M0000395

AC Servo Amplifier

PV

STANDARD INTERFACE FOR INCREMENTAL ENCODERS

USER'S MANUAL

Preliminary

Applicable Amplifier: PV1A0 $\begin{matrix}15\\30\end{matrix}$ E $\begin{matrix}M^*\\N^*\end{matrix}$ 1 $\begin{matrix}S\\P\\T\end{matrix}$ 00

Applicable CPU Version: PVTA0C – PVTA0H

Safety Precautions

This servo system is designed for use in general industrial equipment. It is not designed for use in home electric appliances or medical equipment. Examples of general industrial equipment for which the servo system is designed for include robots, transporters, and chip mounters.

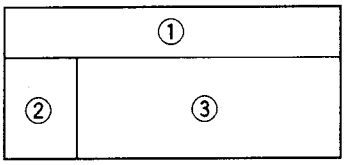
Before using the servo system (installation, operation, maintenance, inspection, etc.), be sure to read this User's Manual thoroughly in order to familiarize yourself with proper operation. Obtain a full understanding of the equipment, safety information, and precautions.

Keep this manual in a convenient location where the operator can refer to it any time.

[Explanation about Indications]

Familiarize yourself with the contents of each indication.

In the following description, each indication is completed as shown in the figure below.



①: Safety precaution item ranking
②: Visual cues
③: Details of each visual cue

[Safety Precaution Item Ranking]

There are four ranks:

This indicates the existence of imminent hazard which, if the system is incorrectly operated, is very likely to result in death or a serious injury.

This indicates the existence of potential hazard which, if the system is incorrectly operated, is very likely to result in a moderate injury or slight injury or only physical damage.

Items described in 

may lead to a very serious result depending on the situation. Each indication contains important information that you should observe.

This indicates restrictions or limitations.

This indicates what must be done without fail.

[Visual cues]

The following eight visual cues are used in this manual:

Kind of symbol	Example of symbol
Visual cue of danger	 Danger, injury  Electric shock
Visual cue for caution	 Caution  Fire  Burn
Visual cue for restriction	 Restriction  Disassembly not allowed
Visual cue for requirement	 Requirement

1. General

 **DANGER**	
     	(General) 1. Do not use the system in an explosive atmosphere. Use an anti-explosive type motor. Doing otherwise may result in injury or fire. 2. Only properly trained staff should take charge of transportation, installation, piping, wiring, operation, manipulation, maintenance, and inspection work. Doing otherwise may result in electric shock, injury, or fire. 3. During operation, never touch a rotating part of the motor. Touching a rotating part may result in injury. 4. Do not conduct work while power is being supplied. Be sure to turn off the power supply beforehand. Doing otherwise may result in electric shock. 5. Never touch the inside of the amplifier. Touching inside the amplifier may result in electric shock. 6. Avoid damaging cables, applying excessive stress to them, putting a heavy objects on them, or nipping them. Doing otherwise may result in electric shock.

CAUTION

(General)

1. Before starting installation, operation, maintenance, or inspection, be sure to read the Operator's Manual carefully and observe the instructions in it. Failure to observe the instructions may result in electric shock, injury, or fire.

2. Do not use the system out of the specifications of the amplifier.
   Doing so may result in electric shock, injury, or damage.

3. Do not use a damaged amplifier.
   Doing so may result in injury or fire.

4. Any product modification executed on the user side is beyond our responsibility, so we accept no liability for it.

5. Do not remove the nameplate.

6. Use an amplifier and a driver in the specified combination.
   Doing otherwise may result in fire or failure.

7. Note that the amplifier/motor and peripheral units will become hot enough to cause a burn.

(Transportation)

1. Take extreme care not to drop or turn over the system, because it is very dangerous.

2. Do not hold the unit by the cables or the motor shaft.
   Doing so may result in injury or equipment failure.

(Scrapping)

1. When discarding the amplifier, dispose of it as a general industrial waste.

RESTRICTION

(Storage)

1. Do not store the system in a place exposed to rain or moisture or in a place where noxious gas or liquid exists.

REQUIREMENT

(Storage)

1. Store the system in a place which is not exposed to direct sunlight and in the determined temperature/humidity range (-20°C to +65°C, 90%RH or less without condensation).
2. When the system is to be stored for a long time, consult us.
   Long-time storage will lower the capacity of the electrolytic capacitor.

(Transportation)

1. Loadage exceeding the specified loading capacity will cause a load collapse.
   Observe the indication.

2. Unpacking

CAUTION

1. Confirm the top and bottom before unpacking.
   Unpacking from the wrong end may result in injury.
2. Check if the product is the ordered one.
   Installing an incorrect wrong product may result in injury or damage.

3. Installation

CAUTION








1. Make sure no obstacle impedes ventilation around the amplifier. If cooling is hindered, the unit could overheat, resulting in explosion, ignition, or burning.
2. Do not block the exhaust port or allow any foreign material to get into it. Inadequate ability to exhaust may result in fire.
3. Be sure to observe the installation directions.
   Failure to observe directions may cause damage.
4. Allow some distance between the main unit and the inner face of the control panel or any other equipment in accordance with the Operator's Manual. An insufficient gap may cause a fire.
5. Never install the system in a place on which water may splash, in an inflammable gas atmosphere, or on the combustible side. Doing so may result in a fire or failure.
6. Never get on top of the unit or put a heavy object on it.
   Doing so may result in injury or damage.
7. Never apply a strong shock to the system.
   Doing so may result in damage.
8. At installation, take extreme care so as to prevent the unit from dropping or turning over.

4. Wiring

DANGER

1. Do not bend, draw, or nip the power cable or motor lead wire by force. Doing so may result in electric shock.
2. Be sure to ground the grounding terminals of the amplifier and the motor. Failure to do so may result in electric shock.
3. Perform a wiring check after the lapse of one minute after turning off the power supply. Failure to do so may result in electric shock.
4. Make a connections with the power cable according to the connection diagram or the Operator's Manual. Failure to do so may result in electric shock or fire.

CAUTION

1. Do not measure the insulation resistance and dielectric strength. Doing so may result in damage.
2. Perform wiring correctly and surely. Failure to do so may cause improper motor operation that may result in injury.
3. Perform wiring in accordance with the Technical Standards for Electric Equipment and the rules of extension lines. Failure to do so may result in a burn or fire.

5. Operation

DANGER

1. Never approach or touch terminals when the power is on. Removing the terminal base cover may result in electric shock.
2. Never touch a rotating part of the motor. Doing so may result in injury.

CAUTION

1. Never touch the heat sink of the amplifier, regenerative resistor, motor, or other part while the power is on or for awhile after the power has been turned off. These parts may become very hot, causing a burn on contact.

2. In the event of any abnormality, stop operating the system at once. Failure to do so may result in electric shock, injury, or fire.

3. Never make an extreme adjustment change that will cause the system operation to become unstable. Doing so may result in a burn.

4. At trial operation, fix the motor and check the operation separate from the mechanical system, then install the system on the machine. Failure to do so may result in an injury.

5. The holding brake is not a stop unit to secure the safety of the machine. Install a stop unit to secure the safety on the machine side. Failure to do so may result in an injury.

6. When an alarm occurs, remove the cause of the alarm and secure safety. After that, reset the alarm, then restart the system operation. Failure to follow this procedure may result in an injury.

7. After a recovery from an instantaneous power interruption, the operation may be restarted suddenly. Do not approach the machine. (Design the machine so that safety for personnel may be secured even if the system operation is restarted.) Approaching the machine when it restarts may result in an injury.

8. Check if the power supply specification is normal. Abnormal power supply may result in a failure.

9. Before connecting to the machine, check the rotating direction. Failure to do so may result in an injury or system damage.

10. Operate the system after making sure that the motor and the amplifier to be used are properly set. Failure to do so may result in a burn or fire.

RESTRICTION

1. The brake built in the motor is used for holding. Do not use it for ordinary braking. Using this brake for braking will damage it.

REQUIREMENT

1. Install an emergency stop circuit outside so that the system operation may be stopped immediately to shut off the power supply.

6. Maintenance

CAUTION

1. When repair is required, please contact us.
   Disassembly of the system by the user may render it inoperable.
2. The capacity of the condenser on the power line will be lowered by impairment. We recommend that you replace the condenser after about 10 years in order to prevent a secondary accident due to a failure. Failure to replace it when necessary will lead to a failure.
3. The amplifier frame becomes very hot. Take care to avoid burns when doing maintenance and inspection.

RESTRICTION

1. Do not disassembly or repair the system.
   Doing so may result in fire or electric shock.

CONTENTS

1. PRECAUTIONS

Take extreme care about the items described below. Incorrect handling is very likely to lead to an unexpected accident or damage.

- Precautions on unpacking
  1. After unpacking, confirm that the servo motor and the servo amplifier look normal.
  2. Check the model numbers to confirm that the delivered motor and amplifier are the ones that were ordered.

- Special precautions on use
  1. When installing the system, be careful to not apply a shock to the servo motor and the servo amplifier. In particular, pay special attention to a servo motor which is provided with an encoder.

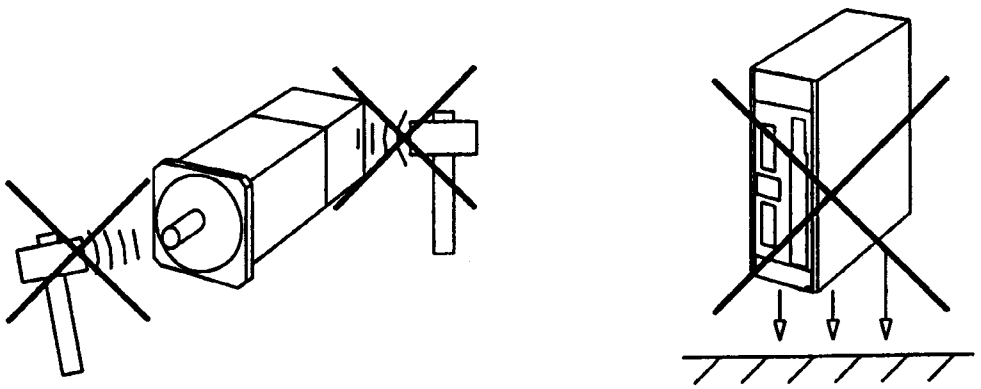


Fig. 1-1

  2. The supply voltage of standard systems of the PV1 series is AC 200 V.
     Operating the system at any other voltage will cause a failure. Operate the system with a power supply complying with the specification.
     If surge voltages are likely, connect a surge absorber in the line to protect the system from power surges.
  3. Always confirm safety, including the load status, before opening or closing the power supply at maintenance or inspection.

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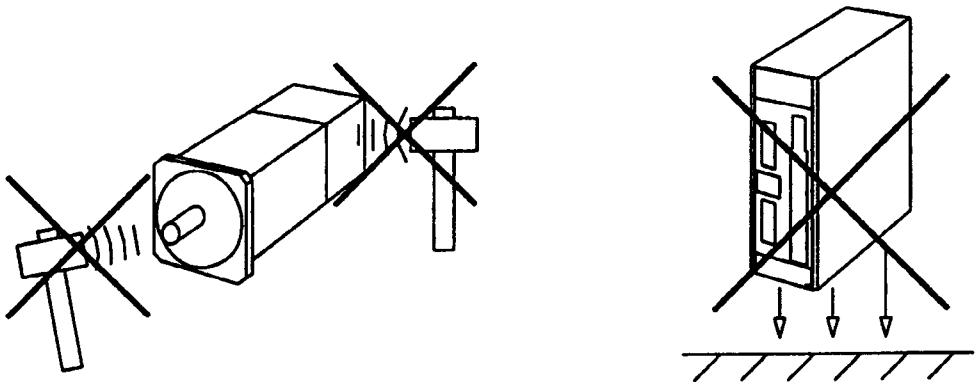

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  3. Always confirm safety, including the load status, before opening or closing the power supply at maintenance or inspection.

4. Never use the system in a place where corrosive (acid, alkali, etc.), flammable, or explosive liquid or gas exists.

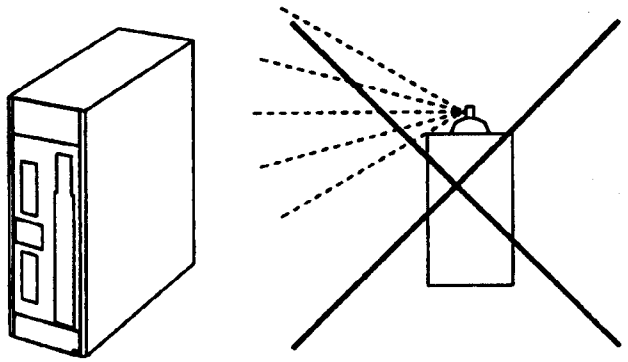


Fig. 1-2

5. Check that ground conductors of class 3 (100Ω or less) or higher are used to ground the servo motor and the servo amplifier.

6. Use the system in an ambient temperature range of 0 to 40 Celsius (0 to 55°C for the servo amplifier) and at a relative humidity of 90% or less.

7. Do not splash water, cutting liquid, or rainwater over the servo motor and the servo amplifier. Doing so may result in an electric leak or electric shock.

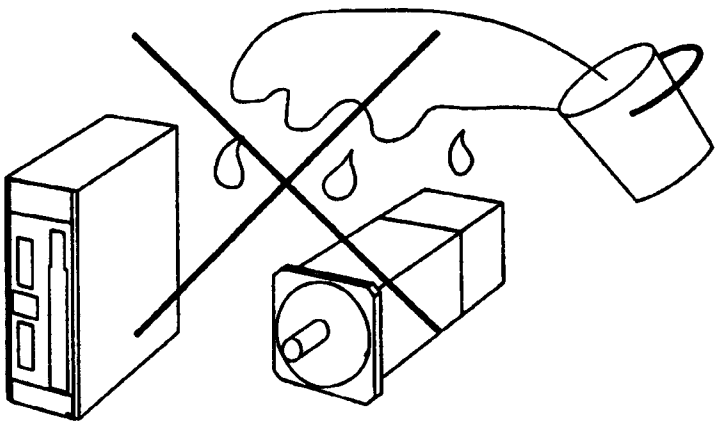


Fig. 1-3

8. Never do a withstand voltage test or megger test. Condenser grounding is performed between 0 V and the main unit. When such a test is required, consult us.

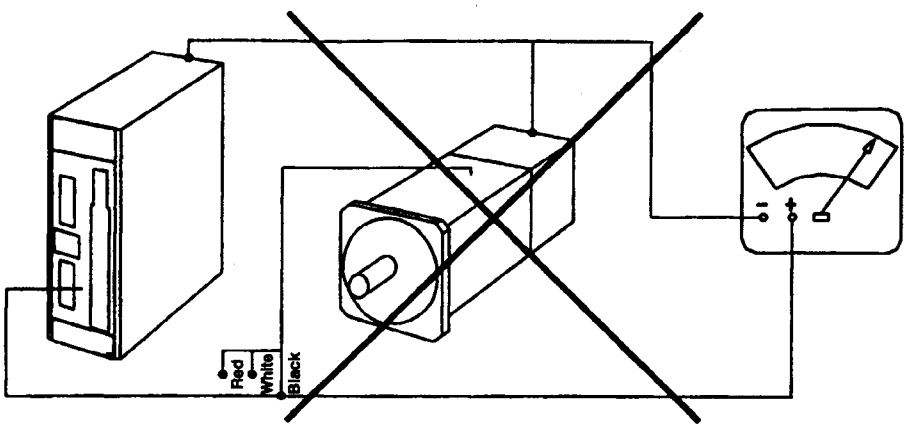


Fig. 1-4

9. Incorrect wiring may damage the servo motor and the servo amplifier. Perform wiring correctly referring to the item pertaining to wiring.

10. The PV1 series servo motor is not an induction motor, so the rotating direction is not changed if the phase sequence of the motor is changed.
    The rotating direction is changed by remote operator.

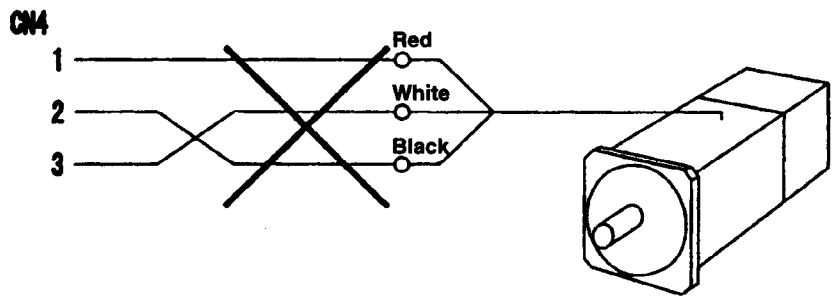


Fig. 1-5

11. Install a surge absorber in relay, electromagnetic contactor, and brake solenoid coils without fail.

2. READING THE MODEL NUMBER

- Request at receipt of ordered product

  Be sure to check the servo amplifier model number and the motor model number.

  The servo amplifier cannot be operated with a motor of a different model number. Upon receipt of the ordered product, be sure to confirm that the servo amplifier model number matches with the motor model number.

◊ Reading the model No. ◊

☆ Servo motor model number

1. Motor series name

   P30... P30 series

   P50... P50 series

2. Indicates a BL motor.

3. Flange angle size

P30 series	04..... 40□	06 .... 60□	08 ..... 80□
P50 series	03..... 35□	04 .... 42□	05 ..... 54□
	07..... 76□	08 .... 86□	

4. Rated output

003 ..... 30W	005 ..... 50W	006 ..... 60W
010 ... 100W	020 ... 200W	030 ... 300W
040 ... 400W	050 ... 500W	075 ... 750W
100 ..... 1KW		

5. Maximum rotation speed

   D .. 4500 min^{-1} (200V type) H ....3000 min^{-1} (200V type)

6. Whether there is a holding brake

   X... No brake B ... Brake provided (90 V)

   C .. Brake provided (24 V)

7. Type of detector

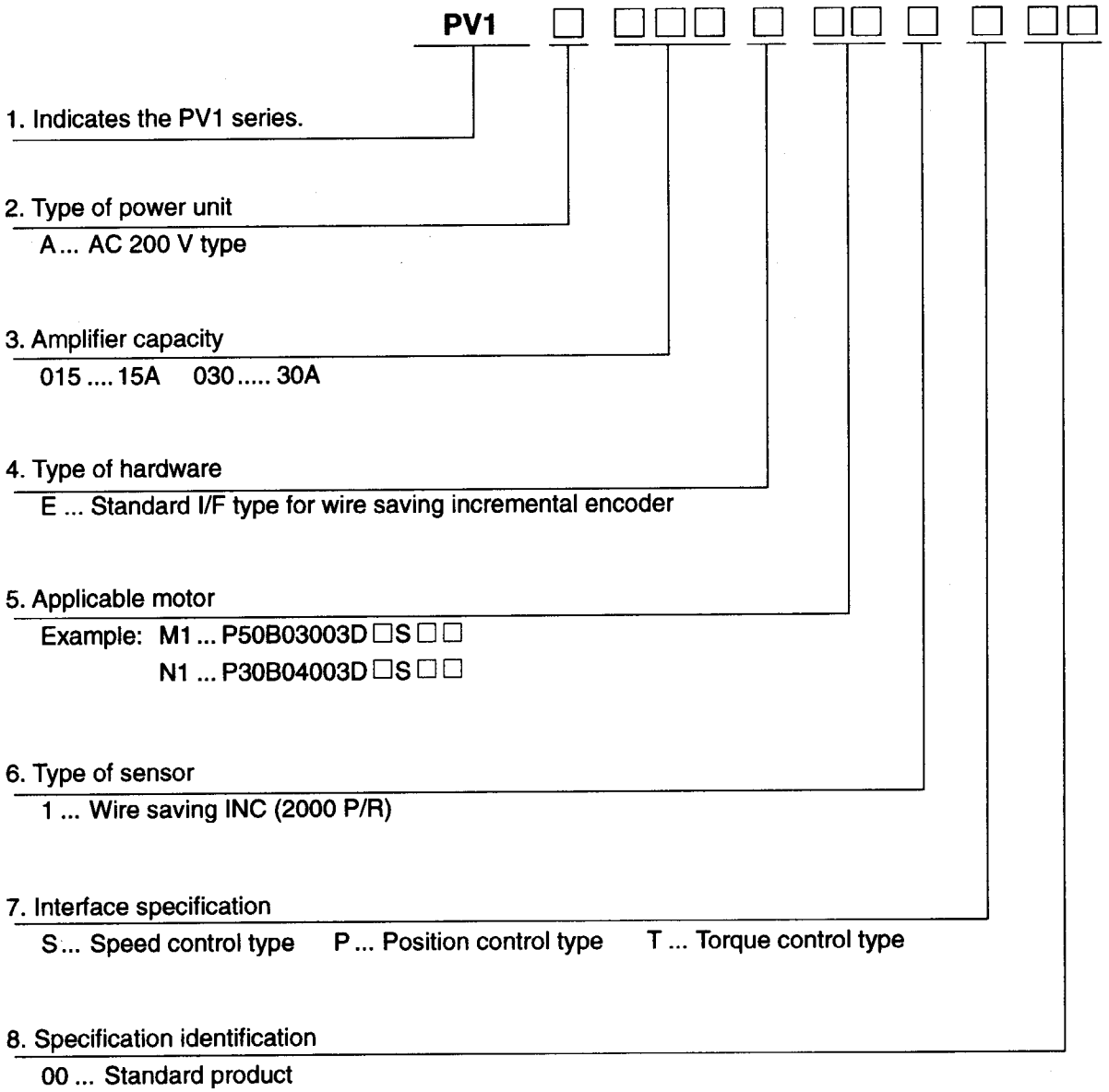
   S... Wire saving incremental encoder (wire saving INC)

8. Specification identification

   00 ... Standard product

Note: The design order is indicated with an alphabetic character at the end of Lot No. on the nameplate.

☆ Servo amplifier model number



Note: The design order is indicated with an alphabetic character at the end of Lot No. on the nameplate.

- PV1 series standard combination table

Table 2-1 Standard Combination Table

Servo amplifier model No.	Servo motor model No.
PV1A015EN11 □□□	P30B04003D□S□□
PV1A015EN21 □□□	P30B04005D□S□□
PV1A015EN31 □□□	P30B04010D□S□□
PV1A015EN41 □□□	P30B06020D□S□□
PV1A015EM11 □□□	P50B03003D□S□□
PV1A015EM21 □□□	P50B04006D□S□□
PV1A015EM31 □□□	P50B04010D□S□□
PV1A015EM41 □□□	P50B05005D□S□□
PV1A015EM51 □□□	P50B05010D□S□□
PV1A015EM61 □□□	P50B05020D□S□□
PV1A015EM81 □□□	P50B07020D□S□□
PV1A015EM91 □□□	P50B07030D□S□□
PV1A030EN51 □□□	P30B06040D□S□□
PV1A030EN61 □□□	P30B08075D□S□□
PV1A030EMA1 □□□	P50B07040D□S□□
PV1A030EMC1 □□□	P50B08050D□S□□
PV1A030EMF1 □□□	P50B08075H□S□□
PV1A030EMG1 □□□	P50B08100H□S□□

3. SERVO SYSTEM CONFIGURATION

• Block diagram

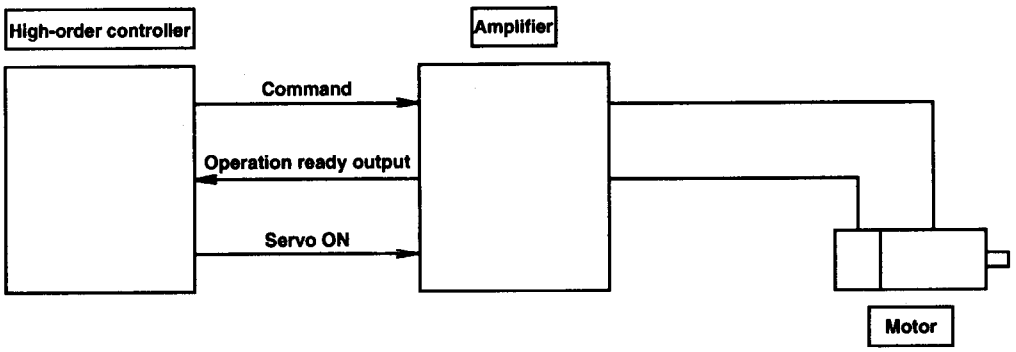
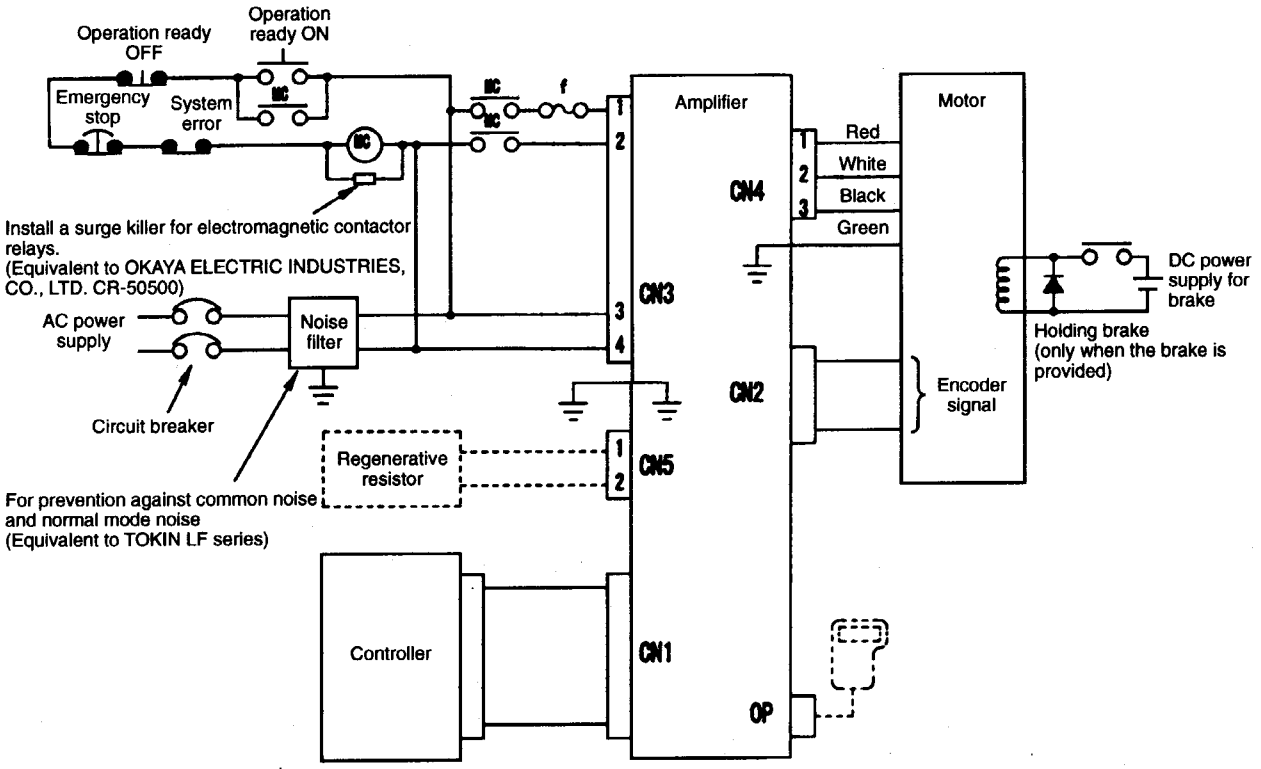


Fig. 3-1

• External mount wiring diagram



*: The dotted-line portion denotes an option.

Fig. 3-2

- Servo amplifier component names

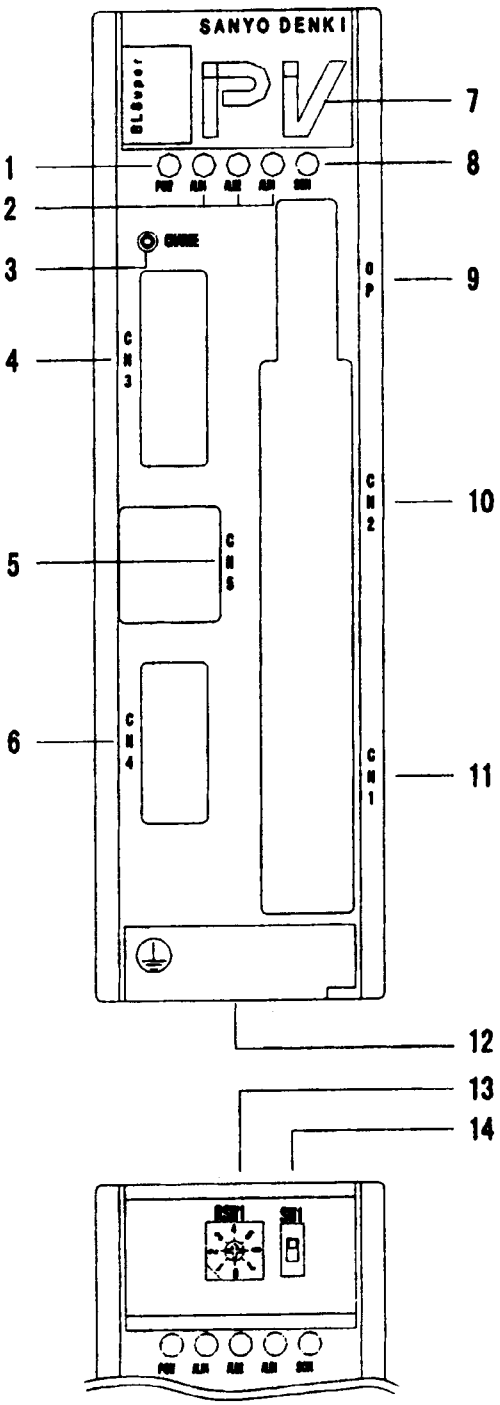


Fig. 3-3

1 ... 5 V power supply set-up (POW)
Indicates the internal 5 V power supply is set up.

2 ... Alarm lamp (ALM1, ALM2, ALM4)
Indicate the alarm status.

3 ... Main circuit power charge (CHARGE)
Indicates that the smoothing condenser of the main circuit power supply is charged.

4 ... Power input connector (CN3)
Connects the control power supply and the main circuit power supply.

5 ... Connector for connecting a regenerative resistor (CN5)
Usually connects the built-in regenerative resistor, and can also connect an external regenerative resistor.

6 ... Connector for connecting the servo motor (CN4)
Connects the power line of the servo motor.

7 ... Adjustment door
This door is opened when the gain must be set in the main unit.

8 ... Servo ON (SON)
Indicates the servo ON status.

9 ... Connector for remote operator (OP)
Connects the optional remote operator.

10 ... Connector for encoder (CN2)
Connects an encoder signal.

11 ... Connector for input/output signal (CN1)
Connects with the high-order controller.

12 ... Ground connecting terminal
Connects the grounding conductor of the servo motor and the grounding conductor of the power supply.

13 ... Gain setting switch (RSW)
A rotary switch which is used when various gains must be set in the main unit. (See P.6-8.)

14 ... Selector switch (SW)
Used to determine which of main unit rotary switch setting and remote operator setting should be made effective with regard to the servo amplifier gain. (See P.6-8.)

- Option list

In the PV1 series, the following peripheral devices are available as options. Please submit your orders for them as required.

(1) Remote operator

A unit connected to the servo amplifier for the purpose of setting various parameters and checking the internal status.

Model No.	RP-001

(2) Externally connected regenerative resistor

Use this regenerative resistor as required, for example, when operating a load with large inertia.

Model No.	Remarks
REGIST–120W100B	120W 100Ω
REGIST–220W100B	220W 100Ω

Note: When using an externally connected regenerative resistor, change the internal parameter (bit 4 and bit 7 of Func 2).
(See P.8-8 and P.8-19.)

4. WIRING

1) Applicable connectors

The following table shows the model name of each connector.

Table 4-1 Applicable Connector Names

Connector No.	Model name	Maker name
CN1	Plug: 10140–3000VE Shell: 10640–5500–008	Sumitomo 3M
CN2	Plug: 10120–3000VE Shell: 10320–52A0–008	Sumitomo 3M
CN3	Housing: 1–178128–4 Contact: 175218–3	AMP, LTD.
CN4	Housing: 1–178138–3 Contact: 175218–3	AMP, LTD.
CN5	Housing: MVSTBR2.5/3–ST–5.08	PHOENIX CONTACT

Note 1: CN1 to CN4 are attached to the product as accessories.
Note 2: CN5 is delivered in the condition in which it is connected to the built-in regenerative resistor.

2) Applicable wire sizes

The following table shows the applicable wire size for each connector.

Table 4-2 Applicable Wire Sizes

Connector No.	Applicable wire size
CN1	0.2 mm^2 or more (partial use of shielded twist-pair wire)
CN2	Shielded twisted-pair wire 0.2 mm^2 or more
CN3	AWG #16 (Finished external diameter 2.8 mm or less)
CN4	AWG #16 (Finished external diameter 2.8 mm or less) (Note 3)
CN5	AWG #18 or AWG #16

Note 1: For wire harness or insertion into a duct, take the allowable current reduction rate of wire into consideration. When the ambient temperature is high, the wire life will be shortened by thermal impairment. In this case, use a heat resistant vinyl wire (HIV).
Note 2: Perform wiring for the main circuit wire and the signal wires as separately as possible. Failure to adequately separate the wiring may result in noise.
Note 3: When the wire length between CN4 and the motor exceeds 5 m, use AWG #14 halfway as a junction wire.

3) Position control type external connection diagram

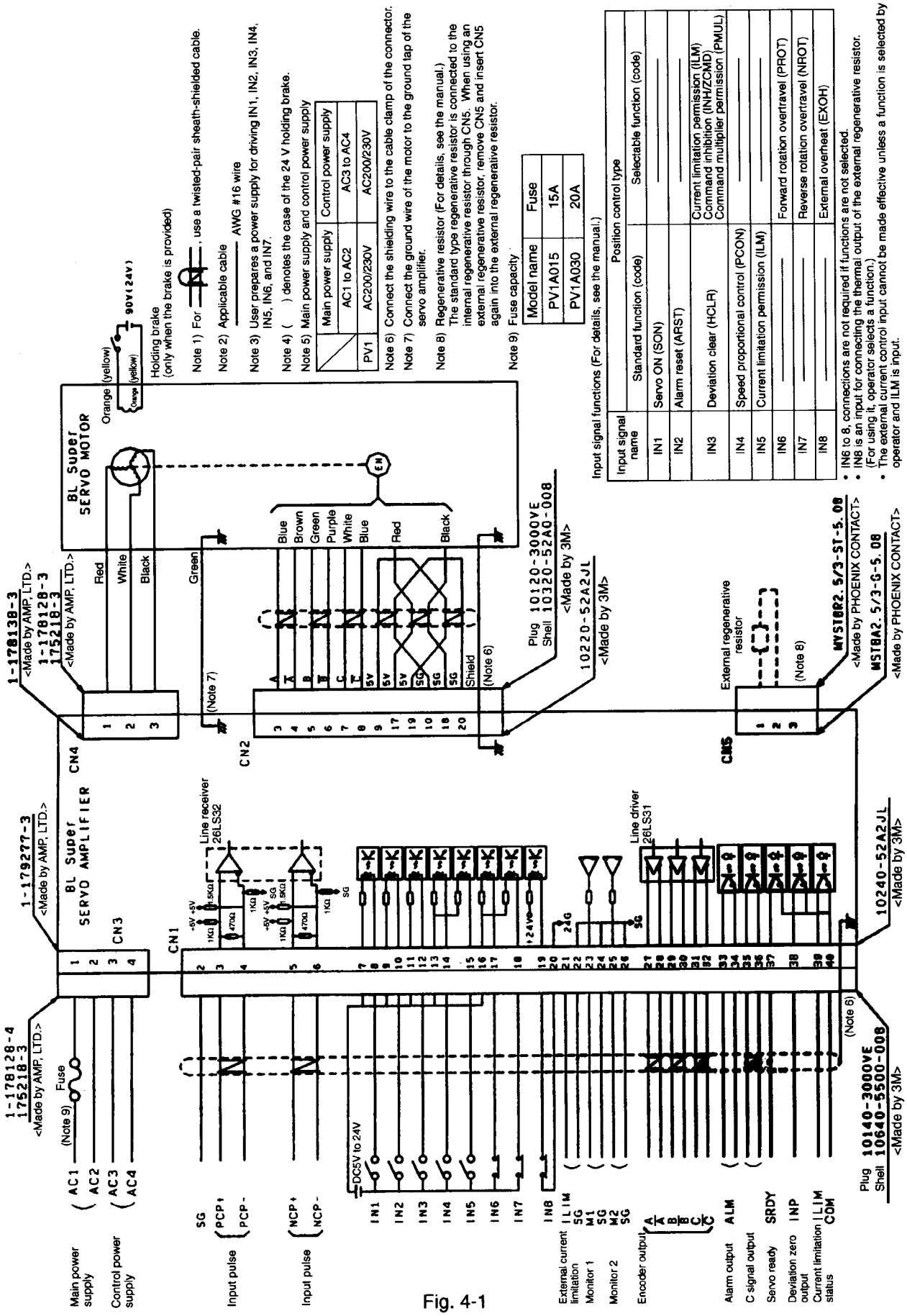
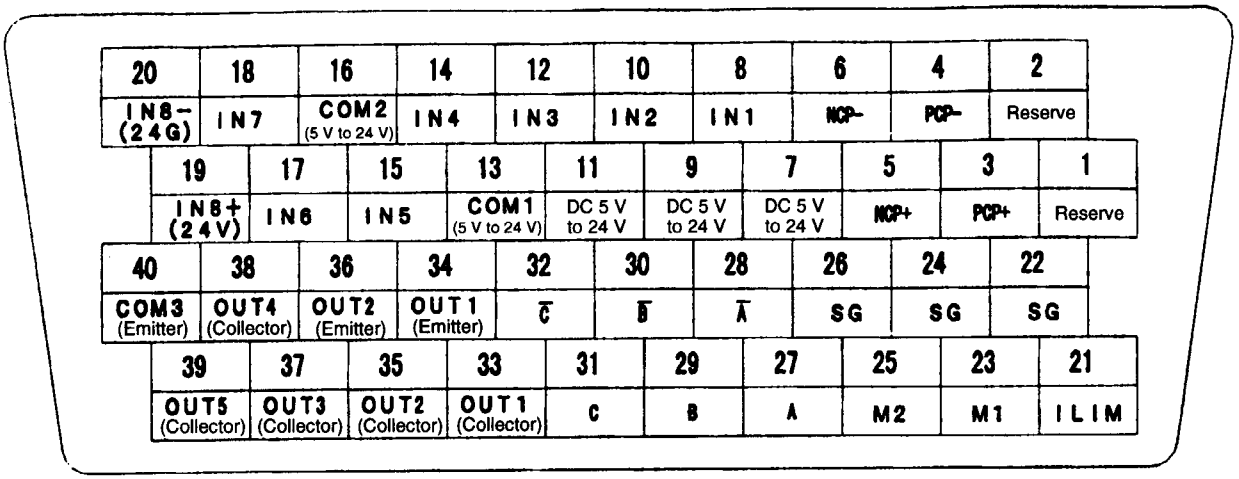


Fig. 4-1

- Connector pin arrangement input/output signal diagram

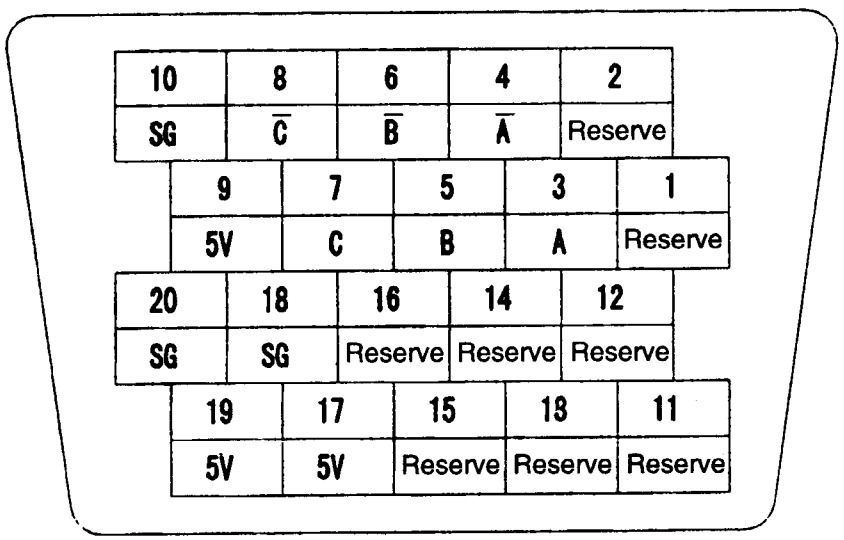
CN1



This diagram is viewed from the connector connection part.

Fig. 4-2

CN2



This diagram is viewed from the connector connection part.

Fig. 4-3

- General specifications of CN1 input/output signals

Table 4-3-1

Signal name	Code	Pin No.	Circuit type	General specification
Forward rotation pulse train command	PCP+ PCP-	3 (2) 4	Type 3	Inputs a command pulse train for forward rotation.
Reverse pulse train command	NCP+ NCP-	5 (2) 6	Type 3	Inputs a command pulse train for reverse direction.
Input signal 1 (Servo ON)	IN1 (SON)	8 (7)	Type 1	A servo ON status is provided with the contact closed, waiting for a pulse train.
Input signal 2 (Alarm reset)	IN2 (ARST)	10 (9)	Type 1	An alarm is reset by inputting this signal.
Input signal 3	IN3	12 (11)	Type 1	<See P.8-9.>
Input signal 4	IN4	14 (13)	Type 1	<See P.8-9.>
Input signal 5	IN5	15 (13)	Type 1	<See P.8-9.>
Input signal 6 (Forward rotation overtravel)	IN6 (PROT)	17 (16)	Type 1	This function is masked at delivery. <See P. 8-8.>
Input signal 7 (Reverse rotation overtravel)	IN7 (NROT)	18 (16)	Type 1	This function is masked at delivery. <See P.8-8.>
Input signal 8 (External overheat)	IN8 (EXOH)	20 (19)	Type 2	This function is masked at delivery. <See P.8-8.>
Input sequence Power supply External power supply	DC 5 V to 24 V	7		Connects the external power supply for IN1.
		9		Connects the external power supply for IN2.
		11	———	Connects the external power supply for IN3.
		13		Connects the external power supply for IN4 and IN5.
		16		Connects the external power supply for IN6 and IN7.
Internal power supply	DC24V	19	———	Outputs the internal power supply for IN8.
External output signal 1 (Alarm output)	OUT1 ALM	33 (34)	Type 6	This signal is turned off in an alarm status. (The logic can be switched by a parameter.)
External output signal 2 (C channel output)	OUT2 Cch	35 (36)	Type 6	Outputs the C-phase by open collector. (When one rotation is given to the encoder, one pulse is output.)
External output signal 3 (Operation ready output)	OUT3 (SRDY)	37 (40)	Type 6	After the main circuit power supply is input, this signal is turned on when receiving a servo ON signal.
External signal 4 (Deviation zero output)	OUT4 (INP)	38 (40)	Type 6	This signal is turned on when the contents of the deviation counter are within the setting range.
External output signal 5 (Current limitation status)	OUT5 (ILIM)	39 (40)	Type 6	This signal is turned on when there is current limitation.

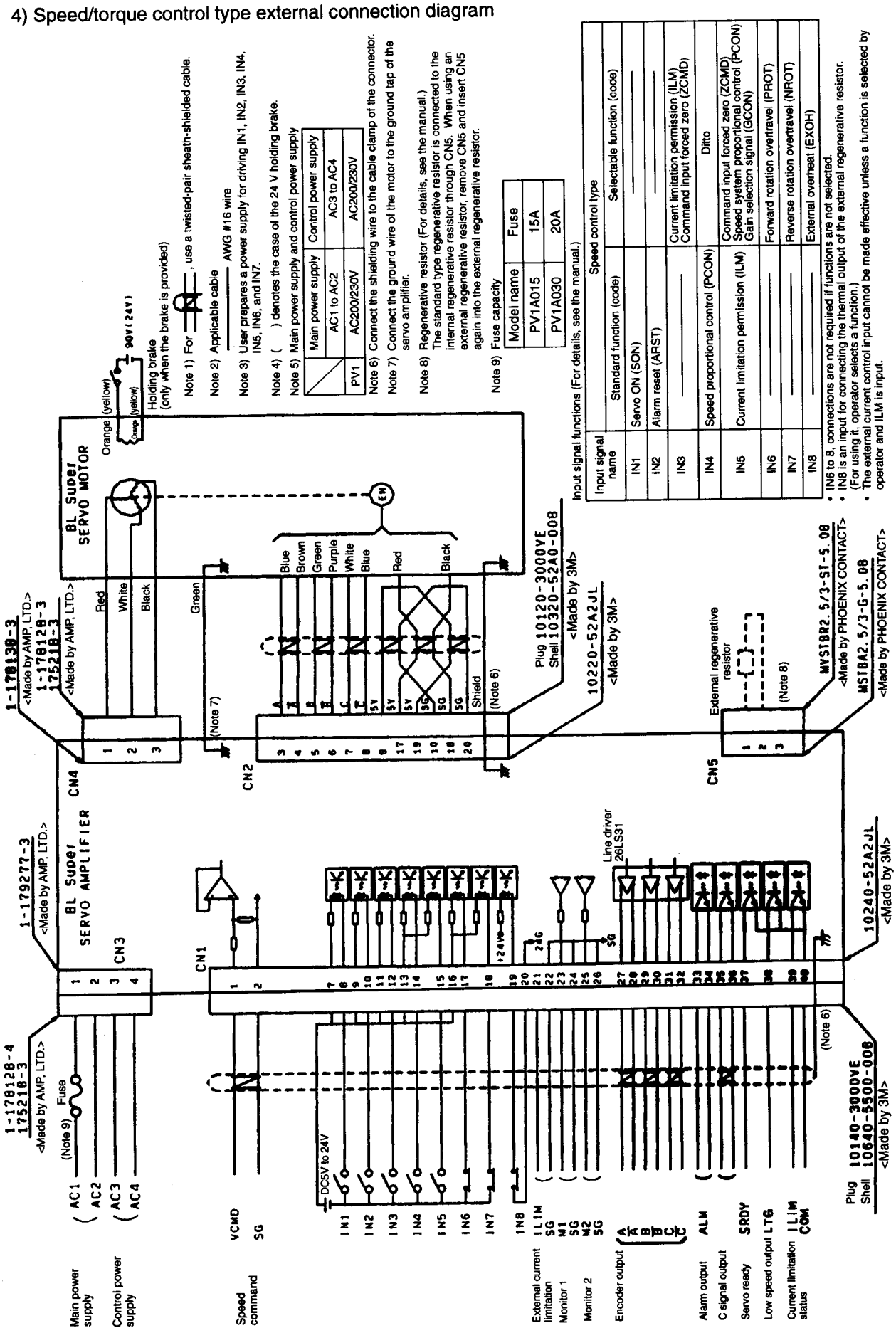
- General specifications of CN1 input/output signals

Table 4-3-2

Signal name	Code	Pin No.	Circuit type	General specification
External current limitation input	ILIMIT	21 (22)	Type 5	This function is masked at delivery. <See P.8-7.>
Monitor 1 output	M1	23 (24)	Type 8	<See P.8-13.>
Monitor 2 output	M2	25 (24)	Type 8	<See P.8-13.>
Encoder signal	A $\overline{A}$ B $\overline{B}$ C $\overline{C}$	27 (26) 28 29 30 31 32	Type 7	This signal is output by line driver (26LS31) after the optical encoder pulse is divided. It is received by line driver (26LS32).

Note 1: The pin number in parentheses denotes the ground or positive common side of each signal.
Note 2: For circuit types, refer to the item pertaining to input/output interfaces.

4) Speed/torque control type external connection diagram



Note 1) For ⊣⊢, use a twisted-pair sheath-shielded cable.

Note 2) Applicable cable ——— AWG #16 wire

Note 3) User prepares a power supply for driving IN1, IN2, IN3, IN4, IN5, IN6, and IN7.

Note 4) ( ) denotes the case of the 24 V holding brake.

Note 5) Main power supply and control power supply

Main power supply / Control power supply	AC1 to AC2	AC3 to AC4
PV1	AC200/230V	AC200/230V

Note 6) Connect the shielding wire to the cable clamp of the connector.

Note 7) Connect the ground wire of the motor to the ground tap of the servo amplifier.

Note 8) Regenerative resistor (For details, see the manual.)
The standard type regenerative resistor is connected to the internal regenerative resistor through CN5. When using an external regenerative resistor, remove CN5 and insert CN5 again into the external regenerative resistor.

Note 9) Fuse capacity

Model name	Fuse
PV1A015	15A
PV1A030	20A

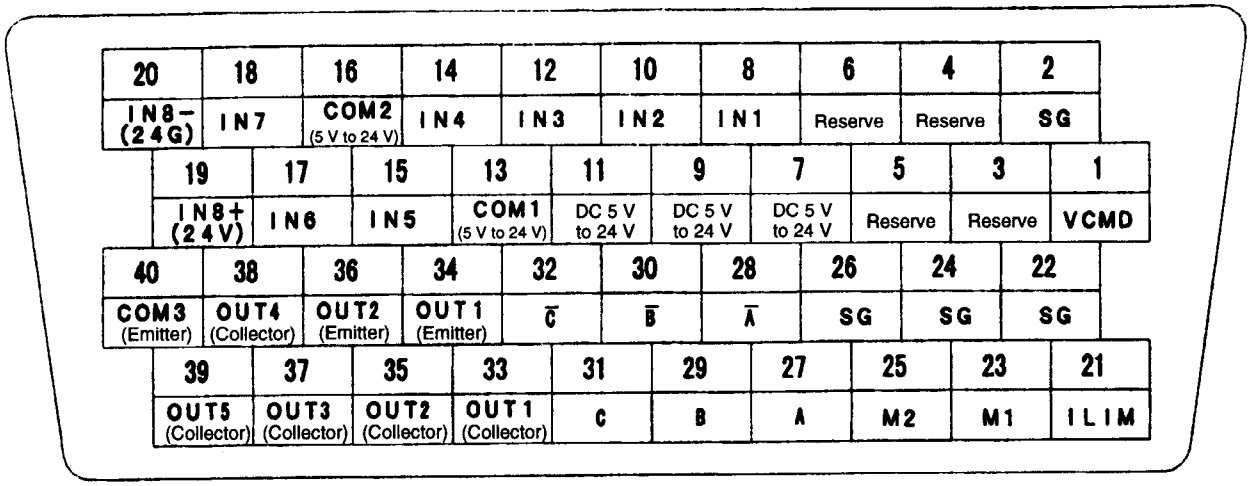
Input signal functions (For details, see the manual.)

Input signal name	Speed control type	
	Standard function (code)	Selectable function (code)
IN1	Servo ON (SON)	———
IN2	Alarm reset (ARST)	———
IN3	———	Current limitation permission (ILM) Command input forced zero (ZCMD)
IN4	Speed proportional control (PCON)	Ditto
IN5	Current limitation permission (ILM)	Command input forced zero (ZCMD) Speed system proportional control (PCON) Gain selection signal (GCON)
IN6	———	Forward rotation overtravel (PROT)
IN7	———	Reverse rotation overtravel (NROT)
IN8	———	External overheat (EXOH)

- IN6 to 8, connections are not required if functions are not selected.
- IN8 is an input for connecting the thermal output of the external regenerative resistor. (For using it, operator selects a function.)
- The external current control input cannot be made effective unless a function is selected by operator and ILM is input.

- Connector pin arrangement input/output signal diagram

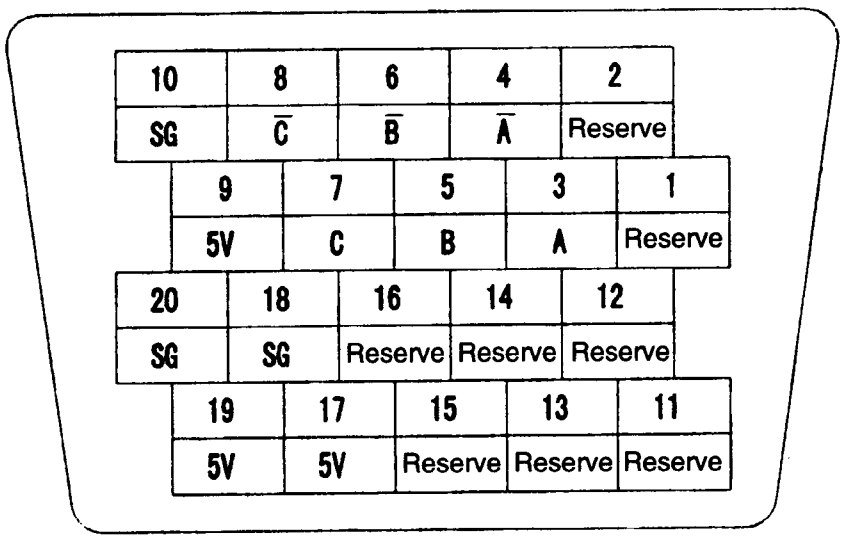
CN1



This diagram is viewed from the connector connection part.

Fig. 4-5

CN2



This diagram is viewed from the connector connection part.

Fig. 4-6

- General specifications of CN1 input/output signals

Table 4-4-1

Signal name	Code	Pin No.	Circuit type	General specification
Analog command input	VCMD	1 (2)	Type 4	The scale can be changed by remote operator. (Maximum input voltage ±10 V)
Input signal 1 (Servo ON)	IN1 (SON)	8 (7)	Type 1	A servo ON status is provided with the contact closed, waiting for a pulse train.
Input signal 2 (Alarm reset)	IN2 (ARST)	10 (9)	Type 1	An alarm is reset by inputting this signal.
Input signal 3	IN3	12 (11)	Type 1	<See P.8-20.>
Input signal 4	IN4	14 (13)	Type 1	<See P.8-20.>
Input signal 5	IN5	15 (13)	Type 1	<See P.8-20.>
Input signal 6 (Forward rotation overtravel)	IN6 (PROT)	17 (16)	Type 1	This function is masked at delivery. <See P. 8-19.>
Input signal 7 (Reverse rotation overtravel)	IN7 (NROT)	18 (16)	Type 1	This function is masked at delivery. <See P.8-19.>
Input signal 8 (External overheat)	IN8 (EXOH)	20 (19)	Type 2	This function is masked at delivery. <See P.8-19.>
Input sequence Power supply External power supply	DC 5 V to 24 V	7	———	Connects the external power supply for IN1.
		9		Connects the external power supply for IN2.
		11		Connects the external power supply for IN3.
		13		Connects the external power supply for IN4 and IN5.
		16		Connects the external power supply for IN6 and IN7.
Internal power supply	DC24V	19	———	Outputs the internal power supply for IN8.
External output signal 1 (Alarm output)	OUT1 ALM	33 (34)	Type 6	This signal is turned off in an alarm status. (The logic can be switched by a parameter.)
External output signal 2 (C channel output)	OUT2 Cch	35 (36)	Type 6	Outputs the C-phase by open collector. (When one rotation is given to the encoder, one pulse is output.)
External output signal 3 (Operation ready output)	OUT3 (SRDY)	37 (40)	Type 6	After the main circuit power supply is input, this signal is turned on when receiving a servo ON signal.
External signal 4 (Deviation zero output)	OUT4 (INP)	38 (40)	Type 6	This signal is turned on when the contents of the deviation counter are within the setting range.
External output signal 5 (Current limitation status)	OUT5 (ILIM)	39 (40)	Type 6	This signal is turned on when there is current limitation.

- General specifications of CN1 input/output signals

Table 4-4-2

Signal name	Code	Pin No.	Circuit type	General specification
External current limitation input	ILIMIT	21 (22)	Type 5	This function is masked at delivery. <See P.8-18.>
Monitor 1 output	M1	23 (24)	Type 8	<See P.8-24.>
Monitor 2 output	M2	25 (24)	Type 8	<See P.8-24.>
Encoder signal	A $\overline{A}$ B $\overline{B}$ C $\overline{C}$	27 (26) 28 29 30 31 32	Type 7	This signal is output by line driver (26LS31) after the optical encoder pulse is divided. It is received by line driver (26LS32).

Note 1: The pin number in parentheses denotes the ground or positive common side of each signal.
Note 2: For circuit types, refer to the item pertaining to input/output interfaces.

5) Input/output interfaces

Input circuit configuration

(1) Type 1 (photo coupler input)

The input circuit of this type is a contactless circuit as shown in Fig. 4-8.
As input signals for type 1, the 7 signals of IN1 to IN7 are available.
A power supply can be used in the range of 5 V to 24 V. User prepares this power supply.
The applicable power specification is:

DC 5 to 24 V ±10%, 100 mA or more

(2) Type 2 (photo coupler input)

The input circuit of this type is a contactless circuit as shown in Fig. 4-8.
As only input signal for type 2 is the signal of IN8 (External overheat).
The power supply is a built-in +24 V power supply.
The power supply specification is:

+24 V ±10%, 10 mA or less

(3) Type 3 (line receiver input)

The input circuit of this type is a circuit as shown in Fig. 4-8.
The applicable line receiver is an equivalent to AM26LS32.
The only input signal for type 3 is the position control type command pulse input.
This type can also be connected to an open collector output.

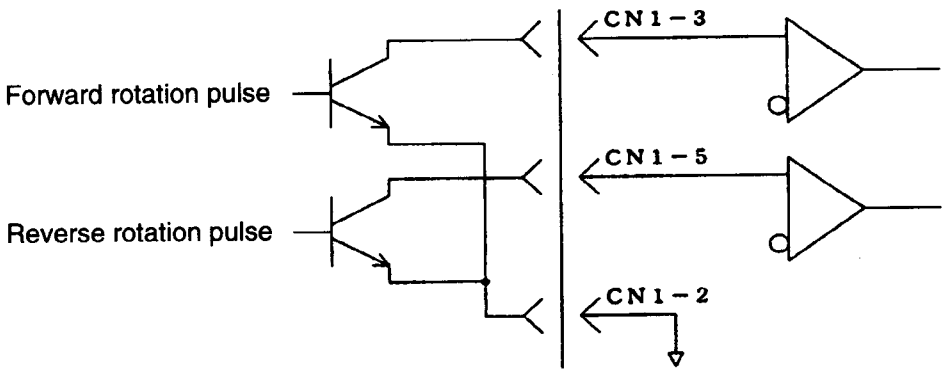


Fig. 4-7 Connection Example

(4) Type 4 (analog input)

The input circuit of this type is a circuit as shown in Fig. 4-8.
The only input signal for type 4 is the analog speed command.

(5) Type 5 (analog input)

The input circuit of this type is a circuit as shown in Fig. 4-8.
The only input signal for type 5 is the current limitation input.

Output circuit configuration

(1) Type 6 (open collector output)

The output circuit of this type is an insulated contactless circuit as shown in Fig. 4-8. As the signals for type 6, the 5 signals of OUT1 to OUT5 are available.

(2) Type 7 (line driver output)

The output circuit of this type is a circuit as shown in Fig. 4-8.

The applicable line driver is an equivalent to AM26LS31.

As the output signals for type 7, the encoder signal A-phase, B-phase and C-phase are available.

(3) Type 8 (analog output)

The input signal of this type is a circuit as shown in Fig. 4-8.

As the signals for type 8, the monitor 1 output and monitor 2 output are available.

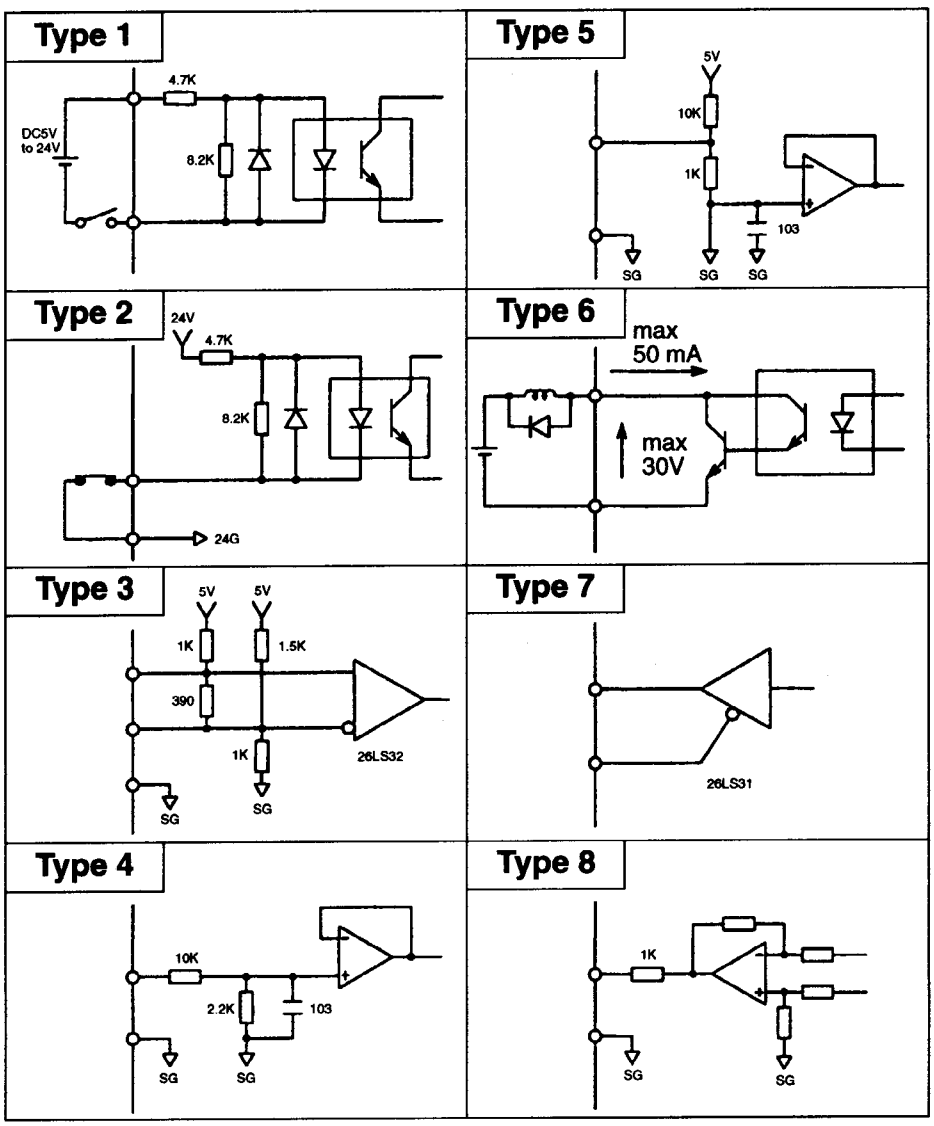
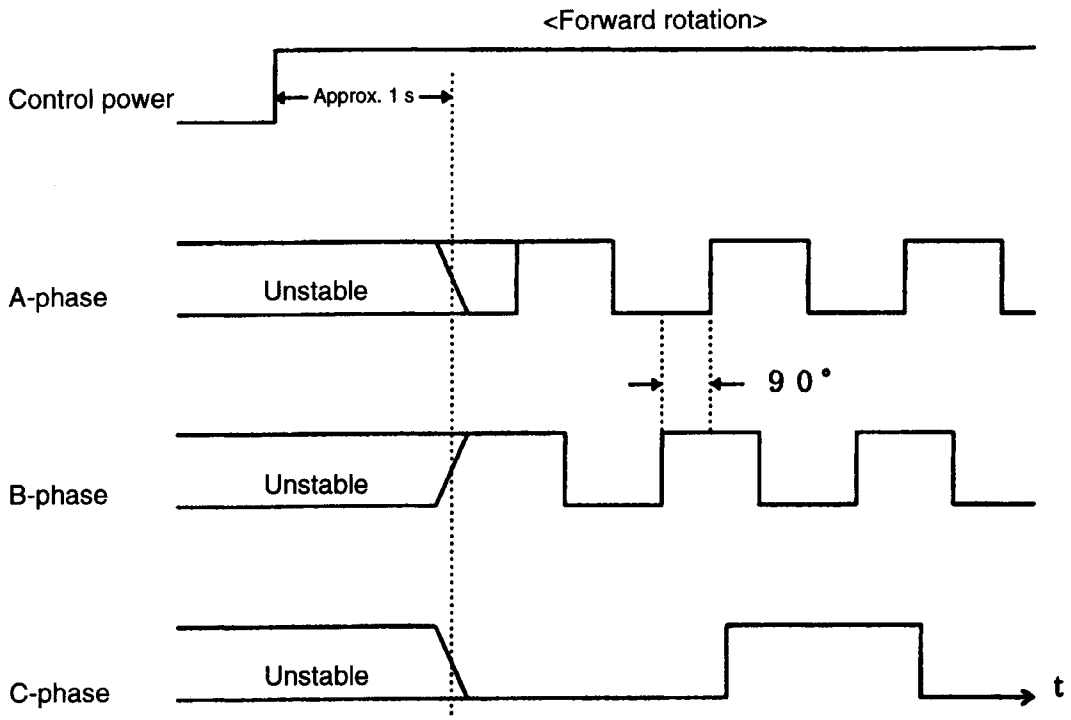


Fig. 4-8

<Position signal output>

The 90-degree phase difference 2-phase pulses (A-phase, B-phase) and the origin pulse (C-phase) are output from CN1-27 to 32.



The B-phase advance 90 degrees from the A-phase.

Fig. 4-9

Note 1: The status is unstable for about 1 s after the control power supply is started.

Note 2: The forward rotation of the motor means the counterclockwise rotation as viewed from the load axis side.

Divided frequency output function

A pulse of the optical encoder signal can be divided into N/8192 (N = 1 to 8191), 1/N (N = 1 to 64) or 2/N (N = 3 to 64) by setting from the remote operator, and then divided results can be output.
The phase relation does not change, but 2/5 division does not have a 90-degree phase difference.
Refer to the explanation of parameters for dividing ratio setting for encoder signal.
The dividing ratio must be a value that can be divided without any remainder when the pulse-number of the optical encoder is divided.
In the case of an optical encoder of 2000 pulses/rev, 1/3, 1/6 and 1/7 cannot be used because they cannot be divided without any remainder.
The following figure shows a divided encoder output waveform example.

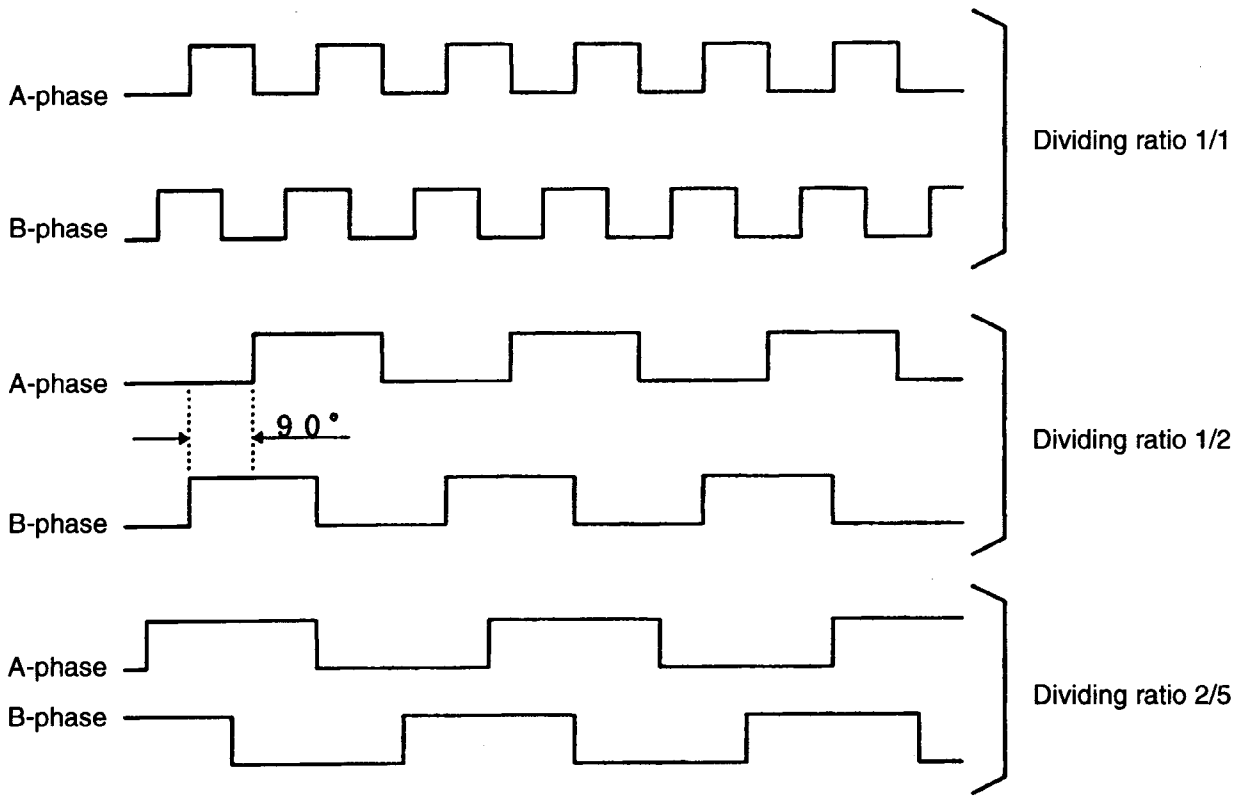


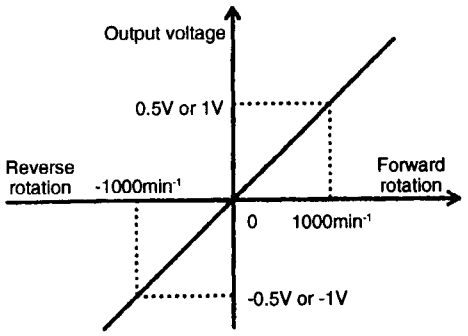
Fig. 4-10 Encoder Signal Output Waveform Example (Forward Rotation)

<Monitor output>

- The contents of monitor 1 (M1) output or monitor 2 (M2) output can be selected by remote operator to output them. <Reference>
- The monitor 1 output and the monitor 2 output are convenient when a check pin is set on the controller side.
- The monitor output is MAX ± 4 V.

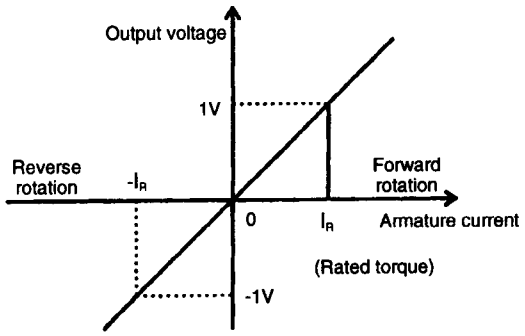
① Speed, torque and position deviation monitors

Speed command, feedback monitor output



Vc 0.5mV/min^{-1}
Vm 0.5mV/min^{-1}
Vc 1mV/min^{-1}
Vm 1mV/min^{-1}
The error is ±0.1V.

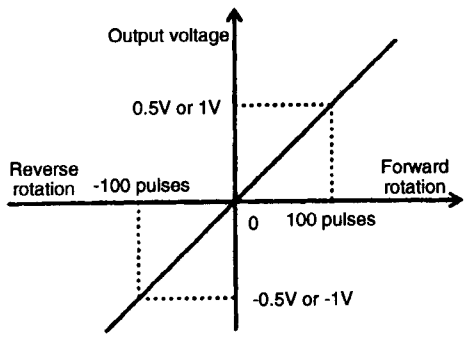
Current command, current feedback monitor output



Ic 1V/IR
Im 1V/IR

The error is ±0.1V.

Position deviation monitor output



Per 5mV/P
Per 10mV/P
The error is ±0.1V.

Fig. 4-11

- Regarding the above monitor outputs, current reverse and absolute value can be selected by remote operator.

② Regenerative load factor monitor output

- The regenerative load factor monitor output is convenient for checking the utilization of the built-in regenerative resistor.
  (When selecting an externally connected regenerative resistor, do not use this monitor.)
- The regenerative load factor monitor is output by:
  Absorbable power of built-in regenerative resistor (5 [W]) = 1 [V]
  And the output voltage is updated every minute.

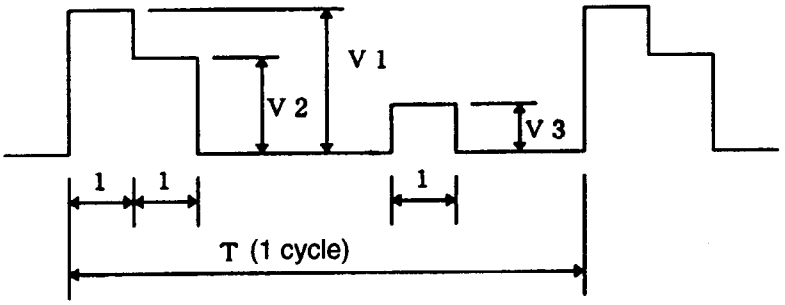


Fig. 4-12

In the case of the above measurement, calculation will be made as:

$$\text{Using ratio of built-in regenerative resistor} = \frac{V1 + V2 + V3}{T} \times 100\%$$

And when the utilization is 100% or less, the built-in regenerative resistor is regarded as OK.

- When using an externally connected regenerative resistor, do not use this monitor output.
- The detectable error of regenerative load factor is ±30%.

Application example of monitor

Rotating speed measurement and current measurement

When connecting a measuring instrument to the speed monitor or torque monitor, use a dual-swing type selected with a DC voltmeter and connect it as shown in Fig. 4-13.

Do wiring with a shielding wire as short as possible. When it is not used, remove it.

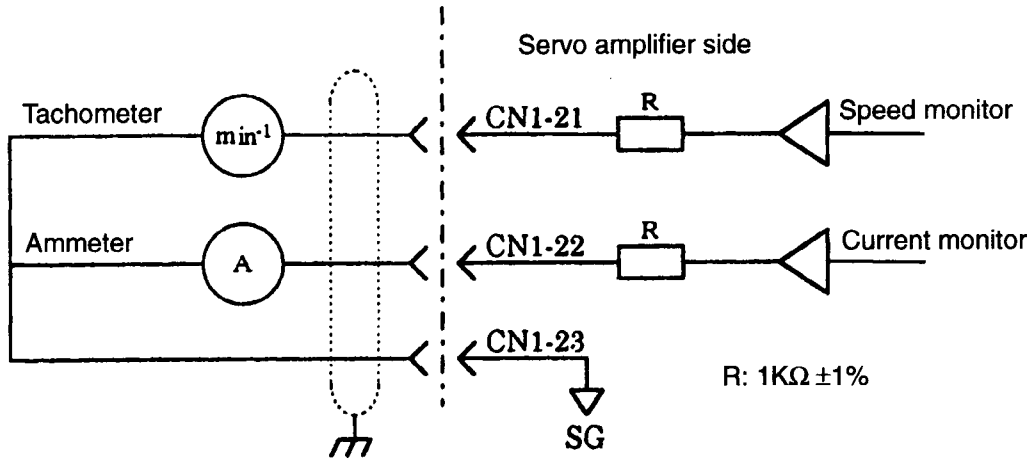


Fig. 4-13 Monitor Measuring Instrument Connection Example

- Speed monitor output (CN1-21) ..... ±0.5V±10%/1000 min^{-1}
- Current monitor output (CN1-22) ... ±1.0V ±20%/rated current
- The monitor output is MAX ±4V.

Note 1: As a measuring instrument for the speed monitor or current monitor, use a DC voltmeter (dual-swing type) that has internal resistance is 10KΩ or more.

Note 2: When changing the contents of the monitor by remote operator, take extreme care not to damage the measuring instrument.

<Position control type>

Two different types of signals can be input as command pulses.

(1) Command pulse

Command pulse type	Input pin No.	For motor forward rotation command	For motor reverse rotation command
Reverse rotation pulse train + Forward rotation pulse train	CN1–5, 6 CN1–3, 4	"L"	"L"
Code + pulse train	CN1–5, 6 CN1–3, 4	"H"	"L"

Fig. 4-14 Command Pulse Types

(2) Command pulse timing

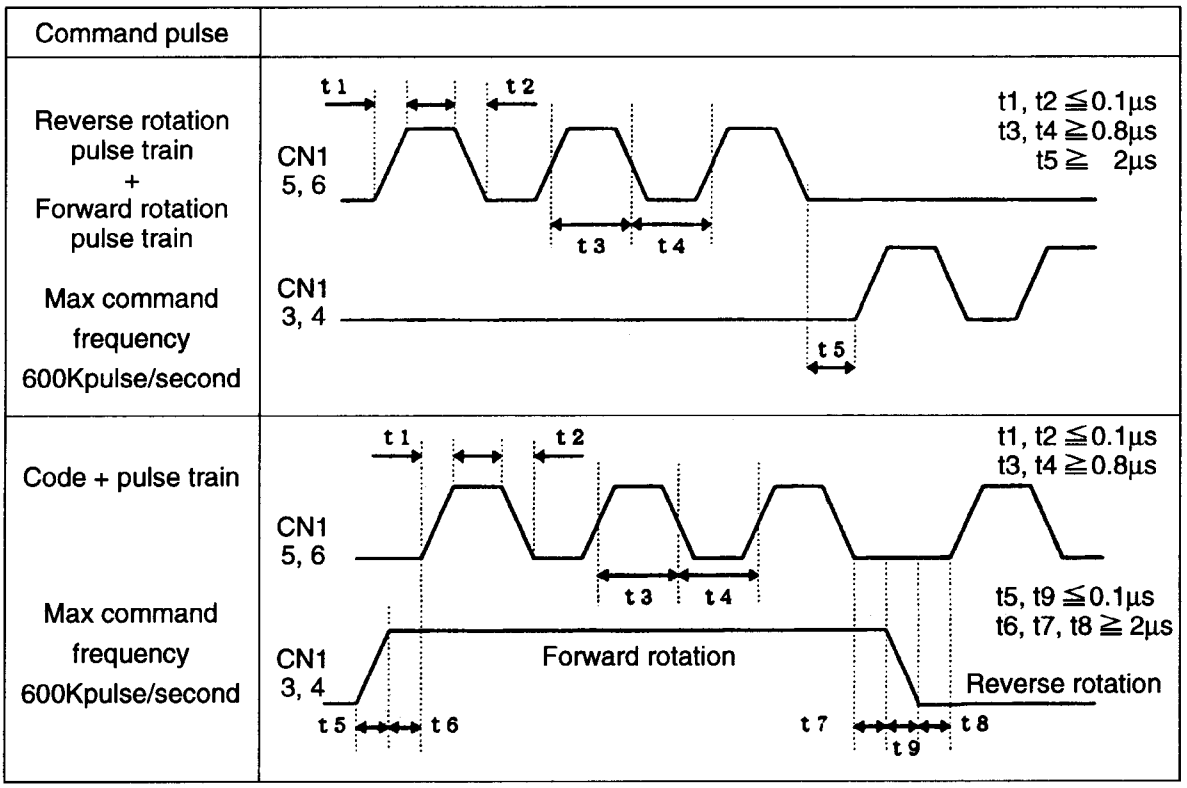


Fig. 4-15 Command Pulse Timing
(Screen mode 0-9 (PMOD) digital filter DFC1,0 = '00')

<Speed/torque control type>

- Specifications of analog input commands

(1) Speed command input (speed control type)

Fig. 4-16 shows the standard characteristics of the speed command voltage and the motor rotation speed.

The speed command voltage means a voltage that is input from analog command input terminals CN1-1 and 2.

The motor forward rotation (+) means the counterclockwise rotation as viewed from the load side.

The polarity can be changed by bit 5 of Func1, and the scale can be changed by Scal at parameter setting. <See P.8-22.>

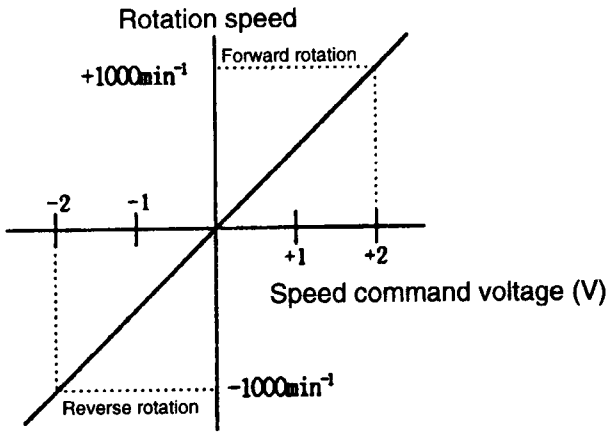


Fig. 4-16 Speed Command - Rotating speed characteristics

(1) Torque command input (torque control type)

Fig. 4-17 shows the standard characteristics of the torque command voltage and the generated torque.

The torque command voltage is a voltage that is input from analog command input terminals CN1-1 and 2.

A positive (+) torque means torque that causes counterclockwise rotation as viewed from the load side.

The polarity can be changed by bit 5 of Func1 and the scale can be changed by Scal at parameter setting. <See P.8-22.>

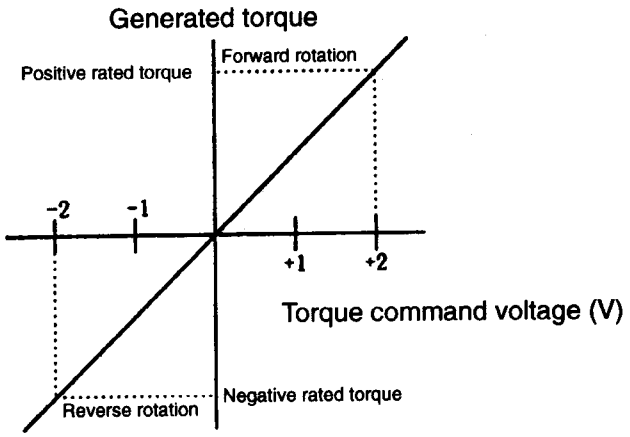


Fig. 4-17 Torque Command - Generated Torque Characteristics

6) Wiring method

The servo amplifier is a control unit for processing signals not exceeding several mV. Accordingly, do wiring in accordance with the following items:

(1) For input/output signal lines and encoder signal lines, use twisted-pair wires and multi-conductor shielded twisted-pair wires.
Length of the command input line is 3 m or less, while length of the encoder signal line is 20 m or less.
Wiring should be as short as possible, separating the main circuit line from the signal circuit line.
Do not run the main circuit line on the side face of the amplifier and near other amplifiers.

(2) Connect the ground conductor to a single point with a wire diameter shown in Table 4-2. Do class 3 grounding (ground resistance: 100Ω or less)

(3) Be sure to connect the servo motor frame (grounding conductor) with the servo amplifier (FG terminal).

(4) When the wiring length (between CN4 and the motor) exceeds 5 m, use AWG #14 as a junction cable.

(5) Take a proper measure against a malfunction due to noise.
① Arrange the noise filter, servo amplifier, and high-order controller at the shortest possible distance.
② Be sure to install a surge absorber circuit for relay, electromagnetic contactor, induction motor, and brake solenoid coils.
③ Do not run the main circuit line and signal lines in the same duct or do not bundle them together.
④ When there is any large noise source such as electric welder or spark erosion machine nearby, insert a noise filter into the power supply and the input circuit.
Avoid bundling the primary and the secondary of the noise filter. Also, avoid making the ground conductor longer.
⑤ Perform wiring for analog input signals so that the terminal may not be open.

(6) Measure against radio interference
Currently, no measure is taken against radio interference for the servo amplifier.
If radio interference becomes problematic, insert a line filter into the power line input.

- Wiring precautions

◊ Noise processing

The main circuit of the servo amplifier uses an IGBT under PWM control. However, At IGBT switching, any effect (switching noise) caused by di/dt and dv/dt may be caused by improper grounding. Because the servo amplifier is provided with a CPU electronic circuit, it is necessary to perform wiring or processing so as to prevent external noise from entering. Avoid trouble due to this noise by wiring and grounding securely. The power noise proof level of the servo amplifier is 30 minutes or less at 1500 V, 1μsec. Do not do a noise test over this limit.

(1) Ground the motor frame

When the motor is grounded to the ground through the frame on the machine side, a Cf × dv/dt current flows from the PWM power unit of the servo amplifier through the motor floating capacity (Cf). To prevent any effects due to this current, be sure to connect the E terminal (motor frame) of the motor to the servo amplifier (FG terminal) and then ground the FG terminal directly to the ground.

(2) Ground wires

When motor wires are put in a metallic conduit or metallic box, be sure to ground the metal. Ground to a single point.

◊ Incorrect wiring

Incorrect wiring for the servo amplifier and the servo motor may cause damaged. Check the wiring carefully.

◊ Power line protection

(1) Be sure to use a circuit breaker and a fuse for the servo amplifier input to protect the power line. Even if the motor frame is grounded as specified, a leak current may flow along the power line. When selecting a leak detection breaker, refer to the item pertaining to specifications and give adequate consideration to prevent causing oversensitive operation due to a high-frequency leak current.

(2) If the power supply is susceptible to surge voltages, connect a surge absorber to absorb the surge voltages.

(3) If there is a possibility that a lightning surge exceeding 2 KV may be applied to the servo amplifier, take proper measure against the lightning surge at the inlet of the control panel.

5. INSTALLATION

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1) Servo amplifier
In the PV1 series, the book type fixed servo amplifier is specified as the standard.

- Installation location

① When housed in a box
The temperature inside the box may become higher than the external temperature because of power dissipation of built-in units and the size of the box. Be sure to consider the size of the box and cooling and arrangement so that the ambient temperature of the servo amplifier may be 55°C or less. For long life and high reliability, the internal temperature of the box should be 40°C or less.

② When there is any vibration source nearby
Install the servo amplifier on a base equiped with a shock absorber so as to prevent vibration of the servo amplifier.

③ When there is any heat source nearby
When a temperature rise may be caused by convection or radiation, the temperature on the servo amplifier side should be 55°C or less.

④ When corrosive gas is present
Contact faults may occur at contact parts (connectors, etc.) after extended use of the servo amplifier.

⑤ When any explosive gas or inflammable gas is present
Parts such as relays and contactors generating an arc (spark) or regenerative brake resistors reaching a high temperature in the box may become ignition sources, thereby causing a fire or explosion.

⑥ When there is dust or oil mist
The dust or oil mist coating or accumulating on the servo amplifier may lower the insulation capability and cause a leak between conductive parts of component parts, resulting in damage.

- Installation method

① Direction

When installing the servo amplifier, place it in the direction shown in Fig. 5-1 but not sideways. Because the cooling method is natural convection, be sure to install the amplifier in the correct direction.

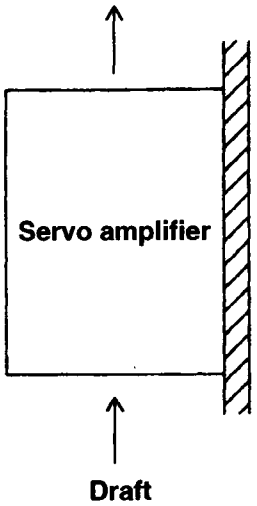


Fig. 5-1

② Unit arrangement

Allow a space of 50 mm or more on both top and bottom sides of each servo amplifier so that the air from the heat radiator has adequate circulation. If heat tends to stay above the top surface of the amplifier, provide circulation with a fan. Allow a space of 10 mm or more between amplifiers.

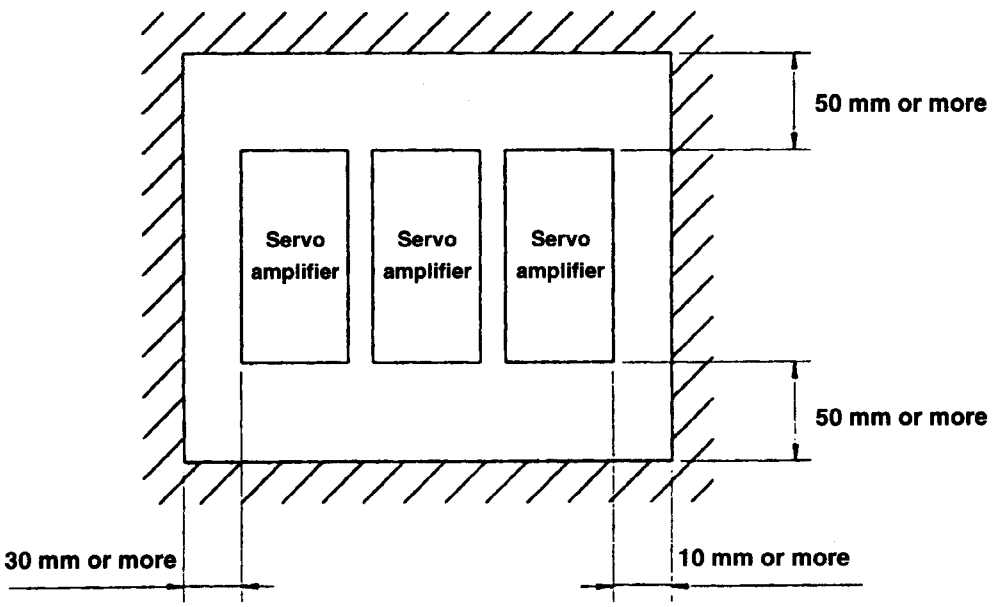


Fig. 5-2

③ Installation method

The following figure shows installation methods.

Rear-side installation

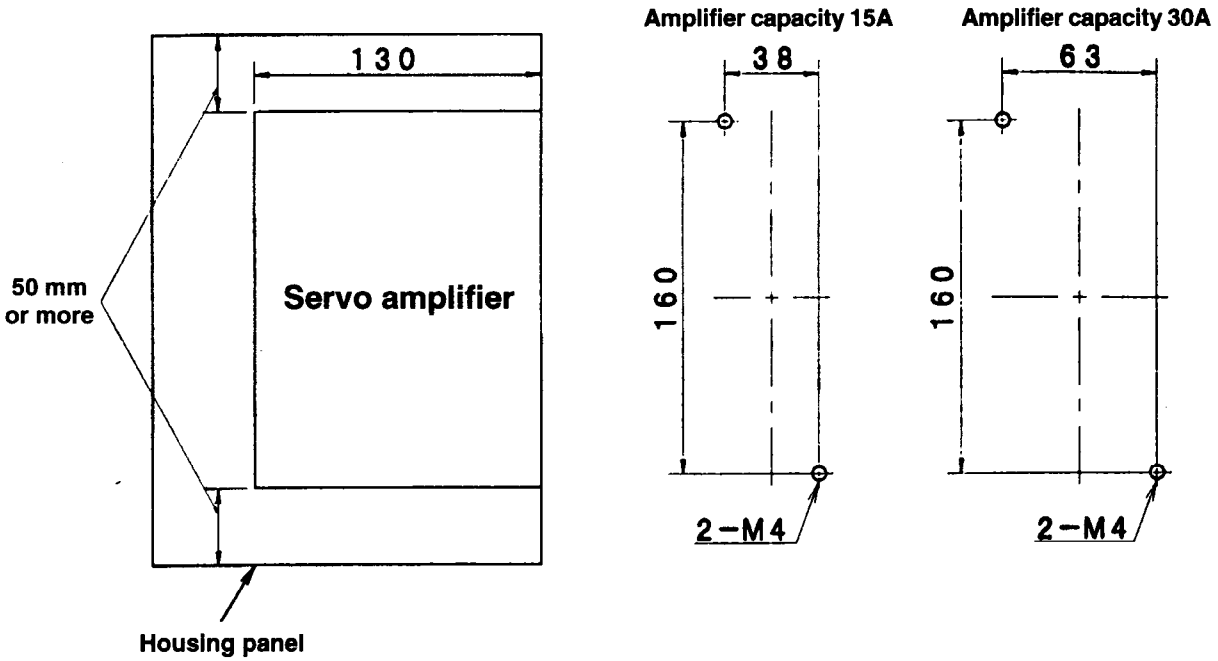


Fig. 5-3

2) Servo motor

- Installation location

  The servo motor is usually installed outdoors. However, operate it in the following environment.

  ① Ambient temperature: 0 to 40 °C
  ② Storage temperature: -20 to 65 °C
  ③ Ambient humidity: 20 to 90%
  ④ Well-ventilated place free from corrosive gas and explosive gas
  ⑤ Location free from dust and foreign materials
  ⑥ Location which is easy to inspect and clean
  ⑦ Never expose the oil seal lip to oil or lots of water droplets, oil droplets, or cutting fluid. It can be protected from slight splashes by the measure taken by the motor side.

- Installation method

  ① Direction of installation
  - Horizontal and shaft up/down installation can be performed.
  - Install the servo motor so that the motor cable may face downward.
  - At vertical installation, provide a cable trap so as to prevent oil and water from reaching the motor.

Fig. 5-4

② Prevention against wetting

- Face the connector (lead outlet) downward on the angle range shown in the figure.
- Install a cover on the side which will be splashed with water (oil).
- Incline the cover so that water (oil) does not stay.
- Do not immerse the cable in water (oil).
- Allow slackness in the cable even on the outside of the cover so that water (oil) may not invade.

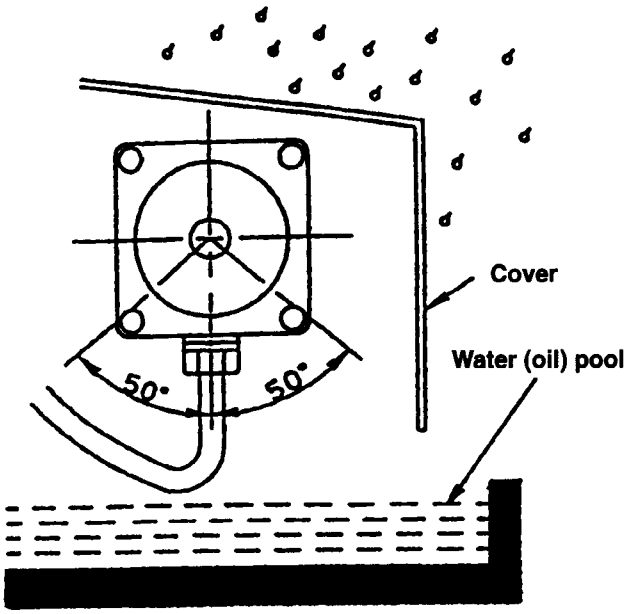


Fig. 5-5

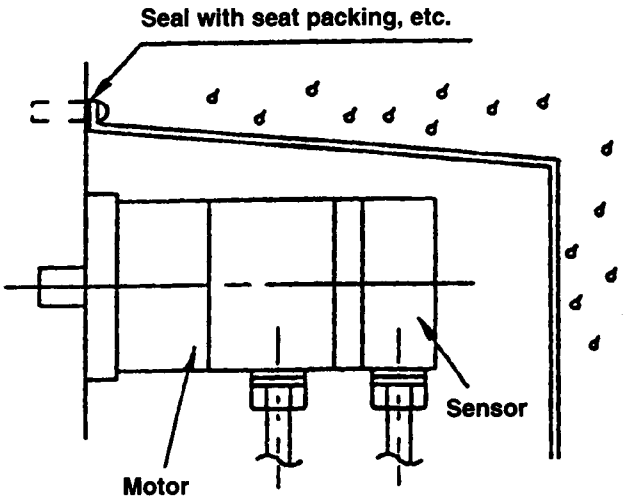


Fig. 5-6

- If the connector (lead outlet) cannot be faced downward at installation for a compelling reason, allow slackness in the cable to prevent water (oil) from invading.

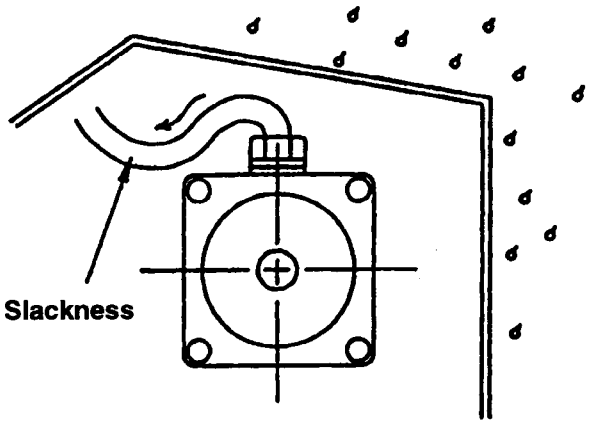


Fig. 5-7

- Make the oil level in the gear box lower than that of the oil seal lip.
- Provide a through hole to avoid increasing the internal pressure of the gear box.

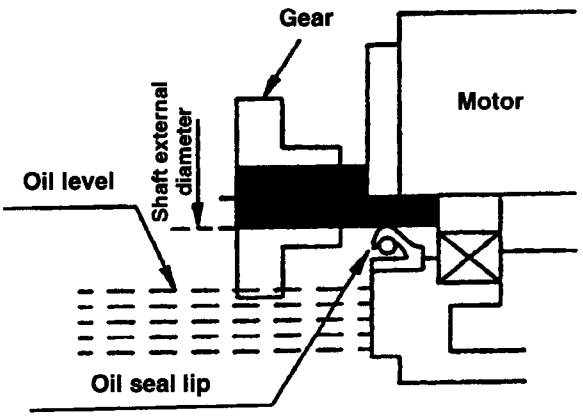


Fig. 5-8

③ Connection with the companion machine

- Accurately center the motor shaft and the companion machine as shown in Fig. 5-9. In particular, when using a rigid body coupling, slight offset will lead to damage to the output shaft.

- When installing a coupling, use the groove in the center of the shaft to avoid applying a shock. The optical encoder is directly connected inside the motor, so take special care not to apply a shock.

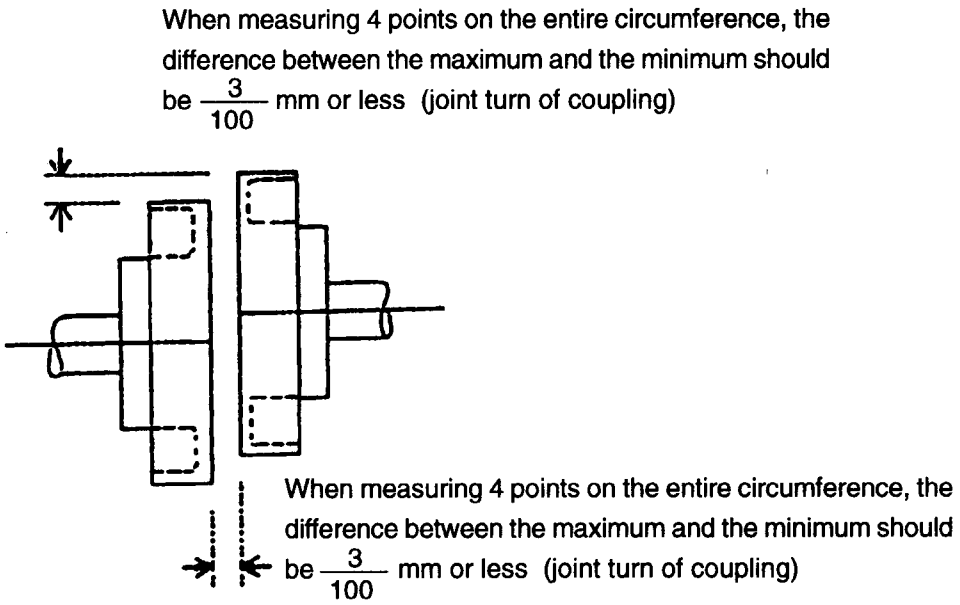


Fig. 5-9 Centering

- For bent drive, check that the value of the bent tension which was converted into shaft value does not exceed the allowable value shown in Table 5-1 and Table 5-2.

④ Allowable value for bearing

Loads that can be applied to the servo motor are shown in Table 5-1 and Table 5-2. Do not apply an excessive thrust load or a radial load.

The thrust load and the radial load shown in the table are allowable load values in the case where the respective load is applied to the shaft independently.

Table 5-1 P30 Series Allowable Radial Load and Allowable Thrust Load

Motor model	Allowable radial load kg	Allowable thrust load kg
P30B04003	5	3
P30B04005	10	3
P30B04010	10	3
P30B06020	20	8
P30B06040	25	10
P30B08075	35	20

Table 5-2 P50 Series Allowable Radial Load and Allowable Thrust Load

Motor model	Allowable radial load kg	Allowable thrust load kg
P50B03003	6	2
P50B04006	10	3
P50B04010	10	3
P50B05005	15	8
P50B05010	15	8
P50B05020	20	8
P50B07020	20	10
P50B07030	20	10
P50B07040	25	10
P50B08050	35	20
P50B08075	35	20
P50B08100	35	20

Note: The allowable radial load means the maximum load that can be applied to the one-third point of the output shaft length from the output shaft.

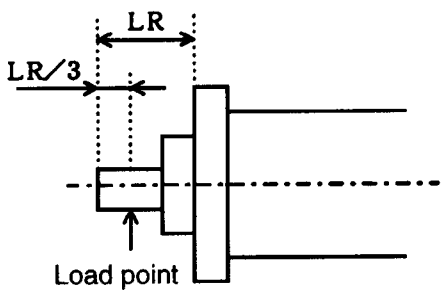
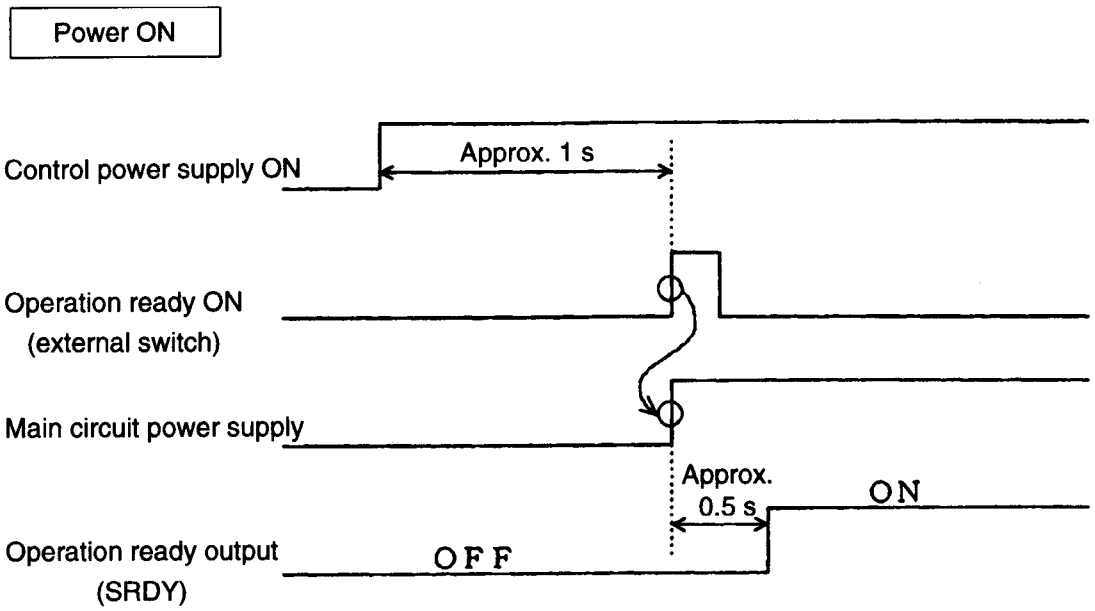


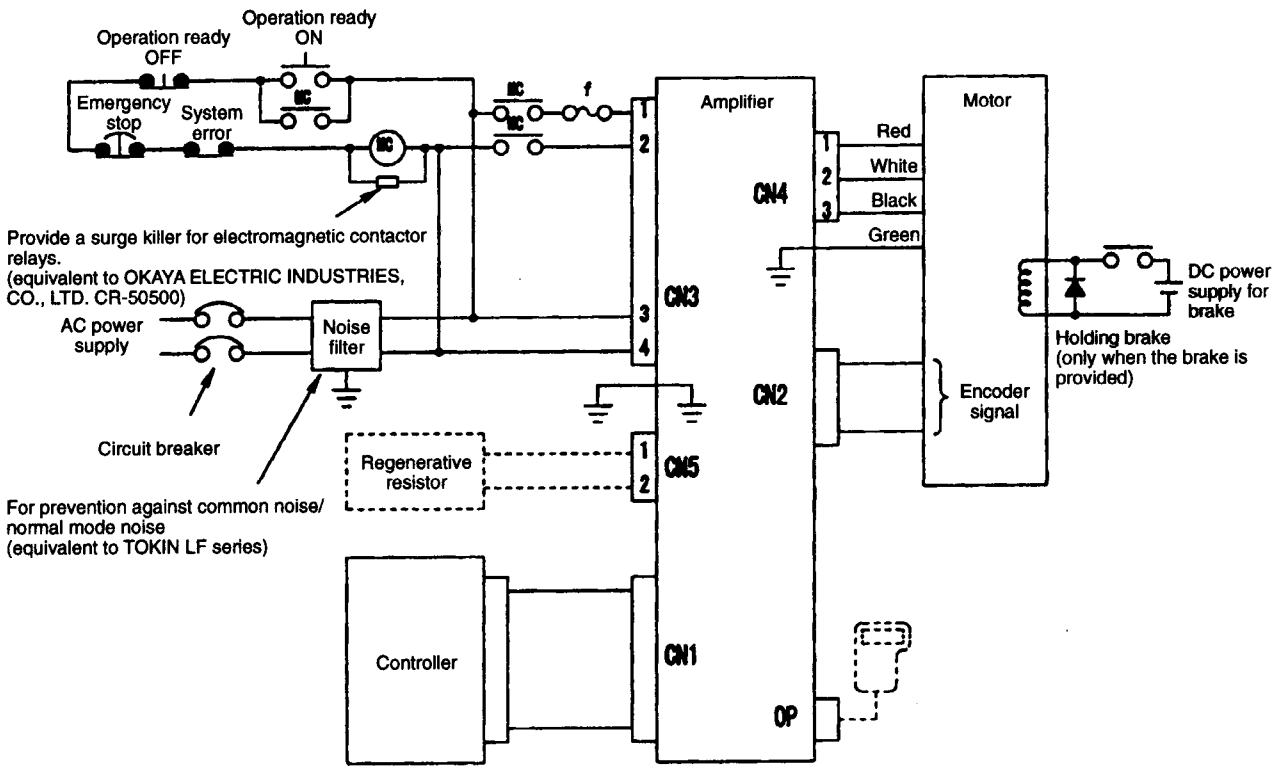
Fig. 5-10 Radial Load Position

- Cable disconnection
  ① Be careful not to apply stress to the cable or otherwise damage it.
  ② When the motor and the cable must be moved by cable bearer for use, determine the bending radius of the cable from the necessary flexure life and wire type.
  The movable portion of the cable should have a structure that can be replaced periodically.

6. OPERATION

1) Operation sequence



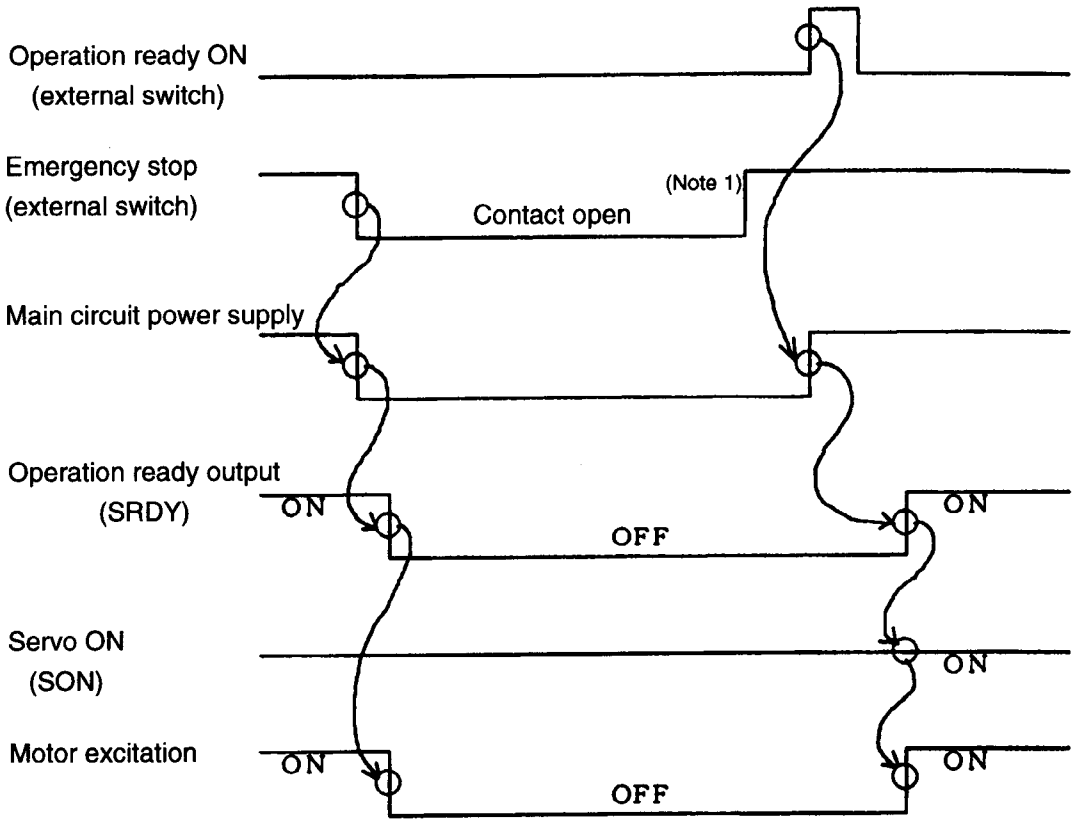


★ : The dotted line denotes an option.

Fig. 6-1

Stop

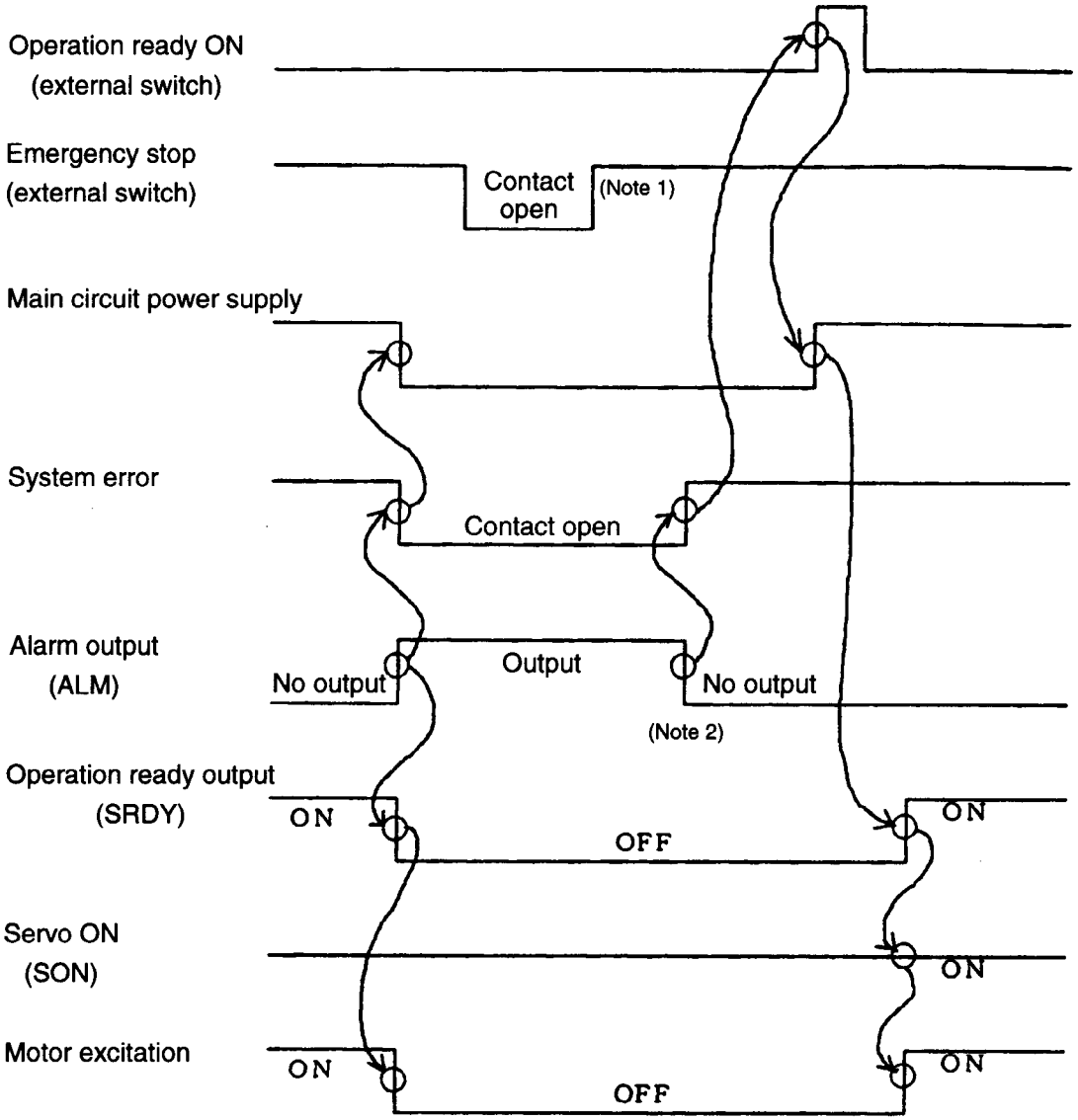
(1) Stop by emergency stop input and recovery



Note 1: Clear the status before the operation ready signal is input.

Note 2: When the emergency stop signal is input during high-speed rotation, the motor will run away. If a counter balance for the vertical shaft is not provided, a fall will occur due to its own weight.

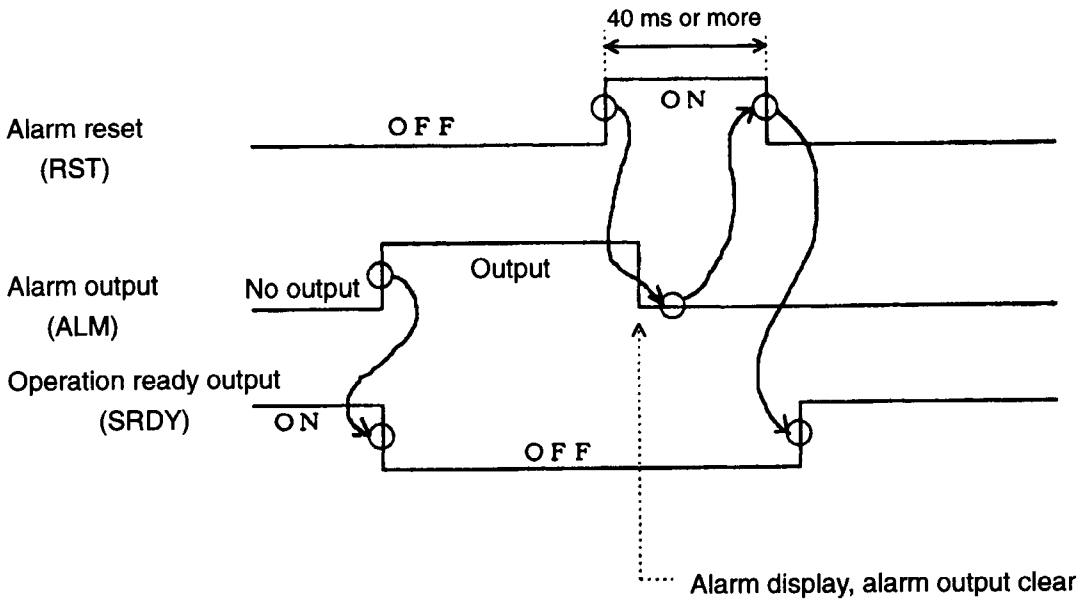
(2) Stop by internal error and recovery



Note 1: In the internal error status, inputting the emergency stop signal does not produce any effect. However, clear this status before making preparations for operation.

Note 2: Refer to the alarm reset sequence.

Alarm reset

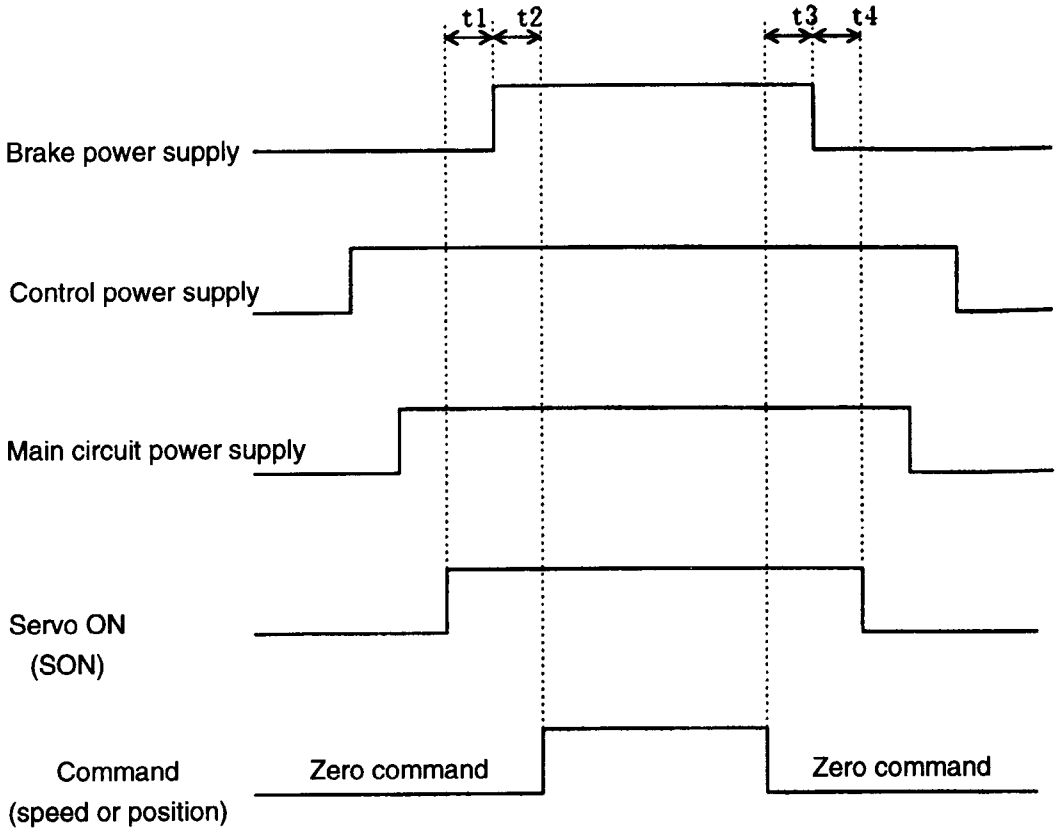


Note 1: After checking that no alarm occurs on the high-order controller, by watching the alarm output, turn off the reset input.

Note 2: When any cause of alarm remains, the alarm output cannot be cleared by inputting the alarm reset signal. Accordingly, be sure to turn off the alarm reset signal after the lapse of 40 ms or more.

Note 3: The sensor error (DE), memory error (MEME), CPU error (CPUE), or servo processor error (DSPE) cannot be reset unless the control power supply is turned off.

Holding brake excitation timing



t1: 2 to 50 ms
t2: Brake release time × 1.5
t3: Motor stop time × 1.2
t4: Brake braking delay time × 1.5

2) Indication

The servo amplifier status and alarm status are indicated by [LED].

1. Status indication

Table 6-1 Status Indication

Indication	Explanation of status
LED [POW] lights.	The internal power supply 5 V is set up.
LED [SON] lights.	The motor is in excitation. (Servo ON status)
LED [CHARGE] lights.	The smoothing condenser in the main circuit power supply is being charged. <When this LED is lit, be careful about high voltage.>

2. Alarm indication

For alarm indication, refer to the item pertaining troubleshooting in "Maintenance".

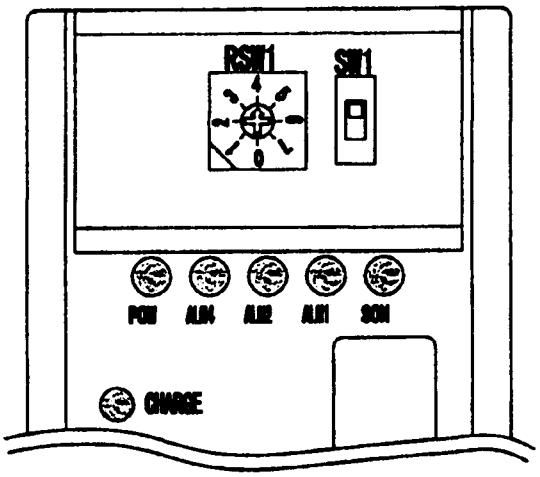


Fig. 6-2

3) Analog command offset adjustment (speed/torque control type)

If the motor rotates when the analog command input is set to 0 V for the reason of internal circuit offset, make an adjustment according to the following procedure.

1. Check that the analog command voltage is 0 V in the servo ON status.

2. Adjust Zero (mode 1-6) by remote operator.

<See P.8-25.>

4) Gain setting

- Selection of gain setting method

The four gain setting methods for position loop gain (Kp), speed loop proportional gain (Kvp), speed loop integral time constant (Tvi), and current command low-pass filter (ILPE) can be divided into two setting methods. One is direct setting by remote operator and the other is selection of combination by the rotary switch of the main unit.

For selection of a gain setting method, the selector switch (SW) in the front panel adjustment door is used. Either gain setting by remote operator or gain setting by rotary switch can be selected by the gain change-over switch (GCON).

The following table shows the relation among the selector switch (SW), gain change-over signal (GCON), and real operating gain.

Table 6-2 Relation between the Selector Switch and Operating Gain (Kp, Kvp, Tvi).

Selector switch (SW)	Gain change-over switch (GCON)	Gain setting switch (RSW)	Real operating gain (indicated in Screen Mode 0)				Change on Screen Mode 0 by remote operator	Servo tuning support function
			Kp	Kvp	Tvi	ILPF		
Up position	OFF	0	20	35	50	500	Disable*2	Disable
		1	20	35	20	500		
		2	30	70	50	500		
		3	30	70	20	500		
		4	45	140	50	500		
		5	45	140	20	500		
		6	60	280	50	500		
		7	60	280	20	500		
	ON	No relation	Kp*1	Kvp*1	Tvi*1	ILPF*1		
Down position	No relation	No relation	Kp*1	Kvp*1	Tvi*1	ILPF*1	Enable	Enable*3

*1: Kp, Kvp, Tvi and ILPF are values set in Screen Mode 0 (setting mode) of the remote operator.

*2: Parameters other than Kp, Kvp, Tvi and ILPF can be changed.

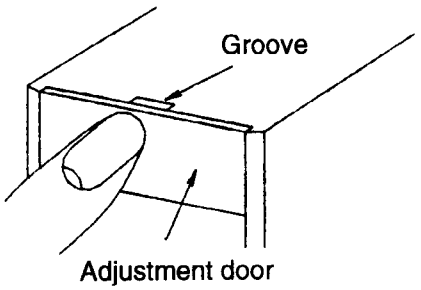
*3: A servo tuning result is automatically set in the parameter value set in Screen Mode 0.

- Gain setting by rotary switch

The gain setting procedure using the gain setting switch (RSW) is shown below:

1. Check that the status is a power OFF or servo OFF status.

2. Open the front panel adjustment door of the main unit.



Set the nail in the groove and open the door toward you.

Fig. 6-4

3. Check that the selector switch (SW) is set at the up position.

4. Change the gain setting by using the gain setting switch (RSW).

5. Close the adjustment door.

Note: When the gain change-over signal (GCON) is input, the gain setting by remote operator will be enabled even if the selector switch (SW) is set at the up position.

- Gain setting by remote operator

For the gain setting method by remote operator, refer to "Remote Operator" and "Explanation of Parameters".

7. REMOTE OPERATOR

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- Remote operator overview
  The following figure shows the remote operator.

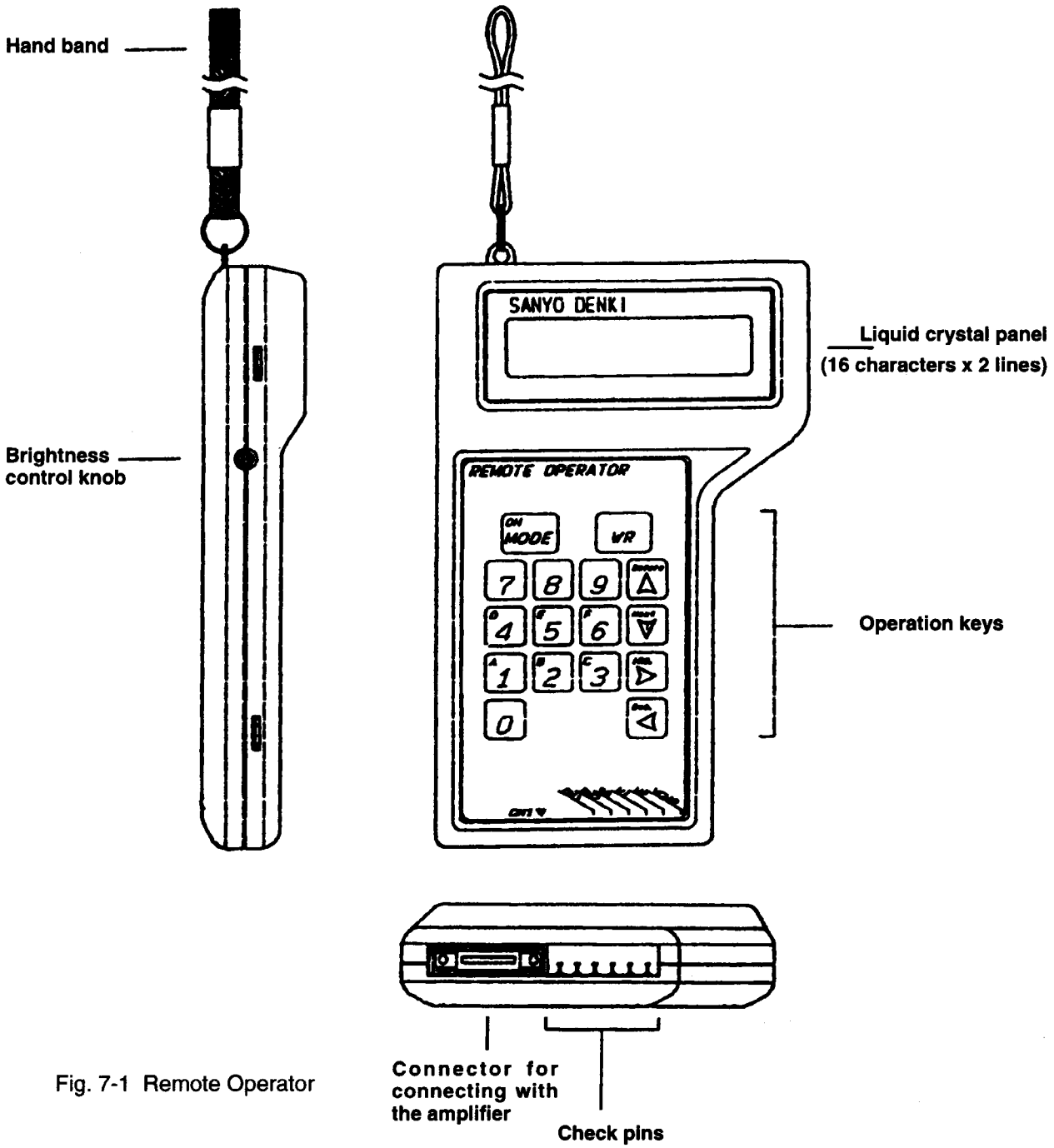


Fig. 7-1 Remote Operator

Table 7-1 Remote Operator Specifications

Item	Specification	
Power supply	Supplied from the servo amplifier	
Connection method	Connector connection by dedicated cable (cable length: 2 m)	
Ambient temperature	At operation (0 to +50°C)	At storage (-20 to +70°C)
Operating atmosphere	Free from oil mist, corrosive gas, and dust.	

Note: Dropping the remote operator may damage the liquid crystal panel. Handle the remote operator carefully.

- Function table

Table 7-2 Remote Operator Functions

Mode	Screen No.	Function
Setting mode	0	Enters each user parameter directly by keys.
	1	Selects a user parameter according to the screen display.
Monitor mode	2	Displays various monitors on the screen. • Status monitor • Input monitor • Output monitor • Speed command • Speed • Current command • Current • U-phase electric angle • Estimated value of effective torque • Position command frequency • Position deviation counter
Alarm trace mode	3	Displays the present and previous 7 alarms.
Test mode	4	Permits performing JOG operation and servo tuning operation.

Table 7-3 Check Pin Functions in the Remote Operator

Name	Contents
VCMD	Monitors the speed command (CN1-1 pin input).
M1	Monitor the same as the amplifier M1 output (CN1-23).
M2	Monitors the same as the amplifier M2 output (CN1-25).
SG	Signal ground (common to amplifier SG)
DM1	Not used
DM2	Not used

- Basic operating procedure

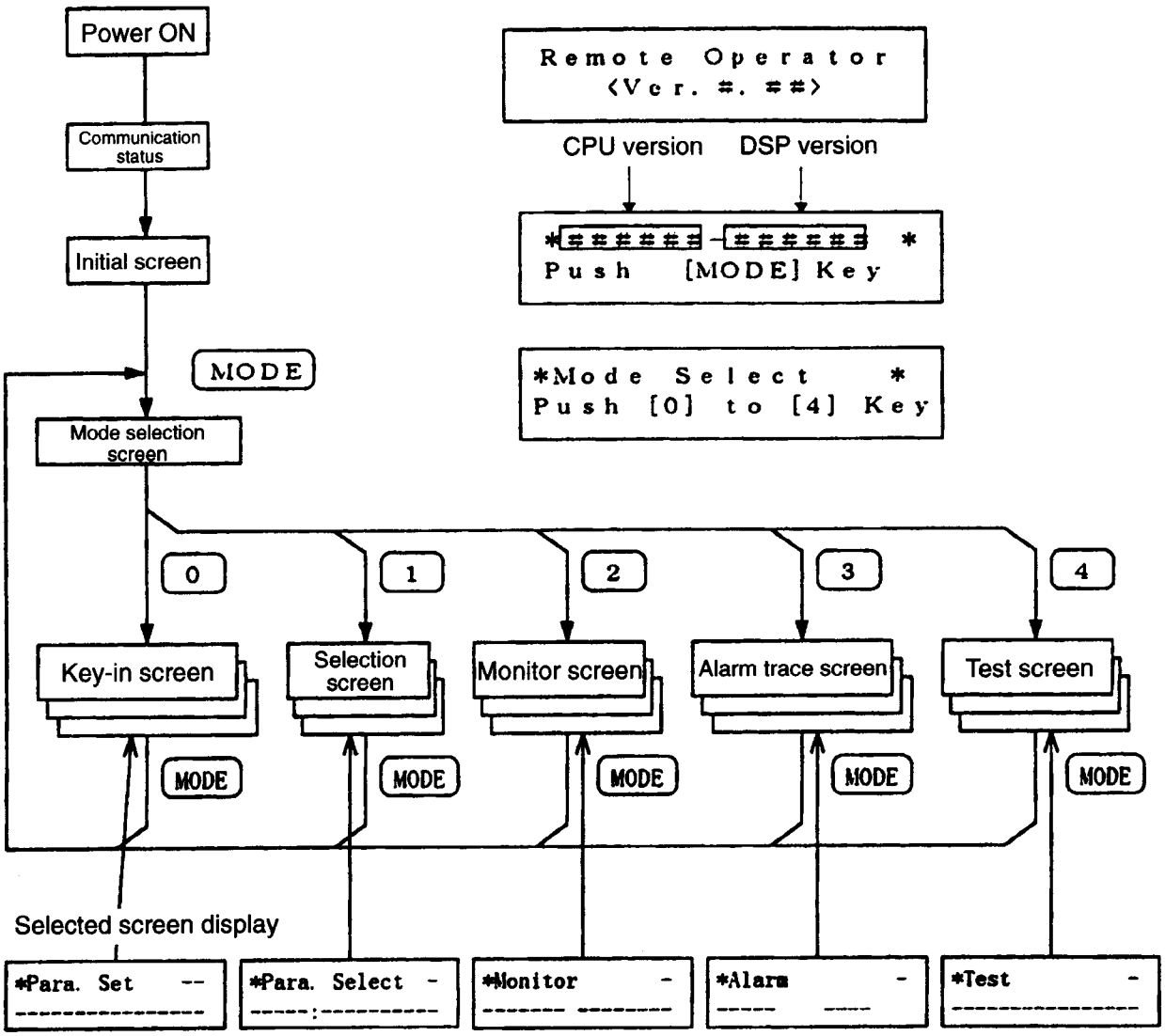


Fig. 7-2 Basic Operations of the Remote Operator

Note: However, when any operation is not done for about 3 minutes, the liquid crystal display clears. For a restart, press the [MODE] key.

- Parameter setting mode (Screen Mode 0)
  In this mode, a value can be set directly by keys.

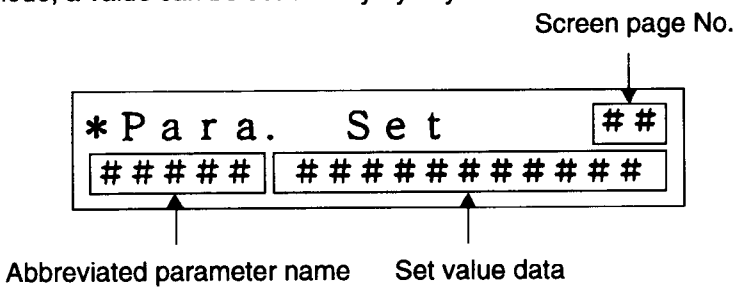


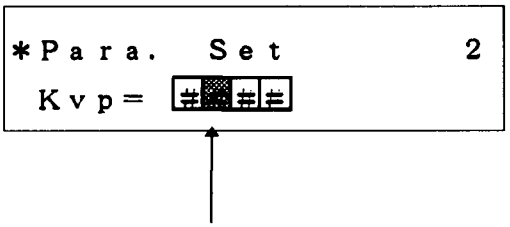
Table4 7-4 Parameters of Screen Mode 0

Page No.	Abbreviation	Name	Setting range	Unit
0	Kp	Position loop gain	1 to 255	rad/s
1	Kff	Feed forward gain	0 to 100	%
2	Kvp	Speed loop proportional gain	10 to 3000	Hz
3	Tvi	Speed loop integral time constant	2 to 1000	msec
4	INP	Positioning completion signal width	1 to 255	Pulse (±)
5	OVF	Deviation excess	1 to 32767	× 256 pulses
6	EGER	Electronic gear ratio	1/10000 up to 32 exclusive	
7	ENCR	Output pulse dividing ratio	1/1 to 1/8192	
8	LTG	Low speed	10 to 9999	min^{-1}
9	PMOD	Command pulse train type	0, 1	
10	UIF 1	User I/F function selection 1	0, 1	
11	UIF 2	User I/F function selection 2	0, 1	
12	Func 1	Selector switch 1	0, 1	
13	Func 1	Selector switch 2	0, 1	
14	Func 1	Selector switch 3	0, 1	
15	Func 1	Selector switch 4	0, 1	
16	IILM	Internal current limitation	30 to 400	%
17	SILM	Sequence current limitation	30 to 400	%
18	FLPF	Feed forward LPF	1 to 990	Hz
19	VLPF	Speed command LPF	1 to 990	Hz
20	ILPF	Current command LPF	1 to 990	Hz
21	IBEF	Current command BEF	200 to 990	Hz
22	Tacc	Speed acceleration/deceleration time constant	0, 10 to 9999	msec
23	Tpcm	Position command acceleration/deceleration time constant	0 to 4000	msec
24	Scal	Analog command scale	900 to 6666	$mV/1000min^{-1}$

(Setting practice)

For example, let's set the speed loop proportional gain to 100.

Step 1: Select page 2 by ◁ and ▷.



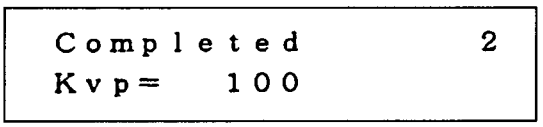
The cursor blinks.

Step 2: Move the cursor to the position of the digit to be entered by ◁ and ▷.

Step 3: Enter 100 continuously by 0 and 1.

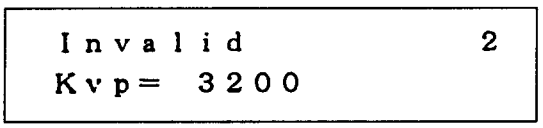
Step 4: The value is stored into the nonvolatile memory by WR and an operation is started at the set value.

After completion of setting:



The above is displayed.

When an attempt is made to store a value out of the setting range:



An example of storing 3200 Hz into the memory

The above is displayed and no operation is performed. At that time, do setting again from step 2.

Step 5: The initial screen can be displayed by pressing MODE.
To set the next page, start with step 1.

Note When the selector switch (SW) on the front panel of the amplifier is set to the up position, the set parameters of page No. 0, 2, 3 and 20 (Kp, Kvp, Tvi, ILPF) cannot be changed from the remote operator.

- Parameter selection mode (Screen mode 1)
  In this mode, parameters are selected in accordance with the screen display.

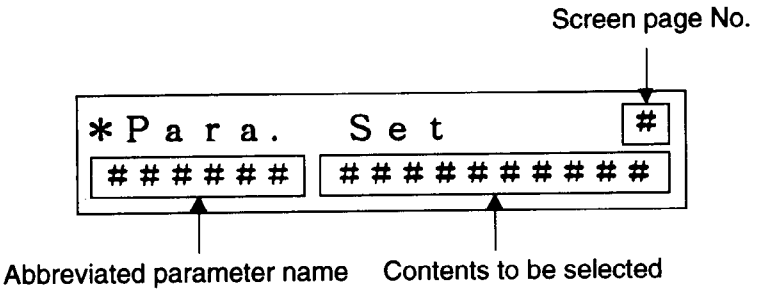


Table 7-5 Parameters of Screen Mode 1

Classification	Page No.	Abbreviation	Name	Number of selections
System parameter	0	TYPE	Control mode	3 modes
	1	ENKD	Encoder type	1 type
	2	ENPL	Encoder pulse-number	12 numbers
	3	MOT.	Motor type	P30, P50 series
Ordinary parameter	4	M1	Monitor 1 output	8 outputs
	5	M2	Monitor 2 output	8 outputs
	6	Zero	Analog command zero adjustment	-127 to +127
	7	PMUL	Command pulse multiplier	5 multipliers

Notes:
1 System parameters cannot be changed unless bit 7 of Func3 (mode 0-14) is set to "1". The setting is not validated unless the control power supply is turned off after a setting change.
2 "Select" of the control mode is a function that will be added in future and cannot be selected at present.
3 The "motor type" function of screen page No. 3 is masked until all the motors are evaluated, so no motor type is displayed.

(Setting practice)

For example, let's change the amplifier control method from Position into Velocity.

Step 1: Select Screen Mode 0.

Step 2: Select page 14 by [△] and [▽].

```
*Para.  Set      14
 Func3 : 1???????
```

"?" requires no setting.

Step 3: Set bit 7 of Func3 to [1], then press [WR].

```
*Completed       14
 Func3 : 1???????
```

Step 4: Select Screen Mode 1.

Step 5: Select page 0 by [△] and [▽], then select "Velocity" by [◁] and [▷].

```
*Para.  Select   2
Type:   Velocity
```

The above will be displayed.

Step 6: When [WR] is pressed, the following will be displayed.

```
*Completed       2
Type:   Velocity
```

Step 7: Pressing [MODE] causes the initial screen to reappear.
To operate the next page, start with step 4.

- Monitor mode (Screen Mode 2)

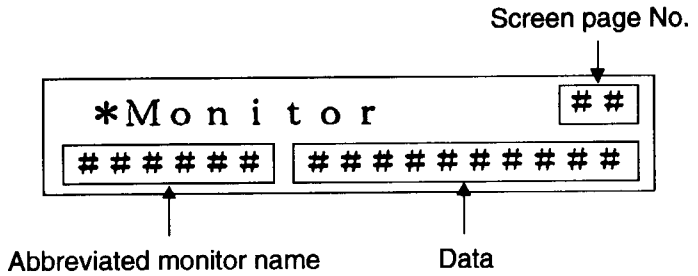


Table 7-6 Screen Mode 2

Page No.	Abbreviation	Contents
0	STATUS	The internal status of the amplifier is displayed. Power OFF, Servo RDY, Servo ON, Alarm (Main circuit power OFF), (Operation ready), (Motor excitation), (Alarm)
1	INPUT	The input status of CN1 is displayed by [1] or [0]. bit 7 6 5 4 3 2 1 0 IN1 IN2 IN3 IN4 IN5 IN6 IN7 0 When [1] is displayed, this indicates an input active status (photo coupler ON).
2	OUTPUT	The output status of CN1 is displayed by [1] or [0]. bit 7 6 5 4 3 2 1 0 0 0 0 0 ILM INP LTG SRDY ALM When [0] is displayed, this indicates an output active status (photo coupler ON).
3	VCMD	The speed command is displayed. [min^{-1}]
4	VFBK	The speed feedback is displayed. [min^{-1}]
5	ICMD	The current command is displayed. [$I_P/I_R \times 100\%$]
6	IFBK	The current feedback is displayed. [$I_P/I_R \times 100\%$]
7	CSU	The U-phase electric angle is displayed. [deg]
8	Trms	The effective torque is displayed. [$Trms/T_R \times 100\%$]
9	PCMD f	The position command frequency is displayed. [pps]
10	Pos. E	The position deviation counter is displayed. [pulse]

Notes:
1 PCMD f displays a value multiplied by the command multiplier.
(This value is a value before the electric gear is multiplied.)
2 Pos. E counts by the pulse-number resulting from multiplying the number of encoder divisions by 4.

- Alarm trace mode (Screen Mode 3)
  In this mode, the alarm history can be traced back and all cleared.
  (1) Alarm trace back

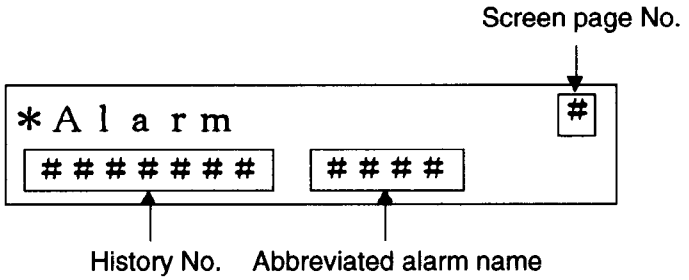


Table 7-7 Screen Mode 3

Page No.	History No.	Abbreviation	Name
0	Now		Current alarm
		None	No alarm
		OC	Power element error
		OL	Overload
		OS	Overspeed
		SE	Speed control error
		DE	Sensor error
		PE	Control power error
		MPE	Main power drop
		OV	Main power overvoltage
		RGOL	Regeneration error
		AOH	Internal overheat
		EXOH	External overheat
		OVF	Deviation excess
		DSPE	Servo processor error
		MEME	Memory error
1	Last 1		Last alarm
2	Last 2		Alarm before the last
3	Last 3		Alarm before the past 2 alarms
4	Last 4		Alarm before the past 3 alarms
5	Last 5		Alarm before the past 4 alarms
6	Last 6		Alarm before the past 5 alarms
7	Last 7		Alarm before the past 6 alarms

(Trace method)

The alarm history can be seen by [△] or [▽] .

Pressing [MODE] causes the initial screen to reappear.

(2) History all clearing

<Clear method>

One page is selected by [△] or [▽] .

*Alarm	2
Last 1 OVF	

This shows an example that Last 1 is OVF (deviation excess).

Press both [0] and [◁] simultaneously.

After the history is all cleared (Last 1 to Last 7), None is displayed.

Pressing [MODE] causes the initial screen to reappear

- Test mode (Screen Mode 4)

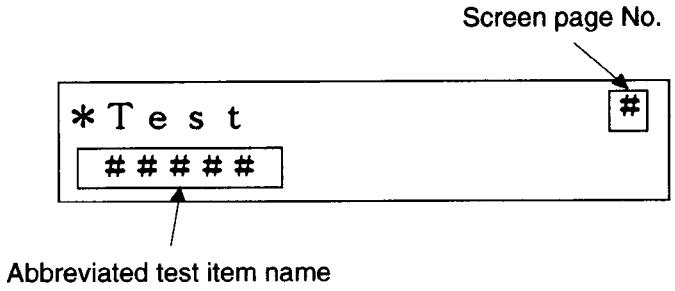


Table 7-8 Screen Mode 4

Page No.	Abbreviation	Contents
0	JOG	JOG operation is performed.
1	Tune	Servo tuning is performed.

● Before starting the test mode

1 Set bit 6 of Func 3 (mode 0-14) to [1].

2 Check that the selector switch (SW) on the front panel of the amplifier is set to the down position.

3 Set the command input to 0.

4 Turn off the servo ON (SON) signal.
In the test mode, forced servo ON is executed from the remote operator.

5 Set up the main circuit power supply.

6 When it is determined to select JOG and Tune in the test mode, turn off the operation ready output.

● After completion of testing

1 Considering that a deviation is left on the controller side when the initial screen is caused to reappear by pressing the [MODE] key, the alarm "Deviation excess" will be output. (However, the deviation is not recorded in the alarm history.) Start an ordinary operation after clearing the alarm. (Input the Deviation clear signal for the position control type amplifier too.)

2 Considering that a deviation may be left in the user controller, check that the command output of the controller is zero, before starting an ordinary operation. (If the command is not zero, sudden action will occur.)

<JOG operation>

(1) JOG operation overview

The motor can be rotated forward or reverse according to the rotating speed set from the remote operator.

(2) Precautions

① In any control mode, the motor is operated in the speed control mode during JOG operation.

② When the [▷] key is pressed, the motor rotating direction becomes forward (counterclockwise rotation as viewed from the load side, and "Fwd Running" is displayed.). When the [◁] key is pressed, the motor is rotated reverse (clockwise rotation, and "Rvs Running" is displayed.).

③ Allow an enough operating range of the motor. In particular, for a large load inertia or a high rotating speed, operate the motor in consideration of the deceleration time.

④ During JOG operation, the current is limited by the sequence current limitation value (standard value = 120%. This can be changed on page 17 of Screen Mode 0.). Accordingly, when the load inertia is large or the load torque is large, the response speed is slower.

⑤ When slow up/down of the motor rotating speed is required, set the speed acceleration/deceleration time on page 22 of the screen mode.

⑥ As a result of JOG operation, a position loop deviation may remain.
To return to the ordinary operation, be sure to execute Deviation Clear.

(3) JOG operation method

- Set bit 6 of Func 3 (mode 0-14) to [1].
- Check that the selector switch (SW) on the front panel of the amplifier is set to the down position. After that, return to the mode selection screen and select Screen Mode 4.

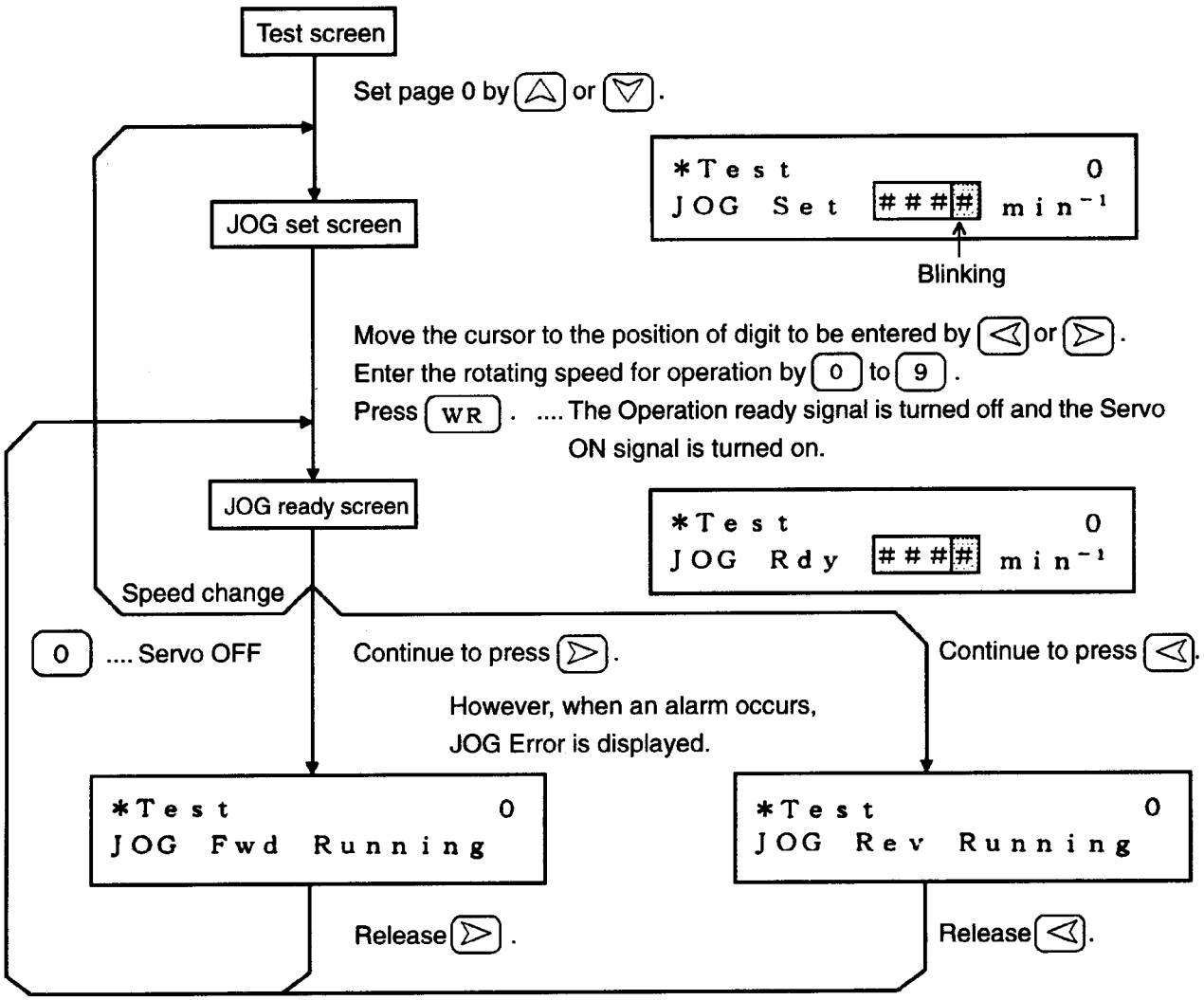


Fig. 7-3 JOG Operation Method

Return from the ready screen to the ready screen by pressing 0, then return the initial screen by pressing MODE. When the initial screen reappears, the alarm "deviation excess" will be output.

When JOG operation is disabled in cases such as when the main circuit power is off, an alarm occurs, selector switch (SW) on the front panel of the amplifier is not set to the down position, etc., the following message will be displayed.

```
*Test                0
JOG   NOT  Ready
```

When JOG operation is enabled, the JOG set screen is displayed.

<Servo tuning function>

(1) Servo tuning function overview

This servo tuning function permits estimating load inertia from the operating status after causing the motor to be operated by the remote operator. Thus, proper parameters can be set automatically. The following four parameters are set by this function: position loop gain (Kp), speed loop gain (Kvp), speed loop integral time constant (Tvi), and current command LPF (ILPF).
Note that when the selector switch is set to the up position, servo tuning cannot be executed.

(2) Precautions on operating conditions and load conditions

When this servo tuning function is executed, the motor will rotate forward and reverse. Accordingly, secure two rotations or more for forward and reverse rotations as the motor operating range. Use this function only when safety can be secured in an oscillation status without subjecting the machine to damage.
In the following cases, proper parameters may not be set by the servo tuning function or a tuning error ("Tune Error") will occur. If this tuning error occurs, check parameters.

- The load inertia is much larger than the allowable load inertia.
- The load inertia and the load torque vary widely.
- The backlashes of ball screws and gears are large.
- The mechanical rigidity including couplings is low, so that machine resonance occurs.
- The remote operator is removed from the amplifier main unit during servo tuning.
  (Remote operator power OFF)
- The main circuit power supply is turned off or an alarm occurs during servo tuning.

(3) Servo tuning operation

① Select rigidity to be tuned out of the three types of Low, Middle, and High in accordance with the machine rigidity.

② After servo tuning, the motor rotates forward and reverse for about 0.5 sec. by the about 60 Hz sine waveform torque command (equivalent to the rated torque at the peak time). The motor operating range at this time varies with load conditions. However, secure two rotations or more for forward and reverse rotations as the standard.

③ When servo tuning is normally terminated, proper parameters will be automatically set from the estimated load inertia and stored into the nonvolatile memory.

④ After this servo tuning is executed, a position loop deviation may remain. To return to the ordinary operation, execute Deviation Clear.

(4) Servo tuning method

- Set bit 6 of SSW2 to "1".
- Check that the selector switch (SW) on the front panel of the amplifier is set to the down position. After that, return to the mode selection screen and select Screen Mode 4.

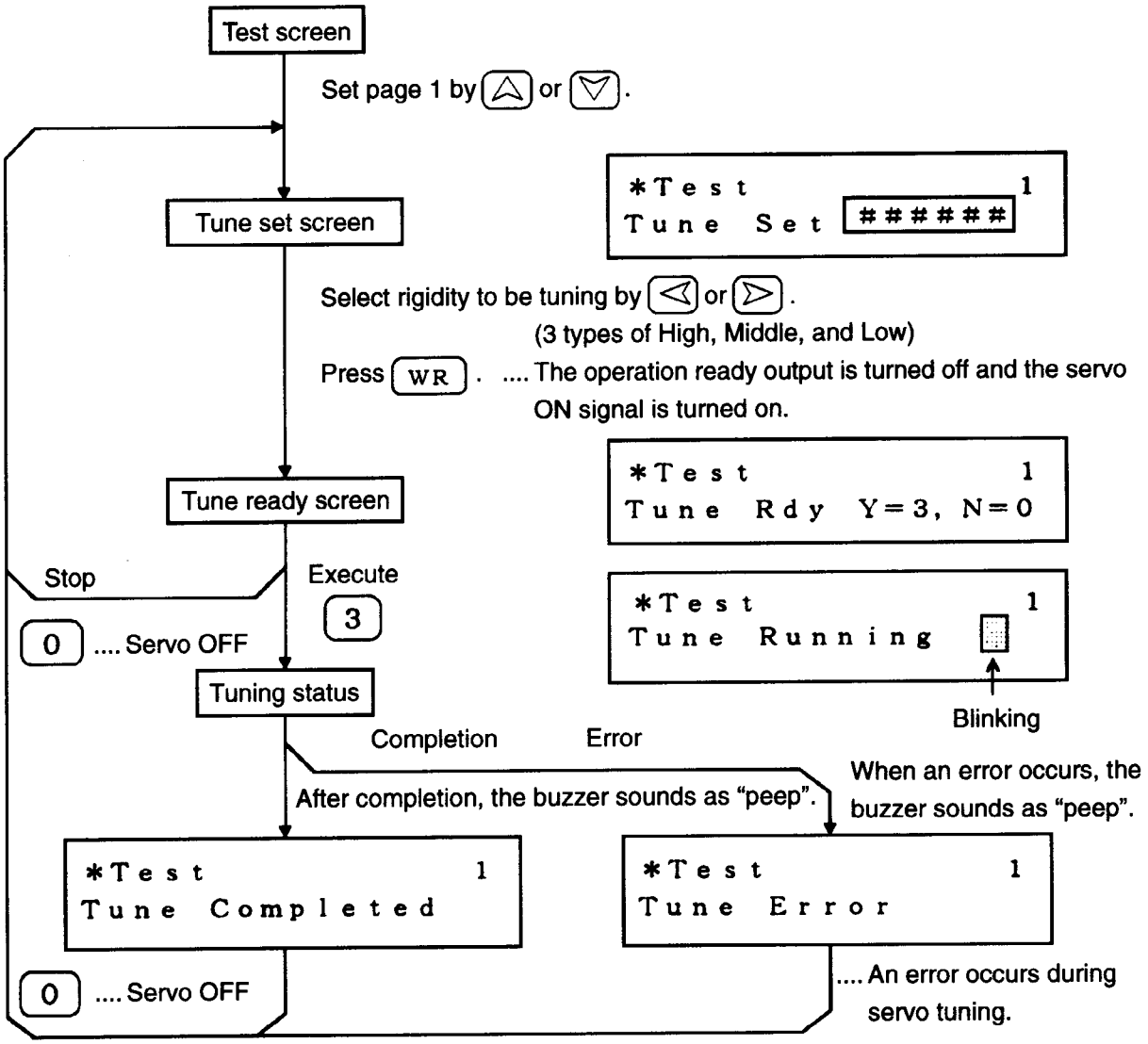


Fig. 7-4 Servo Tuning Operating Method

Return the ready screen to the set screen by pressing 0 , then return to the initial screen by pressing MODE . When the initial screen is displayed, the alarm "deviation excess" is output.

When servo tuning is disabled in cases such as when the main circuit power is off, an alarm occurs, selector switch (SW) on the front panel of the amplifier is not set to the down position, etc., the following is displayed.

```
*Test                1
Tune Not Ready
```

When servo tuning is enabled, the Tune set screen is displayed.

8. EXPLANATION OF PARAMETERS

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1) Positioning control type

• Parameter arrangement diagram

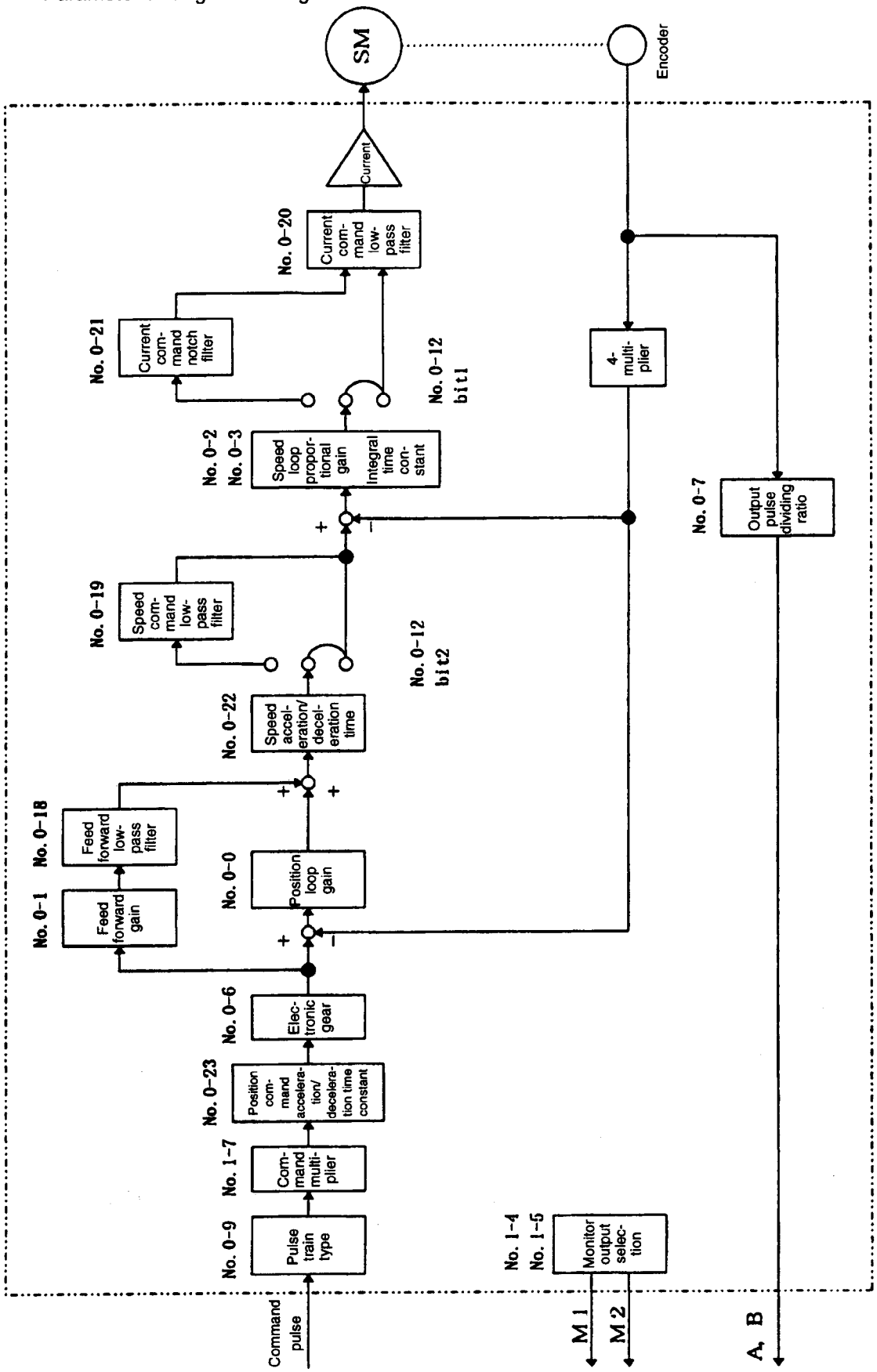


Fig. 8-1 Positioning Control Type Block Diagram

• Parameter table

Table 8-1 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name	Standard value	Unit	Setting range
0	Kp	Position loop gain	30	rad/s	1 to 255
1	Kff	Feed forward gain	0	%	0 to 100
2	Kvp	Speed loop proportional gain	70	Hz	10 to 3000
3	Tvi	Speed loop integral time constant	20	msec	2 to 1000
4	INP	Positioning completion signal width	64	Pulse (±)	1 to 255
5	OVF	Deviation excess	256	× 256 pulses	1 to 32767
6	EGER	Electronic gear ratio	4/1	–	1/1000 to 32 exclusive
7	ENCR	Output pulse dividing ratio	1/1	–	1 to 1/8192
9	PMOD	Position command pulse train type	00000000	bit	0, 1
10	UIF1	User I/F function selection 1	00000000	bit	0, 1
12	Func1	Selector switch 1	00000000	bit	0, 1
13	Func2	Selector switch 2	00000000	bit	0, 1
14	Func3	Selector switch 3	00000000	bit	0, 1
15	Func4	Selector switch 4	00000000	bit	0, 1
16	IILM	Internal current limitation	100	%	30 to 400
17	SILM	Sequence current limitation	120	%	30 to 400
18	FLPF	Feed forward LPF	990	Hz	1 to 990
19	VLPF	Speed command LPF	990	Hz	1 to 990
20	ILPF	Current command LPF	500	Hz	1 to 990
21	IBEF	Current command BEF	990	Hz	200 to 990
22	Tacc	Speed acceleration/deceleration time	0	msec	0, 10 to 9999
23	Tpcm	Position command acceleration/deceleration time constant	0	msec	0 to 4000

Table 8-2 Screen Mode 1 (Menu Input Setting)

Page No.	Abbreviation	Name	Setting at delivery	Setting range	Remarks
0	TYPE	Control mode	Position	3 modes	The setting cannot be validated unless the power supply is turned off after a setting change.
1	ENKD	Encoder type	INC. E	1 types	
2	ENPL	Encoder pulse-number	$$$$	12 numbers	
3	MOT.	Motor type	- - - - -	–	
4	M1	Monitor 1 output	Vm 0.5mV/min^{-1}	8 values	
5	M2	Monitor 2 output	Im 1V/I_R	8 values	
7	PMUL	Command pulse multiplier	1-multiplier	5 values	

$$$$: Depends on the specification provided at delivery from the factory.

• Parameter table

Table 8-3-1 Screen Mode 0 (Key-in Setting)

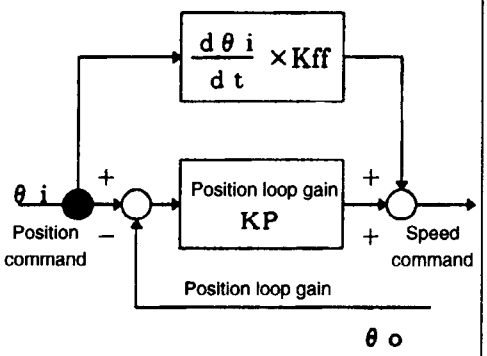
Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
0	Kp	Position loop gain Proportional gain of the positioning controller	30	rad/s	1 to 255	When the selector switch (SW) on the front panel of the amplifier is set to the up position, the setting cannot be changed by operator.
1	Kff	Feed forward gain • Feed forward gain of the position loop. • When this parameter is set to 100%, the waiting pulse-number becomes 0 at constant-speed operation. • The response of the position loop can be improved. However, an excessively high value will cause oscillation.  	0	%	0 to 100	
2	Kvp	Speed loop proportional gain Proportional gain of the speed controller (proportional integration control)	70	Hz	10 to 3000	When the selector switch (SW) on the front side of the amplifier is set to the up position, the setting cannot be changed by operator.

Table 8-3-2 Screen Mode 0 (Key-in Setting)

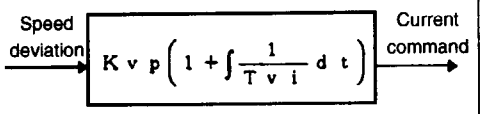
Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
3	Tvi	Speed loop integral time constant Integral time constant of the speed controller (proportional integration control) 	20	msec	2 to 1000	When the selector switch (SW) on the front side of the amplifier is set to the up position, the setting cannot be change by operator.
4	INP	Positioning completion signal (in-position) width • Set the waiting pulse-number of the deviation counter to give a deviation zero output. • The standard value is the 4-multiplier of encoder pulses regardless of electronic gear function and encoder dividing ratio settings. [Example] If this parameter is set to 64 when a 2000-pulse encoder is used, the position completion signal will be output when reaching the following range to the goal position: $64\times\frac{1}{2000\times4}\times360^\circ=2.88^\circ$	64	Pulse (±)	1 to 255	The deviation counter counts by multiplying encoder pulses by 4.
5	OVF	Deviation excess • When the deviation counter exceeds the setting range, a deviation excess alarm will be output.	256	× 256 pulses	1 to 32768	The deviation counter counts by multiplying encoder pulses by 4.

Table 8-3-3 Screen Mode 0 (Key-in Setting)

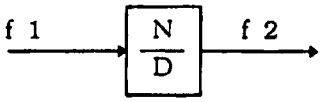
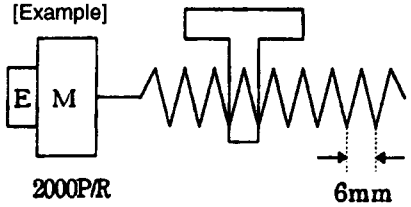
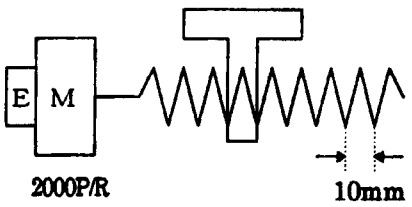
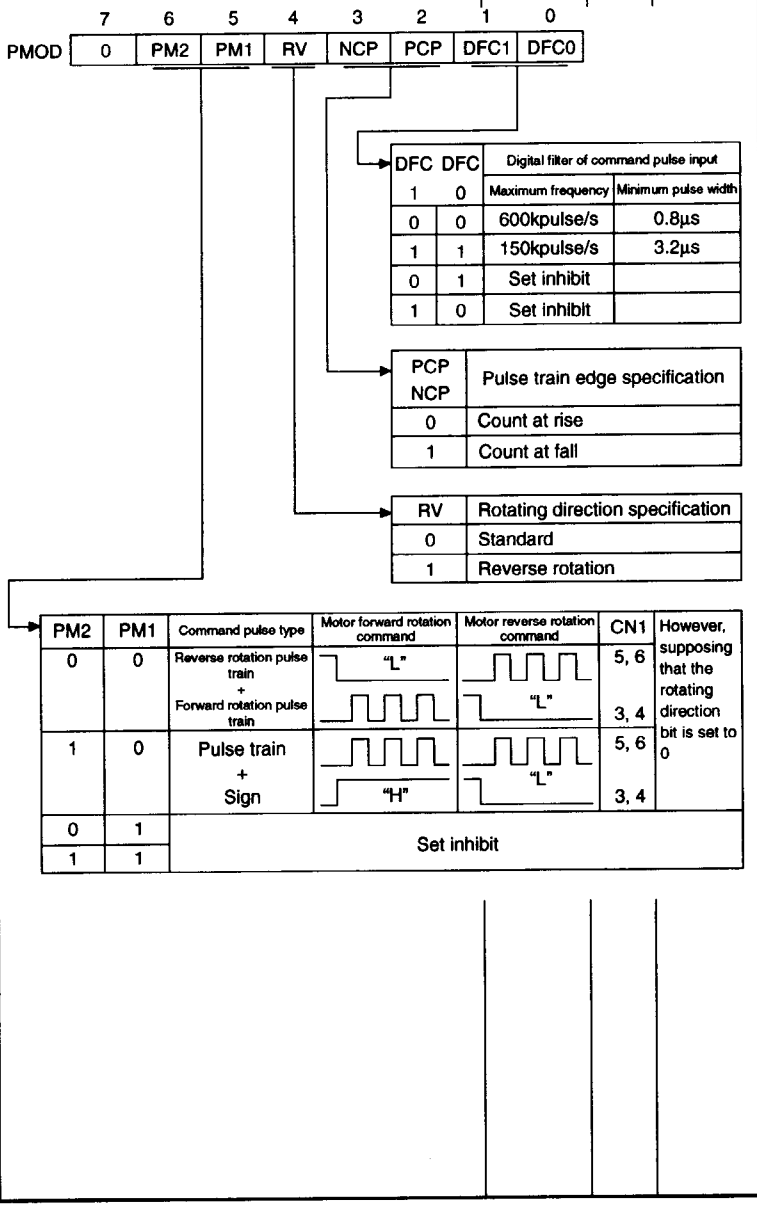
Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
6	EGER	Electronic gear ratio  N: 1 to 10000 D: 1 to 10000 $f2 = f1 \times \frac{N}{D}$ However, $\frac{1}{10000} \leq \frac{N}{D} < 32$ This is effective when there is a difference in pitch between encoder resolution and ball screw. [Example]   • When the ball screw pitch has been changed, set only the electronic gear ratio to (4/1) × (6/10) = 24/10 but do not change the others.	4/1	–	1/10000 to 32 exclusive	Because the electronic gear ratio changes the magnification ratio of the command pulse, the resolution of the position F/B cannot be changed even if this setting is changed. For this reason, note that the minimum resolution of positioning is determined by the encoder in use.
7	ENCR	Output pulse dividing ratio • The dividing ratio of the encoder signal (A-phase, B-phase) can be set. Dividing ratio = β/α However, α-----1 to 64, 8192 β --- 1 (When α = 1 to 64) 2 (When α = 3 to 64) 1 to 8191 (When α = 8192)		–	to	Note that the dividing ratio must be a value that can be divided without remainder when the pulse-number of the encoder is divided.

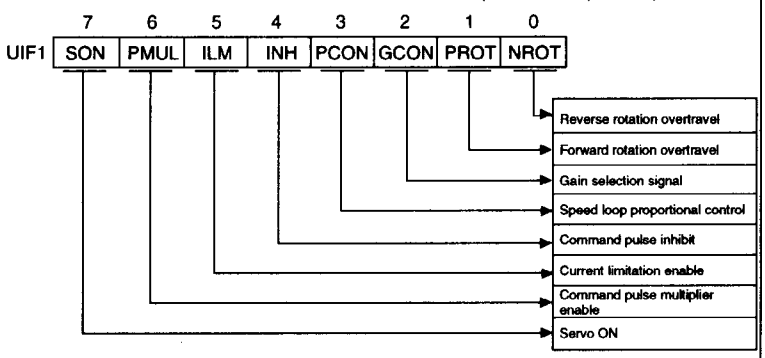
Table 8-3-4 Screen Mode 0 (Key-in Setting)

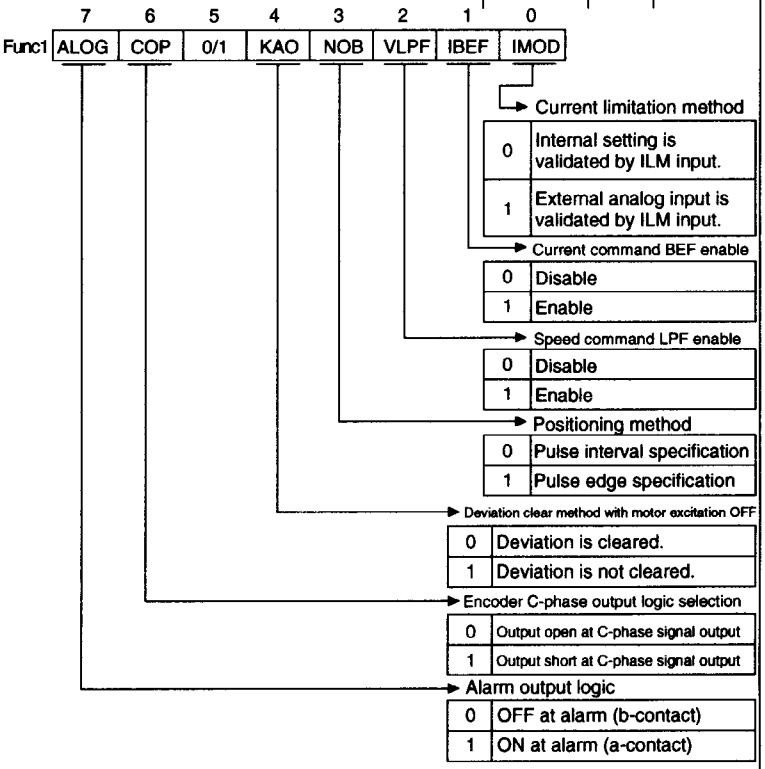
<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Standard value</th><th>Unit</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>9</td><td>PMOD</td><td>Position command pulse train type
• A position command pulse train can be input by using 3 types (forward rotation + reverse rotation pulse train, sign + pulse train).
It is also possible to specify the edge rise or fall command and the rotating direction.

 
</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>The minimum pulse width indicated for the digital filter of bit 0 and bit 1 is for both "H" period and "L" period.

Be sure to set bit 2 and bit 3 to "0" in the case of sign + pulse train.
(The rotating direction may be changed.)</td></tr>
</table>

Table 8-3-5 Screen Mode 0 (Key-in Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Standard value</th><th>Unit</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>10</td><td>UIF1</td><td>User I/F function selection 1
• When desired functions are set to [1] by the digital switch, they can be forcibly turned on.
 

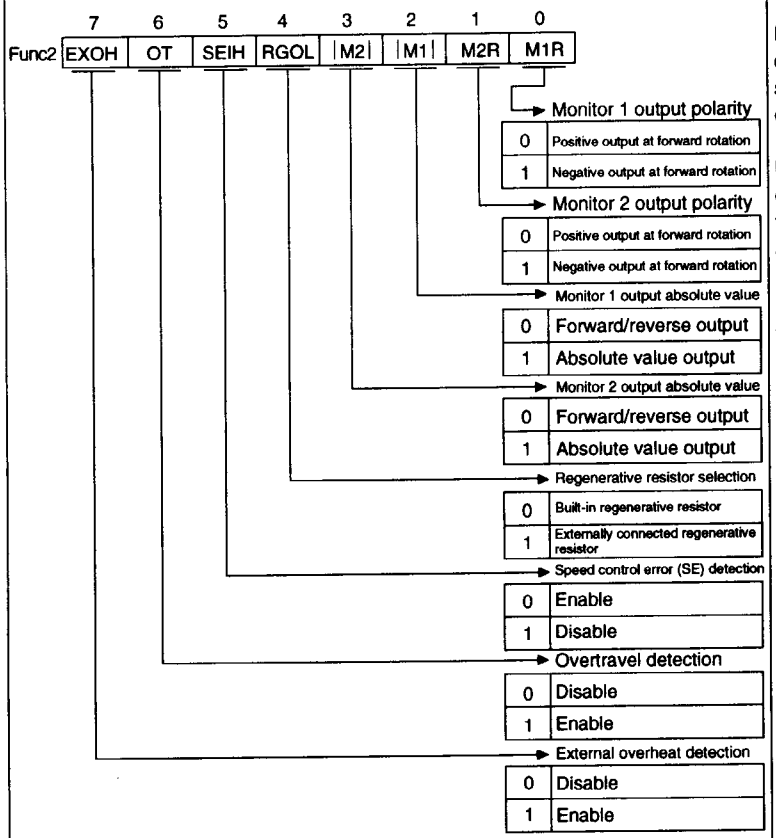
Note: PROT and NROT are always in the overtravel status at [1] regardless of the a-contact and b-contact.</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>Determine whether external signals should be made effective or each function should be forcibly turned on internally.</td></tr>
<tr><td>12</td><td>Func1</td><td>Selector switch 1
• Desired functions can be set by the digital switch.
 

Bit 5 is invalid.</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>When bit 4 is set to [1], the position deviation will not be cleared even upon occurrence of an alarm. For this reason, be sure to clear the deviation before inputting the alarm reset signal.

When bit 7 is set to [1], no alarm will be output upon occurrence of a CPU error.</td></tr>
</table>

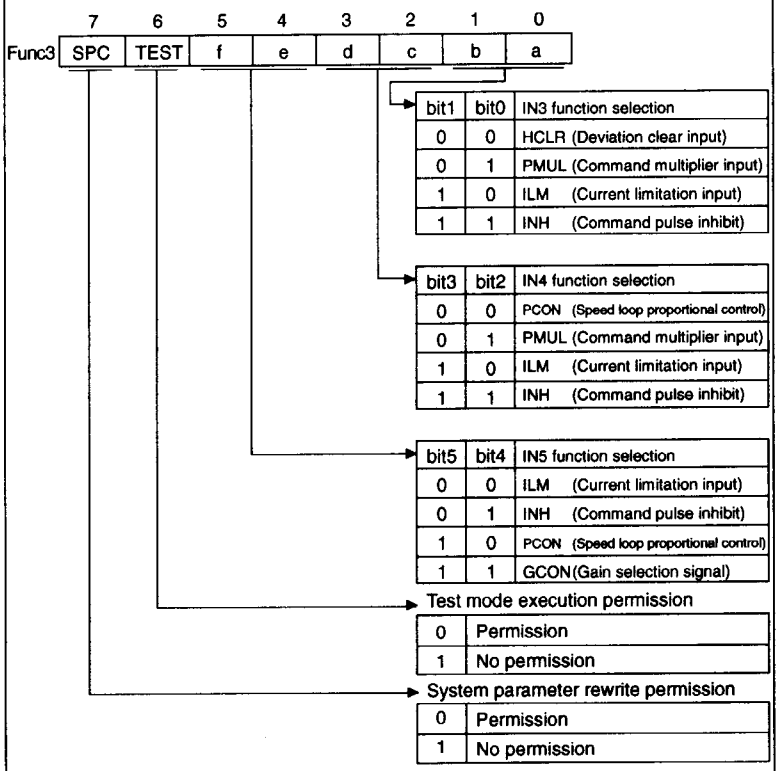
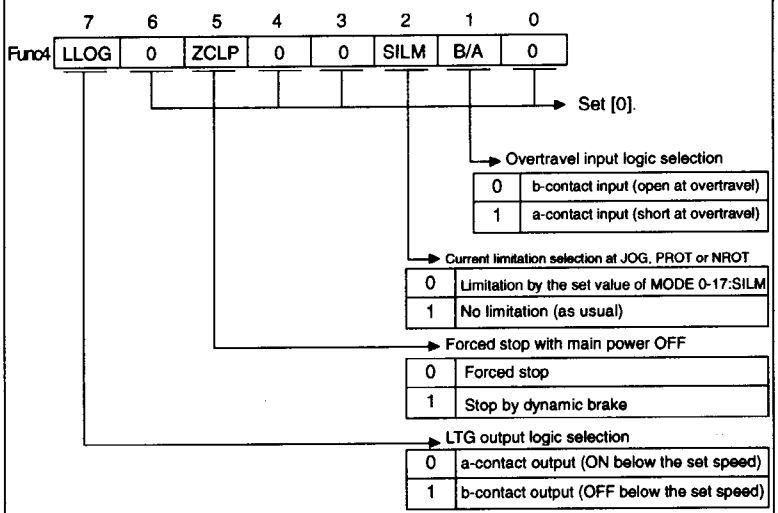
Table 8-3-6 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
13	Func2	Selector switch 2 • Desired functions can be set by digital switch.	0000-0000	bit	0, 1	Forward rotation means the counterclockwise direction as viewed from the motor shaft side. Do not use any externally connected regenerative resistor other than the specified one. Before setting the overtravel detection to "enable", connect the overtravel signal to IN6 and IN7. Before setting the external overheat detection to "enable", connect the thermal pin of the externally connected regenerative resistor to IN8.



Note: Bit 4 and bit 7 cannot be changed unless the control power supply is turned off once.

Table 8-3-7 Screen Mode 0 (Key-in Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Standard value</th><th>Unit</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>14</td><td>Func3</td><td>Selector switch 3
• Desired functions can be set by digital switch.
 
</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>Reset bit 6 and bit 7 to [0] after execution.
These bits are also reset to [0] by turning off the power supply.</td></tr>
<tr><td>15</td><td>Func4</td><td>Selector switch 4
• Desired functions can be set by the digital switch.
 

Note: Be sure to set bits 0, 3, 4 and 6 to [0].</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td></td></tr>
</table>

Table 8-3-8 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
16	ILIM	Internal current limitation • When bit 0 of Func1 (mode 0-12) is set to [0] and the ILIM (current limitation input) signal is input, the current will be limited by the setting. • Do not set this parameter over the instantaneous maximum armature current (I_P) of the motor.	100	%	30 to 400	The unit [%] is the ratio to the rated armature current (I_R) of the motor.
17	SLIM	Sequence current limitation • Set the current limitation for overtravel at JOG operation. • This parameter is validated when bit 1 of Func4 (mode 0-15) is set to [0]. • Do not set this parameter over the instantaneous maximum armature current (I_P) of the motor.	120	%	30 to 400	The unit [%] is the ratio to the rated armature current (I_R) of the motor.
18	FLPF	Feed forward LPF • Set the cut-off frequency of the primary low-pass filter for a feed forward command from the position loop.	990	Hz	0 to 990	
19	VLPF	Speed command LPF • Set the cut-off frequency of the primary low-pass filter for a speed command input. • This parameter is validated when bit 2 of Func1 (mode 0-12) is set to [1].	990	Hz	1 to 990	
20	ILPF	Current command LPF • Set the cut-off frequency of the primary low-pass filter for a current command input.	500	Hz	1 to 990	When the selector switch (SW) on the front panel of the amplifier is set to the up position, the setting cannot be changed by operator.

Table 8-3-9 Screen Mode 0 (Key-in Input)

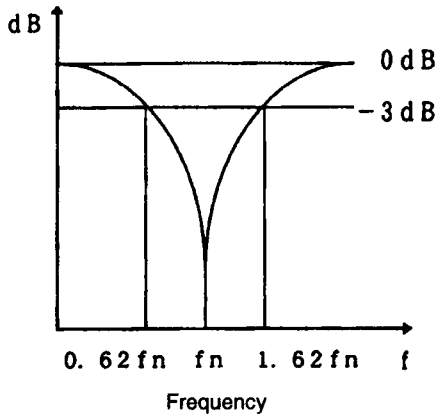
Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
21	IBEF	Current command BEF • Set the center frequency of the notch filter with the following characteristics for a current command. • This parameter is validated when bit 1 of Func1 (mode 0-12) is set to [1]. [Characteristics]  	990	Hz	200 to 990	This parameter can be set in units of 10 Hz. The first digit cannot be changed.
22	Tacc	Acceleration/deceleration time • Set the acceleration time from 0 to 1000 [min^{-1}] and the deceleration time from 1000 to 0 [min^{-1}]. Note 1: This parameter may be oscillated in positioning control type. Avoid using it if possible. Note 2: Even if an overtravel occurs, deceleration is performed by this acceleration/deceleration time.	0	msec	0, 10 to 9999	
23	Tpcm	Position command acceleration/deceleration time constant • Set the time constant for the case where the primary lag filter is inserted for a position command pulse. • When the set value is 0, it is regarded as no filter.	0	msec	0 to 4000	

Table 8-4-1 Screen Mode 1 (Menu Input Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Setting at delivery</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>0</td><td>TYPE</td><td>Control mode
• Select among position control, speed control, and torque control.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>Position
Velocity
Torque</td><td>Positioning control type
Speed control type
Torque control type</td></tr></table></td><td>Position</td><td>3 types</td><td></td></tr>
<tr><td>1</td><td>ENKD</td><td>Encoder type
• Set the type of the encoder to be used.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>INC. E</td><td>Wire saving incremental encoder</td></tr></table></td><td>INC. E</td><td>1 type</td><td>This parameter cannot be changed.</td></tr>
<tr><td>2</td><td>ENPL</td><td>Encoder pulse-number
• Select pulse-number of the encoder.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>2000 P/R</td><td>2000 pulses/rotation encoder</td></tr><tr><td>1000 P/R</td><td>1000 pulses/rotation encoder</td></tr><tr><td>2048 P/R</td><td>2048 pulses/rotation encoder</td></tr><tr><td>1024 P/R</td><td>1024 pulses/rotation encoder</td></tr><tr><td>2500 P/R</td><td>2500 pulses/rotation encoder</td></tr><tr><td>5000 P/R</td><td>5000 pulses/rotation encoder</td></tr><tr><td>6000 P/R</td><td>6000 pulses/rotation encoder</td></tr><tr><td>8192 P/R</td><td>8192 pulses/rotation encoder</td></tr><tr><td>1500 P/R</td><td>1500 pulses/rotation encoder</td></tr><tr><td>3000 P/R</td><td>3000 pulses/rotation encoder</td></tr><tr><td>4000 P/R</td><td>4000 pulses/rotation encoder</td></tr><tr><td>4096 P/R</td><td>4096 pulses/rotation encoder</td></tr></table></td><td>$$$$</td><td>12 types</td><td></td></tr>
</table>

System parameters 0 to 3 are as follows:

1 Change this parameter after setting bit 7 of Func3 (mode 0-14) to [1].
2 When [Completed] is displayed, the setting has been changed. (If [Invalid] is displayed, the setting remains without change.)
3 The parameter change is not validated unless the control power supply is turned off after completion of this change.

Table 8-4-2 Screen Mode 1 (Menu Input Setting)

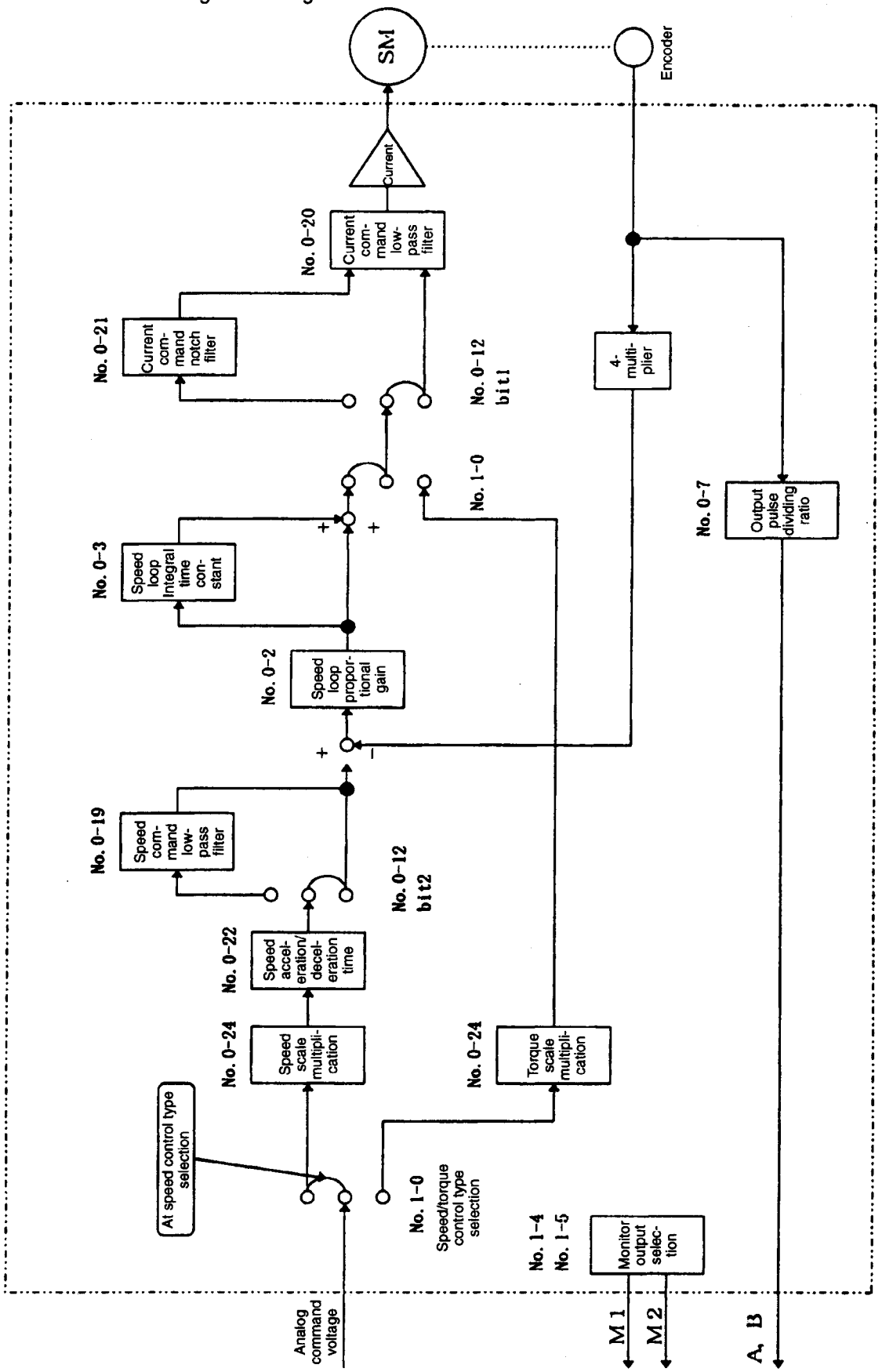
<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Setting at delivery</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>3</td><td>MOT.</td><td>Motor type
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>- - - - - - -</td><td>Special motor is selected.</td></tr></table>
Note: Now motor type selection is disabled.
In the case of a combination with the standard motor, "- - - - - - - - - - " is displayed.</td><td>- - - - - - - - - -</td><td>–</td><td></td></tr>
<tr><td>4</td><td>M1</td><td>Monitor 1 output
• Select the contents of monitor 1 output (CN1 pin 23 and check pin M1 of remote operator). (See the following.)
<table><tr><th>Display</th><th colspan="2">Contents</th></tr><tr><td>Per 5mV/P</td><td>Position deviation</td><td>1V/200 pulses</td></tr><tr><td>Per 10mV/P</td><td>Position deviation</td><td>1V/100 pulses</td></tr><tr><td>Vm0.5mV/min^{-1}</td><td>Speed monitor</td><td>1 V/2000 min^{-1}</td></tr><tr><td>Vm 1mV/min^{-1}</td><td>Speed monitor</td><td>1V/1000 min^{-1}</td></tr><tr><td>Im 1 V/IR</td><td>Current monitor</td><td>1 V/rated current</td></tr><tr><td>Ic 1 V/IR</td><td>Current command</td><td>1 V/rated current</td></tr><tr><td>Rm 0.5V/Full</td><td>Regenerative load factor</td><td>0.5 V/Full</td></tr><tr><td>SINU2.5V/max</td><td>U-shape electric angle</td><td>2.5 V/max</td></tr></table></td><td>Vm0.5mV /min^{-1}</td><td></td><td></td></tr>
<tr><td>5</td><td>M2</td><td>Monitor 2 output
• Select the contents of monitor 2 output (CN1 pin 25 and check pin M2 of the remote monitor). (See the above.)</td><td>Im 1V/1R</td><td></td><td></td></tr>
</table>

Table 8-4-2 Screen Mode 1 (Menu Input Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Setting at delivery</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>7</td><td>PMUL</td><td>Command pulse multiplier
• Select a position command pulse multiplier.
• When the PMUL (command multiplier input) signal is input, the position command pulse will be multiplied by the set value.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>× 1</td><td>Multiplying by 1</td></tr><tr><td>× 2</td><td>Multiplying by 2</td></tr><tr><td>× 4</td><td>Multiplying by 4</td></tr><tr><td>× 8</td><td>Multiplying by 8</td></tr><tr><td>× 16</td><td>Multiplying by 16</td></tr></table></td><td>1-multiplier</td><td>5 multipliers</td><td>When the PMUL signal is not input, the position command pulse will be multiplied by 1.</td></tr>
</table>

2) Speed/torque control type

• Parameter arrangement diagram



* No. "Screen mode No." – "Page No."

Fig. 8-2 Speed Control Type Block Diagram

• Parameter table

Table 8-5 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name	Standard value	Unit	Setting range
2	Kvp	Speed loop proportional gain	70	Hz	10 to 3000
3	Tvi	Speed loop integral time constant	20	msec	2 to 1000
7	ENCR	Output pulse dividing ratio	1/1	–	1 to 1/8192
8	LTG	Low speed output setting	50	min^{-1}	10 to 9999
10	UIF1	User I/F function selection 1	00000000	bit	0, 1
12	Func1	Selector switch 1	00000000	bit	0, 1
13	Func2	Selector switch 2	00000000	bit	0, 1
14	Func3	Selector switch 3	00000000	bit	0, 1
15	Func4	Selector switch 4	00000000	bit	0, 1
16	IILM	Internal current limitation	100	%	30 to 400
17	SILM	Sequence current limitation	120	%	30 to 400
19	VLPF	Speed command LPF	990	Hz	1 to 990
20	ILPF	Current command LPF	500	Hz	1 to 990
21	IBEF	Current command BEF	990	Hz	200 to 990
22	Tacc	Speed acceleration/deceleration time	0	msec	0, 10 to 9999
24	Scal	Analog command input scale	2000	mV/1000 min^{-1} mV/ rated torque	900 to 6666

Table 8-2 Screen Mode 1 (Menu Input Setting)

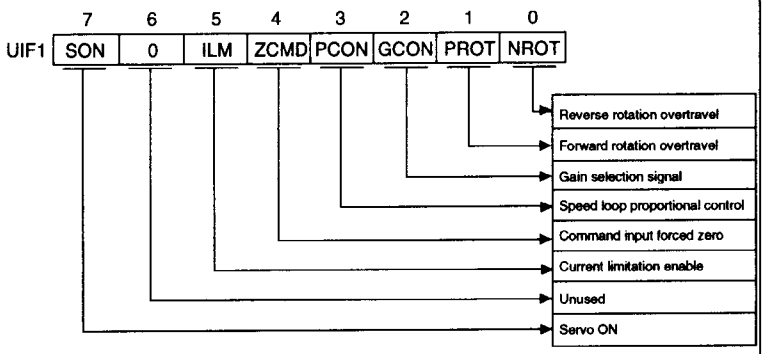
Page No.	Abbreviation	Name and contents	Setting at delivery	Setting range	Remarks
0	TYPE	Control mode	Velocity	3 modes	The setting cannot be validated unless the power supply is turned off after a setting change.
1	ENKD	Encoder type	INC. E	1 types	
2	ENPL	Encoder pulse-number	$$$$	12 numbers	
3	MOT.	Motor type	- - - - -	–	
4	M1	Monitor 1 output	Vm 0.5mV/min^{-1}	8 values	
5	M2	Monitor 2 output	Im 1V/I_R	8 values	
6	Zero	Analog command zero adjustment	0	-127 to 127	

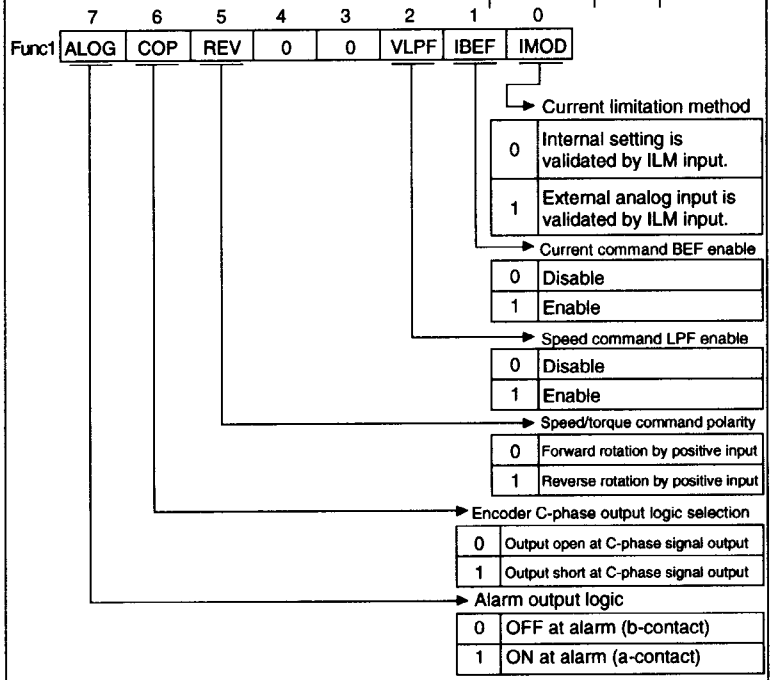
$$$$: Depends on the specification provided at delivery from the factory.

Table 8-7-1 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
2	Kvp	Speed loop proportional gain • Proportional gain of the speed controller (proportional integration control) • The setting unit represents the value for the case where the load inertia is 0.	70	Hz	10 to 3000	When the selector switch (SW) on the front panel of the amplifier is set to the up position, the setting cannot be changed by operator.
3	Tvi	Speed loop integral time constant • Integral time constant of the speed controller (proportional integration control) Speed deviation → $Kvp\left(1+\int\frac{1}{Tvi}dt\right)$ → Current command	20	msec	2 to 1000	When the selector switch (SW) on the front side of the amplifier is set to the up position, the setting cannot be changed by operator.
7	ENCR	Output pulse dividing ratio • The dividing ratio of the encoder signal (A-phase, B-phase) can be set. Dividing ratio = β/α However, α -----1 to 64, 8192 β — 1 (When α = 1 to 64) 2 (When α = 3 to 64) 1 to 8191 (When α = 8192)	1/1		1 to 1/8192	
8	LTG	Low speed • Set the rotating speed of low speed output. • When the rotating speed becomes less than the set rotating speed, the low speed output (LTG) will be turned on.	50	min^{-1}	10 to 9999	

Table 8-7-2 Screen Mode 0 (Key-in Setting)

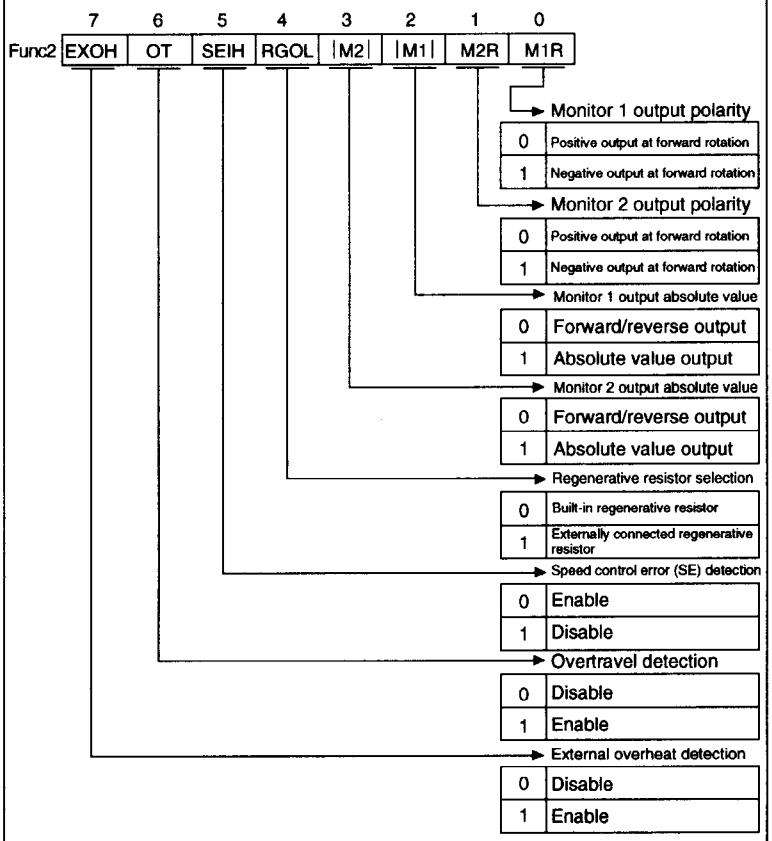
<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Standard value</th><th>Unit</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>10</td><td>UIF1</td><td>User I/F function selection 1
• When desired functions are set to [1] by the digital switch, they can be forcibly turned on.
 

Note: PROT and NROT are always in the overtravel status at [1] regardless of the a-contact and b-contact.</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>Determine whether external signals should be made effective or each function should be forcibly turned on internally.</td></tr>
<tr><td>12</td><td>Func1</td><td>Selector switch 1
• Desired functions can be set by the digital switch.
 

Bit 5 is invalid.</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>When bit 7 is set to [1], no alarm will be output upon occurrence of a CPU error.</td></tr>
</table>

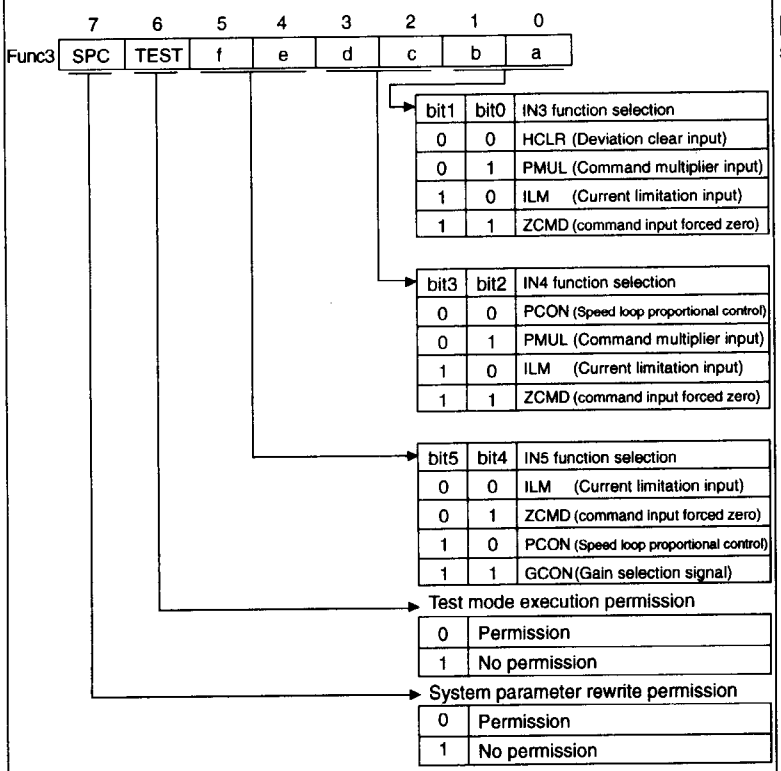
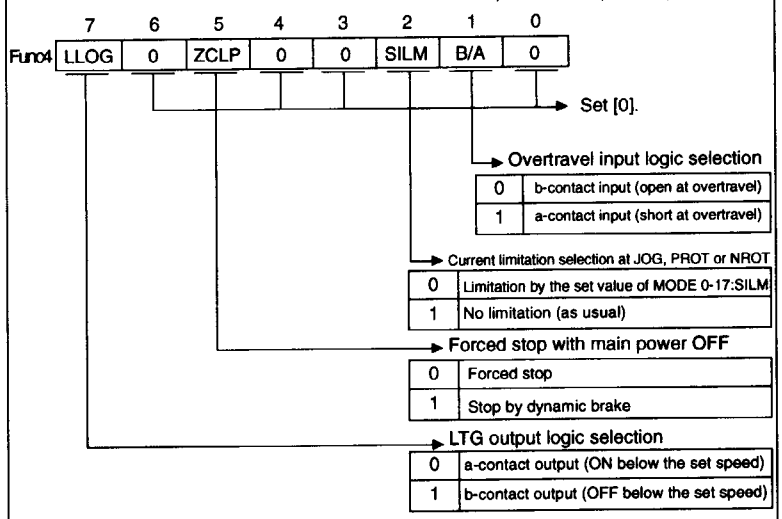
Table 8-7-3 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
13	Func2	Selector switch 2 • Desired functions can be set by digital switch.	0000-0000	bit	0, 1	Forward rotation means the counterclockwise direction as viewed from the motor shaft side. Do not use any externally connected regenerative resistor other than the specified one. Before setting the overtravel detection to "enable", connect the overtravel signal to IN6 and IN7. Before setting the external overheat detection to "enable", connect the thermal pin of the externally connected regenerative resistor to IN8.



Note: Bit 4 and bit 7 cannot be changed unless the control power supply is turned off once.

Table 8-7-4 Screen Mode 0 (Key-in Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Standard value</th><th>Unit</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>14</td><td>Func3</td><td>Selector switch 3
• Desired functions can be set by digital switch.
 
</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td>Reset bit 6 and bit 7 to [0] after execution.
These bits are also reset to [0] by turning off the power supply.</td></tr>
<tr><td>15</td><td>Func4</td><td>Selector switch 4
• Desired functions can be set by the digital switch.
 

Note: Be sure to set bits 0, 3, 4 and 6 to [0].</td><td>0000-0000</td><td>bit</td><td>0, 1</td><td></td></tr>
</table>

Table 8-7-5 Screen Mode 0 (Key-in Setting)

Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
16	ILIM	Internal current limitation • When bit 0 of Func1 (mode 0-12) is set to [0] and the ILIM (current limitation input) signal is input, the current will be limited by the setting. • Do not set this parameter over the instantaneous maximum armature current (I_P) of the motor.	100	%	30 to 400	The unit [%] is the ratio to the rated armature current (I_R) of the motor.
17	SLIM	Sequence current limitation • Set the current limitation for overtravel at JOG operation. • This parameter is validated when bit 1 of Func4 (mode 0-15) is set to [0]. • Do not set this parameter over the instantaneous maximum armature current (I_P) of the motor.	120	%	30 to 400	The unit [%] is the ratio to the rated armature current (I_R) of the motor.
19	VLPF	Speed command LPF • Set the cut-off frequency of the primary low-pass filter for a speed command input. • This parameter is validated when bit 2 of Func1 (mode 0-12) is set to [1].	990	Hz	1 to 990	
20	ILPF	Current command LPF • Set the cut-off frequency of the primary low-pass filter for a current command input.	500	Hz	1 to 990	When the selector switch (SW) on the front panel of the amplifier is set to the up position, the setting cannot be changed by operator.

Table 8-7-6 Screen Mode 0 (Key-in Setting)

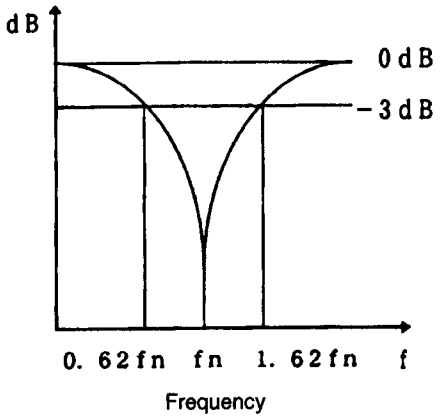
Page No.	Abbreviation	Name and contents	Standard value	Unit	Setting range	Remarks
21	IBEF	Current command BEF • Set the center frequency of the notch filter with the following characteristics for a current command. • This parameter is validated when bit 1 of Func1 (mode 0-12) is set to [1]. [Characteristics]  Frequency	990	Hz	200 to 990	This parameter can be set in units of 10 Hz. The first digit cannot be changed.
22	Tacc	Acceleration/deceleration time • Set the acceleration time from 0 to 1000 [min^{-1}] and the deceleration time from 1000 to 0 [min^{-1}]. Note 1: This parameter is very effective in the speed control type. When forming a position loop externally, do not use this parameter if possible. (There is a possibility of oscillation.) Note 2: Even if an overtravel occurs, deceleration is performed by this acceleration/deceleration time.	0	msec	0, 10 to 9999	
24	Scal	Analog command input scale • The rotating speed of the motor to a command voltage or the output torque scale can be varied. • The allowable command voltage should be MAX ±10 V.	2000	mV/ 1000min^{-1} mV/T_R	900 to 6666	T_R: Rated torque of the motor

Table 8-8-1 Screen Mode 1 (Menu Input Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Setting at delivery</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>0</td><td>TYPE</td><td>Control mode
• Select among positioning control, speed control, and torque control.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>Position
Velocity
Torque</td><td>Positioning control type
Speed control type
Torque control type</td></tr></table></td><td>Velocity</td><td>3 types</td><td></td></tr>
<tr><td>1</td><td>ENKD</td><td>Encoder type
• Set the type of the encoder to be used.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>INC. E</td><td>Wire saving incremental encoder</td></tr></table></td><td>INC. E</td><td>1 type</td><td>This parameter cannot be changed.</td></tr>
<tr><td>2</td><td>ENPL</td><td>Encoder pulse-number
• Select pulse-number of the encoder.
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>2000 P/R</td><td>2000 pulses/rotation encoder</td></tr><tr><td>1000 P/R</td><td>1000 pulses/rotation encoder</td></tr><tr><td>2048 P/R</td><td>2048 pulses/rotation encoder</td></tr><tr><td>1024 P/R</td><td>1024 pulses/rotation encoder</td></tr><tr><td>2500 P/R</td><td>2500 pulses/rotation encoder</td></tr><tr><td>5000 P/R</td><td>5000 pulses/rotation encoder</td></tr><tr><td>6000 P/R</td><td>6000 pulses/rotation encoder</td></tr><tr><td>8192 P/R</td><td>8192 pulses/rotation encoder</td></tr><tr><td>1500 P/R</td><td>1500 pulses/rotation encoder</td></tr><tr><td>3000 P/R</td><td>3000 pulses/rotation encoder</td></tr><tr><td>4000 P/R</td><td>4000 pulses/rotation encoder</td></tr><tr><td>4096 P/R</td><td>4096 pulses/rotation encoder</td></tr></table></td><td>$$$$</td><td>12 types</td><td></td></tr>
<tr><td colspan="6">System parameters 0 to 3 are as follows:
1 Change this parameter after setting bit 7 of Func3 (mode 0-14) to [1].
2 When [Completed] is displayed, the setting has been changed. (If [Invalid] is displayed, the setting remains without change.)
3 The parameter change is not validated unless the control power supply is turned off after completion of this change.</td></tr>
</table>

Table 8-8-2 Screen Mode 1 (Menu Input Setting)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th>Name and contents</th><th>Setting at delivery</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>3</td><td>MOT.</td><td>Motor type
<table><tr><th>Display</th><th>Contents</th></tr><tr><td>- - - - - - -</td><td>Special motor is selected.</td></tr></table>Note: Now motor type selection is disabled.
In the case of a combination with the standard motor, "- - - - - - - - - - " is displayed.</td><td>- - - - - - - - - -</td><td>–</td><td></td></tr>
<tr><td>4</td><td>M1</td><td>Monitor 1 output
• Select the contents of monitor 1 output (CN1 pin 23 and check pin M1 of remote operator). (See the following.)
<table><tr><th>Display</th><th colspan="2">Contents</th></tr><tr><td>Per 5mV/P</td><td>Position deviation</td><td>1V/200 pulses</td></tr><tr><td>Per 10mV/P</td><td>Position deviation</td><td>1V/100 pulses</td></tr><tr><td>Vm0.5mV/min^{-1}</td><td>Speed monitor</td><td>1 V/2000 min^{-1}</td></tr><tr><td>Vm 1mV/min^{-1}</td><td>Speed monitor</td><td>1V/1000 min^{-1}</td></tr><tr><td>Im 1 V/IR</td><td>Current monitor</td><td>1 V/rated current</td></tr><tr><td>Ic 1 V/IR</td><td>Current command</td><td>1 V/rated current</td></tr><tr><td>Rm 0.5V/Full</td><td>Regenerative load factor</td><td>0.5 V/Full</td></tr><tr><td>SINU2.5V/max</td><td>U-shape electric angle</td><td>2.5 V/max</td></tr></table></td><td>Vm0.5mV /min^{-1}</td><td></td><td></td></tr>
<tr><td>5</td><td>M2</td><td>Monitor 2 output
• Select the contents of monitor 2 output (CN1 pin 25 and check pin M2 of the remote monitor). (See the above.)</td><td>Im 1V/1R</td><td></td><td></td></tr>
</table>

Table 8-8-3 Screen Mode 1 (Menu Input Setting)

Page No.	Abbreviation	Name and contents	Setting at delivery	Setting range	Remarks
6	Zero	Analog command offset adjustment • Adjust the analog input offset. • Adjust the offset to 0 min^{-1} by observing the motor rotation while pressing ◁ or ▷ . • When [Completed] is displayed by pressing WR , the adjustment has been completed.	0	-127 to 127	

9. MAINTENANCE

1) Troubleshooting

When an alarm occurs, the alarm output (ALM) will be output and the alarm lamp on the front panel will light up.

Take a proper measure listed in the following table according to the alarm lamp status.

Note 1: Before replacing the servo amplifier, check that there is no external factor.
(Prevention from double damage)

Note 2: An "O" in the alarm lamp denotes that it is lit.

Table 9-1 Troubleshooting

Alarm No.	Alarm lamp			Abbreviation	Alarm name	Operating status	Cause	Corrective measure or action
	ALM4	ALM2	ALM1					
1			O	OC	Power element error (overcurrent)	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
						After the main circuit power supply is turned on, the lamp lights up with Operation ready output signal ON.	• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up with Servo ON.	• Defective motor ground.	• Replace the motor.
							• Defective power module	• Replace the servo amplifier.
							• Wrong wiring in the motor main circuit	• Correct the wiring.
						The lamp lights up when the motor starts or stops.	• Improper combination of motor and amplifier	• Combine motor and amplifier correctly.
2		O		OL	Overload	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up during motor operation.	• The motor is operated over the rated torque.	• Correct the load.
							• The holding brake is not released.	• Release the brake by excitation.
						The motor rotates but no torque is provided. After a while, the lamp lights up during operation.	• Wrong wiring in the motor main circuit • Broken wire in the motor main circuit	• Correct the wiring.
							• Improper combination of motor and amplifier	• Correct the combination.
						The lamp lights up even below the rated torque.	• Defective printed circuit board	• Replace the servo amplifier.

Table 9-2 Troubleshooting

Alarm No.	Alarm lamp			Abbreviation	Alarm name	Operating status	Cause	Corrective measure or action
	ALM4	ALM2	ALM1					
3		O	O	OS	Overspeed	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
							• Defective encoder	• Replace the servo motor.
						The lamp lights up during motor operation.	• Speed command too large	• Change the command within the specification.
							• Defective encoder	• Replace the servo motor.
							• Defective wiring for encoder signals	• Correct the wiring.
						The lamp lights up when the motor starts or stops.	• Overshoot too large	• Reset the servo tuning function. • Moderate the start pattern.
							• Load inertia too large	• Change the load inertia within the specification.
				SE	Speed control error	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up with Servo ON.	• The motor oscillates (vibrates).	• Do servo tuning. • Replace the servo amplifier. • Replace the servo motor.
						The lamp lights up with speed command input.	• Wrong wiring or wire breaking	• Correct the wiring.
4	O			DE	Sensor error	The lamp lights up only by turning on the control power supply.	• Defective motor encoder	• Replace the servo motor.
							• Wrong wiring or wire breaking for encoder signals	• Correct the wiring.
							• Defective printed circuit board	• Replace the servo amplifier.
							• Improper combination of motor and amplifier	• Combine motor and amplifier correctly.
						The lamp lights up when the motor moves slightly.	• Defective motor encoder	• Replace the servo motor.
							• Wrong wiring or wire breaking for encoder signals	• Correct the wiring.

Table 9-3 Troubleshooting

Alarm No.	Alarm lamp ALM4	Alarm lamp ALM2	Alarm lamp ALM1	Abbreviation	Alarm name	Operating status	Cause	Corrective measure or action
5	O		O	PE	Control power supply error	The lamp lights up only by turning on the control power supply.	• The input supply voltage is out of the specification range.	• Change the supply voltage within the specification.
							• Defective printed circuit board	• Replace the servo amplifier.
						The lamp comes on during motor operation.	• Input power variation too large	• Change the supply voltage within the specification.
				MPE	Main circuit power drop	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up when the main circuit power supply is turned on.	• Supply voltage too low	• Change the supply voltage within the specification.
							• Rectifier damage	• Replace the servo amplifier.
						The lamp lights up during motor operation.	• Input power variation too large	• Change the supply voltage within the specification.
							• Defective printed circuit board	• Replace the servo amplifier.
				OV	Overvoltage	The lamp lights up only by the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up when the main circuit power supply is turned on.	• Input supply voltage too high • Distorted input power waveform	• Change the supply voltage within the specification.
						The lamp lights up during motor operation.	• Load inertia too large	• Change the load inertia within the specification.
				RGOL	Regeneration error	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up when the main circuit power supply is turned on.	• Defective printed circuit board	• Replace the servo amplifier.
							• Input supply voltage too high	• Change the supply voltage within the specification.
						The lamp lights up during motor operation.	• The generative capacity is exceeded.	• Provide an externally connected regenerative resistor.
							• Defective parameter	• Correct the parameter.
							• Load inertia too large	• Change the load inertia within the specification. • Make the deceleration time longer.

PE, MPE, OV, RGOL, AOH and EXOH can be distinguished from one another by seeing the history of the remote operator.

Table 9-4 Troubleshooting

Alarm No.	Alarm lamp			Abbreviation	Alarm name	Operating status	Cause	Corrective measure or action
	ALM4	ALM2	ALM1					
5	O		O	AOH	Amplifier overheat	The lamp lights up only by turning on the control power supply.	• Defective temperature sensor on the printed circuit board	• Replace the servo amplifier.
						The lamp lights up during motor operation.	• The ambient temperature of the servo amplifier exceeds 55 degrees.	• Lower the ambient temperature below 55 degrees.
							• Abnormal heat generation from only the servo amplifier	• Replace the servo amplifier.
				EXOH	External overheating	The lamp lights up only by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
							• Wrong wiring or broken wire	• Correct the wiring.
							• Defective external thermal	• Replace the thermal.
						The lamp lights up during motor operation.	• External thermal operation	• Correct the operating conditions.
6	O	O		OVE	Deviation excess	The lamp lights up only by turning on the control power supply.	• Command pulse is input.	• Do not input command pulse, but input Deviation Clear.
							• Defective printed circuit board	• Replace the servo amplifier.
						The lamp lights up during motor operation.	• The set deviation excess is small.	• Correct the deviation excess or the position loop gain.
							• Inertia too large	• Check the inertia converted in terms of motor shaft again.
							• The motor is locked.	• Unlock the motor.
							• Defective wiring for encoder signals	• Correct the wiring.
							• High command frequency	• Lower the frequency.

Table 9-4 Troubleshooting

Alarm No.	Alarm lamp			Abbreviation	Alarm name	Operating status	Cause	Corrective measure or action
	ALM4	ALM2	ALM1					
7	O	O	O	MEME	Memory error	The lamp lights up by turning on the control power supply.	• Defective printed circuit board	• Replace the servo amplifier.
							• Improper combination of motor and amplifier	• Combine motor and amplifier correctly.
							• Improper setting for command pulse type	• Set PM1 and PM0 to any value other than "1" and "1".
				DSPE	Servo processor error	The lamp lights up by turning on the control power supply.	• Defective printed circuit board • The 5 V power supply is lowered.	• Replace the servo amplifier.
							• Servo processor error	• Replace the servo amplifier.
						The lamp lights up during motor operation.	• Servo processor error • The 5 V power supply is lowered.	• Replace the servo amplifier.
				CPUE*	CPU error	The lamp lights up by turning on the control power supply.	• The 5 V power supply is lowered.	• Correct the wiring related to the encoder. • Replace the servo amplifier.
							• Defective printed circuit board	• Replace the servo amplifier.
							• Malfunction of internal circuit	• Turn off the control power supply, then turn it on again. ↓ If the same error recurs, replace the servo amplifier.
						The lamp lights up during motor operation.	• The 5 V power supply is lowered.	• Correct the wiring related to the encoder. • Replace the servo amplifier.
							• Defective printed circuit board	• Replace the servo amplifier.
							• Malfunction of internal circuit	• Turn off the control power supply, then turn it on again. ↓ If the same error recurs, replace the servo amplifier.

Note: CPU error will not be recorded in the alarm history.
When the alarm output logic is set to ON at alarm (bit 2 of Func = '1'), there is no alarm output upon occurrence of a CPU error.

2) Maintenance

When there is no wearing part, routine simple inspection is enough for maintenance of the servo motor and the servo amplifier.

Check items, inspection periods, and procedure are shown below.

1. A megger test on the servo amplifier may result in damage. We recommend that you perform a continuity check with a tester instead.

2. Do not disassemble the servo motor or remove its detector cover.

Table 9-5 Inspection Procedure

Target position for inspection	Inspection conditions			Check item	Inspection method	Corrective measure against error
	Period	During operation	During stop			
Servo motor	Daily	O		Vibration	Check if vibration is greater than in the normal status.	Contact us.
	Daily	O		Sound	Check if any abnormal sound occurs.	
	As required		O	Cleaning	Check for dirt and dust.	Cleaning with a cloth or air.*1
	Yearly		O	Insulation resistance measurement	Contact us.	
	5000 hours*2		O	Oil seal replacement		
Servo amplifier	As required		O	Cleaning	Check if dust has accumulated on the equipped parts.	Remove it with air.*1
	Yearly		O	Screw looseness	Check if connectors CN1 and CN2 are loose.	Tighten them.

*1: Before cleaning, check that air does not include oil or water.

*2: This is the inspection or replacement period for the case where waterproof or oil-proof function is required.

Date of entry on sheet		Page: /	
Equipment			
Shaft name in use			
Amplifier model		Lot. No.	
Motor model		Lot. No.	

Table 11-1 Screen Mode 0 Parameter Sheet

Page No.	Abbreviation	Name	Standard value	Unit	Setting range	Set value
0	Kp	Position loop gain	30	rad/s	1 to 255	
1	Kff	Feed forward gain	0	%	0 to 100	
2	Kvp	Speed loop proportional gain	70	Hz	10 to 3000	
3	Tvi	Speed loop integral time constant	20	msec	2 to 1000	
4	INP	Positioning completion signal width	64	Pulse (±)	1 to 255	
5	OVF	Deviation excess	256	× 256 pulses	1 to 32768	
6	EGER	Electronic gear ratio	4/1		1/10000 to 32 exclusive	
7	ENCR	Output pulse dividing ratio	1/1		1/1 to 1/8192	
8	LTG	Low speed	50	min^{-1}	10 to 9999	
9	PMOD	Command pulse train type	00000000		0, 1	
10	UIF 1	User I/F function selection 1	00000000		0, 1	
11	UIF 2	User I/F function selection 2	00000000		0, 1	
12	Func 1	Selector switch 1	00000000		0, 1	
13	Func 1	Selector switch 2	00000000		0, 1	
14	Func 1	Selector switch 3	00000000		0, 1	
15	Func 1	Selector switch 4	00000000		0, 1	
16	IILM	Internal current limitation	100	%	30 to 400	
17	SILM	Sequence current limitation	120	%	30 to 400	
18	FLPF	Feed forward LPF	990	Hz	1 to 990	
19	VLPF	Speed command LPF	990	Hz	1 to 990	
20	ILPF	Current command LPF	500	Hz	1 to 990	
21	IBEF	Current command BEF	990	Hz	200 to 990	
22	Tacc	Speed acceleration/deceleration time	0	msec	0, 10 to 9999	
23	Tpcm	Position command acceleration/deceleration time constant	0	msec	0 to 4000	
24	Scal	Analog command scale	2000	$mV/1000min^{-1}$	900 to 6666	

Table 11-2 Screen Mode 1 Parameter Sheet

Page No.	Abbreviation	Name	Setting at delivery	Setting range	Set value
0	TYPE	Control mode	$$$$	3 modes	
1	ENKD	Encoder type	INC. E	1 types	
2	ENPL	Encoder pulse-number	$$$$	12 numbers	
3	MOT.	Motor type	- - - - -	P30 and P50 series	
4	M1	Monitor 1 output	Vm 0.5mV/min^{-1}	8 outputs	
5	M2	Monitor 2 output	Im 1V/IR	8 outputs	
6	Zero	Analog command zero adjustment	0	-127 to 127	
7	PMUL	Command pulse multiplier	1-multiplier	5 multipliers	

Note 1: $$$$: Depends on the specification provided at delivery from the factory.

Relation between Operator Functions and CPU Versions

CPU version	Operator function				
	MODE 0	MODE 1	MODE 2	MODE 3	MODE 4
PVTA0C	13: Func 2 bit 4 (regenerative resistor selection) Not usable. bit 7 (external overheat permission) Not usable 24: Scal Not usable	0: TYPE Torque selection inhibit 4: M1 Not usable 5: M2 Not usable	Usable	0: Now Usable 1 to 7 No history function	0: JOG Usable 1: Tune No function
PVTA0D	13: Func 2 bit 4 (regenerative resistor selection) Not usable bit 7 (external overheat permission) Not usable 24: Scal Not usable	0: TYPE Torque selection inhibit 4: M1 Not usable 5: M2 Not usable	Usable	Usable	0: JOG Usable 1: Tune Not usable
PVTA0E	13: Func 2 bit 4 (regenerative resistor selection) Not usable bit 7 (external overheat permission) Not usable	0: TYPE Torque Not selectable 4: M1 5: M2 Regenerative load factor monitor Not selectable	Usable	Usable	0: JOG Usable 1: Tune Not usable
PVTA0F	13: Func 2 bit 4 (regenerative resistor selection) Not usable bit 7 (external overheat permission) Not usable	0: TYPE Torque Not selectable 4: M1 5: M2 Regenerative load factor monitor Not selectable	Usable	Usable	0: JOG Usable 1: Tune Not usable
PVTA0G	Usable	0: TYPE Torque Not selectable	Usable	Usable	Usable
PVTA0H	Usable	Usable	Usable	Usable	Usable

The CPU version can be confirmed by the remote operator. <See P.7-3.>

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