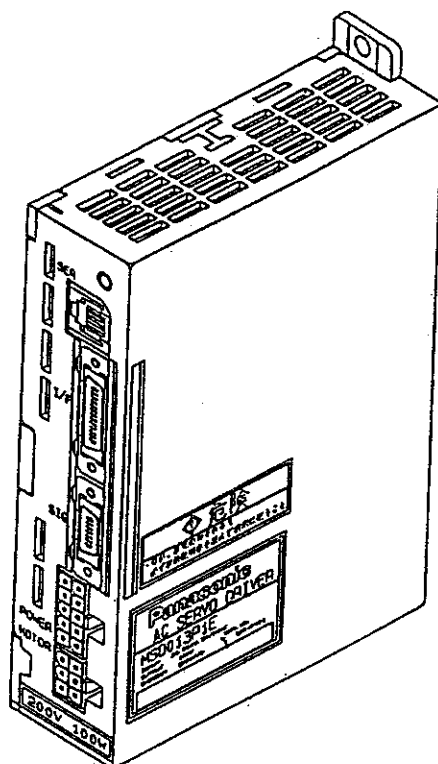


# A C S e r v o D r i v e r

## MSD\*EX Series

### O p e r a t i o n M a n u a l



(Figure shows MSD013P1E.)

- Thank you very much for your purchasing our Panasonic Digital AC Servo Driver; MSD \* EX Series.
- Though the operating procedures and operating methods are not so difficult, wrong operation might cause accidents no one expects, the service life of the driver might be shorten and the performance might be declined. So never fail to read this operation manual thoroughly before you use it in order to use it properly and use it as long as possible.
- Please keep this manual carefully for later use.
- Please be sure to deliver this manual to an end user.
- This manual is subject to change for improvement of contents.

# Precautions in Handling it Safely

Before installing, operating, maintaining and checking this driver, be sure to read this operation manual and all of other attached documents thoroughly, in order to use it properly.

In addition, before using it, it is also necessary to become skillful in operating it and to learn all of the knowledge of this equipment, various information about safety and all of the precautions required.


In this operation manual, cautions to keep safety are ranked "DANGER" and "CAUTION".

## DANGER

: In case of making mistakes when operating or handling it, dangerous conditions can cause then these conditions might kill persons or persons might be seriously injured.

## CAUTION

: In case of making mistakes when operating or handling it, dangerous conditions can cause then injury of medium or slight level cause to persons or only damages on materials can be caused.

Besides, although contents included in  can result in quite serious damages or accident, according to the condition. Then be sure to follow the contents in both cases.

## 1. General Comments

### DANGER

☆ Be sure to observe the following requirements to prevent you from an electric shock and injury.

1. Never touch anywhere inside the driver. It might cause an electric shock.
2. Be sure to ground the earth cable of the driver and motor in order to avoid an electric shock.
3. Be sure to cut the power off and confirm that the LED to indicate that the power is off, before moving (installing), wiring, maintaining and checking the driver in order to avoid an electric shock.



## DANGER

4. Do not damage the cable, give an excessive stress on it and put an heavy thing on it or not to be caught in something in order to avoid an electric shock.
5. During operating the driver, never to touch the rotating section of the motor to prevent from being injured.



## CAUTION

1. The models of the motor and the driver should be matched when using.  
There is a possibility of a fire.
2. Never use the driver, around the place where water splash, corrosive atmosphere, atmosphere of combustible gas and near an inflammable thing.  
There is a possibility of a fire.
3. Do not touch the driver, the motor and the peripheral device, since the temperature of them become too high.  
There is a possibility of being burned.
4. While the power is on or after a while when the power is off, do not touch the radiator, the regenerative resistor and the motor, since they become very hot.  
There is a possibility of being burned.

### 2. Storage



## PROHIBITION

1. Do not store in the place where water, splash, harmful gas and liquid are.



## OBLIGATION

1. Store the driver in the place where it isn't exposed to the sunshine directly and where between the specific range of the humidity.
2. In case of the time of the storage is quite long, please contact the store you bought it or the reference written in this manual.

### 3. Carrying



## CAUTION

1. While carrying it, do not have the cables and the axes of the motor.  
There is a possibility of being injured.



## OBLIGATION

1. Over-stacking of the products can cause to fall to pieces. Then stack the products according to the instruction.

### 4. Installation



## CAUTION

1. Do not ascend the driver and put heavy things.  
There is a possibility of being injured.
2. Do not shut the intake and outlet valve, and try to not intake foreign things.  
There is a possibility of a fire.
3. Be sure to install according to the specified installing direction.  
If the direction is wrong, there is a possibility of a fire.
4. The distances between the body and the inside of the control panel and those between other equipments should be kept as specified.  
There is a possibility of a fire.
5. Do not give a strong shock.  
Abnormal operation might occur then there is a possibility of being injured.
6. Do the installation work properly according to the output power and the weight of the body.  
There is a possibility of being injured.
7. Install the driver to the incombustible material like metal.  
There is a possibility of a fire.

## 5. Wiring



### CAUTION

1. The wiring should be performed properly and certainly.  
There is a possibility of getting an electric shock, an injury and a fire.

## 6. Control, Operation



### CAUTION

1. The motor is not equipped with a protection device. An over-current protection device, an earth leakage breaker, a protection device for high-limit of temperature and an emergency system should be installed.  
There is a possibility of getting an electric shock, an injury and a fire.
2. Check that the specification of the power supply is normal.  
There is a possibility of getting an electric shock, an injury and a fire.
3. After performing the test working with the motor fixed to check the operation without the mechanical systems, install it to the driver.  
There is a possibility of being injured.
4. Since the retaining brake is equipped for retaining the position of the machine, do not use it to obtain the security of the machine itself.  
There is a possibility of being injured.
5. Never perform extreme adjustments and changes. If you do so, the operation become so unstable.  
There is a possibility of being injured.
6. In case of the emergency occurs, first remove the cause then secure the safety then reset the alarm. After this start the machine again.  
There is a possibility of being injured.
7. Immediately after a short power failure, it is possible that the machine sometimes restart suddenly. So do not get near the machine in such a case.  
(Even when you restart the machine, design the machine so that the security for the human being can be obtained.)  
There is a possibility of being injured.

## PROHIBITION

1. Since the brake equipped with the motor is for the retainment, do not use it for usual control.

## OBLIGATION

1. Install an emergency stop circuit outside the machine so that the operation can be stopped immediately and shut the power supply.

### 7. Maintenance and Check

## CAUTION

1. The capacity of the condenser of the power supply line will lower owing to the degradation. Then, in order to avoid the secondly-accident caused by some trouble, we recommend replacement of it each 5 years.

## PROHIBITION



1. When the overhaul is required, be sure to be performed by our company.

### 8. Scrapping

## CAUTION

1. In case of throw away the driver, treat it as an industrial waste.

Meanings of the other signs used in this operation manual

 : Things that you should not do.  : Things that you should do.

	Page
■ Precautions in Handling it Safely -----	2
1. General Comments -----	2
2. Storage -----	3
3. Carrying -----	3
4. Installation -----	4
5. Wiring -----	5
6. Control, Operation -----	5
7. Maintenance and Check -----	6
8. Scrapping -----	6
■ Contents -----	7
1. Before operation -----	8
1-1 After opening the package -----	8
1-2 Confirmation of the applicable motor -----	8
1-3 After Opening the Package -----	8
2. Appearance and Names of Each Part -----	10
3. Caution -----	11
3-1 Caution for Safety -----	11
3-2 Cautions for Storage -----	12
3-3 Cautions for Carriage -----	12
3-4 Cautions for Installation -----	13
3-5 Cautions for Maintenance and Check -----	13
4. Wiring -----	14
4-1 Caution on Wiring -----	14
4-1-1 Wiring to Connector POWER, Connector MOTOR -----	14
4-1-2 Usage of Regenerative Resistance -----	14
4-1-3 Wiring to Connector I/F -----	14
4-1-4 Wiring to Connector SIG -----	16
4-1-5 Wiring to Connector SER -----	20
4-2 Selection of a wiring equipment -----	20
5. Function -----	21
5-1 Input/Output signal(Connector I/F) -----	21
5-2 Structure of Input/Output Circuit -----	24
5-3 Dynamic brake -----	24
5-4 Auto-gain tuning -----	25
5-4-1 Outline of auto-gain tuning -----	25
5-4-2 Applicable range -----	26
5-4-3 Cautions -----	26
5-4-4 Auto-gain tuning operation -----	26
5-4-5 How to operate -----	27
5-5 Protective functions -----	27
5-5-1 Outline -----	28
5-5-2 Detail of protective functions -----	28
6. Running -----	31
6-1 Before running -----	31
6-2 Trial run -----	31
7. Adjustment -----	32
7-1 Gain adjustment -----	33
7-1-1 Basics of gain adjustment -----	33
7-1-2 Caution on the gain adjustment -----	33
8. Parameter -----	34
8-1 Outline of parameter -----	34
8-2 Detail of user parameter -----	37
9. Communication Function -----	42
9-1 Required Components and Devices and Software -----	42
9-1-1 Required Components and Devices -----	43
9-1-2 Software to Control Communication -----	42
10. Specifications -----	43
11. Dimensions -----	44
12. Option parts -----	45
12-1 Connector kit for connecting external equipment -----	45
12-2 Connector kit for connecting motor encoder -----	45
12-3 Communication control software PANATERM -----	47
12-4 RS232C Connection Cable -----	48
12-5 Cable for interface -----	48
12-6 Connector Kit for Connecting the Power Supply of the Driver -----	49
12-7 Regenerative Resistor -----	49
13. Trouble Shooting -----	51

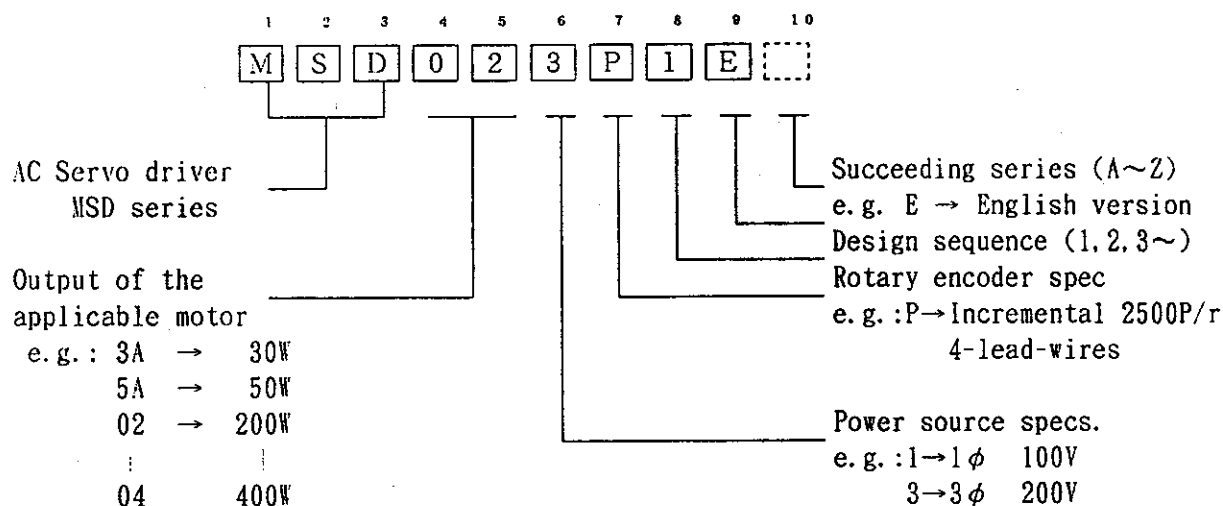
# 1. Before operation

## 1-1 After opening the package

- Please check the followings:
  - (1) Right model No.?
  - (2) Any damage during the transportation?

If you find any damage, please contact to your dealer/distributor

- Following shows how to read the model No. and its symbols;



## 1-2 Confirmation of the applicable motor

This driver is designed to be used with Panasonic AC servo motor. Please refer to the following table for the correct combination of the driver and the motor, and make sure that the number of the encoder pulses matches each other.

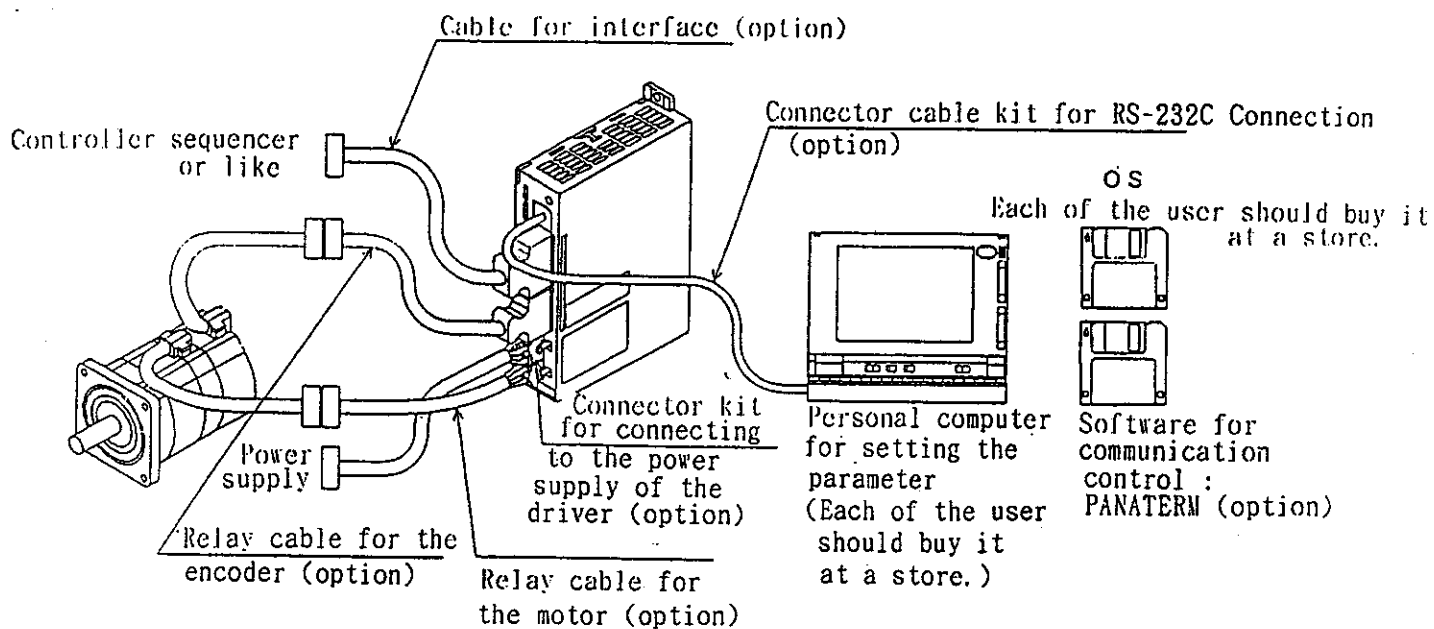
Model No. of driver	Suffix of driver	Applicable motor					
		Series No.	Model No.	Rated output (W)	Input voltage (V)	Rated cycle	Encoder pulses
MSD3A1P1E	A	MSM	MSM3AZP1A	30	100/200	3000r/min	2500P/r
MSD5A1P1E	A		MSM5AZP1A	50	100/200		
MSD011P1E	B		MSM011P1A	100	100		
MSD021P1E	C		MSM021P1A	200	100		
MSD3A3P1E	A		MSM3AZP1A	30	100/200		
MSD5A3P1E	A		MSM5AZP1A	50	100/200		
MSD013P1E	A		MSM012P1A	100	200		
MSD023P1E	B		MSM022P1A	200	200		
MSD043P1E	C		MSM042P1A	400	200		

**Note** Please refer to section 11. "Dimensions" for the suffix.



### 1-3 After Opening the Package

The following things are required when you use this AC Servo Driver properly.



The following things can be purchased optionally. See Section 12 "Optional Parts"(p.45) in detail.

- \* Relay cable for the motor
- \* Relay cable for the encoder
- \* Relay cable for interface
- \* Connector kit for connecting the power supply of the driver /Note 1
- \* Connector cable kit for RS-232C Connection /Note 2
- \* Software for communication control : PANATERM /Note 2

Please prepare the following things by yourself. See Section 9 "Communicating Function" (p.42) in detail.

- \* Personal computer for setting the parameter
- \* OS

Note 1) We do not prepare the cable for connecting to the power supply of the driver. Please prepare it by yourself.

Note 2) This option can use only for the driver of our company. Then it can not be bought off the shelf at every store. Please contact our company to buy it.

## 2. Appearance and Names of Each Part

Mounting section (See Section 3-4 [p.12] and Section 11 [p.44])

Radiator (Metal flame)

Display LED (See Section 5-5 [p.28])

Connector SER (See Section 4-1-5 [p.20]):  
For connecting to the personal computer.

Connector I.F (See Section 4-1-3 [p.17]):  
Required for connection various signals  
when the user needs.

Connector SIG (See Section 4-1-4 [p.19]):  
For connecting to the rotary encoder.

Connector POWER (See Section 4-1-1 [p.14])

R.S.T. : Input power supply

P.B. : Terminals for additional  
regenerative resisters

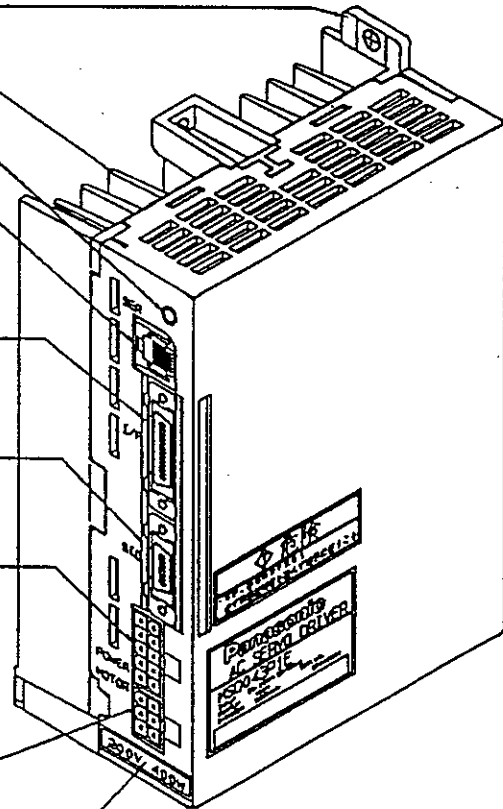
E. : Grounding

Connector MOTOR (See Section 4-1-1 [p.14])

U.V.W. : For motor connection

E. : Grounding

Panel surface



# 3. Caution

## 3-1 Caution for Safety

The following items should be observed, since there is possibility of an electric shock or being injured.

- (1) Even when the servo motor is off, do not touch terminals of the connector MOTOR (U, V, W) while the power is on or immediately after the power is turned off, because these terminals are still charged with high voltage.
- (2) Since a high frequency switching current runs through the servo motor, the grounding terminal (E) of the connector power and the grounding terminal (E) of the connector MOTOR should be ground together without fail. Also Ground the machine as well. We recommend you the third grounding (with 100Ω or less, Φ1.6mm or more) for prevention of an electric shock and malfunction.
- (3) In case of moving, wiring, maintaining and checking, please turn off the power and confirm the display of LED surely before doing these works. Besides, when you want to touch each terminals of the connector, please utterly turn off the input of the power supply outside the driver and wait for 5 minutes and more.
- (4) The cable should not be damaged, applied excessive stress, put heavy things on it and held between something.
- (5) While operating, never touch the rotating section of the motor.
- (6) The motor and the driver should be used according to the specified combination.
- (7) Never install the driver in the place where there is a lot of dust, water, oil and abrasive liquid splash, corrosive gas and flammable gas are generated and near combustible materials.
- (8) Please install it where vibration (0.5G or less) and shock are not applied. Avoid using it continuously at the resonance point.
- (9) While the power is on, do not touch the driver, the motor and the peripheral devices because their temperature is very high. Especially when the regenerative circuit is used, regenerative resistance sometimes become extremely high, do not touch it.
- (10) After for a while when the power is turn off, temperature of radiator of the driver, the regenerative resistor and the motor sometimes become very high, do not touch them.
- (11) While the power is on, in order to avoid to get injury owing to rare malfunction, never get near to the motor or machines run by the motor.
- (12) When you leave it for a long time without using, be sure to turn off the power.
- (13) In case of connecting wire to the power supply, be sure to use an overcurrent protective system (no fuse breaker) according to the Section 4-1-1 "Wiring to the Connector POWER and Connector MOTOR" (p.14).
- (14) No protective system is not equipped with the motor. Install an overcurrent protective device, an earth leakage braker and a temperature over-rise protector and emergency stop system.
- (15) Check that the specification of the power supply is normal.
- (16) In case of the trial operation, check the operation of the motor fixing the motor and separating it from the mechanical system then install it in the machine.
- (17) Since the brake equipped with the motor is for retaining, do not use it as a shut-down device to secure the safety of the machine itself and ordinary brake control.
- (18) Never perform extreme adjustments and changes. If you do so, the operation become so unstable.
- (19) In case of the emergency occurs, first remove the cause then secure the safety then reset the alarm. After this start the machine again.
- (20) Immediately after a short power failure, it is possible that the machine sometimes restart suddenly. So do not get near the machine in such a case (Even when you restart the machine, design the machine so that the security for the human being can be obtained.)

- (21) Install an emergency stop circuit outside the machine so that the operation can be stopped immediately and shut the power supply.

This product is designed and manufactured through the highest quality control. However, unexpectedly higher external noise or application of high static electricity, or wrong wiring, emergency trouble of the parts and terminal wiring may cause wrong operation. Then please pay extra attention for the safety of your machine.

This driver sometimes can not use in the usage which the regenerative energy is extremely high.

- (22) In case of the load inertia is extremely high, overcurrent trouble sometimes may occur while reduction, even if you connect a regenerative resister to this.
- (23) When the rising and falling axis falls then regenerative energy returns continuously, overcurrent trouble may occur even if a regenerative resister (option).

### 3-2 Cautions for Storage

- (1) Do not store the driver in the place where rain and water splash, harmful gas and liquid are usually used.
- (2) Store the driver in the place where direct sunshine falls and store it between the specified temperature and humidity.
- (3) When you stored it for a long time, contact the store you buy it or the reference written in this manual.

### 3-3 Cautions for Carriage

- (1) When you carry the driver, never touch the cable and the motor.
- (2) Over-stacking of the products can cause knocking over them. Then Stack products according to the instruction.

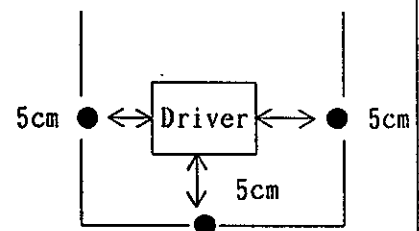
### 3-4 Cautions for Installation

- (1) Do not ascend on the driver and put heavy things on it.
- (2) Do not cover the inlet and outlet hole and be careful not to intake foreign things.
- (3) This driver should be installed vertically. Be sure to observe the installing direction.
- (4) Please take proper action against radiation of heat. Radiation in the controller of the servo driver and heat the current of the motor caused by the operation of the motor is added. If you use the driver with installed in the cover up control box, the temperature in the control box sometimes rise extraordinary. Then, in case of running it with installed in the control box, please take proper action to cool down the temperature around the driver should be lower than the maximum ambient temperature.

Besides, observe the specified distance between the body and the inside of the control panel and the other devices.

#### Ambient Temperature of the Servo Driver

The life time of the driver is greatly affected by the ambient temperature. Check that the ambient temperature at the point from 5cm from the driver is not exceed the maximum ambient temperature.



- (5) Avoid to install it near a heating material. That is, never install near a heater, a large-sized coiling resister and so on. When it is impossible owing to the packaging or installation, install a heat shutter panel between the servo driver and the heating material in order to be affected by the heating material.
- (6) This driver isn't designed for water resistance structure. Do not use it outside.
- (7) Do not apply strong shock.
- (8) Perform installation work properly for the output power and the weight of the body.
- (9) Install on the incombustible material like metal.
- (10) In case of using registration circuit, the temperature of the registration circuit sometimes become extremely high. Then install the driver not to touch the circuit during operation. In addition, take proper action to cool down the degeneration circuit.

### 3-5 Cautions for Maintenance and Check

- (1) The capacity of the condenser of the power supply line lower owing to degradation. In order to prevent the secondly trouble caused by a breakdown.
- (2) When overhaul is required, be sure to be performed our company.

# 4. Wiring

## 4-1 Caution on Wiring

### 4-1-1 Wiring to Connector POWER, Connector MOTOR

- (1) Perform wiring properly according to the example of Fig.4-1 "Example of Wiring to Connector POWER, Connector MOTOR".
- (2) As for the wiring equipment, wires to be used and so on, please refer to Section 4-2 "Selection of Wiring Equipment" (p.20)
- (3) Apply the voltage of the power supply as shown in the name plate.
- (4) Please avoid reverse connection between the terminal of Connector POWER (R,S,T) and those of Connector MOTOR (U,V,W).
- (5) Please avoid grounding the terminals of Connector MOTOR (U,V,W), or shortening them each other.
- (6) Please connect anything to the terminal of Connector POWER (P,B) normally. Also, do not touch these terminals (P,B), since high voltage is applied. In case of using where regenerative energy absorbing ability is insufficient, please use a regenerative resistor (option : DVOP0820). In detail, refer to Section 4-1-2 "Usage of Regenerative Resistor".
- (7) The rotating direction of the AC servo motor can not be changed by exchanging 3-phase like an induction motor. Connect wires as shown in Fig 4-1.
- (8) Be sure to ground the grounding terminal of connector MOTOR (E) and the grounding terminal of connector POWER (E) together with the grounding terminal of the noise filter at the same point. In addition, we recommend you to ground your machine itself. Please ground with ground resistance of  $100\Omega$  or less and  $\Phi 1.6\text{mm}$  (grounding of the third rank).
- (9) When you use a magnetic connector, relay, coil, or motor with brake, please install a surge absorbing circuit between coils or connectors or brake windings.
- (10) Please install non-fuse breaker and shut off the power externally of the driver in case of emergency. In case of using an earth leakage breaker, use that performed countermeasures for high frequency as a brake "for inverter". Besides, no sudden preventing circuit of the condenser is not added to the power supply circuit of the driver.
- (11) Please install a noise filter in order to reduce radio noise and to prevent any malfunction.  
(Example : LF-200 or 300 series by Tokin Inc.)

After wiring is finished, ensure that there is no wrong wiring again before turning on the power.

### 4-1-2 Usage of Regenerative Resistance

- (1) Be sure to use our regenerative resistance (option : DVOP0820). Never use other regenerative resistance.
- (2) The regenerative power which can be absorbed using regenerative resistor is as shown below.

\* in case of 200V specification

$$\text{Sudden regenerative power} = \frac{(\text{Regenerative voltage})^2}{\text{Regenerative resistance value}} = \frac{380^2}{120} \approx 1.2\text{kW}$$

$$\begin{aligned} \text{Average regenerative power} &= \text{Sudden regenerative power} \times \text{Maximum regenerative duty} \\ 1.2\text{kW} \times 1.8\% &\approx 21.6\text{W} \end{aligned}$$

\* in case of 100V specification

$$\text{Sudden regenerative power} = \frac{(\text{Regenerative voltage})^2}{\text{Regenerative resistance value}} = \frac{190^2}{120} \approx 0.6\text{kW}$$

$$\begin{aligned} \text{Average regenerative power} &= \text{Sudden regenerative power} \times \text{Maximum regenerative duty} \\ &= 0.6\text{kW} \times 1.8\% \approx 10.8\text{W} \end{aligned}$$

As for the maximum continuous turning ON time is 2 seconds in both cases:  
200V specification and 100V specification.

- (3) Even if you use the optional regenerative resistance, this can not be used in the case that the absorbing capacity of the regenerative energy is insufficient.  
In such a case, please reduce the regenerative energy by reducing the inertia of the load or by reducing the maximum speed and the adjustable speed.
- (4) The wire between the driver and the regenerative resistance should be as short as possible (50cm or less).
- (5) The wiring of the regenerative resistor should be performed securely, according to Fig. 4-1 "Example of Wiring to Connector POWER and Connector MOTOR".

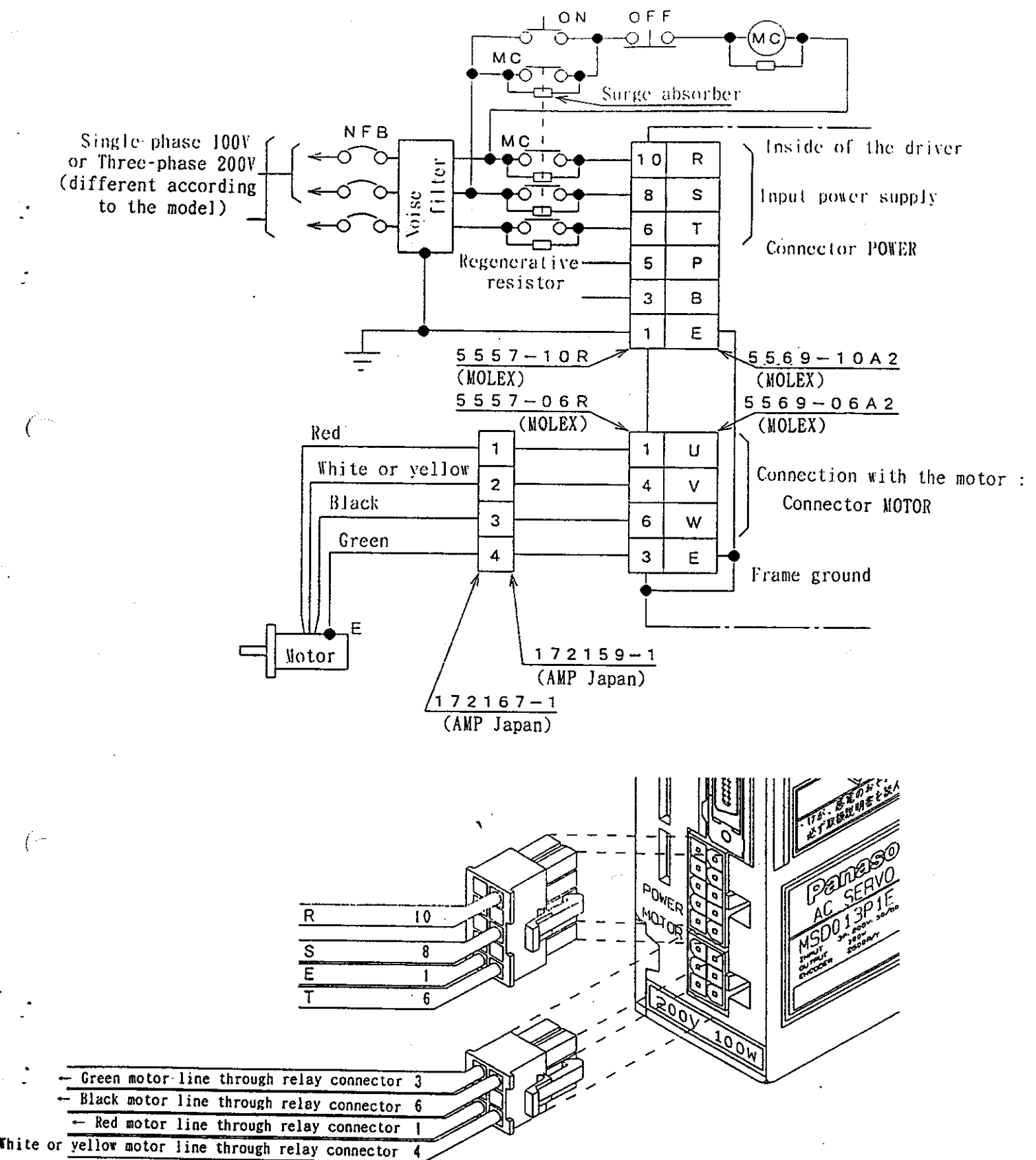


Fig. 4-1 Example of Wiring to Connector POWER and Connector MOTOR



#### 4-1-3 Wiring to Connector I/F

- (1) Please make wiring per Fig. 4-2.
- (2) Please prepare a power supply for a control signal with DC12-24V, used for external control connected between COM + and COM -.
- (3) Please shorten the wiring of the driver and other equipment as much as possible (3 m or shorter).
- (4) Please separate this wiring from the power lines (R, S, T, U, V, W, E), as much as possible (30 cm or more).  
Please avoid passing both wires into the same duct or binding them together.  
This may cause malfunction.
- (5) Please do not apply more than DC 24V, 50mA, to each terminal of the control output (ALM, COIN), or avoid applying reverse polarity.  
This may cause damage to the driver.
- (6) If you directly drive a relay with the control output terminals, please install a diode in parallel with the relay as Fig. 4-2 shows. If you do not install a diode, or install it in reverse direction, this may cause damage to the driver.
- (7) As per Fig. 2, please use shielded, twisted pair wires for a signal line of I/F (analog command input, command pulse input, feed-back pulse output of the encoder etc.). Please ground the shield to the 14-pin (GND) of the driver.  
(The shield of other equipment normally open.)
- (8) Connect nothing to the free pin of the connector I/F (15, 16, 17, 18).  
In addition, never short each other.

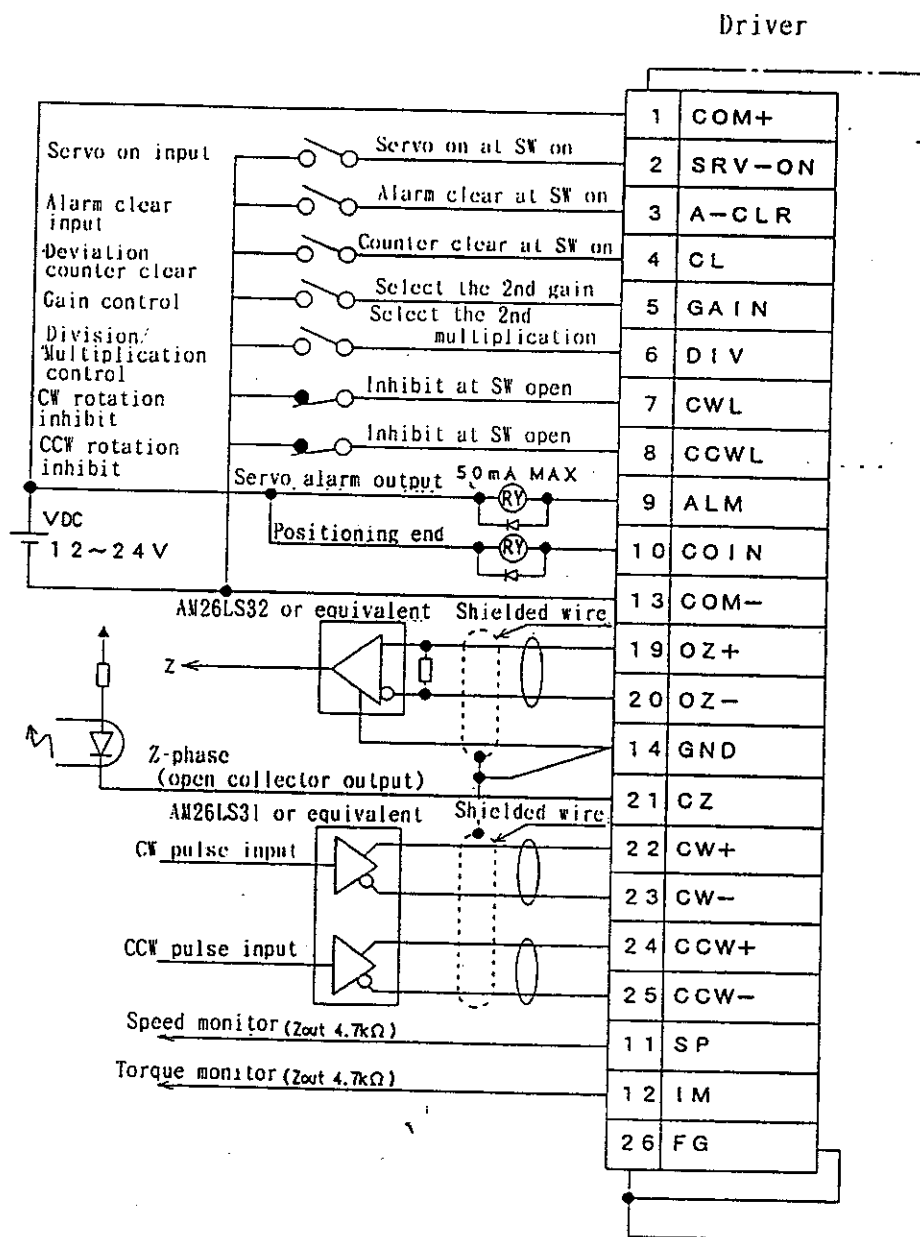


Fig. 4-2 Example of wiring to connector CN 1/F

Receptacle on driver side		Applicable plug on user side		Manufacturer
Connector mark	Product No.	Part name	Product No.	
CN 1 F	10226-52A2JL <sup>*1</sup>	Plug	10126-3000VE <sup>*2</sup>	Sumitomo 3M, Ltd.
		Shell	10326-52A0-008 <sup>*2</sup>	

\*1 Parts equivalent to product number above made by other manufacturers may be used for receptacle and plug.

\*2 Plug and shell kit should be used those having the above product number or equivalents having the above product number and produced by other manufacturer.

# 1 1 1 Wiring to Connector SIG

- (1) For the encoder cable, use a stranded wire having core of 0.18mm<sup>2</sup> or above, a twisted pair of wire having overall shield.
- (2) The length of the cable must be within 20m max. When wiring is long, we recommend double wiring in order to reduce influence by voltage fall for 5V (3, 4 pin) and 0V (1, 2 pin) power supply.
- (3) Be sure to connect the shield on driver side of a relay cable to pin 14 (FG) of SIG. Connect the shield on motor side of a relay cable to the shield of a shielded wire coming from the encoder (pin 6 of relay connector).
- (4) Separate the wires to power line (R, S, T, U, V, W, and E) as far as possible (more than 30cm).  
Do not lead them through the same duct nor tie them together.
- (5) Do not connect anything to unused terminals of CN SIG (pins 5, 6, 7, 8, 9, 10, 13).

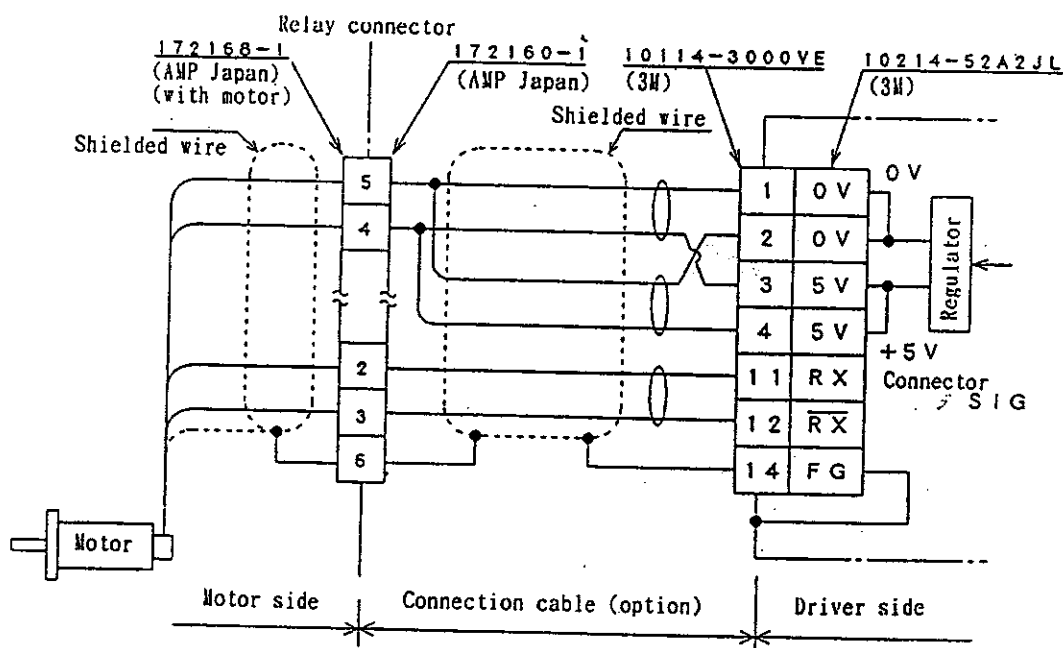


Fig. 4-3 Example of wiring to connector CN SIG

Receptacle on driver side		Applicable plug on user side		Manufacturer
Connector mark	Product No.	Part name	Product No.	
CN SIG	10214-52A2JL <sup>*1</sup>	Plug	10114-30000VE <sup>*2</sup>	Sumitomo 3M, Ltd.
		Shell	10314-52A0-008 <sup>*2</sup>	

\*1 Parts equivalent to product number above made by other manufacturers may be used for receptacle and plug.

\*2 Plug and shell kit should be used those having the above product number or equivalents having the above product number and produced by other manufacturer.

## 4 1 5 Wiring to Connector SER

(1) With a personal computer designated in section 9-1-1 (P.42), you can operate this driver with the following functions;

- \* Setting change of each parameter
- \* Control state reference
- \* Error condition reference
- \* Error record reference
- \* Automatic gain tuning
- \* Waveform graphic function
- \* Saving/loading of the parameter data

(2) Please use the optional connecting cable between the driver and the computer.

As for the optional cable, refer to Section 12-4 "RS-232 C Connector Cable Kit" (p.48).

## 4-2 Selection of a wiring equipment

Applicable motor			Power consumption (At rated lower)	No-fuse breaker (Rated current) [Note] 1	Recommended noise filter [Note] 2	Electromagnetic switch (Composition of contact) [Note] 1	Main circuit wire diameter (R, S, T, U, V, W, E)
Series	Voltage	Output					
MSM	100V	~ 50W	0.3kVA	BBP2-10 (10A)	LF-210	BMF61041 (4a)	0.75mm <sup>2</sup>
		100W	0.4kVA	BBP2-15 (15A)	LF-215	BMF61041 (4a)	0.75mm <sup>2</sup>
		200W	0.5kVA	BBP2-15 (15A)	LF-215	BMF61041 (4a)	0.75mm <sup>2</sup>
	200V	~100W	0.3kVA	BBP3-5 (5A)	LF-305	BMF61042 (4a)	0.75mm <sup>2</sup>
		200W	0.5kVA	BBP3-10 (10A)	LF-310	BMF61042 (4a)	0.75mm <sup>2</sup>
		400W	0.9kVA	BBP3-10 (10A)	LF-310	BMF61042 (4a)	0.75mm <sup>2</sup>

[Note] 1. The product number of no-fuse breaker and electromagnetic switch belongs to Matsushita Electric Works, LTD.

[Note] 2. The product number of noise filter belongs to Tokin, LTD.

# 5. Function

## 5-1 Input/Output signal (Connector I/F)

Note) 1

Type	Title	Symbol	Pin No.	Contents/function	Structure of circuit
Control signal power supply	Control signal power supply	COM+	1	<input type="checkbox"/> Connect (+) of the control signal power supply (12~24V) to the COM+ (1 pin), and (-) to the COM- (13 pin). <input type="checkbox"/> Prepare a control signal power supply at your side. <input type="checkbox"/> Capacity varies depending on a composition of the control output circuit. Allow extra capacity. (200mA or more)	
		COM-	13		
Control input	Servo-ON input	SRV-ON	2	<input type="checkbox"/> When you connect to COM- of the control signal power supply, dynamic brake will be released and the driver turns to "Servo-ON". <input type="checkbox"/> When you open the connection to COM, the driver changes to the servo off condition, then perform the operation when user parameter No.1 E is set the "sequence with servo off". <div> <div>Note</div>           1. When you shift from "Servo-OFF" to "Servo-ON", make sure that the motor is at stop.  <div>Note</div>           2. Turn on/turn off the power at "Servo-OFF" status in order to avoid transitional trouble.  <div>Note</div>           3. Allow 120 ms or more before input the command (speed/pulse etc.) after shifting to "Servo-ON".         </div>	i-1
	Alarm clear input	A-CLR	3	<input type="checkbox"/> You can clear the alarm status when you connect to COM-, and you can return to the normal run. <input type="checkbox"/> At the same time, the deviation counter will be cleared. <div> <div>Note</div>           You cannot clear the overload (OL), overcurrent (OC), encoder error (ST) and system error, parameter error, CPU error and DSP error with this input.            In order to clear the above, please remove the error factor first, then turn off/on the power.         </div>	i-1
	Counter clear input	CL	4	<input type="checkbox"/> If you connect to COM of the power supply of the controlling signal will be cleared and the setting of the deviation counter and the feedback pulse input from the encoder is forbidden. <input type="checkbox"/> As for this input, owing to the user parameter No.19 "Counter clear input mode", the clear setting can be selected "edge or level". As for the setting refer to Section 8-2 "Details of User Parameter" (p.37).	i-1

Note 1) As for the details of the structure of the circuit, refer to Section 5-2 "Structure of Input/Output Circuit" (p.24).

Type	Title	Symbol	Pin No.	Contents/function	Structure of circuit
Control input	Gain switching input	GAIN	5	<input type="checkbox"/> When you set user parameter No.33 "the Second Gain Operation Setting" to "2" then connect the signal power supply for control, COM-, each gain will be changed to various second gains set by user parameter No.30~32.	i-1
	Command circuit switching input	DIV	6	<input type="checkbox"/> If you connect the power supply of the control signal, COM-, the value of the numerator of pulse frequency division will be changed to the value set by the user parameter No.35 ; the second numerator of pulse frequency division.	i-1
	CW rotation inhibit input	CWL	7	<input type="checkbox"/> In case of a linear drive, connect to the limit SW in CW direction (viewed from the motor shaft), and close this limit in case of a normal run. If the SW becomes open exceeding the limit, no CW torque will be generated. <input type="checkbox"/> When you do not use the limit SW, please mask this input through the parameter (refer to section 9-2 (10)), or connect between (-) at any time. <input type="checkbox"/> You can activate a dynamic brake with this input. Refer to section 5-3 "Dynamic brake" (P.25) for a detail.	i-2
	CCW rotation inhibit input	CCWL	8	<input type="checkbox"/> You can prohibit a generation of CCW torque. Refer to the above "CW rotation inhibit input" for the function and composition.	i-2
Control output	Servo-alarm output	ALM	9	<input type="checkbox"/> Transistor turns off when the driver detects the error and activates the protective function.	o-1
	Positioning end signal output	COIN	10	<input type="checkbox"/> When the reserved pulse amount of the deviation counter gets within the positioning end range which you set through the parameter No. 22, transistor turns on.	o-1
Analog signal output	Speed monitor signal	SP	11	<input type="checkbox"/> The driver outputs voltage in proportion to the rotating speed of the motor. As for the relation between the monitor voltage and the rotating speed, refer to Fig.5-1-1. <input type="checkbox"/> You can set 2 types of full scale value of the monitor voltage, by means of user parameter No.08, "Selection of Speed Monitor Gain".	Ao-1
		GND	14		
	Torque monitor signal	IM	12	<input type="checkbox"/> The driver outputs voltage in proportion to the generated torque of the motor. As for the relation between the monitor voltage and the generated torque, refer to Fig. 5-1-2. <input type="checkbox"/> Output impedance : 4.7 $\Omega$	Ao-1
		GND	14		

Note 1) As for the details of the structure of the circuit, refer to Section 5-2 "Structure of Input/Output Circuit" (p.24).

Type	Title		Symbol	Pin No.	Contents/function	Structure of circuit
Pulse row command input	CW pulse output		CW+	22	<input type="checkbox"/> It is input of the command pulse and it is received by the high speed photocapra IC at the driver side. <input type="checkbox"/> Input impedance : 220 $\Omega$	Di-1
			CW-	23		
	CCW pulse input		CCW+	24		Di-1
			CCW-	25		
Encoder pulse output	Pulse output	Z-phase output	OZ+	19	<input type="checkbox"/> Regenerate the Z-phase from the Z information received from the 4-lead-wire encoder and the position information then different output from the line driver (AM26LS31 and the equivalent). (Note 2)	Do-1
			OZ-	20		
		Z-phase output	CZ	21	<input type="checkbox"/> Output from the open collector of the regenerated Z-phase signal regarding the signal GND as common.	Do-2
	Signal ground		GND	14		
	Frame ground		FG	26	<input type="checkbox"/> It is connected with metal frame equipped with the body of the driver.	

Note 1) As for the details of the structure of the circuit, refer to Section 5-2 "Structure of Input/Output Circuit" (p.24).

Note 2) Between the Z-phase output of the driver and the reference signal of the encoder (Z-phase output), delay of 90  $\mu$ s will be generated.  
 As for the Z-phase output of the driver signal open collector output (CZ), the output transistor is turned ON, between the CZ as shown in the following Fig.

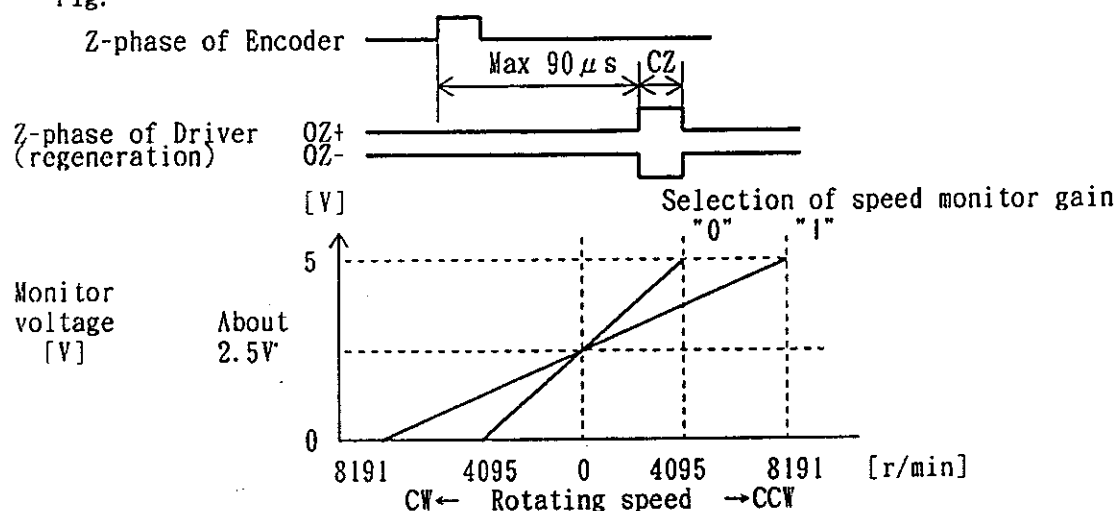


Fig. 5-1-1 Relation between the Speed Monitor Voltage and the Rotating Speed

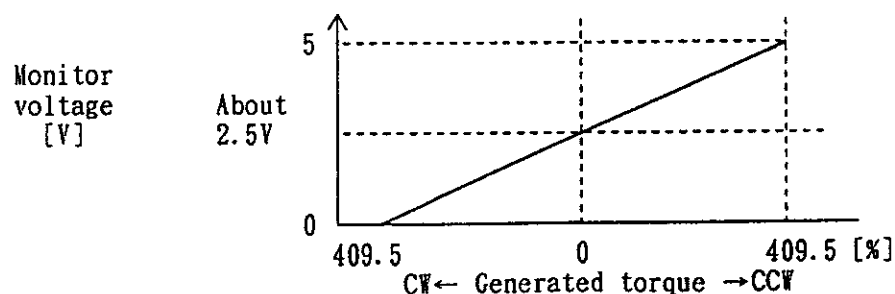
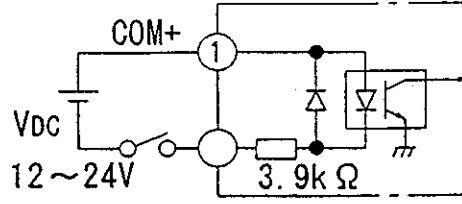
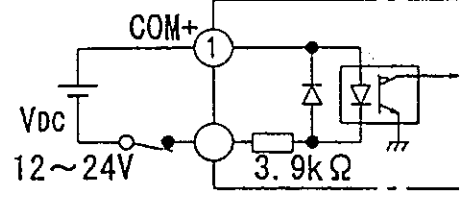
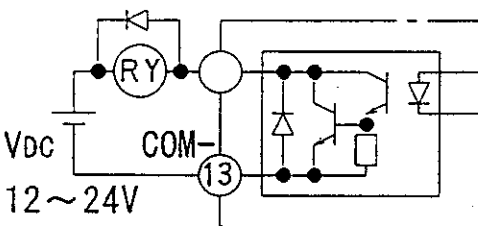
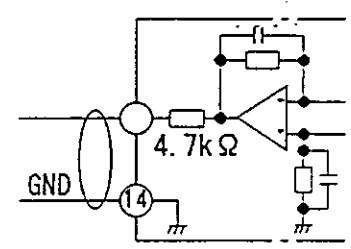
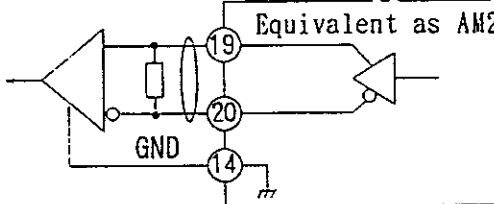
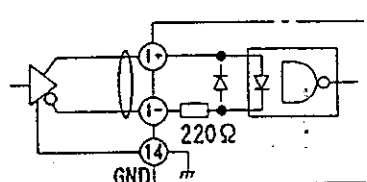
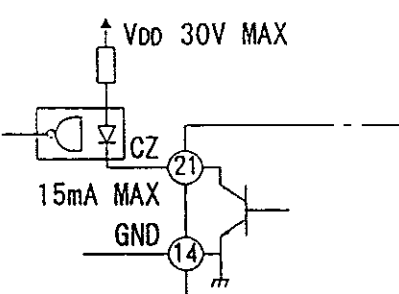
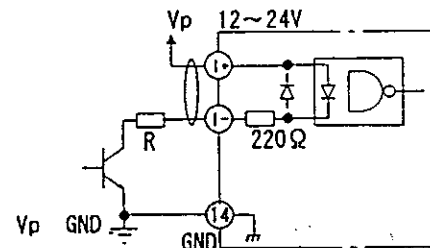


Fig. 5-1-2 Relation between the Torque Monitor Voltage and the Generated Torque

## 5-2 Structure of Input/Output Circuit

<p>Controlling input 1 i-1</p> 	<p>Controlling input 2 i-2</p> 
<p>Controlling output o-1</p>  <p>Note) In order to protect the relay, install a diode as shown in the figure.</p>	<p>Analogue signal output Ao-1</p> 
<p>Digital signal output 1 Do-1</p>  <p>Equivalent as AM26LS31</p>	<p>Pulse train signal input Di-1</p>  <p>In case of line driver MAX 500kpps</p>
<p>Digital signal output 2 Do-2</p>  <p>VDD 30V MAX 15mA MAX</p>	<p>In case of open collector</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <math display="block">\frac{V_p - 1.5}{R + 220} \approx 10\text{mA}</math> </div>



### 5-3 Dynamic brake

MSD\*EX Series have built-in dynamic brake for emergency stop. The dynamic brake will be activated in the following cases:

- (1) when you turn off the main power,
- (2) when you turn the driver to "Servo-OFF",
- (3) when a protective function is activated,
- (4) during deceleration, when the limit SW, connected to "CW rotation inhibit input (CWL)" of the Connector I/F is turned to "open" while the motor is running at CW.
- (5) during deceleration, when the limit SW, connected to "CCW rotation inhibit input (CCWL)" of the Connector I/F is turned to "open" while the motor is running at CCW.

- Note** 1. In case of the above (4) and (5), you can select whether or not to activate the dynamic brake through the following parameter No. 5.  
(Refer to section 8-2 "Detail of user parameter" (P.37))
- |  |                   |
|--|-------------------|
| Sequence in case of rotation inhibit input | : Parameter No.0A |
| Sequence in case of the alarm occurs       | : Parameter No.1D |
| Sequence in case of the servo OFF          | : Parameter No.1E |

- Note** 2. The dynamic brake is rated for a short duration. Use this only for emergency. Avoid a frequent repetition of "Servo-ON/OFF".

## 5-4 Auto-gain tuning

### 5-4-1 Outline of auto-gain tuning

The driver selects the most proper gain automatically, by presuming the load inertia from the required torque when you drive the motor.

### 5-4-2 Applicable range

- ☐ You can apply this function only when the following conditions are satisfied.
- ☐ Even if the conditions are satisfied, there may be the cases when you cannot apply this function, due to various load conditions.  
In these occasions, please setting manually.

	Applicable conditions
Load inertia	<input type="checkbox"/> To be more than 3 times, but less than 20 times that of the rotor inertia of the motor. Inertia to be as stable as possible.
Load	<input type="checkbox"/> Machine stiffness to be as high as possible, including a coupling to the motor. (No belt drive is applicable.) <input type="checkbox"/> Backlash of the gear to be as small as possible. <input type="checkbox"/> Eccentric load to be less than 1/4th, of the rated torque (especially in the use at vertical shift axis). <input type="checkbox"/> Viscous load torque to be less than 1/4th of the rated torque. <input type="checkbox"/> No safety problem nor machine damage to be expected, even when an oscillation occurs. <input type="checkbox"/> Machine to allow two revolutions of the motor for CCW and CW in both forward and reverse direction.

### 5-4-3 Cautions

- (1) In case of performing auto-gain tuning, as for gain switching input (GAIN) and command circuit switching input (DIV), please set the first gain and the first numerator of pulse frequency division is selected.
- (2) During the automatic gain tuning operation, you can expect the motor output torque up to the max. set through the parameter No. 06 and CW & CCW rotation inhibit input becomes inactive.
- (3) Depending on the condition of the load, the driver sometimes may enter an oscillation. Please pay extra attention for the safety. When the oscillation occurs, turn off the power immediately or turn off the servo.
- (4) When any malfunctions occur during the automatic gain tuning operation, turn off the power or turn to "Servo-Off" immediately.
- (5) When load inertia cannot be estimated although automatic gain tuning is performed, gain remains unchanged as a value before tuning.

#### 5-4-4 Auto-gain tuning operation

- (1) When you set the machine stiffness No. (higher the setting No., stiffer the tuning you can set) and execute, you can start the automatic gain tuning operation.
- (2) Rotate 2 revolutions to CCW and 2 revolutions to CW 2 times. Take this process as one cycle, and repeat max. 5 cycles.
- (3) Operation acceleration will be increased by double from the 3rd. cycle onward. Depending on the state of load, there may be some cases when the auto-tuning will be completed before 5 cycles, or the operation acceleration will not change. These are not malfunctions.

Regarding the machine stiffness No.

- ☐ This No. represents the stiffness of the machine, and ranges from 1 to 9. You can set a higher value and higher gain with a higher stiffness machine.
- ☐ Normally you start setting with smaller No., and repeat the automatic gain tuning until you encounter the oscillation, abnormal noise or vibration.

#### 5-4-5 How to operate

- (1) Shift the load where no problem to be seen when the motor rotates 2 revolutions.
- (2) Inhibit the command.
- (3) Turn to "Servo-ON".
- (4) Start up the automatic gain tuning.
- (5) Write into EEPROM if no problem to be seen.

**Note** If "Alarm", "Servo-OFF" or "Deviation counter clear" is inputted during the automatic gain tuning operation, this leads to "Automatic gain tuning error".

## 5-5 Protective functions

### 5-5-1 Outline

- (1) MSD\*EX Series have various protective functions, and the driver trips while an alarm output signal (ALM) is turned "off" from "on" when these functions are activated.

- (2) Displaying the conditions

In case of a protective function operates in MSD\*EX, the error is indicated by the LED's lighting up or blinking (colors and frequency of blinking) on the control panel. In addition, the error condition can be checked on the monitor of the personal computer by using the communication function (Section 9 "Communication Function" (p. 42)).

(As for the detail, refer to the "Operation Manual of PANATERM" to be attached the option : DVOP061 (PANATERM).

The display of error conditions of the displaying LED equipped with the body of the driver are as follows :

- ① When the operation is normal (light up)

Green : Servo ON

Orange : Servo OFF and the servo inside the driver is ready to operate.

- ② When the protective functions work (flashing or lighting up)

\* In case of recovery of the error is possible

(It can be cleared A-CLR signal)

Number of flashing of the red and orange LEDs indicates the Error No.

(As for the Error Nos., refer to Section 5-5-2 "Details on Protective Function".)

Flashing red ----- the units digit

Flashing orange ----- the tens digit

Example) In case of occurrence of the error No.14

(overcurrent protection trouble)

The LEDs blinking in line continuously.

●○○○○●○○○○●○○○○●○○○○ ~



Red (4 times)

Orange (Once)

Exceptions) However, errors concerning the encoder can not be cleared by A-CLR signal.

- \* In case of the recovery from the error is impossible.

(can not be cleared by A-CLR signal.)

In case of the error protective function shown below works, it is displayed high speed flashing of the red LED or lighting up of the red LED.

In case of these cases, turn ON the power again to reset the error.

System Error Protection

CPU Error Protection

Other Error Protections

# 5-5-2 Detail of protective functions

\* According to the error, there are errors whose cause can be recovered (alarm removal) and those can not be recovered by A-CLR signal.

\* Causes that can not be recovered, it is necessary to turn ON the power again.

Protective function	Error code No.	LED indicator	Content	Corrective action
Overvoltage protection	12	No. flush	<input type="checkbox"/> Voltage at converter exceeds 400VDC (for 200V model), or 200VDC (for 100V model), due to regenerative energy.	<input type="checkbox"/> Extend deceleration time. Or reduce load inertia. <b>[Note]</b> This cannot be applied to use regenerative brake continuously.
Undervoltage protection	13	No. flush	<input type="checkbox"/> Power supply voltage drops due to instantaneous power shut off or lack of power capacity.	<input type="checkbox"/> Check if power supply voltage is within permissible range or not. <b>[Note]</b> Check voltage drop due to lack of power capacity, or rush current at Power-ON. Also check open phase of power supply.
Overcurrent protection	14	No. flush	<input type="checkbox"/> Output current of converter increases extraordinarily.	<input type="checkbox"/> Check short of each of motor leads (U,V,W), after shutting off power. <input type="checkbox"/> Verify insulation resistance between motor leads (U,V,W) and motor ground (E), and check any deterioration of insulation resistance. <input type="checkbox"/> If this protection recurs, even after checking and turning on power again, it represents malfunction. Shut off power immediately.
Overload protection	16	No. flush	<input type="checkbox"/> Driver is used continuously with current which exceeds ratings.	<input type="checkbox"/> Extend accel./decel. time or reduce load. Or extend capacity motor/driver.
Detector error	17	No. flush	<input type="checkbox"/> Hard trouble of the power supply sensor is detected.	<input type="checkbox"/> Turn off the power and turn it on again.
Position error limit protection	24	No. flush	<input type="checkbox"/> Position error pulse exceeds permissible range set through the parameter No. 23 (Position error limit setting).	<input type="checkbox"/> Check if motor runs per position command pulse or not. <input type="checkbox"/> Check saturation of output torque at torque monitor. <input type="checkbox"/> Set value of parameter No. 06 "Torque limit" to the max. (300% normally) Verify gain adjustment. <input type="checkbox"/> Extend accel./decel. time or reduce load, if above check does not show any error.
Deviation counter overflow protection	29	No. flush	Position error pulse exceeds $2^{27}=(134217728)$ .	<input type="checkbox"/> Check as same as above.
Overspeed protection	26	No. flush	<input type="checkbox"/> Motor speed exceeds a limit set through the parameter.	<input type="checkbox"/> Check if you input excess speed command or not. Or check input frequency of command pulse and division/multiplication ratio of command pulse. <input type="checkbox"/> Check if overshoot occurs at acceleration due to mis-adjustment of gain.

Protective function	Error code No.	LED indicator	Content	Corrective action
Rotation inhibit input error protection	38	No. flush	<input type="checkbox"/> Driver trips when both CW and CCW rotation inhibit input turns to off, interpreting this as an error.	<input type="checkbox"/> Check any errors of SW, wire, or power supply connected to CW/CCW rotation inhibit input. <input type="checkbox"/> Especially, check start-up delay of power supply for control signal (12~24VDC).
Command pulse division error protection	27	No. flush	<input type="checkbox"/> Driver trips when division/multiplication ratio which you set through parameter No. 25, 26 is not proper. (too high).	<input type="checkbox"/> Set division/multiplication ratio so that command pulse frequency after division/multiplication becomes less than the max. input pulse frequency (500kpps).
Encoder connection error	21	No. flash	<input type="checkbox"/> In case of there is an error on the encoder connection when the power is turned ON (Normal receiving can not be performed at all), tripping occurs.	<input type="checkbox"/> Check the wiring and connection between the driver and the encoder and connecting condition of the connector SIG. <input type="checkbox"/> Check the voltage of the power supply (5V±5%) on the encoder side.
Encoder communication error	22	No. flash	<input type="checkbox"/> In case of where there occurs an error like disconnection on the encoder connection after the power is turned ON, tripping occurs.	<input type="checkbox"/> Check the wiring and connection between the driver and the encoder and connecting condition of the connector SIG. <input type="checkbox"/> Check the voltage of the power supply (5V±5%) on the encoder side.
EEPROM parameter error protection	36	No. flush	<input type="checkbox"/> Shows EEPROM parameter error if the data is damaged, when you read it from EEPROM upon the power on.	<input type="checkbox"/> Set all the parameter again and write into EEPROM.
System error protection	98	Red flush	<input type="checkbox"/> Driver trips by judging some possible error by self-diagnosis function.	<input type="checkbox"/> Turn off power once, then turn on again. If driver still trips, showing the left display, this may represent some malfunction. Shut off power immediately.
CPU error protection	30	Red flush		
Other error protection	99	Red flush		

Note 1) In order to restart the driver after the trip, please remove the trip factor by turning off the power. Then turn on the power gain, or enter an alarm clear signal (A-CLR).

Please note that you cannot reset when the following protective functions (When error protection concerning high speed flashing of the red or the orange LEDs or lighting trouble and encoder connection) are activated, and please reset by turning on the power again:

- Encoder connection error
- Encoder communication error
- System error protection
- CPU error protection
- Other error protection

Turn on power again for resetting.

Note 2) When EEPROM parameter error protection (No. 36) has worked, turn on power again, then check all parameters and reset them.

Note 3) As for the overload error, the driver can be recovered by A-CLR in 10 or more seconds after the alarm occurs.

## 6. Running

### 6-1 Before running

- (1) Any wrong wiring?  
Especially wrong wiring of the power input connector terminal R, S, T, E and the motor output connector terminal U, V, W, E, and loose connection.
- (2) Is the input power correct?
- (3) Any short portion with wire refuse?
- (4) Any loose screw or connector? Is the connector inserted securely?
- (5) Is the motor connecting cable shorted or grounded?

### 6-2 Trial run

- (1) Please make a trial run per below:
  - Run the motor with no load (no load connected to the motor shaft).
  - Fix the motor to avoid any movement due to the quick accel/decel. operation.
- (2) Release a brake if you use the motor with a brake.
- (3) Set polarity of signals, or switches connected to the input signal pins of CN I/F per the following Fig., and apply a signal power supply (DC12~24V).
- (4) Turn on the power to the driver.  
LED indication turns to orange.
- (5) Input a Servo-ON signal.  
The LED display turns green (lighting up), the motor condition is ready to operate.
  - \* Deviation counter clear signal (CL) should be performed clear release {ON(L)-OFF(H)}. Then the motor condition becomes servo lock.
- (6) Please try other functions such as parameter change or gain adjustment.

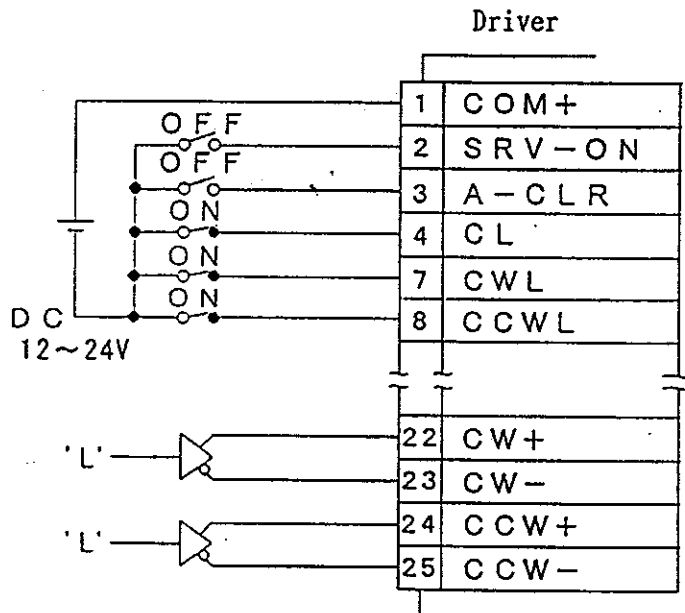


Fig. 6-1 Connector I/F

# 7. Adjustment

## 7-1 Gain adjustment

As explained in section 6-4, some models of MSD\*EX Series have the automatic gain tuning function. If you encounter the case when the automatic gain tuning cannot be performed well due to the load condition, or when the vibration or noise is generated at the stopping or running or when you want to obtain the most proper response or stability matching to the various load conditions, you may need the re-adjustment. In this case, please refer to section 7-1-1, "Basics of gain adjustment", and readjust.

- Though MSD\*EX Series consist of the digital AC Servo, you can make an analog adjustment for the servo gain adjustment. Following chart illustrates the image of making an equivalent conversion of the servo control to the analog servo control:

G1: Position loop gain (Parameter No. 20)  
 G2: Speed loop gain (Parameter No. 03)  
 G3: Speed loop integration time constant (Parameter No. 04)  
 G4: Speed feed forward (Parameter No. 21)

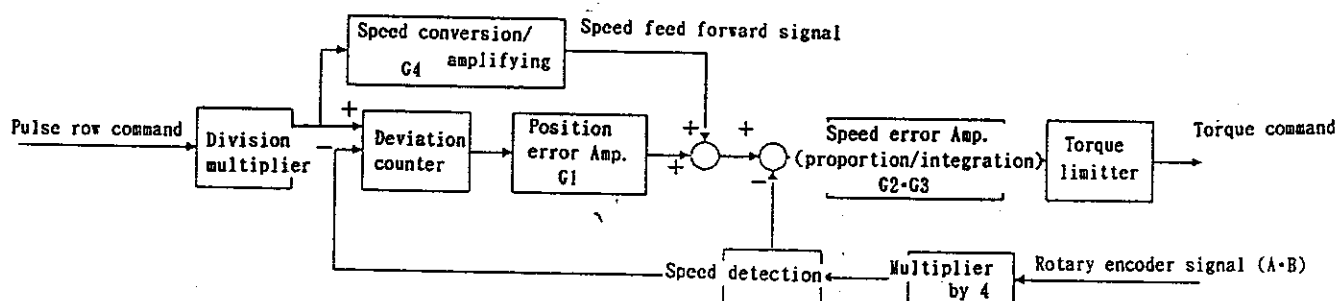


Fig. 7-1 Equivalent block diagram



#### 7-1-1 Basics of gain adjustment

- (1) Set a speed feed forward gain to the minimum (0%) through the Parameter No. 21 (Refer to section 8, "Parameter" and section 9, "Function of communication").
- (2) Set a larger value of the speed loop gain (within the range that no oscillation occurs) through the Parameter No. 03.
- (3) Set the larger value of the position loop gain through the Parameter No. 20. within the range that no oscillation occurs.
- (4) Set the smaller value of the speed loop integration time constant through the Parameter No. 04. Smaller the value you set, faster the speed you can obtain to make the position deviation toward 0.
- (5) When you want to obtain an extremely fast response speed, increase the speed feed forward gain gradually through the Parameter No. 21. If you set too large, it may cause the overshoot.

#### 7-1-2 Caution on the gain adjustment

- (1) The most proper value of the gain setting varies depending on the load. Please make re-adjustment when the load is changed.
- (2) When you set the maximum value of the speed loop integration time constant (1000[ms]) the position-finish may not reach within the range set through the Parameter No. 22 and the positioning end signal (COIN) may not be fed out. Please set this value to "100[ms]" or less at normal condition.
- (3) If you set too high value of the gain setting, it may cause the oscillation. In this case, lower the gain setting to stop the oscillation. If you cannot stop the oscillation, turn the Servo-ON command to OFF by turning off the main power then turn on again to reset the gain from the lower value.

# 8. Parameter

## 8-1 Outline of parameter

- (1) MSD\*EX Series have parameters through which you can set/adjust various features and functions. Changing and checking of the setting of the parameter should be performed using personal computer sold at the market.
- (2) Parameters are classified as follows;
  - ① User parameter which you can set and change the data
  - ② System parameter which you can refer but cannot set nor change the data
 Each parameter consists of 6 pages, and each page is divided by max. 16.
- (3) Following is the list of parameters; Please refer to section 8-2 "Detail of user parameter" (P.37) for the detail.

Type	Parameter No.	Parameter	Adjustable range	Standard factory setting
User parameter  PAGE 1/4	0 0	Name of axis	0~9	0
	0 1	(not in use)	—	
	0 2	(not in use)	—	
	0 3	Speed loop gain	25~3500	100
	0 4	Speed loop integration time constant	1~1000	50
	0 5	Speed detection filter	0~4	4
	0 6	Torque limit	0~400	*
	0 7	(not in use)	—	
	0 8	Speed monitor gain	0~1	0
	0 9	Inactive drive inhibit input	0~1	1
	0 A	Dynamic brake	0~1	0
	0 B	(not in use)	—	
	0 C	(not in use)	—	
	0 D	(not in use)	—	
	0 E	(not in use)	—	
	0 F	(not in use)	—	
User parameter  PAGE 2/4	1 0	(not in use)	—	
	1 1	(not in use)	—	
	1 2	(not in use)	—	
	1 3	(not in use)	—	
	1 4	(not in use)	—	
	1 5	(not in use)	—	
	1 6	(not in use)	—	
	1 7	(not in use)	—	
	1 8	(not in use)	—	
	1 9	Counter clear input mode	0~1	0
	1 A	(not in use)	—	
	1 B	(not in use)	—	
	1 C	(not in use)	—	
	1 D	Sequence when alarm occurs	0~17	0
	1 E	Sequence when servo is OFF	0~145	0
	1 F	(not in use)	—	

Note) \*

Type	Parameter No.	Parameter	Adjustable range	Standard factory setting
User parameter  PAGE 3/4	2 0	Position loop gain	0~1000	50
	2 1	Speed feed forward	0~100	0
	2 2	Positioning end range	0~32766	10
	2 3	Position error limit setting	1~32766	30000
	2 4	Cancel of position error limit	0~1	0
	2 5	Numerator of pulse frequency division	1~10000	10000
	2 6	Denominator of pulse frequency division	1~10000	10000
	2 7	(not in use)	—	
	2 8	(not in use)	—	
	2 9	(not in use)	—	
	2 A	Time constant of torque filter	0~2500	0
	2 B	Time constant of feed forward filter	0~6400	0
	2 C	(not in use)	—	
	2 D	(not in use)	—	
	2 E	(internal use)	—	
	2 F	(not in use)	—	
User parameter  PAGE 4/4	3 0	Second speed loop gain	25~3500	50
	3 1	Time constant when second speed loop is integrated	1~1000	50
	3 2	Second position loop gain	10~1000	50
	3 3	Setting operation of second gain	0~2	0
	3 4	Switching and delaying time of second gain	0~10000	0
	3 5	Second pulse frequency division	1~10000	10000
	3 6	Setting of smoothing filter	0~5	0
	3 7	(not in use)	—	
	3 8	(not in use)	—	
	3 9	(not in use)	—	
	3 A	(not in use)	—	
	3 B	(not in use)	—	
	3 C	(not in use)	—	
	3 D	(not in use)	—	
	3 E	(not in use)	—	
	3 F	(not in use)	—	

Type	Parameter No.	Parameter	Adjustable range	Standard factory setting
System parameter  PAGE 1/2	0 0	Motor pole	* These parameters are set by factory corresponding to the applicable motor and driver. * You cannot change the value of these parameters.	
	0 1	Encoder pulse		
	0 2	J/T ratio		
	0 3	(internal use)		
	0 4	(internal use)		
	0 5	Overspeed level		
	0 6	Max. output torque		
	0 7	Overload time constant		
	0 8	Overload criteria		
	0 9	Shortage voltage detection level		
	0 A	Overvoltage detection level		
	0 B	Regenerative voltage detection level		
	0 C	(internal use)		
	0 D	(internal use)		
	0 E	(internal use)		
	0 F	(internal use)		
System parameter  PAGE 2/2	1 0	(internal use)		
	1 1	(internal use)		
	1 2	(internal use)		
	1 3	(internal use)		
	1 4	(internal use)		
	1 5	(internal use)		
	1 6	(internal use)		
	1 7	(internal use)		
	1 8	(internal use)		
	1 9	(internal use)		
	1 A	(internal use)		
	1 B	(internal use)		
	1 C	(internal use)		
	1 D	(internal use)		
	1 E	(internal use)		
	1 F	(internal use)		

## 8-2 Detail of user parameter

No.	Parameter	Adjustable range	Function • Contents
00	Name of axis	0~9	<input type="checkbox"/> When you use a computer to refer or monitor the parameter setting, you can monitor which axis the computer is accessing, while you control multi-axis. <input type="checkbox"/> This setting does not affect any servo operation.
03	Speed loop gain	25~3500	<input type="checkbox"/> Proportional gain of the speed amplifier. Larger the value you set, larger the gain you can obtain. <input type="checkbox"/> Most appropriate value of the speed loop gain depends on the load inertia and the motor model.
04	Speed loop integration time constant	1~1000	<input type="checkbox"/> Integration time constant of the speed amplifier. Smaller the value you set, faster the integration is made. Note) If you set this to the max. (1000), the integration time constant becomes infinite (no integration).
05	Speed detection filter	0~4	<input type="checkbox"/> You can select the type (time constant) of the digital filter for speed detection signal. Larger the value you set, quieter the noise you can expect from the motor.
06	Torque limit	0~400	<input type="checkbox"/> This driver is designed to accept the max. torque of 300% of the rated torque for a short duration. You can limit this max. torque when you expect any mechanical problem with the motor load or the machine. <input type="checkbox"/> You set the value in percentage of the rated torque (100%). e.g.) When the setting is "200": Permissible output torque is 200% (2 times) of the rated torque Note) You cannot set a higher value than the factory setting value of the system parameter No. 06 (Max. output torque setting). Even if you set a higher value, the max. output torque will be automatically adjusted to the max. output torque of the factory setting.
08	Speed monitor gain	0~1	<input type="checkbox"/> You can set the full scale value of the speed monitor signal (SP). "0" : 4095 r/min full scale "1" : 8191 r/min full scale <input type="checkbox"/> It is set to "0" (4095 [r/min] full scale) in normal specifications. If it is insufficient, set the parameter to "1".
09	Inactive drive inhibit input	0~1	<input type="checkbox"/> You can ignore the CW rotation inhibit input (CWL) and CCW rotation inhibition input (CCWL) by setting this to "1", and the driver runs normally judging this as "non-inhibit". Note) No torque of CW will be generated if you set this to "0" and the CW rotation inhibit input (CWL) is open. Same is applied to CCW. If both CWL and CCWL is open, the driver trips due to "Drive inhibit input error".

No.	Parameter	Adjustable range	Function • Contents																																				
0A	Dynamic brake	0~1	<input type="checkbox"/> You can select among the below, while the CW rotation inhibit input (CWL) or the CCW rotation inhibit input (CCWL) is working, and the motor is decelerating: "0" : Dynamic brake is activated and the motor stops. "1" : Dynamic brake is not activated and the motor makes free run stop.																																				
19	Counter clear input mode	0~1	<input type="checkbox"/> Through this parameter, deviation counter should be cleared by the edge of the counter clear input (CL) or cleared by the level is set. "0" : clear by level "1" : clear by edge																																				
1D	Alarm occurrence sequence	0~17	<input type="checkbox"/> Please set the control patterns to stop the motor when alarm occurs. <table border="1"><thead><tr><th>Number</th><th>Operation when reducing speed</th><th>Operation after stopping</th></tr></thead><tbody><tr><td>0</td><td>DB ON</td><td>DB ON</td></tr><tr><td>1</td><td>Free run</td><td>DB ON</td></tr><tr><td>16</td><td>DB ON</td><td>Free run</td></tr><tr><td>17</td><td>Free run</td><td>Free run</td></tr></tbody></table> <p>DB: Dynamic brake</p> <p>Note) In case of changing the parameter(s), after entering them (it) into EEPROM. Turn ON the power again.</p>	Number	Operation when reducing speed	Operation after stopping	0	DB ON	DB ON	1	Free run	DB ON	16	DB ON	Free run	17	Free run	Free run																					
Number	Operation when reducing speed	Operation after stopping																																					
0	DB ON	DB ON																																					
1	Free run	DB ON																																					
16	DB ON	Free run																																					
17	Free run	Free run																																					
1E	Sequence when servo OFF	0~145	<input type="checkbox"/> Please set the operation patterns in case of servo OFF. <table border="1"><thead><tr><th>Number</th><th>Operation when reducing speed</th><th>Operation after stopping</th><th>Deviation counter</th></tr></thead><tbody><tr><td>0</td><td>DB ON</td><td>DB ON</td><td>Clear</td></tr><tr><td>1</td><td>Free run</td><td>DB ON</td><td>Clear</td></tr><tr><td>16</td><td>DB ON</td><td>Free run</td><td>Clear</td></tr><tr><td>17</td><td>Free run</td><td>Free run</td><td>Clear</td></tr><tr><td>128</td><td>DB ON</td><td>DB ON</td><td>Keep</td></tr><tr><td>129</td><td>Free run</td><td>DB ON</td><td>Keep</td></tr><tr><td>144</td><td>DB ON</td><td>Free run</td><td>Keep</td></tr><tr><td>145</td><td>Free run</td><td>Free run</td><td>Keep</td></tr></tbody></table> <p>DB : Dynamic brake</p> <p>Note) In case of changing the parameter(s), after entering them (it) into EEPROM. Turn ON the power again.</p>	Number	Operation when reducing speed	Operation after stopping	Deviation counter	0	DB ON	DB ON	Clear	1	Free run	DB ON	Clear	16	DB ON	Free run	Clear	17	Free run	Free run	Clear	128	DB ON	DB ON	Keep	129	Free run	DB ON	Keep	144	DB ON	Free run	Keep	145	Free run	Free run	Keep
Number	Operation when reducing speed	Operation after stopping	Deviation counter																																				
0	DB ON	DB ON	Clear																																				
1	Free run	DB ON	Clear																																				
16	DB ON	Free run	Clear																																				
17	Free run	Free run	Clear																																				
128	DB ON	DB ON	Keep																																				
129	Free run	DB ON	Keep																																				
144	DB ON	Free run	Keep																																				
145	Free run	Free run	Keep																																				

No.	Parameter	Adjustable range	Function • Contents
20	Position loop gain	0~1000	<input type="checkbox"/> You can set the position gain at the position control mode with the unit of [1/s]. <input type="checkbox"/> Larger the value you set, larger the gain, and higher the servo stiffness (stiffness at servo-lock) you can obtain. Note) Too large setting may cause an oscillation.
21	Speed feed forward	0~100	<input type="checkbox"/> You can add a speed feed forward function at the position control mode when you need high speed response. <input type="checkbox"/> Set the speed feed forward volume in percentage against the commanded volume. Note) Too large setting may cause an oscillation. We recommend you to set this parameter to "0" unless you need excessive speed response.
22	Positioning end range	0~32766	<input type="checkbox"/> You can set the detection level of judging the positioning end, with the number of pulses. <input type="checkbox"/> The driver will judge the positioning end when the number of reserved pulses of the deviation counter becomes within the preset range, the driver outputs the positioning end signal (COIN). (turns on the output transistor.) Note) Feedback pulse of rotary encoder is multiplied 4 times and input to deviation counter, so the positioning end range is converted into motor rotation angle as: $\text{Setting value} = \frac{\text{Positioning end range}}{4 \times (\text{Pulse count of rotary encoder})}$
23	Position error limit	1~32766	<input type="checkbox"/> Set the detection level of judging the position error, with the number of reserved pulses of the deviation counter. <input type="checkbox"/> Calculate the setting value with the following formula: $\text{Setting value} = \frac{\text{Judging level of position error [PULSE]} \times 16}{16}$ <input type="checkbox"/> The driver trips when the number of reserved pulses of the deviation counter exceeds the above setting value, judging as an error.
24	Cancel of position error limit	0~1	<input type="checkbox"/> You can mask the protective function of the position error limit with this parameter. <input type="checkbox"/> You can cancel the detection of the position error limit, and the driver keeps operating even when the number of reserved pulses of the deviation counter exceeds the detection level, set through the parameter No. 23.
25	Numerator of pulse frequency division	1~10000	<input type="checkbox"/> You can set the numerator of command pulse frequency division • multiplication.

No.	Parameter	Adjustable range	Function • Contents
26	Denominator of pulse frequency division • multiplication	1~10000	<input type="checkbox"/> You can set the denominator of command pulse frequency division • multiplication. Note 1) Like the above section, you set any value of the denominator between 1 and 10000, but we recommend you to use with the range per the below: $\frac{1}{50} \leq \frac{\text{Setting value of numerator}}{\text{Setting value of denominator}} \leq 20$ Note 2) Please set the multiplication ratio so that the command pulse frequency after the multiplication may not exceed the max. command pulse frequency. (500kpps in case of the line driver output, 200kpps in case of the open collector output.)
2A	Time constant of torque filter	0~2500	<input type="checkbox"/> Please set the time constant of the torque filter. <input type="checkbox"/> The higher the setting becomes, the larger the time constant gets. Unit : [ 10 $\mu$ s ]
2B	Time constant of feed forward filter	0~6400	<input type="checkbox"/> Please set the time constant of the feed forward filter. <input type="checkbox"/> The higher the setting becomes, the larger the time constant gets. Unit : [ 10 $\mu$ s ]



No.	Parameter	Adjustable range	Function • Contents
30	Second speed loop gain	25~3500	<input type="checkbox"/> The proportional gain of the speed loop. If you make the setting value larger, the gain gets larger. <input type="checkbox"/> The optimum value of the speed loop gain is different according to the load inertia and the model of the motor.
31	Time constant when second speed loop is integrated	1~1000	<input type="checkbox"/> The time constant of the integration. The smaller you set, the quicker it will be integrated. Note) If you set the time constant of the integration to the maximum value (1000) of the setting range, the time constant of the integration will become infinity (You can not get the result of the integration.).
32	Second position loop gain	10~1000	<input type="checkbox"/> Please set the second position loop gain. The unit of the setting value is [1/s]. <input type="checkbox"/> The larger the setting value becomes, the higher the servo rigidity (this rigidity is most popular when the servo is locked) becomes, when the position is well controlled. Note) If you make the position gain extremely larger, oscillation phenomena sometimes occurs. Then be careful to set the value.
33	Setting operation of second gain	0~2	<input type="checkbox"/> Please set the switching modes for the second gain from parameter No.30~32. 0 : Switching to the second gain is not performed. 1 : Switching to the second gain is automatically performed. 2 : Switching to the second gain is performed by the external input switch named " GAIN ".
34	Switching and delaying time of second gain	0~10000	<input type="checkbox"/> When you set 1 as parameter No.33, delay time before switching to the second gain is set. This delay time means after input to the command pulse ended. Unit : [ 2.56ms ]
35	Second pulse frequency division	1~10000	<input type="checkbox"/> Please set the numerator of the pulse frequency division of the command pulse input.
36	Setting of smoothing filter	0~5	<input type="checkbox"/> Please select the type of the digital filter for the command pulse. <input type="checkbox"/> The larger the number becomes, the later the response to the input pulse becomes.

# 9. Communication Function

The driver of MSD\*EX series have a function to serial communication between a personal computer at a market through RS-232C cable. Using this function, you can use your personal computer as a console.

If you can use a personal computer as a console, you can perform a lot of things on the monitor of the personal computer, for example, various parameters of the driver, monitoring the operation and so on.

## 9-1 Required Components and Devices and Software

### 9-1-1 Required Components and Devices

#### (1) Corresponding Hardware

Owing to the automatic model checking function of the software, you can check the operation of the driver using the following equipment.

- ① Personal computer manufactured by NEC, PC-98 series or other personal computers having interchangeability.

(Example) PC-9801NS/R, NS/T, NA/C, NA and so on

- ② IBM PC/AT model or PC having interchangeability with it.

- ③ DOS/V model

#### (2) Corresponding OS

You should check the OSs of the following version corresponds to the above mentioned software.

- ① In case of using PC 98 series

You should prepare MS-DOS ver. 3.0 or more.

And you should install the file for control RS-232 and "RSDRV.SYS" to the MS-DOS as device driver.

- ② IBM PC/AT model

MS-DOS 6.2 (J)

- ③ DOS/V model

MS-DOS 6.2/V

(Note) In case of using hardware and OS other than the above mentioned ones, you should check them thoroughly.

### 9-1-2 Software to Control Communication (PANATERM)

Please prepare PANATERM for MSD\*EX.

As for the operating procedures, refer to "PANATERM Operation Manual" attached to PANATERM.

Note) Please notice that this PANATERM has no interchangeability with that for MSD\*X.

■ We prepare the cable to connect the connector (CN SER : 6 pin) on the front panel section of the driver to the connector for RS-232C of a personal computer (DSUB 25 pin) as a option.

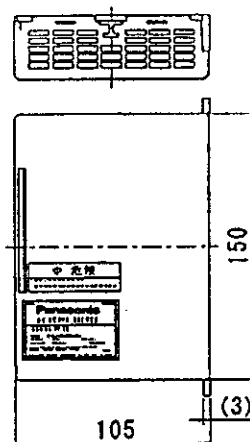
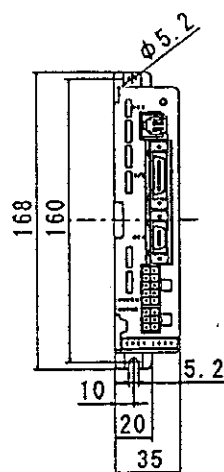
Note) As this cable isn't the same as that for the conventional MSD series (MSD\*X, MSD\*Y), prepare the new one.

# 10. Specifications

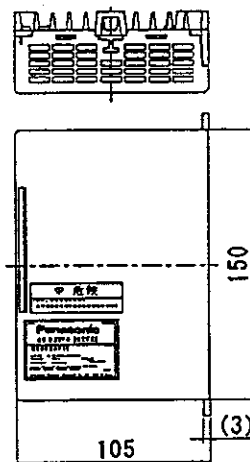
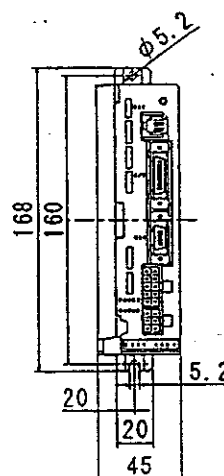
Model			MSD** □ ○ △ ▽	MSD** □ ○ △ ▽	MSD** □ ○ △ ▽	
Basic specifications	Applicable motor/output (W)		MSM 100V type	30, 50	100	200
			200V type	30, 50, 100	200	400
Input power source	100V type		Single phase 100~115V +10%/-15%, 50/60Hz			
	200V type		3-phase 200~230V +10%/-15%, 50/60Hz			
Control method			Transistor PWM (Sine-wave form)			
Feed back			Incremental encoder (2,500P/r)			
Special specifications	Ambient condition		Temperature	Working : 0~50°C, Storage : -20~+85°C		
			Humidity	Working/storage : 90%RH or less (no condensation)		
			Vibration	4.9m/s <sup>2</sup> (0.5G) or less, 10~60Hz (no continuous operation at resonance point is permissible)		
Functional specifications	Control mode		Position control			
	Control input		① Servo-ON input, ② Alarm clear input, ③ Counter clear input, ④ CW rotation inhibit input, ⑤ CCW rotation inhibit input, ⑥ Command division control input ⑦ Gain control input			
	Pulse row command input	Input pulse row status	Differential input. (Forward/Reverse run)			
		Control input	Open collector input. ① Deviation counter clear input			
	Control output		① Servo-alarm, ② Position-finish			
	Encoder feed back signal		Line driver output of encoder pulse (Z). Opencollector output of Z-phase pulse			
	Monitor output		① Speed monitor ② Torque monitor			
	Regenerative		Resistor attached			
	Dynamic brake		① At Servo-OFF, ② At alarm occurs, ③ At main power OFF, ④ At deceleration while CW or CCW rotation inhibit input becomes valid (able to invalidate through parameter)			
	Automatic gain tuning		Built-in (applicable to certain motor models)			
	Masking of unnecessary input wiring		① Drive inhibit input (CW/CCW)			
	Dvsn/Mltplctn of cmdnd pulse		1~10000/1~10000			
	Protective function	Hard error	OV, LV, OS, OL, OC, ST			
		Soft error	CPU error, System error etc.			
	Trace back of alarm data		Traceable back to the past 8 error data (including current error)			
	LED display		LED: 1 pcs., 3-color display			
	Communication with RS232C		Parameter setting and monitoring of the status with IBM (PC/AT) series			
Performance	Applicable load inertia		Less than 15 times the inertia of motor		Less than 20 times (750W)	
	Max. command pulse frequency		500[Kpps] (200[Kpps], in case of opencollector input)			
Weight (Approx.)		0.5 [kg]		0.6 [kg]		0.8 [kg]
Dimensions (refer to section 11)		suffix A		suffix B		suffix C

# 11. Dimensions

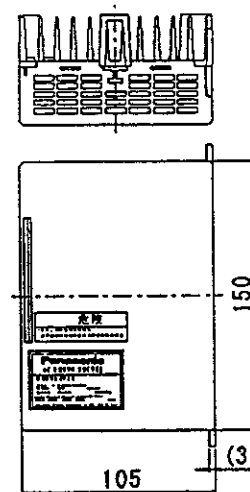
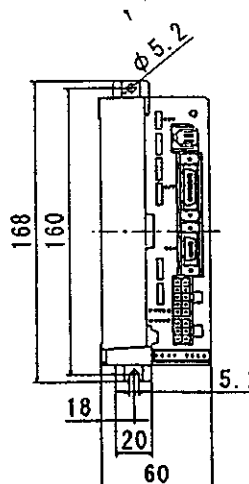
Dimension suffix A



Dimension suffix B



Dimension suffix C



# 12. Option parts

## 12-1 Connector kit for connecting external equipment

(1) Product No. DVOP0770

(2) Constituents

Name	Manufacturer's product No.	Quantity	Manufacturer's name	Remarks
Plug	10126-3000VE	1	Sumitomo 3M, Ltd.	For CN I/F (26 pins)
Shell kit	10326-52A0-008	1		

\* Parts equivalent to product number above made by another manufacturer may be adopted for plug and shell kit.

(3) Pin arrangement of plug for CN I/F

14 OA+	16 OB+	18 RX+	20 COIN	22 S-RDY	29 CWL	31 A-CLR	33 CWTl	35 GND
20 OA-	22 OB-	24 RX-	26 ALM	28 COM-	30 CCWL	32 C-MODE	34 CCWTL /TRQR	36 IM
1 OZ+	3 GND	5 PULS+	7 SIGN+	9 INH	11 COM+	13 CL	15 GND	17 GND
2 OZ-	4 CZ	6 PULS-	8 SIGN-	10 ZEROSPD	12 SRV-ON	14 SPR/SPL	16 SP	18 FG

- [Note] 1. The table above shows the arrangement as viewed from solder side. Also confirm the pin number stamped on plug itself to ensure correct wiring.
- [Note] 2. See the item 5-1 (P.21) for symbols indicating the signal name above, or function of signals.
- [Note] 3. Never connect anything to the spare pins of the connector I/F (15, 16, 17, 18).

## 12-2 Connector kit for connecting motor encoder

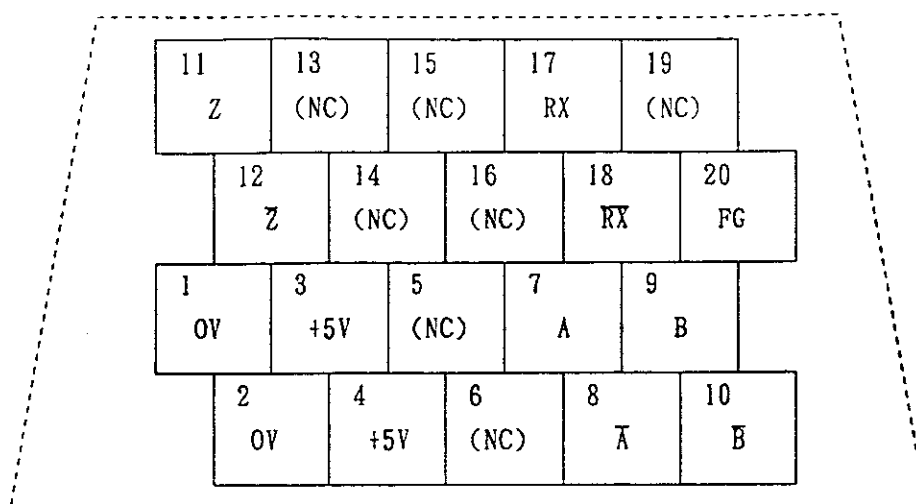
(1) Product No. DVOP0780

(2) Constituents

Name	Manufacturer's product No.	Quantity	Manufacturer's name	Remarks
Plug	10114-3000VE	1	Sumitomo 3M, Ltd.	Connector For SIG (14 pins)
Shell kit	10314-52A0-008	1		
Receptacle	5557-06R	1	MOLEX	Connector For motor (6 pins)
Female terminal	5556PBTl	4		
Cap	172160-1	1	AMP	Encoder cable For relay (6 pins)
Socket	170361-1	5		
Cap	172159-1	1		Motor cable For relay (4 pins)
Socket	170362-1	4		

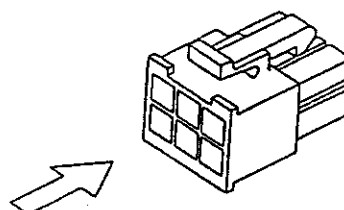
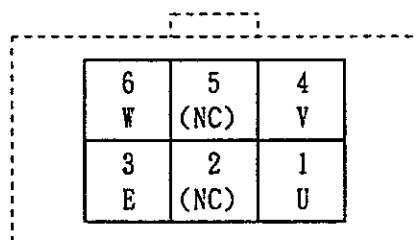
\* Parts equivalent to product number above made by another manufacturer may be adopted for plug and shell kit.

(3) Pin arrangement of plug for CN SIG



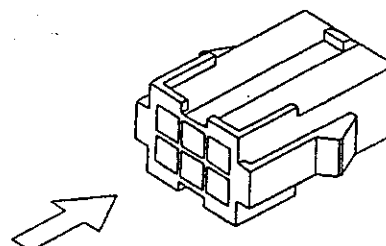
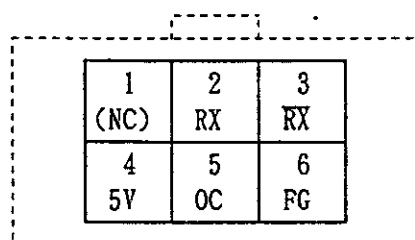
- Note** 1. The table above shows the arrangement as viewed from solder side. Also confirm the pin number stamped on plug itself to ensure correct wiring.
- Note** 2. Be sure to connect shield of shielded wire to be used to pin 14 (FG). Do not connect anything to the pin marked with (NC) in the table above.
- Note** 3. See the section 4-1-4 (P.19) in wiring and connecting.

(4) Arrangement of the Receptacle Pins for Connector MOTOR



- Note** 1) The above table shows the arrangement shown from the direction to insert receptacles to the terminals. In addition, check the NOs. of the pins stamped on the plug itself.
- Note** 2) When wiring and connecting, refer to Section 4-1-1 "Wiring to Connector POWER and Connecting MOTOR" (P.14).

(5) Arrangement of the Connector Pins for Encoder Cable Relay



- Note** 1) The above table shows the arrangement shown from the direction to insert sockets of the cap. In addition, check the NOs. of the pins stamped on the plug itself.
- Note** 2) When wiring and connecting, refer to Section 4-1-1 "Wiring to Connector SIG" (P.19).



## 12-4 RS232C Connection Cable

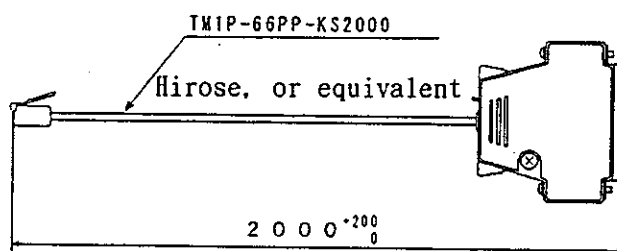
(1) Product No. DV0P0790

(2) Components

Name	Production No. of the maker	Personnel	Maker name	Remark
Cable	TM1P-66PP-KS2000	1	Hirose	For Connector SER (6 pins)
Connector	(Connector only for MSD*EX)	1		

Note) As for the connectors, they are designed and produced only for the our equipment and they are not be sold from our maker in general.  
Then purchase them as options with the body.

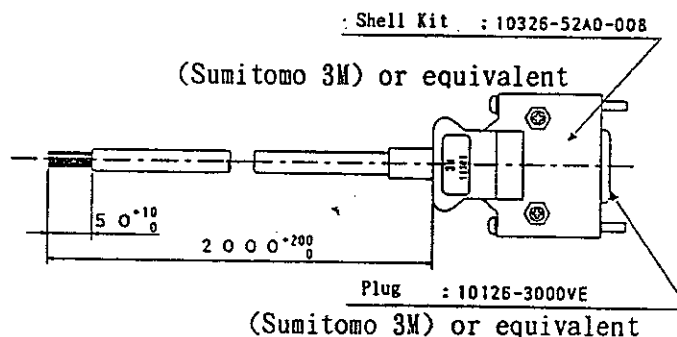
(3) Outer dimension



## 12-5 Cable for interface

(1) Product No. DV0P0800

(2) Outer dimension



(3) Wiring table

Pin No.	Signal name	Core color	Pin No.	Signal name	Core color	Pin No.	Signal name	Core color
1	COM+	Orange(Red 1)	10	COIN	Pink (Black 1)	19	OZ+	Pink (Red 2)
2	SRV-ON	Orange(Black 1)	11	SP	Orange(Red 2)	20	OZ-	Pink (Black 2)
3	A-CLR	Gray (Red 1)	12	IM	Orange(Black 2)	21	CZ	Orange(Red 3)
4	CL	Gray (Black 1)	13	COM-	Gray (Red 2)	22	CW+	Gray (Red 3)
5	GAIN	White (Red 1)	14	GND	Gray (Black 2)	23	CW-	Gray (Black 3)
6	DIV	White (Black 1)	15		White (Red 2)	24	CCW+	White (Red 3)
7	CWL	Yellow(Red 1)	16		White (Black 2)	25	CCW-	White (Black 3)
8	CCWL	Yellow(Black 1)	17		Yellow(Red 2)	26	FG	Orange(Black 3)
9	ALM	Pink (Red 1)	18		Yellow(Black 2)			



- Note** 1. ( ) in the core color block in the table above indicates a dot mark color and mark quantity.
- Note** 2. Nominal section area of core is 0.15 [mm<sup>2</sup>] (Equivalent to AWG26 phase).
- Note** 3. Never connect anything, for example, wire to the spare pins or the equivalent of the connector I/F (15, 16, 17, 18). Besides, never short each other.

## 12-6 Connector Kit for Connecting the Power Supply of the Driver

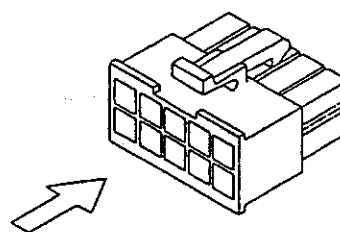
(1) Product No. DVOP0810

(2) Outer dimension

Name	Production No. of the maker	Personnel	Maker name	Remark
Receptacle (10P)	5557-10R	1	MOLEX	For Connector power (10 pins)
Female terminal	5556PBTB	4		

(3) Arrangement of the Connector Pins for Encoder Cable Relay

10 R	9	8 S	7	6 T
5 P	4	3 B	2	1 E



Note 1) The above table shows the arrangement shown from the direction to insert receptacles to the terminals. In addition, check the NOs. of the pins stamped on the plug itself.

Note 2) When wiring and connecting, refer to Section 4-1-1 "Wiring to Connector POWER and Connecting MOTOR" to avoid wrong connection (P.14).

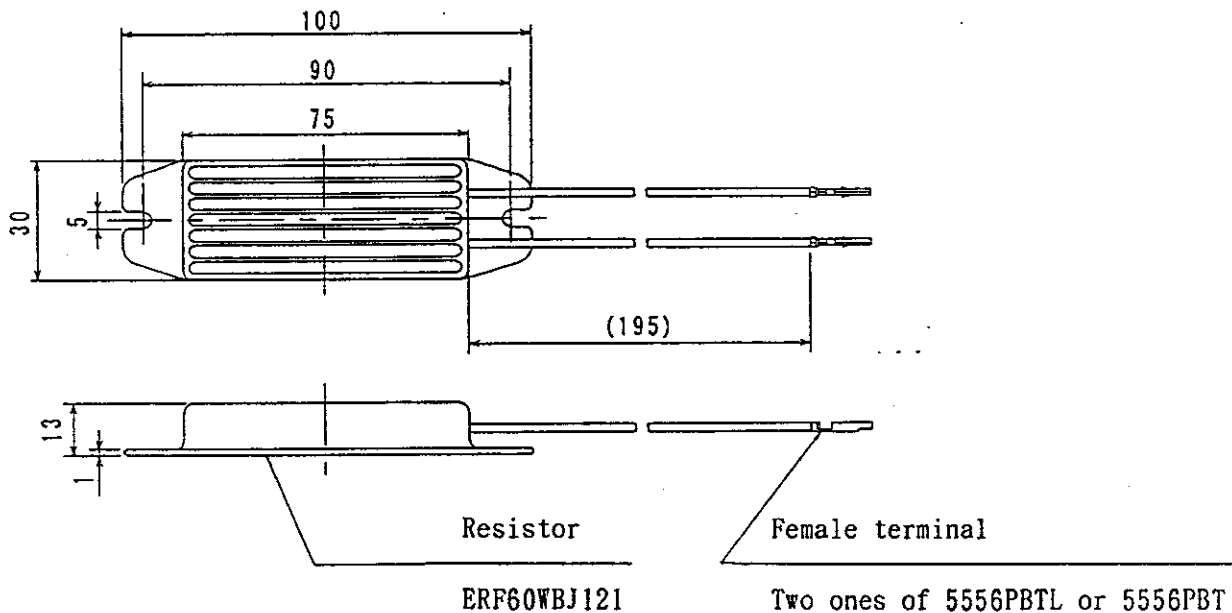
## 12-7 Regenerative Resistor

(1) Product No. DVOP0820

(2) Outer dimension

Name	Production No. of the maker	Personnel	Maker name	Remark
Resistor	ERF60WBJ121	1	Matsushita Electronic Co., Inc.	Spare terminals for extending wires
Female terminal	5556PBTB	2	MOLEX	
Female terminal	5556PBTB	2		

(3) Dimensions



Note 1) Please connect the regenerative resistors to P and B terminals (pins : No.3 and No.5) of the receptacles for Connector POWER. Never connect the other places.

Note 2) Please Refer to Section 4-1-2 "Usage of Regenerative Resistor" (p.14), as for the usage of the regenerative resistor.

In addition to the optional components or parts above-mentioned, we prepare the following parts as options.

- \* Relay cable for the encoder
- \* Relay cable for the motor

As for the details of these parts, contact the shop you bought the driver.

# 13. Trouble Shooting

If a trouble should occur, for example "the motor doesn't rotate", "unstable rotation", "positioning accuracy is wrong", "the machine datum isn't in the right position" and so on, first check the following points and then take proper action.

## Doesn't rotate

Check point	Condition to be confirmed	Solution
<ul style="list-style-type: none"> <li>Check the wiring of the main circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Is the power of the driver turned ON?</li> </ul>	<ul style="list-style-type: none"> <li>If the power isn't turned ON, LEDs do not light up.</li> </ul>
	<ul style="list-style-type: none"> <li>Is the power supply connector of the driver (Connector POWER) connected properly?</li> </ul>	<ul style="list-style-type: none"> <li>If the power isn't supplied, the motor doesn't rotate.</li> </ul>
	<ul style="list-style-type: none"> <li>Is the connector for connecting to the motor (Connector MOTOR) connected properly.</li> </ul>	<ul style="list-style-type: none"> <li>If the phases of wiring to the motor isn't the same as the motor, the motor doesn't rotate.</li> </ul>
<ul style="list-style-type: none"> <li>Check the display LEDs are or are not light up.</li> </ul>	<ul style="list-style-type: none"> <li>After turning the power ON, check that the display LEDs on the panel light up red or orange. Servo ready : Orange one light up Servo ON : Green one light up</li> </ul>	<ul style="list-style-type: none"> <li>If it isn't the other case than the following, that is, the Display LEDs turned ON (Orange: Servo ready, Green: Servo ON), emergency stop function operates. Then remove the cause of the trouble.</li> </ul>
	<ul style="list-style-type: none"> <li>Check that the Display LED is light up green when the servo is ON and the power is ON.</li> </ul>	<ul style="list-style-type: none"> <li>There is a possibility that wiring for the external input signal is abnormal.</li> </ul>
<ul style="list-style-type: none"> <li>Check that the user parameter of the driver and the external input switches.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the driving inhibition input switch of CW or CCW is not turned ON when the setting of the user parameter No. 09 "Driving inhibition input invalid" is set to "0" or not.</li> </ul>	<ul style="list-style-type: none"> <li>When the driving inhibition input is ON, torque output to the direction should be turned OFF.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the setting value of the user parameter No. 06 "torque limit setting" is set to "0" or not.</li> </ul>	<ul style="list-style-type: none"> <li>Set the value of the torque limit to "0", and the driver doesn't generate torque.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the counter clear input is turned ON or not when the setting of the user parameter No. 19 "Counter clear input mode" is set to "0" or not.</li> </ul>	<ul style="list-style-type: none"> <li>Clear the command input pulse and it is judged that there isn't command input pulse.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the setting values both of the user parameter No. 20 "Position loop gain" and the user parameter No. 21 "Speed field forward" are set to "0" or not.</li> </ul>	<ul style="list-style-type: none"> <li>The command input pulse is set to "0" by the gain of the parameter shown left, then it is judged there is no command input.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the setting value of the user parameter No. 23 "position error limit setting" is set to the value near "1".</li> </ul>	<ul style="list-style-type: none"> <li>When this setting value is small, the motor start to rotate and as soon as the positioning deviation occurs, it is judged that the positioning deviation is excessive and the emergency stop function operates to stop the rotation of the motor.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the relation between the setting values, that is, the user parameter No. 25 "Numerator of pulse frequency division" and that of No. 26 "Denominator of pulse frequency division", are not set to the value beyond the specified value or not.</li> </ul>	<ul style="list-style-type: none"> <li>When the frequency after performing pulse frequency division to the command pulse becomes over 500kpps, command pulse division error protection operates to stop the motor.</li> </ul>

<p>■ Check the brake.</p>	<p>■ Check whether the electro-magnetic brake or the mechanical brake operates or not.</p>	<p>■ If the brake operates owing to the external force, the brake will be damaged or it becomes the cause to burn down or damage the motor. Be careful in such a case.</p>
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# Unstable Rotation

Check point	Condition to be confirmed	Solution
■ Check whether the fluctuation of the voltage of the power supply is excessive or not.	■ Check whether the capacity of the power supply and the transformer are too small or capacity of the load is too large.	■ When the voltage of the power supply is too low, the rotating speed is sometimes delayed.
■ Check the command input pulse.	■ Check whether the shield or the installation work is proper, and the peripheral relay and magnet are installed surge absorber or not.	■ When the countermeasure against noise isn't secure, the driver sometimes operates unexpectedly.
	■ Check the length of the wires and cables as specified or not.	■ When the length of the wires and cables are too long, the waveform is weakened and the command can not be received normally.
	■ Check whether there are any distortion or crack on the output waveform from the external command device or not.	■ When there are any distortion or crack on the output waveform, normal operation can not be expected. Check the external command device again.
■ Check whether the capacity correspond to the load is selected or not.	■ Check whether the load inertia is extremely large or not. Adjust the user parameter No.03 : "Speed loop gain", user parameter No.04 : "Speed loop integration time constant" and user parameter No.20 : "position loop gain".	■ In case of the value is beyond the adjustable range, take proper action, for example, lower the load inertia, increase the capacity of the motor and so on.
	■ Check whether the friction load is extremely high or not.	■ When the friction load is extremely high, hunting (a kind of starting phenomenon) may occur around the stopping position. Though this phenomenon calms down when making the speed loop controlled by proportional control, positioning deviation will be noticeable at the stopping position.
	■ Check whether the load change is excessive or not. Adjust the user parameter No.03 : "Speed loop gain", user parameter No.04 : "Speed loop integration time constant" and user parameter No.20 : "position loop gain".	■ In case of the value is beyond the adjustable range, take proper action, for example, lower the load inertia, increase the capacity of the motor and so on.
	■ Check whether there is some break down or resonance or not. Perform check on the coupling, timing belt, gear and so on.	■ In case of the rigidity of the coupling is low, the tension of the timing belt is weak, back rush sometimes occurs and so on, phenomenon like resonance sometimes occurs. Please remedy the state of the mechanical system.
■ Check the signal of the rotary encoder.	■ Check whether the shield or the installation work is proper, and the peripheral relay and magnet are installed on the surge absorber or not.	■ When the countermeasure against noise isn't secure, the driver sometimes operates unexpectedly.

# Positioning accuracy is wrong

Check point	Condition to be confirmed	Solution
<ul style="list-style-type: none"> <li>Check whether the same error always can be get or not.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the user parameter No.25 "Numerator of pulse frequency division" and that of No.26 "Denominator of pulse frequency division", are set properly or not.</li> </ul>	<ul style="list-style-type: none"> <li>When the setting of the pulse frequency division is different, migration length is also different.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the positioning program and data of the external devices are set properly or not.</li> </ul>	<ul style="list-style-type: none"> <li>Please set the positioning program and data of the external devices properly.</li> </ul>
<ul style="list-style-type: none"> <li>Check whether errors can be seen frequently in case of the same driving conditions or not.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether a relay or a magnet and the like operates or not around the driver or not. If a relay or a magnet works, error can be seen or not.</li> </ul>	<ul style="list-style-type: none"> <li>Check the countermeasures against noise. Check whether the following noises invade or not ; servo on signal, counter clear signal, command pulse, and rotary encoder feedback signal.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the positioning program and data of the external devices are set properly or not.</li> </ul>	<ul style="list-style-type: none"> <li>Please set the positioning program and data of the external devices properly.</li> </ul>
<ul style="list-style-type: none"> <li>Check whether errors can be seen irregularly or not.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the countermeasures against noise are taken properly.</li> </ul>	<ul style="list-style-type: none"> <li>Check the countermeasures against noise. Check whether the following noises invade or not ; servo on signal, counter clear signal, command pulse, and rotary encoder feedback signal.</li> </ul>
	<ul style="list-style-type: none"> <li>Check the speed loop is controlled by proportional control or not.</li> </ul>	<ul style="list-style-type: none"> <li>Set the user parameter No.04 "Speed loop integration time constant" to "1000" and the proportional control will begin. Then the stopping accuracy will be decreased.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the integration time constant of the speed loop is too large or not.</li> </ul>	<ul style="list-style-type: none"> <li>If the user parameter No.04 "Speed loop integration time constant" is too large, it takes long time before the positioning.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the position loop gain is too small or not.</li> </ul>	<ul style="list-style-type: none"> <li>If the user parameter No.20 "position loop gain" is too small, it takes long time before the positioning.</li> </ul>

The machine datum isn't  
in the right position

Check point	Condition to be confirmed	Solution
<ul style="list-style-type: none"> <li>Check whether the dimension of the offset is usually the same or not.</li> </ul>	<ul style="list-style-type: none"> <li>Is there any wrong operation like chattering of the datum sensor.</li> </ul>	<ul style="list-style-type: none"> <li>Check the wiring of the datum sensor, take countermeasures against noise and replace the datum sensor.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether there is trouble about the Z-phase signal of the rotary encoder.</li> </ul>	<ul style="list-style-type: none"> <li>Perform check on the wiring around the rotary encoder.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the relation of the position of the Z-phase of the datum sensor and rotary encoder is proper or not.</li> </ul>	<ul style="list-style-type: none"> <li>Move the position of the Z-phase of the rotary encoder to the middle of the position of the datum sensor.</li> </ul>
<ul style="list-style-type: none"> <li>Is the length of the datum sensor enough?</li> </ul>	<ul style="list-style-type: none"> <li>Does the driver slow down around the origin?</li> </ul>	<ul style="list-style-type: none"> <li>Reduce the speed of returning to the machine datum or lengthen the datum sensor.</li> </ul>
<ul style="list-style-type: none"> <li>Check whether noise invade to the Z-phase of the rotary encoder or not.</li> </ul>	<ul style="list-style-type: none"> <li>Check whether the shield or the installation work is proper, and the peripheral relay and magnet are installed on the surge absorber or not.</li> </ul>	<ul style="list-style-type: none"> <li>Take proper measures so that noise doesn't invade to the signal of the rotary encoder.</li> </ul>
	<ul style="list-style-type: none"> <li>Is the waveform of the rotary encoder normal?</li> </ul>	<ul style="list-style-type: none"> <li>In case where the waveform is abnormal even if you take the counter-measures against noise, there is a possibility that the rotary encoder itself has some trouble.</li> </ul>
<ul style="list-style-type: none"> <li>Check whether chattering or wrong operation of the datum sensor or not.</li> </ul>	<ul style="list-style-type: none"> <li>Is there any trouble in the datum sensor?</li> </ul>	<ul style="list-style-type: none"> <li>Try to replace the datum sensor.</li> </ul>
	<ul style="list-style-type: none"> <li>Check whether the power supply of the datum sensor is surely supplied and noise invades to the signal or not.</li> </ul>	<ul style="list-style-type: none"> <li>Check the wiring of the datum sensor.</li> </ul>

