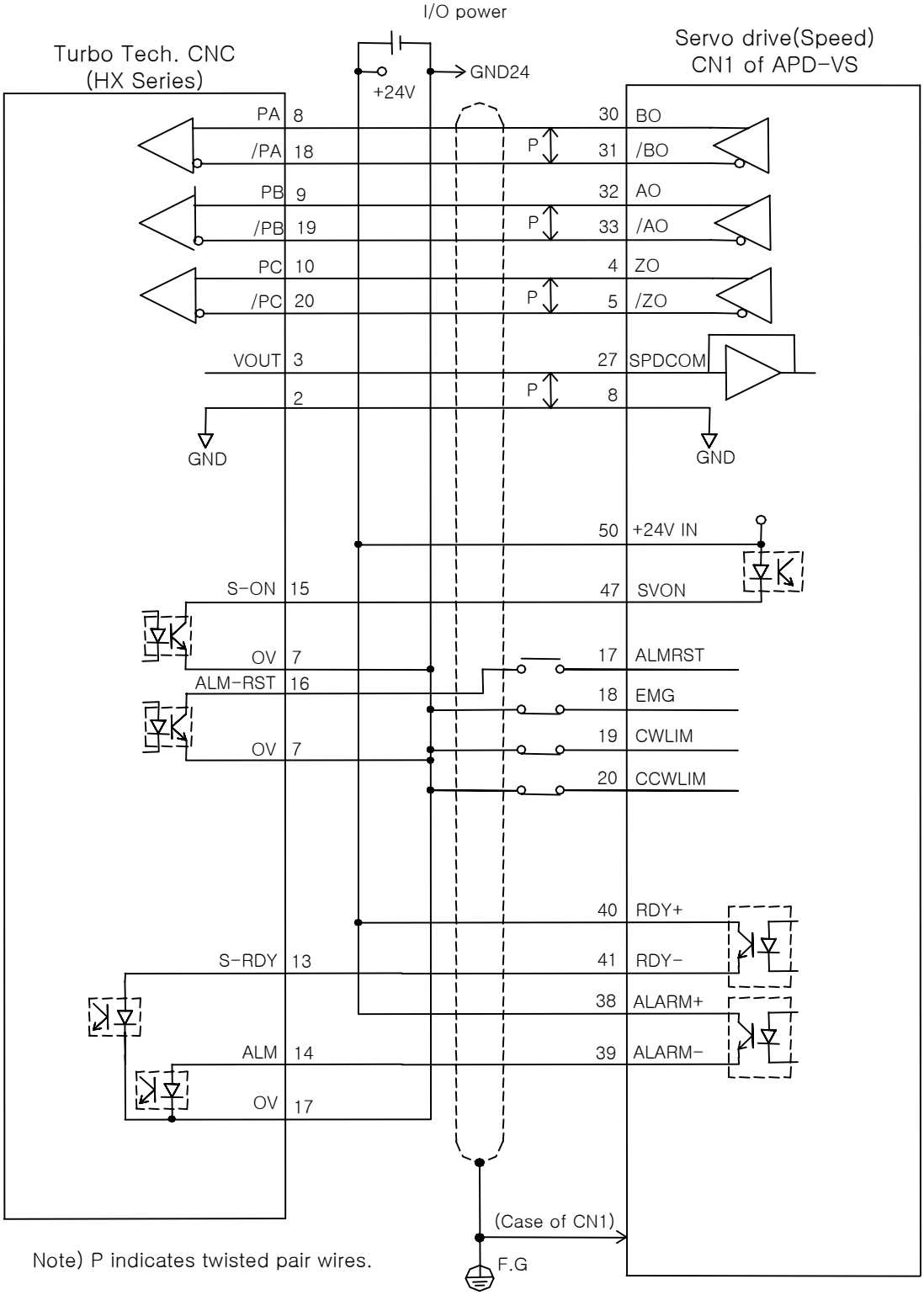
Note) P indicates twisted pair wires

(16) The following diagram shows an example of connecting to the WACOM's CNC Sentrol II



Note) P indicates twisted pair wires

(17) The following diagram shows an example of connecting to the TURBO TECH's CNC(HX Series)



Note) P indicates twisted pair wires.

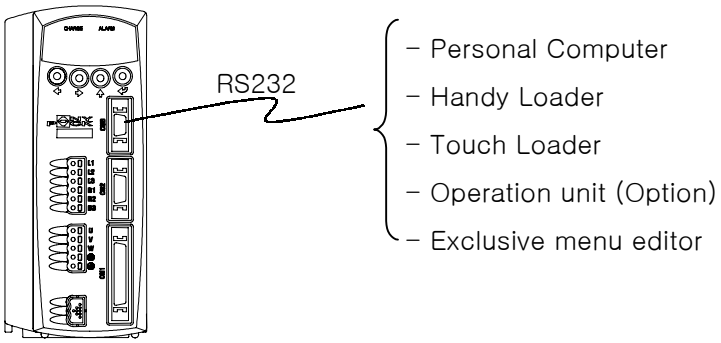
Chapter 6

Communication Protocol[Ver3.1]

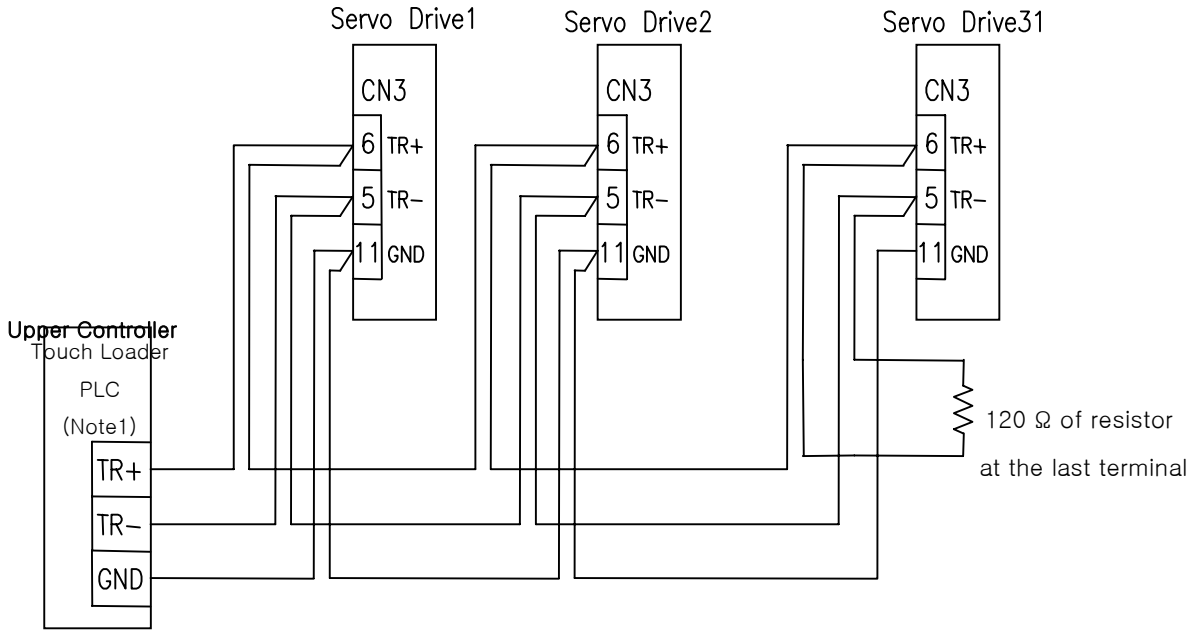
6.1 The Outline and Communication Specification

6.1.1 Outiline

1) Serial communication connection through RS232



2) Multi communication connection through RS485 (Max. 31 machines)



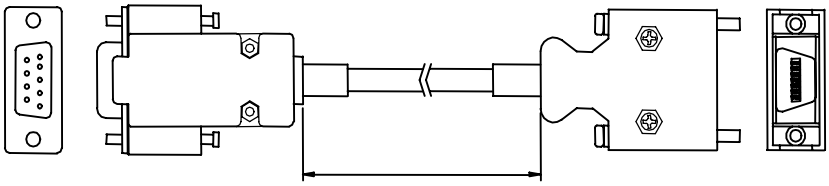
(Note1) In case of using PC as upper controller, RS232/RS485 communication converter should be applied.

6.1.2 Communication Specification & Cable Connection

1) Communication Specification

Item		Specification
Communication type		RS-232C standard
Data type	Data bit	8bit
	Stop bit	1bit
	Parity	None
Synchronous type		Non-synchronous type
Transmission speed		9600 /19200/38400/57600 bps [PE-202] selectable
Transmission length		Max. 15[M]
Consumed current		Less than 100[㎃]

2) Cable Connection



[PC- Serial Port] [Servo drive- CN3]

contents	PC-Serial Port	Servo drive-CN3
Connector name	HDEB-9S	10114-3000VE
Name of case	3600-09-G-L	10314-52A0-008
wiring	No. 2(RXD)	No. 6(TXD)
	No. 3(TXD)	No. 5(RXD)
	No. 5(GND)	No. 11,12(GND)
	Do not connect	Case(Shield)
Cable length	1,2,3,5[m]	

※ Be sure to use Twist pair shield cable as communication cable.
In case of using wrong cable, communication problem and malfunction may be occurred by noise.

6.2 Basic Structure of Communication Protocol

Communication Protocol is a kind of agreement that consists of transmitting/receiving data with a certain form in data communication. And it is made up with a frame structure including Segment, Synchronized control code, Error detecting parity, etc.

6.2.1 Frame type

ENQ	Station No.	Command	Data	EOT	BCC	<- [Request]

[Response] - >	ACK or NAK	Station No.	Command	Processed result	ETX	BCC

① Requested Frame(Max. 256 bytes)

ENQ	Station No.	Command term	Type of command term	Data section	EOT	BCC

② ACK Response Frame(Max. 256 bytes)

ACK	Station No.	Command term	Type of command term	Data section	ETX	BCC

③ NAK Response Frame(Max. 256 bytes)

NAK	Station No.	Command term	Error code	ETX	BCC

※ Data is the ASCII code for hexadecimal value unless it is specified separately. And the applicable data is as below.

- Station No.
- An item that indicates all data's size of structured data section.
- All contents of data.

④ Control code

Control code	HEX	Abbreviation	Content
ENQ	0x05	Enquire	Request Frame Starting code
ACK	0x06	Acknowledge	Starting code of ACK response Frame
NAK	0x15	Not Acknowledge	Starting code of NAK response Frame
EOT	0x04	End of Transmission	Ending code of Requested Frame
ETX	0x03	End of Text	Ending code of Response Frame

⑤ Frame Error check(BCC)

BCC is the data for frame error check. If the main command language/term were Written in small characters, only the lower 1 Byte that was resulted from adding ASCII code value by one Byte from header to tail is converted to ASCII and added to BCC.

If the command language/term with small characters were used in the requested frame, Response frame is also to be the same small characters.

In other words, if it is requested with the frame that includes BCC, Servo drive would Response to it with the frame that includes BCC.

Following is an example of BCC calculation for Individual Reading Frame of direct variables ;

- Adding ASCII value : 05+32+30+72+53+53+30+31+30+36+25+4D+57+31+30+30+04
  = 3A4. And when displaying the lower Byte 'A4' with ASCII, the value would be "41/34".

6.2.2 The collection of commands

Classification		Command term code	Kinds	Content	Page
Data Processing	Reading	RSS/rSS/Rss	Reading menu data individually		6-7
		RSB/rSB/Rsb	Reading menu data continuously		6-12
	Writing	WSS/wSS/Wss	Writing menu data individually		6-15
		WSB/wSB/Wsb	Writing menu data continuously		6-18
	Monitor	X##/x##	Monitor registration		6-21
		Y##/y##	Monitor individual executing		6-25
		Z##/Z##	Monitor continuous executing		6-28
	SET	WDK/wDK/Wdk	Setting the status		6-31
	Check	RCS/rCS/Rcs	Servo condition individual check		6-34
		RCB/rCB/Rcb	Servo condition continuous check		6-37
Operation	Speed	CJR/cJR/Cjr	Speed operation1	Setting operation speed, accel/decel time, operation time	6-40
	Position	CPR/cPR/Cpr	Position operation1	Setting position coordinates, operation speed, accel/decel time (Exclusive command for VP)	6-43
	Program	CTA/cTA/Cta	Auto operation	Auto operation (Auto Run function)	6-46
	Stop	CST/cST/Cst	Operation pause	Reset program operation after pause	6-49
		CSM/cSM/Csm	Emergency stop		6-52
		CSH/cSH/Csh	Operation stop	Operating continuously when operation starts after stopping.	6-55
	Origin	COR/cOR/Cor	Origin operation	Origin operation with the mode that is set at the parameter	6-58
	Tuning	CGR/cGR/Cgr	Gain Tuning Operation	Setting speed, distance, tuning range	6-61

※ For the command term that starts with small + large + large character(Ex : rSS, rSB...), frame error check(BCC) is to be done for better reliability.

※ For the Response frame of the command term that starts with large + small + small character(Ex : Rss, Rsb...), 1 byte of data is to be received from servo drive before it goes to EXT. and this data includes the information of Servo-0N, Alarm occurred, etc.

6.3 Commands for Data Processing

6.3.1 Data Reading Command

1) Reading Menu data individually [RSS/rSS/Rss]

It reads out the data from servo by designating the communication code.

"Status" data of response frame exists only in the response frame of command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Block q'ty		Variable block1								Block 2 ...16	Tail	BCC	
									Variable length		Variable code									
											Type			Comm. code						
ASCII	ENQ	0	0	Rr	Ss	Ss	0	1	0	6	%	M	D	0	0	1		EOT	8	F
HEX	05	30	30	52 72	53 73	53 73	30	31	30	36	25	4D	44	30 30 31				04	38	46

Header : Frame header that is requested for servo should always be ENQ.

Station No. : In the case of RS485 Communication, Station No. should be set at the System ID of Servo and the servo's Station No. need to be designated.
In case of RS232(1 : 1 Communication), the station No. must be set as "0".

Command term : RSS command does not include Frame check(BCC), rSS command includes Frame check(BCC) structure.

Block q'ty : Can designate and request the block upto 16 pieces that consists of variable length and variable code.

Variable length : Indicates the number of variable code letter and it can be set upto Max. 16 letters.

Variable code type

	ASCII	Explanation	Data Q'ty	Remark
%MX	25/4D/58	Request data with 1bit type	1	
%MB	25/4D/42	Request data with 8 bit type	1	Not used
%MW	25/4D/57	Request data with 16bit type	2	Not used
%MD	25/4D/44	Request data with 32bit type	4	

Variable code No.

In case of %MD : Use a communication code as per operation software.

In case of %MX : Communication code×32 + The relative bit No.(0 ~ 31)

(Ex) Bit No.3 of communication code 16 : 16×32+3 = 515

Transmission is to be transmitted with the ASCII value for the data No.

Tail : Request frame's tail(last code) must be EOT(End Of Transmission).

② Response frame(ACK)

Classification	Header	Station No.		Command term			Block q'ty		Data q'ty		Data								Status	Tail	BCC	
ASCII	ACK	0	0	R r	S s	S s	0	1	0	4										ETX		
HEX	06	30	30	52 72	53 73	53 73	30	31	30	34										03		

Header : In case of normal response on servo, Header starts with ACK.

Station No. : In case of RS485(BUS communication), it includes the own Station No.

In case of RS232(1:1), the System ID menu data should be set as 0. and it can be set as 00 when communication is being processed.

Command term : Same as Request frame.

Block Q'ty : Same as Request frame.

Data Q'ty

	Unit Q'ty	Transmission Value (ASCII)	Remark
%MX	01	30 31	
%MB	01	30 31	Not used
%MW	02	30 32	Not used
%MD	04	30 34	

Data Q'ty : "4[04]" in case of %MD

Data

In case of %MD : 32bit = 4(Unit q'ty) x 8bit. and 8 pcs of ASCII value is to be transmitted.

(Ex) 123456789(DEC) -> 075BCD15(HEX)

-> 30/37/35/42/43/44/31/35(ASCII)

In case of %MX : 0, 1bit is to be transmitted to 30 or 31.

Tail : Response frame's tail(last code) must be ETX(End Of Text).

Status

Status Information (8 Bit)	0	0	0	0	1	1	1	1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(1),(2),(3),(4) : Not used.

(5) InSPD/InPOS : "0" -> OFF, "1" -> InSPD/InPOS : ON.

(6)Status(Standard[VS] type : "TLOUT", Controller-embedded type[VP] : "ORGOUT") : "0" -> OFF, "1" -> ON.

(7) Servo-ON :"0" -> Servo-OFF, "1" -> Servo-ON.

(8) Alarm : "0" indicates Normal status, "1" indicates Alarm occurred on servo.

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	R r	S s	S s						ETX		
HEX	15	30	30	52 72	53 73	53 73						03		

Error code

	Explanation	Remark
0101	Header of request frame is not ENQ.	
0102	It is not a designated command term.	
0103	Block qtys exceeded 4 pieces.	
0104	Variable type is not started with %M..	
0105	Variable type is not W,D,B,X.	
0106	Variable No. is out of the designated range.	
0107	Request frame's tail is not EOT.	
0108	CHECKSUM is wrong.	
0109	On continuous reading and writing, it exceeded the max. number of Byte(256Bytes).	
010A	It exceeded the max. transmission No.	
010B	Variable length exceeded 16 letters.	
010C	FLASH Reading Error	
010D	FLASH Writing Error	
0201	On writing data, transmitted data exceeded the setting range.	
0202	Writing is prohibited for this data at Servo ON.	
0203	Writing motor parameter is prohibited. (In case that the motor ID is not 0.)	
0204	Motor ID is not registered.	

◈ Example of Reading menu data individually(RSS/rSS/Rss)

- In case of reading the current speed[Pd-002],
  (Station No. : 0, Current speed : 100[r/min])

① RSS Command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Block q'ty		Variable length		Variable code						Tail
											Type			Comm. code			
ASCII	ENQ	0	0	R	S	S	0	1	0	6	%	M	D	0	0	1	EOT
HEX	05	30	30	52	53	53	30	31	30	36	25	4D	44	30	30	31	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data								Tail
ASCII	ACK	0	0	R	S	S	0	1	0	4	0	0	0	0	0	0	6	4	ETX
HEX	06	30	30	52	53	53	30	31	30	34	30	30	30	30	30	30	36	34	03

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	R	S	S	0	1	0	2	ETX
HEX	15	30	30	52	53	53	30	31	30	32	03

② rSS Command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Block Q'ty		Variable length		Variable code						Tail	BCC	
											Type			Comm. code					
ASCII	ENQ	0	0	r	S	S	0	1	0	6	%	M	D	0	0	1	EOT	8	F
HEX	05	30	30	72	53	53	30	31	30	36	25	4D	44	30	30	31	04	38	46

※ BCC indicates the lower 2 Byte of the total Hex value from header to tail.

※ The total HEX value added is "38F". Therefore, BCC is "8F(38/46)".

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data								Tail	BCC	
ASCII	ACK	0	0	r	S	S	0	1	0	4	0	0	0	0	0	0	6	4	ETX	D	0
HEX	06	30	30	72	53	53	30	31	30	34	30	30	30	30	30	30	36	34	03	44	30

※ The total HEX value added is "3D0". Therefore BCC is "D0(44/30)".

→Response frame(NAK) : In case that it is not a designated command term(0102).

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	r	S	S	0	1	0	2	ETX	5	3
HEX	15	30	30	72	53	53	30 31 30 32				03	35	33

※ The total HEX value added is “253”. Therefore BCC is “53(35/33)”.

③ Rss Command (Checking servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Block Q'ty		Variable length		Variable code						Tail
											Type			Comm. code			
ASCII	ENQ	0	0	R	s	s	0	1	0	6	%	M	D	0	0	1	EOT
HEX	05	30	30	52	73	73	30	31	30	36	25	4D	44	30 30 31			04

→Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data								Status	Tail
ASCII	ACK	0	0	R	s	s	0	1	0	4	0	0	0	0	0	0	6	4	A	ETX
HEX	06	30	30	52	73	73	30	31	30	34	30 30 30 30 30 30 36 34								41	03

※ Status : Servo send ‘A(00001010)’ data.

Can note that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	R	s	s	0	1	0	2	A	ETX
HEX	15	30	30	52	73	73	30 31 30 32				41	03

2) Reading menu data continuously [RSB/rSB/Rsb]

It reads the starting No. of menu and the Q'ty that needs to be read by designating them. "Status" data of response frame exists only in the Response frame of command term that starts with large + small + small character.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code (Starting No.)						Menu Q'ty		Tail	BCC	
									Type			Comm. code							
ASCII	ENQ	0	0	R r	S s	B b	0	6	%	M	D	0	0	1	0	5	EOT		
HEX	05	30	30	52 72	53 73	42 62	30	36	25	4D	44	30 30 31			30	35	04		

(Note) If menu q'ty is "05", it reads 5 pieces of data that are designated communication code "001 ~ 005".

② Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data (Max. 256Bytes)			Status	Tail	BCC	
ASCII	ACK	0	0	R r	S s	B b	0	1	1	4		. . . .			ETX		
HEX	06	30	30	52 72	53 73	42 62	30	31	31	34					03		

(Note) Data q'ty : Data Q'ty of data type X Request Menu Q'ty.

(Ex) If requested data type is %MD, data q'ty is "04" and requested menu qty is "5" pcs. Therefore, requested data qty would be 4 x 5 = 20(DEC) -> 14(HEX).

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	R r	S s	B b						ETX		
HEX	15	30	30	52 72	53 73	42 62						03		

◈ Example of Reading menu data continuously (RSB/rSB/Rsb)

- When reading [PE-301]~[PE-303]

(Inertia ratio : 2.0, Position proportional gain : 50, Position proportional gain 2 : 50)

① RSB Command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable		Variable code (Starting No.) Type			Variable code (Starting No.) Comm. code			Menu Q'ty		Tail
ASCII	ENQ	0	0	R	S	B	0	6	%	M	D	0	6	0	0	3	EOT
HEX	05	30	30	52	53	42	30	36	25	4D	44	30	36	30	30	33	04

→Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data	Tail
ASCII	ACK	0	0	R	S	B	0	1	0	C	00000020000003200000032	ETX
HEX	06	30	30	52	53	42	30	31	30	43	30303030303032303030303030303033323030303030303332	03

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	R	S	B	0	1	0	2	ETX
HEX	15	30	30	52	53	42	30	31	30	32	03

② rSB Command (including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code (Starting No.) Type			Variable code (Starting No.) Comm. code			Menu Q'ty		Tail	BCC	
ASCII	ENQ	0	0	r	S	B	0	6	%	M	D	0	6	0	0	3	EOT	0	E
HEX	05	30	30	72	53	42	30	36	25	4D	44	30	36	30	30	33	04	30	45

※ BCC indicates the lower 2 Byte of the total HEX value from header to tail.

※ The total HEX value added is "50E". Therefore, BCC is "0E(30/45)".

→Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data	Tail	BCC	
ASCII	ACK	0	0	r	S	B	0	1	0	C	00000002000000320000032	ETX	A	D
HEX	06	30	30	72	53	42	30	31	30	43	30303030303030323030303030303033323030303030303332	03	43	44

※ The total HEX value added is "6CD". Therefore, BCC is "CD(43/44)".

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	R	S	B	0	1	0	2	ETX	4	2
HEX	15	30	30	52	53	42	30 31 30 32				03	34	32

※ The total HEX value added is "242". Therefore, BCC is "42(34/32)".

③ Rsb Command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code (Starting No.)						Menu Q'ty		Tail
									Type			Comm. code					
ASCII	ENQ	0	0	R	s	b	0	6	%	M	D	0	6	0	0	3	EOT
HEX	05	30	30	52	73	62	30	36	25	4D	44	30 36 30			30	33	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Block Q'ty		Data Q'ty		Data	Station	Tail
ASCII	ACK	0	0	R	s	b	0	1	0	C	00000020000000320000032	A	ETX
HEX	06	30	30	52	73	62	30	31	30	43	30303030303032303030303030303033323030303030303332	41	03

※ Status : Servo sends 'A(00001010)' data.

Can note that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	R	s	b	0	1	0	2	A	ETX
HEX	15	30	30	52	73	62	30 31 30 32				41	03

6.3.2 Data Writing command

1) Writing menu data individually [WSS/wSS/Wss]

It is the function that writes the data by designating the communication code of servo drive. WSS command is the structure that does not include a Frame check(BCC), and wSS command is the structure that includes a Frame check(BCC) behind tail.

"Status" data of Response frame exists only in the response frame of command term that starts with large + small + small character.

① Request frame(ENQ)

Header	Header	Station No.		Command term			Block Q'ty		Block variable1										Block 2 … 4	Tail	BCC	
									Variable length		Variable code											
											Type			Comm. code			Data					
ASCII	ENQ	0	0	Ww	Ss	Ss	0	1	0	6	%	M	D	0	0	1		….			EOT		
HEX	05	30	30	57 77	53 73	53 73	30	31	30	36	25	4D	44	30 30 31							04		

Block q'ty : Can designate and request the block upto 4 pieces that consists variable length and variable code.

Variable code type

	ASCII	Explanation	Data Q'ty	Remark
%MX	25/4D/58	Request data with 1bit type	1	
%MD	25/4D/44	Request data with 32bit type	4	
%RD	25/52/44	Request data with 32bit type	4	Store in RAM

In case of %MX : Communication code×32 + The relative bit No.(0 ~ 31)

(Ex) Bit No.3 of communication code 16 : 16×32+3 = 515

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	Ww	Ss	Ss		ETX		
HEX	15	30	30	57 77	53 73	53 73		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	Ww	Ss	Ss						ETX		
HEX	15	30	30	57 77	53 73	53 73						03		

◈ Example of Writing menu data individually (WSS/wSS/Wss)

- Change the data value to “3.0” at the Inertia ratio[PE-301].

① WSS command (not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Block Q'ty		Variable length		Variable code						Data	Tail
											Type			Comm. code				
ASCII	ENQ	0	0	W	S	S	0	1	0	6	%	M	D	0	6	0	00000030	EOT
HEX	05	30	30	57	53	53	30	31	30	36	25	4D	44	30	36	30	30303030 30303330	04

→Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	W	S	S	ETX
HEX	06	30	30	57	53	53	03

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	W	S	S	0	1	0	2	ETX
HEX	15	30	30	57	53	53	30	31	30	32	03

② wSS command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Block Q'ty		Variable length		Variable code						Data	Tail	BCC	
											Type			Comm. code						
ASCII	ENQ	0	0	w	S	S	0	1	0	6	%	M	D	0	6	0	00000030	EOT	1	C
HEX	05	30	30	77	53	53	30	31	30	36	25	4D	44	30	36	30	30303030 30303330	04	31	43

※ BCC indicates the lower 2 Byte of total HEX value from header to tail.

※ Total HEX value added is “51C”. Therefore, BCC is “1C(31/43)”.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	w	S	S	ETX	8	6
HEX	06	30	30	77	53	53	03	38	36

※ Total HEX value added is “186”. Therefore, BCC is “86(38/36)”.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	w	S	S	0	1	0	2	ETX	5	8
HEX	15	30	30	77	53	53	30 31 30 32				03	35	38

※ Total HEX value added is “258”. Therefore, BCC is “58(HEX 35/38)”.

③ Wss command (Checking servo status) : In case of InSPD/InPOS, Servo-ON.

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Block Q'ty		Variable length		Variable code						Data	Tail
											Type			Comm. code				
ASCII	ENQ	0	0	W	s	s	0	1	0	6	%	M	D	0	6	0	00000030	EOT
HEX	05	30	30	57	73	73	30	31	30	36	25	4D	44	30 36 30			30303030 30303330	04

→Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	W	s	s	A	ETX
HEX	06	30	30	57	73	73	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can note that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	W	s	s	0	1	0	2	A	ETX
HEX	15	30	30	57	73	73	30 31 30 32				41	03

2) Writing menu data continuously [WSB/wSB/Wsb]

It is the function that corrects the data by designating continuously the Communication code of servo drive, Data q'ty that need to be corrected and Data.

"Status" data of response frame exists only in the response frame of command term that starts with large + small + small character.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code						Menu Q'ty		Data			Tail	BCC	
									Type			Comm. code										
ASCII	ENQ	0	0	Ww	Ss	Bb	0	6	%	M	D	0	0	1				....		EOT		
HEX	05	30	30	57 77	53 73	42 62	30	36	25	4D	44	30 30 31								04		

Variable code type

	ASCII	Explanation	Data Q'ty	Remark
%MX	25/4D/58	Request data with 1bit type	1	
%MD	25/4D/44	Request data with 32bit type	4	
%RD	25/52/44	Request data with 32bit type	4	Store in RAM

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	Ww	Ss	Bb		ETX		
HEX	06	30	30	57 77	53 73	42 62		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	Ww	Ss	Bb						ETX		
HEX	15	30	30	57 77	53 73	42 62						03		

◈ Example of Writing menu data continuously(WSB/wSB/Wsb)

- Change the data value to the following.

  Inertia ratio[PE-301] : 3.0, Position proportional gain[PE-302]: 40,

  Position proportional gain2[PE-303]: 40.

① WSB command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code						Menu Q'ty		Data	Tail
									Type			Comm. code						
ASCII	ENQ	0	0	W	S	B	0	6	%	M	D	0	6	0	0	3	0000003000000028 00000028	EOT
HEX	05	30	30	57	53	42	30	36	25	4D	44	30	36	30	30	33	3030303030303330 3030303030303238 3030303030303238	04

※ Data value is to be changed in sequence of communication code No.60, No.61, No.62.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	W	S	B	ETX
HEX	06	30	30	57	53	42	03

→Response frame(NAK) : In case that it is not a designated command term.(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	W	S	B	0	1	0	2	ETX
HEX	15	30	30	57	53	42	30	31	30	32	03

② wSB command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code						Menu Q'ty		Data	Tail	BCC	
									Type			Comm. code								
ASCII	ENQ	0	0	w	S	B	0	6	%	M	D	0	6	0	0	3	0000003000000028 00000028	EOT	2	1
HEX	05	30	30	77	53	42	30	36	25	4D	44	30	36	30	30	33	3030303030303330 3030303030303238 3030303030303238	04	32	31

※ BCC indicates the lower 2 Byte of the total HEX value from header to tail.

※ Total HEX value added is "821". Therefore, BCC is "21(32/31)".

→Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	w	S	B	ETX	7	5
HEX	06	30	30	77	53	42	03	37	35

※ Total HEX value added is “175”. Therefore, BCC becomes “75(37/35)”.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	w	S	B	0	1	0	2	ETX	4	7
HEX	15	30	30	77	53	42	30	31	30	32	03	34	37

※ Total HEX value added is “247”. Therefore, BCC becomes “47(34/37)”.

③ Wsb command (Checking servo status) : In case of InSPD/InPOS, Servo-ON.

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Variable code						Menu Q'ty		Data	Tail
									Type			Comm. code						
ASCII	ENQ	0	0	W	s	b	0	6	%	M	D	0	6	0	0	3	0000003000000028 00000028	EOT
HEX	05	30	30	57	73	62	30	36	25	4D	44	30	36	30	30	33	3030303030303330 3030303030303238 3030303030303238	04

※ Data value is to be changed in sequence of communication No.60, No.61, No.62.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	W	s	b	A	ETX
HEX	06	30	30	57	73	62	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	W	s	b	0	1	0	2	A	ETX
HEX	15	30	30	57	73	62	30	31	30	32	41	03

6.3.3 Monitor command term

- Monitor command does not have the command term that reads out the “Status” data of response frame.

1) Monitor registration [X##/x##]

It registers the variables to read together with the Reading command and reads out the registered variables by Monitor executing command. Max. 32 pieces of registration is possible. And for the registration type, the range that are from command term to ahead of EOT out of the format either in Individual reading or in Continuous reading can be used.

① Request frame of RSS type(ENQ)

Classification	Header	Station No.		Registration command term		Registration type														Tail	BCC	
						Command term			Block Q’ty		Variable block1								2,3,,,,,,16			
					No.						Length		Variable code									
													Type		Comm.							
ASCII	ENQ	0	0	X x	0 ~ 31	R	S	S	1	6										EOT		
HEX	05	30	30	58 78		52	53	53												04		

(Note) Registration command term No. is available at 0 ~ 31(00 ~ 1F). If we registered the No. that was already registered, the last one registered would be executed.

(Note) Block Q’ty of Registration type is available upto total 16 pieces.

② Request frame of RSB type(ENQ)

Classification	Header	Station No.		Registration command term		Registration type										Tail	BCC	
						Command term			Length		Variable code			Menu Q’ty				
					No.						Type		Comm.					
ASCII	ENQ	0	0	X x	0 ~ 31	R	S	B								EOT		
HEX	05	30	30	58 78		52	53	42								04		

③ Response frame(ACK)

Classification	Header	Station No.		Registration command term			Tail	BCC	
					No.				
ASCII	ACK	0	0	X x			ETX		
HEX	06	30	30	58 78			03		

④ Response frame(NAK)

Classification	Header	Station No.		Registration command term			Error code				Tail	BCC	
					No.								
ASCII	NAK	0	0	X x							ETX		
HEX	15	30	30	58 78							03		

◈ Example of Monitor registration(X##/x##)

- Register the current operation speed[Pd-002], current command speed[Pd-003].

① X## command (Not including BCC)

→ Request frame of RSS type(ENQ) : In case that the communication No. to register is sparsely located.

Classification	Header	Station No.		Registration command term			Registration type																			Tail
					No.		Command term			Block Q'ty		Variable block							Variable block							
												Length	Variable code						Length	Variable code						
													Type			Comm.				Type			Comm.			
ASCII	ENQ	0	0	X	0	1	R	S	S	0	2	0	6	%	M	D	0	0	1	0	6	%	M	D	0	0	2	EOT
HEX	05	30	30	58	30	31	52	53	53	30	32	30	36	25	4D	44	30	30	31	30	36	25	4D	44	30	30	32	04

※ Block Q'ty of registration type is available upto total 16 pieces.

※ In case of RSS command term, the communication code is designated individually.(%MD001, %MD002)

→ Request frame of RSB type(ENQ) : In case that the communication No. to register is connected.

Classification	Header	Station No.		Registration command term			Registration type												Tail
					No.		Command term			Length		Variable code					Menu Q'ty		
												Type			Comm. code				
ASCII	ENQ	0	0	X	0	1	R	S	B	0	6	%	M	D	0	0	1	0	2	EOT
HEX	05	30	30	58	30	31	52	53	42	30	36	25	4D	44	30	30	31	30	32	04

※ Proceed the monitor registration as the menu q'ty("02") after designating the communication code that starts first.

→Response frame(ACK)

Classification	Header	Station No.		Registration command term			Tail
					No.		
ASCII	ACK	0	0	X	0	1	ETX
HEX	06	30	30	58	30	31	03

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Registration command term			Error code				Tail
					No.						
ASCII	NAK	0	0	X	0	1	0	1	0	2	ETX
HEX	15	30	30	58	30	31	30	31	30	32	03

② x## command (Including BCC)

→ Request frame of RSS type(ENQ) : In case that the communication No to register is sparsely located.

Classification	Header	Station No.		Registration command term			Registration type																		Tail		BCC	
					No.		Command term			Block Q'ty		Variable block							Variable block										
												Length	Variable code						Length	Variable code								
													Type			Comm.				Type			Comm.					
ASCII	ENQ	0	0	x	0	1	R	S	S	0	2	0	6	%	M	D	0	0	1	0	6	%	M	D	0	0	2	EOT	F	7
HEX	05	30	30	78	30	31	52	53	53	30	32	30	36	25	4D	44	30	30	31	30	36	25	4D	44	30	30	32	04	46	37

※ If the command term is RSS, the communication code is individually designated.(%MD001, %MD002)

※ Total HEX value added is "5F7". Therefore, BCC becomes "F7(46/37)".

→ Request frame of RSB type(ENQ) : Communication No. to register is connected.

Classification	Header	Station No.		Registration command term			Registration type												Tail		BCC	
					No.		Command term			Length		Variable code						Menu Q'ty				
												Type			Comm. code							
ASCII	ENQ	0	0	x	0	1	R	S	B	0	6	%	M	D	0	0	1	0	2	EOT	3	8
HEX	05	30	30	78	30	31	52	53	42	30	36	25	4D	44	30	30	31	30	32	04	33	38

※ Proceed the monitor registration as Menu q'ty("02") after designating the communication code that starts first.

※ Total HEX value added is "438". Therefore, BCC becomes "38(33/38)".

→Response frame(ACK)

Classification	Header	Station No.		Registration command term			Tail	BCC	
					No.				
ASCII	ACK	0	0	x	0	1	ETX	4	2
HEX	06	30	30	78	30	31	03	34	32

※ Total HEX value added is “142”. Therefore, BCC becomes “42(34/32)”.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Registration command term			Error code				Tail	BCC	
					No.								
ASCII	NAK	0	0	x	0	1	0	1	0	2	ETX	1	4
HEX	15	30	30	78	30	31	30	31	30	32	03	31	34

※ Total HEX value added is “214”. Therefore BCC becomes “14(31/34)”.

2) Monitor Individual Execution [Y##/y##]

It requires the execution of Monitor command(X##/x##) that is registered.

① Request frame(ENQ)

Classification	Header	Station No.		Registration command term			Tail	BCC	
					No.				
ASCII	ENQ	0	0	Y y			EOT		
HEX	06	30	30	59 79			04		

② Response frame(ACK) for RSS type

Classification	Header	Station No.		Registration command term		Data response type						Tail	BCC	
					No.	Block Q'ty		Data Q'ty		Data	2,3... ...16			
ASCII	ACK	0	0	Y y	0 ~ 31	0	1	0	4	....		ETX		
HEX	06	30	30	59 79		30	31	30	34			03		

③ Response frame(ACK) for RSB type

Classification	Header	Station No.		Registration command term		Data response type			Tail	BCC	
					No.	Data Q'ty		Data			
ASCII	ACK	0	0	Y y	0 ~ 31	0	8	....	ETX		
HEX	06	30	30	59 79		30	38		03		

④ Response frame(NAK)

Classification	Header	Station No.		Registration command term			Error code				Tail	BCC	
					No.								
ASCII	NAK	0	0	Y y	0 ~ 31						ETX		
HEX	15	30	30	59 79							03		

◈ Example of Monitor Individual execution (Y##/y##)

- Execute the registration command term “01”.
  In the X01/x01, current speed[Pd-002]:100.0, command speed[Pd-003]:50.0 are Registered.

① Y## command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Registration command term			Tail
					No.		
ASCII	ENQ	0	0	Y	0	1	EOT
HEX	06	30	30	59	30	31	04

→ Response frame(ACK) for RSS type

Classification	Header	Station No.		Registration command term			Registration type																				Tail
						No.	Block Q’ty		Data Q’ty		Data								Data Q’ty		Data								
ASCII	ACK	0	0	Y	0	1	0	2	0	4	0	0	0	0	0	0	6	4	0	4	0	0	0	0	0	0	3	2	ETX
HEX	06	30	30	59	30	31	30	32	30	34	30	30	30	30	30	30	36	34	30	34	30	30	30	30	30	30	33	32	03

→ Response frame(ACK) for RSB type

Classification	Header	Station No.		Registration command term			Registration type																Tail
						No.	Data Q’ty		Data														
ASCII	ACK	0	0	Y	0	1	0	8	0	0	0	0	0	0	6	4	0	0	0	0	0	0	3	2	ETX
HEX	06	30	30	59	30	31	30	38	30	30	30	30	30	30	36	34	30	30	30	30	30	30	33	32	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Registration command term			Error code				Tail
					No.						
ASCII	NAK	0	0	Y	0	1	0	1	0	2	ETX
HEX	15	30	30	59	30	31	30	31	30	32	03

② y## command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Registration command term			Tail	BCC	
					No.				
ASCII	ENQ	0	0	y	0	1	EOT	4	4
HEX	06	30	30	79	30	31	04	34	34

※ Total HEX value added is “144”. Therefore, BCC becomes “44(34/34)”.

→ Response frame(ACK) for RSS type

Classification	Header	Station No.		Registration command term			Registration type																Tail	BCC	
						No.	Block Q’ty		Data Q’ty		Data								Data Q’ty		Data							
ASCII	ACK	0	0	y	0	1	0	2	0	4	0	0	0	0	0	0	6	4	0	4	0	0	0	0	0	3	2	ETX	7	C
HEX	06	30	30	79	30	31	30	32	30	34	30	30	30	30	30	30	36	34	30	34	30	30	30	30	30	33	32	03	37	43

※ Total HEX value added is “57C”. Therefore, BCC becomes “7C(37/43)”.

→ Response frame(ACK) for RSB type

Classification	Header	Station No.		Registration command term			Registration type																		Tail	BCC	
						No.	Data Q’ty		Data																			
ASCII	ACK	0	0	y	0	1	0	8	0	0	0	0	0	0	6	4	0	0	0	0	0	0	3	2	ETX	B	A
HEX	06	30	30	79	30	31	30	38	30	30	30	30	30	30	36	34	30	30	30	30	30	30	33	32	03	42	41

※ Total HEX value added is “4BA”. Therefore, BCC becomes “BA(42/41)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Registration command term			Error code				Tail	BCC	
					No.								
ASCII	NAK	0	0	y	0	1	0	1	0	2	ETX	1	5
HEX	15	30	30	79	30	31	30	31	30	32	03	31	35

※ Total HEX value added is “215”. Therefore, BCC becomes “15(31/35)”.

3) Monitor Continuous Execution [Z##/z##]

It requires the execution of Monitor command(Z##/z##) that is registered.

Once it is executed, Servo drive keep sending data.

(Note) Response would be stopped when other command term comes in while the servo drive is sending Data continuously. If you want to receive the continuous data again after execution of other data except for Z## command.

① Request frame(ENQ)

Classification	Header	Station No.		Registration command term			Tail	BCC	
					No.				
ASCII	ENQ	0	0	Z z			EOT		
HEX	06	30	30	5A 7A			04		

② Response frame(ACK) for RSS type

Classification	Header	Station No.		Registration command term		Data response type						Tail	BCC	
					No.	Block Q'ty		Data Q'ty		Data	2,3... ...16			
ASCII	ACK	0	0	Z z	0 ~ 31	0	1	0	4	....		ETX		
HEX	06	30	30	5A 7A		30	31	30	34			03		

③ Response frame(ACK) for RSB type

Classification	Header	Station No.		Registration command term		Data response type			Tail	BCC	
					No.	Data Q'ty		Data			
ASCII	ACK	0	0	Z z	0 ~ 31	0	8	....	ETX		
HEX	06	30	30	5A 7A		30	38		03		

④ Response frame(NAK)

Classification	Header	Station No.		Command term		Error code				Tail	BCC	
					No.							
ASCII	NAK	0	0	Z z	0 ~ 31					ETX		
HEX	15	30	30	5A 7A						03		

◈ Example of Monitor Individual Execution (Z##/z##)

- Executes the registration command term “01”.
  In the X01/x01, the current speed[Pd-002]:100.0, command speed [Pd-003]:50.0 are registered.
- Servo drive sends the data value continuously before other command terms except for Z## command are sent.

① Z## command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Registration command term			Tail
					No.		
ASCII	ENQ	0	0	Z	0	1	EOT
HEX	06	30	30	5A	30	31	04

→ Request frame(ACK) for RSS type

Classification	Header	Station No.		Registration command term			Registration type																				Tail
						No.	Block Q’ty		Data Q’ty		Data								Data Q’ty		Data								
ASCII	ACK	0	0	Z	0	1	0	2	0	4	0	0	0	0	0	0	6	4	0	4	0	0	0	0	0	0	3	2	ETX
HEX	06	30	30	5A	30	31	30	32	30	34	30	30	30	30	30	30	36	34	30	34	30	30	30	30	30	30	33	32	03

→ Response frame(ACK) for RSB type

Classification	Header	Station No.		Registration command term			Registration type																				Tail
						No.	Data Q’ty		Data																			
ASCII	ACK	0	0	Z	0	1	0	8	0	0	0	0	0	0	6	4	0	0	0	0	0	0	3	2	ETX
HEX	06	30	30	5A	30	31	30	38	30	30	30	30	30	30	36	34	30	30	30	30	30	30	33	32	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Registration command term			Error code				Tail
					No.						
ASCII	NAK	0	0	Z	0	1	0	1	0	2	ETX
HEX	15	30	30	5A	30	31	30	31	30	32	03

② z## command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Registration command term			Tail	BCC	
					No.				
ASCII	ENQ	0	0	z	0	1	EOT	4	4
HEX	06	30	30	7A	30	31	04	34	34

※ Total HEX value added is “144”. Therefore, BCC becomes “44(34/34)”.

→ Response frame(ACK) for RSS type

Classification	Header	Station No.		Registration command term			Registration type																Tail	BCC	
					No.		Block Q’ty		Data Q’ty		Data								Data Q’ty		Data							
ASCII	ACK	0	0	z	0	1	0	2	0	4	0	0	0	0	0	0	6	4	0	4	0	0	0	0	0	0	3	2	ETX	7	D
HEX	06	30	30	7A	30	31	30	32	30	34	30	30	30	30	30	30	36	34	30	34	30	30	30	30	30	30	33	32	03	37	44

※ Total HEX value added is “57D”. Therefore, BCC becomes “7D(37/44)”.

→ Response frame(ACK) for RSB type

Classification	Header	Station No.		Registration command term			Registration type																		Tail	BCC	
					No.		Data Q’ty		Data																				
ASCII	ACK	0	0	z	0	1	0	8	0	0	0	0	0	0	6	4	0	0	0	0	0	0	3	2	ETX	B	B
HEX	06	30	30	7A	30	31	30	38	30	30	30	30	30	30	36	34	30	30	30	30	30	30	33	32	03	42	42

※ Total HEX value added is “4BB”. Therefore, BCC becomes “BB(42/42)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Registration command term			Error code				Tail	BCC	
					No.								
ASCII	NAK	0	0	z	0	1	0	1	0	2	ETX	1	6
HEX	15	30	30	7A	30	31	30 31 30 32				03	31	36

※ Total HEX value added is “216”. Therefore, BCC becomes “16(31/36)”.

6.3.4 SET command

1) KEY SET(manipulation)[WDK/wDK/Wdk]

"Status" data of Response frame exists only in the response frame of command term that starts with large + small + small character.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Variable length		Code					Tail	BCC	
									Type			No.				
ASCII	ENQ	0	0	W w	D d	K k	0	5	%	S	D	0	1	EOT		
HEX	05	30	30	57 77	44 64	4B 6B	30	36	25	53	44	30	31	04		

Code can be defined and used as per the program version.

Code

Classification	Code	Remarks
Alarm Reset	05%SD01	
Alarm History Clear	05%SD02	
Initializing Menu	05%SD03	
Saving current offset	05%SD04	
Initializing the state of I/O contact point	05%SD05	
Reading program data	05%SP00~07	Used for only VP5 program operation type Ex.)%SP00<-Reading program No.1 Ex.)%SP10<-Writing program No.1
Writing program data	05%SP10~17	

② Response frame(ACK)

Classification	Header	Station No.		Commmand term			Status	Tail	BCC	
ASCII	ACK	0	0	W w	D d	K k		ETX		
HEX	06	30	30	57 77	44 64	4B 6B		03		

③ Response frame (NAK)

Classification	Header	Station No.		Commmand term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	W w	D d	K k						ETX		
HEX	15	30	30	57 77	44 64	4B 6B						03		

◈ Example of Setting status (WDK/wDK/Wdk)

- Alarm Reset Manipulation.

① WDK command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station NO.		Command term			Variable length		Code					Tail
									Type			No.		
ASCII	ENQ	0	0	W	D	K	0	5	%	S	D	0	1	EOT
HEX	05	30	30	57	44	4B	30	36	25	53	44	30	31	04

Code can be defined and used as per the program version.

→ Response frame(ACK)

Classification	Header	Station NO.		Command term			Tail
ASCII	ACK	0	0	W	D	K	ETX
HEX	06	30	30	57	44	4B	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station NO.		Command term			Error code				Tail
ASCII	NAK	0	0	W	D	K	0	1	0	2	ETX
HEX	15	30	30	57	44	4B	30	31	30	32	03

② wDK command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station NO.		Command term			Variable length		Code					Tail	BCC	
									Type			No.				
ASCII	ENQ	0	0	w	D	K	0	5	%	S	D	0	1	EOT	F	2
HEX	05	30	30	77	44	4B	30	36	25	53	44	30	31	04	46	32

※ Total HEX value added is “2F2”. Therefore, BCC becomes “F2(46/32)”.

→ Response frame(ACK)

Classification	Header	Station NO.		Command term			Tail	BCC	
ASCII	ACK	0	0	w	D	K	ETX	6	F
HEX	06	30	30	77	44	4B	03	36	46

※ Total HEX value added is "16F". Therefore, BCC becomes "6F(36/46)".

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station NO.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	w	D	K	0	1	0	2	ETX	4	1
HEX	15	30	30	77	44	4B	30 31 30 32				03	34	31

※ Total HEX value is "241". Therefore, BCC becomes "41(34/31)".

③ Wdk command (Checking servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station NO.		Command term			Variable length		Code					Tail
									Type			No.		
ASCII	ENQ	0	0	W	d	k	0	5	%	S	D	0	1	EOT
HEX	05	30	30	57	64	6B	30	36	25	53	44	30	31	04

Code can be defined and used as per the program version.

→ Response frame(ACK)

Classification	Header	Station NO.		Command term			Status	Tail
ASCII	ACK	0	0	W	d	k	A	ETX
HEX	06	30	30	57	64	6B	41	03

※ Status : Servo sends 'A(00001010)' data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station NO.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	W	d	k	0	1	0	2	A	ETX
HEX	15	30	30	57	64	6B	30 31 30 32				41	03

6.3.5 Check command

1) Individual check of servo status [RCS/rCS/Rcs]

Can check the current status of servo.
Individual check command has only one response when sending a command term.
"Status" data of response frame exists only in the response frame of command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station NO.		Command term			Status check code No.								Tail	BCC	
ASCII	ENQ	0	0	R r	C c	S s	①	②	③	④	⑤	⑥	⑦	⑧	EOT		
HEX	05	30	30	52 72	43 63	53 73									04		

Code No. type

=> Code No. is displayed with '0' or '1'. (0 : Not used, 1 : Used)

Code No.	Data
①	Current Speed(32bit) + Command Speed(32bit)
②	Current Pulse(32bit) + Command Pulse(32bit)
③	Current Load(32bit) + Peak Load(32bit)
④	Contact Status(32bit) + DC Voltage(32bit)
⑤	Speed Reference(32bit) + Speed Feedback(32bit)
⑥	Torque Reference(32bit) + Torque Feedback(32bit)
⑦	Not Used('0')
⑧	Not Used('0')

※ One code receives two data.

② Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Status	Tail	BCC	
ASCII	ACK	0	0	R r	C c	S s	0	8	. . .		ETX		
HEX	06	30	30	52 72	43 63	53 73	30	38	. . .		03		

③ Response frame(NAK

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	R r	C c	S s						ETX		
HEX	15	30	30	52 72	43 63	53 73						03		

◈ Example of individual check of servo status(RCS/rCS/Rcs)

- If you want to check the current speed, contact status,

  => Current speed : 1000, Command speed : 1000

  => Contact status : ZSPD(ON), RDY(ON), ALARM(ON), DC voltage : 300

① RCS command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail
ASCII	ENQ	0	0	R	C	S	1	0	0	1	0	0	0	0	EOT
HEX	05	30	30	52	43	53	31	30	30	31	30	30	30	30	04

※ Send the code No. that includes the current speed and contact status.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Tail
ASCII	ACK	0	0	R	C	S	1	0	000003E8000003E8 000B00000000012C	ETX
HEX	06	30	30	52	43	53	31	30	30303030303345383030303030334538 30303042303030303030303030424531	03

※ Data : 8 digits are one data. (1data : 32bit)

Current speed : 000003E8 (Dec1000) Command speed : 000003E8 (Dec1000)

Contact status : 000B0000 (Dec720896) DC voltage : 0000012C (Dec300)

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	R	C	S	0	1	0	2	ETX
HEX	15	30	30	52	43	53	30	31	30	32	03

② rCS command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail	BCC	
ASCII	ENQ	0	0	r	C	S	1	0	0	1	0	0	0	0	EOT	F	3
HEX	05	30	30	72	43	53	31	30	30	31	30	30	30	30	04	46	33

※ Total HEX value added is "2F3". Therefore, BCC becomes "F3(46/33)".

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Tail	BCC	
ASCII	ACK	0	0	R	C	S	1	0	000003E8000003E8 000B00000000012C	ETX	3	7
HEX	06	30	30	72	43	53	31	30	3030303030334538303030303030334538 3030304230303030303030303030313243	03	33	37

※ Total HEX value added is "837". Therefore, BCC becomes "37(33/37)".

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	r	C	S	0	1	0	2	ETX	4	3
HEX	15	30	30	72	43	53	30	31	30	32	03	34	33

※ Total HEX value added is "243". Therefore, BCC becomes "43(34/33)".

③ Rcs command (Checking servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail
ASCII	ENQ	0	0	R	c	s	1	0	0	1	0	0	0	0	EOT
HEX	05	30	30	52	63	73	31	30	30	31	30	30	30	30	04

※ It sends the code No. that includes the current speed and contact status.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Status	Tail
ASCII	ACK	0	0	R	c	s	1	0	000003E8000003E8 000B00000000012C	A	ETX
HEX	06	30	30	52	63	73	31	30	3030303030334538303030303030334538 3030304230303030303030303030424531	41	03

※ Data : 8 digits are one data. (1 data : 32bit)

Current speed : 000003E8 (Dec1000) Command speed : 000003E8 (Dec1000)

Contact status : 000B0000 (Dec720896) DC voltage : 0000012C (Dec300)

※ Status : Servo sends 'A(00001010)' data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	R	c	s	0	1	0	2	A	ETX
HEX	15	30	30	52	63	73	30	31	30	32	41	03

2) Continuous check of servo status [RCB/rCB/Rcb]

You can see the current status of servo continuously.

Once you send out a command, it keeps sending the response message continuously before other command term is sent. "Status" data of response frame exists only in the response frame of command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail	BCC	
ASCII	ENQ	0	0	Rr	Cc	Bb	①	②	③	④	⑤	⑥	⑦	⑧	EOT		
HEX	05	30	30	52 72	43 63	42 62									04		

Code No. type

=> Code No. is displayed with '0' or '1'. (0 : Not used, 1 : Used)

Code No.	Data
①	Current Speed(32bit) + Command Speed(32bit)
②	Current Pulse(32bit) + Command Pulse(32bit)
③	Current Load(32bit) + Peak Load(32bit)
④	Contact Status(32bit) + DC Voltage(32bit)
⑤	Speed Reference(32bit) + Speed Feedback(32bit)
⑥	Torque Reference(32bit) + Torque Feedback(32bit)
⑦	Not Used('0')
⑧	Not Used('0')

※ One code receives two data.

② Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Status	Tail	BCC	
ASCII	ACK	0	0	Rr	Cc	Bb	0	8	. . .		ETX		
HEX	06	30	30	52 72	43 63	42 62	30	38	. . .		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	RR	Cc	Bb						ETX		
HEX	15	30	30	52 72	43 63	42 62						03		

◈ Example of individual check of servo status(RCS/rCS/Rcs)

- If you want to check the current speed, contact status,

  => Current speed : 1000, Command speed : 1000

  => Contact status : ZSPD(ON), RDY(ON), ALARM(ON), DC voltage : 300

① RCS command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail
ASCII	ENQ	0	0	R	C	B	1	0	0	1	0	0	0	0	EOT
HEX	05	30	30	52	43	42	31	30	30	31	30	30	30	30	04

※ Send the code No. that includes the current speed and contact status.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Tail
ASCII	ACK	0	0	R	C	B	1	0	000003E8000003E8 000B00000000012C	ETX
HEX	06	30	30	52	43	42	31	30	30303030303345383030303030334538 30303042303030303030303030424531	03

※ Data : 8 digits are one data. (1 data : 32bit)

Current speed : 000003E8 (Dec1000) Command speed : 000003E8 (Dec1000)

Contact status : 000B0000 (Dec720896) DC voltage : 0000012C (Dec300)

→Response frame(NAK) : In case that it is not a designated command term (0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	R	C	B	0	1	0	2	ETX
HEX	15	30	30	52	43	42	30	31	30	32	03

② rCB command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail	BCC	
ASCII	ENQ	0	0	r	C	B	1	0	0	1	0	0	0	0	EOT	E	2
HEX	05	30	30	72	43	42	31	30	30	31	30	30	30	30	04	45	32

※ Total HEX value added is "2E2". Therefore, BCC becomes "E2(45/32)".

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Tail	BCC	
ASCII	ACK	0	0	r	C	B	1	0	000003E8000003E8 000B00000000012C	ETX	2	6
HEX	06	30	30	72	43	42	31	30	3030303030334538303030303030334538 3030304230303030303030303030313243	03	32	36

※ Total HEX value added is "826". Therefore, BCC becomes "26(32/36)".

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	r	C	B	0	1	0	2	ETX	3	2
HEX	15	30	30	72	43	42	30 31 30 32				03	33	32

※ Total HEX value added is "232". Therefore, BCC becomes "32(33/32)".

③ Rcb command (Checking servo status) : In case of InSPD/InPOS, Servo-ON.

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Status check code No.								Tail
ASCII	ENQ	0	0	R	c	b	1	0	0	1	0	0	0	0	EOT
HEX	05	30	30	52	63	62	31	30	30	31	30	30	30	30	04

※ It sends the code No. that includes the current speed and contact status.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Data Q'ty		Data	Status	Tail
ASCII	ACK	0	0	R	c	b	1	0	000003E8000003E8 000B00000000012C	A	ETX
HEX	06	30	30	52	63	62	31	30	3030303030334538303030303030334538 3030304230303030303030303030424531	41	03

※ Data : 8 digits are one data. (1 data : 32bit)

Current speed : 000003E8 (Dec1000) Command speed : 000003E8 (Dec1000)

Contact status : 000B0000 (Dec720896) DC voltage : 0000012C (Dec300)

※ Status : Servo sends 'A(00001010)' data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	R	c	b	0	1	0	2	A	ETX
HEX	15	30	30	52	63	62	30 31 30 32				41	03

6.4 Commands for Operation

6.4.1 Speed operation command

1) Speed operation mode(Speed, Accel/decel, Operation time setting) [CJR/cJR/Cjr]

Operation speed, Accel/decel time is set and operated.

"Status" data of response frame exists only in the response frame of the command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Dir	Operation Speed					Acceleration time				Deceleration time				Operation time				Tail	BCC	
ASCII	ENQ	0	0	C C	J j	R r																			EOT		
HEX	05	30	30	43 63	4A 6A	52 72																			04		

Operating direction : Set the motor rotating direction.

[0 : CCW direction , 1 : CW direction]

Operation speed : Set the operation speed. [Input unit : 9999.9 r/min]

Acceleration time : Set it with the time that takes to accelerate till the rated speed.

[Input unit : 99.99 second]

Deceleration time : Set it with the time that takes to stop at rated speed.

[Input unit : 99.99 second]

Operation time : Set the total operation time till stop after operation starts.

If it is set with 9999, it is unlimited operation. [Input unit : 9999 second]

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	C c	J j	R r		ETX		
HEX	06	30	30	43 63	4A 6A	52 72		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	C c	J j	R r						ETX		
HEX	15	30	30	43 63	4A 6A	52 72						03		

◈ Example of Speed Operation Mode(CJR/cJR/Cjr)

- Direction=0 , Operation speed=1000.0 , Acceleration time=20.00 ,
  Deceleration time=10.00 , Operation time=100

① CJR command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Dir	Operation Speed					Acceleration time				Deceleration time				Operation time				Tail
ASCII	ENQ	0	0	C	J	R	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	EOT
HEX	05	30	30	43	4A	52	30	31	30	30	30	30	32	30	30	30	31	30	30	30	30	31	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	J	R	ETX
HEX	06	30	30	43	4A	52	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	J	R	0	1	0	2	ETX
HEX	15	30	30	43	4A	52	30	31	30	32	03

② cJR command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Dir	Operation Speed					Acceleration time				Deceleration time				Operation time				Tail	BCC	
ASCII	ENQ	0	0	c	J	R	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	EOT	C	D
HEX	05	30	30	63	4A	52	30	31	30	30	30	30	32	30	30	30	31	30	30	30	30	31	30	30	04	43	44

※ BCC indicates the lower 2 Byte of the total HEX value from header to tail.

※ Total HEX value added is “4CD”. Therefore, BCC becomes “CD(43/44)”,

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	J	R	ETX	6	8
HEX	06	30	30	63	4A	52	03	36	38

※ Total HEX value added is “168”. Therefore, BCC becomes “68(36/38)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	J	R	0	1	0	2	ETX	3	A
HEX	15	30	30	63	4A	52	30	31	30	32	03	33	41

※ Total HEX value added is “23A”. Therefore, BCC becomes “3A(33/41)”.

③ Cjr command (Check the servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Dir	Operation Speed					Accelera :ion time				Decelera :ion time				Operation time				Tail
ASCII	ENQ	0	0	C	j	r	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	EOT
HEX	05	30	30	43	6A	72	30	31	30	30	30	30	32	30	30	30	31	30	30	30	30	31	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	j	r	A	ETX
HEX	06	30	30	43	6A	72	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	j	r	0	1	0	2	A	ETX
HEX	15	30	30	43	6A	72	30	31	30	32	41	03

6.4.2 Position Operation command

1) Position operation mode(Speed, Speed, Accel/Decel time setting) [CPR/cPR/Cpr]

This command term is only applied to the servo drive in which position coordinate operation function is installed. And can set the position coordinates to operate, operation speed and accel/decel time.

“Status” data of response frame exists only in the response frame of command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			mark	Position coordinate	Operation speed	Acc. time	Dec. time	Tail	BCC	
ASCII	ENQ	0	0	C C	P p	R r						EOT		
HEX	05	30	30	43 63	50 70	52 72						04		

Position mark : It sets the mark of position coordinate.

[0 : +coordinate , 1 : -coordinate]

Position coordinate : It is set with the position unit that was set at menu.

[Input unit : 999999]

Operation speed : It set the position operation speed.

[Input unit : 9999.9 r/min]

Acceleration time : It is set with the time that takes to accelerate till the rated speed.

[Input unit : 99.99 second]

Deceleration time : It is set with the time that takes to stop at rated speed.

[Input unit : 99.99 second]

② Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	C c	P p	R r	ETX		
HEX	06	30	30	43 63	50 70	52 72	03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				tail	BCC	
ASCII	NAK	0	0	C c	P p	R r					ETX		
HEX	15	30	30	43 63	50 70	52 72					03		

◈ Example of Position operation mode(CPR/cPR/Cpr)

- Direction=0 , Position coordinate=200 , Operation speed=1000.0 , Acceleration time=20.00 , Deceleration time=10.00

① CPR command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			mark	Position coordinate						Operation speed					Acc. time				Dec. time				Tail
ASCII	ENQ	0	0	C	P	R	0	0	0	0	2	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	EOT
HEX	05	30	30	43	50	52	30	30	30	30	32	30	30	31	30	30	30	30	32	30	30	30	31	30	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	P	R	ETX
HEX	06	30	30	43	50	52	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	P	R	0	1	0	2	ETX
HEX	15	30	30	43	50	52	30	31	30	32	03

② cPR command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			mark	Position coordinate						Operation speed					Acc. time				Dec. time				Tail	BCC	
ASCII	ENQ	0	0	c	P	R	0	0	0	0	2	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	EOT	3	4
HEX	05	30	30	63	50	52	30	30	30	30	32	30	30	31	30	30	30	30	32	30	30	30	31	30	30	30	04	33	34

※ BCC indicates the lower 2 Byte of total HEX value from header to tail.

※ Total HEX value added is “534”. Therefore, BCC is “34(33/34)”.

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	P	R	ETX	6	E
HEX	06	30	30	63	50	52	03	36	45

※ Total HEX value added is “16E”. Therefore, BCC becomes “6E(36/45)”.

→Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	P	R	0	1	0	2	ETX	4	0
HEX	15	30	30	63	50	52	30	31	30	32	03	34	30

※ Total HEX value added is “240”. Therefore, BCC becomes “40(34/30)”.

③ Cpr command (Check servo status) : In case of InSPD/InPOS, Servo-ON.

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			mark	Position coordinate						Operation speed						Acc. time				Dec. time				Tail
ASCII	ENQ	0	0	C	P	r	0	0	0	0	2	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	EOT
HEX	05	30	30	43	70	72	30	30	30	30	32	30	30	31	30	30	30	30	32	30	30	30	31	30	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	p	r	A	ETX
HEX	06	30	30	43	70	72	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	p	r	0	1	0	2	A	ETX
HEX	15	30	30	43	70	72	30	31	30	32	41	03

6.4.3 Program operation command

"Status" data of response frame exists only in the response frame of command term that starts with large + small + small letter.

1) Auto operation(Auto Run)[CTA/cTA/Cta]

It is a Auto operation command same as Auto Run function.

CTA is the structure that includes a frame check(BCC) and cTA is the structure that includes a frame check(BCC).

Other command hereunder are also applied as per the large/small letter(C or c) of first letter with the same way.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ENQ	0	0	C c	T t	A a	EOT		
HEX	05	30	30	43 63	54 74	41 61	04		

② Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	C c	T t	A a	ETX		
HEX	06	30	30	43 63	54 74	41 61	03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	C c	T t	A a					ETX		
HEX	15	30	30	43 63	54 74	41 61					03		

◈ Example of Auto operation(Auto Run)(CTA/cTA/Cta)

① CTA command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail
ASCII	ENQ	0	0	C	T	A	EOT
HEX	05	30	30	43	54	41	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	T	A	ETX
HEX	06	30	30	43	54	41	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	T	A	0	1	0	2	ETX
HEX	15	30	30	43	54	41	30	31	30	32	03

② cTA command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ENQ	0	0	c	T	A	EOT	6	1
HEX	05	30	30	63	54	41	04	36	31

※ BCC indicates the lower 2 Byte of the total HEX value from header to tail.

※ Total HEX value added is “161”. Therefore, BCC becomes “61(36/31)”.

→Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	T	A	ETX	6	1
HEX	06	30	30	63	54	41	03	36	31

※ Total HEX value added is “161”. Therefore, BCC becomes “61(36/31)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	T	A	0	1	0	2	ETX	3	3
HEX	15	30	30	63	54	41	30	31	30	32	03	33	33

※ Total HEX value added is “233”. Therefore, BCC becomes “33(33/33)”.

③ Cta command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail
ASCII	ENQ	0	0	C	t	a	EOT
HEX	05	30	30	43	74	61	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC
ASCII	ACK	0	0	C	t	a	A	ETX
HEX	06	30	30	43	74	61	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON .

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	t	a	0	1	0	2	A	ETX
HEX	15	30	30	43	74	61	30	31	30	32	41	03

6.4.4 Operation command [CST/CSM/CSH/COR/CGR]

1) Operation pause[CST/cST/Cst]

It resets the current step information and operation information after pausing it with a pause command during servo operation.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time					Tail	BCC	
ASCII	ENQ	0	0	C c	S s	T t						EOT		
HEX	05	30	30	43 63	53 73	54 74						04		

Deceleration time : It is set with the time that takes to stop at rated speed.

[Input unit : 99.99 second]

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	C c	S s	T t		ETX		
HEX	06	30	30	43 63	53 73	54 74		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	C c	S s	T t						ETX		
HEX	15	30	30	43 63	53 73	54 74						03		

◈ Example of Operation Pause(CST/cST/Cst)

- Deceleration time :10.00

① CST command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail
ASCII	ENQ	0	0	C	S	T	1	0	0	0	EOT
HEX	05	30	30	43	53	54	31	30	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	S	T	ETX
HEX	06	30	30	43	53	54	03

→ Response frame(NAK) : In case of it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	S	T	0	1	0	2	ETX
HEX	15	30	30	43	53	54	30	31	30	32	03

② cST command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail	BCC	
ASCII	ENQ	0	0	c	S	T	1	0	0	0	EOT	3	4
HEX	05	30	30	63	53	54	31	30	30	30	04	33	34

※ BCC indicates the lower 2 Byte of total HEX value from header to tail.

※ Total HEX value added is “234”. Therefore, BCC becomes “34(33/34)”.

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	S	T	ETX	7	3
HEX	06	30	30	63	53	54	03	37	33

※ Total HEX value added is “173”. Therefore, BCC becomes “73(37/33)”.

→ Response frame(NAK) : In case of it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	S	T	0	1	0	2	ETX	4	5
HEX	15	30	30	63	53	54	30	31	30	32	03	34	35

※ Total HEX value added is “245”. Therefore, BCC becomes “45(34/35)”.

③ Cst command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail
ASCII	ENQ	0	0	C	s	t	1	0	0	0	EOT
HEX	05	30	30	43	73	74	31	30	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	s	t	A	ETX
HEX	06	30	30	43	73	74	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	s	t	0	1	0	2	A	ETX
HEX	15	30	30	43	73	74	30	31	30	32	41	03

2) Emergency stop[CSM/cSM/Csm]

It is the command to stop it with max. deceleration ability at emergency during servo operation. After stopped, it is to be emergency alarm and Servo-OFF.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ENQ	0	0	C C	S s	M m	EOT		
HEX	05	30	30	43 63	53 73	4D 6D	04		

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	C c	S s	M m		ETX		
HEX	06	30	30	43 63	53 73	4D 6D		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	C c	S s	M m						ETX		
HEX	15	30	30	43 63	53 73	4D 6D						03		

◈ Example of Emergency stop(CSM/cSM/Csm)

① CSM command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail
ASCII	ENQ	0	0	C	S	M	EOT
HEX	05	30	30	43	53	4D	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	S	M	ETX
HEX	06	30	30	43	53	4D	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	S	M	0	1	0	2	ETX
HEX	15	30	30	43	53	4D	30	31	30	32	03

② cSM command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ENQ	0	0	c	S	M	EOT	6	C
HEX	05	30	30	63	53	4D	04	36	43

※ BCC indicates the lower 2 Byte of total HEX value from header to tail.

※ Total HEX value added is “16C”. Therefore, BCC becomes “6C(36/43)”.

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	Classification	
ASCII	ACK	0	0	c	S	M	ETX	6	C
HEX	06	30	30	63	53	4D	03	36	43

※ Total HEX value added is “16C”. Therefore, BCC becomes “6C(36/43)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	S	M	0	1	0	2	ETX	3	E
HEX	15	30	30	63	53	4D	30	31	30	32	03	33	45

※ Total HEX value added is "23E". Therefore, BCC becomes "3E(33/45)".

③ Csm command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail
ASCII	ENQ	0	0	C	s	m	EOT
HEX	05	30	30	43	73	6D	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	s	m	A	ETX
HEX	06	30	30	43	73	6D	41	03

※ Status : Servo sends 'A(00001010)' data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	s	m	0	1	0	2	A	ETX
HEX	15	30	30	43	73	6D	30	31	30	32	41	03

3) Operation Stop[CSH/cSH/Csh]

It keep remembers the current step information and operation information after stopped by stop command during servo operation and it operates continuously when the operation start command is input.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail	BCC	
ASCII	ENQ	0	0	C c	S s	H h					EOT		
HEX	05	30	30	43 63	53 73	48 68					04		

Deceleration time : It is set with the time takes to stop at rated speed.

[Input unit : 99.99 second]

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	C c	S s	H h		ETX		
HEX	06	30	30	43 63	53 73	48 68		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	C c	S s	H h						ETX		
HEX	15	30	30	43 63	53 73	48 68						03		

◈ Example of Operation Stop(CSH/cSH/Csh)

- Deceleration time :10.00

① CSH command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail
ASCII	ENQ	0	0	C	S	H	1	0	0	0	EOT
HEX	05	30	30	43	53	48	31	30	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	S	H	ETX
HEX	06	30	30	43	53	48	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	S	H	0	1	0	2	ETX
HEX	15	30	30	43	53	48	30	31	30	32	03

② cSH command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail	BCC	
ASCII	ENQ	0	0	c	S	H	1	0	0	0	EOT	2	8
HEX	05	30	30	63	53	48	31	30	30	30	04	32	38

※ BCC indicates the lower 2 Byte of total HEX value from header to tail.

※ Total HEX value added is “228”. Therefore, BCC becomes “28(32/38)”.

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	S	H	ETX	6	7
HEX	06	30	30	63	53	48	03	36	37

※ Total HEX value added is “167”. Therefore, BCC becomes “67(36/37)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	S	H	0	1	0	2	ETX	3	9
HEX	15	30	30	63	53	48	30	31	30	32	03	33	39

※ Total HEX value added is “239”. Therefore, BCC becomes “39(33/39)”.

③ Csh command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Deceleration time				Tail
ASCII	ENQ	0	0	C	s	h	1	0	0	0	EOT
HEX	05	30	30	43	73	68	31	30	30	30	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	s	h	A	ETX
HEX	06	30	30	43	73	68	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	s	h	0	1	0	2	A	ETX
HEX	15	30	30	43	73	68	30	31	30	32	41	03

4) Origin Operation[COR/cOR/Cor]

It executes the origin operation of mechanical system.

“Status” data of response frame exists only in the response frame of command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ENQ	0	0	C c	O o	R r	EOT		
HEX	05	30	30	43 63	4F 6F	52 72	04		

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
내용	ACK	0	0	C c	O o	R r		ETX		
ASCII	06	30	30	43 63	4F 6F	52 72		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
내용	NAK	0	0	C c	O o	R r						ETX		
ASCII	15	30	30	43 63	4F 6F	52 72						03		

◈ Example of Origin operation(COR/cOR/Cor)

① COR command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail
ASCII	ENQ	0	0	C	O	R	EOT
HEX	05	30	30	43	4F	52	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	O	R	ETX
HEX	06	30	30	43	4F	52	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	O	R	0	1	0	2	ETX
HEX	15	30	30	43	4F	52	30	31	30	32	03

② cOR command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ENQ	0	0	c	O	R	EOT	6	D
HEX	05	30	30	63	4F	52	04	36	44

※ BCC indicates the lower 2 Byte of total HEX value from header to tail.

※ Total HEX value added is “16D”. Therefore, BCC becomes “6D(36/44)”.

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	O	R	ETX	6	D
HEX	06	30	30	63	4F	52	03	36	44

※ Total HEX value added is “16D”. Therefore, BCC becomes “6D(36/44)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	O	R	0	1	0	2	ETX	3	F
HEX	15	30	30	63	4F	52	30	31	30	32	03	33	46

※ Total HEX value added is “23F”. Therefore, BCC becomes “3F(33/46)”.

③ Cor command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Tail
ASCII	ENQ	0	0	C	o	r	EOT
HEX	05	30	30	43	6F	72	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	o	r	A	ETX
HEX	06	30	30	43	6F	72	41	03

※ Status : Servo sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	o	r	0	1	0	2	A	ETX
HEX	15	30	30	43	6F	72	30	31	30	32	41	03

5) Gain Tuning Operation(Setting Speed, Distance & Tuning) [CGR/cGR/Cgr]

"Status" data of response frame exists only in the response frame of command term that starts with large + small + small letter.

① Request frame(ENQ)

Classification	Header	Station No.		Command term			Operation speed				Operation distance			range	Tail	BCC	
ASCII	ENQ	0	0	C c	G g	R r									EOT		
HEX	05	30	30	43 63	47 67	52 72									04		

Operation speed : Sets the Position operation speed. [Input unit : 9999 r/min]

Operation distance : Sets the Position operation distance [Input unit : 999]

Tuning range : Sets the tuning range. [Input unit : 0 ~ 5]

-> '0' is termination.

② Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail	BCC	
ASCII	ACK	0	0	C c	G g	R r		ETX		
HEX	06	30	30	43 63	47 67	52 72		03		

③ Response frame(NAK)

Classification	Header	Station No.		Command term			Error code				Status	Tail	BCC	
ASCII	NAK	0	0	C c	G g	R r						ETX		
HEX	15	30	30	43 63	47 67	52 72						03		

◈ Example of Gain Tuning Operation(CGR/cGR/Cgr)

- Operation speed=1000 , Distance=10 , Tuning range=2

① CGR command (Not including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Operation speed				Operation distance			range	Tail
ASCII	ENQ	0	0	C	G	R	1	0	0	0	0	1	0	2	EOT
HEX	05	30	30	43	47	52	31	30	30	30	30	31	30	32	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail
ASCII	ACK	0	0	C	G	R	ETX
HEX	06	30	30	43	47	52	03

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail
ASCII	NAK	0	0	C	G	R	0	1	0	2	ETX
HEX	15	30	30	43	47	52	30	31	30	32	03

② cGR command (Including BCC)

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Operation speed				Operation distance			range	Tail	BCC	
ASCII	ENQ	0	0	C	G	R	1	0	0	0	0	1	0	2	EOT	E	9
HEX	05	30	30	63	47	52	31	30	30	30	30	31	30	32	04	45	39

※ BCC indicates the lower 2 Byte of the total HEX value from header to tail.

※ Total HEX value added is “2E9”. Therefore, BCC becomes “E9(45/39)”.

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Tail	BCC	
ASCII	ACK	0	0	c	G	R	ETX	6	5
HEX	06	30	30	63	47	52	03	36	35

※ Total HEX value added is “165”. Therefore, BCC becomes “65(36/35)”.

→ Response frame(NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Tail	BCC	
ASCII	NAK	0	0	c	G	R	0	1	0	2	ETX	3	7
HEX	15	30	30	63	47	52	30	31	30	32	03	33	37

※ Total HEX value added is “237”. Therefore, BCC becomes “37(33/37)”.

③ Cgr command (Check servo status) : In case of InSPD/InPOS, Servo-ON

→ Request frame(ENQ)

Classification	Header	Station No.		Command term			Operation speed				Operation distance			range	Tail
ASCII	ENQ	0	0	C	g	r	1	0	0	0	0	1	0	2	EOT
HEX	05	30	30	43	67	72	31	30	30	30	30	31	30	32	04

→ Response frame(ACK)

Classification	Header	Station No.		Command term			Status	Tail
ASCII	ACK	0	0	C	g	r	A	ETX
HEX	06	30	30	43	67	72	41	03

※ Status : Sends ‘A(00001010)’ data.

Can see that the current status is InSPD/InPOS and Servo : ON.

→ Response frame (NAK) : In case that it is not a designated command term(0102)

Classification	Header	Station No.		Command term			Error code				Status	Tail
ASCII	NAK	0	0	C	g	r	0	1	0	2	A	ETX
HEX	15	30	30	43	67	72	30	31	30	32	41	03

Chapter 7

Product Specification

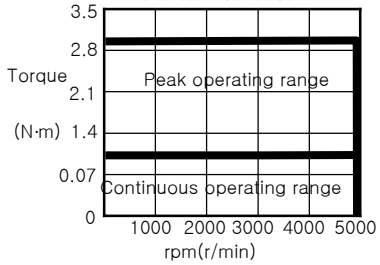
7.1 Servo Motor

7.1.1 Features

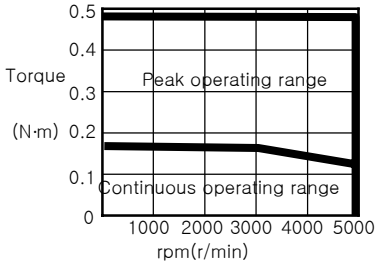
Servo Motor Model (APM-□□□□□)		SAR3A	SAR5A	SA01A	SB01A	SB02A	SB04A
Applicable drive (APD-□□□□)		VSR5		VS01		VS02	VS04
Rated Output	[kW]	0.03	0.05	0.1	0.1	0.2	0.4
Rated Torque	[N·m]	0.095	0.159	0.318	0.318	0.637	1.274
	[kgf·cm]	0.97	1.62	3.25	3.25	6.50	13.0
Maximum Instantaneous Torque	[N·m]	0.286	0.477	0.955	0.955	1.912	3.822
	[kgf·cm]	2.92	4.87	9.74	9.74	19.5	39.0
Rated rpm	[r/min]	3,000					
Maximum rpm	[r/min]	5,000					
Inertia	[kg·m^{2}x10^{-4}]	0.011	0.021	0.045	0.114	0.182	0.321
	[gf·cm·s^2]	0.0112	0.0214	0.0459	0.116	0.186	0.327
Allowable load inertia ratio		30 times of motor inertia			20 times of motor inertia		
Rated power rate	[kW/s]	5.57	10.52	23.80	8.92	22.26	50.65
Speed/Position Detector	Standard	Incremental 2,048[P/R]			Incremental 3,000[P/R]		
	Option	Absolute, 11/13bit Manchester communication					
Specification & Features	Structure	Totally enclosed·Non ventilated IP55(Excluding the shaft-through section and connectors)					
	Rated time	Continuous					
	Ambient temp	0~+40[°C]					
	Ambient humidity	20~80[%](Avoid freezing)					
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust					
	E/V	Elevation/Vibration 49[m/s^2](5G)					
Weight	[kg]	0.3	0.4	0.52	0.84	1.11	1.63

♦Speed-Torque characteristics♦

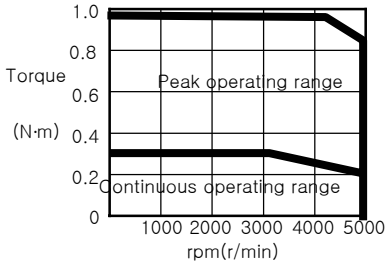
APM-SAR3A



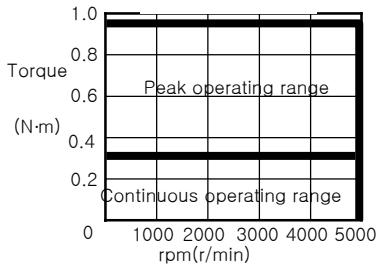
APM-SAR5A



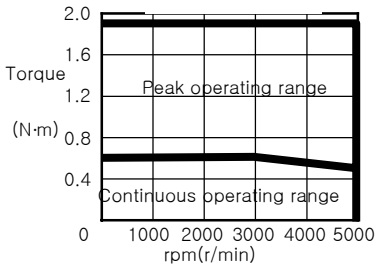
APM-SA01A



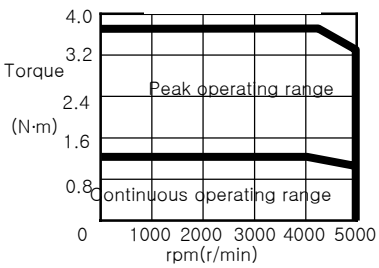
APM-SB01A



APM-SB02A



APM-SB04A

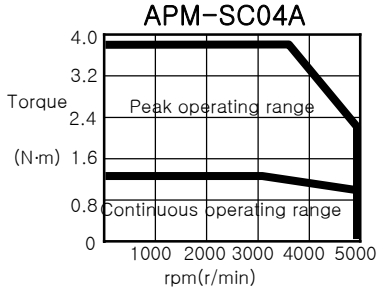


■ Product Features

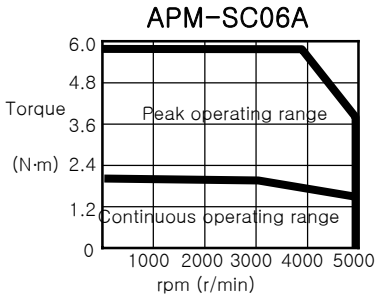
Servo Motor Model (APM-□□□□□)		SC04A	SC06A	SC08A	SC10A	SC03D	SC05D
Applicable drive (APD-□□□□)		VS04		VS05	VS10	VS04	
Rated Output	[kW]	0.4	0.6	0.8	1.0	0.3	0.45
Rated Torque	[N·m]	1.27	1.91	2.55	3.19	1.43	2.15
	[kgf·cm]	13.0	19.5	26.0	32.5	14.6	21.9
Maximum Instantaneous Torque	[N·m]	3.82	5.34	6.88	9.56	4.29	6.44
	[kgf·cm]	39.0	54.5	70.2	97.5	43.8	65.7
Rated rpm	[r/min]	3,000				2,000	
Maximum rpm	[r/min]	5,000				3,000	
Inertia	[kg·m^{2}x10^{-4}]	0.674	1.092	1.509	1.927	0.674	1.092
	[gf·cm·s^2]	0.687	1.114	1.539	1.966	0.687	1.114
Allowable load inertia ratio		15 times of motor inertia				15 times of motor inertia	
Rated power rate	[kW/s]	24.07	33.45	43.02	52.65	30.36	42.19
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]					
	Option	Absolute, 11/13bit Manchester communication					
Specification & Features	Structure	Totally enclosed·Non ventilated IP65(Excluding the shaft-through section and connectors)					
	Rated time	Continuous					
	Ambient temp	0~+40[°C]					
	Ambient humidity	20~80[%](Avoid freezing)					
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust					
	E/V	Elevation/Vibration 49[m/s^2](5G)					
Weight	[kg]	1.85	2.49	3.15	3.80	1.85	2.49

♦Speed-Torque characteristics♦

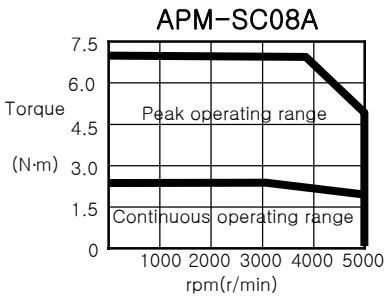
APM-SC04A



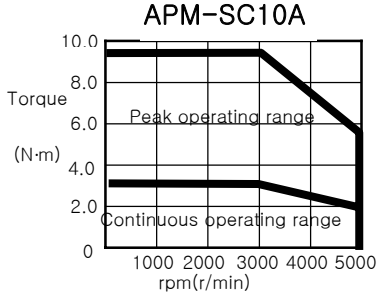
APM-SC06A



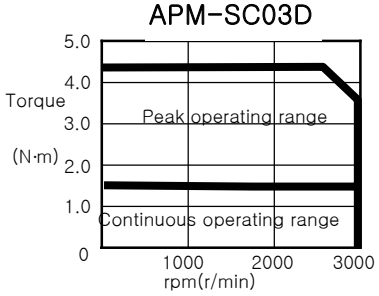
APM-SC08A



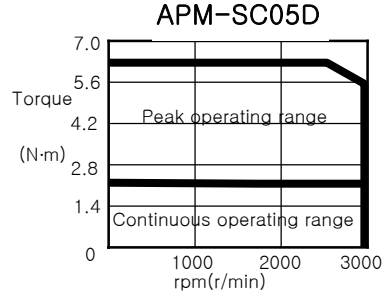
APM-SC10A



APM-SC03D



APM-SC05D

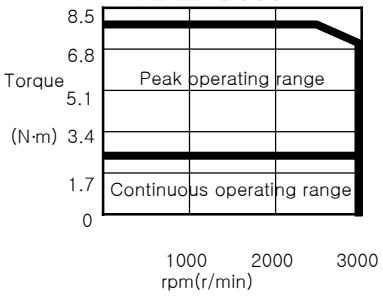


■ Product Features

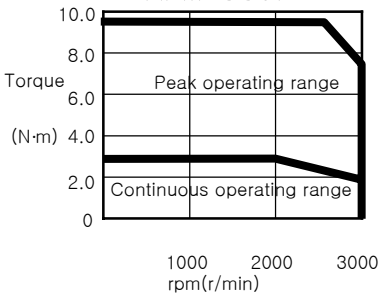
Servo Motor Model (APM-□□□□□)		SC06D	SC07D	SE09A	SE15A	SE22A	SE30A
Applicable drive (APD-□□□□)		VS05		VS10	VS15	VS20	VS35
Rated Output	[kW]	0.55	0.65	0.9	1.5	2.2	3.0
Rated Torque	[N·m]	2.63	3.09	2.86	4.77	7.0	9.55
	[kgf·cm]	26.8	31.6	29.2	48.7	71.4	97.4
Maximum Instantaneous Tprque	[N·m]	7.88	9.29	8.59	14.32	21.01	28.65
	[kgf·cm]	80.4	94.8	87.7	146.1	214.3	292.2
Rated rpm	[r/min]	2,000		3,000			
Maximum rpm	[r/min]	3,000		5,000			
Inertia	[$kg·m^2x10^{-4}$]	1.509	1.927	6.659	11.999	17.339	22.679
	[$gf·cm·s^2$]	1.539	1.966	6.792	12.238	17.685	23.132
Allowable load inertia ratio		15 times of motor inertia		10 times of motor inertia			
Rated power rate	[kW/s]	43.68	47.90	12.31	18.98	28.25	40.17
Speed/Position decector	Standard	Incremental 5[V] Line Drive 3,000[P/R]					
	Option	Absolute, 11/13bit Manchester communication					
Specification & Features	Structure	Totally enclosed·Non ventilated IP65(Excluding the shaft-through section and connectors)					
	Rated time	Continuous					
	Ambient temp	0~+40[°C]					
	Ambient humidity	20~80[%](Avoid freezing)					
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.					
	E/V	49[m/s^2](5G)					
Weight	[kg]	3.15	3.80	5.6	7.2	8.7	10.2

♦Speed-Torque characteristics♦

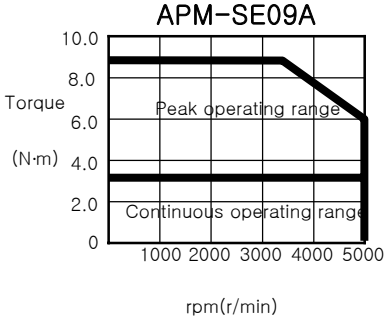
APM-SC06D



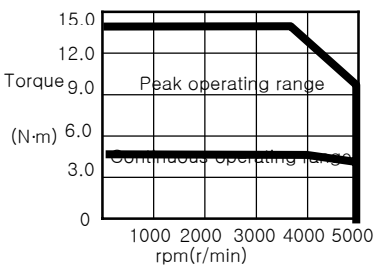
APM-SC07D



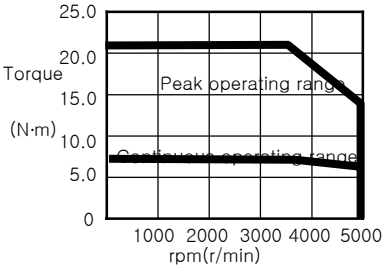
APM-SE09A



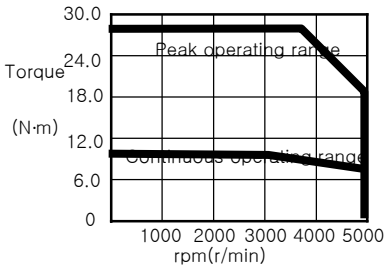
APM-SE15A



APM-SE22A



APM-SE30A

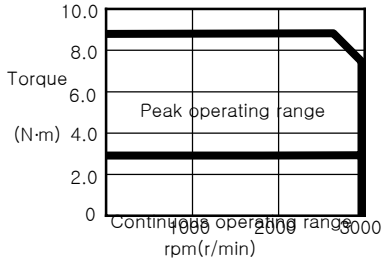


■ Product Features

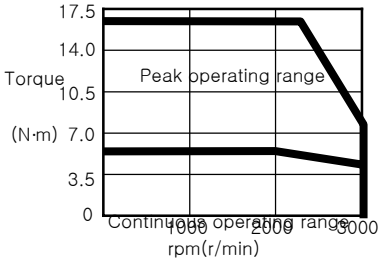
Servo Motor Model (APM-□□□□□)		SE06D	SE11D	SE16D	SE22D	SE03M	SE06M
Applicable drive (APD-□□□□)		VS05	VS10	VS15	VS20	VS04	VS05
Rated Output	[kW]	0.6	1.1	1.6	2.2	0.3	0.6
Rated Torque	[N·m]	2.86	5.25	7.63	10.5	2.86	5.72
	[kgf·cm]	29.2	53.6	77.9	107.1	29.2	58.4
Maximum Instantaneous Torque	[N·m]	8.59	15.75	22.92	31.51	8.59	17.18
	[kgf·cm]	87.7	160.7	233.8	321.4	87.7	175.3
Rated rpm	[r/min]	2,000				1,000	
Maximum rpm	[r/min]	3,000				2,000	
Inertia	[kg·m^{2}x10^{-4}]	6.659	11.999	17.339	22.679	6.659	11.999
	[gf·cm·s^2]	6.792	12.238	17.685	23.132	6.792	12.238
Allowable load inertia ratio		10 times of motor inertia				10 times of motor inertia	
Rated power rate	[kW/s]	12.31	22.97	33.63	48.61	12.31	27.34
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]					
	Option	Absolute, 11/13bit Manchester communication					
Specification & Features	Structure	Totally enclosed·Non ventilated IP65(Excluding the shaft-through section and connectors)					
	Rated time	Continuous					
	Ambient temp	0~+40[°C]					
	Ambient humidity	20~80[%](Avoid freezing)					
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.					
	E/V	49[m/s^2](5G)					
Weight	[kg]	5.6	7.2	8.7	10.2	5.6	7.2

♦Speed-Torque characteristics♦

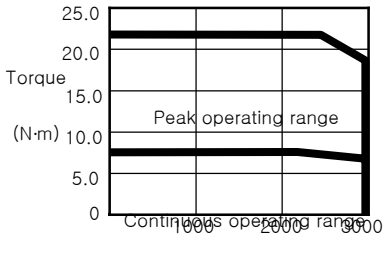
APM-SE06D



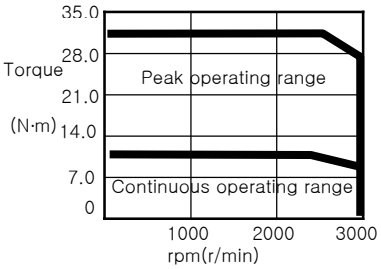
APM-SE11D



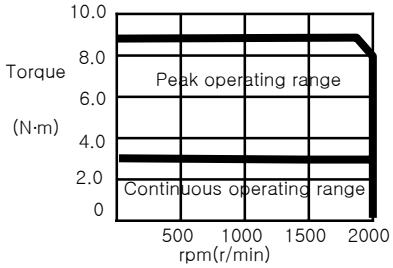
APM-SE16D



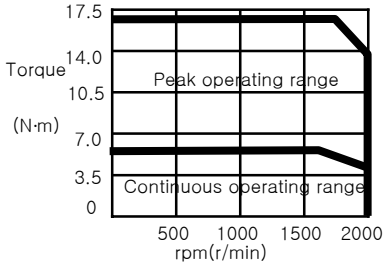
APM-SE22D



APM-SE03M



APM-SE06M

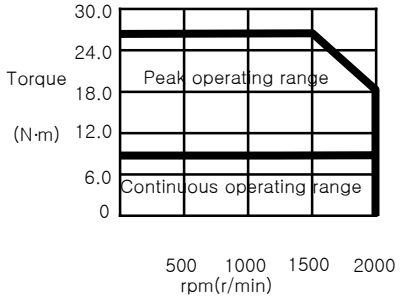


■ Product Features

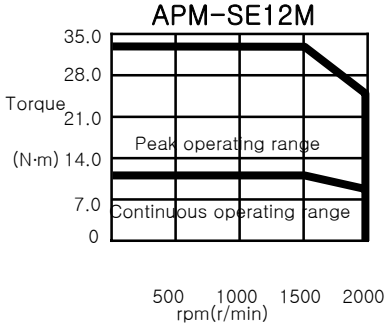
Servo Motor Model (APM-□□□□□)		SE09M	SE12M	SF30A	SF50A	SF22D	SF35D
Applicable drive (APD-□□□□)		VS10	VS15	VS35	VS50	VS20	VS35
Rated Output	[kW]	0.9	1.2	3.0	5.0	2.2	3.5
Rated Torque	[N·m]	8.59	11.46	9.55	15.91	10.5	16.7
	[kgf·cm]	87.7	116.9	97.4	162.3	107.1	170.4
Maximum Instantaneous Torque	[N·m]	25.77	34.22	28.64	47.74	31.5	50.12
	[kgf·cm]	262.9	349.1	292.2	487.0	321.3	511.3
Rated speed	[r/min]	1,000		3,000		2,000	
Maximum speed	[r/min]	2,000		5,000		3,000	
Inertia	[kg·m^{2}x10^{-4}]	17.339	22.679	30.74	52.13	30.74	52.13
	[gf·cm·s^2]	17.685	23.132	31.35	53.16	31.35	53.16
Allowable load inertia ratio		10 times of motor inertia		5 times of motor inertia		5 times of motor inertia	
Rated power rate	[kW/s]	42.56	57.85	29.66	48.56	35.88	53.56
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]					
	Option	Absolute, 11/13bit Manchester communication					
Specification & Features	Structure	Totally enclosed·Non ventilated IP65(Excluding the shaft-through section and connectors)					
	Rated time	Continuous					
	Ambient temp	0~+40[°C]					
	Ambient humidity	20~80[%](Avoid freezing)					
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.					
	E/V	49[m/s^2](5G)					
Weight	[kg]	8.7	10.2	12.4	17.7	12.4	17.7

♦Speed-Torque characteristics♦

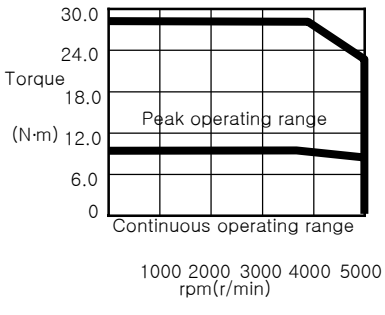
APM-SE09M



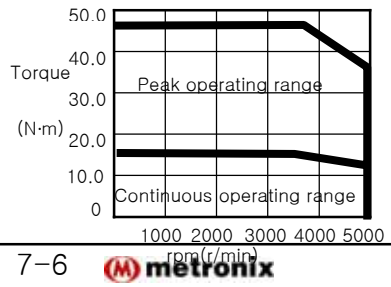
APM-SE12M



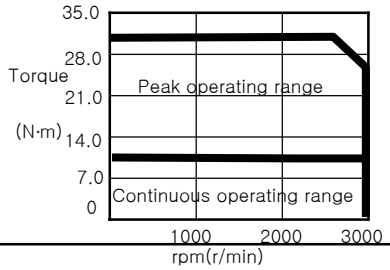
APM-SF30A



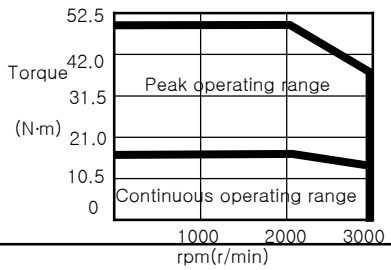
APM-SF50A



APM-SF22D



APM-SF35D

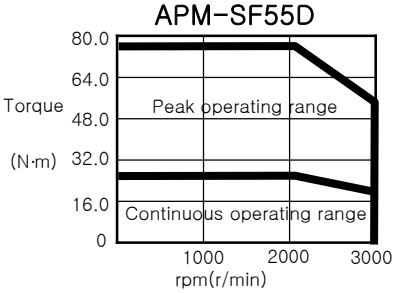


■ Product Features

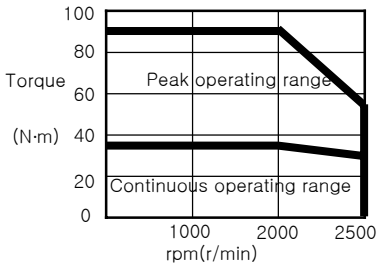
Servo Motor model (APM-□□□□□)		SF55D	SF75D	SF12M	SF20M	SF30M	SF44M
Applicable drive (APD-□□□□)		VS50	VS75	VS15	VS20	VS35	VS50
Rated Output	[kW]	5.5	7.5	1.2	2.0	3.0	4.4
Rated Torque	[N·m]	26.25	35.81	11.46	19.09	28.64	42.02
	[kgf·cm]	267.8	365.41	116.9	194.8	292.2	428.7
Maximum Instantaneous Torque	[N·m]	78.76	89.53	34.38	57.29	85.94	126.05
	[kgf·cm]	803.4	913.53	350.7	584.4	876.6	1286.2
Rated rpm	[r/min]	2,000		1,000			
Maximum rpm	[r/min]	3,000	2,500	2,000			
Inertia	[kg·m^{2}x10^{-4}]	83.60	121.35	30.74	52.13	83.60	121.35
	[gf·cm·s^2]	85.24	123.74	31.35	53.16	85.24	123.74
Allowable load inertia ratio		5 times of motor inertia		5 times of motor inertia			
Rated power rate	[kW/s]	82.56	105.75	42.70	69.96	98.16	145.55
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]					
	Option	Absolute, 11/13bit Manchester communication					
Specification & Features	Structure	Totally enclosed·Non ventilated IP65(Excluding the shaft-through section and connectors)					
	Rated time	Continuous					
	Ambient temp.	0~+40[°C]					
	Atmosphere	20~80[%](Avoid freezing)					
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.					
	E/V	49[m/s^2](5G)					
Weight	[kg]	26.3	35.6	12.4	17.7	26.3	35.6

♦Speed-Torque characteristics♦

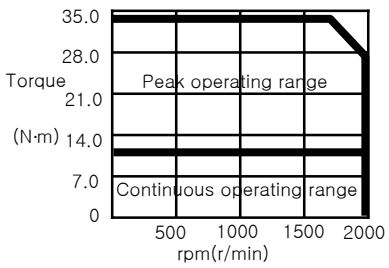
APM-SF55D



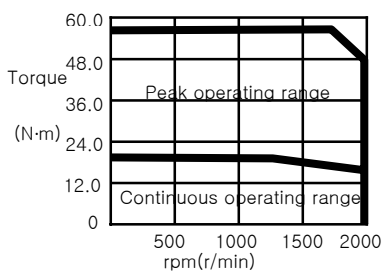
APM-SF75D



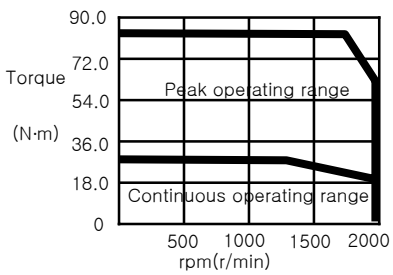
APM-SF12M



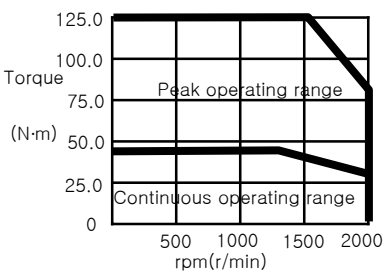
APM-SF20M



APM-SF30M



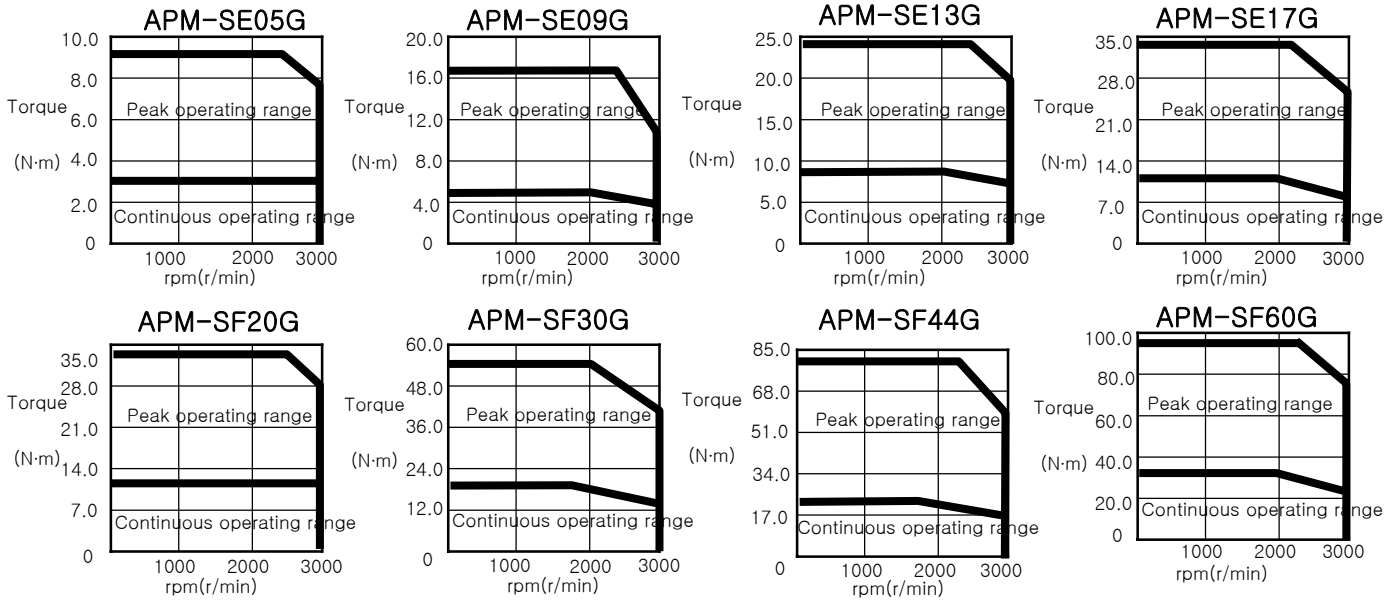
APM-SF44M



■ Product Features

Servo Motor Model (APM-□□□□□)		SE05G	SE09G	SE13G	SE17G	SF20G	SF30G	SF44G	SF60G
Applicable drive (APD-□□□□)		VS05	VS10	VS15	VS20		VS35	VS50	VS75
Rated Output	[kW]	0.45	0.85	1.3	1.7	1.8	2.9	4.4	6.0
Rated Torque	[N·m]	2.86	5.41	8.27	10.82	11.45	18.46	28.0	38.2
	[kgf·cm]	29.22	55.19	84.41	110.38	116.88	188.3	285.7	389.8
Maximum Instantaneous Torque	[N·m]	8.59	16.23	24.82	32.46	34.37	55.38	84.03	95.5
	[kgf·cm]	87.66	165.57	253.23	331.14	350.6	564.9	857.1	974.9
Rated rpm	[r/min]	1,500							
Maximum rpm	[r/min]	3,000							2,500
Inertia	[kg·m^{2}x10^{-4}]	6.659	11.999	17.339	22.679	30.74	52.13	83.60	121.35
	[gf·cm·s^2]	6.792	12.238	17.685	23.132	31.35	53.16	85.24	123.74
Allowable load inertia ratio		10 times of motor inertia				5 times of motor inertia			
Rated power rate	[kW/s]	12.28	24.39	39.54	51.61	42.70	65.36	93.84	120.32
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]							
	Option	Absolute, 11/13bit Manchester communication							
Specification & Features	Structure	Totally enclosed · Non ventilated IP65(Excluding the shaft-through section and connectors)							
	Rated time	Continuous							
	Ambient temp.	0~+40[°C]							
	Ambient humidity	20~80[%](Avoid freezing)							
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.							
	E/V	Elevation/Vibration 49[m/s^2](5G)							
Weight	[kg]	5.6	7.2	8.7	10.2	12.4	17.7	26.3	35.6

♦Speed-Torque characterisitics♦

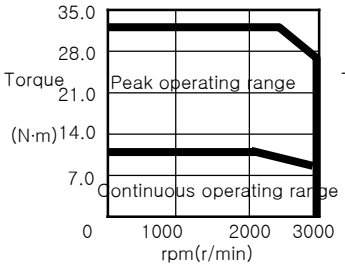


■ Product Features

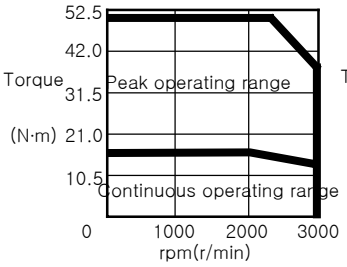
Servo Motor Model (APM-□□□□□)		SG22D	SG35D	SG55D	SG75D	SG110D	SG20G	SG30G
Applicable drive (APD-□□□□)		VS20	VS35	VS50	VS75	VS110	VS20	VS35
Rated Output	[kW]	2.2	3.5	5.5	7.5	11.0	1.8	2.9
Rated Torque	[N·m]	10.5	16.7	26.3	35.8	52.5	11.5	18.5
	[kgf·cm]	107.2	170.5	267.9	365.4	535.9	116.9	188.4
Maximum Instantaneous Torque	[N·m]	31.5	50.1	78.8	89.5	131.3	34.4	55.4
	[kgf·cm]	321.5	511.5	803.8	913.4	1339.7	350.8	565.1
Rated rpm	[r/min]	2,000					1,500	
Maximum rpm	[r/min]	3,000			2,500		3,000	
Inertia	[kg·m^{2}x10^{-4}]	51.42	80.35	132.41	172.91	291.36	51.42	80.35
	[gf·cm·s^2]	52.47	81.99	135.11	176.44	297.31	52.47	81.99
Allowable load inertia ratio		5 times of motor inertia						
Rated power rate	[kW/s]	21.45	34.75	52.07	74.15	94.65	25.53	42.41
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]						
	Option	Absolute, 11/13bit Manchester communication						
Specification & Features	Structure	Totally enclosed · Non ventilated IP65(Excluding the shaft-through section and connectors)						
	Rated time	Continuous						
	Ambient temp.	0~+40[°C]						
	Ambient humidity	20~80[%](Avoid freezing)						
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.						
	E/V	Elevation/Vibration 49[m/s^2](5G)						
Weight	[kg]	17.44	23.12	31.82	40.52	61.76	17.44	23.12

♦Speed-Torque characteristics♦

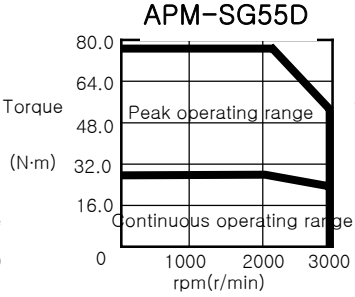
APM-SG22D



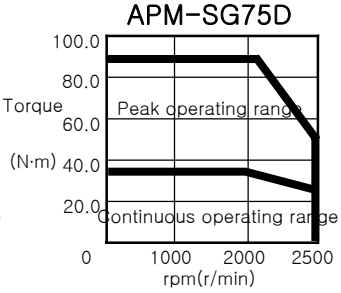
APM-SG35D



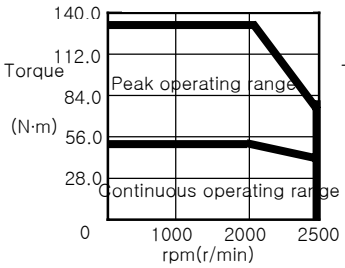
APM-SG55D



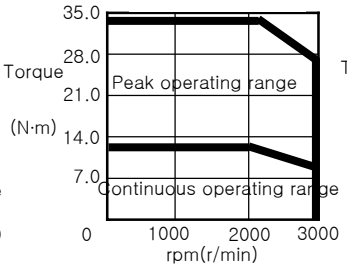
APM-SG75D



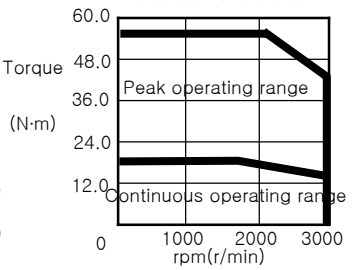
APM-SG110D



APM-SG20G



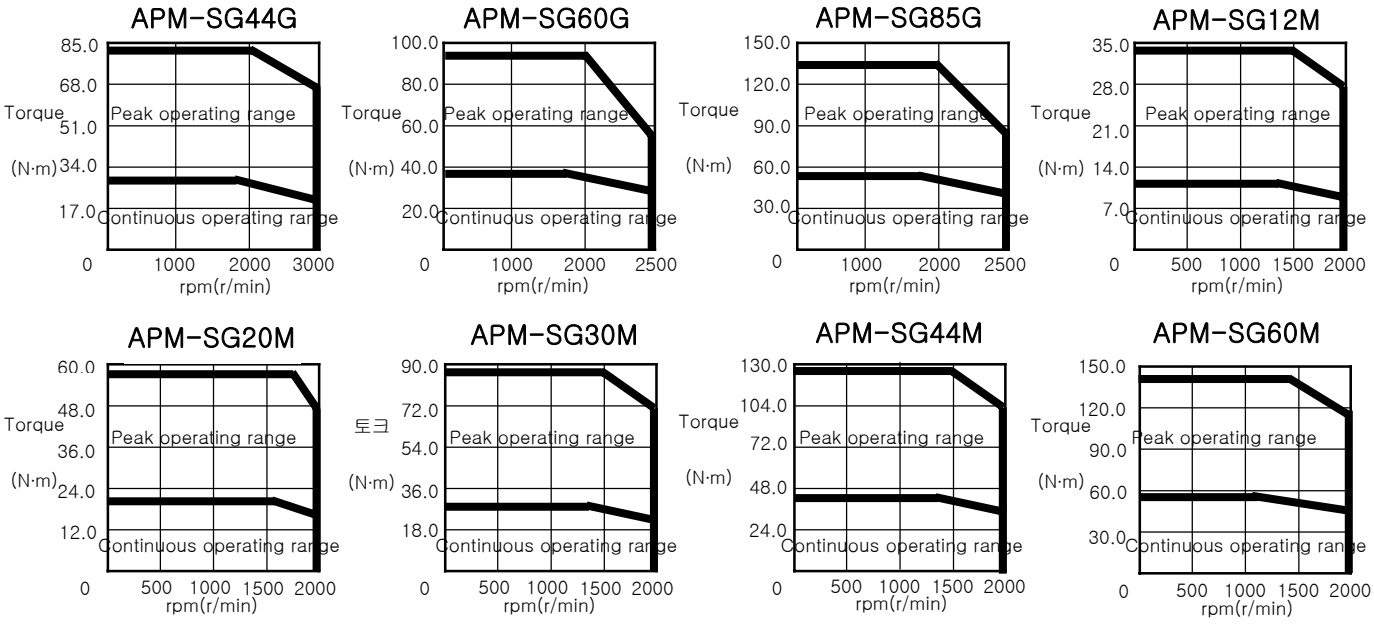
APM-SG30G



■ Product Features

Servo Motor Model (APM-□□□□□)		SG44G	SG60G	SG85G	SG12M	SG20M	SG30M	SG44M	SG60M
Applicable drive (APD-□□□□)		VS50	VS75	VS110	VS15	VS20	VS35	VS50	VS75
Rated Output	[kW]	4.4	6.0	8.5	1.2	2.0	3.0	4.4	6.0
Rated Torque	[N·m]	28.0	38.2	54.1	11.5	19.1	28.6	42.0	57.3
	[kgf·cm]	285.8	389.7	552.1	116.9	194.9	292.3	428.7	584.6
Maximum Instantaneous Torque	[N·m]	84.0	95.5	135.3	34.4	57.3	85.9	126.0	149.8
	[kgf·cm]	857.4	974.3	1380.3	350.8	584.6	876.9	1286.1	1528.6
Rated rpm	[r/min]	1,500			1,000				
Maximum rpm	[r/min]	3,000	2500		2,000				
Inertia	[kg·m^{2}x10^{-4}]	132.41	172.91	291.36	51.42	80.35	132.41	172.91	291.36
	[gf·cm·s^2]	135.11	176.44	297.31	52.47	81.99	135.11	176.44	297.31
Allowable load inertia ratio		5 times of motor inertia							
Rated power rate	[kW/s]	59.25	84.36	78.23	25.53	45.39	61.97	102.08	112.64
Speed/Position detector	Standard	Incremental 5[V] Line Drive 3,000[P/R]							
	Option	Absolute, 11/13bit Manchester communication							
Specification & Features	Structure	Totally enclosed · Non ventilated IP65(Excluding the shaft-through section and connectors)							
	Rated time	Continuous							
	Ambient temp.	0~+40[°C]							
	Ambient humidity	20~80[%](Avoid freezing)							
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas, oil mist, or dust.							
	E/V	Elevation/Vibration 49[m/s^2](5G)							
Weight	[kg]	31.82	40.52	61.76	17.44	23.12	31.82	40.52	61.76

♦Speed-Torque characteristics♦

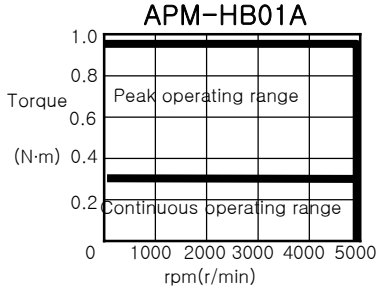


■ Product Features

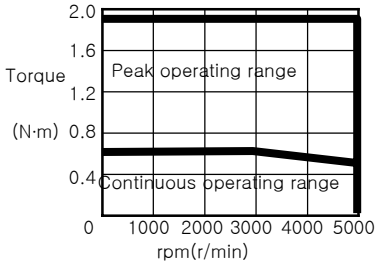
Servo Motor Model (APM-□□□□□)		HB01A	HB02A	HB04A	HE09A	HB15A
Applicable drive (APD-□□□□)		VS01	VS02	VS04	VS10	VS15
Rated Output	[kW]	0.1	0.2	0.4	0.9	1.5
Rated Torque	[N·m]	0.318	0.637	1.274	2.86	4.77
	[kgf·cm]	3.25	6.50	13.0	29.2	48.7
Maximum Instantaneous Torque	[N·m]	0.955	1.912	3.822	8.59	14.32
	[kgf·cm]	9.74	19.5	39.0	87.7	146.1
Rated rpm	[r/min]	3,000			3,000	
Maximum rpm	[r/min]	5,000			5,000	
Inertia	[kg·m^{2}x10^{-4}]	0.269	0.333	0.461	19.558	22.268
	[gf·cm·s^2]	0.274	0.339	0.470	19.943	22.707
Allowable load inertia ratio		20 times of motor inertia			10 times of motor inertia	
Rated power rate	[kW/s]	3.34	11.98	34.47	4.10	10.01
Speed/Position detector		Incremental 5[V] Line Drive 1,024P/R			2,048[P/R]	
Specification & Features	Structure	Totally enclosed · Non ventilated IP55(Excluding the shaft-through section and connectors)				
	Rated time	Continuous				
	Ambient temp.	0~+40°C				
	Ambient humidity	20~80%(Avoid freezing)				
	Atmosphere	Avoid direct sunlight, no corrosive gas, inflammable gas oil mist, or dust.				
	E/V	Elevation/Vibration 49m/s^2(5G)				
Weight	[kg]	0.89	1.16	1.69	5.82	7.43

♦Speed-Torque characteristics♦

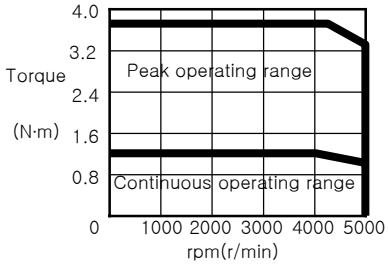
APM-HB01A



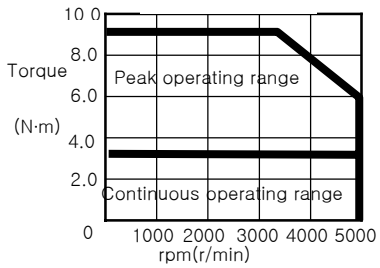
APM-HB02A



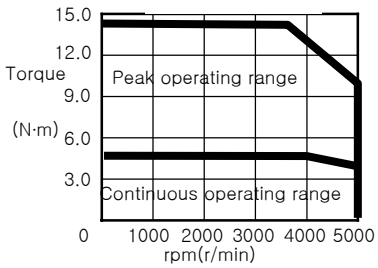
APM-HB04A



APM-HE09A



APM-HE15A



■ Electronic Brake's Specification

사 진

Applicable Motor Series	APM-SA	APM-SB	APM-SC	APM-SE	APM-SF	APM-SG
Use	Maintenance	Maintenance	Maintenance	Maintenance	Maintenance	Maintenance
Power Supply [V]	DC 24V	DC 24V	DC 24V	DC 90V	DC 90V	DC 90V
Rated Friction Torque [N•m]	0.32	1.47	3.23	9.2	40.2	74
Capacity [W]	6	6.5	9	7	33	25
Coil Resistance [Ω]	96	89	64	1150	245	327
Rated Current [A]	0.25	0.27	0.38	0.08	0.37	0.28
Braking type	Spring brake	Spring brake	Spring brake	Spring brake	Spring brake	Spring brake
Insulation Class	F - class	F - class	F - class	F - class	F - class	F - class

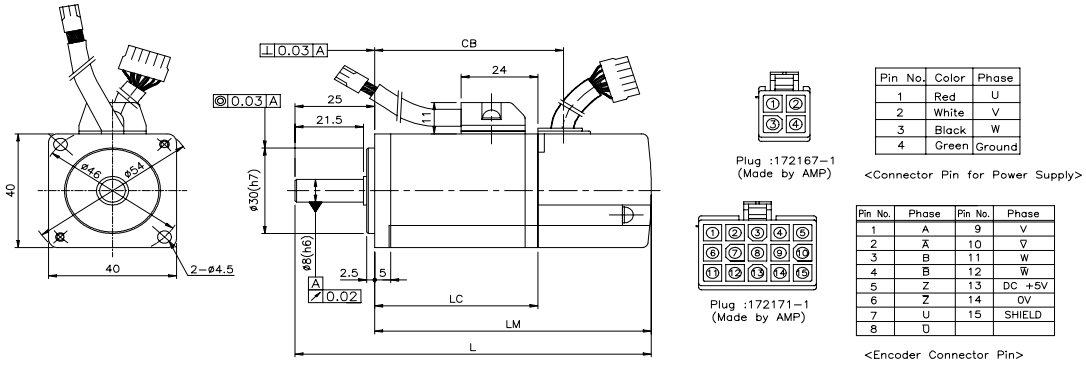
Note) 1. For the Electronic Brake that is attached to our Servo Motor, the same specifications are to be applied as per the series.

2. Never use it for braking purpose because the electronic brake is only for maintenance of stopped condition.

3. The characteristic of electronic brake is measured at 20℃.

7.1.2 External Dimensions

♦ Standard type : APM-SAR3A, APM-SAR5A, APM-SA01A



<Connector Pin for Power Supply>

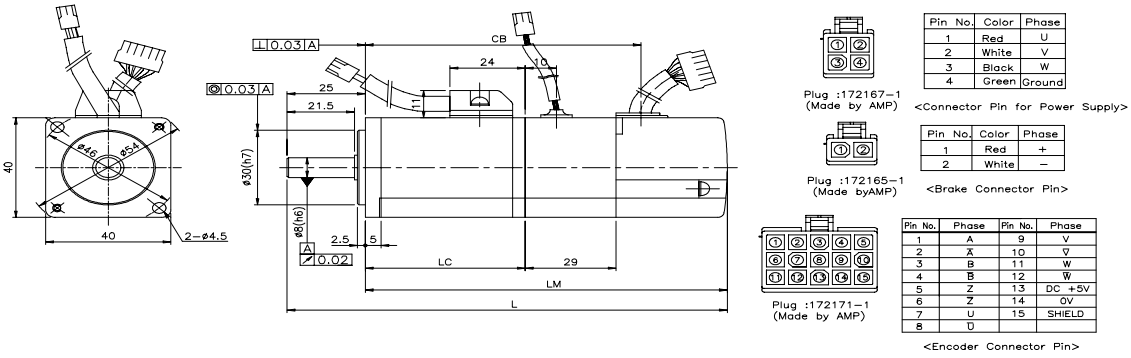
Pin No.	Color	Phase
1	Red	U
2	White	V
3	Black	W
4	Green	Ground

<Encoder Connector Pin>

Pin No.	Phase	Pin No.	Phase
1	A	9	V
2	Ā	10	V̄
3	B	11	W
4	B̄	12	W̄
5	Z	13	DC +5V
6	Z̄	14	0V
7	U	15	SHIELD
8	Ū		

Model	External dimensions				Weight(kg)
	L	LM	LC	CB	
SAR3A	104.5	79.5	44	52	0.3
SAR5A	111.5	86.5	51	59	0.4
SA01A	128.5	103.5	68	76	0.52

♦ Brake-attached type : APM-SAR3A, APM-SAR5A, APM-SA01A



<Connector Pin for Power Supply>

Pin No.	Color	Phase
1	Red	U
2	White	V
3	Black	W
4	Green	Ground

<Brake Connector Pin>

Pin No.	Color	Phase
1	Red	+
2	White	−

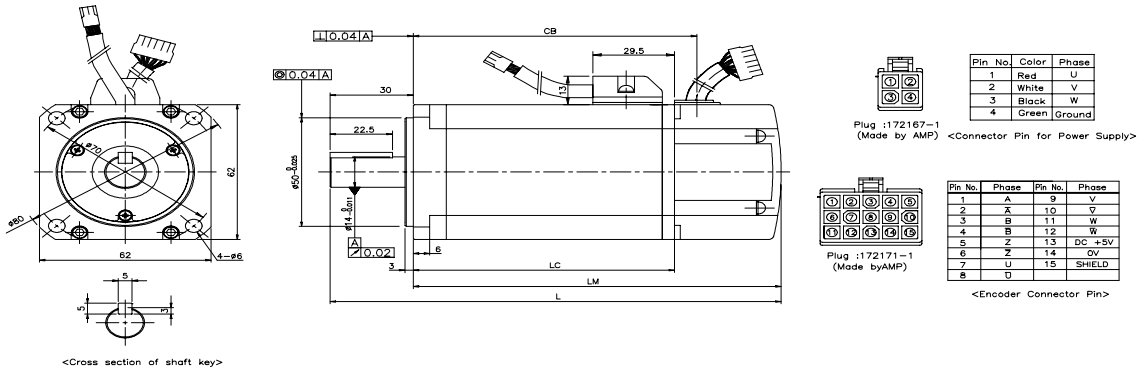
<Encoder Connector Pin>

Pin No.	Phase	Pin No.	Phase
1	A	9	V
2	Ā	10	V̄
3	B	11	W
4	B̄	12	W̄
5	Z	13	DC +5V
6	Z̄	14	0V
7	U	15	SHIELD
8	Ū		

Model	External dimensions				Weight(kg)
	L	LM	LC	CB	
SAR3A	133.5	108.5	44	81	0.65
SAR5A	140.5	115.5	51	88	0.75
SA01A	157.5	132.5	68	105	0.87

Note) Use DC 24[V] for brake input power supply

♦ Standard type : APM-SB01A, APM-SB02A, APM-SB04A

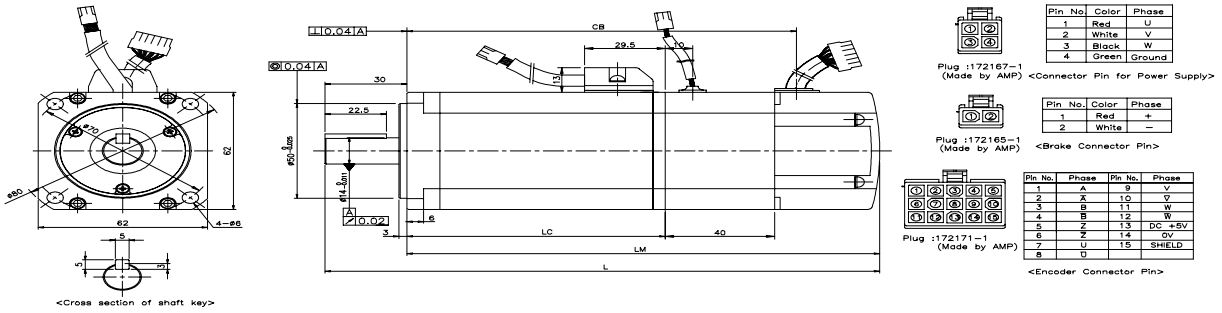


Pin No.	Color	Phase
1	Red	U
2	White	V
3	Black	W
4	Green	Ground

Pin No.	Phase	Pin No.	Phase
1	A	9	V
2	$\bar{A}$	10	$\bar{V}$
3	B	11	W
4	$\bar{B}$	12	$\bar{W}$
5	Z	13	DC +5V
6	$\bar{Z}$	14	0V
7	U	15	SHIELD
8	$\bar{U}$		

Model	External dimensions				Weight(kg)
	L	LM	LC	CB	
SB01A	120.5	90.5	52.5	60.5	0.84
SB02A	134.5	104.5	66.5	74.5	1.11
SB04A	162.5	132.5	94.5	102.5	1.64

♦ Brake-attached type : APM-SB01A, APM-SB02A, APM-SB04A



Pin No.	Color	Phase
1	Red	U
2	White	V
3	Black	W
4	Green	Ground

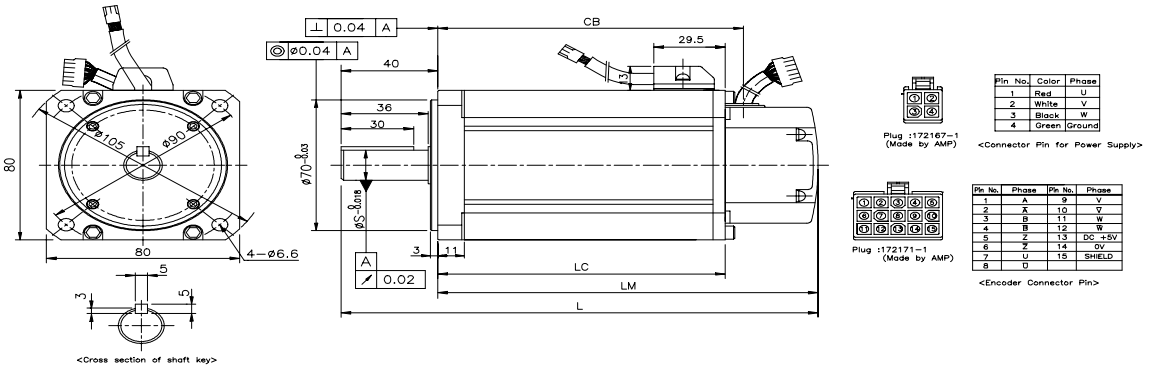
Pin No.	Color	Phase
1	Red	+
2	White	–

Pin No.	Phase	Pin No.	Phase
1	A	9	V
2	$\bar{A}$	10	$\bar{V}$
3	B	11	W
4	$\bar{B}$	12	$\bar{W}$
5	Z	13	DC +5V
6	$\bar{Z}$	14	0V
7	U	15	SHIELD
8	$\bar{U}$		

Model	External dimensions				Weight(kg)
	L	LM	LC	CB	
SB01A	160.5	130.5	52.5	100.5	1.21
SB02A	174.5	144.5	66.5	114.5	1.49
SB04A	202.5	172.5	94.5	142.5	2.05

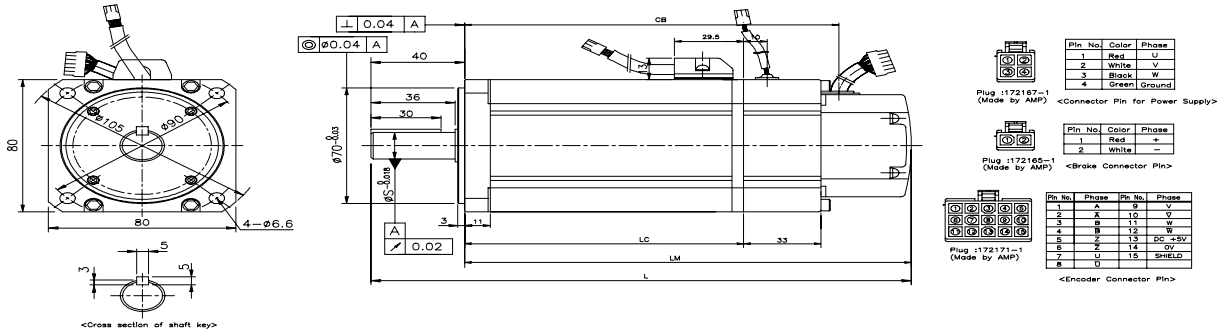
Note) Use DC 24[V] for brake input power supply.

♦ Standard type : APM-SC04A,SC03D, APM-SC06A,SC05D
APM-SC08A,SC06D, APM-SC10A,SC07D



Model	External dimensions					Weight(kg)
	L	LM	LC	CB	S	
SC04A,SC03D	158	118	79	86.5	14	1.85
SC06A,SC05D	178	138	99	106.5	16	2.49
SC08A,SC06D	198	158	119	126.5	16	3.15
SC10A,SC07D	218	178	139	146.5	16	3.80

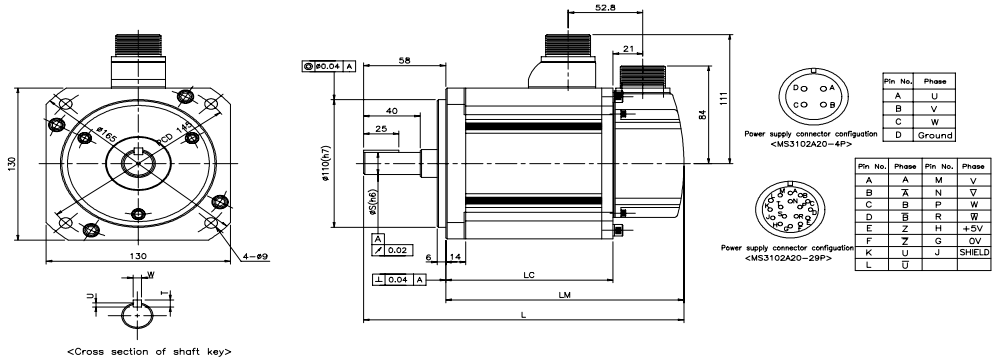
♦ Brake-attached type : APM-SC04A,SC03D, APM-SC06A,SC05D
APM-SC08A,SC06D, APM-SC10A,SC07D



Model	External dimensions					Weight(kg)
	L	LM	LC	CB	S	
SC04A,SC03D	191	151	79	119.5	14	2.45
SC06A,SC05D	211	171	99	139.5	16	3.09
SC08A,SC06D	231	191	119	159.5	16	3.75
SC10A,SC07D	251	211	139	179.5	16	4.40

Note) Use DC 24[V] for brake input power supply.

♦ Standard type : APM-SE09A,SE06D,SE05G,SE03M, APM-SE15A,SE11D,SE09G,SE06M
APM-SE22A,SE16D,SE13G,SE09M, APM-SE30A,SE22D,SE17G,SE12M

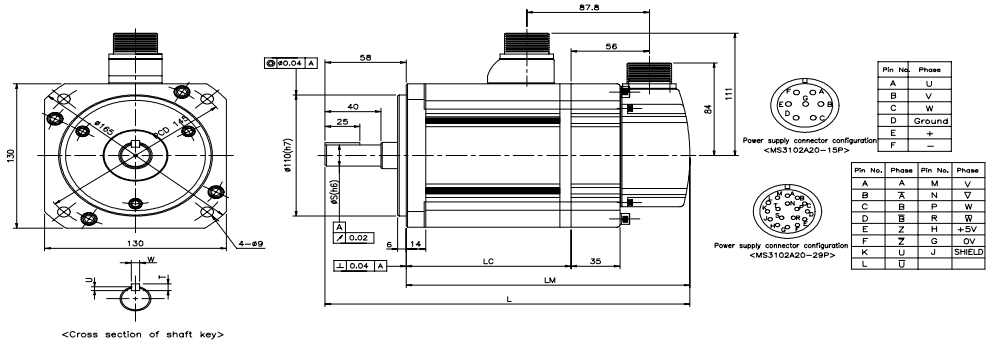


Pin No.	Phase
A	U
B	V
C	W
D	Ground

Pin No.	Phase	Pin No.	Phase
A	A	M	V
B	$\overline{A}$	N	$\overline{V}$
C	B	P	W
D	$\overline{B}$	R	$\overline{W}$
E	Z	H	+5V
F	$\overline{Z}$	G	0V
K	U	J	SHIELD
L	$\overline{U}$		

Model	External dimensions				Key dimensions			Weight(kg)
	L	LM	LC	S	T	W	U	
SE09A,SE06D,SE05G,SE03M	202	144	94	19	5	5	3	5.6
SE15A,SE11D,SE09G,SE06M	226	168	118	19	5	5	3	7.2
SE22A,SE16D,SE13G,SE09M	250	192	142	22	6	6	3.5	8.7
SE30A,SE22D,SE17G,SE12M	274	216	166	22	6	6	3.5	10.2

♦ Brake-attached type : APM-SE09A,SE06D,SE05G,SE03M, APM-SE15A,SE11D,SE09G,SE06M
APM-SE22A,SE16D,SE13G,SE09M, APM-SE30A,SE22D,SE17G,SE12M



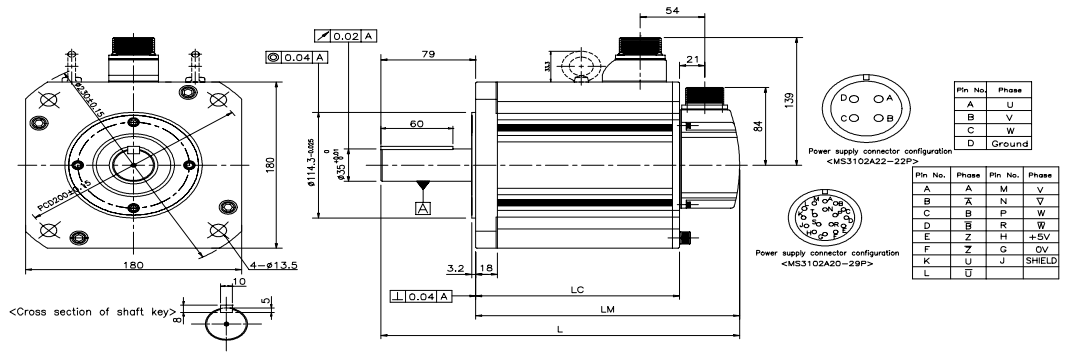
Pin No.	Phase
A	U
B	V
C	W
D	Ground
E	+
F	−

Pin No.	Phase	Pin No.	Phase
A	A	M	V
B	$\overline{A}$	N	$\overline{V}$
C	B	P	W
D	$\overline{B}$	R	$\overline{W}$
E	Z	H	+5V
F	$\overline{Z}$	G	0V
K	U	J	SHIELD
L	$\overline{U}$		

Model	External dimensions				Key dimensions			Weight(kg)
	L	LM	LC	S	T	W	U	
SE09A,SE06D,SE05G,SE03M	237	179	94	19	5	5	3	7.4
SE15A,SE11D,SE09G,SE06M	261	203	118	19	5	5	3	9.0
SE22A,SE16D,SE13G,SE09M	285	227	142	22	6	6	3.5	10.5
SE30A,SE22D,SE17G,SE12M	309	251	166	22	6	6	3.5	12.0

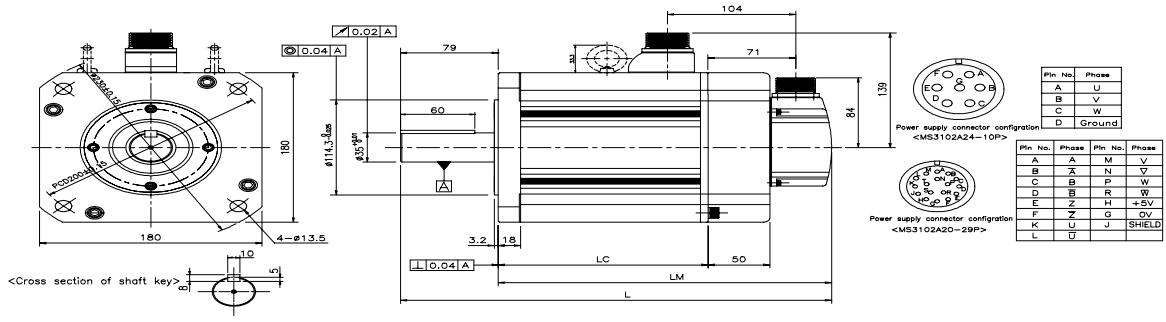
Note) Use DC 90[V] for brake input power supply.

♦ Standard type : APM-SF30A,SF22D,SF20G,SF12M, APM-SF50A,SF35D,SF30G,SF20M
APM-SF55D,SF44G,SF30M, APM-SF75D,SF60G,SF44M



Model	External dimensions			Weight(kg)
	L	LM	LC	
SF30A,SF22D,SF20G,SF12M	261.8	182.8	132.8	12.4
SF50A,SF35D,SF30G,SF20M	294.8	215.8	165.8	17.7
SF55D,SF44G,SF30M	344.8	265.8	215.8	26.3
SF75D,SF60G,SF44M	404.8	325.8	275.8	35.6

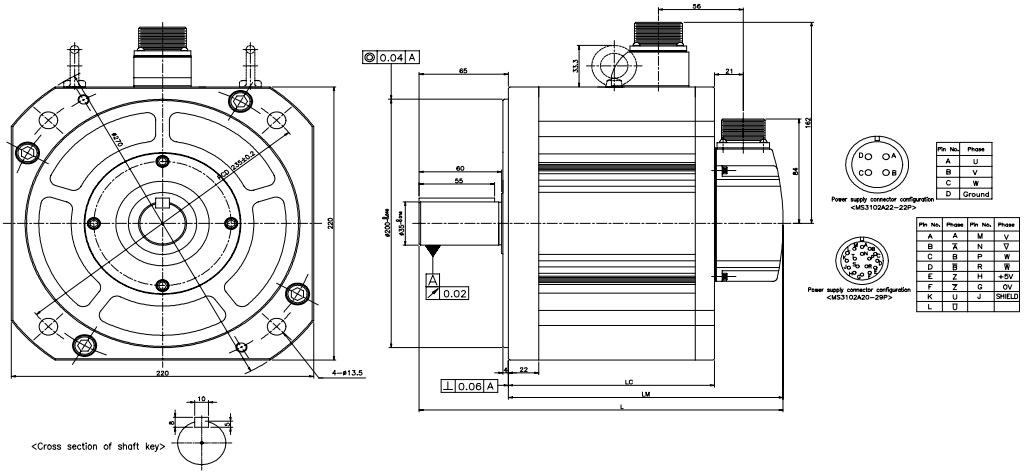
♦ Brake-attached type : APM-SF30A,SF22D,SF20G,SF12M, APM-SF50A,SF35D,SF30G,SF20M
APM-SF55D,SF44G,SF30M, APM-SF75D,SF60G,SF44M



Model	External dimensions			Weight(kg)
	L	LM	LC	
SF30A,SF22D,SF20G,SF12M	311.8	232.8	132.8	17.6
SF50A,SF35D,SF30G,SF20M	344.8	265.8	165.8	24.9
SF55D,SF44G,SF30M	394.8	315.8	215.8	33.5
SF75D,SF60G,SF44M	454.8	375.8	275.8	42.8

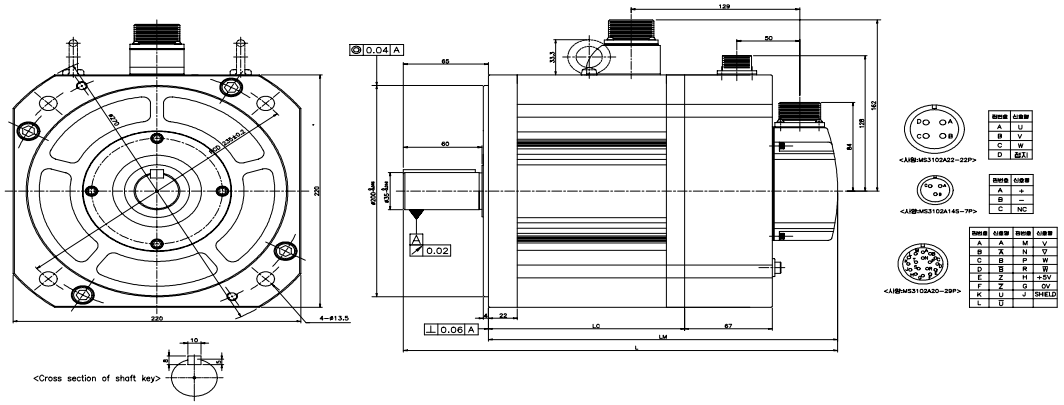
Note) Use DC 90[V] for brake input power supply.

♦ Standard type :APM-SG22D,SG20G,SG12M, APM-SG35D,SG30G,SG20M
APM-SG55D,SG44G,SG30M, APM-SG75D,SG60G,SG44M



Model	External dimensions			Weight(kg)
	L	LM	LC	
SG22D,SG20G,SG12M	245	180	130	17.44
SG35D,SG30G,SG20M	265	200	150	23.12
SG55D,SG44G,SG30M	301	236	186	31.82
SG75D,SG60G,SG44M	329	264	214	40.52

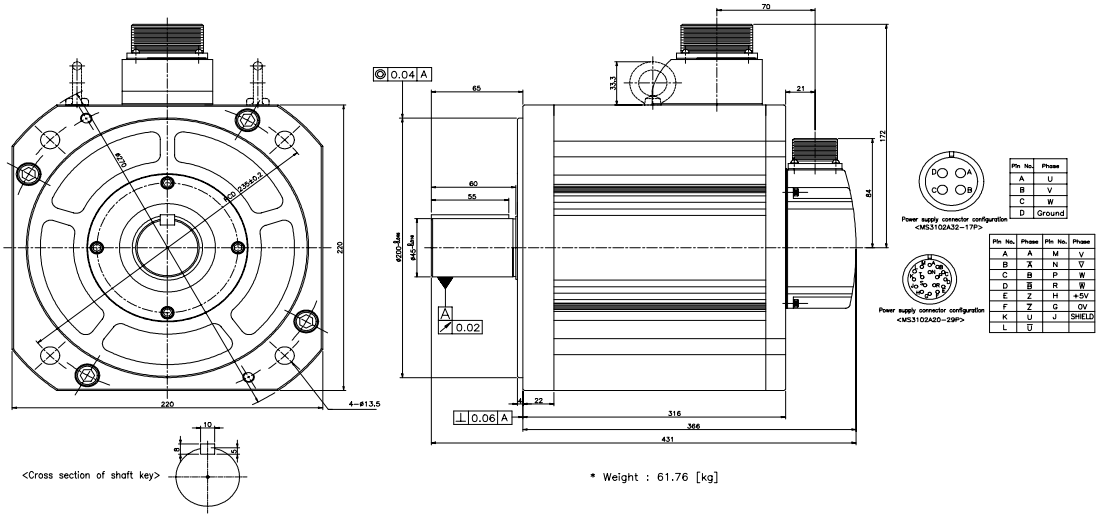
♦ Brake-attached type : APM-SG22D,SG20G,SG12M, APM-SG35D,SG30G,SG20M
APM-SG55D,SG44G,SG30M, APM-SG75D,SG60G,SG44M



Model	External dimensions			Weight(kg)
	L	LM	LC	
SG22D,SG20G,SG12M	312	247	130	31.5
SG35D,SG30G,SG20M	332	267	150	37.2
SG55D,SG44G,SG30M	368	303	186	45.9
SG75D,SG60G,SG44M	396	331	214	54.6

Note) Use DC 90[V] for brake input power supply.

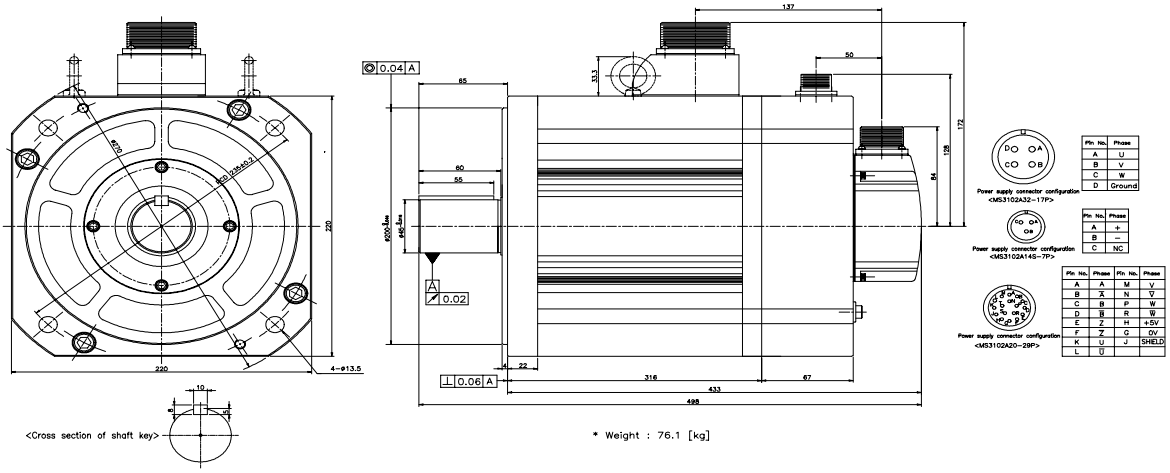
♦ Standard type : APM-SG110D, SG85G, SG60M



Pin No.	Phase
A	U
B	V
C	W
D	Ground

Pin No.	Phase	Pin No.	Phase
A	A	M	V
B	X	N	V
C	B	P	W
D	B	R	W
E	Z	H	+5V
F	Z	G	0V
K	U	J	SHIELD
L	U		

♦ Brake-attached type : APM-SG110D, SG85G, SG60M



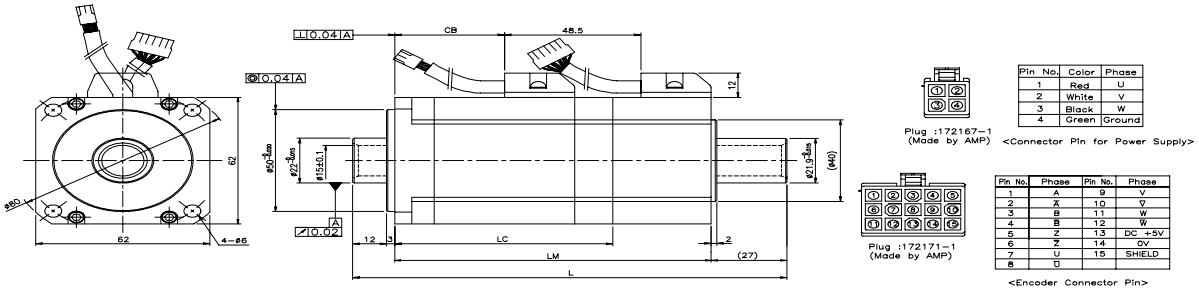
Pin No.	Phase
A	U
B	V
C	W
D	Ground

Pin No.	Phase
A	+
B	–
C	NC

Pin No.	Phase	Pin No.	Phase
A	A	M	V
B	X	N	V
C	B	P	W
D	B	R	W
E	Z	H	+5V
F	Z	G	0V
K	U	J	SHIELD
L	U		

Note) Use DC 90[V] for brake input power supply.

♦ APM-HB01A(Hollow shaft type), APM-HB02A(Hollow shaft type), APM-HB04A(Hollow shaft type)

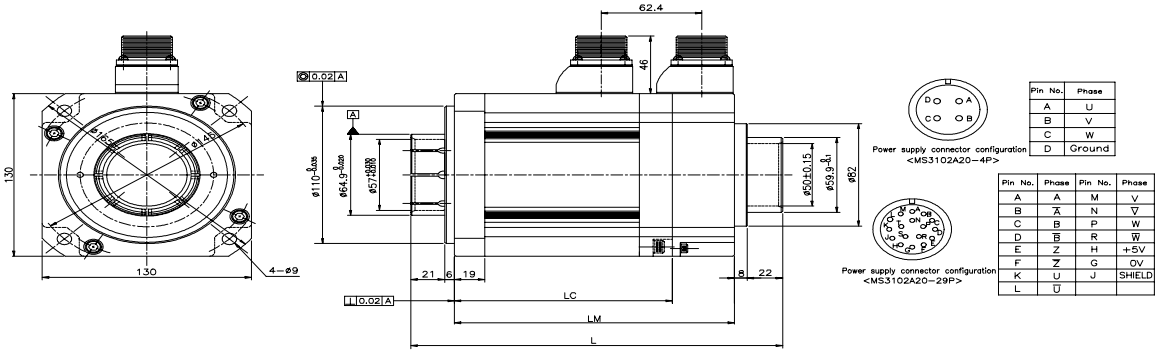


Pin No.	Color	Phase
1	Red	U
2	White	V
3	Black	W
4	Green	Ground

Pin No.	Phase	Pin No.	Phase
1	A	9	V
2	$\overline{A}$	10	$\overline{V}$
3	B	11	W
4	$\overline{B}$	12	$\overline{W}$
5	Z	13	DC +5V
6	$\overline{Z}$	14	0V
7	U	15	SHIELD
8	$\overline{U}$		

Model	External dimensions				Weight(Kg)
	L	LM	LC	CB	Hollow shaft type	
HB01A	140.5	98.5	63.5	25	15	0.89
HB02A	154.5	112.5	77.5	39	15	1.16
HB04A	182.5	140.5	105.5	67	15	1.69

♦ APM-HE09A(Hollow shaft type), APM-HE15A(Hollow shaft type)



Pin No.	Phase
A	U
B	V
C	W
D	Ground

Pin No.	Phase	Pin No.	Phase
A	A	M	V
B	$\overline{A}$	N	$\overline{V}$
C	B	P	W
D	$\overline{B}$	R	$\overline{W}$
E	Z	H	+5V
F	$\overline{Z}$	G	0V
K	U	J	SHIELD
L	$\overline{U}$		

Model	External dimensions			Weight(Kg)
	L	LM	LC	Hollow shaft type	
HE09A	207	150	111.5	50	5.82
HE15A	231	174	135.5	50	7.43

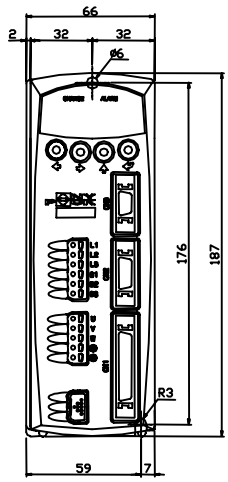
7.2 Servo Drive

7.2.1 Features

Item \ Model		VSR5	VS01	VS02	VS04	VS05	VS10	VS15	VS20	VS35	VS50	VS75	VS110
Input voltage		3 Phase AC 200~230[V]+10[%]-15[%], 50/60[Hz]											
Applicable Motor	Voltage type	3 Phase sine wave PWM-driven AC Servo motor											
	Rated current	1.2	1.65	1.65	3.2	4.3	6.4	11	16	21	32	38	50
	Max.current	3.6	4.95	4.95	9.6	12.9	19.2	33	48	63	96	102	125
Detector system		Standard : Incremental line driver 2000~10000 [P/R] Option : Absolute 11/13bit											
Speed Control mode	Speed control range	Max. 1 : 10000											
	Frequency response	Max. 400[Hz]											
	Speed command	DC –10[V] ~ +10[V](Reverse rotation in case of minus voltage), digital command 7 speeds											
	Accleleration/ Deceleration time	Linear or S shape acceleration/deceleration (0~100,000[ms], Setting 1[ms] unit is possible)											
	Speed variation ratio	±0.01[%]or less [Load variation 0~100%시] , ±0.1[%]or less[온도25±10℃]											
Position Control Mode	Input frequency	500[kpps]											
	Input pulse type	A+B phase, forward and reverse pulse, direction + pulse[Line driver, Open collector]											
	Electrical gear ratio	Setting and selecting 4 digital electronic gear ratio. Precise adjustment is possible.											
Torque Control Mode	Torque command input	DC –10[V] ~ +10[V][-Reverse rotation in case of minus voltage]											
	Torque Linearity	2[%] or less											
	Limit speed command	DC 0[V] ~ +10[V], digital command 3 speeds.											
Built In Function	Generated braking	Standard built in [Operating at servo alarm of servo OFF]											
	Regenerated braking	Option	Built in	Provide standard resistor									Option
	Display	Built in 7-Segments[6Digits], CHARGE & ALARM Lamp											
	Monitor output	DC –5[V] ~ +5[V], 2 channels [speed, torque, position, etc]											
	Protective functions	Overcurrent, overload, overvoltage, voltage shortage, overspeed, wrong wiring, encoder problem, position following problem											
Ambient Ervir on-ment	Temp.	0 ~ 50[℃]											
	Humidity	90[%] or less (avoid condensation)											
	Atmosphere	Indoors, no corrosive gas, inflammable gas and fluid, oil mist, or dust											

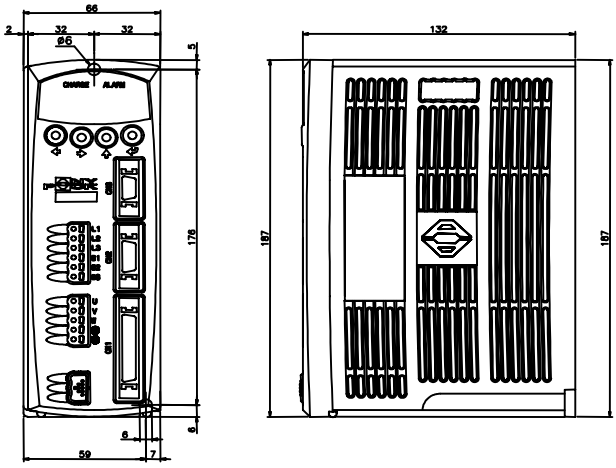
7.2.2 External Dimensions

♦ APD-VSR5N, APD-VS01N, APD-VS02N



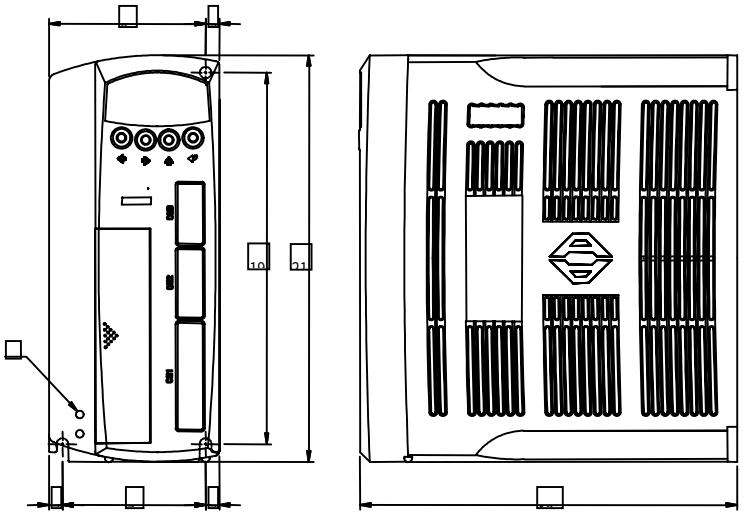
★ Weight : 1.2[kg]

♦ APD-VS04N



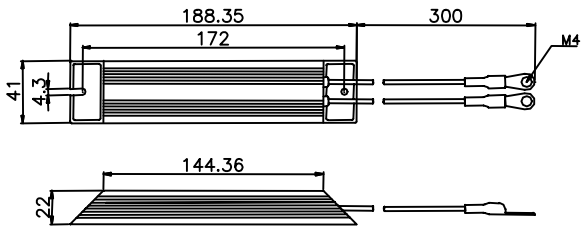
★ Weight : 1.5[kg]

♦ APD-VS05N, APD-VS10N



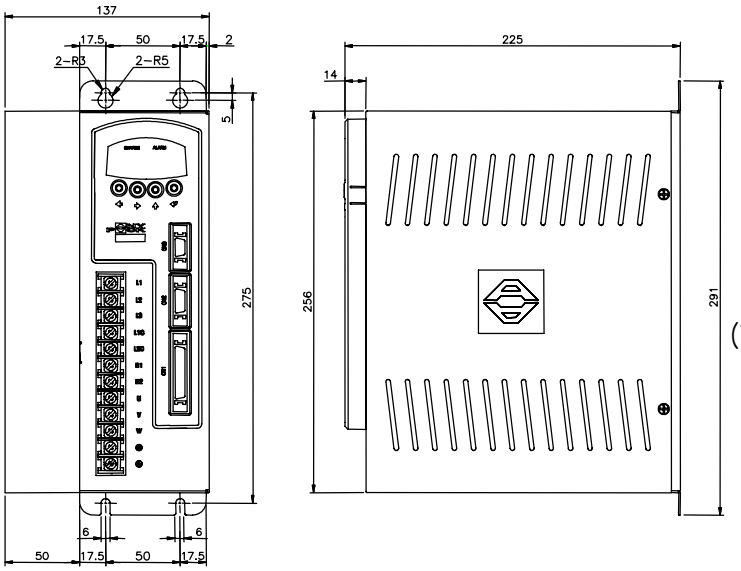
★ Weight:2.5[kg]

[Standard regenerative braking resistance : MRC 140W 40Ω]



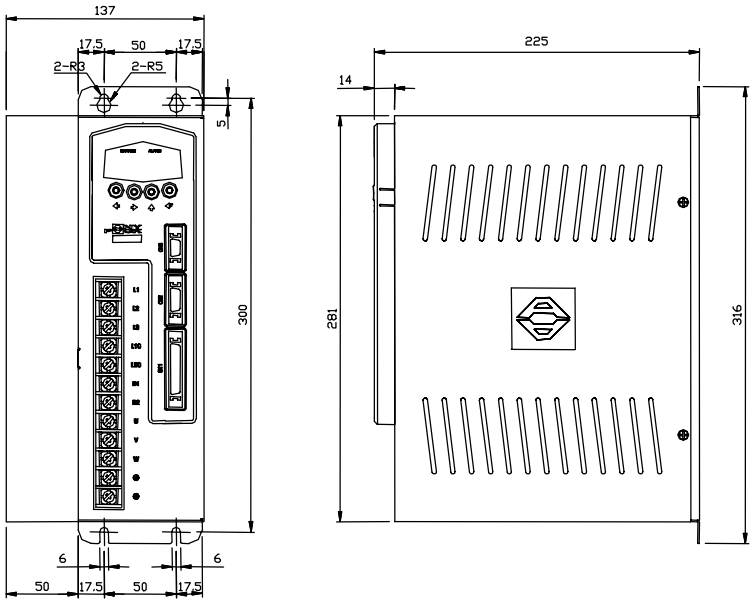
IRH 140W 40ohm

♦ APD-VS15N, APD-VS20N, APD-VS35N, APD-VS50N



★ Weight : 7.2[kg]
(VS35N~50N:Fan Cooling)

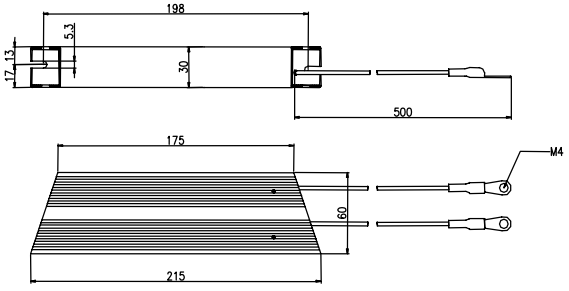
♦ APD-VS75N



★ Weight: 8[kg]
(Fan Cooling)

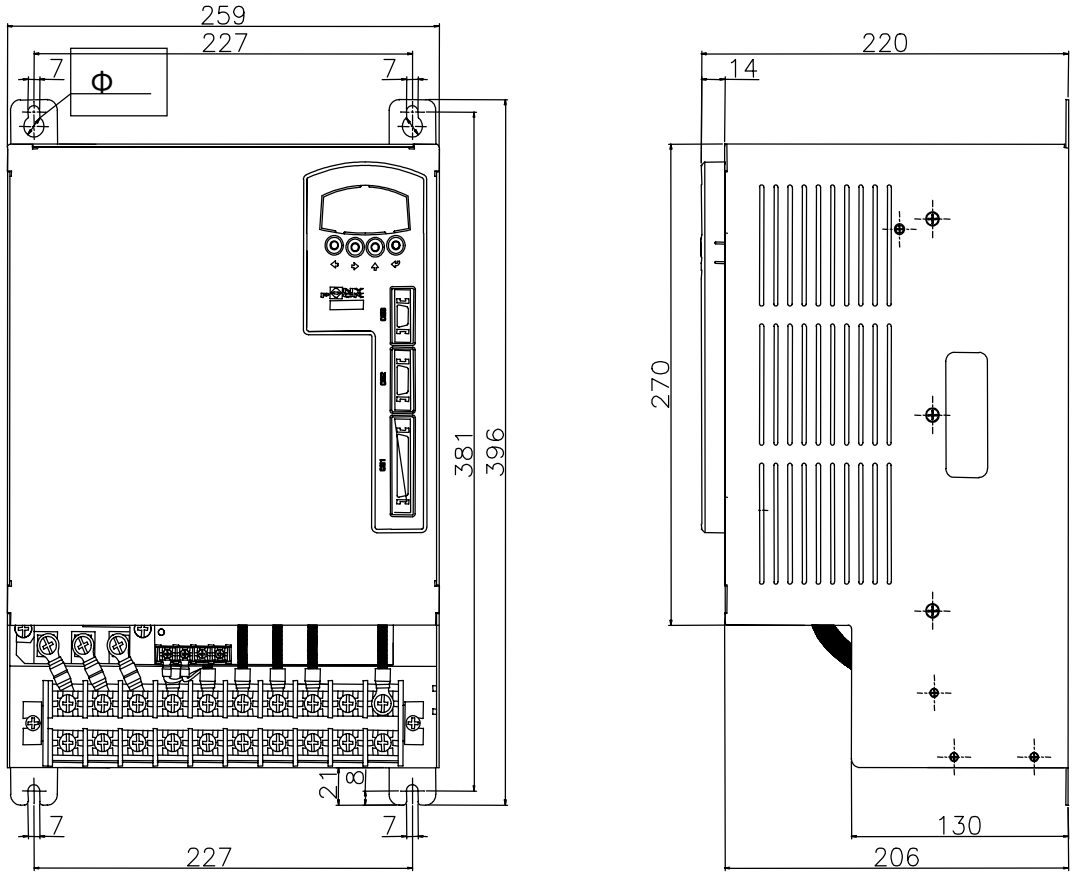
[Standard regenerative braking resistance : IRV 300W 23Ω]

Model No. (APD-VS□□N)	15	20	35	50	75
Braking resistance(Povided)	23[Ω] (300[W])		11.5[Ω] (300[W]×2P)		
Option Braking resistance (Refer to Chapter7.3)	15[Ω] (600[W]×2P)		10[Ω] (600[W]×3P)		



IRV 300W 23ohm

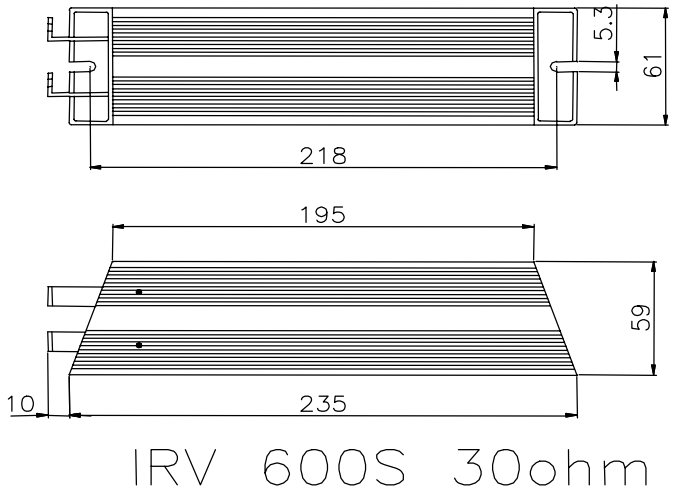
♦ APD-VS110N



★ Weight: 12[kg]
(Fan Cooling)

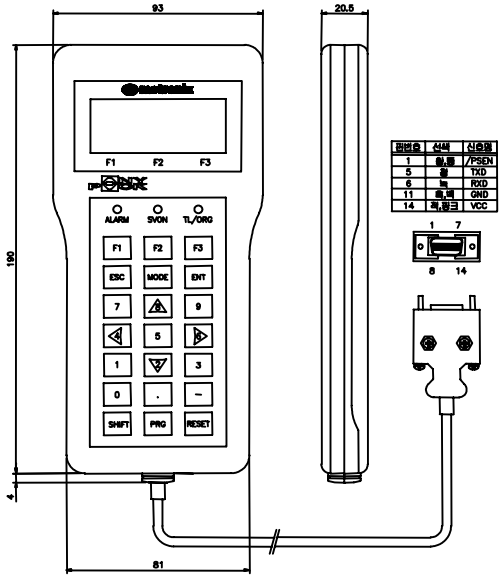
[Regenerative Braking Resistance : Purchase separately (Option)]

1) Model No. : APC-600R30 (600W30Ω)
2) Q'TY : 4 pcs parallel connected (2400W7.5Ω)



7.3 Option and Peripherals

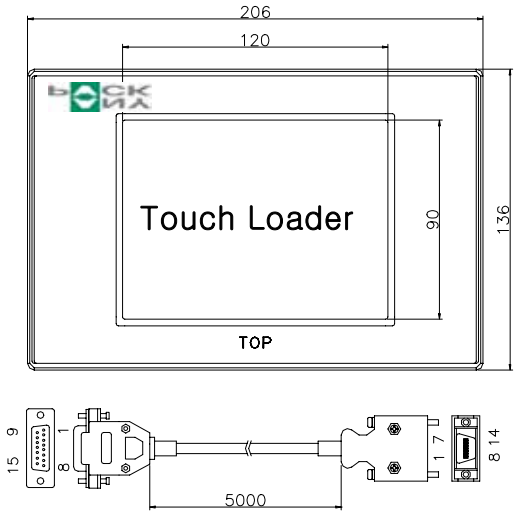
■ Option Specification (Handy Loader)

Classification	Product name	Model	Applicable Drive	Specification
Handy Loader	Handy Loader	APC-HD1□□A	Common use for VS,VP	 1. Standard cable length : 2[m] (Other length available upon request)

Note 1) □□ of Model No. indicates the kind and length of cable, and the declaration is as below

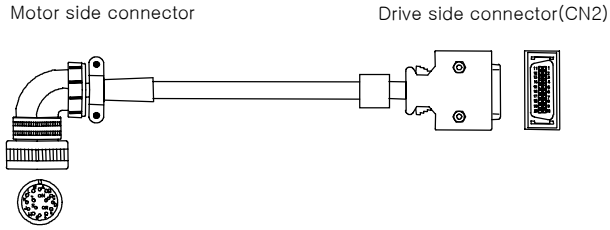
Cable Length (m)	2	3	4	5
Declaration	20	30	40	50

■ Option Specification (Touch Loader)

<table>
<tr><th>Classification</th><th>Product name</th><th>Model</th><th>Applicable drive</th><th>Specification</th></tr>
<tr><td rowspan="2">Touch Loader</td><td>Standard type Mono Touch Loader</td><td>APC-VSTS3M</td><td rowspan="2">All models of APD-VS SERIES</td><td rowspan="2"> 

[Touch Loader-COM2] [Servo drive CN3]
1. Power Supply of Touch Loader : DC24[V]
2. Standard Cable Length : 5[m]
3. Option Cable(Separate Purchasing Item)
1) Communication cable for RS232 COM1
- Item : APC-CN305T2 (Length 5m)
2) Touch Loader O/S, Designing Program, & Download Cable
- Item : APC-CN3TSC (Length 5m)</td></tr>
<tr><td>Standard type Color Touch Loader</td><td>APC-VSTS3TA</td></tr>
</table>

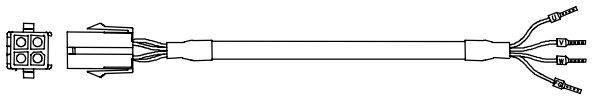
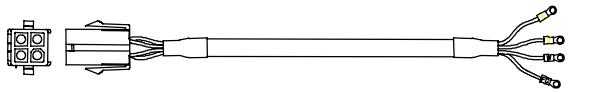
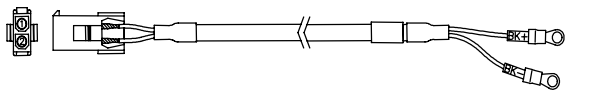
■ Options(Cable)

Classification	Product name	Model(Note1)	Applicable motor	Specification
For Signal	Encoder Cable	APC-E□□□AS	All Models of APM-SA APM-SB APM-SC APM-HB Series	 1. Motor side connector 2. CAP (15 Position) : 172163-1(Made by AMP) 1) SOCKET : 170361-1(Made by AMP) 3. Drive side connector(CN2) 1) CASE : 10320-52A0-008(Made by 3M) 2) CONNECTOR : 10120-3000VE(Made by 3M) 4. Cable : 7Px0.2SQ(AWG24)
For Signal	Encoder Cable	APC-E□□□BS	All Models of APM-SE APM-SF APM-SG APM-HE SERIES	 1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B) 20-29S 2. Drive side connector(CN2) 1) CASE : 10320-52A0-008(Made by 3M) 2) CONNECTOR : 10120-3000VE(Made by 3M) 3. Cable : 7Px0.2SQ(AWG24)

Note 1) □□□ of Model No. indicates the kind and length of cable, and the declaration is as below.

Cable Length(m)	3	5	10	20
Robotic Cable	F03	F05	F10	F20
General Cable	N03	N05	N10	N20

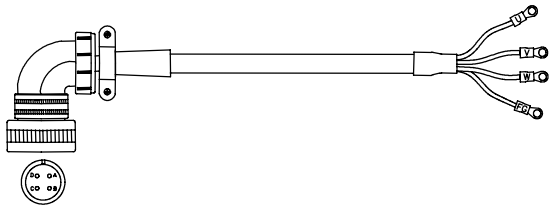
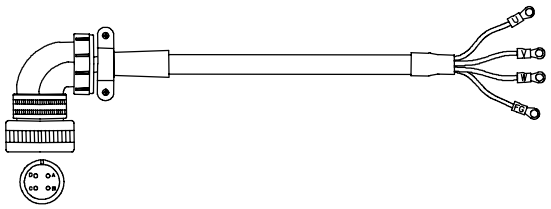
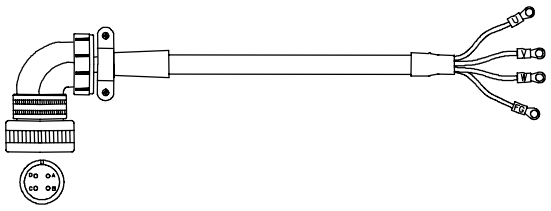
■ Options(Cable)

Classification	Product name	Model(Note1)	Applicable motor	Specification
For Power supply	Standard Power Cable	APC-P□□□CS	All models of APM-SA APM-SB APM-HB Series APM-SC04A APM-SC06A APM-SC03D APM-SC05D	Motor side connector Drive side connection  1. Motor side connector 1) CAP (4 Position) : 172159-1(Made by AMP) 2) SOCKET : 170362-1(Made by AMP) 2. Drive side connector(U,V,W,FG) 1) PIN : UA-F1512(Made by Suh-il Electronic) 2) Compressor : UA-510A(Made by Suh-il) 3. Cable : 4Cx0.75SQ(AWG18) (For APM-SAR3A,SAR5A,SA01A, 0.5SQ is used.)
For Power supply	Standard Power Cable	APC-P□□□DS	APM-SC08A APM-SC10A APM-SC06D APM-SC07D	Motor side connector Drive side connection  1. Motor side connector 1) CAP (4 Position) : 172159-1(Made by AMP) 2) SOCKET : 170362-1(Made by AMP) 2. Drive side connector(U,V,W,FG) 1) Connection terminal : 1.25x3(KET GP110012) 3. Cable : 4Cx0.75SQ(AWG18)
For Power supply	Brake type Power Cable	APC-P□□□KB	All models of APM-SA APM-SB APM-SC SERIES	Motor side connector Drive side connection  1. Motor side connector 1) CAP (6 Position) : 172157-1(Made by AMP) 2) SOCKET : 170362-1(Made by AMP) 2. For power supply of Brake 1) Connection terminal : 1.25x3(KET GP110012) 2) Cable : 2Cx0.75SQ(AWG18)

Note 1) □□□ of Model No. indicates the kinds and length of cable, and declaration is as below.

Cable Length(m)	3	5	10	20
Robotic Cable	F03	F05	F10	F20
General Cable	N03	N05	N10	N20

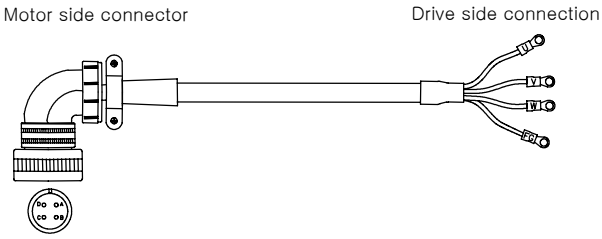
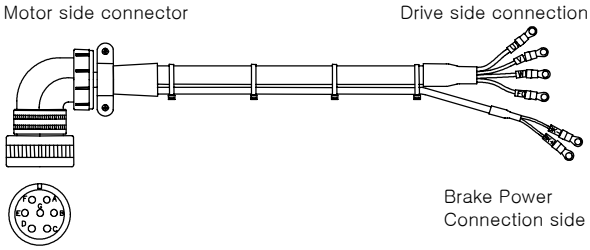
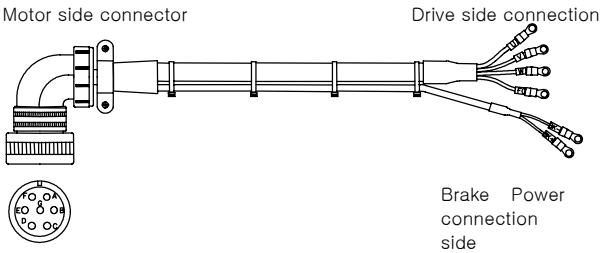
■ Options(Cable)

Classification	Product name	Model(Note1)	Applicable motor	Specification
For Power supply	Standard type Power Cable	APC-P□□□ES	All Models of APM-SE APM-HE SERIES	Motor side connector / Drive side connection  1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)20-4S 2. Drive side connector(U,V,W,FG) 1) Connection terminal : 2.5x4(KET GP110721) 3. Cable : 4Cx2.0SQ(AWG14) Note) Apply UA-F1512 Pin for the drive connection side of APM-SE03M Series cable.
For Power supply	Standard type Power Cable	APC-P□□□FS	APM-SF30A APM-SF22D APM-SF35D APM-SF20G APM-SF30G APM-SF12M APM-SF20M APM-SF30M APM-SG22D APM-SG35D APM-SG20G APM-SG30G APM-SG12M APM-SG20M APM-SG30M	Motor side connector / Drive side connection  1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)22-22S 2. Drive side connector(U,V,W,FG) 1) Connection terminal : 3.5x5(KET GP110028) 3. Cable : 4Cx3.5SQ(AWG12)
For Power supply	Standard type Power Cable	APC-P□□□GS	APM-SF50A APM-SF55D APM-SF75D APM-SF44G APM-SF60G APM-SF44M APM-SG55D APM-SG75D APM-SG44G APM-SG60G APM-SG44M	Motor side connector / Drive side connection  1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)22-22S 2. Drive side connector(U,V,W,FG) 1) Connection terminal : 3.5x5(KET GP110028) 3. Cable : 4Cx5.0SQ(AWG10)

Note 1) □□□ of Model No. indicates the kinds and length of cable, and declaration is as below.

Cable Length(m)	3	5	10	20
Robotic Cable	F03	F05	F10	F20
General Cable	N03	N05	N10	N20

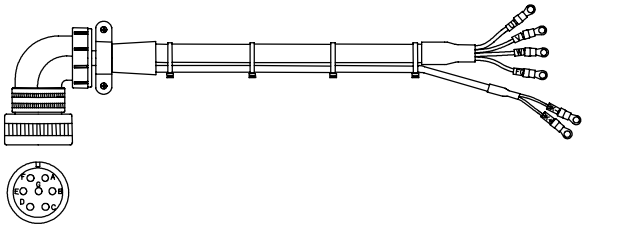
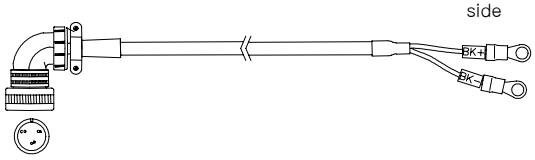
■ Options(Cable)

Classification	Product name	Model(Note1)	Applicable motor	Specification
For Power supply	Standard type Power Cable	APC-P□□□RS	APM-SG110D APM-SG85G APM-SG60M	 1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)32-17S 2. Drive side connector(U,V,W,FG) 1) Connection terminal : 8.0x8(KET GP140841) 3. Cable : 4Cx8.0SQ(AWG8)
For Power supply	Brake type Power Cable	APC-P□□□MB	All Models of APM-SE SERIES	 1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)20-15S 2. Drive side connection(U,V,W,FG) 1) Connection terminal : 2.5x4(KET GP110721) 2) Cable : 4Cx2.0SQ(AWG14) 3. Brake power connection side(+,-) 1) Connection terminal : 1.25x3(KET GP110012) 2) Cable : 2Cx0.75SQ(AWG18) Note) Apply UA-F1512 Pin for the drive connection side of APM-SE03M Series cable.
For Power supply	Brake type Power cable	APC-P□□□NB	APM-SF30A APM-SF22D APM-SF35D APM-SF20G APM-SF30G APM-SF12M APM-SF20M APM-SF30M APM-SG22D APM-SG35D APM-SG20G APM-SG30G APM-SG12M APM-SG20M APM-SG30M	 1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)24-10S 2. Drive side connection(U,V,W,FG) 1) Connection terminal : 3.5x5(KET GP110028) 2) Cable : 4Cx3.5SQ(AWG12)+2Cx0.75SQ 3. Brake Power connection side(+,-) 1) Connection terminal : 1.25x3(KET GP110012) 2) Cable : 2Cx0.75SQ(AWG18)

Note 1) □□□ of Model No. indicates the kinds and length of cable, and declaration is as below.

Cable Length(m)	3	5	10	20
Robotic Cable	F03	F05	F10	F20
General Cable	N03	N05	N10	N20

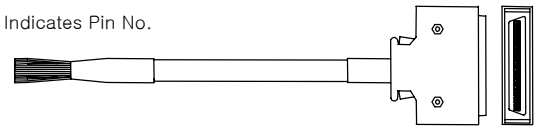
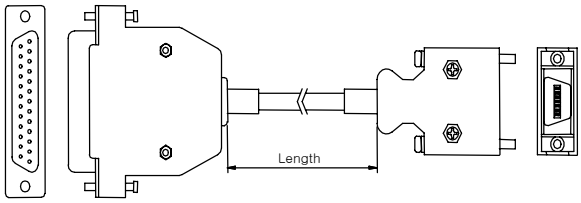
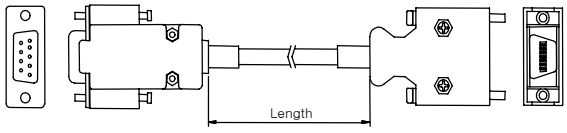
■ Options(Cable)

Classification	Product name	Model(Note1)	Applicable motor	Specification
For Power supply	Brake type Power cable	APC-P□□□PB	APM-SF50A APM-SF55D APM-SF75D APM-SF44G APM-SF60G APM-SF44M APM-SG55D APM-SG75D APM-SG44G APM-SG60G APM-SG44M APM-SG60M	Motor side connector Drive side connection  1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)24-10S 2. Drive side connection(U,V,W,FG) 1) Connection terminal : 3.5x5(KET GP110028) 2) Cable : 6Cx5.0SQ(AWG10) 3. Brake Power connection side(+,-) 1) Connection terminal : 1.25x3(KET GP110012) 2) Cable : 2Cx0.75SQ(AWG18)
For Power supply	Brake type Power cable	APC-P□□□SB	All Models of APM-SG Series	Motor side connector Brake Power connection side  1. Motor side connector(MS:Military Standard) 1) PLUG : MS3108B(MS3106B)14S-7S 2. Drive side connection(+,-) 1) Connection terminal : 1.25x3(KET GP110012) 3. Cable : 2Cx0.75SQ(AWG18)

Note 1) □□□ of Model No. indicates the kinds of length of cable, and declaration is as below.

Cable Length(m)	3	5	10	20
Robotic Cable	F03	F05	F10	F20
General Cable	N03	N05	N10	N20

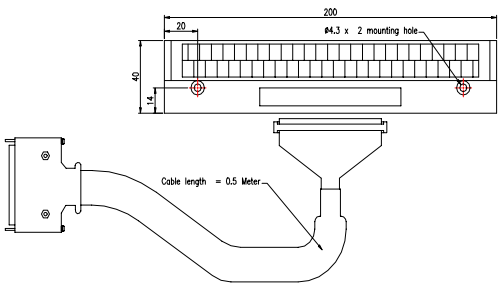
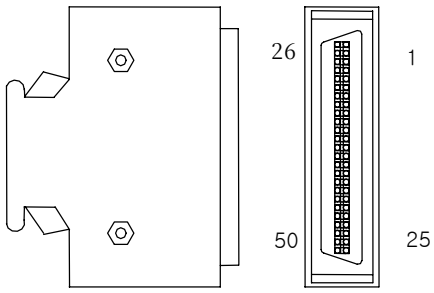
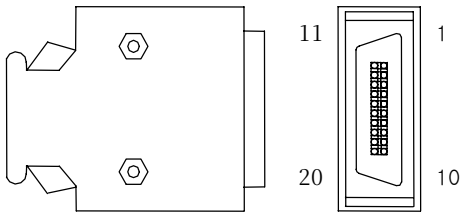
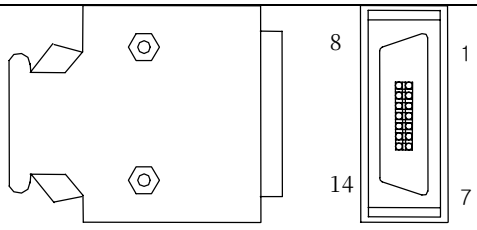
■ Options(Cable)

Classification	Product name	Model(Note 1)	Applicable drive	Specification
For Signal	CN1 Cable	APC-CN1□□A	All Models of APD-VS APD-VP SERIES	[Upper Controller] [Drive connection side CN1]  1. Drive side connection(CN1) 1) CASE : 10350-52F0-008(Made by 3M) 2) CONNECTOR : 10150-3000VE(Made by 3M) 3) CABLE : ROW-SB0.1Cx50C(AWG 28)
For Signal	Soft Download Cable	APC-CN3□□S	All Models of APD-VS APD-VP SERIES	[PC-Parallel Port] [Servo Drive CN3]  1. Standard Cable Length : 2[m]
For Signal	RS232 Communication Cable	APC-CN3□□R	All Models of APD-VS APD-VP SERIES	[PC-Serial Port] [Servo Drive CN3]  1. Standard Cable Length : 2[m]

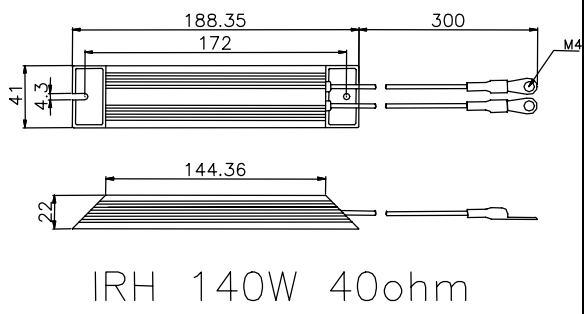
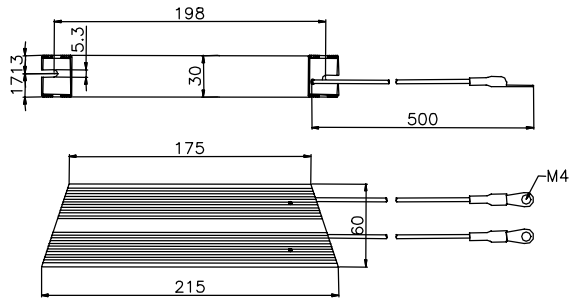
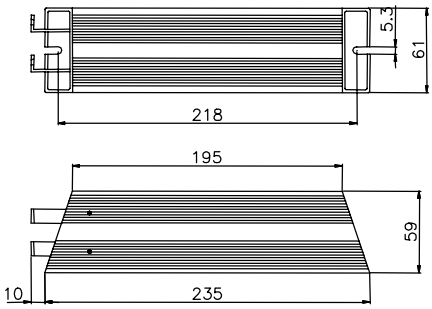
Note) □□ Model No. indicates the Cable length, and declaration is as below.

Cable Length(m)	1	2	3	5
Declaration	01	02	03	05

■ Options(Connector)

Classification	Product name	Model(Note1)	Applicable drive	Specification
T/B	T/B for CN1	APC-VSCN1T APC-VPCN1T	All Models of APD-VS APD-VP SERIES	 1. APC-VSCN1T : CN1 T/B of APC-VS 2. APC-VPCN1T : CN1 T/B of APD-VP 3. Cable length can be adjusted upon request. 4. Standard Cable length : 0.5[m]
CN	CN1 Connector	APC-CN1NNA	All Models of APD-VS APD-VP SERIES	 1) CASE : 10350-52A0-008(Made by 3M) 2) CONNECTOR : 10150-3000VE(Made by 3M)
CN	CN2 Connector	APC-CN2NNA	All Models of APD-VS APD-VP SERIES	 1) CASE : 10320-52A0-008(Made by 3M) 2) CONNECTOR : 10120-3000VE(Made by 3M)
CN	CN3 Connector	APC-CN3NNA	All Models of APD-VS APD-VP SERIES	 1) CASE : 10314-52A0-008(Made by 3M) 2) CONNECTOR : 10114-3000VE(Made by 3M)

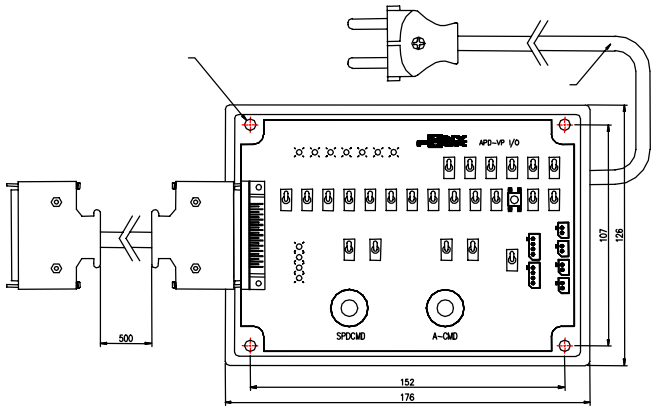
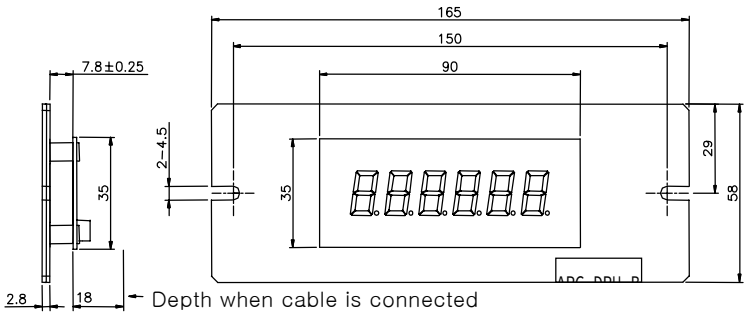
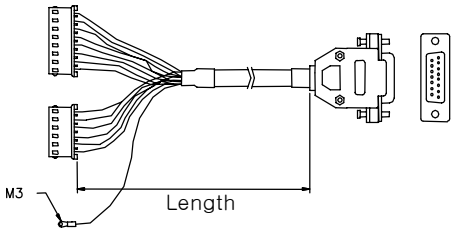
■ Options(Braking Resistance)

Classification	Product name	Model(Note1)	Applicable drive	Specification
Resistance	Braking Resistance	APC-140R40	APD-VS02 VS04 APD-VP02 VP04	 IRH 140W 40ohm
Resistance	Braking Resistance	APC-300R23	APD-VS05 VS10 APD-VP05 VP10	 IRV 300W 23ohm
Resistance	Braking Resistance	APC-600R30	APD-VS15(2P) VS20(2P) VS35(3P) VS50(3P) VS75(3P) VS110(4P) APD-VP15(2P) VP20(2P) VP35(3P) VP50(3P) VP75(3P) VP110(4P)	 IRV 600S 30ohm

Note 1) Standard Braking Resistance for each drive capacity is provided as below table.

Model No.(APD-VS□□N)	R5	01	02	04	05	10	15	20	35	50	75	110
Braking Resistance(Basically provided)	-		Embedded 50[Ω] (50[W])		40[Ω] (140[W])		23[Ω] (300[W])		11.5[Ω] (300[W]×2P)			Option

■ Options(I/O JIG)

Classification	Product name	Model(Note1)	Specification
I/O JIG	Standard type I/O JIG	APC-VSIONA	 1. Input Power supply : Single Phase AC220[V] 2. I/O function of standard type(APD-VS) Servo Drive 3. Cable length can be adjusted.
Indicator	Remote Display	APC-DPU□□B	  1. Cable length can be adjusted upon request. 2. Place an order with Servo Drive(Remote Type). 3. For both of APD-VS/VP

Note1) □□ of Model No. indicates the cable length, and declaration is as below.

Cable Length(m)	1	2	3	5
Declaration	01	02	03	05

Chapter8

Maintenance and Inspection

8.1 Maintenance and Inspection

In the chapter, maintenance and inspection of servo motor and drive are explained.

8.1.1 Caution

① When checking motor voltage : As the voltage applied to the motor from the servo amplifier is PWM controlled, wave form of pulse phase is displayed. There may be significant difference in indicator value depending on types of meters

② When checking motor current : The pulse wave form is smoothed to sine wave to a certain degree by the motor reactance. Connect and use a moving-iron type ampere meter.

③ When checking power : Use an electrodynamics type 3-phase watt-meter

④ Other meters : Use oscilloscopes or digital voltmeter without letting them make contact with the ground. Use meters with input current of 1[mA] or less.

8.1.2 Inspection Items

CAUTION	Charged voltage may remain in the smoothing condenser creating an Element of danger when inspecting drive. Turn off power and wait for Approximately 10 minutes before starting inspection.

- Inspection of servo motor

Inspection items	Inspection period	Method	Remark
Vibration And noise	Every month	With the sense of touch and the sense of hearing.	It should not be big (serious) compared to the normal condition.
External appearance	According to Contamination And damage	Clean it up with fabric or air	-
Insulation Resistor	Once a year At least	Disconnect with drive, and measure resistor with 500V mugger tester. Normal is more than 10[㏁].<Note1>	If resistance is less than 10[㏁], inquire to service department
Change Oil seal	Once in 5,000 Hours at least	Detach from machine, and replace it.	Only for the motor which contains oil seal
Overall inspection	Once in 20,000 Hours or 5 years At least	Inquire to our service department	Customer is required not to disassemble the Servo motor and clean it by themselves.

(Note 1) Measure Between one of U,V,W and FG

- Followings are for maintaining Servo drive.
  The Servo drive need not be checked and maintained on a daily basis as it uses highly reliable parts, but inspect it at least once a year.

Inspection item	Period	Check for	Solution
Main body and circuit board	Once a year at least	Dust, Oil	It should not be big(serious) compared to the normal condition
Terminal screws for looseness	Once a year at least	Screws for connection terminal and connector are securely tightened	Tighten it
Parts for defects on main body and circuit board	Once a year at least	Discoloration caused by heat, damage or disconnection	Inquire to our service department

8.1.3 Period of Replacing Parts

The following parts undergo aging process as time passes due to mechanical friction or the characteristics of the material used, leading to the deterioration of equipment performance or breakdown. Check the parts periodically and replace them, of necessary.

① Smoothing : The characteristics become aged due to the effects of ripple current

The operating life of the condenser varies significantly depending on ambient temperature and operating conditions. When used continuously in normal environment, its standard life span is 10 years. The condenser becomes aged fast during a specific period. Inspect it at least once a year(It is desirable to conduct inspection semi-annually in case the life span is nearing the exhaustion point.)

※ For judgment criteria, visually Check :

a. Case status : Check if the sides and bottom of the case are expanded.

b. Cover plate : Check if significant expansion, severe cracks or damage.

c. Explosion-proof value : Check for significant expansion or wear

d. Check periodically the external condition for cracks, tear, discoloration and water leakage, If the rated capacity of the condenser drops to 85[%] or less, it indicates life span has exhausted.

② Relays : Inadequate contact may occur due to contact wear resulting from switching current. The really wear condition is affected by the power capacity. The standard life span is 100,000 accumulated switching(switching life) operations.

③ Motor bearing : Replace bearing when it is used for 20,000~30,000 hours under rated speed and rated load. The motor bearing condition is dependent upon the operating conditions. Replace the bearing if abnormal noise or vibration is discovered.

[Standard replacement period]

Parts	Standard replacement period	How to replace
Smoothing condenser	7~8 years	Replace with new parts (decide after check)
Relays	-	Decide after check
Fuses	10 years	Replace with new ones
Aluminum electrolytic Condenser on PCB	5 years	Replace with new PCB(Decide after check)
Cooling fan	4~5 years	Replace with new ones
Motor oil seal	-	Decide after check
Motor oil seal	5,000 hours	Replace with new ones

8.2 Fault Diagnosis and Corrective Actions

In case an error occurs during operation, alarm display AL-□□ or Err□□ is displayed on the display window of loader. At this time, take the following steps. If taking such steps does not correct errors, contact our service center.

8.2.1 Servo Motor

[Actions to taken in case of errors]

Symptom	Cause	Inspection	Corrective action
Motor Does not start	CCWLIM, CWLIM input is OFF	Refer to chapter 1.2.System Configuration	Turn "ON" the CCWLIM, CWLIM input
	Menu mis-set	Check menu of motor, encoder and encoder type control mode	Reset menu (refer to chapter 4)
	Motor defective	Check motor lead terminal with a tester(Resistance between each phase ; less than 10[Ω]	If voltage is correct, replace motor
	Screws loosened	Check the screws	Retighten loose screws
	External miswriting or cable disconnected	Check the motor and encoder wiring	Rewire, Replace cable
	Encoder defective	Check the output wave form	Replace encoder(Use A/S service)
Motor Running Unstable	Defective connection	Check connection of the motor lead terminal	Repair defective part
	Input voltage low	Check drive input voltage	Change power supply
	Overloaded	Check machine condition	Remove foreign material from the rotator and lubricate(or grease) it
Motor Over-Heated	Ambient temperature high	Check the motor ambient temperature(should be lover than 40℃)	Change heat-shield structure
	Motor surface stained	Check motor surface for attached Foreign materials	Clean the surface of the motor
	Overloaded	Check the load rate of the drive. Check acceleration/deceleration cycle.	Reduce load Increase Acceleration/deceleration time
	Magnetic power deteriorated	Check counter electromotive voltage	Replace motor
Abnormal noise	Defective coupling	Check the tightness of the coupling screws and the concentricity of joints.	Readjust coupling
	Defective bearing	Check the bearing for vibration or abnormal noise.	Contact our service center
	Parameter misset	Check control parameters	Refer to Chapter 4

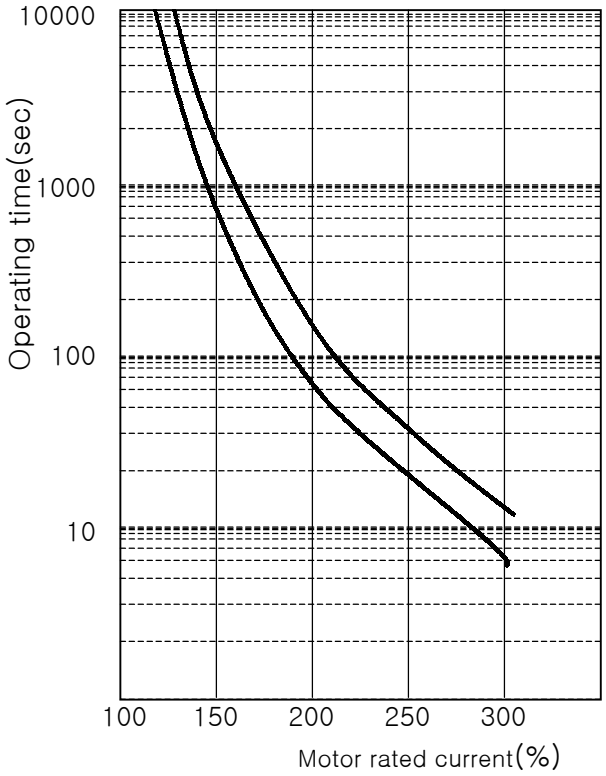
8.2.2 Servo Drive

If the ALARM occurs, error signal out contact (ALARM) is turned OFF, and the motor stops by the action of Dynamic Brake

[Actions to be taken in case of an alarm]

CODE	Name	Cause	Corrective action
Nor-oF	Normal svoff	Servo OFF Normal condition	-
Nor-on	Normal svon	Servo ON Normal condition	-
L1.01	L1.01	RS232 Comm. error, Control circuit operating error	Replace the Drive
AL-01	Emergency Stop	EMG input contact turned OFF	Check external DC24V power supply
AL-02	Power Fail	Main power shut off during Servo ON status	Check the wiring of main power supply
AL-03	Line Fail	Motor and encoder miswriting	Check set values and CN2 wiring, U,V,W wiring.
AL-04	Motor Output	Error of Output (U.V.W) open phase	Check U,V,W wiring and IPM module damage
AL-05	Encoder Pulse	No. of encoder pulse set error	Check set value[PE-204] and CN2 wiring.
AL-06	Following Error	Position pulse following error	Check the [PE-502] position command pulse set value, wiring and Limit contact, gain set value
AL-07	Not Used	Not Used	-
AL-08	Over Current	Over current	Check the output terminal wiring motor・encoder set value, gain set, Replace drive if O.C. continues.
AL-09	Over Load	Over load	Check Load condition, Brake operating condition, wiring, motor・encoder set value.
AL-10	Over Voltage	Over voltage	Check input voltage, wiring If braking resistance, damage of braking resistance, excessive regenerative operation
AL-11	Over Speed	Over speed	Check encoder set value, encoder wiring, gain set
AL-12	Not Used	Not used	-
AL-13	Not Used	Not used	-
AL-14	ABS Data Error	Absolute encoder data transmission error	Check the initial reset [PC-811]
AL-15	ABS Battery Error	Absolute encoder battery error	Check the initial reset [PC-811] and if battery is discharged
AL-16	ABS Multi Error	Absolute encoder multi-rotation data transmission error	Check the initial reset [PC-811]
AL-17	ABS Read Fail	Absolute encoder reading error	Check encoder
AL-18	Not Used	Not used	-
AL-19	Not Used	Not used	-
AL-20	Flash Erase Fail	Deleting error of flash ROM data	Replace drive
AL-21	Flash Write Fail	Writing error of flash ROM data	Replace drive
AL-22	Data Init Error	Error of data initialization	Replace drive
AL-23	EPWR	Hardware error	[PE-203] set error
Err1	Error1	Input of parameters, which cannot be changed, is attempted during Servo ON	Turn OFF the servo and change the set value
Err2	Error2	Input of data which is out of set range	Input values within the set range
Err3	Error3	Change the menu which is locked by [PC-810](Menu Data Lock)	Change the menu [PC-810] with unlock condition

[Overload charateristic curves of Servo Drive]



Rated current (%)	Overload operating time		
	Min.	Max.	Set vlalue
100	∞		
120	∞		
150	600	1500	1200
200	60	150	90
250	20	35	25
300	6	15	9

Appendix1 Summary Program Menu

Menu consists of 9 menu group, and function of each menu is as below.

Comm. Code	Name of Menu Group	Function
Pd-001 ~ Pd-020	Status Menu	Indicates operation status information of Each Servo.
PA-101 ~ PA-120	Alarm Menu	Stores & Indicates records of Alarm that is Happened before.
PE-201 ~ PE-220	System Menu	Stores information of system construction
PE-301 ~ PE-320	Control Menu	Stores set variables that is related to control.
PE-401 ~ PE-420	Analog Menu	Stores set variables that is related to analog I/O.
PE-501 ~ PE-520	InOut Menu	Stores set variables that is related to I/O connection.
PE-601 ~ PE-620	Speed Operation Menu	Stores set variables that is related to Speed operation
PE-701 ~ PE-720	Pulse Operation Menu	Stores set variables that is related to position pulse operation
PC-801 ~ PC-820	Command Menu	Execute operation handling

From the below menu table, the abbreviation for each mode means ;

P : Used at Position control mode

S : Used at Speed control mode

T : Used at Torque control mode

1) Operation State Indicating Menu (Refer to chapter 4.3)

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
0	Pd-001	Current State	– –	– –	Indicates current operation status. (Normal : nor , Alarm : Alarm No.)	PST
1	Pd-002	Current Speed	r/min -9999.9	0.0 9999.9	Indicates current speed.	PST
2	Pd-003	Command Speed	r/min -9999.9	0.0 9999.9	Indicates current command speed.	ST
3	Pd-004	Current Pulse	– -99999	0 99999	Indicates cumulative value of position command Pulse that are input from external device.	P
4	Pd-005	Feedback Pulse	– -99999	0 99999	Indicates feedback pulse when controlling position.	PST
5	Pd-006	Pulse Error	– 0	0 99999	Indicates remained position pulse that is to be operated.	P
6	Pd-007	E-Gear N0	– 1	1000 99999	Indicates numerator 0 of electronic gear ratio.	P
7	Pd-008	Command Torque	[%] -999.99	0 999.99	Indicates current command torque at torque limit operation.	T
8	Pd-009	Torque Limit	[%] 0	300 300	Indicates torque limit setting value.	PST
9	Pd-010	Current Load	[%] -99999	0 99999	Indicates current load ratio compared to rated.	PST
10	Pd-011	Average Load	[%] 0	0 99999	Indicates the average load ratio for 5 seconds Compared to rated.	PST
11	Pd-012	Maximum Load	[%] -99999	0 99999	Indicates instantaneous max. load ratio compared to rated.	PST
12	Pd-013	DC Link Voltage	Volt 0.0	0.0 999.9	Indicates DC Link voltage of current main power.	PST
13	Pd-014	CN1connection state I/O SET	– –	– –	Indicates contactsCN1 I/O status.	PST
14	Pd-015	Input EXT SET	– –	– –	Indicates input status that is handled forcibly by external(Handy Loader, PC) (refer to PC-808)	PST
15	Pd-016	I/O State	– –	– –	Indicates I/O status that is perceived last (It is perceived and indicated when A contact:ON, B contact:OFF)	PST
16	Pd-017	Input Logic Set	– –	– –	Menu that is related to communication.	PST
17	Pd-018	Input Logic Save	– –	– –		
18	Pd-019	Alarm bit	– –	– –		
19	Pd-020	Software Version	– –	– –	Indicates the Software Version.	PST

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

2) Alarm state indicating Menu

MENU			UNIT	INI	Description	App Mode
Comm. Code	CODE	NAME	MIN	MAX		
Alarm history 01 ~ 20			-	-	Indicates Alarm state that is happened before	PST
20 ~ 39	PA-101 ~ PA-120	Alarm History01 ~ Alarm History20	-	-		

Alarm code and details

CODE	Menu title	Cause	Checking Items
nor-oF	Normal sv-off	Servo off Normal condition	-
nor-on	Normal sv-on	Servo on Normal condition	
L1.01	L1.01	RS232Comm.error, Control circuit operation error	Replace the drive
AL-01	Emergency Stop	EMG input contact turned OFF	Check external DC24V power supply
AL-02	Power Fail	Main power shut off during Servo ON status	Check the wiring of main power supply
AL-03	Line Fail	Motor and encoder miswriting	Check set values and CN2 wiring, U,V,W wiring.
AL-04	Motor Output	Error of Output (U.V.W) open phase	Check U,V,W wiring and IPM module damage
AL-05	Encoder Pulse	No. of encoder pulse set error	Check set value[PE-204] and CN2 wiring.
AL-06	Following Error	Position pulse following error	Check the [PE-502] position command pulse set value, wiring and Limit contact, gain set value
AL-07	Not Used	Not Used	-
AL-08	Over Current	Over current	Check the output terminal wiring motor・encoder set value, gain set, Replace drive if O.C. continues.
AL-09	Over Load	Over load	Check Load condition, Brake operating condition, wiring, motor・encoder set value.
AL-10	Over Voltage	Over voltage	Check input voltage, wiring If braking resistance, damage of braking resistance, excessive regenerative operation
AL-11	Over Speed	Over speed	Check encoder set value, encoder wiring, gain set
AL-12	Not Used	Not used	-
AL-13	Not Used	Not used	-
AL-14	ABS Data Error	Absolute encoder data transmission error	Check the initial reset [PC-811]
AL-15	ABS Battery Error	Absolute encoder battery error	Check the initial reset [PC-811] and if battery is discharged
AL-16	ABS Multi Error	Absolute encoder multi-rotation data transmission error	Check the initial reset [PC-811]
AL-17	ABS Read Fail	Absolute encoder reading error	Check encoder
AL-18	Not Used	Not used	-
AL-19	Not Used	Not used	-
AL-20	Flash Erase Fail	Deleting error of flash ROM data	Replace drive
AL-21	Flash Write Fail	Writing error of flash ROM data	Replace drive
AL-22	Data Init Error	Error of data initialization	Replace drive
AL-23	EPWR	Hardware error	[PE-203] set error
Err1	Error1	Input of parameters, which cannot be changed, is attempted during Servo ON	Turn OFF the servo and change the set value
Err2	Error2	Input of data which is out of set range	Input values within the set range
Err3	Error3	Change the menu which is locked by [PC-810](Menu Data Lock)	Change the menu [PC-810] with unlock condition

3) System variables setting menu (Refer to chapter 4.4.1)

Menus marked with "*" cannot be corrected during Servo-On

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
40	*PE-201	Motor ID	–	–	Sets Motor ID (Refer 4.4.1), When setting motor ID: Be set automatically from [PE-210] to [PE-217]	PST
			0	99		
41	*PE-202	RS232 Comm. speed	[bps]	0	Sets RS232 communication speed of CN3 0=9600[bps], 1=19200[bps] 2=38400[bps],3=57600[bps]	PST
		Baud Rate	0	1		
42	*PE-203	Encoder Type	–	0	Sets applied encoder type (0 : A phase lead, 1 : B phase lead, 6 : Absolute encoder)	PST
			0	9		
43	*PE-204	Encoder Pulse	P/r	3000	Sets the number of encoder pulse.	PST
			1	99999		
44	PE-205	CCW TRQ Limit	[%]	300	Sets torque limit value at CCW.	PST
			0	300		
45	PE-206	CW TRQ Limit	[%]	300	Sets torque limit value at CW.	PST
			0	300		
46	*PE-207	System ID	–	0	Sets drive ID on communication	PST
			0	99		
47	*PE-208	System Group ID	–	0	Sets drive group ID on communication	PST
			0	99		
48	PE-209	Start Menu No.	–	2	Sets the operation status display menu with [Pd-001]~[Pd-020] at power on.	PST
			1	20		
49	*PE-210	Inertia	$gf \cdot cm \cdot s^2$	ID	Sets inertia of motor. (Modification is possible when [PE-201] is "0")	PST
			0.01	999.99		
50	*PE-211	Trq Con	kgf·cm/A	ID	Sets torque constant of motor (Modification is possible then [PE-201] is "0")	PST
			0.01	999.99		
51	*PE-212	Phase Ls	mH	ID	Sets phase inductance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
52	*PE-213	Phase Rs	ohm	ID	Sets phase resistance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
53	*PE-214	Rated Is	A	ID	Sets rated current of motor (Modification is possible when [PE-201] is "0" .)	PST
			0.01	999.99		
54	*PE-215	Max Speed	r/min	ID	Sets max.speed of motor (Modification is possible when [PE-201] is "0")	PST
			0.0	9999.9		
55	*PE-216	Rated Speed	r/min	ID	Sets rated speed of motor (Modification is possible when [PE-201] is "0")	PST
			0.0	9999.9		
56	*PE-217	Pole Number	–	8	Sets pole number of motor (Modification is possible when [PE-201] is "0")	PST
			2	98		
57	PE-218	Not Used	–	–		
			–	–		
58	PE-219	Not Used	–	–		
			–	–		
59	PE-220	Not Used	–	–		
			–	–		

※ Communcation code is to be used for selecting the menu when using TOUCH or PC Communication.

Motor type and ID

Model	ID	Watt	Remark
SAR3A	1	30	
SAR5A	2	50	
SA01A	3	100	
SB01A	11	100	
SB02A	12	200	
SB04A	13	400	
SB03A	14	250	Customized type
HB02A	15	200	Hollow Shaft
HB04A	16	400	Hollow Shaft
SC04A	21	400	
SC06A	22	600	
SC08A	23	800	
SC10A	24	1000	
SC03D	25	300	
SC05D	26	450	
SC06D	27	550	
SC07D	28	650	
SC01M	29		
SC02M	30		
SC03M	31		
SC04M	32		
HC06H	33	600	Only S/T
SC05A	34	450	Only S/S
SC05H	35	500	Only S/S
SC08A	36	750	Only S/S
HB01A	37	100	Hollow Shaft
HC10A	38	1000	Hollow Shaft
HE30A	39	3000	Hollow Shaft
HB03H	40	250	Only Semiconductor

Model	ID	Watt	Remark
SE09A	61	900	
SE15A	62	1500	
SE22A	63	2200	
SE30A	64	3000	
SE06D	65	600	
SE11D	66	1100	
SE16D	67	1600	
SE22D	68	2200	
SE03M	69	300	
SE06M	70	600	
SE09M	71	900	
SE12M	72	1200	
SE05G	73	450	
SE09G	74	850	
SE13G	75	1300	
SE17G	76	1700	
HE09A	77	900	Hollow Shaft
HE15A	78	1500	Hollow Shaft
SE11M	79	1050	Customized type
SE07D	80	650	Customized type
SF30A	81	3000	
SF50A	82	5000	
SF22D	85	2200	
SF35D	86	3500	
SF55D	87	5500	
SF75D	88	7500	
SF12M	89	1200	
SF20M	90	2000	
SF30M	91	3000	
SF44M	92	4400	
SF20G	93	1800	
SF30G	94	2900	
SF44G	95	4400	
HC05H	99	500	Customized type

Motor type and ID

Model	ID	Watt	Remark
SE35D	101	3500	Only DS
SE30D	102	3000	Customized type
SF44ML	103	4400	For LG Only
SF75G	104	7500	Customized type
SE35A	105	3500	Customized type
SF55G	106	5500	Customized type
SF60M	107	6000	Customized type
SG22D	111	2200	
SG35D	112	3500	
SG55D	113	5500	
SG75D	114	7500	
SG110D	115	11000	
SG12M	121	1200	
SG20M	122	2000	
SG30M	123	3000	
SG44M	124	4400	
SG60M	125	6000	
SG20G	131	1800	
SG30G	132	2900	
SG44G	133	4400	
SG60G	134	6000	
SG85G	135	8500	
SG110G	136	11000	
SG150G	137	15000	

Model	ID	Watt	Remark

4) Control Variables Setting Menu (Refer to chapter 4.4.2)

Menus marked with "*" cannot be corrected during Servo-ON

MENU			UNIT	INI	Description	Appl. Mode
Comm Code	CODE	NAME	MIN	MAX		
60	PE-301	Inertia Ratio		2.0	Sets inertia ratio of load (Refer to chapter 4.4.2)	PST
			1.0	500.0		
61	PE-302	Position P Gain1	1/s	50	Sets position control proportional gain 1	P
			0	500		
62	PE-303	Position P Gain2	1/s	70	Sets position control proportional gain 2	P
			0	500		
63	PE-304	P Feedforward	[%]	0	Sets position feed-forward control ratio	P
			0	100		
64	PE-305	P FF FLT TC	msec	0	Sets the time-constant of position feed-forward control filter	P
			0	10000		
65	PE-306	P CMD FLT TC	msec	0	Sets the time-constant of position command filter	P
			0	10000		
66	PE-307	Speed P Gain1	rad/s		Sets speed proportional gain 1 (APD-VSR5~04:500, VS05~10:300, VS15~110:200)	PS
			0	5000		
67	PE-308	Speed P Gain2	rad/s		Set speed proportion gain 2.. (APD-VSR5~04:800,VS05~10:400,VS15~110:300)	PS
			0	5000		
68	PE-309	Speed I TC1	msec		Sets speed integral time constant 1 (APD-VSR5~04:20, VS05~10:30, VS15~110:50)	PS
			1	10000		
69	PE-310	Speed I TC2	msec		Sets speed integral time constant 2 (APD-VSR5~04:13, VS05~10:25, VS15~110:30)	PS
			1	10000		
70	PE-311	Speed IN FT	msec	0.0	Sets speed command filter	S
			0.0	100.0		
71	*PE-312	Speed FB FT	msec	0.5	Sets speed feed-back filter	PS
			0.0	100.0		
72	PE-313	Zero Speed Gain	r/min	0.0	Sets the speed range of zero speed gain	PS
			0.0	100.0		
73	PE-314	TORQ. CMD FLT	msec	0.0	Sets torque command filter	PST
			0.0	1000.0		
74	PE-315	DE-Resonance	-	0	Sets avoid resonance driving operation (0 : no operation, 1 : operation)	PST
			0	1		
75	PE-316	Notch Frequency	Hz	300	Sets avoid resonance driving frequency	PST
			0	1000		
76	PE-317	Notch Bandwidth	-	100	Sets avoid resonance band width	PST
			0	1000		
77	PE-318	Overload offset	-	1.1	Set the time of Overload characteristic. (Do not change it as it was already set.)	PST
			1.0	3.0		
78	PE-319	Speed P Control	r/min	100.0	Sets the changed speed at PI-P control ('PCON' input)(P control is operated at less than set speed)	PS
			0.0	9999.9		
79	PE-320	Zero Speed Lock	-	1	Automatically switch from speed control to position control at 'STOP' input or command 0 voltage at [PE-403](SClamp Mode)=1,(0:not used, 1:operation)	PS
			0	1		

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

5) Analog I/O variables setting menu (Refer to chapter 4.4.3)

Menus marked with "*" cannot be corrected during Servo-On

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
80	*PE-401	Analog Speed	r/min 0.0	2000.0 max	Sets analog speed command at 10[V] -Max values is max speed of motor(Refer 4.4.3)	ST
81	PE-402	Speed Offset	mV -1000.0	0.0 1000.0	Sets the offset of speed command	S
82	PE-403	SClamp Mode	- 0	0 1	Sets zero speed clamp operation	S
83	PE-404	SClamp Volt	mV 0.0	0.0 2000.0	Sets zero speed clamp operating voltage	S
84	*PE-405	Speed Override	- 0	0 1	Sets speed override operation (0 : Not used, 1 : Override operation)	S
85	*PE-406	Analog Torque	[%] 0	100 300	Sets analog torque command at 10[V]	PST
86	PE-407	Torque Offset	mV -1000.0	0.0 1000.0	Sets the offset of torque command	T
87	PE-408	TClamp Mode	- 0	0 1	Sets zero torque clamp operation	T
88	PE-409	TClamp Volt	mV -1000.0	0.0 1000.0	Sets zero torque clamp operation voltage	T
89	PE-410	Monitor Type1	- 0	1 10	Sets type of analog output1 for monitoring	PST
90	PE-411	Monitor Mode1	- 0	0 1	Sets mode of analog output1 for monitoring (0:mark direction sorting,1:mark absolute value without direction sort)	PST
91	PE-412	Monitor Scale1	- 0.1	1.0 9999.0	Sets scale of analog output1 for monitoring	PST
92	PE-413	Monitor Offset1	mV -100.0	0.0 100.0	Sets offset of analog output1 for monitoring	PST
93	PE-414	Monitor Type2	- 0	3 10	Sets type of analog output2 for monitoring	PST
94	PE-415	Monitor Mode2	- 0	0 1	Sets mode of analog output2 for monitoring (0:mark direction sorting, 1:mark absolute value without direction sort)	PST
95	PE-416	Monitor Scale2	- 0.1	1.0 9999.0	Sets scale of analog output2 for momitoring	PST
96	PE-417	Monitor Offset2	mV -100.0	0.0 100.0	Sets offset of analog output2 for monitoring	PST
97	PE-418	Torque Com Dir	- 0	0 1	Set motor operating direction for torque command voltage at torque control operation. (0 : Forward direction at + voltage, 1 : Forward direction at –voltage)	
98	PE-419	Not Used	- -	- -		
99	PE-420	Not Used	- -	- -		

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

6) I/O Contacts Variables Setting Menu (Refer to chapter 4.4.4)

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
100	PE-501	Inposition	Pulse 0	100 99999	Sets the output range of position operation finishing signal (Refer to chapter 4.4.4)	P
101	PE-502	Follow Error	Pulse 0	90000 999999	Sets the output range of position operation follow error signal	P
102	PE-503	0 Speed RNG	r/min 0.0	10.0 9999.9	Sets the output range of zero speed signal	PST
103	PE-504	Inspeed	r/min 0.0	100.0 9999.9	Sets the output range of speed reaching signal	S
104	PE-505	Brake SPD	r/min 0.0	50.0 9999.9	Sets brake output speed	PST
105	PE-506	Brake Time	msec 0	10 10000	Sets brake output delay time	PST
106	PE-507	PowerFail Mode	- 0	Per each model 1	Sets operation reset mode of main power error [0 : less than VS041(reset by hand), 1 : more than VS05(automatic reset)]	PST
107	PE-508	DB Control	- 0	1 1	Sets generating brake control operation 0:SVOFFat stop,less than [PE-503](zerospeed):Free-run 1:SVOFF at stop, generating brake function is always operated	PST
108	PE-509	Pulse Clear Mode	- 0	2 2	Sets position pulse clear operating mode 0 : Edge operating 1 : Level operation(response instantly) 2 : Level operation(filter operating)	P
109	PE-510	Pulse Out Rate	- 1	1 16	Sets divide ratio of encoder signal output -Divide ratio : 1,2,3.....16	PST
110	PE-511	Not Used	- -	- -		
111	PE-512	ESTOP Reset	- 0	1 1	Automatically Cancel after ESTOP operation (0:reset by hand, 1 : automatic rest)	PST
112	PE-513	Not Used	- -	- -		
113	PE-514	Dir Select Mode	- 0	0 1	0: DIR→Switching direction, STOP→stop 1: DIR→CW operation, STOP→CCW operation	S
114	PE-515	Output Logic	- 0	30 63	Sets Logic of output contacts. (30=ZSPD output, 26=TGON signal output)	PST
115	PE-516	PWM off Delay	msec 10	0 1000	Sets the delayed time(PWM-off) when command SV-off	PST
116 ~ 117	PE-517 ~ PE-518	Not Used	- -	- -		
118	PE-519	ZSPD Gain Rate	[%] 1.0	50.0 100.0	Set zero speed gain ratio that is applied to the speed range that are below the value which were set in [PE-313].	S
119	*PE-520	Gain Conv Mode 0	-	0	Set switching mode of Gain1, Gain2. 0 : Use Gain1 only	

			0	3	1: When Input contact Gain2 is off, Use Gain1. When Gain 2 is ON, Use Gain2 2: If speed command[PE-503] is higher than zero speed, Gain1 is to be switched to Gain 2. 3: If pulse error[PE-501] is bigger than inpos value, Gain 1 is to be switched to Gain 2.	

※ Communication code is to be used for selecting the menu when using TOUCH or PC Communication.

7) Speed operation variables setting menu(Refer to chapter 4.4.5)

Menus marked with "*" cannot be corrected during Servo-On

MENU			UNIT	INI	Description	Appl. Mode
Comm Code	CODE	NAME	MIN	MAX		
120	*PE-601	Operation Mode	–	1	Sets operation mode (Refer to chapter 4.4.5) 0 : torque control mode 1 : speed control mode 2 : position control mode 3 : speed/position control mode ('MODE' contact=OFF: position mode) 4 : speed/torque control mode ('MODE' contact=OFF: torque mode) 5 : position/torque control mode ('MODE' contact=OFF: torque mode) **(Surely set '0' for [PE-320] when using the operation mode 3 & 4)**	PST
			0	5		
121	PE-602	Speed Command1	r/min	10.0	Be selected as per the status of speed command input contact [SPD1][SPD2][SPD3] [X]: OFF, [O]: ON [X][X][X] : Analog speed command [O][X][X] : Internal speed command 1 [X][O][X] : Internal speed command 2 [O][O][X] : Internal speed command 3 [X][X][O] : Internal speed command 4 [O][X][O] : Internal speed command 5 [X][O][O] : Internal speed command 6 [O][O][O] : Internal speed command 7	ST
			-Max	+Max		
122	PE-603	Speed Command2	r/min	200.0		ST
			-Max	+Max		
123	PE-604	Speed Command3	r/min	500.0		ST
			-Max	+Max		
124	PE-605	Speed Command4	r/min	1000.0		S
			-Max	+Max		
125	PE-606	Speed Command5	r/min	1500.0		S
			-Max	+Max		
126	PE-607	Speed Command6	r/min	2000.0		S
			-Max	+Max		
127	PE-608	Speed Command7	r/min	3000.0		S
			-Max	+Max		
128	PE-609	Accel Time	msec	0	Sets the accelerating time	S
			0	100000		
129	PE-610	Decel Time	msec	0	Sets the decelerating time	S
			0	100000		
130	*PE-611	S Type Control	–	0	Sets S type control on speed control (0 : Linear Accel/Decel , 1 : S type Accel/Decel)	S
			0	1		
131	PE-612	Test Run Speed0	r/min	100.0	Sets speed 0 at continuous test operation	PST
			-Max	+Max		
132	PE-613	Test Run Speed1	r/min	-500.0	Sets speed 1 at continuous test operation	PST
			-Max	+Max		
133	PE-614	Test Run Speed2	r/min	1000.0	Sets speed 2 at continuous test operation	PST
			-Max	+Max		
134	PE-615	Test Run Speed3	r/min	-2000.0	Sets speed 3 at continuous test operation	PST
			-Max	+Max		
135	PE-616	Test Run Time0	sec	5	Sets time 0 at continuous test operation	PST
			1	50000		

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
136	PE-617	Test Run Time1	sec 1	5 50000	Sets time 1 at continuous test operation	PST
137	PE-618	Test Run Time2	sec 1	5 50000	Sets time 2 at continuous test operation	PST
138	PE-619	Test Run Time3	sec 1	5 50000	Sets time 3 at continuous test operation	PST
139	PE-620	Not Used	– –	– –		

※ Communication mode is to be used for selecting the menu when using TOUCH or PC Communication.

8) Position preration variables setting menu (Refer to chapter 4.4.5)

Menu marked with "*" cannot be corrected during Servo-ON

MENU			UNIT	INI	Description	App Mode
Comm Code	CODE	NAME	MIN	MAX		
140	*PE-701	Pulse Logic	–	1	Sets the input pulse logic of position operation (Refer to chapter 4.4.6)	P
			0	5		
141	*PE-702	Electric Gear N0	–	1000	Sets numerator 0 or electronic gear ratio	P
			1	99999		
142	*PE-703	Electric Gear D0	–	1000	Sets denominator 0 or electronic gear ratio	P
			1	99999		
143	*PE-704	Electric Gear N1	–	1000	Sets numerator 1 or electronic gear ratio	P
			1	99999		
144	*PE-705	Electric Gear D1	–	2000	Sets denominator 1 or electronic gear ratio	P
			1	99999		
145	*PE-706	Electric Gear N2	–	1000	Sets numerator 2 or electronic gear ratio	P
			1	99999		
146	*PE-707	Electric Gear D2	–	3000	Sets denominator 2 or electronic gear ratio	P
			1	99999		
147	*PE-708	Electric Gear N3	–	1000	Sets numerator 3 or electronic gear ratio	P
			1	99999		
148	*PE-709	Electric Gear D3	–	4000	Sets denominator 3 or electronic gear ratio	P
			1	99999		
149	*PE-710	Backlash	Pulse	0	Sets backlash compensation in position operation (Standard : 4 interpolation pulse)	P
			0	10000		
150	PE-711	E-Gear Mode	–	0	0:electronic gear ratio 0~3 selecting 1:Offset value override function to numerator 0 of electronic gear ratio	P
			0	1		
151	PE-712	E-Gear offset	–	0	Directly setting numerator 0 of offset value on menu of EGEAR1 contact ON→increase, EGEAR2 contact ON →decrease	P
			-99999	99999		
152	*PE-713	Position Pulse Direction Pulse Dir	–	0	Converts the direction by pulse in position operation 0 : Operating in the direction of command 1 : Operating in the counter direction of command	P
			0	1		
153	PE-714	Not Used	–	–		
			–	–		
154	PE-715	Not Used	–	–		
			–	–		
155	PE-716	Not Used	–	–		
			–	–		
156	PE-717	Not Used	–	–		
			–	–		
157	PE-718	Not Used	–	–		
			–	–		
158	PE-719	ABS Multi Turn	–	–	Absolute encoder's Multi Turn Data. Menu display is not possible as it is for communication only.	P
			–	–		
159	PE-720	ABS Single Turn	–	–	Absolute encoder's Single Turn Data. Menu display is not possible as it is for communication only.	P
			–	–		

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.

9) Operation handling menu (Refer to chapter 5)

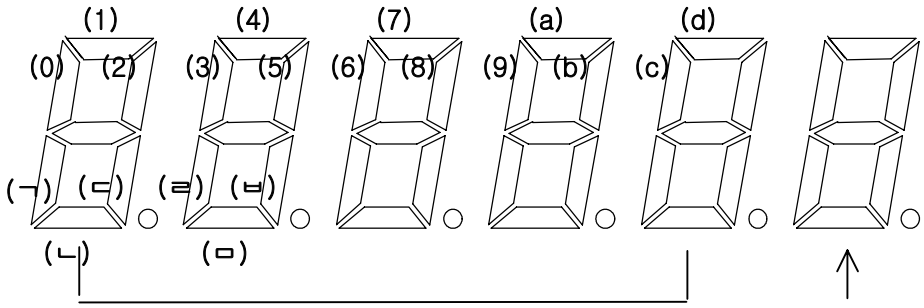
Menu marked with "*" cannot be corrected during Servo-ON

MENU			UNIT	INI	Description
Comm Code	CODE	NAME	MIN	MAX	
160	PC-801	Alarm Reset	-	-	Reset current alarm (Refer to chapter 5)
			-	-	
161	PC-802	Alarm His Clear	-	-	Clear alarm history
			-	-	
162	PC-803	Manual Test Run	-	-	Execute test operation by hand [Left] : forward rotating [Right] : reverse rotating [Up] : test operation speed changing ([PE-602]~[PE-608]) [Enter] : End Operating is not related to input status of CN1
			-	-	
163	PC-804	Auto Test Run	-	-	Continuous operation by speed and time that are set on menu, press [Enter] for end Operating is not related to input status of CN1
			-	-	
164	PC-805	Gain Tune Run	-	1	Sets automatic tuning operation of load inertia. 0: no auto tuning operation 1: auto tuning within 1~5 of inertia range 2: auto tuning within 5~10 of inertia range 3: auto tuning within 10~25 of inertia range 4: auto tuning within 25~50 of inertia range 5: auto tuning within 50~100 of inertia range (Procedure) ①sets the range with[Left], [Right] key ②execute forward/reverse operation about 10 times at 1000[r/min] ③Press [Enter] key, then auto tuning result is saved at [PE-301], [PE-307], [PE-309], and set as "0" automatically
			1	5	
165	PC-806	Z POS Search	-	-	Press [Enter] key, then motor rotate as forward Direction, and search for Z phase of encoder for stop
			-	-	
166	PC-807	IN Logic Set	-	-	After setting the input contact number(0~d) with [Left], [Right] key, press [Up]key, then the status of input contact is changed. Segment "Off" : Normal – A contact Segment "On" : Normal – B contact
			-	-	
167	PC-808	EXT Input Set	-	-	After setting the input contact number (0~d) with [Left], [Right] key, press [Up] key, then input contact is "ON" forcibly. Segment "Off" : Switch status of CN1 Segment "On" : Make "On" forcibly. All contacts are OFF at power off
			-	-	
168	*PC-809	Menu data Init	-	-	Press [Enter] key, then data of menu are changed to initial value automatically But, system menu data of [PE-201]~[PE-220] is not changed (It will be applied when the Power is supplied again.)
			-	-	

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.

MENU			UNIT	INI	Description
Comm Code	CODE	NAME	MIN	MAX	
170	PC-811	ABS Encoder set	-	-	Press [Enter] key at using absolute encoder,then reset absolute encoder for 5 seconds.
			-	-	
171	PC-812	Current Offset	-	-	Compensates current offset of Hall-CT [Left] key : display current offset value of U phase [Right] key : display current offset value of W phase [Up] key : save existing current offset value In case of downloading servo soft, surely turn power ON/OFF 3~5 times, after that press[Up] Key and save current offset value.
			-	-	
172 ~ 173	PC-813 ~ PC-814	Not Used	-	-	
			-	-	
174	PC-815	Peak Load	%	0	Display instantaneous max. load ratio for the rated. [Right] Key : Display instantaneous max. load ratio of forward direction [Left] Key : Display instantaneous max. load ratio of reverse direction [Up] Key : Reset instantaneous max. load ratio.
			-9999	9999	
175	PC-816	Following position pulse Feedback Pulse	Pulse	0	Display the encoder pulse amount that motor is rotated. [Up] Key : Reset encoder pulse amount
			9.9.9.9.9.9	999999	
176 ~ 179	PC-817 ~ PC-820	Not Used	-	-	
			-	-	

※ Communication code is to be used for selecting the menu when using TOUCH or PC communication.



[Input contact : upper]

(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SVON	SPD1/ EGEAR1	SPD2/ EGEAR2	SPD3/ MODE	DIR	PCON	CCWLIM	CWLIM	TLIMIT	EMG
(a)	(b)	(c)	(d)						
STOP	ALMRST	GAIN2	PCLEAR						

[Output contact : lower]

(¬)	(ㄴ)	(ㄷ)	(ㄹ)	(ㅁ)	(ㅂ)
BRAKE	INSPD/INPOS	ZSPD	READY	TLOUT	ALARM

Thanks for purchasing our products.

Customers are requested to follow the following procedure for trial operation.

1. **Verify the product** : Verify if the product is the same one you purchased with the label.(Refer to Chapter1.1)

2. **Connect cable** : Single phase AC 220[V] for L1C,L2C.
   3 Phase AC220[V] for L1,L2,L3 (Refer to Chapter3.2)

3. **Connect signal cable** : Connect CN1.CN2,CN3 & Motor as per the operation mode. (Refer to Chapter 1.2 & 3)

4. **Input the control power supply** : Input Single phase AC220[V] at L1C,L2C (But, Input 3 Phase AC220[V] for APD-VSR5~04)

5. **Setting motor ID** : Set the motor ID in the menu[PE-201].
   (Refer to Appendix1)

6. **Setting Encoder pulse** : Set the encoder pulse in the menu[PE-204].

7. **Input main power supply** : Input the 3Phase AC220[V] at L1,L2,L3

8. **Test operation** : Press Enter key on the menu[PC-803], and can proceed the test operation by manual.
   * **Up Key** : Change the operating speed ([PE-602]~[PE-608])
   * **Right Key** : Motor forward rotation

9. **Setting operation mode :**
Set the operation mode in the menu[PC-601].
"0" : Torque control operation
"1" : Speed control operation
"2" : Position control operation
"3" : Speed/Position control operation.
"4" : Speed/Torque control operation
"5" : Position/Torque control operation

Setting speed operation

Setting Position operation

10.Proceed the speed operation with an Upper controller by adjusting the menu data as follows.
1)Speed operation variable setting menu :[PE-601~611]
2)In/Output variable setting menu : [PE-503, 504, 510, 512, 514, 515, 516]
3)Analog variable setting menu :[PE-401~405]
4)Control variable setting menu : [PE-301, 307, 309, 311, 312, 313, 319, 320]
(Refer to Appendix 1)

11.Proceed the Position operation with an Upper controller by adjusting the menu data as follows.
1)Position operation variable setting menu :[PE-701~711]
2)In/Output variable setting menu : [PE-501, 502, 508, 509, 512, 515, 516]
3) Control variable setting menu : [PE-301~320]
(Refer to Appendix 1)

Selecting Regenerative Braking Resistance

When Servo motor is operated with a Regenerative mode, the energy comes into the axis of Servo drive. This is called a regenerative energy.

Whereas Regenerative energy is charged and absorbed into the smoothing condenser of Servo drive inside, but if it exceeds the energy that can be charged, it consumes the regenerative energy with a regenerative braking resistance.

(1) The operating servo motor conditions with regenerative mode ;

① High speed operation and short deceleration time
② Repeat Accel/Deceleration very frequently
③ When the load inertia is much bigger than motor inertia
④ When operated at the Upper and below axis
⑤ In the case of minus load that rotate the servo motor at load axis

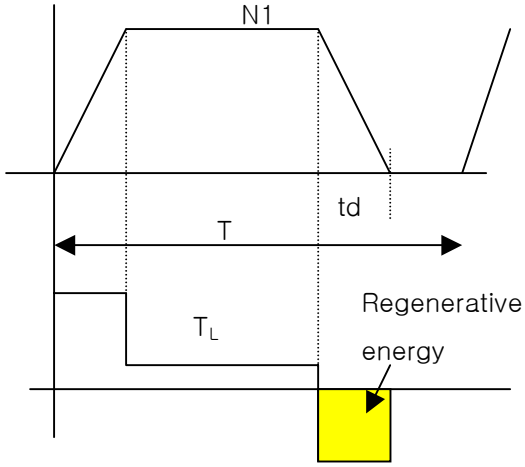
But, Because the regenerative capacity that is installed in the servo drive is a short time rated of deceleration stop range, the continuous operation by minus load is impossible.

(2) On the Regenerative mode operation, the regenerative energy of motor should be less than the energy that can be absorbed in the servo drive for proper operation.

(Motor rotating energy – Motor loss – Deceleration load friction) < (Condenser absorbing energy + Regenerative resistance consuming energy)

- Motor rotating energy = $(J_M + J_L)*(N1^2) / 182$
- Motor loss = Approx. 3~5% of rated capacity
- Decel. Load friction energy = $(\pi/60)*N1*T_L*td$
- Condenser absorbing energy = $1/2 * C * (V1^2 - V2^2)$

But, J : [kgm^2], N : [r/min], T_L [Nm], C[F]
and V1 :385[V], V2 :310[V].



Regenerative Resistance Need[W]

= (Motor rotating energy – Motor loss – Decel. Load friction energy – Condenser absorbing energy)/(0.2*T)

But, Using rate of regenerative resistance is about 20%.
When the result of this value exceeds the regenerative resistance[W], users are requested to install the regenerative resistance that is higher than the calculated value[W].

3) Absorbing way of regenerative energy when over voltage alarm occurred.

① Reduce the load inertia or reduce the operating speed in order to reduce the Motor rotating energy.

② Increase the decal. Time to make the deceleration load friction energy bigger.

③ Change the standard regenerative resistance to option regenerative braking resistance (Chapter 7 Product Specification).

(4) APD-VS Regenerative capacity (10[%]ED : Standard)

Model No.	Regenerative IGBT	Inside Absorbing energy[J]	Standard Regenerative Braking resistance	Standard Regenerative energy (10[%]ED)	Option Regenerative Braking resistance	Option Regenerative energy (10[%]ED)
VSR5	-	8.6	-	-	-	-
VS01	-	8.6	-	-	-	-
VS02	20[A]	8.6	50[W]50[Ω]	296	140[W]40[Ω]	370
VS04	20[A]	17.2	50[W]50[Ω]	296	140[W]40[Ω]	370
VS05	20[A]	20.3	140[W]40[Ω]	370	300[W]23[Ω]	644
VS10	20[A]	30.5	140[W]40[Ω]	370	300[W]23[Ω]	644
VS15	30[A]	43.8	300[W]23[Ω]	644	1200[W]15[Ω]	988
VS20	50[A]	58.4	300[W]23[Ω]	644	1200[W]15[Ω]	988
VS35	50[A]	73	600[W]11.5[Ω]	1289	1800[W]10[Ω]	1482
VS50	50[A]	87.6	600[W]11.5[Ω]	1289	1800[W]10[Ω]	1482
VS75	50[A]	116.8	600[W]11.5[Ω]	1289	1800[W]10[Ω]	1482
VS110	75[A]	175.1	Option(주4)	-	2400[W]7.5[Ω]	1976

(Note1) Regenerative consuming energy = $(V1^2/R) * ([\%]ED/100)$

(Note2) APD-VSR5~01 Type does not include regenerative circuit and regenerative resistance.

(Note3) For APD-VS02~04 Type, standard regenerative resistance(50[W], 50[Ω]) is

installed inside and the terminal between B2~B3 is not connected.
If the regenerative capacity is quite big due to the frequent accel/deceleration, users are requested to remove the short pin(B2-B3) and install the outside option regenerative resistance at (B1-B2).

(Note4) For APD-VS110 Type, users need to purchase the regenerative resistance separately as an option item when need it.