P-Driver

PULSE DRIVE

Operation Manual First Edition

IAI America, Inc.

▮P-Driver
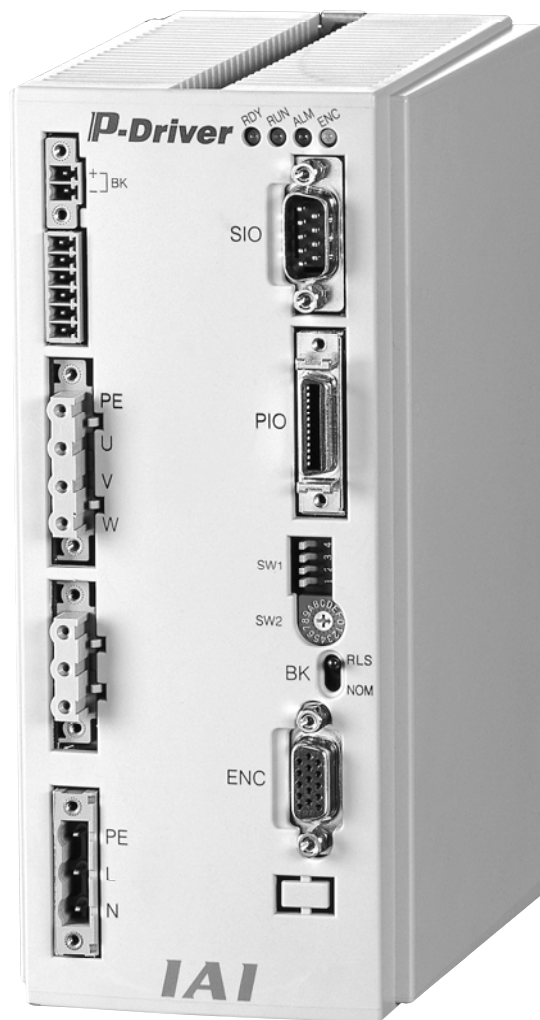
<u>Directions for Safe Use</u>

Please read these "Directions for Safe Use" thoroughly before selecting a model and using the product. The following precautions are provided so that you can use this product safely and avoid bodily injury and/or property damage.
Please observe these precautions together with the safety regulations of JIS B 8433 (general rules for industrial robots).

Directions are classified into "danger," "warning," "caution" and "note," according to the degree of risk.

⚠ Danger	Indicates an item where imminent danger causing death or serious injury may occur if the product is mishandled
⚠ Warning	Indicates an item where there is a risk of causing death or serious injury if the product is mishandled
⚠ Caution	Indicates an item where there is a possibility of injury or damage to the equipment if the product is mishandled
Note	Indicates an item to be observed in order to use the product properly, even though there is no possibility of damage

This product has been designed and manufactured as a component for general industrial machinery.

Devices must be selected and handled by a system designer, person in charge of the system or similar individual with sufficient knowledge and experience, after reading both the catalog and operation manual (particularly the "Directions for Safe Use" section). Mishandling poses a risk.

Please read the operation manuals for all devices, including the main unit and controller.
It is the customer's responsibility to verify and judge the compatibility between this product and the customer's system, and to use them properly.

After reading the catalog, operation manual and other materials, store them in a place where other users will have easy access to them when necessary.

Be sure to attach the catalog, operation manual and other materials to the product conspicuously if you transfer or lend the product to others, so that the new owner or user can understand its safe and proper use.

The danger, warning and caution directions in this "Directions for Safe Use" do not cover every possible situation. Please read the catalog and operation manual for the given device, particularly for descriptions unique to it, to ensure its safe and proper handling.

⚠ Danger

General

● Do not use this product for the following applications:
　1. Medical devices related to the support and maintenance of human life and body
　2. Mechanisms and machinery used for the purpose of moving and transporting people
　3. Important security components of machinery
This product is not designed for applications requiring a high degree of security. We do not guarantee the safety of human life, and the guarantee coverage is limited to this delivered product exclusively.

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Installation

- Do not use this product in a place where hazardous substances such as combustible, flammable or explosive substances exist. There is a possibility of the product generating sparks, catching fire or causing an explosion.
- Do not use this product in a place where there is a possibility of water and oil drops being splashed on the main unit and controller.
- Never cut and reconnect the cable of this product in order to change the cable length. Doing so may cause the risk of equipment catching fire.

Operation

- People using pacemakers or similar devices must not approach within one meter of this product. Pacemakers may malfunction due to the magnetic field caused by the strong magnet within this product.
- Do not pour water on this product. Pouring water on the product, washing it or using it immersed in water may cause injury due to abnormal operation, electric shock, fire, etc.

Maintenance, Inspection and Service

- Never modify this product. Doing so may cause injury due to abnormal operation, electric shock, fire, etc.
- Do not attempt to disassemble this product. Doing so may cause injury, electric shock, fire, etc.

⚠ Warning

General

- Do not use this product outside the specified range. Using it outside the specified range may cause failure, breakdown and damage to the product. Doing so may also lead to a significant reduction in the product's useful life. Be sure to observe, in particular, the maximum load weight and speed specifications.

Installation

- Design a safety circuit or devices so that device damage and physical injury will not occur if the machine stops at system errors such as emergency stop and electric power failure.
- Make sure to perform D-class grounding (formerly third-class grounding, with ground resistance of 100 Ω or less) for the actuator and controller. There is a possibility of electric shock and malfunction in the event of current leakage to the ground.
- Be sure to confirm the safety of the operating range of devices before supplying power to and operating this product. If the power is supplied improperly, there is a risk of electric shock and injury caused by contact with a movable part.
- Wire this product correctly while checking against the operation manual. Connect the cables and connectors securely so that they do not get pulled out or loosened. Failure to do so may lead to abnormal operation of this product or fire.

Operation

- Do not touch the terminal blocks or switches while the power is turned on. There is a risk of abnormal operation and electric shock.
- Check to see that the servo is off (using the teaching pendant) before manually moving movable parts of this product (such as manual positioning). Failure to do so may lead to injury.
- The cables used are highly flexible but not robotic. Do not store them in a movable wiring duct (e.g. cable bearer) whose radius is less than the specification.
- Do not damage any of the cables. Damaging, forcibly bending, pulling, winding or pinching cables, or placing heavy objects on them may cause current leakage, fire and/or electric shock due to poor conduction, abnormal operation, etc.

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- Turn off the power in case of electric power failure. Failure to do so may cause injury and product damage, since the product may start moving suddenly upon recovery from the electric power failure.
- Turn off the power immediately if the product generates abnormal heat, smoke or odor. Failure to do so may lead to product damage or fire.
- Turn off the power immediately if the protective device (alarm) of the product is activated. Failure to do so may lead to injury due to abnormal operation of the product or may lead to the product being broken or damaged. After turning off the power, investigate and remove the cause of the alarm before turning on the power again.
- Turn off the power immediately if the LEDs of the product fail to light when the power is turned on. A protective device (e.g. fuse) on the live side may be alive, not blown. Send a repair request to the sales office from which you purchased the product. (All the LEDs should be turned off when an emergency stop is activated.)

Maintenance, Inspection and Service

- Be sure to completely remove the supply of electricity before performing various tasks such as maintenance/inspection, service or replacement. At this point, observe the following precautions:
  1. Post a display, for instance "Work in Progress: Do not turn on the power," in an easy-to-see location, so that a person other than the operator does not turn on the power inadvertently while the operator is working in the area.
  2. If several operators are involved in the maintenance/inspection, do not turn the power supply on/off or move the axis until the safety of all operators has been confirmed and all operators are made fully aware of such operations.

Disposal

- Do not throw this product into the fire. The product may explode or poisonous gases may be discharged.

⚠ Caution

Installation

- Do not use this product in places subjected to direct sunlight (ultraviolet light) or dust, salt and iron powder, humid places, or in an atmosphere containing organic solvent, phosphate-ester hydraulic oil, etc. The product may stop functioning in a short period of time, or the performance may be deteriorated and the lifetime of the product may be significantly reduced.
- Do not use this product in an atmosphere containing corrosive gases (sulfuric acid, hydrochloric acid, etc.). The durability of the product may be diminished due to the generation of rust.
- Take appropriate shielding measures if this product is used in the following places. Failure to take such measures may lead to a malfunction.
  1. Places where large current or strong magnetic fields are generated
  2. Places where arc discharges may occur, such as in welding operations
  3. Places where electrical noise may be generated due to static electricity
  4. Places that may be exposed to radiation
- Install the main unit and controller in a place with minimum dust and dirt. If they are installed in a place filled with dust and dirt, they may malfunction.
- Do not install the product in a place where it may be subjected to strong vibration or impact (4.9 m/s^2 or more). Doing so may result in the malfunctioning of the product.
- Place an emergency-stop breaker in an easily accessible location so that it is possible to stop the operation of the product immediately in the event of a potential danger.
- When installing this product, be sure to secure sufficient space for maintenance. If sufficient space is not secured, daily inspection and maintenance cannot be conducted properly, which will eventually lead to device failure and/or damage to the product.
- Do not hold on to movable parts or cables of this product at the time of installation. Doing so may lead to injury.

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- Be sure to use genuine parts supplied by IAI for the cable between the actuator and controller. Moreover, be sure to use genuine parts supplied by IAI for each component, such as an actuator, controller or teaching pendant.
- Post a display, for instance "Work in Progress: Do not turn on the power," when performing tasks relating to installation, adjustment, etc., so that the power is not turned on inadvertently. If the power is turned on inadvertently, there is a risk of electric shock or injury due to sudden activation of the actuator.

Operation

- Turn on the power to the host device first. Failure to do so may lead to injury or product damage, since the product may be activated suddenly.
- Do not place fingers or objects in any of the opening parts of this product. Doing so may lead to fire, electric shock and injury.
- Do not place floppy disks or other magnetic media within one meter of this product. Data stored on the floppy disks may be damaged by the strong magnetic field caused by the magnet within this product.

Maintenance, Inspection and Service

- Do not touch the terminals when conducting the insulation-resistance test. Doing so may cause electric shock. (Do not conduct the withstand voltage test on a product that uses a DC power supply.)

Note

General

- Be duly cautious in use by providing a sufficient margin to the stated rating and performance limitations, as well as safety measures (for instance, failsafe measures), if you are considering using the product under conditions or in environments not described in the catalog and operation manual. This also applies if you are considering using the product for applications requiring special security such as air navigation facilities, combustion equipment, entertainment devices, cleanrooms, security devices or other situations where significant influence on the safety of human life and properties can be expected. Be sure to consult our sales representative.

Installation

- Do not place obstacles that prevent ventilation near the controller. Doing so may damage the controller.
- Do not configure control loops that may cause workpieces to be dropped in case of a power failure. Configure the control loops so that tables and workpieces can be prevented from dropping in case of power failure and/or the emergency stop of machinery.

Installation, Operation and Maintenance

- When handing this product, wear protective gloves, safety glasses, protective footwear, etc., as necessary to secure safety.

Disposal

- If this product becomes unusable or no longer necessary, dispose of it properly as industrial waste.

Others

- ■ IAI shall have no liability if the general precautions in "Directions for Safe Use" are not observed.
- ■ For inquires about this product, please contact your local sales office. Addresses and telephone numbers of sales offices are listed at the end of the operation manual.

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Before Using the Product

■ Precautions

(1) Be sure to read this operation manual to ensure the proper use of the product.
(2) It is prohibited to use or copy any part of this manual without permission.
(3) Please be aware that we shall have no liability for any effects caused by operations not described in this manual.
(4) The information provided in this manual is subject to change without notice.

■ Handling at Emergency

* If this product is in a dangerous condition, turn off all the power-supply switches of the main unit and connected devices, or pull out all power-supply cords from their sockets. (A "dangerous condition" refers to any situation where fire and physical danger can be expected due to abnormal heat, smoke and/or fire.)

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1.   Overview

This product is a pulse-train input type controller for actuators manufactured by IAI.
It allows controls according to the command signals from the positioning control function of a host controller (PLC).

1.1   Features

■   Dedicated Homing Signal
P-Driver supports our proprietary stroke end push homing operation. This function allows automatic homing without using complex sequences or external sensors.

■   Brake Control Function
The power supply of the electromagnetic brake is supplied to the controller, separately from the main power supply. Since the brake is controlled by the controller, there is no need to program a sequence. Moreover, the electromagnetic brake can be released at any point after the main power supply is cut off.

■   Torque Limiting Function
The actuator torque can be limited using external signal (via parameter setting), and a signal is output when the specified torque is reached. With the use of this function, push operation and press-fitting become possible.

■   Feed-Forward Control Function
Response can be raised under certain conditions, such as when the load inertial ratio is high. Increasing this parameter setting decreases the deviation (difference between the position command and the position feedback), thus resulting in improved response.

■   Position-Command Primary Filter Function
Soft start and stop are possible even if acceleration/deceleration is not specified in the command pulse input.

■   Feedback Function
Position detection data can be output as pulse trains (differential output). This enables reading of the current position in real time from the host controller.

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1.2 Name and Function of Each Part of the Controller

(6) Status indicator LED

RUN (green)

ALM (red)

RDY (green)

ENC (yellow)

(5) Input connector for electromagnetic-brake power supply

(7) Communication connector

(4) Input connector for actuator sensor (optional)

(8) I/O signal connector

(3) Motor connector

(9) System setting switch

(2) Connector for regenerative resistance unit (optional)

(10) Brake release switch

(11) Encoder brake connector

(1) Input connector for main power supply

(1) Input connector for main power supply .... Connects the power supply.
(2) Connector for regenerative resistance unit ..... Connects a regenerative resistance unit (optional).
(3) Motor connector .... Connects the actuator's power cable.
(4) Input connector for actuator sensor .... Connects cables from the actuator's sensors such as LS, CREEP and OT (optional).
(5) Input connector for electromagnetic-brake power supply ....
   Connects the power supply for electromagnetic brake. (An electromagnetic brake requires an external power supply.)
(6) Status indicator (LED) .... Used to monitor the controller's operating condition.
   RDY (green): Indicates that P-Driver is operating normally.
   RUN (green): Indicates that the servo is on.
   ALM (red):   Indicates that an alarm is generated.
   ENC (yellow): Indicates that the encoder is disconnected or not connected.
(7) Communication connector .... Connects the PC software cable.
(8) I/O signal connector .... Connects the control I/O signals.

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(9)   System setting switches ......Used to change the encoder voltage and boot mode (for remote start).
(The rotary switch is used for adjustment by the manufacturer.)

System setting switches

Switch	Symbol	Function	
1	/BTRT	Switch for changing boot mode (Set to OFF.)	
2	ENCV2	Switch for adjusting encoder power-supply voltage 2	See the table below for the setting.
3	ENCV1	Switch for adjusting encoder power-supply voltage 1	
4	-	Not used (Set to OFF.)	

[Settings of switches for changing encoder power-supply voltage]

Set these switches according to the cable length of the encoder.

Switch		Cable length [m]	Output voltage [V]
2	3		
ENCV2	ENCV1		
OFF	OFF	-	5.15
OFF	ON	$L < 15$	5.45
ON	OFF	$15 \leq L < 25$	5.75
ON	ON	$25 \leq L < 30$	6.05

(10) Brake release switch ....Used to forcibly release the brake.

(11) Encoder brake connector ....Connects the actuator's encoder/brake cable connector.

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1.3　How to Read the Model Specification

PDR — **I** — **100 B** — **1** — **P**

\<Basic model\>

\<Encoder type\>
　I: Incremental

\<Motor capacity of actuator\>
　20: 20 W
　30: 30 W
　60: 60 W
　100: 100 W
　150: 150 W
　200: 200 W
　400: 400 W
　600: 600 W
　750: 750 W

\<I/O signal specification\>
Blank: NPN
P:　　PNP

\<Power-supply voltage\>
1: 100 V specification
2: 200 V specification

\<Options\>
Blank: None
B:　　Brake
C:　　Creep sensor
L:　　Limit switch
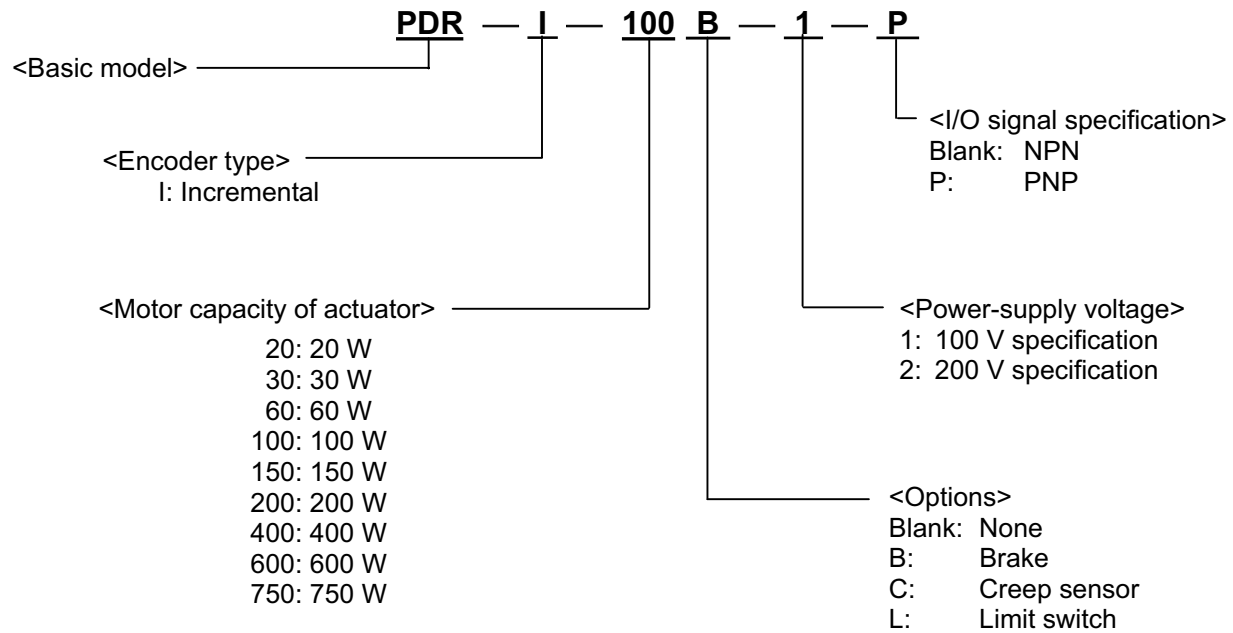
1.4　Applicable Actuators

It is possible to control the following types of actuators.

(1)　RCS-SS (R)
(2)　RCS-SM (R)
(3)　RCS-RA55
(4)　RCS-F55
(5)　RCS-RB7530/7535
(6)　RCS-R10I/20I/30I
(7)　RCS-G20I
(8)　ISP (D)
(9)　IS (D)
(10)　IF
(11)　FS
(12)　SS
(13)　12RS-30/60
(14)　DS-SA4/SA5/SA6

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1.5 Options

(1) PC Software (Model PDR-101-MW)

Content: CD-ROM, PC link cabl e 1.5 m (Unit model CB-ST-SIO015)
Used to set P-Driver parameters, monitor jogging operation during debugging, check various signals, and so on.

PC link cable

1.5 m

Taiyo Electric Wire & Cable (7-core twisted paired cable with shield; UL/cUL compliant)
2464-1061-2A-SB-5PX24AWG

D-sub 9-pin socket:
XM2D-0901 (Omron)
Hood:
XM2S-0913 (Omron)

D-sub 9-pin socket:
XM2D-0901 (Omron)
Hood:
XM2S-0913 (Omron)

Controller side
XM2D-0901

PC side
XM2D-0901

Wire	Color	Signal	No.		No.	Signal	Color	Wire
			1		1			
	Orange with black dots	RD	2		3	TXD	Orange with black dots	
	Orange with red dots	SD	3		2	RXD	Orange with red dots	
AWG24 x 7 cores		ER	4		4	DTR		AWG24 x 7 cores
	Yellow with black dots	SG	5		5	SG	Yellow with black dots	
		DR	6		6	DSR		
		RS	7		7	RTS		
		CS	8		8	CTS		
			9		9			

(2) External I/O Cable (Model CB-PD-PIOS020)

Content: Plug, shell and 2-m shielded cable
Use this cable for connection between I/O signals and the host device.
No connector for the host device side is provided.
Perform wiring according to the host device to be used.

2 m

Sunlight SX (N), 13P x 0.2 sq. (Taiyo Electric Wire & Cable)

No connector at end

Plug: 10126-3000VB (Sumitomo 3M)
Shell: 0326-52A0-008 (Sumitomo 3M)

10126-3000VE

Wire	Color	Signal	No.		Host device side
	Black	COM-A	1		Black
	White/black	COM-A	2		White/black
	Red	SRDY	3		Red
	White/red	RUN	4		White/red
	Green	INP	5		Green
	White/green	ORGR	6		White/green
	Yellow	TLR	7		Yellow
	White/yellow	ALM	8		White/yellow
	Brown	SON	9		Brown
	White/brown	RES	10		White/brown
	Blue	ORGC	11		Blue
	White/blue	TL	12		White/blue
0.2 sq., soldered	Gray	CSTP	13		Gray
	White/gray	COM-B	14		White/gray
	Orange	NP	15		Orange
	White/orange	/NP	16		White/orange
	Purple	PP	17		Purple
	White/purple	/PP	18		White/purple
	Light green	AFB	19		Light green
	White/light green	/AFB	20		White/light green
	Pink	BFB	21		Pink
	White/pink	/BFB	22		White/pink
	Sky blue	ZFB	23		Sky blue
	White/sky blue	/ZFB	24		White/sky blue
	White	GND	25		White
	Black/white	GND	26		Black/white
Shield is connected to a cable clamp					Shield

Shield

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(3) Regenerative Resistance Unit (Model REU-1)

When the actuator is operating, the motor (drive unit) uses supplied electric energy to rotate. On the contrary, when it decelerates, the motor acts as an electric generator that supplies current back to the controller. This is called a regenerative current.
In the case of a vertical application, a large regenerative current will flow into the controller at descending.
P-Driver has a built-in regenerative resistance, but in the case of vertical applications, an additional regenerative resistance unit is required, which is sold separately.

♦ Regenerative resistance unit specification

Model	REU-1
Unit dimensions	W34 mm x H195 mm x D126 mm
Unit weight	0.9 kg
Ratings of built-in regenerative resistance	220 Ω 80W
Accessory	Controller link cable (1 m) Model CB-ST-REU010

♦ Installation conditions and quantity

A regenerative resistance unit is required only in the case of vertical applications. It is not required for horizontal applications.

Motor wattage of vertical axis	Quantity
0~150 W	Not required
~200 W	1 unit is required.
~400 W	1 unit is required.
~600 W	1 unit is required.
~750 W	2 units are required.

⚠ **Caution**

● Alarms are not detected.
● Thus, excessive heat may be generated if the number of regenerative resistance units is insufficient. Exercise caution.

♦ External dimensions
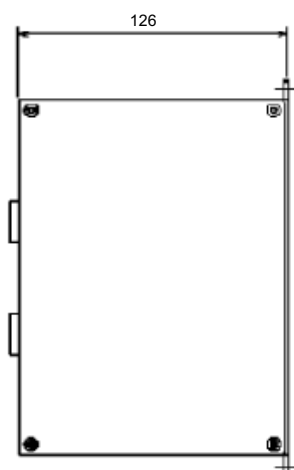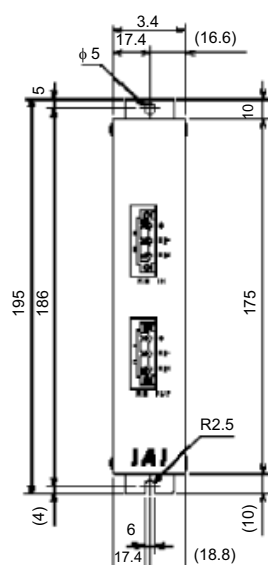
♦ Connection method
Controller

RB

Controller link cable

Regenerative resistance unit
First unit   Second unit

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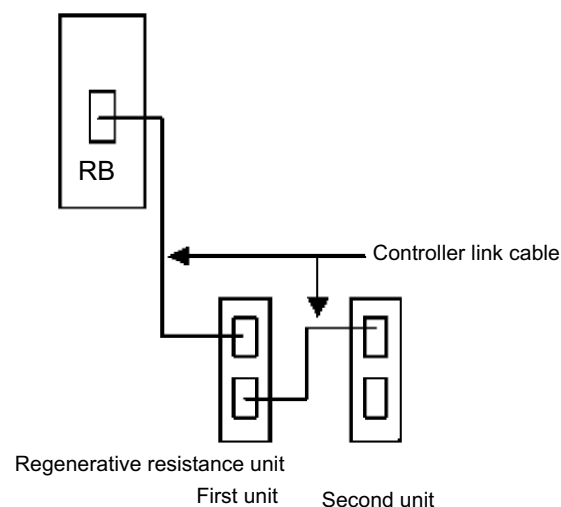
2. Specification

2.1 Specification List

Actuator motor capacity (W)		20	30	60	100	150	200	400	600	750
Power-supply capacity	(W)	34	42	100	150	210	270	520	770	1000
	(VA)	57	70	160	240	350	450	870	1300	1600
Input power supply		100 V specification: single-phase, 100 to 115 VAC $\pm$10%, 50/60 Hz						-		
		200 V specification: single-phase, 200 to 230 VAC $\pm$10%, 50/60 Hz								
Control method		Sine wave PWM, vector current control								
Position detection method		Incremental encoder								
Braking method		Regenerative resistance								
Function/performance	Control mode	Position control via pulse-train input								
	Maximum input pulse frequency	Max. 500 kpps (differential) / Max. 200 kpps (open-collector)								
	Command pulse magnification (electronic gear: $\frac{A}{B}$)	A, B = 1 to 4096 $\quad$ $\frac{1}{50} < \frac{A}{B} < \frac{50}{1}$ (parameter setting)								
	Positioning completion width	1 to 4096 pulses (parameter setting)								
Power supply for I/O signal interface		24 VDC $\pm$20%, 0.8 A (supplied externally)								
Power supply for electromagnetic brake		24 VDC $\pm$20%, 1 A (peak value) (supplied externally)								
Communication function		RS232C (for dedicated PC software)								
Protection functions		Motor overvoltage, overcurrent, abnormal driver temperature, encoder error, motor overload, etc.								
Environmental conditions	Operating temperature/humidity	0 to 40°C, 85% RH or less (non-condensing)								
	Storage temperature	-20 to 70°C (non-condensing)								
	Operating ambience	Free from corrosive or flammable gases, oil mist or dust								
	Durability/vibration	4.9 m/s^2 (0.5 G)								
Withstand voltage		1500 VAC for 1 minute (1000 VAC for 1 minute with actuator connected)								
Protection structure		Open, forced air cooling (IP20)								
Weight		1.2 kg								

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2.2 External Dimensions

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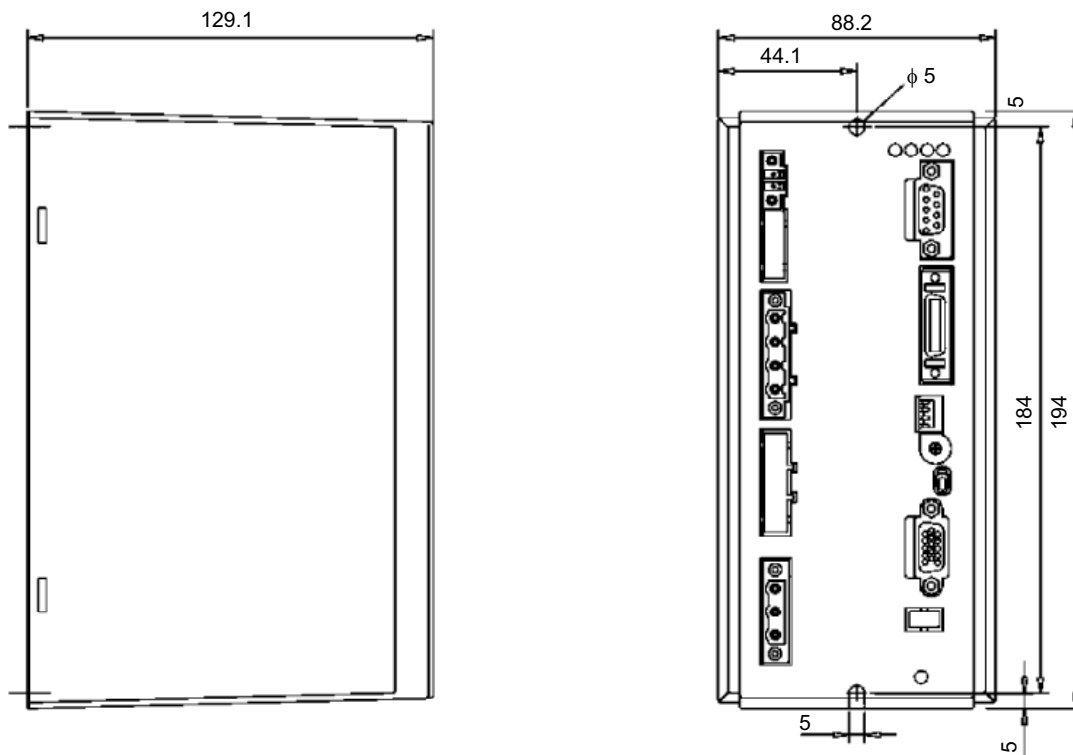
3.   Installation and Noise Prevention

> Please pay attention to the controller's installation environment.

3.1   Installation Environment

   a. Avoid blocking air vents for cooling when installing and wiring the controller. (Insufficient ventilation prevents the controller from achieving full performance and may also cause failure.)
   b. Prevent foreign objects from entering the controller through the air vents. Moreover, be aware that the controller is neither dust-proof nor water (or oil)-proof; avoid using it in dusty environments or locations where oil mist and cutting fluid may be scattered.
   c. Avoid subjecting the controller to heat radiation from large heat sources such as direct sunlight or heat-treatment furnaces.
   d. Use the controller in an environment with an ambient temperature of 0 to 40°C and a humidity of 85% or less (no condensation), and free from corrosive or flammable gases.
   e. Use the controller in an environment free from external vibration and impact.
   f. Avoid inducing electric noise to the controller unit and wiring cables.

3.2   Supply Power

   Depending on the type of controller, it is possible to select the supply power from 100 VAC or 200 VAC.

3.3   Noise Prevention and Grounding

(1)   Wire and Power Supply

   Power-supply terminal block PE is protective ground; perform D-class (third-class) grounding. Moreover, use electric wires with a thickness of 0.75 mm^2 (AWG18) or more, and thicker than the AC power-supply wire used.

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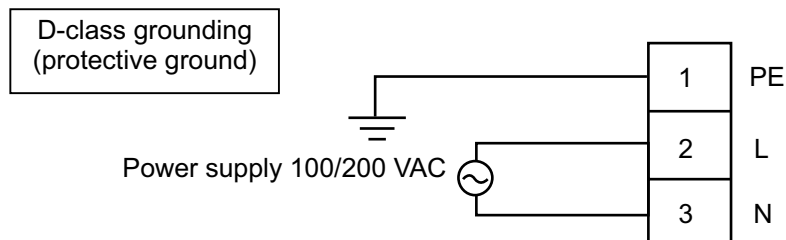
(2) Grounding for Noise Prevention

a. It is necessary to ground the controller to prevent noise, regardless of whether it is configured as a 100 or 200 VAC system.

Connect the controller unit by affixing it to the metal enclosure directly with screws.

100/200 V controller

Protective ground

1

2

3

(AC power supply)

Make the ground wire as thick and short as possible.

Metal enclosure
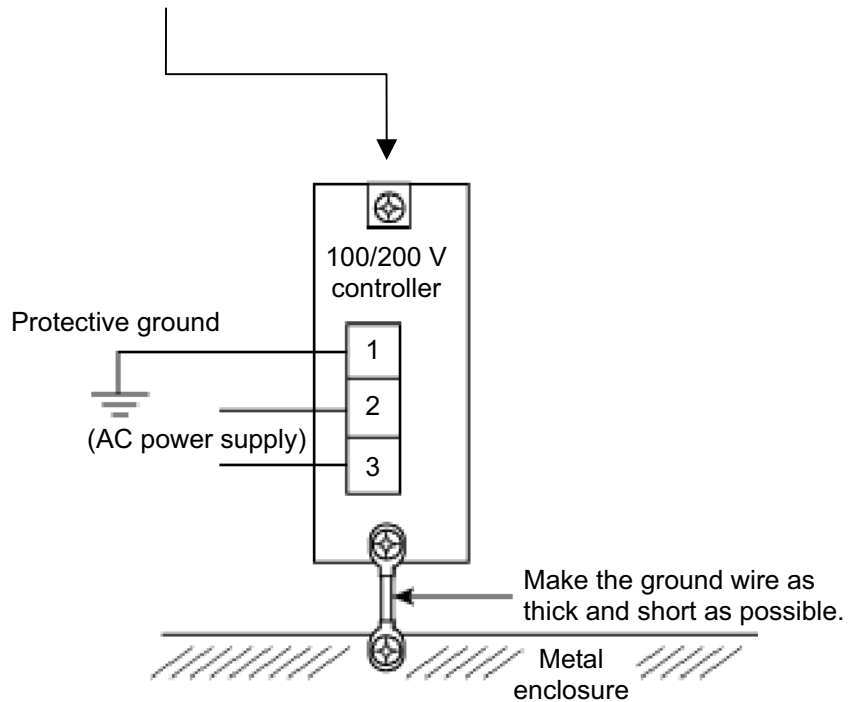
b. General precautions on wiring method
Separate the wiring of the controller from strong electric lines such as the power circuit. (Do not bind wires together, and do not place in the same duct.)
Consult IAI's Technical Service Department or Sales Technology Department if you need longer cables for motor or encoder wiring.

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(3) Protecting Against Noise Emitting Sources

There are many types of noise emitting sources, but the most familiar ones when building a system include solenoid valves, magnet switches and relays. The controller can be protected against noise from such sources by the following actions:

a. AC solenoid valves, magnet switches and relays

Action: Mount a surge killer in parallel with each coil
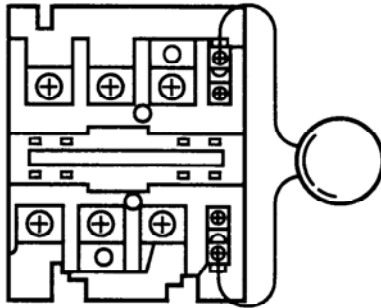
← Point
  Connect the surge killer to each coil with the shortest possible wiring.
  When it is connected to a terminal block or similar, the effect is lost if the distance to coil is large.

b. DC solenoid valves, magnet switches and relays

Action: Mount a diode in parallel with each coil. Determine the capacity of the diode according to the load capacity.
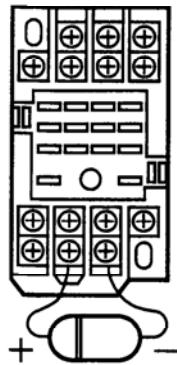
Careful attention should be paid in the case of DC current; if the polarity of the diode is mistaken, the diode, internal circuitry of the controller and/or DC power supply may be destroyed.

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3.4 Heat Dissipation and Installation

Design the size of the control panel, layout of the controller installation and cooling method so that the peripheral area of the controller is 40°C or less.
Install the controller vertically on a wall. The controller is cooled by forced ventilation (a jet on the top part).
Observe this direction when installing and ensure a clearance of 100 mm or more above the controller and 50 mm or more below the controller.
If two or more controllers are installed in parallel, the ambient temperature can be made even by mounting an additional fan to ensure air circulation in the air above the controllers.
Moreover, ensure a clearance of 100 mm or more between the front side of the controller and wall (cover).
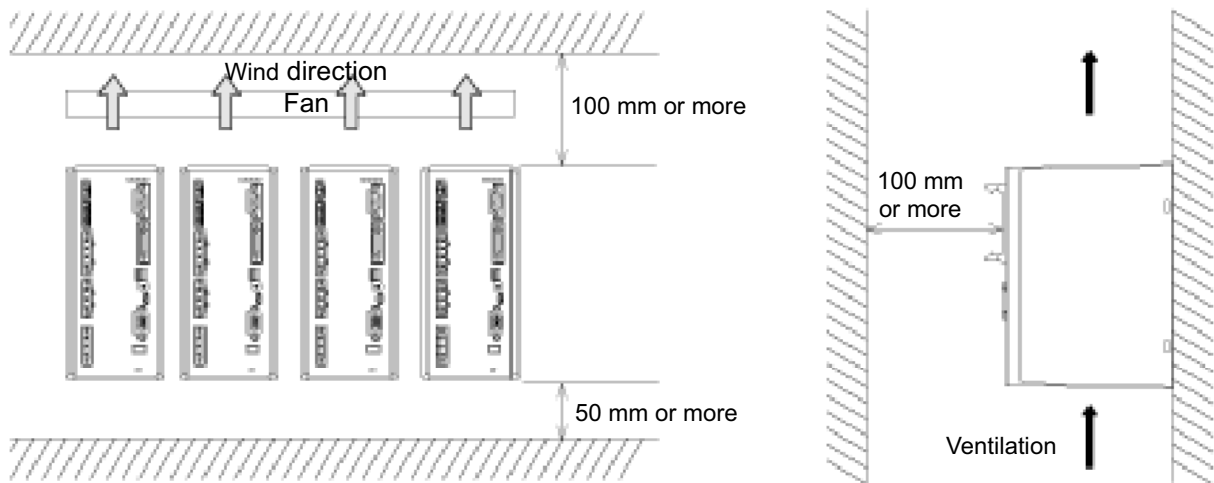
Ensure a clearance between controllers that allows easy installation and removal of individual controllers, regardless of the number of controllers.

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4. Wiring

4.1   Configuration

[Parts to be prepared by the customer]

Single-phase AC power supply

| 100~115 V | 50/60 Hz |
| 200~230 V | 50/60 Hz |

Power-supply breaker
Switches the power supply on/off and prevents damages due to short-circuit current.

Electromagnetic contact
Used when disconnecting this product from the power supply, such as at emergency stop.

AC reactor
Used when the power-supply capacity is large, in order to control voltage fluctuations and higher harmonics.

Line filter
Since the PWM control circuit of this product generates higher harmonics due to switching, radiation noise and conduction noise may influence peripheral devices connected to the same power supply. In such cases, mount a line filer.

Actuator

Motor cable
Encoder cable
LS cable (optional)

[Parts to be prepared by the customer]

General-purpose PC
The PC software dedicated for P-Driver allows parameter setting and operation adjustment.

Brake power supply
24 VDC, 1 A

External (host) controller
P-Driver supports various controllers of pulse-train output type.

Power supply for I/O signals
24 VDC 0.8 A

Regenerative resistance unit (optional)

> ⚠ **Caution**
>
> ● Separate the power supply for the brake from the power supply for the I/O signal interface.

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P-Driver

4.2 Connection Diagram

The following figure shows a connection diagram of the P-Driver unit.

(1) Standard

(2) Option

```
Regenerative
resistance unit

         RB+     RB-      PE

                 24V  ←              Actuator

                  N   ←

                  LS  ←

                CREEP ←

                  OT  ←

                 RSV  ←
```
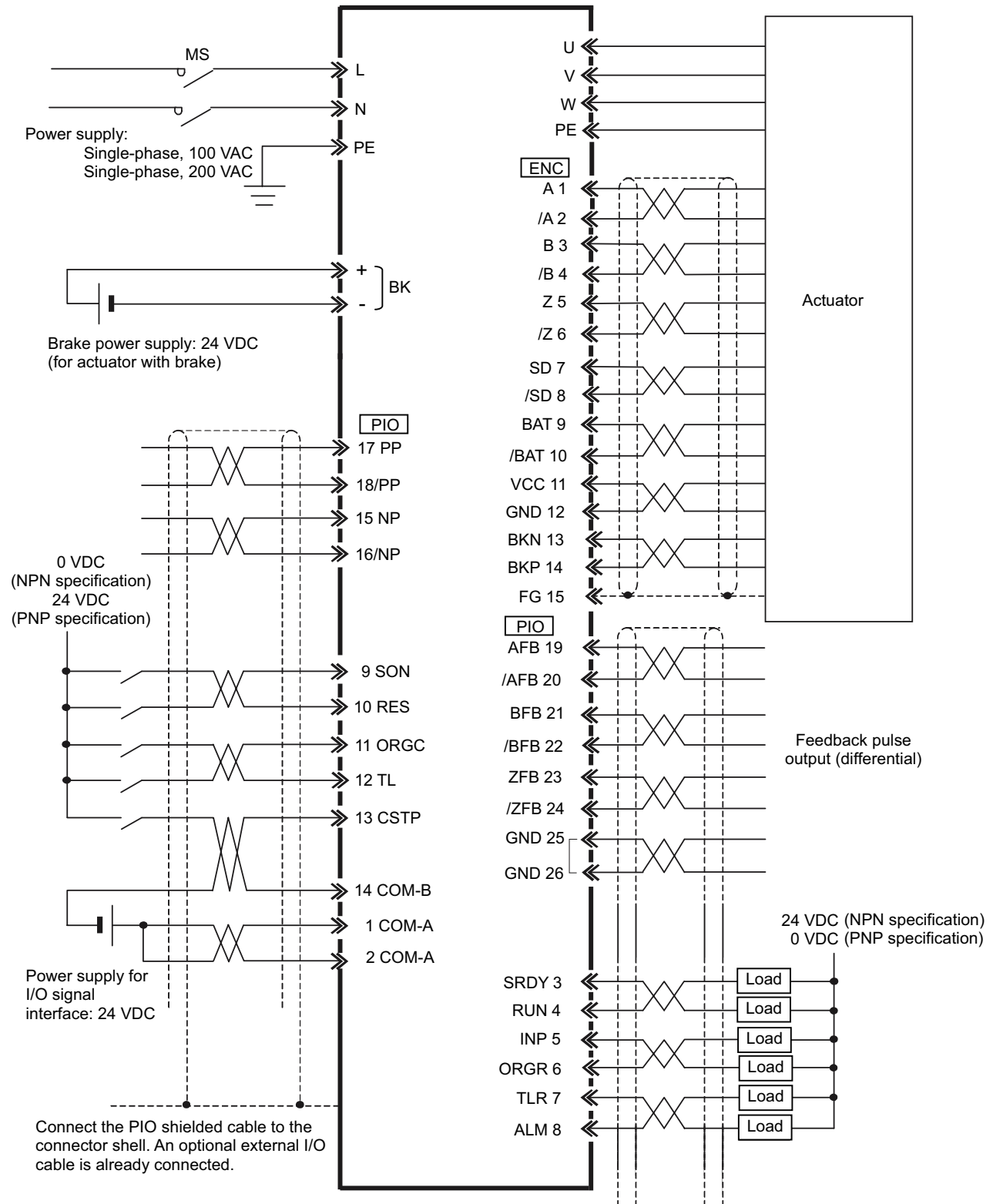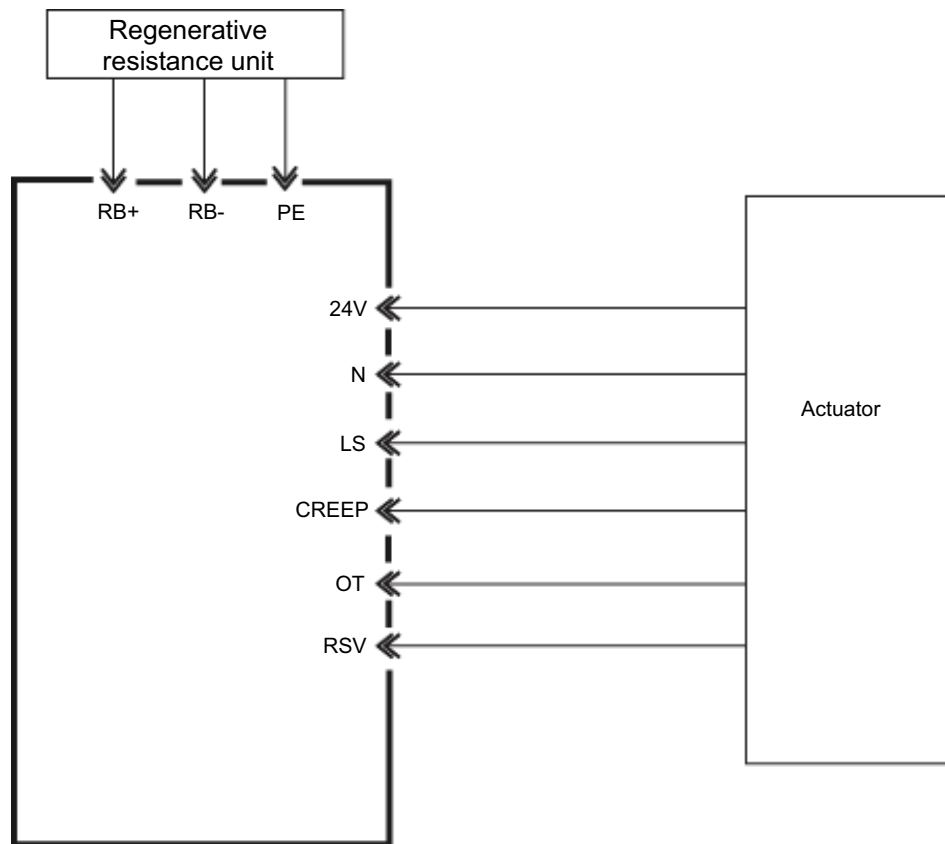
P-Driver

4.3 Power-Supply Input Interface

Connect the power supply specified in 2.1, "Specification List," to P-Driver.
It must be possible to cut off the AC power supply via an electromagnetic contact in case of an emergency stop.

(1) Commercial Power

a. 100 V specification: single-phase, 100 to 115 VAC ±10%, 50/60 Hz

b. 200 V specification: single-phase, 200 to 230 VAC ±10%, 50/60 Hz

List of AC power-supply input connector terminals (Phoenix GMSTB2.5/3-GF-7.62 DIP)

Symbol	Function
L	Main power-supply input terminals
N	
PE	Ground terminal; perform D-class (third-class) grounding or higher.

* Connectors (plugs) are standard accessories.

P-Driver

(2) Emergency Stop

It must be possible to cut off the AC power supply via an electromagnetic contact in case of an emergency stop.
The following figure shows a reference circuit.

Input an alarm/fault signal (ALM) (ON in normal circumstances).
In this circuit, when PB 1 is turned on and the power is supplied via MS, MS is self-maintained unless P-Driver enters an alarm status.
MS is kept turned on unless EMG PB is pressed or P-Driver enters an alarm status.

Input an operation ready signal (RUN).

(100 msec)
* Reference value
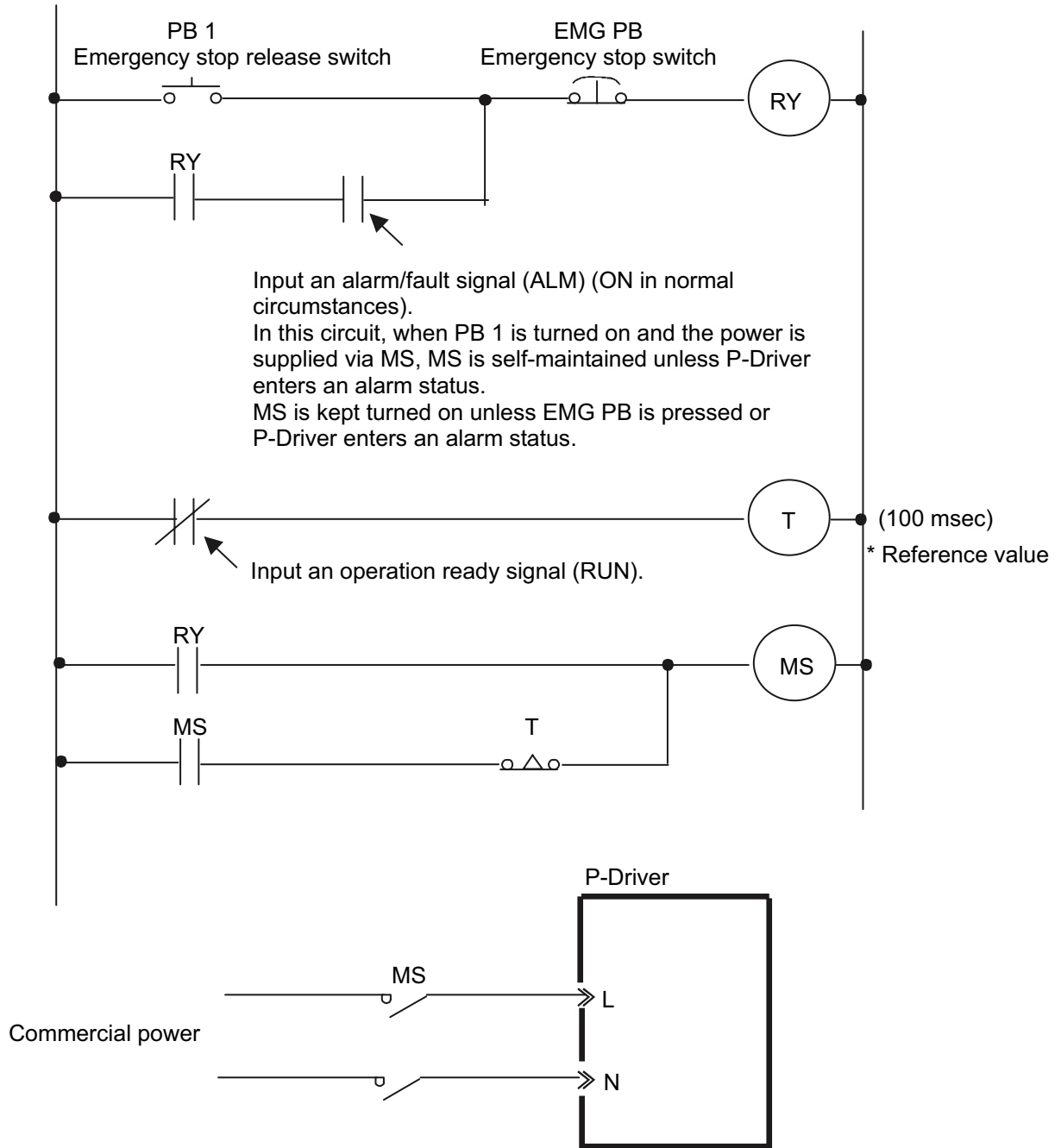
★ Turn the forced stop signal (CSTP) on by turning RY off.
When CSTP is turned on, the forced stop processing is performed and the servo is turned off.
Note that if the timer (T) is set short, the drive unit may be cut off before the servo is turned off and the motor is placed in the free-run status and may become unable to stop. For this reason, wait until sufficient time has elapsed to allow the motor to stop and then cut off the power to the drive unit (be careful with the setting of T).

P-Driver

(3) Electromagnetic Brake Power-Supply Input

This input is required when the actuator has an electromagnetic brake.
Connect a dedicated external power supply.

24 VDC ±20%   1.0 A (peak value)

Do not use the same power supply for the brake power supply as for the I/O signals.

List of electromagnetic brake power-supply input connector terminals (Phoenix MC1.5/2-GF-3.81 DIP)

Symbol		Function
BK	+	Electromagnetic brake power-supply input terminals
	-	

* Connectors (plugs) are standard accessories.

4.4   I/O Signals

Connect the control I/O signals to the external (host) controller.

List of DI/DO interface connector terminals (3M 10226-52A2JL)

Signal classification	Pin No.	Symbol	Signal name	Function
Power supply	1	COM-A	Power-supply common (+)	Power supply common for external I/O signals. Connect this terminal to the + side of a 24 VDC supply. (Pin No. 1 and 2 are internally connected.)
	2			
Sequence signal output	3	SRDY	System ready	Turns on when the initialization is completed normally and control of P-Driver is enabled after the power supply is turned on. Synchronized with the RDY LED located on the front side of the controller.
	4	RUN	Operation ready	Turns on when the servo is turned on and operation of the servo motor is enabled. Synchronized with the RUN LED located on the front side of the controller.
	5	INP	Positioning completion	Turns on when the robot enters the set in-position range. (The in-position range is set via parameters.)
	6	ORGR	Homing completion	Turns on when homing is complete, as indicated by the ORGC input.
	7	TLR	Torque limiting	Turns on when the torque reaches the set torque limit value while TL is on. (The torque limit value is set via parameters.)
	8	ALM	Alarm	Turns off when a protection circuit (function) is actuated and the base current is interrupted. This signal is normally turned on after the power supply is turned on. Synchronized with the ALM LED located on the front side of the controller. The ALM LED is lit in case of an alarm.

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P-Driver

Signal classification	Pin No.	Symbol	Signal name	Function
Sequence signal input	9	SON	Servo ON	Operation of the servo motor is enabled when this signal is turned on. The servo motor is placed in the free-run status when this signal is turned off. In the case of an actuator with a brake, the brake is released when this signal is turned on. If this signal is turned off during operation, forced stop processing is performed and the motor is placed in the free-run status. In the case of an actuator with a brake, the brake is applied at the same time as the motor is placed in the free-run status.
	10	RES	Alarm reset	Alarms are reset at the rising edge of this signal.
	11	ORGC	Homing command	Homing operation starts at the rising edge of this signal.
	12	TL	Torque limit selection	The torque limit value set in the parameter becomes valid when this signal is turned on. To perform push operation, turn this signal on before starting the positioning of the actuator or in the middle of the positioning operation.
	13	CSTP	External forced stop	When this signal is turned on, the robot decelerates to a stop at the forced stopping torque and the servo is turned off.
Power supply	14	COM-B	Power-supply common (-)	Power-supply common for external I/O signals. Connect this terminal to the - side of a 24 VDC supply.
Command pulse input	15	NP	Pulse-train input	Inputs pulse-train for positioning command. Open-collector method: Max. 200 kpps Differential receiver method: Max. 500 kpps

The command pulse mode can be chosen from 90-degree phase shifted signal (phases A/B, in quadrature), pulse-train + forward/reverse signal, and forward/reverse pulse, and input logic mode can be selected from positive logic and negative logic for each of the above. Moreover, the amount of unit movement per pulse can be set by an electric gear. (The command pulse input mode and electric gear settings are specified using parameters.) |
	16	/NP		
	17	PP		
	18	/PP		

P-Driver

Signal classification	Pin No.	Symbol	Signal name	Function
Feedback pulse output (differential)	19	AFB	+A	Outputs position detection data as a pulse train (differential).
	20	/AFB	-A	The output pulse mode can be chosen from 90-degree phase shifted signal (phases A/B, in quadrature), pulse train + forward/reverse signal, and forward/reverse pulse, and output logic mode can be selected from positive logic and negative logic for each of the above. (The output pulse mode is specified using parameters.)
	21	BFB	+B	
	22	/BFB	-B	
	23	ZFB	+Z	The resolution is determined by the electric gear ratio of the command pulse input. (The position detection data is output with the same resolution as the command signal.)
	24	/ZFB	-Z	
	25	GND	Reference potential	Line driver ground line for feedback pulse output (Pins 25 and 26 are internally connected.)
	26			

* Connectors (plugs and shells) are standard accessories.

* Optional external I/O cables (CB-PD-PIOS020) are prepared.

⚠ Caution

- Note that the actuator moves in the negative direction with a forward pulse (forward for the motor) and in the positive direction with a reverse pulse (reverse for the motor). (Opposite applies to folded motor type actuators.)
- When considering the forward/reverse direction, pay attention to the settings of the host controller or connection of PP and /PP as well as NP and /NP.
- * The rotation direction of the motor is indicated by setting CCW to forward, as seen from the axis edge of the load side.

P-Driver

4.5 I/O Signal Interface Circuit

(1) Sequence Input Part

Item	Specification
Input voltage	24 VDC $\pm$ 20%
Input current	7 mA/circuit
Operating voltage	ON voltage --- Min. 16 V (4.5 mA) OFF voltage --- Max. 6 V (1.4 mA)
Insulation method	Photo-coupler

NPN specification

PNP specification

P-Driver
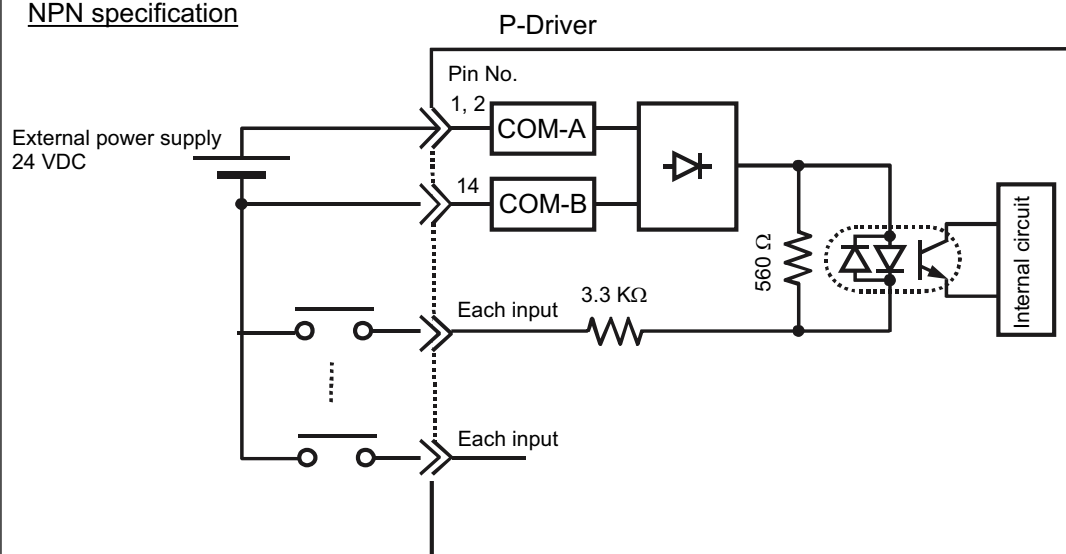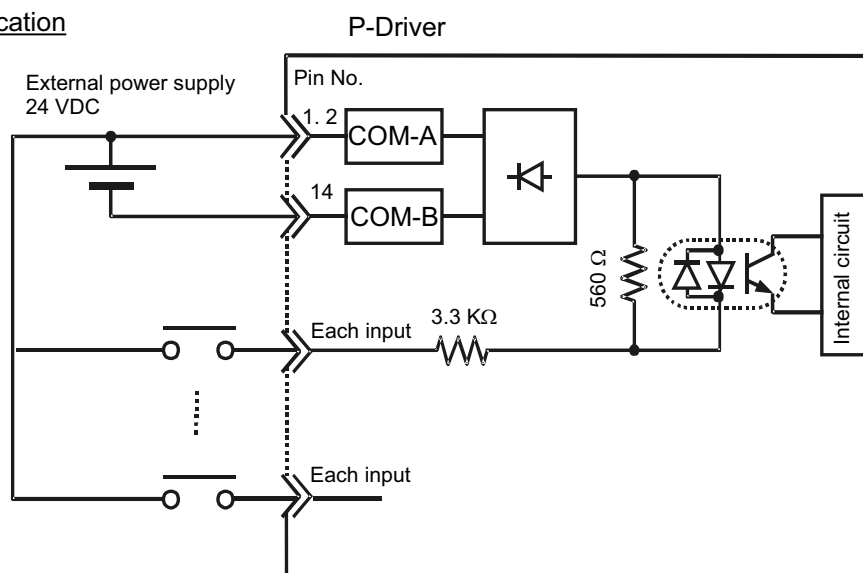
(2) Sequence Output Part

Item	Description
Rated load voltage	24 VDC/60 V (peak; without flywheel diode)
Maximum load current	100 mA/circuit
Insulation method	Photo-coupler
Overcurrent protection	Fuse resistance: 10 Ω, 0.1 W

NPN specification
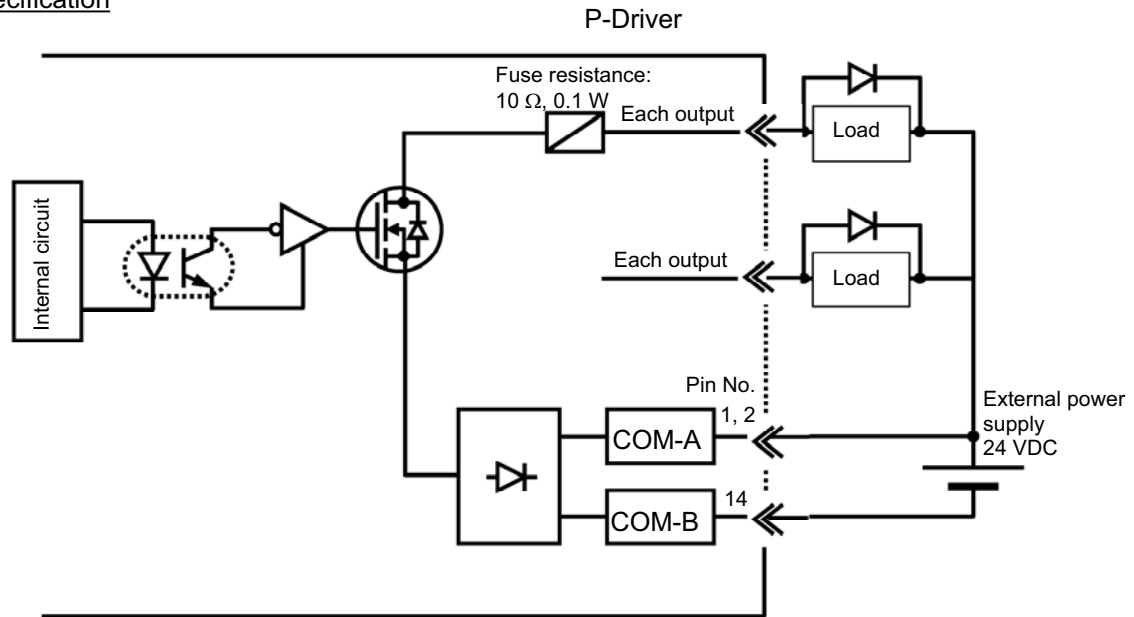
PNP specification
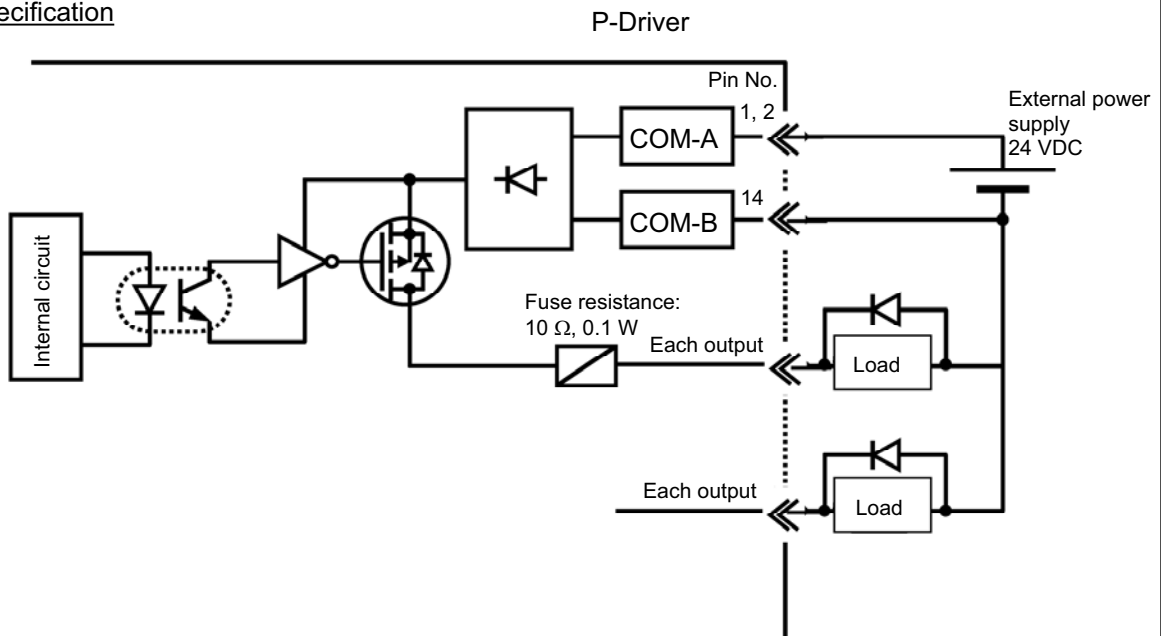
P-Driver

(3)   Command Pulse-Train Input Part

Differential line-driver input
Applicable line driver: 26C31 or equivalent

P-Driver

Pin No.
15/(17)

16/(18)
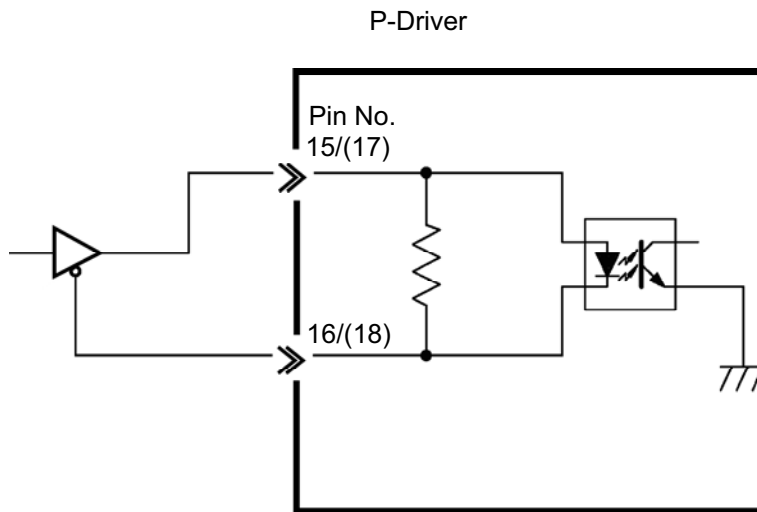
Open-collector input
Pull up with a resistor of 2.2 kΩ.

P24

P-Driver

2.2 kΩ

Pin No.
15/(17)

16/(18)

N24

▮P-Driver
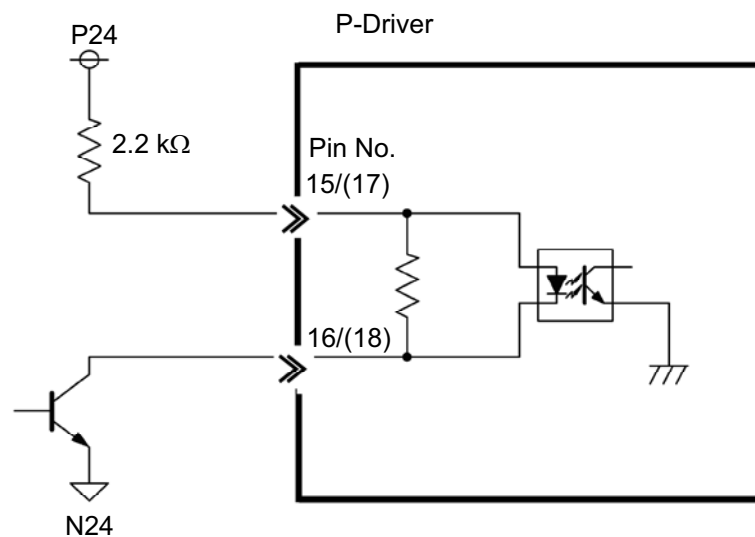
(4)   Feedback Pulse Output Part

Applicable line receiver: 26C32 or equivalent

P-Driver

Pin No.
18/(21)/(23)

Pin No.
20/(22)/(24)

P-Driver
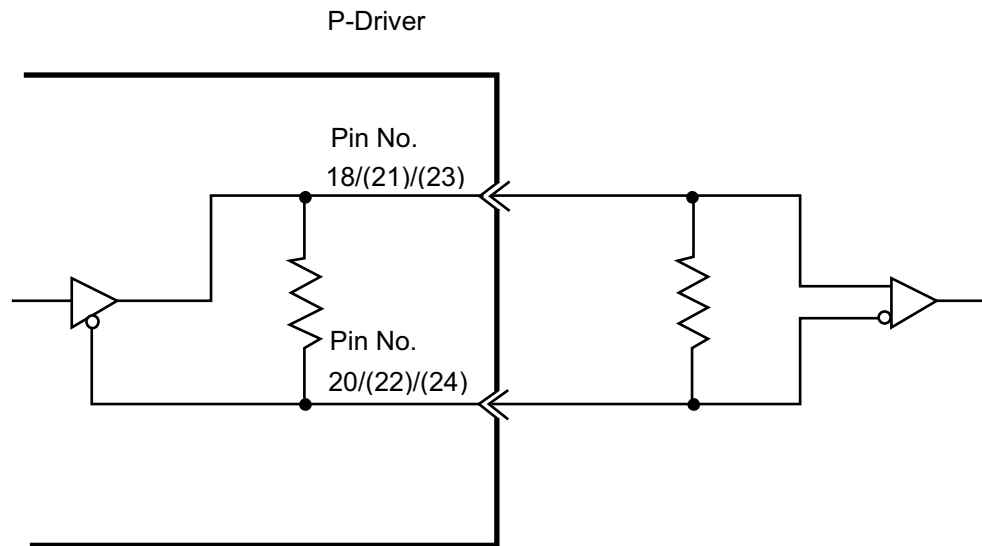
4.6　Motor Cable Connector

List of motor connector terminals (Phoenix GIC2.5/4-GF-7.62 DIP)

Symbol	Function
U	Motor power cable connection terminals of actuator
V	
W	
PE	

* The connector (plug) is attached to the motor cable.

4.7　Encoder Cable Connector

List of encoder connector terminals (Omron XM3B-2542-502L)

Pin No.	Symbol	Function
1	A	Encoder phase A signal
2	/A	
3	B	Encoder phase B signal
4	/B	
5	Z	Encoder phase Z signal
6	/Z	
7	SD	Serial data line (serial encoder)
8	/SD	Magnetic pole detection function switch signal (encoder with magnetic pole detection)
9	BAT+	Not used
10	BAT-	
11	PG5V	Encoder power supply
12	PGND	
13	BKN	Brake drive power supply
14	BKP	
15	NC	Not used

* The connector (plug) is attached to the encoder cable.

4.8　Sensor (Optional) Input Connector

This is an input connector for LS (limit sensor), OT (over-travel sensor) and CREEP (creep sensor), which are optional sensors that may be attached to the actuator.

List of actuator sensor input terminals (Phoenix MC1.5/6-G-3.5)

Symbol	Function
24V	Power supply for sensor, 24 VDC (+ side)
N	Power supply for sensor, 24 VDC (- side)
LS	Limit sensor
CREEP	Creep sensor
OT	Over-travel sensor
RSV	Not used

⚠ **Caution**

● 24V and N are power-supply terminals dedicated for sensors and cannot be used for other purposes. Do not connect cables other than the LS cable attached to the actuator to these terminals.

4.9　Regenerative Resistance Unit Connector

This is a connector for connecting a regenerative resistance unit (optional).

List of regenerative resistance unit connection terminals (Phoenix MC1.5/6-G-3.5)

Symbol	Function
RB+	Regenerative resistance unit connection terminal (+ side)
RB-	Regenerative resistance unit connection terminal (- side)
PE	Regenerative resistance unit ground terminal

* The connector (plug) is attached to the regenerative resistance connection cable.

P-Driver

4.10   RS232C Interface

This is a communication interface for the PC software supporting this product.
Use the cable supplied with the PC software (PDR-101-MW) described in 1.5 (1) or equivalent for the connection cable.

List of RS232C interface signals (Omron XM2C-0942-502L)

Pin No.	Symbol	Name
1	-	Cannot be used
2	RXD	Reception data
3	TXD	Transmission data
4	DTR	Data terminal ready
5	GND	(Signal) ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	-	Cannot be used

⚠ **Caution**

● Do not connect anything to pin numbers 1 and 9.

P-Driver

5. Control and Function of I/O Signals

5.1 Input Signals

Input signals to the controller are filtered using a time constant set in order to prevent malfunction due to chattering, noise, etc. (This does not apply to an external forced stop signal (CSTP) input and command pulse-train input (PP, /PP, NP and /NP).)
Therefore, input each input signal continuously for 6 ms or more.
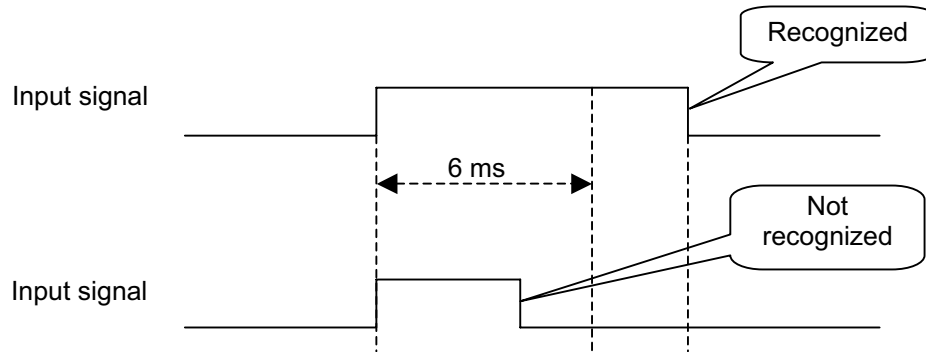
5.1.1 Servo ON Signal (SON)

This signal places the servo motor of the actuator in operable status.

■ Function
The actuator is operable while the SON signal is turned on.
The actuator cannot be operated while this signal is off, even if the power is supplied to the controller.
If this signal is turned off while the actuator is operating, the actuator decelerates to a stop at the forced stopping torque. After it stops, the servo is turned off and the motor is placed in the free-run status.
At this point, the function (dynamic brake, electromagnetic brake or deviation counter clear) selected with the flag for setting function at stop (an actuator parameter) is activated.

P-Driver
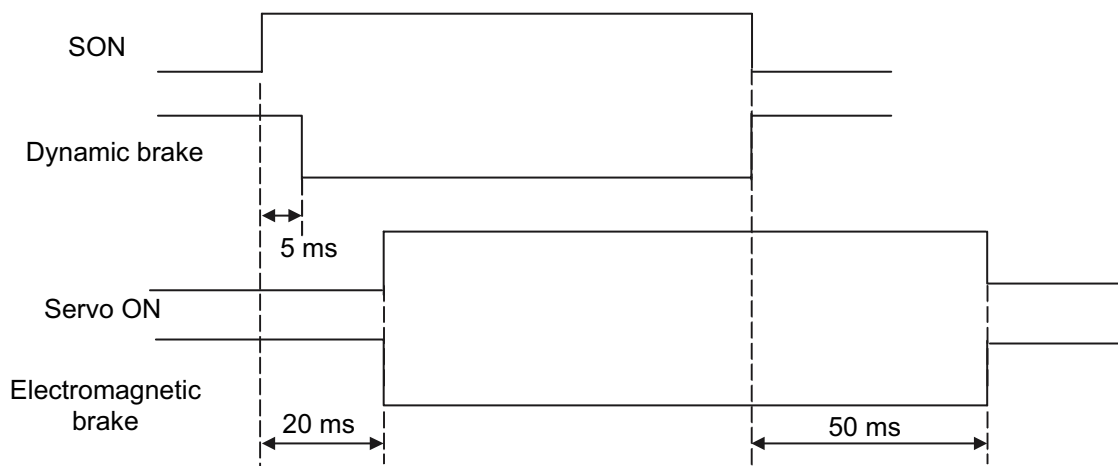
★ Servo OFF status
1. There is no holding torque after stopping.
2. Pulse-train inputs, ORGC (homing command signal), TL (torque limit selection signal) and CSTP (external forced stop signal) are all ignored.
3. Output signals, including RUN (operation ready signal), INP (positioning completion signal), ORGR (homing completion signal) and TLR (torque limiting signal), are all cleared (set to off).

★ Related parameters
It is possible to disable the SON signal using the PIO function setting flag, which is an external interface parameter (the servo is always on).
In this case, the servo is automatically turned on when the power is supplied to the controller.

5.1.2 Alarm Reset Signal (RES)

This signal resets the alarm detection of the controller.

■ Function
Alarm detection of the controller can be reset by turning the RES signal on.

⚠ **Caution**

● If an error at the cold start level occurs, turn the RES signal on while the SON (servo ON) signal is off to cancel the displayed error. If the SON signal is turned on again, however, an alarm is generated again.
● Check the cause of the alarm and eliminate the reasons for it; then restart the controller.

★ Related parameters
It is possible to disable the RES signal using the PIO function setting flag, an external interface parameter.
In this case, the alarm can only be reset by turning the power supply to the controller off and back on again or using the PC software.

P-Driver

5.1.3 Homing Command Signal (ORGC)

This signal commands the actuator to perform automatic homing.

■ Function
When the ORGC signal is turned on, this instruction is handled at the rising (ON) edge and the actuator performs the automatic homing operation.
When homing is completed, the ORGR (homing completion) output signal is turned on.
When the ORGR signal is turned on, set the current value register of the host controller (PLC) to the home value (enter 0) using the current value preset function.
This signal is always enabled as far as the servo is turned on.
It is possible to perform homing even after homing is completed, by turning the ORGC signal on.

⚠ **Caution**

● The ORGC signal takes priority over the pulse-train command input. For this reason, the actuator starts homing once the ORGC signal is turned on, even if it is being operated by the pulse-train command.
● The ORGC signal is only handled at the rising (ON) edge.
● The homing operation is stopped if the SON signal is turned off, the CSTP (external forced stop) signal is turned on or alarm is detected while homing. When the servo is turned off, the homing command is canceled even if the ORGC signal is still turned on. For this reason, it is recommended to turn the ORGC signal off and then on before performing the homing operation again.

★ Related parameters
It is possible to disable the ORGC signal using the PIO function setting flag, an external interface parameter.
Disable the ORGC signal if you are using the homing function of the host controller (PLC).

5.1.4 Torque Limit Selection Signal (TL)

This signal limits the torque of the motor.

■ Function
While the signal is turned on, it is possible to limit the actuator's thrust (motor torque) to the torque set in the torque limit value of a speed/current control parameter.
While the TL signal is turned on, if the torque reaches the torque limit value, the TLR (torque limiting) output signal is turned on. The TL signal is disabled while homing and during forced stop.

P-Driver

> ⚠ **Caution**
>
> - Do not turn the TL signal off while the TLR signal is turned on.
> - While the torque is being limited (the TL signal is turned on), excessive deviation (standing pulse) may be generated (if the actuator cannot operate due to applied load, for instance in the push status). If the TL signal is turned off in this status, control at the maximum torque is immediately started and the actuator may operate suddenly or go out of control. After turning the TL signal on (after the push operation is completed, etc.), make sure to move the actuator to the opposite direction and check that the TLR signal is turned off. Turn the servo off if moving in the opposite direction is impossible.

★ Related parameters
It is possible to disable the TL signal using the PIO function setting flag, an external interface parameter. Disable the TL signal if it is not used.

5.1.5　Forced Stop Signal (CSTP)

This signal forcibly stops the actuator.

■ Function
Make sure to input the CSTP signal continuously for 10 ms or more. When the actuator receives the CSTP signal, it decelerates to a stop at the forced stopping torque and the servo is turned off. At this point, the function (dynamic brake, electromagnetic brake or deviation counter clear) selected with the flag for setting function at stop (an actuator parameter) is activated.
See 5.1.1, "Servo ON Signal (SON)," for handling and status of servo off.

★ Related parameters
The CSTP signal can be disabled with the PIO function setting flag, an external interface parameter, but do not use this setting.
The CSTP signal is used to urgently stop the actuator at emergency stop.
See 4.3 (2), "Emergency Stop," for emergency stop handling.

5.1.6　Command Pulse Inputs (PP, /PP, NP, /NP)

These signals are pulse-train inputs for positioning commands.

■ Function
It is possible to input pulse-trains of up to 200 kpps in open-collector mode and 500 kpps in differential receiver mode.
The command pulse mode can be chosen from 90-degree phase shifted signal (phases A/B, in quadrature), pulse-train + forward/reverse signal, and forward/reverse pulse, and the input logic mode can be selected from positive logic and negative logic for each of the above.
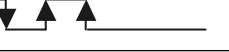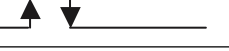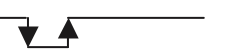
⚠ **Caution**

● Note that the actuator moves in the negative direction with a forward pulse (forward for the motor) and in the positive direction with a reverse pulse (reverse for the motor). (Opposite applies to folded motor type actuators).
● When considering the forward/reverse direction, pay attention to the settings of the host controller or connection of PP and /PP as well as NP and /NP.
* The rotation direction of the motor is indicated by setting CCW to forward, as seen from the axis edge of the load side.

★ Related parameters
It is possible to set six types of command pulse modes by the command pulse input mode, a position control parameter.

Command pulse-train mode		Input terminal	Forward	Reverse
Negative logic	Forward pulse train	PP・/PP		
	Reverse pulse train	NP・/NP		
	A forward pulse train indicates motor revolutions in the forward direction, while a reverse pulse train indicates motor revolutions in the reverse direction.			
	Pulse train	PP・/PP		
	Sign	NP・/NP	Low	High
	A command pulse indicates motor revolutions and its sign indicates the rotating direction of the motor.			
	Phase A/B pulse train	PP・/PP		
		NP・/NP		
	Motor revolutions and rotating direction are specified by phases A/B (4 multiplications) with a 90-degree phase difference.			
Positive logic	Forward pulse train	PP・/PP		
	Reverse pulse train	NP・/NP		
	Pulse train	PP・/PP		
	Sign	NP・/NP	High	Low
	Phase A/B pulse train	PP・/PP		
		NP・/NP		

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P-Driver

5.2 Output Signals

5.2.1 System Ready Signal (SRDY)

This signal turns on when control of P-Driver is enabled after the main power supply is turned on.

■ Function
   This signal turns on when the initialization is normally completed and control of P-Driver is enabled after the main power supply is turned on, regardless of the status of alarm and servo.
   It is turned on as far as P-Driver is in a controllable status, even if it is in an alarm status.
   It is synchronized with the RDY LED located on the front side of the controller.

5.2.2 Operation Ready Signal (RUN)

This signal turns on when the servo motor becomes operable.

■ Function
   This signal turns on when the servo is turned on and becomes operable (able to receive the pulse-train input signal, i.e., in pulse mode) as a result of the SON (servo ON) signal being turned on.
   It is turned off when the servo is turned off as a result of the SON signal or CSTP (forced stop) signal being turned off.
   See 5.1.1, "Servo ON Signal (SON)," for handling and status of servo on/off.
   It is synchronized with the RUN LED located on the front side of the controller.

> ⚠ **Caution**
>
> ● This signal is turned off while the SIO mode is selected by the PC software. In this case, however, the RUN LED located on the front side of the controller is not turned off. Moreover, the servo ON status is maintained.
> ● With this signal, it is possible to identify whether the servo is in the SIO mode or pulse (normal) mode. See 9.6.1, "Jog Movement Window," for how to switch between the pulse mode and SIO mode.

5.2.3 Positioning Completion Signal (INP)

This signal turns on when the deviation (standing pulse) of the deviation counter is within the in-position range.

■ Function
   This signal turns on when the servo is turned on and the standing pulse of the deviation counter is within the range of the pulse number set in the in-position width, a position control parameter.
   It is turned off when the servo is turned off.

P-Driver

> ⚠️ **Caution**
>
> - This signal turns on when the servo is turned on (because the actuator is positioned at that location).
> - Since this signal is turned on by the deviation (standing pulse) only, if the in-position width, a position control parameter, is made excessively large, the signal turns on once the actuator enters the in-position range during low-speed operation even if it is operating (positioning is not completed).

5.2.4   Homing Completion Signal (ORGR)

This signal turns on when homing is completed and the coordinate system is established.

■ Function
This signal turns on when homing by the ORGC (homing command) signal or the PC software is completed.
It is turned off when the servo is turned off. Perform homing again after servo off.

> ⚠️ **Caution**
>
> - The software stroke limit, an actuator parameter, is valid only when this signal is turned on.
> - Operation is possible even without using this function, but take actions so that pulse commands larger than the valid stroke are not sent or the actuator is forcibly stopped by setting an external limit switch.

5.2.5   Torque Limiting Signal (TLR)

This signal turns on when the torque reaches the limit value while the torque limit selection signal is turned on.

■ Function
This signal turns on when the actuator's thrust (motor torque) reaches the torque set in the torque limit value, a speed/current control parameter, when the TL (torque limit selection) signal is turned on.
It is turned off when the motor torque decreases.

> ⚠️ **Caution**
>
> - This signal is not turned on if the actuator's trust does not reach the set torque even when the TL signal is turned on.
> - Do not turn the TL signal off while this signal is turned on. (See ⚠️ **Caution** in 5.1.4, "Torque Limit Selection Signal (TL).")

5.2.6 Alarm/Fault Signal (ALM)

This signal turns off when the protection circuit (function) of P-Driver detects an error.

■ Function
  This signal turns off when an alarm is detected and the protection circuit (function) is actuated, and the base current is interrupted. This signal is normally turned on. After having been turned off, it can be turned on again when the cause of the alarm is removed and the RES (reset) signal is turned on (except in case of alarms at the cold start level).
  When an alarm is detected, the ALM LED located on the front side of the controller turns on. This LED is normally turned off.

⚠ **Caution**

- If an error at the cold start level occurs, turn the RES signal on while the SON (servo ON) signal is off to cancel the displayed error. If the SON signal is turned on again, however, an alarm is generated again.
- Check the cause of the alarm and eliminate the reasons for it; then restart the controller. Alarm codes can be checked with the PC software. The controller can store 16 alarm history messages, which are kept in memory unless the power supply is interrupted. Moreover, the PC software displays the occurrence times along with the alarm history messages; it is thus possible to check when and what alarm occurred.
- See 9.5.2, "Error List Window," for details of alarm history messages.

5.2.7 Feedback Pulse Output Signals (AFB, /AFB, BFB, /BFB, ZFB, /ZFB, GND)

These signals output position detection data as differential pulse trains.

■ Function
  These signals output position detection data as differential pulse trains (phases A, B and Z). The host controller can read the current position value of the actuator in real time using the counter function, etc.

★ Related parameters
  The resolution of the pulse output is determined by the electronic gear ratio of the command pulse input set in the position control parameters; the position detection data is output with the same resolution as the command signal.
  The feedback pulse output mode can be set by specifying the FBP mode, a position control parameter. It is possible to disable these pulse signals using the PIO function setting flag, an external interface parameter. Disable the feedback pulse outputs if they are not used.

⚠ **Caution**

- Set these signals in such a way that there are no logical contradictions if you import them in the host controller to configure a closed loop.
- Phase Z signals are output as is if the encoder of the actuator is not a serial encoder. With serial encoders, the range of $\pm 0.5°$ in mechanical angle from the position of point 0 (home) is output as phase Z signal. This precision is only guaranteed when the revolution speed of the motor is 100 rpm or less due to the communication cycle with the encoder.

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6. Parameters

6.1 Parameter Configuration

The parameters are classified into the following five types depending on the content:

a. Driver information
b. External interface information
c. Actuator information
d. Position control information
e. Speed/current control information

6.2 Parameter List

Default values indicated by [A] are determined according to the actuator specifications.
These parameters are set to appropriate values corresponding to the applicable actuator at shipment from the factory.

Type	No.	Name	Symbol	Default value (reference)	Unit	Input range	Description		
Driver information	1	Emergency stop torque	EMTQ	1.0	(multiplier)	Reference only	To be adjusted by the manufacturer		
	2	Servo ON delay time	SONT	20	msec	Reference only	To be adjusted by the manufacturer		
	3	Servo OFF delay time	SOFT	50	msec	Reference only	To be adjusted by the manufacturer		
	4	Cumulative number of writing operations to non-volatile memory area	CEEP	0	Number of times	Reference only	To be adjusted by the manufacturer		
External interface information	1	PIO function setting flag	FPIO	0b	(Bit input)	0000000~ 1111111b	BIT0	SON	0: Enabled, 1: Disabled
							BIT1	RES	0: Enabled, 1: Disabled
							BIT2	ORGC	0: Enabled, 1: Disabled
							BIT3	TL	0: Enabled, 1: Disabled
							BIT4	CSTP	0: Enabled, 1: Disabled
							BIT5	FBP	0: Enabled, 1: Disabled
							BIT6	CPR	0: Positive pulse count direction 1: Negative pulse count direction
	2	Communication speed	BRSL	38400	bps	9600~ 115200	SIO communication speed setting 9,600/19,200/38,400/57,600 115,200 bps		
	3	Gate switch delay time	RTIM	5	msec	Reference only	To be adjusted by the manufacturer		
Actuator information	1	Flag for setting function at stop	FSTP	101b (actuator without brake) 111b (actuator with brake)	(Bit input)	000~111b	BIT0	Clear deviation counter at servo off and alarm generation 0: Enabled, 1: Disabled	
							BIT1	Electromagnetic brake 0: Enabled, 1: Disabled	
							BIT2	Dynamic brake 0: Enabled, 1: Disabled	

Type	No.	Name	Symbol	Default value (reference)	Unit	Input range	Description		
Actuator information	2	Software stroke limit, positive side (actual stroke)	LIMM	[A]	pulse	134217727~ -134217728	Actual stroke value on positive side (Set by the number of pulses.)		
	3	Software stroke limit, negative side (actual stroke)	LIML	[A]	pulse	13421777~ -134217728	Actual stroke value on negative side (Set by the number of pulses.)		
	4	Ball screw lead length	LEAD	[A]	mm	0.1~102.4	Ball screw lead of the actuator		
	5	Ratio of moment of inertia of actuator load	RINA	[A]	(multiplier)	Reference only	To be adjusted by the manufacturer		
	6	Motor type	MTYP	[A]	(HEX input)	00~20h	**HEX input value**	**Actuator**	
								Type	Motor capacity
							00~Fh	Not used	
							10h	RCS-RB7530	60 W
							11h	RCS-RB7530 RCS-RB7535	100 W
							12h	RCS-RB7535	150 W
							13h	RCS-SS(R) RCS-RA55 RCS-F55 ISP(D) IS(D) IF FS SS 12RS-60	60 W
								12RS-30	30 W
							14h	RCS-SM(R) RCS-RA55 RCS-F55 SS	100 W
							15h	RCS-SM(R) SS	150 W
							16h	ISP(D) IS(D) IF FS	100 W
							17h	ISP(D) IS(D) IF FS	200 W
							18h	ISP(D) IS(D) IF FS	400 W
							19h	ISP(D)-W	600 W
							1Ah	ISP(D)-W	750 W
							1Bh	RCS-R10I/20I/30I RCS-G20I	60 W
							1C~ 1Eh	Not used	
							1Fh	DS-SA4/5 [T1]	20 W
							20h	DS-SA6 [T1]	30 W

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Type	No.	Name	Symbol	Default value (reference)	Unit	Input range	Description		
Actuator information	7	Instantaneous maximum current limit value	CMLM	[A]	(multiplier)	Reference only	To be adjusted by the manufacturer		
	8	Encoder type	ETYP	[A]	(HEX input)	0~5h	HEX input value	Actuator type	
							0h	RCS-SS(R) RCS-SM(R) RCS-RA55 RCS-F55 ISP(D) IS(D) IF FS SS 12RS-60 12RS-30 DS-SA4/5/6 [T1]	
							1h	Not used	
							2h	RCS-RB7530/7535	
							3h	Not used	
							4h	RCS-R10I/20I/30I RCS-G20I	
							5h	Not used	
	9	Number of encoder pulses	EPLS	[A]	pulse /rev	1~131072	If the encoder type HEX input value is 0: 16384 If the encoder type HEX input value is 2: 3072 If the encoder type HEX input value is 4: 4096		
	10	Maximum revolution speed	MAXV	[A]	pulse /sec	Reference only	To be adjusted by the manufacturer		
	11	Axis I/O function selection	AIOF	[A]	(Bit input)	Reference only	To be adjusted by the manufacturer		
	12	Temperature increase at rated current conduction	TPRT	[A]	°C	Reference only	To be adjusted by the manufacturer		
	13	Thermal time constant	TMCT	[A]	sec	Reference only	To be adjusted by the manufacturer		
	14	Axis operation type	ATYP	[A]		0~1	Input value	Type	
							0	Linear axis	
							1	Rotational axis	
Position control information	1	Control mode selection	CMOD	[A]		Reference only	To be adjusted by the manufacturer		
	2	In-position width	INP	100	pulse	1~4096	Output width of a positioning completion signal (INP)		
	3	Deviation error output range	ECNT	Three times the number of encoder pulses	pulse	1~99999	Deviation error detection value		
	4	Command pulse input mode (Command pulse-train input mode)	CPMD	01h	(HEX input)	00~12h	HEX input value	Command pulse-train mode	
							00	Phase A/B pulse train	Positive logic
							01	Pulse-train + sign	Positive logic
							02	Forward/reverse pulse train	Positive logic
							10	Phase A/B pulse train	Negative logic
							11	Pulse-train + sign	Negative logic
							12	Forward/reverse pulse train	Negative logic
	5	Electronic gear numerator	CNUM	2048		1~4096	Command pulse magnification numerator		
	6	Electronic gear denominator	CDEN	125		1~4096	Command pulse magnification denominator		
	7	Homing pattern code	ORGP	[A]		0~1	Input value	Motor revolution direction at homing	
							0	Reverse	
							1	Forward	

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Type	No.	Name	Symbol	Default value (reference)	Unit	Input range	Description
Position control information	8	Speed command value at homing	OVCM	[A]	pulse/sec	1~819200	Moving speed at homing
	9	Acceleration command value at homing	OACC	[A]	pulse/sec^2	1,000~19267584	Moving acceleration at homing
	10	Creep sensor approach speed	VCRP	[A]	pulse/sec	Reference only	To be adjusted by the manufacturer
	11	Current limit value at homing	OCLM	[A]	(multiplier)	Reference only	To be adjusted by the manufacturer
	12	Timeout value at homing	OTIM	180,000	msec	Reference only	To be adjusted by the manufacturer
	13	Offset amount at homing	OFST	[A]	pulse	1~134217727	Amount of offset at homing, after the homing command signal is detected
	14	Homing deviation pulse	OPLS	[A]	pulse	1~134217727	Detected amount of mechanical end push deviation at homing
	15	Position control system proportional gain	PLPG	20	rad/sec	1~200	Proportional gain of position control loop
	16	Position-command primary filter time constant	PLPF	0.0	msec	0.0~100.0	Constant at S-shaped acceleration/deceleration
	17	Position feed-forward gain	PLFG	0		0~100	Feed-forward gain of the position control system
	18	Jog acceleration default value	ACC	[A]	pulse/sec^2	1000~19267584	Default acceleration value at jog operation with the PC software
	19	Jog deceleration default value	DEC	[A]	pulse/sec^2	1000~19267584	Default deceleration value at jog operation with the PC software
	20	Jog speed default value	VEL	[A]	pulse/sec	1~1092266	Default speed value at jog operation with the PC software
	21	Maximum speed at incomplete homing	SVEL	[A]	pulse/sec	1~819200	Default limit speed at jog operation with the PC software, before homing
	22	Maximum acceleration value	ACMX	[A]	pulse/sec^2	1000~19267584	Acceleration limit value of the actuator
	23	Maximum deceleration value	DCMX	[A]	pulse/sec^2	1000~19267584	Deceleration limit value of the actuator
	24	Soft limit actual position margin	SLMR	[A]	pulse	1~134217727	Amount of movement compared to the actual stroke at which soft limit over error is detected
	25	Internal stop pulse	IINP	[A]	pulse	Reference only	To be adjusted by the manufacturer
	26	FBP mode Feedback pulse output mode	FBPT	01h	(HEX input)	00~12h	HEX input value / Command pulse-train mode: 00 Phase A/B pulse train Positive logic; 01 Pulse-train + sign Positive logic; 02 Forward/reverse pulse train Positive logic; 10 Phase A/B pulse train Negative logic; 11 Pulse-train + sign Negative logic; 12 Forward/reverse pulse train Negative logic
Speed/current control information	1	Speed loop gain	VLPG	[A]		10~10000	Gain of the speed control loop
	2	Speed loop integration time constant	VLPT	[A]	msec	0~1000	Integration time constant of the speed control loop
	3	Torque filter time constant	TRQF	[A]	msec	0.00~327.67	Filter time constant with respect to torque command
	4	Disturbance observer time constant	DOBT	0.00	msec	Reference only	To be adjusted by the manufacturer
	5	Current control bandwidth	CLPF	[A]		500~32767	Control bandwidth of the current control system
	6	Torque limit value	TQLM	0.7	(multiplier)	0.01~0.70	Torque amplification when the torque limit selection signal (TL) is turned on

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6.3 Parameter Setting

Parameters can be set and changed with the PC software.
Parameter settings and changes become valid by performing a "software reset" by the PC software or turning the power supply off and back on again.

6.3.1 Basic Settings

This section describes the parameters that must be set in order to operate P-Driver.
(P-Driver can be operated simply by setting these parameters, if only positioning operation is required.)

(1) Electronic Gear

Name	Symbol	Unit	Input range	Default value (reference)
Electronic gear numerator	CNUM	-	1~4096	2048
Electronic gear denominator	CDEN	-	1~4096	125

These are parameters for determining the amount of unit movement of the actuator per 1 pulse of the command pulse-train input.

Amount of unit movement for linear axis = Minimum amount of movement (e.g. 1, 0.1, 0.01 mm)/pulse
Amount of unit movement for rotational axis = Minimum amount of movement (e.g. 1, 0.1, 0.01 deg)/pulse

■ Calculation formula for electronic gear

In the case of linear axis:

$$\frac{\text{Ball screw lead lenght (mm/rev)}}{\text{Number of encoder pulses (pulse/rev)}} \times \frac{\text{Electronic gear numerator (CNUM)}}{\text{Electronic gear denominator (CDEN)}} = \text{Amount of unit movement (mm/pulse)}$$

$$\frac{\text{Electronic gear numerator (CNUM)}}{\text{Electronic gear denominator (CDEN)}} \times \frac{\text{Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead lenght (mm/rev)}} = \text{Amount of unit movement (mm/pulse)}$$

In the case of rotational axis:

$$\frac{360 \text{ (deg/rev)} \times \text{Rotational axis gear reduction rate}}{\text{Number of encoder pulses (pulse/rev)}} \times \frac{\text{Electronic gear numerator (CNUM)}}{\text{Electronic gear denominator (CDEN)}} = \text{Amount of unit movement (deg/pulse)}$$

$$\frac{360 \text{ (deg/rev)} \times \text{Rotational axis gear reduction rate}}{\text{Number of encoder pulses (pulse/rev)}} \times \frac{\text{Electronic gear numerator (CNUM)}}{\text{Electronic gear denominator (CDEN)}} = \text{Amount of unit movement (deg/pulse)}$$

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The number of pulses of the encoder varies depending on the type of actuator.

Actuator type	Number of encoder pulses (pulse/rev)
RCS-SS(R)/RCS-SM(R)/RCS-RA55/RCS-F55 ISP(D)/IS(D)/IF/FS/SS 12RS-60/12RS-30 DS-SA4/5/6 [T1]	16384
RCS-RB7530/7535	3072
RCS-R10I/20I/30I	4096

The gear reduction rate of the rotational axis is as follows:

Actuator type	Gear reduction rate
12RS-60	1/50 or 1/100
12RS-30	
RCS-R10I	1/18
RCS-R20I	
RCS-R30I	1/4

■ Calculation example

If the amount of unit movement is set to 0.01 (1/100 mm) for an actuator equipped with an encoder with a ball screw lead length of 10 (mm) and a number of encoder pulses of 16384 (pulse/rev):

$$\frac{\text{Electronic gear numerator (CNUM)}}{\text{Electronic gear denominator (CDEN)}} \times \frac{\text{Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead lenght (mm/rev)}} = \text{Amount of unit movement (mm/pulse)}$$

$$= \frac{16384}{10} \times \frac{1}{100} = \frac{2048}{125}$$

The electronic gear numerator (CNUM) is set to 2048 and the electronic gear denominator (CDEN) is set to 125. With this setting, the amount of movement per pulse of the command pulse-train input is 0.01 (mm).

⚠ **Caution**

a. Make sure to cancel common factors in the electronic gear numerator (CNUM) and denominator (CDEN), so that both integers to be entered become 4096 or less.
   Moreover, CNUM and CDEN must satisfy the following relational expression:

$$2^{31} \geqq \frac{\text{Stroke length (mm)}}{\text{Ball screw lead length (mm)}} \times \text{Number of encoder pulses (pulse) x (CNUM)}$$

$$2^{31} \geqq \frac{\text{Stroke length (mm)}}{\text{Ball screw lead length (mm)}} \times \text{Number of encoder pulses (pulse) x (CDEN)}$$

b. Do not enter a value less than the encoder's resolution for the minimum movement unit.

$$\text{Linear axis encoder resolution (mm/pulse)} = \frac{\text{Ball screw lead length (mm/rev)}}{\text{Number of encoder pulses (pulse/rev)}}$$

$$\text{Rotational axis encoder resolution (deg/pulse)} = \frac{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}{\text{Number of encoder pulses (pulse/rev)}}$$

The actuator will not move until the sum of command pulses sent to P-Driver has accumulated to the level of the encoder's resolution or more.

(2) Command Pulse Input Mode

Name	Symbol	Unit	Input range	Default value (reference)
Command pulse input mode	CPMD	(HEX input)	00~12h	01h

Set the pulse train input mode of the command pulse inputs (PP, /PP, NP and /NP).

Command pulse-train mode		Symbol	Forward	Reverse	Setting value
Negative logic	Forward pulse train	PP · /PP			12h
	Reverse pulse train	NP · /NP			
	A forward pulse train indicates motor revolutions in the forward direction, while a reverse pulse train indicates motor revolutions in the reverse direction.				
	Pulse train	PP · /PP			11h
	Sign	NP · /NP	Low	High	
	A command pulse indicates motor revolutions and its sign indicates the rotating direction of the motor.				
	Phase A/B pulse train	PP · /PP			10h
		NP · /NP			
	Motor revolutions and rotating direction are specified by phases A/B (4 multiplications) with a 90-degree phase difference.				
Positive logic	Forward pulse train	PP · /PP			02h
	Reverse pulse train	NP · /NP			
	Pulse train	PP · /PP			01h
	Sign	NP · /NP	High	Low	
	Phase A/B pulse train	PP · /PP			00h
		NP · /NP			

> ⚠ **Caution**
>
> Make the same positive/negative logic setting as for FBPT regardless of whether the feedback pulse (FBPT) is used or not. See (27), "FBP Mode," for the explanation about FBPT.

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6.3.2 Application Settings

Set the parameters explained in this section as necessary according to the system and load.
Default values indicated by [A] have already been set to appropriate values corresponding to the applicable actuator at shipment from the factory. They normally do not require changing.
Some of the parameters must be input as binary values (indicated as bit input in the unit column).

[Data structure of bit-input parameters]

The layout of numerical values for a setting value is as follows. Follow the layout below to set each bit explained in this manual.

Bit No.	7	6	5	4	3	2	1	0

(1) PIO Function Setting Flag

Name	Symbol	Unit	Input range	Default value (reference)
PIO function setting flag	FPIO	(Bit input)	0000000~1111111b	0b

Set the functions of I/O signals by setting each of the 7 bits to 1 or 0.

Bit No.	Signal name	Symbol	Setting		Status
6	Command pulse count direction	CPR	0	+	The motor rotates in the forward direction by a forward pulse
			1	-	The motor rotates in the reverse direction by a reverse pulse.
5	Feedback pulse	FBP	0	Enabled	The feedback pulse is output.
			1	Disabled	The feedback pulse is not output.
4	External forced stop	CSTP	0	Enabled	It is possible to disable a given signal by setting the corresponding bit to "1."
			1	Disabled	If "Disabled" is set for a signal, it is treated as "off" regardless of whether the input signal is turned on or off.
3	Torque limit selection	TL	0	Enabled	
			1	Disabled	
2	Homing command signal	ORGC	0	Enabled	
			1	Disabled	
1	Alarm reset	RES	0	Enabled	
			1	Disabled	
0	Servo ON	SON	0	Enabled	With this input signal turned on, the servo is turned off when the servo ON signal is turned off.
			1	Disabled	The servo is turned on when the power supply is turned on.

⚠ **Caution**

a. The revolution direction of the motor relative to the direction of the input pulse can be changed using bit No. 6.
   The actuator moves in the negative direction with a forward pulse (forward for the motor) and in the positive direction with a reverse pulse (reverse for the motor). (Opposite applies to folded motor type actuators).
   When considering the forward/reverse direction, pay attention to the settings of the host controller or connection of PP and /PP as well as NP and /NP.
   * The rotation direction of the motor is indicated by setting CCW to forward, as seen from the axis edge of the load side.
b. If "Disabled" is selected for bit No. 0, the servo is turned on/off by turning the power supply on/off.
   While the power supply is turned on, the servo can only be turned on/off by the PC software.

(2) Communication Speed

Name	Symbol	Unit	Input range	Default value (reference)
Communication speed	BRSL	bps	9600~115200	38400

This parameter sets the speed of communication with the PC software.

Communication speeds that can be set = 9,600/19,200/38,400/57,600/115,200 bps

(3) Flag for Setting Function at Stop

Name	Symbol	Unit	Input range	Default value (reference)
Flag for setting function at stop	FSTP	(Bit input)	000~111b	[A] 101b (actuator without brake) 111b (actuator with brake)

This parameter sets the function activated at a stop operation where the servo is turned off.

Bit No.	Function	Setting		Status
2	Dynamic brake	0	Disabled	Disable a dynamic brake.
		1	Enabled	Enable a dynamic brake.
1	Electromagnetic brake	0	Disabled	Disable an electromagnetic brake.
		1	Enabled	Enable an electromagnetic brake.
0	Deviation counter clear (when the servo is turned off and an alarm is generated)	0	Disabled	Do not clear the deviation counter.
		1	Enabled	Clear the deviation counter.

⚠ **Caution**

● When the electromagnetic brake bit is set to "Enabled," an "electromagnetic brake not released error" is output and operation is cancelled if the electromagnetic-brake power is not supplied.
● Always set the electromagnetic brake bit to "Disabled" when using P-Driver together with an actuator that is not equipped with an electromagnetic brake.

(4) Software Stroke Limit

Name	Symbol	Unit	Input range	Default value (reference)
Software stroke limit, positive side (actual stroke)	LIMM	pulse	134217727~ 134217728	[A]
Software stroke limit, negative side (actual stroke)	LIML	pulse	134217727~ -134217728	[A]

Set the upper and lower limits of the actual stroke (catalog values) of the actuator in pulse values. At shipment from the factory, appropriate values corresponding to the applicable actuator have been set.

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■ Calculation formula for stroke pulse value

In the case of linear axis:

$$Setting\,value(pulse) = \frac{Stroke\,value(mm) \times Number\,of\,encoder\,pulses(pulse/rev)}{Ball\,screw\,lead\,length(mm/rev)}$$

In the case of rotational axis:

$$Setting\,value(pulse) = \frac{Stroke\,value(deg) \times Number\,of\,encoder\,pulses(pulse/rev)}{360(deg/rev) \times Rotational\,axis\,gear\,reduction\,rate}$$

⚠ Caution

● The software stroke limit is set differently according to the setting of homing pattern code (motor revolution direction at homing), a position control information parameter. For example, in the case of an actuator with a stroke of 100 (mm), a lead of 10 (mm) and a number of encoder pulses of 16384 (pulse), the stroke pulse value is calculated as follows:

$$Stroke\,pulse\,value(pulse) = \frac{Stroke\,value(mm) \times Number\,of\,encoder\,pulses(pulse/rev)}{Ball\,screw\,lead\,length(mm/rev)}$$

$$= \frac{100(mm) \times 16384(pulse/rev)}{10(mm/rev)} = 163840(pulses)$$

The limits are set as follows:

a. If the setting of homing pattern code is "1" (the motor revolution direction is forward at homing), LIMM is set to 0 (pulse) and LIML is set to -163840 (pulse).

b. If the setting of homing pattern code is "0" (the motor revolution direction is reverse at homing), LIMM is set to 163840 (pulse) and LIML is set to 0 (pulse).

For this reason, it is necessary to change these parameters as well if the homing pattern code parameter is to be changed.

Note, however, that the values of LIML and LIMM are automatically rewritten when the homing pattern code is changed if the display unit is set to "Millimeter (mm)" and the coordinate plus process display is set to "Display" in the environment setting of the PC software.

(5) Ball Screw Lead Length

Name	Symbol	Unit	Input range	Default value (reference)
Ball screw lead length	LEAD	mm	0.1~102.4	[A]

Set the ball screw lead length of the actuator in units of millimeter (mm).

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

(6) Motor Type

Name	Symbol	Unit	Input range	Default value (reference)
Motor type	MTYP	(HEX input)	00~20h	[A]

Set the type of motor according to the type of actuator.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

The type and capacity of the motor vary depending on the type of actuator.

The table below lists setting values for motor type according to the type of actuator and motor capacity.

Actuator Type	Motor capacity	Setting value	Actuator Type	Motor capacity	Setting value
RCS-RB7530	60 W	10h	RCS-SM(R) SS	150 W	15h
RCS-RB7530 RCS-RB7535	100 W	11h	ISP(D) IS(D) IF FS	100 W	16h
RCS-RB7535	150 W	12h			
RCS-SS(R) RCS-RA55 ISP(D) IS(D) IF FS SS 12RS-60	60 W	13h	ISP(D) IS(D) IF FS	200 W	17h
			ISP(D) IS(D) IF FS	400 W	18h
12RS-30	30 W		ISP(D)-W	600 W	19h
RCS-SM(R) RCS-RA55 RCS-F55 SS	100 W	14h	ISP(D)-W	750 W	1Ah
			RCS-R10I/20I/30I RCS-G20I	60 W	1Bh
			DS-SA4/5 [T1]	20 W	1Fh
			DS-SA6 [T1]	30 W	20h

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(7) Encoder Type

Name	Symbol	Unit	Input range	Default value (reference)
Encoder type	ETYP	(HEX input)	00~20h	[A]

Set the type of encoder according to the type of actuator.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

The type of encoder varies depending on the type of actuator.

The table below lists setting values for each encoder type according to the type of actuator.

Actuator type	Encoder	Setting value
RCS-SS(R)/RCS-SM(R)/RCS-RA55/RCS-F55 ISP(D)/IS(D)/IF/FS/SS 12RS-60/12RS-30 DS-SA4/5/6 [T1]	Serial	0h
RCS-RB7530/7535	Incremental	2h
RCS-R10I/20I/30I RCS-G20I	Incremental	4h

(8) Number of Encoder Pulses

Name	Symbol	Unit	Input range	Default value (reference)
Number of encoder pulses	EPLS	pulse/rev	1~131072	[A]

Set the number of pulses per revolution of the encoder according to the type of actuator.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

The number of encoder pulses varies depending on the type of actuator.

Actuator type	Setting value (pulse/rev)
RCS-SS(R)/RCS-SM(R)/RCS-RA55/RCS-F55 ISP(D)/IS(D)/IF/FS/SS 12RS-60/12RS-30 DS-SAA4/5/6 [T1]	16384
RCS-RB7530/7535	3072
RCS-R10I/20I/30I RCS-G20I	4096

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(9) Axis Operation Type

Name	Symbol	Unit	Input range	Default value (reference)
Axis operation type	ATYP	-	0~1	[A]

Set the operation type, i.e., whether the actuator uses a linear axis or rotational axis.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

Actuator axis operation type	Setting value (pulse/rev)
Linear axis	0
Rotational axis	1

(10) In-Position Width

Name	Symbol	Unit	Input range	Default value (reference)
In-position width	INP	pulse	1~4096	100

Set the number of pulses of the deviation counter at which the positioning completion (INP) signal output is triggered.

INP turns on when the number of standing pulses of the deviation counter is equal to or less than the setting value.

■ Calculation formula for the number of pulses for positioning width (mm)
The setting value of the positioning width is converted from mm to pulses using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse)} = \frac{\text{Positioning width (mm)} \times \text{Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse)} = \frac{\text{Positioning width (deg)} \times \text{Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev)} \times \text{Rotational axis gear reduction rate}}$$

> ⚠ **Caution**
>
> ● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

P-Driver

(11) Deviation Error Output Range

Name	Symbol	Unit	Input range	Default value (reference)
Deviation error output range	ECNT	pulse	1~ 99999	[A] Three times the number of encoder pulses

Set the number of pulses at which deviation errors are detected during position control.

A deviation error (error code: C6B) occurs if the number of standing pulses counted by the deviation counter exceeds the setting value.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

> ⚠ **Caution**
>
> ● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

(12) Homing Pattern Code

Name	Symbol	Unit	Input range	Default value (reference)
Axis operation type	ORGP	-	0~1	[A]

Set the direction of motor revolution at homing.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

Motor revolution direction at homing	Setting value
Reverse	0
Forward	1

> ⚠ **Caution**
>
> ● The actuator moves in the negative direction with a forward pulse (forward for the motor) and in the positive direction with a reverse pulse (reverse for the motor). (Opposite applies to folded motor type actuators).
> When considering the forward/reverse direction, pay attention to the settings of the host controller or connection of PP and /PP as well as NP and /NP.
> * The rotation direction of the motor is indicated by setting CCW to forward, as seen from the axis edge of the load side.

P-Driver

(13) Speed Command Value at Homing

Name	Symbol	Unit	Input range	Default value (reference)
Speed command value at homing	OVCM	pulse/sec	1~819200	[A]

Set the moving speed at homing.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec) of speed (mm/sec)
The setting value of the speed is converted from mm/sec to pulse/sec using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec)} = \frac{\text{Speed (mm/sec) x Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec)} = \frac{\text{Speed (deg/sec) x Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

IP-Driver

(14) Acceleration Command Value at Homing

Name	Symbol	Unit	Input range	Default value (reference)
Acceleration command value at homing	OACC	pulse/sec^2	1000~19267584	[A]

Set the acceleration at homing.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec^2) of acceleration (mm/sec^2)
The setting value of the acceleration is converted from mm/sec^2 to pulse/sec^2 using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Acceleration (mm/sec}^2) \times \text{Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Acceleration (mm/deg}^2) \times \text{Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev)} \times \text{Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

---

(15) Offset Amount at Homing

Name	Symbol	Unit	Input range	Default value (reference)
Offset amount at homing	OFST	pulse	1~134217727	[A]

Set the amount of movement from the position at which phase Z is detected after reversing at the mechanical end in a push operation, for the homing operation.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

(16) Homing Deviation Pulse

Name	Symbol	Unit	Input range	Default value (reference)
Homing deviation pulse	OPLS	pulse	1~134217727	[A] Half of the number of encoder pulses

Set the amount of deviation at which the mechanical end is detected in a homing operation. The actuator reverses if the amount of deviation reaches the setting value in a push operation to the mechanical end.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

The number of encoder pulses varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

(17) Position Control Loop Proportional Gain

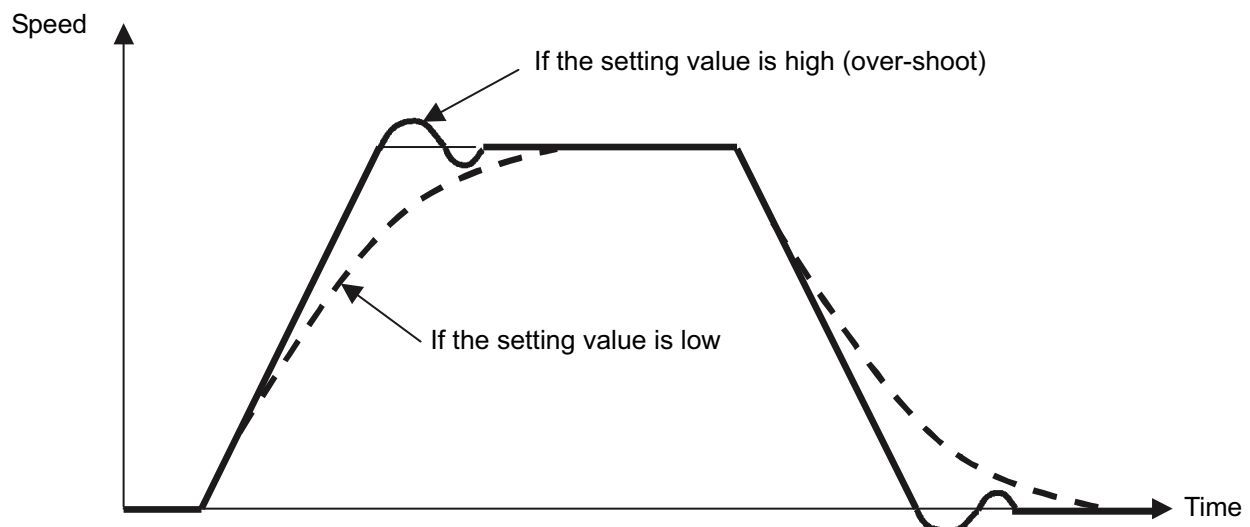| Name	Symbol	Unit	Input range	Default value (reference)
Position control loop proportional gain	PLPG	rad/sec	1~200	20

Set the proportional gain of the position control loop.

This parameter determines the response of the position control loop. Set a larger value to make the control loop follow the position command signals more aggressively. Note, however, that over-shoot tends to occur if the setting value is too large.

If the setting value is too small, the control loop does not follow position command signals well and positioning takes longer.

It too large a value is set for systems whose mechanical rigidity or natural frequency is low, resonance may occur in the mechanical parts, causing not only vibration and noise but also overload alarms (error code: D0A).

In case it cannot be avoided to make the setting value small, it may be possible to improve the response by setting parameter (19), "Position Feed-Forward Gain," appropriately.

P-Driver

(18) Position Command Primary Filter Time Constant

Name	Symbol	Unit	Input range	Default value (reference)
Position command primary filter time constant	PLPF	msec	0.0~100.0	0.0

With the setting of this parameter, the actuator can be made to accelerate/decelerate according to an S-shaped curve.

If a command pulse-train input is given with a constant frequency, the actuator accelerates/decelerates gradually according to the set time constant.

The actuator moves only the distance corresponding to the command pulse-train signal.

It is possible to perform smooth acceleration/deceleration even when the host controller does not have any acceleration/deceleration function, or when the frequency of the command pulse-train changes sharply.
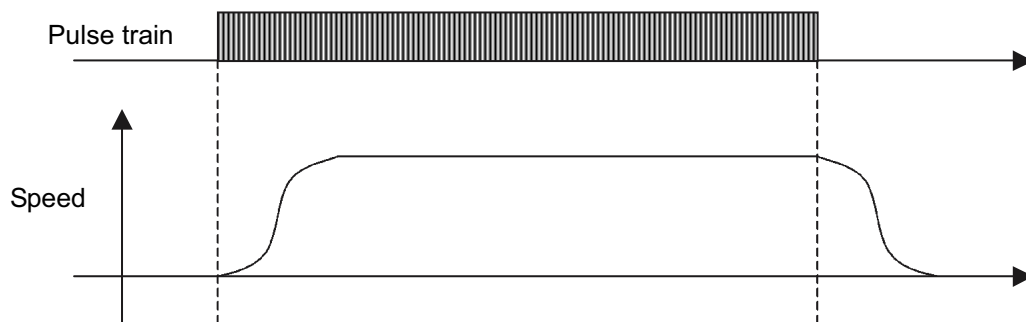
(19) Position Feed-Forward Gain

Name	Symbol	Unit	Input range	Default value (reference)
Position feed-forward gain	PLFG	-	0~100	0

Set the amount of feed-forward gain of the position control system.

When this parameter is set, the servo gain increases and the response speed of the position control loop is improved.

There is no significant effect if (17), "Position Control Loop Proportional Gain," is set to a sufficiently large value.

Use this parameter to improve the response of systems whose mechanical rigidity is low or systems where the load inertial ratio of the mechanical part is large.

Use values between 10 and 50 as a guideline; if a larger value is set, the amount of deviation becomes smaller and the response speed improves.

If the value is set too high, vibration and noise may be generated. Make sure to check the response while adjusting the value if you use this parameter.

P-Driver

(20) Jog Acceleration Default Value

Name	Symbol	Unit	Input range	Default value (reference)
Jog acceleration default value	ACC	pulse/sec^2	1000~19267584	[A]

Set the default acceleration value used when performing jog operation with the PC software.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec^2) of acceleration (G)
The setting value of the acceleration is converted from G to pulse/sec^2 using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Acceleration (G) x 9800 x Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Acceleration (G) x 9800 x Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

P-Driver

(21) Jog Deceleration Default Value

Name	Symbol	Unit	Input range	Default value (reference)
Jog deceleration default value	DEC	pulse/sec^2	1000~19267584	[A]

Set the default deceleration value used when performing jog operation with the PC software.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec^2) of deceleration (G)
The setting value of the deceleration is converted from G to pulse/sec^2 using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Deceleration (G) x 9800 x Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Deceleration (G) x 9800 x Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

P-Driver

(22) Jog Speed Default Value

Name	Symbol	Unit	Input range	Default value (reference)
Jog speed default value	VEL	pulse/sec	1~1092266	[A]

Set the default speed value used when performing jog operation with the PC software.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec) of speed (mm/sec)
The setting value of the speed is converted from mm/sec to pulse/sec using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec)} = \frac{\text{Speed (mm/sec) x Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec)} = \frac{\text{Speed (deg/sec) x Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

P-Driver

(23) Maximum Speed at Incomplete Homing

Name	Symbol	Unit	Input range	Default value (reference)
Maximum speed at incomplete homing	SVEL	pulse/sec	1~819200	[A]

Set the speed limit for a jog movement command from the PC software before homing.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec) of speed (mm/sec)
The setting value of the speed is converted from mm/sec to pulse/sec using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec)} = \frac{\text{Speed (mm/sec) x Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec)} = \frac{\text{Speed (deg/sec) x Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

P-Driver

(24) Maximum Acceleration Value

Name	Symbol	Unit	Input range	Default value (reference)
Maximum acceleration value	ACMX	pulse/sec^2	1000~19267584	[A]

Set the acceleration limit value of the actuator.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec^2) of acceleration (G)
The setting value of the acceleration is converted from G to pulse/sec^2 using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Acceleration (G) x 9800 x Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Acceleration (G) x 9800 x Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev) x Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

(25) Maximum Deceleration Value

Name	Symbol	Unit	Input range	Default value (reference)
Maximum deceleration value	ACMX	pulse/sec^2	1000~19267584	[A]

Set the deceleration limit value of the actuator.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

■ Calculation formula of the setting value (pulse/sec^2) of deceleration (G)
The setting value of the deceleration is converted from G to pulse/sec^2 using the following formulae:

In the case of linear axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Deceleration (G)} \times 9800 \times \text{Number of encoder pulses (pulse/rev)}}{\text{Ball screw lead length (mm/rev)}}$$

In the case of rotational axis:

$$\text{Setting value (pulse/sec}^2) = \frac{\text{Deceleration (G)} \times 9800 \times \text{Number of encoder pulses (pulse/rev)}}{360 \text{ (deg/rev)} \times \text{Rotational axis gear reduction rate}}$$

⚠ **Caution**

● The setting value of this item indicates pulses of the encoder, and is independent of the electronic gear setting. The number of pulses of the encoder varies depending on the type of actuator. See (8), "Number of Encoder Pulses."

(26) Soft Limit Actual Position Margin

Name	Symbol	Unit	Input range	Default value (reference)
Soft limit actual position margin	SLMR	pulse	1~134217727	[A]

Set the amount of movement at which a soft limit over error is detected by the actuator.
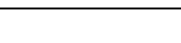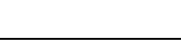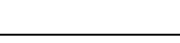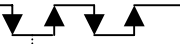
An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

If the amount of movement exceeds this setting value, which is relative to the amount of actual stroke set in (4), "Software Stroke Limit," a soft limit over error (error code: C74) is generated and operation is cancelled. This parameter is enabled when the homing command (ORGC) signal, which is an I/O signal, is input or homing by the PC software is completed (after ORGR is output).

P-Driver

(27) FBP Mode (Feedback Pulse Output Mode Selection)

Name	Symbol	Unit	Input range	Default value (reference)
FBP mode	FBPT	(HEX input)	00~12h	01h

Set the pulse train output mode of the feedback pulse outputs (AFB, /AFB, BFB, /BFB, ZFB and /ZFB).

Command pulse-train mode		Symbol	Forward	Reverse	Setting value
Negative logic	Forward pulse train	AFB · /AFB			12h
	Reverse pulse train	BFB · /BFB			
	A forward pulse train indicates motor revolutions in the forward direction, while a reverse pulse train indicates motor revolutions in the reverse direction.				
	Pulse train	AFB · /AFB			11h
	Sign	BFB · /BFB	Low	High	
	A command pulse indicates motor revolutions and its sign indicates the rotating direction of the motor.				
	Phase A/B pulse train	AFB · /AFB			10h
		BFB · /BFB			
	Motor revolutions and rotating direction are specified by phases A/B (4 multiplications) with a 90-degree phase difference.				
Positive logic	Forward pulse train	AFB · /AFB			02h
	Reverse pulse train	BFB · /BFB			
	Pulse train	AFB · /AFB			01h
	Sign	BFB · /BFB	High	Low	
	Phase A/B pulse train	AFB · /AFB			00h
		BFB · /BFB			
ZFB, /ZFB			Phase Z signals are output as is if the encoder of the actuator is not a serial encoder. With serial encoders, the range of ±0.5° in mechanical angle from the position of point 0 (home) is output as phase Z signal. This precision is only guaranteed when the revolution speed of the motor is 100 rpm or less due to the communication cycle with the encoder. * See (7) for the encoder types.		

The resolution of the output pulse trains is determined by the electric gear ratio of the command pulse input set in the position control parameters, and the pulses are output with the same resolution as the command signal.

These pulse signals can be disabled with the PIO function setting flag explained in (1). Disable them if pulse feedback is not used.

⚠ **Caution**

- Set the same positive/negative logic as for the command pulse input mode (CPMD) regardless of whether these signals are used or not.
- Set these signals in such a way that there are no logical contradictions if you import them in the host controller to configure a closed loop.

---

(28) Speed Loop Gain

Name	Symbol	Unit	Input range	Default value (reference)
Speed loop gain	VLPG	-	10~10000	[A]

Set the gain of the speed control loop.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

This parameter determines the response of the speed control loop. Set a larger value to make the control loop follow the speed command signals more aggressively (the servo rigidity increases). Make the setting value higher for larger load inertial ratios. Note, however, that over-shoot and oscillation tend to occur if the setting value is made too large, causing vibrations to be generated in the mechanical parts of the system.
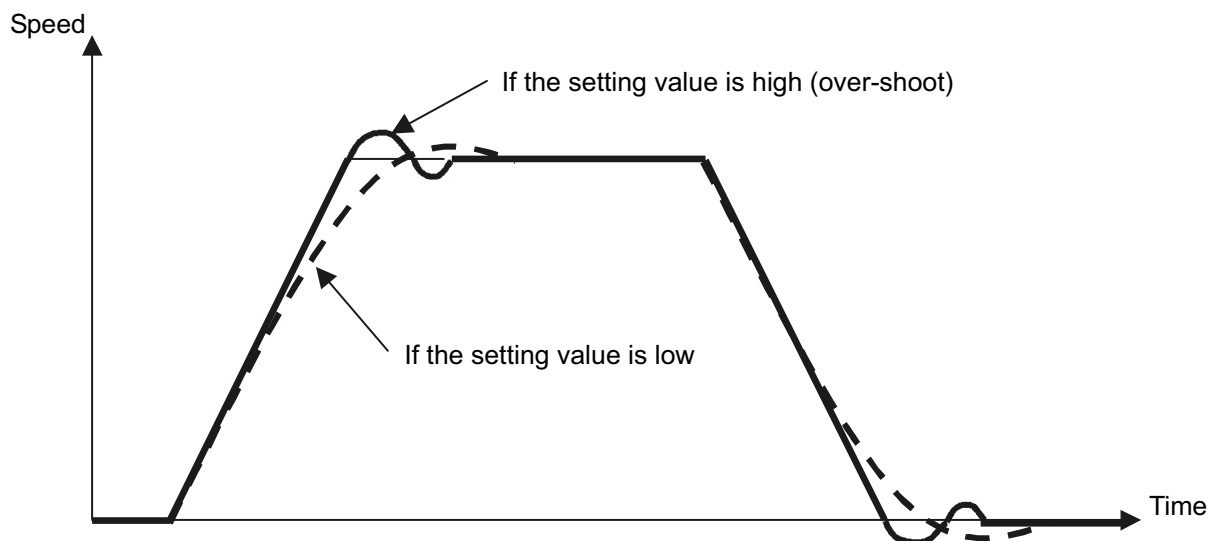
(29) Speed Loop Integration Time Constant

Name	Symbol	Unit	Input range	Default value (reference)
Speed loop integration time constant	VLPT	msec	0~1000	[A]

Set the integration time constant of the control loop.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

This parameter determines the response of the speed control loop. Set a larger value to make the response to speed commands slower. Note, however, that the robustness of the control loop against load fluctuations becomes weaker if the setting value is too large. Over-shoot and oscillation tend to occur if the setting value is made too small, causing vibrations to be generated in the mechanical parts of the system.
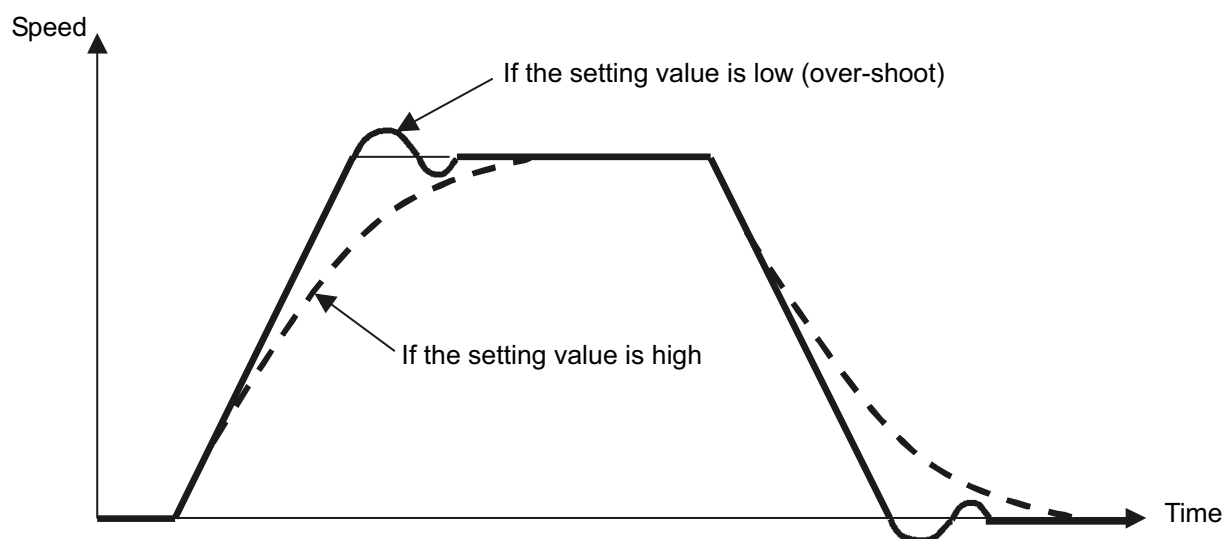
(30) Torque Filter Time Constant

Name	Symbol	Unit	Input range	Default value (reference)
Torque filter time constant	TRQF	msec	0.00~327.67	[A]

Set the time constant for the torque command filter.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

The motor may begin to vibrate if the resonance frequency of the machine is less than the response frequency of the servo loop. The resonance between the mechanical parts of the system can be suppressed by setting this parameter to a large value. If it is made too large, however, the stability of the control system may be lost.

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(31) Current Control Bandwidth

Name	Symbol	Unit	Input range	Default value (reference)
Current control bandwidth	CLPF	msec	500~32767	[A]

This parameter sets the control bandwidth of the current control system.

An appropriate value corresponding to the applicable actuator has been set at shipment from the factory.

Never change this parameter. Changing this parameter is very dangerous because the stability of the control system may be lost.

(32) Torque Limit Value

Name	Symbol	Unit	Input range	Default value (reference)
Torque limit value	TQLM	(multiplier)	0.01~0.70	0.7

Set the torque limit value by the torque limit selection signal (TL), an external input signal.

The torque limit value should be set as a multiplication factor of the rated thrust (catalog value).

The torque limit corresponding to the setting value is applied when the torque limit selection signal (TL), an external input signal, is turned on.

If the torque current reaches the current value corresponding to the setting value, the torque limiting signal (TLR), an external output signal, is output.

P-Driver

6.4 Servo Adjustment

When P-Driver is shipped from the factory, the parameters are set in such a way that the closed-loop operation characteristics at the rated load capacity (maximum load capacity) of the actuator become stable.

At the actual operation sites, however, the ideal load conditions (i.e. no resonance, vibration induction or excessive load fluctuation) may not always be guaranteed.

For this reason, it may be necessary to adjust the servo loop depending on the operating conditions. This section explains the basic adjustment method.

6.4.1 Control Block Diagram
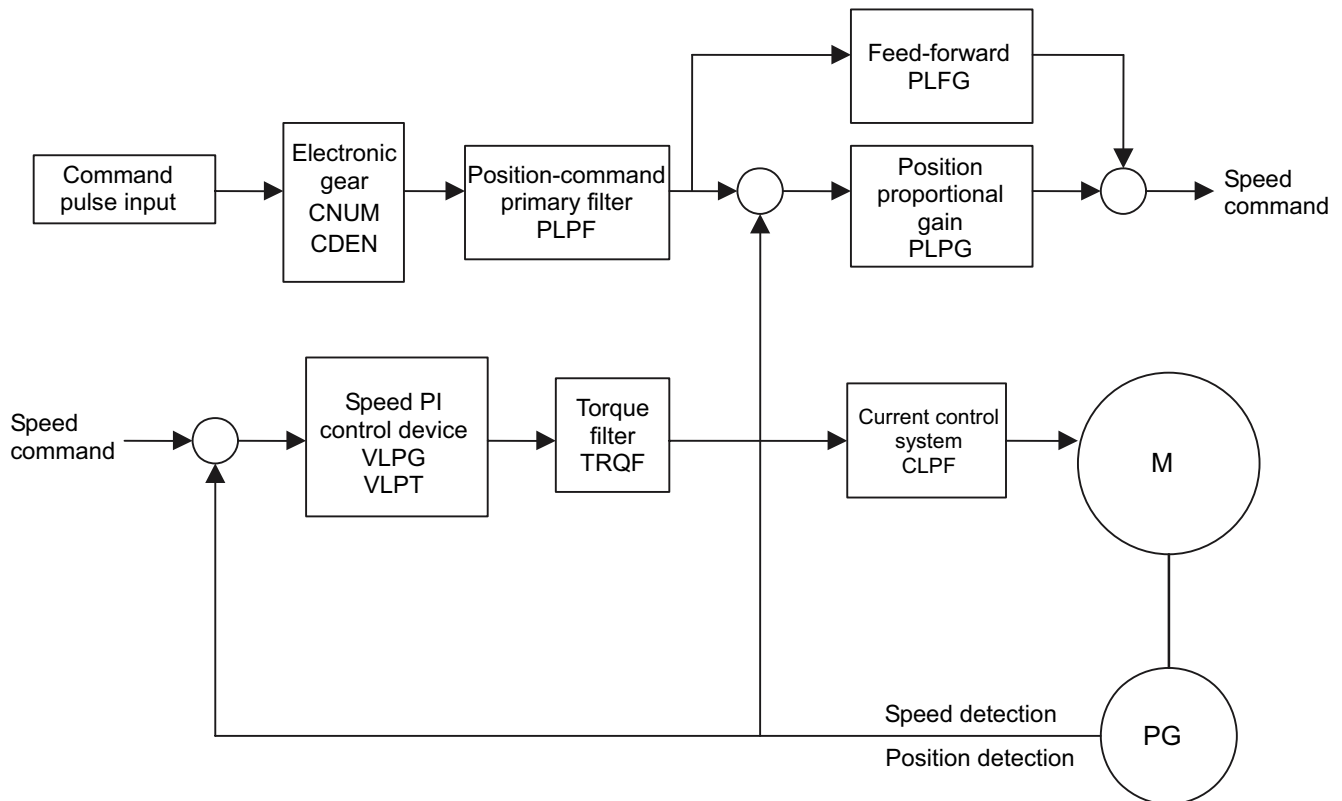
[Control Block Diagram and Parameters (Symbols) of P-Driver]

6.4.2   Adjustment 1

(1)   The Host Controller is not Equipped with Acceleration/Deceleration Function or the Input Pulse Frequency Changes Sharply

■ Set the "position command primary filter time constant." .... See (18) in Section 6.3.2.

It is possible to accelerate or decelerate smoothly even if the host controller is not equipped with acceleration/deceleration function or the frequency of the pulse train changes sharply.

Pulse train

Speed

Settling time
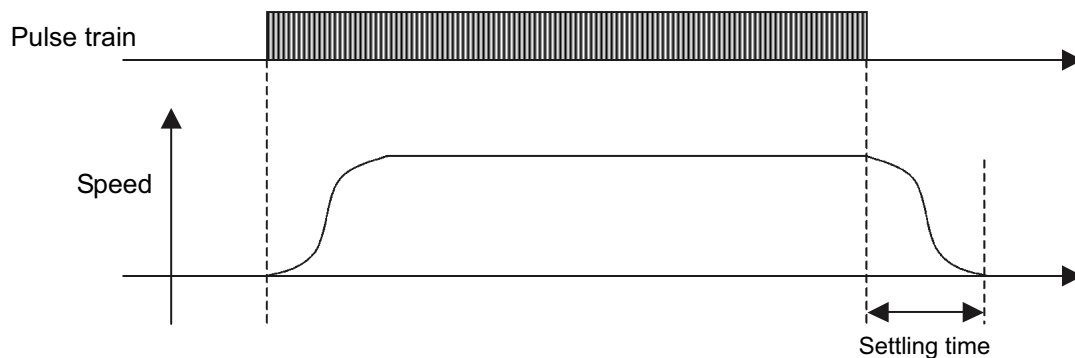
In case the host controller is not equipped with the acceleration/deceleration function or the frequency of pulse train changes sharply, if the command value is input as is, the speed command changes sharply, which may cause alarms such as "position deviation error" (alarm code: C6B) and "overload" (alarm code: D0A).

Moreover, a large load is applied to the mechanical parts of the system including the actuator, which may lead to system failure.

In such cases, use the "position command primary filter time constant" to perform smooth acceleration and deceleration. (This function is also valid for command pulse signals that have taken acceleration/deceleration into account.)

The time required for the positioning loop to settle after a command pulse input stops is approximately three times the setting value.

For example, if the parameter is set to 100 msec, the settling time is approximately 300 msec.
The setting at shipment from the factory is 0 msec and the settling time is adjusted to approximately 150 msec.

P-Driver

(2)   The Actual Speed does not Follow Commands Well

The actual speed is abnormally slow compared to the commanded speed, vibrations occur during movement, it takes long for the positioning to complete, etc.

- ■ Increase the "position control loop proportional gain." ....See (17) in Section 6.3.2.
- ■ Set the "position command primary filter time constant" to "0." ....See (18) in Section 6.3.2.
- ■ Increase the "speed loop gain." ....See (28) in Section 6.3.2.
- ■ Decrease the "speed loop integration time constant." ....See (29) in Section 6.3.2.

If command signals are not followed well because the load weight is heavy or the sliding resistance is large, it is possible to make adjustments so that the response to command pulse signals becomes faster.

[Points]

1) Position control loop proportional gain
    Position command signals are followed better if this value is set larger.
    Set the value in the range from 30 to 50 as a guideline. An even higher value can be set as far as the operation characteristics of the system's mechanical parts are ensured.
    However, over-shoot tends to occur if the value is set too large.

2) Position command primary filter time constant
    As explained in (1), this parameter should be set when it is desirable to slow down the response. Thus, set this parameter to "0" (or a small setting value) to improve the response speed.

3) Speed loop gain
    Speed command signals are followed better if this value is set larger.
    In order to secure the stability of the control system, which may have been lowered by increasing the position control loop proportional gain, raise the speed loop gain as well.
    Note, however, that if this value is set too large, the mechanical parts of the system tend to vibrate.

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6.4.3 Adjustment 2

(1) Shocks at Start/Stop

It is desired to move smoothly without sudden acceleration/deceleration or accelerate/decelerate smoothly to change the speed to match the command speed (including a speed of 0).

■ Set the "position command primary filter time constant." .... See (18) in Section 6.3.2.

(2) Abnormal Noise at Low Speed (Stop)

High-pitched abnormal noise occurs, in particular, at low speeds (50 mm/sec or less).

■ Set the "torque filter time constant." .... See (30) in Section 6.3.2.

■ Lower the "current control bandwidth. .... See (31) in Section 6.3.2.

⚠ **Caution**

● This phenomenon tends to occur when the rigidity of the system's mechanical parts is not maintained. The actuator unit itself may generate torsional resonance if its stroke exceeds 600 mm or if it is a belt-driven type.
Check the following items before making adjustment:
1. The position control loop proportional gain, speed loop gain and speed loop integration time constant are not set too high.
2. The rigidity of the load is maintained as much as possible, and the load is securely mounted without looseness and play.
3. There is no distortion on the actuator's mounting surface.
4. The actuator body is installed securely.

[Points]

1) Torque filter time constant
Resonance between mechanical parts of the system can be suppressed by setting this value higher (increase the value in steps of 500 μsec). Note, however, that if the value is set too high, the stability of the control system may be lost (vibration occurs).

2) Current control bandwidth
It is possible to make adjustment by decreasing the setting value of this parameter (decrease the value in steps of 200 rad/sec as a guideline), but this should only be done if the problem cannot be adjusted with the torque filter.
If the current control bandwidth is lowered, the torque filter time constant may be lowered as well in some cases. Place priority on the torque filter time constant when making adjustment.

P-Driver

7. Troubleshooting

7.1 Handling Problems

If problems occur, handle them according to the following procedure for prompt recovery and prevention of recurrence.

a. Check the status indicator LEDs
   RDY (Green) ....Indicates that P-Driver is operating normally.
   RUN (Green) ....Indicates that the servo is on.
   ALM (Red) ....Indicates that an alarm is generated.
   ENC (Yellow) ....Indicates that the encoder is disconnected or not connected.
b. Host controller errors
c. Check the voltage of the main power supply
d. Check the voltage of the power supply for I/O signal interface
e. Check the voltage of the brake power supply (in the case of an actuator with brake)
f. Check the alarm status
   Check alarm codes with the PC software.
g. Check the cable connections to see if they are not disconnected or caught
   When checking cables for conductivity, turn the power supply off first (to prevent runaway) and remove wiring (to prevent current from being conducted from electrical circuits).
h. Check the I/O signals
i. Check the noise prevention measures (e.g. connection of grounding wire, installation of surge killers)
j. Review the situation before the problem occurred and the operating conditions at the occurrence
k. Analyze the causes of the problem
l. Take appropriate action

> Please check items (a) through (j) before contacting IAI.

7.2 Fault Diagnosis

Fault conditions can be classified into the following three types:

a. Errors occurring when turning the power supply on
b. Errors without alarm display
c. Errors with alarm display

★ Check the alarm display (alarm codes) using the PC software.

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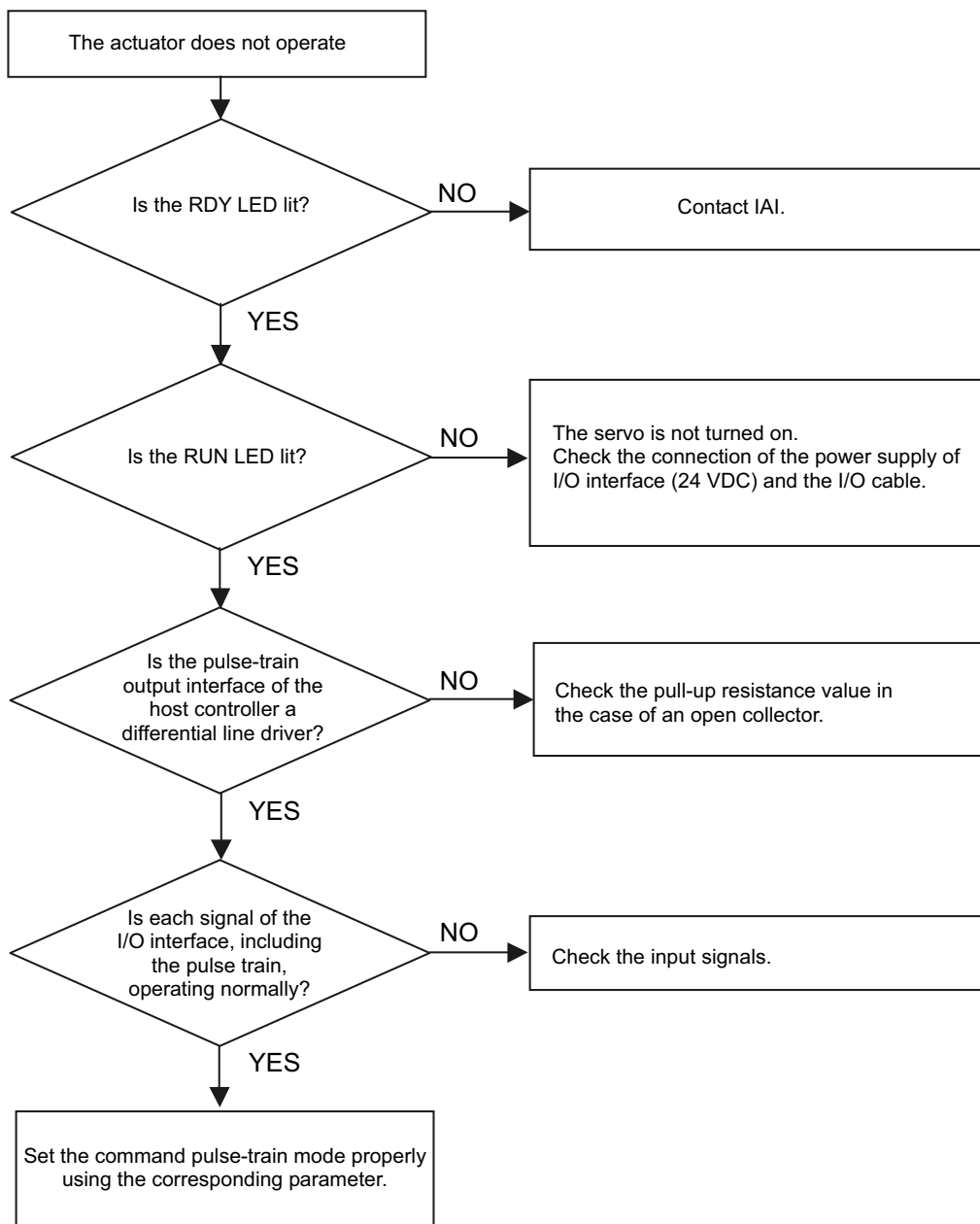## 7.2.1 Errors Occurring when Turning the Power Supply on

When the prescribed power is supplied to the main power supply of P-Driver, the RDY LED of the status indicator turns on.

★ Contact us if the RDY LED does not turn on even if the prescribed power is supplied (please check the voltage).
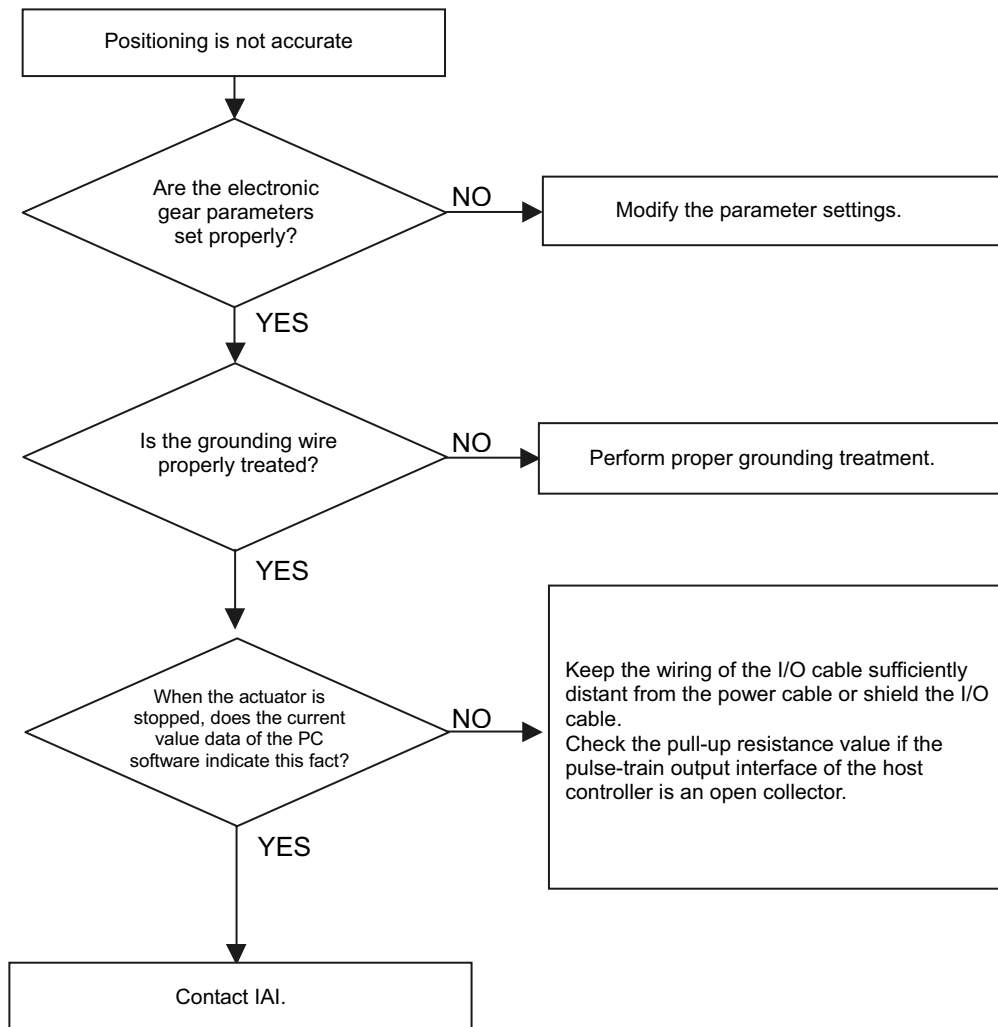
7.2.2 Errors Without Alarm Display

The ALM LED of the status indicator on the front of P-Driver is not lit. No alarm has been generated even with the PC software connected.

(1) The Actuator does not Operate

```
          ┌─────────────────────────────┐
          │ The actuator does not operate│
          └─────────────────────────────┘
                        │
                        ▼
                     ◇ Is the RDY LED lit? ◇ ──NO──▶ ┌──────────────┐
                        │                             │ Contact IAI. │
                       YES                            └──────────────┘
                        │
                        ▼
                     ◇ Is the RUN LED lit? ◇ ──NO──▶ ┌──────────────────────────────┐
                        │                             │ The servo is not turned on.  │
                       YES                            │ Check the connection of the  │
                        │                             │ power supply of I/O interface│
                        │                             │ (24 VDC) and the I/O cable.  │
                        │                             └──────────────────────────────┘
                        ▼
          ◇ Is the pulse-train output interface ◇ ──NO──▶ ┌──────────────────────────────┐
          ◇ of the host controller a           ◇         │ Check the pull-up resistance │
          ◇ differential line driver?          ◇         │ value in the case of an open │
                        │                                 │ collector.                   │
                       YES                                └──────────────────────────────┘
                        │
                        ▼
          ◇ Is each signal of the I/O interface, ◇ ──NO──▶ ┌──────────────────────────┐
          ◇ including the pulse train,          ◇         │ Check the input signals. │
          ◇ operating normally?                 ◇         └──────────────────────────┘
                        │
                       YES
                        │
                        ▼
          ┌────────────────────────────────────────┐
          │ Set the command pulse-train mode        │
          │ properly using the corresponding        │
          │ parameter.                              │
          └────────────────────────────────────────┘
```

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(2) Positioning is not Accurate

```
┌─────────────────────────────────┐
│   Positioning is not accurate   │
└─────────────────────────────────┘
                 │
                 ▼
         ╱─────────────╲                    ┌──────────────────────────────┐
        ╱ Are the        ╲       NO          │                              │
       ╱  electronic      ╲─────────────────▶│  Modify the parameter        │
       ╲  gear parameters ╱                  │  settings.                   │
        ╲ set properly?  ╱                   └──────────────────────────────┘
         ╲─────────────╱
                 │ YES
                 ▼
         ╱─────────────╲                    ┌──────────────────────────────┐
        ╱ Is the         ╲       NO          │  Perform proper grounding    │
       ╱  grounding wire  ╲─────────────────▶│  treatment.                  │
       ╲  properly treated?╱                 └──────────────────────────────┘
        ╲               ╱
         ╲─────────────╱
                 │ YES
                 ▼
         ╱─────────────╲                    ┌──────────────────────────────┐
        ╱ When the       ╲                   │ Keep the wiring of the I/O   │
       ╱  actuator is     ╲      NO          │ cable sufficiently distant   │
      ╱  stopped, does the ╲────────────────▶│ from the power cable or      │
      ╲  current value data╱                 │ shield the I/O cable.        │
       ╲ of the PC        ╱                   │ Check the pull-up resistance │
        ╲software indicate╱                   │ value if the pulse-train     │
         ╲this fact?    ╱                     │ output interface of the host │
          ╲──────────╱                        │ controller is an open        │
                 │ YES                        │ collector.                   │
                 ▼                            └──────────────────────────────┘
         ┌─────────────┐
         │ Contact IAI.│
         └─────────────┘
```

(3) Abnormal Noise and Vibration are Generated

```
┌─────────────────────────────────┐
│  Abnormal noise and vibration   │
│       are generated.            │
└─────────────────────────────────┘
                 │
                 ▼
         ╱─────────────╲                    ┌──────────────────────────────┐
        ╱ Are the        ╲       NO          │  Check the parameter         │
       ╱  parameter       ╲─────────────────▶│  settings.                   │
       ╲  settings         ╱                 └──────────────────────────────┘
        ╲ appropriate?   ╱
         ╲─────────────╱
                 │ YES
                 ▼
         ┌─────────────┐
         │ Contact IAI.│
         └─────────────┘
```

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7.2.3 Alarms

(1) Alarm Levels

Alarms are classified into the following three levels according to the error description:

Alarm level	Alarm code (HEX)	ALM LED	Condition at occurrence	Cancellation method
Message	900~AFF	Turned off	Alarm display in the PC software (The actuator is not stopped.)	
Operation cancellation	B00~CFF	Turned on	The actuator is forcibly stopped.\n\n(The actuator decelerates to a stop and the servo is turned off. The homing completion status is canceled.)	Reset the controller using the alarm reset signal (RES) or the PC software.\n\n(It is necessary to perform homing operation again.)
Cold start	D00~FFF	Turned on	The actuator is forcibly stopped.\n\n(The actuator decelerates to a stop and the servo is turned off. The homing completion status is canceled.)	Turn the power supply off and back on again.\n\n(It is necessary to perform homing operation again.)

★ Cancel the alarm after investigating and removing the cause in all the cases.

★ Contact IAI if the cause of an alarm cannot be removed or an alarm cannot be canceled even if the cause is removed.

⚠ **Caution**

● If the same error occurs after canceling an alarm, the cause of the alarm has not been removed. Try removing the cause and canceling the alarm again.

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(2) List of Alarms

a. Message Level

Alarm code (HEX)	Name	Cause
801	SCIF over-run status (at protocol reception)	Error in communication with the PC software (communication interference, noise, errors in connected devices and communication settings)
802	SCIF receive ER status (at protocol reception)	Error in communication with the PC software (communication interference, noise, short-circuit or disconnection of communication cable, errors in connected devices and communication settings)
803	Reception timeout status (at protocol reception)	Error in communication with the PC software (disconnection of communication cable and errors in connected devices)
A17	Message sum check error (at protocol reception)	Error in communication with the PC software 1 (check sum error in a received message)
A18	Message sum check error (at protocol reception)	Error in communication with the PC software 2 (check sum error in a received message)
A19	Message station number error (at protocol reception)	Error in communication with the PC software (station number error in a received message)
A1A	Message ID error (at protocol reception)	Error in communication with the PC software (ID error in a received message)
A1C	Message conversion error	Error in communication with the PC software (a transmitted message does not match with message format)
A31	Number of parameter changes error	It was attempted to refer to or change a number of parameters not specified in the communication protocol.
A32	Parameter type error	It was attempted to refer to or change a parameter type not specified in the communication protocol.
A33	Parameter No. error	It was attempted to refer to or change a parameter No. not specified in the communication protocol.
A3D	Unit type error	It was attempted to refer to or change a unit type not specified in the communication protocol.
A4A	Monitoring data type error	Error of data type referenced in monitoring data
A4B	Number of monitoring records specification error	Specification error of the number of records referenced in monitoring data
A4F	Software reset rejection error during operation	Software reset (SIO) is prohibited during operation.
A53	Servo in-use rejection error	It was attempted to perform processing not allowed while the servo is being used.
A6D	Error of accessing addresses outside writing range at direct writing	It was attempted to access address outside the specified range with the communication protocol.
A9E	Shipped parameter area check sum error	Error in check sum value within EEPROM/shipped parameter area
A9F	Forced stop input	Forced stop caused by forced stop signal input

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b. Operation Cancellation Level (Forced Stop)

Alarm code (HEX)	Name	Cause
B05	Estimated stroke over error at homing	Error in home sensor, creep sensor, etc.
B11	Home sensor escape timeout error	Home limit switch was not located. Possibly mis-wiring of the home limit switch.
C6B	Position deviation error	The position deviation (difference between command pulse and feedback pulse) exceeded the position deviation error output range (ECNT) set in the parameter.
C6E	Servo-off axis used error	An operation command is given to an axis whose servo is turned off with the PC software.
C74	Soft limit over error	After homing is completed (the homing completion signal is being output), the slider (or rod) exceeded the stroke length (LIMM/LIML) + soft limit actual position margin (SLMR) set in the parameters.
CF4	POE cause undetermined error	Hardware detection error (other errors not determined as error)
CF5	Encoder data DMA transfer not completed error	The encoder communication took longer than the time limit set in the parameter.
CF6	Homing timeout	After starting a homing operation, the operation was not completed within the time limit set in the homing timeout (OTIM) parameter.
CF7	Command counter overflow	The number of command pulse inputs exceeded ±134217728 (H' F8000000 to H' 07FFFFFF).
CF8	Electromagnetic brake not released error	When the electromagnetic brake is enabled by the flag for setting function at stop (FSTP parameter) and the servo ON command is input, the brake power is not supplied.
CF9	Encoder communication parity error	Transmission error status of a serial encoder
CFA	Encoder communication delimiter error	Transmission error status of a serial encoder
CFB	Control field error	Reception error status of a serial encoder
CFC	Transmission under-run error	Error in the FPGA communication processing of a serial encoder (When sending data, the transmission data was not sent to the transmission buffer.)
CFD	Reception over-run error	Error in the FPGA communication processing of a serial encoder (When receiving data, data was updated before the data was read from the reception buffer.)
CFE	Frame error	Error in the FPGA communication processing of a serial encoder (The logic of the start and stop bits is not consistent.)

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c. Cold Start Level

Alarm code (HEX)	Name	Cause
D03	Count error	Error status of a serial encoder
D08	Encoder communication CRC error	CRC error (reception error) of a serial encoder
D09	Over speed	The motor revolution speed exceeded the maximum revolution speed (MAXV) set in the parameter.
D0A	Overload	The effective output torque value exceeded the allowable value of the motor.
D10	Overcurrent	The output current of the converter part became abnormally large.
D12	Encoder out	The encoder is not connected.
D13	FPGA error	Error in the FPGA operation clock
D19	Reception timeout error	Error in the FPGA communication processing of a serial encoder (After the transmission is completed and 4 μs has elapsed, the reception start bit is still not asserted.)
D0F	IPM temperature error	Abnormal heating of the converter part
E29	EEPROM error	A writing signal is sent to EEPROM when access to EEPROM is prohibited.
E3E	Parameter sum check error	Error of sum check value within EEPROM/parameter area
E67	Motor overvoltage	Voltage of the converter part increased abnormally (400 V or more) due to regenerative voltage, etc.
EA3	AC power supply interruption detection error	An AC power supply interrupt was detected.
FFA	Driver part program processing error	Error in processing of the driver part of a system program
FFB	Feedback pulse data writing error	Feedback pulse data could not be written within the cycle.
FFD	Control power supply voltage error	Error in the voltage of the control power supply
FFE	Current sensor error	The offset adjustment amount of the current sensor exceeded the internally specified value.
FFF	CPU error	The CPU operated abnormally.

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8.   Operation Procedure

Operate P-Driver according to the four-step procedure as specified below:

Step 1	Checking unit operation of the delivered product
	Perform unit operation of the actuator to check that the delivered product operates normally (check wiring, the product and parameter settings).
	In this test run of the actuator and P-Driver, no workpieces should be mounted on the actuator.

Step 2	Checking connection with the host controller
	Connect with the host controller and conduct a test run of the actuator unit (without workpieces), in order to check that the I/O interface is properly connected and set and check related parameters.

Step 3	Load test
	Check the operation by the host controller under conditions where the actual load is applied to check the operation characteristics. Adjust parameters, if necessary.

Step 4	Continuous operation
	Operate the system to check that there is no error.

8.1   Step 1

Connect the servo driver and actuator in order to conduct a test run with the PC software. See 4, "Wiring," for wiring procedure.

In step 1, a test run is conducted without mounting workpieces on the actuator to check the following items:

[Items to be checked]
1. Check the wiring of the P-Driver power supply (L, N, PE).
2. Check the motor power cable (U, V, W) and encoder cable.
3. Check the operation of the servo driver and actuator.

![P-Driver]

[Test Run Procedure]
1. Temporarily fix the actuator at a safe location.
2. Connect P-Driver and the actuator.
   (Connect the brake power supply if the actuator is equipped with a brake. If a regenerative resistance unit is used, connect it as well.)
3. Turn the power supply on.
   Check the SRDY LED. The system is normal if SRDY (green) is lit.
   If an alarm is detected (ALM (red) turns on), check the alarm description using the PC software (check the wiring connection as well), remove the cause of the alarm, and cancel the alarm.
4. Conduct a test run from the PC software.
   If it is difficult to input the servo ON signal (SON) via the I/O signal interface (for example, if the test run is conducted without connecting the external I/O cable), set bit 0 of the "PIO function setting flag" parameter to "1" (to disable the SON signal) and turn the power supply off and back on again or perform a software reset. The servo is turned on and operation is enabled.
   Perform homing and jog operations from the PC software to check that P-Driver operates normally.

If there are no errors, proceed to step 2.

8.2   Step 2

Connect the servo driver to the host controller and conduct a test run of the actuator unit by the host controller.
At this point, if bit 0 of the "PIO function setting flag" parameter was set to "1" (the SON signal was disabled) in step 1, set it to "0" (enable the SON signal) and turn the power supply off and back on again or perform a software reset. The servo ON signal (SON) from the I/O signal interface is enabled.

In step 2, check the following items:

[Items to be checked]
1. Check the wiring between the host controller and P-Driver.
2. Check I/O signals from/to the host controller.
3. Check the basic setting parameters of the position control loop (CNUM, CDEN, CPMD).
   See 6.3.1, "Basic Settings."

[Test Run Procedure]
1. Temporarily fix the actuator at a safe location.
2. Connect I/O signals to the host controller.
   (Connect the brake power supply if the actuator is equipped with a brake. If a regenerative resistance unit is used, connect it as well.)
3. Turn the power supply on.
   Check the SRDY LED. The system is normal if SRDY (green) is lit.
   If an alarm is detected (ALM (red) turns on), check the alarm description using the PC software (check the wiring connection as well), remove the cause of the alarm, and cancel the alarm.
4. Conduct a test run from the host controller.
   Check the operation using I/O signals from the host controller to confirm that P-Driver operates normally. Check the operation of safety circuits such as the emergency stop breaker.

If there are no errors, proceed to step 3.

8.3   Step 3

Check the operation by the host controller by applying the actual load. At this point, do not make the entire system operate at once; rather, test each individual operation required for the actuator one by one and check the operation status.

[Items to be checked]
1. Check the operation status (abnormal noise, vibration).
2. Check the parameters.
   See 6.4, "Servo Adjustment."

[Test Run Procedure]
1. Install the actuator in the system (device) (apply the actual load).
   Make sure that there is no play or distortion in the installation.
2. Conduct a test run from the host controller.
   Check the operation using I/O signals from the host controller to confirm that P-Driver operates normally. At this point, do not make the entire system operate at once; rather, test each individual operation required for the actuator one by one and check the operation status (making sure there is no abnormal noise and vibration). Adjust parameters, if necessary.

If there are no errors, proceed to step 4.

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8.4   Step 4

Operate the entire system from the host controller under the actual usage conditions and check that P-Driver operates normally.

[Items to be checked]
1. Check the operation status (abnormal noise, vibration).
2. Check the parameters.
   See 6.4, "Servo Adjustment."

[Test Run Procedure]
1. Operate the entire system with the host controller.
   Operate the entire system from the host controller and check the operation status (making sure there is no abnormal noise and vibration). Adjust parameters, if necessary.

If there are no errors, the test runs are completed.

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9. PC Software (PDR-101-MW)

9.1 Before Using the PC Software

(1) Checking Accessories

Before using the software, check that each of the following items is provided:

1) CD-ROM containing the software	2 disks
2) Software license agreement (description)	1 sheet
3) User registration card (serving as software license agreement; postal card) *1	1 card
4) PC connection cable *2	1 piece

---

*1   Please make sure to send the user registration card (software license agreement) back to us. If you do not send it back, we cannot provide user support.

*2   If you are using an NEC computer as the host controller, please be aware that a separate adapter may be required for some models.

---

(2) Preparation (Operating Environment)

This software requires the following computer and peripheral equipment.

1) Computer and compatible keyboard
   A personal computer (hereinafter referred to as "PC") (DOS/V specification) running Windows with a compatible keyboard
2) Memory
   The PC must have sufficient memory capacity to run Windows.
3) Monitor
   A monitor (hereinafter referred to as "CRT") compatible with the PC environment
4) Graphics card
   VGA or better display standards
5) Pointing device such as mouse and compatible driver
   A pointing device such as a mouse for easy operation of this software, and a compatible driver
6) Operating system
   Windows 98, Windows Me, Windows NT4.0, Windows 2000 or Windows XP
7) CD-ROM drive

8) Hard disk space

   A hard disk with 2 MB or more of free space (This software is installed on the hard disk.)

9) Serial port

   An RS-232C serial port (D-sub 9-pin)

10) Printer

   A printer compatible with the PC

(3)　Installing the Software

This software is installed on the hard disk of the PC. This section explains how to install the software.

1) Close all applications. (Resident virus-scan software and similar applications must be disabled temporarily.)
2) Insert CD-ROM of this software in the CD-ROM drive.
3) Double click in CD-ROM.
4) The installation program is executed. Follow the messages displayed on the screen.
5) When the installation program is completed, you may be prompted to restart the PC.
6) An item called "PC software for P-Driver" is added to Programs (P) in the Start menu; it can be executed by selecting Start → Programs (P) → IAI → P-Driver → PC software for P-Driver. This software is started by selecting the item.

(4)　Starting the Software

1) Turn off the power supply to P-Driver and the PC and then connect P-Driver and the PC with the attached PC connection cable.
2) Turn on the power supply to P-Driver and the PC and start Windows.
3) Start this software from the Start menu.
4) A dialog box for checking connected axes appears. After checking, enter necessary information for your operation purposes according to the screen display.

9.2 Checking Connection

When you start the application, the connection check dialog box (Figure 9.2.1) appears first. The PC communicates with the driver according to the "communication port" and "baud rate" set in the application setting window, which is explained later.

When the connection with the driver is checked, the application starts up in the online mode. If the driver cannot be found or the Esc key is pressed, the application starts up in the offline mode. (Even if the application is started up in the offline mode, it is possible to switch to the online mode by performing "re-connection," which will be explained later.)

Figure 9.2.1   Connection Check Dialog Box

9.3 Main Window

When the connection check is completed, the online startup window (Figure 9.3.1) appears. If the driver cannot be found, the window starts up in the offline mode (Figure 9.3.2). Select the following items from the menu or click the corresponding tool buttons to operate the software.
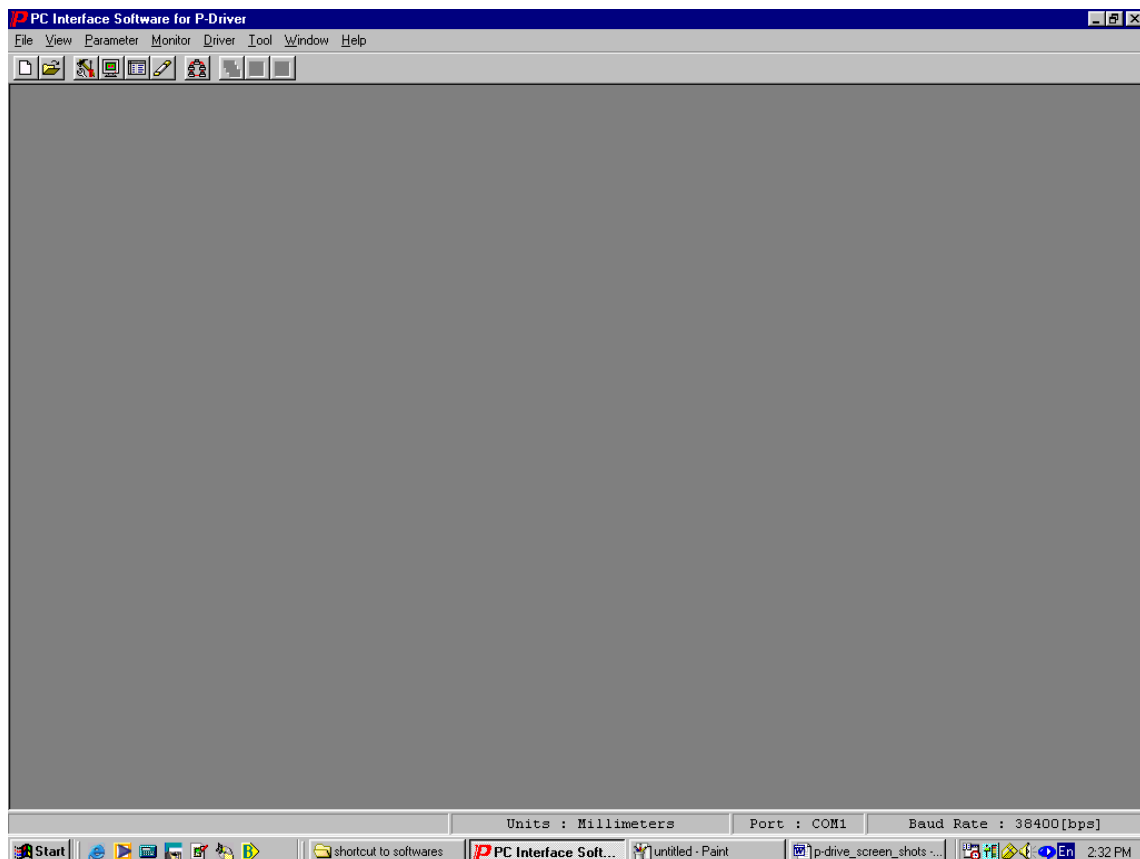
Figure 9.3.1   Online Startup Window

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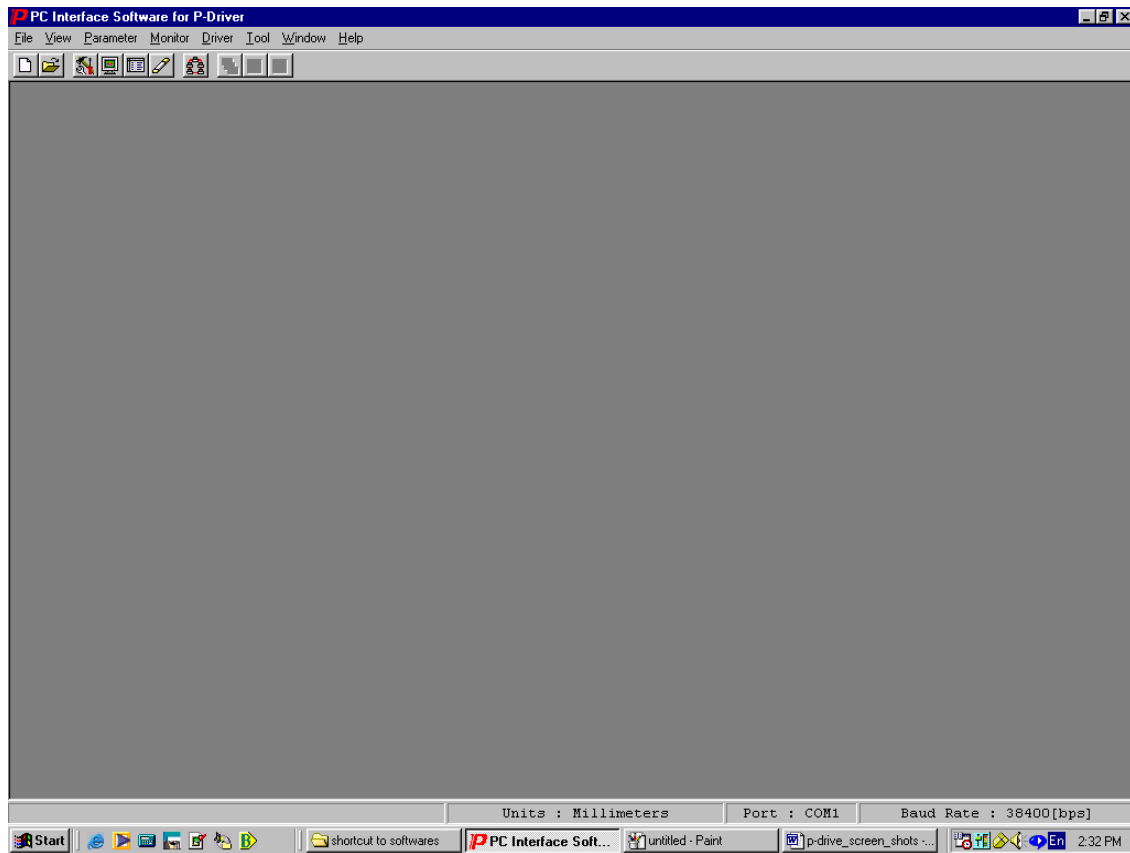
Figure 9.3.2　Offline Startup Window

9.3.1　Operations from the Main Menu

(1)　File Menu (F)

1.	New (N)	Create new parameter data.
2.	Open (O)	Read data saved in a file.
3.	Close (C)	Close the currently active window.
4.	Print Setting (P)	Set the printing font and printer options.
5.	Exit (X)	Exit the application.

(2)　View Menu (V)

This menu is used to set display options.

1.	Font Size (F)	Set the size of the font displayed in the window.

(3)　Parameter Menu (P)

This menu is used to perform operations related to parameters.

1.	Edit (E)	Read parameters from the controller and edit them. *1
2.	Transfer to Driver (S)	Copy the data on the line selected by the cursor in the edit window. *1
3.	Print (P)	Output the parameter data currently being edited to a printer.

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(4) Monitor Menu (<u>M</u>)

This menu is used to monitor various statuses, port conditions, etc. and reference error histories.

1. Status (<u>S</u>)   Open the status monitor window. *1
2. Error List (<u>E</u>)   Open the error list window. *1

(5) Driver Menu (<u>D</u>)

This menu is used to perform operations related to the driver, such as re-connection and software reset.

1. Jog (<u>J</u>)   Open the jog movement window. *1
2. Re-connect (<u>C</u>)   Re-establish communication with the driver.

   If the driver is in communication ready state, the application can be switched from the offline mode to the online mode.

   If the environment setting has been changed, such change becomes valid by re-connecting the driver through this menu option.

3. Initialize Memory (<u>I</u>)   Initialize parameters. *1
4. Software Reset (<u>R</u>)   Perform software reset of the driver. *1

(6) Tool Menu (<u>T</u>)

This menu is used to perform settings related to this application.

1. Environment Setting (<u>S</u>)   Perform settings to run the application.

(7) Window Menu (<u>W</u>)

This menu is used to change how windows are displayed.

1. Cascade (<u>C</u>)   Arrange the displayed windows in such a way that they overlap, slightly diagonally shifted relative to one another.
2. Tile Vertically (<u>V</u>)   Arrange the displayed windows by dividing the main window vertically.
3. Tile Horizontally (<u>H</u>) Arrange displayed windows by dividing the main window horizontally.
4. Arrange Icons (<u>A</u>)   Arrange minimized windows
5. Minimize All (<u>M</u>)   Minimize all the displayed windows.
6. Restore Up All (<u>N</u>)   Restore all the minimized windows to their original size.
7. Close All (<u>W</u>)   Close all the displayed windows.

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(8) Help Menu (H)

    1.   About (A)   Display the version information of this application.

    *1. Valid only in the online mode.

9.3.2 Operations from the Toolbar

This section explains the toolbar (Figure 9.3.3) located in the upper area of the main window (below the menu).

Figure 9.3.3   Toolbar

New Parameter	Same as selecting	File (F) → New (N)
Open File	Same as selecting	File (F) → Open (O)
Edit Parameter	Same as selecting	Parameter (P) → Edit (E)
Monitor Status	Same as selecting	Monitor (M) → Status (S)
Error List	Same as selecting	Monitor (M) → Error List (E)
Jog	Same as selecting	Driver (D) → Jog (J)
Re-connect	Same as selecting	Driver (D) → Re-connect (C)
Cascade	Same as selecting	Window (W) → Cascade (C)
Tile Vertically	Same as selecting	Window (W) → Tile Vertically (V)
Tile Horizontally	Same as selecting	Window (W) → Tile Horizontally (H)

9.4　Edit Parameter Window

9.4.1　Explanation About the Edit Parameter Window

    a.　Select Parameter (P) and then Edit (E) from the menu.

    b.　The Edit Parameter window appears.

       Select a desired parameter and change the value.

       Note that values displayed in gray are for reference only, and cannot be changed.

       Save As
       Click this button to save parameter data in a file with a new name.

       Transfer to Driver　　Same as selecting ⌈ Parameter (P) ⌋ → ⌈ Transfer to Driver (T) ⌋
       Click this button to transfer parameter data to the driver.

       Print　　　　　　　Same as selecting ⌈ Parameter (P) ⌋ → ⌈Print (P) ⌋
       Click this button to print parameter data.
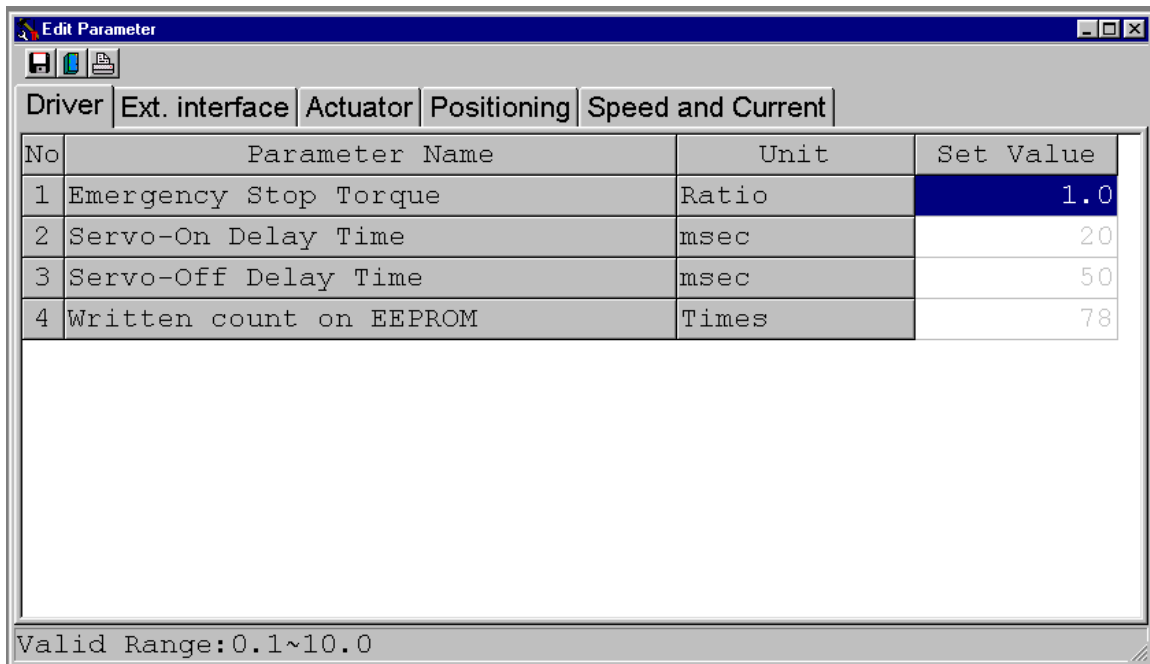
Figure 9.4.1　Edit Parameter Window

    * Figure 9.4.1 shows driver parameters. Click other tabs to display other types of parameters.

* When you open the Edit Parameter window for the first time after starting the application, the parameter input ranges are acquired from the driver.

  In the offline mode, default values in the application are used for the parameter input ranges.

9.4.2 Saving Parameters and Completing Editing

(1) Saving Parameter Data Currently Being Edited to a File

Click the <u>Save As</u> button in the Edit Parameter window.
* The extension of parameter files is "pdp."

(2) Transferring Parameter Data Currently Being Edited to the Driver

Save parameter data you are editing to the non-volatile memory area of the driver.
Click the <u>Transfer to Driver</u> button in the Edit Parameter window.
This button can only be used at online editing.

(3) Restarting the Driver (Software Reset)

After you transfer parameter data, a confirmation dialog box (Figure 9.4.2) appears with the message "Restart driver No.0?"
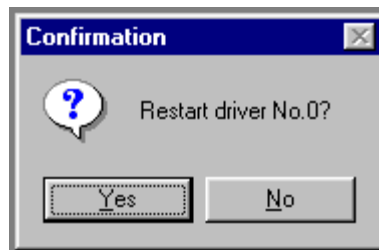
Figure 9.4.2 Confirmation

| Yes (Y) | Enable the parameters you have changed. |

| No (N) | Some of the parameters you have changed are not enabled. |

In order to enable all the parameters you have changed, restart the driver (software reset) or turn off the power supply and back on again.

(4) Completing Editing Parameters

When you close the Edit Parameter window, a confirmation dialog box appears with the message "Transmit Edited Data to the Driver?"
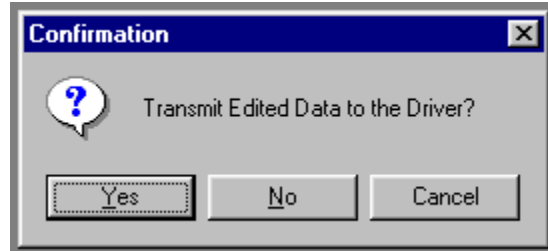
Figure 9.4.3　Confirmation

Yes (Y)　　　　Transfer the edited data to the driver; then proceed to (3) Restarting the Driver.

No (N)　　　　Discard the edited data and close the Edit Parameter window.

Cancel　　　　Cancel closing and return to the Edit Parameter window.

* It is recommended to save parameters at delivery or when you startup the system.

9.5　Monitor

9.5.1　Status Monitor Window

　　a.　Select Monitor (M) and then Status (S) from the menu.

　　b.　The Status Monitor window appears.

　　　　You can display information of only the category you need using the buttons in the toolbar.

　　　　Every time you click one of the buttons, the corresponding information is displayed or hidden.
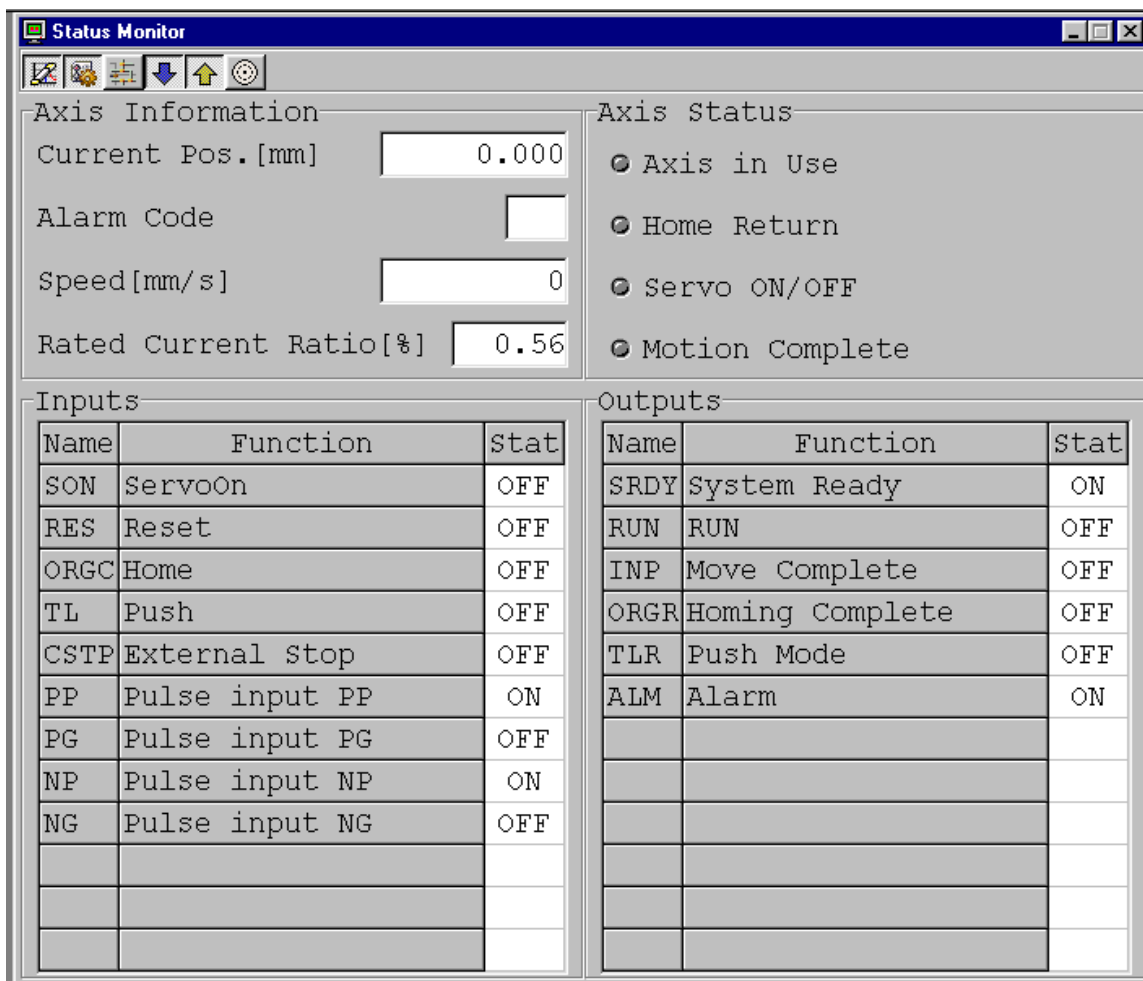
Figure 9.5.1　Status Monitor

Axis Information

Click this button to display axis information, such as current position.

Axis Status

Click this button to display the status of the axis, such as servo status.

Axis Sensor Input Status

Click this button to display the states of limit switch, etc.

Inputs

Click this button to display the on/off status of each signal of the input port.

Outputs

Click this button to display the on/off status of each signal of the output port.

⊚   <u>Encoder Status</u>

Click this button to display the status of the encoder.

* At the point when you open this window, the axis sensor input status and encoder status are not displayed. Click the corresponding button to display each of the states.

9.5.2   Error List Window

a.   Select Monitor (<u>M</u>) and then Error List (<u>E</u>) from the menu.

b.   The Error List window appears.
This window displays the last 16 alarms/warnings that occurred in the driver in the past, along with their dates and times of occurrence.

* There may be slight errors in the times of occurrence, because they are calculated by subtracting the value counted within the driver from the internal clock of the PC. Use them for reference purposes only.

No	Alm Code	Message	Date Generated
1	C74	Actual Position Out of Range	08/06/2003 15:24:58
2	C6E	Tried Using Axis whose Servo is OFF	08/06/2003 15:22:59
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Completed Data Read

Figure 9.5.2   Error List

🖫   <u>Save As</u>

Click this button to save the error list in a file in CSV format.

![P-Driver logo]

📇 <u>Print</u>
     Click this button to print the error list.

⚡ <u>Data Acquisition</u>
     Click this button to update the error list with the latest error information.

🖉 <u>Error List All Clear</u>
     Click this button to delete the entire error list of the driver.

9.6　Driver

9.6.1　Jog Movement Window

    a.   Select Driver (<u>D</u>) and then Jog (<u>J</u>) from the menu.
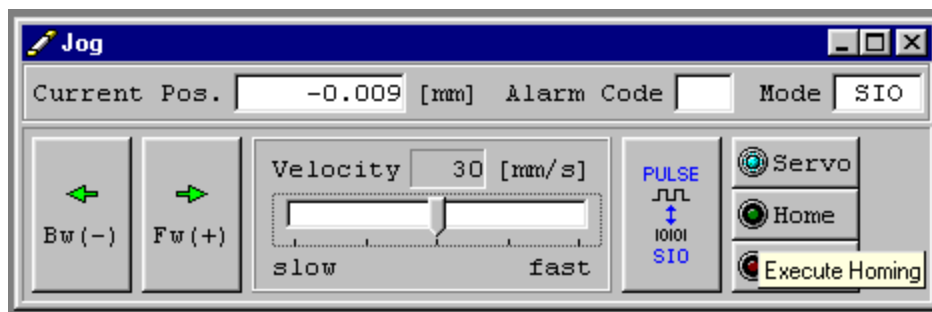
    b.   The Jog Movement window appears.

Figure 9.6.1　Jog Movement

(1)　Current Position, Alarm Code and Mode Display Panel

    This panel displays the current position of the axis (the display unit varies depending on the environment setting), alarm code and mode.
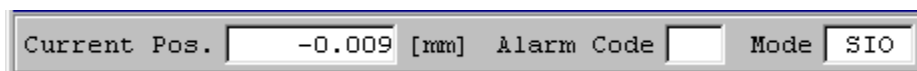
Figure 9.6.2　Current Position, Alarm Code and Mode Display Panel

(2) Jog Operation Panel

Operate the axis using the ⎟ Fw (+) ⎟ and ⎟ Bw (-) ⎟ buttons.

Select the velocity from 1, 10, 30, 50 or 100 [mm/sec] with the slider bar.
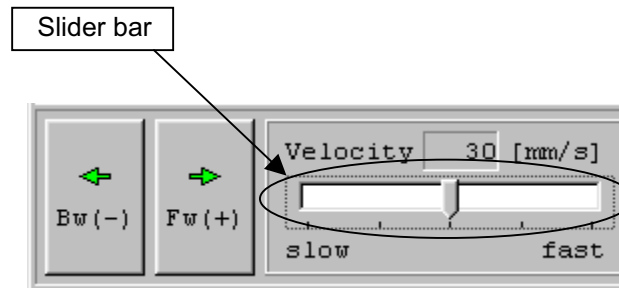
Figure 9.6.3   Jog Operation Panel

(3) Button Panel

Mode Switch

Every time you click this button, the operation mode of the axis switches between pulse and SIO communication mode.

Jog operation can only be performed in the SIO mode.

*   The mode cannot be switched while the axis is moving.

Servo

Click this button to turn the servo on/off.

When the servo is turned on, the button is highlighted in blue.

Home

Click this button to perform homing operation.

The button is highlighted in yellow while homing and highlighted in green after homing is completed.
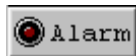
Alarm

Click this button to cancel the alarm status.

Only alarm codes from 0 to CFF (HEX) can be canceled. To cancel alarm codes D00 (HEX) or onward, it is necessary to turn off the power supply to the driver and back on again.

(4)　Processing when Closing the Jog Movement Window

If you try closing the Jog Movement window in the SIO mode, the confirmation dialog box shown in Figure 9.6.4 appears and asks whether you want to change the operation mode to the pulse operation mode.

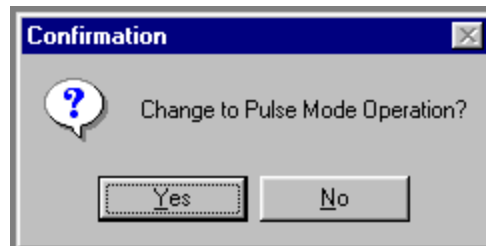* If you close the window in the SIO mode, the driver no longer accepts pulse inputs.

Figure 9.6.4　Confirmation

9.6.2　Re-Connection

a.　Select Driver (D) and then Re-connect (C) from the menu.

b.　If the application is in the offline mode, the connection check dialog box shown in Figure 9.2.1 appears, which allows you to shift from the offline to online mode.

　　If the application is in the online mode, the confirmation dialog box shown in Figure 9.6.5 appears.
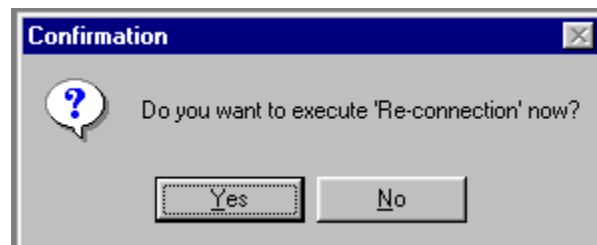
Figure 9.6.5　Confirmation

Changes to the environment setting made in 9.7.1 are also enabled by re-connecting to the driver in this manner.

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9.6.3   Memory Initialization

 a. Select Driver (<u>D</u>) and then Initialize Memory (<u>I</u>) from the menu.

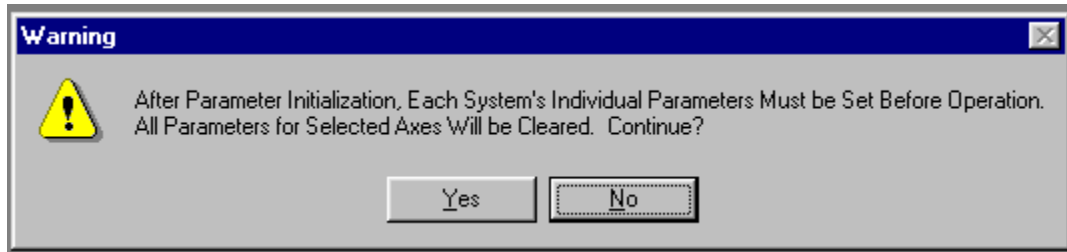 b. The warning dialog box shown in Figure 9.6.6 appears.

Figure 9.6.6 Warning

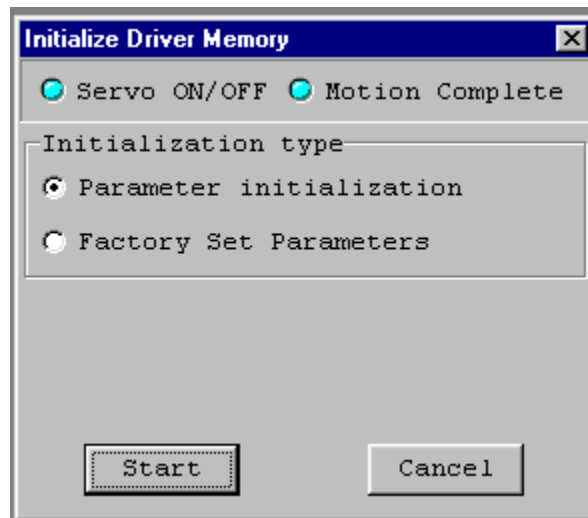 c. Click Yes (Y) to display the Initialize Driver Memory window.

Figure 9.6.7 Initialize Driver Memory

 d. Select <u>Parameter initialization</u> under <u>Initialization type</u> in order to overwrite the parameters with the default values, or select <u>Factory Set Parameters</u> to overwrite the parameters with the values at shipment from the factory. Click the Start button to start overwriting.

  * The servo must be turned off, or any operation system commands currently being performed must be completed normally, before the initialization can be started.

9.6.4   Software Reset

 a. Select Driver (<u>D</u>) and then Software Reset (<u>R</u>) from the menu.

 b. The dialog box shown in Figure 9.4.2 appears.

 c. If you click Yes (Y) , the message "Restarting the driver" is displayed for several seconds and the connection check dialog box shown in Figure 9.2.1 appears.

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9.7 Tool

9.7.1 Environment Setting

a. Select Tool (T) and then Environment Setting (S) from the menu.

b. Click the | Communication | tab to display the window shown in Figure 9.7.1.

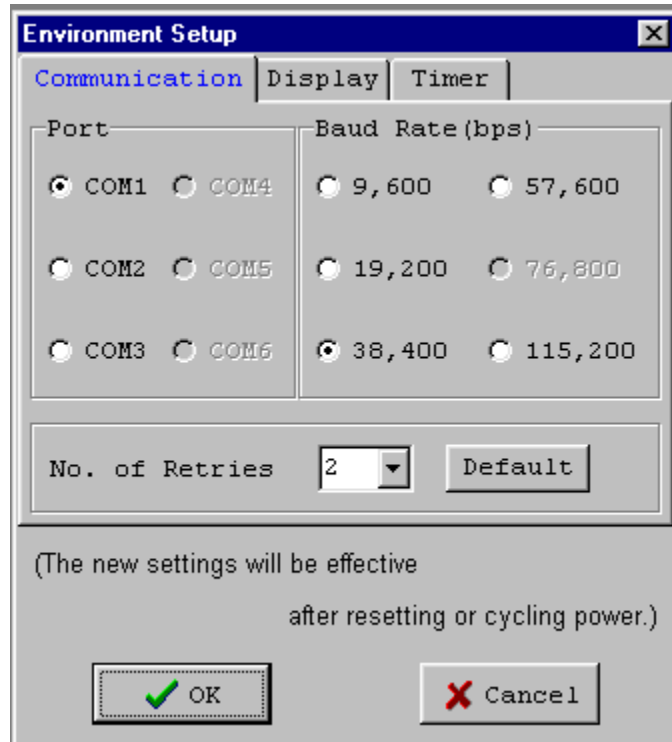In this tab, you can set the communication port, baud rate and number of retries.

Figure 9.7.1   Environment Setting – Communication

c. Click the ⎸Display⎹ tab to display the window shown in Figure 9.7.2.

  In this tab, you can set the display unit and coordinate revised display.
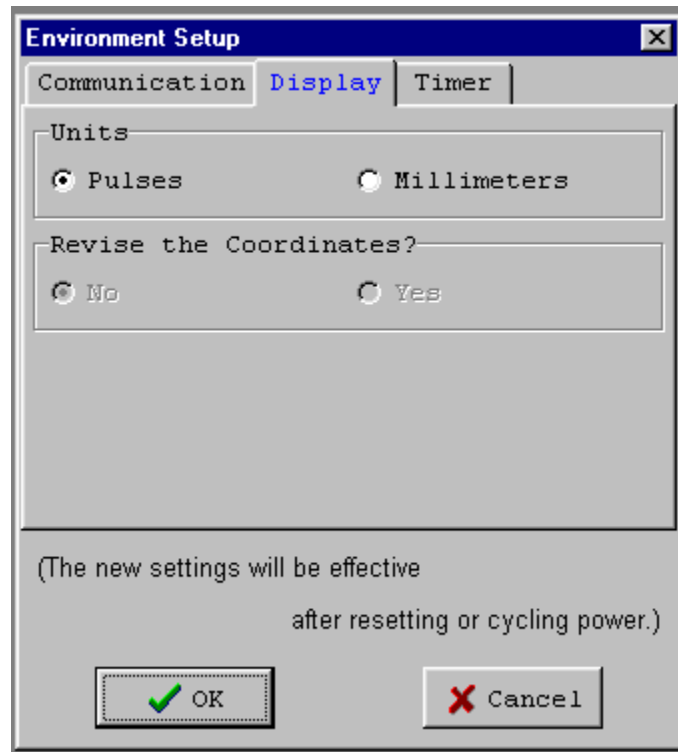

Figure 9.7.2 Environment Setting – Display

If you set the display unit to <u>Pulses</u>, parameter inputs and the current values in the monitor are displayed in units of pulses. If you select <u>Millimeters</u>, you can input and display values in millimeters, after conversion using parameters such as the lead length and the number of encoder pulses.

d. Click the [Timer] tab to display the window shown in Figure 9.7.3.

In this tab, you can set the timing at which the PC software reads various data from the driver. Under normal circumstances, the information in this tab does not require changing.
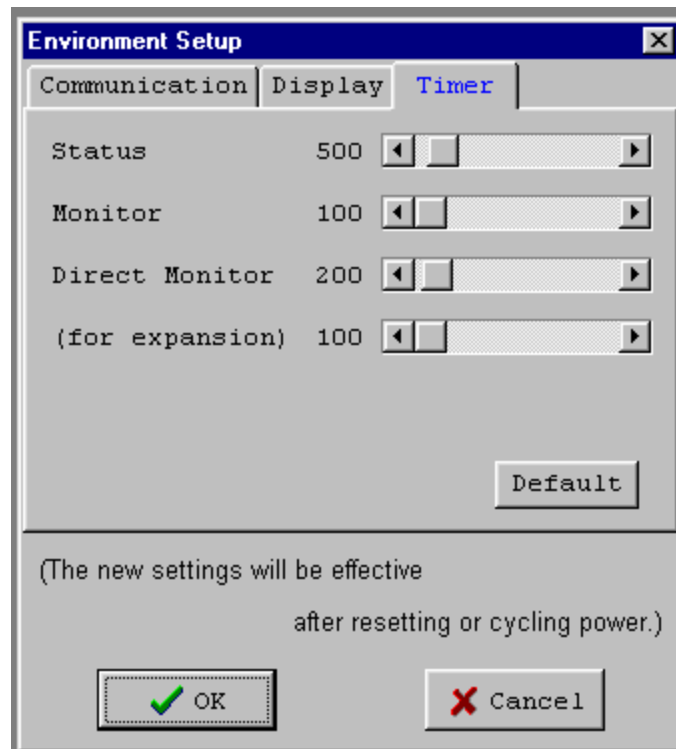

Figure 9.7.3   Environment Setting – Timer

9.8　Help

9.8.1　Version Information

    a. Select Help (<u>H</u>) and then About (<u>A</u>) from the menu.

    b. The window shown in the Figure 9.8.1 appears.

       This window displays the versions of the application and driver (main and driver parts).
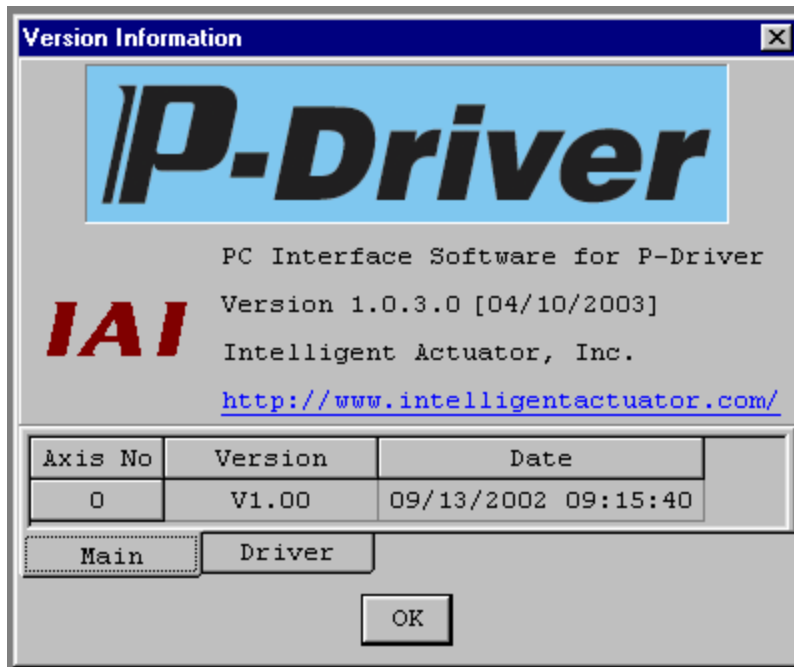

Figure 9.8.1　Version Information

P-Driver

Change History

Revision Date	Description of Revision
January 2012	First edition Edition 1B 　　　Pg. 5, 79, 80 　　　The floppy disk is changed to CD-ROM.

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