Instruction Manual (Abridgement)

Manual Version: [ver 1.1]

Software Version: Higher than 2.35

The first edition: 2008. 10. 01.

Revised edition: 2008. 10. 01.

Thank you for purchasing Mecapion's 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".

⚠ WARNING

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

⚠ CAUTION

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

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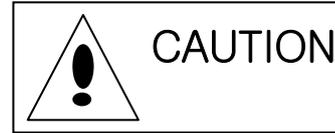
- Make sure to keep the install direction.
- Do not throw down and prevent from impact.
- Never use the equipment where it may be exposed to splashes of water, corrosive or flammable gases, or near flammable materials.(Failure to observe this warning may lead to electric shock or fire)
- Use the equipment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

◆ 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.
- If the motor moves by Machine, please use Robot Cable.
- 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.

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◆ 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   ⚠ WARRNING

- 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

Content

◈ Precaution

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1.1 Product Construction

1.1.1 Checking Products

① Check if the products are the right one 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 in accordance with the standard.
 - Check if the motor shaft is correct.
 - Check if the Oil Seal and Brake is correct.
 - Check if the reducer/gearbox and reduction ratio is correct.
 - Check if the Encoder type is correct.

③ Check the External Appearance
 - Check if there is no dust or moisture
 - Check if there is fading, contamination, damage, and disconnection
 - Check if the tightness of fitting & bolts are correct.
 - Check if there is no noise or excessive friction at rotating

■ Servo drive Type Designation

APD – VS 04 N A4

AnyPack Series Servo Drive	Type	Drive Capacity		Encoder Type	Exclusive Option Code
	VS : Standard type	R5 : 50W	35 : 3.5kW	N : Incremental	
	VP : Controller-Embedded type	01 : 100W	50 : 5.0kW	A : Absolute	
		02 : 200W	75 : 7.5kW		
	VT : Tension Control type	04 : 400W	110: 11.0 kW		
		05 : 500W	150: 15.0 kW		
		10 : 1.0kW	220 : 22.0kW		
		15 : 1.5kw	300 : 30.0kW		
		20 : 2.0kW	370 : 37.0kW		
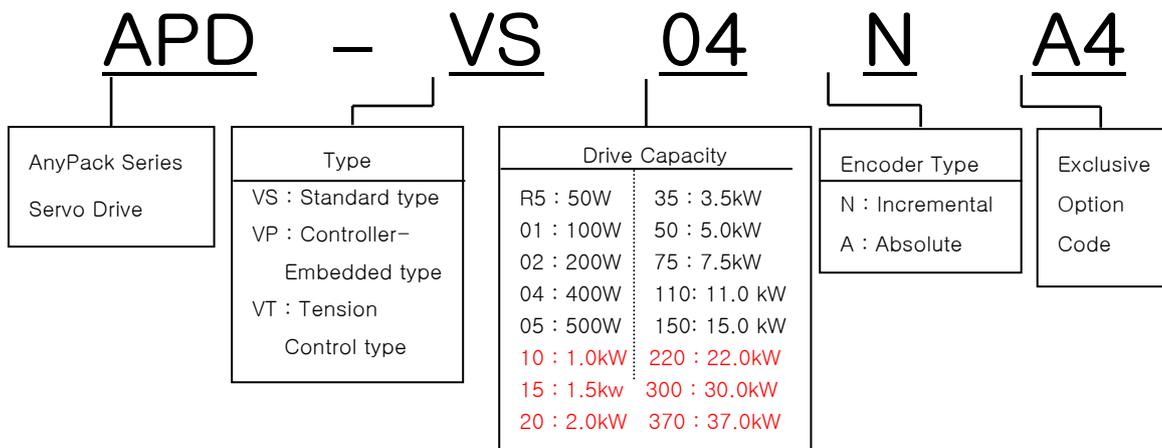
■ Servo Motor Product Type

APM – S B 04 A E K 1 G1 03

AnyPack Series
Servo Motor

Motor Shape Type
S : Solid Shaft
H : Hollow Shaft
B : Built-in

Flange Size
A : 40 Flange
B : 60 Flange
C : 80 Flange
D : 100 Flange
E : 130 Flange
F : 180 Flange
G : 220 Flange
H : 250 Flange
J : 280 Flange

Motor Capacity
R3 : 30[W]
R5 : 50[W]
01 : 100[W]
02 : 200[W]
03 : 300[W]
04 : 400[W]
05 : 450[W]
06 : 550/600[W]
07 : 650[W]
08 : 750/800[W]
09 : 850/900[W]
10 : 1.0[kW]
⋮
150 :15.0[kW]
220 :22.0[kW]
300 :30.0[kW]
370 :37.0[kW]

Rated Speed
A : 3000 [rpm]
D : 2000 [rpm]
G : 1500 [rpm]
M : 1000 [rpm]

Shape of Shaft
N : Straight
K : One side round
    (Standard)
C : C Cut
D : D Cut
T : Taper shape
R : Both side round
H : Hollow Shaft

Encoder Type
A : Inc. 1024 [P/R]
B : Inc. 2000 [P/R]
C : Inc. 2048 [P/R]
D : Inc. 2500 [P/R]
E : Inc. 3000 [P/R]
F : Inc. 5000 [P/R]
G : Inc. 6000 [P/R]
H : Abs. 1024 [P/R]
K : Abs. 2048 [P/R]
L : Abs. 4096 [P/R]
M: Abs. 8192 [P/R]

Reduction ratio
03 : 1/3
10 : 1/10
⋮

Reducer
None : No Reducer
G1 : For General industry
    (Foot Mount)
G2 : General industry
    (Flange Mount)
G3 : Precision Gearbox

Oil Seal, Brake
None : none
1 : Oil Seal
2 : Brake
3 : Oil Seal, Brake

1.2. System Composition

1.2.1 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).
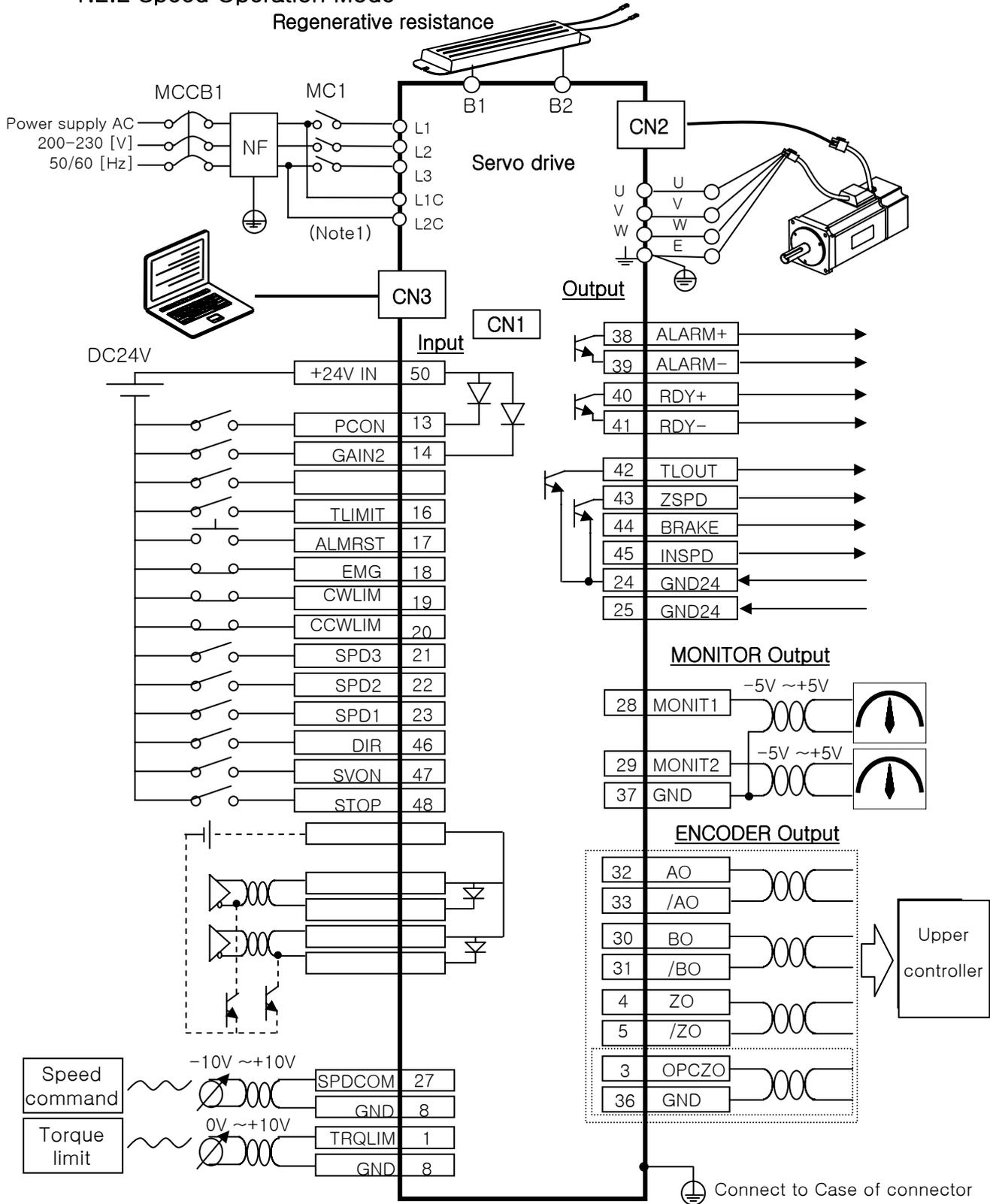
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Regenerative resistance

MCCB1   MC1

Power supply AC
200-230 [V]
50/60 [Hz]

NF

B1   B2

CN2

L1
L2
L3
L1C
L2C

Servo drive

U
V
W

U
V
W
E

(Note1)

DC24V

CN3

CN1

Output

Input

+24V IN   50

38   ALARM+
39   ALARM−
40   RDY+
41   RDY−

PCON   13
GAIN2   14
PCLEAR   15
TLIMIT   16
ALMRST   17
EMG   18
CWLIM   19
CCWLIM   20

42   TLOUT
43   ZSPD
44   BRAKE
45   INPOS
24   GND24
25   GND24

EGEAR2   22
EGEAR1   23

MONITOR Output

−5V ~+5V
28   MONIT1

SVON   47

−5V ~+5V
29   MONIT2
37   GND

PULCOM   49

ENCODER Output

Line drive

Upper
controller

PF+   9
PF−   10
PR+   11
PR−   12

32   AO
33   /AO
30   BO
31   /BO
4   ZO
5   /ZO

Upper
controller

Open
collector

Torque
limit

0V ~+10V

TRQLIM   1
GND   8

3   OPCZO
36   GND

Connect to Case of connector

1.2.2 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.

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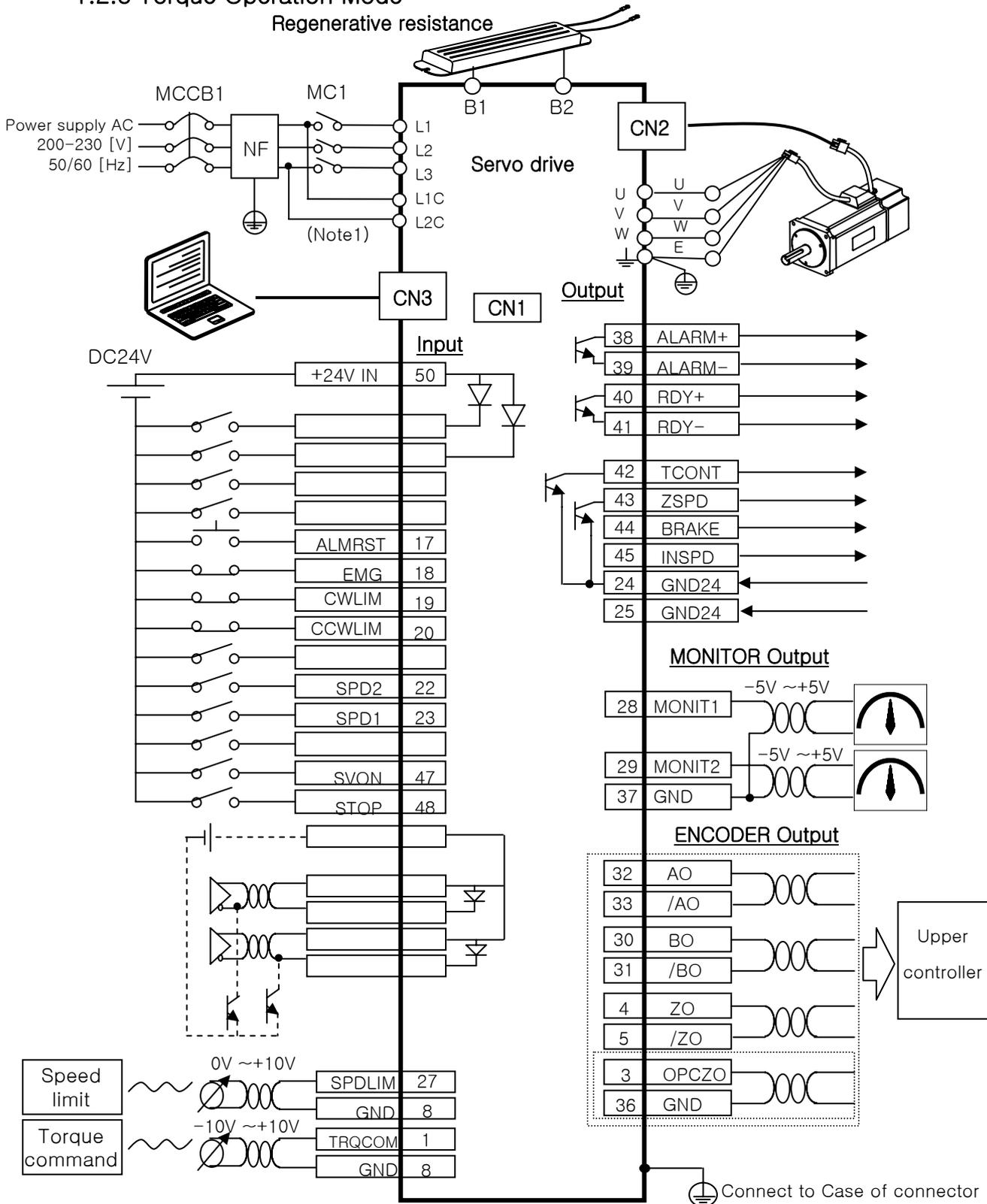
Note1) The models that are higher than VS05 have a control power terminal(L1C, L2C)

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

Note3) Surely set Speed limit type by SPDLIM, SP01, SP2D terminal.

1.2.4 Speed/Position Operation Mode

Regenerative resistance

Servo drive

Power supply AC
200-230 [V]
50/60 [Hz]

MCCB1 MC1 NF

B1 B2

L1
L2
L3
L1C
L2C

(Note1)

CN2

U U
V V
W W
E

CN3

CN1

DC24V

Input

Output

38	ALARM+	
39	ALARM−	
40	RDY+	
41	RDY−	
42	TLOUT	
43	ZSPD	
44	BRAKE	
45	INSPD/POS	
24	GND24	
25	GND24	

+24V IN	50
PCON	13
GAIN2	14
PCLEAR	15
TLIMIT	16
ALMRST	17
EMG	18
CWLIM	19
CCWLIM	20
MODE	21
SPD2/EGR2	22
SPD1/EGR1	23
DIR	46
SVON	47
STOP	48

(Note2)

MONITOR Output

−5V ~+5V

28	MONIT1
29	MONIT2
37	GND

−5V ~+5V

PULCOM 49

Line drive

Upper controller

PF+	9
PF−	10
PR+	11
PR−	12

Open collector

ENCODER Output

32	AO
33	/AO
30	BO
31	/BO
4	ZO
5	/ZO
3	OPCZO
36	GND

Upper controller

Speed command

−10V ~+10V

SPDCOM	27
GND	8

Torque limit

0V ~+10V

TRQLIM	1
GND	8

Connect to Case of connector

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

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1.2.5 Speed/Torque Operation Mode

Regenerative resistance

Power supply AC
200–230 [V]
50/60 [Hz]

MCCB1   MC1

NF

(Note1)

Servo drive

B1   B2

CN2

U V W → U V W E

CN3

DC24V

CN1

Input

+24V IN	50
PCON	13
GAIN2	14
TLIMIT	16
ALMRST	17
EMG	18
CWLIM	19
CCWLIM	20
MODE	21	(Note2)
SPD2	22
SPD1	23
DIR	46
SVON	47
STOP	48

Output

38	ALARM+
39	ALARM−
40	RDY+
41	RDY−
42	TLOUT
43	ZSPD
44	BRAKE
45	INSPD
24	GND24
25	GND24

MONITOR Output

28	MONIT1	−5V ~+5V
29	MONIT2	−5V ~+5V
37	GND

ENCODER Output

32	AO
33	/AO
30	BO
31	/BO
4	ZO
5	/ZO
3	OPCZO
36	GND

Upper controller

Speed Command /limit
−10V ~+10V

| SPDCOM/LIM | 27 |
| GND | 8 |

Torque limit /command
−10V ~+10V

| TRQLIM/COM | 1 |
| GND | 8 |

Connect to Case of connector

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

1.2.6 Position/Torque Operation Mode
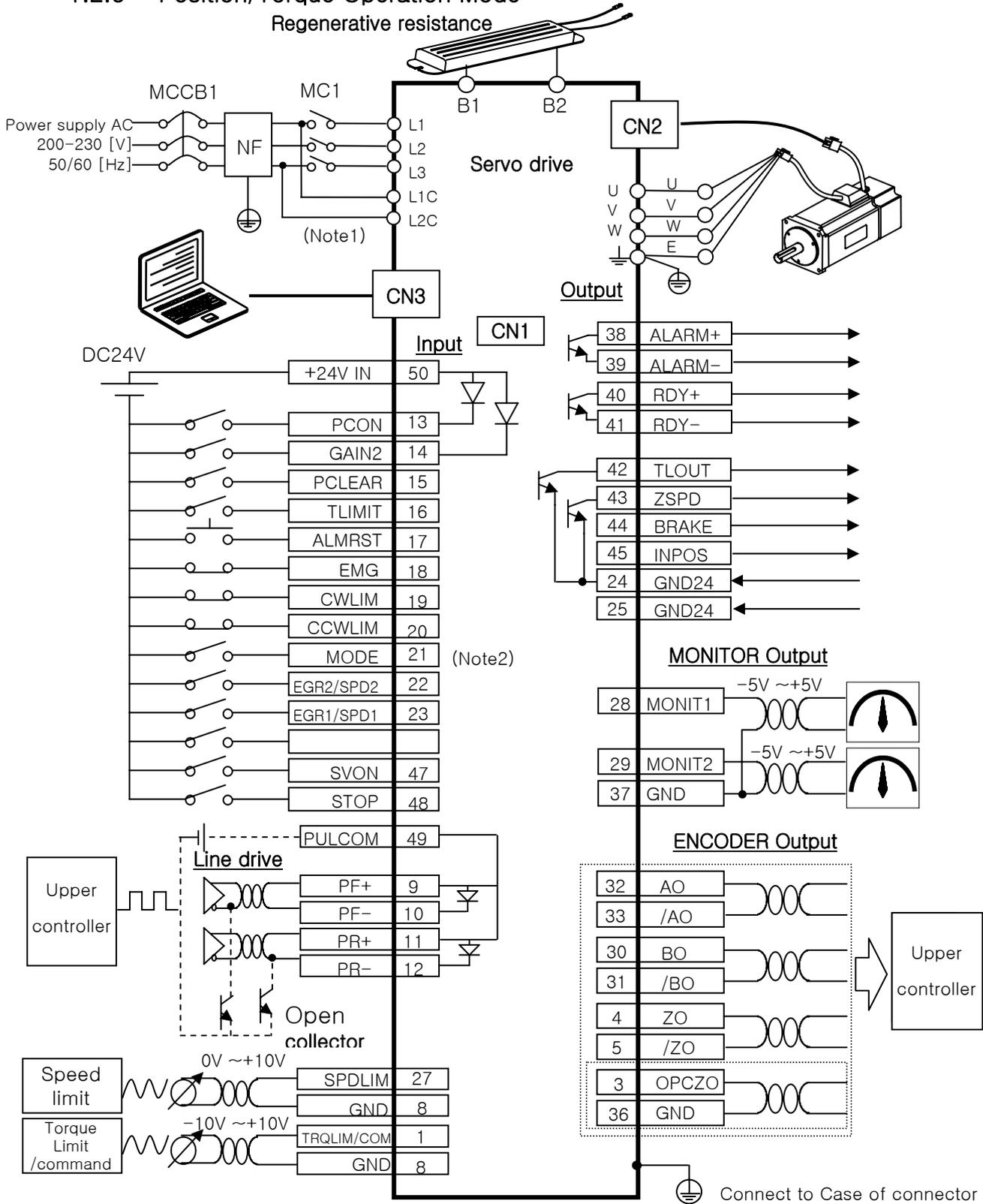
Mote1)The models that are higher than VS05 have a control power terminal(L1C, L2C)

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

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1.3 Signal Explanation

1.3.1 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 Command2 / Selecting Speed limit2	X	O	O	O/X	O	X/O
	EGEAR2	Switching electronic gear ratio2	O	X	X	X/O	X	O/X
23	SPD1	Selecting Command1 / Selecting Speed limit1	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

1.3.2 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.
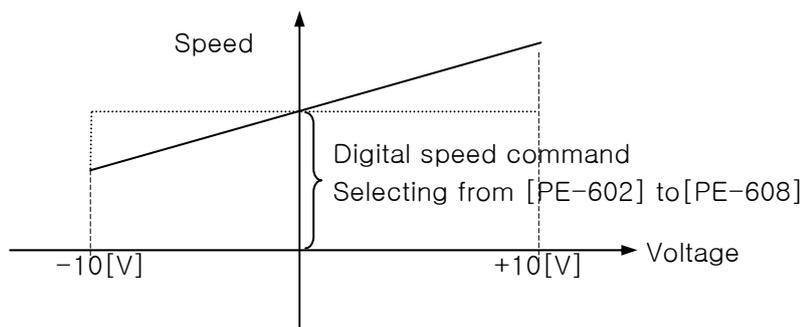
1.3.3 Pulse Input Signal

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

1.3.4 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

1.3.5 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

1.3.6 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

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[㎧²]	Excessive vibration might cause shortening of bearing lifetime

2.1.2 Preventing Excessive Impact

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

CAUTION
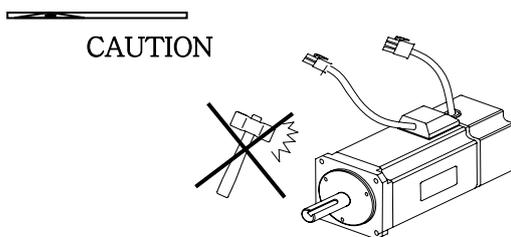
2.1.3 Wiring

- Connecting commercial power supply directly to motor would cause damage of motor
  So, the User should 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.

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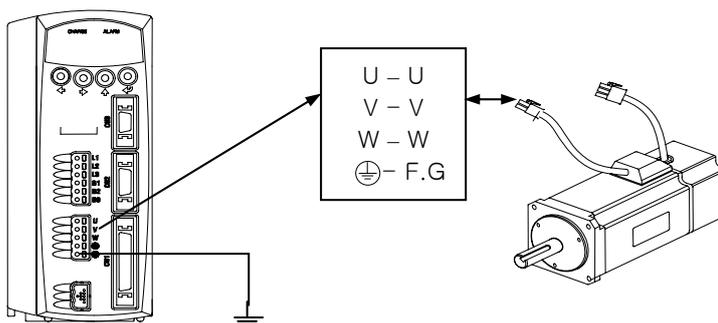
- Match the U, V and W terminals of the motor with those of the driver
- Check if there are out of placed pin or fault of connection
- In case of moisture or condensation on motor, Surely check if the insulation resistance is more than 10[㎆] and (500V), and then installation.

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2.1.4 Assembling Load System

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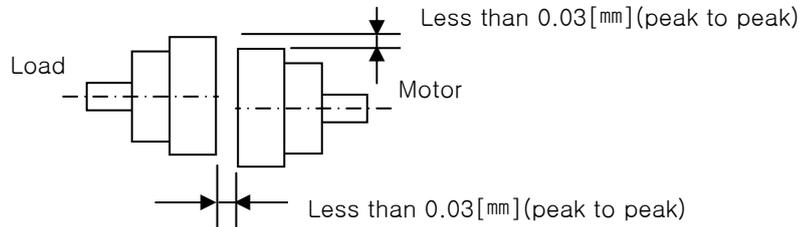
- Pulley assembling :

Flange	Radial load		Axial load		Reference diagram
	N	kgf	N	kgf	
40	148	15	39	4	Nr : Less than30[㎜]
60	206	21	69	7	Radial load
80	255	26	98	10	
130	725	74	362	37	
180	1548	158	519	53	Axial load
220	1850	189	781	90	
250	5880	600	2156	220	Nr : Less than [100mm]
280	7448	760	2156	220	

2.1.5 Cable Installation

- In case of vertical Installation, care about oil or water that can be flowed into joint
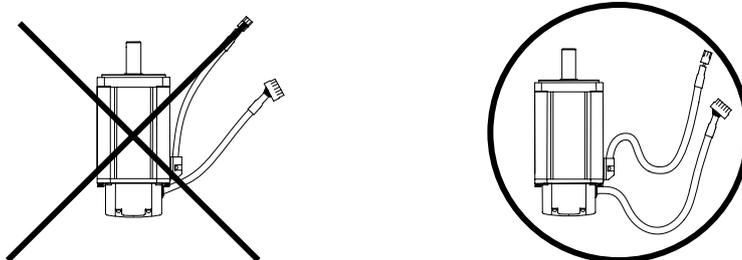
- Prevent Cable from the stress or flaw

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
- Must use Servo Drive in indoors which satisfy below conditions

Items	Operating environment	Remarkable	
Temp.	0~50[℃]	⚠ CAUTION	Avoid heat by installing fans in order to keep the proper ambient temperature.
Humidity	Less than 90[%]RH	⚠ CAUTION	Stopping for long time, drive can be damaged by condensation or tree zing Therefore, operate after removing the moisture of drive sufficiently.
External Vibration	Vibration Acceleration Less than 5.9[㎧²]	Excessive vibration might cause shortening the lifetime and malfunction.	
Environment	- Avoid direct sunlight - Avoid corrosive and flammable gas. - Avoid oil mist or dust. - Keep ventilation on closed place.		

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2.2.2 Installing in a Control Board(Panel)

- Installation space is as below.
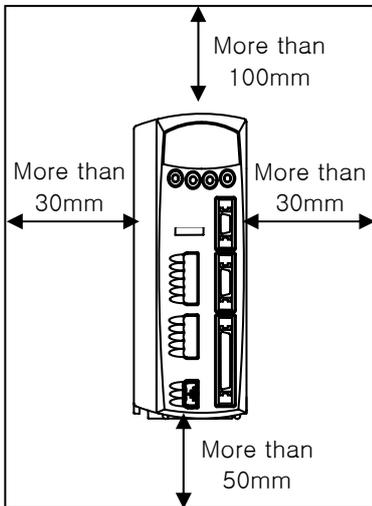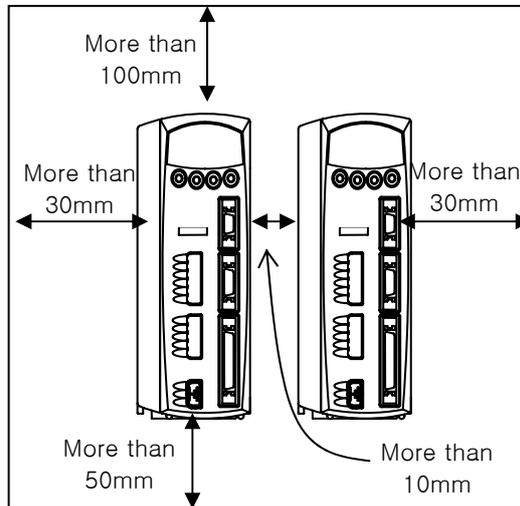
Install 1 drive   Install more than 2 drives

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 when over voltage is supplied.

- 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
VS05~VS10	40[Ω]	External 140[W]	When expanding regenerative capacity, the resistance value should be referred to "7.3 Option and peripherals"
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.

MECAPION

3.1 Power Board Wiring
## 3.1.1 Wiring (Rated output is less than 400[W])
[APD-VSR5 ~ APD-VS04]
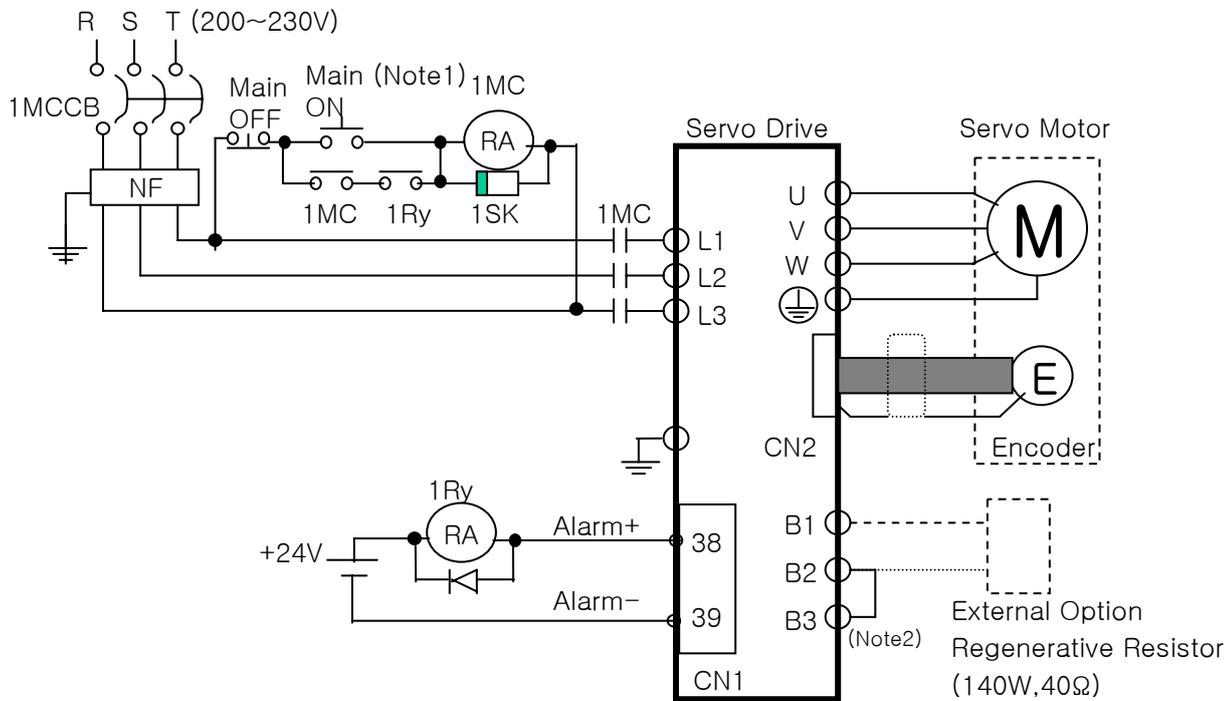
(note1) : It takes approximately 1~2 seconds before alarm signal is activated   after power is
connected.   Press main power on switch for at least 2 seconds of longer.

(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 that the optional Brake resistor should be 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).
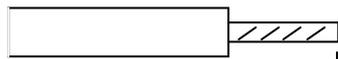
(Note4) : Connect or remove the wiring of main circuit power board after press the
button (   ) of terminal.

3.1.2 Wiring (Rated output is from 0.5 to 37.0[kW] [APD-VS05~APD-VS370]
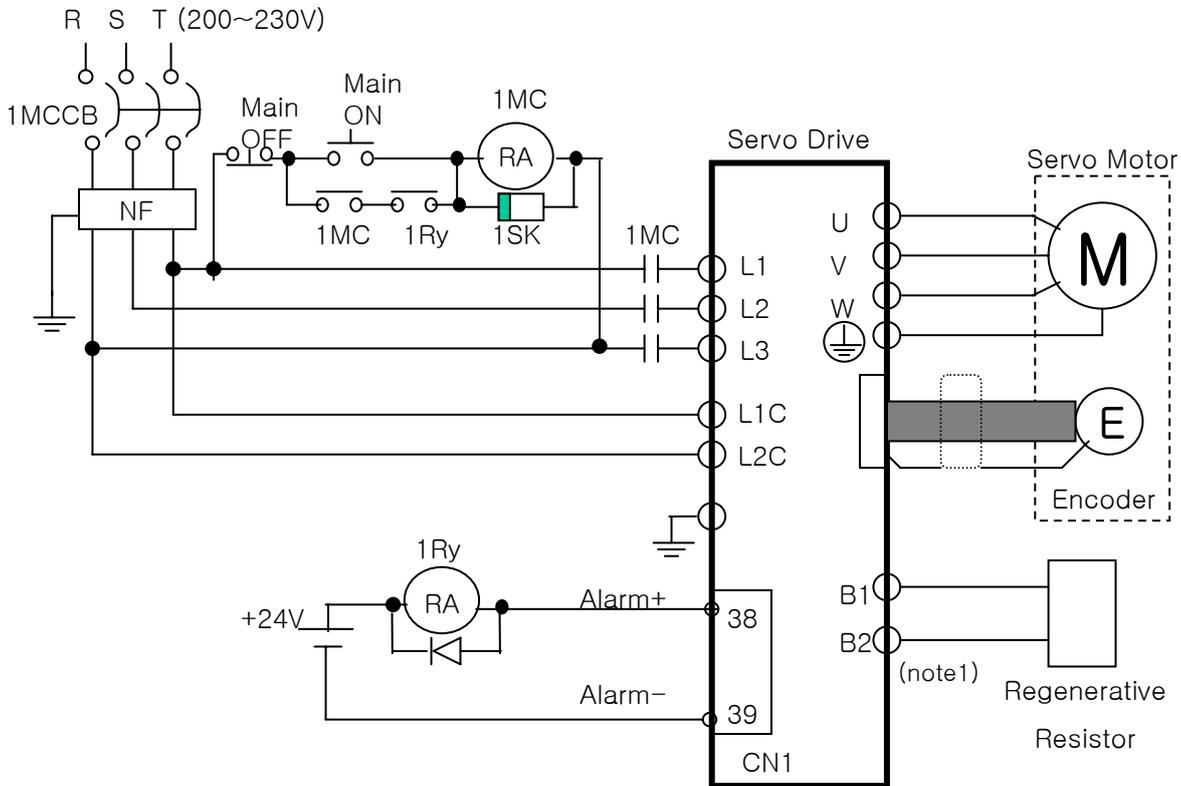

(Note1) : If regenerative capacity is large due to frequent acceleration/deceleration, the

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 Wiring of Control Signal

3.2.1 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.
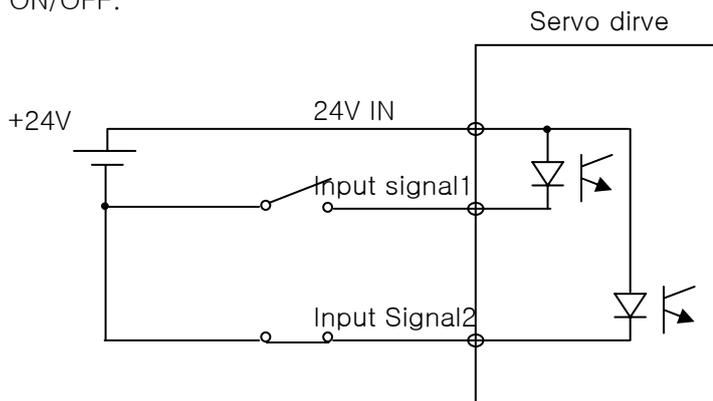
3.2.2 Output Contact Signal

> ⚠ CAUTION The output contact internally uses transistor switch.   Take precaution because over voltage or over current may cause damage to the system.
> − Power supply : DC24[V]±10%, 150[㎃]
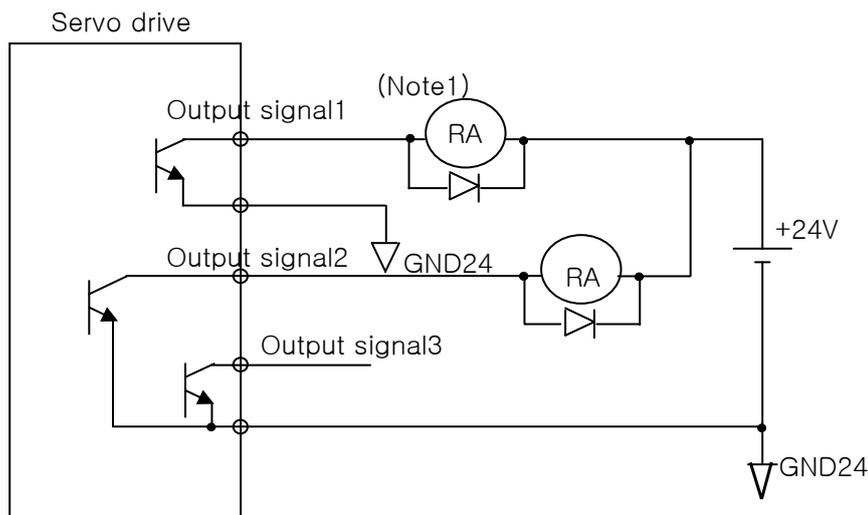
(Note1) For the output signal of Alarm and Ready, the GND24 terminal is separated.

3.2.3 Analog I/O Signal
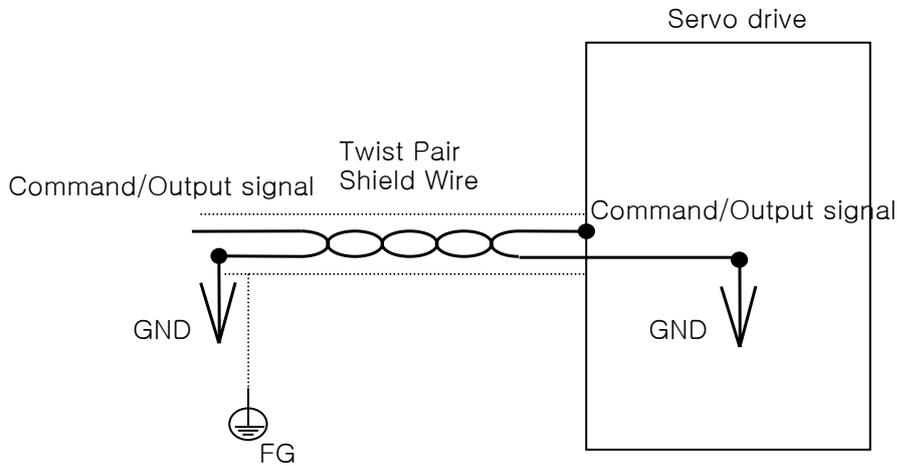
① GND terminal must be 0[V] of the control power supply.

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

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[mA] at maximum.

Do not exceed this capacity.

MECAPION
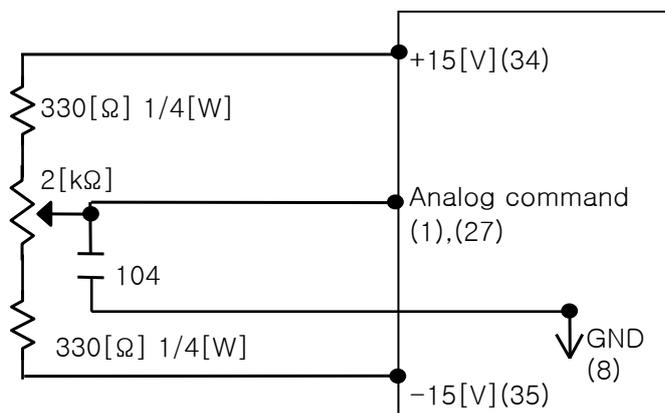
3.2.4 Pulse Input Signal

(1) Line driver(5[V]) Pulse input
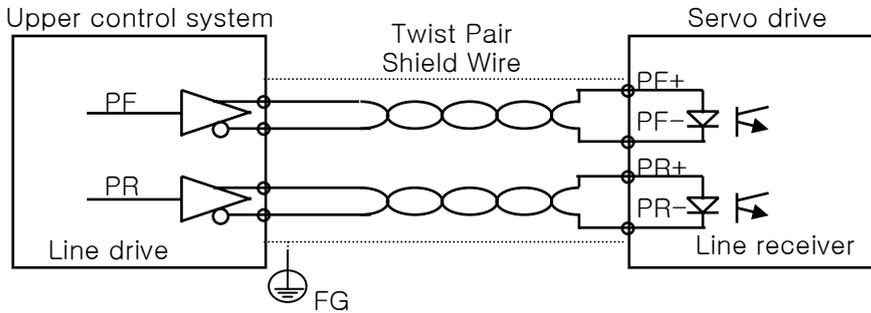
(2) Open collector(24[V]) Pulse input
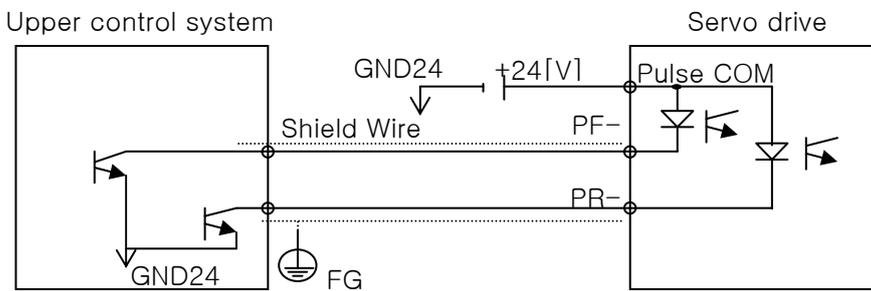
(3) 12[V] or 5[V] NPN Open Collector Pulse Command
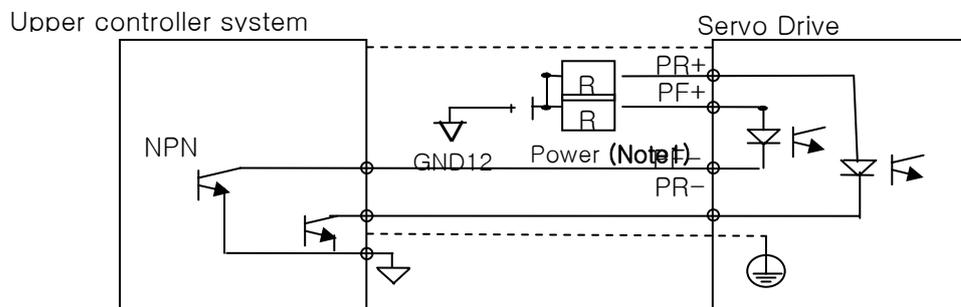
(Note1) When the power supply 12[V] is used : Resistance R=560~680[ohm], 1/2W

When the power supply 5[V] is used : Resistance R=100~150[ohm], 1/2W

When the power supply 24[V] is used : Resistance R=1.5[ohm], 1/2W

## (4) PNP Open Collector type pulse command
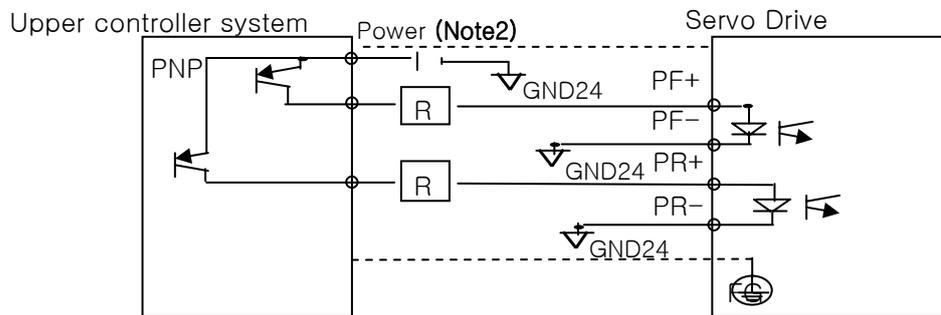
(Note 2) When the power supply 24[V] is used: Resistance R=1.5[kohm], 1/2W

When the power supply 12[V] is used: Resistance R=560~680 [ohm], 1/2W

When the power supply 5 [V] is used: Resistance R=100~150[ohm], 1/2W

3.2.5 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.

MECAPION
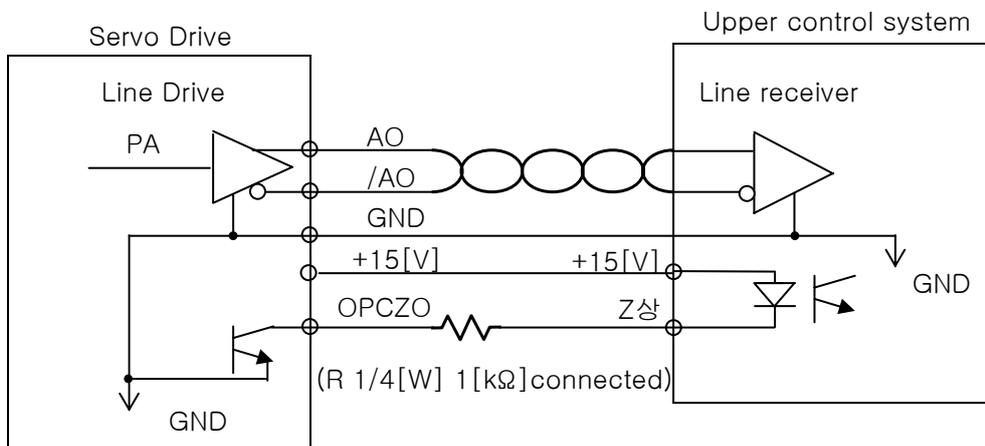
3.3 Wiring of Communication (Option) Signal

3.3.1 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.
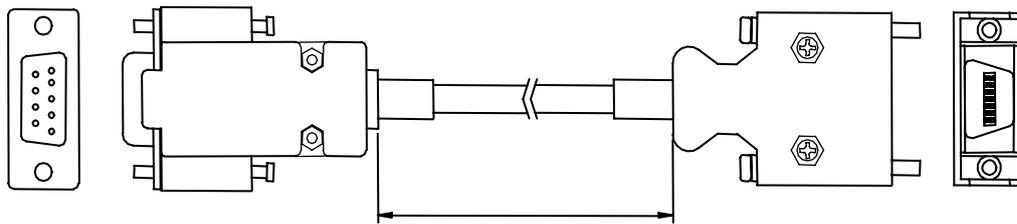
[PC- Serial Port]   [Servo Drive- CN3]

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] (Set it as the same speed
                                    in the menu [PE-202])
   Data bit : 8
   Parity : none
    Stop bit : 1
    Flow control : Xon/Xoff

4.1 How to Operate Loader

4.1.1 External View

Left Right Up Enter
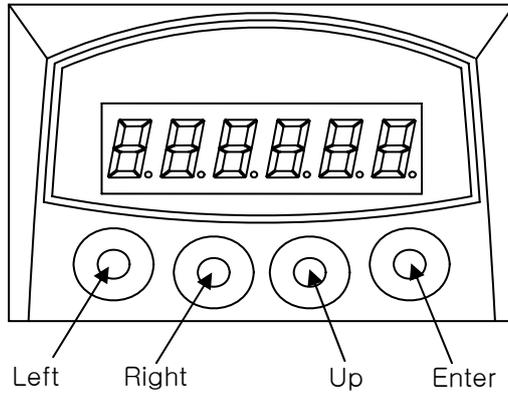
4.1.2 Name of each Part

① Move Menu

② Editing Menu

PE-201 Enter → [8.8.8.8.8.8.]
        ← Enter

*Change Position : Left/Right
*Change Value : Up

Initial Blinking digit
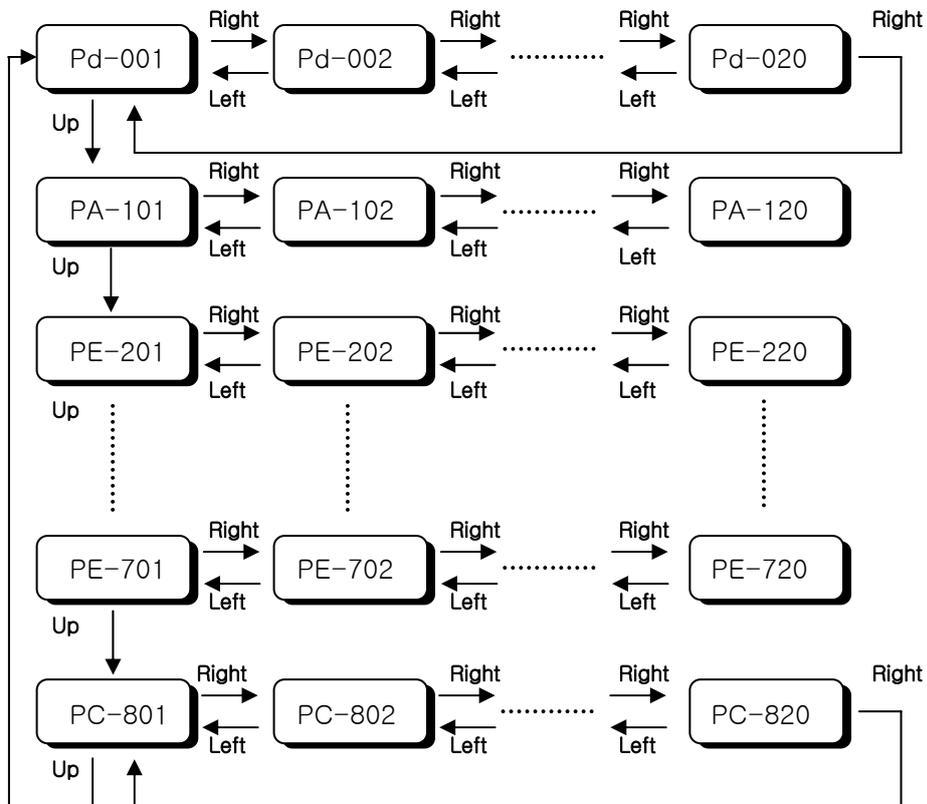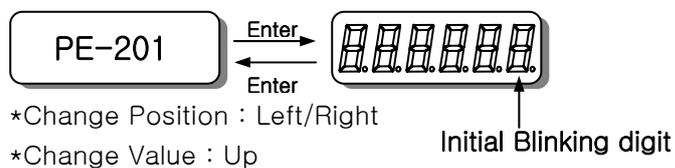
- Shift to the menu for editing in the same method of ①
- After above, press[Enter] Key, then data of menu is displayed   " 13 "
  And, the last digit is blinking ; you can change the value where blink is located.
- For moving the blinking position, press [Left] or [Right].
- For changing value, press [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.

4.2 Program Menu Summary

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

Comm. Code	Name of Menu Group	Function
Pd-001 ~ Pd-020	Status Menu	Indicate operation status information of Each Servo.
PA-101 ~ PA-120	Alarm Menu	Save & Indicate records of Alarm that is Happened before.
PE-201 ~ PE-220	System Menu	Save information of system construction
PE-301 ~ PE-320	Control Menu	Save set variables that are related to control.
PE-401 ~ PE-420	Analog Menu	Save set variables that are related to analog I/O.
PE-501 ~ PE-520	InOut Menu	Save set variables that are 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	Save set variables that are 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

MECAPION

4.2.1 Operation State Indicating Menu

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	–	–		PST
			–	–		
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 .

4.4.2 Alarm state indicating Menu

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

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, Changing the Motor
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, phrase resistance encoder set value, wiring, Replace drive
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 of braking resistance, damage of braking resistance, excessive regenerative operation
AL-11	Over Speed	Over speed, Input power when a Motor take free-run	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 error	Check the initial reset [PC-811], Encoder overflow
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

4.2.3 System variables setting menu

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 (Applicable after re-power on) 0=9600[bps], 1=19200[bps] 2=38400[bps],3=57600[bps]	PST
		Baud Rate	0	3		
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·cm·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	mohm	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 .

4.2.4 System variables setting menu (for Special Large size: APD-VS220, VS300, VS370)

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-218]	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·cm·s²	ID	Sets inertia of motor. (Modification is possible when [PE-201] is "0")	PST
			0.1	9999.9		
50	*PE-211	Trq Con	kgf·cm/A	ID	Sets torque constant of motor (Modification is possible then [PE-201] is "0")	PST
			0.001	99.999		
51	*PE-212	Q-axis Inductance	mH	ID	Sets Q-axis inductance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
52	*PE-213	D-axis Inductance	mH	ID	Sets D-axis inductance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
53	*PE-214	Phase Rs	mohm	ID	Sets phase resistance of motor (Modification is possible when [PE-201] is "0")	PST
			0.001	99.999		
54	*PE-215	Rated Is	A	ID	Sets rated current of motor (Modification is possible when [PE-201] is "0" .)	PST
			0.01	999.99		
55	*PE-216	Max Speed	r/min	ID	Sets max.speed of motor (Modification is possible when [PE-201] is "0")	PST
			0.0	9999.9		
56	*PE-217	Rated Speed	r/min	ID	Sets rated speed of motor (Modification is possible when [PE-201] is "0")	PST
			0.0	9999.9		
57	*PE-218	Pole Number	–	8	Sets pole number of motor (Modification is possible when [PE-201] is "0")	PST
			2	98		
58	PE-219	Ibs Offset Save	A	0	Sets current offset of motor (Modification is possible when [PE-201] is "0")	PST
			–99.999	99.999		
59	PE-220	Ics Offset Save	A	0	Sets current offset of motor (Modification is possible when [PE-201] is "0")	PST
			–99.999	99.999		

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

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
HC03H	41	250	Only Semiconductor
HC03HC6	42	300	Only Semiconductor
SE15D	50	1500	Special type
SC20B	51	2000	Special type

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	Only LG
SF75G	104	7500	Customized type
SE35A	105	3500	Customized type
SF55G	106	5500	Customized type
SF60M	107	6000	Customized type
SF35A	108	3500	Customized type
SE08D	109	750	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	
SH220G	141	22000	
SH300G	142	30000	
SJ370G	143	37000	

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4.2.5 Control Variables Setting Menu
Menus marked with "*" cannot be corrected during Servo-ON

Comm Code	CODE	NAME	UNIT / MIN	INI / MAX	Description	Appl. Mode
60	PE-301	Inertia Ratio	1.0	2.0 / 500.0	Sets inertia ratio of load (Refer to chapter 4.4.2)	PST
61	PE-302	Position P Gain1	1/s / 0	50 / 500	Sets position control proportional gain 1	P
62	PE-303	Position P Gain2	1/s / 0	50 / 500	Sets position control proportional gain 2	P
63	PE-304	P Feedforward	[%] / 0	0 / 100	Sets position feed-forward control ratio	P
64	PE-305	P FF FLT TC	msec / 0	0 / 10000	Sets the time-constant of position feed-forward control filter	P
65	PE-306	P CMD FLT TC	msec / 0	0 / 10000	Sets the time-constant of position command filter	P
66	PE-307	Speed P Gain1	rad/s / 0	/ 5000	Sets speed proportional gain 1 (APD-VSR5~04:500, VS05~10:300, VS15~75:200)	PST
67	PE-308	ZSPD Gain Rate	[%] / 1.0	50.0 / 100.0	Sets zero speed gain rate which will be applied for the speed lower than that of [PE-313].	PS
68	PE-309	Speed I TC1	msec / 1	/ 10000	Sets speed integral time constant 1 (APD-VSR5~04:20, VS05~10:30, VS15~75:50)	PST
69	PE-310	Speed I TC2	msec / 1	/ 10000	Sets speed integral time constant 2 (APD-VSR5~04:20, VS05~10:30, VS15~75:50)	PST
70	PE-311	Speed IN FT	msec / 0.0	0.0 / 100.0	Sets speed command filter	S
71	*PE-312	Speed FB FT	msec / 0.0	0.5 / 100.0	Sets speed feed-back filter	PS
72	PE-313	Zero Speed Gain	r/min / 0.0	0.0 / 100.0	Sets the speed range of zero speed gain	PST
73	PE-314	TORQ. CMD FLT	msec / 0.0	0.0 / 1000.0	Sets torque command filter	PST
74	PE-315	DE-Resonance	– / 0	0 / 1	Sets avoid resonance driving operation (0 : no operation, 1 : operation)	PST
75	PE-316	Notch Frequency	Hz / 0	300 / 1000	Sets avoid resonance driving frequency	PST
76	PE-317	Notch Bandwidth	– / 0	100 / 1000	Sets avoid resonance band width	PST
77	PE-318	Overload offset	– / 1.0	1.1 / 3.0	Set the time of Overload characteristics (User is requested not to change it)	PST
78	PE-319	Speed P Control	r/min / 0.0	100.0 / 9999.9	Sets the changed speed at PI-P control ('PCON' input)(P control is operated at less than set speed)	PST
79	PE-320	Zero Speed Lock	– / 0	1 / 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)	PST

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

4.2.6 Analog I/O variables setting menu

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

Comm Code	CODE	NAME	UNIT MIN	INI MAX	Description	App Mode
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	Not Used	- -	- -		
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

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4.2.7 I/O Contacts Variables Setting Menu

Comm Code	CODE	NAME	UNIT MIN	INI MAX	Description	App Mode
100	PE-501	Inposition	Pulse 0	100 99999	Sets the output range of position operation completed 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 the output speed of break operating signal	PST
105	PE-506	Brake Time	msec 0	10 10000	Sets the output delay time of break operating signal	PST
106	PE-507	PowerFail Mode	– 0	0 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 manual, 1 : Automatic reset)	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.	
119	PE-520	Gain Conv Mode	– 0	0 3	Set Gain1, Gain 2 switching mode. 0: Use Gain1 only. 1: When gain2 off, use gain1, gain2 on use gain 2 2. When [PE-503] IS over 0speed: Gain2, below 0speed: Gain1 3. Pulse error is bigger than [PE-501], convert Gain 1 –> Gain 2	

4.2.8 Speed operation variables setting menu

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

Comm Code	_ MENU _		UNIT	INI	Description	Appl. Mode
	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 * Used as Speed limit when Torque control	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 shape control on speed control (0 : Linear Accel/Decel , 1 : S shape 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		

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

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

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

4.2.9 Position opreration variables setting menu

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 (data up/down function)	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	Switch 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 this is for Communication only.	
			–	–		
159	PE-720	ABS Single Turn	–	–	Absolute encoder's Single Turn Data. Menu display is not possible as this is for communication only.	
			–	–		

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

4.2.10 Operation handling menu

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

Comm Code	CODE	NAME	UNIT	INI	Description
			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

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**

Display Input contact logic   Handling position of Input contact

[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]

(A)	(B)	(C)	(D)	(E)	(F)
BRAKE	INSPD/INPOS	ZSPD	READY	TLOUT	ALARM

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4.3 Display Operation State

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

- Display current operation state.
  * nor-off : Servo off normal operation state.
  * nor-on : Servo on 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]

(A)	(B)	(C)	(D)	(E)	(F)
BRAKE	INSPD/INPOS	ZSPD	READY	TLOUT	ALARM

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

   CN1 Connector is ON (Short) : Lamp ON

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CN1 Connector is OFF (Open) : Lamp OFF

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

- Display state when manipulating 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 can 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)

S 2.01 - 3

Standard   Version   Drive type
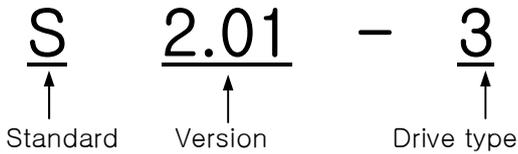
● Software type is "S" in this
  Manual.

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 Customized type (300A)
d	VS150
e	VS220
f	VS300
g	VS370

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	Model No.	ID	Watt	Remark
SAR3A	1	30		HC03H	41	250	Semi-conductor
SAR5A	2	50		SE15D	50	1500	Special type
SA01A	3	100		SC20B	51	2000	Special type
SB01A	11	100		SE09A	61	900	
SB02A	12	200		SE15A	62	1500	
SB04A	13	400		SE22A	63	2200	
SB03A	14	250	Customized type	SE30A	64	3000	
HB02A	15	200	Hollow Shaft	SE06D	65	600	
HB04A	16	400	Hollow Shaft	SE11D	66	1100	
SC04A	21	400		SE16D	67	1600	
SC06A	22	600		SE22D	68	2200	
SC08A	23	800		SE03M	69	300	
SC10A	24	1000		SE06M	70	600	
SC03D	25	300		SE09M	71	900	
SC05D	26	450		SE12M	72	1200	
SC06D	27	550		SE05G	73	450	
SC07D	28	650		SE09G	74	850	
SC01M	29			SE13G	75	1300	
SC02M	30			SE17G	76	1700	
SC03M	31			HE09A	77	900	Hollow shaft
SC04M	32			HE15A	78	1500	Hollow shaft
HC06H	33	600	S/T only	SE11M	79	1050	Special type
SC05A	34	450	S/S only	SE07D	80	650	Special type
SC05H	35	500	S/S only	SF30A	81	3000	
SC08A	36	750	S/S only	SF50A	82	5000	
HB01A	37	100	Hollow Shaft	SF22D	85	2200	
HC10A	38	1000	Hollow Shaft	SF35D	86	3500	
HE30A	39	3000	Hollow Shaft	SF55D	87	5500	
HB30H	40	250	Semi-conductor	SF75D	88	7500	

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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	Only LG
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	
SH220G	141	22000	
SH300G	142	30000	
SJ370G	143	37000	

- Setting each motor constant

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

Motor constant is as below

Comm Code	CODE	NAME	UNIT		INI		Explanation
			MIN		MAX		
40	*PE-201	Motor ID	–		–		Sets motor ID
			0		99		: set automatically from [PE-210]to[PE-217]
49	*PE-210	Inertia	gf·cm·s^2		ID		Sets inertia of motor. (Modification is possible
			0.01		999.99		when [PE-201] is "0")
50	*PE-211	Trq Con	kgf·cm/A		ID		Sets torque constant of motor.(Modification is
			0.01		999.99		possible when [PE-201] is "0")
51	*PE-212	Phase Ls	mH		ID		Sets phase inductance of motor.(Modification
			0.001		99.999		Is possible when [PE-201] is "0")
52	*PE-213	Phase Rs	mohm		ID		Sets phase resistance of motor. (Modification
			0.001		99.999		is possible when[PE-201] is "0")
53	*PE-214	Rated Is	A		ID		Sets rated current of motor. (Modification is
			0.01		999.99		possible when [PE-201] is "0")
54	*PE-215	Max Speed	r/min		ID		Sets Max. speed of motor. (Modification is
			0.0		9999.9		possible when [PE-201] is "0")
55	*PE-216	Rated Speed	r/min		ID		Sets rated speed of motor. (Modification is
			0.0		9999.9		possible when [PE-201] is "0")
56	*PE-217	Pole Number	–		8		Sets pole number of motor. (Modification is
			2		98		possible when [PE-201] is "0")
Only Special-Large Capacity Menu(APD-VS220, VS300, VS370)							
40	*PE-201	Motor ID	–		–		Sets motor ID
			0		99		: set automatically from [PE-210]to[PE-217]
49	*PE-210	Inertia	gf·cm·s^2		ID		Sets inertia of motor. (Modification is possible
			0.01		999.99		when [PE-201] is "0")
50	*PE-211	Trq Con	kgf·cm/A		ID		Sets torque constant of motor.(Modification is
			0.01		999.99		possible when [PE-201] is "0")
51	*PE-212	Phase Lq	mH		ID		Sets phase inductance of motor.(Modification
			0.001		99.999		Is possible when [PE-201] is "0")
52	*PE-213	Phase Ld	mH		ID		Sets phase inductance of motor.(Modification
			0.001		99.999		Is possible when [PE-201] is "0")
53	*PE-214	Phase Rs	mohm		ID		Sets phase resistance of motor. (Modification
			0.001		99.999		is possible when[PE-201] is "0")
54	*PE-215	Rated Is	A		ID		Sets rated current of motor. (Modification is
			0.01		999.99		possible when [PE-201] is "0")
55	*PE-216	Max Speed	r/min		ID		Sets Max. speed of motor. (Modification is
			0.0		9999.9		possible when [PE-201] is "0")
56	*PE-217	Rated Speed	r/min		ID		Sets rated speed of motor. (Modification is
			0.0		9999.9		possible when [PE-201] is "0")
57	*PE-218	Pole Number	–		8		Sets pole number of motor. (Modification is
			2		98		possible when [PE-201] is "0")

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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	

(Warning) When the Encoder which is applied to real motor is not same as [PE-203]

　　　　Value, the motor speed will be high. So please set up the same Value.

　　– 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, we can give ID to Servo.

　　At this time, Option items that are related to communication is required.

　　– 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

Please refer to below for setting up control variable

▶ [PE-301] Setting Load Inertia Ratio : Refer to 5.3.1 Auto Gain tuning

▶ [PE-302] Controlling Position Ratio Gain : Increasing within the range of No
  Oscillation or Overshooter of Servo Motor (Do not use Speed and Torque operating)

▶ [PE-307] Controlling Speed Ratio Gain : Increasing within the range of No
  Vibration of Servo Motor

▶ [PE-309] Controlling Speed Integral Time Constant : Setting after referring to
  below table by [PE-307] Setting Value of Speed Ratio Gain

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 are 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 ~ 280	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)
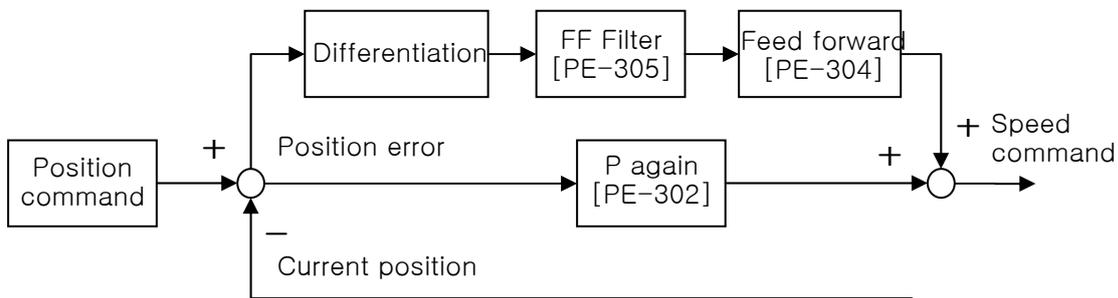
 - Position command : Count the position command pulse from external. And

convert it to position command value, and it pass through 1st filter. and then it is used

as the internal position command.

- Current position : Count the pulse signal from encoder, and convert it to current position
  by using electrical gear ratio setting and then convert it to the current position value.
- 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

> ⚠ CAUTION The function of Position Proportional gain 2 [PE-303] is not supported to
> current software version

③ speed control gain (Application Mode : PST, PS, S)
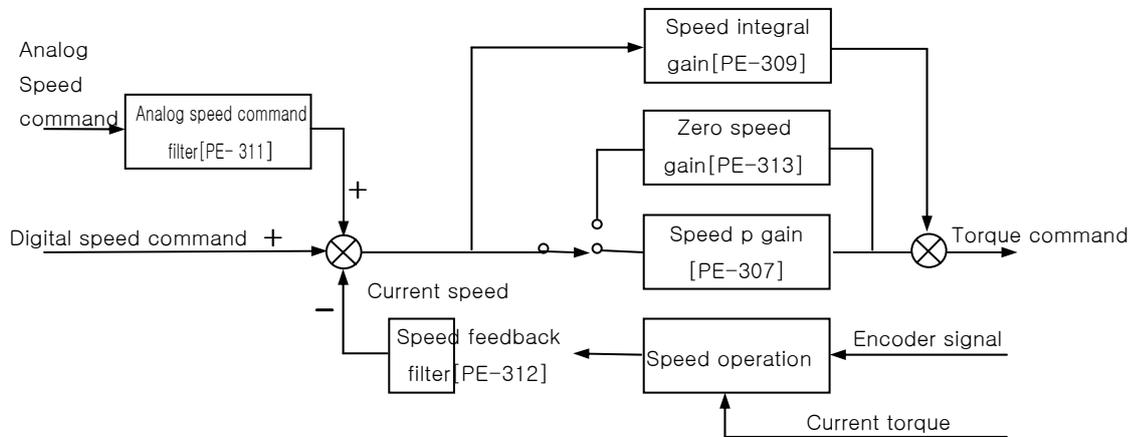
- Speed command : Use analog speed signal which is inputted from external passed through analog speed command filter [PE-311] as speed command or use digital speed command by [r/min] unit which is set on internal menu

- Current speed : Calculate the speed by counting encoder signal as per the time and the calculated speed is to be used as the current speed after going through the filter. 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]
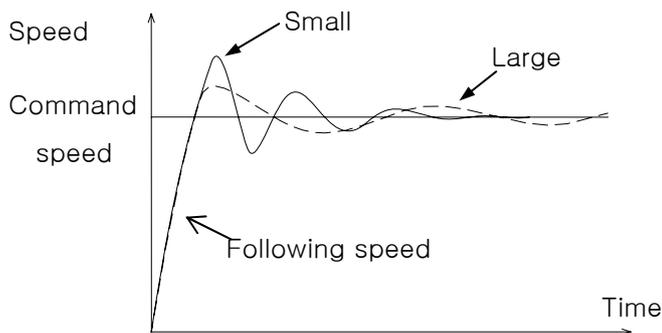
- Speed proportional gain[PE-307] : Convert to torque command by multiplying speed error by proportional gain

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
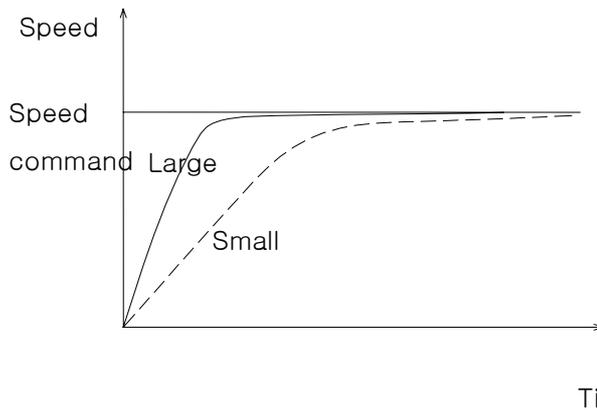
- Zero speed gain ratio[PE-308] : Set specific zero speed gain ratio that is to be applied within the range that are less than the speed set at zero speed gain[PE-313].

- 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 the has too large inertia, the vibration controlled by applying filter to speed feedback.
  * Recommend setting value = 0 ~ Speed proportional gain[PE-309]/10

- Zero speed gain [PE-313] : When controlling vibration with speed feedback gain, system could be unstable by stop vibration. At this time, set the range of zero speed gain, and control the gin within that range to control vibration.

| ⚠ CAUTION | The function of speed P-gain2 [PE-308] and speed I-gain2 [PE-310] is not supported to this software version. |

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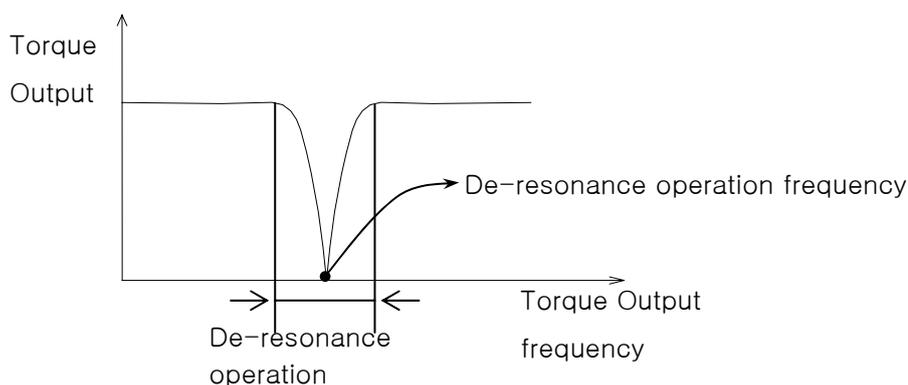
- If vibration is generated due to mechanical resonance from specific frequency, the vibration caused by resonant can be controlled by limiting torque output for this frequency range.
- De-resonance operation [PE-315] : It is not operated at "0". But, operated at "1".

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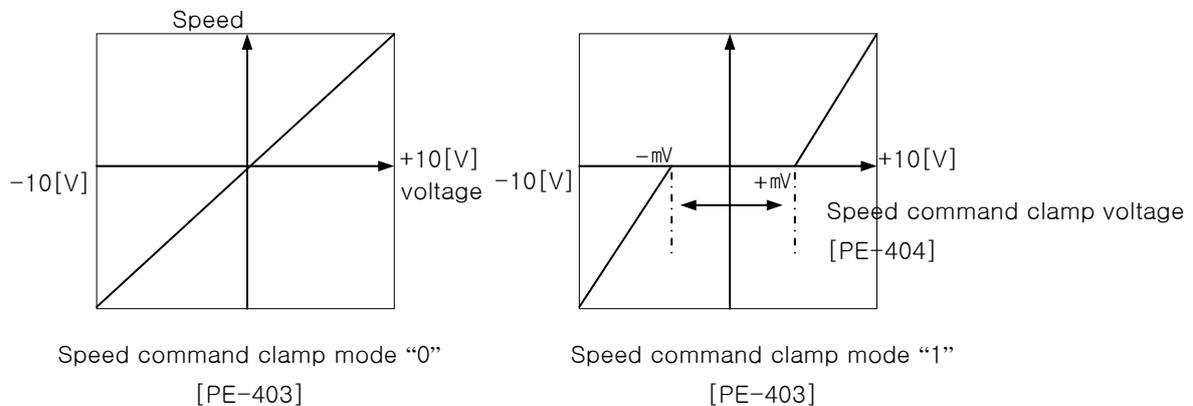
- Speed override operation [PE-405] : Operate speed command operation by overriding the analog speed command to digital speed command.
"0" : Not operated.
"1" : Override operation

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]
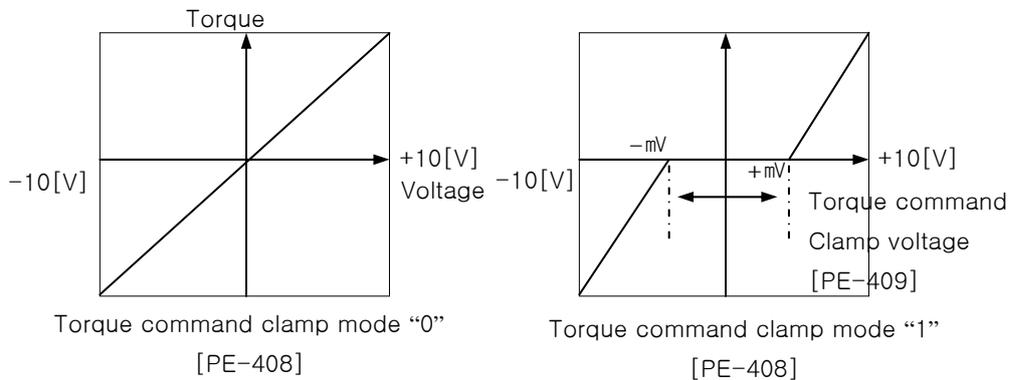
③ Setting analog output

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

* Special-Large Capacity(VS220, VS300, VS370) Motor Max Speed [PE-216]

- 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 [㎷]

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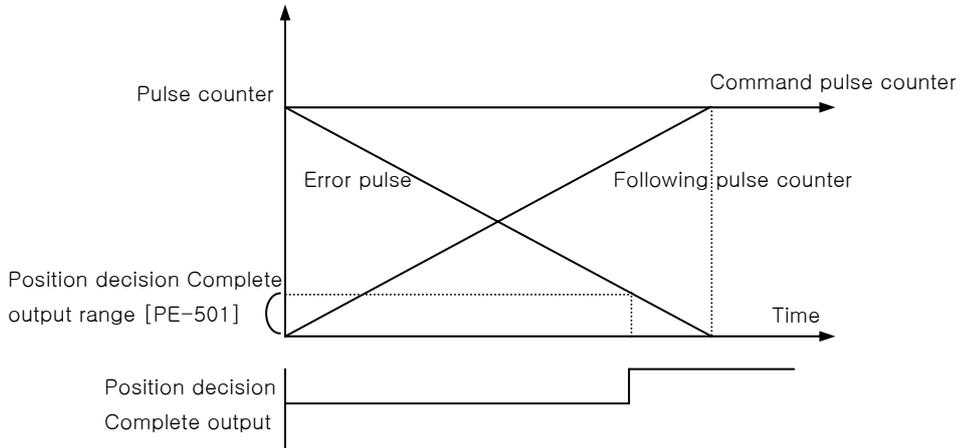
If setting value is excessively high, position decision complete signal could be occurred during operation according to position command pulse. Therefore set the value properly

- Position operation following error range [PE-502]
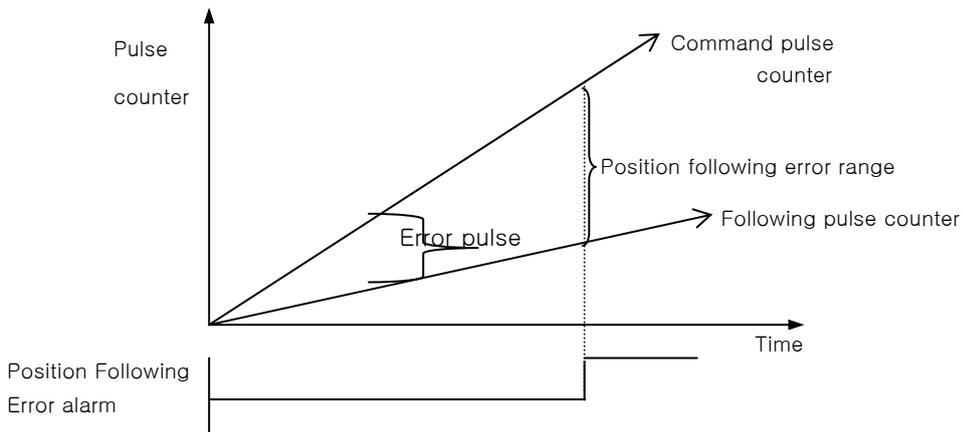
If the error pulse is larger than following error range set value, Position following error alarm would be occurred.

② Setting speed operation variables (Application Mode : PST, S)
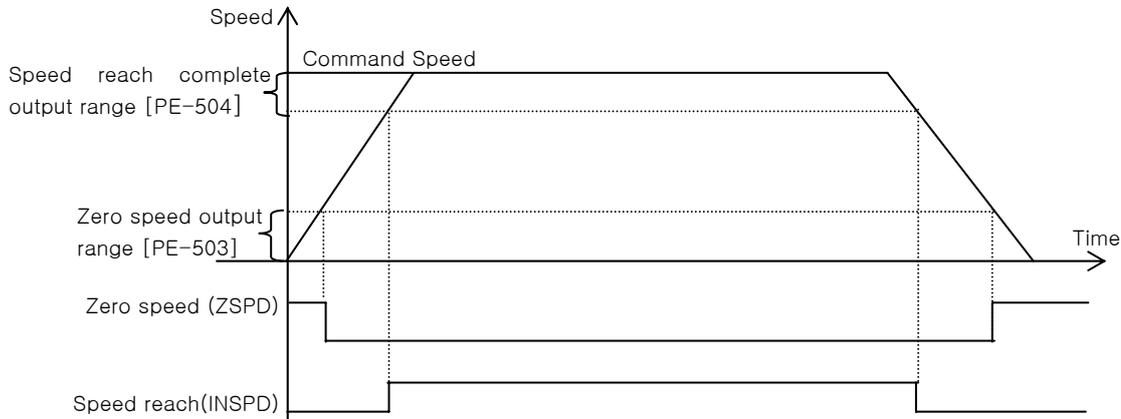
- Zero speed output range [PE-503] : If current speed is less than set speed, zero speed signal comes out.
- Speed reach complete output range [PE-504] : Speed reach complete signal comes out.

③ Setting brake signal output variables (Application Mode : PST)
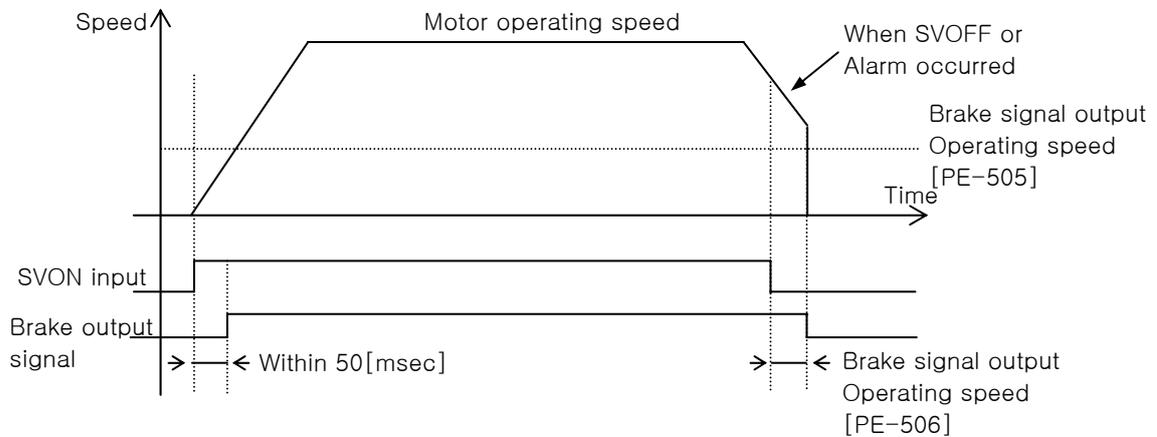
- Brake signal output operating speed [PE-505], Brake signal output delay time [PE-506] ;
The Servo motor brake that is installed inside is used when a servo drive controls a vertical axis. In other words, a servo motor with brake prevents the movable part from shifting due to the force of gravity when 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 dividing ratio "1" : 3,000[P/R]×1=3,000[P/R]

Encoder pulse output at setting the dividing 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 manual.

"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 0 Speed Gain rate[PE-519] : At "0" Speed Gain Speed[PE-313], set "0" Speed Gain's rate which will be applied under set Speed.

⑫ Gain1, Gain2 Change mode[PE-520]

Set	Operating method
0	Applied only Gain 1.
1	Input a point of contact Gain2 off : Applied Gain1, Input a point of contact Gain2 on : Applied Gain2
2	When Speed Command[PE-503] is over range of "0" Speed at speed controller, apply Gain2(apply Hysteresis : 50%)
3	When Pulse error is over inposition at position controller, apply Gain2 (apply Hysteresis : 50%)

※ If Gain2[PE-303], [PE-308], [PE-310] is smaller than Gain1 [PE-302][PE-307], [PE-309], apply Gain1.

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 control	Torque control
X	X	X	Analog speed command	Analog speed limit
O	X	X	Digital speed command 1	Digital speed limit 1
X	O	X	Digital speed command 2	Digital speed limit 2
O	O	X	Digital speed command 3	Digital speed limit 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.

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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 = 12000×10^{-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

Note3) When operation, Difference between Command Pulse and Following Pulse Is Error Pulse[Pd-006]

=> Error Pulse Ep = Command Pulse frequency * Electronic Gear Ratio * {1-(0.01* [PE-304])}/[PE-302]

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 Changing the Position Pulse Direction[PE-713] : Changing operating direction by Command Pulse

  " 0 " : Operating with same Command Pulse direction

  " 1 " : Operating with opposite Command Pulse direction

5.1 Adjustment

5.1.1 Gain Tuning

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

□□□.□

Inertia ratio displayed
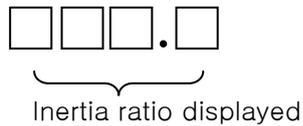
① Inertia ratio range is automatically changed from 1 to 50.
② When pressing [Up] key, the Auto gain tuning operation is started with the operation speed 100[r/min].
③ When keep pressing [Up] key, the operation speed is increased 100->300 ->500[r/min]. Increased by 200[r/min]. Tuning time is quicker 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.

5.1.2 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

5.2 Test Operation
5.2.1 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.

5.2.2 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]

5.2.3 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.

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6.1 External Dimensions

♦ APD-VSR5N, APD-VS01N,

♦ APD-VS04N, APD-VS02N
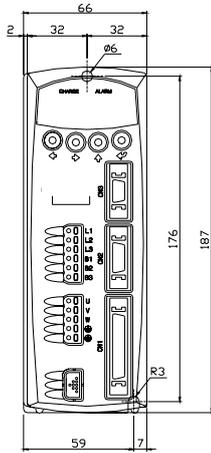
★ Weight : 1.2[kg]
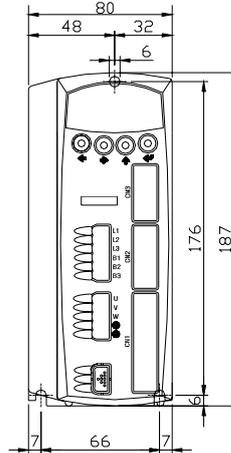
★ Weight : 1.5[kg]
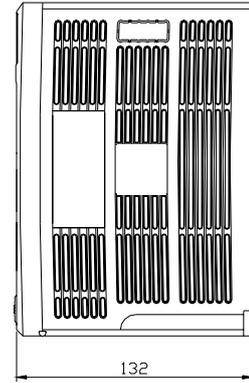
♦ APD-VS05N, APD-VS10N
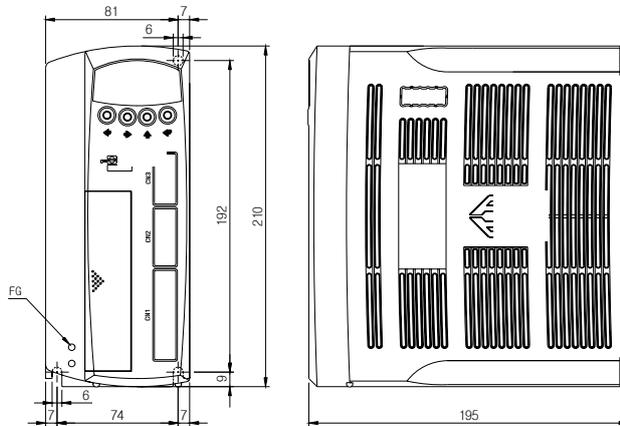
★ Weight:2.5[kg]

[Standard regenerative braking resistance : MRC 140W 40Ω]
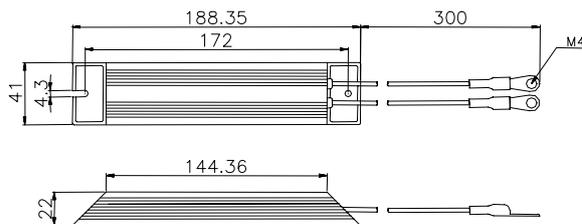
IRH 140W 40ohm

♦ APD-VS15N, APD-VS20N, APD-VS35N, APD-VS50N
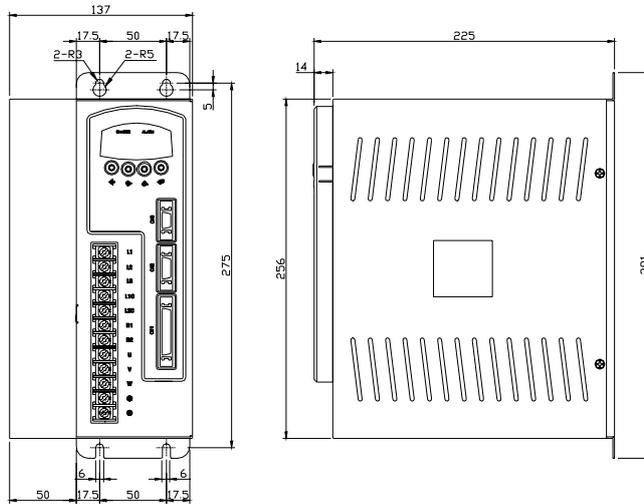

★ Weight : 7.2[kg]
(VS35N~50N:Fan Cooling)

♦ APD-VS75N
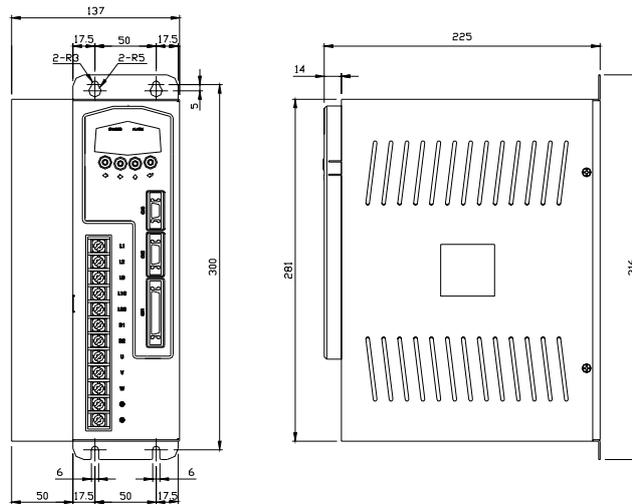

★ Weight: 8[kg]
(Fan Cooling)

[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	15[Ω] (600[W]×2P)		10[Ω] (600[W]×3P)		
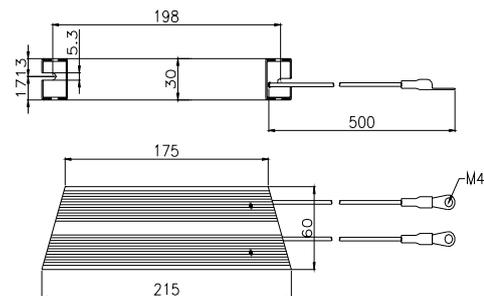
IRV 300W 23ohm

◆ APD-VS110N
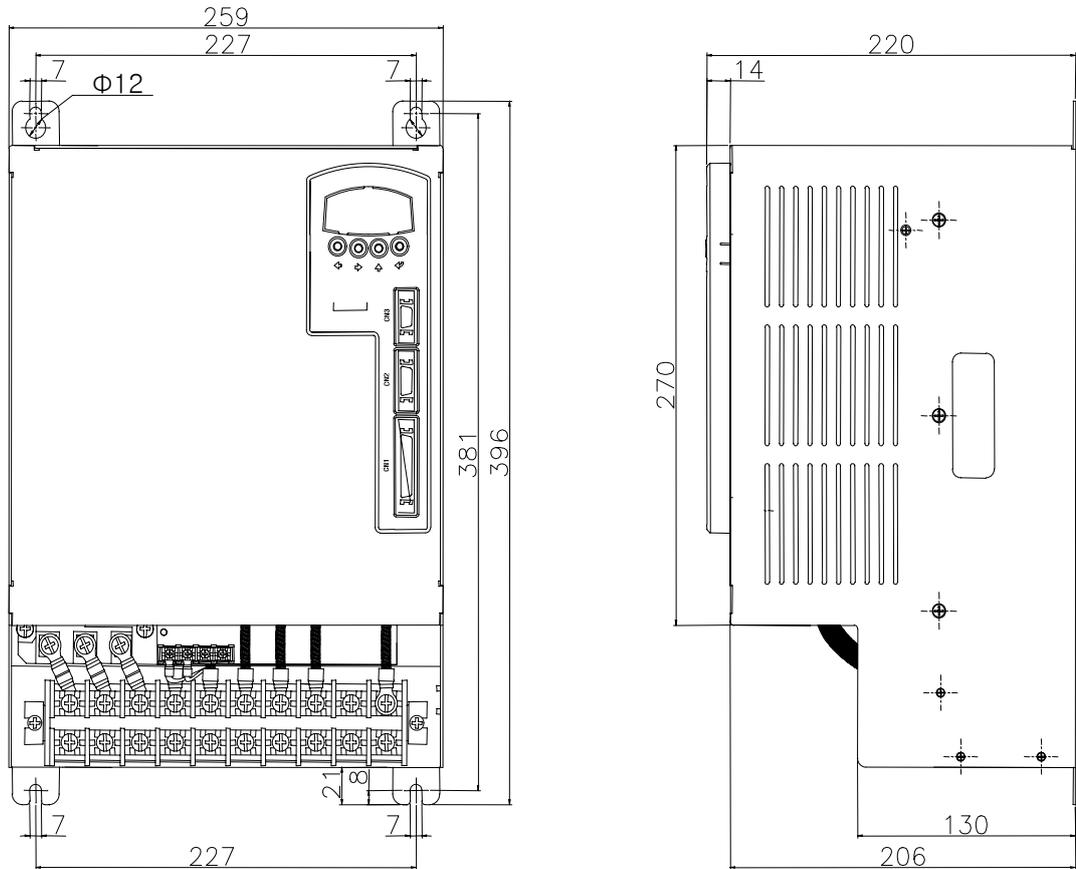
★ Weight: 12[kg]

(Fan Cooling)

[Regenerative Braking Resistance : Purchase separately (Option)]

1) Model No. : APC-600R30 (600W30Ω)

2) Q'TY : 4 pcs parallel connected (2400W7.5Ω)
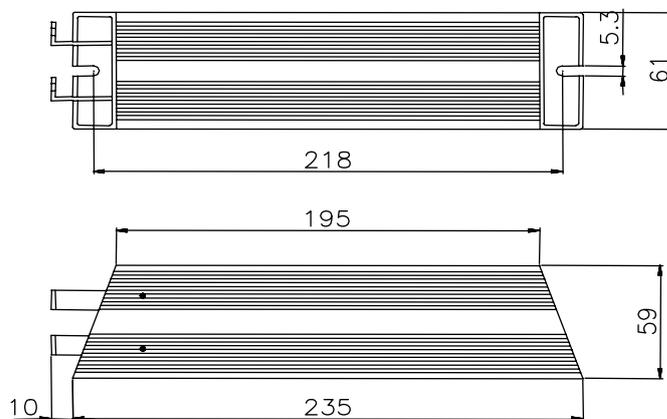

IRV 600S 30ohm

♦ APD-VS150N
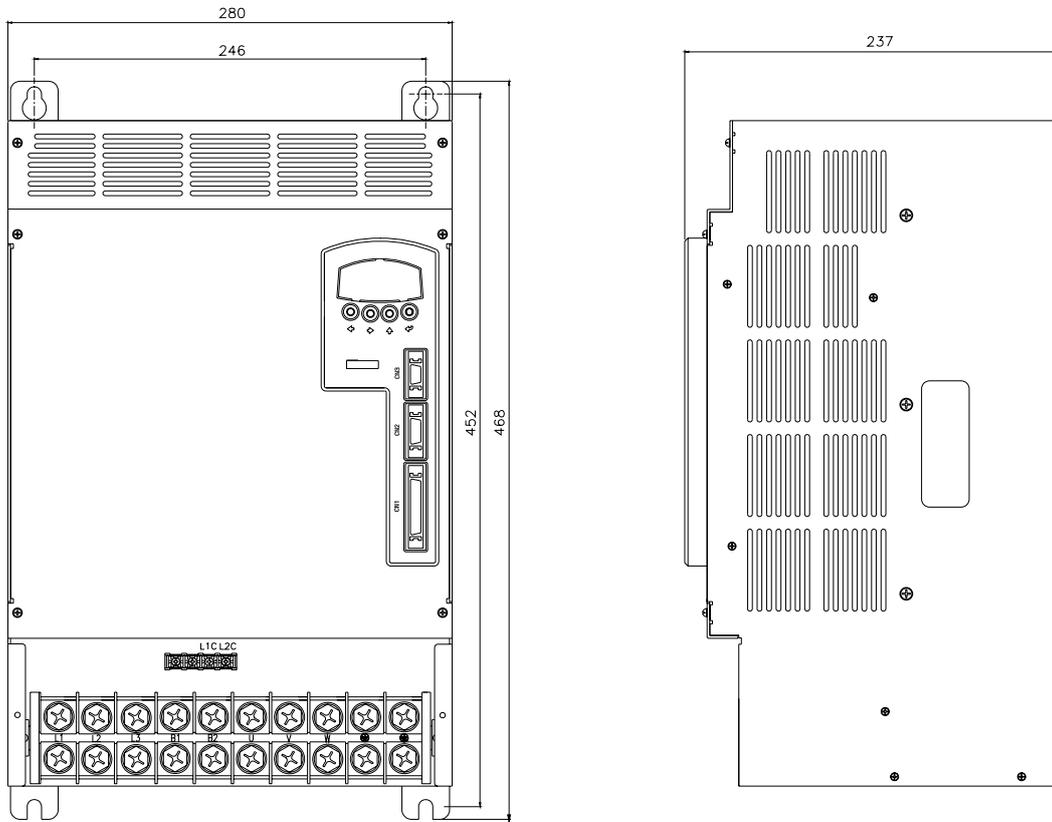
★ Weight : 17[kg]

(Fan Cooling)

[Regenerative Braking Resistance : Purchase separately (Option)]

3)   Model No. : APC-1000R6R5 (1000W6.5Ω)

4)   Q'TY : 2 pcs parallel connected (2000W3.25Ω)
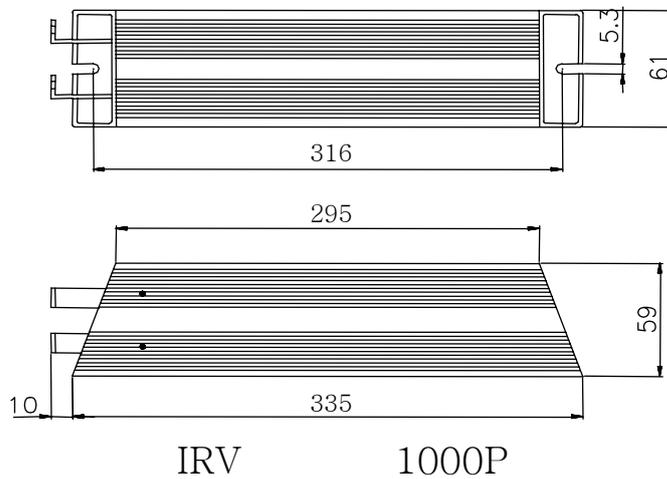

IRV   1000P

◆ APD-VS220N, APD-VS300N, APD-VS370N
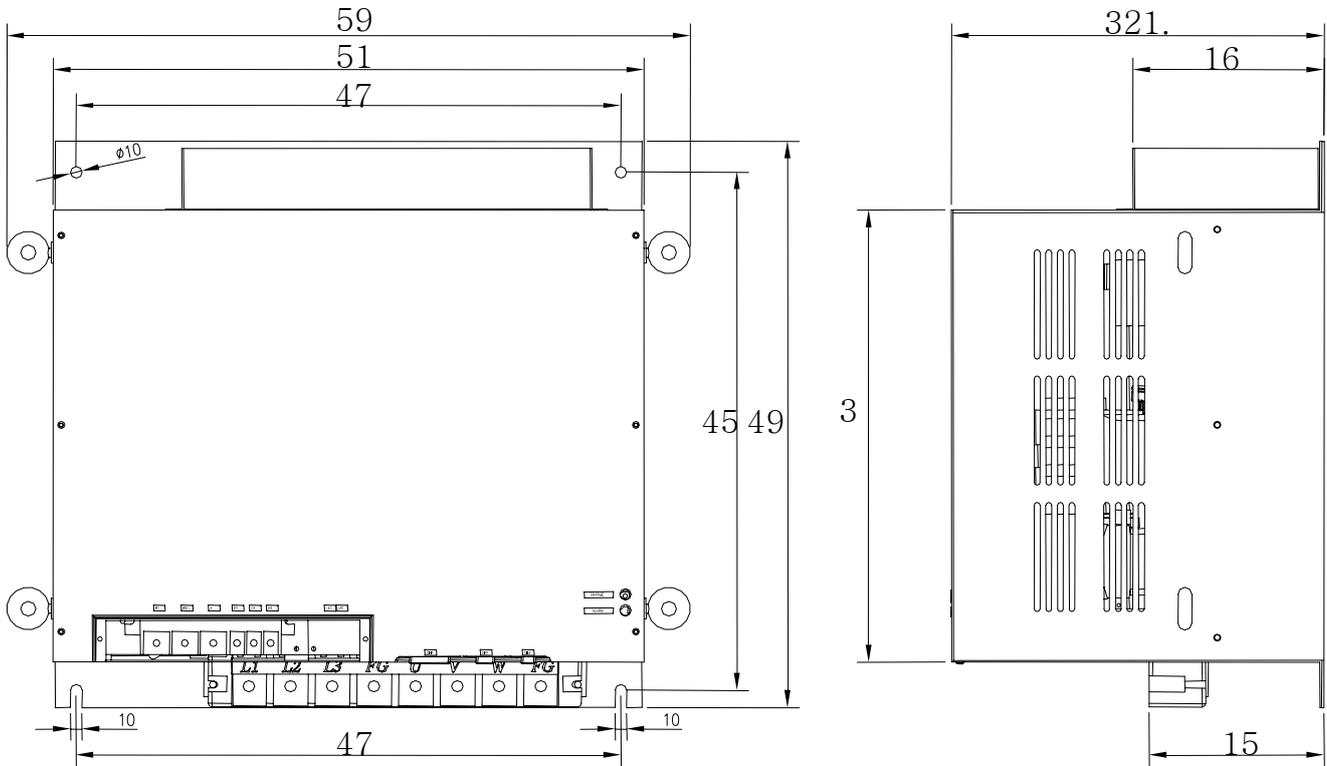
[Regenerative Braking Resistance : Purchase separately (Option)]

    1) APD-VS220 : 2400W 2.4 [Ω]

    2) APD-VS370, APD-VS300 : 4800W 1.6 [Ω]   (2400W 3.2 [Ω] 2 pcs parallel connected)
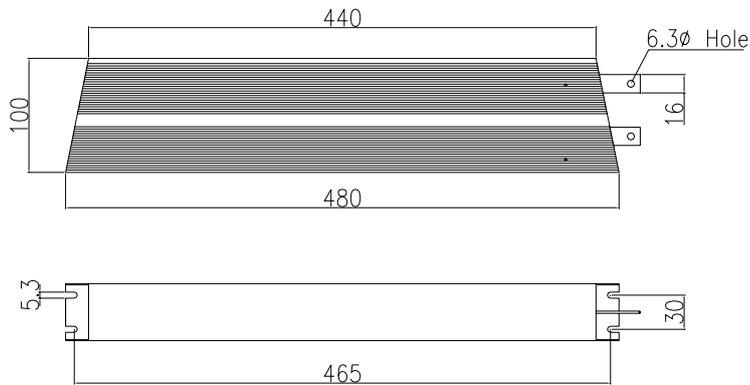
7.1 Maintenance and Inspection

In the chapter, maintenance and inspection of servo motor and drive are explained.

7.1.1 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 devices : When using oscilloscope or digital volt meter, please make sure that they should not be contacted to the ground.   For input current, please use 1[mA] or less of current.

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7.1.2 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 to be checked and maintained on a daily basis as it uses highly reliable parts, but check it at least once in a year.

Inspection item	Period	Check for	Solution
Main body and circuit board	Once a year at least	Dust, Oil	Clean up with air or cloths.
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

7.1.3 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

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7.2 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.

7.2.1 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	Normal	Normal operating 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 of 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

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[Overload charateristic curves of Servo Drive] : Applied MAX 15KW
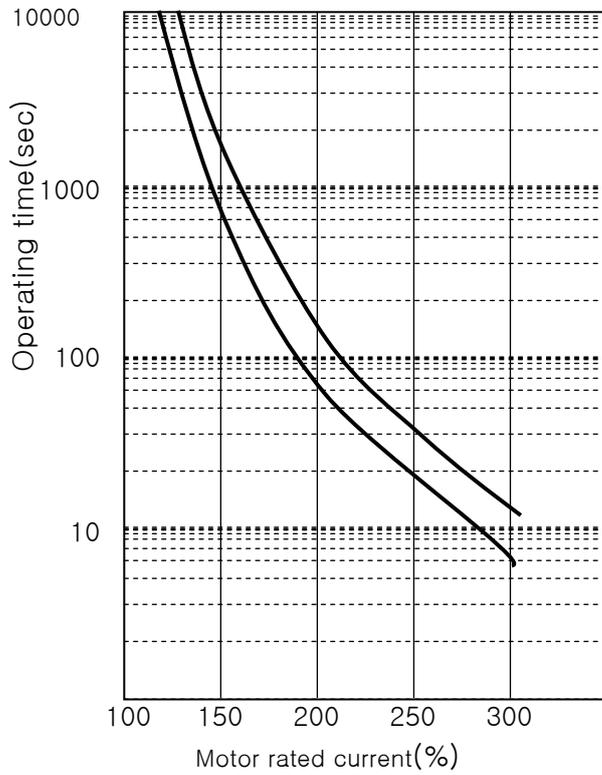
Rated current (%)	Overload operating time		
	Min.	Max.	Set vlaue
100	∞		
120	∞		
150	500	1300	800
200	50	110	70
250	15	30	20
300	5	10	7