OPERATION MANUAL

AC Servo Drive

FDA5000C Series

Ver 2.3 (Soft. Ver. 8.02 ~)

FDA5000C Series

Servo Drive User Manual

HIGEN

< CAUTION >

1. Check Motor ID certainly. (P1-01)

2. Check Drive Amp-Type certainly. (P1-10)

Model	5001C	5002C	5004C	5005C	5010C	5012C	5015C	5020C	5030C	5045C	5075C
Amp Type	0	1	2	5	6	7	11	12	13	14	15

3. Check Encoder Pulse certainly. (P1-12)

Example) **FMALN09-AA00**

Encoder Type

Symbol	Pulse	Type
A	2000	Incremental 15 wires
B	2500	
C	3000	
D	5000	
E	6000	
F	2048	
G	2048	Absolute 11/13bit

4. Operate servo system after autotuning is off. (P2-23)

5. Avoid impacting to the Motor in connecting. Especially, avoid impacting to the Encoder in connecting coupling to the Motor shaft or operating.

6. Recommended specifications in Encoder wiring.
Check Encoder Type and use authorized shield cable.

Encoder Type	Reference Page
Incremental Encoder	3-16
Absolute Encoder	3-18

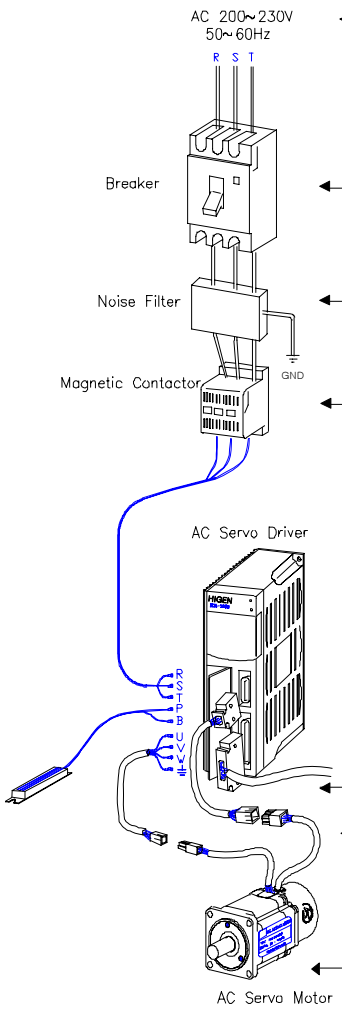
7. Treatment of the servo motor attached holding brake .
: The brake built in the servo motor is a normal closed type brake. Which is used only to hold and can not be used for braking. Use the holding brake only to hold a stopped servo motor.

Contents

1. Checking and Handling

1.1 Handling (Connection of main circuit and motor)

Thank you for purchasing HIGEN AC Servo Drive. Incorrect handling of the driver may lead to unsatisfactory operation or, in some cases, to the rapid reduction of its life, or damage to the servo. Handle and operate the drive according to the instructions given in this manual.



* Power Supply : Use power supply within specification
(3-phase AC200~230V)
(Caution!) If the power voltage is AC 440V,use a transformer to change AC 440V to AC 220V

* No Fuse Circuit Breaker or Auto Breaker : Large level of current flows when power is applied to the servo
For selection of breakers, refer to Table 3.1, chapter3.3

* Noise Filter : Use noise filters to eliminate external noise that comes with the commercial power supply
For selection of noise filters, refer to Table3.1, Chapter3.3

* Install magnetic contactors
Do not use magnetic contactor to start or stop the servo as it may reduce its life.

* Installation place : The operating life of the servo is affected by ambient temperature.
Maintain ambient temperature at a level below 50℃

* Wiring : Improper wiring may damage to the servo. The control signal line must be sufficiently away from the main circuit wiring so that the line is not affected by noises.

* Connection with output terminals : Do not connector condensers ,radios or noise filters during operation as it may cause damage to the equipment.

* Grounding : To prevent electric shock and effectively control noise,ground the motor and driver at the shortest distance. (Caution) Use higher than class-3 earth

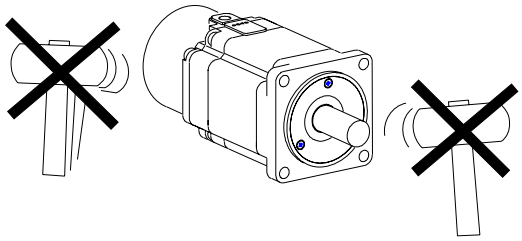
* Motor system : Do not strike the motor shaft and detecter with a hammer.
(Caution) Impact may cause damage th the encoder inside the motor

1.2 Caution during use

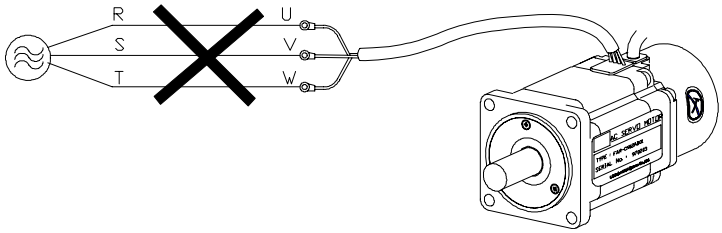
Improper handling of the driver may lead to unexpected accident or damage. The following are important points in operating the driver.

1.2.1 Handling

- Avoid impact to the encoder, the motor detector.
  Striking the shaft with a hammer may cause the motor to drop leading to unexpected damage.



- Do not connect commercial power supply (AC 220V) directly to the motor.
  Direct connection induces flow of over current leading to the deterioration of the magnetic effect.
  Always use specified servo driver.



1.2.2 Wiring

- Connect the driver and the motor earth terminals in the direction of the driver, and ground the terminals at the shortest distance in one operation. To prevent electric shock and improper operation, use class-3 earth (Less than 100 Ω).
- Always match the U, V, W and FG terminals of the motor with those of the driver. You cannot change the direction of rotation by changing 2 wires as in the case of widely used common motors.
- Connecting commercial power supply to the U, V ,W and FG terminals of the driver may cause damage.
  (Apply 200V power supply to R, S and T terminals)
  Use a transformer in case power supply is other than 200V.
- Connect standard regenerated resistance to the P and B terminals of the driver.

1.2.3 Operation

- Use the magnetic brake of the motor only for emergency and maintenance (preservation).
  The brake is designed for maintenance (preservation) during power outage. If used to reduce speed, the brake wears out fast.

- Install brakes and magnetic contactors on power supply terminals R, S and T.
  In case an error occurs or abnormal current flows, shut off the circuit to prevent secondary fire.

1.2.4 Maintenance and inspection

- "High voltage" still remains inside the driver for a while even after power supply is shut off.
  (Danger!)
  To prevent electric-shock, carry out wiring work or inspection at least l0 minutes after the power is cut off and the charge lamp is turned off.

- The regenerated resistance and the servo motor remain hot for a while after power is turned off. Touching them may cause burns.

- Conducting megger test on the driver may cause damage to the driver. Do not perform megger test.

- The motor detector is not detachable. Never remove the cover.

1.3 Installation

1.3.1 Installation of servo driver

- Operating environment

Ambient temperature	0-50℃ (There should be no freezing) Note)
Ambient humidity	90% RH or lower (There should be no steam)

Note) Inside panel temperature specifications: To ensure maximum operating life and reliability of the driver, maintain the average panel temperature at 40℃ or lower.
If the driver is installed in a place within arm's reach, install the fan to maintain the temperature of driver at 70℃ or lower.

- Installation direction and intervals
  - Install the servo driver in such a way that FDA-5000 can be seen from the front.
  - If the drivers are installed in a closed panel, maintain an interval of more than 10 mm between drivers and more than 40 mm between top and bottom. If multiple number of panels are installed in parallel, about 100 mm space is required on the upper side. Avoid heat by installing fans.
  - Install heat sources, such as regenerated resistance, away from the driver.

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

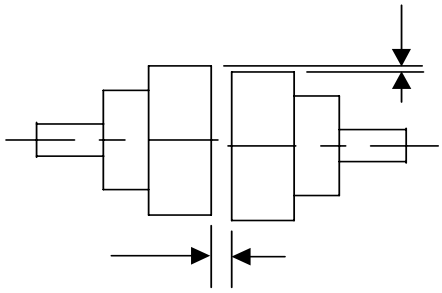
1.3.2 Servo motor installation

- Operating environment

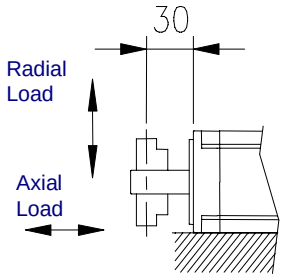
Ambient temperature	0-40℃ (There should be no freezing)
Ambient humidity	80% RH or lower (There should be no steam)
External vibration	X, Y = 19.6 m/s2 (2G)

- Caution when assembling load system (Prevent impact on shaft)
  It is important to accurately match the motor shaft with the shaft center of the connecting machine. Unmatched shaft center causes vibration, and may cause damage to the bearing. Use a rubber hammer to install couplings to prevent excessive force from being applied to the shaft and bearing.

Check 4 places in turn. The difference between maximum and minimum should be 0.03 or lower.

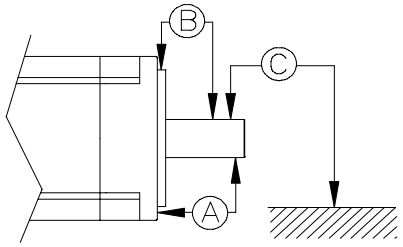


- Load tolerance on shaft
  - Use flexible couplings, and maintain the shaft center deviations within the specified tolerance.
  - Use pulleys and sprockets that can accommodate the allowable load.

MOTOR MODEL		RADIAL LOAD		AXIAL LOAD		REFERENCE DIAGRAM
Series	Type	N	Kgf	N	kgf	
CN	CN01~CN05	196	20	68	7	
	CN06~CN08	245	25	98	10	
	CN09~CN15	490	50	196	20	
	CN20~CN30	686	70	343	35	
	CN30A~CN50A	1470	150	490	50	
KN	KN03~KN07	245	25	98	10	
	KF08~KN11	490	50	196	20	
	KF15~KN22	686	70	343	35	
	KN22A~KN55	1470	150	490	50	
TN	TN05~TN09	490	50	196	20	
	TN13~TN17	686	70	343	35	
	TN20~TN75	1470	150	490	50	
LN	LN03~LN06	490	50	196	20	
	LN09~LN12	686	70	343	35	
	LN12A~LN40	1470	150	490	50	
KF	KF08~KF10	490	50	196	20	
	KF15	686	70	343	35	
	KF22~KF50	1470	150	490	50	
TF	TF05~TF09	490	50	196	20	
	TF13	686	70	343	35	
	TF20~TF44	1470	150	490	50	
LF	LF03~LF06	490	50	196	20	
	LF09	686	70	343	35	
	LF12~LF30	1470	150	490	50	

- Accuracy of attachments

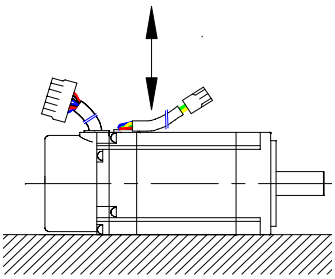
  The accuracies of the output shaft and attachments of the AC servo motor are shown on the following table.

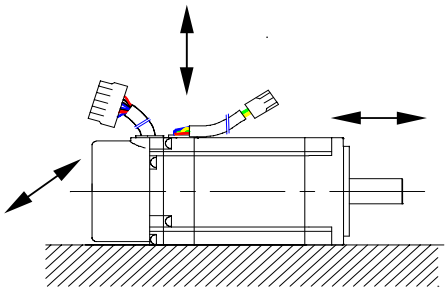
Item	Accuracy (T.I.R.)	Reference Diagram
Perpendicularity of flange attachment plane and output shaft (A)	0.04mm	
Eccentricity of flange fitting outer diameter (B)	0.04mm	
Vibration of output shaft end (C)	0.02mm	

(Note) T.I.R : Total Indicator Reading

- **Impact resistance**

The driver withstands an acceleration of 10G and two times of impacts when up-and-down impacts are applied after setting the motor shaft horizontally.
However, a precision detector is attached to the end of the shaft on the opposite side of the load. Take caution not to apply impact directly to this end.





- **Vibration resistance**

The driver withstands a vibration acceleration of 2.0G when vibration is applied in up and down, left and right, and front and back directions after setting the motor shaft horizontally.

- **Vibration grade**

The vibration grade of the AC servo motor is V15 at the rated rpm.

- **Direction of installation**

  - Motor can be installed horizontally or at the top or bottom of the shaft.
  - Keep the motor cable downward.
  - If the motor is installed vertically, install a cable trap so that oils or water do not flow into the motor.

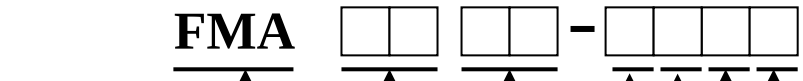
- **Cable disconnection**

  - Take caution not to cause stress or damage to the cables.
  - If the motor is used as a mobile motor, use movable cables.

1.4 Order Specifications

Prior to installing the product, check the ratings plate to see if the related specifications match with those of the order.

1.4.1 Servo motor model marking



AC servo motor type

Series

Symbol	Use
CN,CK	High-speed, low torque type
KF,KN	Medium-speed, standard type
TF,TN	Medium-speed, high torque type
LF,LN	Low-speed, large torque type

Rated output (Watt)

Symbol	Rated output (W)	Symbol	Rated output (W)
01	100	15	1500
02	200	16	1600
03	300	20	2000
04	400	22	2200
05	450/500	30	3000
06	550/600	35	3500
07	650	40	4000
08	750/800	44	4400
09	850/900	50	5000
10	1000	55	5500
12	1200	75	7500
13	1300		

Oil Seal

Symbol	Item
0	None
1	Oil seal attached

Brake

Symbol	Item
0	None
1	Brake Type
2	130Flange 24V application

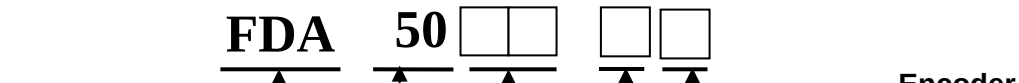
Shaft type

Symbol	Item
A	Straight(No key)
B	Straight(With key)
C	Taper & Key

Encoder type

Symbol	Pulse	Type
A	2000	Incremental 15 선
B	2500	
C	3000	
D	5000	
E	6000	
F	2048	
G	2048	Absolute 11/13bit

1.4.2 Servo driver model marking



AC servo driver

5000 Series

Rated Power

Encoder Type

Type

Symbol	Encoder type
None	Incremental
A	Absolute

Symbol	Power (Watt)	Symbol	power (Watt)	Symbol	Power (Watt)
01	100	10	1000	30	3000
02	200	12	1200	45	4500
04	400	15	1500	75	7500
05	500	20	2000		

Symbol	Type
None	Standard Type
C	Position decision Type

1.4.3 AC Servo application table

Motor	Flange	Model	FDA-5001C	FDA-5002C	FDA-5004C	FDA-5005C	FDA-5010C	FDA-5012C	FDA-5015C	FDA-5020C	FDA-5030C	FDA-5045C	FDA-5075C
CK Series *3000 /5000 (r/min)*	**40**	**CKZ5**	◎										
		CK01	◎										
	60	**CK02**		◎									
		CK04			◎								
CN Series *3000 /5000 (r/min)*	**60**	**CN01**	◎										
		CN02		◎									
		CN03			◎								
		CN04			◎								
		CN05			◎								
	80	**CN04A**			◎								
		CN06				◎							
		CN08				◎							
		CN10					◎						
	130	**CN09**					◎						
		CN15							◎				
		CN22								◎			
		CN30									◎		
	180	**CN30A**								◎			
		CN50A										◎	
		CN70											◎
KN Series *2000 /3000 (r/min)*	**80**	**KN03**			◎								
		KN05			◎								
		KN06				◎							
		KN07					◎						
	130	**KN06A**				◎							
		KN11					◎						
		KN16							◎				
		KN22								◎			
	180	**KN22A**								◎			
		KN35									◎	◎	
		KN55											
		KN70											
TN Series *1500 /3000 (r/min)*	**130**	**TN05**				◎							
		TN09					◎						
		TN13							◎				
		TN17								◎			
	180	**TN20**								◎			
		TN30									◎	◎	
		TN44											
		TN55											
		TN75											◎

Motor	Drive Flange	Model	FDA-5001C	FDA-5002C	FDA-5004C	FDA-5005C	FDA-5010C	FDA-5012C	FDA-5015C	FDA-5020C	FDA-5030C	FDA-5045C	FDA-5075C
LN Series *1000 /2000 (r/min)*	**130**	**LN03**			◎								
		LN06				◎							
		LN09					◎						
		LN12						◎					
	180	**LN12A**						◎					
		LN20								◎			
		LN30									◎	◎	
		LN40										◎	
KF Series *2000 /3000 (r/min)*	**130**	**KF08**					◎						
		KF10					◎						
		KF15							◎				
	180	**KF22**								◎			
		KF35									◎		
		KF50										◎	
TF Series *1500 /3000 (r/min)*	**130**	**TF05**				◎							
		TF09					◎						
		TF13							◎				
	180	**TF20**								◎			
		TF30									◎		
		TF44										◎	
LF Series *1000 /2000 (r/min)*	**130**	**LF03**			◎								
		LF06				◎							
		LF09					◎						
	180	**LF12**						◎					
		LF20								◎			
		LF30									◎		

2. Ratings and Specifications

2.1 Ratings and specifications for AC servo driver FDA-5000C series

Item \ Model			FDA-5001C	FDA-5002C	FDA-5004C	FDA-5005C	FDA-5010C	FDA-5012C	FDA-5015C	FDA-5020C	FDA-5030C	FDA-5045C	FDA-5075C
Input power supply	Power supply voltage *(Note 1)		3 phase AC200~230V +10/-15%, 50/60Hz										
	Power capacity [kVA]		0.5	0.8	1.3	1.5	2.1	2.5	3.1	4.1	6.0	8.0	12.0
Applicable motor	Voltage type		3-phase sine wave drive AC servo motor										
	Continuous output current [A]		1.25	2.1	3.2	4.2	6.9	9.8	11	16	21	32	50
	Maximum output current [A]		3.8	6.3	9.6	12.6	19.2	29	33	48	63	96	132
Detector	Detector model		Standard: Incremental 2000 [p/rev] 15-wire type										
	Output signal type		Differential line driver output										
	Detector accuracy		1000-10000 [p/rev] (Not to exceed 400 [kp/sec])										
	Detector power supply		Not to exceed DC 5 [V], 0.3 [A]										
Drive system			3-phase voltage type PWM drive (IPM used)										
Run Mode specifications	Absolute Mode	Position setting	Absolute position data(31 points) setting										
		Command input	Select absolute position data(31 points) by input contact										
		System	Absolute position command method, short distance discrimination function										
	Relative Mode	Position setting	Relative position data(31 points) setting										
		Command input	Select relative position data(31 points) by input contact										
		System	Relative position command method										
	Sequence Mode	Position setting	Position data 4 points setting										
		System	Sequence loop operation, select Step/Auto operation										
Position control specifications	MPG	Input frequency	300[kpps]										
		Pulse Logic	Direction + pulse, forward run pulse + reverse run pulse 2-phase pulse (A phase + B phase)										
		Input Type	Open collector, line driver system										
	Jog operation		Digital Loader/input contact										
	Origin Rule		Be selected by parameter										
	Speed override function		Be set by parameter										
	Speed accel/decel time		Able to set 4 patterns(8 positions/ 1 pattern)										
Built-in functions	Protective functions		Overcurrent, regenerated overvoltage, overload, motor miswiring, drive overheat, encoder error, voltage shortage, overspeed and excessive error.										
	Regenerated resistance		Standard separately attached type										
	Load inertia (GD²)		See motor specifications table										
	Monitor output		Speed, torque (-4 ~ +4 [V])										
	Dynamic brake		built in										
	Additional functions		Testing function (jog and motorless operation), alarm history, forward and backward run, encoder signal frequency division output										
Option			Power cable, encoder cable, CN1 connector, CN2 connector										
			Digital Loader										
Environmental specifications	Operating ambient temperature		0-50 [℃]										
	Ambient humidity		Not to exceed 90 [%] (Should be free of dewing)										
	Storage temperature		-20 ~ +80 [℃]										
	Insulating resistance		To be greater than DC 500 [V] 10 [MΩ]										
Structure			Book Type										

(Note 1) The model name of the servo driver which uses absolute value encoder is FDA-5000CA.

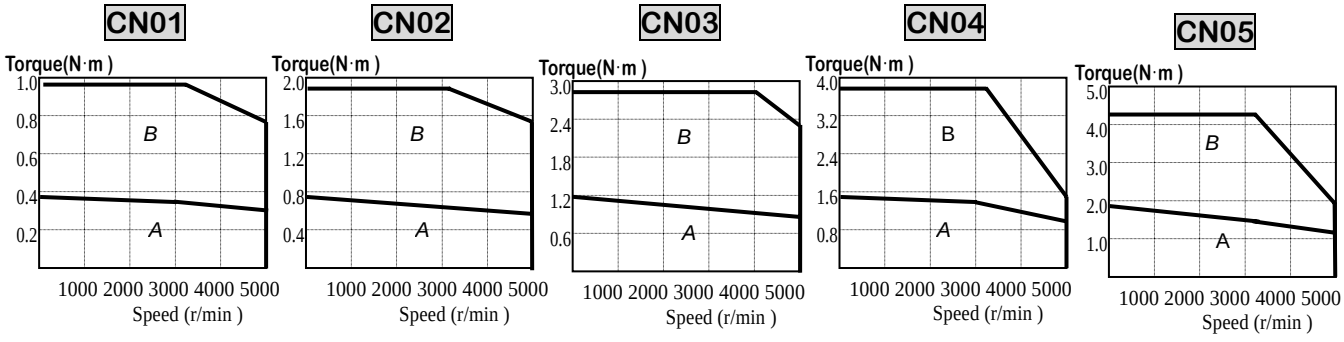
(Note 2) Single-phase AC 220V can also be used. However, as output may become lower than the rated value, increase the servo driver capacity by 1 step if possible.

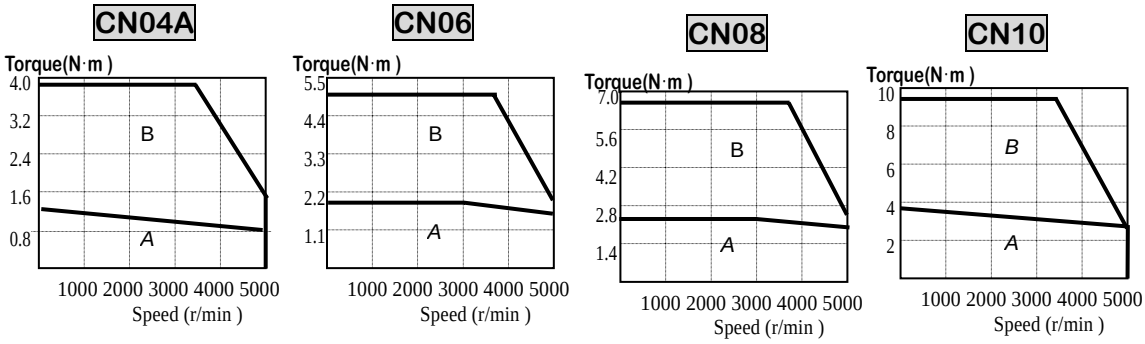
2.2 AC Servo Motor Ratings and Specifications

Spec. \ Model	Motor	CN01	CN02	CN03	CN04	CN05	CN04A	CN06	CN08	CN10
	Driver	5001C	5002C	5004C				5005C		5010C
Flange size (□)		60					80			
Rated output	(W)	100	200	300	400	500	400	600	800	1000
Rated torque	(N·m)	0.32	0.64	0.96	1.27	1.59	1.27	1.91	2.54	3.18
	(kgf·cm)	3.25	6.5	9.75	13.0	16.2	13.0	19.5	26.0	32.5
Maximum instantaneous torque	(N·m)	0.96	1.92	2.88	3.81	4.77	3.81	5.3	6.85	9.53
	(kgf·cm)	9.75	19.5	29.3	39.0	48.7	39.0	54.5	70.2	97.5
Rated rpm	(r/min)	3000								
Maximum rpm	(r/min)	5000								
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	0.061	0.095	0.126	0.160	0.204	1.1	1.5	1.77	2.11
	($kg \cdot m^2 \times 10^{-4}$)	0.06	0.093	0.129	0.163	0.208	1.08	1.47	1.74	2.07
Allowable load inertia Ratio(Versus rotor)		Not exceeding 30 times					Not exceeding 20 times			
Rated power rate	(kW/s)	17.0	43.6	73.9	103.5	126.1	15.0	24.8	37.4	49.0
Detector type	Standard	Incremental 2000								
	Option	Absolute 11/13bit 2048P/rev								
Weight	(kg)	0.85	1.14	1.43	1.73	2.03	2.1	2.55	3.1	3.7

■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone



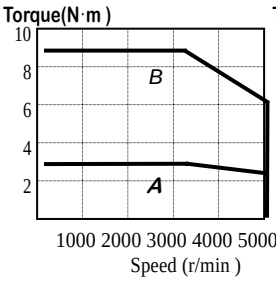


Model / Spec.	Motor	CN09	CN15	CN22	CN30	CN30A	CN50A	KN03	KN05	KN06	KN07
	Driver	5010C	5015C	5020C	5030C	5030C	5045C	5004C	5004C	5005C	5010C
Flange size (□)		130				180		80			
Rated output (W)		900	1500	2200	3000	3000	5000	300	450	550	650
Rated torque	(N · m)	2.86	4.77	7.0	9.54	9.54	15.9	1.43	2.15	2.57	3.04
	(kgf · cm)	29.2	48.7	71.4	97.4	97.4	162.3	14.6	21.9	26.2	31
Maximum instantaneous torque	(N · m)	8.6	14.3	21	28.6	23.9	39.8	4.29	6.45	7.42	9.12
	(kgf · cm)	87.6	146	214	292	243.5	405.8	43.8	65.7	72.7	93
Rated rpm (r/min)		3000						2000			
Maximum rpm (r/min)		5000				4500		3000			
Rotor inertia (= $GD^2/4$)	(gf · cm · s^2)	4.12	7.63	11.12	14.63	26.1	43.8	1.1	1.5	1.77	2.11
	($kg \cdot m^2 \times 10^{-4}$)	4.04	7.48	10.9	14.34	25.6	42.9	1.08	1.47	1.74	2.07
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times						Not exceeding 20 times			
Rated power rate (kW/s)		20.4	30.6	45.1	63.9	35.7	58.9	18.9	31.3	38.0	44.6
Detector type	Standard	Incremental 2000									
	Option	Absolute 11/13bit 2048P/rev									
Weight (kg)		5.5	7.0	8.5	10.0	12.9	18.2	2.1	2.55	3.1	3.7

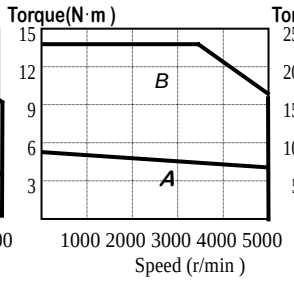
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

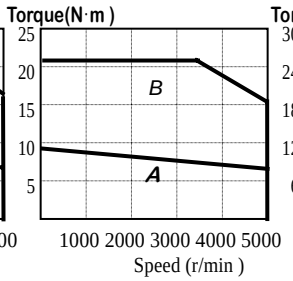
CN09



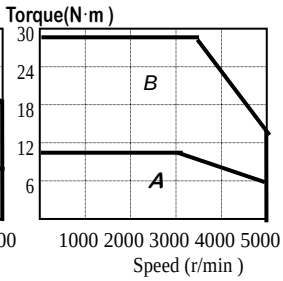
CN15



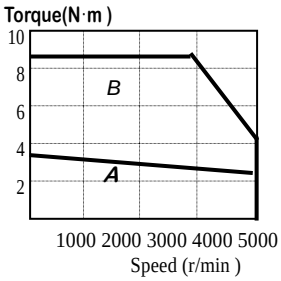
CN22



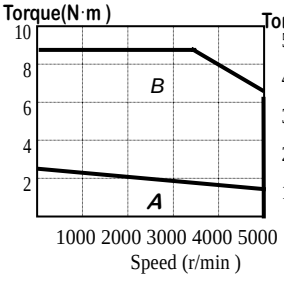
CN30



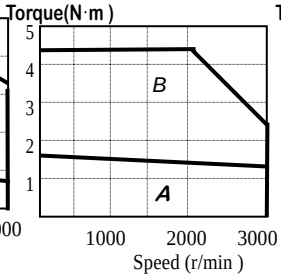
CN30A



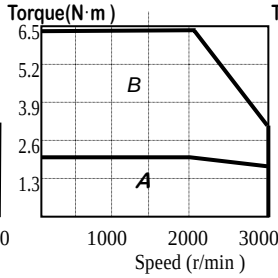
CN50A



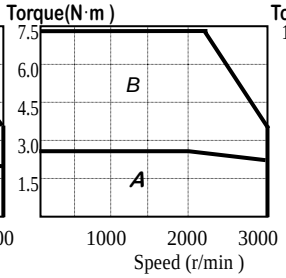
KN03



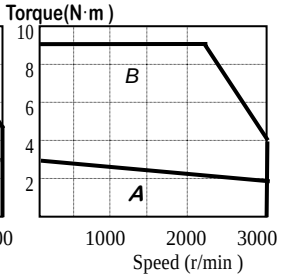
KN05



KN06



KN07

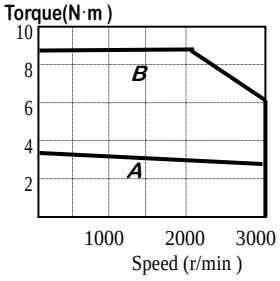


Spec. \ Model	Motor	KN06A	KN11	KN16	KN22	KN22A	KN35	KN55
	Driver	5005C	5010C	5015C	5020C	5020C	5030C	5045C
Flange size (□)		130				180		
Rated output	(W)	600	1100	1600	2200	2200	3500	5500
Rated torque	(N·m)	2.86	5.25	7.64	10.5	10.49	16.67	26.18
	(kgf·cm)	29.2	53.6	77.9	107	107	170	267
Maximum instantaneous torque	(N·m)	8.6	14.2	22.5	28.6	26.2	41.7	65.4
	(kgf·cm)	87.6	145	230	292	267.5	425.0	667.5
Rated rpm	(r/min)	2000						
Maximum rpm	(r/min)	3000						
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	4.12	7.63	11.12	14.63	26.1	43.8	67.8
	($kg \cdot m^2 \times 10^{-4}$)	4.04	7.48	10.9	14.34	25.6	42.9	66.4
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times						
Rated power rate	(kW/s)	20.4	30.6	53.5	76.7	43.0	64.7	103.0
Detector type	Standard	Incremental 2000						
	Option	Absolute 11/13bit 2048P/rev						
Weight	(kg)	5.5	7.0	8.5	10.0	12.9	18.2	26.8

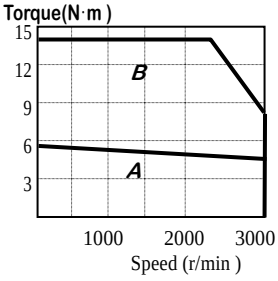
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

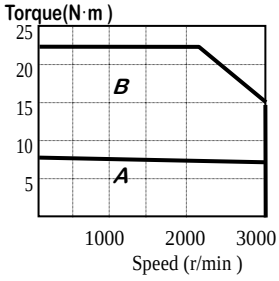
KN06A



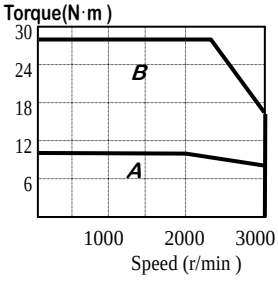
KN11



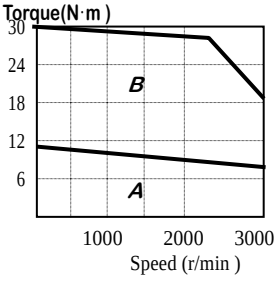
KN16



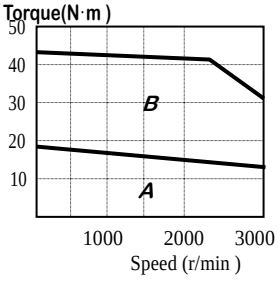
KN22



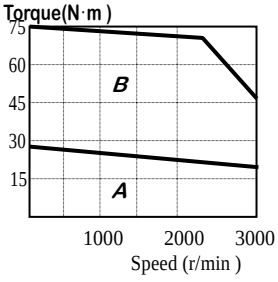
KN22A



KN35



KN55

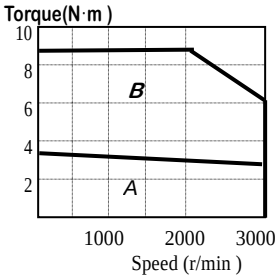


Spec. \ Model	Motor	TN05	TN09	TN13	TN17	TN20	TN30	TN44	TN75
	Driver	5005C	5010C	5015C	5020C	5020C	5030C	5045C	5075C
Flange size (□)		130				180			
Rated output	(W)	450	850	1300	1700	1800	2900	4400	7500
Rated torque	(N·m)	2.87	5.41	8.27	10.8	11.5	18.6	27.9	47.7
	(kgf·cm)	29.3	55.2	84.4	110	117	190	285	486.9
Maximum instantaneous torque	(N·m)	8.61	14.2	22.5	29.4	28.7	46.6	69.9	119.3
	(kgf·cm)	89.5	145	230	300	292.5	475	712.5	1217
Rated rpm	(r/min)	1500							
Maximum rpm	(r/min)	3000							
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	4.12	7.63	11.12	14.63	26.1	43.8	67.8	126.4
	($kg \cdot m^2 \times 10^{-4}$)	4.04	7.48	10.9	14.34	25.1	42.9	66.4	123.9
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times							
Rated power rate	(kW/s)	20.5	39.1	62.8	81.1	51.5	80.8	117.4	183.8
Detector type	Standard	Incremental 2000							
	Option	Absolute 11/13bit 2048P/rev							
Weight	(kg)	5.5	7.0	8.5	10.0	12.9	18.2	26.8	45.7

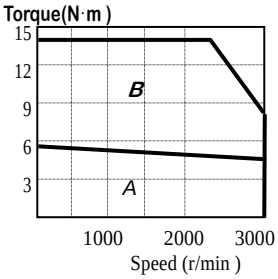
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

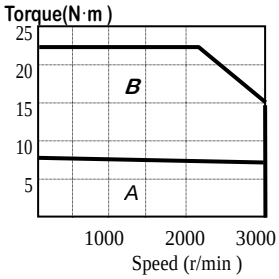
TN05



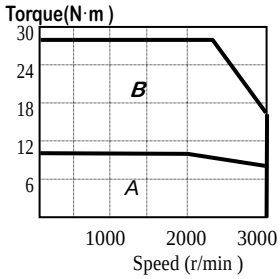
TN09



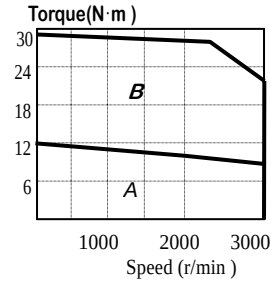
TN13



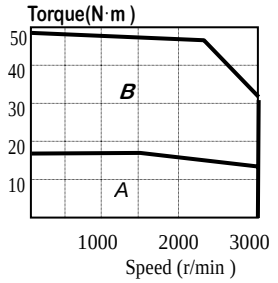
TN17



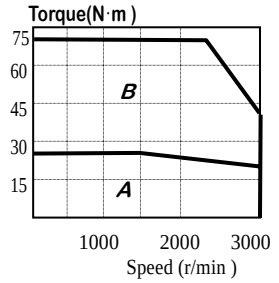
TN20



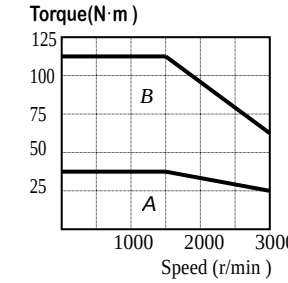
TN30



TN44



TN75

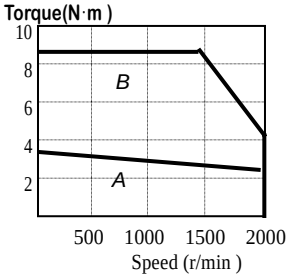


Spec. \ Model	Motor	LN03	LN06	LN09	LN12	LN12A	LN20	LN30	LN40
	Driver	5004C	5005C	5010C	5012C	5012C	5020C	5030C	5045C
Flange size (□)		130				180			
Rated output	(W)	300	600	900	1200	1200	2000	3000	4000
Rated torque	(N·m)	2.86	5.72	8.6	11.5	11.5	19.1	28.6	38.2
	(kgf·cm)	29.2	58.4	87.7	117	116.9	194.8	292.2	389.6
Maximum instantaneous torque	(N·m)	8.6	14.3	22.1	34.4	28.7	47.8	71.6	95.5
	(kgf·cm)	87.6	146	226	351	292.3	487	730.5	974
Rated rpm	(r/min)	1000							
Maximum rpm	(r/min)	2000							
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	4.12	7.63	11.12	14.63	26.1	43.8	67.8	100.1
	($kg \cdot m^2 \times 10^{-4}$)	4.04	7.48	10.9	14.34	25.6	42.9	66.4	98.1
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times							
Rated power rate	(kW/s)	20.5	43.3	68.2	91.7	51.4	84.9	123.4	148.6
Detector type	Standard	Incremental 2000							
	Option	Absolute 11/13bit 2048P/rev							
Weight	(kg)	5.5	7.0	8.5	10.0	12.9	18.2	26.8	36.1

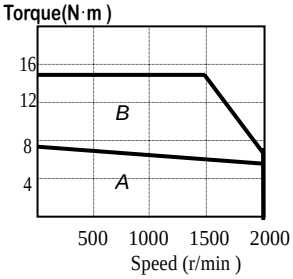
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

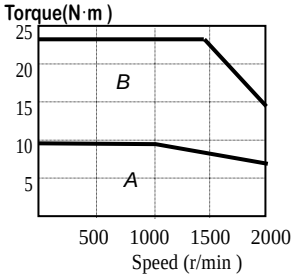
LN03



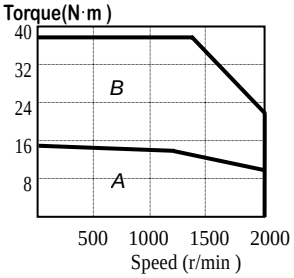
LN06



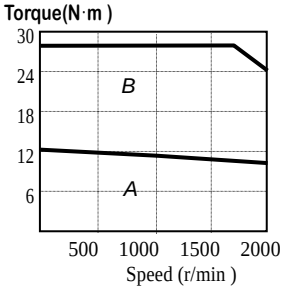
LN09



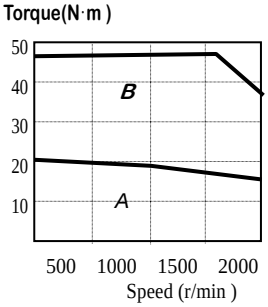
LN12



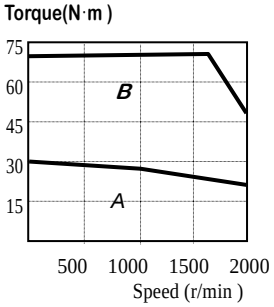
LN12A



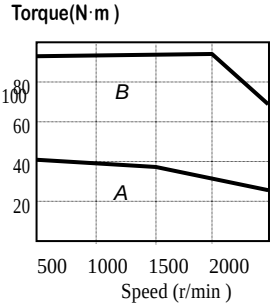
LN20



LN30



LN40

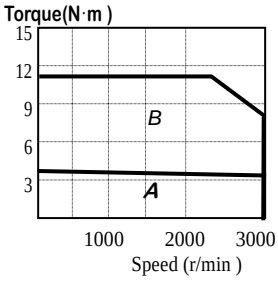


Spec. \ Model	Motor	KF08	KF10	KF15	KF22	KF35	KF50
	Driver	5010C		5015C	5020C	5030C	5045C
Flange size (□)		130			180		
Rated output	(W)	750	1000	1500	2200	3500	5000
Rated torque	(N·m)	3.58	4.77	7.16	10.5	16.7	23.9
	(kgf·cm)	36.53	48.7	73.1	107	170	244
Maximum instantaneous torque	(N·m)	10.74	14.31	21.56	31.4	50.0	71.7
	(kgf·cm)	109.5	146.0	220.0	321	510	732
Rated rpm	(r/min)	2000					
Maximum rpm	(r/min)	3000					
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	10.5	15.5	25.3	65.3	100.5	159.1
	($kg \cdot m^2 \times 10^{-4}$)	10.3	15.2	24.8	64.0	98.5	156
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times					
Rated power rate	(kW/s)	12.3	15.0	20.7	17.2	28.2	36.4
Detector type	Standard	Incremental 2000					
	Option	Absolute 11/13bit 2048P/rev					
Weight	(kg)	8.2	11.6	15.8	17.2	27.4	38.3

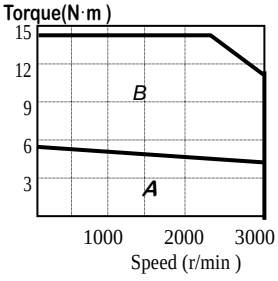
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

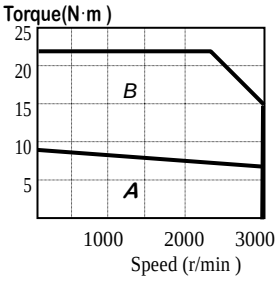
KF08



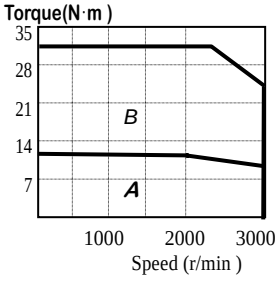
KF10



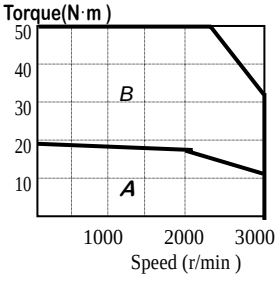
KF15



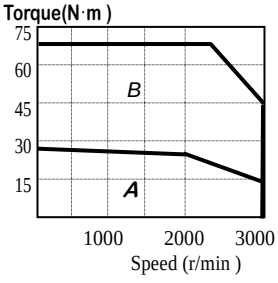
KF22



KF35



KF50

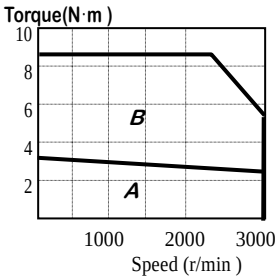


Spec. \ Model	Motor / Driver	TF05	TF09	TF13	TF20	TF30	TF44
	Driver	5005C	5010C	5015C	5020C	5030C	5045C
Flange size (□)		130			180		
Rated output	(W)	450	850	1300	1800	2900	4400
Rated torque	(N·m)	2.87	5.41	8.27	11.5	18.6	27.9
	(kgf·cm)	29	55	85	117	190	285
Maximum instantaneous torque	(N·m)	8.61	14.7	24.5	34.4	55.9	77.5
	(kgf·cm)	89.5	150	250	351	570	790
Rated rpm	(r/min)	1500					
Maximum rpm	(r/min)	3000					
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	10.5	15.5	25.3	65.3	100.5	159.1
	($kg \cdot m^2 \times 10^{-4}$)	10.3	15.2	24.8	64.0	98.5	156
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times					
Rated power rate	(kW/s)	7.85	19.1	28.0	20.5	35.2	50.0
Detector type	Standard	Incremental 2000					
	Option	Absolute 11/13bit 2048P/rev					
Weight	(kg)	8.2	11.6	15.8	17.2	27.4	38.3

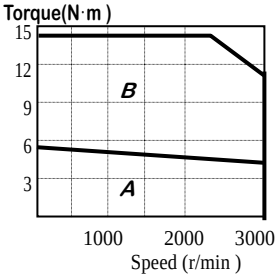
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

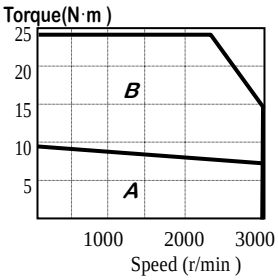
TF05



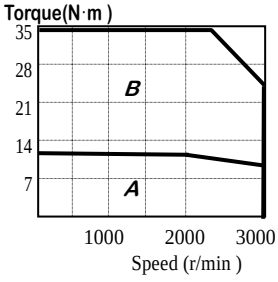
TF09



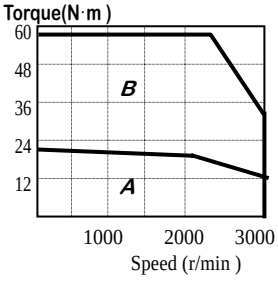
TF13



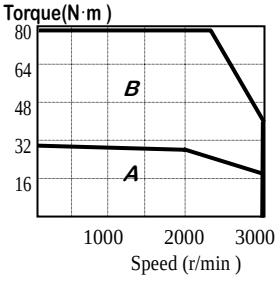
TF20



TF30



TF44

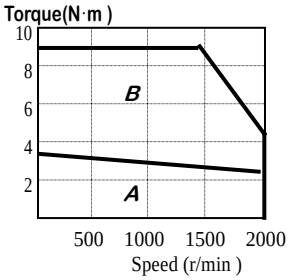


Spec. \ Model	Motor / Driver	LF03	LF06	LF09	LF12	LF20	LF30
	Driver	5004C	5005C	5010C	5012C	5020C	5030C
Flange size (□)		130			180		
Rated output	(W)	300	600	900	1200	2000	3000
Rated torque	(N·m)	2.84	5.68	8.62	11.5	19.1	28.4
	(kgf·cm)	29	58	88	117	195	290
Maximum instantaneous torque	(N·m)	8.7	16.5	23.0	34.4	57.3	78.7
	(kgf·cm)	90	169	235	351	585	803
Rated rpm	(r/min)	1000					
Maximum rpm	(r/min)	2000					
Rotor inertia (= $GD^2/4$)	($gf \cdot cm \cdot s^2$)	10.5	15.5	25.3	65.3	100.5	159.1
	($kg \cdot m^2 \times 10^{-4}$)	10.3	15.2	24.8	64.0	98.5	156
Allowable load inertia Ratio(Versus rotor)		Not exceeding 10 times					
Rated power rate	(kW/s)	7.85	21.3	30.0	20.5	37.0	51.8
Detector type	Standard	Incremental 2000					
	Option	Absolute 11/13bit 2048P/rev					
Weight	(kg)	8.2	11.6	15.8	17.2	27.4	38.3

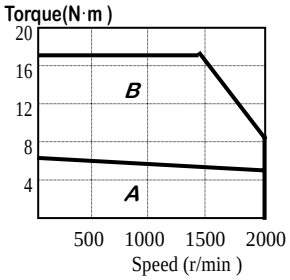
■ Speed and Torque Characteristics

A : Continuous duty zone & B : Intermittent duty zone

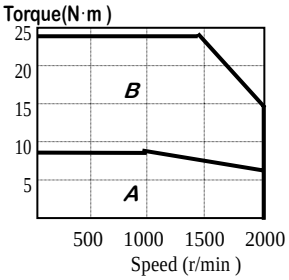
LF03



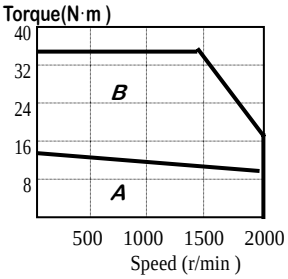
LF06



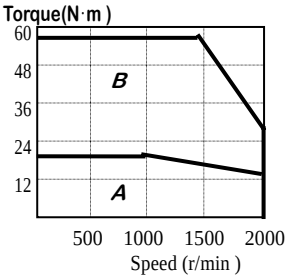
LF09



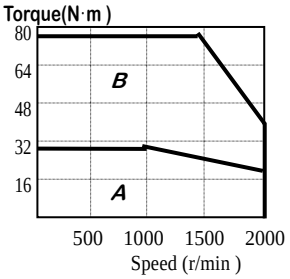
LF12



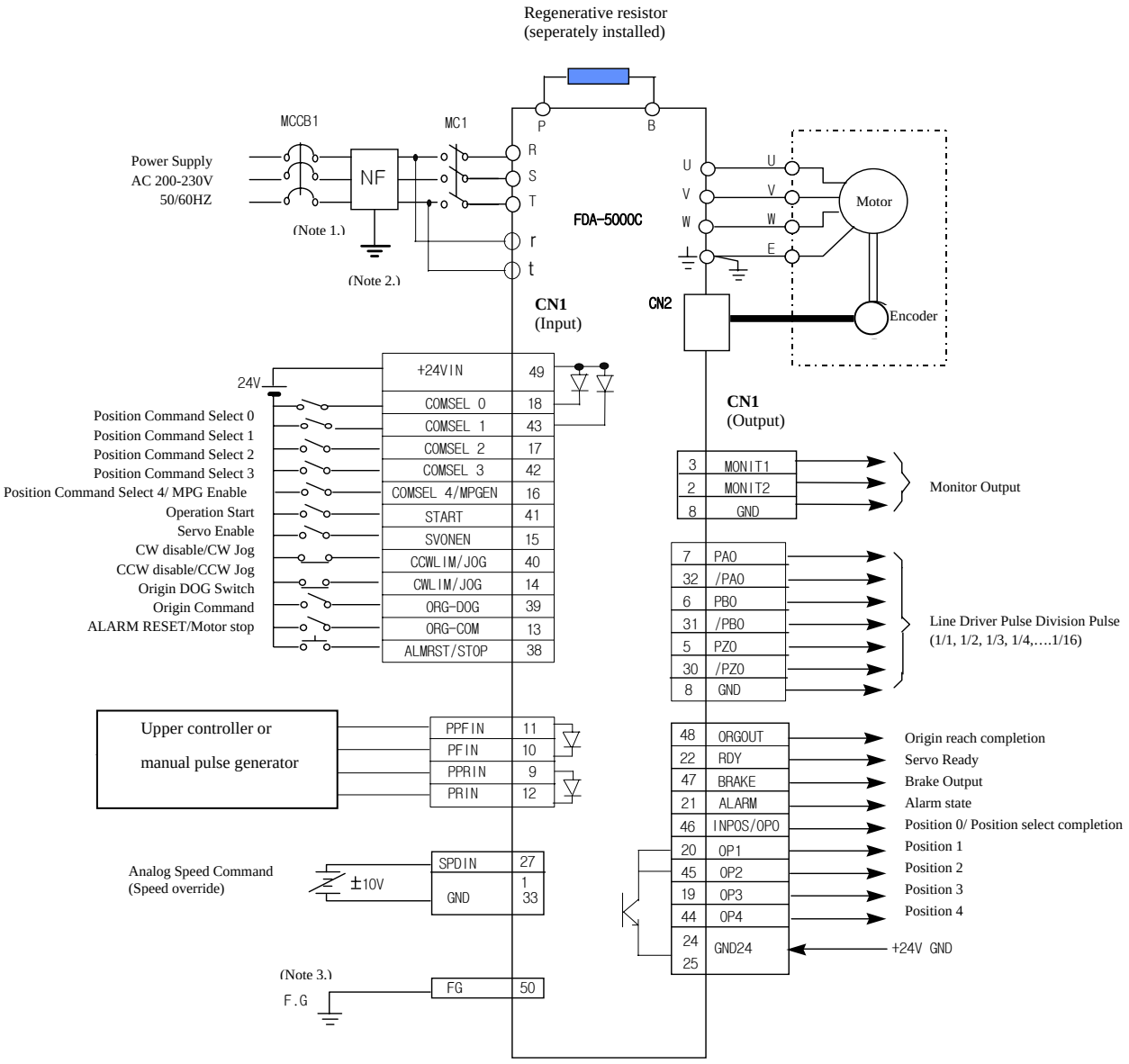
LF20



LF30



3. Wiring and Signals

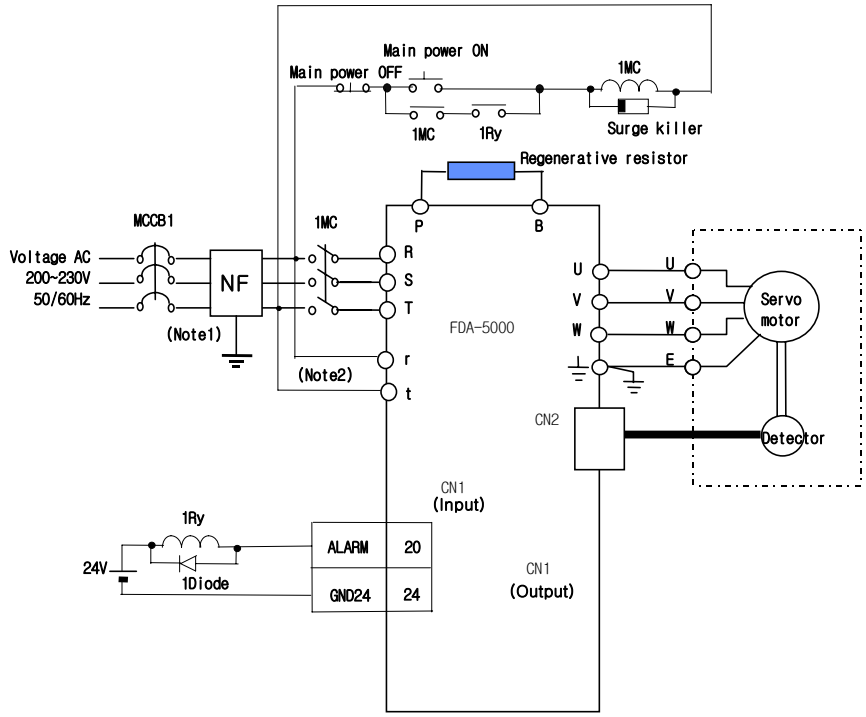


Note 1) NF is an abbreviation for Noise Filter. Use this to prevent infiltration of noise from external sources.

Note 2) For FDA-5005C-75C type, connect single-phase AC220 [V] to the r and t terminals of the spare power supply.FDA-5001C-4C type is not provided with r and t terminals.

Note 3) Use CN1 earth cable to ground the F.G. (Frame Ground) terminals.

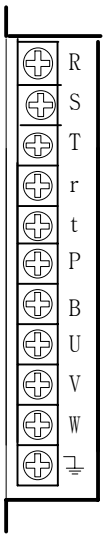
3.1 Power parts wiring



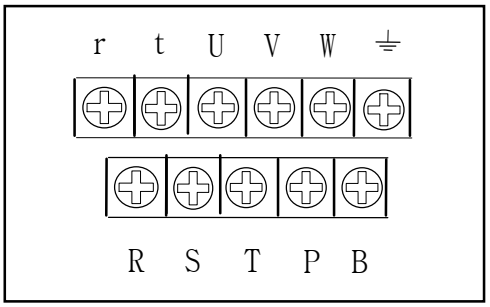
Note 1) NF is an abbreviation for Noise Filter. Use this to prevent infiltration of noise from external sources.

Note 2 For FDA-5005C-75C type, connect single-phase AC220[V] to the r and t terminals of spare power supply.
FDA-5001C-4C type is not provided with the r and t terminals.

3.1.1 Main circuit terminal board wiring

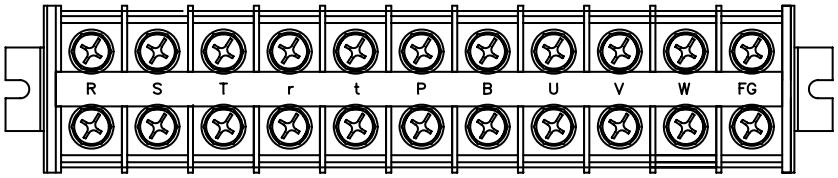


Open the main circuit terminal board cover to see the terminal board. Terminal names are located on the right side of the terminal board. (See figure on the right side.)



[FDA-5005C□-5012C□ Main circuit terminal]

[FDA-5015C□-5045C□ Main circuit terminal]



[FDA-5075C□ Main circuit terminal]

1.Uses and wiring methods of FDA-5001C□-5004C□ are as follows.

1) The R, S and T terminals are used to connect main power supply of 3-phase AC 200-230 [V] to the power circuits.

*__(Note)__ Single-phase AC 220V may also be used; however, output may be lower than the rated value. Install overcurrent breaker on the main power supply input unit. Also, install noise filter on the power supply input terminal to shut off noise coming from the power lines.

2) Connect regenerated resistance between P and B terminals. The standard regenerated resistance (See Table 3.1) is a standard item. (Install it on the electric panel.)

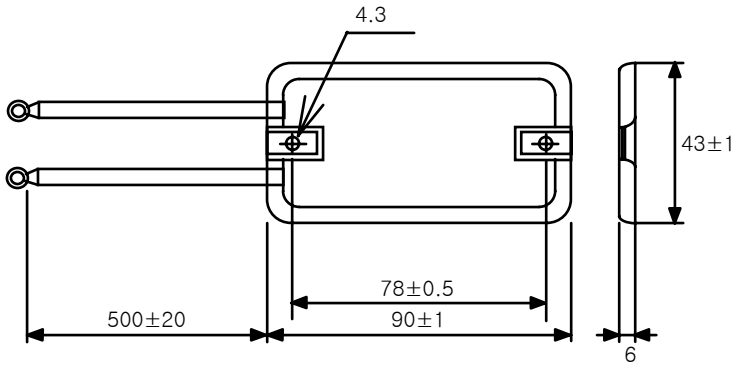
3) Connect the U, V and W phases of the servo motor to the U, V and W terminals.

4) Ground the terminal. Also connect the servo motor earth cable to this terminal.

[Table 3.1. Recommended parts to be installed on electric panel]

AC Servo drive system	FDA-5001C□	FDA-5002C□	FDA-5004C□
Wire thickness	AWG #16 (1.25 mm^2)		
Drive system side press terminal	KET GP110012		
Switch	GMC - 12 (13A) or equivalent		
Breaker	ABS 33b (5A) or equivalent		
Noise filter	NFS 305 or NFS 310		
Standard regenerated resistance (for P and B terminals)	50W 50Ω (Size: Refer to external view 1.)		

[External view 1] 50W 50Ω



2. Uses and wiring methods of FDA-5005C ~ 5075C are as follows.

1) The R, S and T terminals are used to connect main power supply of 3-phase AC 200 ~ 230[V] to the power circuits.
*__(Note)__ Single-phase AC 220V may also be used; however, output may be lower than the rated value. Install over current breaker on the main power supply input unit. Also, install noise filter on the power supply input terminal to shut off noise coming from the power lines.
The terminals of fan power are S,T in FDA5020C~FDA5045C and r,t in FDA5075C.
2) The R and T terminals are for the auxiliary power supply of the power circuit. Connect single phase AC 200 ~ 230 [V] to these terminals.
3) Connect regenerated resistance between P and B terminals. The standard regenerated resistance (See Table 3.1) is a standard item. (Install it on the electric panel.)
4) Connect the U, V and W phases of the servo motor to the U, V and W terminals.
5) Ground the terminal. Also connect the servo motor earth cable to this terminal.

[Table 3.2. Recommended parts to be installed on electric panel]

<table>
<tr><th>AC SERVO
Drive system</th><th>FDA
5005C</th><th>FDA
5010C</th><th>FDA
5012C</th><th>FDA
5015C</th><th>FDA
5020C</th><th>FDA
5030C</th><th>FDA
5045C</th><th>FDA
5075C</th></tr>
<tr><td>Wire thickness</td><td>AWG #14
(2.0mm^2)</td><td colspan="4">AWG #12
(3.5mm^2)</td><td colspan="2">AWG #10
(5.5mm^2)</td><td>AWG #8
(8.0mm^2)</td></tr>
<tr><td>Drive system side press terminal</td><td>KET
GP110012</td><td colspan="4">KET
GP110721</td><td colspan="2">KET
GP110027</td><td>KET GP110733</td></tr>
<tr><td>Switch</td><td>GMC-12(13A)
or
equivalent</td><td colspan="2">GMC-22(20A)
or equivalent</td><td colspan="2">GMC-40(35A)
or equivalent</td><td colspan="2">GMC-65(65A) or equivalent</td><td>GMC-85(80A)
or equivalent</td></tr>
<tr><td>Breaker</td><td>ABS33b
(5A)
or
equivalent</td><td colspan="3">ABS33b (10A)
or equivalent</td><td>ABS33b
(20A)
or
equivalent</td><td colspan="2">ABS33b (30A)
or equivalent</td><td>ABS53b
(50A)
or equivalent</td></tr>
<tr><td>Noise Filter</td><td>NFS-310</td><td colspan="3">NFS-315</td><td>NFS-320</td><td>NFZ-4030SG</td><td>NFZ-4040SG</td><td>NFZ-4050SG</td></tr>
<tr><td>Standard regenerated resistance (for P and B terminals)</td><td colspan="3">150W 50Ω

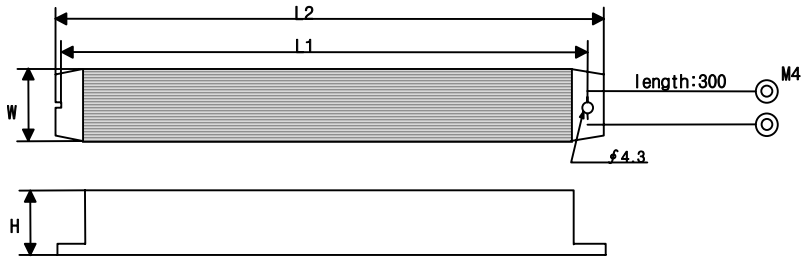
(L1=172, L2=188, W=42, H=20)</td><td>250W 25Ω

(L1=220, L2=239, W=60,H=30)</td><td colspan="3">250W 25Ω

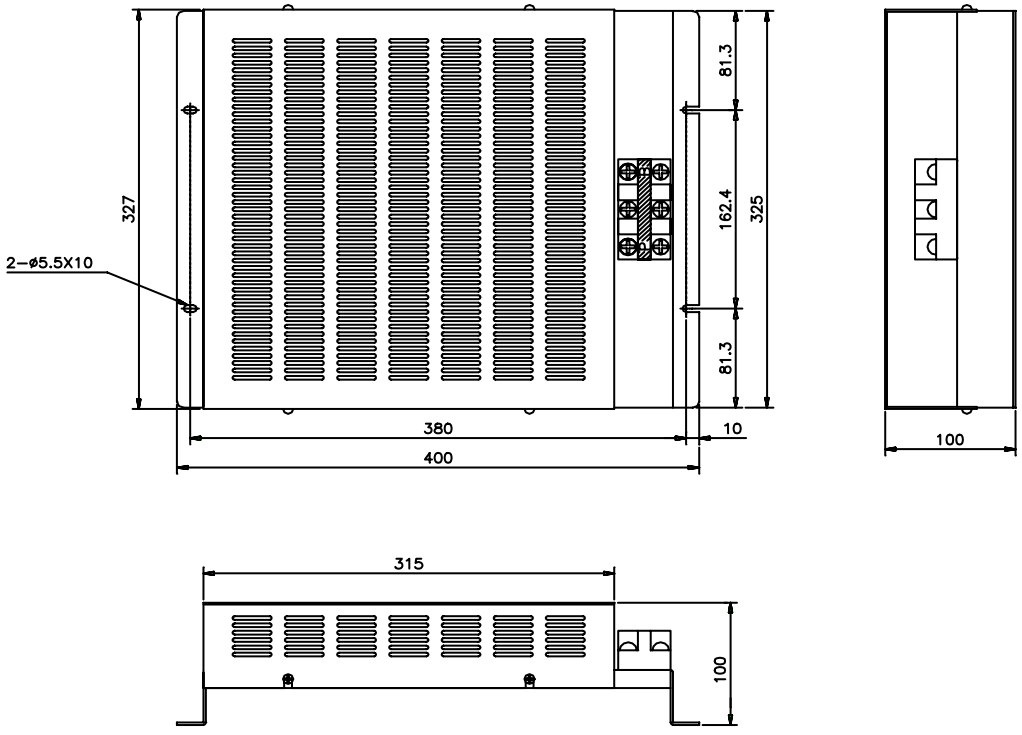
2 units in parallel
(same as left)</td><td>250W 25Ω
4 units in parallel</td></tr>
</table>

Size	See external view 2	See external view 3

[External view 2] 150W / 250W



[External view 3] 250W*4 (FDA-5075)



3.1.2 Turning ON/Off of power supply

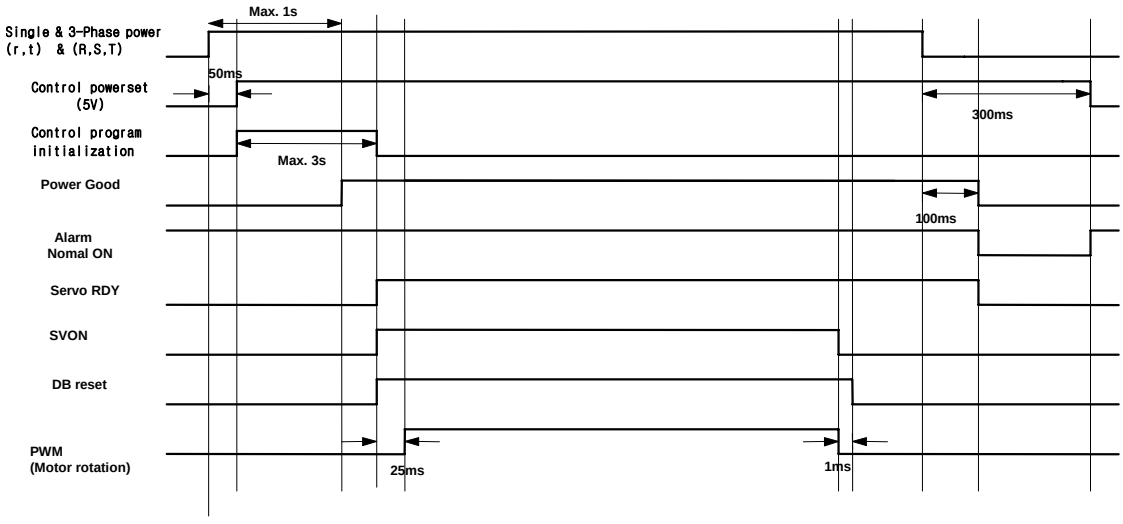
As the main circuit of the servo driver is designed in condenser input type, high charging current (charging time approximately 03-0.5 seconds) flows when main power is connected. If the main power supply is turned ON/OFF frequently, the main circuit element may be deteriorated leading to an error. Use SVONEN (CN1-15) terminal and Stop (CN1-38) terminal to start or stop the motor.

(Caution!)

1) It takes approximately 1-2 seconds before Alarm signal is activated after power is connected. Press power switch for at least 2 seconds or longer.
2) If the main power is connected immediately after power is shut off, Power Fail (AL-04) alarm may occur. Connect power at least 10 seconds after the power is turned off.
3) The above wiring diagram shows that only the main power is turned off when alarm occurs and you can check the details of the alarm.

3.1.3 Timing diagram at the time of power connection

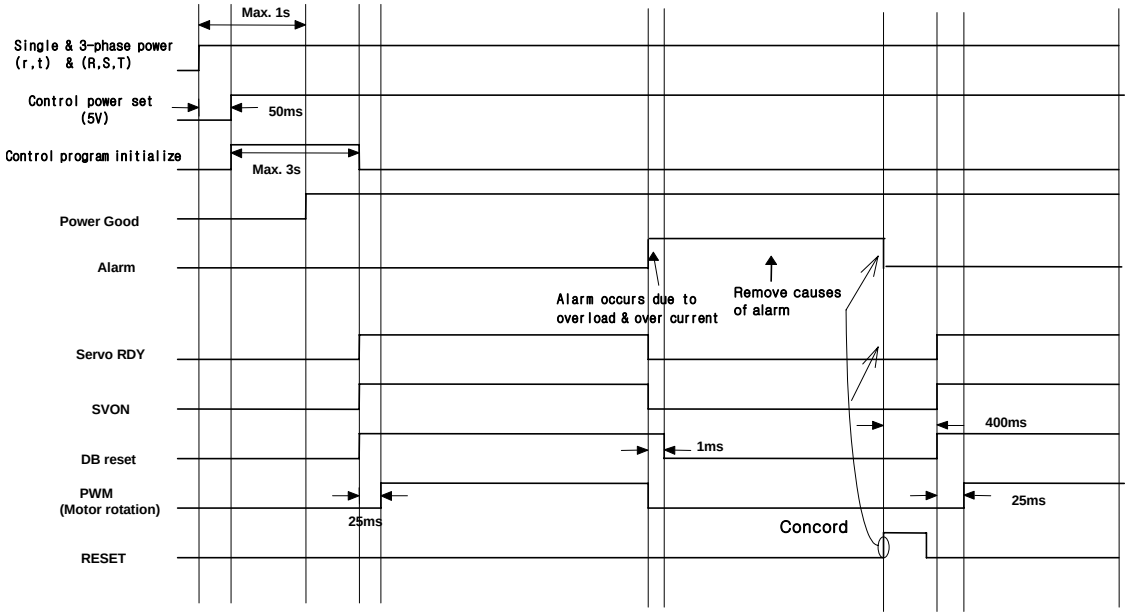
Power is supplied to the control circuit if single-phase power is connected to the r and t terminals. Servo becomes RDY after maximum 3s, the time required to initialize the inside of the drive system; and if the servo drive signal is turned on, operation starts 25 ms later.



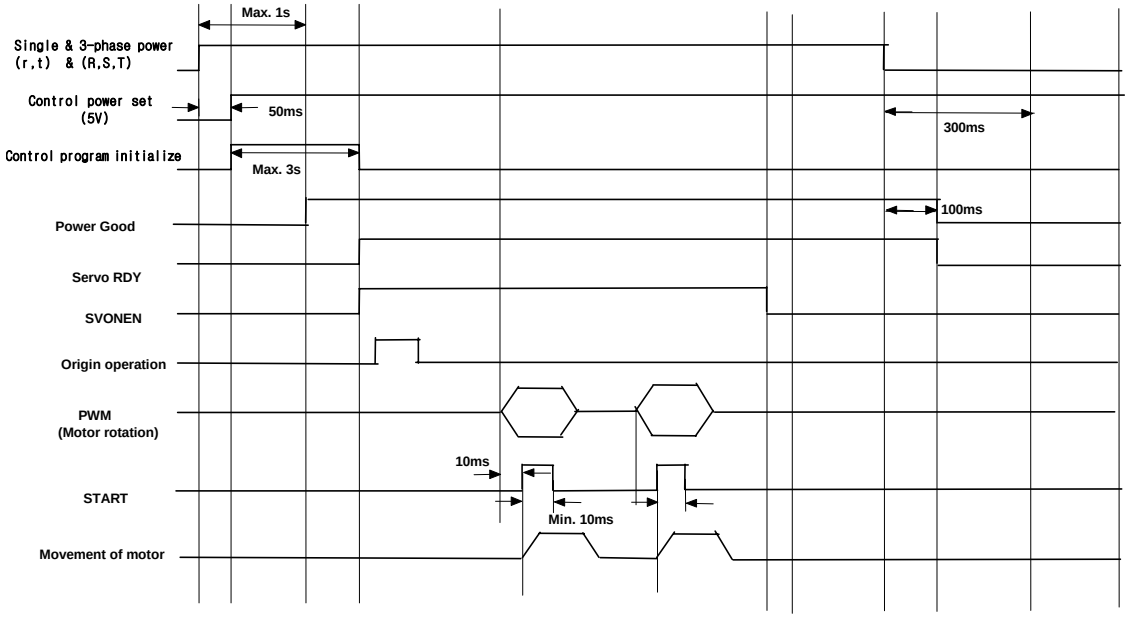
3.1.4 Timing diagram at the time of Alarm occurrence

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

(Caution!) Check and remove causes of Alarm and turn off the servo motor drive command (SVONEN) before resetting Alarm.



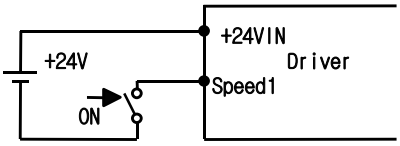
3.1.5 Timing diagram in operation



3.2 Connection and signal-form of input/output

3.2.1 Input contact signal

Function of each input contact signal is shown on the following table. The input contacts are classified into A contact and B contact depending on the contact characteristics. Check before use. Connect external power supply greater than DC +24 [V], 1 [A] to the +24 [V] power input terminal (CN1-49) to use the contact input.



Input contactor wiring(example)

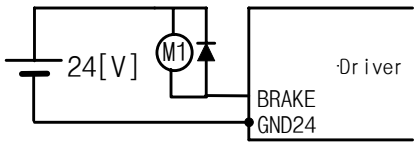
Pin number (No.)	Signal function in controlling position	Contact Type
COMSEL0 (18)	Position Command selection 0	ON=1, OFF=0 Select thirty one position CMD MPG_SEL(P8-06)=1, MPGEN signal : ON = Pulse command operation
COMSEL1 (43)	Position Command selection 1	
COMSEL2 (17)	Position Command selection 2	
COMSEL3 (42)	Position Command selection 3	
COMSEL4/MPGEN (16)	Position Command selection 4/MPGEN	
START (41)	Start Command	ON = Starting operation
SVONEN (15)	Enable to servo operation	ON = Servo drive enable
CCWLIM/JOG (40)	Not CW/ CW Jog	OFF = Not CW/CW Jog
CWLIM/JOG (14)	Not CCW/ CCW Jog	OFF = Not CCW/CCW Jog
ORG (39)	Origin DOG switch	ON = Dog switch range
ORGCOM (13)	Origin Command	ON = Origin operation
ALMRST.STOP (38)	ALARM RESET/ Motor stop	ON = ALARM REST ON = Motor stop

Note 1) ON : Application contact connected to " GND24"
OFF : Application contact connected to "+24V", or applicable contact not connected.

Note 2) ALARM RESET do necessarily after servo drive ENABLE(SVOEN) signal OFF.

Note 3) If we select CW/CCW Jog function(P8-03:LIM_SEL:1), cannot use CW disable/CCW disable function

3.2.2 Output contact signal



Output contactor wiring(example)

The output contact signal functions are shown on the following table. The output contact internally uses transistor switch. Take precaution because overvoltage or overcurrent may cause damage to the system. (Power supply: DC +24 [V] ±10%). Brake signal is used to drive the brake installed inside the motor. The sequence must be configured so when this output is turned on, power is supplied to the brake and the break is released . Other signals are the outputs which indicate the status of the drive system and the motor. Each function is shown on the following table.

Pin number (No.)	Signal function in controlling position	Contact Type
ORGOUT (48)	Completion of position selection	ON= Completion
RDY (22)	Servo READY	ON = READY
BRAKE (47)	BRAKE operation	ON = BRAKE cancellation OFF = BRAKE operation
ALARM (21)	ALARM	OFF = Alarm status
INPOS/OP0 (46)	Completion of origin reaching/position0	ON = Completion
OP1	Position 1(Turret Mode)	ON = Completion
OP2	Position 2(Turret Mode)	ON = Completion
OP3	Position 3(Turret Mode)	ON = Completion
OP4	Position 4(Turret Mode)	ON = Completion

Note 1) ON : Application contact connected to " GND24"

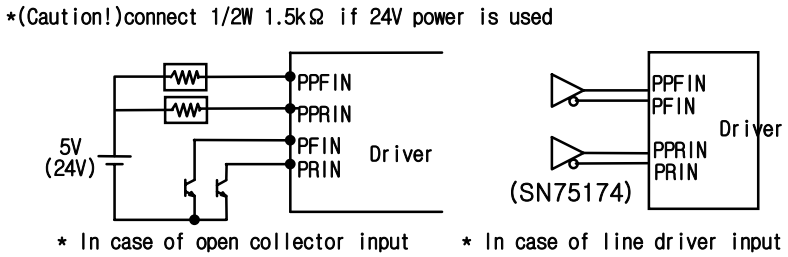
OFF : Application contact connected to "+24V", or applicable contact not connected.

3.2.3 Position command pulse input signal

To use the driver in position MPG mode, input the position command pulse by using the open collector input, line drive input, and pulse output of the MPG (Manual Pulse Generator) or PLC position control card using external power supply of 5 [V] and 24 [V]. The types of pulses that can be used are "direction + pulse", "forward pulse + reverse pulse", and "LEAD pulse + LAG pulse". Select the type of pulse from the [Pulse Logic (P4-14)] menu of the front operation panel [Position Mode (P4--)] menu

Photo coupler has been used in the pulse input circuit to insulate the internal control unit of the drive system from the external pulse signal. However, if 5 [V] is used as the open collector input, connect 1/2W 150Ω resistance, or 1/2W 1.5kΩ resistance if 24 [V] is used.

Pin No (CN1-)	PPRIN (9)	PRIN (12)	PPFIN (11)	PFIN (10)
Signal function	+ 5VA	R pulse input	+ 5VA	F pulse input



[Position command pulse application circuit(example)]

3.2.4 Analog I/O signal

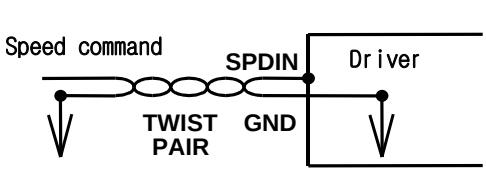
Analog signal is based on 0 [V] (GND terminal) of the control power supply. Connect the GND terminal of the circuit connected to this signal with the GND terminal of CN1. The analog speed

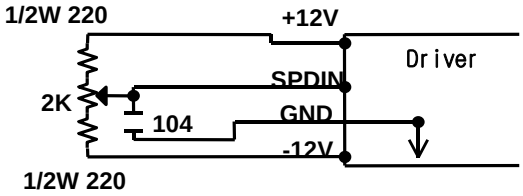
command input (CN1-27) runs the motor at a speed determined from the [10V Speed [RPM] (P3-13)] menu of [Speed Mode (P3-13)]. The motor runs at a maximum speed in the forward direction if +10 [V] is loaded, and in the reverse direction if -10 [V] is loaded. Analog torque limit (CN1-28) is activated when the analog torque limit function (CN1-14) terminal is turned on.
If the analog torque limit function is not selected, the function can be used up to the torque set at [TRQ LMT (+) (P2-05)], [TRQ LMT (-) (P2-06)]. To wire analog signals, connect GND wire with the signal wire by twisting them using twist pair wire in order to minimize noise. Functions of each analog signal are as follows.

Pin Name	SPDIN (27)	TRQIN (28)	MONIT1 (3)	MONIT2 (2)
Signal function	Speed command *1 Speed limit *2 -10～+10 [V] input	Torque limit *1, *3 Torque command *2 -10～+10 [V] input	Monitor output 1 -5～+5 [V] output	Monitor output 2 -5～+5 [V] output

Analog signal is based on GND signal, and produces ±12 [V] power just in case speed commands, speed limits, torque limits and torque commands are applied through the use of variable resistance. The output capacity of this power supply is 30 [mA] at maximum. Do not exceed the maximum capacity. The power supply pin array is shown on the following table.

Pin Name	+ 12 V (35)	- 12 V (37)	GND (1,8,26,33,34,36)
Signal function	+ 12 [V]	- 12 [V]	0 [V]



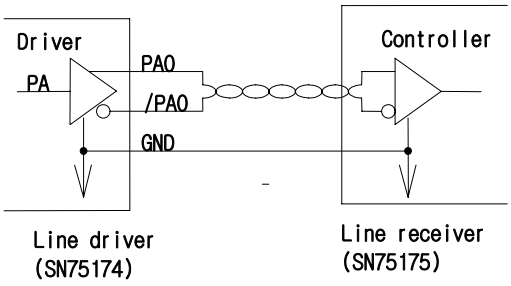


[Analog signal connection] [Using the internal power for the analog command]

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 driver system after the AC servo motor encoder signal received from CN2 is divided according to the frequency dividing ratio set by the sub-menu [Pulse Out Rate (P2-07)] of the main menu [Control Mode (P2-)]. Functions of each signal is as follows.

Signal function	A phase output	B phase output	Z phase output
PIN No(CN1-)	PAO(7)/PAO(32)	PBO(6)/PBO(31)	PZO(5)/PZO(30)



Encoder signal connection example

3.3 CN1 Wiring and Signal

3.3.1 CN1 Wiring and Signal

Signal	Title	Pin No.	Function
Start Command	START	41	Start operation (OFF → ON: Operation)
Origin Command	ORGCOM	13	Use to set origin of machine(ON: Origin command)
CW unable /CW Jog	CCWLIM/ CCWJOG	40	Parameter set at LIM_SEL(P8-03) (0:Rotation Unable, 1: Jog) OFF: Rotation Unable /Jog operation ON : Rotation Able /Jog Stop
CCW unable /CCW Jog	CWLIM/ CWJOG	14	
Alarm reset /motor stop	ALMRST/ STOP	38	Alarm state : Reset Alarm Normal Operation : Motor stop (maintain stop torque when this)
Origin switch	ORG-DOG	39	Contact DOG switch signal (ON: switch domain)
Servo Motor Operation Command	SVONEN	15	Determines whether servo motor can be started (ON: can start, OFF : cannot start)
Position command select 0	COMSEL0	18	Set internal position command(0-30) by combining five signal [MPG-SEL(P8-6)] = 0 : Select position command 4 1 : Select MPG operation Enable
Position command select 1	COMSEL1	43	
Position command select 2	COMSEL2	17	
Position command select 3	COMSEL3	42	
Position command select 4/MPGEN	COMSEL4 /MPGEN	16	
+24(V) Power Input	+24VIN	49	Connect greater than (+24(VDC)±10% 1.0[A]) of external power supply. * Note) If used as I/O contact power supply simultaneously, recalculate the power supply capacity according to the number of output points.
+24(V) GND Input	GND24	24 25	Connect GND of external power supply
BRAKE Drive Output	BRAKE	47	This is the output signal intended to drive internal brake of motor * See [Break SPD(P2-08)], [Brake time (P2-09)

READY State Output	RDY	22	This is No Alarm, Power Good status when power is turned ON..
Position decision completion /Position 0	INPOS/ OP0	46	Display approachment position CMD_Position [0-30] in position completion signal in case of absolute position operation Display position decision completion signal(INPOS) output in case of relative position/sequence operation [In Position Type(P8-08)]=0 : OP0~OP4Output 1 : INPOS Output
Position 1	OP1	20	
Position 2	OP2	45	
Position 3	OP3	19	
Position 4	OP4	44	
Alarm state	ALARM	21	Turn OFF if alarm is detected (Turn ON during normal operation)
Origin reach completion	ORGOUT	48	Turn ON when reach origin,
FRAME GROUND	FG	50	Connects earth cable of CN1.
Encoder Output	PAO	7	Outputs the encoder signal of motor in line drive system after driving it according to the frequency dividing ratio set by the parameter [Pulse out rate(P2-06)]
	/PAO	32	
	PBO	6	
	/PBO	31	
	PZO	5	
	/PZO	30	
Analog Speed Command (Override)	SPDIN	27	If we input speed command in analog voltage of the ratio set by parameter[10V Speed(P3-14)], speed override function operates.
Monitor Output 1	MONIT1	3	Outputs within the range of -5 ~ +5 [V] according to values set to [Monitor1 Select (P2-11)], [Monitor1 ABS (P2-12)], [Monitor1 Scale (P2-13)], [Monitor1 offset (P2-14)]. [Monitor1 Select] - 0: speed, 1: torque, 2: speed command See section 6.11 for [Monitor1 ABS (P2-12)], [Monitor1 Scale (P2-13)], [Monitor1 offset (P2-14)].
Monitor Output 2	MONIT2	2	Outputs within the range of -5 ~ +5 [V] according to values set to [Monitor2 Select (P2-15)], [Monitor2 ABS (P2-16)], [Monitor2 Scale (P2-17)], and [Monitor2 offset (P2-18)]. [Monitor2 Select] - 0: speed, 1: torque, 2: speed command See section 6.11 for [Monitor2 ABS (P2-15)], [Monitor2 Scale (P2-16)], and [Monitor2 offset (P2-18)].
+12(V) Output	+12V	35	Output ±12(V) used only when speed override command are simply applied.
-12(V)Output	-12V	37	
0(V)	GND	1	This is the power supply common Ground Terminal for analog speed Override Command, positive speed monitor output, and encoder output terminals.
		8	
		26	
		33	
		34	
		36	
F Pulse	PPFIN	11	Set pulse forms according to the set value of the parameter

	PFIN	10	[Pulse Logic(P4-4)] Pulse form ①Direction + Pulse ②CW Pulse + CCW Pulse ③Two phase pulse(Phase A + Phase B)
R Pulse	PPRIN	9	
	PRIN	12	

3.3.2 CN1 pin arrangement

CN1 is the connector located at the right lower part of the front of drive system. This connector is used to connect the drive system with the upper control system which commands the operation.

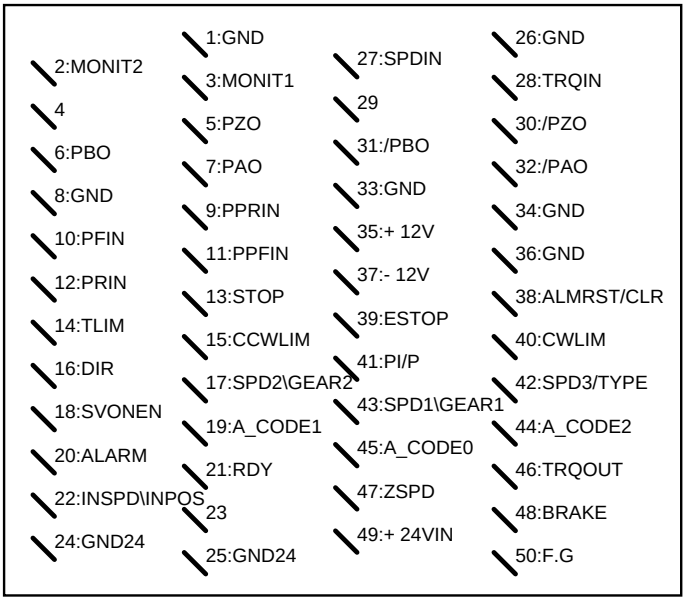
The figure on the right side shows the pin array of the connector CN1 seen from the user side connector.

(Note 1) CN1 connector is an option item.

∗ Maker: 3M

∗ Case name: 10350-52FO-008

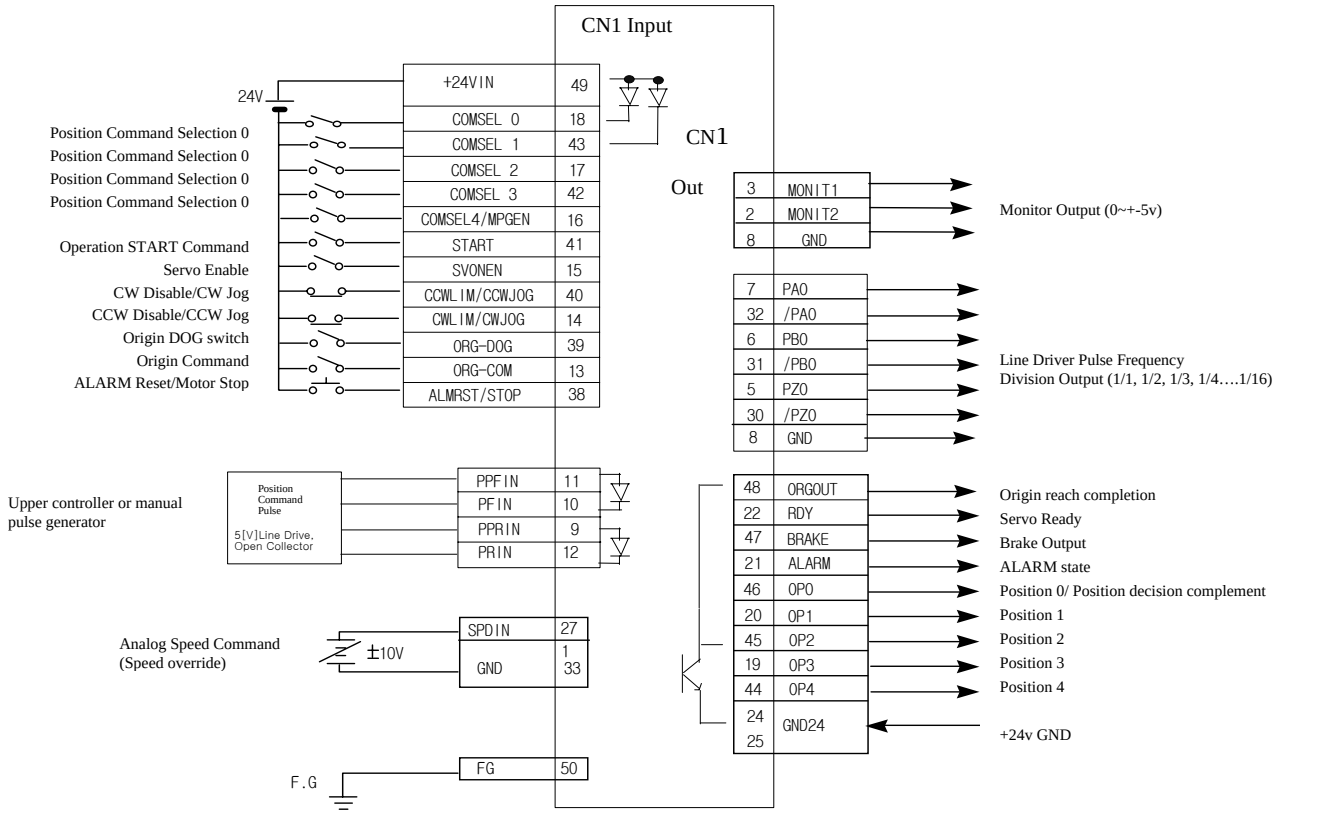
∗Connector (For soldering): 10150-3000VE



PIN Array of CN1

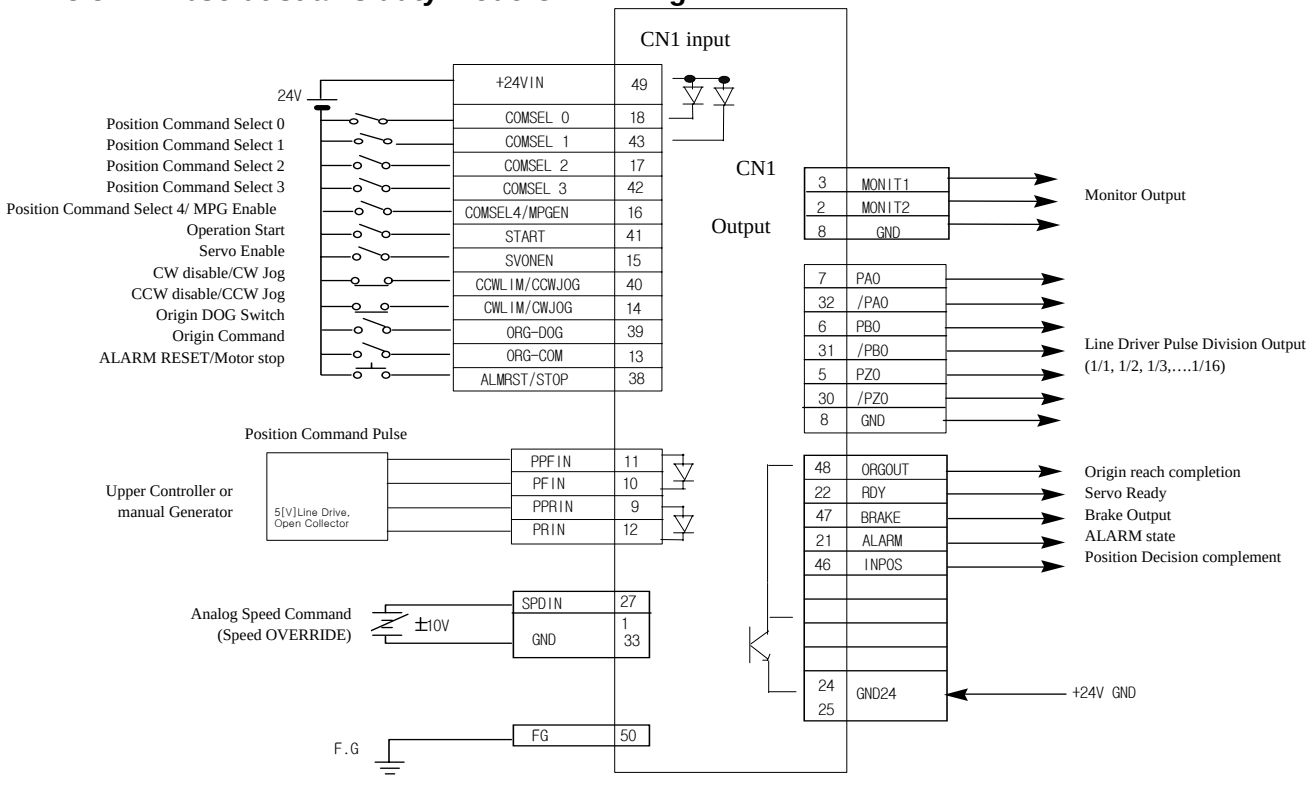
(Based on the soldered side of the user connector)

3.3.3 Absolutist axis duty mode CN1 wiring



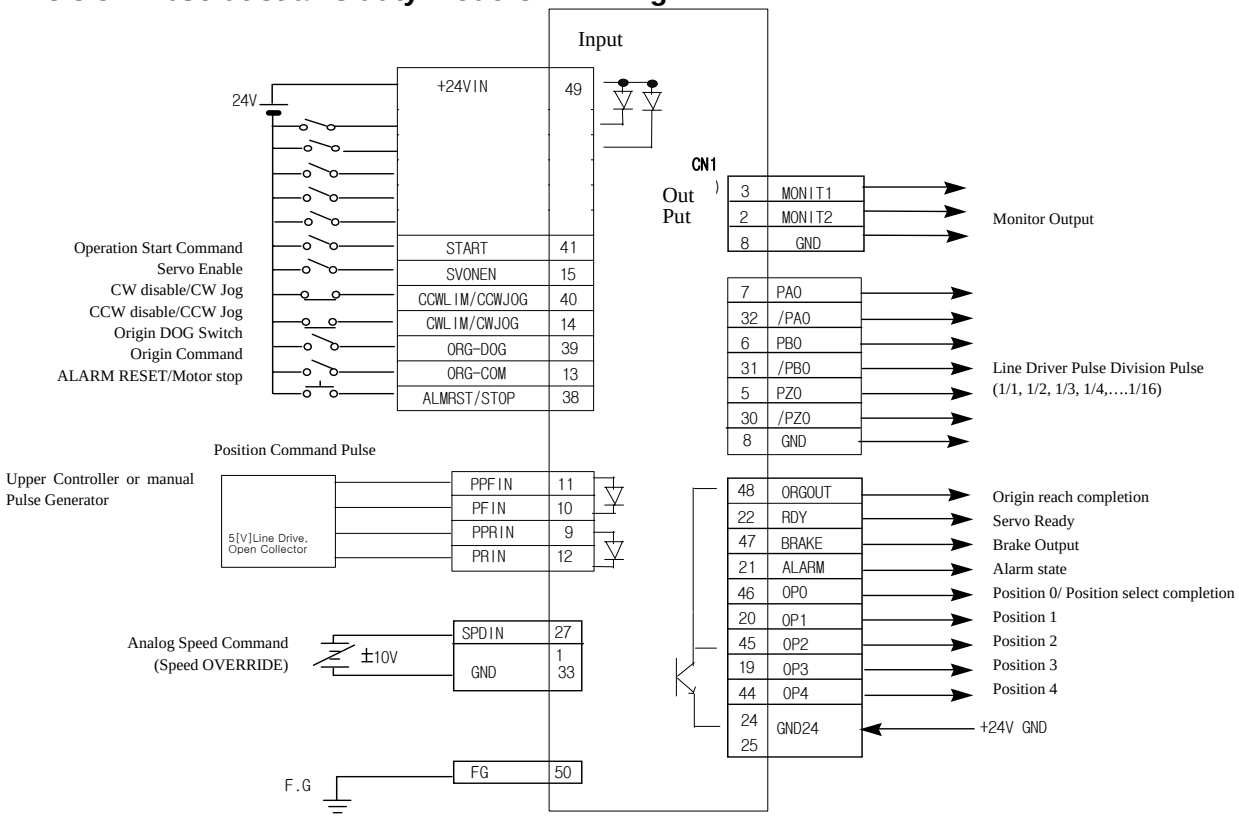
* F, G terminal Connect GND of CN1 cable

3.3.4 Absolutist axis duty mode CN1 wiring



* F,G terminal connect GND of CN1 cable

3.3.5 Absolutist axis duty mode CN1 wiring



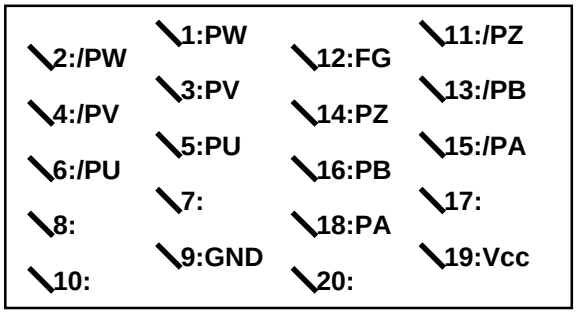
* F, G terminal connect GND of CN1 cable

3.4 Description of CN2 Wiring and Signals

3.4.1 Wiring and signals of incremental encoder

CN2 is a connecter located in the right center of the front part of the drive system. This is used to connect the drive system and servo motor encoder.

The right figure shows pin array viewed from the user connector. Encoder signal varies slightly according to the types of encoder.



PIN array of CN2
[Based on the soldered side of the user connector]

Wiring of CN2 and the FMA-CN series AC servo motor's incremental encoder is shown on the following table.

(Caution!) When absolute value encoder is used, refer to Chapter 14. Interface and Use of Absolute Value Encoder.

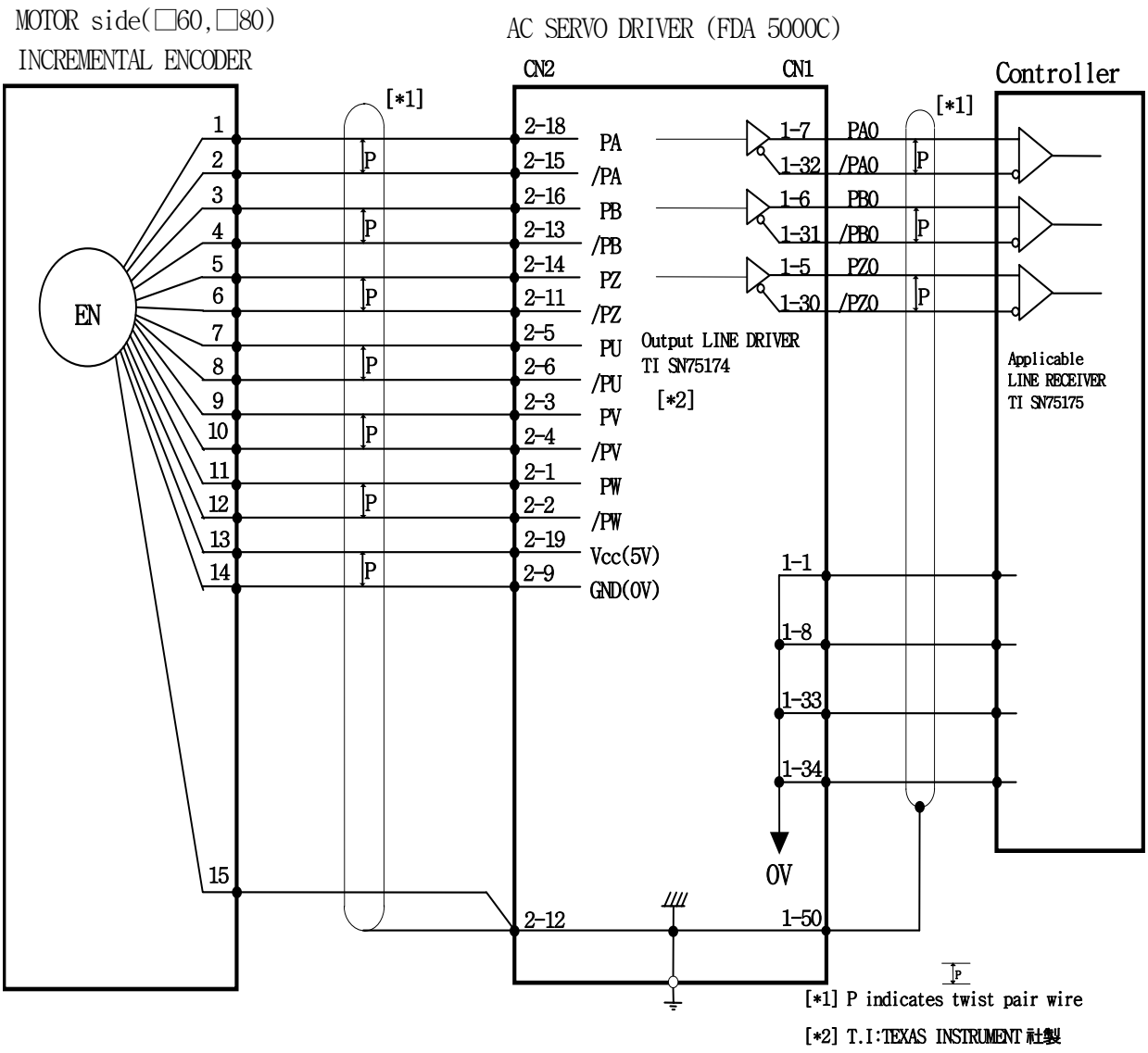
CN2 pin No.	Signal name	Motor (□60, 80 series) side encoder connector pin No.	Motor (□130, 180 series) side encoder connector pin No.

1	PW	11	P
2	/PW	12	R
3	PV	9	M
4	/PV	10	N
5	PU	7	K
6	/PU	8	L
7			
8			
9	GND	14	G
10			
11	/PZ	6	F
12	F.G.	15	J
13	/PB	4	D
14	PZ	5	E
15	/PA	2	B
16	PB	3	C
17			
18	PA	1	A
19	Vcc(DC 5V)	13	H
20			

(Caution!) Connect the earth cable of the encoder wiring to F.G.

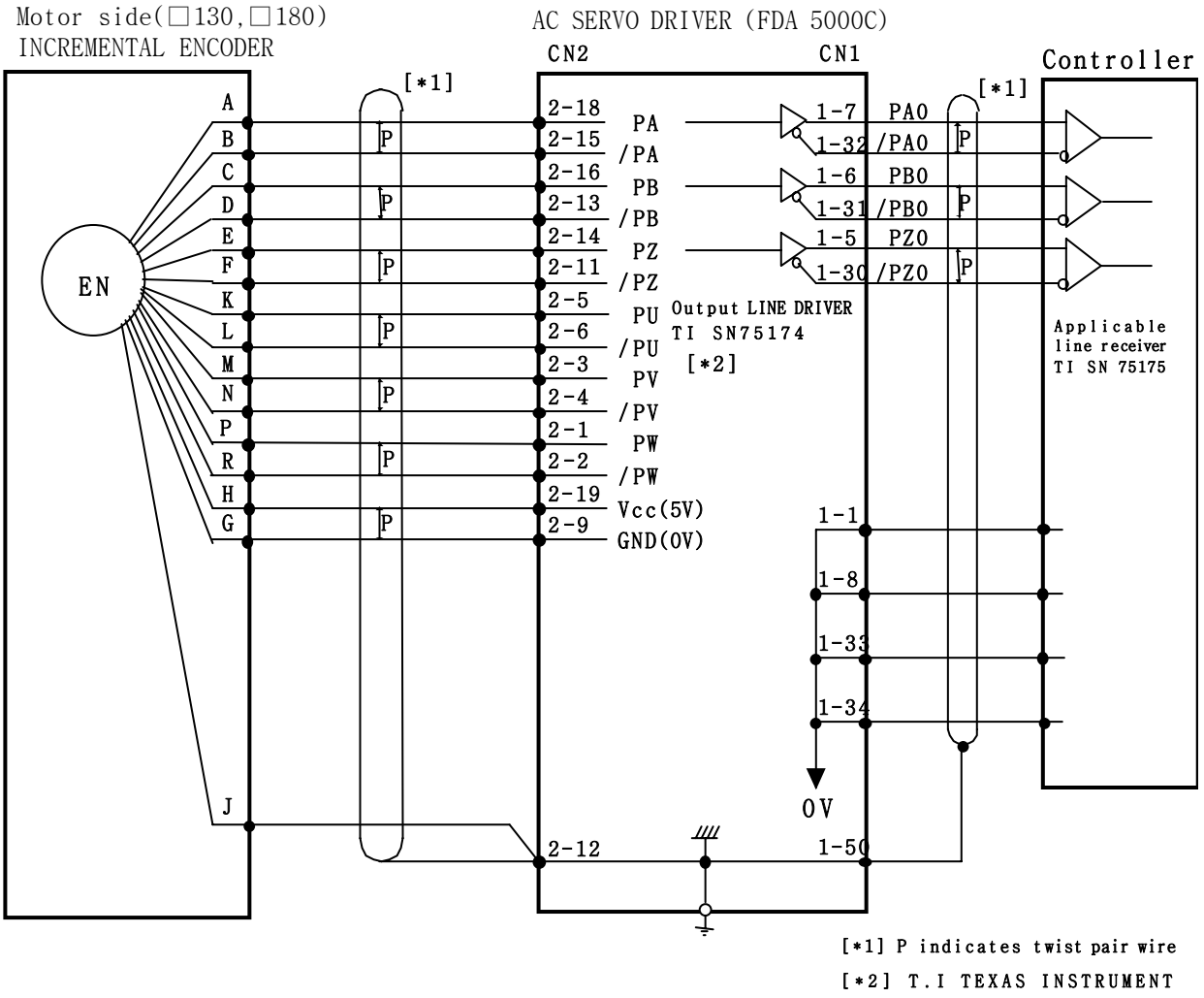
(Caution!) Cable specifications: - AWG24 x 9 pair twist, shield cable (maximum length: 20 m)
- COVV(LS Cable) or equivalent

[Example of wiring between motor side (□60, 80 series) and FDA 5000C CN2 when incremental encoder is used]



[CN2 wiring diagram]

[Example of wiring between motor side (□130, 180 series) and FDA 5000C CN2 when incremental encoder is used]

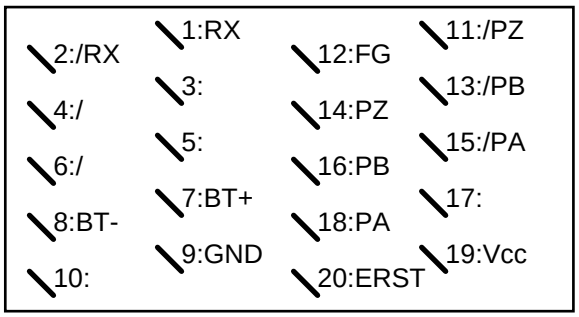


[CN2 wiring diagram]

3.4.2 Wiring diagram of CN2 using absolute value encoder

CN2 is a connecter located in the right center of the front part of the drive system. This is used to connect the drive system and servo motor encoder.

The right figure shows pin array viewed from the user connector. Encoder signal varies slightly according to the types of encoder.



PIN array of CN2

(Based on the soldered side of the user connector)

(Note) CN2 connector is an option item.

∗ Maker: 3M

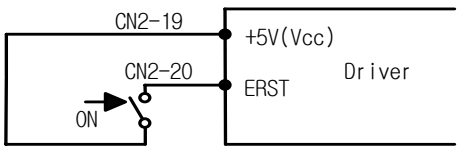
∗ Case product name: 10320-52FO-008
∗ Connector (For soldering): 10120-3000VE

Wiring between CN2 and the FMA-series AC servo motor absolute value encoder is shown on the following table.

CN2 pin No.	Signal name	Motor side encoder connector pin No.	
		□60, 80 series	□130, 180 series
1	RX	11	P
2	/RX	12	R
3			
4			
5			
6			
7	BAT+	9	K
8	BAT-	10	L
9	GND	14	G
10			
11	/PZ	6	F
12	F.G.	8	N
13	/PB	4	D
14	PZ	5	E
15	/PA	2	B
16	PB	3	C
17			
18	PA	1	A
19	Vcc(DC 5V)	13	H
20	ERST	7	M

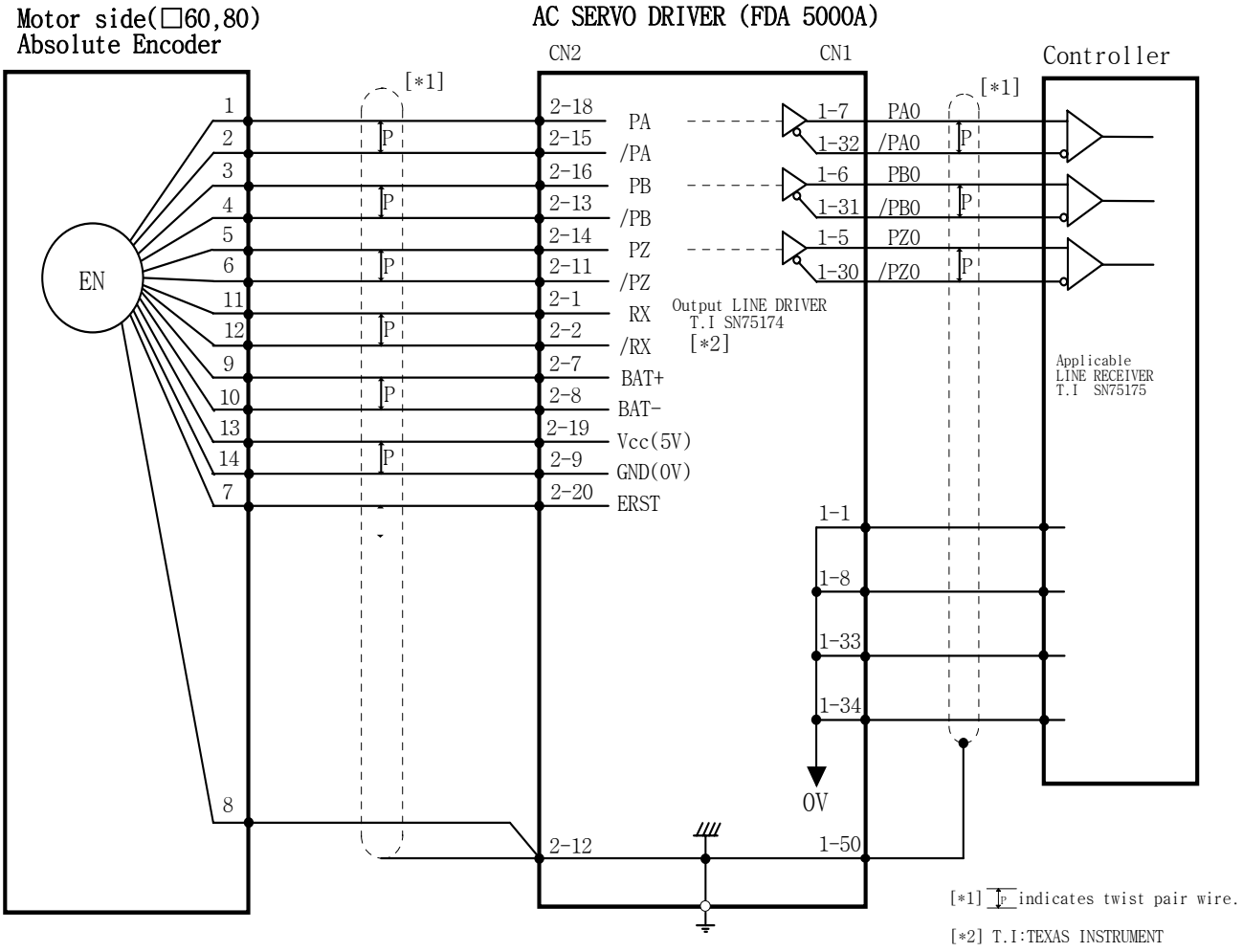
∗ Connect the earth cable of the encoder wiring to F.G.
∗ Cable specifications: - AWG24 x 9 pair twist, shield cable (maximum length: 20 m)
- COVV(LS Cable) or equivalent

Press the encoder Reset switch connected between the encoder reset terminal ERST (CN2-20) and the Vcc terminal (CN2-19) for longer than 4 seconds to set the zero point of the absolute value encoder itself or in case of alarm.



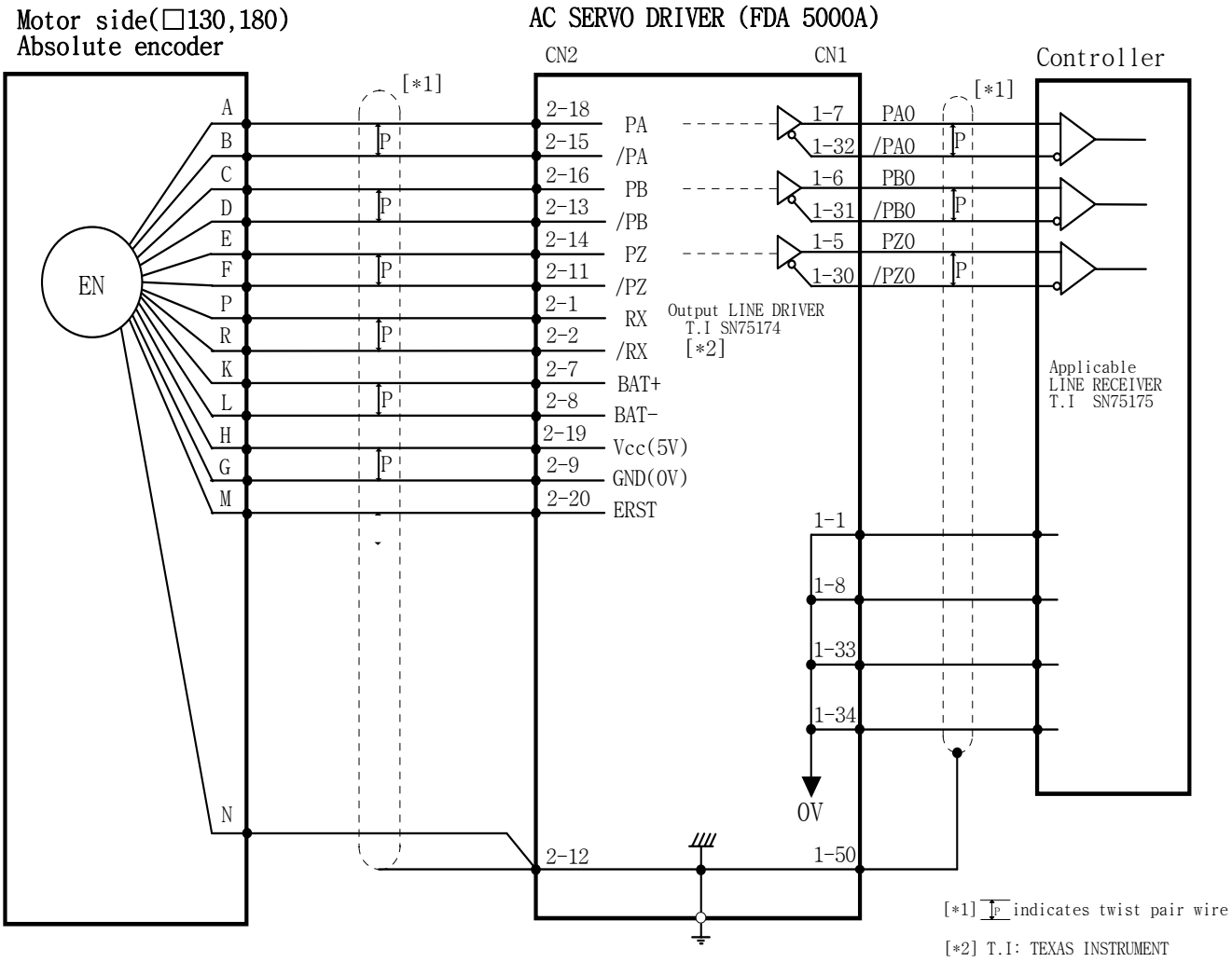
[Wiring of encoder reset switch]

[Example of wiring between motor side (□60, 80 series) and FDA 5000CA CN2 when absolute value encoder is used]



[CN2 Wiring diagram]

[Example of wiring between motor side (□130, 180 series) and FDA 5000CA CN2 when absolute value encoder is used]



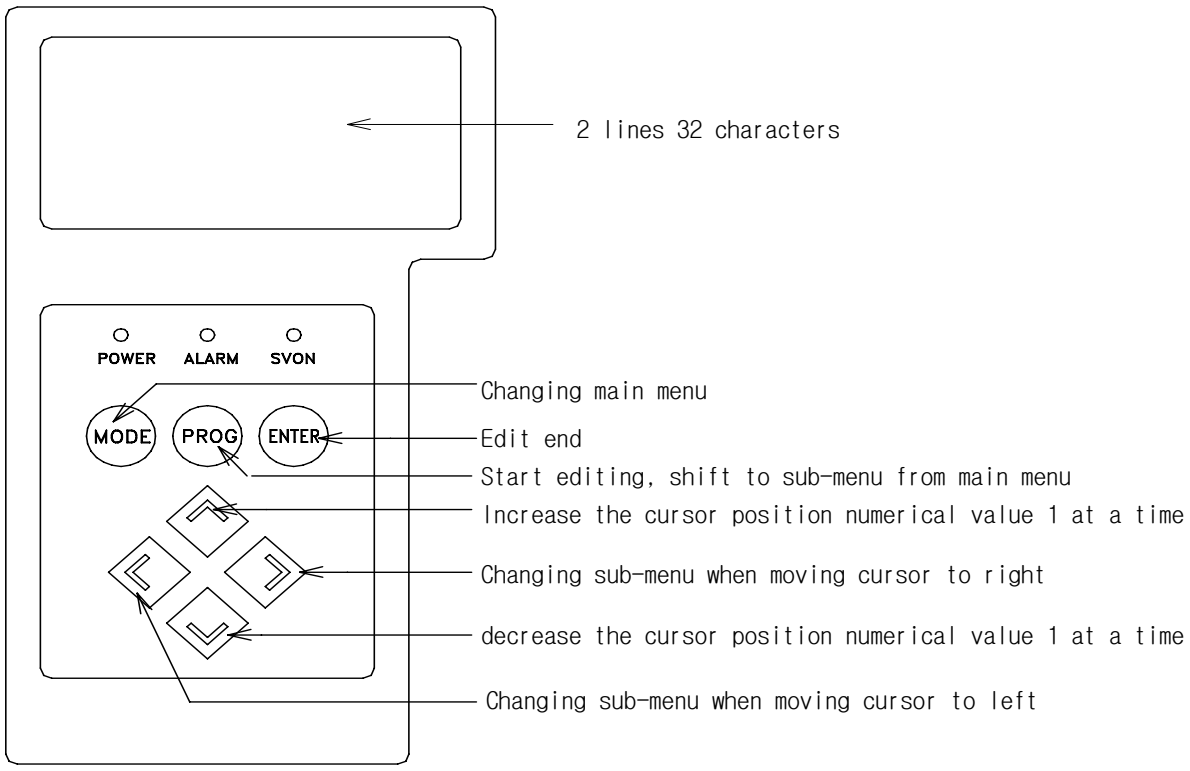
[CN2 wiring diagram]

4. Digital Loader Operation

Prior to connecting power and turning ON the servo, check the parameters [Motor parameters (P1--)] related to the motor at the digital loader. In order for the servo system to operate satisfactorily based on the information on the motor connected to the servo, accurate value must be set.

Next, monitor [Status Window (St--)] and verify that all commands and limit values are properly set.

For initial operation, verify certain degree of stability through autotuning and trial operation (jog, simulation). Autotuning can be achieved through on-line system, but it is not necessary to use this function in case stabilized control gain is acquired through off-line system.



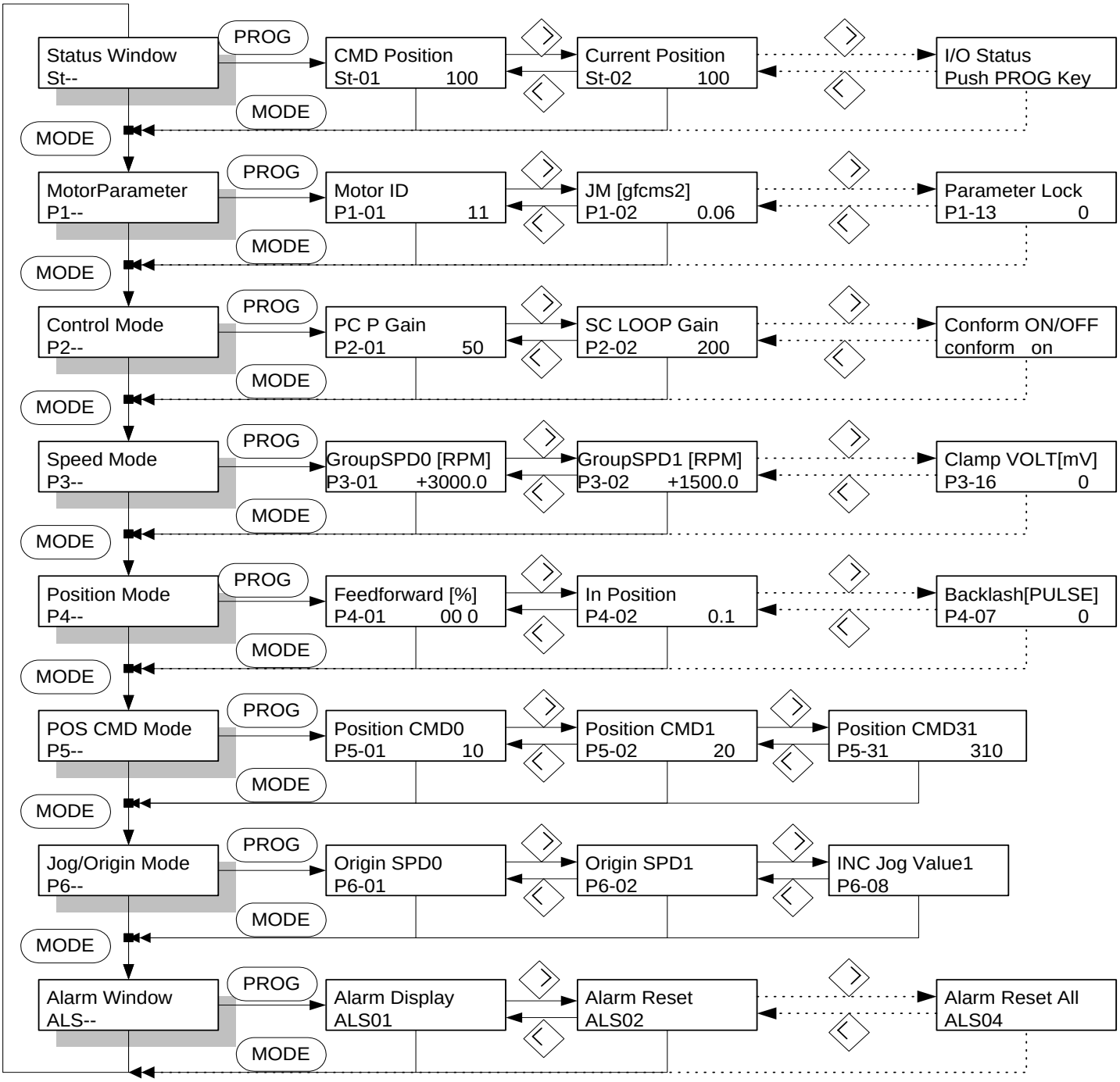
External view of digital loader

4.1 Handling and Menu system

PROG — Moves from main menu to sub-menu; Start editing

MODE — Moves from main menu to main menu or from sub-menu to main menu

< > — Moves between sub-menus



4.2 Changing Parameters

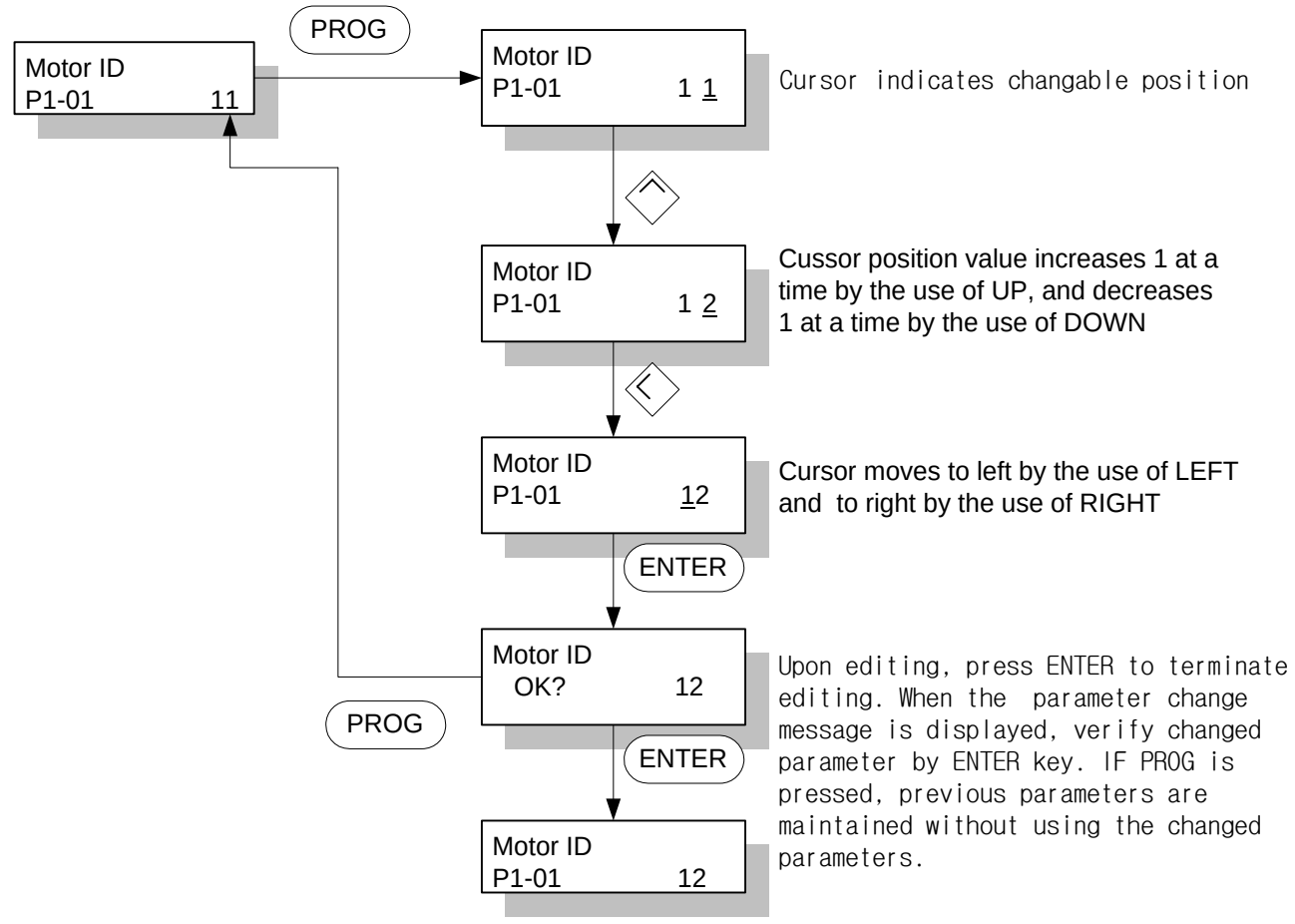
The parameter value can be changed in the same method.
Even though the changeable range varies according to menu, operation methods are the same.
Hence, [Motor ID (P1-01)] is presented here as a representative example.

PROG Starts parameter editing and cancels parameter change

ENTER Verifies changed parameter

Increases or decreases cursor position value

Moves cursor to left or right



5. Parameter Setting

Menus can be set by the digital loader and mount loader. See Chapter 4 and 5 for information on how to use the digital loader and mount loader.
Abbreviations used in this manual and their meanings are as follows.

Abbreviation	Meaning	Abbreviation	Meaning
PC	Position Controller	ACCEL	Acceleration
SC	Speed Controller	DECEL	Deceleration
LMT	Limit	VOLT	Voltage
RPM	r/min	SPD	Speed
ms	Msec	OFFS	Offset
μs	μsec	TC	Time Constant
FRQ	Frequency	FF	Feedforward
FLT	Filter	FB	Feedback
ENB	Enable	ERR	Error
INIT	Initialize	FLLW	Follow
DFLT	Default	ELCTR	Electric
PROG	Program	NUM	Numerator
CMD	Command	DEN	Denominator

5.1 Parameter Summary

Digital loader displays menus along with menu names, but the mount loader shows only menus.

(1) Status window (Status window: St--)

Menu	Menu title	Description	Unit	Display range	Initial value
St-01	CMD Position	Position Command	User	-99999.9~99999.9	0
St-02	Current Position	Current Position	User	-99999.9~99999.9	0
St-03	Position Error	Position Error	User	-99999.9~99999.9	0
St-04	Motor Speed[r/min]	Motor speed	R/min	-9999.9~9999.9	0
St-05	Limit Speed[r/min]	Command speed	R/min	-9999.9~9999.9	0
St-06	Torque Limit[%]	Torque restriction	%	0 ~ 999	300
St-07	Load Rate[%]	Load ratio	%	-99999 ~ 99999	0
St-08	Max Load Rate[%]	Maximum Ratio	%	-99999 ~ 99999	0
St-09	Program Version	Program Version			Ver
St-10	I/O Status	I/O Status			1.0

(2) Motor and system parameter (Motor parameters: P1--)

Menu	Menu title	Unit	Display range	Initial value	Mode
* P1-01	Motor ID		0 ~ 99		SPT
* P1-02	JM [gfcms2]	gf-cm-sec^2	0.01 ~ 999.99		SPT
* P1-03	KT [kgfcm/A]	kgf-cm/A	0.001 ~ 999.99		SPT
* P1-04	Ls(Phase)[mH]	mH	0.001 ~ 999.99		SPT
* P1-05	Rs(Phase)[ohm]	ohm	0.001 ~ 999.99		SPT
* P1-06	Is(Rated)[Arms]	A (rms)	0.01 ~ 999.99		SPT
* P1-07	SPD(Max)[RPM]	r/min	0.1 ~ 9999.9		SPT
* P1-08	SPD(Rated)[RPM]	r/min	0.1 ~ 9999.9		SPT
* P1-09	Pole Number	pole	2 ~ 98	8	SPT
* P1-10	Power Amp Type		0 ~ 20	By capacity	SPT
* P1-11	Encoder Type		0 ~ 9	0	SPT
* P1-12	Encoder PLS[PPR]	ppr	1 ~ 10000	2000	SPT
*P1-13	Parameter Lock		0/1	0	SPT

(Caution !) Menus marked with "*" cannot be corrected during Servo-ON.

(3) Control parameter (Control mode: P2--)

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-01	PC P Gain	rad/sec	0 ~ 500	50	P
P2-02	SC LOOP Gain	rad/sec	0 ~ 5000	(Note 1) By capacity	SPT
P2-03	SC I TC [msec]	msec	1 ~ 10000	(Note 2) By capacity	SPT
P2-04	TRQ LMT(+) [%]	%	0 ~ 300	300	SP
P2-05	TRQ LMT(-) [%]	%	0 ~ 300	300	SP
P2-06	Pulse Out Rate	division	1 ~ 16	1	SPT
P2-07	Current Offset		0, 1	0	SP
P2-08	Brake SPD[RPM]	r/min	0.0 ~ 9999.9	50.0	SPT
P2-09	Brake Time[ms]	msec	0 ~ 10000	10	SPT
P2-10	Monitor1 Select		0 ~ 2	0	SPT
P2-11	Monitor1 ABS		0,1	0	SPT
P2-12	Monitor1 Scale	multiple	1.00 ~ 20.00	1.00	SPT
P2-13	Monitor1 offset	%	-100.0 ~ 100.0	0	SPT
P2-14	Monitor2 Select		0 ~ 2	1	SPT
P2-15	Monitor2 ABS		0,1	0	SPT
P2-16	Monitor2 Scale	multiple	1.00 ~ 20.00	1.00	SPT
P2-17	Monitor2 offset	%	-100.0 ~ 100.0	0	SPT
P2-18	Resonant RQ[Hz]	Hz	0 ~ 1000	300	SP
P2-19	Resonant BW[Hz]	Hz	0 ~ 1000	100	SP
P2-20	De-Resonant ENB		0,1	0	SP
P2-21	Inertia Ratio	multiple	1.0~500.0	1.0	SPT
P2-22	Autotune Range		0~9	0	SP
P2-23	Autotune ON/OFF		ON/OFF	OFF	SP

* P2-24	Parameter Init		currt/dFLT	Currt	SPT
P2-25	Power fail Mode		0,1	By capacity	SPT
P2-26	DB Control		0,1	1	SPT
P2-27	Display Select		1~10	1	SPT
P2-28	Zero SPD VIB RJT	r/min	0.0~100.0	0.0	SP
P2-29	Confirm ON/OFF		ON/OFF	ON	SPT

(Note 1) Initial value of SC Loop gain by capacity - FDA-5001C-4C: 500, FDA-5005C-75C: 200

(Note 2) Initial value of SC TC[ms] by capacity - FDA-5001C-4C: 20, FDA-5005C-75C: 50

(Note 3) Initial value of Powerfail Mode by capacity - FDA-5001C-4C: 20, FDA-5005C-75C: 50

(Caution !) Menus marked with "*" cannot be corrected during Servo-ON.

(4) Speed control parameter (Speed Mode: P3--)

Menu	Menu title	Description	Unit	Range	Init. value
P3-01	Group SPD0 [RPM]	Moving speed 0	RPM	0 ~ 9999.9	100
P3-02	Group SPD1 [RPM]	Moving speed 1	RPM	0 ~ 9999.9	500
P3-03	Group SPD2 [RPM]	Moving speed 2	RPM	0 ~ 9999.9	1000
P3-04	Group SPD3 [RPM]	Moving speed 3	RPM	0 ~ 9999.9	1500
P3-05	Group ACC0 [ms]	Moving acceleration time 0	msec	0 ~ 10000	10
P3-06	Group ACC1 [ms]	Moving acceleration time 1	msec	0 ~ 10000	20
P3-07	Group ACC2 [ms]	Moving acceleration time 2	msec	0 ~ 10000	30
P3-08	Group ACC3 [ms]	Moving acceleration time 3	msec	0 ~ 10000	40
P3-09	Group DEC0 [ms]	Moving deceleration time 0	msec	0 ~ 10000	10
P3-10	Group DEC1 [ms]	Moving deceleration time 0	msec	0 ~ 10000	20
P3-11	Group DEC2 [ms]	Moving deceleration time 0	msec	0 ~ 10000	30
P3-12	Group DEC3 [ms]	Moving deceleration time 0	msec	0 ~ 10000	40
* P3-13	FDELAY [ms]	Speed trajectory delay	msec	0.0 ~ 100.0	0
* P3-14	10V Speed[RPM]	10V speed	RPM	0 ~ 9999.9	0
P3-15	Zero Clamp Mode	ZERO Clamp mode		0 ~ 2	0
P3-16	Clamp VOLT[mV]	Clamp voltage	mV	-1000 ~ 1000	0

(5) Position control parameter (Position Mode: P4--)

Menu	Menu title	Description	Unit	Range	Init. value
P4-01	Feedforward[%]	Feedforward Gain	%	0 ~ 100	0
P4-02	In Position	Position decision range	USER	0.001 ~999.999	0.1
P4-03	Following Error	Error and range	USER	-99999.9~99999.9	90000
* P4-04	Pulse Logic	Select Command Pulse forms		0 ~ 5	0
P4-05	FF FLT TC[ms]	Feedforward filter time constant	Msec	0 ~ 10000	0
P4-06	S-Type TC[ms]	Position command filter time constant	Msec	0 ~ 10000	0

(6) Position command parameter (POS Command Mode: P5--)

Menu	Menu title	Description	unit	Range	Init. value
P5-01	Position CMD0	Inner position command 0	USER	-99999.9~99999.9	10
P5-02	Position CMD1	Inner position command 1	USER	-99999.9~99999.9	20
P5-03	Position CMD2	Inner position command 2	USER	-99999.9~99999.9	30
P5-04	Position CMD3	Inner position command 3	USER	-99999.9~99999.9	40
P5-05	Position CMD4	Inner position command 4	USER	-99999.9~99999.9	50
P5-06	Position CMD5	Inner position command 5	USER	-99999.9~99999.9	60
P5-07	Position CMD6	Inner position command 6	USER	-99999.9~99999.9	70
P5-08	Position CMD7	Inner position command 7	USER	-99999.9~99999.9	80
P5-09	Position CMD8	Inner position command 8	USER	-99999.9~99999.9	90
P5-10	Position CMD9	Inner position command 9	USER	-99999.9~99999.9	100
P5-11	Position CMD10	Inner position command 10	USER	-99999.9~99999.9	110
P5-12	Position CMD11	Inner position command 11	USER	-99999.9~99999.9	120
P5-13	Position CMD12	Inner position command 12	USER	-99999.9~99999.9	130
P5-14	Position CMD13	Inner position command 13	USER	-99999.9~99999.9	140
P5-15	Position CMD14	Inner position command 14	USER	-99999.9~99999.9	150
P5-16	Position CMD15	Inner position command 15	USER	-99999.9~99999.9	160
P5-17	Position CMD16	Inner position command 16	USER	-99999.9~99999.9	170
P5-18	Position CMD17	Inner position command 17	USER	-99999.9~99999.9	180
P5-19	Position CMD18	Inner position command 18	USER	-99999.9~99999.9	190
P5-20	Position CMD19	Inner position command 19	USER	-99999.9~99999.9	200
P5-21	Position CMD20	Inner position command 20	USER	-99999.9~99999.9	210
P5-22	Position CMD21	Inner position command 21	USER	-99999.9~99999.9	220
P5-23	Position CMD22	Inner position command 22	USER	-99999.9~99999.9	230
P5-24	Position CMD23	Inner position command 23	USER	-99999.9~99999.9	240
P5-25	Position CMD24	Inner position command 24	USER	-99999.9~99999.9	250
P5-26	Position CMD25	Inner position command 25	USER	-99999.9~99999.9	260
P5-27	Position CMD26	Inner position command 26	USER	-99999.9~99999.9	270
P5-28	Position CMD27	Inner position command 27	USER	-99999.9~99999.9	280
P5-29	Position CMD28	Inner position command 28	USER	-99999.9~99999.9	290
P5-30	Position CMD29	Inner position command 29	USER	-99999.9~99999.9	300
P5-31	Position CMD30	Inner position command 30	USER	-99999.9~99999.9	310

(7) Jog/Original mode parameter (Jog/Origin Mode: P6--)

Menu	Menu title	Description	unit	Range	Init. value
P6-01	Origin SPD0[RPM]	Origin operation speed 0	RPM	0.0 ~ 9999.9	50
P6-02	Origin SPD1[RPM]	Origin operation speed 1	RPM	0.0 ~ 9999.9	10
P6-03	Origin Torque[%]	Damper Origin Torque	%	0.0 ~ 300	50
P6-04	Origin Offset	Coordinates value of Origin Position	USER	-9999.9 ~ 9999.9	0
P6-05	Jog Speed0[RPM]	Jog Operation speed 0	RPM	0.0 ~ 9999.9	100
P6-06	Jog Speed1[RPM]	Jog Operation speed 1	RPM	0.0 ~ 9999.9	200
P6-07	INC Jog Value0	INC Jog Movement quantity 0	USER	0.0 ~ 99999.9	50
P6-08	INC Jog Value1	INC Jog Movement quantity 1	USER	0.0 ~ 99999.9	100

(8) Mechanical mode parameter (Mechanical Mode: P7--)

Menu	Menu title	Description	unit	Range	Init. value
*P7-01	Move Motor	Motor rotation quantity	USER	1 ~ 50000	1
*P7-02	Move Mechanical	Device movement quantity	USER	1 ~ 50000	100
*P7-03	Move Polarity	Movement Direction		0 ~ 1	1
*P7-04	Turret Cycle	Machinery Position per a cycle	USER	0 ~ 50000	0
*P7-05	MPG Move[REV]	Motor rotation quantity	REV	1 ~ 10000	1
*P7-06	MPG Pulse[PLS]	Input MPG Pulse Number	PLS	1 ~ 100000	100
*P7-07	Angle Division	Stop angle division when Jog operation	USER	0 ~ 1000	0

(9) Operation mode parameter (Operation Mode: P8--)

Menu	Menu title	Description	unit	Range	Init. value
*P8-01	Run Mode	Operation Mode		0 ~ 7	1
P8-02	Stop Time [ms]	Continuous operation stop time	msec	0 ~ 10000	10
*P8-03	Limit Select	Limit↔Jog		0 ~ 1	0
*P8-04	Auto Origin	Automatic Origin Operation		0 ~ 1	0

*P8-05	Origin Rule	Origin execution Method		0 ~ 20	2
*P8-06	MPG Select	Select MPG		0 ~ 1	0
*P8-07	ABS ORG SET	Set origin of absolute type encoder		0 ~ 1	0
*P8-08	IN POSITION TYPE	IN POS Complete Signal output type		0~1	1
*P8-09	Stop select	Stop Fuction selection		0,1,2	0
*P8-11	Ias Offset	Save Offset value		99.999~-99.999	
*P8-12	Ics Offset	Save Offset value		99.999~-99.999	
*P8-13	Command abs data	Multi-Turn Data On cmd position		100000~ -100000	
*P8-14	Current abs data	Multi-Turn Data On cur position		100000~ -100000	
*P8-15	ABS Counter2	Abs encoder Data		99999~-99999	
*P8-16	ABS Counter1	Abs encoder Data		99999~-99999	
*P8-17	ABS Counter0	Abs encoder Data		99999~-99999	

(10) Alarm status (Alarm Status: ALS--)

Menu	Menu title	Description	unit	Initial value
ALS01	Alarm Display	Alarm witch happens how		
ALS02	Alarm Reset	Now Reset ALARM		
ALS03	Alarm History	ALARM history		
ALS04	Alarm Reset All	Reset ALARM history		

(11) Jog Operation status (Jog Status)

If press Enter-KEY in Position CMD subordinate Mode, set Jog Mode.

Menu	Menu title	Description	unit	Range	Init. value
	JOG State0	Loader Jog 0		-99999.9 ~ 99999.9	
	JOG State1	Loader Jog 1		-99999.9 ~ 99999.9	
	IJOG State0	Loader I_Jog 0		-99999.9 ~ 99999.9	
	IJOG State1	Loader I_Jog 1		-99999.9 ~ 99999.9	

5.2 Motor and System Parameters (Motor Parameters: P1--)

These parameters are used to set the motor and the system. User must set parameters to suit the motor and the system prior to use.

Menu	Menu title	Description	Unit	Setting range	Initial value	Mode
*P1-01	Motor ID	Motor ID		0 ~ 99	0	SPT

ID	Model	ID	Model	ID	Model	ID	Model	ID	Model
0	Individual input	20	TF05	40	LF03	60	KN03	80	LN03
1		21	TF09	41	LF06	61	KN05	81	LN06
2		22	TF13	42	LF09	62	KN06	82	LN09
3		23	TF20	43	LF12	63	KN07	83	LN12
4		24	TF30	44	LF20	64	KN06A	84	LN12A
5	CKZ5	25	TF44	45	LF30	65	KN11	85	LN20
6	CK01	26	TF09-05	46		66	KN16	86	LN30
7		27		47		67	KN22	87	LN40
8	CK02	28		48		68	KN22A	88	
9	CK04	29		49		69	KN35	89	
10		30	KF08	50	CN04A	70	TN05	90	
11	CN01	31	KF10	51	CN06	71	TN09	91	
12	CN02	32	KF15	52	CN08	72	TN13	92	
13	CN03	33	KF20	53	CN10	73	TN17	93	
14	CN04	34	KF35	54	CN09	74	TN20	94	
15	CN05	35	KF50	55	CN15	75	TN30	95	
16		36		56	CN22	76	TN44	96	
17		37		57	CN30	77	TN75	97	
18		38		58	CN30A	78		98	
19		39		59	CN50	79	KN55	99	

If the motor used is in the above table, input motor ID to [Motor ID(P1-01)].
In such case, [JM (P1-02)], [KT (P1-03)], [Ls(Phase) (P1-04)], [Rs(Phase) (P1-05)], [Is(Rated) (P1-06)], [SPD(Max) (P1-07)], [SPD(Rated) (P1-08)], [Pole Number (P1-09)] among the set values are automatically set, and individual editing is not allowed.
If the motor used is not shown on the above table, or if it is desired to change one or more of the set values related to the motor, input 0 to [Motor ID (P1-01)]..

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-02	JM [gfcms2]	gf-cm-sec^2	0.01 ~ 999.99		SPT

Convert the motor inertia moment in [gf-cm-sec^2] and input the data.

In this mode, input the inertia of the motor which does not include load inertia.

For information on how to input load inertia, see section [Inertia Ratio (P2-22)].

Procedure of converting general unit to that of [gf-cm-sec^2] is as follows.

1[kg-cm^2] $\rightarrow$ 1.02 [gf-cm-sec^2]

1[kg-m^2] $\rightarrow$ 1.02 $\times$ 10^4[gf-cm-sec^2]

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-03	KT [kgfcm/A]	kgf-cm/A	0.001 ~ 999.99		SPT

Convert the motor torque constant in [kgf-cm/A] and input the data.

Torque constant is defined in the torque level corresponding to 1[A, rms].

Procedure of converting MKS unit to that of [kgf-cm/A] is as follows.

1[N-m/A] $\rightarrow$ 10.2[kgf-cm/A]

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-04	Ls(Phase)[mH]	MH	0.001 ~ 999.99		SPT
*P1-05	Rs(Phase)[ohm]	Ohm	0.001 ~ 999.99		SPT

Convert the motor phase inductance in [mH] and input the data.

Convert the motor phase resistance in [Ω] and input the data.

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-06	Is(Rated)[Arms]	A (rms)	0.01 ~ 999.99		SPT

Convert the motor rated current in [A] and input the data.

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-07	SPD(Max)[RPM]	RPM	0.1 ~ 9999.9	5000.0	SPT
*P1-08	SPD(Rated)[RPM]	RPM	0.1 ~ 9999.9	3000.0	SPT

Input motor's maximum speed and rated speed in RPM (r/min).

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-09	Pole Number	Pole	2 ~ 98	8	SPT

Input the number of motor poles.
The number of motor poles is always expressed in even number. Take caution not to input odd numbers.
Our company servo motor has 8 numbers in all.

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-10	Power Amp Type		0 ~ 20	By capacity	SPT

Input the following set values according to the capacity of the servo motor.

5001C	5002C	5004C	5005C	5010C	5012C	5015C	5020C	5030C	5045C	5075C
0	1	2	5	6	7	11	12	13	14	15

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-11	Encoder Type		0 ~ 9	0	SPT

The value has been set to "0" at the time of delivery based on general incremental encoder (A Lead in case of forward run).
(Based on using Our company standard motor)
If other encoders are used, set the value according to the following classification.

Type of encoder	Set value	Remarks
General incremental encoder	0	A lead in case of forward run
General incremental encoder	1	A lead in case of forward run
Sumtak 9-wire incremental encoder	5	Optional
Sumtak absolute value encoder (2048p/r)	6	Optional

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-12	Encoder PLS[PPR]	PPR	1 ~ 10000	2000	SPT

Input the number of pulses on the encoder A and B phases.

Menu	Menu title	Unit	Display range	Initial value	Mode
*P1-13	Parameter Lock		0/1	0	SPT

Set whether parameter locking is to be executed.
0: Parameter correction possible
1: Parameter correction not possible

5.3 Control Parameter (Control Mode: P2--)

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-01	PC P Gain	rad/sec	0 ~ 500	50	P

If the proportional gain is large, the time to reach the command position is reduced. However, if the proportional gain is excessively large, vibration occurs when the motor stops, or overshoot occurs in transient status.

Recommended maximum set value $= \frac{\text{[SC LOOP Gain (P2 - 03)]}}{10}$ **[rad/sec]**

Recommended maximum set value $= \frac{\text{[SC LOOP Gain (P2 - 03)]}}{4}$ **[rad/sec]**

If the maximum set value is exceeded, overshoot may occur on the position.

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-02	SC LOOP Gain	rad/sec	0 ~ 5000	By capacity	SPT

If the speed loop gain is large, high speed response characteristics may be obtained but the normal condition characteristics may become deteriorated. Set appropriate level of loop gain to ensure desired performance.

If the ratio of the overall system inertia (Sum of motor inertia and load inertia) to the motor inertia is set in [Inertia Ratio (P2-22)], or if the value set by using the autotuning [Autotuning (P2-24)] provided with the servo is the same as the following, the recommended set values of [SC Loop Gain (P2-03)] by servo capacity are as follows.

(Caution!) Initial value by capacity - FDA-5001C-4C: 500, FDA-5005C-75C: 200

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-03	SC I TC	Msec	1 ~ 1000	By capacity	SPT

If the SC I TC value is reduced, the characteristic of steady and transient state is improving. But too much reduction brings out the overshoot of speed. So, set appropriate level of TC to ensure desired performance. If “10000” value is inputted, speed control type is “P” type.

(Caution!) Initial value by capacity – FDA-5001C-4C: 20, FDA-5005C-75C: 50

Recommended set value $= \frac{10000}{\text{[SC LOOP Gain(P2-02)]}}$ [msec]

Recommended minimum $= \frac{3000}{\text{[SC LOOP Gain(P2-02)]}}$ [msec]

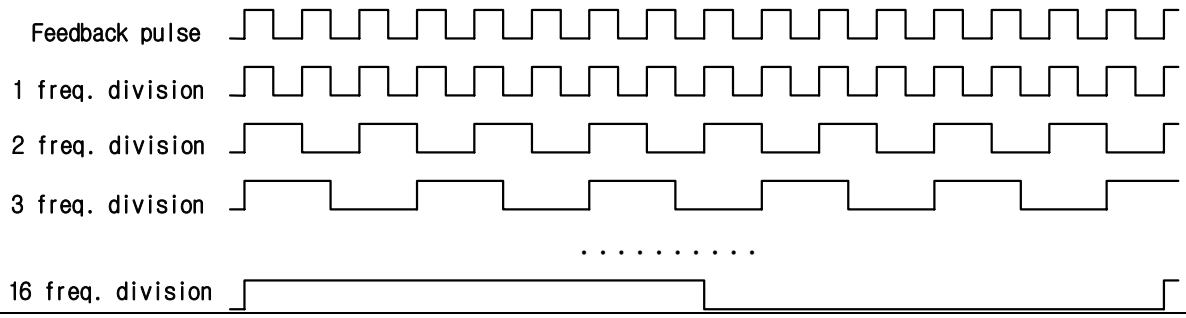
Menu	Menu title	Unit	Display range	Initial value	Mode
P2-04	TRQ LMT(+) [%]	%	0 ~ 300	300	SP
P2-05	TRQ LMT(-) [%]	%	0 ~ 300	300	SP

$$\text{Maximum CW torque} = \frac{[\text{TRQ LMT(+) (P2-05)}]}{100} \times \text{rated torque}$$

$$\text{Maximum CCW torque} = \frac{[\text{TRQ LMT(+) (P2-06)}]}{100} \times \text{rated torque}$$

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-06	Pulse Out Rate	Division	1 ~ 16	1	SPT

Divide the A and B phase encoder pulses fed back from the motor, and set the encoder pulse dividing ratio to be output in line drive method. The allowable dividing ratio is from 1 division to 16 divisions. Input desired dividing ratio in this item. Frequency division is defined as follows.



Menu	Menu title	Unit	Display range	Initial value	Mode
P2-07	Current Offset		0, 1	0	SP

Motor speed may have periodic ripple due to the effects of the servo current offset. If this happens, use the current offset function.
"1" = Automatically offsets current offset during Servo-On.

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-08	Brake SPD[RPM]	RPM	0.0 ~ 9999.9	50.0	SPT

If the servo is turned OFF during servo motor operation and the brake speed is reduced, set the speed which activates the external machine brake in RPM (r/min). The output contact (Brake) is turned OFF at this time.

Menu	Menu name	Unit	Display range	Initial value	Mode
P2-9	Brake Time[ms]	msec	0 ~ 10000	10	SPT
If the servo is turned OFF during servo motor operation and the brake speed is reduced, set the time which activates the machine brake after a specific time irrespective of [Brake SPD (P-29)] in [msec]. The output contact (Brake) is turned OFF at this time. If "0" is input: The machine brake is activated only by [Brake SPD (P-29)], but is not activated according to time.					

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-10	Monitor1 Select		0 ~ 2	0	SPT
P2-14	Monitor2 Select		0 ~ 2	1	SPT
Set parameter to be displayed on the monitor. (0: Position, 1: Speed, 2: Torque)					

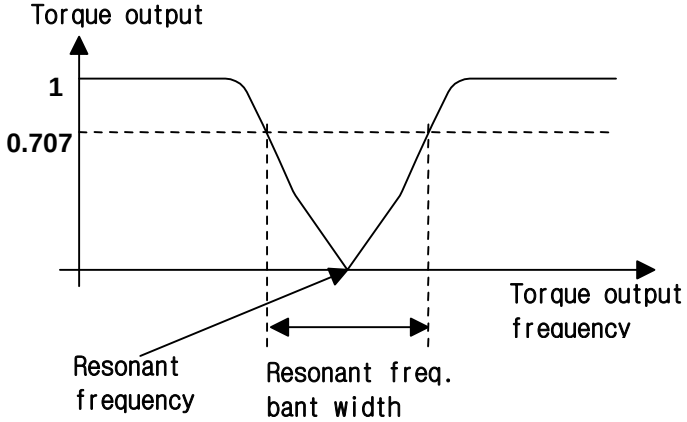
Menu	Menu title	Unit	Display range	Initial value	Mode
P2-11	Monitor1 ABS		0,1	0	SPT
P2-15	Monitor2 ABS		0,1	0	SPT
0: Displays type of symbols 1: Displays absolute values regardless of the type of symbols.					

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-12	Monitor1 Scale	Multiple	1.00 ~ 20.00	1.00	SPT
P2-16	Monitor2 Scale	Multiple	1.00 ~ 20.00	1.00	SPT
This function, in case viewing is difficult because the analog output value is small, enables viewing by multiplying the parameter by appropriate multiples. For example, if 3 is input, the size of the parameter is enlarged by 3 times. Basic magnification: speed, speed command (maximum speed /4[V]) Torque (3 x rated torque /4[V])					

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-13	Monitor1 offset	%	-100.0 ~ 100.0	0.0	SPT
P2-17	Monitor2 offset	%	-100.0 ~ 100.0	0.0	SPT
This function enables output by applying appropriate offset to the analog output value. This is to allow adjustment of the value displayed on 0[V] potential, by applying offset to the monitor display. Unit is [%] and maximum value is 100[%]. Assuming maximum speed is 5000[RPM] and if offset 20 is input to display speed, 1000[RPM], 20[%] of 5000, is displayed on 0[V]					

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-18	Resonant FRQ[Hz]	Hz	0 ~ 1000	300	SP
P2-19	Resonant BW[Hz]	Hz	0 ~ 1000	100	SP

Input the band width of resonant frequency and resonant frequency band in [Hz].



Use resonant frequency greater than $\frac{[\text{SC LOOP Gain (P2-03)}]}{6}$ **[Hz]**

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-20	De-Resonant ENB		0,1	0	SP

0: Resonance removal operation stop
1: Resonance removal operating

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-21	Inertia Ratio	Multiple	1.0 ~ 500.0	1.0	SPT

The system inertia is the sum of motor inertia and load inertia. This item sets the ratio of system inertia to motor inertia in terms of [times].

$$\text{Inertia Ratio} = \frac{\text{System inertia (Motor inertia+load inertia)}}{\text{Motor inertia}}$$

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-22	Autotune Range		0 ~ 9	0	SP

Prior to using the automatic setting function, input approximate ratio of system inertia to motor Inertia ($\frac{\text{System inertia (Motor inertia + load inertia)}}{\text{Motor inertia}}$) to define the range.

If the ratio of system inertia to motor inertia is unknown, input "0".

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-23	Autotune ON/OFF		ON/OFF	OFF	SP
ON: Auto set function is activated and the results are automatically stored in [SC LOOP Gain (P2-03)], [Inertia Ratio (P2-22)].					

Menu	Menu title	Unit	Display range	Initial value	Mode
*P2-24	Parameter Init		Currt/dFLT	currt	SPT
When servo is used, parameters are set in various values. To restore parameters to servo's initial value (basic set value) during operation, press Prog key. When "Parameter dFlt" is displayed on the screen, press Enter key. All parameters except the motor parameters ([P1-01] - [P1-09]) are restored to their initial values.					

Menu	Menu title	Unit	Display range	Initial value	Mode
*P2-25	Powerfail Mode		Currt/dFLT	currt	SPT
0: Maintain ALARM starts until Reset 1: Reset automatic alarm when power supply recover alarm happens.					

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-26	DB Control		0,1	1	SPT

Enables quick motor control during servo operation by turning off SVONEN terminal and forming DB control circuit while the gating motion is turned off when the motor stops. However, if the DB control status is continuously maintained while the motor remains stopped, it is not easy to achieve free-run of the motor in case the user so desires. This menu therefore helps the user to achieve free-run of the motor by turning off the SVONEN terminal to create DB control circuit when controlling the motor and by opening the DB control circuit when the motor comes to a stop.

0: The DB control circuit is activated only during motor control by turning off the SVONEN terminal of the motor, and free-run is activated only below the (P3-11) Zero Speed set value after the motor stops.

1: DB control always operates even when the motor servo is turned off.

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-27	Display Select		1~11	1	SPT

Depending on the set value of [Display Select (P2-28)], the following initial menus can be displayed.

VALUE	Initial Menu	VALUE	Initial Menu	VALUE	Initial Menu
1	CMD Position	5	Limit Speed	9	Program Ver.
2	Current Positior	6	Torque Limit(%)	10	I/O Status
3	Position Error	7	Load Rate(%)	11	P5-01
4	Motor Speed	8	Max.Load Rate		

If set value of [Display Select(P2-27)] is eleven, when power is ON, initial screen is displayed in parameter position CMD0[P5-01]. If we change the set value, position transportation quantity is also changed.
(It must be appointed in position CMD0 by input contact COMSEL0-4)

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-28	Zero SPD VIB RJT	[rpm]	0.0 ~ 100.0	ON	SP

If the motor vibrates at low speed, including zero speed, input the speed range desired to remove vibration from in terms of [rpm].
In this case, in crease the set value on a gradual basis until vibration is reduced.
However, when 0.0 is set, the zero speed vibration suppression function will not operate.

Menu	Menu title	Unit	Display range	Initial value	Mode
P2-29	Conform ON/OFF		ON/OFF	ON	SPT

This menu controls confirmation work when parameters are input. If ON is selected, the servo reconfirms parameter change through the message "OK?" prior to changing parameters. If OFF is selected, the servo changes parameters without going through confirmation process.
This menu is supported only on digital loaders. Parameters are changed without confirmation on mount loaders.

5.4 Speed control parameter (Speed Mode : P3--)

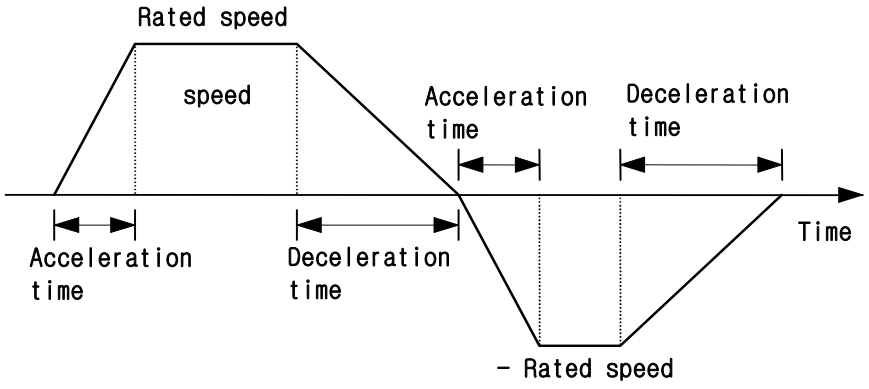
Menu	Menu title	Unit	Display range	Initial value	Mode
P3-01	Group SPD0[RPM]	[RPM]	0.0 ~ 9999.9	100	SP
P3-02	Group SPD1[RPM]	[RPM]	0.0 ~ 9999.9	500	SP
P3-03	Group SPD2[RPM]	[RPM]	0.0 ~ 9999.9	1000	SP
P3-04	Group SPD3[RPM]	[RPM]	0.0 ~ 9999.9	1500	

Input Limit Speed of position CMD[0-07] to [Group SPD0] in [r/min]. In the same way, input limit speed of position CMD[08-15], position CMD[16-23], Position CMD[24-30] to [Group SPD1], [group SPD2], [Group SPD3] respectively.

Menu	Menu title	Unit	Display range	Initial value	Mode
P3-05	Group ACC0[10ms]	10[ms]	0 ~ 10000	10	SP
P3-06	Group ACC1[10ms]	10[ms]	0 ~ 10000	20	SP
P3-07	Group ACC2[10ms]	10[ms]	0 ~ 10000	30	SP
P3-08	Group ACC3[10ms]	10[ms]	0 ~ 10000	40	SP
P3-09	Group DEC0[10ms]	10[ms]	0 ~ 10000	10	SP
P3-10	Group DEC1[10ms]	10[ms]	0 ~ 10000	20	SP
P3-11	Group DEC2[10ms]	10[ms]	0 ~ 10000	30	SP
P3-12	Group DEC3[10ms]	10[ms]	0 ~ 10000	40	SP

[Group Acc] inputs acceleration time in terms of 10[ms] from the stopped status up to the rated speed. If 10 is loaded, speed is accelerated for 100 [ms] up to the rated speed from the stopped status. To increase the acceleration time to the maximum, input 0.

[Group DEC] inputs deceleration time in terms of 10[ms] from the rated speed to the stopped status. If 10 is loaded, speed is decelerated for 100 [ms] from the rated speed to the stopped status. To increase the deceleration time to the maximum, input 0.
Input deceleration/acceleration time of position CMD[0-07] to [Group ACC0],[Group DEC0]
Input deceleration/acceleration time of position CMD[8-15] to [Group ACC1],[Group DEC1]
Input deceleration/acceleration time of position CMD[16-23] to [Group ACC2],[Group DEC2]
Input deceleration/acceleration time of position CMD[24-30] to [Group ACC3],[Group DEC3]

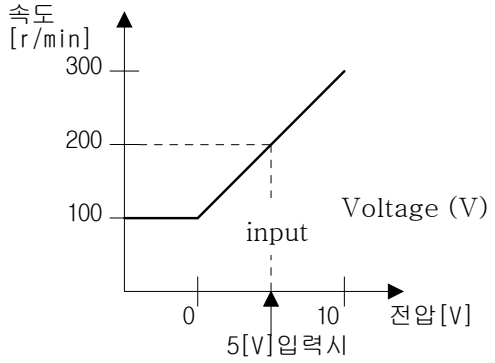


Menu	Menu title	Unit	Display range	Initial value	Mode
*P3-13	FDELAY	msec	0.0 ~ 100.0	0.0	SPT

If vibration and noise happens to the motor, after the motor speed detection value passes through the primary delay filter, input the delay time constant in [msec]. In case noise occurs on the motor shaft during feeding due to vibration, adjust the delay time constant value to reduce noise level. If the value is adjusted too much at a time, problem may occur on speed control. Gradually increase the [FDELAY (P-37)] set value from 0.
Recommended maximum set value = [SCITC (P2-04) set value]
(Example) If P2-04 is 20 [msec], the maximum FDELAY set value is 20, and the speed feedback delay time is 20 [msec].

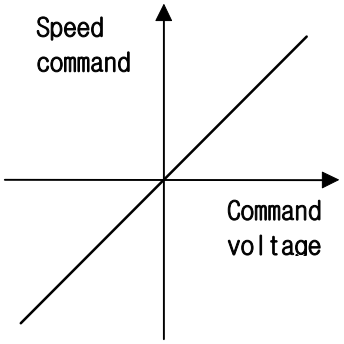
Menu	Menu title	Unit	Display range	Initial value	Mode
*P3-14	10 V Speed	[rpm]	0.0 ~ 100.0	ON	SP

If the motor vibrates at low speed, including zero speed, input the speed range desired to remove vibration fror Speed of [rpm].
In this case, in crease the set value on a gradual basis until vibration is reduced.
However, when 0.0 is set, the zero speed vibration suppression function will not operate.

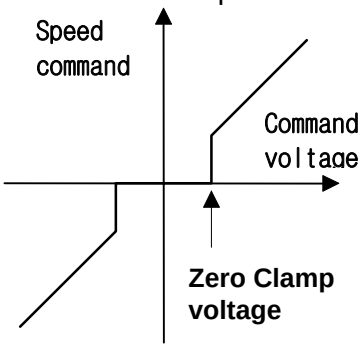


Menu	Menu title	Unit	Display range	Initial value	Mode
P3-16	Zero Clamp Mode		0 ~ 2	0	S

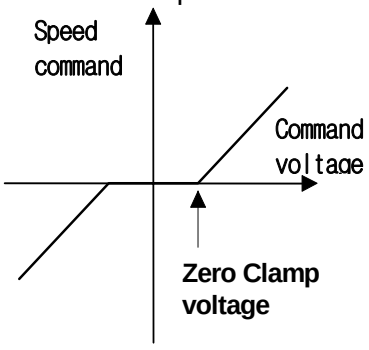
0 : Zero Clamp Mode0



1 : Zero Clamp Mode1



2 : Zero Clamp Mode2



5.5 Position control parameter (Position Mode: P4--)

Menu	Menu title	Unit	Display range	Initial value	Mode
P4-01	Feedforward[%]	%	0 ~ 100	0	P

Input the Feedforward rate of the position command speed in [%]. The delay element of the position controller can be reduced if the value of this item is increased. However, if the value is increased excessively, overshoot may occur on the position system, or performance of the position controller is deteriorated. Select appropriate value. If this value is 0, the position controller becomes a simple position proportional controller.
Refer to the following MAX [Feedforward] value for each K=[SC LOOP Gain]/[PC P Gain] value.

Menu	Menu title	Unit	Display range	Initial value	Mode
P4-02	In Position	Pulse	0 ~ 99999	100	P

Input the error range of the position where (INPOS) contact is turned ON in the unit (after multiplying by 4) of pulse quantity. In other words, if the difference between the position pulse and command pulse is within the range set at [In Position (P4-04)], (INPOS) is turned ON.

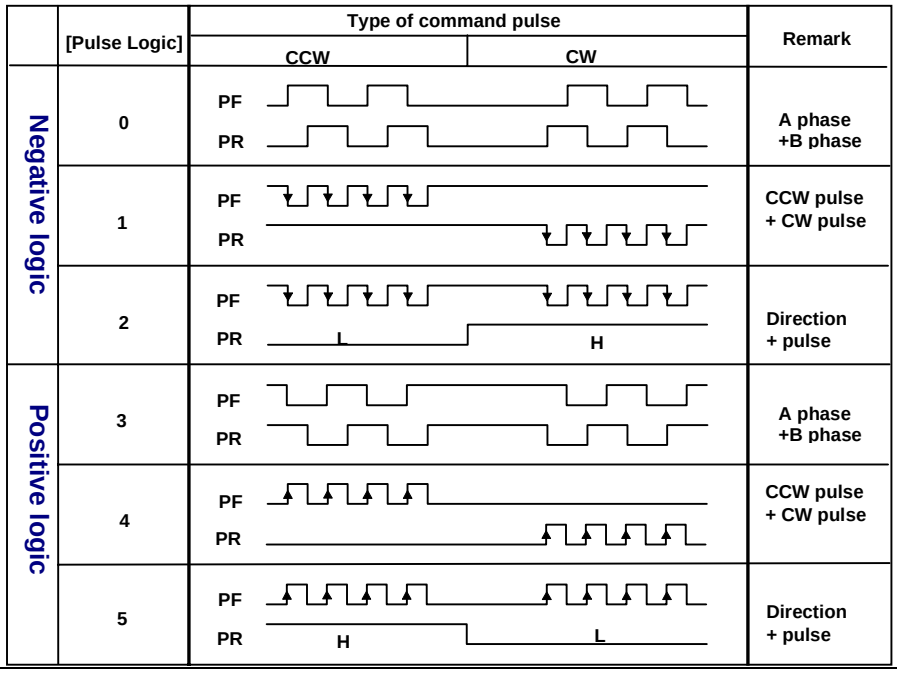
Menu	Menu title	Unit	Display range	Initial value	Mode
P4-03	FLLW ERR [PULSE]	Pulse	0 ~ 99999	20000	P

Set the range of the transient position error detection in [User]
When MPG mode, in normal condition, the position error is
In normal condition, the pulse error is

$$\frac{1\text{-}0.01\times[\text{Feedforward (P4-01)}]}{[\text{PC P Gain (P2-02)}]} \times (\text{MPG input pulse freq.[hz]}) \times \frac{\text{Move Mechanical}}{\text{Move motor*4*Encoder PL}}$$

In case ([Pulse Logic (P4-14)] is 0 or 3, set value greater than x4) value. Set the greater value than this.

Menu	Menu title	Unit	Display range	Initial value	Mode
*P4-04	Pulse Logic		0 ~ 5	1	P



Menu	Menu title	Unit	Display range	Initial value	Mode
P4-05	FF FLT TC[ms]	msec	0 ~ 10000	0	P

Input the primary filter time constant of the position command speed Feedforward in [msec]. The loaded position command is differentiated and passes through the primary filter before it is used as the Feedforward input. The time constant of this filter can be adjusted. Increase this value in applications where the position command is rapidly changed, and decrease this value in applications where the position command is slowly changed. Input 0 in case it is not needed to use this filter.

Menu	Menu title	Unit	Display range	Initial value	Mode
P4-06	CMD FLT TC[ms]	msec	0 ~ 10000	0	P

Input the filter time constant of the position command input in [ms].
The output which passes through the primary filter is used as the position command for the loaded position command. Set the time constant of this filter. Enter 0 in case it is not needed to use this filter.

5.6 Position Command Parameter(POS Command Mode : P5--)

Menu	Menu title	Script	Unit	Range	Initial value
P5-01	Position CMD0	Inner position command 0	User	-99999.9-99999.9	10
P5-02	Position CMD1	Inner position command 1	User	-99999.9-99999.9	20
P5-03	Position CMD2	Inner position command 2	User	-99999.9-99999.9	30
P5-04	Position CMD3	Inner position command 3	User	-99999.9-99999.9	40
P5-05	Position CMD4	Inner position command 4	User	-99999.9-99999.9	50
P5-06	Position CMD5	Inner position command 5	User	-99999.9-99999.9	60
P5-07	Position CMD6	Inner position command 6	User	-99999.9-99999.9	70
P5-08	Position CMD7	Inner position command 7	User	-99999.9-99999.9	80
P5-09	Position CMD8	Inner position command 8	User	-99999.9-99999.9	90
P5-10	Position CMD9	Inner position command 9	User	-99999.9-99999.9	100
P5-11	Position CMD10	Inner position command 10	User	-99999.9-99999.9	110
P5-12	Position CMD11	Inner position command 11	User	-99999.9-99999.9	120
P5-13	Position CMD12	Inner position command 12	User	-99999.9-99999.9	130
P5-14	Position CMD13	Inner position command 13	User	-99999.9-99999.9	140
P5-15	Position CMD14	Inner position command 14	User	-99999.9-99999.9	150
P5-16	Position CMD15	Inner position command 15	User	-99999.9-99999.9	160
P5-17	Position CMD16	Inner position command 16	User	-99999.9-99999.9	170
P5-18	Position CMD17	Inner position command 17	User	-99999.9-99999.9	180
P5-19	Position CMD18	Inner position command 18	User	-99999.9-99999.9	190
P5-20	Position CMD19	Inner position command 19	User	-99999.9-99999.9	200
P5-21	Position CMD20	Inner position command 20	User	-99999.9-99999.9	210
P5-22	Position CMD21	Inner position command 21	User	-99999.9-99999.9	220
P5-23	Position CMD22	Inner position command 22	User	-99999.9-99999.9	230
P5-24	Position CMD23	Inner position command 23	User	-99999.9-99999.9	240
P5-25	Position CMD24	Inner position command 24	User	-99999.9-99999.9	250
P5-26	Position CMD25	Inner position command 25	User	-99999.9-99999.9	260
P5-27	Position CMD26	Inner position command 26	User	-99999.9-99999.9	270
P5-28	Position CMD27	Inner position command 27	User	-99999.9-99999.9	280
P5-29	Position CMD28	Inner position command 28	User	-99999.9-99999.9	290
P5-30	Position CMD29	Inner position command 29	User	-99999.9-99999.9	300
P5-31	Position CMD30	Inner position command 30	User	-99999.9-99999.9	310
Input position command by User's unit. If push the ENTER-Key in Digital Loader(P1-01 ~ P1-31). We can enter the loader Jog Mode					

[Loader Jog Mode]

The jog Mode comprises sub-menu of position command mode.

The jog mode operates even when status of non-contact, only possible in Digital Loader.

In Position command subordinate mode

Digital loader: “ENTER-Key”

Menu	Menu title	Script	Unit	Range	Initial value
	JOG State0	Loader Jog 0		-9999.9-9999.9	
Display current position					

If >(right) key is pressed, motor runs CW with Jog Speed 0[P6-05].

If <(left) key is a pressed, motor run CCW with Jog Speed 0.

Digital Loader: ”DOWN-Key”

Menu	Menu title	Script	Unit	Range	Initial value
	JOG State1	Loader Jog 0		-9999.9-9999.9	
Display current position.					

If >(right) key is pressed, motor runs CW with Jog Speed 1[P6-06].

If <(left) key is pressed, motor runs CCW with Jog Speed 0.

Digital Loader: ”DOWN-Key”

Menu	Menu title	Script	Unit	Range	Initial value
	IJOG State0	Loader Jog 0		-9999.9-9999.9	
Display current position					

If >(right) key is pressed, motor runs CW like the position at INC Jog Value0 [P06-07],

If <(left) key is a pressed, motor run CCW like the position at INC Jog Value0.

Digital Loader: ”DOWN-Key”

Menu	Menu title	Script	Unit	Range	Initial value
	IJOG State1	Loader Jog 0		-9999.9-9999.9	
Display current position					

If >(right) key is pressed, motor runs CW like the position at INC Jog Value1 [P06-07],

If <(left) key is a pressed, motor run CCW like the position at INC Jog Value1.

Digital Loader “ENTER-Key”: Save Current Position Data at Position CMD

Digital Loader “PROG-Key”: Not save Current Position Data at Position CMD

5.7 Jog/Original Mode Parameter (Jog/Origin Mode: P6--)

Menu	Menu title	Description	Unit	Range	Initial value
P6-01	Origin SPD0[r/min]	Origin operation speed 0	r/min	0.0-9999.9	50
P6-02	Origin SPD1[r/min]	Origin operation speed 1	r/min	0.0-9999.9	10
Move [Origin SPD0] to the ultimate contact point position when operation in origin. User can not set the deceleration/acceleration on operation in origin					

Menu	Menu title	Description	Unit	Range	Initial value
P6-03	Origin Torque[%]	Damper origin torque	%	0.0-300.0	50
[Origin Torque] is used to discern the collision machinery part with Damper when operation in Damper Origin. If this value is 100[%], torque is rated, discern that it collided the damper, start rotation in opposite direction					

Menu	Menu name	Description	Unit	Range	Initial value
P6-04	Origin Offset]	Coordinates value of origin	User	-9999.9-9999.9	0
Input the coordinates value of users.					

Menu	Menu title	Description	Unit	Range	Initial value
P6-05	Jog Speed0[r/min]	Jog operation speed 0	r/min	0.0-9999.9	100
P6-06	Jog Speed0[r/min]	Jog operation speed 0	r/min	0.0-9999.9	200
Use [Jog Speed 0] with move speed value, when operating in Jog Mode with contact point Can use Jog speed of two steps when operating in Digital Loader * MPG Speed is applied to P6-05(Jog_Speed0).					

Menu	Menu title	Description	Unit	Range	Initial value
P6-07	INC Jog Value0		User	0.0-9999.9	50
P6-08	INC Jog Value0		User	0.0-9999.9	100
When operating in jog, can set the moving quantity about one command with two steps. Input moving quantity with user's coordinates value moving speed cannot be set by user operation in jog is only possible Digital Loader					

5.8 Mechanical Parameter (Mechanical Mode : P7--)

Menu	Menu title	Description	Unit	Range	Initial value
*P7-01	Move Motor		USER	1-10000	1
*P7-02	Move Mechanical		USER	1-10000	100

Moving motor and Move Mechanical set the rate of moving quantity of user's coordinates and the encoder pulse number equivalent this.
Ex) 1) If we hope to use the coordinates of unit in [mm] about the machine which moves 10.0mm per rotation, only set Move Motor='1' and Move Machines='10'
2) If we hope to use the coordinates of unit in [degree] about the machine which moves 360.0 degree per fifty rotations, only set Move Motor='50' and Move Machines='360'

Menu	Menu title	Description	Unit	Range	Initial value
*P7-03	Move Polarity	Direction of movement		0-1	1

0: User's coordinates is increased, when motor rotates opposite direction(CW direction)
Ex) When use the input contact point CCWJOG : Motor rotates CW direction.
When use the input contact point CWJOG : Motor rotates CCW direction.
1: User's coordinates is increase, when motor rotates right direction(CCW direction)

Menu	Menu title	Description	Unit	Range	Initial value
*P7-04	Turret Cycle	Position on mechanical cycle	User	0-10000	0

When move 360.0 degree structures coordinates of machine, approach the same point again, as in the case of irrelevant to rotation direction, if wish to move from the current position 359.0 degree to 0,0, it needs movement of –359.0 degree. But if only move current position 359.0by 1.0 because 0.0 equal to 360.0, approach the wanting points.
As in the case of this, if Turret Cycle value is set to 360.0. It is controller by automatically moving near direction when operation (short distance discrimination function)
(Caution!) Short distance discrimination function must only use in Turret Operation
When exists pressed pipe or wire in lead side, using Turret Cycle function, don't use wiring can get intertwined.
If Turret Cycle value is set to 0.0, this function doesn't be used.

Menu	Menu title	Description	Unit	Range	Initial value
*P7-05	MPG Move[REV]]	Rotation quantity of motor	User	0-10000	1

Set the rotation quantity about input command pulse or MPG pulse

Menu	Menu title	Description	Unit	Range	Initial value
*P7-06	MPG Pulse[REV]		User	0-100000	100

Set command pulse or MPG pulse input quantity.
Ex) If set to P7-05=1, P7-06=100, when MPG pulse is putted 100 pulse motor rotates one revolution
Namely, pulse number/one revolution= P7-06/P7-05= 100 pulse / 1 rotation

Menu	Menu title	Description	Unit	Range	Initial value
*P7-07	Angle Division	Stop angle division in JOG operation	User	0-1000	0
When using turret operation mode, as in the case of stopping in JOG operation, Set the ordinary rate of the angle that is stopped. Ex) If set value=30 When operating in JOG Mode, as in the case of inputting the stop command in optional angle only stop the multiples of 30 degree which is set (Danger !) RUN_MODE[P8-01]: Only applied in zero turret operation Digital Loader As in the case of IJOG transportation by Digital Loader and stop by input contact point STOP. Angle-division-stop doesn't operate					

5.9 Operational Mode Parameter (Operation Mode : P8--)

Menu	Menu title	Description	Unit	Range	Initial value
*P8-01	RUN_MODE	Operation Mode		0-7	1

Set the operation type (3.3.4 reference the operation timing diagram)

0: Absolute position operation (Turret operation)
Can choose the absolute position in COMSEL0-4, if the position come to by the input of START signal, position completed signal is displayed by OP0-4.
Also, as in the case of using with angle operation like Turret of construction machines, if Turret Cycle(P7-04) is set to 360, short distance discrimination function is operated. If it always hopes to stop in the multiple of fixed angle, during the operation by input contact point JOG terminal, use Angle Division(P7-07)

1: Relative position STEP Manual operation (Roll Feeder STEP Manual operation)
Can choose the relative position in COMSEL0-4, display the position completed signal by INPOS position

2: Relative position AUTO Manual operation (Roll Feeder AUTO Manual operation)
Can choose the relative position in COMSEL0-4, if START signal is putted on time, it's position transports stop time during continuous transportation is set by STOP_TIME(P8-02), if approached the position, display the position completed signal by INPOS position

3: Absolute sequence STEP Manual operation, whenever put the START Signal the sequenced set value 4Point(Position CMD 0,8,16,24) about absolute position, position is transported, if approaches the position.

4. Absolute position sequence STEP Auto operation
If put a START signal sequenced set value 4Point(Position CMD 0,8,16,24) about absolute position, it's position is transported stop time during continuous transportation is set by STOP_TIME(P8-02). If approach the position, display the position complete signal by INPOS.

5 : Relative Position PROCESS Operation

If START signal is putted on time, transport in the CCW direction. At this time, speed is Origin Spd0(P6-01).

After that, detect Dog signal and transport to selected relative position in COMSEL0-4.

* caution : can't execute seeking the origin point in process operation.

Danger!) After RUN_MODE changes, it is necessary that we use after origin operation. It may cause an accident.

Menu	Menu title	Description	Unit	Range	Initial value
*P8-01	RUN_MODE	Operation Mode		0-7	1

Set the operation type (3.3.4 reference the operation timing diagram)

6 : Relative Position PROCESS Operation

If START signal is putted on time, transport in the CW direction. At this time, speed is Origin Spd0(P6-01).

After that, detect Dog signal and transport to selected relative position in COMSEL0-4.

* caution : can't execute seeking the origin point in process operation.

* 5,6 PROCESS Operation is the same except initial direction.

7 : Absolute Position RETURN Operation

If START signal is putted on time, return to selected absolute position in COMSEL0-4.

If you start input once more, system is not transported.

Danger!) After RUN_MODE changes, it is necessary that we use after origin operation. It may cause an accident.

Menu	Menu title	Description	Unit	Range	Initial value
P8-02	STOP_TIME	Continuous operation stop time	10msec	0-10000	10

When operation in relative position STEP Auto operation/Absolute position sequence STEP Auto operation MODE set stop time of each step the unit in 10[msec]

Menu	Menu title	Description	Unit	Range	Initial value
*P8-03	LIM_SEL	Limit<->Jog		0-1	0

Can choose the function of input contact point switch CCWLimit, CWLimit
0: Operate the function of CCWLimit, CWLimit
1: Operate the function of CCWJog, CWJog

Menu	Menu title	Description	Unit	Range	Initial value
*P8-04	AUTO_ORG	Automatic Origin operation		0-1	0

If first makes SVON after putting the power source, can automatically operate Origin function by ORG_RULE(P8-05)
0: Cannot operate automatically Origin function
1: Can operate automatically Origin function

Menu	Menu title	Description	Unit	Range	Initial value
*P8-05	ORG_RULE	Operation method of origin		0-16	2

Can set the method of seeking the origin point
0: Don't seek the origin point.(when the power source is on, it's position is the origin, as in the case of this, ORGOUT output is maintained state)
1,2 : Seek the origin point by using the CWLimit
3,4 : Seek the origin point by using the CCWLimit
5,6 : Seek the origin point by using the CWLimit Switch and origin DOG switch
7,8 : Seek the origin point by using the CCWLimit Switch and origin DOG switch
9,10 : Progress in CW->CCW direction, seek the origin point by using origin DOG switch
11,12 : Progress in CCW->CW direction, seek the origin point by using origin DOG switch
13,14 : Seek the origin point by using the CW Damper
15,16 : Seek the origin point by using the CCW Damper
Right direction in situation of servo motor is rotation direction when operation phase rotation U->V->W in sequence as in the case of our company Servo motor it is CCW direction
When use the CCW with switch establish the tail of the right direction rotation (CW is opposite direction) by the operation method in, ultimate origin point change.

Operation way	Final Position	Final Value
Odd number	Z phase position + ORIGIN OFFSET(P6-04)	0
Even number	Final z phase pulse position	Origin Offset(P6-04) Setting value

(reference !) A detailed contact reference that follows chapter six origin point operation method.

(Caution !) Origin point operation method of absolute value encoder reference the menu P8-07[ABS_ORG_SET]

Menu	Menu title	Description	Unit	Range	Initial value
*P8-06	MPG_SEL	Select MPG		0-1	0

Can choose presence of MPG function

0: Can't use MPG function

1: Can use MPG function COMSEL4/MPGEN contact point='1' of input

As, in the case of this, position command be able to use to position CMD0-14 using input contact point COMSEL0-3

* MPG Speed is applied to P6-05(Jog_Speed0).

Menu	Menu title	Description	Unit	Range	Initial value
*P8-07	ABS_ORG_SET	Set origin point of Absolute encoder		0~1	0
This is the menu of operating the origin point of absolute type encoder. Ex) Consider to motor for absolute type encoder, after move motor to the position equivalent to origin point, if set the P8-07[ABS_ORG_SET]=1, over changing 1->0 after 1-2 seconds, current position is considered as an origin point					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-08	IN POSITION TYPE	IN POS Complete Signal Output Type		0~1	1
You can select IN POS Complete Signal Output Type 0 : When position decision ,Selected Position CMD0~30 Output via OP0 ~ OP4 1 : When position decision , Output via INPOS					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-09	STOP SELECT	STOP Function selection		0, 1, 2	0
This function is available to RETURN Operation (P8-01="7"). 0 : Stop at present position 1 : Stop at Start position 2 : Stop at Command position					

Menu	Menu title	Description	Unit	Range	Initial value
P8-11	Ias Offset	Save Offset value		99.999~-99.999	
Save Ias_Offset Value to P8-11.					

Menu	Menu title	Description	Unit	Range	Initial value
P8-12	Ics Offset	Save Offset value		99.999~-99.999	
Save Ics_Offset Value to P8-12.					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-13	Command ABS Data	Multi-Turn Data On CMD Position		100000~-100000	
Save Multi-Turn Data.					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-14	Current ABS Data	Multi-Turn Data On CUR Position		100000~-100000	
Save Multi-Turn Data.					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-15	ABS Counter 2	Abs Encoder Data		99999~-99999	
Save compensated value of Multi-Turn Data overflow prior to RESET in Turret Cycle. (Abs Encoder Overflow reset compensated value)					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-16	ABS Counter 1	Abs Encoder Data		99999~-99999	
Save position data of Multi-Turn 1024 unit prior to power off . (Abs Encoder the latest Multi-Turn portion➔ Display 8 portion of 8192 Turns)					

Menu	Menu title	Description	Unit	Range	Initial value
*P8-17	ABS Counter 0	Abs Encoder Data		99999~-99999	
Save the initial value of encoder in ABS Encoder origin initialization.					

5.10 Description of servo status (Status Window: St--)

Screen display	Description
Motor Speed[RPM] St-01	Indicates current motor speed in [RPM]
CMD Speed[r/min] St-02	Indicates servo motor speed command in [RPM]
CMD Pulse St-03	Indicates current command pulse when controlling positions
Feedback Pulse St-04	Indicates feedback pulse when controlling positions
Pulse ERR St-05	Indicates the difference between the current command pulse and feedback pulse when controlling positions
Speed Limit[r/min] St-06	Current speed limit value when controlling torques
Torque Limit[%] St-07	Indicates current torque limit value in [%]
Load Rate [%] St-08	Indicates current motor load in [%] based on torque
Max Load Rate[%] St-09	Indicates maximum servo torque
Inertia Ratio St-10	Indicates inertia ratio (system inertia/motor inertia) in [multiple]
Program Version St-11	Indicates current program version
I/O CON. STATUS	Indicates contact I/O status

5.10.1 Digital Loader

(1) Input signal display

The status of input contact recognized within the system is indicated with either "0" or "1". Therefore, if the status input from the external sources is different from the displayed information, it indicates problem on the input system. As each signal carries different meaning, explanation is provided through examples below.

(Example of display)

IN :	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**
IN :	ALIMRST	ORGCOM	ORG	CWLIM	CCWLIM	SVONNE	START	COMSEL[4,3,2,1,0]				

1: Input signal operating

0: Input signal not operating

Signal	Display	Description
COMSEL0	1	Position command = set Position CMD[1]
COMSEL1	0	
COMSEL2	0	
COMSEL3	0	
COMSEL4	0	
START	1	JOB start command operation
SVONEN	1	Servo motor start command operation
CCWLIM	0	CCW direction rotation not possible
CWLIM	1	CW direction rotation possible
ORG-DOG	0	Situate outside Dog switch domain
ORGCOM	0	Origin Command disable
ALIMRST	0	Alarm reset function disable

The above examples are based on the current status of each signal. System operates in reverse if signals are in opposite status

(2) Output signal display

As each signal carries different meaning, explanation is provided through examples below.

(Example of display)

OUT :	1	1	1	1	1	1	1	1	1
OUT :	OP4	OP3	OP2	OP1	INPOS/OP0	ALARM	BRAKE	RDY	ORGOUT

1: Output signal operating

0: Output signal not operating

Signal	Display	Description
ORGOUT	1	Completely reach the origin point displayed
RDY	1	No Alarm, power good displayed.
BRAKE	1	Motor brake reset signal display.
ALARM	1	No Alarm displayed

INPOS/OP0	1	Command position reached displayed/(Turret operation position reached displayed 0)
OP1	1	(TURRET operation) Command position reached displayed 1
OP2	1	(TURRET operation) Command position reached displayed 2
OP3	1	(TURRET operation) Command position reached displayed 3
OP4	1	(TURRET operation) Command position reached displayed 4

The above examples are based on the current status of each signal. System operates in reverse if signals are in opposite status

5.11 Alarm Status Display (Alarm Status : ALS--)

Menu	Menu title	Description	Mode
ALS01	Alarm Display	Displays current alarms (In normal condition: displays "normal").	SPT
ALS02	Alarm Reset	Resets current alarms.	SPT
ALS03	Alarm History	Displays the latest 10 alarms.	SPT
ALS04	Alarm Reset All	Resets all alarm history stored in the Alarm History.	SPT

[Details of ALARM displays (sub-menus)]

Menu	Menu title	Cause
Normal		Normal operating condition
AL-00	EMER STOP	External ESTOP contact input turned OFF
AL-01	OVER CURNT	Driver output terminal (U, V, W) short-circuited; output overcurrent
AL-02	OVER VOLT	Input voltage excessive (greater than 280V); regeneration brake resistance burned; load GD^2 excessive
AL-03	OVER LOAD	Mechanical overload; motor miswiring
AL-04	POWER FAIL	Main power disconnected when Servo is ON
AL-05	LINE FAIL	Motor and encoder set value error, motor miswiring, and mechanical overload
AL-06	OVER HEAT	Heat shield overheated
AL-07	OVER SPEED	Gain excessive, menu set value error, excessive gravity load
AL-08	FOLLOW ERR	Rapid deceleration/acceleration, gain set value error, command pulse frequency excessive (greater than 300 kpps), miswiring, mechanical overload

AL-09	Output NC	Output (U, V, W) open phase
AL-10	PPR ERROR	Encoder pulse level setting error
AL-11	ABS DATA	Absolute value encoder data transmission error
AL-12	ABS BATT	Battery level below 2.8V
AL-13	ABS MDER	Absolute value encoder multi-rotation data transmission error
AL-14	ORG ERR	Origin Search Err.
Parameter Err 1		Unchangeable parameter input tried during servo ON, parameters locked
Parameter Err 2		Set value input error

In case of an alarm, the alarm signal output contact(ALARM) is turned off and the motor stops by the action of the dynamic brake.

To reset the contents of current alarms, use the Alarm Reset (ALS02) menu, or use the input contact ALMRST (CN1-38) terminal.

The submenu of Alarm History (ALS03) includes Alarm 1, Alarm 2, Alarm 3, Alarm 4, Alarm 5, Alarm 6, Alarm 7, Alarm 8, Alarm 9, and Alarm 10 which are the past alarms. Alarm 1 indicates the latest alarm, while the remaining alarms indicates those which occurred previously.

To reset all past alarm history, use the menu Alarm Reset All (ALSO4). However, EMER STOP (AL-00) cannot be stored in the Alarm History (ALS03).

6. Operation Mode and How to use

6.1 An important point check and set items, when operation

Before servo operating, surely check and set the items below.

***** Set error can damage to servo and machines.**

1) Where it is rightly chosen the form of purchase product.

Title	Parameter		Setting
	No.	Name	
Servo moter	P1-01	Motor ID	Set ID number according to servo motor types.
Drive	P1-10	Amp Type	Set ID number according to drive types.
Encoder	P1-11	Encoder Type	Set ID number according to encoder signal types.
Encoder pulse	P1-12	Encoder Pulse	Set encoder pulse number.

2) Notify Brake reset sequence when using motor internal brake

Title	Parameter		Setting
	No.	Name	
Speed of brake operation	P2-08	Brake SPD	Set brake operation starting speed when stopping.
Time of brake operation	P2-09	Brake Time	Operate brake after passing the set time when stopping.

→ Check the brake operation parameter set whether there is error or not.

→ Check whether brake out contact was connected with drive unit.

→ Check the output voltage of brake drive unit.

3) Set proper gain according to the inertia of load

Title	Parameter		Setting
	No.	Name	
Position proportional gain	P2-01	PC P Gain	Reference below
Speed loop proportional gain	P2-02	SC LOOP Gain	Reference below
Speed integral	P2-03	SC I TC	Reference below
Inertia ratio	P2-21	Inertia Ration	Reference below
Auto setting range	P2-22	Automatic Range	Reference below
Auto setting ON/OFF	P2-23	Autotune ON/OFF	Reference below

a) How to autotunning

Autotuning only use in case of rotating motor over a fifty times make OFF after set during normal operation.

Set the range according to roughly inertia ratio.

Inertia ratio	setting	Inertia ratio	setting
Unknown	0	15-100	5
1-3	1	25-200	6
2-10	2	100-300	7
3-15	3	200-400	8
10-25	4	300-500	9

* inertia ratio = (inertia of motor + load inertia)/motor inertia

→If autotuning(P2-23) is on and practice five times deceleration and acceleration operation inertia value is saved to P2-21.

→If the value of inertia ratio is set make the autotunning OFF

b) How to gain tuning

→ Incase of knowing the inertia ration, Input the inertia ratio passively.

→ Tune the below value according to the inertia ratio.

Inertia ratio		Setting				
60,80	130	SC LOOP Gain (P2-02)	SC I TC (P2-03)		PC P Gain (P2-01)	
1		500	20	6	50	125
2		350	30	9	35	85
3		290	35	11	29	70
5	1	220	45	14	22	55
10	2	160	60	19	16	40
20	3	110	90	27	11	27
50	5	70	140	42	7	18
100	10	50	200	60	5	13
	20	30	300	100	3	8

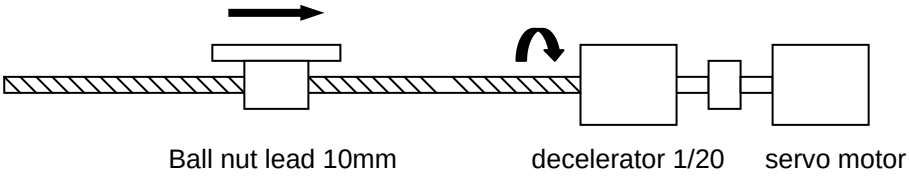
→ If the SC Loop gain is too low, vibration occurs and response becomes fast if it is high, but vibration occurs if the gain is excessively high. Response becomes fast if SC I TC is reduced, but overshoot occurs if it is reduced excessively. Position reaching time is shortened if the PC P gain is increased; however, excessive gain may cause vibration and overshoot.

→ If SC Loop Gain is too low, vibration happens and if SC Loop Gain is high, response becomes more fast, but SC Loop Gain is to high, vibration happens. In case that happens noise by vibration in motor, tune FDELAY(P3-13). If FDELAY increase, noise is lessen, but it is stable that is used within SCITC value.

→ If motor is unstable in above course, inquire technique department. That records parameter tunned is good

6.2 How to operate absolute position

6.2.1 Rectangular coordinate operation



1) Set machine momentum

ex) In case of 10 pulse per rotation : MPG MOVE[P7-01]=2 & Device moving quantity [P7-01]=1

2) Set moving direction[P7-03]

In case of CW, Coordinates value increases : 0

In case of CCW, Coordinates value decreases : 1

3) Set MPG operation

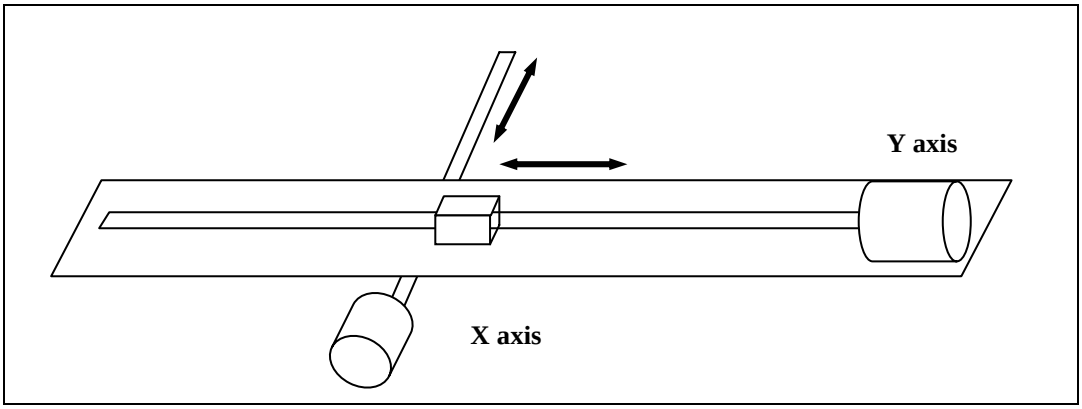
In case of using MPG, can only use the position coordinates till 0-15 MPG signal equals to COMSEL4 and coordinates selection use four input contact of COMSEL0-COMSEL3.

MPG Speed is applied to P6-05(Jog_Speed0).

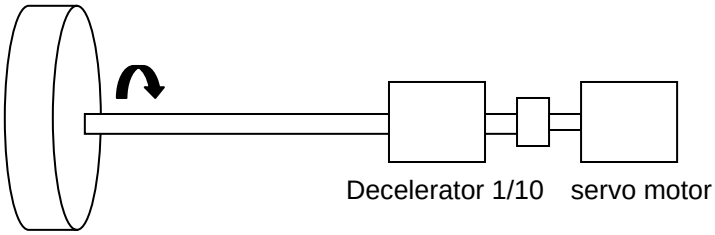
4) Main application field

31 point operating I/O selection in an axis or multiple axes which don't use interpolation function.

ex) Application to two Robot(In case of simple coordinate movement operation: Can operation till 31 points)



6.2.2 Rotary coordinate operation



1) Set machine momentum

ex) In case of 10 pulse per rotation : Motor revolution quantity [P7-01]=10 & Device moving quantity[P7-02]=360

2) Set moving direction[P7-03]

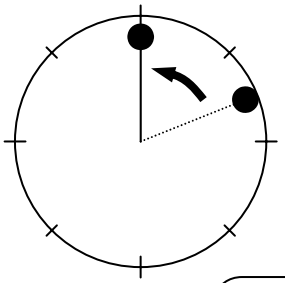
In case of CW, Coordinates value increases : 0
In case of CCW, Coordinates value decreases : 1

3) Set MPG operation

In case of using MPG, can only use the position coordinates till 0-15 MPG signal equals to COMSEL4 and coordinates selection use four input contact of COMSEL0-COMSEL3.

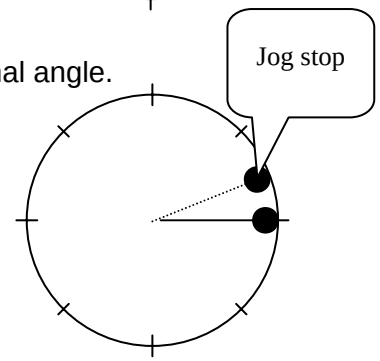
4) Short distance discrimination function.

In case that becomes the position after one cycle and regardless of rotation direction in machine structure, discriminate short distance and make rotation operation on such direction.



5) Angle division stop in JOG.[P7-07]

Although stop command is putted in JOG operation mode at optional angle. stop at set value angle division position.
ex) In case of [P7-07]=45

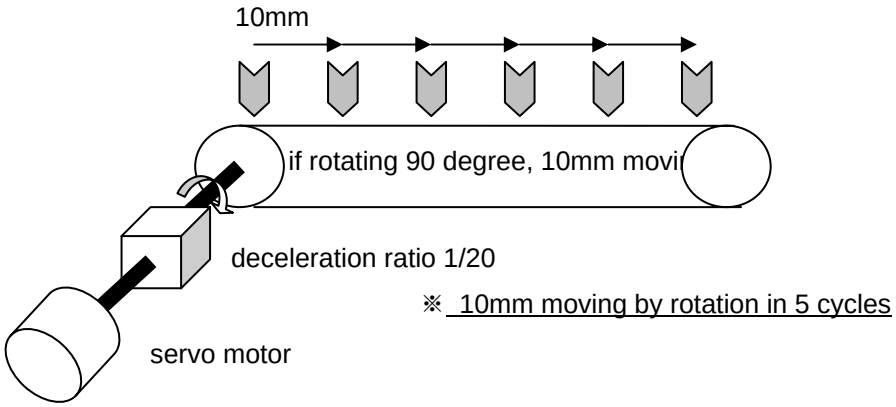


6) Main application field

Do the turret of building machine or addition axis and all sorts INDEX machine angle division operation.

6.3 How to use relative position operation.

6.3.1 Roll Feeder operation



1) Set machine momentum

ex) In case of 10 pulse per rotation : Motor revolution quantity [P7-01]=5 & Device moving quantity[P7-02]=10

2) Set moving direction[P7-03]

In case of CW, Coordinates value increases : 0

In case of CCW, Coordinates value decreases : 1

3) Position completion signal: INPOS(Completion of position decision) : 48 No. terminal of CN1

As a set the position decision range [P4-02] can display completion signal within fixed range.

4) Autotunning stopping time[P8-02]

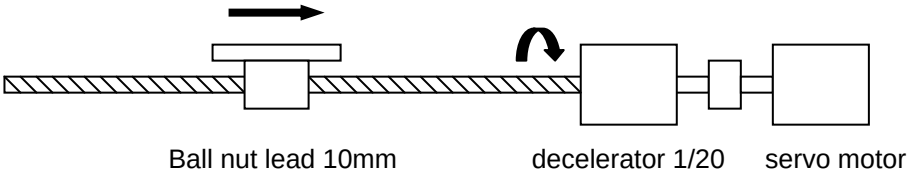
In case of auto operation(continuous operation in order) can set stop time of each step.

5) Main application field

Input transportation quantity of maximum 31 in parameter at all sorts, Feeder and conveyer transportation device, Manual operation mode : In case of START Contact=ON after select the I/O contact, transport operation equivalent to relevant quantity

Auto operation mode ; n case f START contact=ON, continuous sequential operation.

6.4 How to use sequential operation.



1) Set machine momentum

ex) In case of 10 pulse per rotation : Motor revolution quantity [P7-01]=5 & Device moving quantity[P7-02]=10

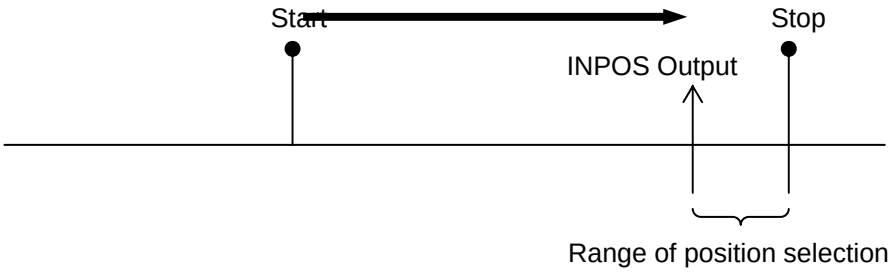
2) Set moving direction[P7-03]

In case of CW, Coordinates value increases : 0

In case of CCW, Coordinates value decreases : 1

3) Position completion signal: INPOS(Completion of position decision) : 48 No. terminal of CN1

As a set the position decision range [P4-02] can display completion signal within fixed range.



4) Autotunning stopping time[P8-02]

In case of auto operation(continuous operation in order) can set stop time of each step.

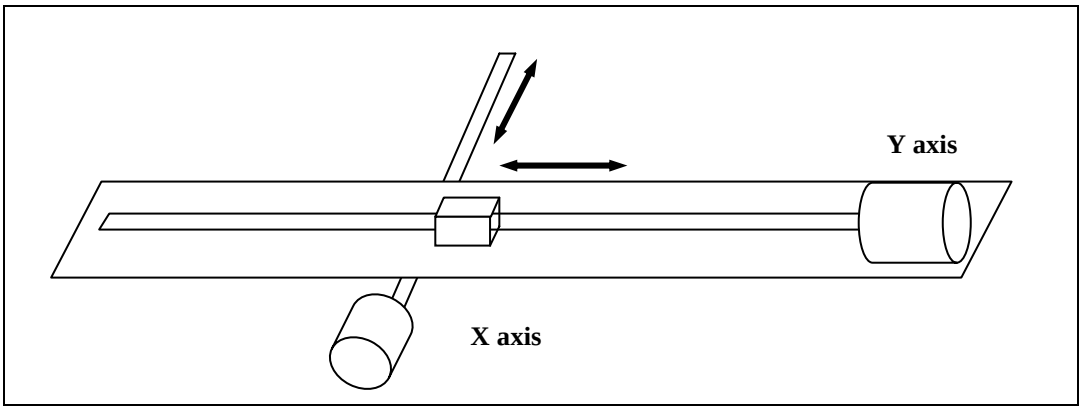
5) Main application field

In an axis or multiple axes machine which don't use interpolation function. input absolute position value in parameters and execute sequential operation by START contact of ON

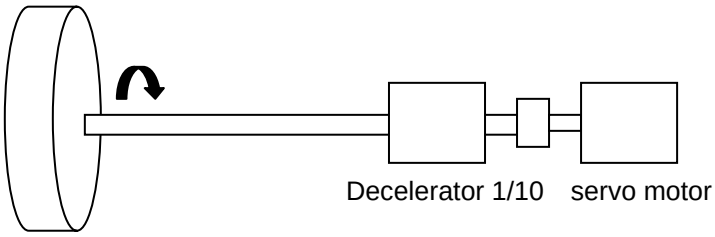
Manual operation mode : START contact=ON, step operation

Auto operation mode : START contact=ON, continuously sequential operation

ex) Application to two axes Robot (Incase of simple coordinates movement operation)



6.4.2 Rotary Coordinate Operation



1) Set machine momentum

ex) In case of 10 pulse per rotation : Motor revolution quantity [P7-01]=10 & Device moving quantity[P7-02]=360

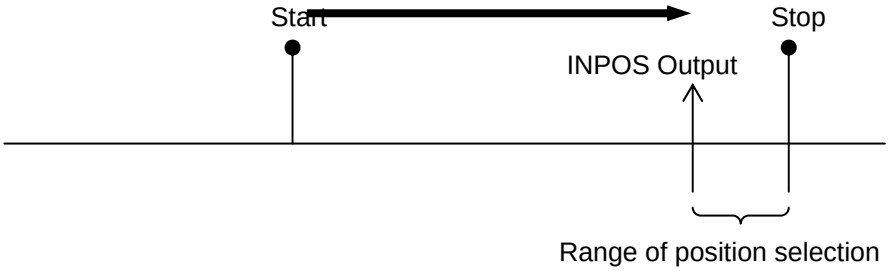
2) Set moving direction[P7-03]

In case of CW, Coordinates value increases : 0

In case of CCW, Coordinates value decreases : 1

3) Position completion signal: INPOS(Completion of position decision) : 48 No. terminal of CN1

As a set the position decision range [P4-02] can display completion signal within fixed range.



4) Autotunning stopping time[P8-02]

In case of auto operation(continuous operation in order) can set stop time of each step.

5) Main application field

Input absolute position value in parameter at all sorts INDEX machine, respectively and sequent ional operation is executed by START contact of ON,

Manual operation mode : START contact=ON; 1 step operation

Auto operation mode : START contact=ON, continuously sequential operation

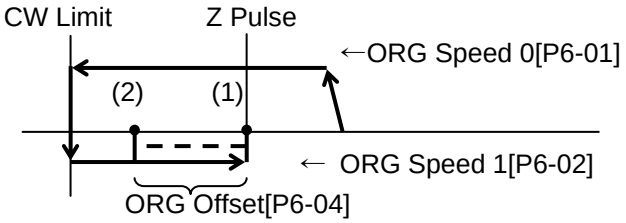
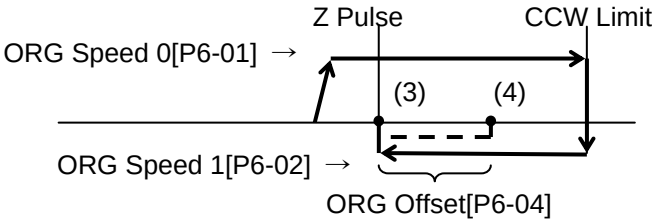
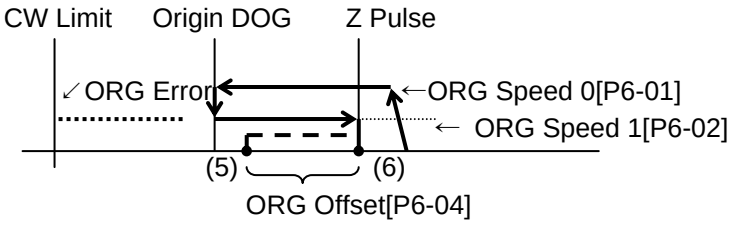
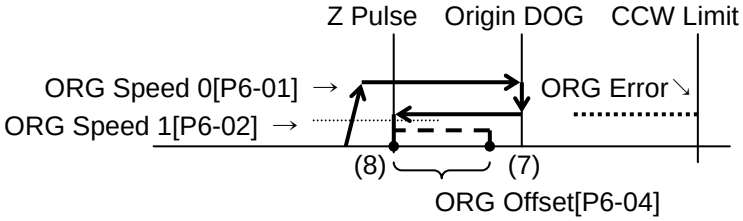
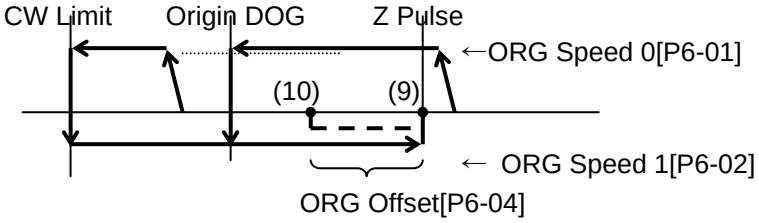
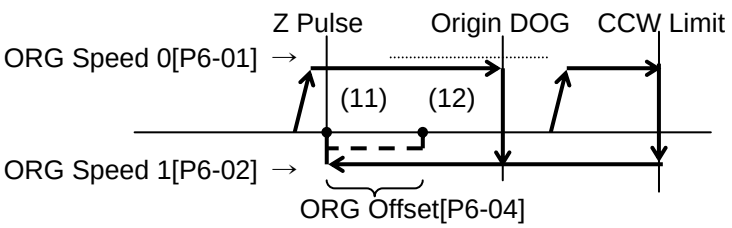
6.5 Setting of position, input and output

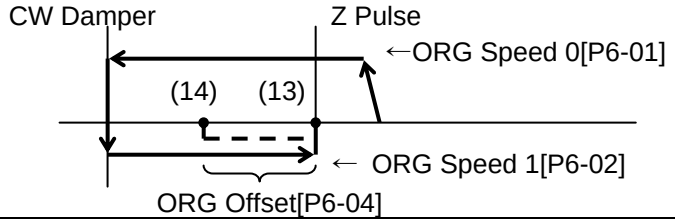
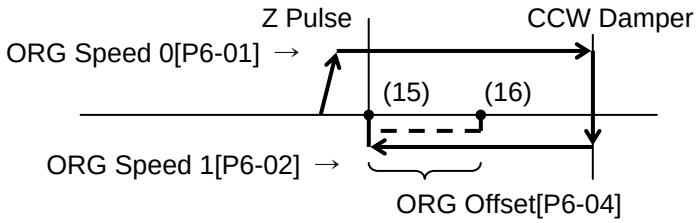
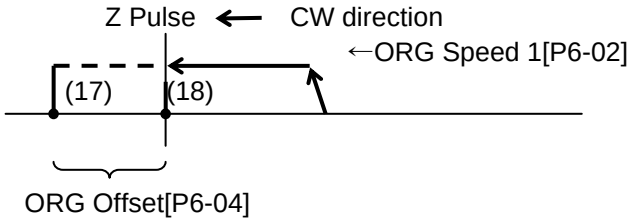
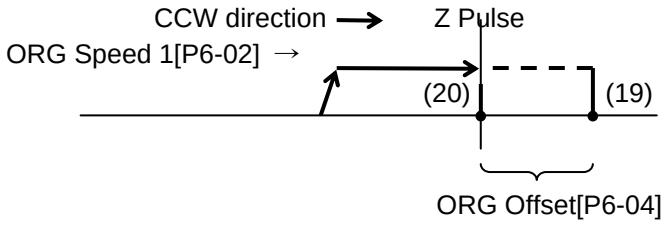
Parameter			Input					Output				
No.		**Initial**	**0**	**1**	**2**	**3**	**4**	**0**	**1**	**2**	**3**	**4**
P5-01	Position CMD0	10	0	0	0	0	0	0	0	0	0	0
P5-02	Position CMD1	20	1	0	0	0	0	1	0	0	0	0
P5-03	Position CMD2	30		1	0	0	0	0	1	0	0	0
P5-04	Position CMD3	40	1	1	0	0	0	1	1	0	0	0
P5-05	Position CMD4	50	0	0	1	0	0	0	0	1	0	0
P5-06	Position CMD5	60	1	0	1	0	0	1	0	1	0	0
P5-07	Position CMD6	70	0	1	1	0	0	0	1	1	0	0
P5-08	Position CMD7	80	1	1	1	0	0	1	1	1	0	0
P5-09	Position CMD8	90	0	0	0	1	0	0	0	0	1	0
P5-10	Position CMD9	100	1	0	0	1	0	1	0	0	1	0
P5-11	Position CMD10	110	0	1	0	1	0	0	1	0	1	0
P5-12	Position CMD11	120	1	1	0	1	0	1	1	0	1	0
P5-13	Position CMD12	130	0	0	1	1	0	0	0	1	1	0
P5-14	Position CMD13	140	1	0	1	1	0	1	0	1	1	0
P5-15	Position CMD14	150	0	1	1	1	0	0	1	1	1	0
P5-16	Position CMD15	160	1	1	1	1	0	1	1	1	1	0
P5-17	Position CMD16	170	0	0	0	0	1	0	0	0	0	1
P5-18	Position CMD17	180	1	0	0	0	1	1	0	0	0	1
P5-19	Position CMD18	190	0	1	0	0	1	0	1	0	0	1
P5-20	Position CMD19	200	1	1	0	0	1	1	1	0	0	1
P5-21	Position CMD20	210	0	0	1	0	1	0	0	1	0	1
P5-22	Position CMD21	220	1	0	1	0	1	1	0	1	0	1
P5-23	Position CMD22	230	0	1	1	0	1	0	1	1	0	1
P5-24	Position CMD23	240	1	1	1	0	1	1	1	1	0	0
P5-25	Position CMD24	250	0	0	0	1	1	0	0	0	1	1
P5-26	Position CMD25	260	1	0	0	1	1	1	0	0	1	1
P5-27	Position CMD26	270	0	1	0	1	1	0	1	0	1	1
P5-28	Position CMD27	280	1	1	0	1	1	1	1	0	1	1
P5-29	Position CMD28	290	0	0	1	1	1	0	0	1	1	1
P5-30	Position CMD29	300	1	0	1	1	1	1	0	1	1	1
P5-31	Position CMD30	310	0	1	1	1	1	0	1	1	1	1

Note1) 0: contract OFF, 1: Contact On

Note2) can only use till P5-01-P516 when use MPG.

6.6 Origin Operation

Origin mode[P8-05]		Origin Operation
No.	Origin	
(0)	Not	Not using Origin Operation
(1) (2)	Using CW Limit	
(3) (4)	Using CCW Limit	
(5) (6)	Using CW direction and origin DOG	
(7) (8)	Using CCW direction and origin DOG	
(9) (10)	Using CW→CCW direction (CW Limit) and origin DOG	
(11)(12)	Using CCW→CW direction (CCW Limit) and origin DOG	

Origin Mode[P8-05]		Origin operation
No.	Origin Mode	
(13) (14)	Using CW Damper	
(15) (16)	Using CCW Damper	
(17) (18)	Using CW rotation Z Pulse	
(19) (20)	Using CCW rotation Z Pulse	

Note1) Can use origin speed of two for exact and quick origin execution(ORG Speed o[P6-01], ORG Speed 0[P6-02])

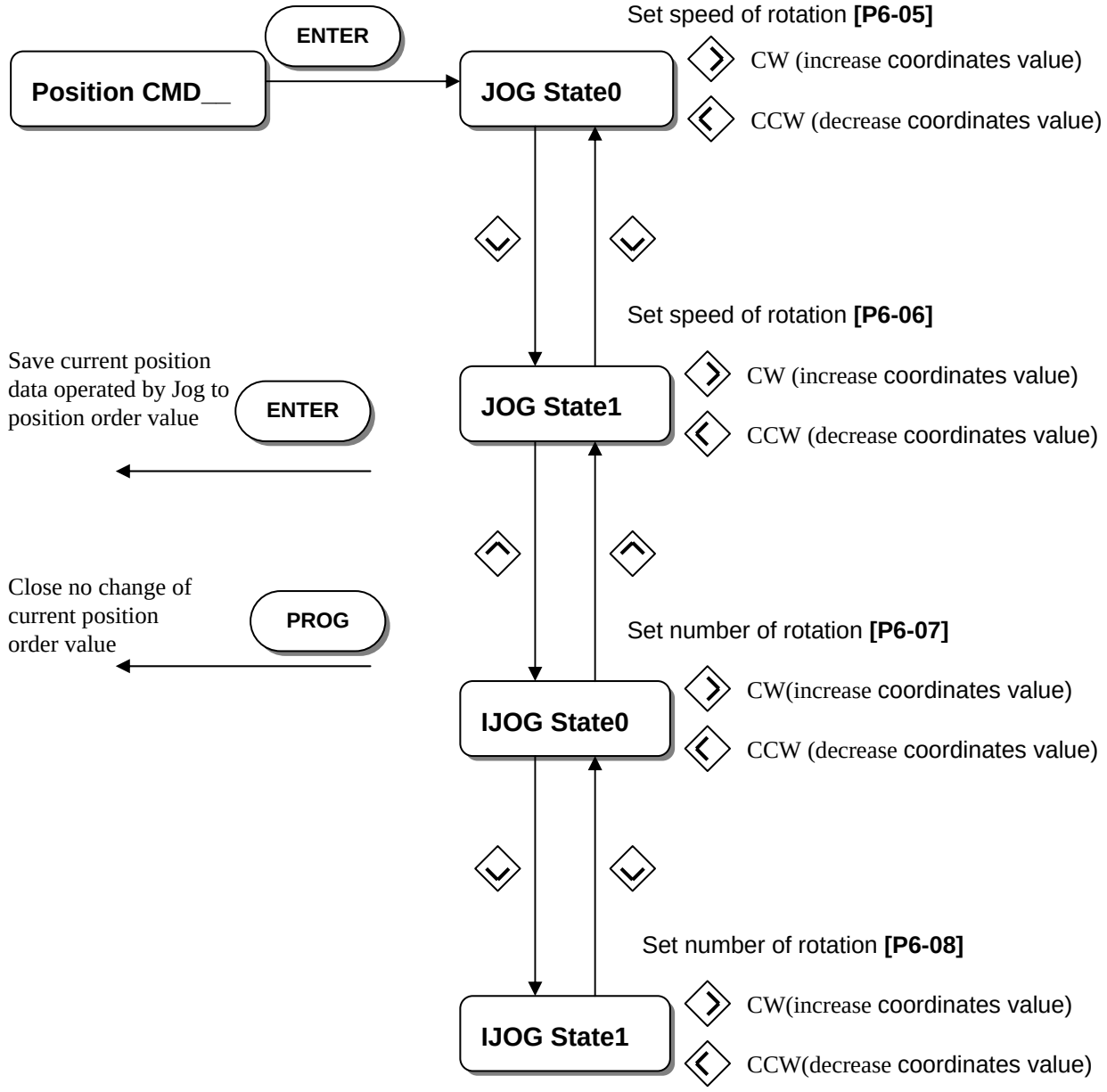
Note2) Can specify origin equivalent to the position which z phase position fixed distance by using ORG Offset[P6-04]

Note3) In case of using Damper(13-16) set torque in ratings torque ratio(%) for recognition in collision with damper.

Note4) When servo in ON, in case that do origin execution, set automatic origin operation[P8-04]

6.7 How to JOG operation

JOG mode is comprised of subordinate menu of position coordinates input(position command mode P5--) and, Jog mode is enable the the digital loader without outer contact signal.



6.8 How to use Monitor

The servo's internal speed command and torque, and the feedback motor speed can be monitored from outside through the analog output (MONIT1) and (MONIT2). The range of output voltage is -5[V] - 5[V]. The following are the parameters related to the use of the motor

Menu	Menu name	Descript	Unit	Range	Initial value
P2-10	Monitor1 Select	Set monitor 1		0-2	0
P2-14	Monitor2 Select	Set monitor 2		0-2	1
Set parameter to be output on the monitor (0; position 1: speed 2:torque)					

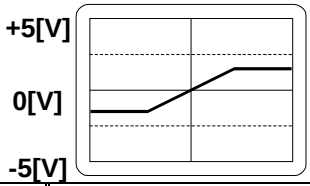
Menu	Menu name	Script	Unit	Range	Initial value
P2-11	Monitor1 ABS	Monitor1 mode		0,1	0
P2-15	Monitor2 ABS	Monitor2 mode		0,1	0
0: Output codes by type 1: Output absolute values					

Menu	Menu name	Script	Unit	Range	Initial value
P2-12	Monitor1 Scale	Monitor1 magnification	multiple	1-20	1
P2-16	Monitor2 Scale	Monitor2 magnification	multiple	1-20	0
In case that observation in diffisult because analog output value is small, it is to see that variable multiply pertinent multiple. For example, in case of input 3, variable size enlarges three times. [Basis magnification] Position :99999.9;/4[V] Speed : Maximum speed/4[V] torque :(3*rating torque)/4[V]					

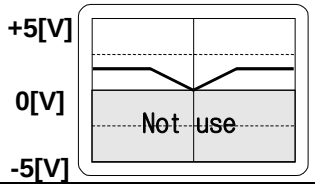
Menu	Menu name	Script	Unit	Range	Initial value
P2-13	Monitor1 offset	Monitor1 offset	%	-100-100	0
P2-17	Monitor2 offset	Monitor2 offset	%	-100-100	0
This is used to output values by applying appropriate offset to the analog output values. This is to enable adjustment of the values output on 0[V] potential by applying offset to the monitor output. Unit used is [%], and the maximum value is 100 [%]. If the speed is output assuming the maximum speed as being 5000[RPM], 1000[RPM], 20[%] of 5,000, is displayed on 0[V] when offset 20 is loaded.					

Monitor outputs according to the parameter set values are as follows. As the method of using monitor 1 and monitor 2 is the same, the following figures show outputs of monitor 1 only.

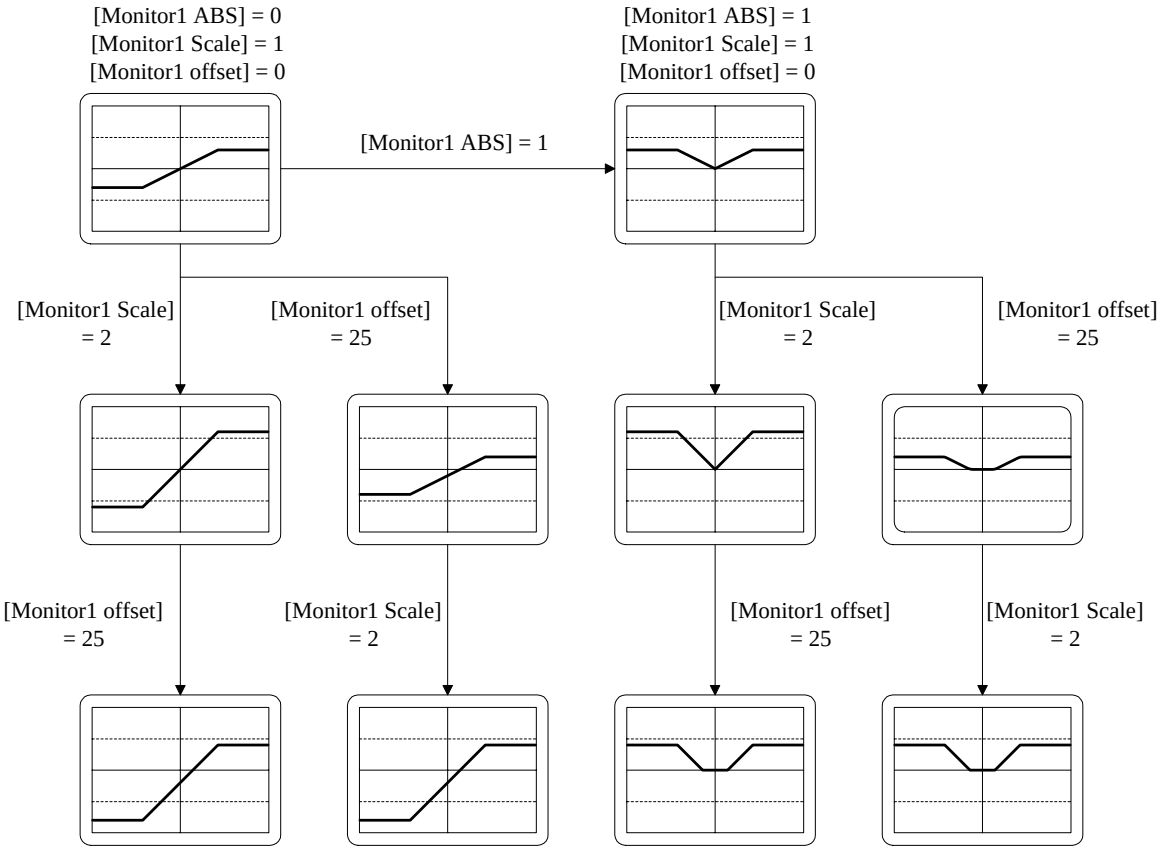
(1) In case of [Monitor 1 ABS (P2-12)] = 0



(2) In case of [Monitor 1 ABS (P2-12)] = 1



	Speed, speed command	**Torque**
Max	$\frac{\text{1.25 x maximum speed}}{\text{[Monitor1 Scale (P2-13)]}}$	$\frac{\text{1.25 x 3 times rated torque}}{\text{[Monitor1 Scale (P2-13)]}}$
Offset	Maximum speed $\times \frac{\text{[Monitor1 offset (P2-14)]}}{100}$	(3 times rated torque) $\times \frac{\text{[Monitor1 offset (P2-14)]}}{100}$



7. Maintenance and Inspection

The servo driver need not be checked and maintained on a daily basis as it uses highly reliable parts, but inspect it at least once a year. The brushless servo motor is semi-permanent; however, check it periodically for signs of abnormal noise or vibration.

7.1 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. Always use rectifier type voltmeter to obtain accurate measurement.

2. When checking motor current: The pulse wave form is smoothed to sine wave to a certain degree by the motor reactance. Connect and use a moving-iron type ampere meter.

3. When checking power: Use an electrodynamics type 3-phase watt-meter.

4. Other meters: Use oscilloscopes or digital voltmeter without letting them make contact with the ground. Use meters with input current of 1 mA or less.

7.2 Inspection Items

(Caution !!) Charged voltage may remain in the smoothing condenser creating an element of danger when inspecting the driver. Turn off power and wait for approximately 10 minutes before starting, inspection.

1. Check the inside of the machine for cable chips, dust or other debris and clean it up.
2. Check the terminal screws for looseness. Tighten them if necessary.
3. Check parts for defects (discoloration caused by heat, damage or disconnection).
4. Use high resistance range of the tester to test the conductivity of the control circuit.
   Do not use mugger or buzzer.
5. Check the cooling fan for normal operation.
6. Check for abnormal noise (motor bearing, brakes)
7. Check cables for signs of damage or defects (particularly the detector cables). Check periodically during operation.
8. Check the load connection axis for center deviation, and make necessary adjustment.

7.3 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, if necessary.

1. **Smoothing condenser:** 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 judgement criteria, visually check:
   a. Case status: Check if the sides and bottom of the case are expanded.
   b. Cover plate: Check for significant expansion, severe cracks or damage.
   c. Explosion-proof valve: 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 relay 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 year	Replace with new ones
Motor bearing	-	Decide after check
Aluminium electrolytic condenser on PCB	5 years	Replace with new PCB (Decide after check)

7.4 Maintenance

7.4.1 Motor

If the motor is not used immediately, store it in the following manner.

1) Store the motor in a clean and dry place.

Ambient temperature	Ambient humidity
-15 ℃ ~ +70℃	Less than 90 % RH

(Caution !) Must be free of dewing or freezing.

2) If the motor is stored outside or in a place with humidity, cover it with an appropriate type of cover to prevent infiltration of rain or dust.

3) If the motor is to be stored for a long period of time after use, apply rust-proof agent on the shaft or on slideways to prevent rust.

7.4.2 Servo drive

It is not desirable to leave the servo driver unused for a long period of time. If the servo driver is not used immediately, store it in the following manner.

1) Store the driver in a clean and dry place.

Ambient temperature	Ambient humidity
-15 ℃ ~ +65℃	Less than 90 % RH

(Caution !) Must be free of dewing or freezing.
Ambient temperature applies to short period of time, such as during transporting.

2) As the driver is in open structure, exercise caution not to allow dust to be accumulated.

8. Troubleshooting

In case an error occurs during operation, take the following steps. If taking such steps does not correct errors, contact our service center.

8.1 Servo Motor

Actions to be taken in case of errors

Symptom	Cause	Inspection	Corrective action
Motor does not start	Parameter misset	Check parameters related to motor, encoder, encoder type and control mode.	Reset parameters. (See sections 5 and 6)
	Overloaded	Check machine running condition.	Readjust mechanical systems.
	Motor defective	Check motor lead terminal with a tester.	If voltage is correct, replace motor.
	Screws loosened	Check the screws.	Retighten loose screws.
	External miswiring, 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 lower 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 and wave form.	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 (inertia ratio, gain, time constant)	Check control parameters.	See Chapter 6. Parameter Setting.

8.2 Servo driver

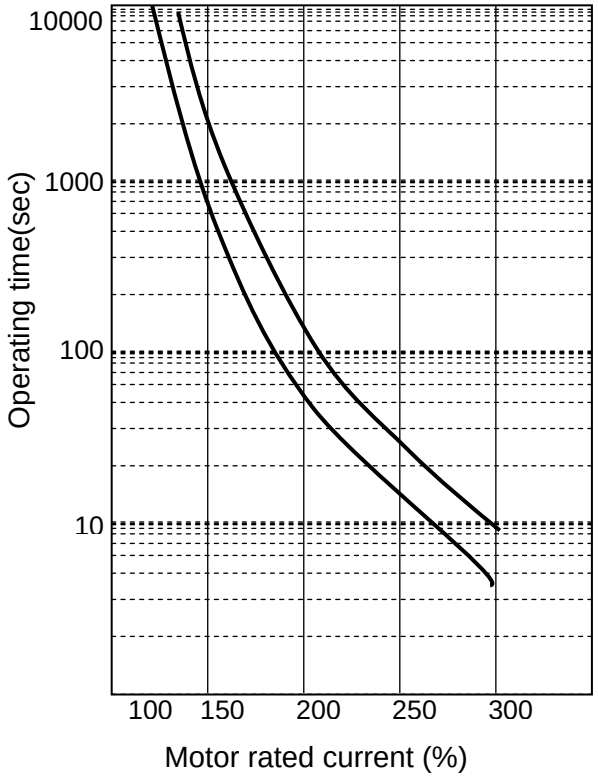
If an alarm occurs, error signal output contact (Alarm) is turned OFF, and the motor stops by the action of dynamic brake.

Actions to be taken in case of an alarm

Screen display	Cause	Corrective action
Normal		
AL-00 EMER STOP	External ESTOP contact input turned OFF.	Check external DC 24V power supply. Check if the ESTOP contact is turned ON.
AL-01 OVER CURNT	Servo driver output terminal (U, V, W) short-circuited, output overcurrent.	Check the output terminal wiring. Restart after resetting alarm. Replace driver if O.C. continues.
AL-02 OVER VOLT	Input voltage excessive (greater than 280V). Regeneration control resistance burned. Load GD^2 excessive.	Use input voltage lower than 230V. Replace control resistance, increase acceleration/deceleration time. Replace servo driver.
AL-03 OVER LOAD	Mechanical overload. Motor miswiring.	Check load condition. Check the motor and encoder wiring.
AL-04 POWER FAIL	Main power shut off during Servo ON status.	Check the 3-phase main power supply (R, S, T) input status.
AL-05 LINE FAIL	Motor and encoder set value error, motor and encoder miswiring, defective encoder, mechanical overload.	Check motor and encoder wiring and set values. Remove excessive load.
AL-06 OVER HEAT	Ambient temperature increased. Continuous overload operation.	Improve heat-shield system condition (ambient temperature to be less than 50℃). Check load condition.
AL-07 OVER SPEED	Excessive gain, parameter set value error, excessive gravity load.	Adjust gain. Check parameters (P3-14). Remove excessive gravity load.
AL-08 FOLLOW ERR	Rapid acceleration/deceleration, gain set value error, command pulse frequency excessive (higher than 300 kpps), miswiring, mechanical overload.	Adjust position gain, increase menu (P4-03) set value, adjust command pulse frequency, check motor and encoder wiring.

Screen display	Cause	Corrective action
AL-09 Output NC	Output (U, V, W) open phase.	Check motor wiring. Replace servo driver.
AL-10 PPR ERROR	No. of encoder pulse set error.	Set the number of encoder pulse (P1-12) accurately.
AL-11 ABS DATA	Absolute value encoder data transmission error.	Reset and retransmit the absolute value encoder data.
AL-12 ABS BATT	Battery voltage drops below 2.8V.	Replace battery (3.6V).
AL-13 ABS MDER	ABS encoder multi-rotation data transmission error.	Reset and retransmit the absolute value encoder data.
AL-14 ORG ERROR	When 5~8 origin rule search, meet limit signal in out of Dog portion.	Reset and Origin search to meet Limit signal in Dog portion.
Parameter Err 1	Input of parameters, which cannot be changed, is attempted during Servo ON. Parameters locked.	Turn OFF the servo and change the set value. Reset parameter locking menu (P1-13).
Parameter Err 2	Set value input error.	Input values within the set range.

[Overload characteristic curves of Servo Driver]



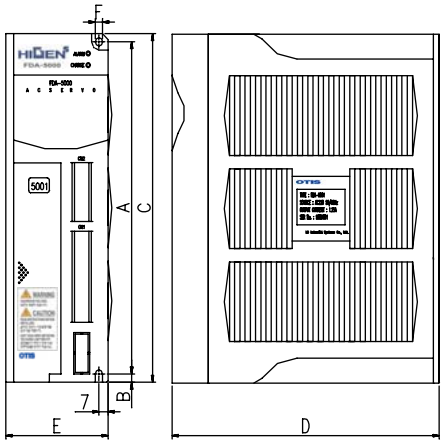
Rated current (%)	Overload operating time		
	Min.	Max.	Set value
100	∞		
120	∞		
150	300	1500	760
200	60	150	107
250	20	40	30
300	6	15	7

(note) If AL-03 (OVER LOAD) happens often, refer servo drive overload characteristic-curve and re-establish suitable load of servo motor.

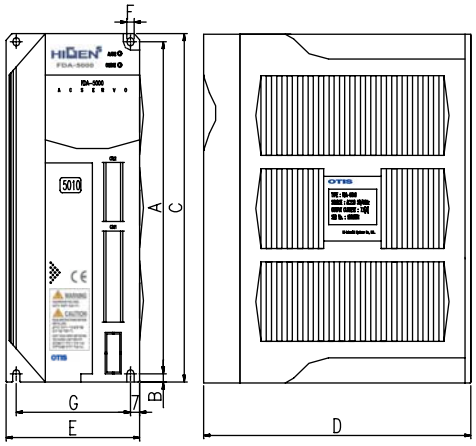
9. External View

9.1 External Dimensions of AC Servo Driver

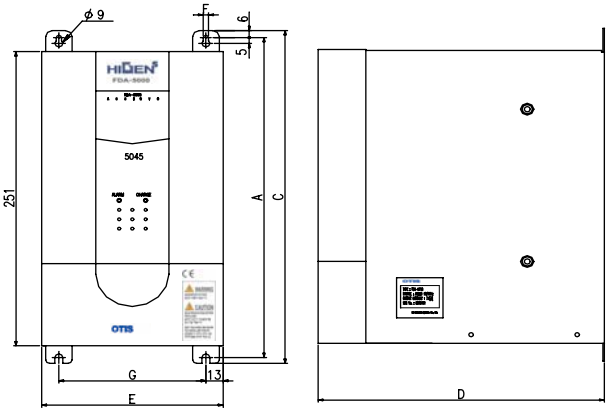
<Outline Drawing A>



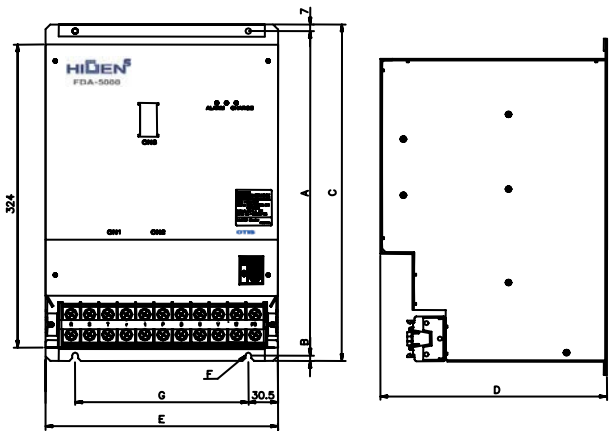
<Outline Drawing B>



<Outline Drawing C>



<Outline Drawing D>

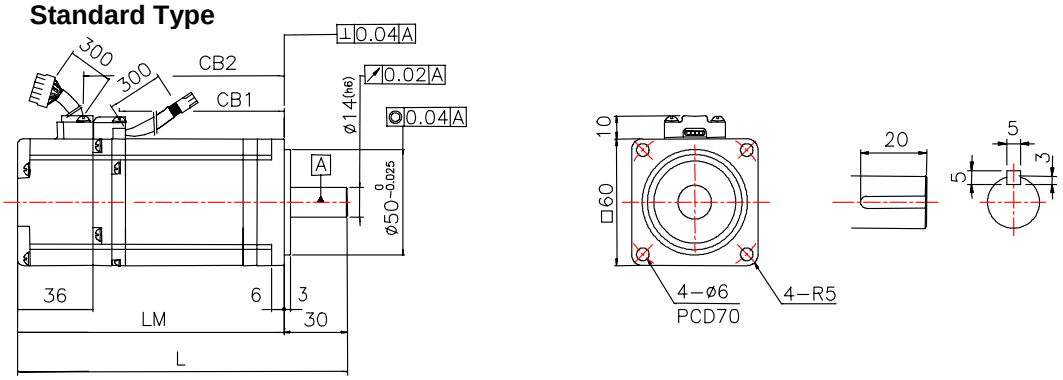


Product	A	B	C	D	E	F	G	Weight [Kg]	Cooling system	Outline Drawing
FDA5001C	164	5	175	130	60	5.5	-	1.0	Self-cooling	A
FDA5002C	164	5	175	130	60	5.5	-	1.0		
FDA5004C	164	5	175	130	77	5.5	63	1.3		B
FDA5005C	200	5	210	184	94	5.5	80	2.0		
FDA5010C	200	5	210	184	94	5.5	80	2.0		
FDA5012C	200	5	210	184	103	5.5	80	2.3	Forced cooling (Fan)	
FDA5015C	272	6	284	218	135	6.0	111	4.5	Self-cooling	C
FDA5020C	272	6	284	218	135	6.0	111	4.8	Forced cooling (Fan)	
FDA5030C	272	6	284	218	135	6.0	111	4.9		
FDA5045C	272	6	284	218	135	6.0	111	5.0		
FDA5075C	347	6	360	234	240	6.0	179	15		D

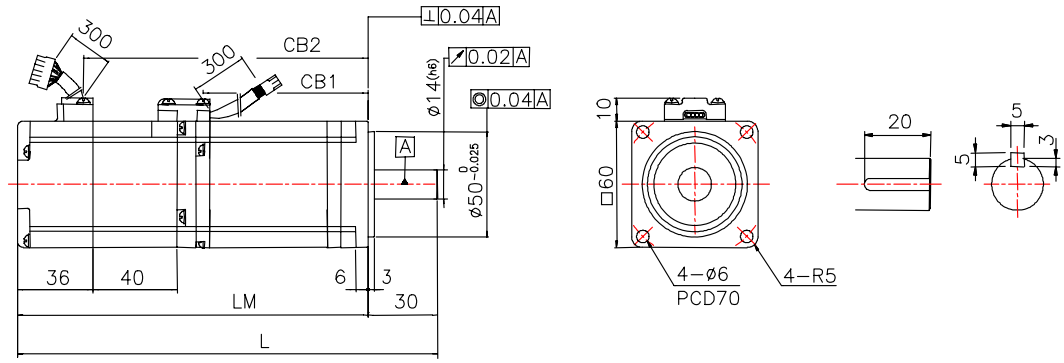
9.2 External Dimensions of AC Servo Motor

9.2.1 Flange 60 Series

Standard Type

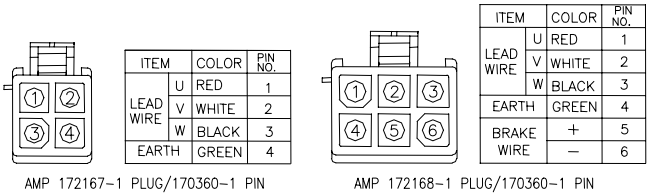


Brake Type



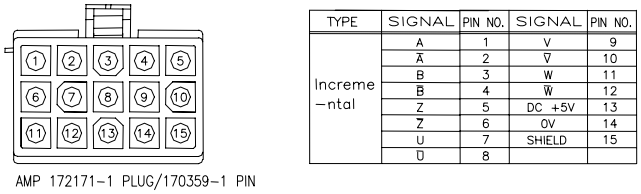
형 명	L	LM	CB1	CB2	중량(kg)
FMA-CN01(B)	115(155)	85(125)	44(44)	57(97)	0.85(1.4)
FMA-CN02(B)	129(169)	99(139)	58(58)	71(111)	1.14(1.7)
FMA-CN03(B)	143(183)	113(153)	72(72)	85(125)	1.43(2.0)
FMA-CN04(B)	157(197)	127(167)	86(86)	99(139)	1.73(2.3)
FMA-CN05(B)	171(211)	141(181)	100(100)	113(153)	2.03(2.6)

* Figures in ( ) indicate brake-attached type.
* Use DC 24V for brake input power supply.
* In case of applying absolute encoder, Motor length is extended 15mm.



AMP 172167-1 PLUG/170360-1 PIN　　AMP 172168-1 PLUG/170360-1 PIN

MOTOR CONNECTOR DIAGRAM

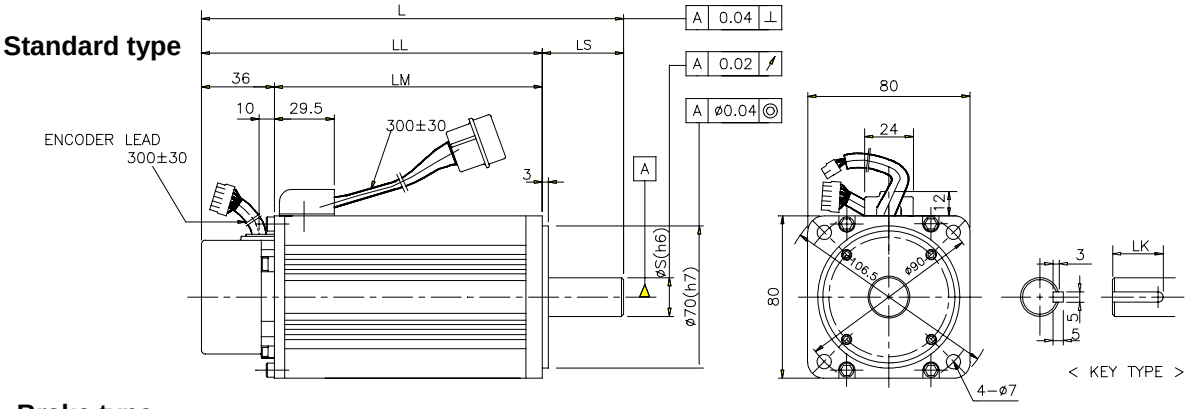


AMP 172171-1 PLUG/170359-1 PIN

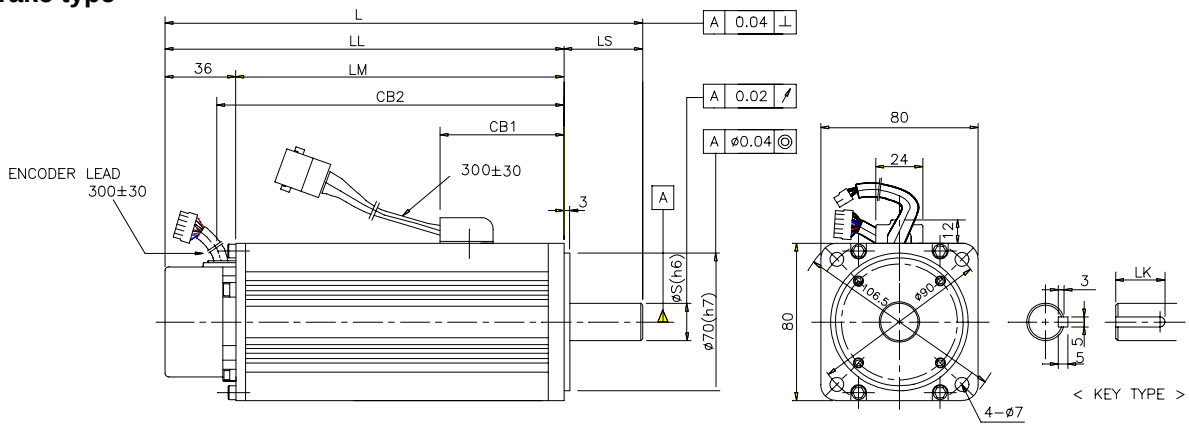
ENCODER CONNECTOR DIAGRAM

9.2.2 Flange 80 Series

Standard type

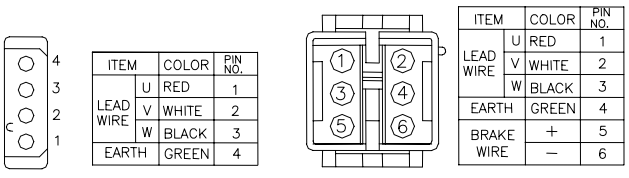


Brake type

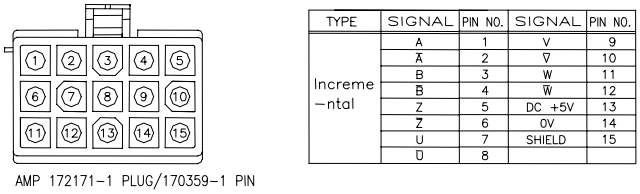


Model	External dementions					Key dimensions			Weight
	L	LL	LM	CB1	CB2	S	LS	LK	
CN04A, KN03	147(174)	112(139)	76(103)	(63)	(113)	14	35	20	2.1(2.9)
CN06, KN05	171(198)	131(158)	95(122)	(63)	(132)	16	40	25	2.6(3.3)
CN08, KN06	193(219)	153(179)	117(143)	(63)	(153)	16	40	25	3.1(3.9)
CN10, KN07	213(246)	173(206)	137(170)	(70)	(180)	16	40	25	3.7(4.6)

* Figures in ( ) indicate brake-attached type.
* Use DC 24V for brake input power supply.
* In case of applying absolute encoder, Motor length is extended 15mm.

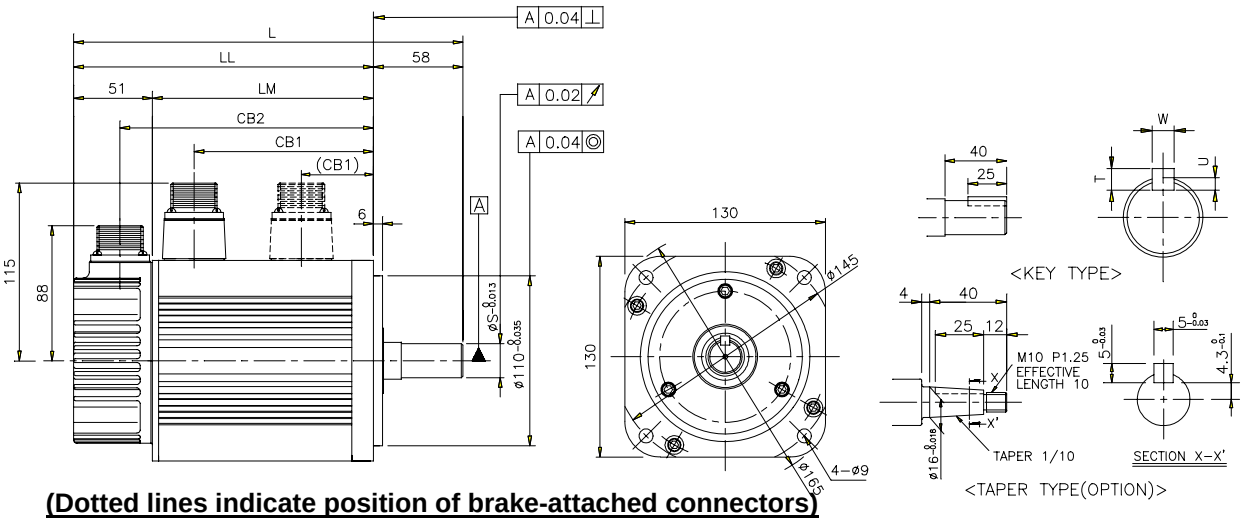


MOTOR CONNECTOR DIAGRAM



ENCODER CONNECTOR DIAGRAM

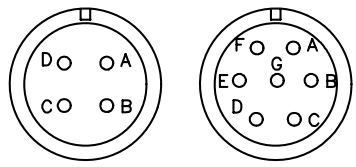
9.2.3 Flange 130 Series



(Dotted lines indicate position of brake-attached connectors)

Model				External dementions					Key dimensions				Weight
				L	LL	LM	CB1	CB2	S	T	U	W	
		TF05	LF03	269 (315)	211 (257)	160 (206)	132 (53)	180 (226)	19	5	3	5	8.2 (10.4)
	KF08			285 (325)	227 (267)	176 (216)	148 (53)	196 (236)	19	5	3	5	8.8 (11.0)
	KF10	TF09	LF06	325 (365)	267 (307)	216 (256)	188 (53)	236 (276)	19	5	3	5	11.6 (13.8)
	KF15	TF13	LF09	385 (425)	327 (367)	276 (316)	248 (53)	296 (336)	22	6	3.5	6	15.8 (18.0)
CN09	KN06A	TN05	LN03	207 (250)	149 (192)	98 (141)	70 (71)	118 (161)	19	5	3	5	5.5 (7.7)
CN15	KN11	TN09	LN06	231 (274)	173 (216)	122 (165)	94 (71)	142 (185)	19	5	3	5	7.0 (9.2)
CN22	KN16	TN13	LN09	255 (298)	197 (240)	146 (189)	118 (71)	166 (209)	22	6	3.5	6	8.5 (10.7)
CN30	KN22	TN17	LN12	279 (322)	221 (264)	170 (213)	142 (71)	190 (233)	22	6	3.5	6	10.0 (12.2)

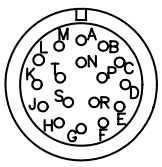
* Figures in ( ) indicate brake-attached type.
* Use DC 90V for brake input power supply.



MS3102A20-4P (STANDARD TYPE)
MS3102A20-15P (BRAKE TYPE)

Item	Lead Wire Marking	PIN No.
Motor	U	A
	V	B
	W	C
	Ground	D
Brake	+	E
	−	F

Motor Cable Connector Diagram



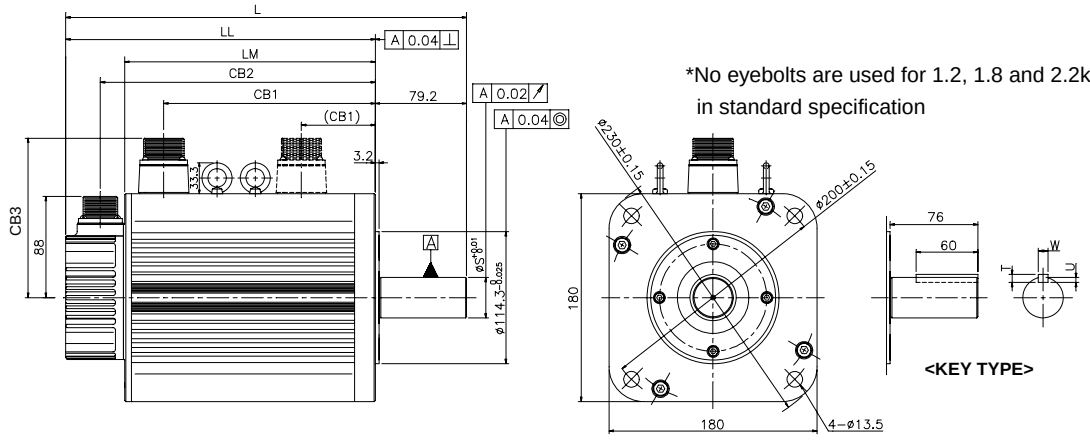
MS3102A20-29P

Encoder Signal	PIN No.	Encoder Signal	PIN No.
A	A	U	K
$\overline{A}$	B	$\overline{U}$	L
B	C	V	M
$\overline{B}$	D	$\overline{V}$	N
Z	E	W	P
$\overline{Z}$	F	$\overline{W}$	R
0V	G	SHIELD	J
+5V	H		

Encoder Cable Connector Diagram

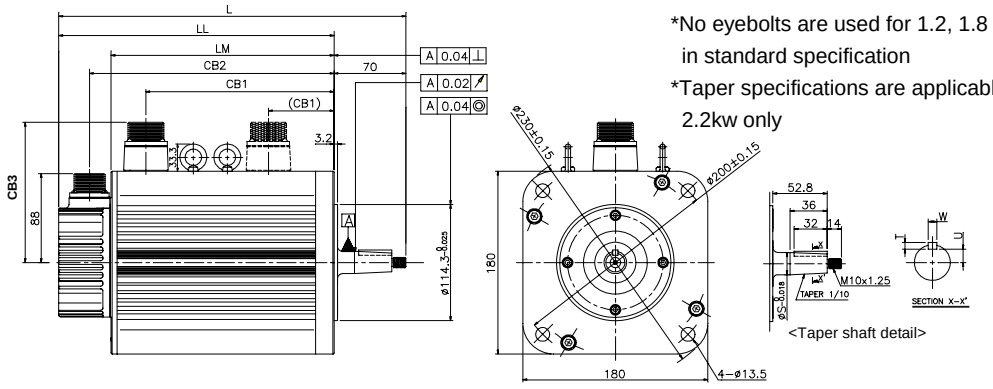
9.2.4 Flange 180 Series

Straight Shaft(Standard) Type (Dotted lines indicate position of brake-attached connectors)



*No eyebolts are used for 1.2, 1.8 and 2.2kw in standard specification

Taper Shaft(Standard) Type (Dotted lines indicate position of brake-attached connectors)

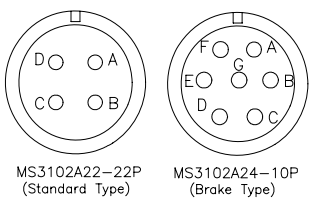


*No eyebolts are used for 1.2, 1.8 and 2.2kw in standard specification

*Taper specifications are applicable to 1.2, 1.8 and 2.2kw only

Model				External dementions						Key dimenstions				Weight
				L	LL	LM	CB1	CB2	CB3	S	T	U	W	
CN30A	KN22A	TN20	LN12A	265 (332)	186 (253)	135 (202)	102 (96)	156 (223)	138	24	5	3	5	12.9 (18.5)
	KN35	TN30	LN20	300 (367)	221 (288)	170 (237)	137 (96)	191 (258)	138	35	8	5	10	18.2 (24.0)
CN50A				310 (377)	231 (298)	180 (247)	147 (96)	201 (268)	138	35	8	5	10	19.9 (25.7)
	KN55	TN44	LN30	350 (417)	271 (338)	220 (287)	187 (96)	241 (308)	138	35	8	5	10	26.8 (32.5)
			LN40	410 (477)	331 (398)	280 (347)	247 (96)	301 (368)	138	35	8	5	10	36.1 (41.8)
		TN75		461 (527)	382 (448)	331 (397)	298 (96)	352 (418)	147	35	8	5	10	45.7 (51.4)
	KF22	TF20	LF12	347 (421)	268 (342)	217 (291)	181 (96)	238 (312)	138	35	8	5	10	17.2 (24.7)
	KF35	TF30	LF20	407 (476)	328 (397)	277 (346)	241 (96)	298 (367)	138	35	8	5	10	27.4 (34.9)
	KF50	TF44	LF30	507 (571)	428 (492)	377 (441)	341 (96)	398 (462)	138	35	8	5	10	38.3 (45.8)

*) Figures in ( ) indicate brake-attached type. *) Use DC 90V for brake input power supply. *)In case of Taper shaft, shaft length is shorted 9.2mm.

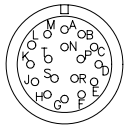


MS3102A22-22P (Standard Type)

MS3102A24-10P (Brake Type)

Item	Lead Wire Marking	PIN No.
Motor	U	A
	V	B
	W	C
	Ground	D
Brake	+	E
	–	F

Motor Cable Connector Diagram



MS3102A20-29P

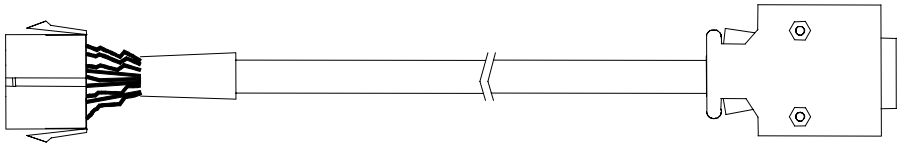
Encoder Signal	PIN No.	Encoder Signal	PIN No.
A	A	$\overline{U}$	K
$\overline{A}$	B	$\overline{U}$	L
B	C	V	M
$\overline{B}$	D	$\overline{V}$	N
Z	E	W	P
$\overline{Z}$	F	$\overline{W}$	R
0V	G	SHIELD	J
+5V	H		

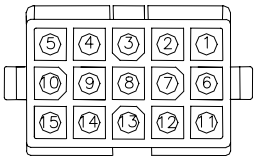
Encoder Cable Connector Diagram

10. Specifications of options

10.1 AC servo motor cable specifications

10.1.1 Encoder signal cable (Flange 60, 80 Series)

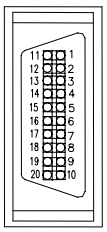




PIN No.	Encoder Signal	PIN No.	Encoder Signal
1	A	9	V
2	$\overline{A}$	10	$\overline{V}$
3	B	11	W
4	$\overline{B}$	12	$\overline{W}$
5	Z	13	+5V
6	$\overline{Z}$	14	0V
7	U	15	SHIELD
8	$\overline{U}$		

AMP 172163-1 CAP/170361-1 PIN

<Motor side Connector>



PIN NO.	Encoder Signal	PIN NO.	Encoder Signal
1	W	11	$\overline{Z}$
2	$\overline{W}$	12	SHIELD
3	V	13	$\overline{B}$
4	$\overline{V}$	14	Z
5	U	15	$\overline{A}$
6	$\overline{U}$	16	B
7	–	17	–
8	–	18	A
9	0V	19	+5V
10	–	20	–

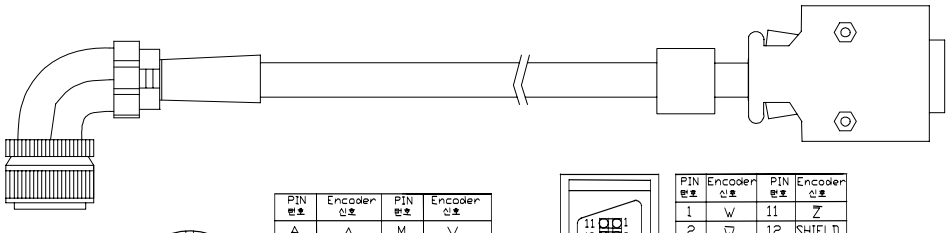
CONNECTOR 10120-3000VE 3M
CONNECTOR COVER 10320-52A0-008 3M

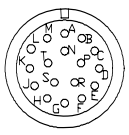
<Driver side Connector>

Order side(FCA_□□□□□)

Flange	Operating type				Non-operatig type			
	3m	5m	10m	20m	3m	5m	10	20m
60,80	EA03F	EA05F	EA10F	EA20F	EA03N	EA05N	EA10N	EA20N

10.1.2 Encoder singal cable (Flange 130,180 Series)

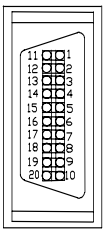




PIN 번호	Encoder 신호	PIN 번호	Encoder 신호
A	A	M	V
B	$\overline{A}$	N	$\overline{V}$
C	B	P	W
D	$\overline{B}$	R	$\overline{W}$
E	Z	H	+5[V]
F	$\overline{Z}$	G	0[V]
K	U	J	SHIELD
L	$\overline{U}$		

MS 3108B20-29P

<Motor Side Connector>



PIN 번호	Encoder 신호	PIN 번호	Encoder 신호
1	W	11	$\overline{Z}$
2	$\overline{W}$	12	SHIELD
3	V	13	$\overline{B}$
4	$\overline{V}$	14	Z
5	U	15	$\overline{A}$
6	$\overline{U}$	16	B
7	–	17	–
8	–	18	A
9	0V	19	+5V
10	–	20	–

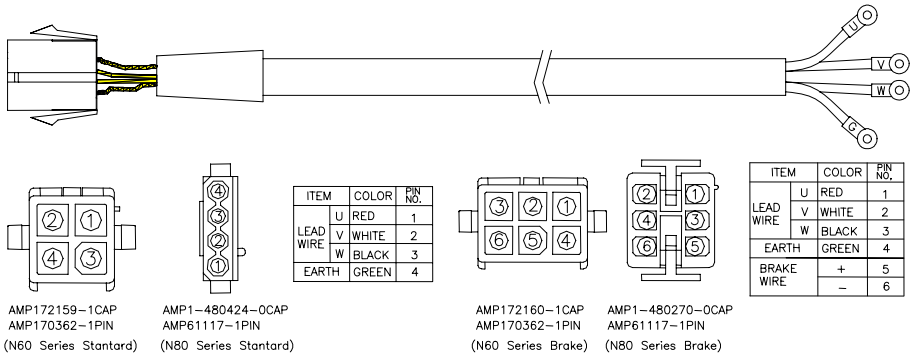
CONNECTOR 10120-3000VE 3M
CONNECTOR COVER 10320-52A0-008 3M

<Driver Side Connector>

Order code(FCA_□□□□□)

Flange	Operating type				Non-operating type			
	3m	5m	10m	20m	3m	5m	10	20m
130,180	FC03F	FC05F	FC10F	FC20F	FC03N	FC05N	FC10N	FC20N

10.1.3 Power cable for motor (Flange 60,80 Series)

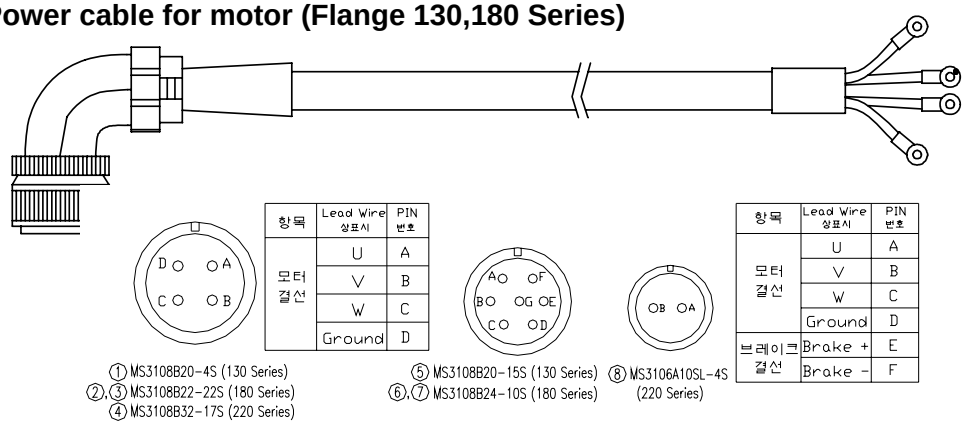


Motor Cable Connector Diagram

Order code(FCA–□□□□□)

Flange	Type	Operating type				Non-operating type			
		3m	5m	10m	20m	3m	5m	10	20m
60	Standard	SA03F	SA05F	SA10F	SA20F	SA03N	SA05N	SA10N	SA20N
	Brake	BA03F	BA05F	BA10F	BA20F	BA03N	BA05N	BA10N	BA20N
80	Standard	SB03F	SB05F	SB10F	SB20F	SB03N	SB05N	SB10N	SB20N
	Brake	BB03F	BB05F	BB10F	BB20F	BB03N	BB05N	BB10N	BB20N

10.1.4 Power cable for motor (Flange 130,180 Series)



Motor Cable Connector Diagram

Order code(FCA–□□□□□)

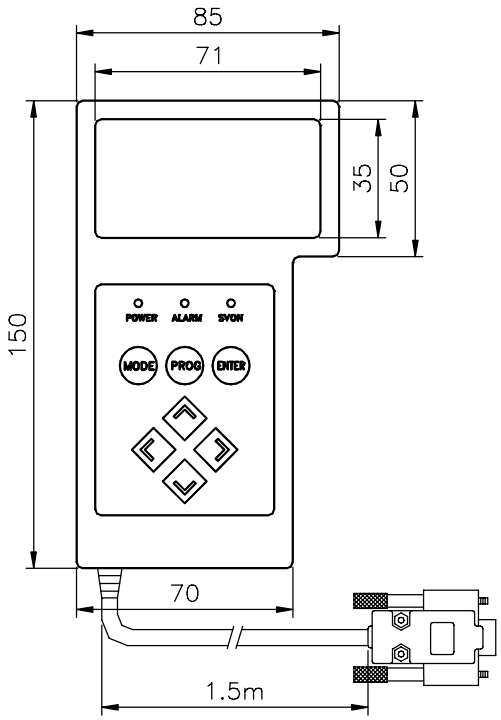
Flange	Type		Operating type				Non-operating type			
			3m	5m	10m	20m	3m	5m	10	20m
130	Standard		SC03F	SC05F	SC10F	SC20F	SC03N	SC05N	SC10N	SC20N
	Brake		BC03F	BC05F	BC10F	BC20F	BC03N	BC05N	BC10N	BC20N
180 (5.5Kw)	Standard	①	SD03F	SD05F	SD10F	SD20F	SD03N	SD05N	SD10N	SD20N
		②	SE03F	SE05F	SE10F	SE20F	SE03N	SE05N	SE10N	SE20N
180 (7Kw~)	Standard	③	SF03F	SF05F	SF10F	SF20F	SF03N	SF05N	SF10N	SF20N
180	Brake	①	BD03F	BD05F	BD10F	BD20F	BD03N	BD05N	BD10N	BD20N
		②	BE03F	BE05F	BE10F	BE20F	BE03N	BE05N	BE10N	BE20N

Note) Application ①:1.2~3.5kW , ②:4.4~5.5Kw, ③:7Kw~

Power cable model for above 7Kw : MS3108B32-17S

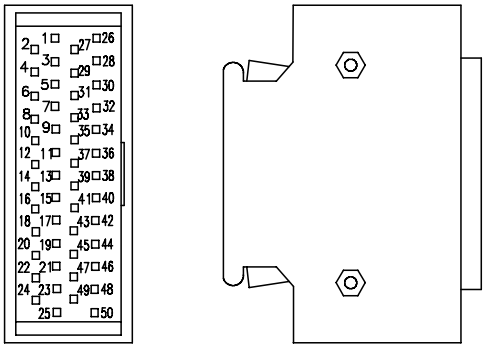
10.2 AC servo drive

10.2.1 Digital Loader (Order code No.: FDA500004S)



10.2.2 CN1 Connector (Order code No.: FDACON50P-3M)

Item No.: 10150-3000VE,10350-52A0-008,Maker:3M

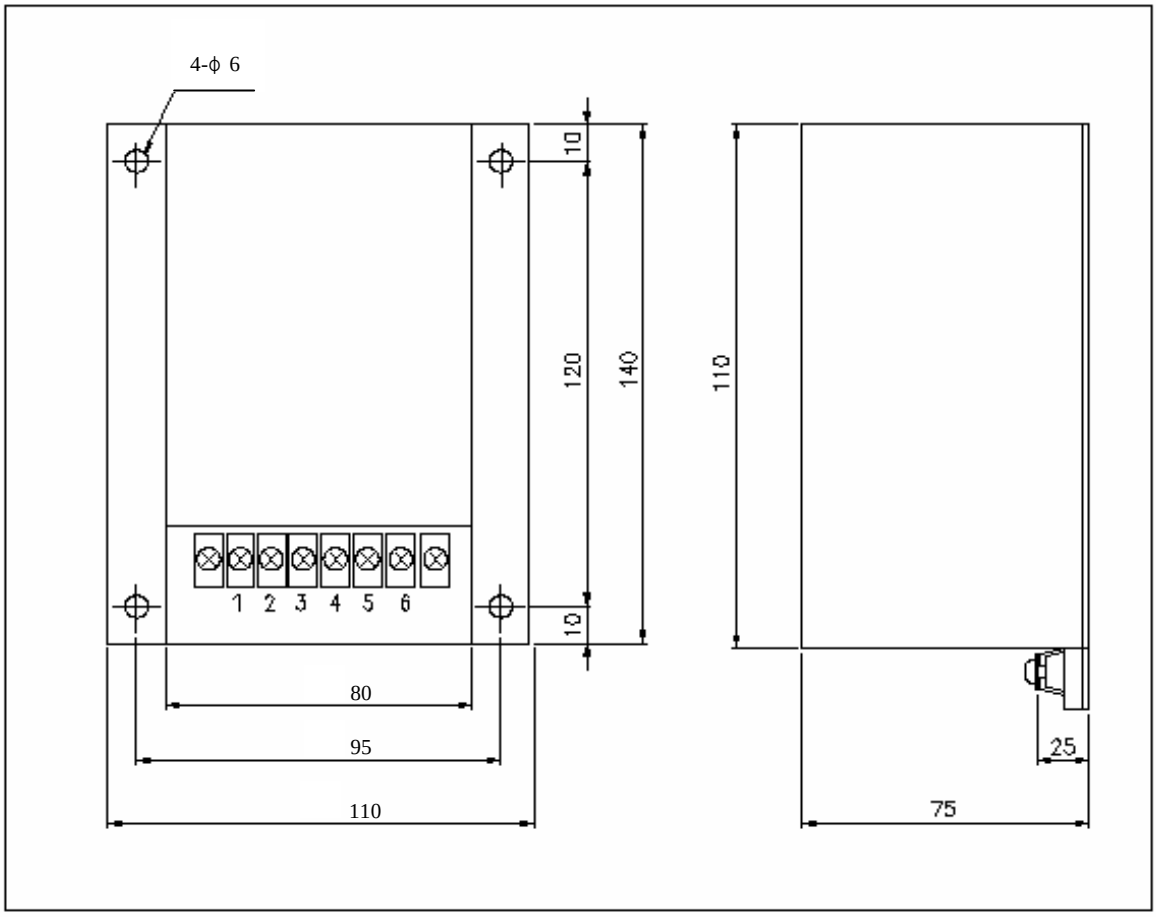


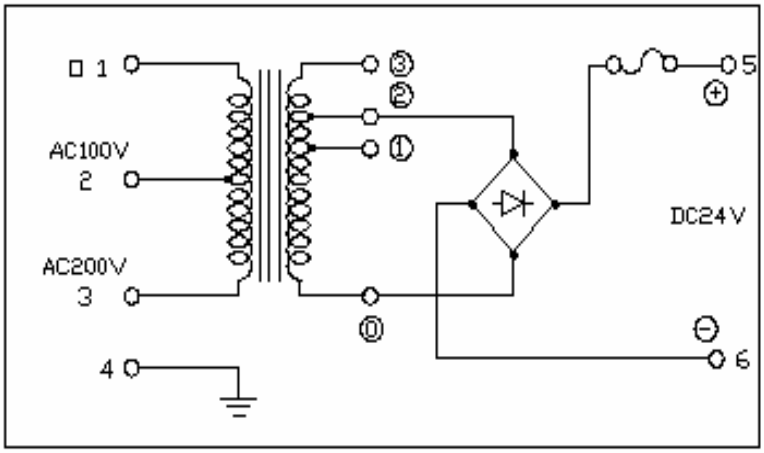
10.2.3 Noise Filter

AC SERVO DRIVE	FDA5001C ~ FDA5030C	FDA5045C	FDA5075C
NOISE FILTER	NFZ-4030SG	NFZ-4040SG	NFZ-4050SG

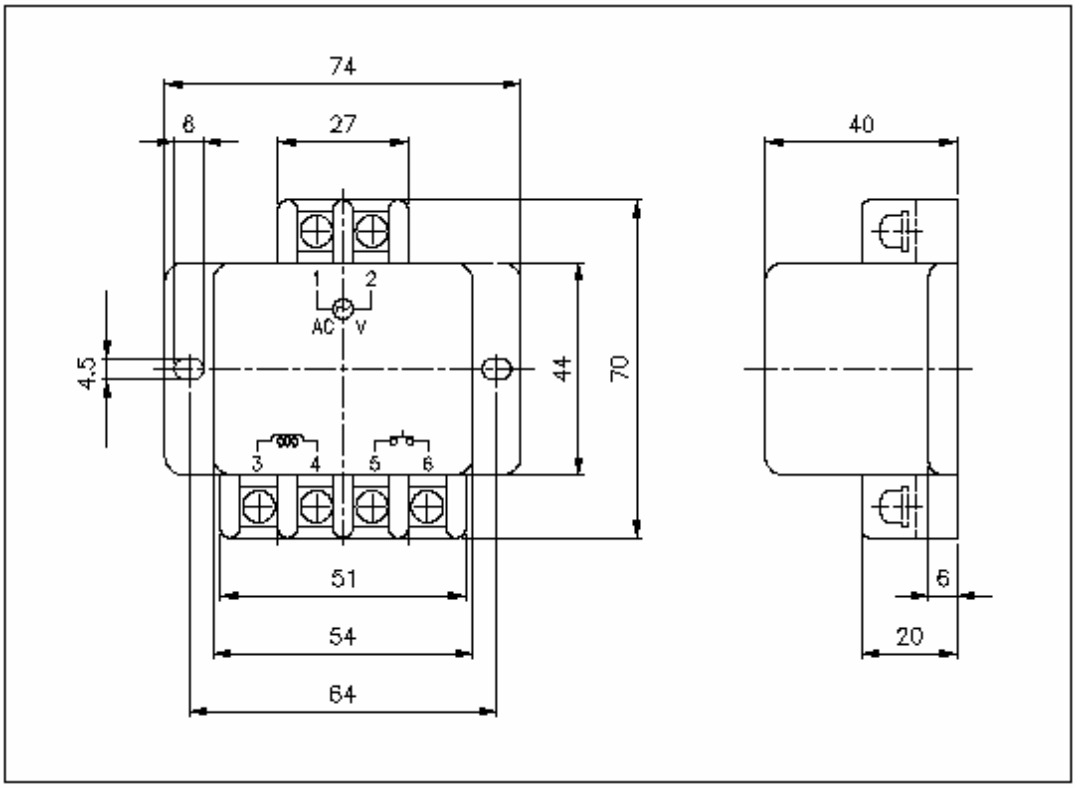
10.2.4 Power unit for brake(Item No.: BPU-109A)

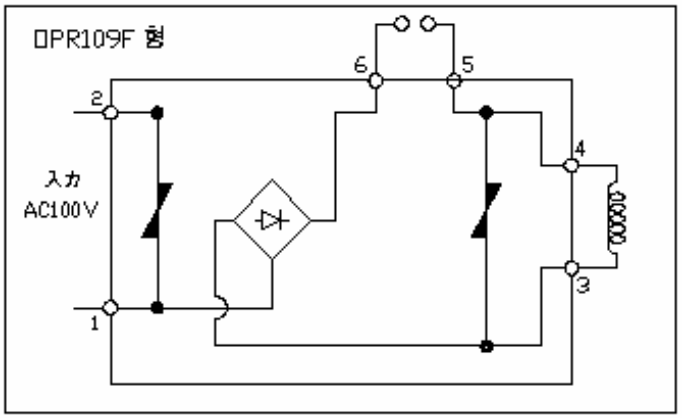
10.2.4.1 DC 24V, OPT-12(JAPAN, OGURA)





10.2.4.2 DC 90V, OPR-109 (JAPAN, OGURA)





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Order NO : 702003132