DS Controller

Operating Manual

IAI America, Inc.

This publication was written to assist you in better understanding this part of your IA system. If you require further assistance, please contact IA Technical Support. For Central and East Coast Time Zones, please call our Itasca, IL office at 1-800-944-0333 or FAX630-9912. For Mountain and Pacific Time Zones, please call our Torrance, CA office at 1-800-736-1712 or FAX 310-891-0815; Monday thru Friday from 8:30AM to 5:00PM.

INTELLIGENT ACTUATOR

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DS

Foreword

DS

Thank you very much for selecting the Intelligent Actuator, DS series actuator/controller system. The DS series is compact, easy to use and can control the actuator and peripheral devices with ease. Also, the SEL language used in the DS series makes it possible to perform high level control with simple programming. Please read through this manual carefully to gain an understanding of the proper method of operating and handling the DS controller and actuator.

1. Safety Precauitions and Warranty

Safety Precautions:

This product was developed as components for driving automated equipment and is designed not to produce greater torquing or speed than is necessary. However, strictly observe the following items to prevent any accidents from occurring.

1. As a rule, any handling or operating methods not described in this manual should be viewed as things that should not be attempted. Please contact the company if any portion of the contents of this manual are unclear.

2. Use only the products specified for wiring between the actuator and controller.

3. Stand clear of the operating range of the machine when it is in motion or is ready to operate. Surround the system with safety partitions if there is a possibility that people can enter the area where the machine is being used.

4. When assembling, adjusting, or performing maintenance on the machine, always disengage the power supply to the controller. During work, display a sign stating work in progress where it is readily visible. Also, keep the power cable close to the operator so that another person cannot inadvertently switch on the power.

5. When more than one person is working on the system, agree on signals beforehand to ensure everyone's safety before beginning work. In particular, when doing work involving axis movement, always call out for everyone's safety regardless of whether power is ON or OFF, or the axis is to be mechanically driven or manually moved.

6. When the user needs to lengthen the cables, check the wiring carefully to make sure it is correct before turning the power ON since miswiring can lead to misoperation.

Warranty Period and Scope:

1. This product is under warranty for a period of one year from the date it is shipped to the customer. If the product breaks down due to a manufacturing defect during this period, IAI will repair it at no cost.

2. The following are not covered under the warranty, even if the product is still under the warranty period.

   a. Damage due to incorrect handling or use that does not adhere to the instructions in the user's manual.
   b. When electrical or mechanical revisions have been performed on the product.
   c. Part wear when traveling distance has exceeded 5,000 km.
   d. Breakdown or damage caused by fire, earthquake or other natural disasters.
   e. Any other breakdown or damage that is not recognized as the company's responsibility.

2. Setting Up

1. Precautions When Using the Emergency Stop

As a rule, emergency stops should only be applied from the I/O.
Do not turn the power (AC117V) ON/OFF to effect an emergency stop.
If you stop the actuator by turning the power OFF, wait at least 15 seconds before turning the power ON again. If you disregard this warning, and repeatedly turn the power ON/OFF without waiting a sufficient amount of time, you may damage the controller.

2. Restarting the Controller After an Emergency Stop (refer to part 3, 1-4 "Emergency Stop Release" for details)

The Super SEL controller and Table Top type (TT-300) both use a "hard reset" to restart after an emergency stop. The operation is nearly the same as turning the power OFF/ON. (Homing is required).

(1) Emergency Stop from the teaching pendant

① Press EMERGENCY STOP on the teaching pendant. Continue pressing and the screen will display the following.

Teaching pendant display   Controller code display

```
EMG STOP.

ReStart (Flashing display)
F1 | F2 | F3 | F4
```

| EG |

(A red *ALARM lamp lights up)
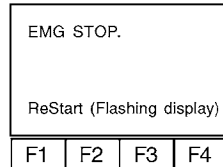
② Take your finger off the EMERGENCY STOP button to do a hard reset and the following screen appears.

Teaching pendant display   Controller code display

```
EMG STOP.

ReStart (Flashing display)
F1 | F2 | F3 | F4
```

| rd |

(A green *READY lamp lights up)
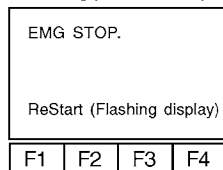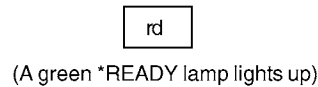
③ If you press the **F1** key (ReStart) on the teaching pendant, the initial screen reappears.

Teaching pendant display   Controller code display

```
F1 | F2 | F3 | F4
```

| rd |

(A green *READY lamp lights up)
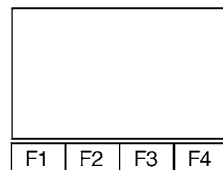
(2) Pressing the controller emergency stop button or an emergency stop condition caused by an external signal
When the emergency stop is released after pressing the emergency stop button on the controller front panel, you must follow the same procedure as described above or the teaching pendant will not reset (you cannot operate the teaching box if the code display on the controller front panel reads EG .

> (!) **Warning**
> If you are using the Auto Start PRG in the system program parameter mode, always write the program so that movement will not resume unless there is some kind of input condition. This is to avoid sudden startup of movement because of the automatic start program right after the emergency stop is released.

3.1 Part Names

Code display

LED display

DS
Controller

CODE

O READY
O ALARM
O BAT.

Function switch

BRAKE
RELEASE — BAU.R
COPY
NORMAL — F/R

Brake release switch

TEACHING/
RS232 PORT

TEACHING/RS232 PORT connector

PORT switch

ON

OFF
PORT

IAI Corporation

Brake connector

External I/O or use device connector

BK

M-PG

Motor encoder connector

N 24V

POWER EMG

I/O

Power and emergency stop terminal block

Ground terminal block
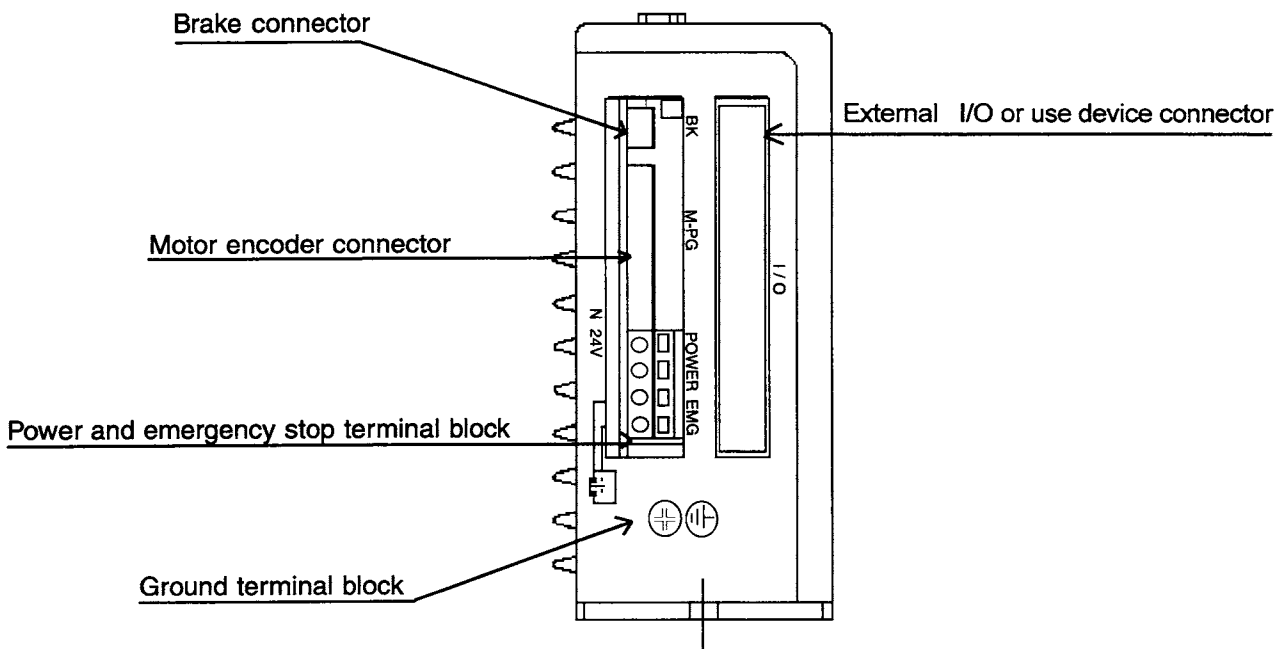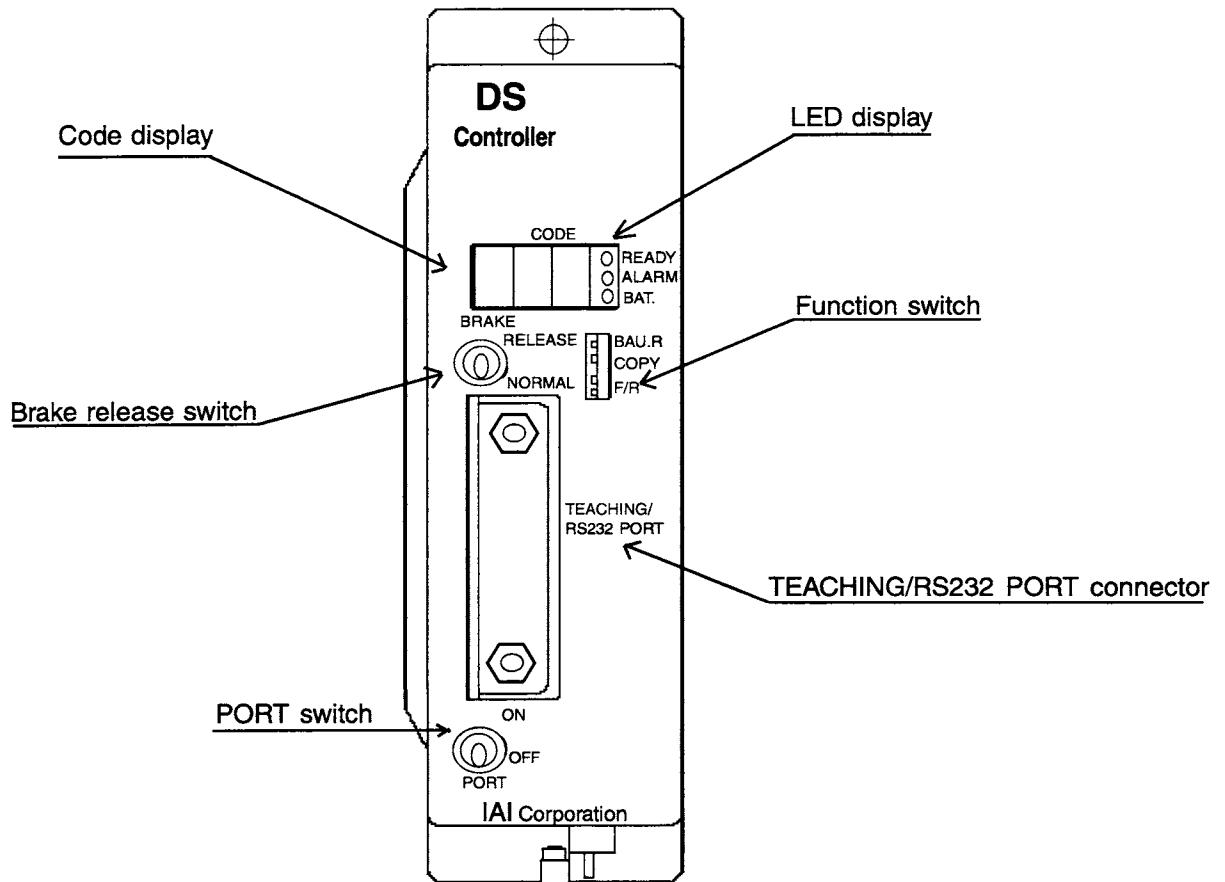
3. Part Names and Functions

3.2 Functions

CODE display

This is a 3-digit display device that indicates the operating status of the controller.

LED display

READY   : This indicates that the controller is ready to be operated.
ALARM   : This is the display when there is a malfunction in the equipment.
BAT.   : This indicates battery voltage is low.

Brake release switch

RELEASE : The brake is released.
NORMAL   : The brake is ON. (This is the normal setting)

The brake release switch is enabled durng the servo free state indicated below:

1. From the time the power is turned ON until the homing command is given.
2. When [Svof] is selected during direct teaching.
3. When an alarm occurs.

PORT switch

ON   : The TEACHING/RS232PORT is enabled. However, when the TEACHING/ RS232 PORT connector is not connected, an emergency stop occurs.
OFF   : The TEACHING/RS232PORT is disengaged. However, even when the TEACH-ING/RS232PORT connector is not connected, the emergency stop is controlled by the external E-stop connection.

Note: When the controller is powered up, plug in or remove the TEACHING/RS232PORT connector when the PORT switch is OFF.

Function switch

BAU.R   : This is the switch for changing the Baud rate.
COPY   : This is the switch for COPY from ROM to FLASH memory.
F/R   : This is the switch for changing FLASH and ROM.

Note: At the time the unit is shipped, all switches are set to OFF so use them under normal circumstances.

TEACHING/RS232
PORT connector

This is a 25 pin RS232 connector for the teaching pendant or to a personal computer.

3. Part Names and Functions

Brake connector   This is the actuator's brake connection.

Motor connector   This is the connector for connecting the actuator motor • encoder cable.

I/O device connector   This is a 34 pin I/O connector.

Ground terminal block   This is the M3 screw for the ground connection.

Power and emergency   This is the terminal for POWER N and 24V power.
stop terminal block   The two EMG terminals are for connecting the emergency stop switch.
                                  (When the unit is shipped, the EMG terminal is shorted.)

POWER EMG

N   24V
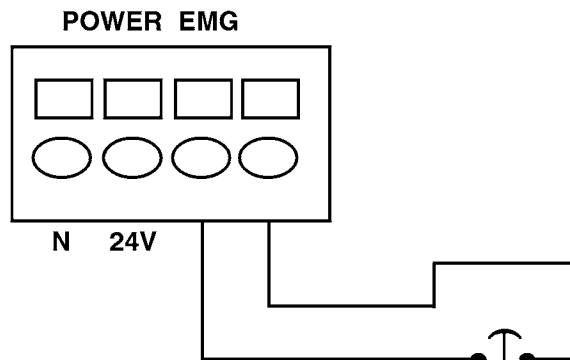
The user should meet the requirements and conditions given in the table below with respect to the power lines that are connected.

Suitable power line	Solid wire ϕ1.2 (AWG 16) Standard wire 1.25mm² (AWG 16)
Usable power line range	Solid wire ϕ0.4 (AWG26)~ ϕ1.2 (AWG 16) Standard wire 0.3mm² (AWG22)~1.25mm² (AWG 16) Standard diameter ϕ0.18 or greater
Standard line length	11mm
Suitable tool for button operation	Slot screwdriver (axis diameter ϕ3, width of tip 2.6)

Note: This controller does not have a power switch.

3.3 Explanation of Code Display

`oPn`	Open display
`SIo`	Serial I/O check display
`Sru`	Servo check display
`Pro`	Program check display
`rdy`	Ready display
`CPy`	Flash memory copy display
`End`	Flash memory copy complete display
`uPd`	Update display
`Ero`	Emergency stop display
`rES`	CPU reset
`Hor`	Homing display
`Pxx`	Startup program No. display
`xxx`	Position No. display (001~500)
`Ixx`	Interrupt error display
`Lxx`	Software error display
`Exx`	Other error display

4. Specifications

4.1 Controller Specifications

Item	Description
Power Voltage	DC24V±10%
Power Current	24W Rated/1A (Maximum 48W)
Ambient Temperature & Humidity	Temperature: 0~40°C Humidity 85% RH or less
Operating Environment	Free of corrosive gas, no excessive dust
Isolation Resistance	500V 10MΩ or more
Unit Weight	560g
Safety Features	Driver alarm (Motor excess current: Excess voltage • Driver temperature check) Overload Check, software limit check
Motor	AC Servo Motor 20W
Control Functions	Multi-task Control Super SEL Controller
Memory Capacity	Total: 1000 steps, 500 positions
Memory Device	COMS RAM Battery Backup
Number of programs	32 programs, Multi-task function (maximum of 8 programs)
Input/Output (DC24V) Non-insulated	Dedicated inputs: 8 (PRG No. 1, 2, 4, 8 ,1, 20) Dedicated inputs: 1 (START) User inputs: 15 Dedicated outputs: 2 (Ready, ALARM) User outputs: 6
Data Input Method	Teaching Pendant or RS232 Communication
Communication	EIA RS232 Standard Asychronous
Remote Update Functions	Software update (via network or floppy disk)

4. Specifications

DS
Controller

4.2 External I/O Specifications

External Input Circuit

Item	Specification
External Power Voltage	DC 24V ± 10%
Input Current	7mA / DC24V
ON / OFF Voltage	ON voltage ··· Main DC 18 OV OFF voltage ··· Main DC 6 OV
Insulation	Non-insulated
Extent Connection Device	No-voltage contact point (minimum load about DC 5V • 1mA) Photoelectric • proximity sensor (NPN type) PLC Transistor output (open collector type) PLC Contact point output (minimum load about DC5V • 1mA)

Note: When a no-contact circuit is connected to an external circuit, make sure that
the leakage current is under 1mA when the switch if OFF or, it could cause faulty
operation.

External Output Circuit

Item	Specification	
Load Voltage	DC 24V	Application for TD62084
maximum Load Voltage	100mA / 1 point 400mA peak (all current)	
Recommend Load Voltage	20mA / 1 point	
Leakage Current	Max 0.1mA	
InsulationExternal Connection Device	Non-insulated	
External Connection Device	Miniature relay Sequence input unit (sink type)	

Note 1: For all of the external outputs, the flyback diode (D) is connected on the inside.
Note 2: Take care when connecting because if the load short circuits or the current exceeds the
maximum load current, this will cause a failure in the output circuit.

External I/O Circuit
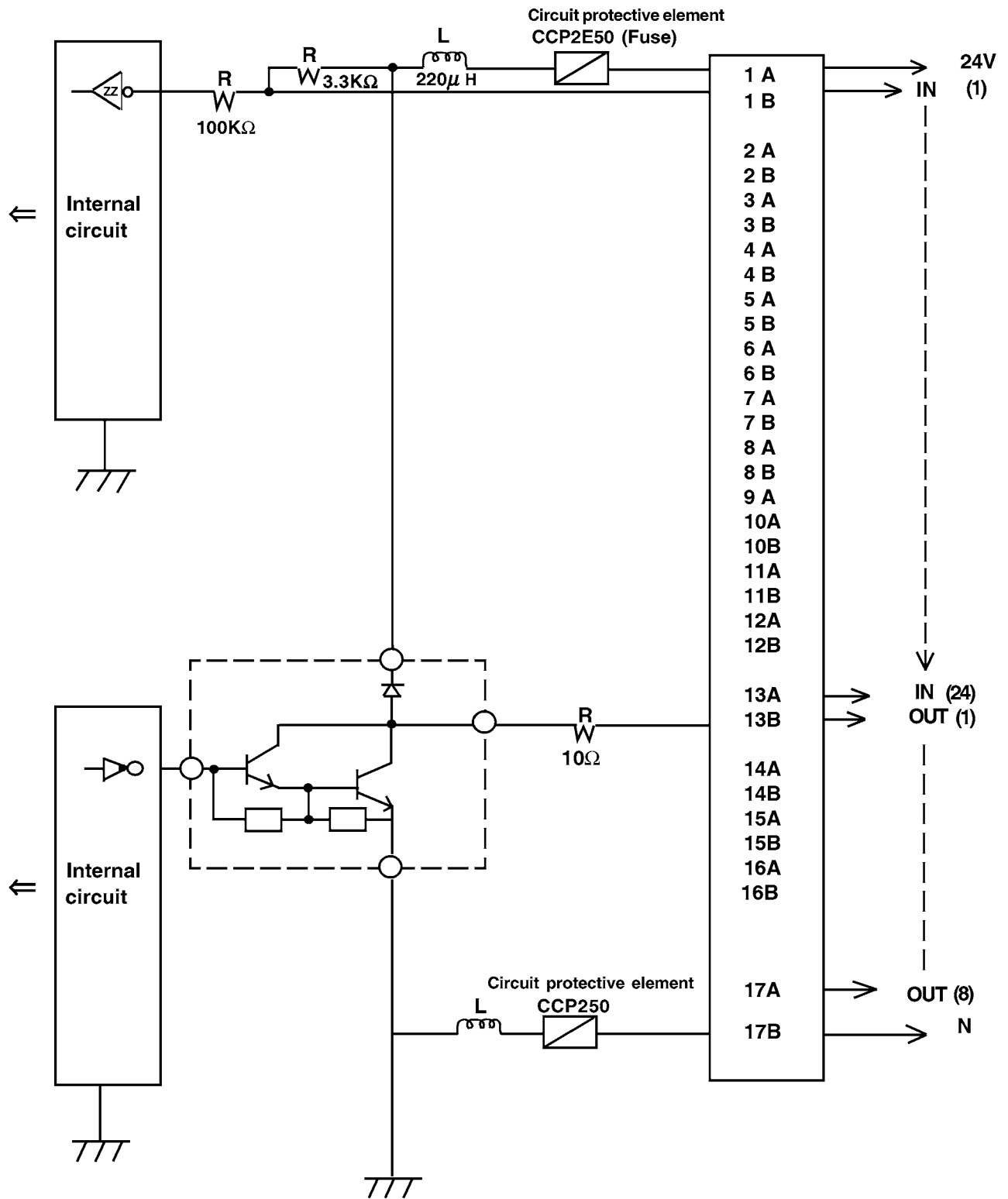
4.3 Interface List

Specifications for I/O Interface during program mode and position mode are different.

The interface list for each is indicated in the following tables:

Position Mode
I/O Connector (34 Pin)

NPN

Pin No.	Section	Port No.	Function	Cable Color
1A	24 VDC		24 VDC	1-Brown
1B			NC	1-Red
2A			NC	1-Orange
2B			NC	1-Yellow
3A			NC	1-Green
3B			NC	1-Blue
4A			NC	1-Purple
4B			Reserve	1-Gray
5A			CPU Reset Input	1-White
5B		000	Start Input	1-Black
6A		001	Hold Input	2-Brown
6B		002	NC	2-Red
7A	Input	003	NC	2-Orange
7B		004	Position No. 1 Input	2-Yellow
8A		005	Position No. 2 Input	2-Green
8B		006	Position No. 4 Input	2-Blue
9A		007	Position No. 8 Input	2-Purple
9B		008	Position No. 10 Input	2-Gray
10A		009	Position No. 20 Input	2-White
10B		010	Position No. 40 Input	2-Black
11A		011	Position No. 80 Input	3-Brown
11B		012	Position No. 100 Input	3-Red
12A		013	Position No. 200 Input	3-Orange
12B		014	Position No. 400 Input	3-Yellow
13A		015	NC	3-Green
13B		300	Alarm Output	3-Blue
14A		301	Ready Output	3-Purple
14B		302	Position Complete Output	3-Gray
15A	Output	303	NC	3-White
15B		304	NC	4-Black
16A		305	NC	4-Brown
16B		306	NC	4-Red
17A		307	NC	4-Orange
17B	0 VDC		0 VDC	4-Yellow

Caution:
External 24V power must be connected to I/O connector 1A pin and 17B. Make sure that the power is OFF during connection, and avoid short circuit and reverse connection.

Note:
PRG = Program
NC = No contact

* Do not use number 1B (PRG No.1 input) through pin number 4A (PRG No.20) since these are for program number input.
* Position mode can be used when program number input is "0" (OFF).
* When using the controller in position mode, use pin number 7B (Port No.004) through pin number 12B(Port No. 014) for position number input.
* Homing is performed when position number input is "0" (OFF) and start input is set to "1" (ON).
* Please note that when the I/O connector (external 24V power) is not connected, the controller considers all input ports and program inputs to be "1" (ON). In this case, the controller changes to reset status.

4. Specifications

NPN

Program Mode
I/O Connector (34 pin)

Pin No.	Section	Port No.	Function	Cable Color
1A	24 VDC		24 VDC	1-Brown
1B			PRG No. 1 Input	1-Red
2A			PRG No. 2 Input	1-Orange
2B			PRG No. 4 Input	1-Yellow
3A			PRG No. 8 Input	1-Green
3B			PRG No. 10 Input	1-Blue
4A			PRG No. 20 Input	1-Purple
4B			Reserve	1-Gray
5A			CPU Reset Input	1-White
5B		000	Start Input	1-Black
6A		001	User Input	2-Brown
6B		002	User Input	2-Red
7A	Input	003	User Input	2-Orange
7B		004	User Input	2-Yellow
8A		005	User Input	2-Green
8B		006	User Input	2-Blue
9A		007	User Input	2-Purple
9B		008	User Input	2-Gray
10A		009	User Input	2-White
10B		010	User Input	2-Black
11A		011	User Input	3-Brown
11B		012	User Input	3-Red
12A		013	User Input	3-Orange
12B		014	User Input	3-Yellow
13A		015	User Input	3-Green
13B		300	Alarm Output	3-Blue
14A		301	Ready Output	3-Purple
14B		302	User Output	3-Gray
15A	Output	303	User Output	3-White
15B		304	User Output	4-Black
16A		305	User Output	4-Brown
16B		306	User Output	4-Red
17A		307	User Output	4-Orange
17B	0 VDC		0 VDC	4-Yellow

Caution:
External 24V power must be connected to I/O connector 1A pin and 17B. Make sure that the power is OFF during connection, and avoid short circuit and reverse connection.

Note: *PRG = Program*

* Please use pin No. 1B (PRG No.1 input) through pin No. 4A (PRG No.20) to input program numbers.
* Please note that when the I/O connector (external 24V power) is not connected, the controller considers all input ports and program inputs to be "1" (ON). In this case, the controller changes to reset status.

Specifications for I/O Interface during program mode and position mode are different.
The interface list for each is indicated in the following tables:

Position Mode
I/O Connector (34 Pin)

PNP

Pin No.	Section	Port No.	Function	Cable Color
1A	0 VDC		0 VDC	1-Brown
1B			NC	1-Red
2A			NC	1-Orange
2B			NC	1-Yellow
3A			NC	1-Green
3B			NC	1-Blue
4A			NC	1-Purple
4B			Reserve	1-Gray
5A			CPU Reset Input	1-White
5B		000	Start Input	1-Black
6A		001	Hold Input	2-Brown
6B		002	NC	2-Red
7A	Input	003	NC	2-Orange
7B		004	Position No. 1 Input	2-Yellow
8A		005	Position No. 2 Input	2-Green
8B		006	Position No. 4 Input	2-Blue
9A		007	Position No. 8 Input	2-Purple
9B		008	Position No. 10 Input	2-Gray
10A		009	Position No. 20 Input	2-White
10B		010	Position No. 40 Input	2-Black
11A		011	Position No. 80 Input	3-Brown
11B		012	Position No. 100 Input	3-Red
12A		013	Position No. 200 Input	3-Orange
12B		014	Position No. 400 Input	3-Yellow
13A		015	NC	3-Green
13B		300	Alarm Output	3-Blue
14A		301	Ready Output	3-Purple
14B		302	Position Complete Output	3-Gray
15A	Output	303	NC	3-White
15B		304	NC	4-Black
16A		305	NC	4-Brown
16B		306	NC	4-Red
17A		307	NC	4-Orange
17B	24 VDC		24 VDC	4-Yellow

Caution:
External 24V power must be connected to I/O connector 1A pin and 17B. Make sure that the power is OFF during connection, and avoid short circuit and reverse connection.

Note:
PRG = Program
NC = No contact

* Do not use number 1B (PRG No.1 input) through pin number 4A (PRG No.20) since these are for program number input.
* Position mode can be used when program number input is "0" (OFF).
* When using the controller in position mode, use pin number 7B (Port No.004) through pin number 12B(Port No. 014) for position number input.
* Homing is performed when position number input is "0" (OFF) and start input is set to "1" (ON).

4. Specification

DS Controller

Program Mode
I/O Connector (34 pin)

PNP

| Pin No.	Section	Port No.	Function	Cable Color
1A	0 VDC		0 VDC	1-Brown
1B			PRG No. 1 Input	1-Red
2A			PRG No. 2 Input	1-Orange
2B			PRG No. 4 Input	1-Yellow
3A			PRG No. 8 Input	1-Green
3B			PRG No. 10 Input	1-Blue
4A			PRG No. 20 Input	1-Purple
4B			Reserve	1-Gray
5A			CPU Reset Input	1-White
5B		000	Start Input	1-Black
6A		001	User Input	2-Brown
6B		002	User Input	2-Red
7A	Input	003	User Input	2-Orange
7B		004	User Input	2-Yellow
8A		005	User Input	2-Green
8B		006	User Input	2-Blue
9A		007	User Input	2-Purple
9B		008	User Input	2-Gray
10A		009	User Input	2-White
10B		010	User Input	2-Black
11A		011	User Input	3-Brown
11B		012	User Input	2-Red
12A		013	User Input	3-Orange
12B		014	User Input	3-Yellow
13A		015	User Input	3-Green
13B		300	Alarm Output	3-Blue
14A		301	Ready Output	3-Purple
14B		302	User Output	3-Gray
15A	Output	303	User Output	3-White
15B		304	User Output	4-Black
16A		305	User Output	4-Brown
16B		306	User Output	4-Red
17A		307	User Output	4-Orange
17B	+24 VDC		24 VDC	4-Yellow

Note: PRG=Program

- Please use pin No. 1B (PRG No. 1 input) through pin No.4A (PRG No. 20) for inputting program numbers.

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4.4 TEACHING/RS232PORT

D-Sub 25 DTE (Special x)
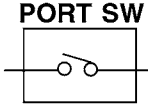
Pin No.	Signal Name	Pin No.	Signal Name
1	FG		
		14	NC
2	TXD		
		15	NC
3	RXD		
		16	NC
4	(RTS) Short Circuit (CTS)		
		17	NC
5		18	+ 6V Output ✽
6	DSR		
		19	ENABLE ✽
7	SG (GND)		
		20	DTR
8	NC		
		21	NC
9	NC		
		22	NC
10	NC		
		23	EMG-STOP ✽
11	NC		
		24	NC
12	EMG S2 ✽		
		25	GND ✽
13	EMG S1 ✽		

EMG SW (pins 12, 13)

ENABLE SW (pins 18, 19)

PORT SW

Note: Controller will E-stop if Teaching/RS232 port SW is ON with nothing connected.

✽ In the case of RS232C, never connect pin numbers 12, 13, 18, 19, 23 and 25 since these are signal wires for the teaching pendant.

✽ Pin numbers 4 and 5 are shorted.

✽ Since pin numbers 18 and 19 are connecting terminals for the ENABLE SW, it is necessary to connect these when the servo is ON.

✽ TEACHING/RS232 PORT SW

        PORT SW (ON) •••• The teaching pendant or RS232 communication lines can be used.
        PORT SW (OFF) •••• The connector function stops.
                 The pin numbers 12 and 13 EMG SW and the pin numbers 18 and 19 ENABLE SW are shorted internally.

4.5 PORT

MPG Connector

Pin No.	Signal Name	Wire Color
1	5V	Red
2	GND	Black
3	PG A	Gray
4	PG B	Yellow
5	PG Z	Green
6	PG $\overline{Z}$	Brown
7	FG	Clear
8	U	Red
9	V	White
10	W	Black

BK Connector

Pin No.	Signal Name
1	BK+
2	BK-

5. Dimensions

5.1 Plastic Type

Controller DS-S-C1

6. Installation Environment and Noise Measures
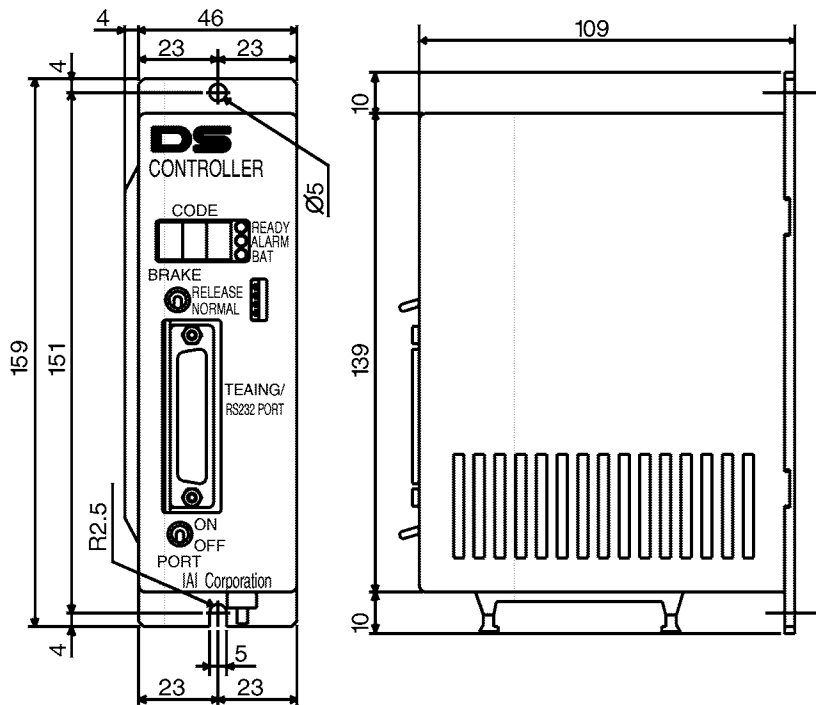
6.1 Installation Environment

(1) Do **NOT** block the air vents of your controller during installation and wiring.
(Not only will insufficient ventillation prevent optimal performance, but it may lead to a malfunction in the controller)

(2) Your DS Controller is NOT dust, water, or oil proof. Take steps to prevent foreign matter from getting into the controller air vents. Avoid using your controller in environments subject to contamination by dust, oil mist, or cutting oil.

(3) Do not expose your controller to direct sunlight or place it near a heat source.

(4) The controller should be used in an environment where the ambient temperature is 0°C ~4 0°C, humidity 85% or less (no condensation) and is free of corrosive or inflammable gases.

(5) Avoid external vibration, unnecessary impact, or excessive shocks to your controller.

(6) Take steps to shield all cables and wires from electromagnetic noise.

6.2 Power Source

Power supply is DC24V.

6.3 Noise Supression

This section explains noise suppression measures when using the controller.

(1) Wiring & Power

For grounding, please use a dedicated ground of Class D or better. The thickness of the cable should be 2.0~5.5mm² or larger.

Class 3 ground   Correct   Avoid this method
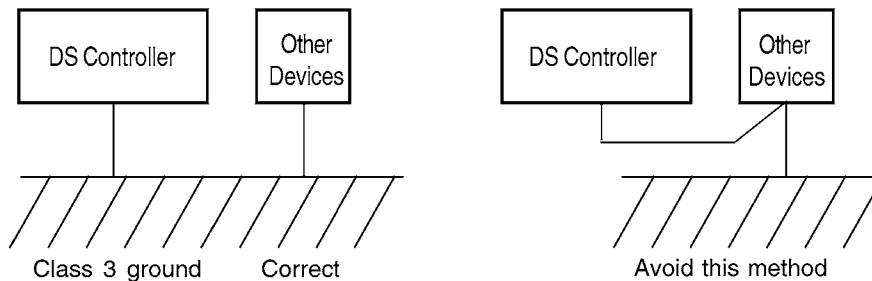
(2) Noise Source and Noise Suppression

Noise comes from many sources but the most immediate when building a system are solenoid valves, magnetic switches and relays. Noise from the devices can be prevented by taking the following steps:

AC solenoid valve · magnetic switch · relay

- Install a surge absorber parallel to the reactance load (solenoid and relay coils).
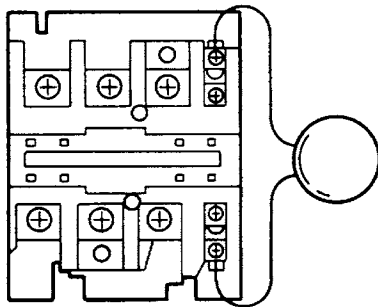
Note Use the shortest possible wiring between the surge absorber and the noise-creating device. Use of excessively long wiring will decrease the performance of the surge absorber.

- The most effective method is to install a surge absorber and surge killer in parallel to the reactance load (solenoid and relay coils). This will reduce noise in a wide band of frequencies.

Surge Absorber (Metal Oxide Varistor or Transzorb)

Surge Killer (Resistor Capacitor Snubber)
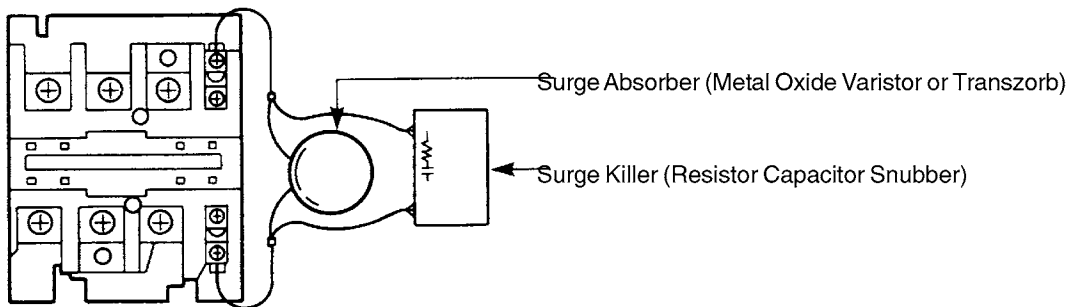
6. Installation Environment and Noise Measures

Install a diode in parallel with a coil • Diode Capacity is determined by the load capacity.
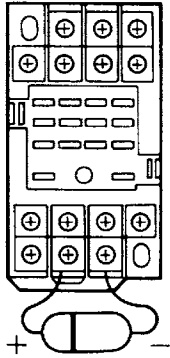
In the case of DC power, be careful not to exceed the diode polarity as this can lead to a breakdown of the diode, inside the controller or of the DC power.

Circuit Example

DS Controller

OUT

COM

VO3C

MY2
DC24V

+24V
AC 100V

0V

CR

SOL ENB221D-14A

0V

Solenoid Valve
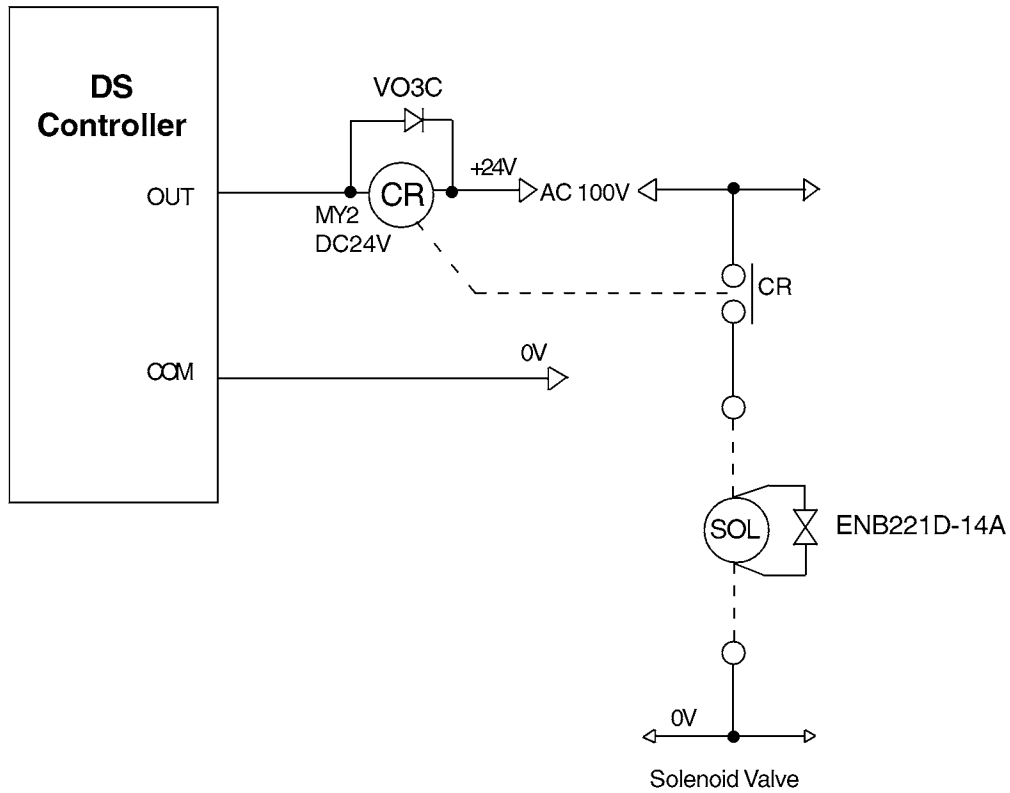
6.4 Heat Dissipation and Mounting

Air Flow According to Natural Convention
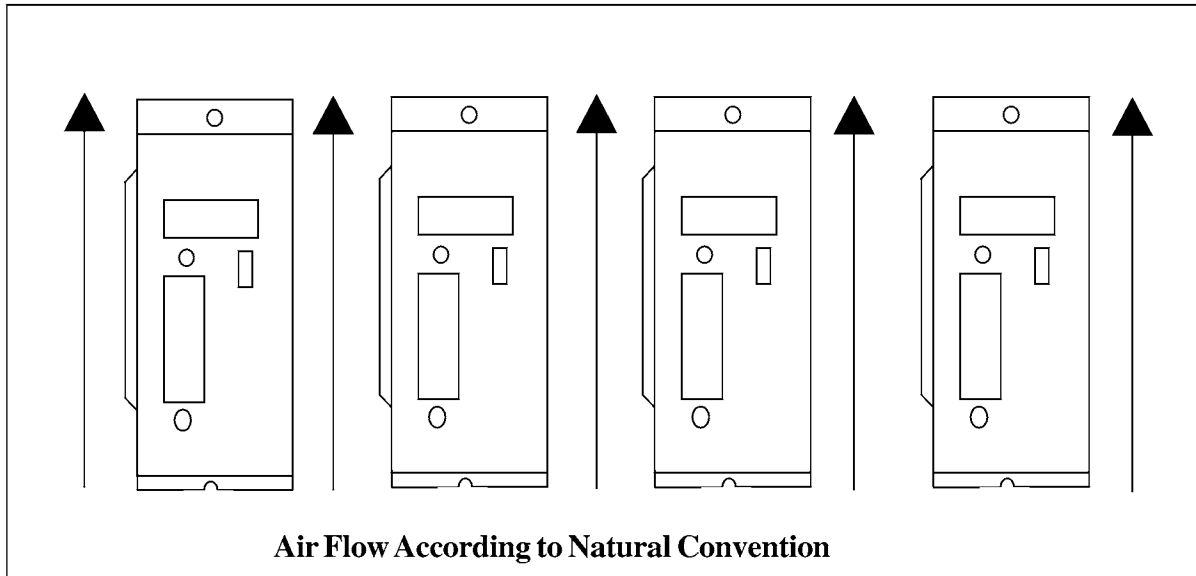
This controller is designed for assembling inside the control board. Since the heat dissipation for this controller is about 10~12W, cooling is done according to natural convention. As for the spacing between the controllers, whether or not it's a single or multiple controllers, please leave enough space so that controller mounting and removal may be done easily.

6..5 Power Supply to the Controller

(1) Please make sure that the power is OFF when wiring into to the I/O connector and main power.

(2) Please make sure that the N(OV) is common when setting the main power and I/O power separately.

(3) To maintain safety during emergency stop, when cutting off the main power of the controller, close/open just the 24V side.

7. Connections

7.1 Connection Method

Please make sure that all connectors are plugged in correctly and securely. Excluding the TEACING/RS232 PORT, do **NOT** plug or unplug the connectors while the power is ON!

Teaching Pendant
(Option)

DS TEACHING BOX

* You may not use other types of cables.

RS232 Cable* (5m) is included in the PC Software

DS
CONTROLL

CODE

READY
ALARM
BAT.

BRAKE
RELEA
NORMA

2m

TE
RS2

ON
OFF
PORT

Controller

IAI Corporation

Emergency Stop SW Box

PC Software
(Option)

5m

Servo Actuator

POWER EMG

N 24V

24V Power
Over 2A

EMG
SW

External Device

2m
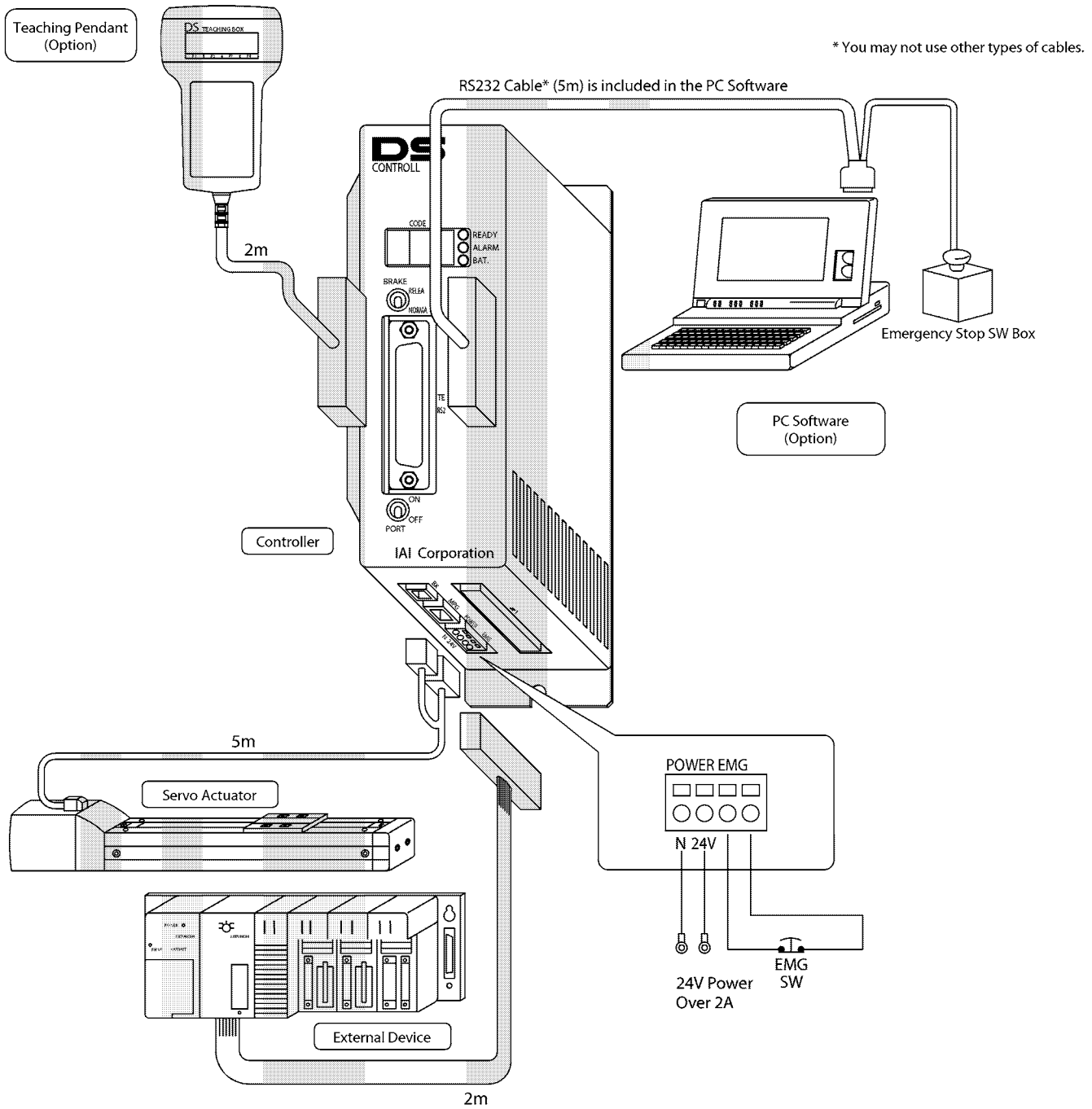
(1) Connect the motor · encoder cable and brake cables coming from the actuator to the connector.

(2) Connect the teaching pendant to the controller. After connecting, turn the PORT Switch ON.
   (If it is OFF, the teaching pendant will not work when the power is turned ON)

(3) Supply 24V power to the controller terminal block (power).

   a) Power Terminal Block, as shown on Page 6.
   b) External I/O device connector, between Pin No. 1A (24V, cable color brown) and Pin No. 17B.
      (OV cable color yellow).

(4) If the CODE display shows, 「ūꞂ-ᴎ→ ᏸ! ō → 5ᵣ→ → Ꞃᵣō → ᵣᴅꞌꞌ」 in sequence, then, the DS Controller is ready to operate.

   If the CODE display shows, 「 ᏸᵣ-ᴸ 」then, the EMERGENCY STOP input will release.

   a) Power 24V DC must be supplied to the external I/O.
   b) Input pin No. 5A for the external I/O should be logically OFF.

   If the CODE display is, 「 ᵣᏸ5 」 then, either a CPU reset has been input or I/O current is disconnected.

   The controller preparation is now complete.

   Note 1:   *The controller terminal block (EMG) is for connecting an emergency stop switch and is a b-type contact input (normally closed). When the unit is shipped, it is shorted and the emergency stop is released.*

   Note 2:   Do not recycle power quickly.

7.2 Diagram of External Device Connector

The following is an example of connections with an external device in the **program** mode.

NPN

Pin No.	Signal Name
1	N
2	24V
3	24V
4	EMG SW

EMG SW

I/O Connector (34 pin)

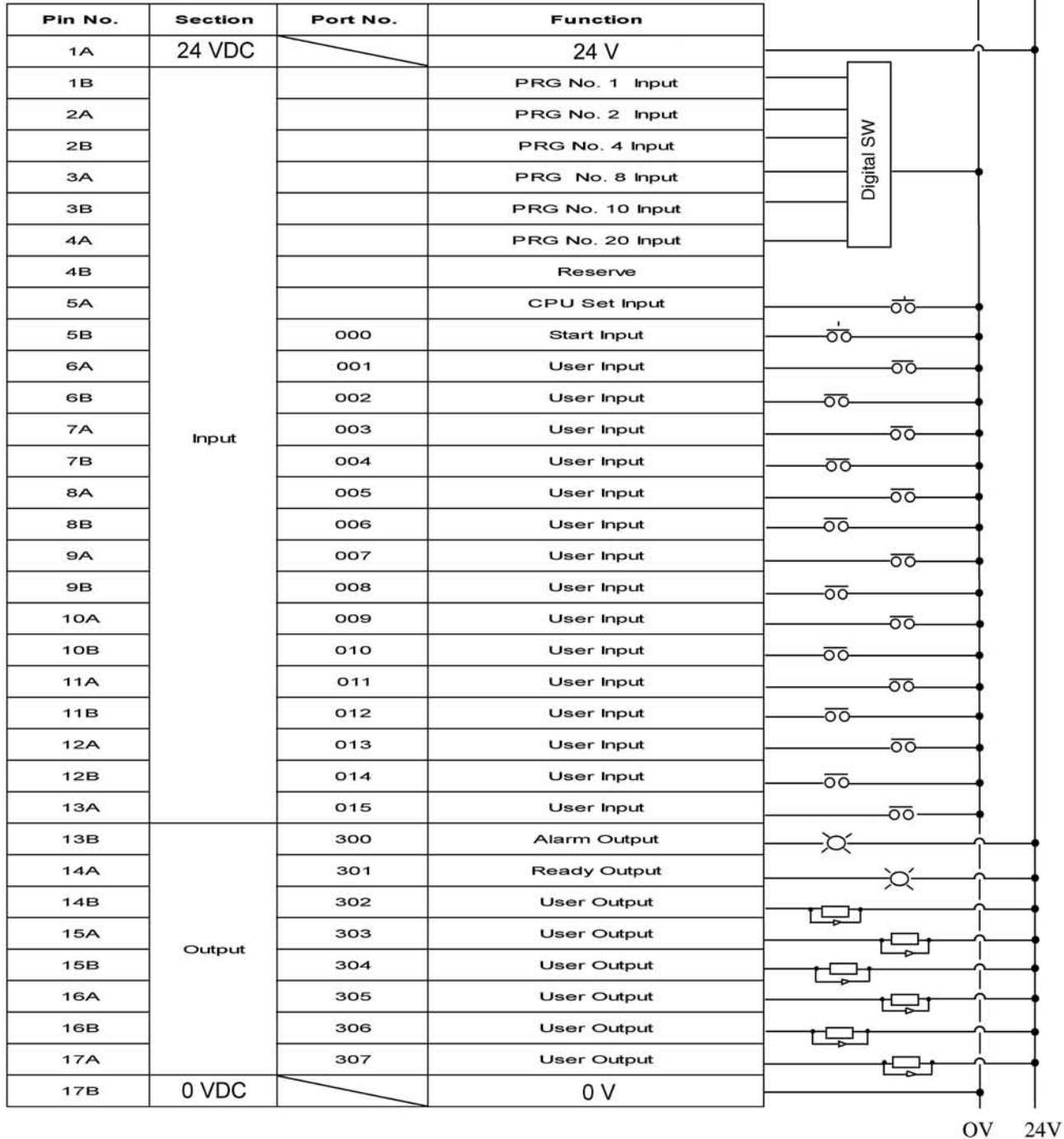| Pin No.	Section	Port No.	Function
1A	24 VDC		24 V
1B			PRG No. 1 Input
2A			PRG No. 2 Input
2B			PRG No. 4 Input
3A			PRG No. 8 Input
3B			PRG No. 10 Input
4A			PRG No. 20 Input
4B			Reserve
5A			CPU Set Input
5B		000	Start Input
6A		001	User Input
6B		002	User Input
7A	Input	003	User Input
7B		004	User Input
8A		005	User Input
8B		006	User Input
9A		007	User Input
9B		008	User Input
10A		009	User Input
10B		010	User Input
11A		011	User Input
11B		012	User Input
12A		013	User Input
12B		014	User Input
13A		015	User Input
13B		300	Alarm Output
14A		301	Ready Output
14B		302	User Output
15A	Output	303	User Output
15B		304	User Output
16A		305	User Output
16B		306	User Output
17A		307	User Output
17B	0 VDC		0 V

Digital SW

OV   24V

7.2 Diagram of External Device Connector

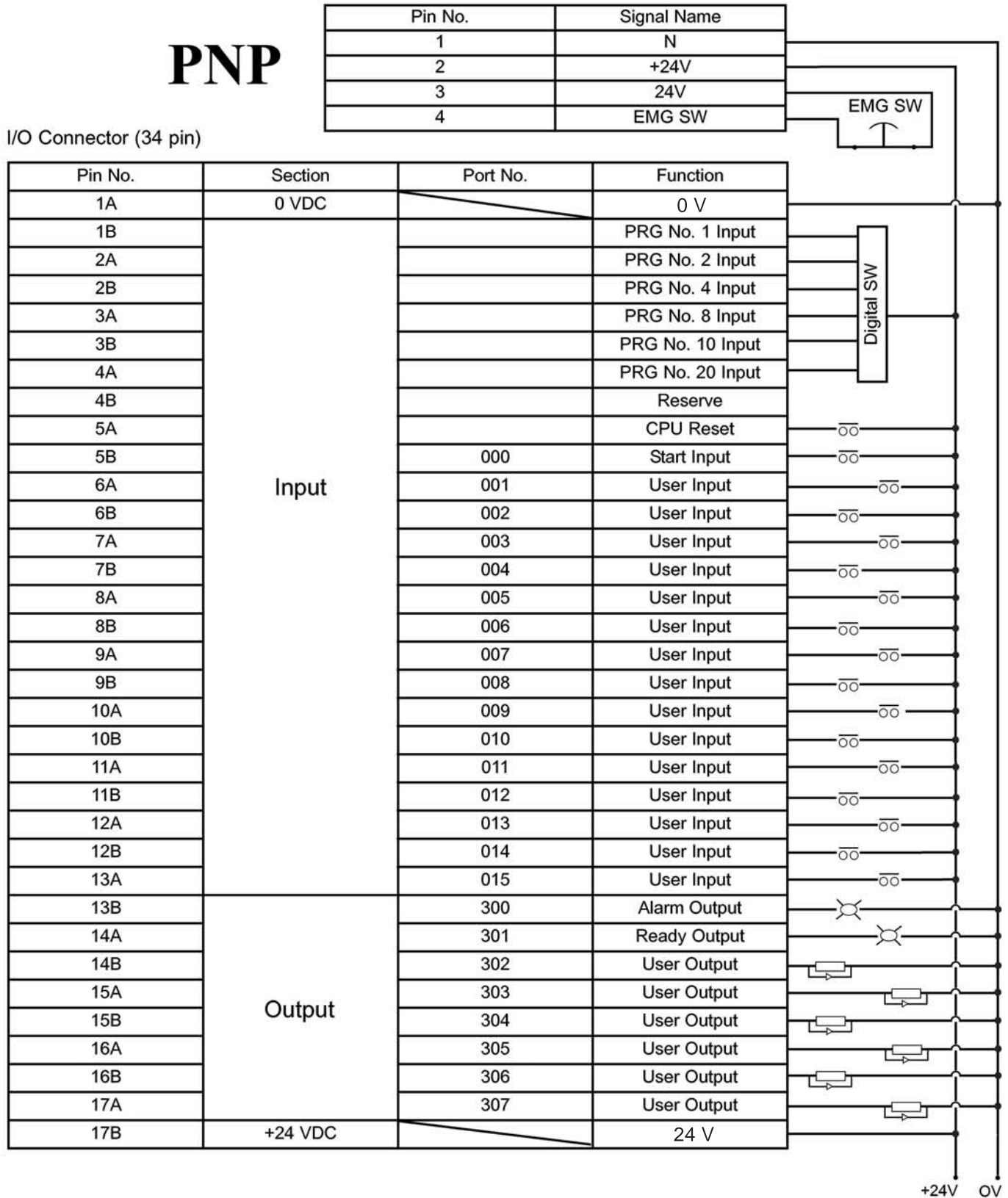The following is an example of connections with an external device in the program mode.

PNP

Pin No.	Signal Name
1	N
2	+24V
3	24V
4	EMG SW

EMG SW

I/O Connector (34 pin)

Pin No.	Section	Port No.	Function
1A	0 VDC		0 V
1B	Input		PRG No. 1 Input
2A			PRG No. 2 Input
2B			PRG No. 4 Input
3A			PRG No. 8 Input
3B			PRG No. 10 Input
4A			PRG No. 20 Input
4B			Reserve
5A			CPU Reset
5B		000	Start Input
6A		001	User Input
6B		002	User Input
7A		003	User Input
7B		004	User Input
8A		005	User Input
8B		006	User Input
9A		007	User Input
9B		008	User Input
10A		009	User Input
10B		010	User Input
11A		011	User Input
11B		012	User Input
12A		013	User Input
12B		014	User Input
13A		015	User Input
13B	Output	300	Alarm Output
14A		301	Ready Output
14B		302	User Output
15A		303	User Output
15B		304	User Output
16A		305	User Output
16B		306	User Output
17A		307	User Output
17B	+24 VDC		24 V

Digital SW

+24V   OV

The following is an example of connections with an external device in the **position** mode.

NPN

Pin No.	Signal Name
1	N
2	24V
3	24V
4	EMG SW

I/O Connector (34 pin)

Pin No.	Section	Port No.	Function
1A	24 VDC		24 V
1B			NC
2A			NC
2B			NC
3A			NC
3B			NC
4A			NC
4B			NC
5A			CPU Reset
5B		000	Start Input
6A		001	Hold Input
6B		002	NC
7A	Input	003	NC
7B		004	Position No. 1 Input
8A		005	Position No. 2 Input
8B		006	Position No. 4 Input
9A		007	Position No. 8 Input
9B		008	Position No. 10 Input
10A		009	Position No. 20 Input
10B		010	Position No. 40 Input
11A		011	Position No. 80 Input
11B		012	Position No. 100 Input
12A		013	Position No. 200 Input
12B		014	Position No. 400 Input
13A		015	NC
13B		300	Alarm Output
14A		301	Ready Output
14B		302	Position Complete Output
15A	Output	303	NC
15B		304	NC
16A		305	NC
16B		306	NC
17A		307	NC
17B	0 VDC		0 V

OV   24V

The following is an example of connections with an external device in the **position** mode.

PNP

Pin No.	Signal Name
1	N
2	24V
3	24V
4	EMG SW

I/O Connector (34 pin)

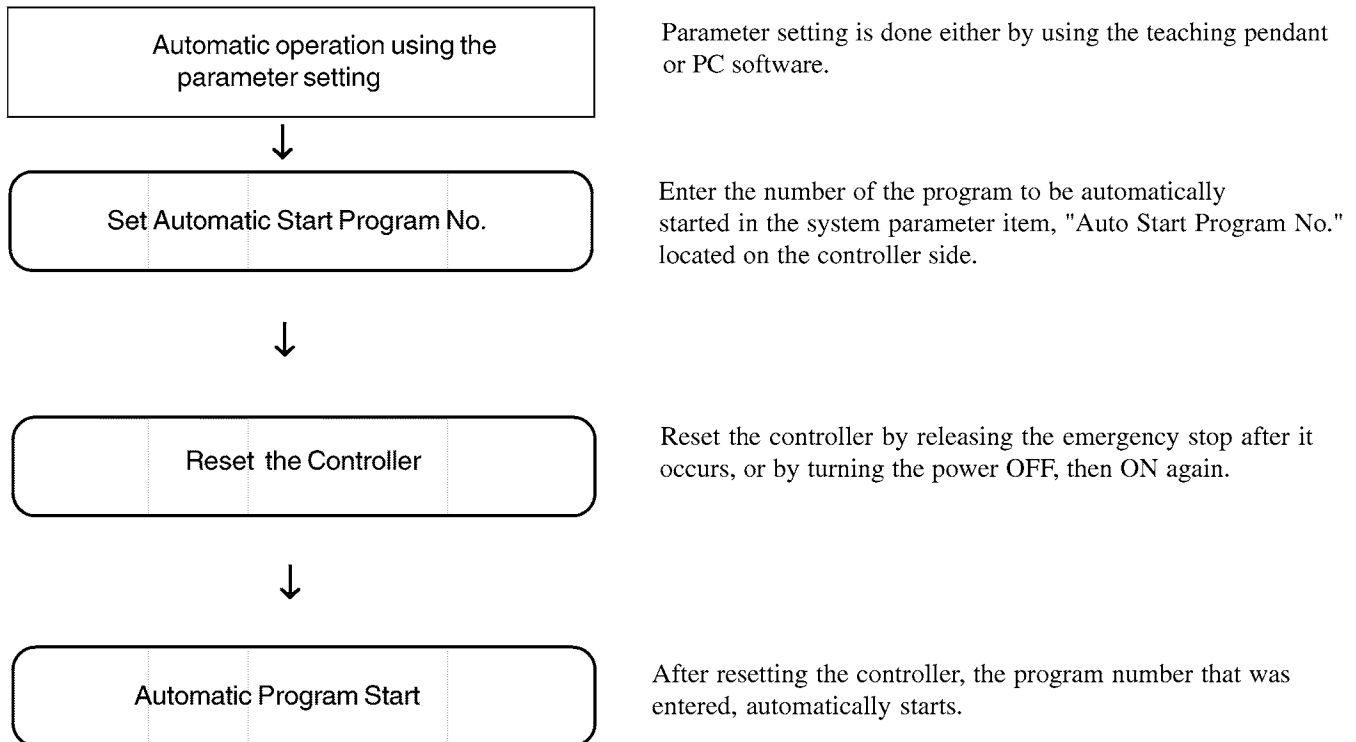| Pin No.	Section	Port No.	Function
1A	0 VDC		0 V
1B			NC
2A			NC
2B			NC
3A			NC
3B			NC
4A			NC
4B			NC
5A			CPU Reset
5B		000	Start Input
6A		001	Hold Input
6B		002	NC
7A	Input	003	NC
7B		004	Position No. 1 Input
8A		005	Position No. 2 Input
8B		006	Position No. 4 Input
9A		007	Position No. 8 Input
9B		008	Position No. 10 Input
10A		009	Position No. 20 Input
10B		010	Position No. 40 Input
11A		011	Position No. 80 Input
11B		012	Position No. 100 Input
12A		013	Position No. 200 Input
12B		014	Position No. 400 Input
13A		015	NC
13B		300	Alarm Output
14A		301	Ready Output
14B		302	Position Complete Output
15A	Output	303	NC
15B		304	NC
16A		305	NC
16B		306	NC
17A		307	NC
17B	24 VDC		24 V

OV   24V
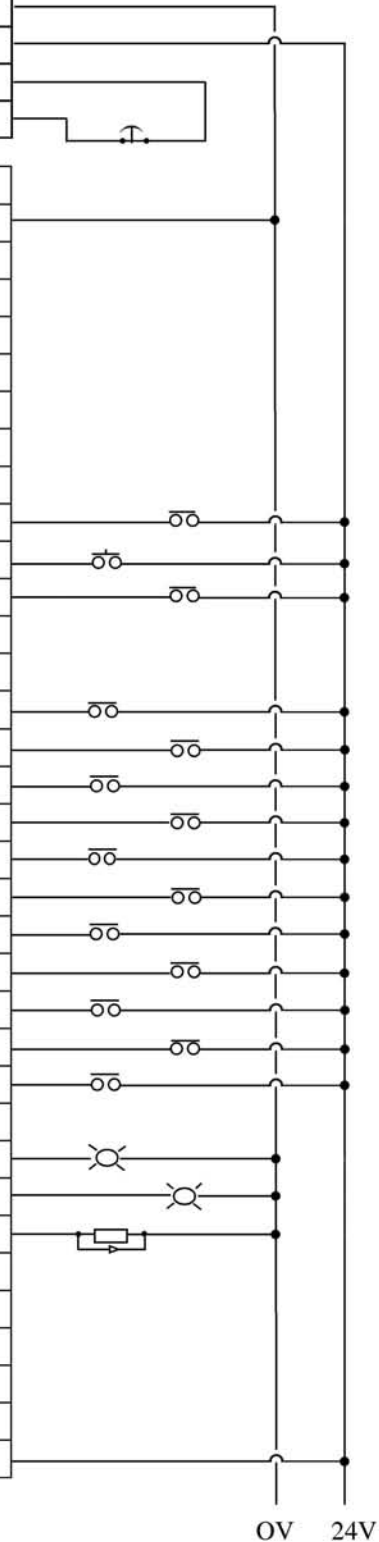
There are two ways to move the actuator. One is the program mode where a program in the memory drives the actuator, and the other is the positioning mode where the actuator is moved between recorded positions.

8.1 Program Mode

There are two methods of operating the actuator in the program mode. The first is "operation from a teaching pendant" and "operation using the PC software" which are used for simple operating checks (during program debugging on a trial run). The second is "automatic operation based on parameter settings" and "operation based on selection of external signals" which are used in general application examples on site. The following section explains the second method.
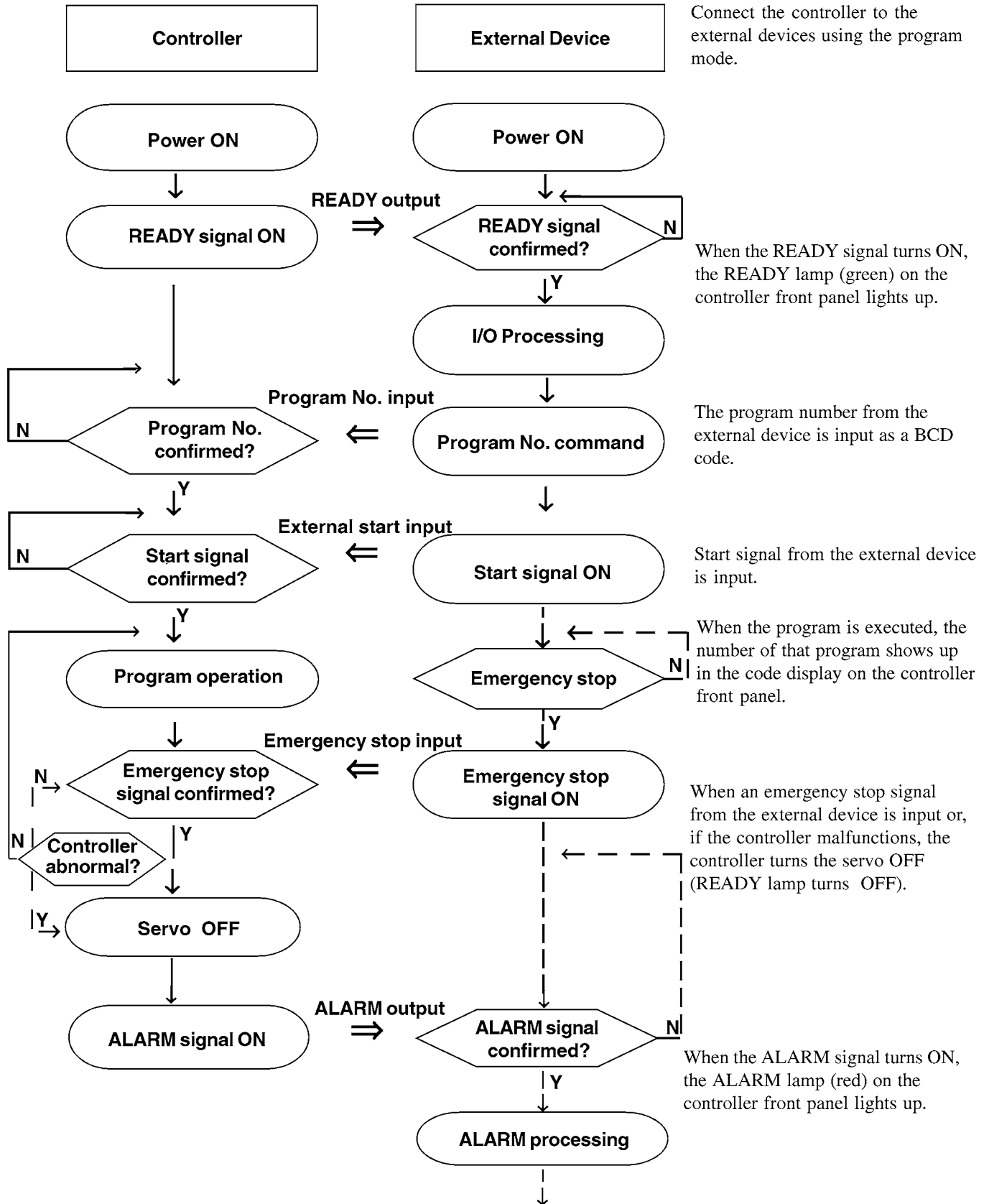
| Automatic operation using the parameter setting | Parameter setting is done either by using the teaching pendant or PC software. |

↓

| Set Automatic Start Program No. | Enter the number of the program to be automatically started in the system parameter item, "Auto Start Program No." located on the controller side. |

↓

| Reset the Controller | Reset the controller by releasing the emergency stop after it occurs, or by turning the power OFF, then ON again. |

↓

| Automatic Program Start | After resetting the controller, the program number that was entered, automatically starts. |

Precautions when using an auto start program:

The servo actuator will start automatically, immediately after the controller is reset which may startle the operator. To ensure safety, always use an interlock at the start of a program, such as having the actuator operate after receiving a confirmation signal. To start simultaneous multiple-programming, set all other programs into EXPG command, placing them ahead of the main auto program. As always, please take safety precautions when using an auto start program.

8. Moving the Actuator

DS

Controller

Operation Based on the External Start Signal Selection

(1) Program Operation

Controller	External Device

Connect the controller to the external devices using the program mode.

Power ON → **Power ON**

READY output ⇒

READY signal ON → **READY signal confirmed?** — N / Y

When the READY signal turns ON, the READY lamp (green) on the controller front panel lights up.

I/O Processing

Program No. input

Program No. confirmed? — N / Y ⇐ **Program No. command**

The program number from the external device is input as a BCD code.

External start input

Start signal confirmed? — N / Y ⇐ **Start signal ON**

Start signal from the external device is input.

Program operation / **Emergency stop** — N / Y

When the program is executed, the number of that program shows up in the code display on the controller front panel.

Emergency stop input

Emergency stop signal confirmed? — N / Y ⇐ **Emergency stop signal ON**

Controller abnormal? — N / Y

When an emergency stop signal from the external device is input or, if the controller malfunctions, the controller turns the servo OFF (READY lamp turns OFF).

Servo OFF

ALARM output ⇒

ALARM signal ON → **ALARM signal confirmed?** — N / Y

When the ALARM signal turns ON, the ALARM lamp (red) on the controller front panel lights up.

ALARM processing

8. Moving the Actuator

DS
Controller

(2) Timing of Each Signal

When exchanging signals with an external device, timing becomes critical. See the timing charts that follow:

Timing of Each Signal

Ready Output

Program No. Input

Outer Start Input

T1: The time from when the READY output turns ON until the external start signal can be input.

T1 = ≈50ms or more

T2: The time from the program number is input until the external start signal can be input.

T2 = ≈30ms or more

T3: The time from the input of the external start signal.

T3 = ≈30ms or more

8. Moving the Actuator
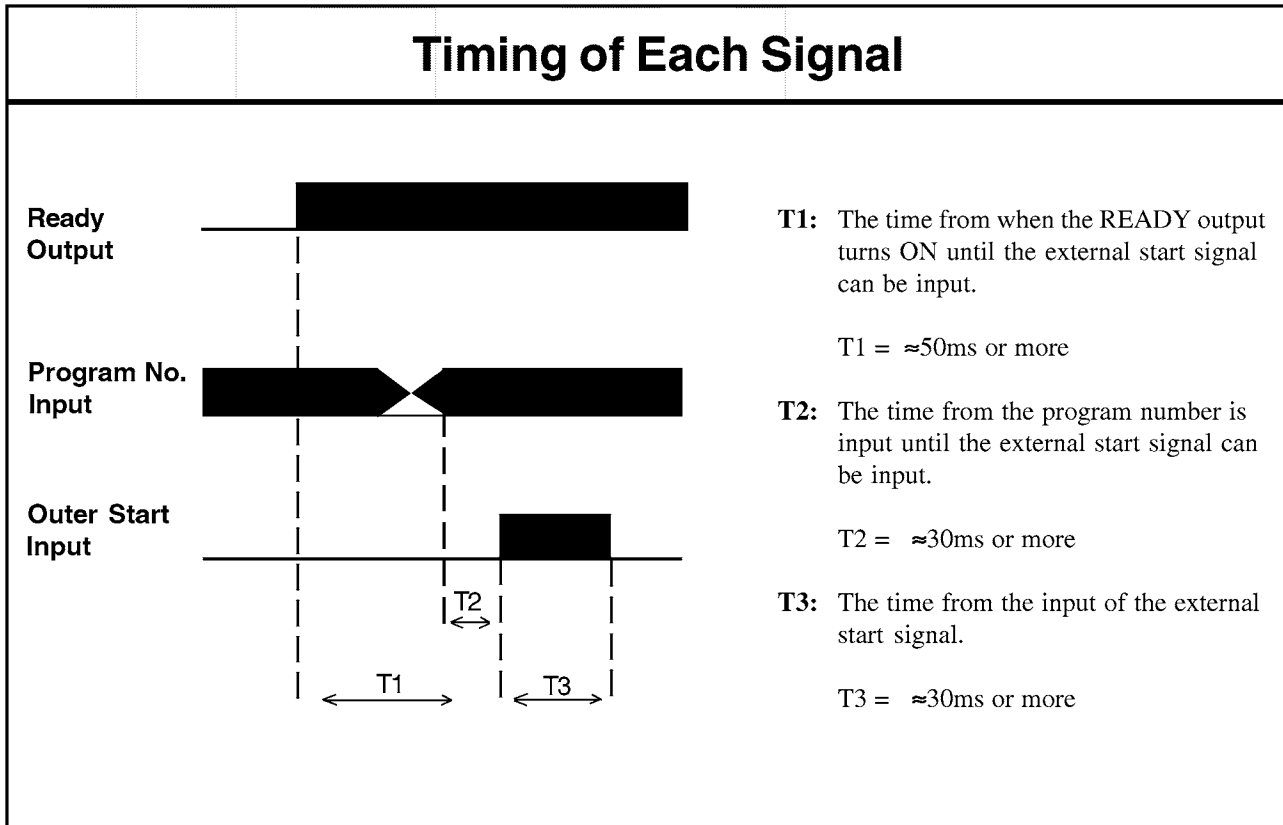
8.2 Operation Using the Positioning Mode

Operation Based on the External Start Signal Selection

(1) Homing

Controller		External Device
↓		↓
Power ON		Power ON

READY output

READY signal ON	⟹	READY signal confirmed?	N

The positioning mode consists of "Operation from the teaching pendant," "Operation using the PC software," and "Operation based on the external start signal selection." This section explains the last method.

Y ↓

Set all Position No. command to OFF (0).

Once the READY signal is ON, the READY lamp (green) on the controller front panel lights up.

External start input

Start signal confirmed?	⟸	Start signal ON

N

Homing Start

Homing is performed when all position number inputs from the external device are OFF ("0") and the start signal is input.

Homing Complete

After homing is completed, the positioning complete signal is output and the controller goes into a wait stage.

Positioning Complete Signal

Position Complete Signal ON	⟹	ALARM signal confirmed?	N

Y

NOTE:
By homing, for later operations, commands from the external device have priority. When switching over to an operation from the teaching pendant or using a PC software, perform homing after cutting the power once.

(2) Positioning

Controller	External Device

Power ON — READY output ⟹ — Power ON

READY signal ON — READY signal confirmed? **N**

↓Y

I/O processing

Position No. input ⟸ Position No. command

N — Position No. confirmed?

↓Y

N — Start signal confirmed?

↓Y

Y — Homing complete? — External operation input

↓N

Homing Complete

Move to command position

Move complete — Start signal ON

Positioning complete signal ON — Position complete output ⟹ Positioning complete confirmed? **N**

↓Y

I/O processing

Emergency stop switch ON? ←

↓Y

N — Emergency stop signal confirmed? — Emergency stop signal ON **N**

↓Y

Controller abnormal?

N / **Y**

Servo OFF — ALARM signal confirmed? **N**

↓Y

ALARM signal ON — ALARM output ⟹ ALARM processing

Side notes:

When the READY signal turns ON, the READY lamp (green) on the controller front panel lights up.

The program number from the external device is input as a BCD code.

Note 1:
When a position number greater than 501 is designated, the signal is disregarded.

Note 2:
When there is no data in the designated position number, the signal is disregarded.

Note 3:
If homing has not been performed and a position is designated and a start signal input, the actuator will home first and then, move to the position.

When the move is completed, a positioning complete signal is output.

When an emergency stop signal from the external device is input or, if the controller malfunctions, the controller turns the servo OFF (READY lamp turns OFF).

When the ALARM signal turns ON, the ALARM lamp (red) on the controller front panel lights up.

(3) Timing of Signals

When exchanging signals with an external device, timing becomes critical. See the timing charts that follow:
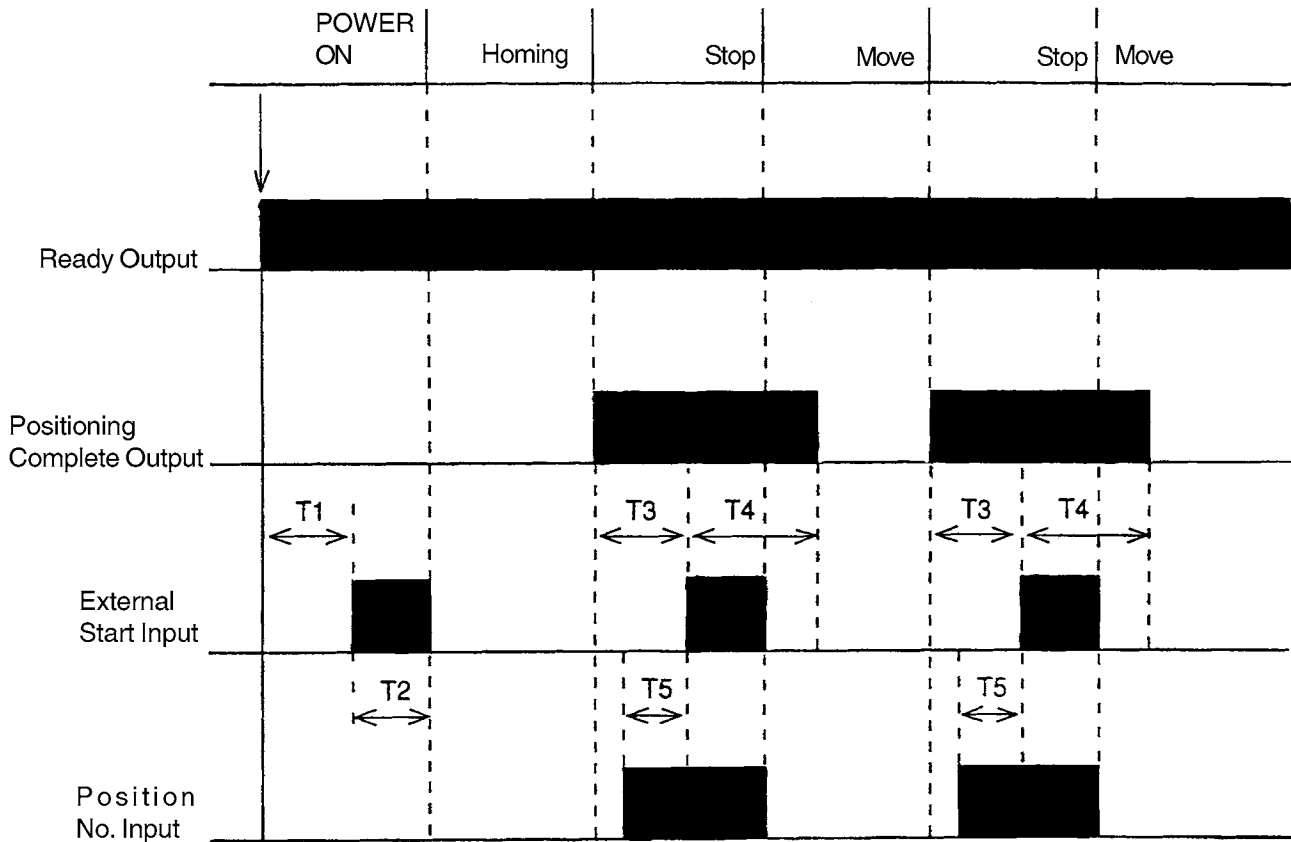
T1: The time from the READY signal ON to homing start input.

T2: External start input (over 30msec).

T3: The time from the the previous positioning complete output ON to when the external start signal input can be entered (50msec).

T4: The time it takes from external start input ON to positioning complete output OFF.

T5: The time it takes to input from position number input to external start.

* The interchange timing of each position number input is effective after receiving external start input.

* **Alarm Output**

During emergency stop input, and during CPU reset input, outputs when the protective function of the controller operates. Upon releasing the input of the emergency stop, or by releasing the input of CPU reset, the controller will restart.

* **Position Number Input**

Input is possible up to 500 positions using the BCD input.
(Example): No.100+No.20+No.4+No.1= Position No. 125

(4) Timing for Position No. Switching

Position No.
Input

External Start
Input

| A

| B

A: Position 1 execution start

B: Position 2 execution start

Positioning Complete
Output
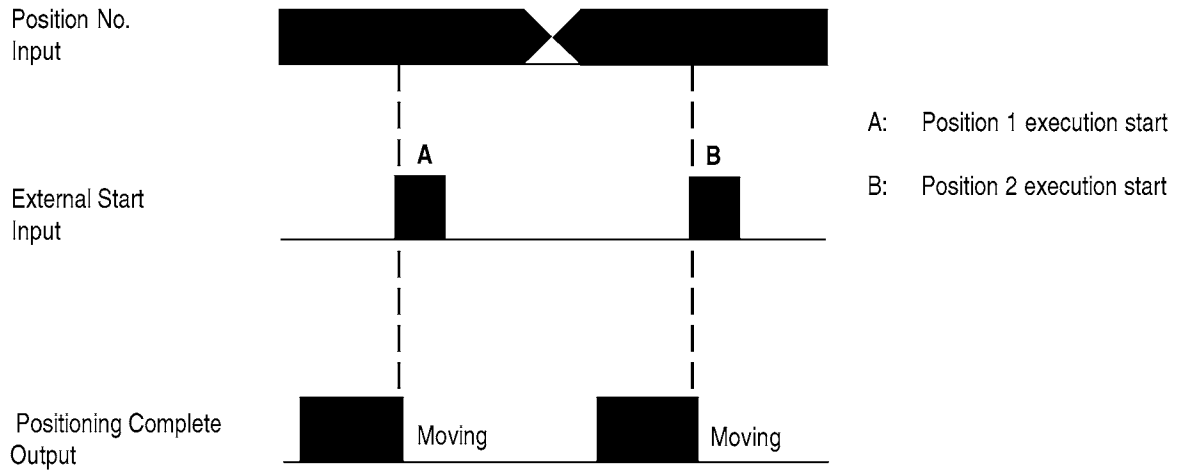
Moving

Moving

The timing for position number shifting is the time from after the position presently being executed is completed until the next external start input (start signal) can be input.

8. Moving the Actuator

(5) Timing of Motion Using a Hold Signal

| Position Input |
| Actuator movement |

Slowing to a stop   Movement start
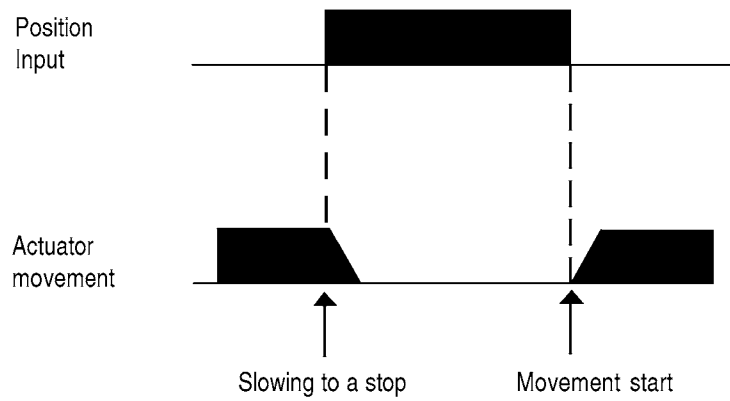
The servo actuator is slowed to a stop by turning the hold signal ON while the actuator is moving and starts up again by turning the hold signal OFF.

8. Moving the Actuator

(6) Movement in Random Sequence

To move the actuator in a random order, select the position number and input external start signal for each movement.

Position No.	Acceleration	Velocity	Position
1	0.3	100	50.000
2	0.3	100	200.000
3	0.3	200	100.000
4	0.3	200	250.000
5	X.X	XXX	XXX.XXX
6	0.3	300	150.000
7	0.3	300	150.000
8	X.X	XXX	XXX.XXX
9	X.X	XXX	XXX.XXX
. . .	. . .	. . .	. . .
492	X.X	XXX	XXX.XXX
493	X.X	XXX	XXX.XXX
494	0.3	200	150.000
495	0.3	200	380.000
496	0.3	200	400.000
497	0.3	200	200.000
498	0.3	100	250.000
499	X.X	XXX	XXX.XXX
500	X.X	XXX	XXX.XXX

Select Position Number

External Start Input

Movement Complete
Positioning Complete ON
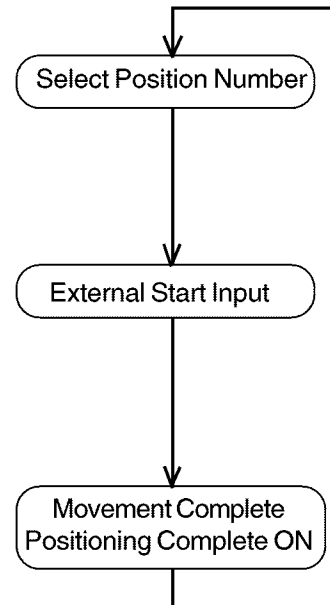
9. Error Code list

Controller

When an error occurs, the alarm LED (red color) on the controller's front side will light up. At the same time, the I/O alarm output will turn ON and the READY output will turn OFF.

Error Code List

Error Code	Error Name	Explanation
A1	External Interrupt Error	1. Motor over current 2. Over regenerative current (over negative load) 3. Driver overheat
A2	Motor Overload Error	Mechanical overload of motor
A3	Deviation Error	Motor is unable to perform properly due to mechanical overload
A4	Software Limit Error	Exceeded software limit
A5	Pole Sense Error	Unable to sense pole
B0	No Program Error	Program does not exist
B1	Program Execution Error	Execution of a currently executing program
B2	Program Over Error	Number of tasks exceeds those set as parameters
B3	Double Subroutine Number Error	Two or more of the same subroutine number are used
B4	Double Tag Number Error	Two or more of the same tag number are used
B5	Undefined Subroutine Number	Subroutine number is not defined
B6	Undefined Tag Number	Tag number is not defined
B7	Subroutine Pair Error	BGSR and EDSR are not the same quantity
B8	Step 1 BGSR Error	Step 1 is a BGSR Error
B9	DO, EDDO Pair Error	DO and EDDO are not the same quantity
BA	DO Nest Over Error	DO was used more than 15 times
BB	IF Pair Error	IF and ELSE are not the same quantity
BC	ELSE Error	ELSE was used in a place which was not between IF and EDIF
C0	No Homing Error	Homing was not performed before running actuators
C1	Point Data Error	Attempt has been made to executed unregistered point data
C2	Axis Double Execution Error	Move command given to axis currently moving
C3	Software Limit Error	Software limit exceeded in program
CE	S Motion Percent Error	S motion percent ws set outside the range of 0 ~ 50%
D0	Acceleration Error	Acceleration exceeds limits
D1	No Velocity Error	Velocity has not been set
D2	Override Error	Override was set outside the range of 1 ~ 100%
D4	Axis Pattern Error	Axis pattern was not set correctly. Displays D4 also for C1 (point data error)
D5	Axis Number Error	Axis number was set outside the range of 1 ~ 8
D7	Program Number Error	Program number exceeds the limit
D8	Position Number Error	Position number exceeds the limit
D9	Point Number Error	Negative number was input in the point number
DA	Flag Number Error	Flag is not assigned correctly
DB	Variable Error	Variable is not assigned correctly
DC	Digits Over Error	Assigned number exceeds 8 digits (binary 32 bits)
DD	Division (0) Error	Result of the division is "0"
DF	Task Level Error	Task level was set outside of the range of 1 ~ 5
E0	Undefined Command Error	Attempted to execute undefined command
E1	Subroutine Over Nesting Error	Nesting of more than 15 subroutines
E2	Subroutine Under Nesting Error	EXSR and EDSR are not making a pair
E3	Controlling Column Error	Use of condition is not correct
EG	EMG Error	Emergency (Emergency Stop) was asserted
F0	Interrupt Error	Motor CPU and Interrupt management do not match

Note: An "E" appears at the head of the error code, followed by 3 digits.

10. Maintenance

DS
Controller

To ensure safe and trouble-free operation of your system, a regular maintenance and inspection program should be implemented. Be sure to turn OFF the power before initiating any maintenance or inspection work. An inspection is recommended at least once every 6 to 12 months. However, depending on the environment, a more frequent inspection schedule may be advisable.

(1) Inspection Guidelines

- Check and make sure that the power supply to your controller is within the specification range (DC24V±10%).

- Check the controller vents and clean any accumulated dirt or dust.

- Check the controller cable (controller → axis) and make sure that there are no loose screws or disconnections.

- Check for loose controller mounting screws. Tighten if necessary.

- Check each cable (axis cables, general I/O cables, system I/O cables, power supply cable).
  Check for loose connections, damage, or excessive wear. Replace if necessary.

(2) Recommended Spare Parts

Should a breakdown occur, even if it is discovered early, repairs can not be done if there are no spare parts.
It is advisable to keep a small supply of spare parts, especially for those parts that wear down with use.
The following spare parts are recommended:

- Cables

- Batteries
  (Ni-Cd batteries have a general shelf life of about 6 years but this varies depending on use conditions and environment)

(3) Memory Backup

When the controller is fully charged, the backup memory is guaranteed for 3 months. In actuality, the backup memory is not erased for 6-8 months but if the controller is to be left for a long period (more than 3 months) without having current run through it, please take precautions to save your program, position data, and parameters. To fully charge the controller if it does not contain any data, you will need to leave the controller with the power ON for 3 days. If the memory is erased, the system's preset parameters will be set but the actuator will not run properly in this condition.

Page 38

1.1 Part Names
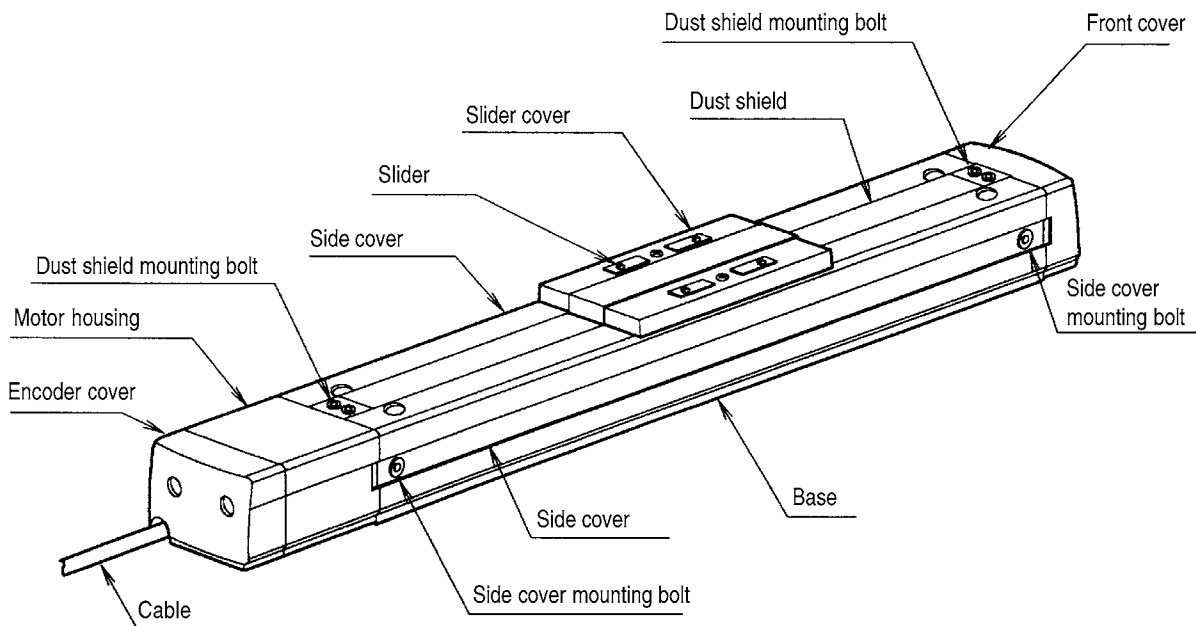
Please note the following when handling the actuator.
• To handle the actuator, support it from underneath or grasp the area around the side cover mounting bolts.
• Do not place excessive load on the cable.
• Do not place heavy loads on the encoder cover, slider cover or other plastic parts.

1.2 Operating Environment

Install the actuator in a place where the operator can work without protective gear. See the table below for specific operating environment criteria.

No.	Operating Conditions
1	Ambient temperature 0~40°C
2	Relative humidity 35~90%
3	Avoid direct sunlight
4	Avoid exposure to water, cutting oil and other liquids
5	Avoid exposure to corrosive or combustible gas
6	Minimal dust
7	Do not subject to vibrations or shock greater than 0.5G
8	Avoid strong electromagnetic waves, ultraviolet rays and radiation

2. Installation

2.1 Installing the Actuator
(SA4, SA5 Type)

Mount the actuator to a machined surface or one of comparable precision. Install the actuator as shown below.
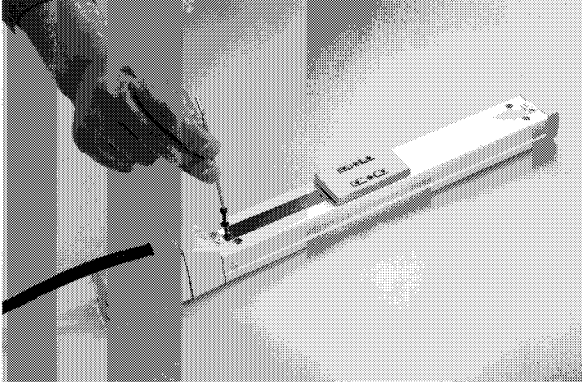
The actuator base and lower surface are parallel to the guide. When travelling precision is required, use this surface as a reference to mount the actuator. For basic mounting, use the four mounting holes located on the upper surface of the actuator.

The reamer holes on the back side for positioning pin may be used as needed.

Machine Type	When opposite material is copper	When opposite material is aluminum
DS-SA4	M3X35	
DS-SA5	M4X40	M4X45

For mounting bolts, depending on the material of the foundation side, use the bolt with hexagonal holes as indicated below.

Machine Type	Reamer Hole	Depth
DS-SA4	φ3H10	Under 5mm
DS-SA5	φ4H10	Under 5mm
DS-SA6	φ4H10	Under 5mm
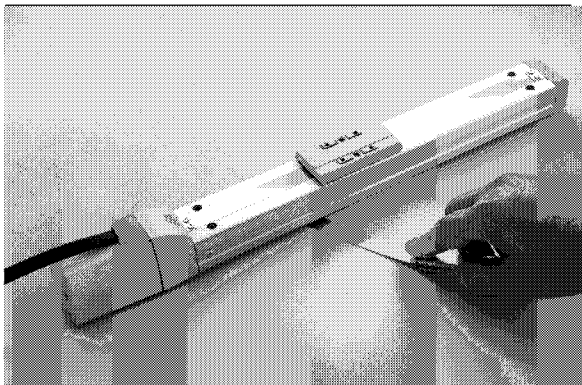
Rest the actuator on the mounting surface and check to see that a 0.1mm thickness gauge cannot be inserted at the four mounting holes. If the bolts go in a steel surface with tapped holes, then use hexagon sockets with length shown in ① and if the surface is a light metal, use the length in ②.

2. Installation

(S6 Type)
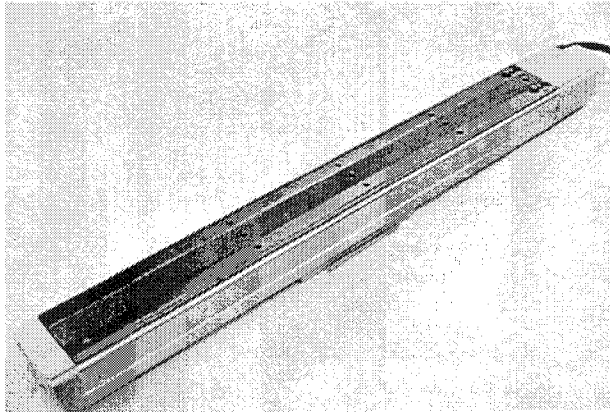
On the base of the actuator, you can use the two mounting holes at the motor end and the tapped holes on the underside of the base but please make note of the following.

Back Side Mounting Tap Holes

Machine Type	Bolt Size	Tap Depth	Engagement depth
DS-SA4	M3	5mm	Over 3mm Under 5mm
DS-SA5	M4	7mm	Over 4mm Under 7mm
DS-SA6	M5	9mm	Over 5mm Under 9mm

Suggested Tightening Torque

Bolt Size	When the bolt surface is steel	When the bolt surface is aluminum
M3	1.6N • m (0.16kgf • m)	1.1N • m (0.11kgf • m)
M4	3.7N • m (0.38kgf • m)	2.3N • m (0.23kgf • m)
M5	7.5N • m (0.77kgf • m)	4.3N • m (0.44kgf • m)

2.2 Attaching the Workpiece
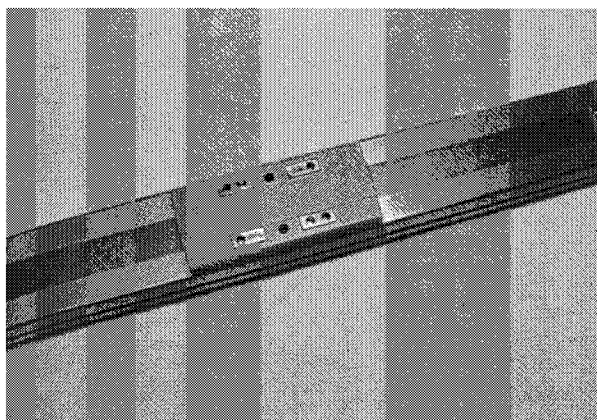
Use the four tapped holes at the top of the slider to attach the workpiece.

To attach the workpiece, select bolts that will have the engagement lengths indicated in the table below and adjust the length of the washer if necessary. Ma ke sure that the workpiece does not touch the slider cover , and note the following:

Machine Type	Slider Mounting Area	Engagement Depth
DS-SA4	M3 depth 7mm	Over 3mm Under 7mm
DS-SA5	M4 depth 9mm	Over 4mm Under 9mm
DS-SA6	M5 depth 9mm	Over 5mm Under 9mm

Bolt Size	When the bolt surface is steel	When the bolt surface is aluminum
M3	1.6N • m (0.16kgf • m)	1.1N • m (0.11kgf • m)
M4	3.7N • m (0.38kgf • m)	2.3N • m (0.23kgf • m)
M5	7.5N • m (0.77kgf • m)	4.3N • m (0.44kgf • m)

2.3 Wiring Cable

The actuator cable is resistant to bending fatigue but it is not robot cable. Avoid housing the cable in movable wire duct with a small radius. In an application where the cable cannot be anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable hose as large radial wire duct to limit the load on the cable.

2.4 Adjusting Home Position

After installing the actuator, perform the homing operation to confirm home. Home direction can be changed with the parameters. If you allow a large offset amount, the moving range is limited by that amount. If you specify an offset amount greater than 1mm, you will have to reset the software limit and reduce the stroke by that amount.
Note: To change the home offset amount requires the optional PC software.

2.5 Load on the Actuator

Do not exceed the load shown in the specification table as indicated in Chapter 4 of this manual. Please note in particular the slider moment and allowable overhang length and the load weight.

The base of the actuator warps easily when it is used with an overhang so please keep the Ma and Mc moments under 1/2 of the rated value.
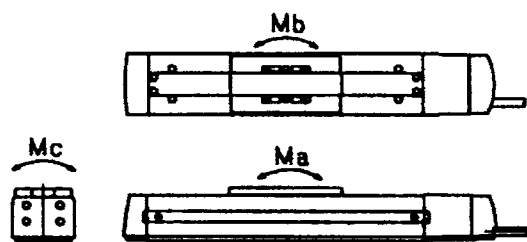
3. Maintenance

3.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

Maintenance Checkpoints

	Visual inspection	Check for loose dust shield	Check interior	Lubrication
Start operation	O			
After 1 month of operation	O	O	O	
After 6 months of operation	O	O	O	O
Semiannually therafter	O	O		
Annually thereafter	O	O	O	O

Note 1: The above schedule assumes running time is 8 hours per day. When running time is high such as continuous day and night operation, shorten the maintenance intervals as required.

Note 2: The motor housing supports the ball screw, so please do not disassemble. The end cover supports the ball screw so please do not remove it. Do not remove the encoder cover as this contains precision equipment.

3.2 Cleaning the Exterior

1. Wipe off dirt with a soft cloth.
2. Wipe the dust shield gently so that it does not bend.
3. Do not use strong compressed air on the actuator as this may force dust into the crevices.
4. Do not use petroleum-based solvents on plastic parts or painted surfaces.
5. If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth and wipe lightly.

3. Maintenance

3.3 Inspecting the Interior

(1) Removing the cover
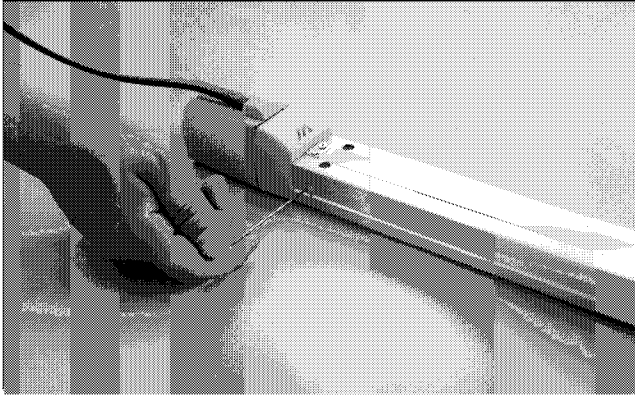
Turn the power OFF. Using a 1.5mm hexagonal wrench, remove the cover as shown in the picture and visually inspect the interior.

(2) Visual check of the interior
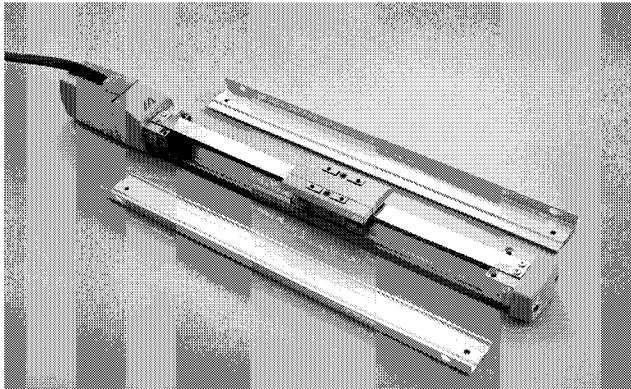
Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the travelling surface appears shiny.

3.4 Lubrication

When the grease contains dust, becomes dull in color or begins to wear away through extended use, lubricate the actuator using the procedure below.
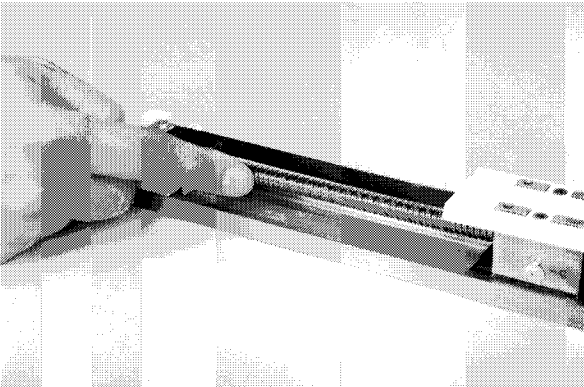
(1) How to lubricate

To lubricate the ballscrew, apply grease to the screw with your finger then spread it out by moving the slider back and forth.
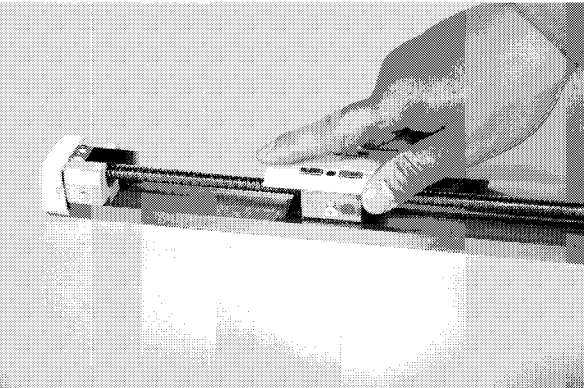
To lubricate the slider, apply grease to the underside of the slider with your finger, then spread it out by moving the slider back and forth.

(2) What grease to use

IAI uses lithium grease No. 2. There are other brands of grease commerciallly available for the ballscrew and slider. These are acceptable as long as they are a lithium-type grease.

Note: Never use a fluorine-based grease. Mixing this with a lithium grease produces a chemical reaction which damages the actuator.

(3) Replacing the cover
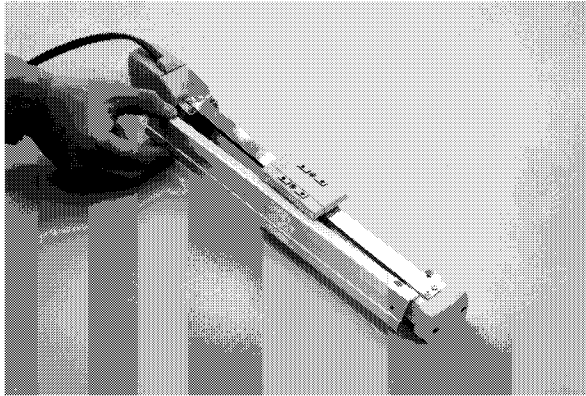
Inside the slider cover is a spring that allows it to follow along the dust shield. Lift the shield up from the bottom and attach the side cover.
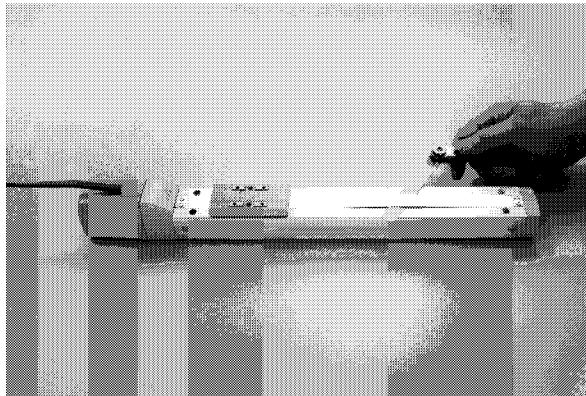
If the shield is not straight, move the slider slightly to straighten out the shield. Or, lift the shield gently to straighten it out. Tighten the bolts on the side cover. The torque should be for a small plus screw (0.6Nm, 6 kgcm).

After completing the inspection, replace the cover.

3. Maintenance

3.5 Checking the Dust Shield

The dust shield is made from stainless steel and is adjusted at the time of shipment. If the shield slackens with use, make the following adjustments.
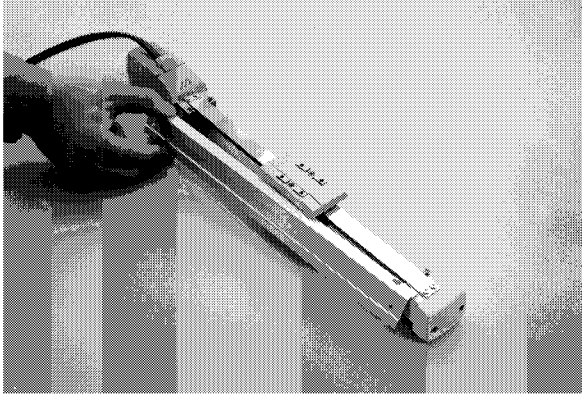
Move the slider to the end. Loosen the screw at the front end with a 1.5mm wrench.
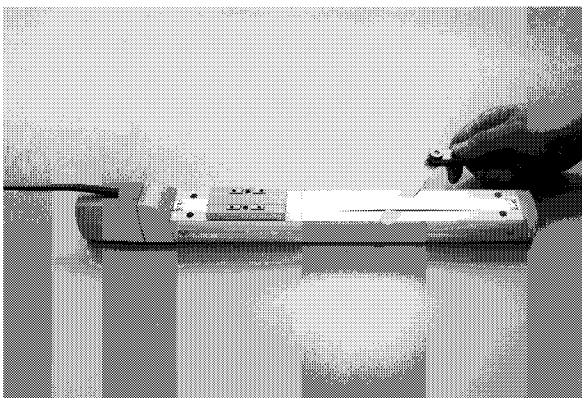
Pull the shield just enough to make it taut. Move the slider manually to make sure it moves easily. If there is resistance in the movement, there is too much tension in the shield.

1. General

1.1 Part Names

Motor bracket

Pulley cover

Screw cover
mounting screws

Screw cover

Slider

Motor housing

Cable
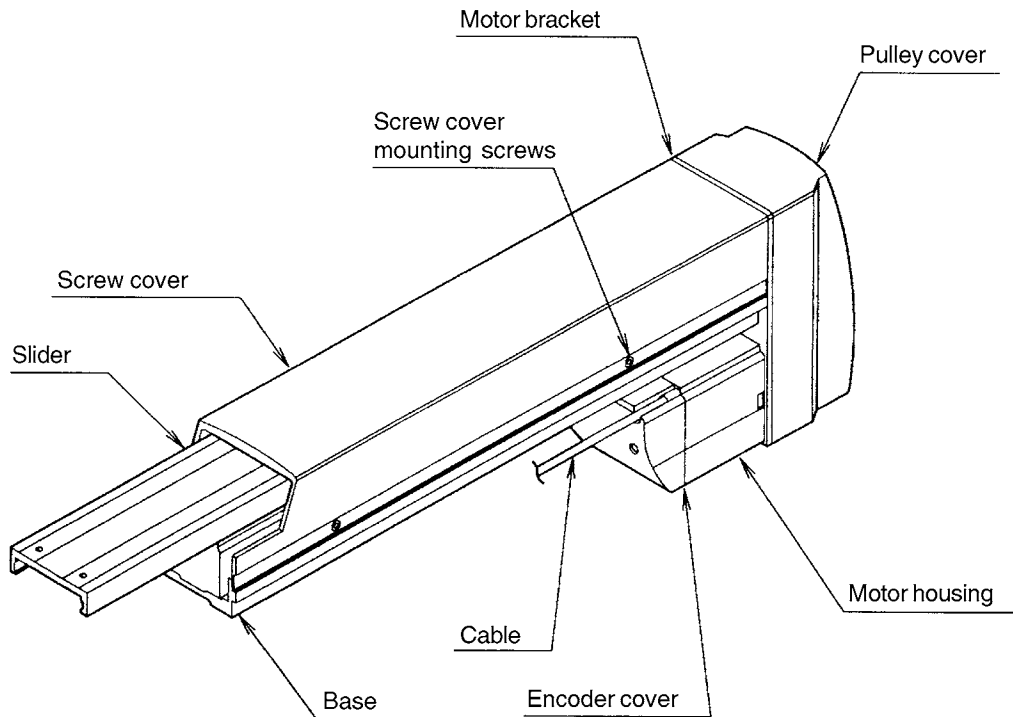
Base

Encoder cover

Please note the following when handling the actuator.
- Support the base when handling the actuator.
- Do not place excessive load on the cable.
- Do not place heavy loads on the pulley cover, encoder cover or other plastic parts.

1.2 Operating Environment

Install the actuator in a place where the operator can work without protective gear. Specific criteria for the operating environment are shown in the table below.

No.	Operating Conditions
1	Ambient temperature 0~40°C
2	Relative humidity 35~90%
3	Avoid direct sunlight
4	Avoid exposure to water, cutting oil and other liquids
5	Avoid exposure to corrosive or combustible gas
6	Minimal dust
7	Do not subject to vibrations or shock greater than 0.5G
8	Avoid strong electromagnetic waves, ultraviolet rays and radiation

2. Installation

2.1 Installing the Actuator

Mount the actuator to a machined surface or one of comparable precision.
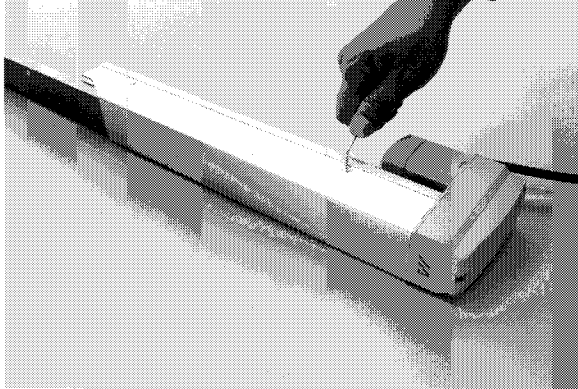
This actuator has a built-in brake. Connect the controller to the unit, then release the brake with the brake switch. After releasing the brake, pull the slider to the stroke end. Turn off the controller power before proceeding to the next step.
Remove the four mounting screws from the screw cover. (The cover can be removed using a 1.5mm hexagonal wrench).
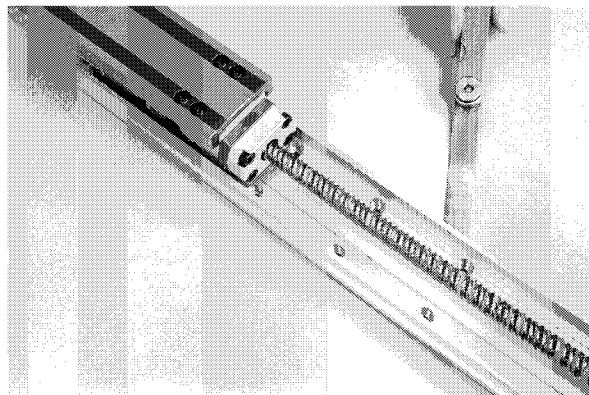
Rest the actuator on the mounting surface and check to see that a 0.1mm thickness gauge cannot be inserted at the four mounting holes.
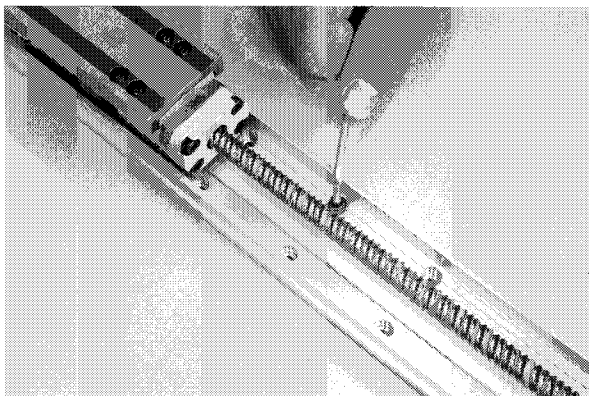
Affix the actuator using the mounting holes in the base. If the bolts go into a steel surface, then use hexagon sockets with the length shown in (1) and if the surface is a light metal, use the length in (2).

After mounting the actuator, reattach the screw cover.

Actuator	(1)	(2)
DS-A6	M5x40	M5x15
DS-A5	M4X8	M4X12
DS-A4	M3X8	M3X12

2. Installation

2.2 Attaching the Workpiece

Tapped holes for
mounting workpiece
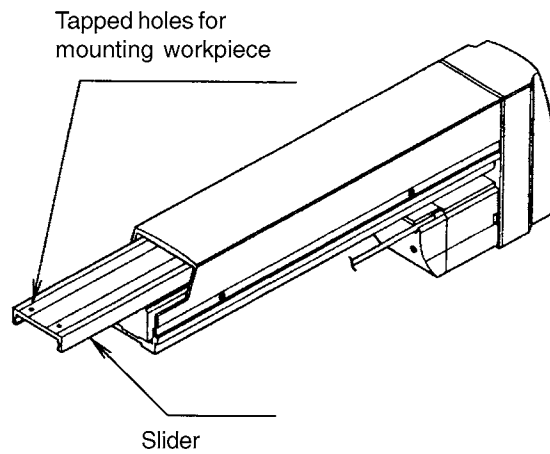
Use the four tapped holes at the top of the
slider to attach the workpiece.

Slider

There are 4 M4 screws for attaching the workpiece to the slider. To ensure the slider does not become deformed
when the workpiece is attached, check to make sure the surface where the workpiece rests is flat. A deformity in the
slider causes stiff movement and shortens the life of the actuator.
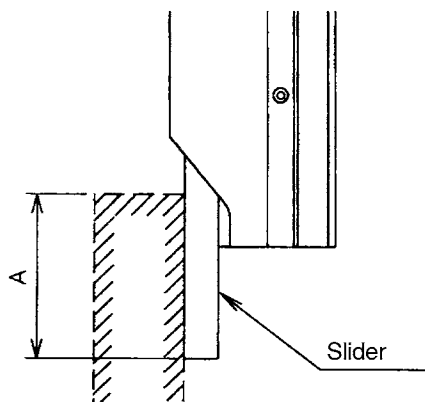
Do not exceed the load indicated in the specification tables at
Part 4. Please note in particular the slider moment, allowable
overhang length and the load weight.

Keep the overhang at the upper portion of the workpiece to the
measurements below to prevent interference between the screw
cover and workpiece.

DS-A6 Type	A=70mm
DS-A5 Type	A=65mm
DS-A4 Type	A=53mm

Slider

2.3 Wiring Cable

The actuator cable is resistant to bending fatigue but it is not robot cable so avoid housing the cable in movable wire duct with a small radius. In an application where the cable cannot be properly anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable hose as large radial wire duct to limit the load on the cable.

2.4 Adjusting Home Position

After installing the actuator, perform the homing operation to confirm home. Home direction can be changed with the parameters. If you allow a large offset amount, the moving range is limited by that amount. If you specify an offset amount greater than 1mm, you will have to reset the software limit and reduce the stroke by that amount.

Note: To change the home offset amount requires the optional PC software.

2.5 Changing Motor Position

You can change the position of the motor for greater flexibility when installing the actuator.
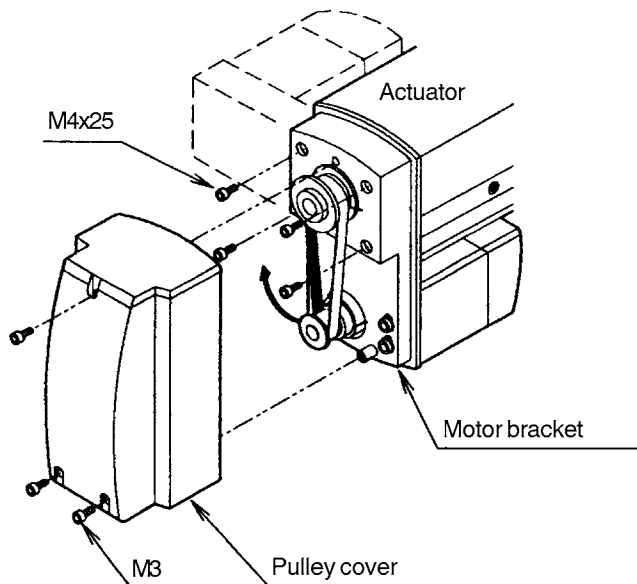
1. Remove the pulley cover.
2. Remove the four bolts (M4 x 25) used to mount the motor bracket.
3. While pushing the motor bracket lightly against the actuator, rotate it and set the position.
4. Reattach the motor bracket with M4 x 25 bolts.
5. Reattach the pulley cover.

Changing the motor position will affect the home position so always make sure to readjust home. (For a ball screw lead of 6mm, home will move 1.5mm for every 90° change).

3. Maintenance

3.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

	Visual Inspection	Internal Check	Lubrication
Start of operation	O		
After 1 month of operation	O		
After 6 months of operation	O	O	
After 1 year of operation	O	O	O
Semiannually thereafter	O		
Annually thereafter	O	O	O

Note 1: The above schedule assumes running time is 8 hours per day. When running time is high such as continuous day and night operation, shorten the maintenance intervals as required.

Note 2: The end cover supports the ball screw so please do not remove it. Do not remove the encoder cover as this contains precision equipment

3.2 Cleaning the Exterior

1. Wipe off dirt with a soft cloth.
2. Do not use strong compressed air on the actuator as this may force dust does into the crevices.
3. Do not use petroleum-based solvents on plastic parts or painted surfaces.
4. If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth and wipe lightly.

3.3 Inspecting the Interior
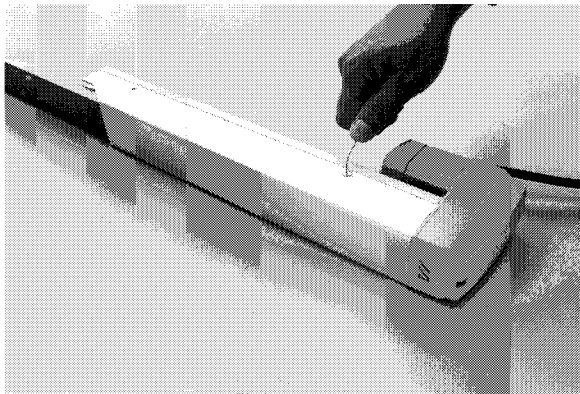
(1) Removing the cover

Turn the power OFF. Using a 1.5mm hexagonal wrench, remove the cover as shown in the picture and visually inspect the interior.

(2) Visual check of the interior
Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the travelling surfaces appear shiny.
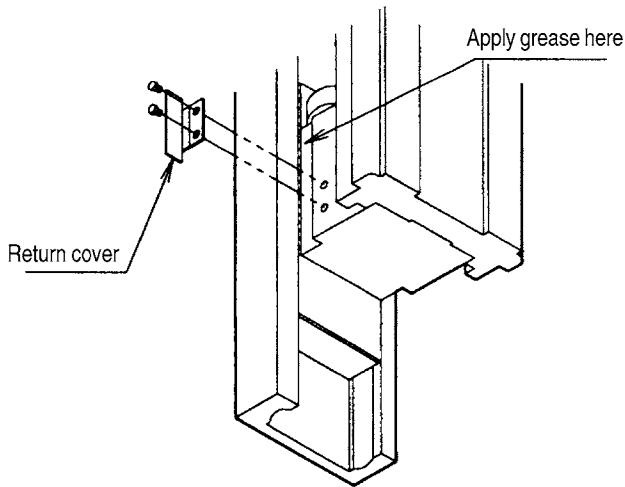
3.4 Lubrication

When the grease contains dust, becomes dull in color or begins to wear away through extended use, lubricate the actuator using the procedure below.
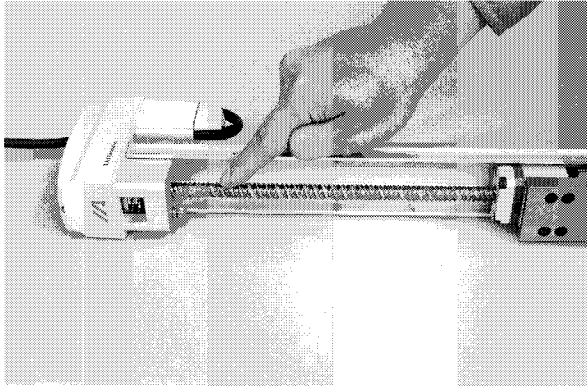
(1) How to lubricate

To lubricate the ball screw, apply grease to the screw with your finger then spread it out by moving the slider back and forth.

To lubricate the slider, remove the return cover attached to the guide block and apply grease directly on the bearing.

(2) What grease to use

IAI uses lithium grease No. 2. There are other brands of grease commerciallly available for the ball screw and slider. These are acceptable as long as they are a lithium-type grease.

Note: Never use a fluorine-based grease. Mixing this with a lithium grease produces a chemical reaction which damages the actuator.

3. Maintenance

3.5 Inspecting and Replacing the Timing Belt

(1) Removing the belt cover
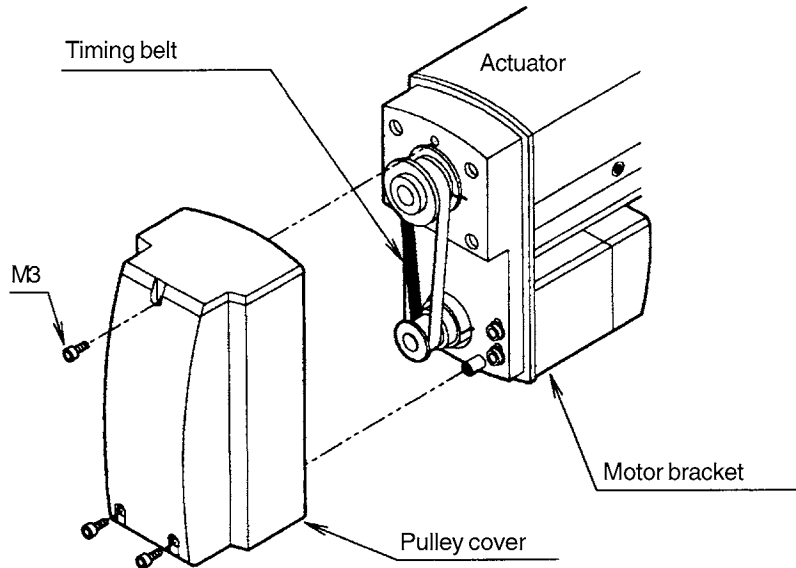
Remove the pulley cover as shown at left and inspect the timing belt.

(2) Inspecting the timing belt

The durability of the timing belt is largely dependent on the operating conditions. It is difficult to give an absolute rule regarding when to replace the timing belt but generally the belt has a lifetime of so many millions of rotations. The more practical approach is to replace the belt if any of the following conditions occur.
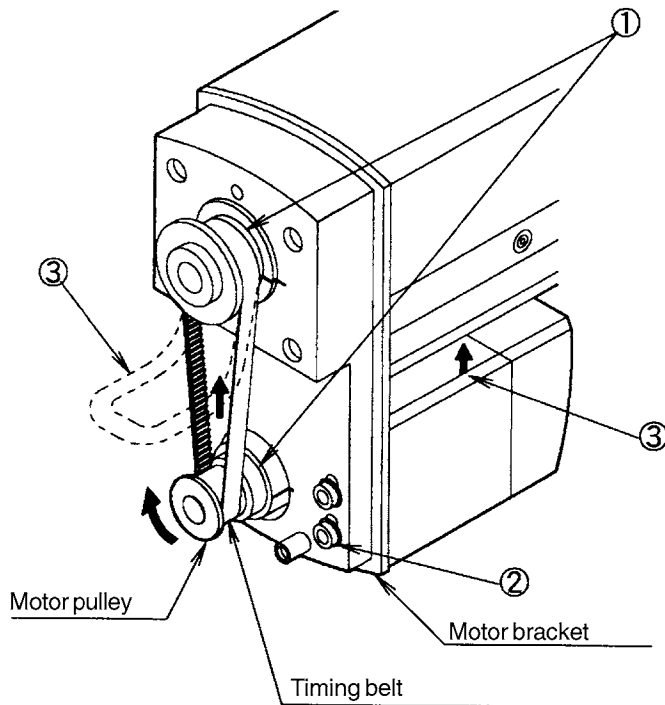
• The belt end or belt teeth have worn away.
• There are cracks in or other damage to the belt or teeth.
• The belt breaks.

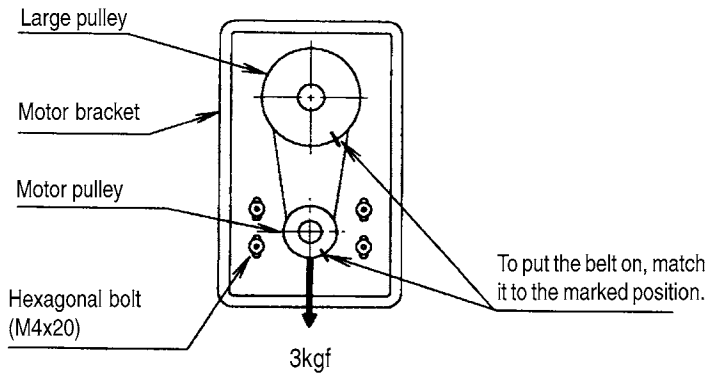If you need to replace the belt, please contact IAI.

(3) Replacing the timing belt

Follow the procedure below to replace the timing belt.


Motor pulley

Motor bracket

Timing belt

① Mark the pulley and motor bracket so that you do not change home position.
② Loosen the four bolts.
③ Put the new belt on while pushing the motor up.
④ After the new belt is in place, do the same procedure in reverse to reassemble.

(4) Adjusting the tension of the timing belt

Large pulley

Motor bracket

Motor pulley

Hexagonal bolt
(M4x20)

3kgf

To put the belt on, match it to the marked position.

After you change the timing belt, it is necessary to readjust the tension. As shown in the upper diagram at left, push the motor pulley up, then adjust the tension and set it.

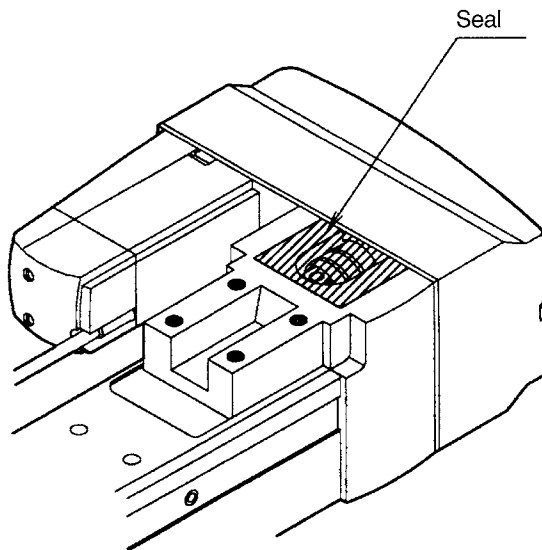Use the method shown in the left lower diagram to check whether the tension of the timing belt is suitable.

Check tension

$\delta = 1mm$
$F=100gf$
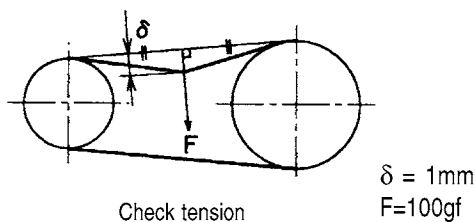
3.6 Inspecting and Adjusting the Brake

(1) Brake inspection

Set screw

Stator

Armature

Inner driver
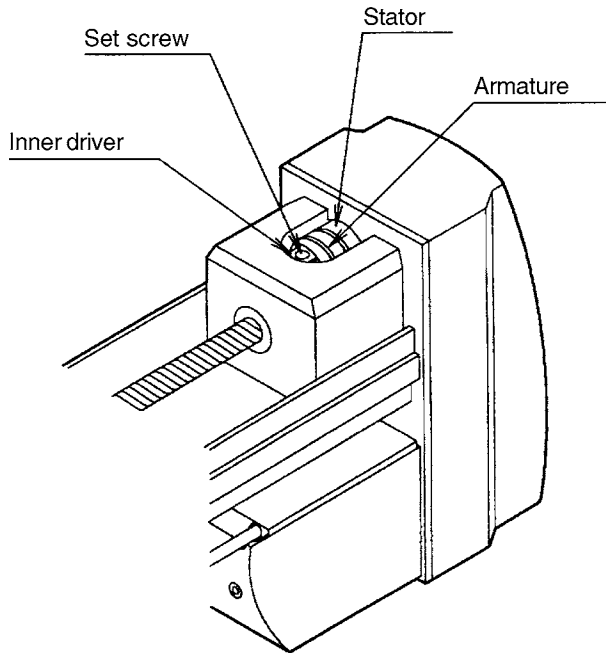
DS5 TYPE (DS-A5)

① Remove the screw cover to inspect the brake.

② Visually check the condition of the brake.

Seal

DS4 TYPE (DS-A4)

① Peel off the seal to inspect the brake.

② Visually check the condition of the brake.

Note: When the motor is folded backwards (S type), you must change the direction to the right or the left.

(2) Adjusting the brake gap

Normally, the inner driver requires no maintenance but if adjustments are necessary, use the following procedure.
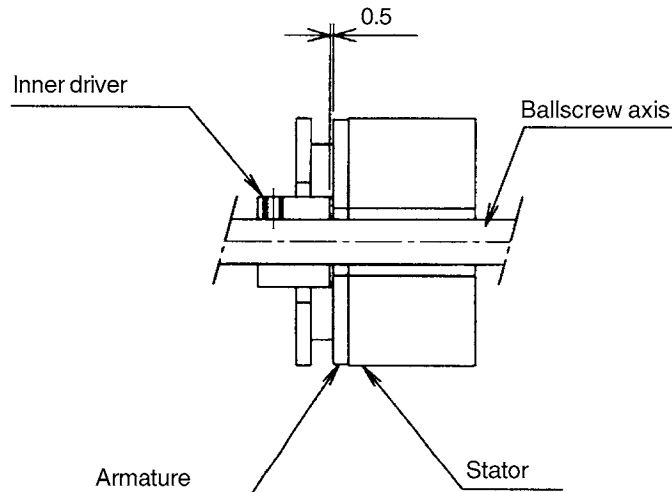
Brake Cross Section

① We recommend the actuator be placed on a horizontal surface when adjusting the brake gap. If you are doing the adjustment with the actuator in a vertical position, first move the slider to the stroke end.
② Release the brake and loosen the two set screws.
③ Set the inner driver about 0.5mm from where it would hit up against the armature.

(3) Attaching the cover
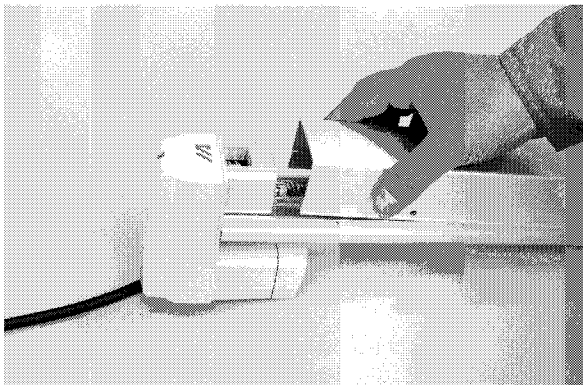
Follow the procedure used to remove the cover in reverse order and reattach the screw cover and pulley cover.
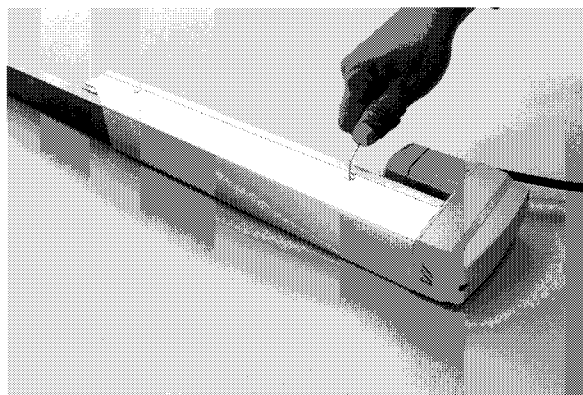
After you finish the inspection, replace the cover as it was at the start.

1. Specifications for the SlideType

1.1 High Speed Type DS-SA6H

	Specifications														
Specifications	Model	DS-SA6H	50	100	150	200	250	300	350	400	450	500	550	600
	Stroke	mm	50	100	150	200	250	300	350	400	450	500	550	600
	Rated Output	W	30											
	Rated Speed	mm/sec	800									760	640	540
	Rated Thrust	N(kgf)	24.2(2.4)											
	Repeatability	mm	±0.05											
	Unit Weight	kg	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5

Structure of Main Component

Motor	AC Servo Motor
Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse ¼ rotation)
Ballscrew	Ø10mm Lead 12mm Rolled thread C10 Backlash 0.1mm or less
Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
Slider	Special steel alloy
Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
Dust Shield	Stainless steel
Motor Housing	Aluminum die-cast Baked finish
Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
Cable	11-conductor composite cable 5m (standard length)
Grease	Ballscrew: Lithium type grease
	Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

Application Limit

	Model	DS-SA6H	50	100	150	200	250	300	350	400	450	500	550	600
	Maximum Thrust (1)	N(kgf)	72(7.3)											
	Payload (2, 3)	kgw	Horizontal: 6kg Vertical: 1.5kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
			Ma: 8.9(0.9) Mb: 12.7(1.3) Mc: 18.6(1.9)											
	Overhang Load Length L (5)	mm	Ma 220 or less Mb, Mc 220 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.3G and a speed of 800mm/sec.
4: Direction of load moment is:

Mb direction

Mc direction Ma direction

5: When the center of gravity for the attached object is ½ the overhang length.

L

M b, Mc direction

Ma, Mc moment
Standard location of offset

Ma direction

1.2 Medium Speed DS-SA6M

Model	DS-SA6M	50	100	150	200	250	300	350	400	450	500	550	600
Stroke	mm	50	100	150	200	250	300	350	400	450	500	550	600
Rated Output	W	30											
Rated Speed	mm/sec	400									380	320	270
Rated Thrust	N(kgf)	48.4(4.9)											
Repeatability	mm	±0.02											
Unit Weight	kg	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5

(Left margin label: Specifications)

Motor	AC Servo Motor
Encoder	AC motor attached 192P/R Signal wave A,B,Z Phase A Phase Input voltage +5V B Phase C Phase (Homing pulse: 1 pulse ½ rotation)
Ballscrew	Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less
Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
Slider	Special steel alloy
Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
Dust Shield	Stainless steel
Motor Housing	Aluminum die-cast Baked finish
Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
Cable	11-conductor composite cable 5m (standard length)
Grease	Ballscrew: Lithium type grease Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

(Left margin label: Structure of Main Component)

Model	DS-SA6M	50	100	150	200	250	300	350	400	450	500	550	600
Maximum Thrust (1)	N(kgf)	145(14.7)											
Payload (2, 3)	kgw	Horizontal: 12kg Vertical: 3kg											
Moment (2, 4)	N·m (kgf·m)	5000km life expectancy Ma: 8.9(0.9) Mb: 12.7(1.3) Mc: 18.6(1.9)											
Overhang Load Length L (5)	mm	Ma 220 or less Mb, Mc 220 or less											

(Left margin label: Application Limit)

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.3G and a speed of 400mm/sec.
4: Direction of load moment is:
5: When the center of gravity for the attached object is ½ the overhang length.

Mb direction

Mc direction   Ma direction

L

M b, Mc direction

Ma, Mc moment
Standard location of offeset

Ma direction

1. Specifications for the SlideType

1.3 Low Speed High Thrust DS-SA6L

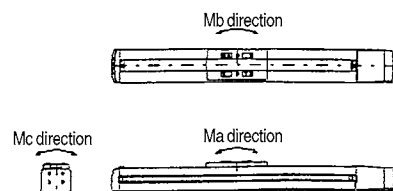<div style="writing-mode: vertical">Specifications</div>

Model	DS-SA6L	50	100	150	200	250	300	350	400	450	500	550	600
Stroke	mm	50	100	150	200	250	300	350	400	450	500	550	600
Rated Output	W	30											
Rated Speed	mm/sec	200									190	160	135
Rated Thrust	N(kgf)	96.8(9.8)											
Repeatability	mm	±0.02											
Unit Weight	kg	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5

<div style="writing-mode: vertical">Structure of Main Component</div>

Motor	AC Servo Motor
Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse 1 rotation)
Ballscrew	Ø10mm Lead 3mm Rolled thread C10 Backlash 0.1mm or less
Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
Slider	Special steel alloy
Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
Dust Shield	Stainless steel
Motor Housing	Aluminum die-cast Baked finish
Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
Cable	11-conductor composite cable 5m (standard length)
Grease	Ballscrew: Lithium type grease
	Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

<div style="writing-mode: vertical">Application Limit</div>

Model	DS-SA6L	50	100	150	200	250	300	350	400	450	500	550	600
Maximum Thrust (1)	N(kgf)	290(29.5)											
Payload (2, 3)	kgw	Horizontal:12kg Vertical: 6kg											
Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
		Ma: 8.9(0.9) Mb: 12.7(1.3) Mc: 18.6(1.9)											
Overhang Load Length L (5)	mm	Ma 220 or less Mb, Mc 220 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 200mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

Mb direction

Mc direction   Ma direction

L

Mb, Mc direction

Ma, Mc moment
Standard location of offset

Ma direction

1. Specifications for the SlideType

1.4 High Speed DS-SA5H
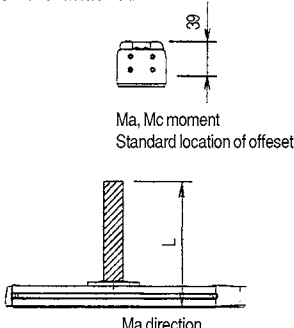
	Model	DS-SA5H	50	100	150	200	250	300	350	400	450	500		
Specifications	Stroke	mm	50	100	150	200	250	300	350	400	450	500		
	Rated Output	W												
	Rated Speed	mm·sec	800								760			
	Rated Thrust	N(kgf)	16.7(1.7)											
	Repeatability	mm	±0.05											
	Unit Weight	kg	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1		

Structure of Main Component	Motor	AC Servo Motor
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse ¼ rotation)
	Ballscrew	Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
	Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
	Slider	Special steel alloy
	Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
	Dust Shield	Stainless steel
	Motor Housing	Aluminum die-cast Baked finish
	Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
	Cable	11-conductor composite cable 5m (standard length)
	Grease	Ballscrew: Lithium type grease Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

	Model	DS-SA5H	50	100	150	200	250	300	350	400	450	500		
Application Limit	Maximum Thrust (1)	N(kgf)	33.3(3.4)											
	Payload (2, 3)	kgw	Horizontal: 4kg Vertical: 1kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
			Ma: 4.9(0.5) Mb: 6.8(0.7) Mc: 11.7(1.2)						Mc:7.8(0.8)					
	Overhang Load Length L (5)	mm	Ma 150 or less Mb, Mc 150 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.3G and a speed of 800mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

Ma, Mc moment
Standard location of offset

Mb direction

Mc direction   Ma direction

L

Mb, Mc direction

Ma direction

1.5 Medium Speed DS-SA5M

Specifications	Model	DS-SA5M	50	100	150	200	250	300	350	400	450	500		
	Stroke	mm	50	100	150	200	250	300	350	400	450	500		
	Rated Output	W	20											
	Rated Speed	mm/sec	400									380		
	Rated Thrust	N(kgf)	33.3(3.4)											
	Repeatability	mm	±0.02											
	Unit Weight	kg	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1		

Structure of Main Component	Motor	AC Servo Motor
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse ½ rotation)
	Ballscrew	Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
	Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
	Slider	Special steel alloy
	Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
	Dust Shield	Stainless steel
	Motor Housing	Aluminum die-cast Baked finish
	Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
	Cable	11-conductor composite cable 5m (standard length)
	Grease	Ballscrew: Lithium type grease
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

Application Limit	Model	DS-SA5M	50	100	150	200	250	300	350	400	450	500		
	Maximum Thrust (1)	N(kgf)	65.7(6.7)											
	Payload (2, 3)	kgw	Horizontal: 8kg Vertical: 2kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
			Ma: 4.9(0.5) Mb: 6.8(0.7) Mc: 11.7(1.2) Mc:7.8(0.8)											
	Overhang Load Length L (5)	mm	Ma 150 or less Mb, Mc 150 or less											

1: At a speed of 70mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.3G and a speed of 400mm/sec.
4: Direction of load moment is:
5: When the center of gravity for the attached object is ½ the overhang length.

Ma, Mc moment
Standard location of offeset

Mb direction

Mc direction   Ma direction

L

Mb, Mc direction

Ma direction

1.6 Low Speed High Thrust DS-SA5L

	Model	DS-SA5L	50	100	150	200	250	300	350	400	450	500		
Specifications	Stroke	mm	50	100	150	200	250	300	350	400	450	500		
	Rated Output	W												
	Rated Speed	mm/sec	200								190			
	Rated Thrust	N(kgf)	65.7(6.7)											
	Repeatability	mm	±0.02											
	Unit Weight	kg	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1		

Structure of Main Component		
Motor	AC Servo Motor
Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse 1 rotation)
Ballscrew	Ø10mm Lead 3mm Rolled thread C10 Backlash 0.1mm or less
Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
Slider	Special steel alloy
Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
Dust Shield	Stainless steel
Motor Housing	Aluminum die-cast Baked finish
Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
Cable	11-conductor composite cable 5m (standard length)
Grease	Ballscrew: Lithium type grease
	Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

	Model	DS-SA5L	50	100	150	200	250	300	350	400	450	500		
Application Limit	Maximum Thrust (1)	N(kgf)	131.4(13.7)											
	Payload (2, 3)	kgw	Horizontal: 8kg Vertical: 4kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
			Ma: 4.9(0.5) Mb: 6.8(0.7) Mc: 11.7(1.2)						Mc:7.8(0.8)					
	Overhang Load Length L (5)	mm	Ma 150 or less Mb, Mc 150 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 200mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

Mb direction

Mc direction   Ma direction

L

Mb, Mc direction

M a, Mc moment
Standard location of offset

Ma direction

1. Specifications for the SlideType

DS

1.7 High Speed DS-SA4H

Specifications	Model	DS-SA4H	50	100	150	200	250	300						
	Stroke	mm	50	100	150	200	250	300						
	Rated Output	W	20											
	Rated Speed	mm/sec	665											
	Rated Thrust	N(kgf)	19.6(2.0)											
	Repeatability	mm	±0.05											
	Unit Weight	kg	0.6	0.7	0.8	0.9	1.0	1.1						

Structure of Main Component		
Motor	AC Servo Motor	
Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V	Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse ¼ rotation)
Ballscrew	Ø8mm Lead 10mm Rolled thread C10 Backlash 0.1mm or less	
Guide	Direct recirculating ball bearing: Hardened carbon steel ground track	
Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis	
Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated	
Slider	Special steel alloy	
Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated	
Dust Shield	Stainless steel	
Motor Housing	Aluminum die-cast Baked finish	
Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic	
Cable	11-conductor composite cable 5m (standard length)	
Grease	Ballscrew: Lithium type grease	
	Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent	

Application Limit	Model	DS-SA4H	50	100	150	200	250	300						
	Maximum Thrust (1)	N(kgf)	39.2(4.0)											
	Payload (2, 3)	kgw	Horizontal: 4kg Vertical: 1kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
			Ma: 2.7(0.28) Mb:3.9(0.4) Mc: 6.8(0.7)											
	Overhang Load Length L (5)	mm	Ma 120 or less Mb, Mc 120 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.3G and a speed of 665mm/sec.
4: Direction of load moment is indicated on the right.
5: When the center of gravity for the attached object is ½ the overhang length.

Mb direction
Mc direction
Ma direction
M a, Mc moment Standard location of offset
L
M b, Mc direction
Ma direction
31.2

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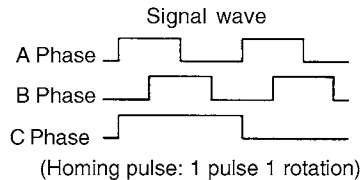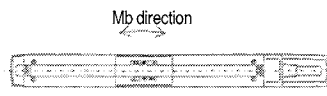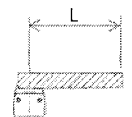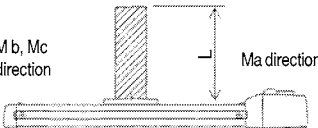
1.8 Medium Speed DS-SA4M

	Model	DS-SA4M	50	100	150	200	250	300						
Specifications	Stroke	mm	50	100	150	200	250	300						
	Rated Output	W	20											
	Rated Speed	mm/sec	330											
	Rated Thrust	N(kgf)	39.2(2.0)											
	Repeatability	mm	±0.02											
	Unit Weight	kg	0.6	0.7	0.8	0.9	1.0	1.1						

Structure of Main Component	Motor	AC Servo Motor
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase ⎍⎍⎍ B Phase ⎍⎍⎍ C Phase ⎍ (Homing pulse: 1 pulse ½ rotation)
	Ballscrew	Ø8mm Lead 5mm Rolled thread C10 Backlash 0.1mm or less
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
	Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
	Slider	Special steel alloy
	Side Cover	Eclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
	Dust Shield	Stainless steel
	Motor Housing	Aluminum die-cast Baked finish
	Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
	Cable	11-conductor composite cable 5m (standard length)
	Grease	Ballscrew: Lithium type grease
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

	Model	DS-SA4M	50	100	150	200	250	300						
Application Limit	Maximum Thrust (1)	N(kgf)	78.4(8.0)											
	Payload (2, 3)	kgw	Horizontal: 5kg Vertical: 2.5kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy Ma: 2.7(0.28) Mb:3.9(0.4) Mc: 6.8(0.7)											
	Overhang Load Length L (5)	mm	Ma 120 or less Mb, Mc 120 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.3G and a speed of 330mm/sec.
4: Direction of load moment is indicated on the right.
5: When the center of gravity for the attached object is ½ the overhang length.

Mb direction

Mc direction

Ma direction

M a, Mc moment
Standard location of offset

M b, Mc direction

Ma direction

L

31.2
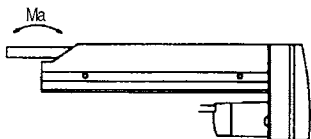
1.9 Low Speed High Thrust DS-SA4L

	Model	DS-SA4L	50	100	150	200	250	300						
Specifications	Stroke	mm	50	100	150	200	250	300						
	Rated Output	W	20											
	Rated Speed	mm/sec	165											
	Rated Thrust	N(kgf)	78.4(8.0)											
	Repeatability	mm	±0.02											
	Unit Weight	kg	0.6	0.7	0.8	0.9	1.0	1.1						

Structure of Main Component	Motor	AC Servo Motor
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse 1 rotation)
	Ballscrew	Ø8mm Lead 2.5mm Rolled thread C10 Backlash 0.1mm or less
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track
	Motor/Ballscrew Connection	Integrated motor axis and ballscrew axis
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated
	Slider	Special steel alloy
	Side Cover	Eclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated
	Dust Shield	Stainless steel
	Motor Housing	Aluminum die-cast Baked finish
	Encoder Cover, Front Cover, Slide Cover	Polyacetal plastic
	Cable	11-conductor composite cable 5m (standard length)
	Grease	Ballscrew: Lithium type grease
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent

	Model	DS-SA4L	50	100	150	200	250	300						
Application Limit	Maximum Thrust (1)	N(kgf)	156.8(16.0)											
	Payload (2, 3)	kgw	Horizontal: 5kg Vertical: 4.5kg											
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy											
			Ma: 2.7(0.28) Mb:3.9(0.4) Mc: 6.8(0.7)											
	Overhang Load Length L (5)	mm	Ma 120 or less Mb, Mc 120 or less											

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 165mm/sec.
4: Direction of load moment is indicated on the right.
5: When the center of gravity for the attached object is ½ the overhang length.

Mb direction
Mc direction
Ma direction

M a, Mc moment
Standard location of offset

L
M b, Mc direction
Ma direction
31.2

2.1 Medium Speed DS-A6M

<table>
<tr><td rowspan="7">Specifications</td><td>Model</td><td>DS-A6M</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
<tr><td>Stroke</td><td>mm</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
<tr><td>Rated Output</td><td>W</td><td colspan="4">30</td></tr>
<tr><td>Rated Speed</td><td>mm/sec</td><td colspan="4">400</td></tr>
<tr><td>Rated Thrust</td><td>N(kgf)</td><td colspan="4">48.4(4.9)</td></tr>
<tr><td>Repeatability</td><td>mm</td><td colspan="4">±0.02</td></tr>
<tr><td>Unit Weight</td><td>kg</td><td>3.0</td><td>3.3</td><td>3.6</td><td>3.9</td></tr>
</table>

<table>
<tr><td rowspan="20">Structure of Main Components</td><td colspan="2">Motor</td><td colspan="4">AC Servo Motor</td></tr>
<tr><td colspan="2" rowspan="4">Encoder</td><td colspan="4">AC motor attached</td></tr>
<tr><td colspan="4">A·B·Z phase   Voltage output   Signal wave</td></tr>
<tr><td colspan="4">Input voltage   +5V   A Phase   B Phase   Z Phase</td></tr>
<tr><td colspan="4">(Homing pulse: 1 pulse ½ rotation)</td></tr>
<tr><td rowspan="5">Brake</td><td>Specifications</td><td colspan="4">Dry, single head, on when deenergized, electromagnetic brake</td></tr>
<tr><td>Model</td><td colspan="4">MCNB1. 5-03</td></tr>
<tr><td>Holding torque N(kgf)</td><td colspan="2">73.5(7.5)</td><td>Single brake torque N·m(kgf·cm)</td><td>14.7 (1.5)</td></tr>
<tr><td>Mounting position</td><td colspan="4">Ballscrew axis</td></tr>
<tr><td>Rated voltage</td><td colspan="4">DC24V</td></tr>
<tr><td colspan="2">Ballscrew</td><td colspan="4">Ø10mm   Lead 12mm   Rolled thread C10   Backlash 0.1mm or less</td></tr>
<tr><td colspan="2">Guide</td><td colspan="4">Integrated with base, DS dedicated</td></tr>
<tr><td colspan="2">Motor/Ballscrew Connection</td><td colspan="4">Timing belt   Reduction ratio ½</td></tr>
<tr><td colspan="2">Slider</td><td colspan="4">Hardened alloyed steel</td></tr>
<tr><td colspan="2">Base</td><td colspan="4">Extruded aluminum (A6N01S-T5) White alumite treated</td></tr>
<tr><td colspan="2">Side Cover</td><td colspan="4">Extruded aluminum (A6063S-T5) White alumite treated</td></tr>
<tr><td colspan="2">Motor Housing</td><td colspan="4">Aluminum die-cast   Baked finish</td></tr>
<tr><td colspan="2">Encoder Cover, Pulley Cover</td><td colspan="4">Polyacetal plastic</td></tr>
<tr><td colspan="2">Cable</td><td colspan="4">11-conductor composite cable   5m (standard length)</td></tr>
<tr><td colspan="2" rowspan="2">Grease</td><td colspan="4">Ballscrew: Lithium type grease</td></tr>
<tr><td colspan="4">Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent</td></tr>
</table>

<table>
<tr><td rowspan="4">Application Limit</td><td>Maximum Thrust (1)</td><td>N(kgf)</td><td colspan="2">145(14.7)</td></tr>
<tr><td>Payload (2, 3)</td><td>kgw</td><td colspan="2">Vertical: 3kg</td></tr>
<tr><td rowspan="2">Moment (2, 4)</td><td rowspan="2">N·m (kgf·m)</td><td colspan="2">5000km life expectancy</td></tr>
<tr><td colspan="2">Ma:8.1(0.8)   Mb: 10.0(1.0)   Mc:6.5(0.6)</td></tr>
</table>

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 400mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

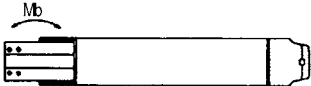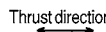## 2.2 L ow Speed High Thrust DS-A6L

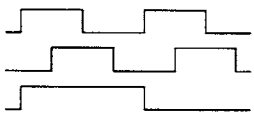<table>
<tr><td colspan="2" rowspan="7">Specifications</td><td>Model</td><td>DS-A6L</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
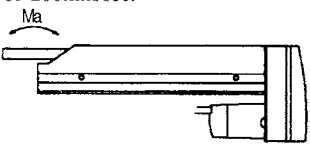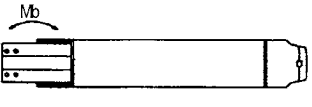<tr><td>Stroke</td><td></td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
<tr><td>Rated Output</td><td>W</td><td colspan="4">30</td></tr>
<tr><td>Rated Speed</td><td>mm/sec</td><td colspan="4">200</td></tr>
<tr><td>Rated Thrust</td><td>N(kgf)</td><td colspan="4">96.8(9.8)</td></tr>
<tr><td>Repeatability</td><td>mm</td><td colspan="4">±0.02</td></tr>
<tr><td>Unit Weight</td><td>kg</td><td>3.0</td><td>3.3</td><td>3.6</td><td>3.9</td></tr>
<tr><td colspan="2" rowspan="20">Structure of Main Components</td><td colspan="2">Motor</td><td colspan="4">AC Servo Motor</td></tr>
<tr><td colspan="2" rowspan="5">Encoder</td><td colspan="4">AC motor attached

A·B·Z phase   Voltage output   Signal wave

Input voltage   +5V   A Phase
B Phase
Z Phase

(Homing pulse: 1 pulse ½ rotation)</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="6">Brake</td><td colspan="2">Specifications</td><td colspan="3">Dry, single head, on when deenergized, electromagnetic brake</td></tr>
<tr><td colspan="2">Model</td><td colspan="3">MCNB1. 5-03</td></tr>
<tr><td colspan="2">Holding torque N(kgf)</td><td>147.0 (15.0)</td><td>Single brake torque N·m(kgf·cm)</td><td>14.7 (1.5)</td></tr>
<tr><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td colspan="2">Mounting position</td><td colspan="3">Ballscrew axis</td></tr>
<tr><td colspan="2">Rated voltage</td><td colspan="3">DC24V</td></tr>
<tr><td colspan="2">Ballscrew</td><td colspan="4">Ø10mm   Lead 6mm   Rolled thread C10   Backlash 0.1mm or less</td></tr>
<tr><td colspan="2">Guide</td><td colspan="4">Integrated with base, DS dedicated</td></tr>
<tr><td colspan="2">Motor/Ballscrew Connection</td><td colspan="4">Timing belt   Reduction ratio ½</td></tr>
<tr><td colspan="2">Slider</td><td colspan="4">Hardened alloyed steel</td></tr>
<tr><td colspan="2">Base</td><td colspan="4">Extruded aluminum (A6N01S-T5) White alumite treated</td></tr>
<tr><td colspan="2">Side Cover</td><td colspan="4">Extruded aluminum (A6063S-T5) White alumite treated</td></tr>
<tr><td colspan="2">Motor Housing</td><td colspan="4">Aluminum die-cast   Baked finish</td></tr>
<tr><td colspan="2">Encoder Cover, Pulley Cover</td><td colspan="4">Polyacetal plastic</td></tr>
<tr><td colspan="2">Cable</td><td colspan="4">11-conductor composite cable   5m (standard length)</td></tr>
<tr><td colspan="2" rowspan="2">Grease</td><td colspan="4">Ballscrew: Lithium type grease</td></tr>
<tr><td colspan="4">Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent</td></tr>
<tr><td colspan="2" rowspan="4">Application Limit</td><td colspan="2">Maximum Thrust (1)</td><td>N(kgf)</td><td colspan="3">290(29.5)</td></tr>
<tr><td colspan="2">Payload (2, 3)</td><td>kgw</td><td colspan="3">Vertical: 6kg</td></tr>
<tr><td colspan="2" rowspan="2">Moment (2, 4)</td><td rowspan="2">N·m (kgf·m)</td><td colspan="3">5000km life expectancy</td></tr>
<tr><td colspan="3">Ma:8.1(0.8)   Mb: 10.0(1.0)   Mc:6.5(0.6)</td></tr>
</table>

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 200mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

2.3 Medium Speed DS-A5M

<table>
<tr><td rowspan="7">Specifications</td><td>Model</td><td>DS-A5M</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
<tr><td>Stroke</td><td>mm</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
<tr><td>Rated Output</td><td>W</td><td colspan="4">20</td></tr>
<tr><td>Rated Speed</td><td>mm/sec</td><td colspan="4">400</td></tr>
<tr><td>Rated Thrust</td><td>N(kgf)</td><td colspan="4">33.3(3.4)</td></tr>
<tr><td>Repeatability</td><td>mm</td><td colspan="4">±0.02</td></tr>
<tr><td>Unit Weight</td><td>kg</td><td>2.2</td><td>2.4</td><td>2.6</td><td>2.8</td></tr>
<tr><td rowspan="20">Structure of Main Components</td><td colspan="2">Motor</td><td colspan="4">AC Servo Motor</td></tr>
<tr><td colspan="2" rowspan="3">Encoder</td><td colspan="4">AC motor attached

A·B·Z phase   Voltage output   Signal wave

Input voltage   +5V   A Phase
B Phase
Z Phase

(Homing pulse: 1 pulse ½ rotation)</td></tr>
</table>

Structure of Main Components	Brake	Specifications	Dry, single head, on when deenergized, electromagnetic brake			
		Model	MB33			
		Holding torque N(kgf)	51.0(5.2)	Single brake torque N·m(kgf·cm)		0.098(1.0)
		Mounting position	Ballscrew axis			
		Rated voltage	DC24V			
	Ballscrew		Ø10mm Lead 12mm Rolled thread C10 Backlash 0.1mm or less			
	Guide		Integrated with base, DS dedicated			
	Motor/Ballscrew Connection		Timing belt Reduction ratio ½			
	Slider		Hardened alloyed steel			
	Base		Extruded aluminum (A6N01S-T5) White alumite treated			
	Side Cover		Extruded aluminum (A6063S-T5) White alumite treated			
	Motor Housing		Aluminum die-cast Baked finish			
	Encoder Cover, Pulley Cover		Polyacetal plastic			
	Cable		11-conductor composite cable 5m (standard length)			
	Grease		Ballscrew: Lithium type grease			
			Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent			
Application Limit	Maximum Thrust (1)	N(kgf)	65.7(6.7)			
	Payload (2, 3)	kgw	Vertical: 2kg			
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy			
			Ma:4.5(0.46) Mb: 5.4(0.55) Mc:4.1(0.42)			

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 400mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

2.4 Low Speed High Thrust DS-A5L

<table>
<tr><td rowspan="7">Specifications</td><td>Model</td><td>DS-A5L</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
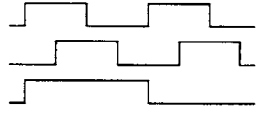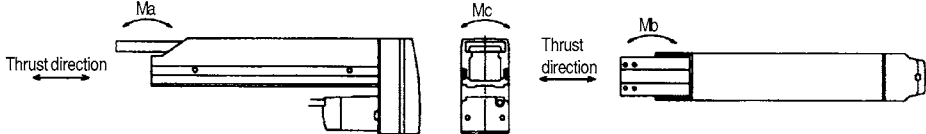<tr><td>Stroke</td><td>mm</td><td>50</td><td>100</td><td>150</td><td>200</td></tr>
<tr><td>Rated Output</td><td>W</td><td colspan="4">20</td></tr>
<tr><td>Rated Speed</td><td>mm/sec</td><td colspan="4">200</td></tr>
<tr><td>Rated Thrust</td><td>N(kgf)</td><td colspan="4">65.7 (6.7)</td></tr>
<tr><td>Repeatability</td><td>mm</td><td colspan="4">±0.02</td></tr>
<tr><td>Unit Weight</td><td>kg</td><td>2.2</td><td>2.4</td><td>2.6</td><td>2.8</td></tr>
<tr><td rowspan="19">Structure of Main Components</td><td colspan="2">Motor</td><td colspan="4">AC Servo Motor</td></tr>
<tr><td colspan="2" rowspan="3">Encoder</td><td colspan="4">AC motor attached
A·B·Z phase   Voltage output   Signal wave
Input voltage   +5V   A Phase
B Phase
Z Phase

(Homing pulse: 1 pulse ½ rotation)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="5">Brake</td><td>Specifications</td><td colspan="4">Dry, single head, on when deenergized, electromagnetic brake</td></tr>
<tr><td>Model</td><td colspan="4">MB33</td></tr>
<tr><td>Holding torque N(kgf)</td><td>103.0(10.5)</td><td colspan="2">Single brake torque N·m(kgf·cm)</td><td>0.098(1.0)</td></tr>
<tr><td>Mounting position</td><td colspan="4">Ballscrew axis</td></tr>
<tr><td>Rated voltage</td><td colspan="4">DC24V</td></tr>
<tr><td colspan="2">Ballscrew</td><td colspan="4">Ø10mm   Lead 6mm   Rolled thread C10   Backlash 0.1mm or less</td></tr>
<tr><td colspan="2">Guide</td><td colspan="4">Integrated with base, DS dedicated</td></tr>
<tr><td colspan="2">Motor/Ballscrew Connection</td><td colspan="4">Timing belt   Reduction ratio ½</td></tr>
<tr><td colspan="2">Slider</td><td colspan="4">Hardened alloyed steel</td></tr>
<tr><td colspan="2">Base</td><td colspan="4">Extruded aluminum (A6N01S-T5) White alumite treated</td></tr>
<tr><td colspan="2">Side Cover</td><td colspan="4">Extruded aluminum (A6063S-T5) White alumite treated</td></tr>
<tr><td colspan="2">Motor Housing</td><td colspan="4">Aluminum die-cast   Baked finish</td></tr>
<tr><td colspan="2">Encoder Cover, Pulley Cover</td><td colspan="4">Polyacetal plastic</td></tr>
<tr><td colspan="2">Cable</td><td colspan="4">11-conductor composite cable   5m (standard length)</td></tr>
<tr><td colspan="2" rowspan="2">Grease</td><td colspan="4">Ballscrew: Lithium type grease</td></tr>
<tr><td colspan="4">Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent</td></tr>
<tr><td rowspan="4">Application Limit</td><td colspan="2">Maximum Thrust (1)</td><td>N(kgf)</td><td colspan="3">131.4(13.4)</td></tr>
<tr><td colspan="2">Payload (2, 3)</td><td>kgw</td><td colspan="3">Vertical: 4kg</td></tr>
<tr><td colspan="2" rowspan="2">Moment (2, 4)</td><td rowspan="2">N·m (kgf·m)</td><td colspan="3">5000km life expectancy</td></tr>
<tr><td colspan="3">Ma:4.5(0.46)   Mb: 5.4(0.55)   Mc: 4.1(0.42)</td></tr>
</table>

1: At a speed of 10mm/sec for 5 seconds.
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
3: At an acceleration of 0.2G and a speed of 200mm/sec.
4: Direction of load moment is:

5: When the center of gravity for the attached object is ½ the overhang length.

* Appendix

DS

1. Trouble Shooting

Discrepencies		Cause	Compliance
"RES" (reset appears on the LED display when power is supplied.	1	I/O connector is not connected.	Connect the I/O connector.
	2	I/O connector +24V is not supplied to pin 1A and I/O connector OV is not supplied to pin 17.	Supply power against the I/O connector.
	3	Pin 1A (+24V) of I/O connector and pin 17B (OV) were reversed.	Check the I/O wiring.
	4	100V(200V) was input to the I/O connector.	Check the I/O wiring.
	5	Output ports load exceeds 100mA.	Check the load ratio.
	6	Total load of output ports exceeds 140mA.	Check the load ratio.
	7	N side of the controller main power was not connected properly.	Check the main power wires.
	8	From the above causes 3, 4, 5, 6, and 7, the circuit component protection (CCP) has been damaged.	Return for repair.
"ERG" (emergeny stop) appears on the LED display once power is supplied.	1	Emergency stop activated.	Release emergency stop.
	2	The wiring is disconnected at the emergency stop terminal board of the controller.	Connect emergency stop wiring.
	3	Emergency stop box of the PC cable is not connected to the PC cable.	Connect emergency stop box.
	4	IN, OUT of the PC cable are connected in reverse.	Check connection.
	5	PC cable was not connected properly.	Connect properly.
	6	Main power +24V and OV were connected in reverse.	Swap connection.
	7	Non-assigned cable was connected to the RS232C connector.	Connect assigned cable.
	8	100V (200V) was input to the controller.	Check wiring.
	9	Protective source (L1) of the ermergency stop circuit has shorted from above causes 7, 8 and 9.	Return for repair.
The output port does not output is not in correct state.	1	Output port was short circuitted to 24V due to no load.	Check for wiring.
	2	Load of output port exceeds 100mA for each pin.	Check load ratio.
	3	Total load of output port exceeds 400mA.	Check load ratio.
	4	Output port was connected to 100V(200V).	Check wiring.
	5	Protective resistance of the output has broken down due to above causes 2, 3 and 4.	Return for repair.
	6	Transistor array (TD62084) has broken down due to above causes 2, 3 and 4.	Return for repair.

Discrepencies		Cause	Compliance
Once output port is turned ON, all ports have a output signal (simultaneously).	1	Output port is wired incorrectly.	Check wiring.
	2	Due to output port short circuit, excessive load from excessive voltage, the fly wheel diode of the transistor array (TD62084) has gone into breakdown.	Return for repair.
Leakage current of output port is significant. The input LED display is lightly blinking.	1	+24V was not input to pin 1A of I/O connector.	Check wiring.
	2	Damage has occured to the circuit component protection (CCP).	Return for repair.
Stops suddenly during movement without releasing an alarm. Upon cycling power, LED display dissapears and resets. Communication with the controller is not possible (timeout error) and display shows error.	1	Static electricity or high level noise have occured in the C.P.U.	Check earth ground. Check noise, static electricity levels with compliance levels.
	2	Breakdown has occured in CMOS and RAM, as well as in the surrounding circuitry.	Return for repair.
Program position data and parameters are lost.	1	Static electricity and high level noise in the main CPU, CMOS, and RAM have occured.	Check earth. Noise, static electricity compliance.
	2	Breakdown has occured in the main CPU and surrounding circuitry as well as CMOS and RAM.	Return for repair.
	3	Breakdown has occured in the backup battery and surrounding circuitry.	Return for repair.
Timeout error occurs without communicating with the controller.	1	Poorly connected teaching pendant and PC, or breakdown have occured.	Check connection.
	2	Possible bad wire in the teaching pendant and PC cable.	Return for repair.
	3	Breakdown has occured in the controller's main CPU and surrounding circuitry.	Return for repair.
Controller is not receiving power.	1	Main power is not connected to the controller.	Check wiring.
	2	100V (200V) was input to the controller 's main power.	Return for repair.
	3	Breakdown has occured on the power board of the controller.	Return for repair.
I/O circuit is chattering.	1	Incorrect contact of the I/O wiring has occured.	Check wiring.
	2	Intermittent pulse on the I/O board has occured.	Stabilize the power supply
	3	Noise and static electricity have occured on the I/O board.	Noise, static electricity compliance