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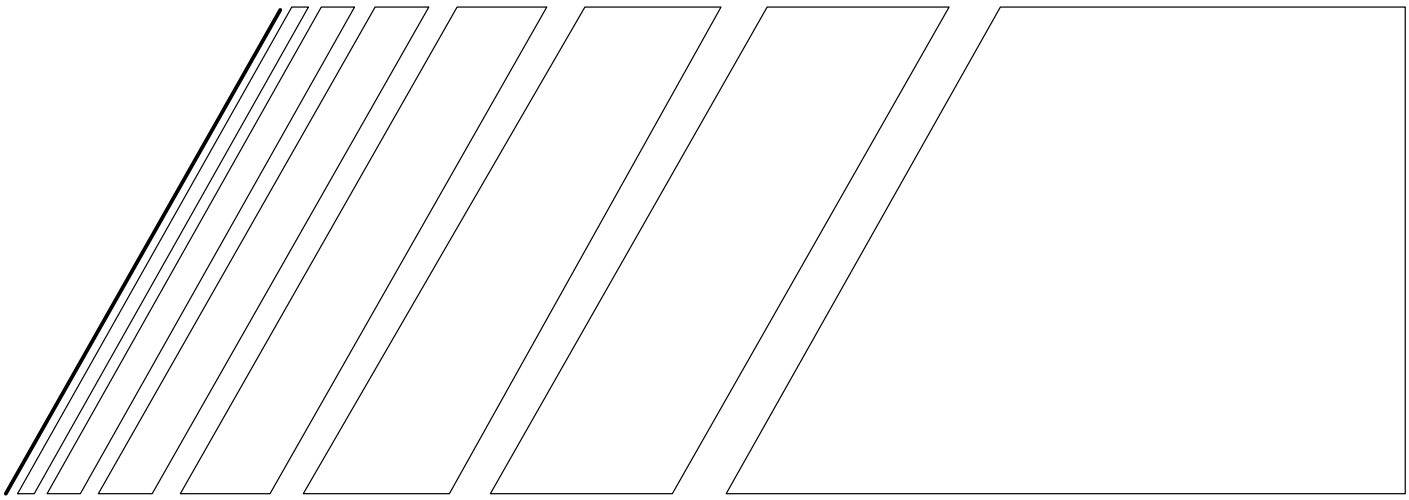
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Cat. No. I524-E1-2

OMRON



USER'S MANUAL

OMNUC FND-X SERIES

MODELS FND-X□ (DIO Type)
FND-X□-SRT (CompoBus/S Type)

POSITION DRIVERS

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Thank you for choosing this OMNUC FND-X-series product.
This manual provides details on the installation, wiring, troubleshooting, and maintenance of OMNUC FND-X-series products along with parameter settings for the operation of the products.

- Make sure that actual users of this product will read this manual thoroughly and handle and operate the product with care.
- Retain this manual for future reference.
- This manual describes the specifications and functions of the product and relations with other products. Assume that nothing described in this manual is possible.
- Specifications and functions may change without notice to improve product performance.
- Forward and reverse rotation of AC Servomotors described in this manual are defined as looking at the end of the output shaft of the motor as follows: counterclockwise rotation is forward and clockwise rotation is reverse.

General Instructions

1. Refer to Precautions first and carefully read and be sure to understand the information provided.
2. Familiarize yourself with this manual and understand the functions and performance of the Servomotor and Servo Driver for proper use.
3. The Servomotor and Servo Driver must be wired and operated by experts in electrical engineering.
4. We recommend that you add the following precautions to any instruction manuals you prepare for the system into which the product is being installed.
   - Precautions on the dangers of high-voltage equipment.
   - Precautions on touching the terminals of the product even after power has been turned OFF. (These terminals are live even with the power turned OFF.)
5. Do not perform withstand voltage or other megameter tests on the product. Doing so may damage internal components.
6. Servomotors and Servo Drivers have a finite service life. Be sure to keep replacement products on hand and to consider the operating environment and other conditions affecting the service life.
7. Do not set any parameter not described in this manual, otherwise the Servomotor or Servo Driver may malfunction. Contact your OMRON representatives if you have any inquiry.

NOTICE

Before using the product under the following conditions, consult your OMRON representatives, make sure that the ratings and performance characteristics of the product are good enough for the systems, machines, or equipment, and be sure to provide the systems, machines, or equipment with double safety mechanisms.

1. Conditions not described in the manual.
2. The application of the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, or safety equipment.
3. The application of the product to systems, machines, or equipment that may have a serious influence on human life and property if they are used improperly.

Items to Check After Unpacking

Check the following items after removing the product from the package:

- Has the correct product been delivered (i.e., the correct model number and specifications)?
- Has the product been damaged in shipping?

The product is provided with Safety Precautions Sheets. No connectors or mounting screws are provided.

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Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠**DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠**WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠**Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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General Precautions

Observe the following precautions when using the OMNUC Position Drivers and peripheral devices.

This manual may include illustrations of the product with protective covers removed in order to describe the components of the product in detail. Make sure that these protective covers are on the product before use.

Consult your OMRON representative when using the product after a long period of storage.

⚠ WARNING Do not touch the inside of the Servo Driver. Doing so may result in electric shock.

⚠ WARNING Always connect the frame ground terminals of the Servo Driver and the Servomotor to a class-3 ground (to 100 Ω or less). Not connecting to a class-3 ground may result in electric shock.

⚠ WARNING Do not remove the front cover, terminal covers, cables, Parameter Units, or optional items while the power is being supplied. Doing so may result in electric shock.

⚠ WARNING Operation, maintenance, or inspection must be performed by authorized personnel. Not doing so may result in operation stoppage, burning of the product, electric shock, or injury.

⚠ WARNING Wiring or inspection must be performed at least 1 minute after turning off the power supply. Doing so may result in electric shock.

⚠ WARNING Do not damage, pull on, apply stress to, place heavy objects on, or pinch the cables. Doing so may result in electric shock.

⚠ WARNING Do not touch the rotating parts of the Servomotor under operation. Doing so may result in injury.

⚠ WARNING Do not modify the product. Doing so may result in injury or damage to the product.

⚠ Caution Use the Servomotors and Servo Drivers in a specified combination. Not doing so may result in fire or damage to the products.

⚠ Caution Do not store or install the product in the following places. Doing so may result in electric shock, fire or damage to the product.

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to shock or vibration.
- Locations subject to exposure to water, oil, or chemicals.

⚠ Caution Do not touch the Servo Driver radiator, regenerative resistor, or Servomotor while the power is being supplied or soon after the power is turned off. Doing so may result in a skin burn due to the hot surface.

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Storage and Transportation Precautions

⚠ **Caution** Do not hold by the cables or motor shaft while transporting the product. Doing so may result in injury or malfunction.

⚠ **Caution** Do not place any load exceeding the figure indicated on the product. Doing so may result in injury or malfunction.

⚠ **Caution** Use the motor eye-bolts only for transporting the Servomotor. Using them for transporting the machinery may result in injury or malfunction.

Installation and Wiring Precautions

⚠ **Caution** Do not step on or place a heavy object on the product. Doing so may result in injury.

⚠ **Caution** Do not cover the inlet or outlet ports and prevent any foreign objects from entering the product. Doing so may result in fire.

⚠ **Caution** Be sure to install the product in the correct direction. Not doing so may result in malfunction.

⚠ **Caution** Provide the specified clearances between the Servo Driver and the control panel or with other devices. Not doing so may result in fire or malfunction.

⚠ **Caution** Do not apply any strong impact. Doing so may result in malfunction.

⚠ **Caution** Be sure to wire correctly and securely. Not doing so may result in motor runaway, injury, or malfunction.

⚠ **Caution** Be sure to firmly tighten the screws fixing the product, the terminal block, and cables. Not doing so may result in malfunction.

⚠ **Caution** Use crimp terminals for wiring. Do not connect bare stranded wires directly to the terminal block. Doing so may result in fire.

⚠ **Caution** Use the power supply voltages specified in this manual. Not doing so may result in burning.

⚠ **Caution** Take appropriate measures to ensure that the specified power with the rated voltage is supplied. Be particularly careful in places where the power supply is unstable. Not doing so may result in damage to the product.

⚠ **Caution** Install external breakers and take other safety measures against short-circuiting in external wiring. Not doing so may result in fire.

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⚠ **Caution** Provide an appropriate stopping device on the machine side to secure safety. (A holding brake is not a stopping device for securing safety.) Not doing so may result in injury.

⚠ **Caution** Provide an external emergency stopping device that allows an instantaneous stop of operation and power interruption. Not doing so may result in injury.

⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations. Not doing so may result in equipment damage.

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields and magnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

Operation and Adjustment Precautions

⚠ **Caution** Confirm that no adverse effect will occur in the system before performing the test operation. Not doing so may result in equipment damage.

⚠ **Caution** Check the newly set parameters for proper execution before actually running them. Not doing so may result in equipment damage.

⚠ **Caution** Do not make any extreme adjustments or setting changes. Doing so may result in unstable operation and injury.

⚠ **Caution** Separate the Servomotor from the machine, check for proper operation, and then connect to the machine. Not doing so may cause injury.

⚠ **Caution** When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation. Not doing so may result in injury.

⚠ **Caution** Do not come close to the machine immediately after resetting momentary power interruption to avoid an unexpected restart. (Take appropriate measures to secure safety against an unexpected restart.) Doing so may result in injury.

⚠ **Caution** Do not use the built-in brake of the Servomotor for ordinary braking. Doing so may result in malfunction.

Maintenance and Inspection Precautions

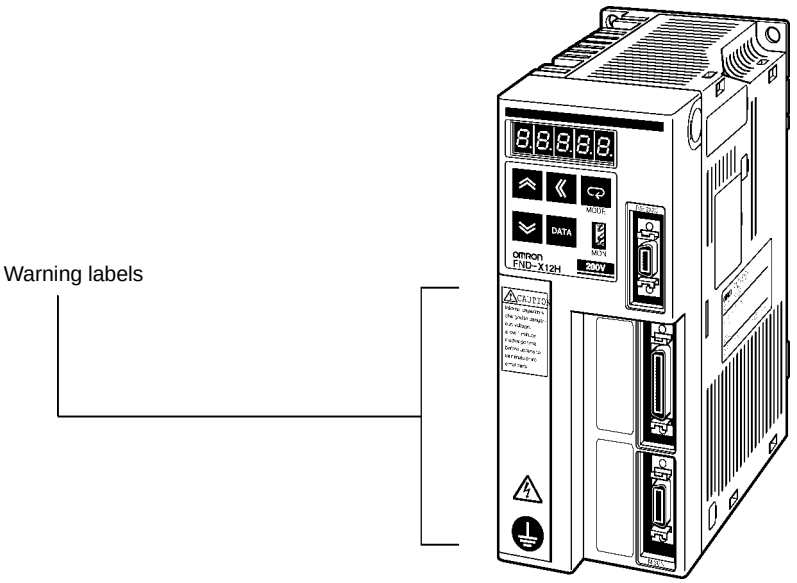
⚠ **WARNING** Do not attempt to take the Unit apart or repair. Doing either of these may result in electrical shock or injury.

⚠ **Caution** Resume operation only after transferring to the new Unit the contents of the data required for operation. Not doing so may result in equipment damage.

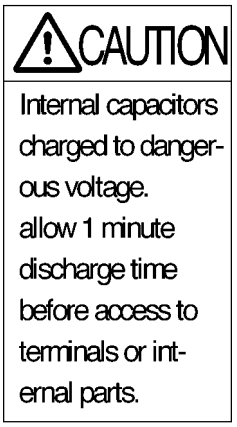
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Warning Labels

Warning labels are pasted on the product as shown in the following illustration. Be sure to follow the instructions given there.



Warning Labels



Warning label 1



May cause electric shock.

Warning label 2



Connect to a ground of 100 Ω or less.

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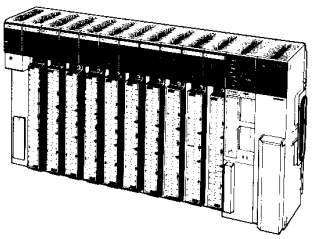
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For users who wish to begin operations quickly.

The OMNUC FND-X-series Position Driver allows motor test operation only by wiring the driver and motor without connecting the controller. Read *3-2 Turning ON Power and Checking Display*, properly set the motor model code, and then operate the motor according to *3-8-2 System Check Mode*.

Do not connect any load (machines) when performing test operation. Perform test operation only after confirming that no adverse effects will be caused by test operation.

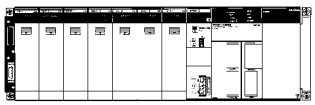
SYSMAC C/CV Programmable Controller



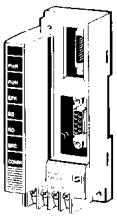
5-3-1 General Control Cable Specifications

I/O signals

SYSMAC C200H-HX/HG/HE or CQM1 Programmable Controller



SRM1-C01/-C02 Master Controller



Section 6 CompoBus/S Specifications

CompoBus/S signals

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OMNUC FND-X Series

Teaching Box



CVM1-PRO01 Teaching Box

ROM Cassette:
CVM1-MP702
(Common for MC Units and Position Drivers)

CVM1-MP703

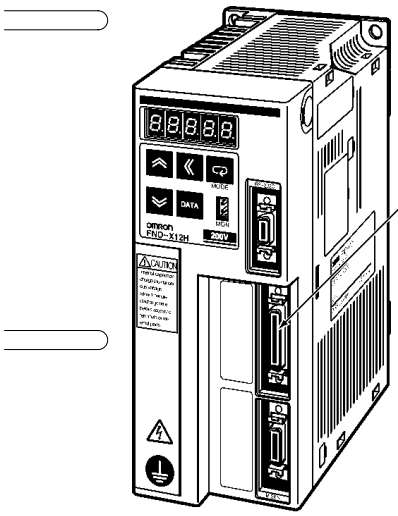
For details refer to Cat. No. W354-E1.

RS-422 Teaching Box connections cable

OMNUC FND-X-series Position Drivers

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2-2-3 Wiring Terminal Blocks
3-3-3 Mode Details
6-3 Connecting a CompoBus/S System

2-2-2 Control Circuitry Terminal Wiring





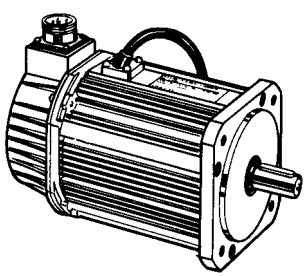
DIO Type
200 V: FND-X□□H
100 V: FND-X□□L

CompoBus/S Type
200 V: FND-X□□H-SRT
100 V: FND-X□□L-SRT

5-3 Cable Specifications

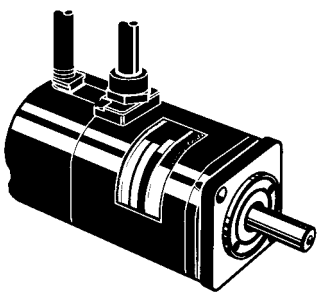
Power signals ⇑ ⇓ Encoder/Resolver signals

OMNUC M-series
AC Servomotors



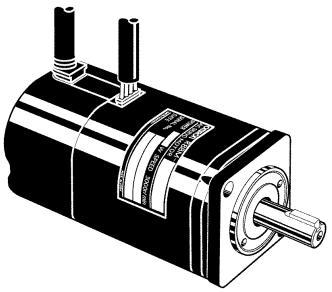
1200 r/min: 200 to 1.8 kW with Resolver
2000 r/min: 200 to 2.2 kW with Resolver
4000 r/min: 60 to 2 kW with Resolver

OMNUC U-series
AC Servomotors



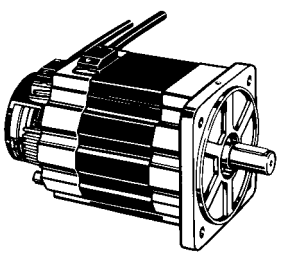
3000 r/min: 30 to 2 kW with Incremental Encoder
3000 r/min: 30 to 2 kW with Absolute Encoder

OMNUC U-UE-series
AC Servomotors



3000 r/min: 100 to 750 W with Incremental Encoder

OMNUC H-series
AC Servomotors



3000 r/min: 50 to 1100 W with Incremental Encoder

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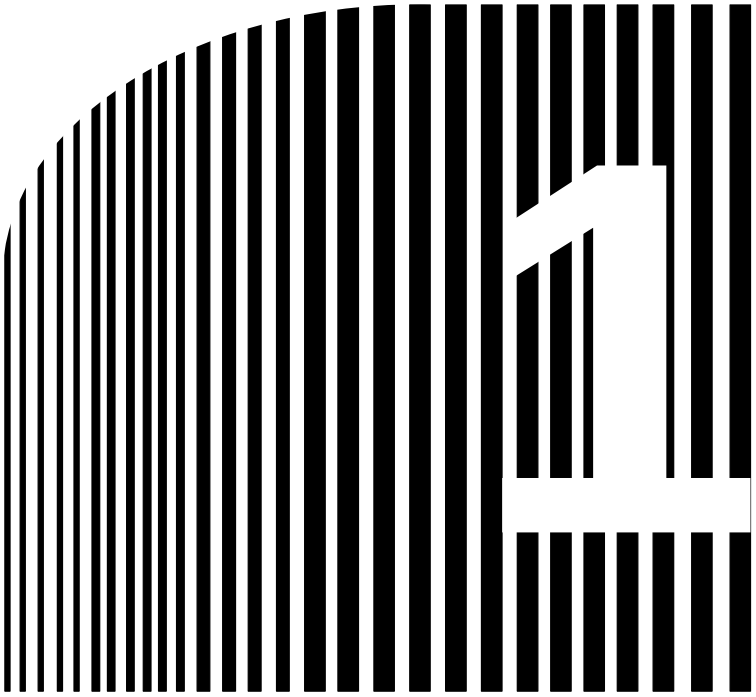
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Chapter 1

• Introduction •

1-1 Functions
1-2 Nomenclature and Key Operations
1-3 Supported Standards and Supporting Models

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1-1 Functions

OMRON's FND-X Position Drivers are servo drivers with built-in positioner functions that control AC servomotors according to positioning data.

☐FND-X-Series Models

There are two types of FND-X Position Drivers, according to the type of control signals used.

Control signals	Model
DIO	FND-X H/FND-X L
CompoBus/S	FND-X H-SRT/FND-X L-SRT

Up to eight CompoBus/S Position Drivers can be connected to one Master Unit for 128 input and 128 output points. Two-wire communications are used, reducing system wiring. High-speed communications are also achieved, with a communications cycle time of 0.5 or 0.8 ms.

Note Only the high-speed communications mode is available with the FND-X.

☐International Standards: EC Directives and UL/cUL Standards

Position Drivers manufactured beginning April 1999 are available that conform to EC directives and UL/cUL standards, making it easier to conform to these standards in the overall system. When conforming to directives/standards, use U-series Servomotors that also conform to the require directives/standards.

☐Applicable Servomotor Models

The following AC Servomotors can be connected to FND-X-series Position Drivers.

- OMNUC U Series (30 to 750 W)

  Servomotors Conforming to UL/cUL Standards
  - With incremental encoders: R88M-U HA-
  - With absolute encoders: R88M-U TA-

  Servomotors Conforming to EC Directives
  - With incremental encoders: R88M-U VA-
  - With absolute encoder: R88M-U XA-

- OMNUC U Series (1 to 2 kW)

  Servomotors Not Conforming to Standards
  - With incremental encoder: R88M-U H-
  - With absolute encoder: R88M-U T-

  Servomotors Conforming to EC Directives
  - With incremental encoder: R88M-U V-
  - With absolute encoder: R88M-U X-

- OMNUC U-UE Series (100 to 750 W)

  Servomotors Not Conforming to Standards
  - With incremental encoder: R88M-UE H-

  Servomotors Conforming to EC Directives
  - With incremental encoder: R88M-UE V-

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- OMNUC H (50 to 1,100 W) Series (with incremental encoder): R88M-H -
- OMNUC M (60 to 2,200 W) Series (with resolver): R88M-M -

Note H-series and M-series models do not conform to the EC Directives and UL/cUL standards.

- The following models are available with different output capacities, and are arranged according to input power supply.

Position Driver and AC Servomotor Combinations

Position Driver		Applicable AC Servomotor			
Input power supply	**Model**	**Series**	**Model**	**Output capacity**	**Rated r/min**
Single-phase 200/240 (170 to 264) VAC at 50/60 Hz	FND-X06H-	U	R88M-U03030 A	30 W	3,000 r/min
			R88M-U05030 A	50 W	
			R88M-U10030 A	100 W	
		U-UE	R88M-UE10030 -S1	100 W	3,000 r/min
		H	R88M-H05030	50 W	3,000 r/min
			R88M-H10030	100 W	
	FND-X12H-	U	R88M-U20030 A	200 W	3,000 r/min
			R88M-U40030 A	400 W	
		U-UE	R88M-UE20030 -S1	200 W	3,000 r/min
			R88M-UE40030 -S1	400 W	
		H	R88M-H20030	200 W	3,000 r/min
			R88M-H30030	300 W	
		M	R88M-M06040	60 W	4,000 r/min
			R88M-M12040	120 W	
			R88M-M20040	200 W	
			R88M-M40040	400 W	
			R88M-M20020	200 W	2,000 r/min
			R88M-M40020	400 W	
			R88M-M20012	200 W	1,200 r/min
			R88M-M40012	400 W	
	FND-X25H-	U	R88M-U75030 A	750 W	3,000 r/min
			R88M-U1K030	1000 W	
		U-UE	R88M-UE75030 -S1	750 W	3,000 r/min
		H	R88M-H50030	500 W	3,000 r/min
			R88M-H75030	750 W	
			R88M-H1K130	1100 W	
		M	R88M-M70040	700 W	4,000 r/min
			R88M-M1K140	1100 W	
			R88M-M70020	700 W	2,000 r/min
			R88M-M1K120	1100 W	
			R88M-M70012	700 W	1,200 r/min

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Position Driver		Applicable AC Servomotor			
Input power supply	**Model**	**Series**	**Model**	**Output capacity**	**Rated r/min**
Three-phase 200/240 (170 to 264) VAC at 50/60 Hz	FND-X50H-	U	R88M-U1K530	1500 W	3000 r/min
			R88M-U2K030	2000 W	
		M	R88M-M2K040	2000 W	4000 r/min
			R88M-M1K820	1800 W	2000 r/min
			R88M-M2K220	2200 W	
			R88M-M1K112	1100 W	1200 r/min
			R88M-M1K412	1400 W	
			R88M-M1K812	1800 W	
Single-phase 100/115 (85 to 127) VAC at 50/60 Hz	FND-X06L-	U	R88M-U03030 A	30 W	3,000 r/min
			R88M-U05030 A	50 W	
			R88M-U10030 A	100 W	
		U-UE	R88M-UE10030 -S1	100 W	3,000 r/min
		H	R88M-H05030	50 W	3,000 r/min
			R88M-H10030	100 W	
	FND-X12L-	U	R88M-U20030 A	200 W	3,000 r/min
		U-UE	R88M-UE20030 -S1	200 W	3,000 r/min
		H	R88M-H20030	200 W	3,000 r/min
		M	R88M-M06040	60 W	4,000 r/min
			R88M-M12040	120 W	
			R88M-M20040	200 W	
			R88M-M20020	200 W	2,000 r/min
			R88M-M20012	200 W	1,200 r/min

Note 1. Even when a U-series or U-UE-series Servomotor is used in combination with a100-VAC-input Position Driver, a 200-VAC Servomotor must be used. A 100-VAC Servomotor cannot be connected.

Note 2. Straight-axis servomotors are available either with or without a key or brake. In the above table, the Servomotors have the following features.

U-series	Straight axis without brake, without key
U-series UE models	Straight axis without brake, with key (not available without key)
H-series	Straight axis without brake, with key
M-series	Straight axis without brake, with key (“A” cut for small-capacity)

Note 3. Motor control is enabled by setting the user parameter UP-02 of the Position Driver.

Note 4. U-series UE-type and H-series Servomotors can be used only with Position Driver software version 4.01 (September 1997) or later.
U-series 1-kW to 2-kW Servomotors and M-series 1.1-kW to 2.2-kW Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

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□Servomotor Features and Selection Standards

Any FND-X-series Position Driver can be freely selected according to the application. When making the selection, take the following points into consideration.

Servomotor Features

U/UE Series

Compact size, high-speed response

High resolution (except for UE type)

Absolute encoder system can be configured (except for UE type).

H Series

High resolution

High application load inertia (less than 10 times the rotary inertia)

Usable in systems with comparatively low mechanical rigidity.

M Series

High application load inertia (less than 10 times the rotary inertia)

Usable in systems with comparatively low mechanical rigidity.

High output torque in a low-rotation motor

Up to a maximum of 50 meters between Servomotor and Servo Driver.

Motor Selection Standards (Reference)

Drive system type	Low inertia	High inertia
Ball screw direct connection	U, U-UE, H, M	U, U-UE, H, M
Turntable direct connection	U, U-UE, H, M	U, U-UE, H, M
Feeder (direct connection)	U, U-UE, H, M	U, U-UE, H, M
Harmonic drive	U, U-UE, H, M	H, M
Chain drive	U, U-UE, H, M	H, M
Belt drive	U, U-UE, H, M	H, M
Rack & pinion	U, U-UE, H, M	H, M

Note “Low inertia” means that the motor axis conversion inertia is approximately 0 to 5 times the rotary inertia for H-series and M-series Servomotors, and approximately 0 to 15 times the rotary inertia for U-series and U-series UE-type Servomotors.
“High inertia” means that the motor axis conversion inertia is approximately 5 to 10 times the rotary inertia for H-series and M-series Servomotors, and approximately 15 to 30 times the rotary inertia for U-series and U-series UE-type Servomotors.

□Position Control Functions

Pulse Rate Setting Function

Pulse rate setting makes it possible to set positioning data (i.e., positions and speeds) according to the mechanical axis.

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Control Mode

The following four types of control modes are available to the Position Driver: PTP control and feeder control modes with the internal point data preset in the Position Driver and these same modes with direct I/O signal input.

Internal Point Data

- A maximum of 64 points of data (Pd01 to Pd64) can be set internally in the Position Driver.
- Positions can be set within a range between –39,999,999 to 39,999,999 with the absolute or incremental value specified.

Positioning Data Instruction by Direct Input

Eight-point input and input timing signals are used to input position data and speed data within the following ranges into the Position Driver.

Position Setting Range:	–39,999,999 to 39,999,999 (with incremental or absolute setting)
Speed Setting Range:	1% to 100% (override setting with respect to reference speed)

Position Compensation Function

This function executes backlash compensation when PTP control is used, and slip compensation when feeder control is used.

Acceleration/Deceleration Function

- Either linear (trapezoidal) acceleration or deceleration time or S-shaped (primary low-pass filter) acceleration or deceleration time can be selected. In addition, different times can be set for acceleration and deceleration.
- The S-shaped acceleration/deceleration function makes it possible, for example, to start up conveyors smoothly or achieve feeder control with minimal feeder slippage.

Stop Methods

- The stop method for when the STOP signal is turned OFF can be selected with PP-24.

Free-running stop:	Motor power supply turned OFF.
Deceleration stop:	Servo-lock after the operation decelerates to a stop in preset time.
Error counter reset stop:	Servo-lock after an immediate deceleration to a stop with the error counter reset.

- The stop method of the Position Driver in the case of overrun or software limit signal detection can be selected with PP-25.

Overrun:	Servo free-running stop with the alarm AL38 turned ON or servo-lock stop.
Software limit detection:	Servo-lock stop with or without alarms AL34 and AL35 turned ON.

□Teaching Functions

Position Teaching

The Position Driver has a teaching function that enables the Position Driver stop the mechanical axis with an external force by going into servo-free status or JOG operation and to take up the stop position data automatically as part of PTP data.

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Mechanical Origin Teaching

An optional position can be specified as the mechanical origin by moving the position to the mechanical origin and teaching after the completion of origin search.

□Motor Control Functions

Motor Type and Capacity Selection by Motor Code

A motor type and capacity can be selected by setting UP-02 to the corresponding motor code.

Auto-tuning Function

- The Position Driver has an auto-tuning function. If a machine and motor are connected to the Position Driver, this function makes it possible to check the capacity and characteristics of the machine load by turning the motor and enables the automatic gain control of the Position Driver according to the capacity and characteristics of the machine load.
- The auto-tuning function makes it possible to save system startup time.

□Programming Devices

Teaching Box: CVM1-PRO01 + ROM Cassette

The Teaching Box provides for easy operation, including the following:

Position Driver status monitoring
Parameter editing and transfer
Teaching
Jogging
Positioning to specified points
Autotuning

Note Refer to the *CVM1-PRO01 Teaching Box Operation Manual (W354)* for more information.

OMNUC FND-X Series Monitoring Software

The OMNUC FND-X Series Monitoring Software runs on an IBM PC/AT or compatible computer and provides for easy operation, including the following:

Position Driver status monitoring
Parameter editing and transfer
Speed and current waveform displays
Autotuning

□Monitor Functions

Monitor Mode

The motor speed, present value, reference value, position deviation value, machine speed, motor current, effective load factor, electronic thermal value, electrical angle, and regenerative absorption rate can be monitored on the front panel of the Position Driver in this mode.

Check Mode

The I/O signal status, alarm details, alarm history, and software version are displayed on the front panel of the Position Driver in this mode.

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□Protection and Self-diagnostic Functions

Hardware Protection

The Position Driver is protected from overcurrent, overvoltage, low voltage, abnormal power, clock failure, overcurrent (soft), speed amplifier saturation, and overload damage.

Mechanical System Protection

The mechanical system is protected from damage resulting from overspeed, error counter overflows, soft limit overflows, coordinate counter overflows, or overrun.

Parameter Setting-related Errors

The Position Driver detects parameter setting errors.

Detector-related Errors

Resolver wire burnout, resolver failure, encoder wire disconnection, encoder communications failure, absolute encoder backup failure, absolute encoder checksum failure, absolute encoder battery failure, absolute encoder absolute failure, absolute encoder overspeed failure, encoder data failure, and encoder initialization failure.

Position-related Errors

BCD data, indefinite PV, and PTP data non-setting errors.

□Test Functions

Motor Test Function

The Position Driver has a motor test function that makes it possible to easily check whether a motor is connected to the Position Driver. When this function is enabled, the motor rotation direction can be controlled with the operation keys and the motor speed can be set in UP-29. The motor speed is set to 50 r/min before shipping.

Sequential Output Test Function

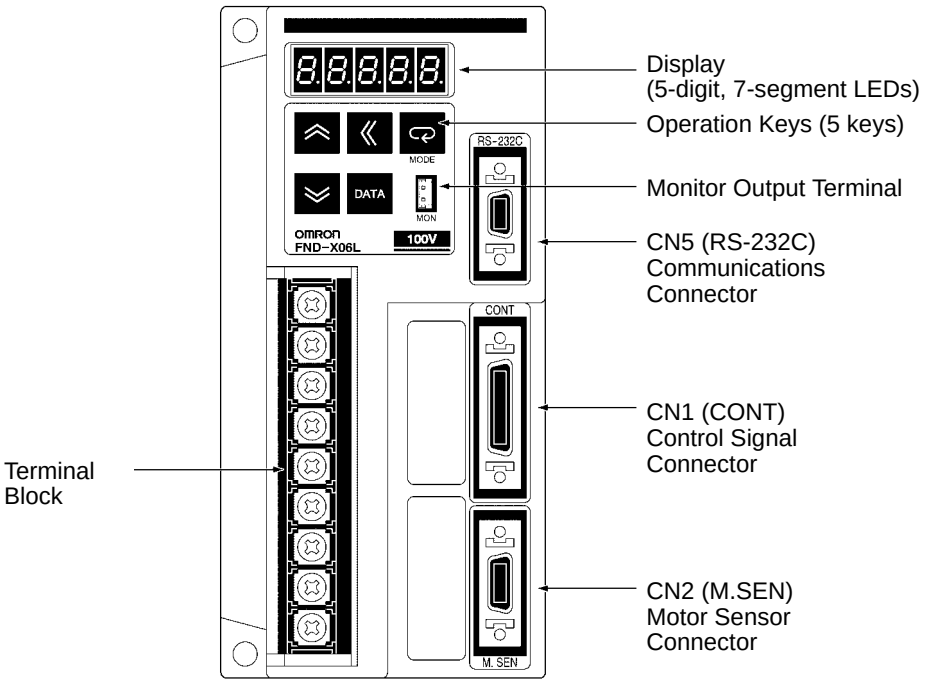
The Position Driver has a sequential output test function that makes it possible to easily check whether a host controller is connected to the Position Driver. This function makes it possible to turn any output terminal ON or OFF with the operation keys.

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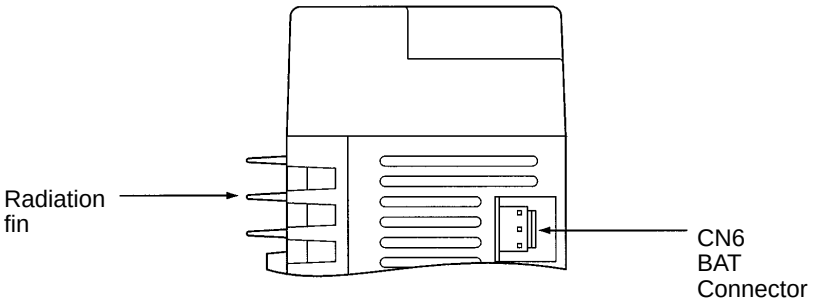
1-2 Nomenclature and Key Operations

DIO Position Drivers

Front View



Bottom View



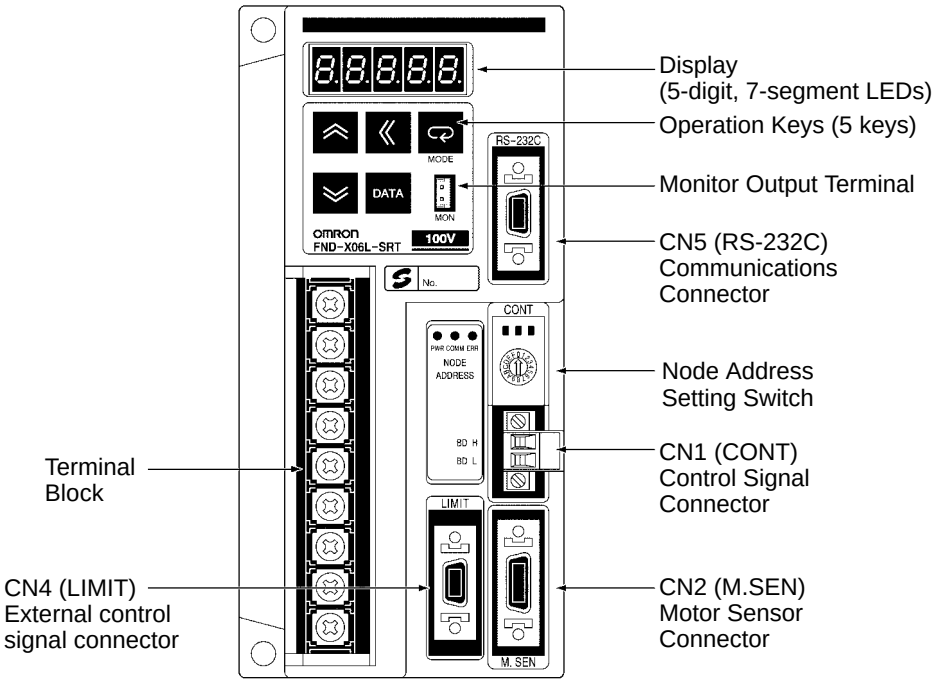
□Key Operations

Key	Name	Main function
	Mode Key	Changes the Position Driver's mode.
	Shift Key	Shifts the operation column to the left.
DATA	Data Key	Saves the set data.
	Increment Key	Increments the parameter address or data value.
	Decrement Key	Decrements the parameter address or data value.

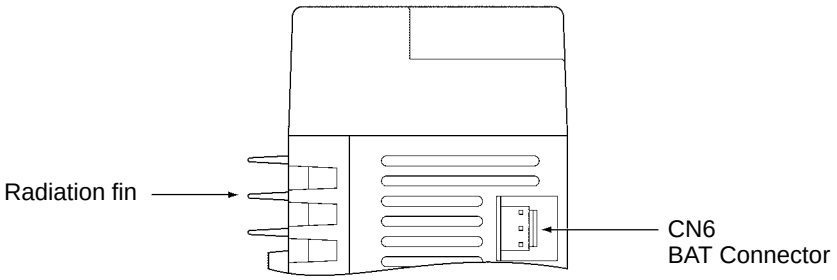
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CompoBus/S Position Drivers

Front View



Bottom View



□Key Operations

Key	Name	Main function
	Mode Key	Changes the Position Driver's mode.
	Shift Key	Shifts the operation column to the left.
DATA	Data Key	Saves the set data.
	Increment Key	Increments the parameter address or data value.
	Decrement Key	Decrements the parameter address or data value.

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1-3 Supported Standards and Supporting Models

1-3-1 Standards Supported by Position Drivers

Standard		Supported standard	File No.	Remarks
UL/cUL		UL508C	E179149	Electrical power conversion devices
EC	Low-voltage Directive	EN50178	---	Industrial product specifications
	EMC Directive	EN55011 class A group 1	---	Radio interference limits and measurement methods for radio frequency devices for industrial, scientific, and medical applications
		EN61000-4	---	Electromagnetic compatibility and immunity

Note All Position Drivers in the FND-X Series conform to UL/cUL standards and EC directives.

1-3-2 Standards Supported by AC Servomotors

Standard		Supported standard	File No.	Remarks
UL/cUL		UL1004	E179189	Electric motors
		cUL C22.2 No. 100	E179189	Motors and generators
EC	Low-voltage Directive	IEC34-1, -5, -8, -9	---	Rotating electric devices
	EMC Directive	EN55011 class A group 1	---	Radio interference limits and measurement methods for radio frequency devices for industrial, scientific, and medical applications
		EN61000-4	---	Electromagnetic compatibility and immunity

□Servomotors Conforming to UL/cUL Standards

Power supply	AC Servomotors	Encoder
200 VAC	R88M-U 30HA- (30 to 750 W)	Incremental encoder
200 VAC	R88M-U 30TA- (30 to 750 W)	Absolute encoder

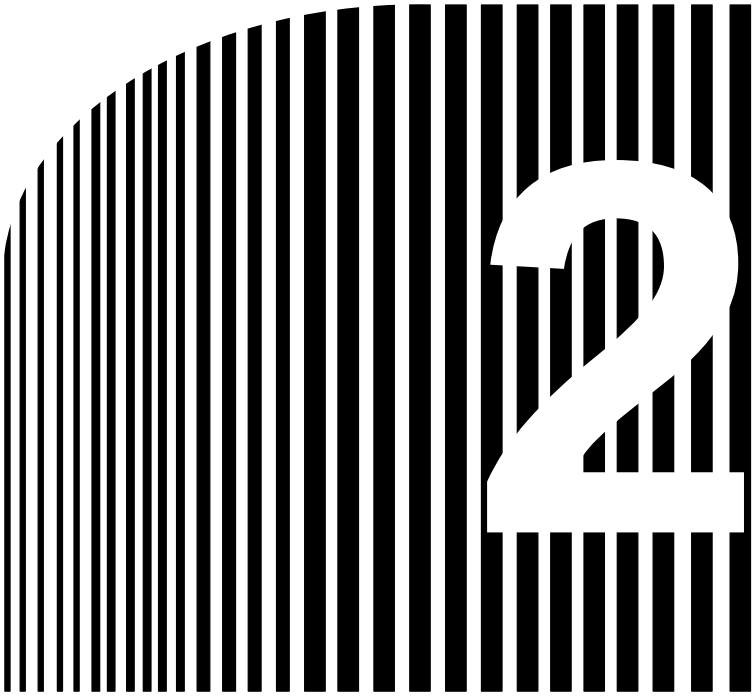
Note Servomotors manufactured beginning in May 1998 conform to UL/cUL standards.

□Servomotors Conforming EC Directives

Power supply	AC Servomotors	Encoder
200 VAC	R88M-U 30VA- (30 to 750 W)	Incremental encoder
200 VAC	R88M-U 30XA- (30 to 750 W)	Absolute encoder
200 VAC	R88M-UE 30V- (100 to 750 W)	Incremental encoder
200 VAC	R88M-U 30V- (1 to 2 kW)	Incremental encoder
200 VAC	R88M-U 30X- (1 to 2 kW)	Absolute encoder

Note The Servomotors must be wired as described in *2-2 Wiring* to conform to the EMC Directive.

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Chapter 2

• Design and Installation

2-1 Installation
2-2 Wiring

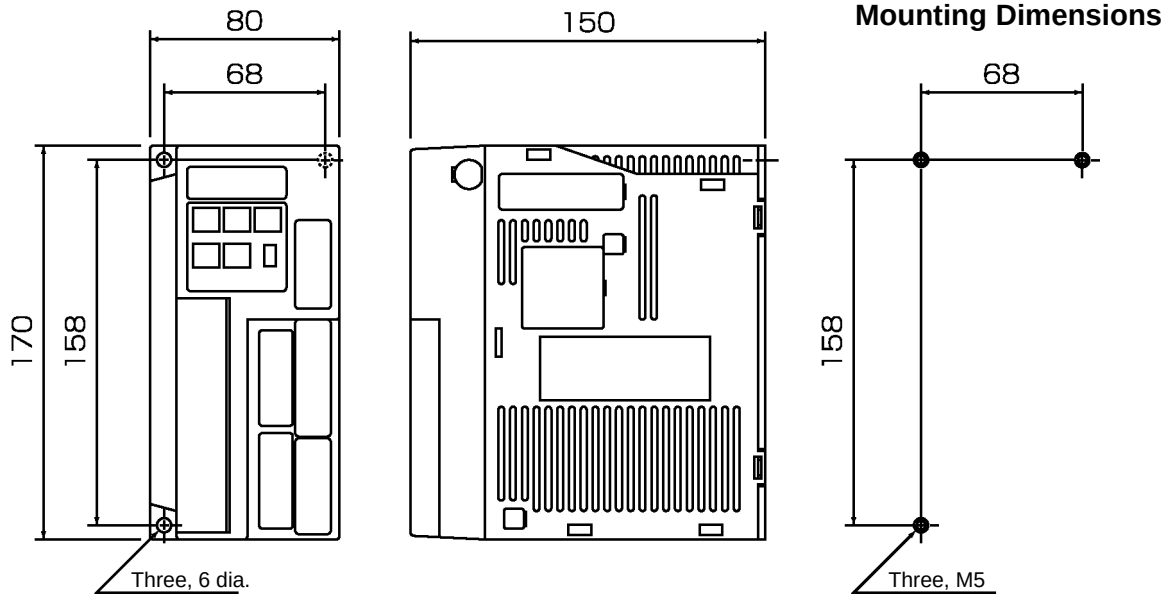
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2-1 Installation

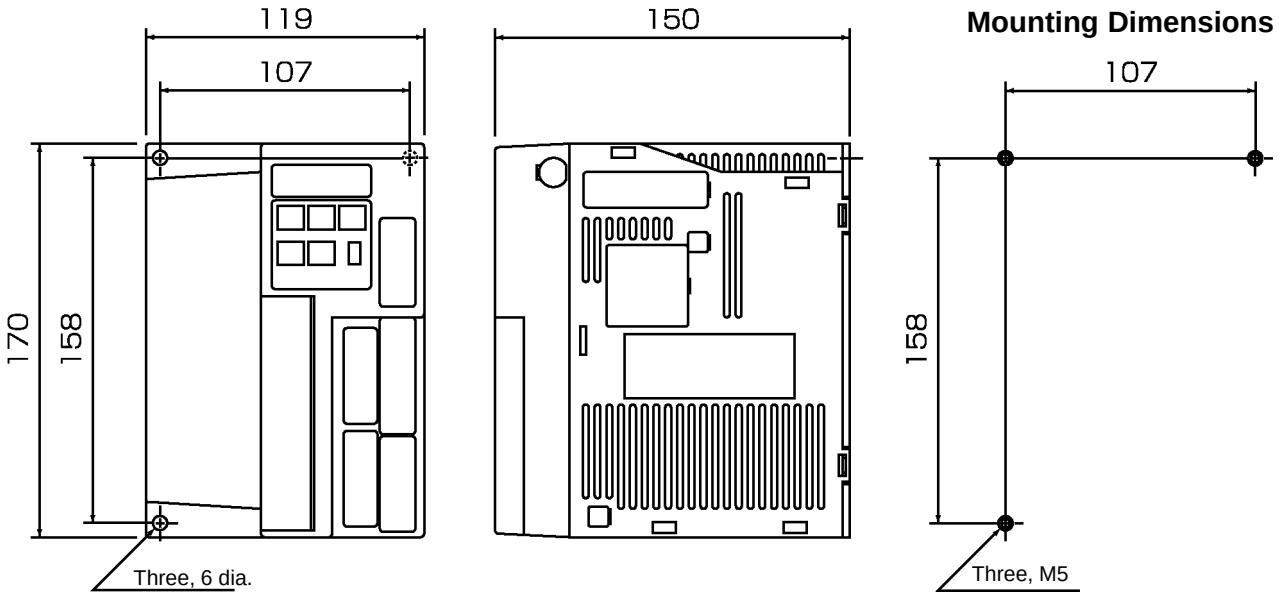
2-1-1 External Dimensions (Unit: mm)

DIO and CompoBus/S Position Drivers

□200-VAC FND-X06H- /-X12H-
100-VAC FND-X06L- /-X12L-

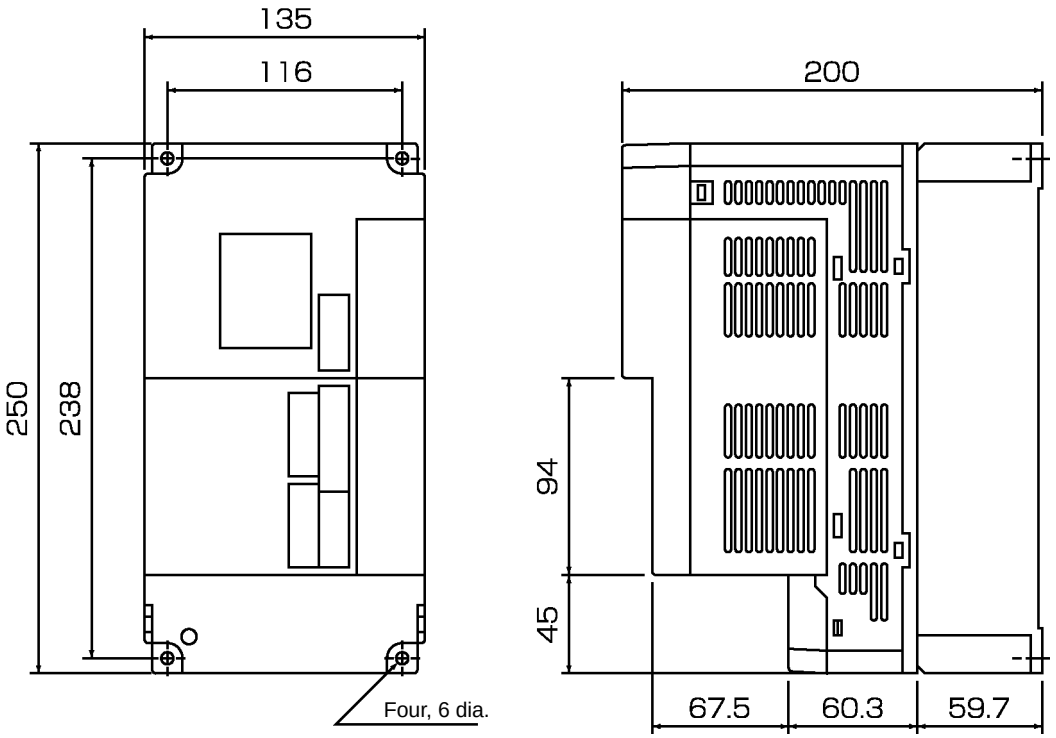


□200-VAC FND-X25H-

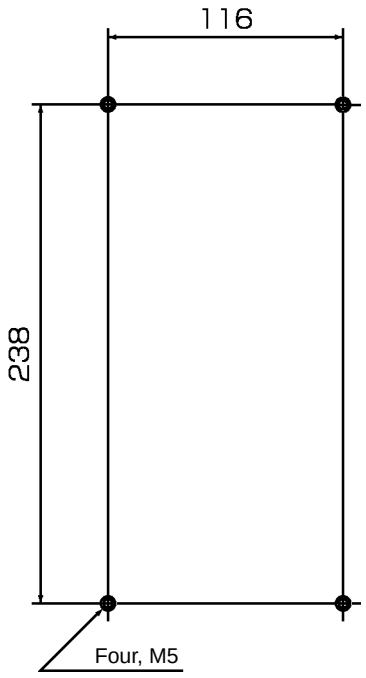


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□200-VAC FND-X50H-



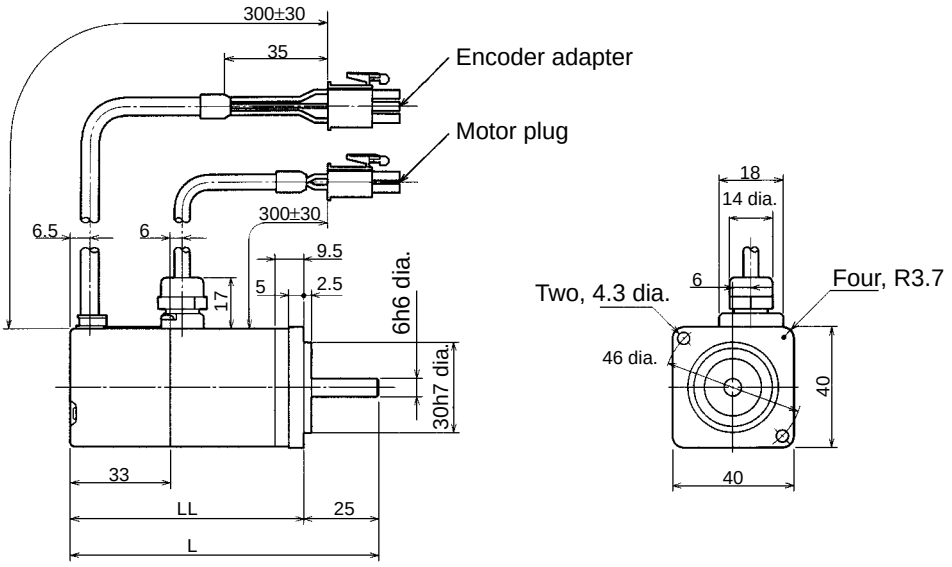
Mounting Dimensions



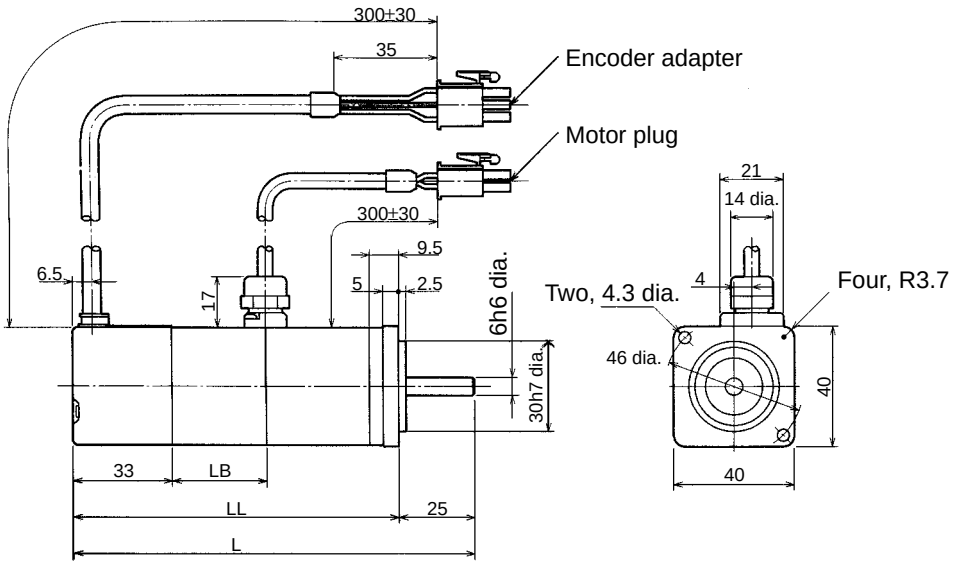
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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to UL/cUL

□30-W/50-W/100-W Standard Models (Without Brakes): R88M-U03030HA, R88M-U05030HA, R88M-U10030HA



□30-W/50-W/100-W Models with Brakes: R88M-U03030HA-B, R88M-U05030HA-B, R88M-U10030HA-B



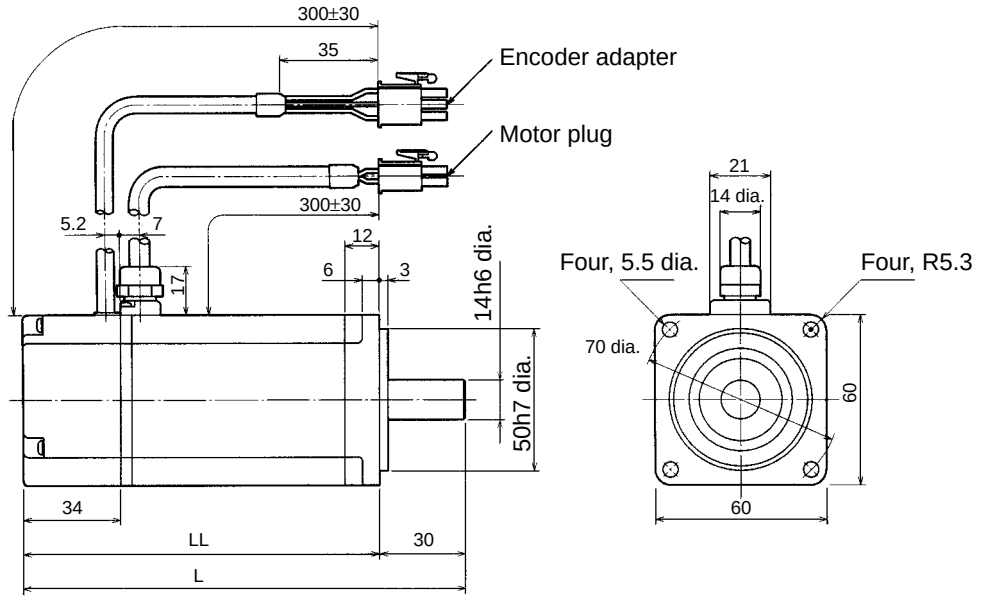
Standard Models (Without Brakes)			
Model	**L**	**LL**	**S**
R88M-U03030HA	94.5	69.5	6
R88M-U05030HA	102.0	77.0	6
R88M-U10030HA	119.5	94.5	8

Models with Brakes				
Model	**L**	**LL**	**LB**	**S**
R88M-U03030HA-B	126	101	31.5	6
R88M-U05030HA-B	133.5	108.5	31.5	6
R88M-U10030HA-B	160	135	40.5	8

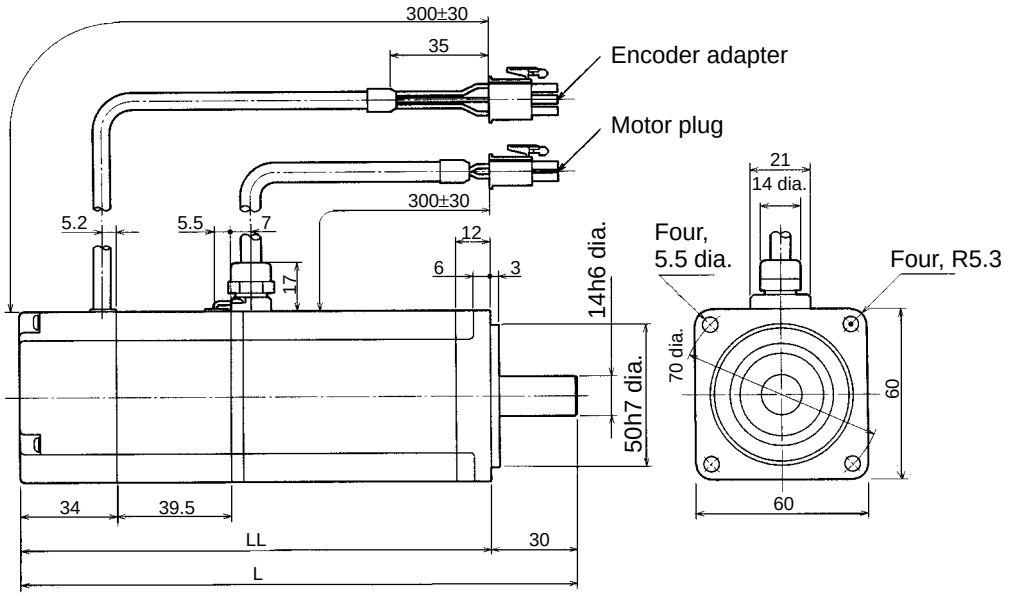
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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to UL/cUL (Contd.)

□200-W/400-W Standard Models (Without Brakes): R88M-U20030HA, R88M-U40030HA



□200-W/400-W Models with Brakes: R88M-U20030HA-B, R88M-U40030HA-B



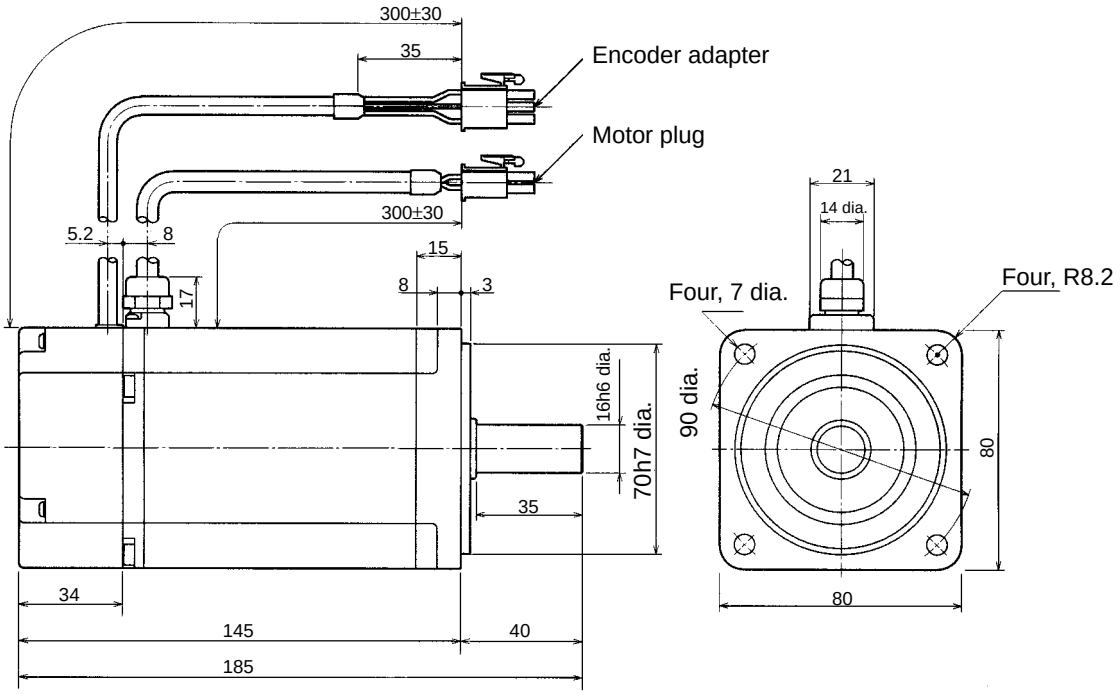
Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-U20030HA	126.5	96.5
R88M-U40030HA	154.5	124.5

Models with Brakes		
Model	**L**	**LL**
R88M-U20030HA-B	166	136
R88M-U40030HA-B	194	164

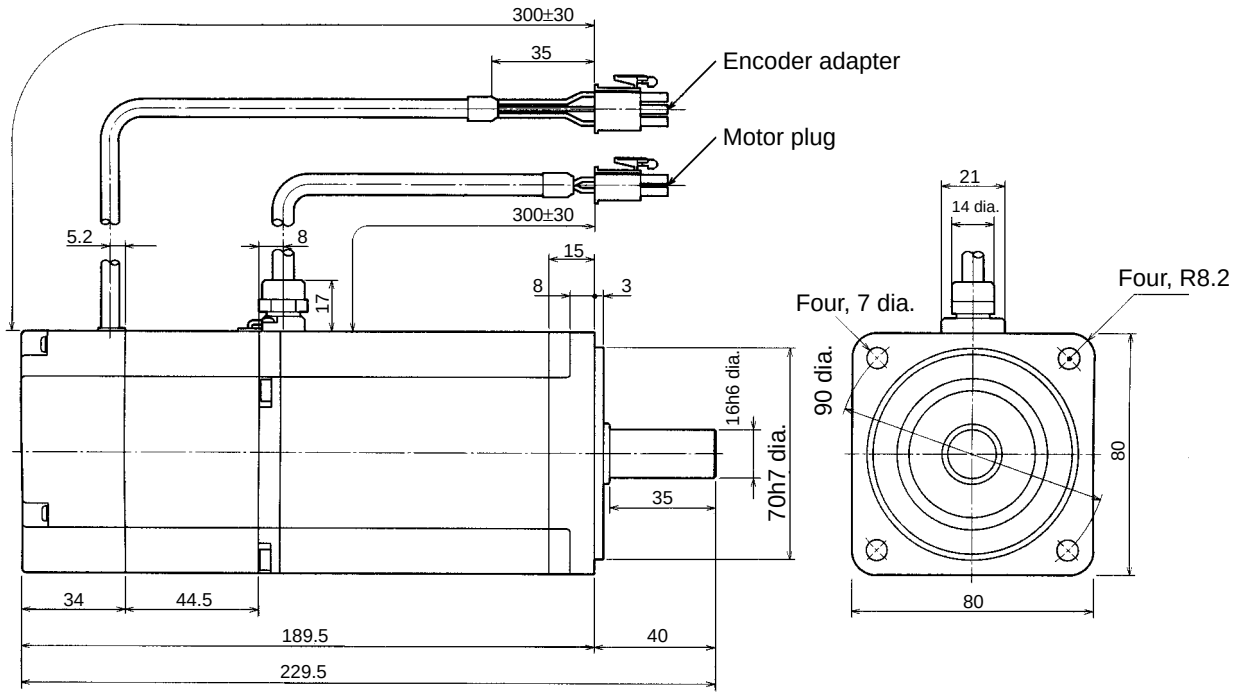
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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to UL/cUL (Contd.)

□750-W Standard Models (Without Brakes): R88M-U75030HA



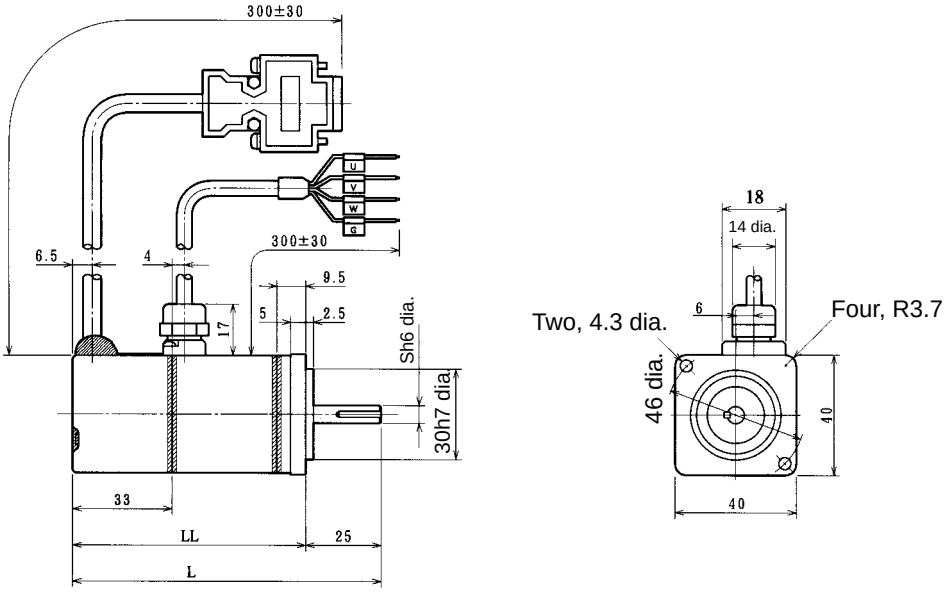
□750-W Models with Brakes: R88M-U75030HA-B



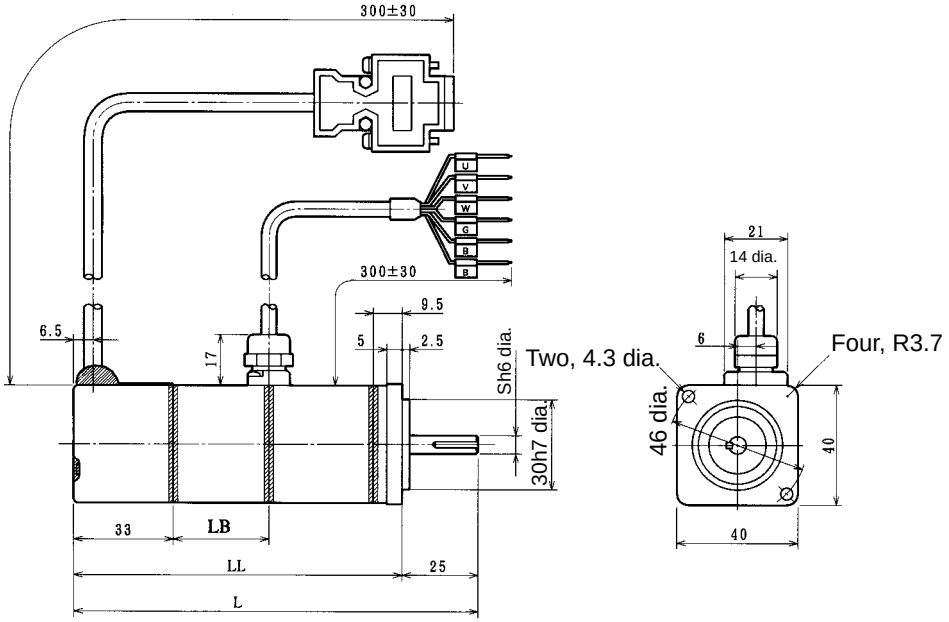
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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to EC Directives

□30-W/50-W/100-W Standard Models (Without Brakes): R88M-U03030VA-S1, R88M-U05030VA-S1, R88M-U10030VA-S1



□30-W/50-W/100-W Models with Brakes: R88M-U03030VA-BS1, R88M-U05030VA-BS1, R88M-U10030VA-BS1



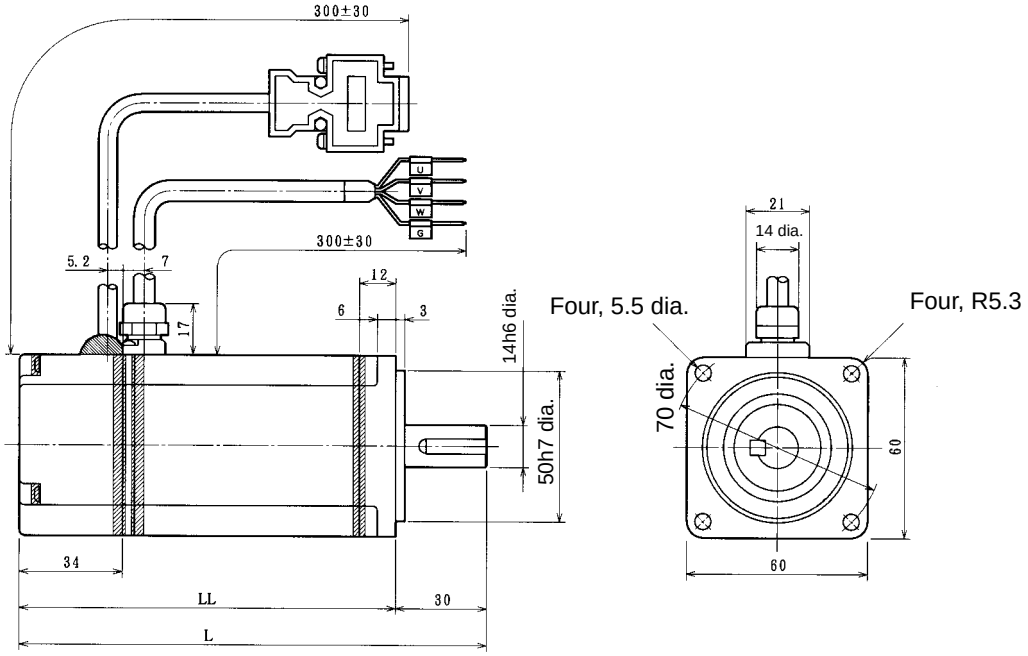
Standard Models (Without Brakes)			
Model	**L**	**LL**	**S**
R88M-U03030VA-S1	94.5	69.5	6
R88M-U05030VA-S1	102.0	77.0	6
R88M-U10030VA-S1	119.5	94.5	8

Models with Brakes				
Model	**L**	**LL**	**LB**	**S**
R88M-U03030VA-BS1	126	101	31.5	6
R88M-U05030VA-BS1	133.5	108.5	31.5	6
R88M-U10030VA-BS1	160	135	40.5	8

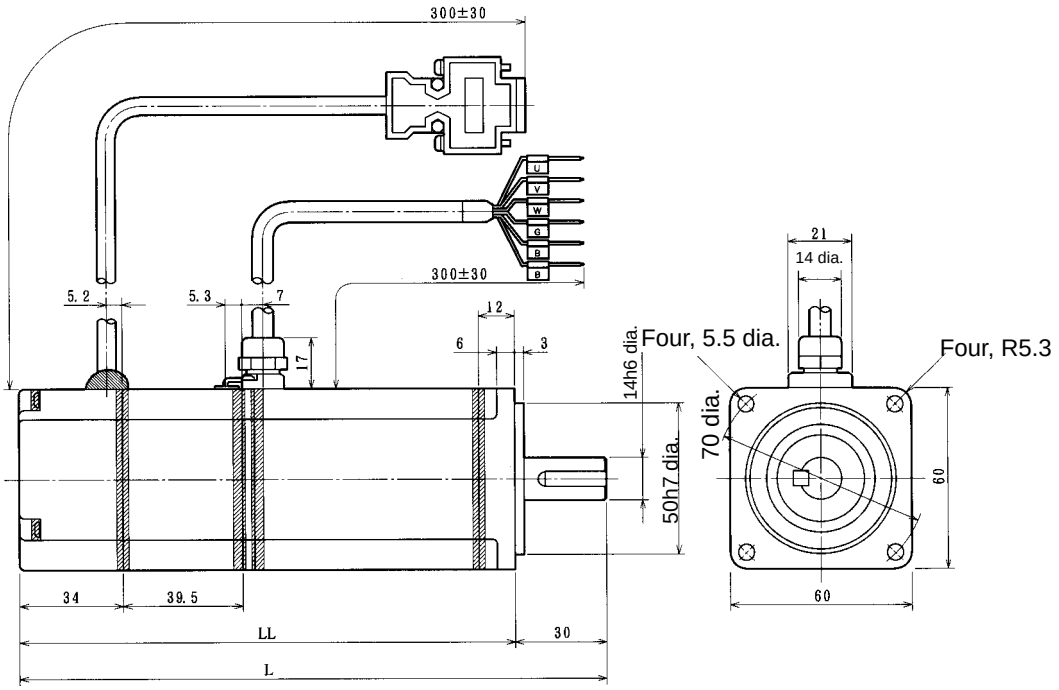
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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to EC Directives (Contd.)

□200-W/400-W Standard Models (Without Brakes): R88M-U20030VA-S1, R88M-U40030VA-S1



□200-W/400-W Models with Brakes: R88M-U20030VA-BS1, R88M-U40030VA-BS1



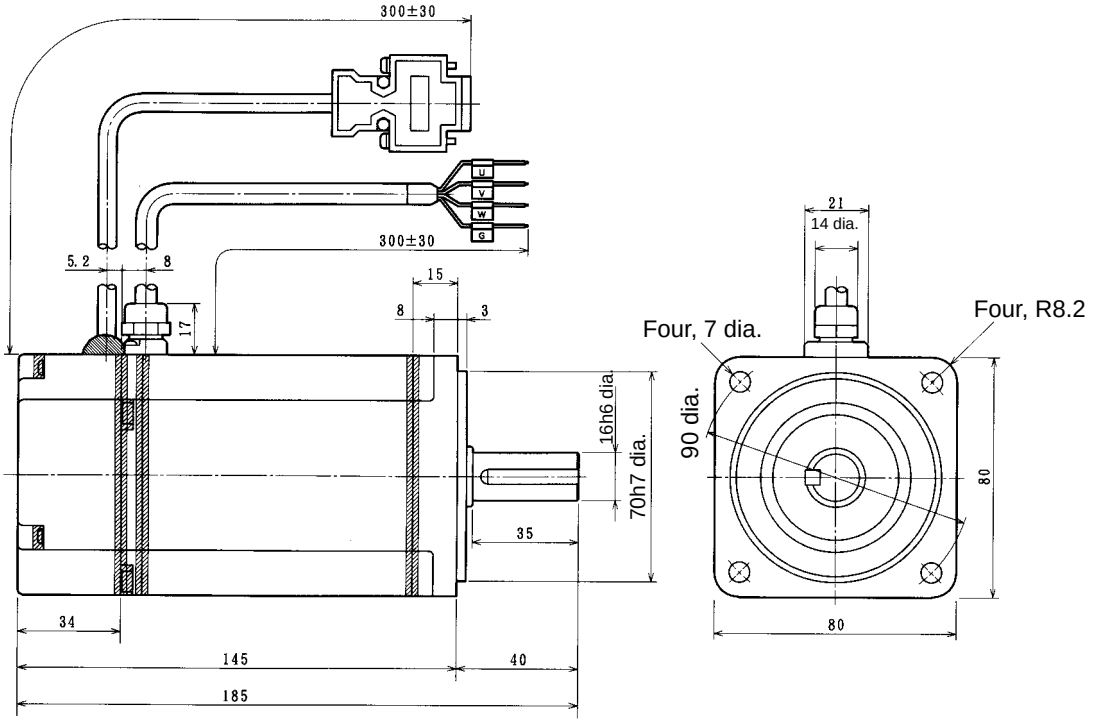
Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-U20030VA-S1	126.5	96.5
R88M-U40030VA-S1	154.5	124.5

Models with Brakes		
Model	**L**	**LL**
R88M-U20030VA-BS1	166	136
R88M-U40030VA-BS1	194	164

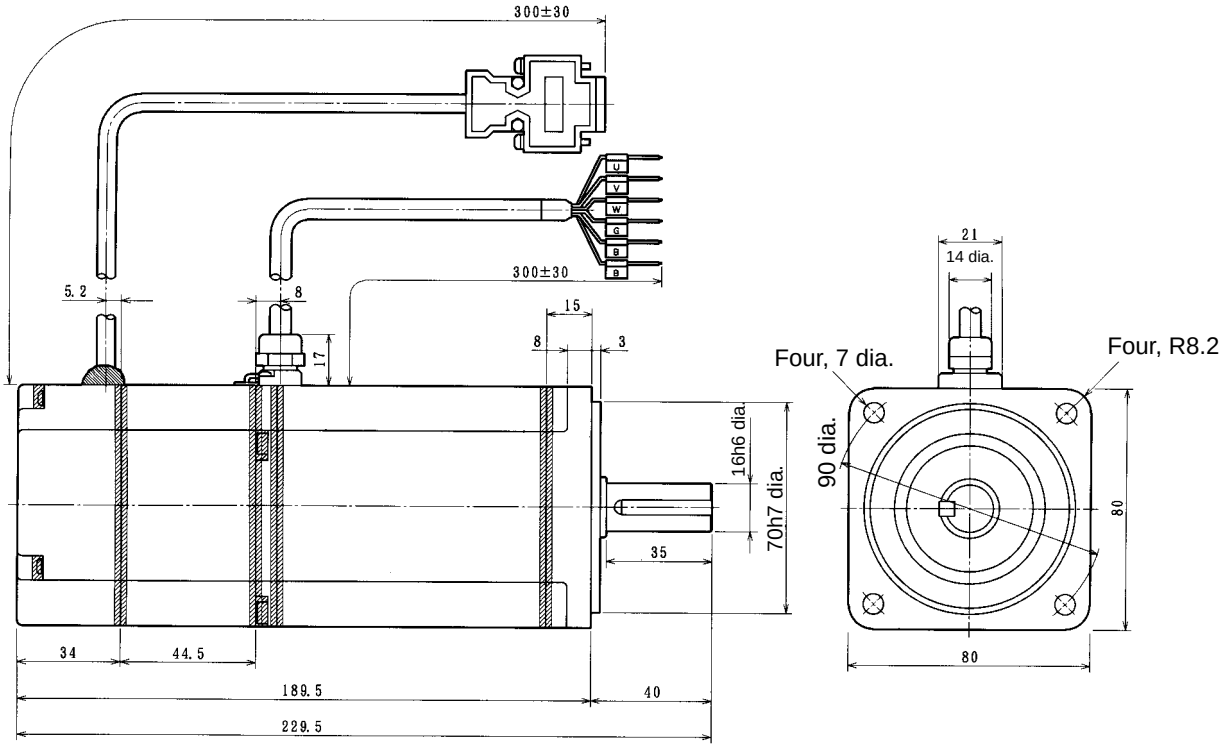
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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to EC Directives (Contd.)

□750-W Standard Models (Without Brakes): R88M-U75030VA-S1



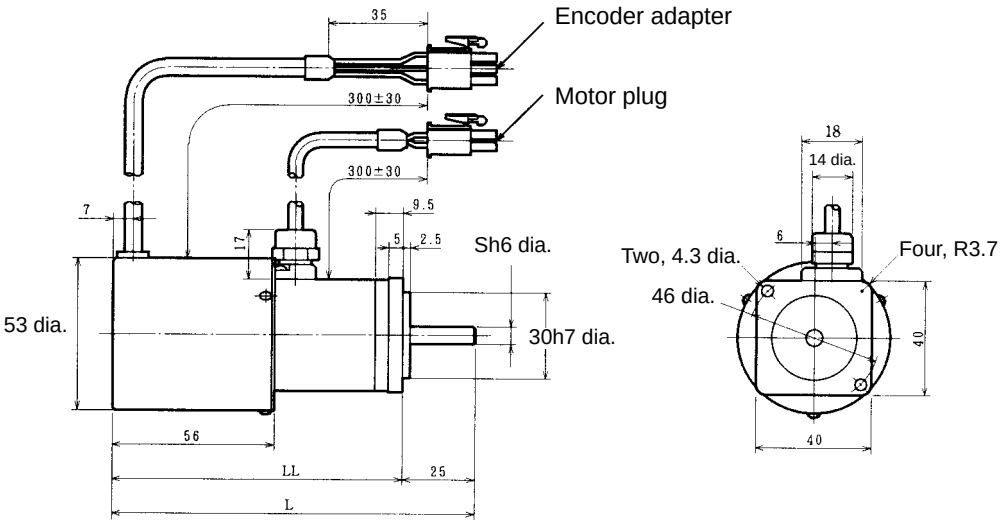
□750-W Models with Brakes: R88M-U75030VA-BS1



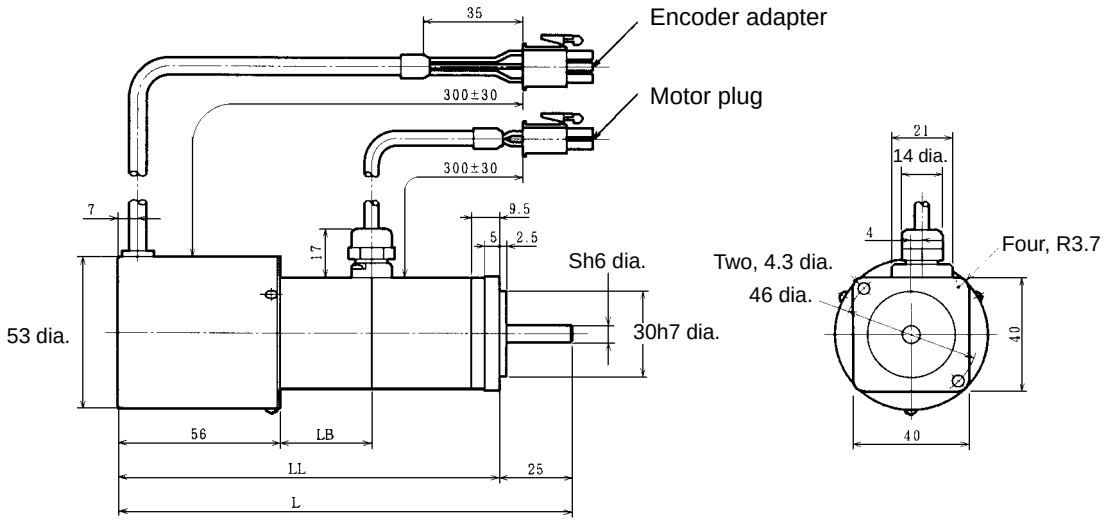
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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to UL/cUL

□30-W/50-W/100-W Standard Models (Without Brakes): R88M-U03030TA, R88M-U05030TA, R88M-U10030TA



□30-W/50-W/100-W Models with Brakes: R88M-U03030TA-B, R88M-U05030TA-B, R88M-U10030TA-B



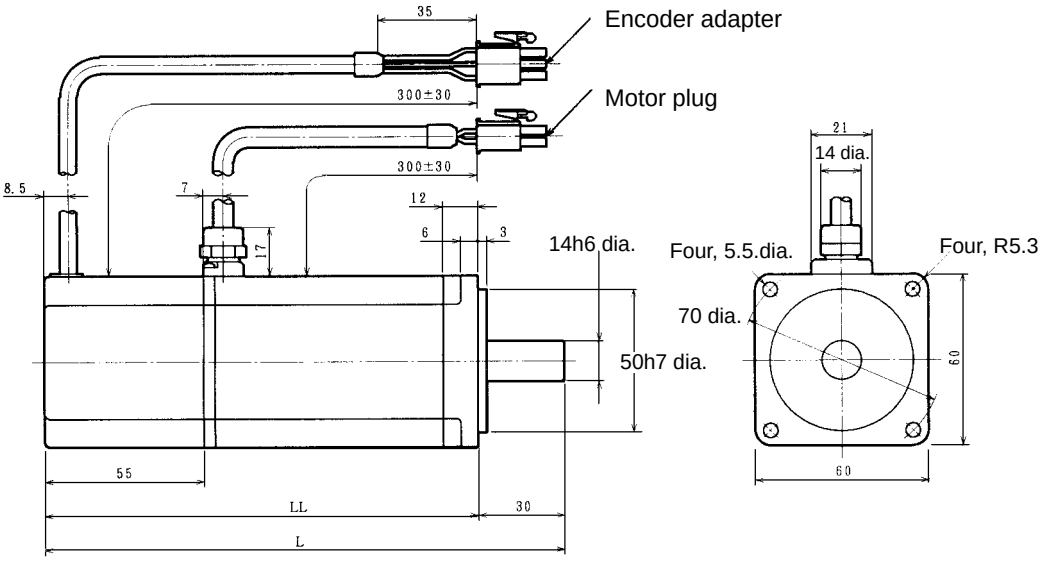
Standard Models (Without Brakes)			
Model	**L**	**LL**	**S**
R88M-U03030TA	117.5	92.5	6
R88M-U05030TA	125	100	6
R88M-U10030TA	142.5	117.5	8

Models with Brakes				
Model	**L**	**LL**	**LB**	**S**
R88M-U03030TA-B	149	124	31.5	6
R88M-U05030TA-B	156.5	131.5	31.5	6
R88M-U10030TA-B	183	158	40.5	8

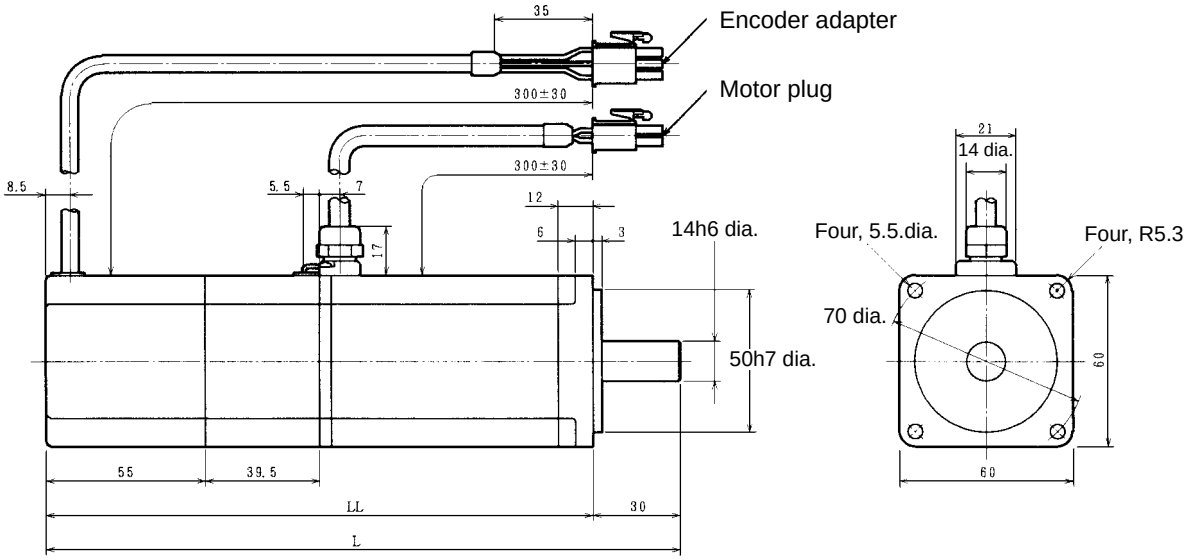
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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to UL/cUL (Contd.)

□200-W/400-W Standard Models (Without Brakes): R88M-U20030TA, R88M-U40030TA



□200-W/400-W Models with Brakes: R88M-U20030TA-B, R88M-U40030TA-B



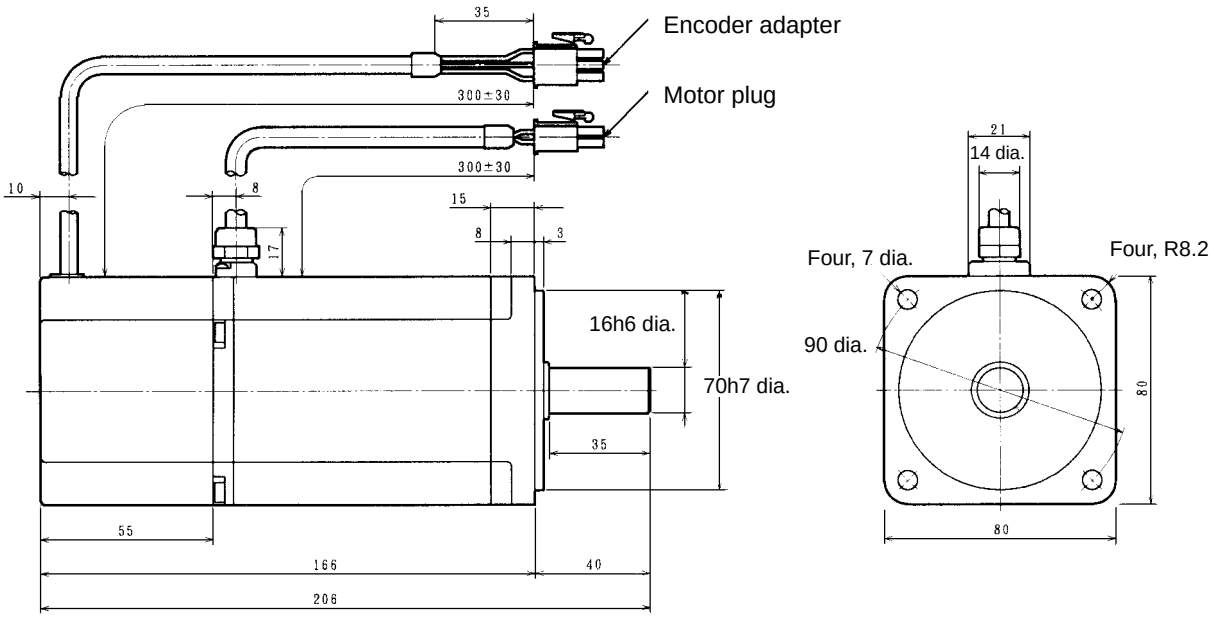
Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-U20030TA	147.5	117.5
R88M-U40030TA	175.5	145.5

Models with Brakes		
Model	**L**	**LL**
R88M-U20030TA-B	187	157
R88M-U40030TA-B	215	185

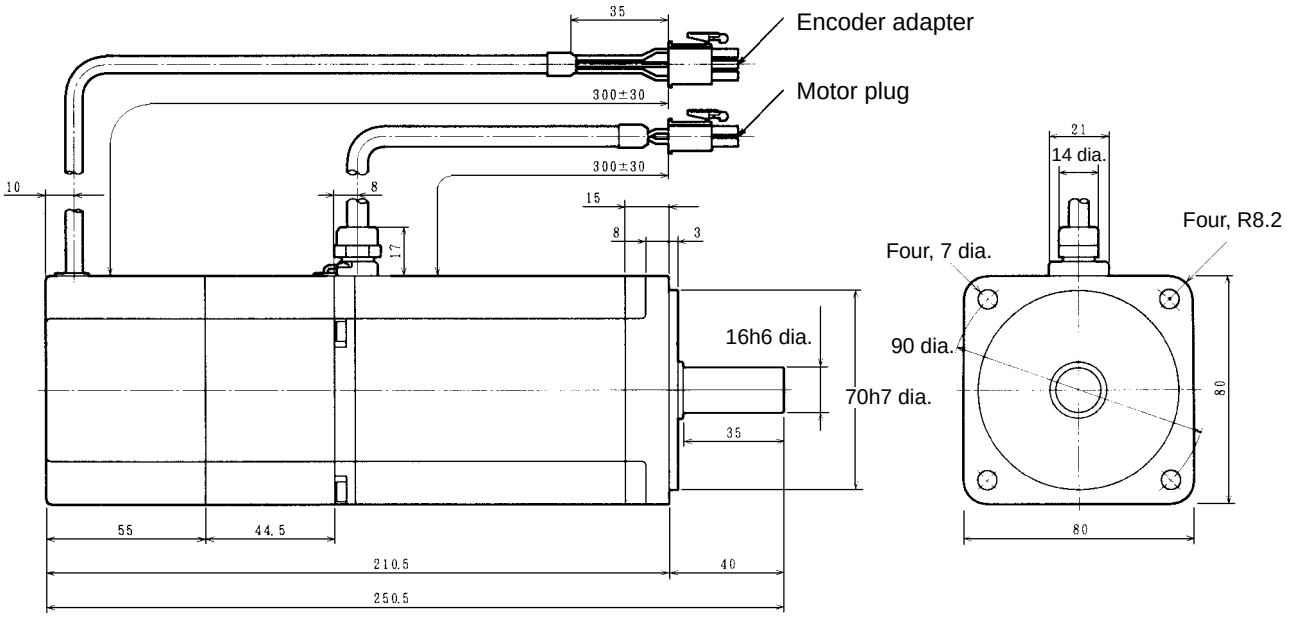
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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to UL/cUL (Contd.)

□750-W Standard Models (Without Brakes): R88M-U75030TA



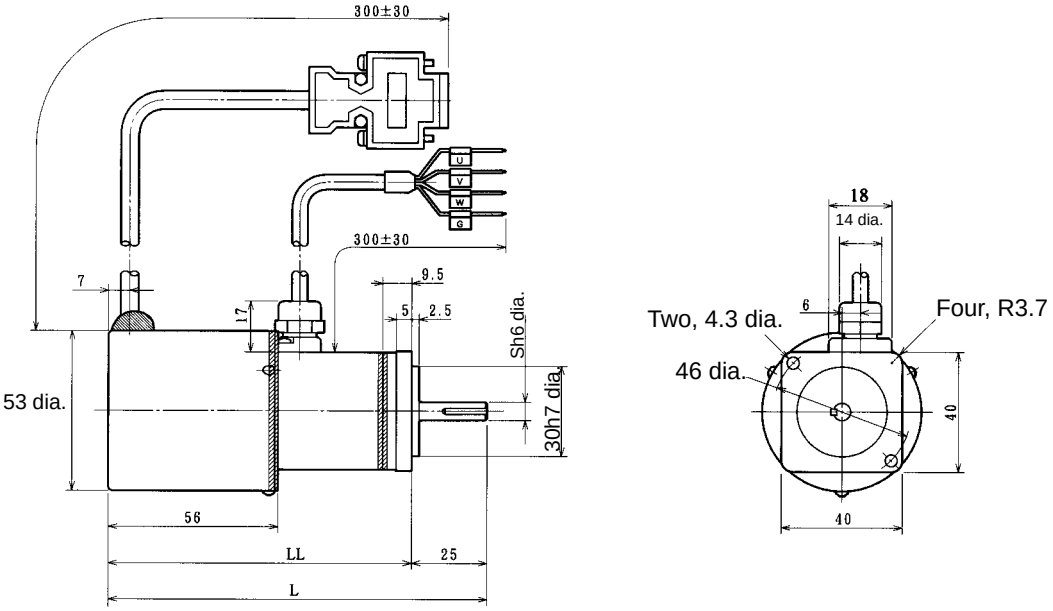
□750-W Models with Brakes: R88M-U75030TA-B



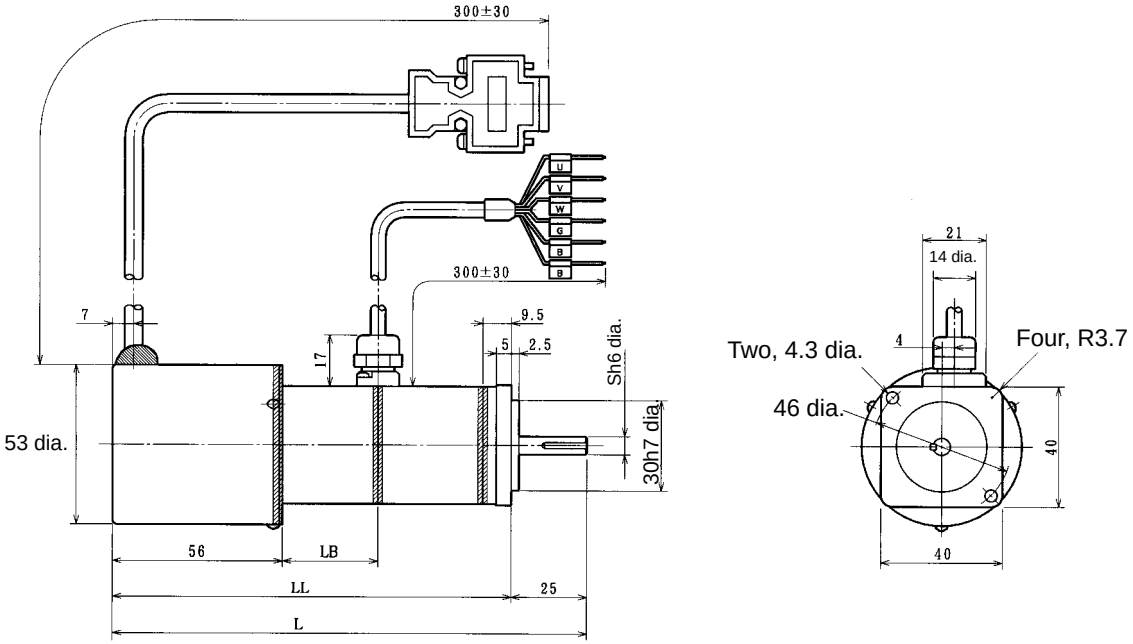
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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to EC Directives

□30-W/50-W/100-W Standard Models (Without Brakes): R88M-U03030XA-S1, R88M-U05030XA-S1, R88M-U10030XA-S1



□30-W/50-W/100-W Models with Brakes: R88M-U03030XA-BS1, R88M-U05030XA-BS1, R88M-U10030XA-BS1



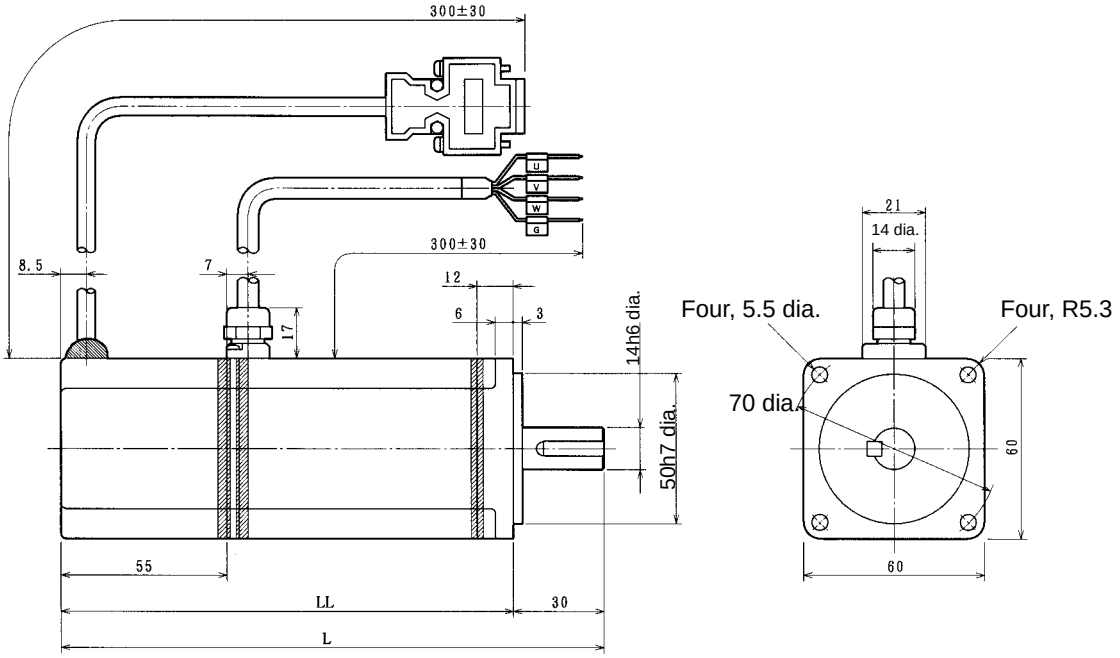
Standard Models (Without Brakes)			
Model	**L**	**LL**	**S**
R88M-U03030XA-S1	117.5	92.5	6
R88M-U05030XA-S1	125	100	6
R88M-U10030XA-S1	142.5	117.5	8

Models with Brakes				
Model	**L**	**LL**	**LB**	**S**
R88M-U03030XA-BS1	149	124	31.5	6
R88M-U05030XA-BS1	156.5	131.5	31.5	6
R88M-U10030XA-BS1	183	158	40.5	8

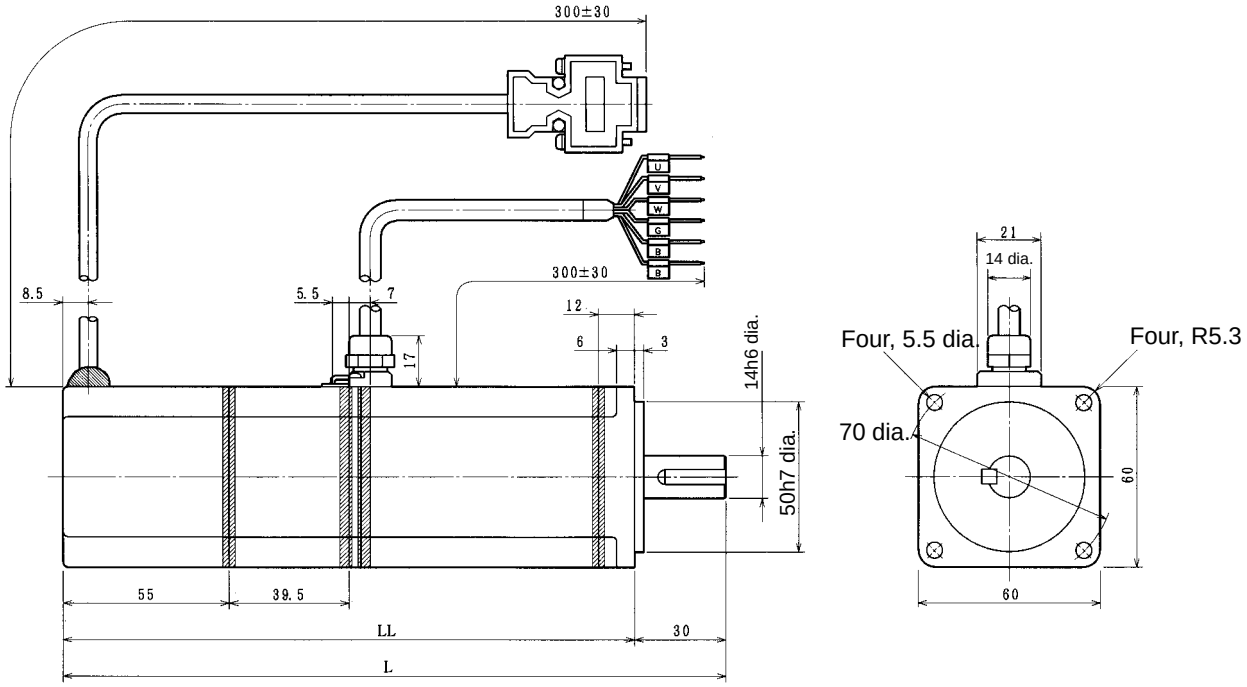
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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to EC Directives (Contd.)

□200-W/400-W Standard Models (Without Brakes): R88M-U20030XA-S1, R88M-U40030XA-S1



□200-W/400-W Models with Brakes: R88M-U20030XA-BS1, R88M-U40030XA-BS1



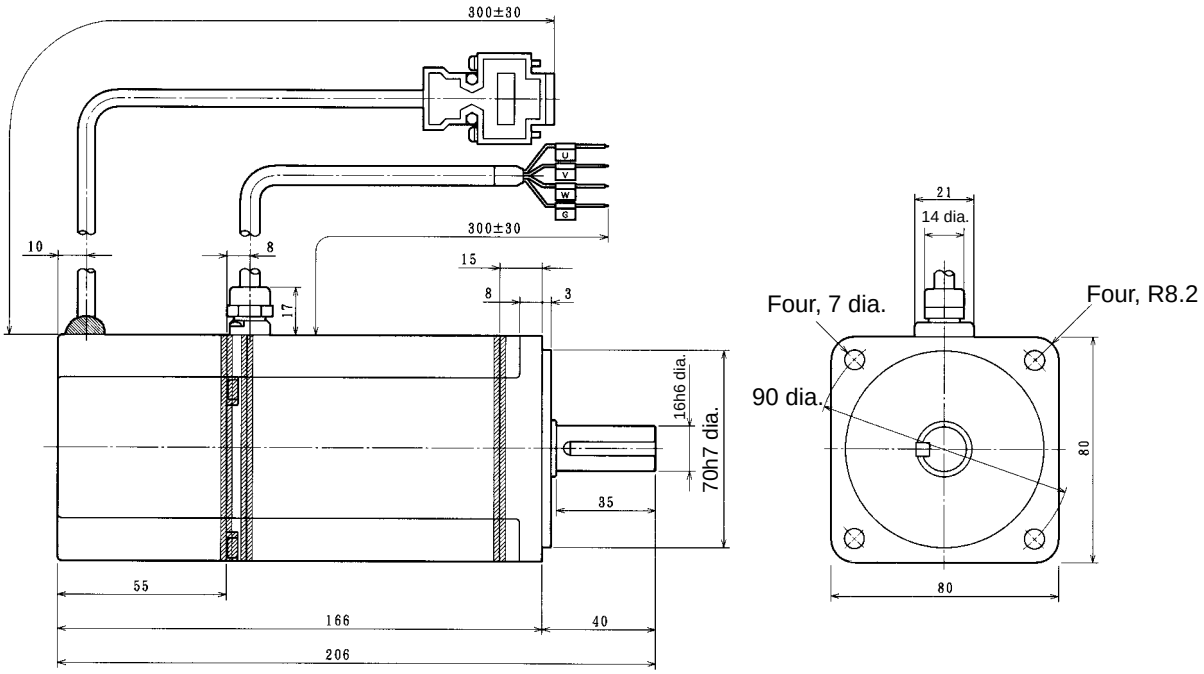
Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-U20030XA-S1	147.5	117.5
R88M-U40030XA-S1	175.5	145.5

Models with Brakes		
Model	**L**	**LL**
R88M-U20030XA-BS1	187	157
R88M-U40030XA-BS1	215	185

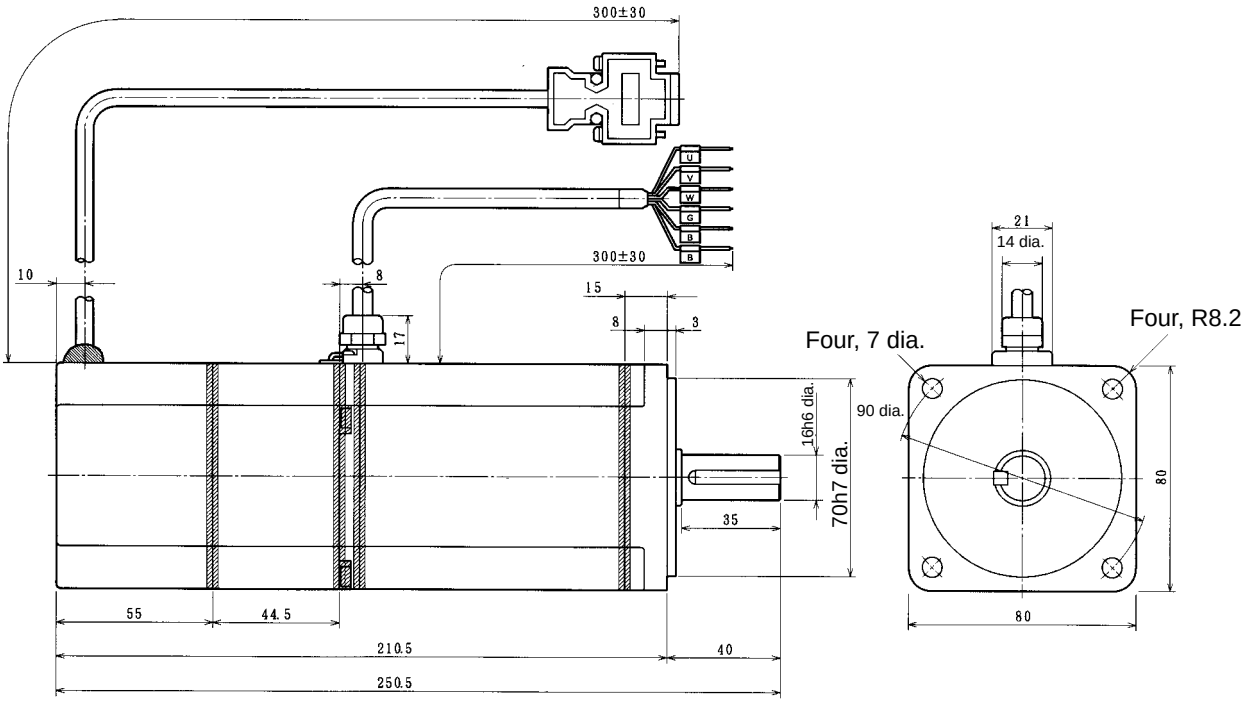
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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS, 30 to 750 W) Conforming to EC Directives (Contd.)

□750-W Standard Models (Without Brakes): R88M-U75030XA-S1



□750-W Models with Brakes: R88M-BS1



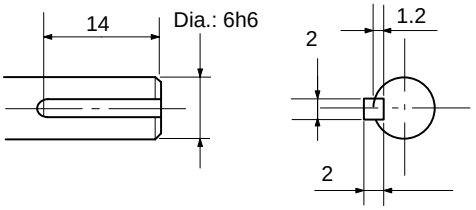
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U-Series AC Servomotor Shaft Dimensions with Keys (U-INC, U-ABS, 30 to 750 W)

Standard U-series AC Servomotors do not have keys on the shafts. The shaft dimensions of motors with keys are shown below. Motors with keys are indicated by adding "-S1" to the end of the model number. Key slots are based on JIS B1301-1976.

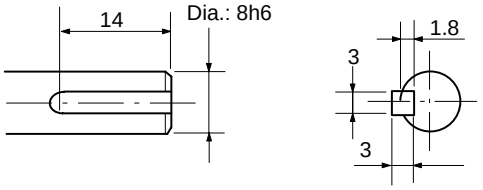
□30-W/50-W Models

Standard: R88M-U03030 -S1, R88M-U05030 -S1
With Brakes: R88M-U03030 -BS1, R88M-U05030 -BS1



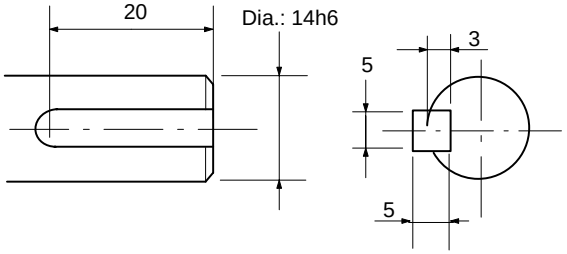
□100-W Models

Standard: R88M-U10030 -S1
With Brakes: R88M-U10030 -BS1



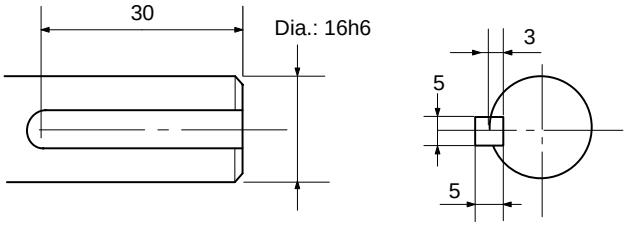
□200-W/400-W Models

Standard: R88M-U20030 -S1, R88M-U40030 -S1
With Brakes: R88M-U20030 -BS1, R88M-U40030 -BS1



□750-W Models

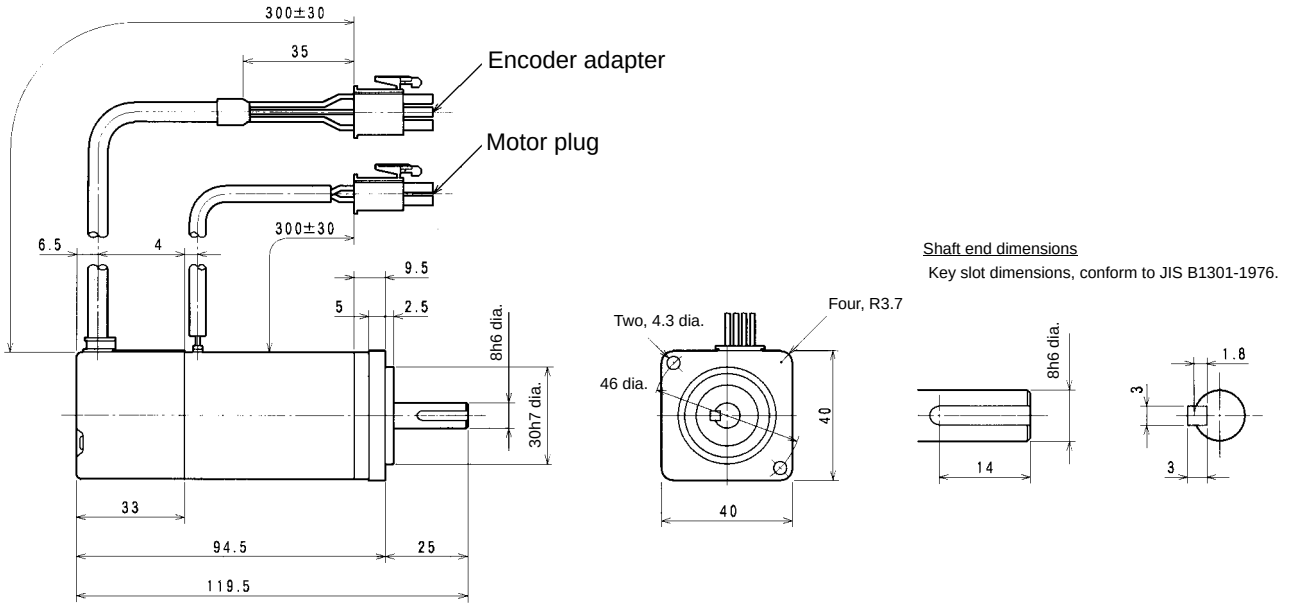
Standard: R88M-U75030 -S1
With Brakes: R88M-U75030 -BS1



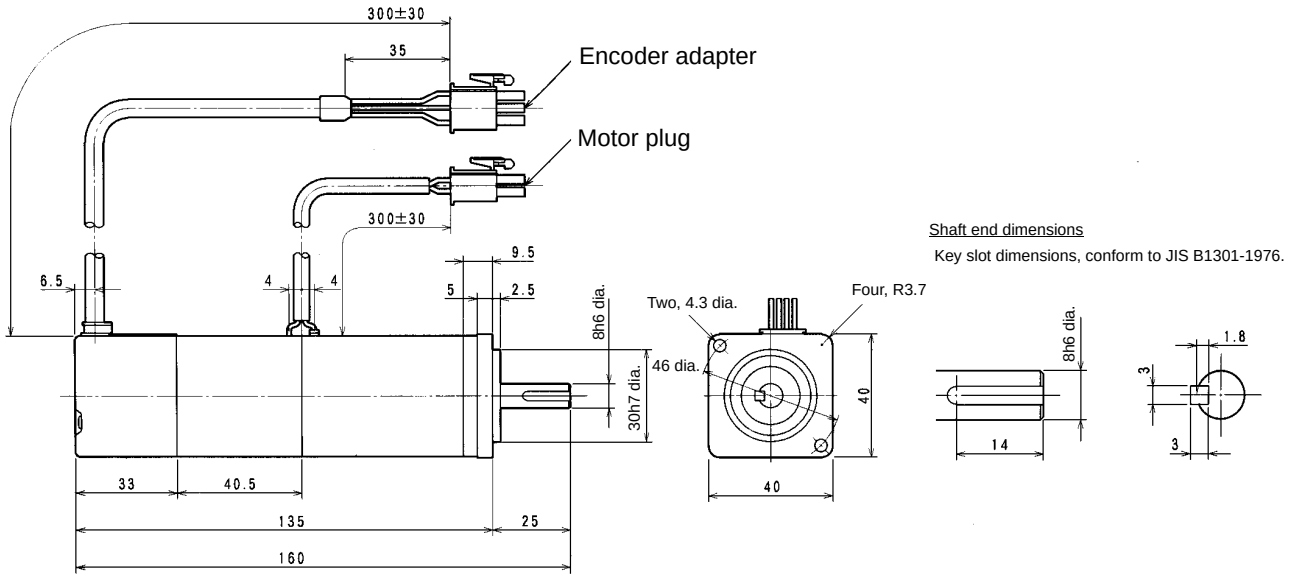
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OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Not Conforming to Any Standards

□100-W Standard Models (Without Brakes): R88M-UE10030H-S1



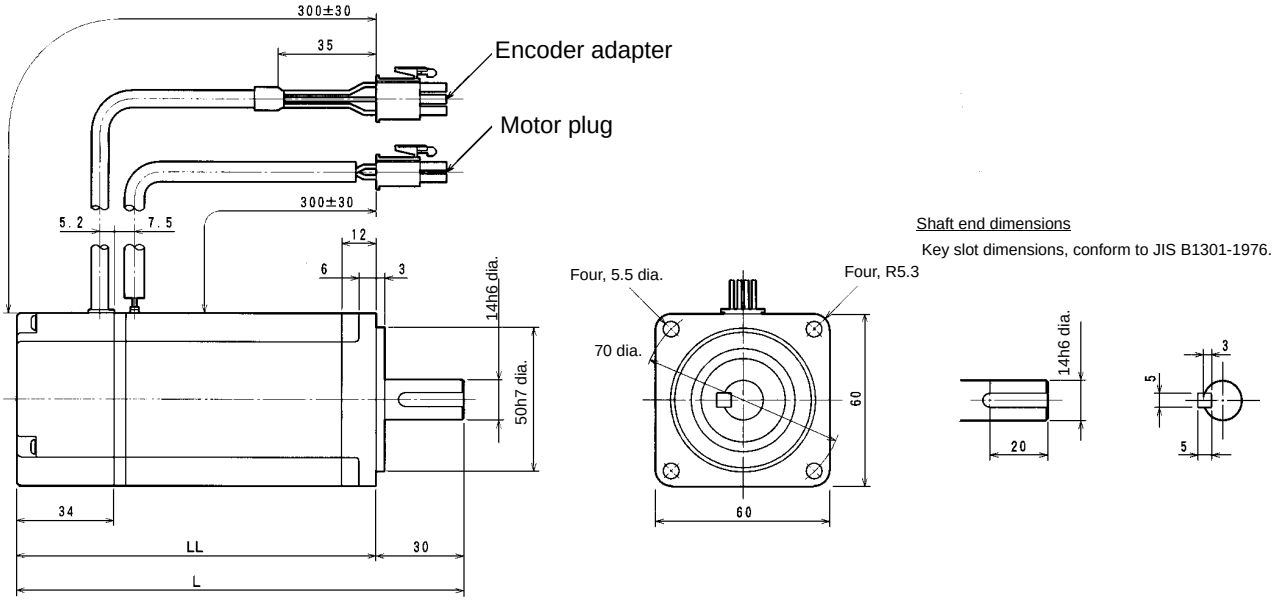
□100-W Models with Brakes: R88M-UE10030H-BS1



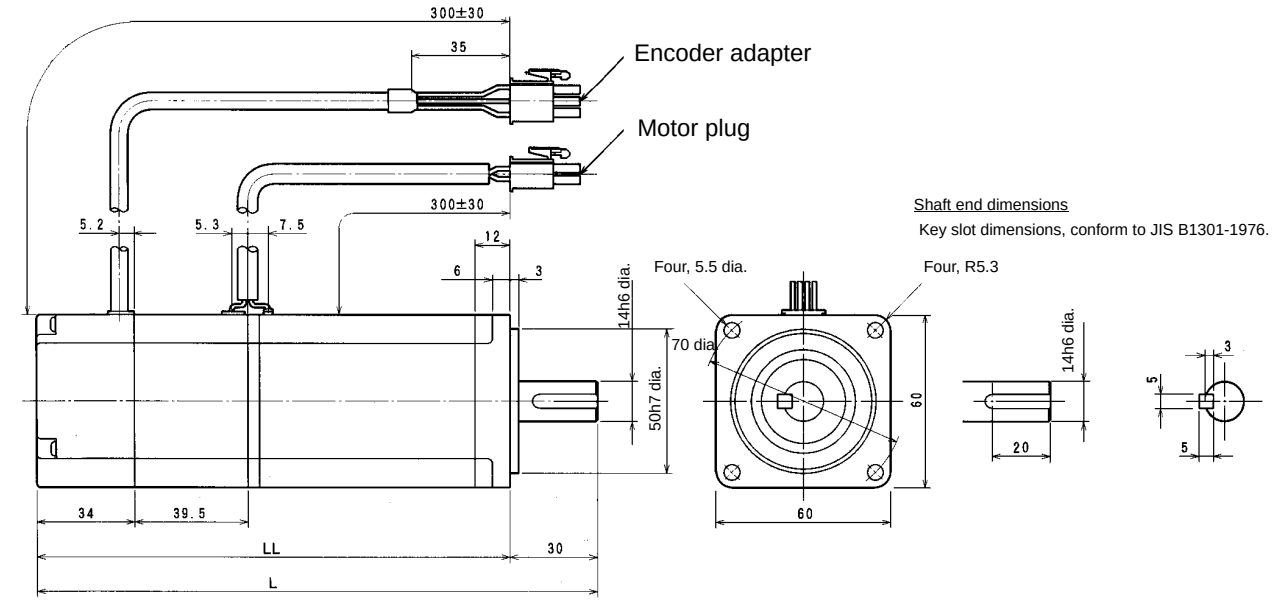
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OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) (Contd.)

□200-W/400-W Standard Models (Without Brakes): R88M-UE20030H-S1, R88M-UE40030H-S1



□200-W/400-W Models with Brakes: R88M-UE20030H-BS1, R88M-UE40030H-BS1



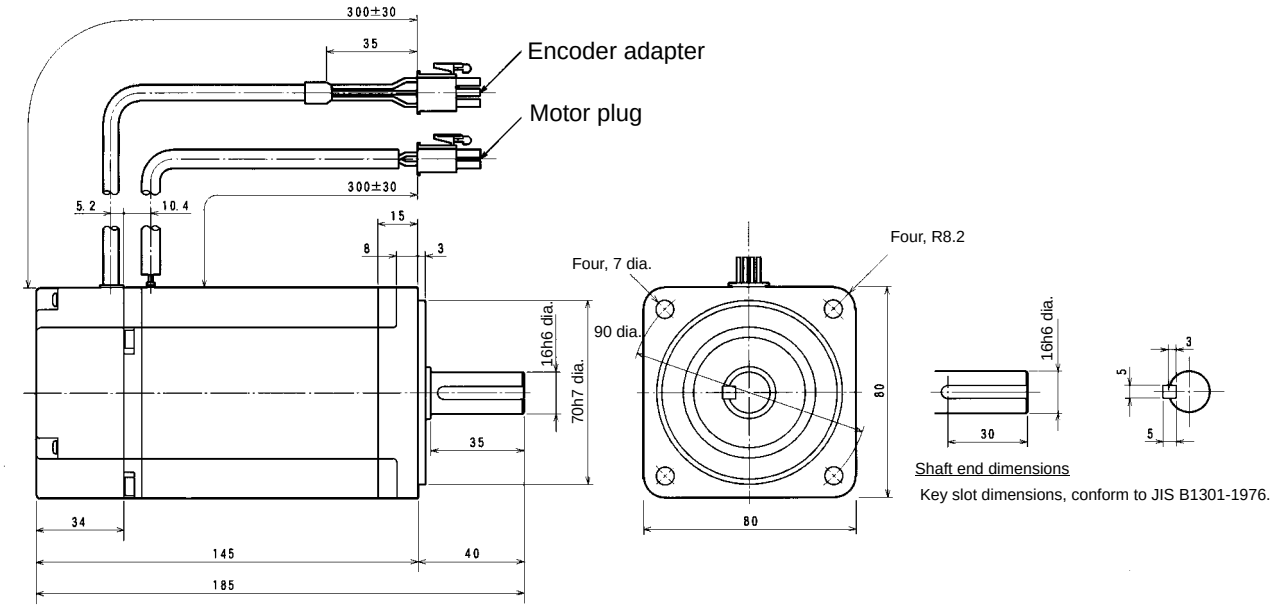
Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-UE20030H-S1	126.5	96.5
R88M-UE40030H-S1	154.5	124.5

Models with Brakes		
Model	**L**	**LL**
R88M-UE20030H-BS1	166	136
R88M-UE40030H-BS1	194	164

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OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Not Conforming to Any Standards (Contd.)

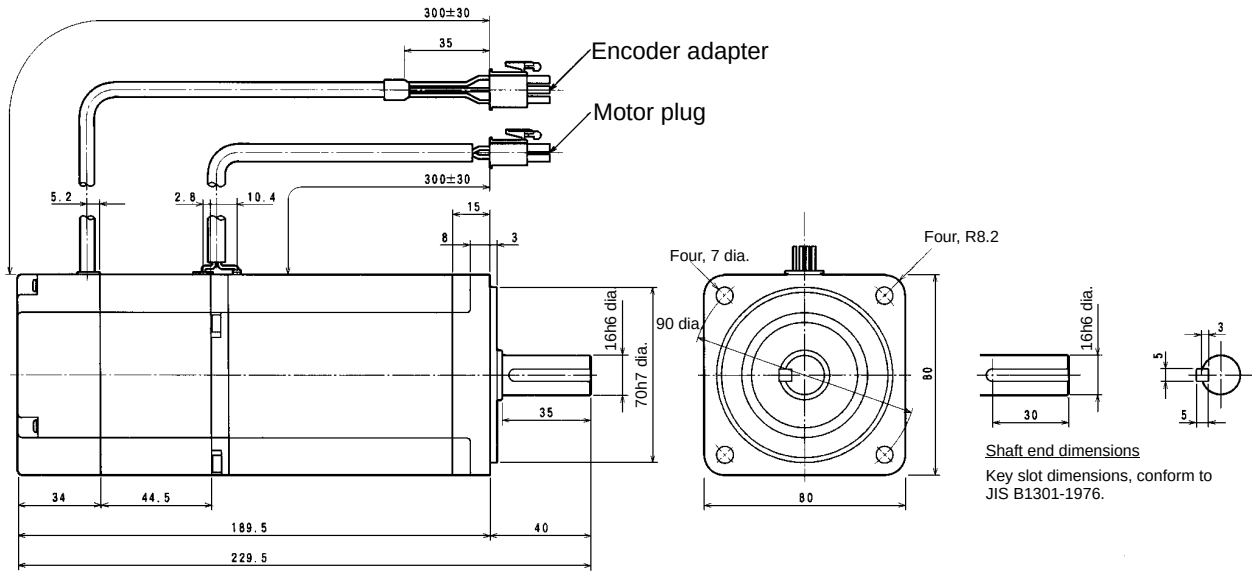
□750-W Standard Models (Without Brakes): R88M-UE75030H-S1



Shaft end dimensions

Key slot dimensions, conform to JIS B1301-1976.

□750-W Models with Brakes: R88M-UE75030H-BS1



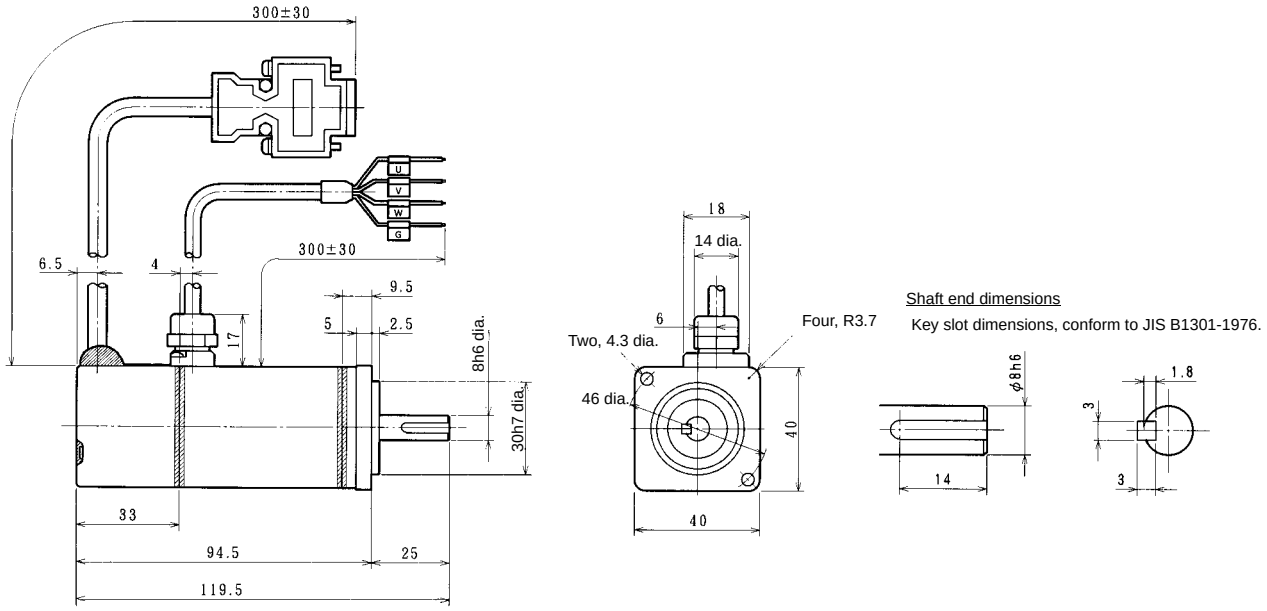
Shaft end dimensions

Key slot dimensions, conform to JIS B1301-1976.

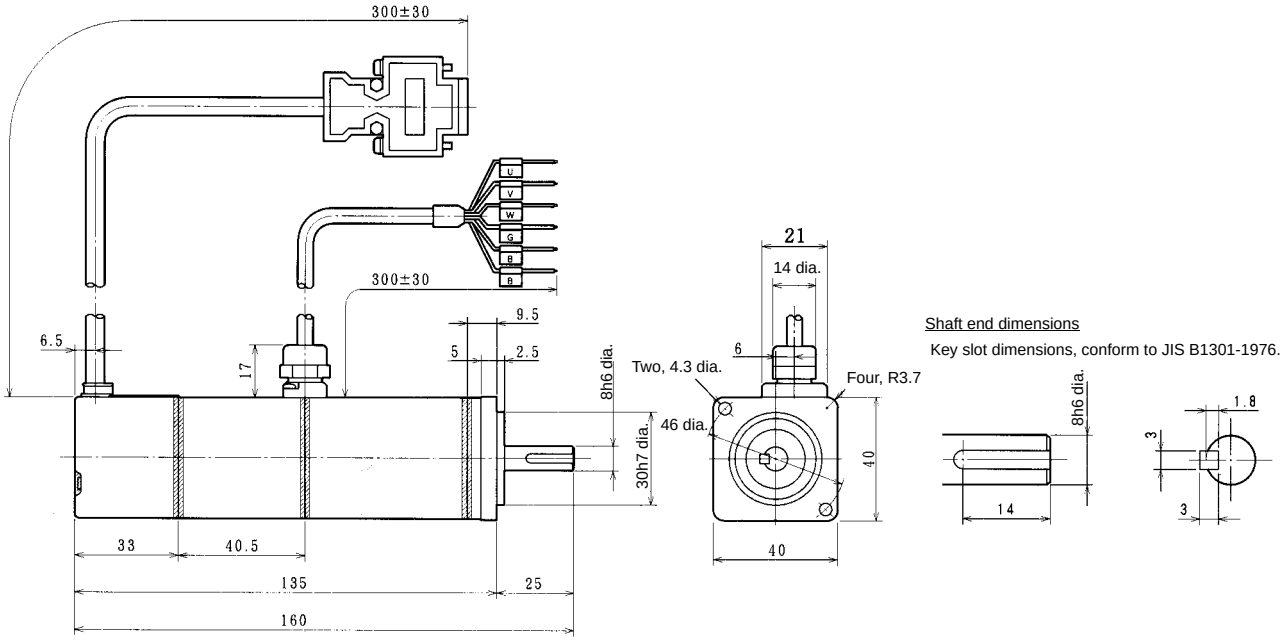
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OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Conforming to EC Directives

□100-W Standard Models (Without Brakes): R88M-UE10030V-S1



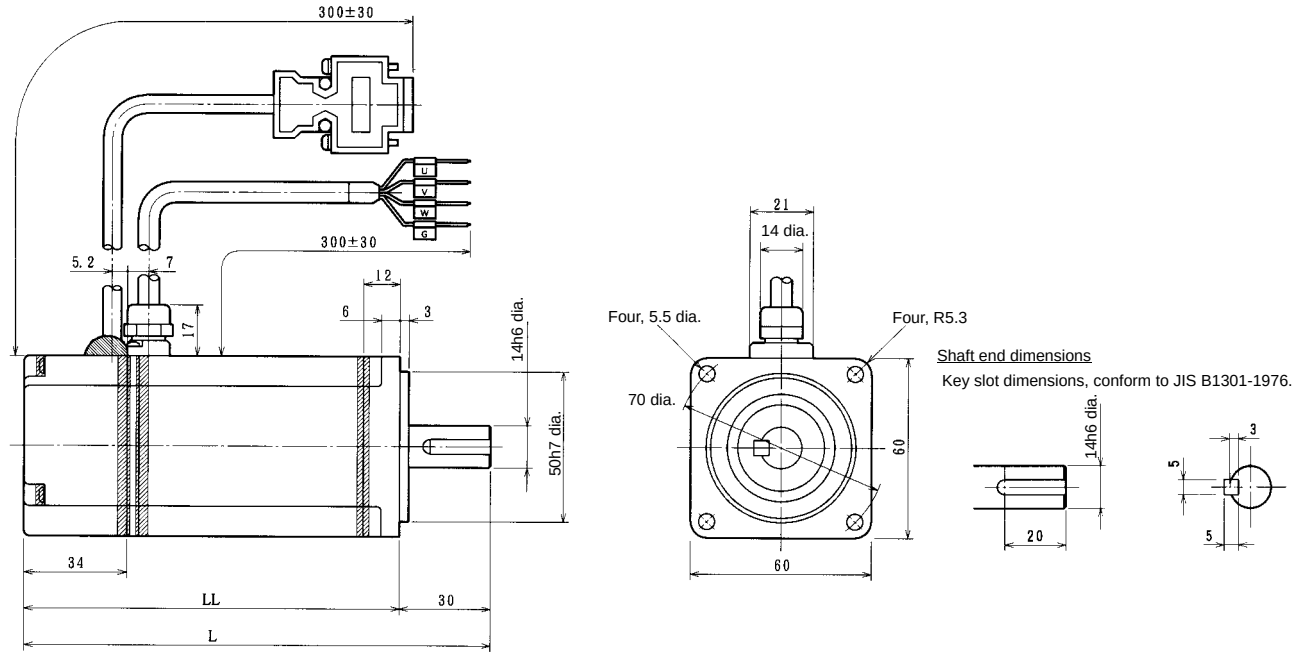
□100-W Models with Brakes: R88M-UE10030V-BS1



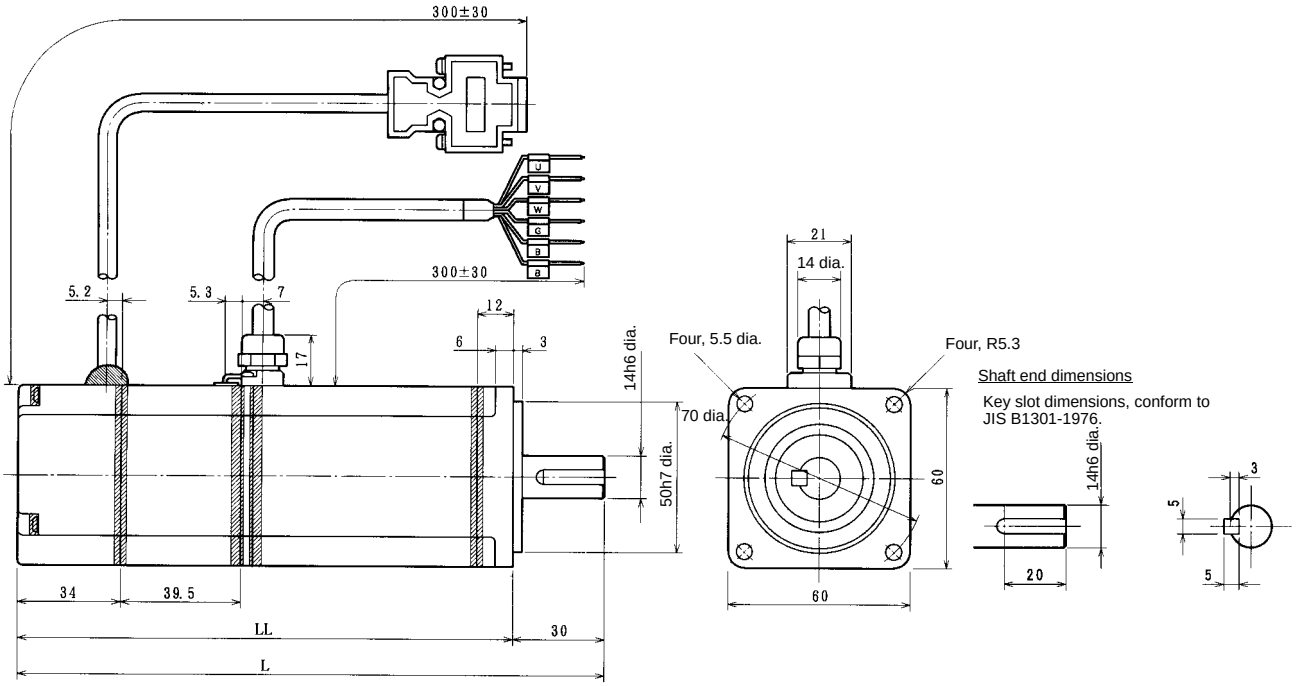
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OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Conforming to EC Directives (Contd.)

□200-W/400-W Standard Models (Without Brakes): R88M-UE20030V-S1, R88M-UE40030V-S1



□200-W/400-W Models with Brakes: R88M-UE20030V-BS1, R88M-UE40030V-BS1



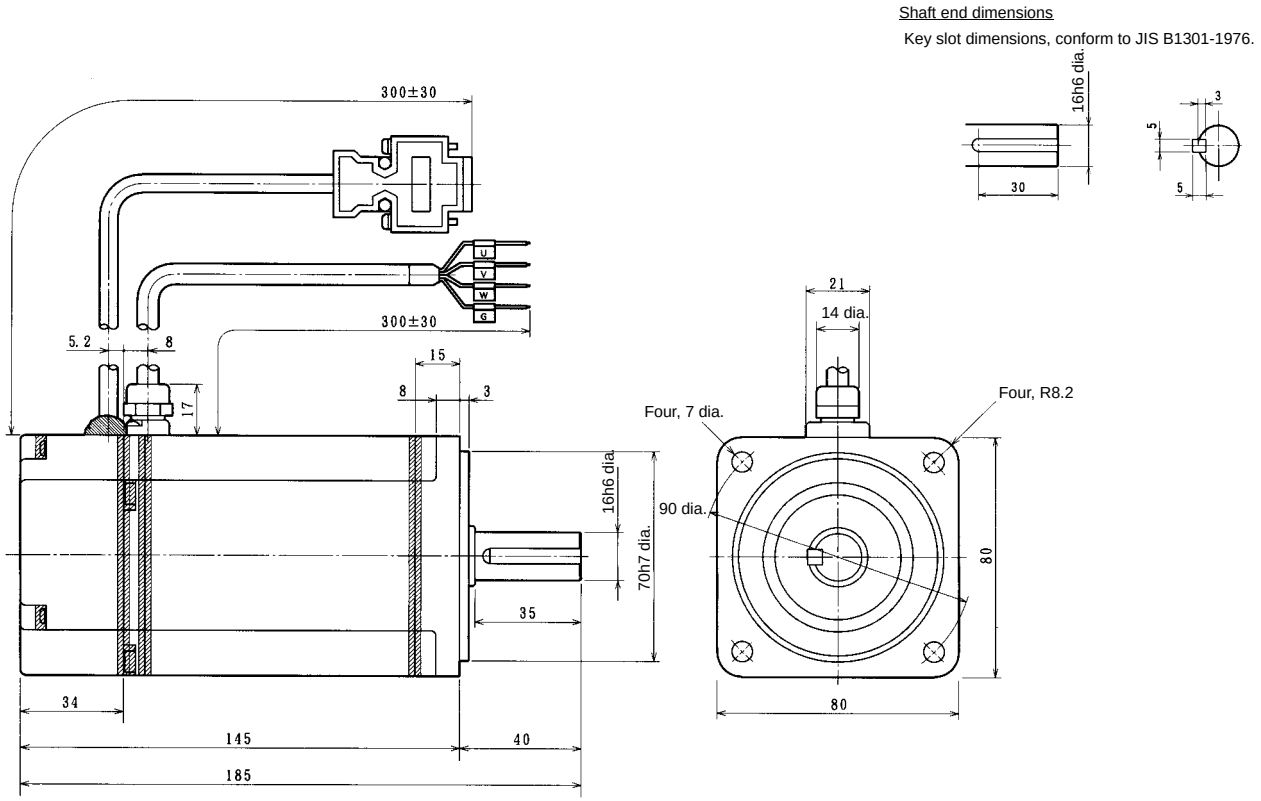
Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-UE20030V-S1	126.5	96.5
R88M-UE40030V-S1	154.5	124.5

Models with Brakes		
Model	**L**	**LL**
R88M-UE20030V-BS1	166	136
R88M-UE40030V-BS1	194	164

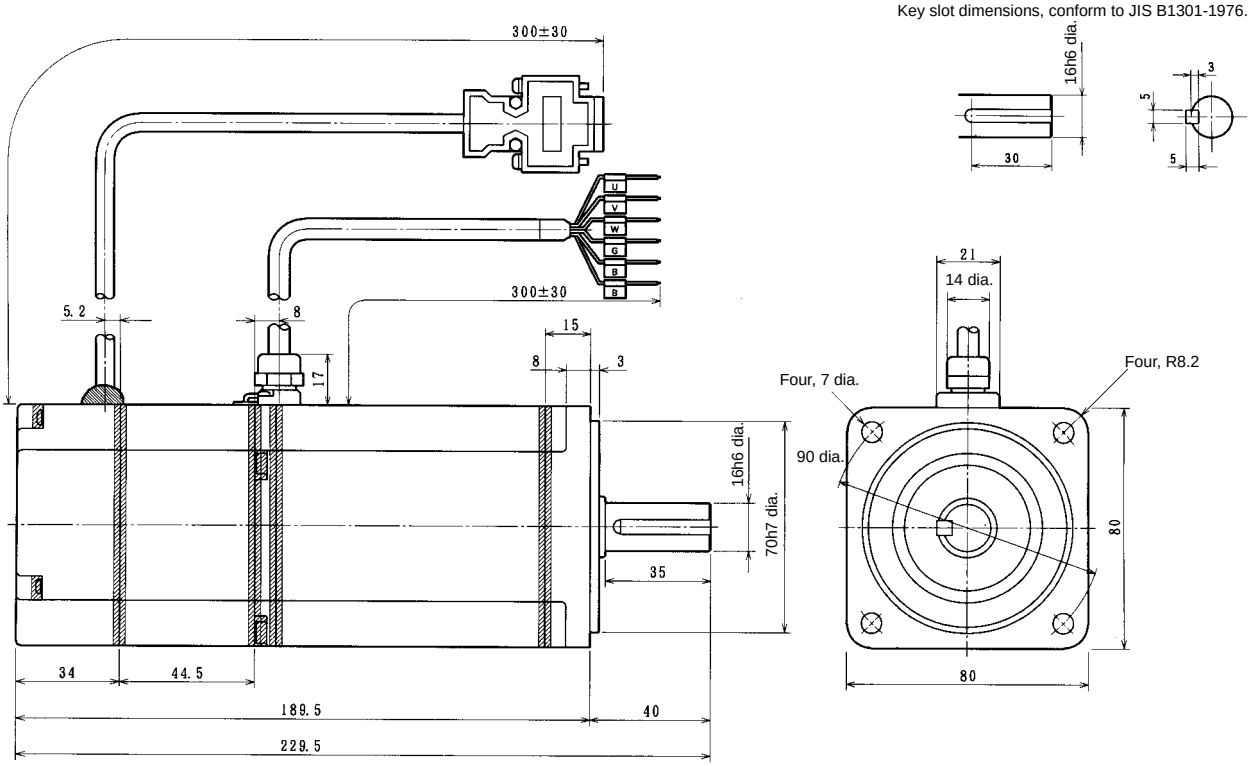
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OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Conforming to EC Directives (Contd.)

□750-W Standard Models (Without Brakes): R88M-UE75030V-S1



□750-W Models with Brakes: R88M-UE75030V-BS1

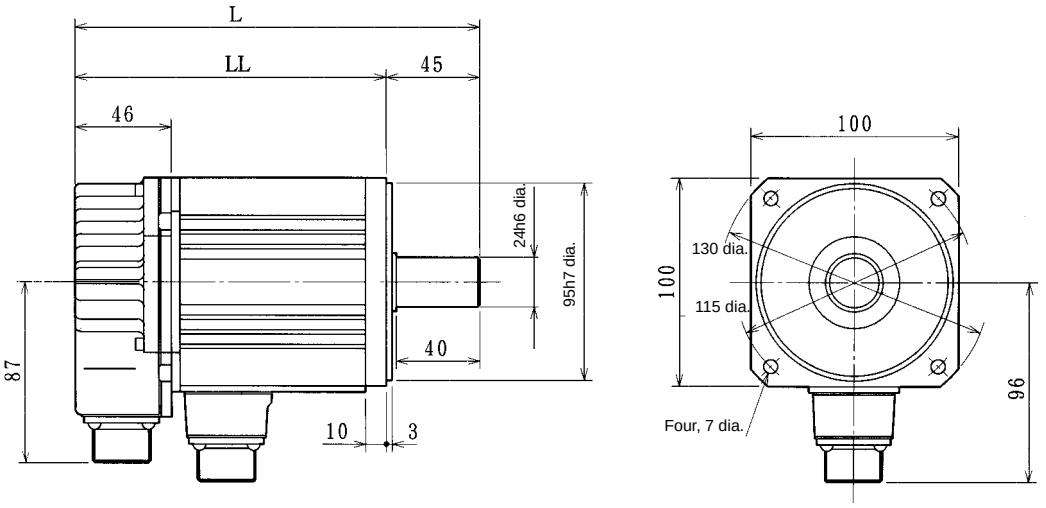


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OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 1 to 2 kW)

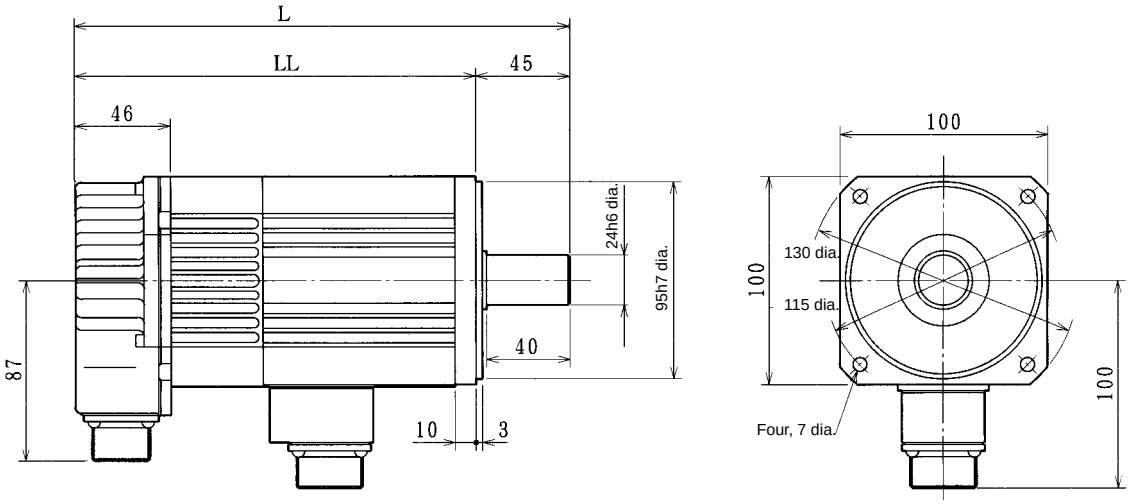
□1.0-kW/1.5-kW/2.0-kW Standard Models (Without Brakes)

Not Conforming to Any Standards: R88M-U1K030H/-U1K530H/-U2K030H
Conforming to EC Directives: R88M-U1K030V-S1/-U1K530V-S1/-U2K030V-S1



□1.0-kW/1.5-kW/2.0-kW Models With Brakes

Not Conforming to Any Standards: R88M-U1K030H-B/-U1K530H-B/-U2K030H-B
Conforming to EC Directives: R88M-U1K030V-BS1/-U1K530V-BS1/-U2K030V-BS1



Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-U1K030	194	149
R88M-U1K530	220	175
R88M-U2K030	243	198

Models with Brakes		
Model	**L**	**LL**
R88M-U1K030 -B	238	193
R88M-U1K530 -B	264	219
R88M-U2K030 -B	287	242

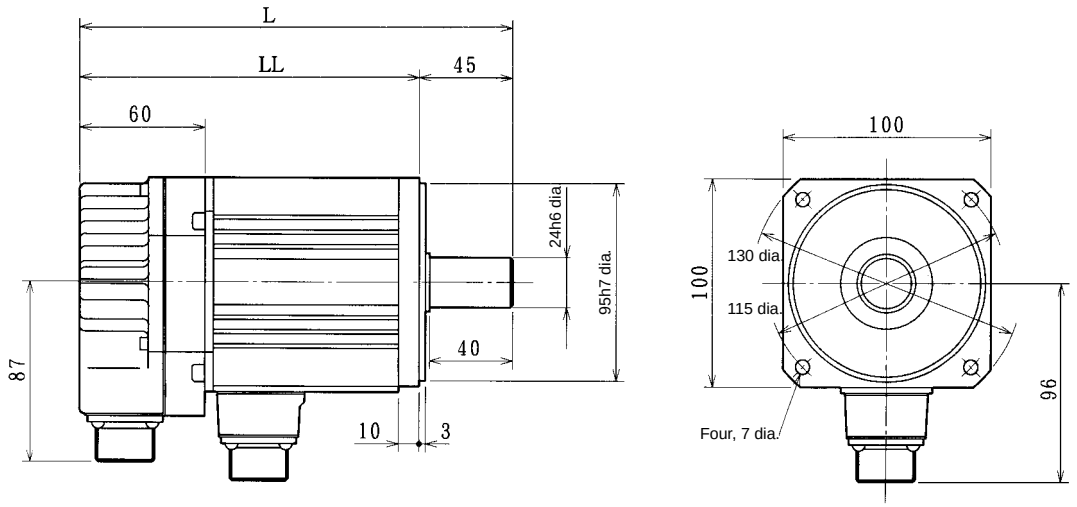
Note Servomotors with model numbers ending in “S1” have straight shafts with keys. Refer to *page 2-25 U-Series AC Servomotor Shaft Dimensions with Keys* for key dimensions**.**

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OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 1 to 2 kW)

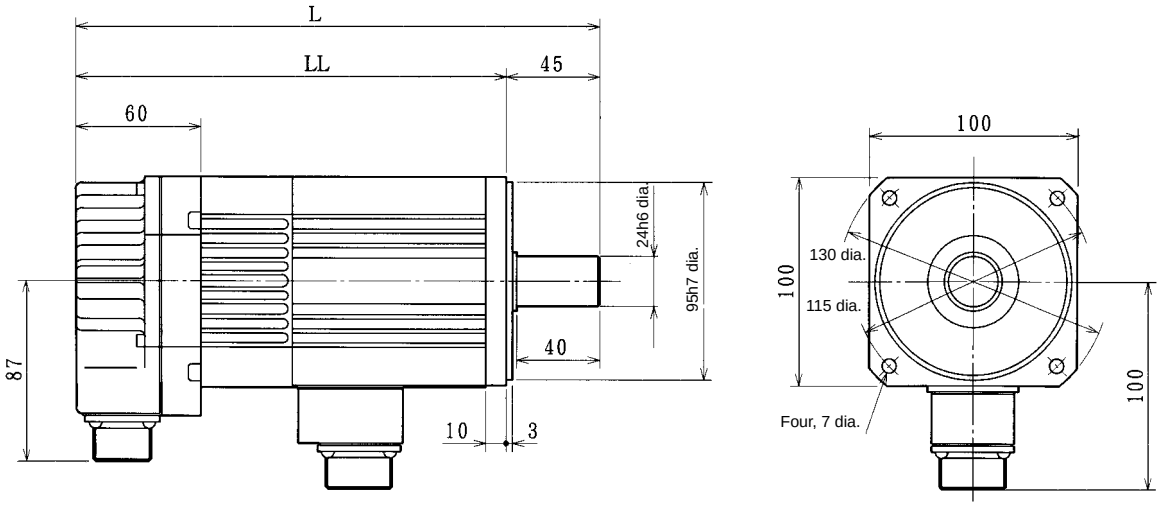
□1.0-kW/1.5-kW/2.0-kW Standard Models (Without Brakes)

Not Conforming to Any Standards: R88M-U1K030T/-U1K530T/-U2K030T
Conforming to EC Directives: R88M-U1K030X-S1/-U1K530X-S1/-U2K030X-S1



□1.0-kW/1.5-kW/2.0-kW Models With Brakes

Not Conforming to Any Standards: R88M-U1K030T-B/-U1K530T-B/-U2K030T-B
Conforming to EC Directives: R88M-U1K030X-BS1/-U1K530X-BS1/-U2K030X-BS1



Standard Models (Without Brakes)		
Model	**L**	**LL**
R88M-U1K030	208	163
R88M-U1K530	234	189
R88M-U2K030	257	212

Models with Brakes		
Model	**L**	**LL**
R88M-U1K030 -B	252	207
R88M-U1K530 -B	278	233
R88M-U2K030 -B	301	256

Note Servomotors with model numbers ending in “S1” have straight shafts with keys. Refer to *page 2-25 U-Series AC Servomotor Shaft Dimensions with Keys* for key dimensions**.**

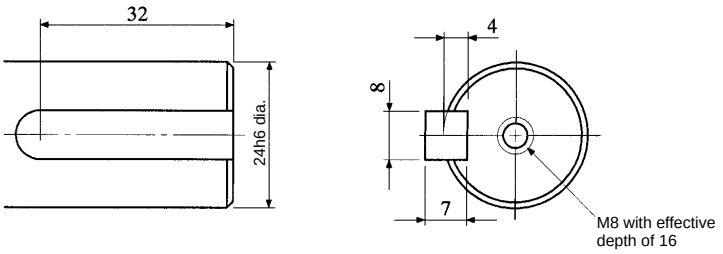
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U-Series AC Servomotor Shaft Dimensions with Keys (U-INC, U-ABS, 1 to 2 kW)

Standard U-series AC Servomotors do not have keys on the shafts. The shaft dimensions of motors with keys are shown below. Motors with keys are indicated by adding “-S1” to the end of the model number. Key slots are based on JIS B1301-1976.

□1.0-kW/1.5-kW/2.0-kW Models

Standard: R88M-U1K030 -S1, R88M-U1K530 -S1, R88M-U2K030 -S1
With Brakes: R88M-U1K030 -BS1, R88M-U1K530 -BS1, R88M-U2K030 -BS1

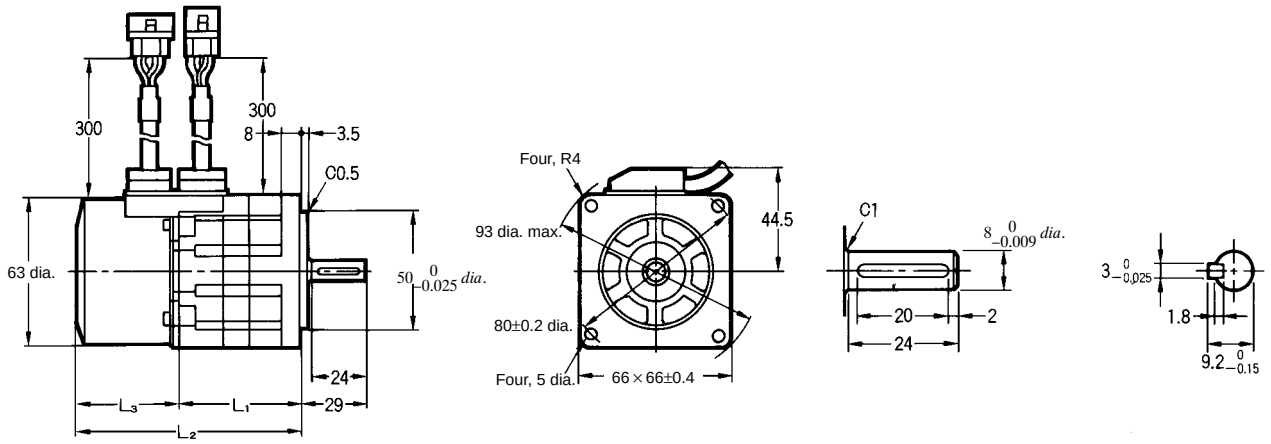


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OMNUC H-Series AC Servomotor with Incremental Encoder (H)

□50-W/100-W Standard Models (Without Brakes): R88M-H05030, R88M-H10030

□50-W/100-W Models with Brakes: R88M-H05030-B, R88M-H10030-B

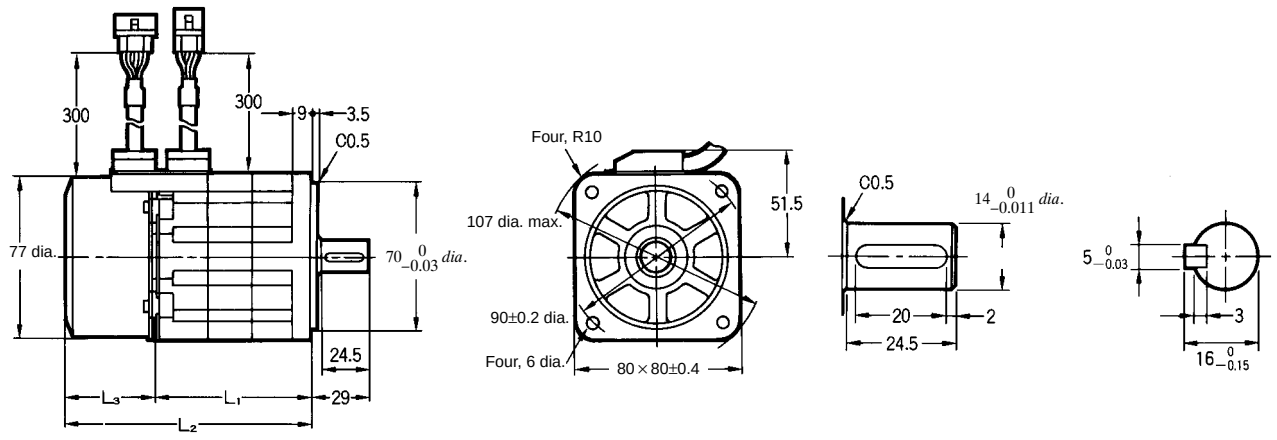


Standard Models (Without Brakes)			
Model	**L1**	**L2**	**L3**
R88M-H05030 (50 W)	53.5	99	45.5
R88M-H10030 (100 W)	63.5	109	45.5

Models With Brakes			
Model	**L1**	**L2**	**L3**
R88M-H05030-B (50 W)	84.5	130	45.5
R88M-H10030-B (100 W)	94.5	140	45.5

□200-W/300-W Standard Models (Without Brakes): R88M-H20030, R88M-H30030

□200-W/300-W Models with Brakes: R88M-H20030-B, R88M-H30030-B



Standard Models (Without Brakes)			
Model	**L1**	**L2**	**L3**
R88M-H20030 (200 W)	77	123.5	46.5
R88M-H30030 (300 W)	89	135.5	46.5

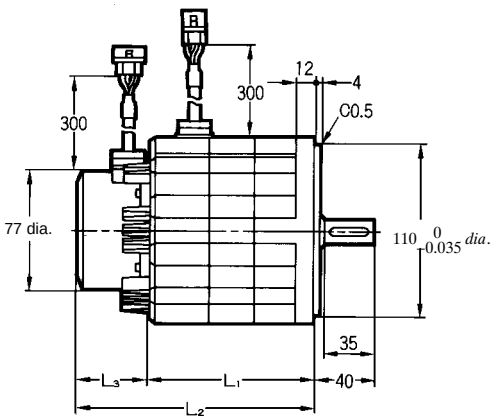
Models With Brakes			
Model	**L1**	**L2**	**L3**
R88M-H20030-B (200 W)	107.5	154	46.5
R88M-H30030-B (300 W)	119.5	166	46.5

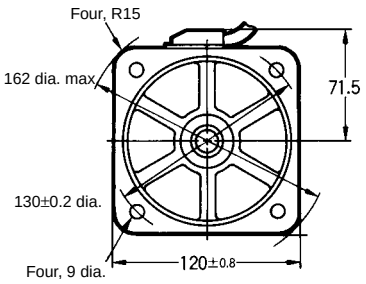
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OMNUC H-Series AC Servomotors with Incremental Encoders (H) (Contd.)

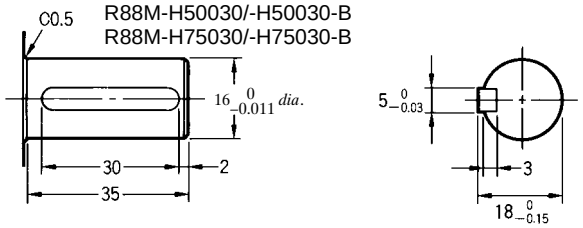
□500-W/750-W/1100-W Standard Models (Without Brakes): R88M-H50030, R88M-H75030, R88M-H1K130

□500-W/750-W/1100-W Models with Brakes: R88M-H50030-B, R88M-H75030-B, R88M-H1K130-B

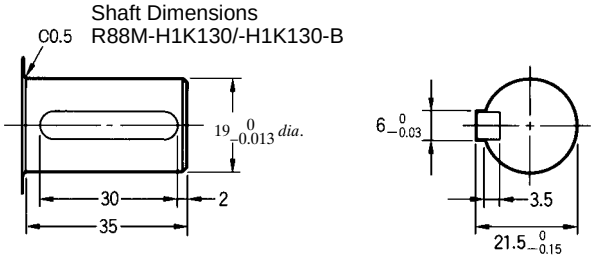




Shaft Dimensions
R88M-H50030/-H50030-B
R88M-H75030/-H75030-B



Shaft Dimensions
R88M-H1K130/-H1K130-B



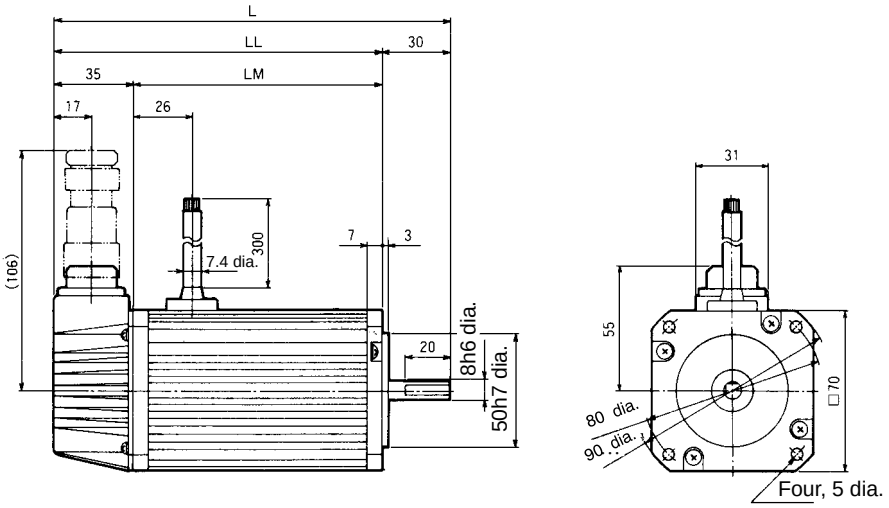
Standard Models (Without Brakes)			
Model	**L1**	**L2**	**L3**
R88M-H50030 (500 W)	107.5	154.0	46.5
R88M-H75030 (750 W)	126.0	172.5	46.5
R88M-H1K130 (1100 W)	144.5	191.0	46.5

Models With Brakes			
Model	**L1**	**L2**	**L3**
R88M-H50030-B (500 W)	148.5	195.0	46.5
R88M-H75030-B (750 W)	167.0	213.5	46.5
R88M-H1K130-B (1100 W)	185.5	232.0	46.5

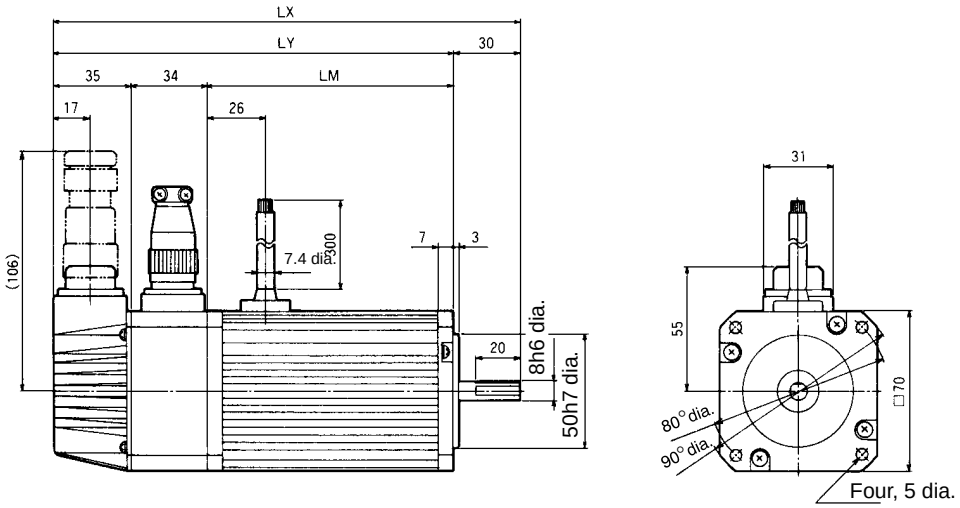
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OMNUC M-Series AC Servomotors with Resolvers (M)

□60-W/120-W (4,000 r/min) Standard Models (Without Brakes): R88M-M06040, R88M-M12040



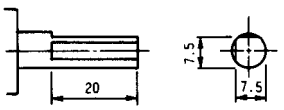
□60-W/120-W (4,000 r/min) Models with Brakes: R88M-M06040-B, R88M-M12040-B



Standard Models (Without Brakes)			
Model	**L**	**LL**	**LM**
R88M-M06040	150	120	85
R88M-M12040	175	145	110

Models with Brakes			
Model	**LX**	**LY**	**LM**
R88M-M06040-B	184	154	85
R88M-M12040-B	209	179	110

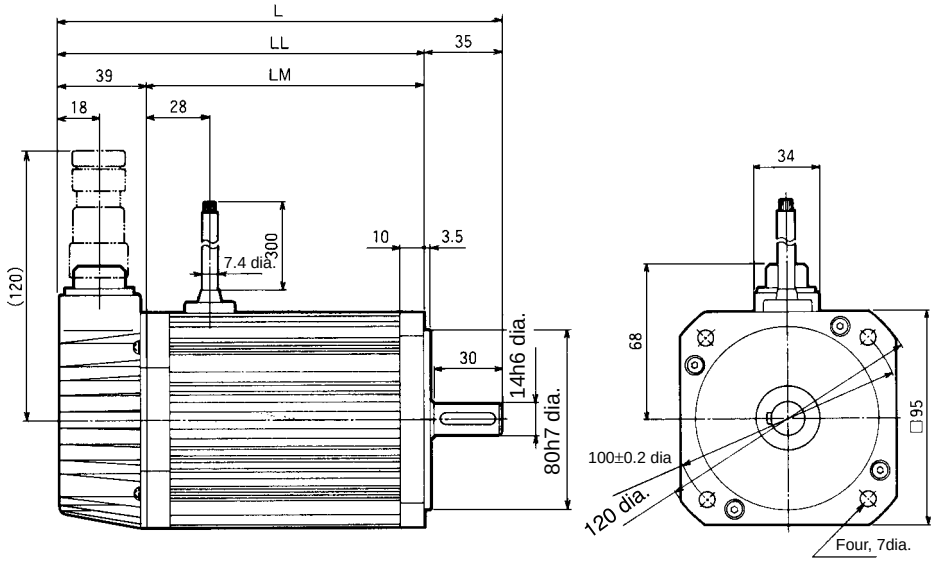
□Shaft End Dimensions



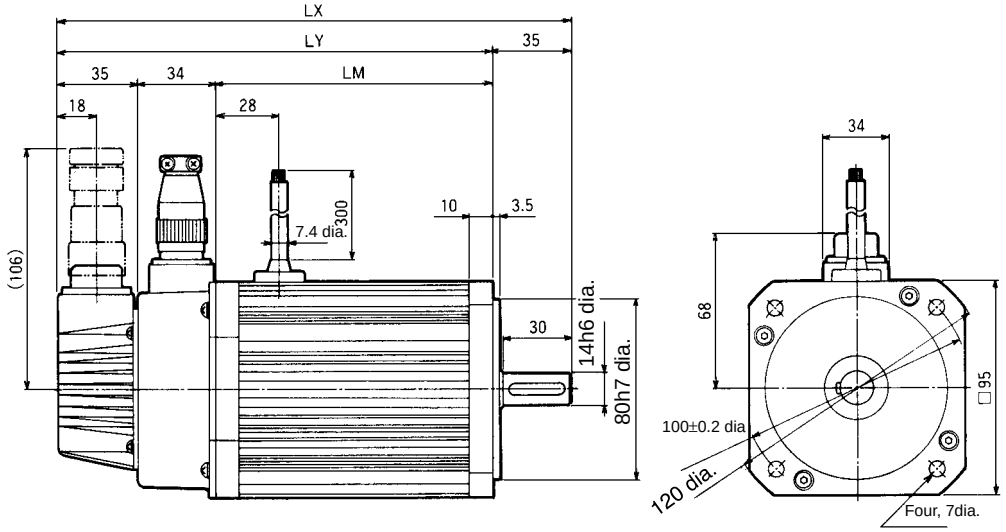
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OMNUC M-Series AC Servomotors with Resolvers (M) (Contd.)

□200-W (2,000 r/min) Standard Models (Without Brakes): R88M-M20020
□200-W/400-W (4,000 r/min) Standard Models: R88M-M20040, R88M-40040



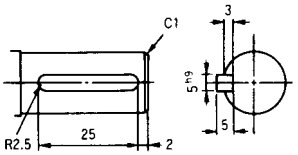
□200-W (2,000 r/min) Models with Brakes: R88M-M20020-B
□200-W/400-W (4,000 r/min) Models with Brakes: R88M-M20040-B, R88M-M40040-B



Standard Models (Without Brakes)			
Model	**L**	**LL**	**LM**
R88M-M20040	166	131	92
R88M-M20020	196	161	122
R88M-M40040			

Models with Brakes			
Model	**LX**	**LY**	**LM**
R88M-M20040-B	196	161	92
R88M-M20020-B	226	191	122
R88M-M40040-B			

□Shaft End Dimensions



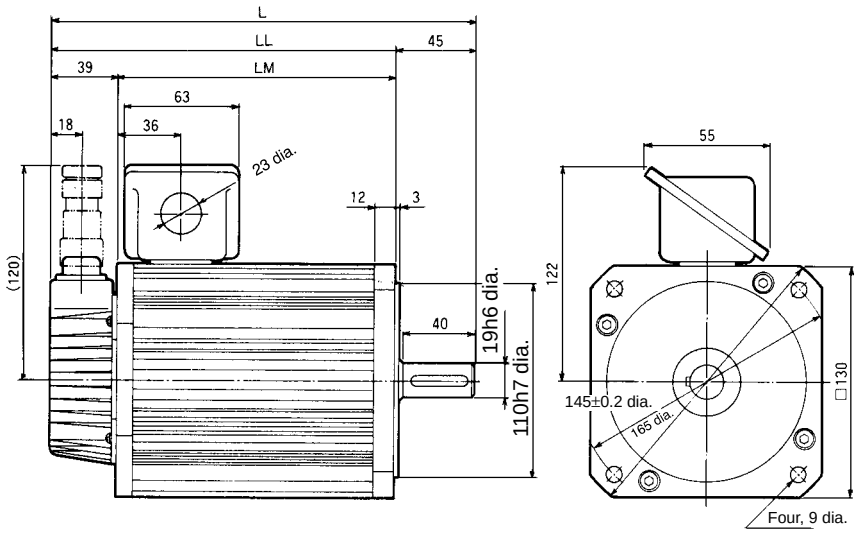
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OMNUC M-Series AC Servomotors with Resolvers (M) (Contd.)

□200-W/400-W/700-W (1,200 r/min)
Standard Models (Without Brakes): R88M-M20012, R88M-M40012, R88M-M70012

□400-W/700-W/1,100-W (2,000 r/min) Standard Models (Without Brakes): R88M-M40020, R88M-M70020, R88M-M1K120

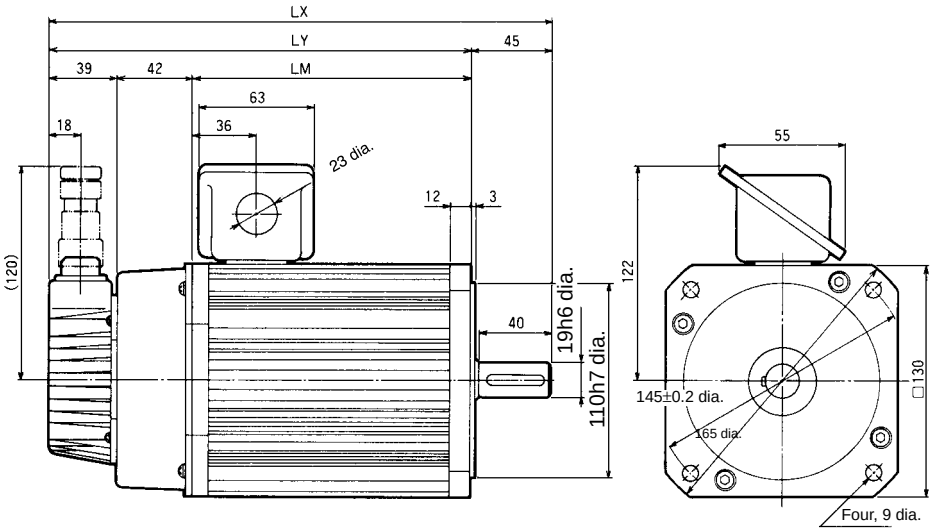
□700-W/1,100-W/2,000-W (4,000 r/min) Standard Models (Without Brakes): R88M-70040, R88M-M1K140, R88M-M2K040



□200-W/400-W/700-W (1,200 r/min)
Models with Brakes: R88M-M20012-B, R88M-M40012-B, R88M-M70012-B

□400-W/700-W/1,100-W (2,000 r/min) Models with Brakes: R88M-M40020-B, R88M-M70020-B, R88M-M1K120B

□700-W/1,100-W/2,000-W (4,000 r/min) Models with Brakes: R88M-M70040-B, R88M-M1K140-B, R88M-M2K040-B

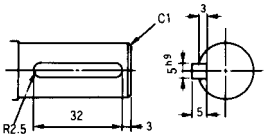


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Standard Models			
Model	**L**	**LL**	**LM**
R88M-M20012	240	195	156
R88M-M40020			
R88M-M70040			
R88M-M40012	275	230	191
R88M-M70020			
R88M-M1K140			
R88M-M70012	345	300	261
R88M-M1K120			
R88M-M2K040			

Models with Brakes			
Model	**LX**	**LY**	**LM**
R88M-M20012-B	282	237	156
R88M-M40020-B			
R88M-M70040-B			
R88M-M40012-B	317	272	191
R88M-M70020-B			
R88M-M1K140-B			
R88M-M70012-B	387	342	261
R88M-M1K120-B			
R88M-M2K040-B			

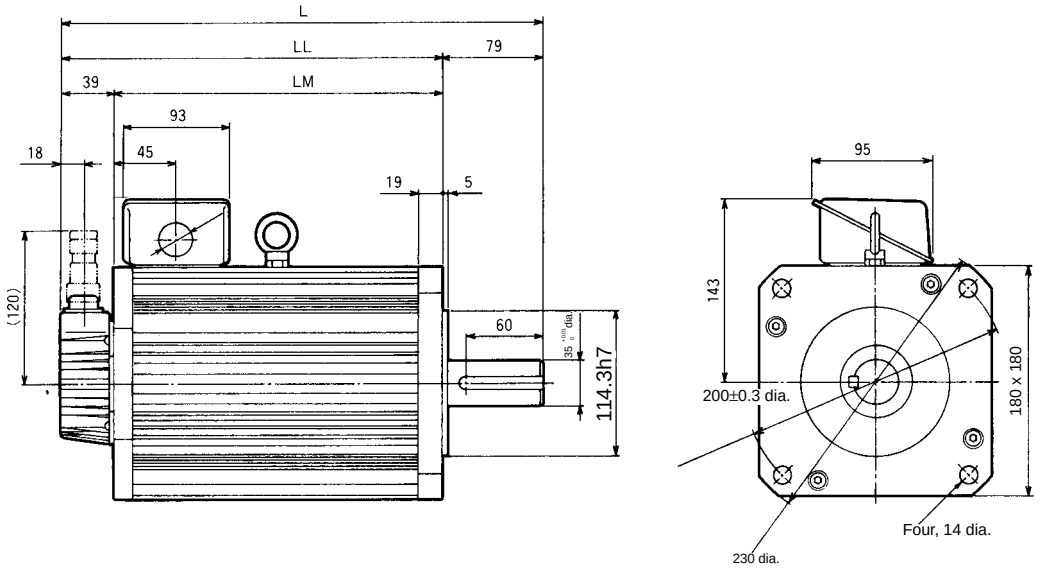
□Shaft End Directions



OMNUC M-Series AC Servomotors with Resolvers (Contd.)

□1,100-W/1,400-W/1,800-W (1,200 r/min) Standard Models: R88M-M1K112/-M1K412/-M1K812

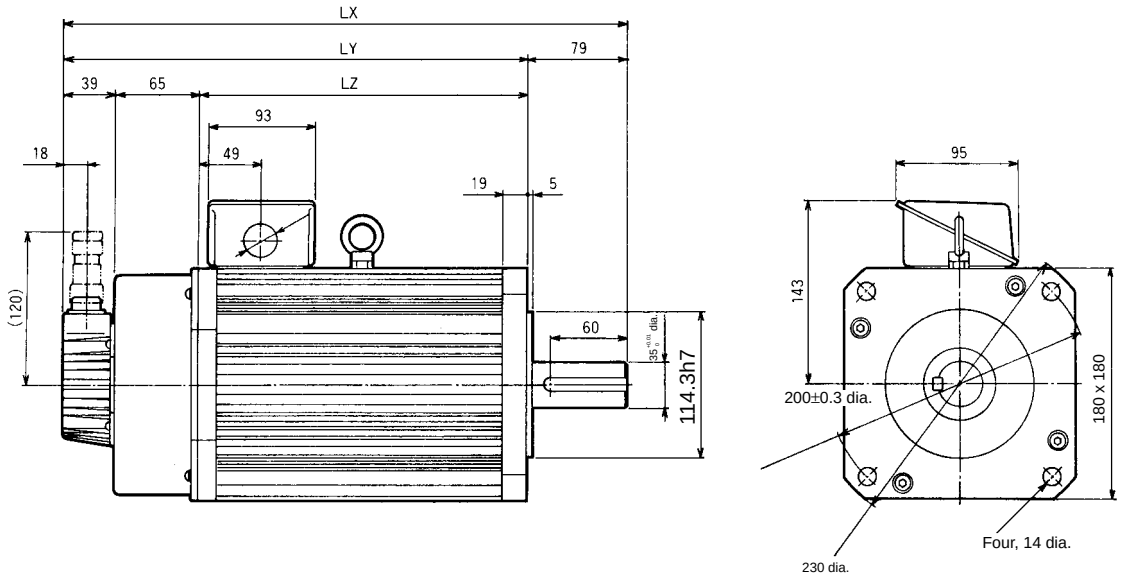
□1,800-W/2,200-W (2,000 r/min) Standard Models: R88M-M1K820/-M2K220



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□1,100-W/1,400-W/1,800-W (1,200 r/min) Models with Brakes: R88M-M1K112-B/-M1K412-B/-M1K812-B

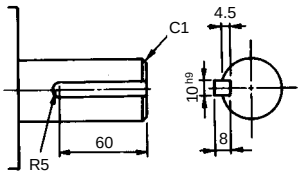
□1,800-W/2,200-W (2,000 r/min) Models with Brakes: R88M-M1K820-B/-M2K220-B



Standard Models						
Model	**L**	**LL**	**LM**	**LX**	**LY**	**LZ**
R88M-M1K112	370	291	252	439	360	256
R88M-M1K820						
R88M-M1K412	400	321	282	469	390	286
R88M-M2K220						
R88M-M1K812	460	381	342	529	450	346

Models with Brakes						
Model	**L**	**LL**	**LM**	**LX**	**LY**	**LZ**
R88M-M1K112-B	370	291	252	439	360	256
R88M-M1K820-B						
R88M-M1K412-B	400	321	282	469	390	286
R88M-M2K220-B						
R88M-M1K812-B	460	381	342	529	450	346

□Shaft End Directions



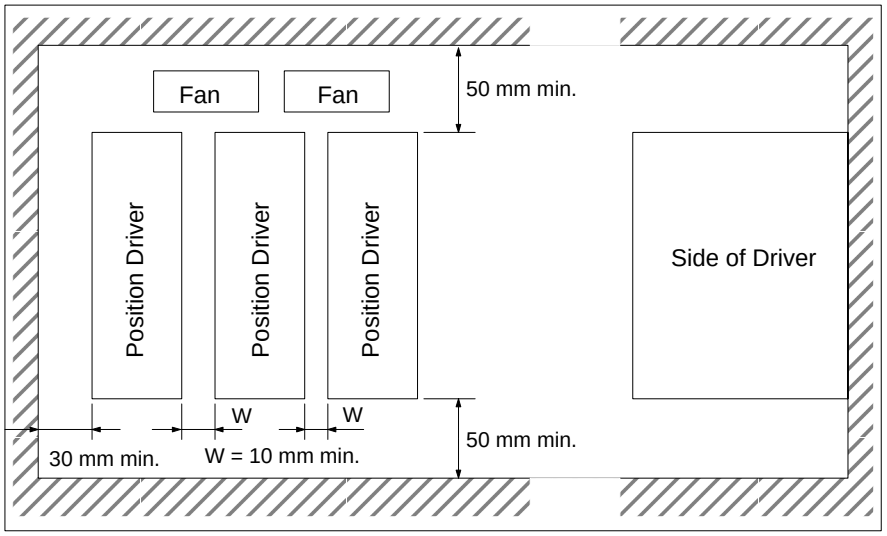
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2-1-2 Installation Conditions

Position Driver

□Space Around Drivers

- Install Position Drivers according to the dimensions shown in the following illustration to ensure proper heat dispersion and convection inside the panel. Also install a fan for circulation if Position Drivers are installed side by side to prevent uneven temperatures from developing inside the panel.
- Mount the Position Drivers vertically (so that the model number and writing can be read).



□Operating Environment

Be sure that the environment in which Position Drivers are operated meets the following conditions.

- Ambient operating temperature: 0°C to +55°C
- Ambient operating humidity: 35% to 90% (RH, with no condensation)
- Atmosphere: No corrosive gases.

□Ambient Temperature

- Position Drivers should be operated in environments in which there is minimal temperature rise to maintain a high level of reliability.
- Temperature rise in any Position Driver installed in a closed space, such as a control box, will cause the ambient temperature to rise inside the entire closed space. Use a fan or a air conditioner to prevent the ambient temperature of the Position Driver from exceeding 55°C.
- Position Driver surface temperatures may rise to as much as 40°C above the ambient temperature. Use heat-resistant materials for wiring, and keep separate any devices or wiring that are sensitive to heat.
- The service life of a Position Driver is largely determined by the temperature around the internal electrolytic capacitors. The service life of an electrolytic capacitor is affected by a drop in electrolytic volume and an increase in internal resistance, which can result in overvoltage alarms, malfunctioning due to noise, and damage to individual elements. If a Position Driver is always operated at the maximum ambient temperature of 35°C, then a service life of approximately 50,000 hours can be expected. A drop of 10°C in the ambient temperature will approximately double the expected service life.

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□Keeping Foreign Objects Out of Units

- Place a cover over the Units or take other preventative measures to prevent foreign objects, such as drill filings, from getting into the Position Driver during installation. Be sure to remove the cover after installation is complete. If the cover is left on during operation, heat buildup may damage the Driver.
- Take measures during installation and operation to prevent foreign objects such as metal particles, oil, machining oil, dust, or water from getting inside of the Position Driver.

AC Servomotors

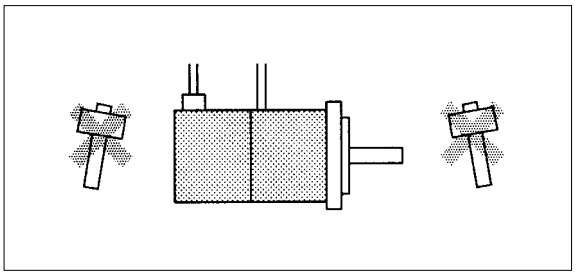
□Operating Environment

Be sure that the environment in which the Servomotor is operated meets the following conditions.

- Ambient operating temperature: 0°C to +40°C
- Ambient operating humidity: OMNUC U Series: 20% to 80% (RH, with no condensation)
  OMNUC U-UE Series: 20% to 80% (RH, with no condensation)
  OMNUC H Series: 35% to 85% (RH, with no condensation)
  OMNUC M Series: 35% to 85% (RH, with no condensation)
- Atmosphere: No corrosive gases.

□Impact and Load

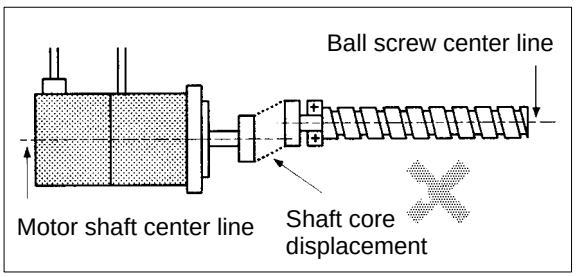
- The Servomotor is resistant to impacts of up to 98 m/s^2 {10 G}. Do not subject it to heavy impacts or loads during transport, installation, or positioning. In addition, do not hold onto the encoder/resolver area, cable, or connector areas when transporting it.
- Always use a pulley remover to remove pulleys, couplings, or other objects from the shaft.



- Secure cables so that there is no impact or load placed on the cable connector areas.

□Connecting to Mechanical Systems

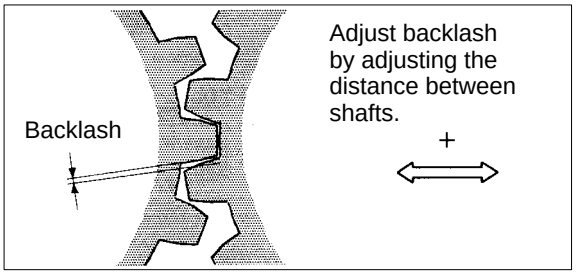
- The axial loads for Servomotors are specified in section *5-2 Servomotor Specifications*. If an axial load greater than that specified is applied to a Servomotor, it will reduce the service life of the motor bearings and may damage the motor shaft. When connecting to a load, use couplings that can sufficiently absorb mechanical eccentricity and variation.



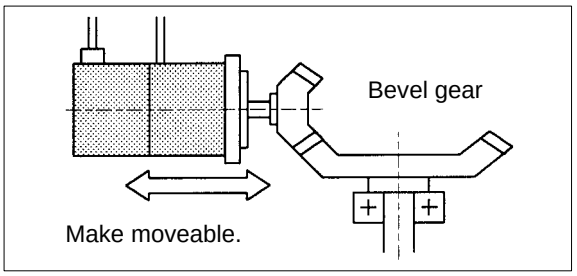
Recommended Coupling

Name	Maker
Oldham coupling	Myghty Co., Ltd

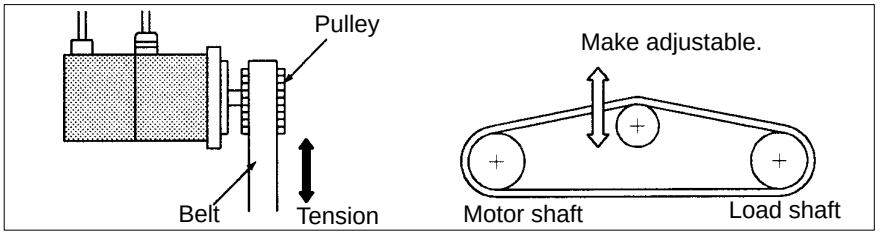
- For spur gears, an extremely large radial load may be applied depending on the gear precision. Use spur gears with a high degree of accuracy (for example, JIS class 2: normal line pitch error of 6 μm max. for a pitch circle diameter of 50 mm). If the gear precision is not adequate, allow backlash to ensure that no radial load is placed on the motor shaft.



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- Bevel gears will cause a load to be applied in the thrust direction depending on the structural precision, the gear precision, and temperature changes. Provide appropriate backlash or take other measures to ensure that no thrust load is applied which exceeds specifications.
- Do not put rubber packing on the flange surface. If the flange is mounted with rubber packing, the motor flange may separate due to the tightening strength.
- When connecting to a V-belt or timing belt, consult the maker for belt selection and tension. A radial load twice the belt tension will be placed on the motor shaft. Do not allow a radial load exceeding specifications to be placed on the motor shaft due to belt tension. If an excessive radial load is applied, the motor shaft may be damaged. Set up the structure so that the radial load can be adjusted. A large radial load may also be applied as a result of belt vibration. Attach a brace and adjust Position Driver gain so that belt vibration is minimized.



□Water and Drip Resistance

- The Servomotor does not have a water-proof structure. Except for the connector areas, the protective structure meets the following JEM (The Japan Electrical Manufacturers' Association) standards:
  U Series, 30 to 750 W Conforming to UL/cUL and UE Type Not Conforming to Any Standards: IP-42
  U Series, 30 to 750 W Conforming to EC Directives and UE Type Conforming to EC Directives: IP-44 (except shaft penetration point)
  U Series, 1 to 2 kW Not Conforming to Any Standards: IP-65 (except shaft penetration point)
  U Series, 1 to 2 kW Conforming to EC Directives: IP-55 (including shaft penetration point)
  H Series: IP-52
  M Series: IP-42

Note Protective Structure: Indicated as IP- (IP: Protection rating symbol, : rating class) according to the IEC standard (IEC529: 1989-11).

- If the Servomotor is used in an environment in which condensation occurs, water may enter inside of the encoder/resolver from the end surfaces of cables due to motor temperature changes. Either take measures to ensure that water cannot penetrate in this way, or use water-proof connectors. Even when machinery is not in use, water penetration can be avoided by taking measures, such as keeping the motor in servo-lock status, to minimize temperature changes.
- If machining oil with surfactants (e.g., coolant fluids) or their spray penetrate inside of the motor, insulation defects or short-circuiting may occur. Take measures to prevent machining oil penetration.
- The water and drip resistance of the standard cables for U-Series Servomotors of 1 to 2 kW is equivalent to IP-30. Use water-resistance cables for the power cables and encoder cables in locations subject to contact with water. Use the following recommended products for power cable and encoder cable connectors when the device is to meet EC directives.

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Power Cable Connectors

Servomotor	Servomotor model R88M-	Connector model	Cable clamp model	Manufacturer
Standard	U1K030 - U1K530 - U2K030 -	Elbow connectors: CE05-8A18-10SD-B-BAS Straight connectors: CE05-6A18-10SD-B-BSS	Sheath exterior diameter of 6.5 to 8.7 mm: CE3057-10A-3 (D265) Sheath exterior diameter of 8.5 to 11 mm: CE3057-10A-2 (D265) Sheath exterior diameter of 10.5 to 14.1 mm: CE3057-10A-1 (D265)	Daiichi Electronic Industries Co., Ltd.
With Brakes	U1K030 -B U1K530 -B U2K030 -B	Elbow connectors: JL04V-8A20-15SE-EB Straight connectors: JL04V-6A20-15SE-EB	Sheath exterior diameter of 6.5 to 9.5: JL04-2022CK (09) Sheath exterior diameter of 9.5 to 13: JL04-2022CK (12) Sheath exterior diameter of 12.9 to 15.9: JL04-2022CK (14)	Japan Aviation Electronics Industry, Ltd.

Encoder Cable Connectors

Servomotor	Connector model	Cable clamp model	Manufacturer
All models	Elbow connectors: JA08A-20-29S-J1-EB Straight connectors: JA06A-20-29S-J1-EB	Sheath exterior diameter of 6.5 to 9.5 mm: JL04-2022CKE (09) Sheath exterior diameter of 9.5 to 13 mm: JL04-2022CKE (12) Sheath exterior diameter of 12.9 to 16 mm: JL04-2022CKE (14)	Japan Aviation Electronics Industry, Ltd.

□Other Precautions

- Do not apply commercial power directly to the Servomotor. The Servomotors run on synchronous AC and use permanent magnets. Applying 3-phase power will burn out the motor coils.
- Do not carry the Servomotor by its cable, otherwise the cable may become disconnected or the cable clamp may become damaged.
- The shafts are coated with anti-rust oil when shipped. Apply anti-rust oil or grease to the shaft if necessary. When anti-rust oil or grease is applied, connections such as couplings to the load shaft may slip causing dislocations. Therefore, pay careful attention to the connections after applying anti-rust oil or grease.
- Absolutely do not remove the encoder/resolver cover or take the motor apart. The magnet and the encoder/resolver are aligned in the Servomotor. If they become misaligned, the motor will not operate.

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- The Servomotor may not produce sufficient torque when moved only a small distance from the point where power is turned ON (a distance equivalent to about ±6 pulses). If only a very small distance is to be moved, move the motor at least ±6 pulses after turning ON the power before starting actual operation.

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2-2 Wiring

2-2-1 Overview

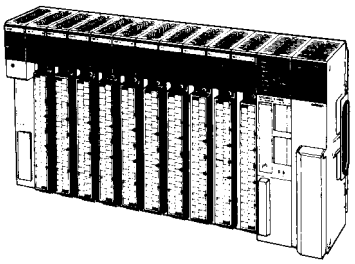
Use a general-purpose control cable (purchased separately) to connect the Position Driver to the Programmable Controller. For connecting the Position Driver to an AC Servomotor, use a dedicated Encoder/Resolver Cable and a Power Cable. (For the M Series there is no dedicated power cable. It must be prepared by the user.)

Note Refer to *Chapter 5 Specifications* for details on connectors and cables.

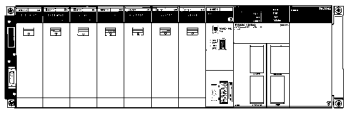
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Using OMNUC U-series AC Servomotors: 30 to 750 W Conforming to UL/cUL or UE Type Not Conforming to Any Standards

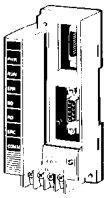
SYSMAC CV/C-series
Programmable Controller

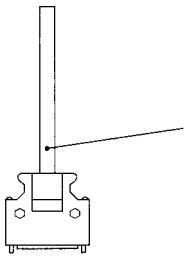


C200HX/HG/HE or CQM1
Programmable Controller

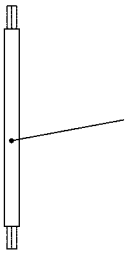


SRM1-C01/-C02
Master Control Unit

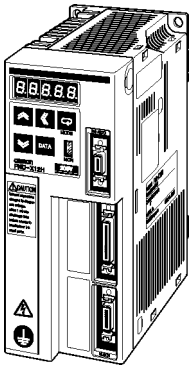




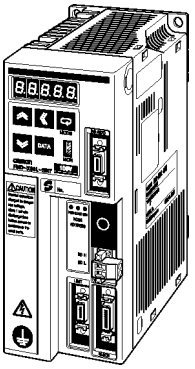
General-purpose Control Cable
FND-CCX S



CompoBus/S Communications Cable (SCA1-4F10 Flat Cable or commercially available VCTF cable)

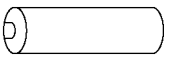


FND-X-series Position Driver (DIO Type)



FND-X-series Position Driver (CompoBus/S Type)

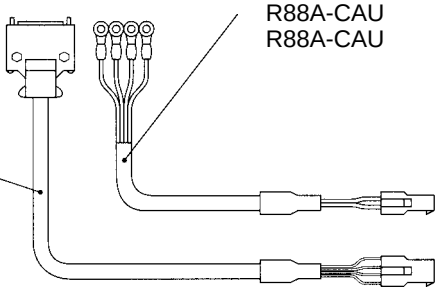
Backup Battery

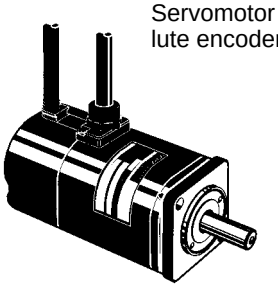


Connect when using a Servomotor with an absolute encoder.

Power Cable
R88A-CAU S
R88A-CAU B

Encoder Cable
R88A-CRU C
(for incremental encoder)
R88A-CSU C
(for absolute encoder)



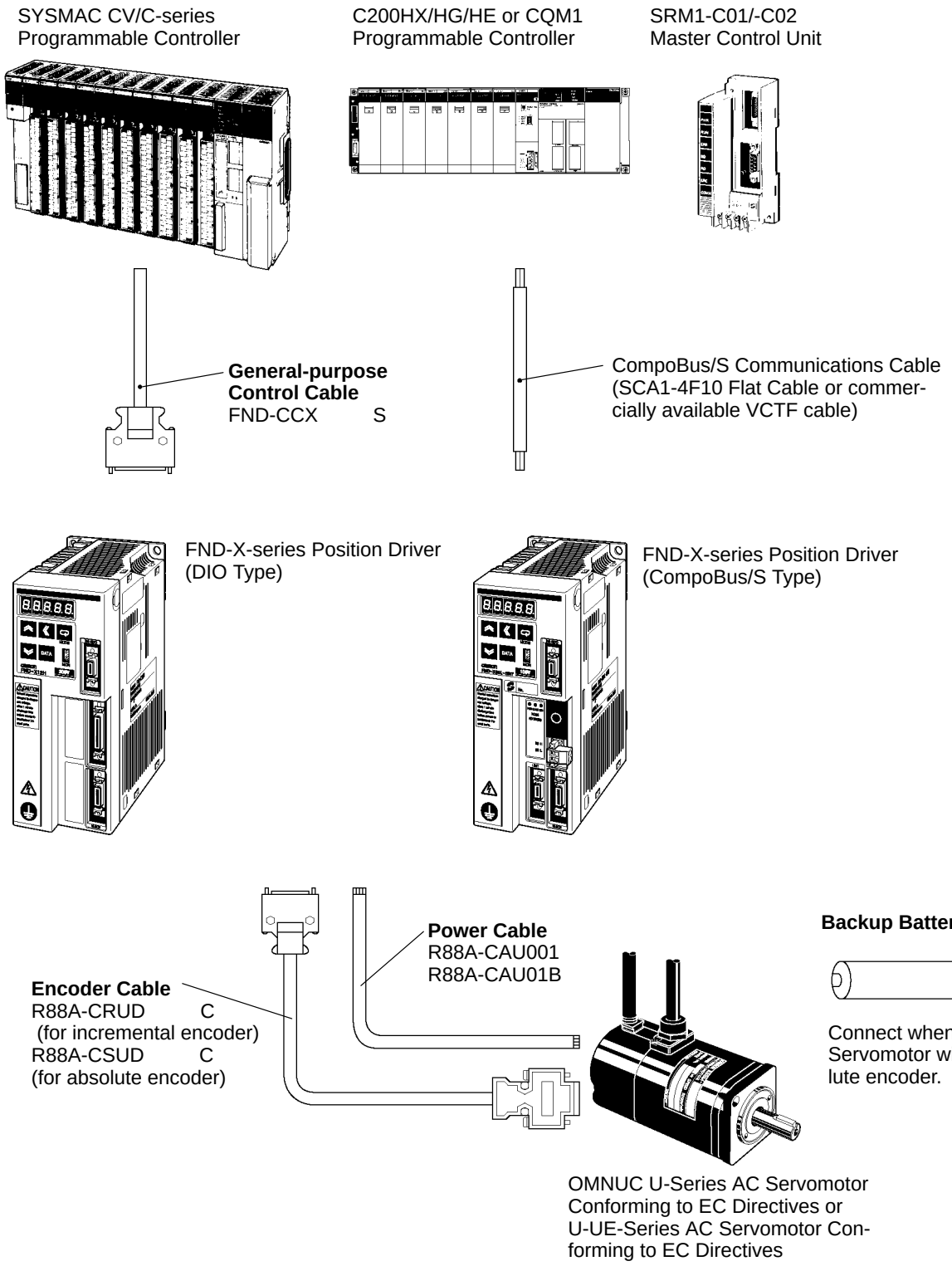


OMNUC U-Series AC Servomotor
Conforming to UL/cUL or
U-UE-Series AC Servomotor Not
Conforming to Any Standards

Note Refer to *Chapter 5 Specifications* for connector and cable specifications.

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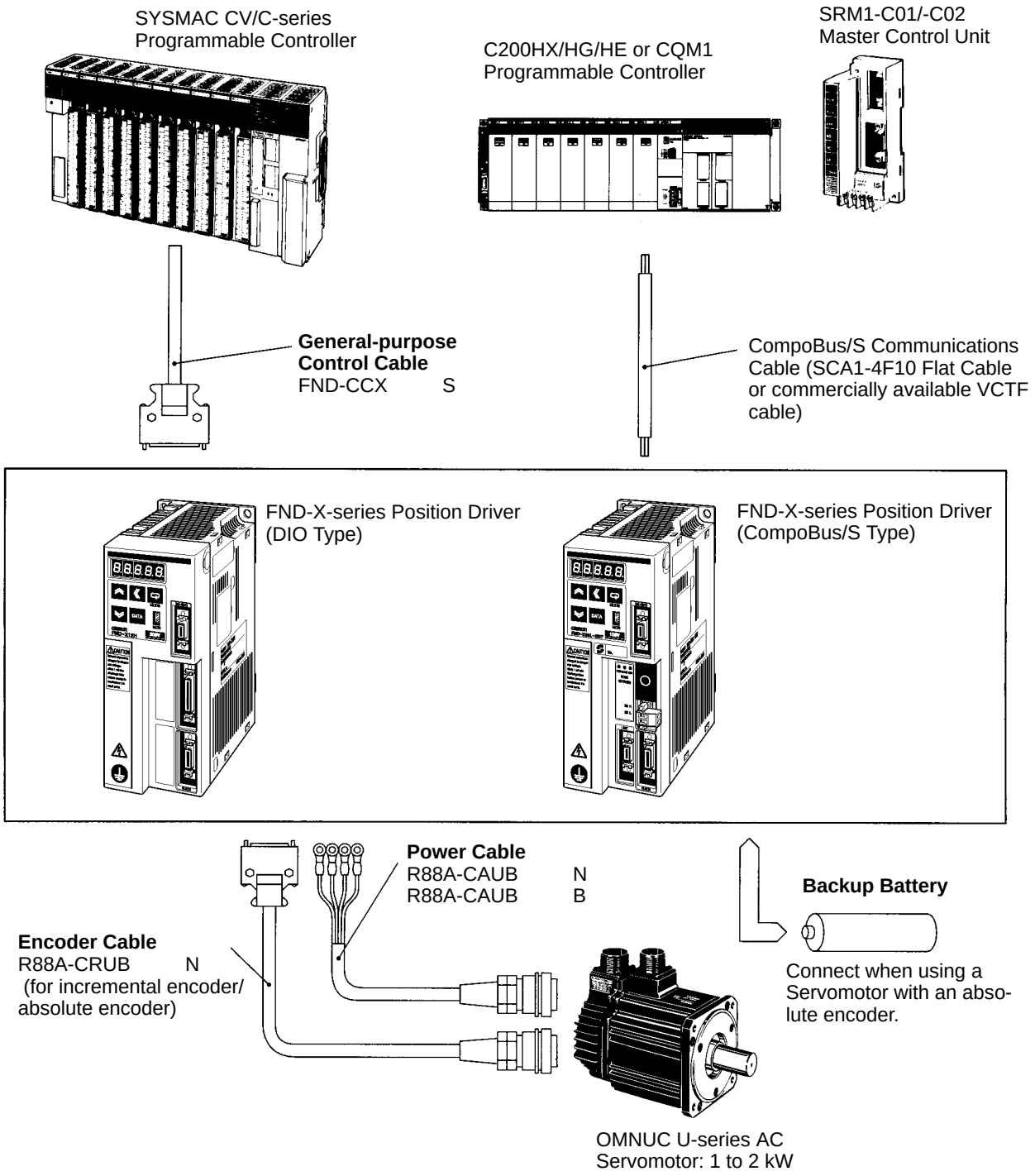
Using OMNUC U-series AC Servomotors: 30 to 750 W Conforming to EC Directives or UE Type Conforming to EC Directives



Note Refer to *Chapter 5 Specifications* for connector and cable specifications.

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Using OMNUC U-series AC Servomotors: 1 to 2 kW

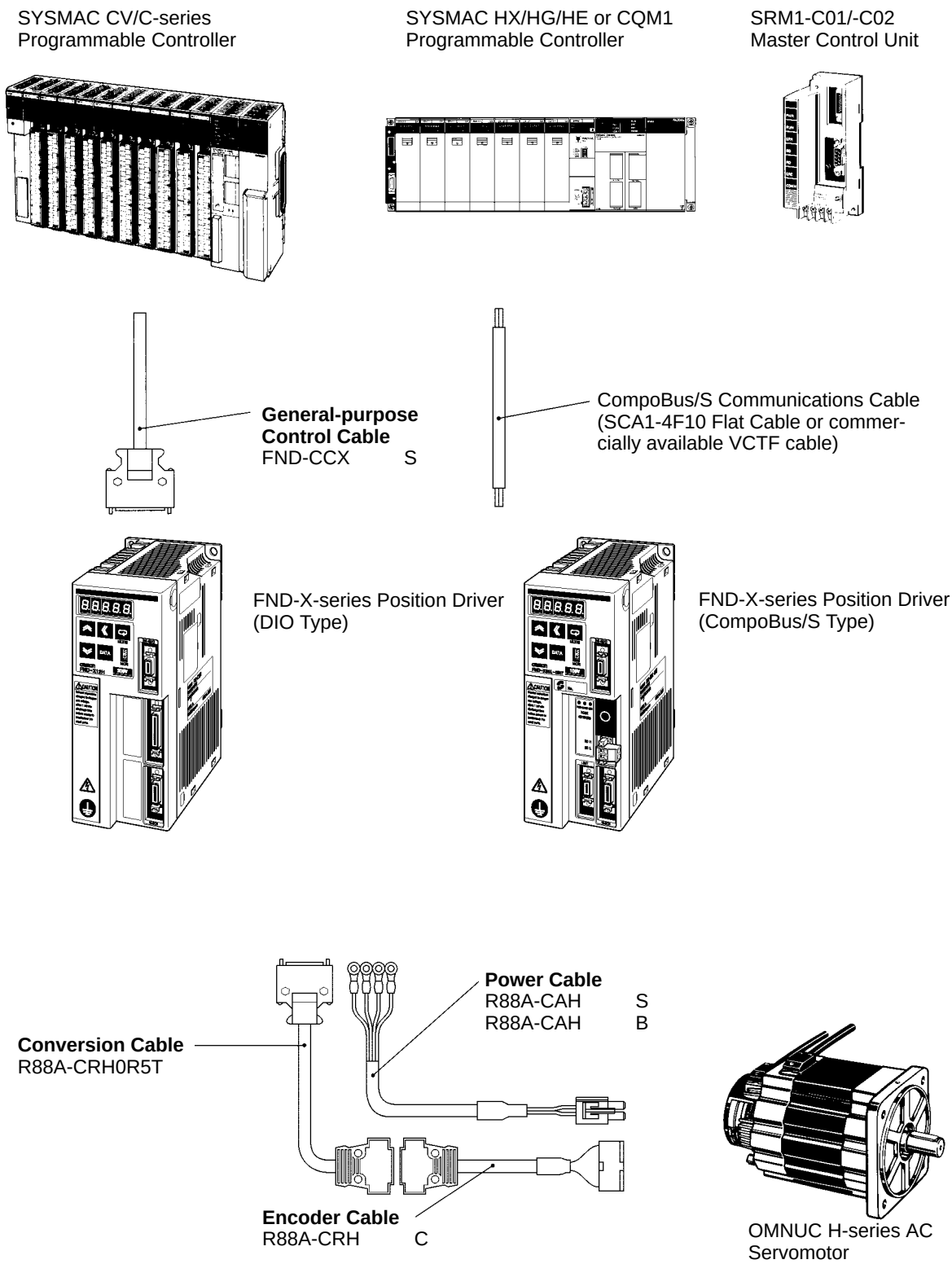


Note 1. Refer to *Chapter 5 Specifications* for connector and cable specifications.

Note 2. To perform mounting in accordance with EC Directives, use a Servomotor that conforms to EC Directives. In addition, replace the connectors for the power cable and the encoder cable at the Servomotor with the recommended Connectors listed under *Water and Drip Resistance* in *2-1-2 Installation Conditions.*

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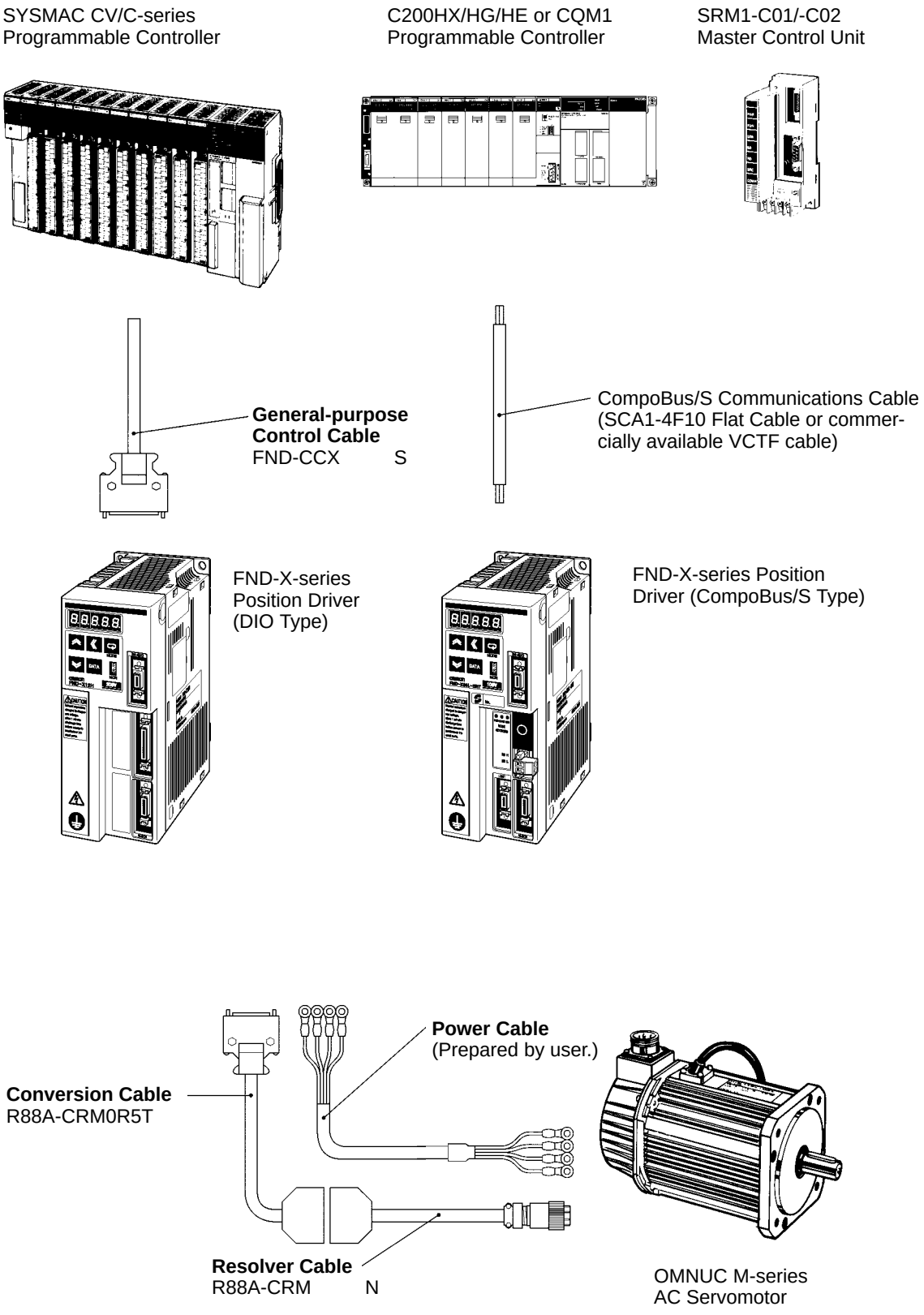
Using an OMNUC H-series AC Servomotor



Note Refer to *Chapter 5 Specifications* for connector and cable specifications.

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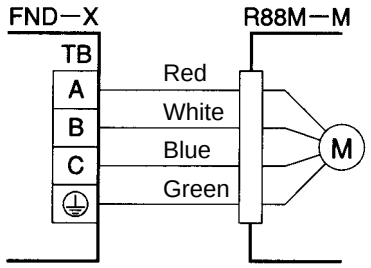
Using an OMNUC M-series AC Servomotor



Note Refer to *Chapter 5 Specifications* for connector and cable specifications.

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□Wiring Power Cables



□Power Cable Wire Sizes

Model R88M-	Wire size	
	mm^2	AWG
M20012	1.25	AWG16
M40012	1.25	AWG16
M70012	1.25	AWG16
M1K112	2	AWG14
M1K412	2	AWG14
M1K812	2	AWG14
M20020	0.9	AWG18
M40020	1.25	AWG16
M70020	1.25	AWG16
M1K120	1.25	AWG16

Model R88M-	Wire size	
	mm^2	AWG
M1K820	3.5	AWG12
M2K220	3.5	AWG12
M06040	0.9	AWG18
M12040	0.9	AWG18
M20040	0.9	AWG18
M40040	0.9	AWG18
M70040	1.25	AWG16
M1K140	1.25	AWG16
M2K040	3.5	AWG12

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2-2-2 Control Circuitry Terminal Wiring

DIO Position Drivers

Control Signal Connector (CN1: CONT) Pin Arrangement

2	CWL	CW limit input	1	CCWL	CCW limit input	20	STOP	Deceleration stop	19	OGND	Output ground
4	RUN	RUN command	3	ORG	Origin proximity	22	READY	Ready	21	BO	Brake output
6	RESET	Alarm reset	5	START	Start	24	ORGSTP	Origin stop	23	S.COM	Origin search completed
8	+JOG	+JOG operation	7	SEARCH	Origin search	26	RUNON	Motor running	25	T.COM	Teaching completed
10	TEACH	Teach	9	–JOG	–JOG operation	28	$\overline{\text{ALM}}$	Alarm	27	INP	Positioning completed
12	P.IN1	Point selection 1 /Position 1	11	P.IN0	Point selection 0 /Position 0	30	P.OUT1	Point output 1/ Position selection 2	29	P.OUT0	Point output 0/ Position selection 1
14	P.IN3	Point selection 3 /Position 3	13	P.IN2	Point selection 2 /Position 2	32	P.OUT3	Point output 3/ Position selection 4	31	P.OUT2	Point output 2/ Position selection 3
16	P.IN5	Point selection 5 /Position 5	15	P.IN4	Point selection 4 /Position 4	34	P.OUT5	Point output 5	33	P.OUT4	Point output 4/ Speed selection
18	P.IN7	Position 7	17	P.IN6	Point selection 6 /Position 6	36	+24V	+24-VDC power supply input for control	35	P.OUT6	Point output 6

☐Connectors Used

Sumitomo 3M	Receptacle at Position Driver	10236-6202JL
	Soldered plug at cable side	10136-3000VE
	Case at cable side	10336-52A0-008

CompoBus/S Position Drivers

CompoBus/S Communications Terminal Block (CN1: CONT) Pin Arrangement

Signal	Name	Functions
BD H	CompoBus/S serial line (+)	These are the terminals for connecting CompoBus/S communications cables. Be careful to connect the polarities correctly.
BD L	CompoBus/S serial line (–)	

☐I/O Allocation

The FND-X has 16 input points and 16 output points.

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IN (16 Input Points)

I/O allocation	Signal	Name
OUT0	RUN	RUN command
OUT1	START	START
OUT2	RESET	Alarm reset
OUT3	SEARCH	Origin search
OUT4	+JOG	+JOG operation
OUT5	–JOG	–JOG operation
OUT6	TEACH	Teach
OUT7	STOP (see note 2)	Deceleration stop
OUT8	P. IN0	Point selection 0/Position 0
OUT9	P. IN1	Point selection 1/Position 1
OUT10	P. IN2	Point selection 2/Position 2
OUT11	P. IN3	Point selection 3/Position 3
OUT12	P. IN4	Point selection 4/Position 4
OUT13	P. IN5	Point selection 5/Position 5
OUT14	P. IN6	Point selection 6/Position 6
OUT15	P. IN7	Position 7

OUT (16 Output Points)

I/O allocation	Signal	Name
IN0	BO	Brake output
IN1	READY	READY
IN2	S.COM	Origin search completed
IN3	ORGSTP	Origin stop
IN4	T.COM	Teaching completed
IN5	RUNON	Motor running
IN6	INP	Positioning completed
IN7	$\overline{\text{ALM}}$	Alarm
IN8	P. OUT0	Point output 0/Position selection 1
IN9	P. OUT1	Point output 1/Position selection 2
IN10	P. OUT2	Point output 2/Position selection 3
IN11	P. OUT3	Point output 3/Position selection 4
IN12	P. OUT4	Point output 4/Speed selection
IN13	P. OUT5	Point output 5
IN14	P. OUT6	Point output 6
IN15	---	Not used

Note 1. The I/O allocation indicates the word allocation for the Master Unit.

Note 2. The Servomotor cannot be driven if the deceleration stop signal is OFF for the external control input (CN4-4) or the CompoBus/S input (OUT7).

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External Control Signal Connectors (CN4: LIMIT) Pin Arrangement

			1	CCWL	CCW limit				8	BO	Brake output
2	CWL	CW limit				9					
			3	ORG	Origin proximity				10		
4	STOP	Deceleration stop (see note)				11					
			5						12		
6						13					
			7	+24 V	+24-VDC power supply input for control				14	OGND	Output ground
8											

□Connectors Used

Sumitomo 3M	Receptacle at Position Driver	10214-6202JL
	Soldered plug at cable side	10114-3000VE
	Case at cable side	10314-52A0-008

Note The Servomotor cannot be driven if the deceleration stop signal if OFF for the external control input (CN4-4) or the CompoBus/S input (OUT7).

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Control I/O Specifications

DIO	Compo Bus/S	Signal	Name	Function and interface	Internal allocation
CN1-1	CN4-1	CCWL	CCW limit input	Inputs the + direction limit signal (status enabled) ON: Drive possible OFF: Motor stopped by limit detection when driving in the + direction.	IN15
CN1-2	CN4-2	CWL	CW limit input	Inputs the – direction limit signal (status enabled) ON: Drive possible OFF: Motor stopped by limit detection when driving in – direction.	IN16
CN1-3	CN4-3	ORG	Origin proximity	Signal for mechanical origin setting	IN17
CN1-4	OUT0	RUN	RUN command	Command for beginning power on to motor (status enabled) When OFF, error counter is cleared. ON: Power ON to motor OFF: Power OFF to motor	IN0
CN1-5	OUT1	START	START	Begins positioning operation (rising edge enabled) ON: START	IN1
CN1-6	OUT2	RESET	Alarm reset	Alarm reset signal (rising edge enabled)	IN2
CN1-7	OUT3	SEARCH	Origin search	When RUN is ON (rising edge enabled): ON: Origin search begins When RUN is OFF (status enabled): ON: Origin teaching awaited	IN3
CN1-8	OUT4	+JOG	+JOG operation	+JOG operation (status enabled) ON: Rotate	IN4
CN1-9	OUT5	–JOG	–JOG operation	–JOG operation (status enabled) ON: Rotate	IN5
CN1-10	OUT6	TEACH	Teach	When ORIGIN SEARCH is OFF (status enabled): When UP-01 = 11 or 12, motor's present position is taken for PTP data when this bit turns ON. When UP-01 = 13 or 14, P.IN0 to P.IN7 is taken as positioning data when this bit turns ON. When RUN is OFF and ORIGIN SEARCH is ON (status enabled): Motor's present position is taken for origin compensation amount.	IN6

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DIO	Compo Bus/S	Signal	Name	Function and interface	Internal allocation
CN1-11	OUT8	P.IN0	Point selection 0/ Position 0	Positioning data inputs (status enabled) When UP-01 = 11 or 12, PTP data No. is input as positioning data. Range: 1 to 64, BCD input. When UP-01 = 13 or 14, positioning data is input. Range: 1 to 99, BCD input. Taken in order, two digits at a time, from the rightmost digits.	IN7
CN1-12	OUT9	P.IN1	Point selection 1/ Position 1		IN8
CN1-13	OUT10	P.IN2	Point selection 2/ Position 2		IN9
CN1-14	OUT11	P.IN3	Point selection 3/ Position 3		IN10
CN1-15	OUT12	P.IN4	Point selection 4/ Position 4		IN11
CN1-16	OUT13	P.IN5	Point selection 5/ Position 5		IN12
CN1-17	OUT14	P.IN6	Point selection 6/ Position 6		IN13
CN1-18	OUT15	P.IN7	Position 7		IN14
CN1-20	CN4-4 OUT7	STOP	Deceleration stop	Stops according to deceleration stop mode (falling edge enabled) ON: Motor driven OFF: Motor stopped	IN18
CN1-36	CN4-7	+24V	+24-VDC power supply input for control	Power supply input terminal for control input.	---
CN1-19	CN4-14	OGND	Output ground common	Output ground common for control input.	---
CN1-21	CN4-8 IN0	BO	Brake output	External brake timing signal output. Output OFF when brake is operating.	OUT14
CN1-22	IN1	READY	Ready	Outputs ready status for receiving ORIGIN SEARCH, START, TEACH, or point selection signal input. Output turns ON when positioning data is received or when motor rotation is completed.	OUT0
CN1-23	IN2	S.COM	Origin search completed	Output turns ON when motor's present position is established.	OUT1
CN1-24	IN3	ORGSTP	Origin stop	Output turns ON when positioning is stopped at mechanical origin position.	OUT2
CN1-25	IN4	T.COM	Teaching completed	Output turns ON when teaching input processing is completed.	OUT3
CN1-26	IN5	RUNON	Motor running	Output turns ON when power is turned ON to the motor.	OUT4
CN1-27	IN6	INP	Positioning completed	Output turns ON when error counter residual pulses are within the UP-07 (positioning completed range) setting.	OUT5
CN1-28	IN7	$\overline{\text{ALM}}$	Alarm	Output indicates error occurrence at the driver or motor. Output OFF when an alarm occurs.	OUT6

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DIO	Compo Bus/S	Signal	Name	Function and interface	Internal allocation
CN1-29	IN8	P.OUT0	Point output 0/ Position selection 1	When UP-01 = 11 or 12: Outputs (BCD) point No. during waiting or execution. When UP-01 = 13 or 14: Outputs request signal for receiving positioning data (position and speed). The output ON time is set for PP-26 (selection signal output time).	OUT7
CN1-30	IN9	P.OUT1	Point output 1/ Position selection 2		OUT8
CN1-31	IN10	P.OUT2	Point output 2/ Position selection 3		OUT9
CN1-32	IN11	P.OUT3	Point output 3/ Position selection 4		OUT10
CN1-33	IN12	P.OUT4	Point output 4/ Speed selection		OUT11
CN1-34	IN13	P.OUT5	Point output 5		OUT12
CN1-35	IN14	P.OUT6	Point output 6		OUT13

Note The “internal allocations” are the numbers allocated in the CPU Unit.

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Control Input Details

DIO	CN1-1	CompoBus/S	CN4-1	
CCWL	CCW limit			N.C. condition

- Pin No. 1 is the plus (+) direction limit input signal. When this signal is not being input (ON), the motor cannot be rotated in the plus (+) direction.
- If this signal turns OFF during motor rotation in the plus (+) direction, the motor will be stopped according to the PP-25 (alarm selection) setting.

DIO	CN1-2	CompoBus/S	CN4-2	
CWL	CW limit			N.C. condition

- Pin No. 2 is the minus (–) direction limit input signal. When this signal is not being input (ON), the motor cannot be rotated in the minus (–) direction.
- If this signal turns OFF during motor rotation in the minus (–) direction, the motor will be stopped according to the PP-25 (alarm selection) setting.

DIO	CN1-3	CompoBus/S	CN4-3	
ORG	Origin proximity			N.O. condition

- Pin No. 3 is the input for determining the mechanical origin.
- When an origin search is executed, operation stops at the motor's Z-phase position and the origin is determined after the origin proximity signal turns from ON to OFF during motor rotation in the direction set by PP-19 (origin search direction).
- When PP-06 and PP-07 (leftmost and rightmost digits for the origin compensation amount) are set, positioning will be executed from this position by the amount set for origin compensation, and then that compensated position will be taken as the mechanical origin.

DIO	CN1-4	CompoBus/S	OUT0	
RUN	RUN command			N.O. condition

The pin No. 4 signal input turns ON the power to drive the motor and begins motor operation. If this signal is not input (turned ON), the motor cannot be driven.

DIO	CN1-5	CompoBus/S	OUT1	
START	START			N.O. condition

- The pin No. 5 signal input executes the specified positioning (point No. input or direct input).
- When this signal is input (turned ON), the motor is operated and positioning is executed based on the positioning data.

DIO	CN1-6	CompoBus/S	OUT2	
RESET	Alarm reset			N.O. condition

- This is the alarm's external reset signal.
- When this signal is input (turned ON), the alarm is cleared and the alarm output is turned ON. (The alarm will not be cleared, however, if the alarm condition remains in effect.)
- If this signal is input under normal conditions (i.e., when no alarm is generated), the motor is decelerated to a stop according to the deceleration time.
- When positioning is being executed according to PTP data, the point number is taken again.
- When an alarm is generated, remove the cause of the alarm before beginning operation again. For safety's sake, turn OFF the RUN command before inputting the alarm reset signal.

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DIO	CN1-7	CompoBus/S	OUT3
SEARCH	Origin search		N.O. condition

- The pin No. 7 signal input begins an origin search or origin teaching operation.
- When this signal is input (turned ON) while RUN is ON, an origin search operation is executed. (The motor rotates in the direction set in PP-19 (origin search direction).
- When this signal is input (turned ON) while RUN is OFF, an origin teaching operation is executed. If the teaching (TEACH) signal is turned ON while the origin search signal is ON, the position at that time will be automatically taken into PP-06/PP-07 (origin compensation amount) as the origin compensation amount.

DIO	CN1-8	CompoBus/S	OUT4
+JOG	+JOG operation		N.O. condition

- The pin No. 8 signal input rotates the motor in the + JOG direction at the JOG speed.
- While this signal is being input (i.e., while it is ON), the motor rotates in the forward direction at the speed set in PP-16 (JOG speed).

DIO	CN1-9	CompoBus/S	OUT5
–JOG	–JOG operation		N.O. condition

- The pin No. 9 signal input rotates the motor in the – JOG direction at the JOG speed.
- While this signal is being input (i.e., while it is ON), the motor rotates in the reverse direction at the speed set in PP-16 (JOG speed).

DIO	CN1-10	CompoBus/S	OUT6
TEACH	Teach		N.O. condition

□Teaching [Origin established, UP-01 (Control Mode) = 11 or 12, Origin search signal OFF]

- This is the signal input for automatically taking the PTP data's position data.
- When this signal is input (turned ON), the motor's present value is taken as an absolute value to the position data for the PTP data (Pd-) selected by the point selection signal.

□Taking Direct Positioning Data [Origin established, UP-01 (Control Mode) = 13 or 14, RUN command OFF, origin search signal OFF]

- This is the signal input for taking the positioning data (position, speed) from the control input.
- When this signal is input (turned ON), the position and speed data are taken sequentially from the positioning data inputs (P.IN 0 to 7), two digits at a time, beginning from the rightmost digits.
- The position and speed selection signals (P.OUT 0 to 4) are output as data request signals.

□Origin Teaching [Origin established, RUN command OFF, origin search signal ON]

- This is the input signal for automatically taking the origin compensation amount.
- When this signal is input (turned ON), the motor's present value is taken into PP-06/PP-07 (origin compensation amount) as the origin compensation amount, at the encoder/resolver resolution conversion.

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DIO	CN1-11 to 18	CompoBus/S	OUT8 to 15	
P.IN0 to 7	Point selection / Position data			N.O. condition

□Point Selection 0 to 6 [UP-01 (Control Mode) = 11 or 12]

- This is the signal input for selecting positioning data from PTP data.
- The range of data is 1 to 64, in BCD.
- Point selections 0 to 3 become the data input for digit 10^0, and point selections 4 to 6 become the data input for digit 10^1.

  Example: When point No. 12 is set.

Point selection

6	5	4	3	2	1	0
0	0	1	0	0	1	0

0: OFF, 1: ON

□Positions 0 to 7 [UP-01 (Control Mode) = 13 or 14]

- This is the positioning data signal input.
- The range of data is 0 to 99, in BCD (up to a maximum of “F9,” for the position’s leftmost digits only).
- The 32 bits for the position data and the 8 bits for the speed data are taken eight bits at a time. At this time the position and speed selection signals (P.OUT 0 to 4) are output as data request signals. Refresh the input data according to the data request signals.
- If the speed is set to “0,” it will be taken as 100%.

DIO	CN1-20	CompoBus/S	CN4-4 / OUT7	
STOP	Deceleration stop			N.C. condition

- This is the signal input for forcibly stopping motor rotation.
- While this signal is not being input (ON), the motor cannot be driven.
- With the CompoBus/S Position Drivers, the motor cannot be driven unless the external control signal input (CN4-4) and the CompoBus/S input (OUT7) are both input.
- The method for stopping the motor depends on the set value for PP-24 (deceleration stop mode).

Control Output Details

DIO	CN1-21	CompoBus/S	CN4-8 / IN0
BO	Brake output		

- When UP-16 (brake mode) is set to 1, 2, or 3 (brake retention), the timing signal for applying the electromagnetic brake is output. If the motor’s rotation speed falls below the UP-28 (brake-ON r/min) set value under the following circumstances, the output will be turned OFF and the electromagnetic brake will be operated.

  When the RUN signal has been turned OFF.

  When an error shutting OFF the power to the motor has occurred.

  When a deceleration stop turns OFF while PP-24 (deceleration stop mode) is set to 0 (free-run stop).
- When UP-16 is set to 0 (dynamic brake), the timing signal for applying the dynamic brake is output. Under the following circumstances the output is turned OFF and the dynamic brake is operated.

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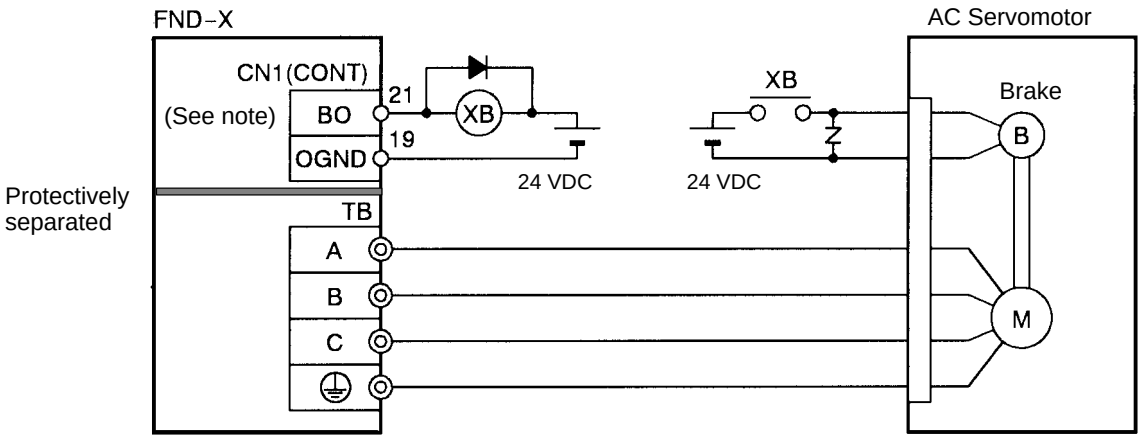
When the RUN signal has been turned OFF.

When an error shutting OFF the power to the motor has occurred.

When a deceleration stop turns OFF while PP-24 (deceleration stop mode) is set to 0 (free-run stop).

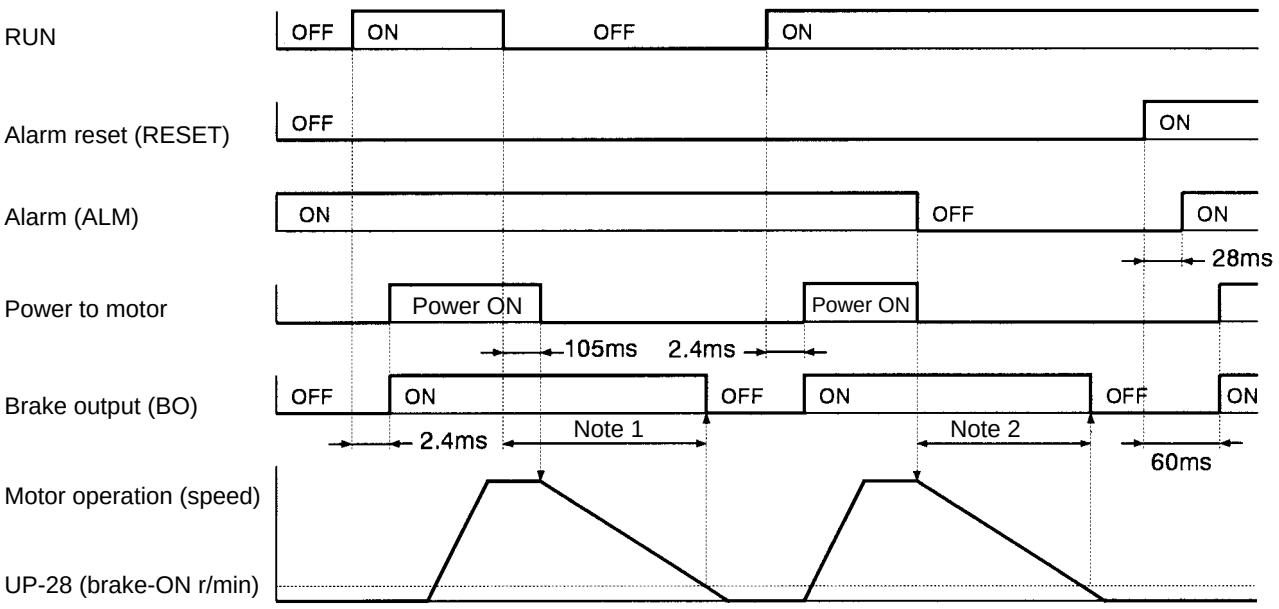
Electromagnetic Brake Wiring and Operational Sequence

• Wiring



Note With the CompoBus/S Position Drivers, outputs are made to CN4 (LIMIT). BO (CN4 to 8) and OGND (CN4 to 14) are provided. For controlling brake drive bits, use the CN4 to CN8 pin outputs.

• Operational Sequence



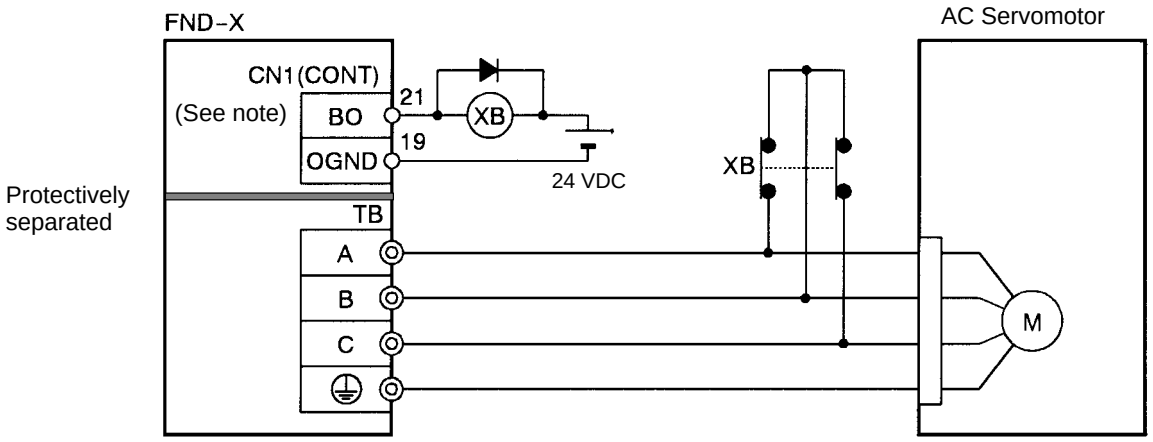
Note 1. When the motor is stopped, the brake output turns OFF in approximately 2.4 ms.

Note 2. When the motor is stopped, the brake output turns OFF in approximately 0.8 ms.

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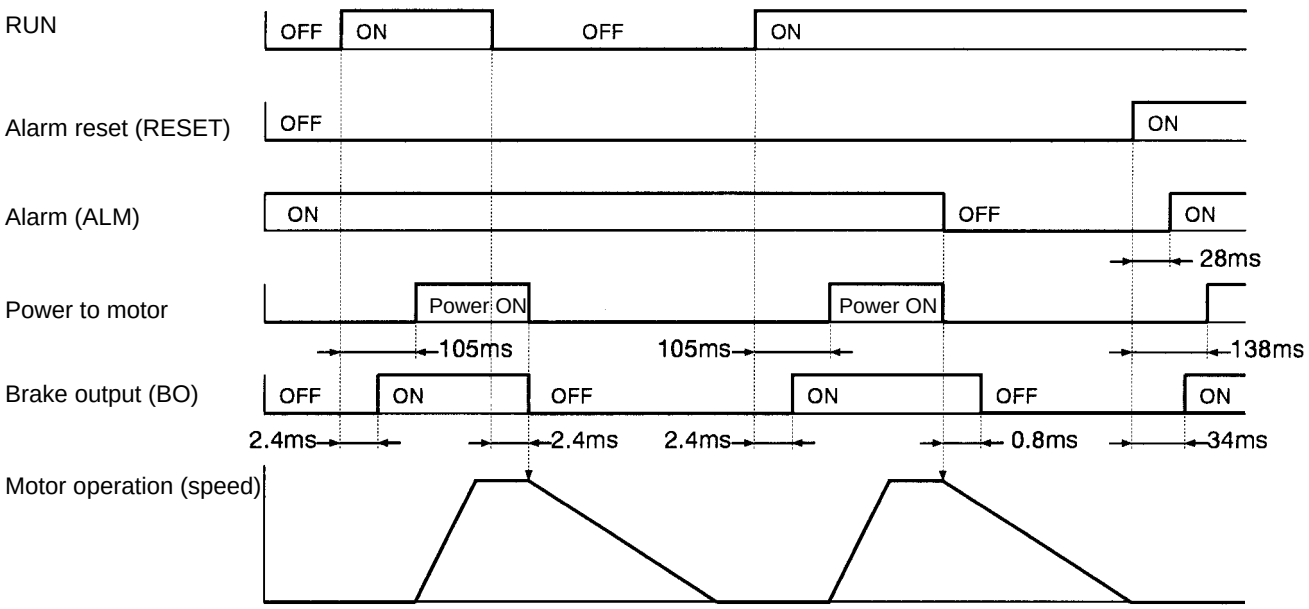
Dynamic Brake Wiring and Operational Sequence

- **Wiring**



Note With the CompoBus/S Position Drivers, outputs are made to CN4 (LIMIT). BO (CN4 to 8) and OGND (CN4 to 14) are provided. For controlling dynamic brake drive bits, use the CN4 to CN8 pin outputs.

- **Operational Sequence**



DIO	CN1-22	CompoBus/S	IN1
READY	READY		

- This output turns ON when the input signal processing is completed and the origin search, start, teach, and point selection signal inputs are ready.
- The output turns OFF when position data is taken and positioning begins, and turns ON when the processing is completed. The time set for HP-46 (positioning completed timer) must be OFF.
- While this signal is OFF, any START signal that is input will be invalid.

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DIO	CN1-23	CompoBus/S	IN2
S.COM	Origin search completed		

- This output turns ON when the mechanical origin is established.
- The output conditions are as follows:

  When a motor with an absolute-value encoder is connected, the signal turns ON when the power supply is input.

  When a motor with an incremental encoder or resolver is connected:

  When UP-01 (control mode) is 11 or 13, the signal turns ON after origin search is completed.
  When UP-01 (control mode) is 12 or 14, the signal turns ON when the power supply is input.

DIO	CN1-24	CompoBus/S	IN3
ORGSTP	Origin stop		

The output turns ON when the motor is stopped at the mechanical origin.

DIO	CN1-25	CompoBus/S	IN4
T.COM	Teaching completed		

- This output turns ON when the teaching input processing is completed.
- The output turns OFF when the teaching input turns OFF.

DIO	CN1-26	CompoBus/S	IN5
RUNON	Motor running		

This output turns ON when the RUN command is input to the motor and power begins to flow to the motor.

DIO	CN1-27	CompoBus/S	IN6
INP	Positioning completed		

- This output turns ON when error counter residual pulses are within the UP-07 (positioning completed range) setting.
- The output turns OFF when positioning begins.
- After positioning is completed, the output remains ON until the time set for HP-46 (positioning completed timer) elapses.

DIO	CN1-28	CompoBus/S	IN7
$\overline{\text{ALM}}$	Alarm		

- This output turns OFF when the driver detects an error.
- The output is OFF when the power supply is turned ON, and the output turns ON when the initial processing is completed.

DIO	CN1-29 to 35	CompoBus/S	IN8 to 14
P.OUT0 to 6	**Point output / Position selection, speed selection**		

□Point Outputs 0 to 6 [UP-01 (Control Mode) = 11 or 12]

- The PTP data number that is waiting or being executed is output.
- The range of output data is 0 to 64, in BCD. (0: When point selection not input.)

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- Point outputs 0 to 3 become the data output for digit 10^0, and point outputs 4 to 6 become the data output for digit 10^1.

  Example: When point No. 12 is selected.

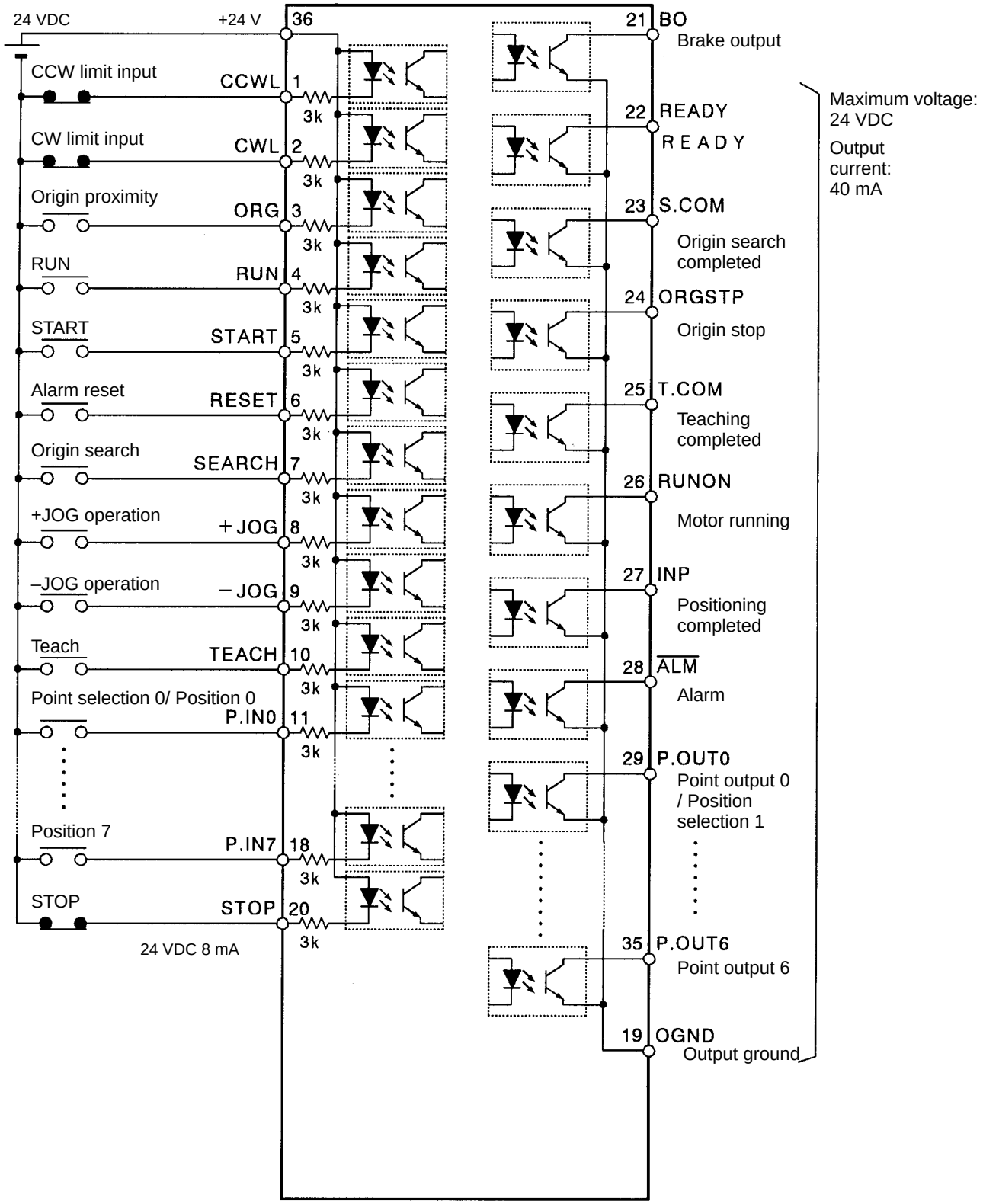
Point output	6	5	4	3	2	1	0	
	0	0	1	0	0	1	0	0: OFF, 1: ON

□Position Selection 1 to 4 [UP-01 (Control Mode) = 13 or 14]

- This is the request signal output for obtaining positioning data.
- Refresh the data for positions 0 to 7 (P.IN 0 to 7) according to the data request signals.
- The output ON time can be set by PP-26 (selection signal output time). Adjust this parameter when inputting data from a source such as a Programmable Controller.

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Control I/O Connections and External Signal Processing (DIO Position Drivers)

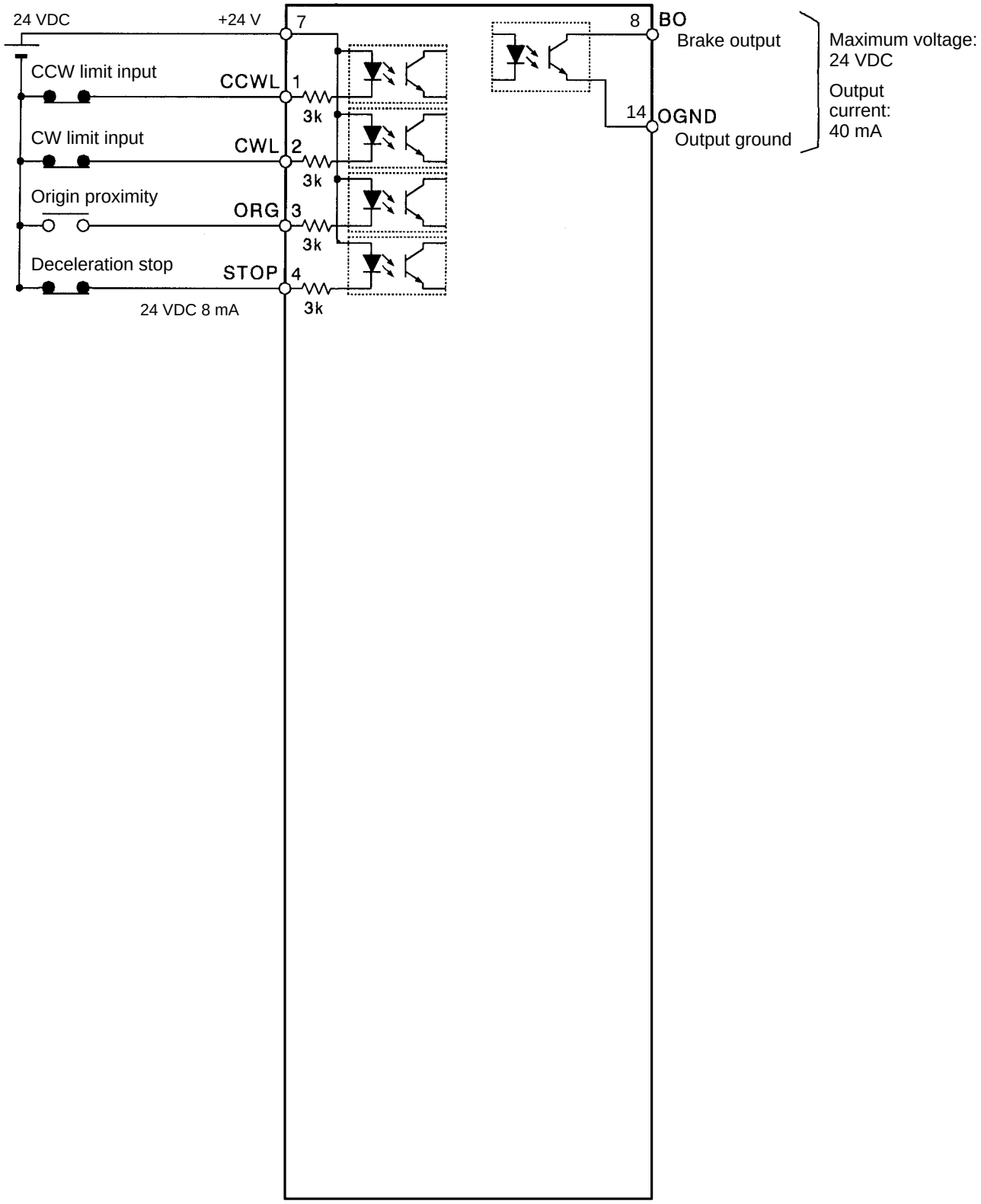


Note 1. The wiring for control inputs P.IN 1 to 6 is omitted. The input circuitry is the same as for P.IN0.

Note 2. The wiring for control inputs P.OUT 1 to 5 is omitted. The output circuitry is the same as for P.OUT 0.

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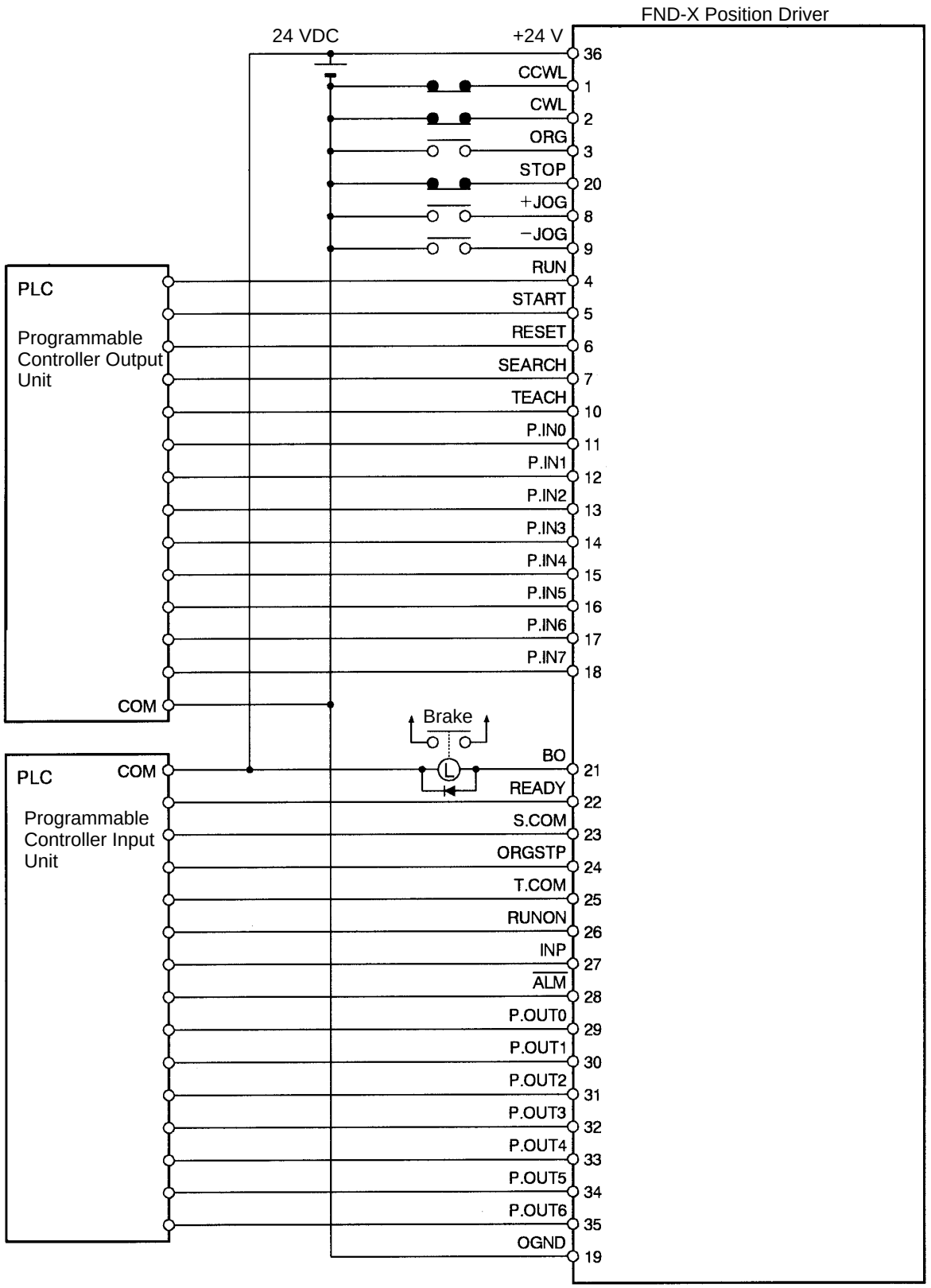
Control I/O Connections and External Signal Processing (CompoBus/S Position Drivers)



Note The Servomotor cannot be driven if the deceleration stop signal if OFF for the external control input (CN4-4) or the CompoBus/S input (OUT7).

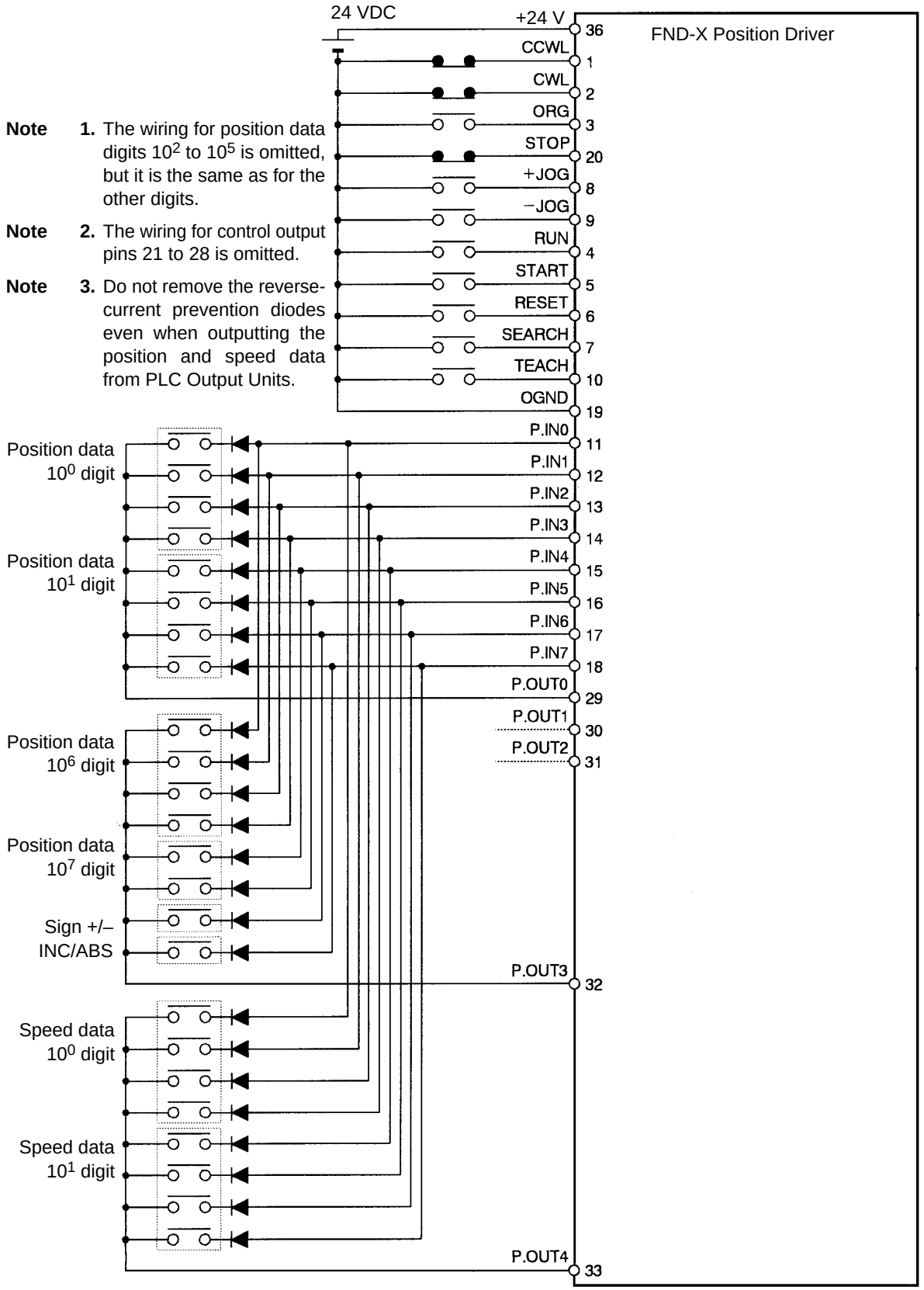
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Example: Connecting DIO Position Drivers to a Programmable Controller



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Example: Connecting DIO Position Drivers to Thumbwheel Switch (Positioning Data Designation by Direct Input)



Note **1.** The wiring for position data digits 10^2 to 10^5 is omitted, but it is the same as for the other digits.

Note **2.** The wiring for control output pins 21 to 28 is omitted.

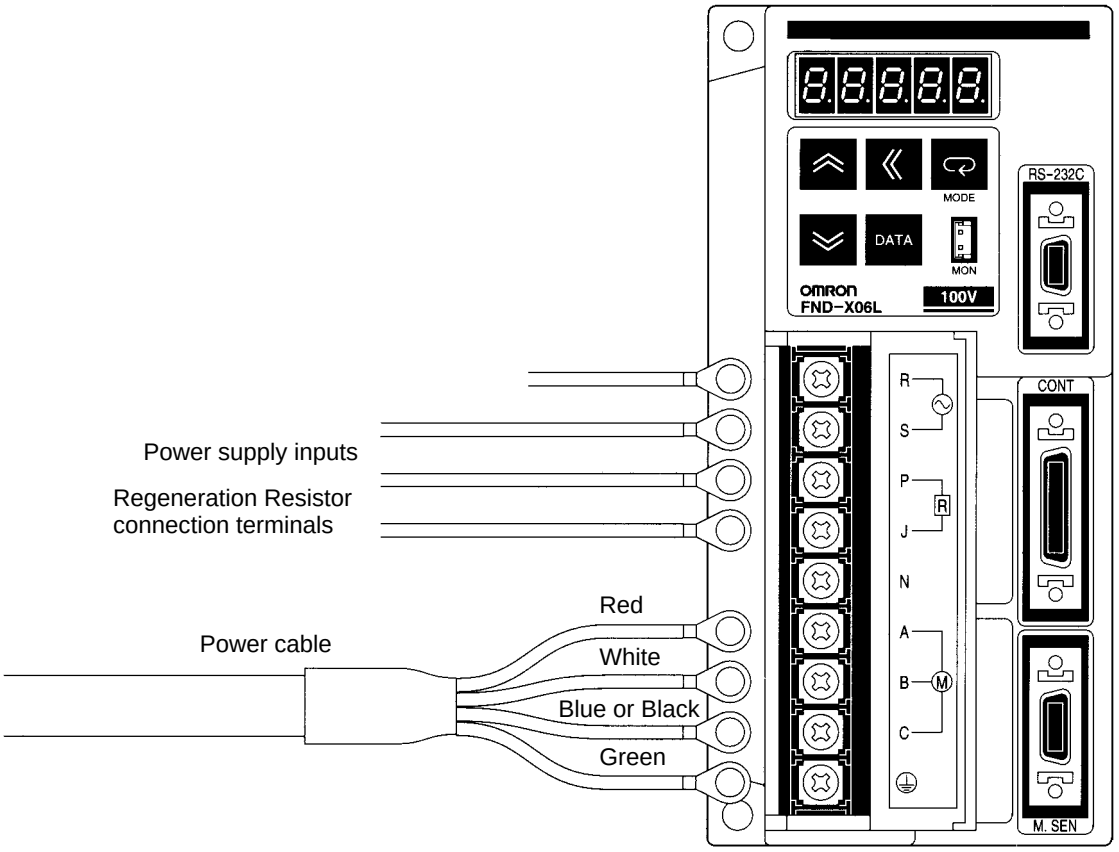
Note **3.** Do not remove the reverse-current prevention diodes even when outputting the position and speed data from PLC Output Units.

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2-2-3 Wiring Terminal Blocks

Provide proper wire diameters, ground systems, and noise resistance when wiring terminal blocks.

Wiring FND-X06 to X25 Terminal Blocks



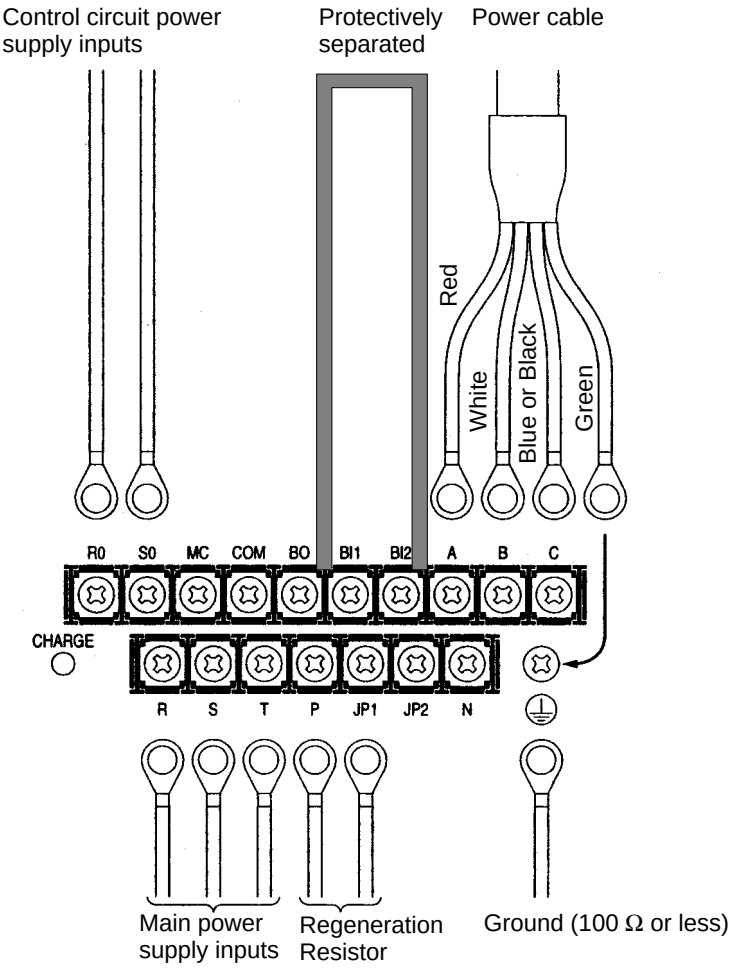
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Terminal label	Name	Function	
R S	Power supply input	The commercial power supply input terminals for the main circuit and the control circuits. FND-X H- : Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz FND-X L- : Single-phase 100/115 VAC (85 to 127 V) 50/60 Hz	
P J	Main circuit DC output Regenerative Resistor connection terminals	Connector terminals for the R88A-RR20030 or R88A-RR40030 Regenerative Resistor, which will be required if there is excessive regenerative energy. (see note)	
N	Main circuit DC output	Main circuit DC output terminal.	
A	Phases A and U motor output	Red	These are the output terminals to the Servomotor. Be careful to wire them correctly. OMNUC Servomotors can be connected to these terminals with R88A-CAU Cable (for U-series Servomotors) or R88A-CAH Cable (for H-series Servomotors). OMRON does not provide a cable to connect these terminals to OMNUC M-series Servomotors, so the user must provide an appropriate cable if an M-series Servomotor is used.
B	Phases B and V motor output	White	
C	Phases C and W motor output	Blue or black	
⏚	Frame ground	Green	Ground (to 100 Ω or less). This terminal is used for both motor output and power supply input.

Note Refer to *3-10 Regenerative Energy Absorption* for the methods to calculate regenerative energy.

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Wiring FND-X50 Terminal Blocks



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Terminal label	Name	Function	
R0	Control circuit power supply input	The commercial power supply input terminals for the control circuits.	
S0		Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz	
R	Main power supply input	The commercial power supply input terminals for the main circuits.	
S			
T		Three-phase 200/240 VAC (170 to 264 V) 50/60 Hz	
P	Main circuit DC output Regenerative Resistor connection terminals	Connector terminals for the R88A-RR20030 or R88A-RR40030 Regenerative Resistor, which will be required if there is excessive regenerative energy. In this case, remove the short bar between JP1 and JP2. (see note)	
J1			
J2			
N	Main circuit DC output	Main circuit DC output terminal.	
MC	Not used.	Do not connect anything to these terminals and do not remove the short bar between BI1 and BI2.	
COM			
BO			
BI1			
BI2			
A	Phases A and U motor output	Red	These are the output terminals to the Servomotor. Be careful to wire them correctly. OMNUC Servomotors can be connected to these terminals with R88A-CAUB Cable (for U-series Servomotors). OMRON does not provide a cable to connect these terminals to OMNUC M-series Servomotors, so the user must provide an appropriate cable if an M-series Servomotor is used.
B	Phases B and V motor output	White	
C	Phases C and W motor output	Blue or black	
⏚	Frame ground	Green	Ground (to 100 Ω or less). This terminal is used for both motor output and power supply input.

Note Refer to *3-10 Regenerative Energy Absorption* for the methods to calculate regenerative energy.

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Terminal Block Current and Wire Sizes

The following table shows the rated effective currents flowing to the Position Driver's terminal block, and also the sizes of the electrical wires.

☐Position Drivers with 200-VAC Input (FND-X H-)

Driver		FND-X06H-	FND-X12H-	FND-X25H-	FND-X50H-
Main power supply input terminals (R, S, T)	Effective current	2.1 A	4.9 A	10.1 A	16 A
	Wire size	0.75 mm^2		1.25 mm^2	
	Tightening torque	1.3 N·m			
Control circuit power supply input terminals (R0, S0)	Effective current	---			0.35 A
	Wire size	---			0.75 mm^2
	Tightening torque	---			1.3 N·m
Motor output terminals (A, B, C, PE)	Effective current	1.4 A	3.4 A	5.7 A	14.1 A
	Wire size	0.75 mm^2		1.25 mm^2	2.0 mm^2
	Tightening torque	1.3 N·m			
Frame ground terminal (PE)	Wire size	0.75 mm^2		1.25 mm^2	2.0 mm^2
	Tightening torque	1.3 N·m			

☐Position Drivers with 100-VAC Input (FND-X L-)

Driver		FND-X06L-	FND-X12L-
Main power supply input terminals (R, S)	Effective current	2.9 A	3.3 A
	Wire size	0.75 mm^2	
	Tightening torque	1.3 N·m	
Motor output terminals (A, B, C, PE)	Effective current	1.4 A	2.1 A
	Wire size	0.75 mm^2	
	Tightening torque	1.3 N·m	
Frame ground terminal (PE)	Wire size	0.75 mm^2	
	Tightening torque	1.3 N·m	

Wire Sizes and Allowable Current

The following table shows allowable currents when there are three electrical wires. Use values equal to or lower than the specified values.

☐Heat-resistant Vinyl Wiring, UL1007, Rated Temperature 80°C (Reference Value)

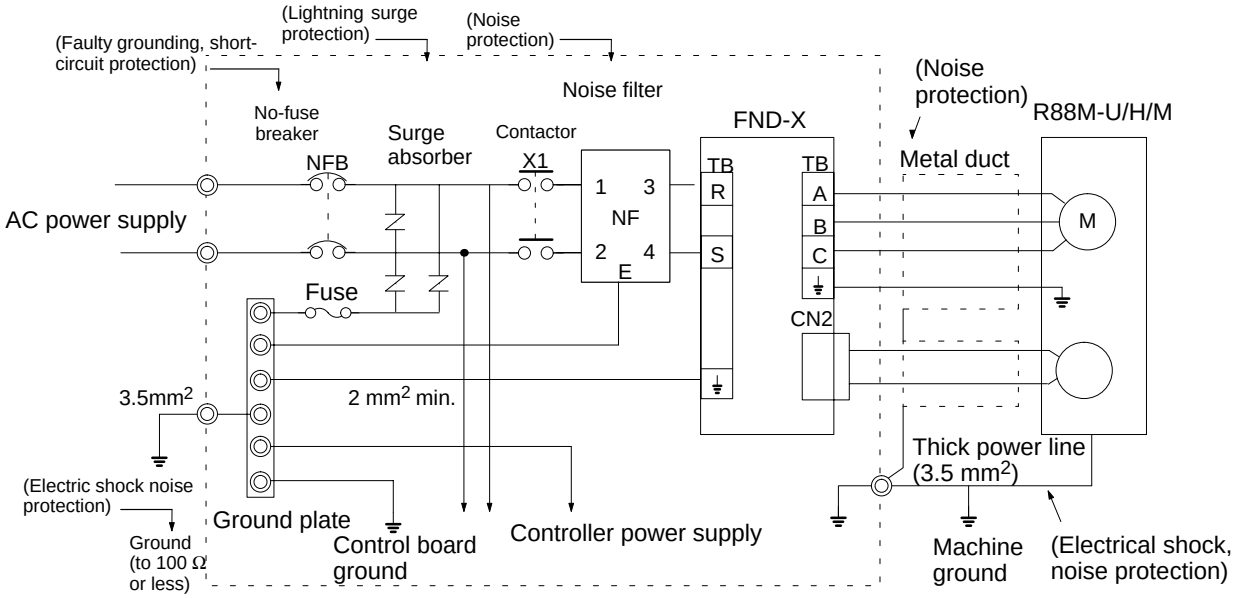
AWG size	Nominal cross-sectional area (mm^2)	Configuration (wires/mm^2)	Conductive resistance (Ω/km)	Allowable current (A) for ambient temperature		
				40°C	50°C	60°C
20	0.5	19/0.18	39.5	6.6	5.6	4.5
---	0.75	30/0.18	26.0	8.8	7.0	5.5
18	0.9	37/0.18	24.4	9.0	7.7	6.0
16	1.25	50/0.18	15.6	12.0	11.0	8.5
14	2.0	7/0.6	9.53	23	20	16
12	3.5	7/0.8	5.41	33	29	24
10	5.5	7/1.0	3.47	43	38	31

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2-2-4 Wiring for Noise Resistance

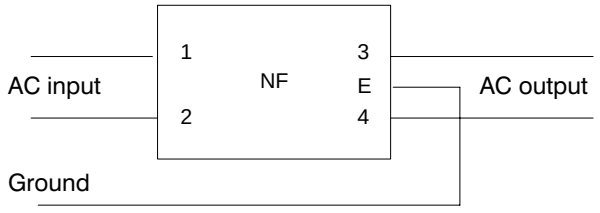
□Wiring Method for FND-X06 to -X25

Noise resistance will vary greatly depending on the wiring method used. Resistance to noise can be increased by paying attention to the items described below.

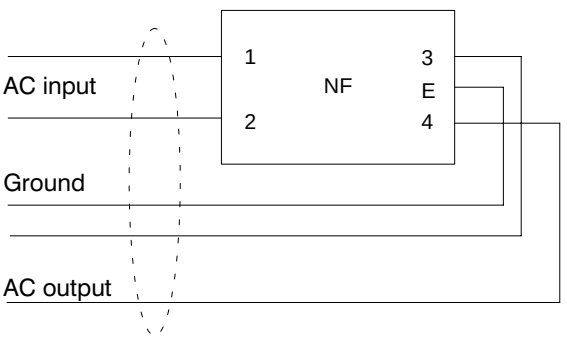


- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Use a grounding plate for the frame ground for each Unit, as shown in the illustration, and ground to a single point.
- Use ground lines with a minimum thickness of 3.5 mm^2, and arrange the wiring so that the ground lines are as short as possible.
- If no-fuse breakers are installed at the top and the power supply line is wired from the lower duct, use metal tubes for wiring and make sure that there is adequate distance between the input lines and the internal wiring. If input and output lines are wired together, noise resistance will decrease.
- No-fuse breakers, surge absorbers, and noise filters (NF) should be positioned near the input terminal block (ground plate), and I/O lines should be isolated and wired using the shortest means possible.
- Wire the noise filter as shown at the left in the following illustration. The noise filter should be installed at the entrance to the control panel whenever possible.

Right: Separate input and output

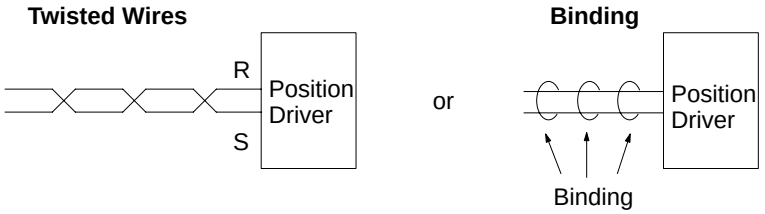


Wrong: Noise not filtered effectively



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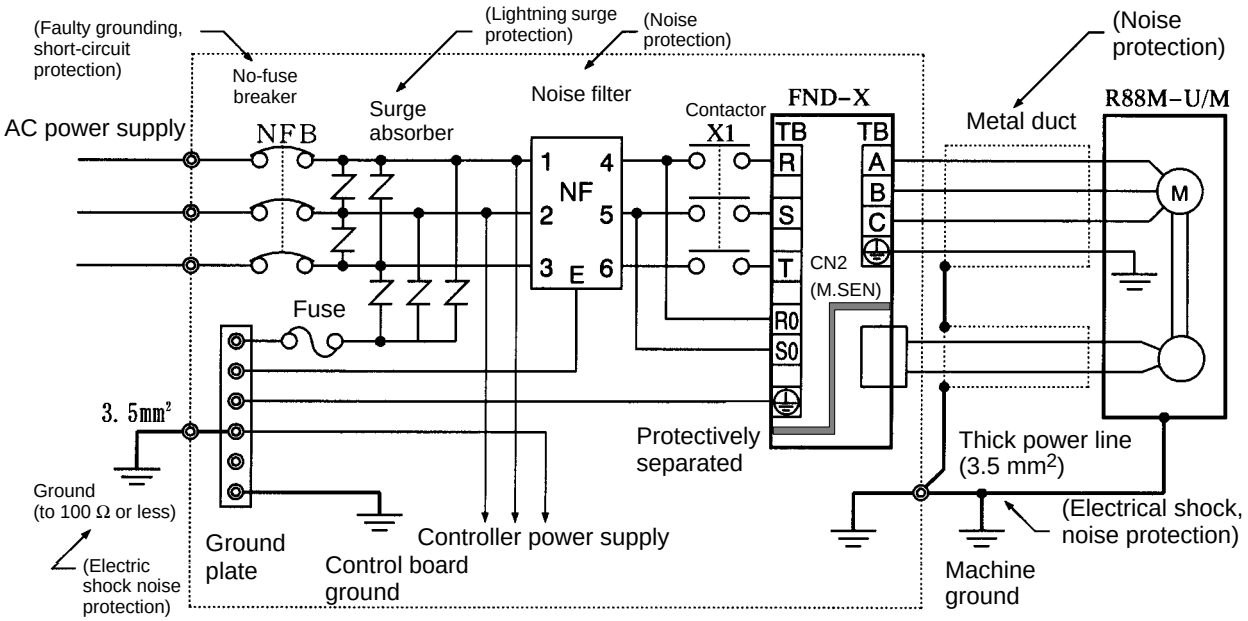
- Use twisted-pair cables for the power supply cables whenever possible, or bind the cables.



- Separate power supply cables and signal cables when wiring.

□Wiring Method for FND-X50H-

Noise resistance will vary greatly depending on the wiring method used. Resistance to noise can be increased by paying attention to the items described below.

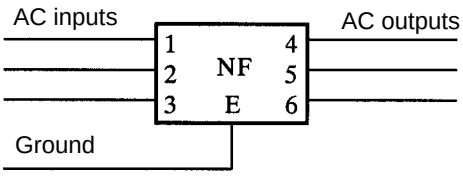


- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Use a grounding plate for the frame ground for each Unit, as shown in the illustration, and ground to a single point.
- Use ground lines with a minimum thickness of 3.5 mm^2, and arrange the wiring so that the ground lines are as short as possible.
- If no-fuse breakers are installed at the top and the power supply line is wired from the lower duct, use metal tubes for wiring and make sure that there is adequate distance between the input lines and the internal wiring. If input and output lines are wired together, noise resistance will decrease.
- No-fuse breakers, surge absorbers, and noise filters (NF) should be positioned near the input terminal block (ground plate), and I/O lines should be isolated and wired using the shortest means possible.

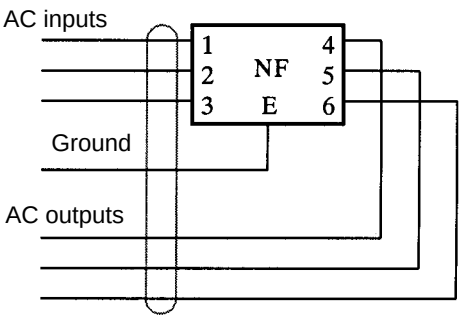
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- Wire the noise filter as shown at the left in the following illustration. The noise filter should be installed at the entrance to the control panel whenever possible.

Right: Separate input and output

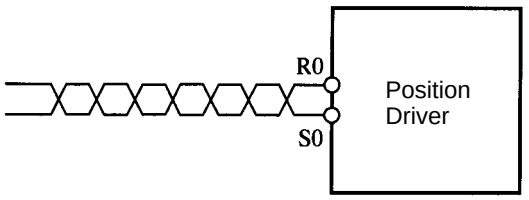


Wrong: Noise not filtered effectively

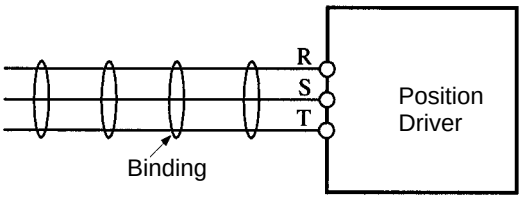


- Use twisted-pair cables for the power supply cables whenever possible, or bind the cables.

Twisted Wires



Binding



- Separate power supply cables and signal cables when wiring.

□Selecting Components

This section explains the standards for selecting the required components for improving noise resistance. When selecting components, it is necessary to understand characteristics such as the capacity, performance, applicable range, and so on. For details regarding any of the recommended products listed in the tables below, contact their respective makers.

No-fuse Breakers

When selecting no-fuse breakers, take into consideration the maximum output current and the inrush current. The momentary maximum output for a servo system is approximately three times that of the rated output, and a maximum output of three seconds can be executed. Therefore, select no-fuse breakers with an operating time of at least five seconds at 300% of the rated maximum output. General-purpose and low-speed no-fuse breakers are generally suitable. Refer to the table in *2-2-3 Wiring Terminal Blocks* for the power supply input currents for each motor, and then add the current consumption for the number of shafts, other controllers, etc., to make the selection.

The Position Driver inrush current flows at a maximum of 50 A for 20 ms when 200 V is input. With low-speed no-fuse breakers, a inrush current 7 to 8 times the rated current flows for 0.1 second. When making the selection, take into consideration the entire inrush current for the system.

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Surge Absorbers

Use surge absorbers to absorb surges from power supply input lines due to lightning, abnormal voltages, etc. When selecting surge absorbers, take into account the varistor voltage, the amount of surge immunity, and the amount of energy resistance. For 200-VAC systems, use a varistor voltage of 470 V. The surge absorbers shown in the following table are recommended.

Maker	Model	Varistor voltage	Max. limit voltage	Surge immunity	Energy resistance	Fuse capacity	Type
Matsushita Electric Industrial	ERZC10DK471 (W)	470 V	775 V	1,250 A	45J	3 to 5 A	Tester
	ERZC14DK471 (W)	470 V	775 V	2,500 A	80J	3 to 10 A	
	ERZC20DK471 (W)	470 V	775 V	4,000 A	150J	5 to 15 A	
	ERZC20EK471 (W)	470 V	775 V	5,000 A	150J	---	Block
Ishizuka Electric	Z10L471	470 V	773 V	1,000 A	15W s	3 to 5 A	Tester
	Z15L471	470 V	738 V	1,250 A	20W s	3 to 5 A	
	Z21L471	470 V	733 V	3,000A	30W s	5 to 10 A	
	Z25M471S	470 V	810 V	10,000 A	235J	---	Block
Okaya Electric Industrial	R A V-781 BWZ-2A	---	783 V	1,000 A	---	---	Block
	R A V-781 BXZ-2A	---	783 V	1,000 A	---	---	
	R-A-V-401-621BYR-2	---	620 V	1,000 A	---	---	

Note 1. The “(W)” for the Matsushita Electric Industrial products indicates that they are UL- and CSA-approved products.

Note 2. Refer to manufacturers documentation for operating details.

Note 3. The surge immunity is for a standard impulse current of 8/20 μs. If pulses are wide, either decrease the current or change to a larger-capacity surge absorber.

Note 4. The energy resistance is the value at 2 ms. At 700 V or less, high-energy pulses may not be avoidable. In that case, use an insulated transformer or reactor for surge absorption.

Noise Filters for Power Supply Input

- Use a noise filter for external noise attenuation and for the reduction of radiation noise from the Position Driver.
- Select a noise filter with a rated current of at least double that of the Driver’s input current.
- The noise filters shown in the following table can be used for 40-dB attenuation of noise between 200 kHz and 30 MHz.

Maker	Model	Rated current	Remarks
Tokin	LF-210N	10 A	For single phase
	LF-215N	15 A	
	LF-220N	20 A	
	LF-315K	15 A	For three phase
	LF-325K	25 A	

Note 1. For attenuating noise in a low-frequency band of less than 200 kHz, use an insulated transformer and a noise filter.

Note 2. For attenuating noise in a high-frequency band of more than 30 MHz, use a ferrite core and a high-frequency noise filter employing a through-type capacitor.

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Noise Filters for Servomotor Output

- For Servomotor output lines, use a filter type without a built-in capacitor.
- The following table shows recommended noise filters for Servomotor output lines.

Maker	Model	Rated current	Remarks
Tokin	LF-310KA	10 A	3-phase block noise filter
	LF-320KA	20 A	
	ESD-R-47B	---	EMI core for radiation noise
Fuji Electrochemical	RN80UD	---	10 turns for radiation noise

Note The same noise filter cannot be used for Servomotor output lines as for the power supply.

⚠ **Caution** Ordinary noise filters are created for a power supply frequency of 50/60 Hz, so connecting an output of 10 kHz (the Position Driver's PWM frequency) can generate an extremely high (approximately 100 time the normal) leakage current flow to the capacitor in the noise filter and cause damage to the Position Driver.

Surge Killers

Install surge killers for loads that have induction coils, such as relays, solenoids, brakes, clutches, etc. The following table shows types of surge killers and recommended products.

Type	Features	Recommended products
Diode	Diodes are relatively small devices such as relays used for loads when reset time is not an issue. The reset time is increased because the surge voltage is the lowest when power is cut OFF. Used for 24/48-VDC systems.	Use a fast-recovery diode with a short reverse recovery time. Fuji Electric Co., ERB44-06 or equivalent
Thyristor or Varistor	Thyristor and varistor are used for loads when induction coils are large, as in electromagnetic brakes, solenoids, etc., and when reset time is an issue. The surge voltage when power is cut OFF is approximately 1.5 times that of the varistor.	Select varistor voltage as follows: 24-VDC system varistor: 39 V 100-VDC system varistor: 200 V 100-VAC system varistor: 270 V 200-VAC system varistor: 470 V
Capacitor + resistor	Use capacitors and resistors for vibration absorption of surge when power is cut OFF. The reset time can be shortened by proper selection of the capacitor or resistor.	Okaya Electric Industrial Co. CR-50500 0.5 μF-50 Ω CRE-50500 0.5 μF-50 Ω S2-A-0 0.2 μF-500 Ω

Note Thyristors and varistors are made by the following companies. Refer to manufacturers documentation for operating details.
Thyristors: Ishizuka Electronics Co.
Varistors: Ishizuka Electronics Co., Matsushita Electric Industrial Co.

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Contactors

When selecting contactors, take into consideration the circuit's inrush current and the momentary maximum current. The Position Driver inrush current is 50 A, and the momentary maximum current is approximately twice the rated current. The following table shows the recommended contactors.

Maker	Model	Rated current	Momentary maximum current	Coil voltage
OMRON	G6C-2BND	10 A	---	24 VDC
	LY2-D	10 A	---	24 VDC
	G7L-2A-BUBJ	25 A	---	24 VDC, 200 to 240 VAC
	J7AN-E3	15 A	120 A	24 VDC
	LC1D25106	26 A	---	200 VAC
	LP1D25106	26 A	---	24 VDC

Leakage Breakers

- Select leakage breakers designed for inverters.
- Since switching operations take place inside the Position Driver, high-frequency current leaks from the armature of the Servomotor. With inverter leakage breakers, high-frequency current is not detected, preventing the breaker from operating due to leakage current.
- When selecting leakage breakers, also remember to add the leakage current from devices other than the Servomotor, such as machines using a switching power supply, noise filters, inverters, and so on.
- For detailed information on how to select leakage breakers, refer to the catalogs provided by the manufacturers.
- The following table shows the Servomotor leakage currents for each Driver model.

Driver model	Leakage current (direct) (including high-frequency current)	Leakage current (resistor-capacitor, in commercial power supply frequency range)
FND-X06 /X12	35 $mA_{0\text{-}P}$	2 mA_{rms}
FND-X25	40 $mA_{0\text{-}P}$	2 mA_{rms}
FND-X50H	120 $mA_{0\text{-}P}$	3 mA_{rms}

Note 1. Leakage current values shown above are for motor power lines of 10 m or less. The values will change depending on the length of power cables and the insulation.

Note 2. Leakage current values shown above are for normal temperatures and humidity. The values will change depending on the temperature and humidity.

□Improving Encoder and Resolver Cable Noise Resistance

Signals from the encoder are A-phase, B-phase, or S-phase. The A-phase and B-phase frequency is 154 kHz, and the S-phase baud rate is 616K bits/s.

Signals from the resolver are analog voltage signals.

Follow the wiring methods outlined below to improve encoder/resolver noise resistance.

- Be sure to use dedicated encoder and resolver cables.
- If lines are interrupted in the middle, be sure to connect them with connectors, making sure that the cable insulation is not peeled off for more than 50 mm. In addition, be sure to use shielded wire.

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- Do not coil cables. If cables are long and are coiled, mutual induction and inductance will increase and will cause malfunctions. Be sure to use cables fully extended.
- When installing noise filters for encoder cables, use clamp filters. The following table shows the recommended clamp filter models. (Do not use the clamp filters for resolver cables.)

Maker	Name	Model
Tokin	EMI core	ESD-QR-25-1
TDK	Clamp filter	ZCAT2032-0930
		ZCAT3035-1330
		ZCAT2035-0930A

- Do not wire the encoder or resolver cable in the same duct as power cables and control cables for brakes, solenoids, clutches, and valves.

□Improving Control I/O Signal Noise Resistance

Position can be affected if control I/O signals are influenced by noise. Follow the methods outlined below for the power supply and wiring.

- Use completely separate power supplies for the control power supply (especially 24 VDC) and the external operation power supply. In particular, be careful not to connect two power supply ground wires. Install a noise filter on the primary side of the control power supply.
- If the control power supply wiring is long, noise resistance can be improved by adding 1-μF laminated ceramic capacitors between the control power supply and ground at the Position Driver input section and the controller output section.
- Use shielded cable for the control cables, and connect the shield to the connector frame at the Driver.

2-2-5 Wiring Products Conforming to EMC Directives

Position Drivers will meet the requirements of the EMC Directives if they are connected to a U-Series Servomotor that conforms to the EC directives and are wired under the conditions described in this section. If the connected devices, wiring, and other conditions cannot be made to fulfill the installation and wiring conditions when the product is incorporated into a machine, the compliance of the overall machine must be confirmed.

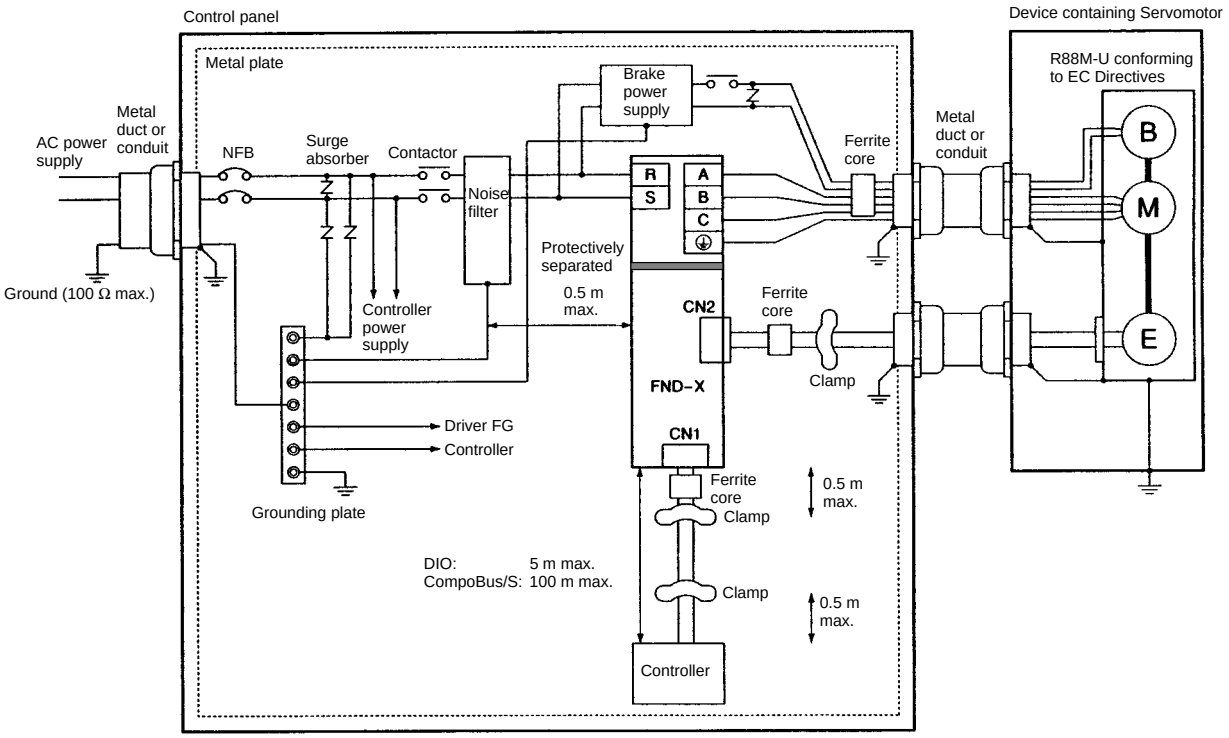
The following conditions must be met to conform to EMC Directives.

- The Position Driver must be installed in a metal case (control panel).
- Noise filters and surge absorbers must be installed on all power supply lines.
- Shielded cables must be used for all I/O signal lines and encoder lines. (Use tin-plated, soft copper wires for the shield weaving.)
- All cables leaving the control panel must be wired in metal ducts or conduits with blades.
- Ferrite cores must be attached to the shielded cable and the shield must be clamped directly to the ground plate to ground it.

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□Wiring Methods

FND-X06 to X25 Position Drivers



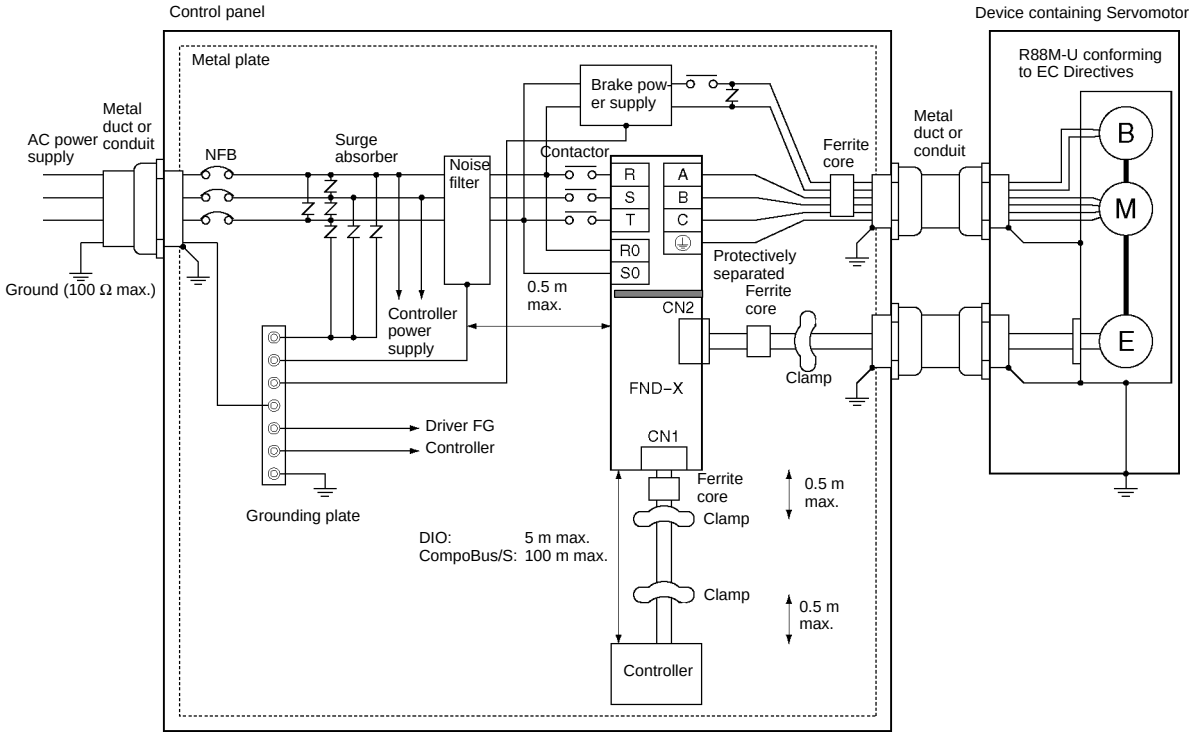
Note 1. The cable winding for the ferrite core must be 1 turn.

Note 2. Remove the sheathes from the cables at the clamps and ground them directly to the metal plate at the clamps.

Note 3. For DIO Position Drivers, remove the sheath from control cables and connect the shield directly to the metal plate. For CompoBus/S Position Drivers, place the control cables in metal ducts or conduits and connect the duct or conduit directly to the metal plate.

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FND-X50H- Position Drivers



Note 1. The cable winding for the ferrite core must be 1 turn.

Note 2. Remove the sheathes from the cables at the clamps and ground them directly to the metal plate at the clamps.

Note 3. For DIO Position Drivers, remove the sheath from control cables and connect the shield directly to the metal plate. For CompoBus/S Position Drivers, place the control cables in metal ducts or conduits and connect the duct or conduit directly to the metal plate.

All Position Drivers

- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Connect the frame ground for each Unit as shown in the diagram and using ground lines as short as possible.
- If no-fuse breakers (MCCB) are installed at the top and the power supply line is wired from the lower duct, use metal tubes for wiring or make sure that there is adequate distance between the input lines and the internal wiring. If input and output lines are wired together, noise resistance will decrease.
- No-fuse breakers (MCCB), surge absorbers, and noise filters (NF) should be positioned near the input terminal block (ground plate), and I/O lines should be isolated and wired using the shortest means possible.

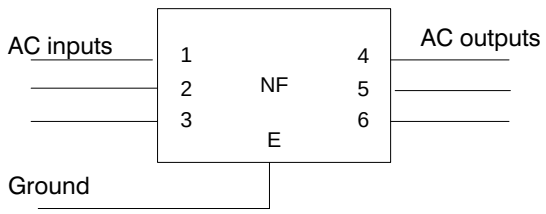
□Noise Filters

- Remove the coating (or mask when coating) from the panel area to which the Position Driver and noise filters are mounted to improve electrical conductivity.
- Locate noise filters as close to the Position Driver as possible and keep the wiring distance between the noise filters and Position Driver as short as possible.

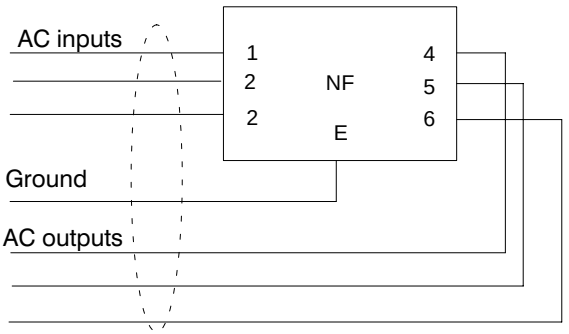
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• Wire the noise filter as shown at the left in the following illustrations.

Good: Separate input and output

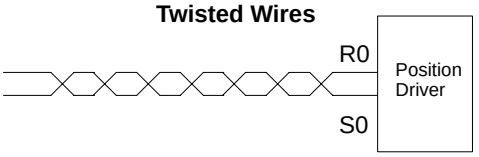


NO: Noise not filtered effectively

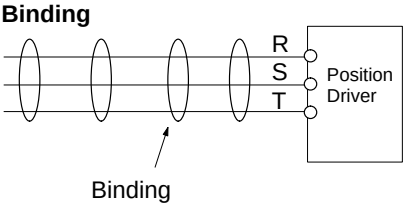


• Use twisted-pair cables for the power supply cables whenever possible, or bind the cables.

Twisted Wires

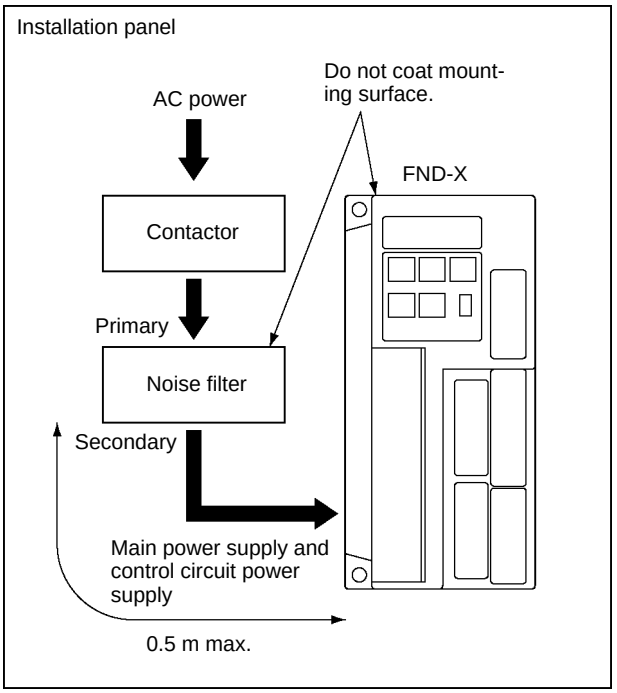


Binding

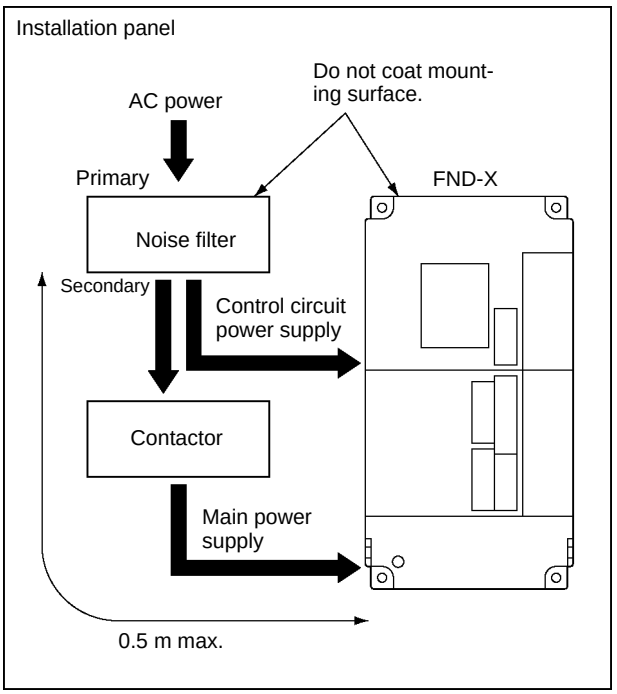


• Separate power supply cables and signal cables when wiring.

FND-X06 to X25 Position Drivers



FND-X50H- Position Drivers



☐Connecting Cables

• Used shielded cables for control cables and encoder cables.

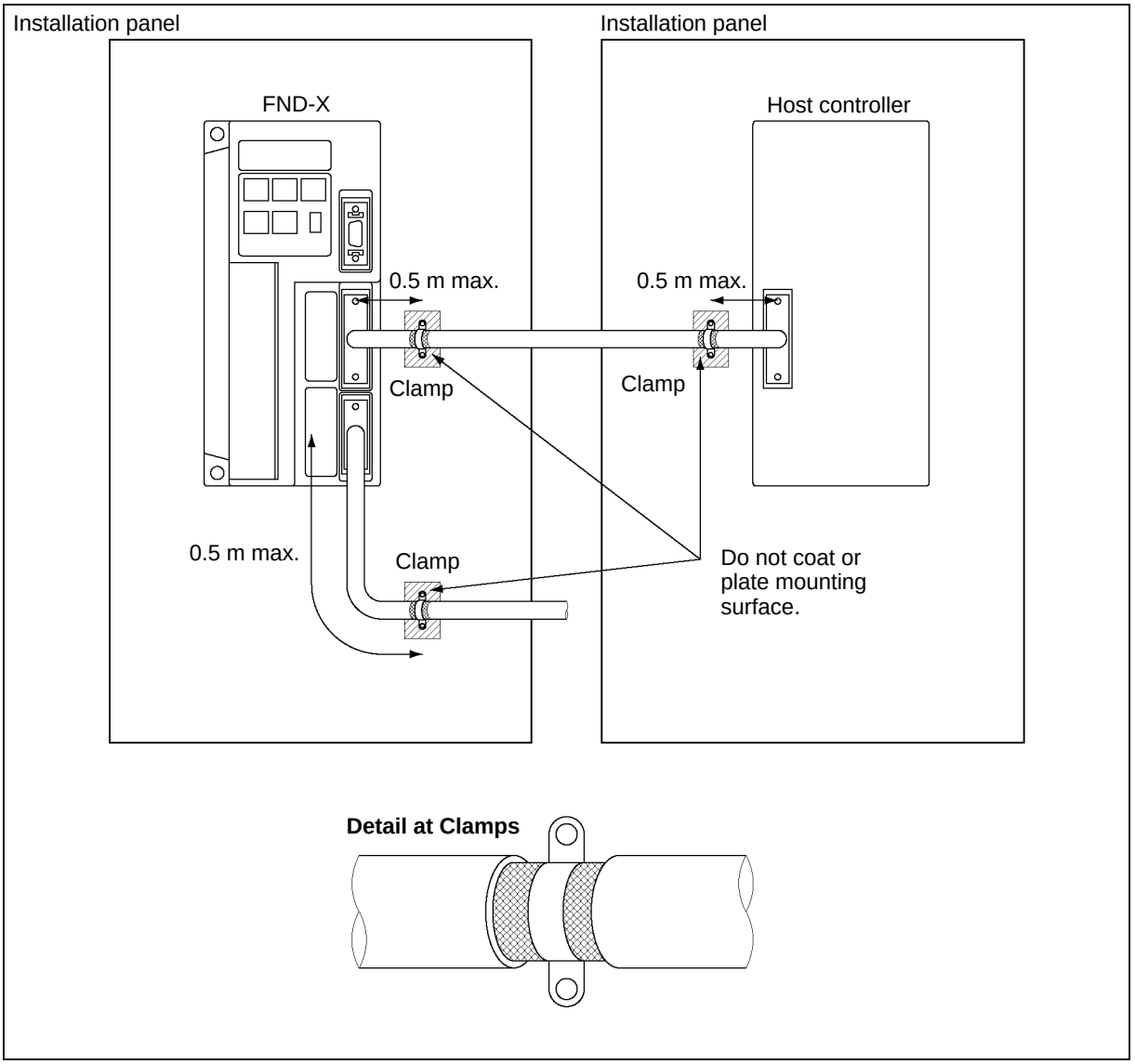
• All cables leaving the control panel must be wired in metal ducts or conduits with blades.

• All power cables and encoder cables to the Servomotors must be 20 m or less.

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- Remove the sheathes from the control cables and encoder cables at the clamps and ground the shield directly at the clamps.
- Ground the metal ducts and conduits with blades
- Attach ferrite cores on all cables as near as possible to the Position Driver.

Shield Connections



□Control Panel Structure

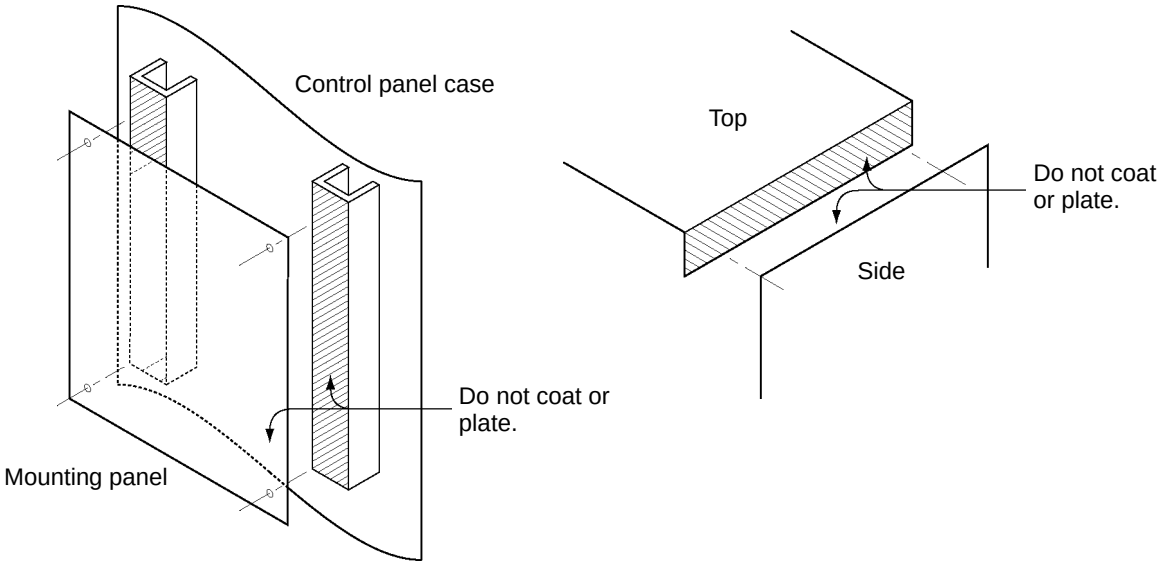
Any gaps in the cable entrances, mounting screws, cover, or other parts of a control panel can allow electric waves to leak from or enter the control panel. The items described in this section must be abided by in panel design and selection to ensure that electric waves cannot leak or enter the control panel.

Case Structure

- Use a metal control panel with welded joints on the top, bottom, and all sides. The case must be electrically conductive.

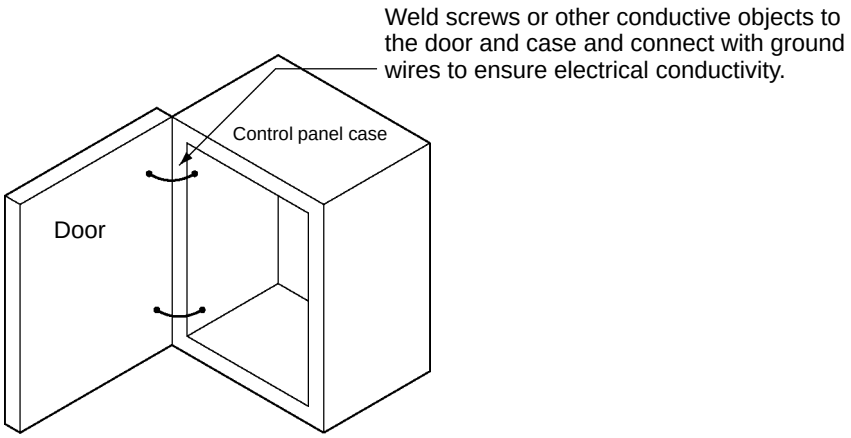
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- When assembling the control panel, remove the coating from all joints (or mask the joints when coating) to ensure electrical conductivity.
- Be sure that no gaps are created when installing the control panel, as gaps can be caused by distortion when tightening screws.
- Be sure there are not any electrically conductive parts that are not in electrical contact.
- Ground all Units mounted in the control panel to the panel case.
- Never open holes in the control panel that are any larger than necessary. Open smaller individual holes (e.g., for individual cables, cooling fans, etc.). Large holes will allow allow electric waves to leak from or enter the control panel.
- Be sure that the panels to check the Position Driver and other Units are mounted are electrically conductive with the control panel.



Door Structure

- Use a metal door.
- Connect the door and the control panel with short wires at several locations to ensure electrical conductivity.
- Be sure that no gaps are created when installing the cover, as gaps can be caused by distortion when tightening screws.



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□Selecting Components

This section describes standards to be considered when selecting components to be connected to reduce noise. Select components after reviewing characteristics such as capacities, performance, and application ranges. Recommended components are listed below for reference. For further details, consult the manufacturer.

No-fuse Breakers (MCCB)

When selecting no-fuse breakers, take into consideration the maximum output current and the inrush current.

The momentary maximum output for a servo system is approximately three times that of the rated output, and a maximum output of three seconds can be executed. Therefore, select no-fuse breakers with an operating time of at least five seconds at 300% of the rated maximum output. General-purpose and low-speed no-fuse breakers are generally suitable. Refer to the table in *2-2-3 Wiring Terminal Blocks* for the power supply input currents for each motor. Be sure to add the current consumption for the number of shafts, other controllers, etc., to make the selection.

The Position Driver inrush current flows at a maximum of 50 A for 20 ms when 200 V is input. With low-speed no-fuse breakers, a inrush current 7 to 8 times the rated current flows for 0.1 second. When making the selection, take into consideration the entire inrush current for the system.

Surge Absorbers

Use surge absorbers to absorb surges from power supply input lines due to lightning, abnormal voltages, etc. When selecting surge absorbers, take into account the varistor voltage, the amount of surge immunity, and the amount of energy resistance. For 200-VAC systems, use a varistor voltage of 470 V. The surge absorbers shown in the following table are recommended.

Maker	Model	Max. limit voltage	Surge immunity	Type	Remarks
Okaya Electric Ind.	R.A.V-781BYZ-2	783 V	1,000 A	Block	For power supply line
	R.A.V-781BXZ-4	783 V	1,000 A		For power supply line ground

Note 1. Refer to manufacturer's documentation for operating details.

Note 2. The surge immunity is for a standard impulse current of 8/20 μs. If pulses are wide, either decrease the current or change to a larger-capacity surge absorber.

Ferrite Cores

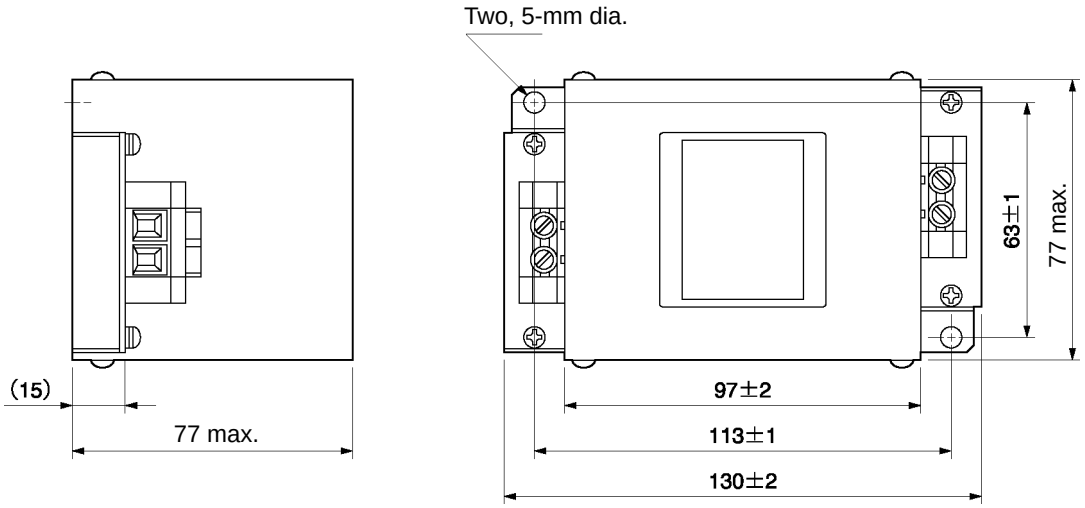
Maker	Model
TDK	ZCAT305-1330

Power Supply Input Noise Filters

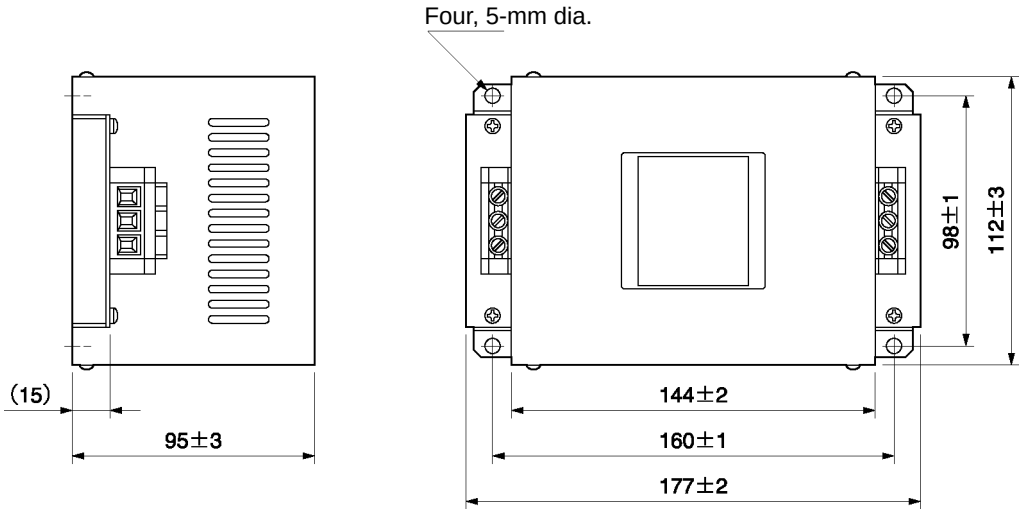
Maker	Motor capacity	Model	Remarks
Soshin Electric Co., Ltd.	30 to 500 W	NF2010A-PI	Single-phase, 10 A
	750 to 1,000 W	NF2015A-PI	Single-phase, 15 A
	1.5 to 2 kW	HF3010A-PI	Three-phase, 10 A

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NF2010A-PI/NF2015A-PI Dimensions



HF2030A-PI Dimensions



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Surge Killers

Install surge killers for loads that have induction coils, such as relays, solenoids, brakes, clutches, etc. The following table shows types of surge killers and recommended products.

Type	Features	Recommended products
Diode	Diodes are relatively small devices such as relays used for loads when reset time is not an issue. The reset time is increased because the surge voltage is the lowest when power is cut off. Used for 24/48-VDC systems.	Use a fast-recovery diode with a short reverse recovery time. Fuji Electric Co., ERB44-06 or equivalent
Thyristor or Varistor	Thyristor and varistor are used for loads when induction coils are large, as in electromagnetic brakes, solenoids, etc., and when reset time is an issue. The surge voltage when power is cut off is approximately 1.5 times that of the varistor.	Select varistor voltage as follows: 24-VDC system varistor: 39 V 100-VDC system varistor: 200 V 100-VAC system varistor: 270 V 200-VAC system varistor: 470 V
Capacitor + resistor	Use capacitors and resistors for vibration absorption of surge when power is cut off. The reset time can be shortened by proper selection of the capacitor or resistor.	Okaya Electric Ind. CR-50500 0.5 μF-50 Ω CRE-50500 0.5 μF-50 Ω S2-A-0 0.2 μF-500 Ω

Note Thyristors and varistors are made by the following companies. Refer to manufacturer's documentation for operating details. Thyristors: Ishizuka Electronics Co.
Varistors: Ishizuka Electronics Co., Matsushita Electric Parts

Contactors

When selecting contactors, take into consideration the circuit's inrush current and the momentary maximum current. The Position Driver inrush current is 50 A, and the momentary maximum current is approximately twice the rated current. The following table shows the recommended contactors.

Maker	Model	Rated current	Coil voltage
OMRON	LC1D25106	26 A	200 VAC
	LC1D40116	35 A	
	LC1D50116	50 A	
	LC1D80116	80 A	
	LP1D25106	26 A	24 VDC
	LP1D40116	35 A	
	LP1D50116	50 A	
	LP1D80116	80 A	

Leakage Breakers

- Select leakage breakers designed for inverters.
- Switching operations take place inside the Position Driver, causing high-frequency current to leak from the armature of the Servomotor. With inverter leakage breakers, high-frequency current is not detected, preventing the breaker from operating due to leakage current.
- When selecting leakage breakers, also remember to add the leakage current from devices other than the Servomotor, such as machines using a switching power supply, noise filters, inverters, and so on.
- For detailed information about the selection methods of leakage breakers, refer to catalogs provided by manufacturers.

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- The following table shows the Servomotor leakage currents for each Position Driver.

Driver	Leakage current (resistor) (including high-frequency current)	Leakage current (resistor-capacitor, in commercial power supply frequency range)
FND-X06 /X12	35 mA_{0-P}	2 mA_{rms}
FND-X25	40 mA_{0-P}	2 mA_{rms}
FND-X50H	120 mA_{0-P}	3 mA_{rms}

Note 1. Leakage current values shown above are for motor power lines of 10 m or less. The values will change depending on the length of power cables and the insulation.

Note 2. Leakage current values shown above are for room temperature and humidity. The values will change depending on the temperature and humidity.

☐Improving Encoder/Resolver Cable Noise Resistance

Signals from the encoder are either A, B, or S phase. The frequency for A- or B-phase signals is 154 kHz and the transmission speed for S-phase signals is 616 kbps. The Resolvers use analog voltage signals. Follow the wiring methods outlined below to improve encoder/resolver noise resistance.

- Be sure to use dedicated encoder/resolver cables.
- If lines are interrupted in the middle, connect them with connectors, making sure that the cable insulation is not peeled off for more than 50 mm. In addition, be sure to use shielded wire.
- Do not coil cables. If cables are long and are coiled, mutual induction and inductance will increase and will cause malfunctions. Be sure to use cables fully extended.
- When installing noise filters for encoder cables, use clamp filters. The following table shows the recommended clamp filter models. Do not use these with resolver cables.
- Do not wire the encoder/resolver cable in the same duct as power cables and control cables for brakes, solenoids, clutches, and valves.

☐Improving Control I/O Signal Noise Resistance

Position can be affected if control I/O signals are influenced by noise. Follow the methods outlined below for the power supply and wiring.

- Use completely separate power supplies for the control power supply (especially 24 VDC) and the external operation power supply. In particular, be careful not to connect two power supply ground wires. Install a noise filter on the primary side of the control power supply.
- If the control power supply wiring is long, noise resistance can be improved by adding 1-μF laminated ceramic capacitors between the control power supply and ground at the Position Driver input section and the controller output section.
- Use twisted-pair shielded cables for control cables, and the shield wire to the connector frame at the Position Driver.

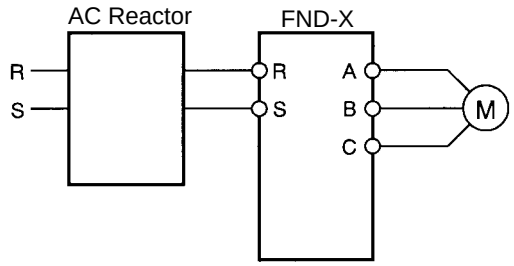
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□Harmonic Current Suppression

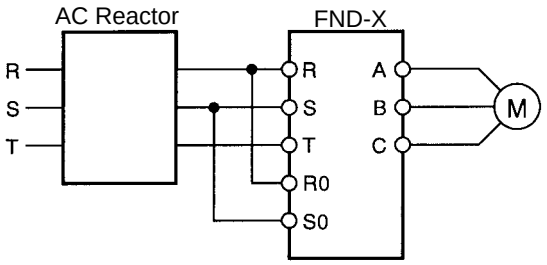
- An AC Reactor that controls steep current changes is used for suppressing harmonic current.
- Guidelines issued by MITI in September 1994 regarding countermeasures for harmonic suppression of domestic or general-purpose electric appliances require measures that control the flow of harmonic current to the power supply line.
- Select an appropriate AC Reactor depending on the Position Driver to be used.
- When using a single-phase power supply, one connection terminal will become open. Be sure to insulate this terminal with insulation tape, etc.

Connection Example

FND-X06 to -X25



FND-X50



Application Specifications

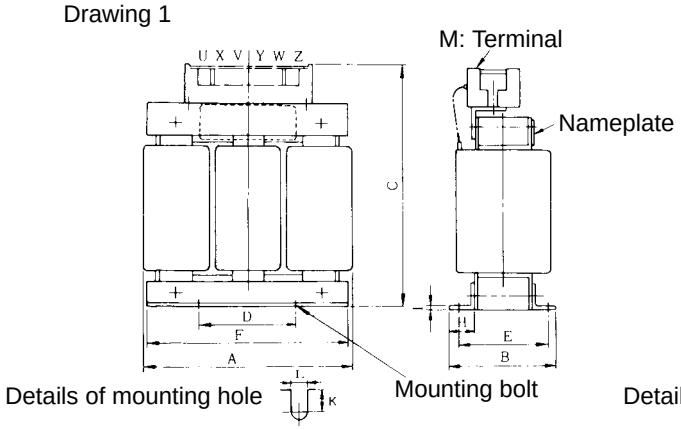
Drivers	AC Reactor				
	Model	Rated current	Inductance	Loss	Weight
FND-X06L-	3G3IV-PUZBAB5A2.1MH	5 A	2.1 mH	15 W	2.5 kg
FND-X12L-					
FND-X06H-	3G3IV-PUZBAB2.5A4.2MH	2.5 A	4.2 mH	15 W	2.5 kg
FND-X12H-	3G3IV-PUZBAB5A2.1MH	5 A	2.1 mH	15 W	2.5 kg
FND-X25H-	3G3IV-PUZBAB10A1.1MH	10 A	1.1 mH	25 W	3 kg
FND-X50H-	3G3IV-PUZBAB20A0.53MH	20 A	0.53 mH	35 W	3 kg

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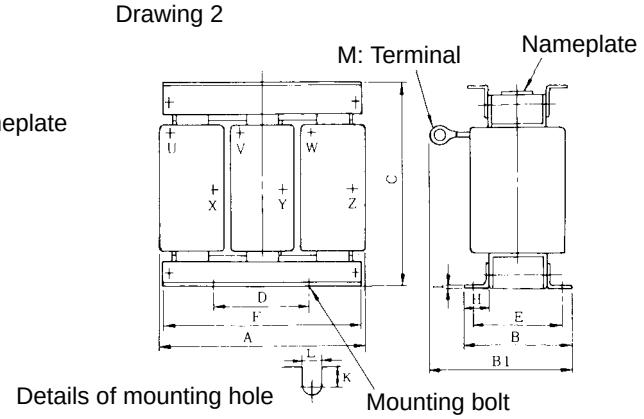
Dimensions

Model 3G3IV-PUZBAB	Drawing	Dimensions (mm)											
		A	B	B1	C	D	E	F	H	J	K	L	M
2.5A4.2MH	1	120	71	---	120	40	50	105	20	M6	10.5	7	M4
5A2.1MH		120	71	---	120	40	50	105	20	M6	10.5	7	M4
10A1.1MH	2	130	88	---	130	50	65	130	22	M6	11.5	7	M4
20A0.53MH		130	88	114	105	50	65	130	22	M6	11.5	7	M5

Drawing 1



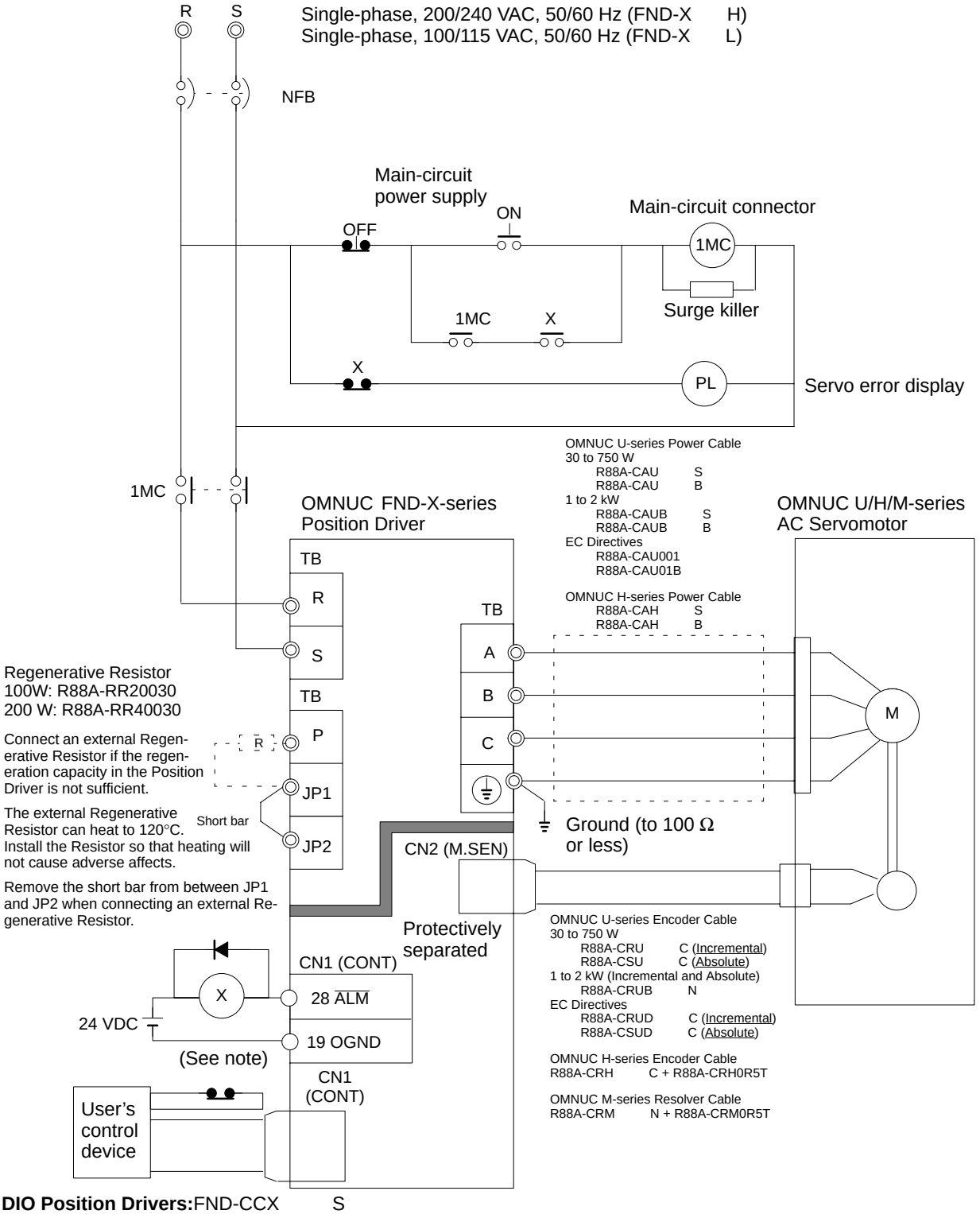
Drawing 2



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2-2-6 Peripheral Device Connection Examples

□Connecting FND-X06 to X25 Position Drivers to Peripheral Devices

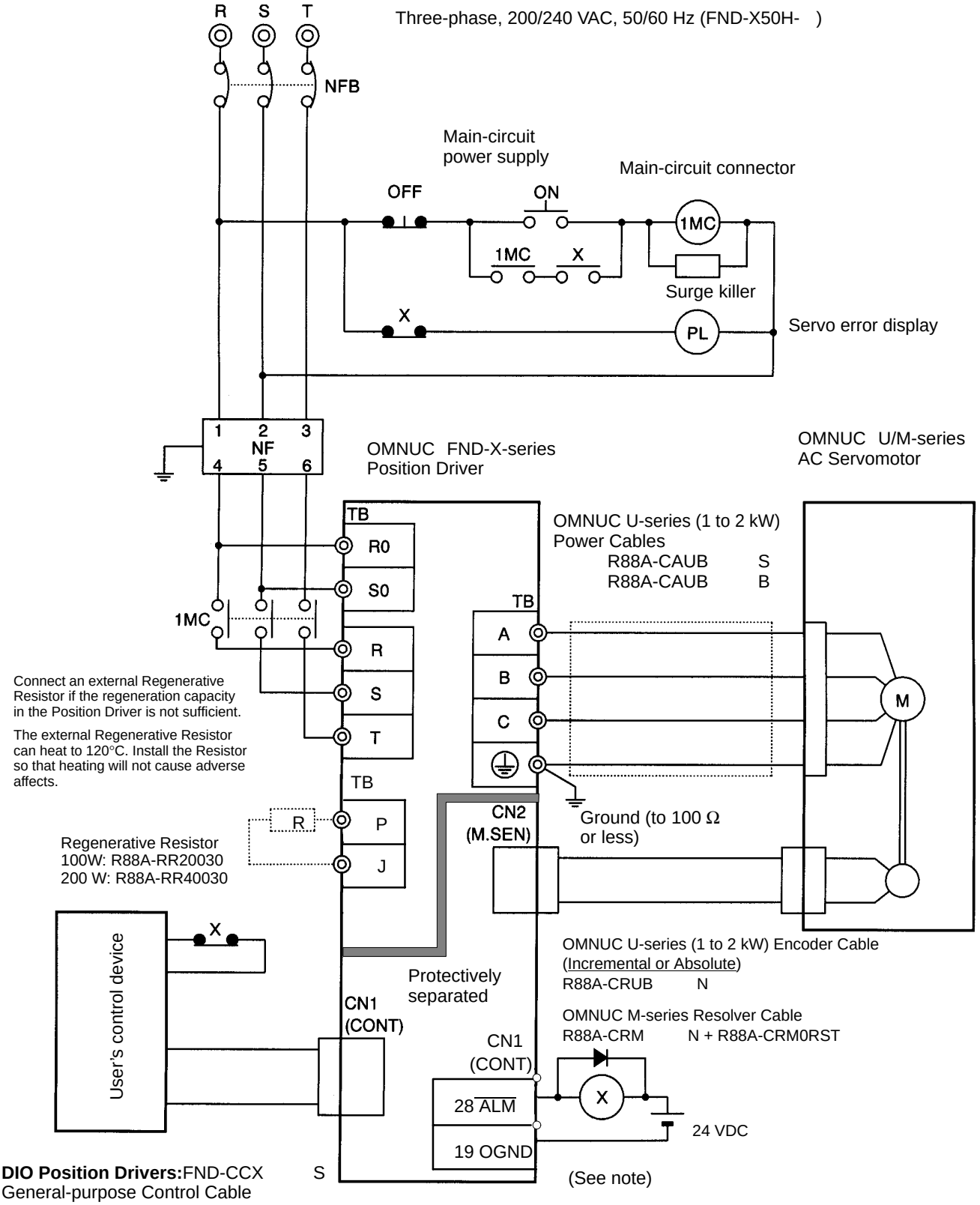


DIO Position Drivers:FND-CCX S
General-purpose Control Cable
CompoBus/S Position Drivers: Communications Cable
(SCA1-4F10 Flat Cable or commercially available VCTF cable (VCTF JIS C3306 2-core 0.75mm^2))

Note When using the CompoBus/S Position Drivers, create the same sequence using the $\overline{\text{ALM}}$ bit.

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□Connecting FND-X50H- Position Drivers to Peripheral Devices



DIO Position Drivers:FND-CCX S
General-purpose Control Cable
CompoBus/S Position Drivers: Communications Cable
(SCA1-4F10 Flat Cable or commercially available VCTF cable (VCTF JIS C3306 2-core 0.75mm^2))

Note When using the CompoBus/S Position Drivers, create the same sequence using the $\overline{\text{ALM}}$ bit.

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2-2-7 Battery Wiring and Encoder Setup for Absolute Encoder

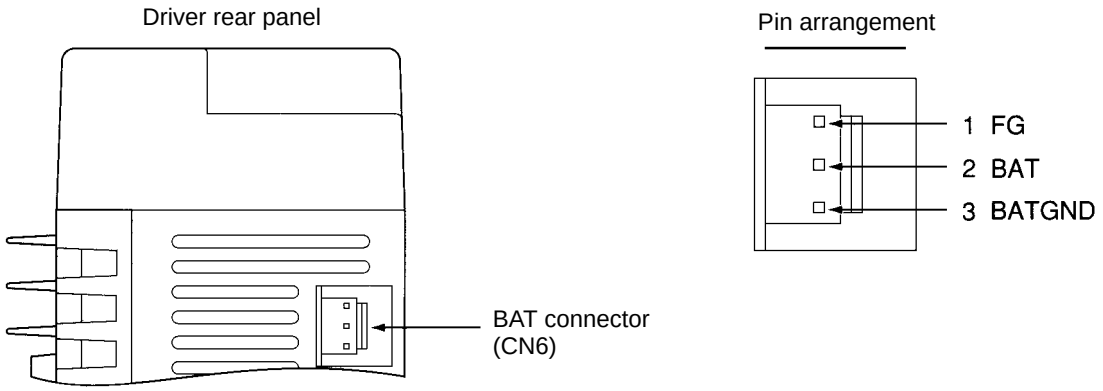
When using a U-series Servomotor with an absolute encoder, connect a lithium battery to the BAT connector (C6) so that the position data will be retained when the power supply is turned OFF. This section explains how to wire and replace the battery, and how to set up the absolute encoder.

Use one of the following methods.

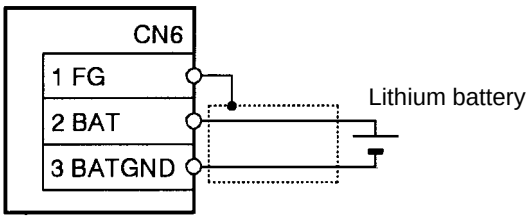
1. Obtain an OTS-BAT01 Battery with Connector and Cable.
2. Obtain a lithium battery and connector and prepare the battery so that it can be connected to CN6. (The C500-BAT08 Battery cannot be connected directly. The connector must be replaced with a recommend connector and the battery must be prepared for connection.)

The rest of this section describes the battery wiring and replacement methods and the absolute encoder setup.

□BAT Connector (CN6)



□Battery Wiring



Pin No.	Symbol	Name and contents
1	FG	Frame ground
2	BAT	Backup battery + input: connects 2.8 to 4.5-VDC battery.
3	BATGND	Backup battery – input: ground for backup battery.

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□Lithium Battery (Recommended Products)

With an absolute encoder, a battery must be used in order to retain position data when the power is turned OFF.

Maker	Model	Voltage	Electrical capacity	Estimated service life
Toshiba	ER6V	3.6 V	2,000 mA h	Approx. 10 years
OMRON (made by Hitachi Maxell)	3G2A9-BAT08	3.6 V	1,650 mA h	Approx. 7 years

Note 1. When power is turned OFF internally at the Position Driver, the battery voltage is not monitored. Be careful not to let the voltage drop below 2.8 V. If necessary, install a battery voltage-drop detection circuit or a monitor in the system.

Note 2. Use one battery for one Position Driver. (The estimated battery service life is calculated based on this condition.)

Note 3. The Toshiba lithium battery does not have a connector for BAT connections. It is necessary to separately purchase and attach a connector for BAT connections.

□Replacing the Battery

The following method can be used to replace the battery while retaining the absolute encoder's rotation data.

1. Turn ON the Position Driver's power supply and leave it ON for three minutes. This will charge the capacitor in the encoder.
2. Turn OFF the Position Driver's power supply and leave it OFF while replacing the battery. Connect the battery between pins 2 and 3 of the Position Driver's BAT connector (CN6).

Note 1. After step 1 above has been implemented, the encoder will operate normally even with the battery removed for up to two days (at 0°C to 40°C).

Note 2. While replacing the battery, be careful not to short-circuit the plus and minus terminals.

Note 3. When disconnecting the lead wires, disconnect the plus and minus terminals separately. Disconnecting them at the same time can cause them to short-circuit and create sparks.

Note 4. Be sure to use the prescribed method for disposing of used batteries. In particular, do not under any circumstances dispose of them in a fire. Doing so may cause them to explode.

□Setting up the Absolute Encoder

Setup is required to set the amount of machine rotation to zero for trial operation of the Servomotor or when the absolute encoder has been left disconnected from the battery for more than two days. (This is because the voltage of the capacitor inside the absolute encoder will drop if a battery is left unconnected for more than two days, possibly interfering with the proper operation of internal elements.)

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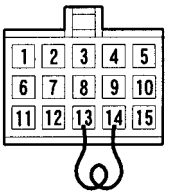
□Setup Method

Perform the following procedure carefully. Mistakes may lead to errors in the setup.

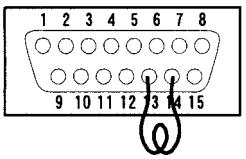
1. Wire the Position Driver, Servomotor, and encoder correctly if they are not already wired correctly.
2. Connect the battery.
3. Turn ON power to the Position Driver.
4. Leave the power ON for three minutes.

Note An alarm may be generated, but it can be cleared with the following procedure.

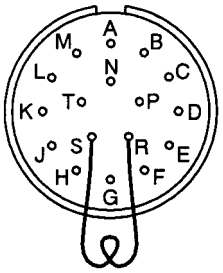
5. Perform the following steps for 30-W to 750-W models.
   a) Turn OFF the power to the Position Driver.
   b) Remove the encoder connector.
   c) Reset the data by shorting between encoder connector terminals 13 and 14 (on the motor side) for one or two seconds. (See the following diagram.)



Models conforming to UL/cUL



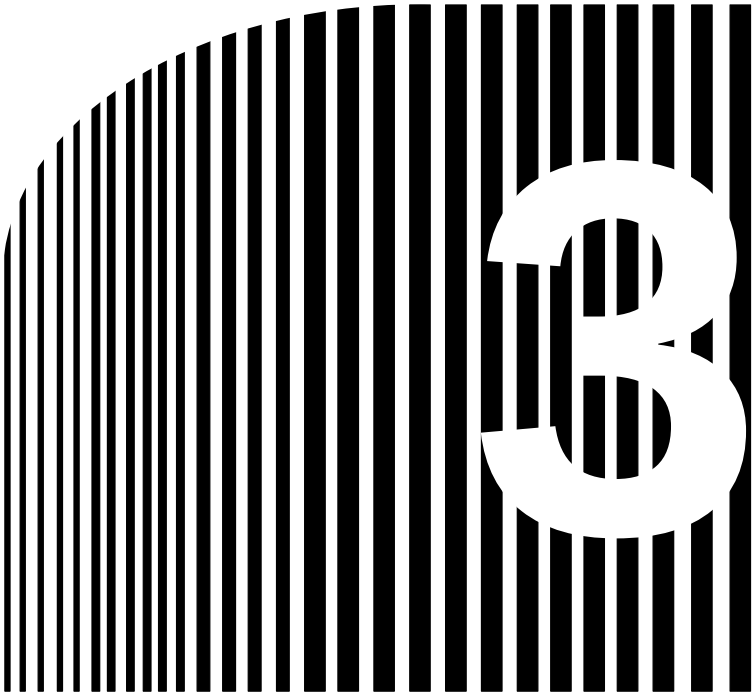
Models conforming to EC Directives



1-kW/2-kW models

6. Perform the following steps for 1-kW to 2-kW models.
   a) Turn OFF the power to the Position Driver.
   b) Remove the encoder connector.
   c) Reset the data by shorting between encoder connector terminals R and S (on the motor side) for two minutes. (See the above diagram.)
   d) Remove the short between R and S.
   e) Confirm that the voltage between R and S is 0.4 V or less. The S terminal is ground.
   f) If the voltage is greater than 0.4 V, reconnect the terminals until the voltage drops to 0.4 V or less.
7. Restore the wiring to its original state.
8. Turn the power back ON to the Position Driver.
9. If no error occurs, the setup has been completed.
10. If an alarm (A.L41, 42 or 43) occurs, repeat this procedure from the beginning.

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Chapter 3

• Operation •

3-1 Operational Procedure

3-2 Turning ON Power and Checking Displays

3-3 Using the Display Area

3-4 Setting Functions: User Parameters (H Parameters)

3-5 Position Control Settings (PTP Parameters)

3-6 Setting Positioning Data (PTP Data, Direct Input)

3-7 Operational Sequence

3-8 Trial Operation

3-9 Making Adjustments

3-10 Regenerative Energy Absorption

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3-1 Operational Procedure

After confirming that the system has been correctly installed and wired, make the initial settings for the Position Driver. Then, set the position control functions according to the position control methods.
Any incorrect settings in the parameters could cause unexpected motor operation, creating an extremely dangerous situation. Use the procedures provided in this chapter to carefully set all parameters.

☐ Startup Procedure

1. Mounting and installation

   Install the Servomotor and Driver according to the installation conditions. Refer to *2-1 Installation*.

2. Wiring and connections

   Connect to power supply and peripheral devices. Refer to *2-2 Wiring*.

3. Turning ON power supply

   Before turning ON the power supply, check the necessary items. In order to make the initial settings, turn ON the applicable power supply. Refer to *3-2-1 Items to Check Before Turning ON Power*.

4. Checking display status

   Check by means of the displays to see whether there are any internal errors in the Driver. Refer to *3-2-2 Turning ON Power and Confirming the Display*.

5. Function settings

   Set the user parameters for operation. Refer to *3-4 Setting Functions: User Parameters (H Parameters)*.

6. Position control settings

   Set the PTP parameters according to the position control methods. Refer to *3-5 Position Control Settings (PTP Parameters)*.

7. Position data settings

   Set the data for executing positioning with PTP data or direct input. Refer to *3-6 Setting Positioning Data (PTP Data, Direct Input)*.

8. Trial operation

   Before performing trial operation, turn the power supply off and then back on so that any parameters that have been set will be valid. Check to see whether protective functions such as emergency stop and operational limits are working reliably. Check operation at both low speed and high speed. Refer to *3-8 Trial Operation*.

9. Adjustments

   Execute auto-tuning. Manually adjust the gain as required. Refer to *3-9 Making Adjustments*.

10. Operation

    Operation can now begin. Should any trouble occur, refer to *Chapter 4 Application*.

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Operation and Adjustment Precautions

⚠ **Caution** Confirm that no adverse effect will occur in the system before performing the test operation. Not doing so may result in equipment damage.

⚠ **Caution** Check the newly set parameters for proper execution before actually running them. Not doing so may result in equipment damage.

⚠ **Caution** Do not make any extreme adjustments or setting changes. Doing so may result in unstable operation and injury.

⚠ **Caution** Separate the Servomotor from the machine, check for proper operation, and then connect to the machine. Not doing so may cause injury.

⚠ **Caution** When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation. Not doing so may result in injury.

⚠ **Caution** Do not come close to the machine immediately after resetting momentary power interruption to avoid an unexpected restart. (Take appropriate measures to secure safety against an unexpected restart.) Doing so may result in injury.

⚠ **Caution** Do not use the built-in brake of the Servomotor for ordinary braking. Doing so may result in malfunction.

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3-2 Turning ON Power and Checking Displays

3-2-1 Items to Check Before Turning ON the Power

☐ Checking Power Supply Voltage

Check to be sure that the power supply voltage is within the ranges shown below.

FND-X06H- /-X12H- /-X25H- (single-phase, 200-VAC specifications):
Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz

FND-X50H- (three-phase, 200-VAC specifications):
Three-phase 200/240 VAC (170 to 264 V) 50/60 Hz

FND-X L- (single-phase, 100-VAC specifications):
Single-phase 100/115 VAC (85 to 127 V) 50/60 Hz

☐ Checking Terminal Block Wiring

- Power supply inputs (models with single-phase inputs: R and S, models with three-phase inputs: R, S, T, R0, S0) must be properly connected to the terminal block.
- The Servomotor's red (A/U), white (B/V), and blue/black (C/W) power lines and the green ground wire (⏚) must be properly connected to the terminal block.

☐ Checking the Servomotor Wiring

- There should be no load on the Servomotor. (Do not connect to the mechanical system.)
- The power line connectors at the Servomotor must be securely connected.

☐ Checking Encoder and Resolver Connectors Wiring

- Encoder and resolver cables must be securely connected to the motor sensor connectors (CN2) at the Driver.
- Encoder and resolver cables must be securely connected to the encoder/resolver connectors at the Servomotor.

☐ Checking Control Signal Connector Wiring

- Be sure that the control signal connectors or the CompoBus/S terminals and external control signal connectors are firmly connected.
- The RUN command must be OFF.

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3-2-2 Turning ON the Power and Checking the Display

□Turning ON the Power

Before turning ON the power supply, check carefully to confirm that it is safe.

□Checking Displays

When the power is turned ON, one of the codes shown below will be displayed.

Normal (motor speed display)	Error (alarm display)	Factory settings (parameter setting error)
r 0	A.L 40.	A.L 26.

Note The alarm code (the number shown in the alarm display) changes depending on the contents of the error.

If the power is turned ON with the factory settings in place, a parameter setting error (A.L 26) will be displayed. This is because the applicable motor parameter (UP-02) factory setting is “0000.” Referring to the following tables and example procedure, set in UP-02 the model code for the motor that is to be used.

U Series (With Incremental Encoder)

Motor model	Capacity	Code
R88M-U03030HA(VA)	30 W	1401
R88M-U05030HA(VA)	50 W	1402
R88M-U10030HA(VA)	100 W	1403
R88M-U20030HA(VA)	200 W	1404
R88M-U40030HA(VA)	400 W	1405
R88M-U75030HA(VA)	750 W	1406
R88M-U1K030H(V)	1 KW	1607
R88M-U1K530H(V)	1.5 kW	1608
R88M-U2K030H(V)	2 kW	1609

Note The motor code for R88M-U1K315H(V) is 160D.

U Series (With Absolute Encoder)

Motor model	Capacity	Code
R88M-U03030TA(XA)	30 W	1501
R88M-U05030TA(XA)	50 W	1502
R88M-U10030TA(XA)	100 W	1503
R88M-U20030TA(XA)	200 W	1504
R88M-U40030TA(XA)	400 W	1505
R88M-U75030TA(XA)	750 W	1506
R88M-U1K030T(X)	1 KW	1507
R88M-U1K530T(X)	1.5 kW	1508
R88M-U2K030T(X)	2 kW	1509

Note The motor code for R88M-U1K315X is 1513.

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U-UE Series

Motor model	Capacity	Code
R88M-UE10030H(V)-S1	100 W	1603
R88M-UE20030H(V)-S1	200 W	1604
R88M-UE40030H(V)-S1	400 W	1605
R88M-UE75030H(V)-S1	750 W	1606

H Series

Motor model	Capacity	Code
R88M-H05030	50 W	1007
R88M-H10030	100 W	1008
R88M-H20030	200 W	1009
R88M-H30030	300 W	1010
R88M-H50030	500 W	1011
R88M-H75030	750 W	1012
R88M-H1K130	1100 W	1013

M Series (1,200 r/min)

Motor model	Capacity	Code
R88M-M20012	200 W	0105
R88M-M40012	400 W	0106
R88M-M70012	700 W	0107
R88M-M1K112	1100 W	0108
R88M-M1K412	1400 W	0109
R88M-M1K812	1800 W	010A

M Series (2,000 r/min)

Motor model	Capacity	Code
R88M-M20020	200 W	0205
R88M-M40020	400 W	0206
R88M-M70020	700 W	0207
R88M-M1K120	1100 W	0208
R88M-M1K820	1800 W	0217
R88M-M2K220	2200 W	0218

M Series (4,000 r/min)

Motor model	Capacity	Code
R88M-M06040	60 W	0405
R88M-M12040	120 W	0406
R88M-M20040	200 W	0407
R88M-M40040	400 W	0408
R88M-M70040	700 W	0409
R88M-M1K140	1100 W	040A
R88M-M2K040	2000 W	040B

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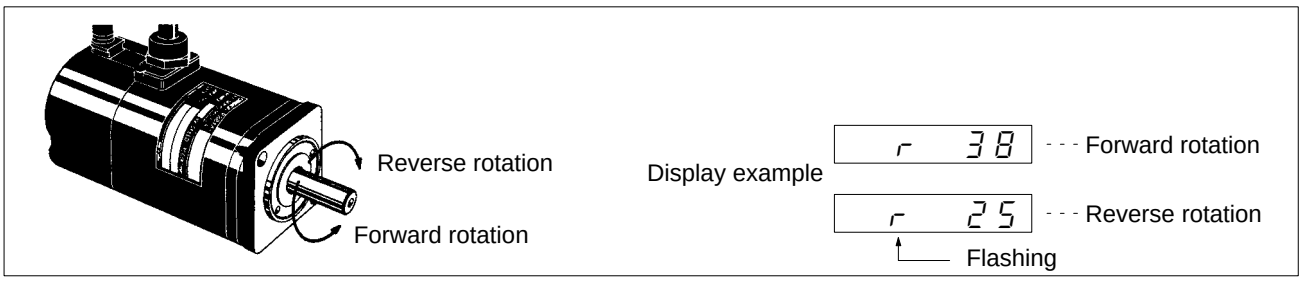
Note U-UE-series (U-series, UE-type) and H-series Servomotors can only be used with Position Driver software version 4.01 (September 1997) or later. U-series 1 to 2-kW and M-series 1.1 to 2.2-kW Servomotors can only be used with Position Driver software version 4.04 (April 1999) or later.

Example: Procedure for Setting Code 1403

Display	Key operation
A.L 26.	Parameter setting error (A.L 26) displayed. (The "." in the rightmost digit flashes.)
UP 02 1.	Press the Mode Key twice to display the user parameters.
0000.	Press the Increment Key three times to display the contents of UP-02 (applicable motor).
0000.	Press the Data Key and the Shift Key simultaneously to enable data to be changed.
0003.	Press the Increment Key three times to enter "3" for the rightmost digit.
0003.	Press the Shift Key twice. The "100" digit (the third digit from the right) will flash.
0403.	Press the Increment Key four times to enter "4" for the "100" digit.
1403.	In the same way, press the Shift Key again so that the "1,000" digit (the leftmost digit) flashes, and then press the Increment Key to enter "1" for that digit.
1403.	Finally, press the Data Key to set the data.

Note After setting the parameters, turn OFF the power and check to be sure that the displays have turned OFF before turning the power back ON again. (The values set for UP-02 will go into effect when the power is turned back ON.)

If the display is normal (motor speed display) after the power is turned ON, rotate the motor shaft by hand in both the forward and reverse directions and check to make sure that the positive and negative signs in the display match the direction of rotation. If they do not match, check the encoder and resolver cables to make sure they are connected correctly.



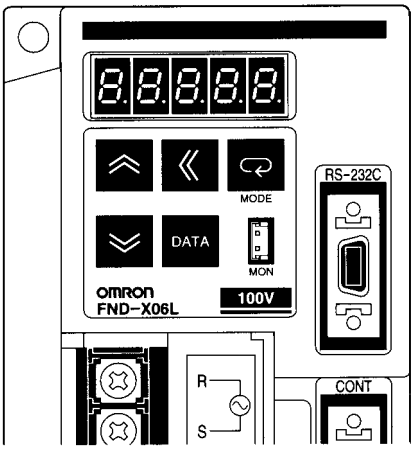
If an error message (A.L) is displayed when the power is turned ON, refer to *Chapter 4 Application* and take the necessary countermeasures.

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3-3 Using the Display Area

3-3-1 Key Operations

☐Display Area Layout



☐Key Functions

Key operation	Main function
MODE	The Mode Key changes the mode.
≪	The Shift Key shifts to the digit on the left.
DATA	The Data Key saves data.
∧	The Increment Key increments parameter numbers and data.
∨	The Decrement Key decrements parameter numbers and data.
∧ + DATA	The Increment Key and Data Key together increment the parameter number by 10 (or 2 for PTP data).
∨ + DATA	The Decrement Key and Data Key together decrement the parameter number by 10 (or 2 for PTP data).
DATA + ≪	The Data Key and Shift Key together enable data to be changed.

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3-3-2 Modes and Mode Changes

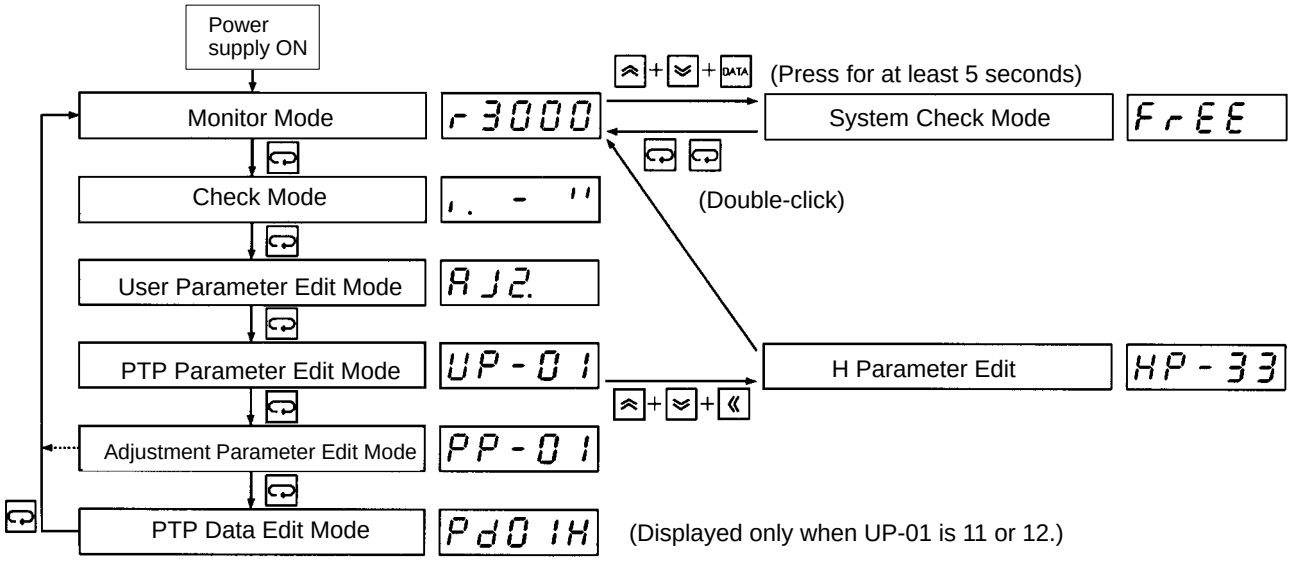
□Modes

The OMNUC FND-X Series has the following seven modes:

Mode	Function
Monitor Mode	Monitors motor speed, present value, reference value, position deviation value, machine speed, motor current, effective load factor, electronic thermal value, electrical angle, and regenerative absorption rate.
Check Mode	Displays the I/O signal status, alarm details, alarm history, and software version.
Adjustment Parameter Edit Mode	Displays and sets the adjustment parameters.
User Parameter Edit Mode	Displays and sets the user parameters and H parameters.
PTP Parameter Edit Mode	Displays and sets the PTP parameters.
PTP Data Edit Mode	Displays and sets the PTP data.
System Check Mode	Used for motor test operation, output signal testing, and auto-tuning.

□Changing Modes

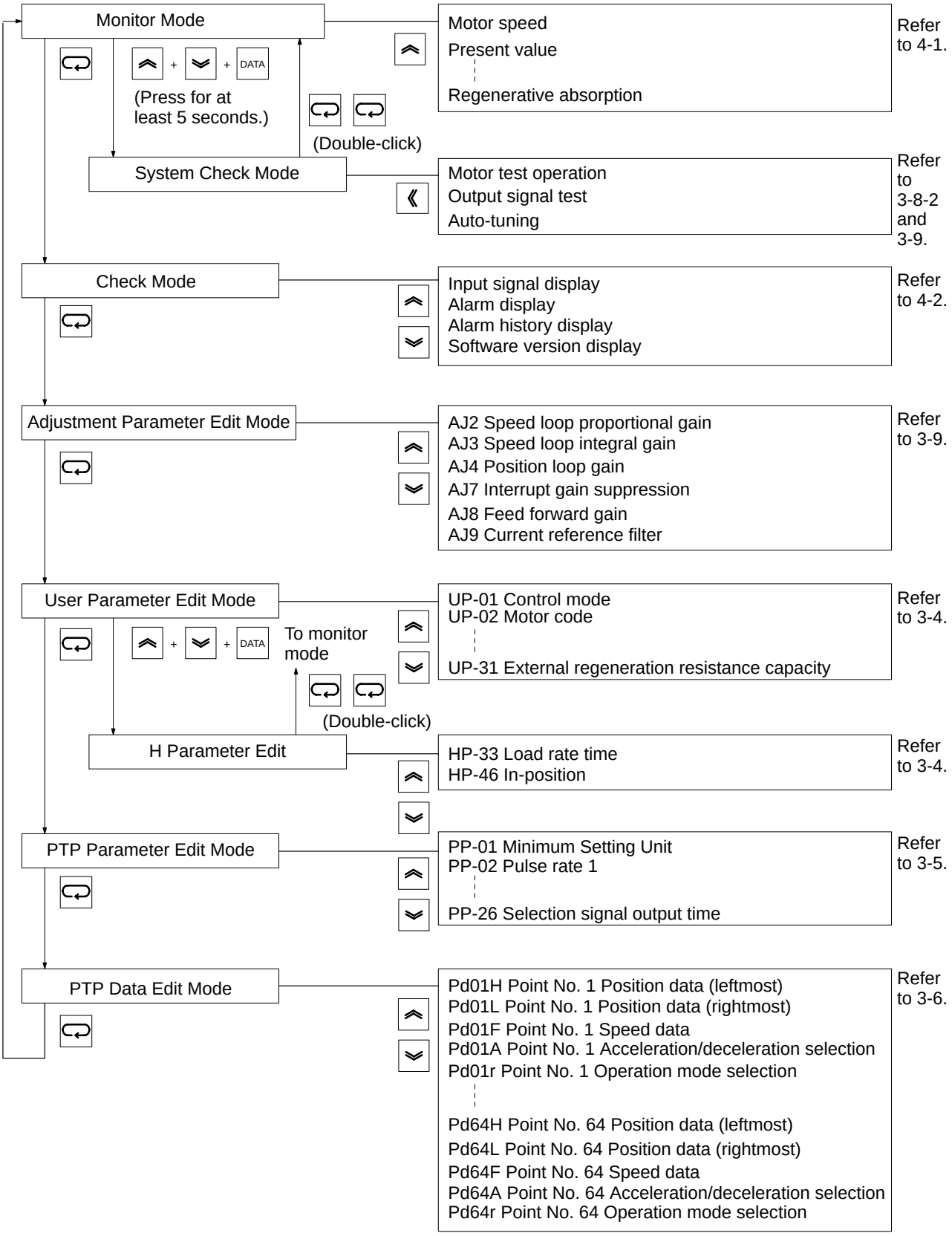
To change modes, press the Mode Key. The System Check Mode and H parameter editing, however, require special operations.



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3-3-3 Mode Details

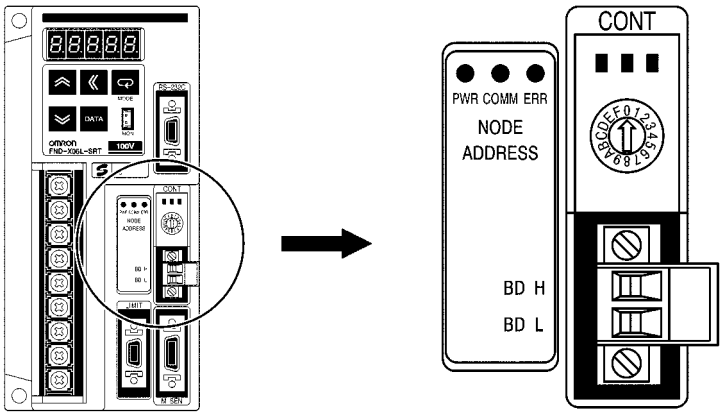
The following diagram outlines the contents of each of the modes.



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3-3-4 CompoBus/S Communications Display and Setting Panel

□Layout of Display and Setting Panel



□Rotary Switch

The rotary switch is used for setting the node address. Each FND-X Position Driver occupies two consecutive node addresses, set for IN and OUT respectively by the switch. The OUT Slave Area is allocated to the FND-X Position Driver's input area, and the IN Slave Area is allocated to the FND-X Position Driver's output area. The node addresses are allocated by the switch settings as follows:

Switch setting	Output signals	Input signals
0/1	IN Slave 0, IN Slave 1	OUT Slave 0, OUT Slave 1
2/3	IN Slave 2, IN Slave 3	OUT Slave 2, OUT Slave 3
4/5	IN Slave 4, IN Slave 5	OUT Slave 4, OUT Slave 5
6/7	IN Slave 6, IN Slave 7	OUT Slave 6, OUT Slave 7
8/9	IN Slave 8, IN Slave 9	OUT Slave 8, OUT Slave 9
A/B	IN Slave 10, IN Slave 11	OUT Slave 10, OUT Slave 11
C/D	IN Slave 12, IN Slave 13	OUT Slave 12, OUT Slave 13
E/F	IN Slave 14, IN Slave 15	OUT Slave 14, OUT Slave 15

The procedure when the C200HW-SRM21 is used for the Master Unit is provided here as an example.

Example: Master Unit Unit Number set to 0, Position Driver Node Address set to 0

When the Master Unit number is 0, the starting word for the CPU Bus Unit area of the Programmable Controller that is allocated to the Programmable Controller will be set to word 100. Also, when the node address of the Position Driver is set to 0, the Slave areas of IN Slave 0 and 1 and OUT Slave 0 and 1 will be allocated to the Position Driver. The control I/Os of the Position Driver are allocated to the Special I/O Unit area of the Programmable Controller as shown in the following tables.

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Word 100

OUT Slave 1

Bit	Signal name	Signal allocation
15	P. IN7	OUT15
14	P. IN6	OUT14
13	P. IN5	OUT13
12	P. IN4	OUT12
11	P. IN3	OUT11
10	P. IN2	OUT10
9	P. IN1	OUT9
8	P. IN0	OUT8

OUT Slave 0

Bit	Signal name	Signal allocation
7	STOP	OUT7
6	TEACH	OUT6
5	–JOG	OUT5
4	+JOG	OUT4
3	SEARCH	OUT3
2	RESET	OUT2
1	START	OUT1
0	RUN	OUT0

Word 108

IN Slave 1

Bit	Signal name	Signal allocation
15	---	IN15
14	P. OUT6	IN14
13	P. OUT5	IN13
12	P. OUT4	IN12
11	P. OUT3	IN11
10	P. OUT2	IN10
9	P. OUT1	IN9
8	P. OUT0	IN8

IN Slave 0

Bit	Signal name	Signal allocation
7	$\overline{\text{ALM}}$	IN7
6	INP	IN6
5	RUNON	IN5
4	T.COM	IN4
3	ORGSTP	IN3
2	S.COM	IN2
1	READY	IN1
0	BO	IN0

Note 1. When using the CQM1-SRM21 as the Master Unit, be sure to set the number of points allocated to one node address to 8-point mode. If used in 4-point mode, an area overlap error will be occur.

Note 2. For details regarding Master Unit word allocation, refer to the Master Unit operation manual.

□CompoBus/S Communication Status Indicators

Indicator	Name	Color	Status	Meaning
PWR	Power supply	Green	Lit	The power is turned ON.
			Not lit	The power is turned OFF.
COMM	Communicating	Yellow	Lit	Communications are being executed normally.
			Not lit	There is a communications error or communications are being awaited.
ERR	Communications error	Red	Lit	A communications error has occurred.
			Not lit	Communications are being executed normally or communications are being awaited.

Note For details on diagnosis using the communication status indicators, refer to *4-4-3 CompoBus/S-type Position Driver Protective and Diagnostic Functions*.

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3-4 Setting Functions: User Parameters (H Parameters)

User parameters and H parameters are parameters for selecting the control mode, applicable motor, and so on, which are required for system startup. Match the settings to the system being used.

Some of the user parameters go into effect when the power has been turned OFF and then back ON again. (Check to be sure that the display has turned OFF.) Those user parameters that need to have the power turned OFF and ON again are indicated in the tables in *3-4-2 User Parameter and H Parameter Tables*.

Use the following procedure to set the user parameters:

Go to the User Parameter Edit Mode.	Mode Key
Display the pertinent parameter number.	Increment Key, Decrement Key, Increment Key +Data Key, Decrement Key + Data Key
Display the parameter contents (data).	Increment Key
Enable the data change.	Data Key + Shift Key
Change the data.	Increment Key, Decrement Key, Shift Key
Save the data in memory.	Data Key

3-4-1 Setting User Parameters and H Parameters

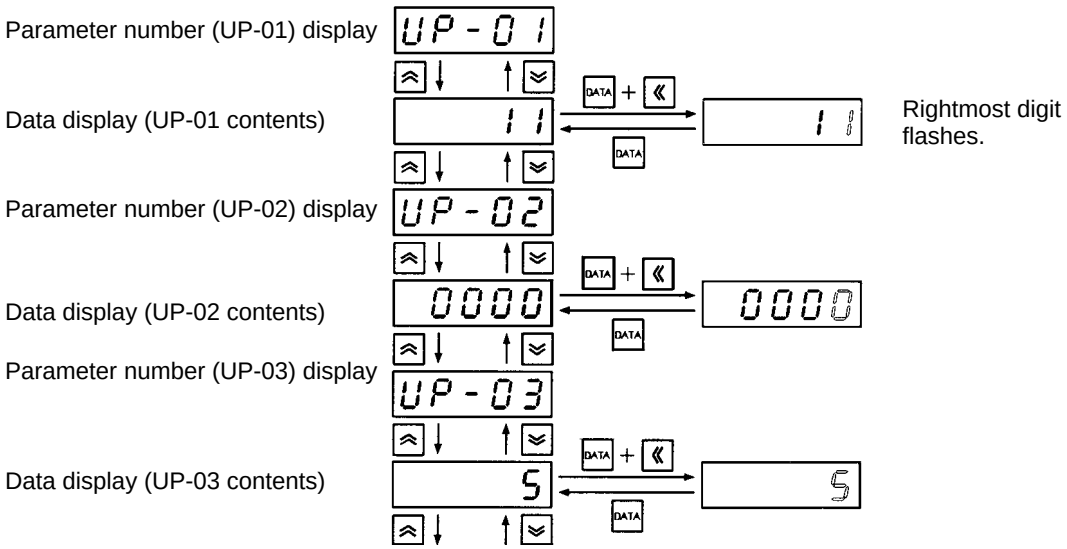
□Setting User Parameters

Use the following procedure to set the user parameters.

1. Press the Mode Key to go to the Users Parameter Edit Mode (UP-01).
2. Use the Up and Decrement Keys to display the parameter number (UP-) desired.
3. Press the Increment Key to display the parameter data.
4. Press the Data Key and Shift Key simultaneously to enable a data change. The rightmost digit will flash.
5. Use the Up and Decrement Keys to change the data. The flashing numeral can be changed. To move to the next digit, press the Shift Key.
6. Press the Data Key to save the changed data in memory.

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User Parameters Display Example

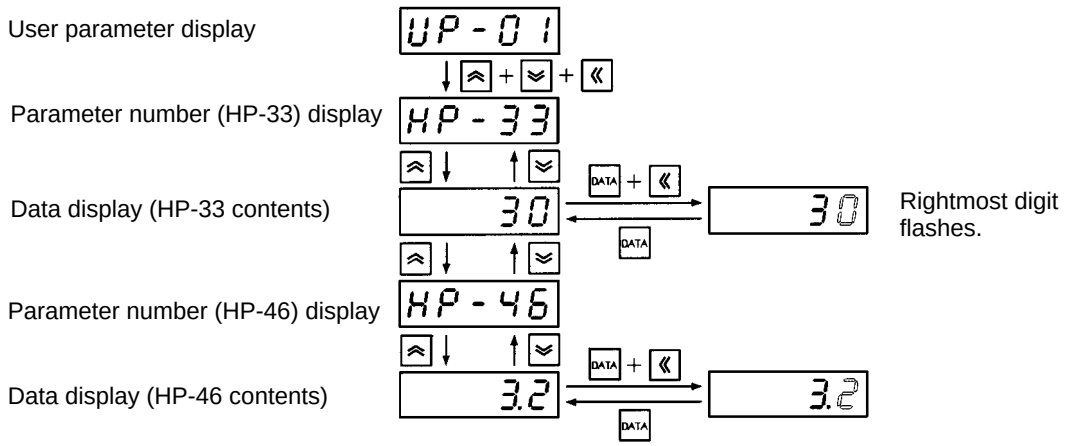


☐ Setting H Parameters

Use the following procedure to set the H parameters.

1. Press the Mode Key to go to the Users Parameter Edit Mode (UP-01).
2. Press the Increment Key, Decrement Key, and Shift Key simultaneously to display H parameter HP-33.
3. Use the Up and Decrement Keys to display the parameter number (HP-) desired.
4. Press the Increment Key to display the parameter data.
5. Press the Data Key and Shift Key simultaneously to enable a data change. The rightmost digit will flash.
6. Use the Up and Decrement Keys to change the data. The flashing numeral can be changed. To move to the next digit, press the Shift Key.
7. Press the Data Key to save the changed data in memory.
8. Double-click the Mode Key to go from H Parameter Edit to the Monitor Mode.

H Parameters Display Example



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3-4-2 User Parameter and H Parameter Tables

The following tables list the user parameters (UP-01 to UP-29) and H parameters (HP-33 and HP-46).

□User Parameters

No. UP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?
01	Control mode	---	00 to FF	11	Specifies position control mode: 11: Point positioning (PTP) 12: Point positioning (feeder) 13: Direct positioning (PTP) 14: Direct positioning (feeder)	Yes
02	Motor code	---	0000 to FFFF	0000	Motor model code	Yes
03	Resolver cable length	1 m	1 to 120	5	Sets the resolver cable length for when M-series motor is used. (Valid only for M-series motors.)	No
07	In-position width	1 pulse	1 to 32,767	3	Outputs positioning completed signal (INP) according to number of motor sensor pulses set as positioning deviation. OMNUC U Series (30 to 750 W) with incremental encoder: 8,192 pulses/rotation OMNUC U Series (30 to 650 W) with absolute encoder: 4,096 pulses/rotation OMNUC U Series (1 to 2 kW) with incremental encoder: 16,384 pulses/rotation OMNUC U Series (1 to 2 kW) with absolute encoder: 32,768 pulses/rotation OMNUC U-UE Series: 4,096 pulses/rotation OMNUC H Series: 8,000 pulses/rotation OMNUC M Series: 24,000 pulses/rotation	No
11	Current limit	0.1%	0.0 to 100.0	100.0	Specifies rate based on maximum motor current as 100%.	No
14	S-curve acceleration/deceleration time	0.01 s	0.00 to 32.76	0.00	Sets the time until 90% of the target speed is obtained. “0.00“ sets trapezoidal acceleration and deceleration.	No
16	Brake mode	---	0 to 3	0	0: Dynamic brake 1: On-hold brake (stops in deceleration time) 2: On-hold brake (stops after rotation according to error counter’s accumulated number of pulses) 3: On-hold brake (free-running stop)	Yes

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No. UP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?
25	Monitor output	---	000 to 011	010	Specifies monitor output function. 0 └ Positive voltage 0: Not reversed 1: Reversed └ Speed/Current selection 0: Current 1: Speed	No
26	Motor rotation direction	---	0, 1	0	Specifies motor rotation direction. 0: Forward rotation 1: Reverse direction	No
28	Brake ON speed	0.1%	0.0 to 100.0	1.0	Specifies r/min to turn OFF break output in on-hold brake mode. Specifies rate based on rated motor r/min as 100%. * The brake may be damaged if the on-hold brake mode is selected for motors rotating at high speed.	No
29	Motor test speed	1 r/min	1 to 8,000	50	Specifies r/min for motors for testing. * When testing a motor, make sure that the set value is less than the rated motor r/min.	No
30	External regeneration resistance value	0.1 Ω	0.0 to 100.0	0.0	Specifies the regeneration absorption resistance value (Ω) * Only valid for FND-X50H- . * When using an OMRON External Regeneration Resistor, set to 30.0 (Ω).	Yes
31	External regeneration resistance capacity	0.01 kW	0.00 to 327.67	0.00	Specifies the regeneration absorption resistance capacity (kW). * Only valid for FND-X50H- .	Yes

□H Parameters (HP-33, HP-46)

No. HP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?
33	Load rate time	1 s	1 to 60	30	Specifies interval for effective load factor calculation to value obtained from machine cycle time multiplied by an integer.	No
46	In-position timer	3.2 ms	3.2 to 320.0	3.2	Specifies minimum positioning completion ON time and minimum ready signal OFF time.	No

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Note If the positioning completed signal (READY) is input to the Programmable Controller (PC), make sure that the set value is large enough so that the PC will be able to respond.
Set value ≧ PC cycle time × 2 + PC input delay time + 1 ms
With CompoBus/S-type Position Drivers, use the following formula for the Programmable Controller's input circuit delay time:
PC input circuit delay time = (Communications cycle time) x 2

3-4-3 User Parameter and H Parameter Details

□User Parameters

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-01	**Control mode**	**00 to FF**	**---**	**11**

This parameter specifies the positioning control mode.

Set value	Description
11	Point positioning (PTP) • Executes position control according to positioning data set for internal point data (PTP data: Pd). • The maximum number of points is 64. For the point number to be executed, select from control inputs P.IN0 to 6 (point selection 0 to 6). • Used for positioning between points, such as pick-and-place.
12	Point positioning (feeder) • Executes position control according to positioning data set for internal point data (PTP data: Pd). • The maximum number of points is 64. For the point number to be executed, select from control inputs P.IN0 to 6 (point selection 0 to 6). • Present position is cleared at startup. Used for feed control such as sheet feeding.
13	Direct positioning (PTP) • Executes position control according to position and speed data entered for control inputs P.IN0 to 7 (position data 0 to 7). • Used for positioning between points, such as pick-and-place.
14	Direct positioning (feeder) • Executes position control according to position and speed data entered for control inputs P.IN0 to 7 (position data 0 to 7). • Present position is cleared at startup. Used for feed control such as sheet feeding.

Note After setting this parameter, turn OFF the power and check to be sure that the displays have turned OFF before turning the power back ON again. (The new settings will go into effect when the power is turned back ON.)

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-02	**Motor code**	**0000 to FFFF**	**---**	**0000**

- This parameter specifies the motor model code.
- If the power is turned ON with the factory settings in place, a parameter setting error (A.L 26) will be displayed. Refer to the following tables and set in UP-02 the model code for the motor that is to be used.

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U Series (With Incremental Encoder)

Motor model	Capacity	Code
R88M-U03030HA(VA)	30 W	1401
R88M-U05030HA(VA)	50 W	1402
R88M-U10030HA(VA)	100 W	1403
R88M-U20030HA(VA)	200 W	1404
R88M-U40030HA(VA)	400 W	1405
R88M-U75030HA(VA)	750 W	1406
R88M-U1K030H(V)	1 kW	1607
R88M-U1K530H(V)	1.5 kW	1608
R88M-U2K030H(V)	2 kW	1609

Note The motor code for R88M-U1K315H(V) is 160D.

U Series (With Absolute Encoder)

Motor model	Capacity	Code
R88M-U03030TA(XA)	30 W	1501
R88M-U05030TA(XA)	50 W	1502
R88M-U10030TA(XA)	100 W	1503
R88M-U20030TA(XA)	200 W	1504
R88M-U40030TA(XA)	400 W	1505
R88M-U75030TA(XA)	750 W	1506
R88M-U1K030T(X)	1 kW	1507
R88M-U1K530T(X)	1.5 kW	1508
R88M-U2K030T(X)	2 kW	1509

Note The motor code for R88M-U1K315X is 1513.

U-UE Series

Motor model	Capacity	Code
R88M-UE10030H(V)-S1	100 W	1603
R88M-UE20030H(V)-S1	200 W	1604
R88M-UE40030H(V)-S1	400 W	1605
R88M-UE75030H(V)-S1	750 W	1606

H Series

Motor model	Capacity	Code
R88M-H05030	50 W	1007
R88M-H10030	100 W	1008
R88M-H20030	200 W	1009
R88M-H30030	300 W	1010
R88M-H50030	500 W	1011
R88M-H75030	750 W	1012
R88M-H1K130	1100 W	1013

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M Series (1,200 r/min)

Motor model	Capacity	Code
R88M-M20012	200 W	0105
R88M-M40012	400 W	0106
R88M-M70012	700 W	0107
R88M-M1K112	1100 W	0108
R88M-M1K412	1400 W	0109
R88M-M1K812	1800 W	010A

M Series (2,000 r/min)

Motor model	Capacity	Code
R88M-M20020	200 W	0205
R88M-M40020	400 W	0206
R88M-M70020	700 W	0207
R88M-M1K120	1100 W	0208
R88M-M1K820	1800 W	0217
RR88M-M2K220	2200 W	0218

M Series (4,000 r/min)

Motor model	Capacity	Code
R88M-M06040	60 W	0405
R88M-M12040	120 W	0406
R88M-M20040	200 W	0407
R88M-M40040	400 W	0408
R88M-M70040	700 W	0409
R88M-M1K140	1100 W	040A
R88M-M2K040	2000 W	040B

Note After setting this parameter, turn OFF the power and check to be sure that the displays have turned OFF before turning the power back ON again. (The new setting will go into effect when the power is turned back ON.)

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-03	**Resolver cable length**	**1 to 120**	**m**	**5**

- This parameter specifies the resolver cable length for when M-series AC Servomotors are connected.
- Be sure to make this setting correctly. If the set value differs from the actual cable length, the motor's torque will be reduced.
- This parameter is not valid for motors other than M-series AC Servomotors.

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PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-07	**In-position width**	**1 to 32,767**	**Pulse**	**3**

- This parameter specifies, by the number of motor sensor pulses, the position deviation for outputting the positioning completed signal (INP).
- OMNUC U Series 30 to 750 W with incremental encoder: 8,192 pulses/rotation
  OMNUC U Series 30 to 750 W with absolute encoder: 4,096 pulses/rotation
  OMNUC U Series 1 to 2 kW with incremental encoder: 16,384 pulses/rotation
  OMNUC U Series 1 to 2 kW with absolute encoder: 32,768 pulses/rotation
  OMNUC U-UE Series with incremental encoder: 4,096 pulses/rotation
  OMNUC H Series with incremental encoder: 8,000 pulses/rotation
  OMNUC M Series with resolver: 24,000 pulses/rotation
  (absolute precision: 0.18°; ambient temperature: 25°C)
- Match this setting to the mechanical precision.

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-11	**Current limit value**	**0.0 to 100.0**	**%**	**100.0**

- This parameter specifies the maximum current provided to the motor, with the motor's momentary maximum current as 100%.
- Use this parameter to limit the torque added to the mechanical system.

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-14	**S-curve acceleration/deceleration time**	**0.0 to 32.76**	**s**	**0.00**

- This parameter specifies the S-curve (filter characteristic) for the acceleration/deceleration time (PP-20 to PP-23).
- Use this parameter to suppress the impact to the mechanical system during acceleration and deceleration.
- If the acceleration/deceleration time is 0, this will become the time until 90% of the target speed is obtained.
- When this parameter is set to "0.00," the S-shaped acceleration/deceleration will be invalidated and a trapezoidal curve will be employed according to the acceleration/deceleration time (PP-20 to PP-23).

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-16	**Brake mode**	**0 to 3**	**---**	**0**

This parameter specifies the brake output (BO) function and the method for stopping the motor when the RUN command is OFF.

Set value	Description
0	Brake output: dynamic brake; stop method: free-running stop
1	Brake output: on-hold brake; stop method: stop in deceleration time during execution
2	Brake output: on-hold brake; stop method: stop after rotation according to error counter's accumulated number of pulses
3	Brake output: on-hold brake; stop method: free-running stop

Note After setting this parameter, turn OFF the power and check to be sure that the displays have turned OFF before turning the power back ON again. (The new setting will go into effect when the power is turned back ON.)

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PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-25	**Monitor output**	**000 to 011**	**---**	**010**

This parameter specifies the analog monitor output data and the output polarity.

Set value	Description
000	Current monitor output; output not reversed (positive voltage for forward torque)
001	Current monitor output; output reversed (negative voltage for forward torque)
010	Speed monitor output; output not reversed (positive voltage for forward motor rotation)
011	Speed monitor output; output reversed (negative voltage for forward motor rotation)

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-26	**Motor rotation direction**	**0, 1**	**---**	**0**

This parameter specifies the direction of motor rotation.

Set value	Description
0	Rotation in forward direction with + direction command
1	Rotation in reverse direction with + direction command

Note "+direction" indicates the present value addition direction, and "– direction" indicates the present value subtraction direction.

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-28	**Brake ON speed**	**0.0 to 100.0**	**%**	**1.0**

- When the on-hold brake (1, 2, 3) is set for the brake mode (UP-16), this parameter specifies the r/min for turning OFF the brake output (BO).
- Set the motor's rated r/min as 100%.

⚠ **Caution** If the on-hold brake is operated during high-speed motor rotation it will cause damage to the brake.

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-29	**Motor test speed**	**1 to 8,000**	**r/min**	**50**

- This parameter specifies the r/min for motor test operation.
- Set the motor test r/min to a value no higher than than the motor's rated r/min.

PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-30	**External regeneration resistance value**	**0.0 to 100.0**	**Ω**	**0.0**

- When attaching an External Regeneration Resistor, this parameter specifies its resistance value (Ω).
- This parameter is used for calculating the regeneration absorption rate. (The regeneration absorption rate is displayed in Monitor Mode.)

Note 1. This parameter is only valid for the FND-X50H- .

Note 2. When using an OMRON External Regeneration Resistor, set to 30.0 (Ω).

Note 3. After this parameter has been set, it will become valid when the power supply is turned OFF (check that the display has been cleared) and ON again.

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PRM No.	Parameter name	Setting range	Unit	Factory setting
UP-31	**External regeneration resistance capacity**	**0.00 TO 327.67**	**kW**	**0.00**

- When attaching an External Regeneration Resistor, this parameter specifies its capacity (kW).
- This parameter is used for calculating the regeneration absorption rate. (The regeneration absorption rate is displayed in Monitor Mode.)

Note 1. This parameter is only valid for the FND-X50H- .

Note 2. After this parameter has been set, it will become valid when the power supply is turned OFF (check that the display has been cleared) and ON again.

□H Parameters

PRM No.	Parameter name	Setting range	Unit	Factory setting
HP-33	**Load rate time**	**1 to 60**	**s**	**30**

- This parameter specifies the time interval for the effective load factor calculation.
- Set the integer multiple for the machine cycle time.
- The effective load factor is displayed in Monitor Mode.

PRM No.	Parameter name	Setting range	Unit	Factory setting
HP-46	**In-position timer**	**3.2 to 320.0**	**ms**	**3.2**

- This parameter specifies the minimum ON time for the positioning completed signal and the minimum OFF time for the ready signal.
- Be sure to set enough time so that the Programmable Controller (PC) will be able to respond when the positioning completed signal and the ready signal are received by the PC.

  Set value $\geqq$ PC cycle time $\times$ 2 + PC input delay time + 1 ms
- When the Increment and Decrement Keys are pressed, the set value is changed in units of 3.2 ms. The digit to be set cannot be specified by pressing the Shift Key.

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3-5 Position Control Settings (PTP Parameters)

PTP parameters are the parameters required for setting position data such as the minimum setting unit, pulse rate, reference speed, and so on.
Some of the user parameters go into effect when the power has been turned OFF and then back ON again. Those user parameters are indicated in the tables in *3-5-2 PTP Parameters (PP-01 to PP-26)*.

Go to the User Parameter Edit Mode.	Mode Key
Display the pertinent parameter number.	Increment Key, Decrement Key, Increment Key +Data Key, Decrement Key + Data Key
Display the parameter contents (data).	Increment Key
Enable the data change.	Data Key + Shift Key
Change the data.	Increment Key, Decrement Key, Shift Key
Save the data in memory.	Data Key

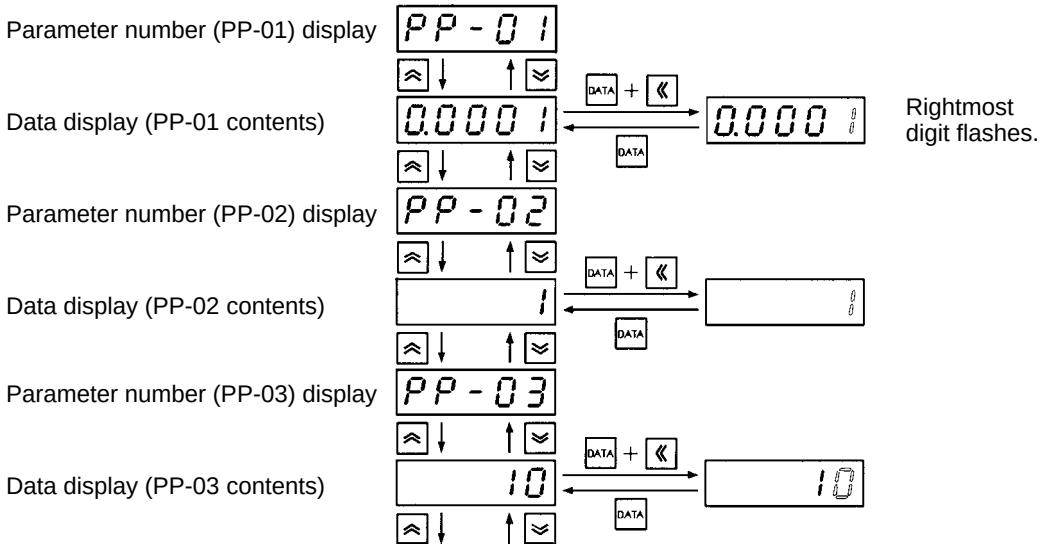
3-5-1 Setting PTP Parameters (PP-01 to PP-26)

Use the following procedure to set the PTP parameters.

1. Press the Mode Key to go to the PTP Parameter Edit Mode (PP-01).
2. Use the Increment and Decrement Keys to display the parameter number (PP-) desired.
3. Press the Increment Key to display the parameter data.
4. Press the Data Key and Shift Key simultaneously to enable a data change. The rightmost digit will flash.
5. Use the Increment and Decrement Keys to change the data. The flashing numeral can be changed. To move to the next digit, press the Shift Key.
6. Press the Data Key to save the changed data in memory.

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PTP Parameter Display Example



3-5-2 PTP Parameters (PP-01 to PP-26)

No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?
01	Minimum setting unit	---	0.0001 to 1	0.0001	Specifies basic unit for movement and speed value setting and display.	Yes
02	Pulse rate 1 (Rotation)	1 revolution	1 to 32,767	1	Specifies PP-02 to n and PP-03 to x (Note: “n” is the number of motor revolutions and “x” is machine axis movement.)	Yes
03	Pulse rate 2 (Movement)	1	1 to 32,767	10		Yes
04	Minimum resolution (leftmost digits)	---	---	0.0	Used to display machine axis movement per motor sensor pulse. This factory-set value cannot be changed.	Yes
05	Minimum resolution (rightmost digits)	---	---	0042		Yes
06	Origin compensation (leftmost digits)	1 pulse	–9,999 to 9,999	0	Specifies number of motor sensor pulses for movement between origin search completion position and machine axis origin. * The value can be obtained by origin teaching.	No
07	Origin compensation (rightmost digits)		0 to 9,999	0		No
08	Compensation (leftmost digits)	(PP-01) (See note 1.)	0 to 9,999	0	Specifies backlash compensation if UP-01 is set to 11 or 13 in PTP control mode. Specifies slip compensation if UP-01 is set to 12 or 14 in feeder control mode.	No
09	Compensation (rightmost digits)		0 to 9,999	0		No
10	Forward software limit (leftmost digits)	(PP-01) (See note 1.)	–9,999 to 9,999	9,999	Specifies software limit position in the forward direction. * The software limit overflow in the positive direction will not be detected if the value is set to 9999,9999.	No
11	Forward software limit (rightmost digits)		0 to 9,999	9,999		No

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No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?
12	Reverse software limit (leftmost digits)	(PP-01) (See note 1.)	–9,999 to 9,999	–9,999	Specifies software limit position in the reverse direction. * The software limit overflow in the reverse direction will not be detected if the value is set to –9999,9999.	No
13	Reverse software limit (rightmost digits)		0 to 9,999	9,999		No
14	Reference speed (leftmost digits)	1/s	0 to 9,999	0	Specifies machine axis reference speed per second.	No
15	Reference speed (rightmost digits)		0 to 9,999	500		No
16	JOG speed	1%	1 to 199	10	Specifies motor r/min in JOG operation as override value based on reference speed.	No
17	Origin search high speed	1%	1 to 199	10	Specifies origin proximity search speed in origin search operation as override value based on reference speed. This value is used as axis speed for origin compensation as well. * Set an appropriate value so that the origin proximity signal can be detected accurately.	No
18	Origin search low speed	1%	1 to 199	1	Specifies phase-Z search speed in origin search operation as override value based on reference speed. * Set an appropriate value so that the speed will be 500 r/min maximum.	No
19	Origin search direction	---	0, 1	0	Specifies origin search direction. 0: Forward direction 1: Reverse direction	No
20	Acceleration time 0	1 ms	0 to 9,999	0	Specifies time spent in reaching reference speed after system is in operation. * This value is used as acceleration time for the Position Driver in origin search operation, JOG operation, point positioning operation, and direct positioning operation.	No
21	Acceleration time 1	1 ms	0 to 9,999	100	Specifies time spent in reaching reference speed after system is in operation. * This value will be valid if the Position Driver is in point positioning operation.	No

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No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?
22	Deceleration time 0	1 ms	0 to 9,999	0	Specifies time spent in decelerating reference speed to a stop. * This value is used as deceleration time for the Position Driver in origin search operation, JOG operation, point positioning operation, and direct positioning operation.	No
23	Deceleration time 1	1 ms	0 to 9,999	100	Specifies time spent in decelerating reference speed to a stop. * This value will be valid if the Position Driver is in point positioning operation.	No
24	Deceleration stop mode	---	0 to 2	1	Selects stop method with STOP signal OFF. 0: Free-running stop 1: Deceleration stop 2: Error counter reset stop	No
25	Alarm selection	---	00 to 11	11	Selects alarm processing method with limit or soft limit detection. └ Overrun 0: Servo-lock stop 1: Servo-free alarm └ Soft limit 0: Servo-lock stop 1: Servo-lock alarm	No
26	Selection signal output time (See note 2.)	0.8 ms	0.8 to 800.0	20.0	Specifies time during which P.OUT0 to P.OUT4 signals are turned ON for selecting position data and speed data for direct positioning.	No

Note 1. The minimum setting value varies with the value set in PP-01. The setting unit is used for machine axis movement and can be changed with the pulse rate setting.
Setting unit examples:
Linear movement: mm, cm, m, inch, yard
Rotating movement: degree, rad, revolution
Other movement: Pulse

Note 2. Be sure to set enough time so that the Programmable Controller (PC) will be able to respond when the position and speed data selections are received by the PC.
Set value ≧ PC cycle time × 2 + PC input delay time + 1 ms
With CompoBus/S-type Position Drivers, use the following formula for the Programmable Controller's input circuit delay time:
PC input circuit delay time = (Communications cycle time) x 2

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3-5-3 PTP Parameter Details (PP-01 to PP-26)

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-01	**Minimum setting unit**	**0.0001 to 1**	**Machine axis movement**	**0.0001**

- This parameter specifies the basic unit for movement and speed value setting and display.
- Any of the following five basic units can be be set: 0.0001, 0.001, 0.01, 0.1, 1.
- Set this unit according to the minimum feeding amount. For example, if the minimum feeding amount is 0.1 (mm), set a minimum setting unit of no more than 0.1.

Note 1. After setting this parameter, turn OFF the power and check to be sure that the displays have turned OFF before turning the power back ON again. (The new setting will go into effect when the power is turned back ON.)

Note 2. If parameter PP-01 is changed after the position and speed data have been set, the position and speed digits will change. After setting the parameters (PP-01 to PP-03) that serve as references for the other parameter settings, turn the power OFF and then ON again to put these reference parameter settings into effect before setting the rest of the parameters.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-02	**Pulse rate 1**	**1 to 32,767**	**Rotation**	**1**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-03	**Pulse rate 2**	**1 to 32,767**	**Mechanical axis movement**	**10**

- In order to set the amount of mechanical axis movement as positioning data, set the relationship between the motor shaft rotation and the mechanical axis movement.
- For example, for a relationship of one motor rotation to 10 mm of mechanical axis movement, set PP-02 to “1” and PP-03 to “10.”

Note After setting this parameter, turn OFF the power and check to be sure that the displays have turned OFF before turning the power back ON again. (The new setting will go into effect when the power is turned back ON.)

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-04	**Minimum resolution (left-most digits)**	**---**	**Mechanical axis movement**	**0.0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-05	**Minimum resolution (right-most digits)**	**---**	**Mechanical axis movement**	**0042**

These parameters are used to display the mechanical axis movement per encoder/resolver pulse. The factory-set values cannot be changed.

Displayed value = pulse rate 2 / (pulse rate 1 x motor sensor resolution)

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Motor sensor resolution:

OMNUC U Series 30 to 750 W with incremental encoder:	8,192 pulses/rotation
OMNUC U Series 30 to 750 W with absolute encoder:	4,096 pulses/rotation
OMNUC U Series 1 to 2 kW with incremental encoder:	16,384 pulses/rotation
OMNUC U Series 1 to 2 kW with absolute encoder:	32,768 pulses/rotation
OMNUC U Series with absolute encoder:	4,096 pulses/rotation
OMNUC U-UE Series with incremental encoder:	4,096 pulses/rotation
OMNUC H Series with incremental encoder:	8,000 pulses/rotation
OMNUC M Series with resolver:	24,000 pulses/rotation

Note The displayed value will be changed after PP-01 to PP-03 have been set and the power has been turned OFF and back ON again.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-06	**Origin compensation (left-most digits)**	**–9,999 to 9,999**	**Pulse**	**0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-07	**Origin compensation (right-most digits)**	**0 to 9,999**	**Pulse**	**0**

- These parameters are used to set the mechanical origin to any position.
- Set the number of motor sensor pulses for movement between the origin search completion position and the mechanical origin.
- When origin teaching is executed, the data is automatically written to these parameters and the teaching position becomes the origin.
- After these parameters have been set, the mechanical origin can be moved by executing an origin search.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-08	**Compensation (leftmost digits)**	**0 to 9,999**	**Mechanical axis movement**	**0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-09	**Compensation (rightmost digits)**	**0 to 9,999**	**Mechanical axis movement**	**0**

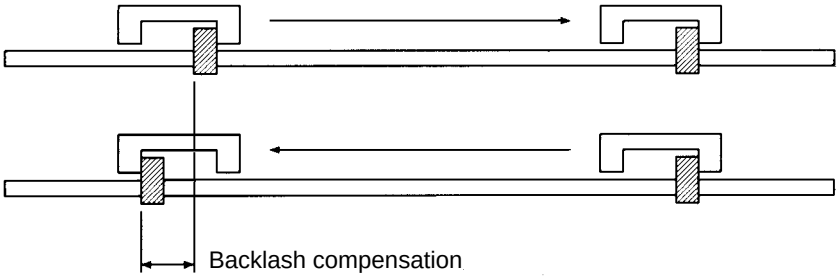
- These parameters specify the amount of mechanical axis movement for compensation during positioning operations.
- The decimal point location is set by PP-01 (minimum setting unit).
- For PTP control (UP-01: 11 or 13), this compensation becomes backlash compensation; for feeder control (UP-01: 12 or 14), it becomes slip compensation.

Backlash Compensation

- Set the amount of play (backlash) for a mechanical system such as gears or chains.
- When movement is in the reverse direction from that of the previous operation, stopping precision can be improved by feeding an exact amount of compensation to absorb the backlash in the mechanical system.

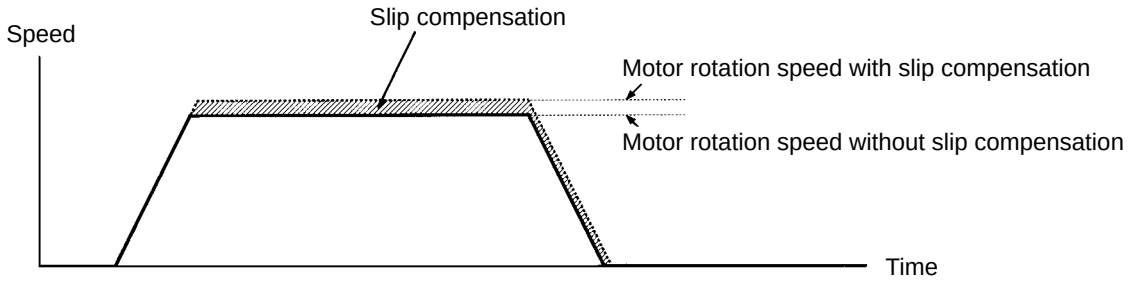
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- The following diagram provides an example of backlash compensation during operation.



Slip Compensation

- Set slip compensation if slippage occurs in the mechanical system during feeding.
- Set these parameters to compensate for the amount of slippage that occurs when feeding for just the amount set for pulse rate 2. For example, if 10 mm is fed with PP-01 (minimum setting unit) set to 0.001 and PP-03 (pulse rate 2) to 10 (mm), and if the slippage amount is 0.1 mm, then set PP-08 to 0 and PP-09 to 0.100.
- Compensating for just the amount of slippage that occurs during feeding absorbs the play from the mechanical system and improves the stopping precision. Also, in order to match the mechanical axis speed to the command value, the motor is speeded up for just the amount of slippage (within the motor's maximum speed range).
- The following diagram provides an example of slip compensation during operation.



PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-10	**Positive software limit (leftmost digits)**	**–9,999 to 9,999**	**Mechanical axis move-ment**	**9,999**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-11	**Positive software limit (rightmost digits)**	**0 to 9,999**	**Mechanical axis move-ment**	**9,999**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-12	**Negative software limit (leftmost digits)**	**–9,999 to 9,999**	**Mechanical axis move-ment**	**–9,999**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-13	**Negative software limit (rightmost digits)**	**0 to 9,999**	**Mechanical axis move-ment**	**9,999**

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- These parameters set limits on mechanical system movement.
- The decimal point location is set by PP-01 (minimum setting unit).
- When a software limit is detected, the motor is placed in servo-lock and stopped. The alarm output status at that time is determined by the PP-25 (alarm selection) setting.
- After the motor has been stopped as a result of a software limit having been detected, the motor will only be able to be driven in the direction which will release it from the software limit. (If alarm A.L34 or A.L35 has been generated, the alarm must be reset before the motor can be driven.)
- If the maximum value is set for a given detection direction (e.g., 99,999,999 for the positive software limit), then the software limit for that direction will be ignored and the alarm detection will not be activated.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-14	**Reference speed (leftmost digits)**	**0 to 9,999**	**Mechanical axis movement**	**0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-15	**Reference speed (rightmost digits)**	**0 to 9,999**	**Mechanical axis movement**	**500**

- These parameters specify the motor's speed during positioning, as the amount of mechanical axis movement per second.
- The actual speed becomes the reference speed x the override. (The override value is set as PTP speed data or by direct input.)

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-16	**JOG speed**	**1 to 199**	**%**	**10**

This parameter specifies the motor r/min in JOG operation (+JOG, –JOG) as an override value based on the reference speed as 100%.

Note Set the JOG speed at or below the motor's maximum speed.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-17	**Origin search high speed**	**1 to 199**	**%**	**10**

- This parameter specifies origin proximity signal search speed in origin search operation as an override value based on the reference speed as 100%.
- The origin search high speed is also used as the speed during origin compensation

Note Set an appropriate value so that the origin proximity signal can be detected accurately.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-18	**Origin search low speed**	**1 to 199**	**%**	**1**

In origin search operation, this parameter specifies the motor sensor's Z-phase search speed after origin proximity signal detection as an override value based on the reference speed as 100%.

Note Set an appropriate value so that the speed will be 500 r/min maximum.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-19	**Origin search direction**	**0, 1**	**---**	**0**

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This parameter specifies the direction for beginning an origin search operation.

Set value	Description
0	Begins origin search in the positive direction (incrementing the present value).
1	Begins origin search in the negative direction (decrementing the present value).

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-20	**Acceleration time 0**	**0 to 9,999**	**ms**	**0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-21	**Acceleration time 1**	**0 to 9,999**	**ms**	**100**

- These parameters specify the time from a stop until the reference speed is reached.
- The actual acceleration time can be obtained from the following formula:
  [(Target speed – present speed) / reference speed] x acceleration time

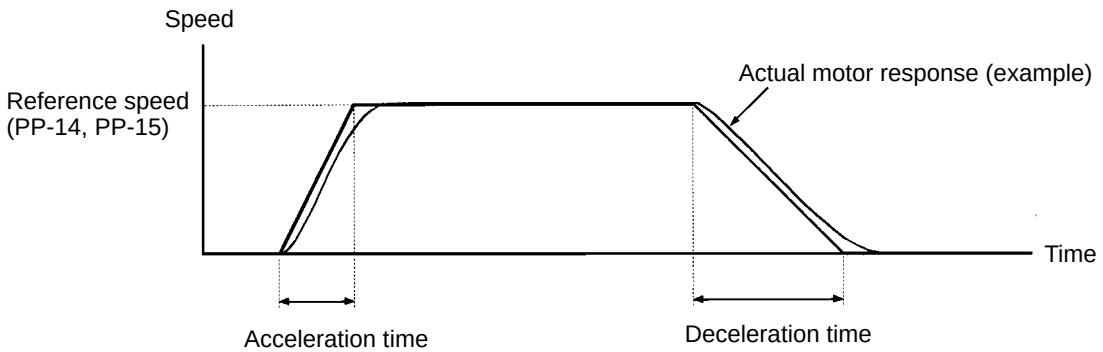
  If S-curve acceleration time (UP-14) is set, the acceleration time will be lengthened.
- Acceleration time 0 is used as the acceleration time for origin search, JOG operation, and positioning by direct input.
- When positioning with PTP data, acceleration time 0 or 1 can be selected using the PTP data's acceleration/deceleration selection (Pd A).

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-22	**Deceleration time 0**	**0 to 9,999**	**ms**	**0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-23	**Deceleration time 1**	**0 to 9,999**	**ms**	**100**

- These parameters specify the time from the reference speed until the positioning is stopped.
- The actual deceleration time can be obtained from the following formula:
  [(Present speed – target speed) / reference speed] x deceleration time
- Deceleration time 0 is used as the deceleration time for origin search, JOG operation, and positioning by direct input.
- When positioning with PTP data, deceleration time 0 or 1 can be selected using the PTP data's acceleration/deceleration selection (Pd A).

Acceleration/Deceleration Operation



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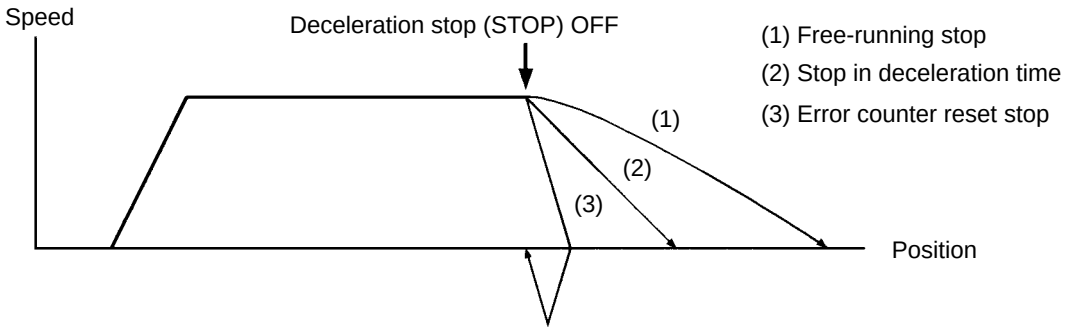
PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-24	**Deceleration stop mode**	**0, 1, 2**	**---**	**1**

This parameter selects the stop method for when the deceleration stop (STOP) signal is OFF.

Set value	Description
0	Free-running stop. (Servo OFF)
1	Stop in deceleration time specified by positioning data during operation. (Servo-lock after stop)
2	Stop with error counter reset. (Servo-lock after stop)

Note With a free-running stop, after the STOP signal has turned ON operation can be re-started by turning the RUN command from OFF to ON.

Deceleration Stop Operation



Note After the deceleration stop (STOP) signal turns OFF, there is a maximum delay of 1.6 ms before the stop processing begins.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-25	**Alarm selection**	**00 to 11**	**---**	**11**

This parameter specifies the alarm processing method for when limit detection (overrun) or software limit detection occurs.

Set value	Description
0	Servo-lock stop when software limit is detected.
1	Alarm (A.L34, A.L35) and servo-lock stop when software limit is detected.
0	Servo-lock stop when limit is detected.
1	Alarm (A.L38) and servo-free stop when limit is detected.

PRM No.	Parameter name	Setting range	Unit	Factory setting
PP-26	**Selection signal output time**	**0.8 to 800.0**	**ms**	**20.0**

- This parameter specifies the time during which P.OUT0 to P.OUT4 signals are turned ON for selecting position data and speed data for positioning by direct input.

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- Be sure to set enough time for the Programmable Controller (PC) to respond when the position and speed data selections are received by the PC.
  Set value ≧ PC cycle time × 2 + PC input delay time + 1 ms
  With CompoBus/S-type Position Drivers, use the following formula for the Programmable Controller's input circuit delay time:
  PC input circuit delay time = (Communications cycle time) x 2
- When the Increment and Decrement Keys are pressed, the set value is changed in units of 0.8 ms. The digit to be set cannot be specified by pressing the Shift Key.

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3-6 Setting Positioning Data (PTP Data, Direct Input)

Positioning data includes the following data settings: position, speed, acceleration/deceleration, and operation mode. (The acceleration/deceleration and operation mode selection settings are not made for position control by direct input.)

Go to the User Parameter Edit Mode.	Mode Key
Display the pertinent parameter number.	Increment Key, Decrement Key, Increment Key +Data Key, Decrement Key + Data Key
Display the parameter contents (data).	Increment Key
Enable the data change.	Data Key + Shift Key
Change the data.	Increment Key, Decrement Key, Shift Key
Save the data in memory.	Data Key

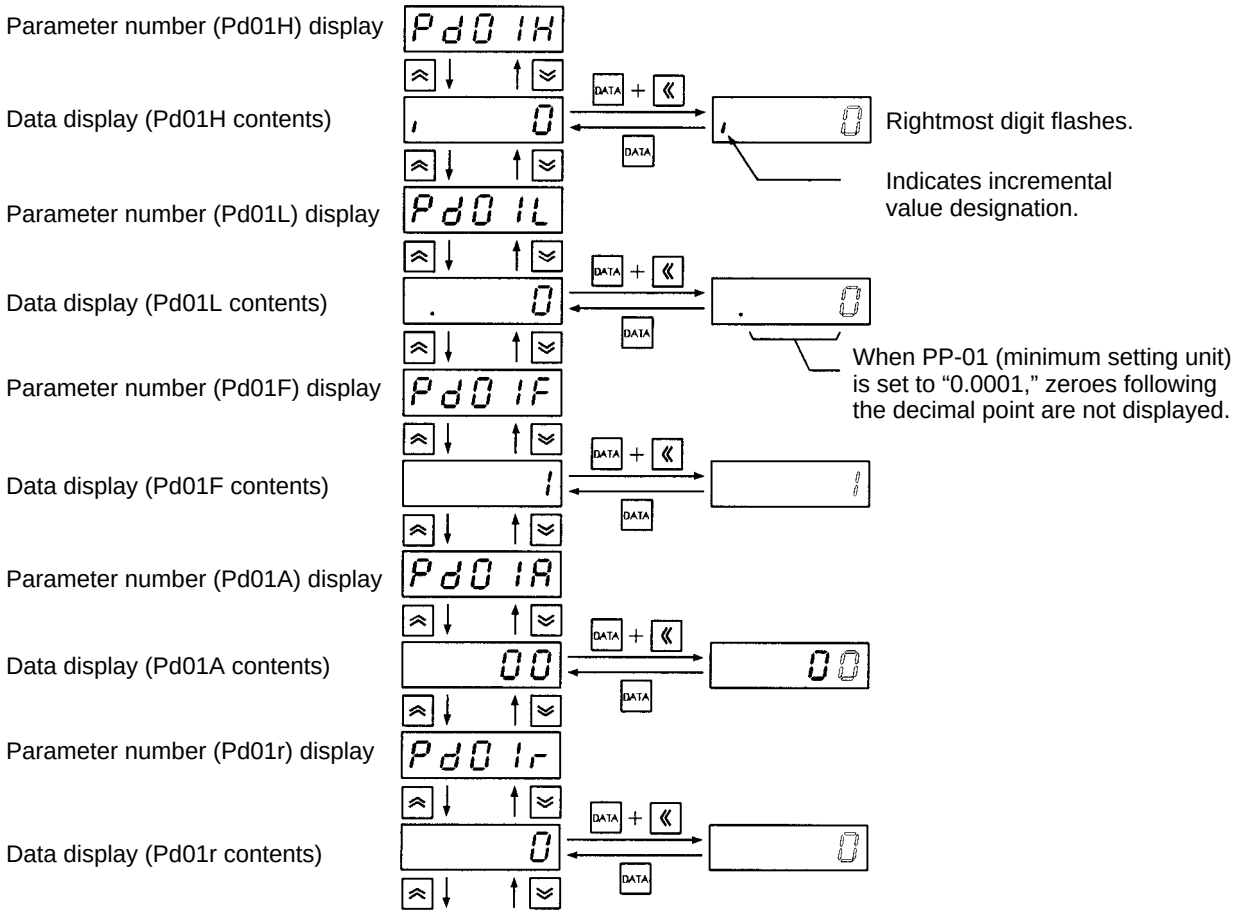
3-6-1 Setting PTP Data (When UP-01 is 11 or 12)

Use the following procedure to set the PTP data (Pd01 to Pd64).

1. Press the Mode Key to go to the PTP Data Edit Mode (Pd01H).
2. Use the Increment and Decrement Keys to display the parameter number (Pd) desired.
3. Press the Increment Key to display the parameter data.
4. Press the Data Key and Shift Key simultaneously to enable a data change. The rightmost digit will flash.
5. Use the Increment and Decrement Keys to change the data. The flashing numeral can be changed. To move to the next digit, press the Shift Key.
6. Press the Data Key to save the changed data in memory.

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PTP Data Display Example



3-6-2 Setting Direct Input (When UP-01 is 13 or 14)

- With direct input, the control inputs (P.IN0 to 7), position data (7 + 1/2 digits BCD), sign bit, I (incremental value) or A (absolute value) designation bit, and speed data (2 digits BCD) are taken in order.
- P.OUT0 to 4 (position selection 1 to 4, speed selection) are output as timing signals for taking the data.
- Data is taken on the falling edge of the P.OUT signal. When setting data from the Programmable Controller, output the data between the time that P.OUT turns ON and turns OFF. The time that P.OUT stays ON for can be set by PP-26 (selection signal output time).

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Direct Input Positioning Data

Position data range: –39,999,999 to 39,999,999 (with incremental or absolute setting)

Speed data range: 0 to 99 (100%, 1 to 99%)

Input signal	Output signal									
Name	Position selection 1		Position selection 2		Position selection 3		Position selection 4		Speed selection	
Position 7	2nd digit (Position)	Bit 3	4th digit (Position)	Bit 3	6th digit (Position)	Bit 3	Position I/A bit		2nd digit (Speed)	Bit 3
Position 6		Bit 2		Bit 2		Bit 2	Position sign bit			Bit 2
Position 5		Bit 1		Bit 1		Bit 1	8th digit (Position)	Bit 1		Bit 1
Position 4		Bit 0		Bit 0		Bit 0		Bit 0		Bit 0
Position 3	1st digit (Position)	Bit 3	3rd digit (Position)	Bit 3	5th digit (Position)	Bit 3	7th digit (Position)	Bit 3	1st digit (Speed)	Bit 3
Position 2		Bit 2		Bit 2		Bit 2		Bit 2		Bit 2
Position 1		Bit 1		Bit 1		Bit 1		Bit 1		Bit 1
Position 0		Bit 0		Bit 0		Bit 0		Bit 0		Bit 0

Note 1. For example, when position selection 1 (P.OUT0) is ON, positions 0 to 7 (P.IN0 to 7) are taken as the position data's first and second digits. (They are taken at the falling edge of P.OUT0.)

Note 2. The position sign bit specifies the position as "plus" when OFF (0), and "minus" when ON (1).

Note 3. The position data takes the value set by PP-01 (minimum setting unit).

Note 4. When the position I/A bit is OFF (0), I (incremental value) is set; when it is ON (1), A (absolute value) is set.

Note 5. Set the speed data with the reference speed (PP-14, PP-15) override value (%). If the speed data is set to "0," the override value will be 100%.

Note 6. With direct input, the acceleration/deceleration time is fixed at PP-20 (acceleration time 0) and PP-22 (deceleration time 0).

Direct Input Setting Example

In this example, positioning is moved at 250 mm/s to an absolute-value position of 1,000 mm, with the mechanical system set for 10 mm of movement per motor rotation, a minimum feed amount of 1 μm, and a reference speed of 500 mm/s.

Parameter Settings

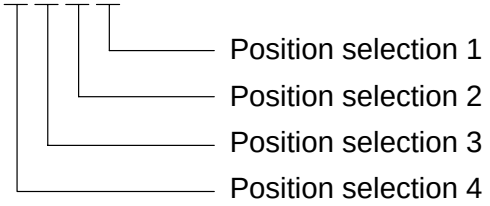
Minimum setting unit: PP-01 = 0.001 (minimum feed amount: 0.001 mm)
Pulse rate: PP-02 = 1; PP-03 = 10 (10 mm of movement per motor rotation)
Reference speed: PP-14 = 0; PP-15 = 500 (500 mm/s)

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Direct Input Data (Signal) Settings

Position data: "A + 01000000" (x 0.001 mm) = 81000000

Speed data: 50 (%)



Input signal	Output signal										
Name	Position selection 1		Position selection 2		Position selection 3		Position selection 4			Speed selection	
Position 7	OFF	0	OFF	0	OFF	0	ON	A	8	OFF	5
Position 6	OFF		OFF		OFF		OFF	+		ON	
Position 5	OFF		OFF		OFF		OFF	0		OFF	
Position 4	OFF		OFF		OFF		OFF			ON	
Position 3	OFF	0	OFF	0	OFF	0	OFF	1		OFF	0
Position 2	OFF		OFF		OFF		OFF			OFF	
Position 1	OFF		OFF		OFF		OFF			OFF	
Position 0	OFF		OFF		OFF		ON			OFF	

3-6-3 PTP Data (Pd01 to Pd64)

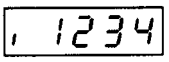
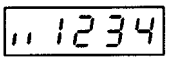
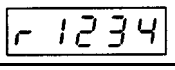
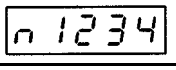
No. Pd	Name	Minimum setting unit	Setting range	Factory setting	Description
01H	Point No. 1 position data (leftmost digits)	(PP-01)	(I/A) –3,999 to 3,999	(I) 0	Specifies point No. 1 position data. A value between –39,999,999 and 39,999,999 can be set. Leftmost digit is used to specify "A" (absolute) or "I" (incremental) value.
01L	Point No. 1 position data (rightmost digits)	(PP-01)	0 to 9,999	0	
01F	Point No. 1 speed data	1%	1 to 199	1	Specifies override value based on reference speed.
01A	Point No. 1 acceleration/deceleration selection	---	00 to 11	00	Selects acceleration/deceleration time for positioning. └ Acceleration 0: Acceleration time 0 1: Acceleration time 1 └ Deceleration 0 Deceleration time 0 1: Deceleration time 1
01r	Point No. 1 operation mode selection	---	0 to 2	0	0: Independent operation mode 1: Automatic incremental mode 2: Continuous operation mode

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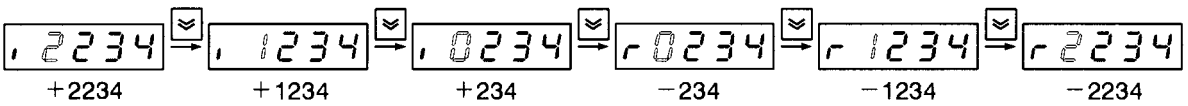
Pd02 to Pd63 are the same as Pd01 in data except for the point number.

64H	Point No. 64 position data (leftmost digits)	(PP-01)	(I/A) –3,999 to 3,999	(I) 0	Same as point No. 1.
64L	Point No. 64 position data (rightmost digits)	(PP-01)	0 to 9,999	0	
64F	Point No. 64 speed data	1%	1 to 199	1	
64A	Point No. 64 acceleration/deceleration selection	---	00 to 11	00	
64r	Point No. 64 operation mode selection	---	0	0	Available in independent operation mode only.

Note 1. The position data (leftmost digits) display is as follows, according to whether the sign is plus or minus and whether the values are incremental or absolute.

Sign	I (Incremental value designation)	A (Absolute value designation)
+	I + 1234 	A + 1234 
–	I – 1234 	A – 1234 

Note 2. When the value set for the position data's leftmost digits is negative, pressing the Decrement Key with the fourth digit (i.e., the leftmost numeral) flashing will cause that digit to change as follows:



Note 3. When the value set for the position data's leftmost digits is negative, pressing the Increment Key causes the flashing numeral to be decremented. (Since it is negative, this actually increments the overall number.)

Note 4. To set the I/A designation, press the Increment Key or the Decrement Key while the fifth (leftmost) digit is flashing to toggle between "I" and "A."

3-6-4 PTP Data Details (Pd)

PRM No.	Parameter name	Setting range	Unit	Factory setting
Pd H	**Positioning data (leftmost digits)**	**(I/A), –3,999 to 3,999**	**Mechanical axis movement**	**(I) 0**

PRM No.	Parameter name	Setting range	Unit	Factory setting
Pd L	**Positioning data (rightmost digits)**	**0 to 9,999**	**Mechanical axis movement**	**0**

- The above PTP data determines the mechanical movement distance (i.e., the amount of motor rotation), the sign, and the data attribute (i.e., I or A).

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- The decimal point location is determined by the PP-01 (minimum setting unit) setting. If, for example, you want to move to a position (incremental value) of 1,000 mm from the present position, with the mechanical system set for 10 mm of movement per motor rotation and a minimum feed amount of 1 μm, then make the following settings.

PTP Parameter Settings

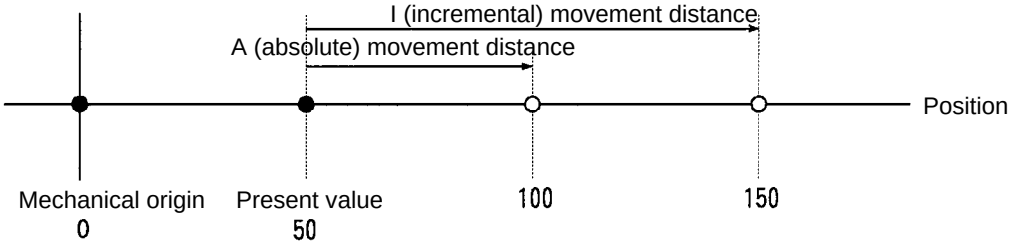
Minimum setting unit: PP-01 = 0.001 (minimum feed amount: 0.001 mm)
Pulse rate: PP-02 = 1; PP-03 = 10 (10 mm of movement per motor rotation)

PTP Data Settings

Leftmost digits	Pd	H = "I + 100"	I 100
Rightmost digits	Pd	L = "0.000"	0.000

- **Data Attribute (I/A Designation)**
  I (incremental value designation) is the method for designating the amount of movement from the present point (the present value).
  A (absolute value designation) is the method for designating the amount of movement from the mechanical origin (the zero position).

Incremental and Absolute Movement Example (Position Data: 100)



Note 1. If the data attribute "I" is set, the position moves to the one obtained from the present value added to 100.
If the data attribute "A" is set, the position moves to the position specified by the coordinate value 100.

Note 2. With feeder control (UP-01: 12), the present value is cleared when the start signal turns ON, and then positioning is executed. Therefore, set the position data based on the position where the start signal was turned ON as 0.

PRM No.	Parameter name	Setting range	Unit	Factory setting
Pd F	**Speed data**	**1 to 199**	**%**	**1**

- This data specifies the movement speed for positioning operations.
- Set an override value as a percentage with respect to the reference speed set in PP-14 and PP-15. For example, make the following settings for a speed of 250 mm/s on condition that the reference speed is 500 mm/s.

PTP Parameter Setting

Reference speed PP-14 = 0, PP-15 = 500 (500 mm/s)

PTP Data Setting

Speed Data Pd F = 50 (%)

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PRM No.	Parameter name	Setting range	Unit	Factory setting
Pd A	**Acceleration/deceleration selection**	**00 to 11**	**---**	**00**

This data specifies the acceleration time and deceleration time for positioning.

Set value	Description
0	Selects deceleration time 0 (set in PP-22).
1	Selects deceleration time 1 (set in PP-23).
0	Selects acceleration time 0 (set in PP-20).
1	Selects acceleration time 1 (set in PP-21).

Note If the S-curve deceleration/acceleration time constant is set in UP-14, the S-curve acceleration/deceleration filter will be enabled, in which case the acceleration and deceleration time will be longer in proportion to the time constant.

PRM No.	Parameter name	Setting range	Unit	Factory setting
Pd r	**Operation mode selection**	**0 to 2**	**---**	**0**

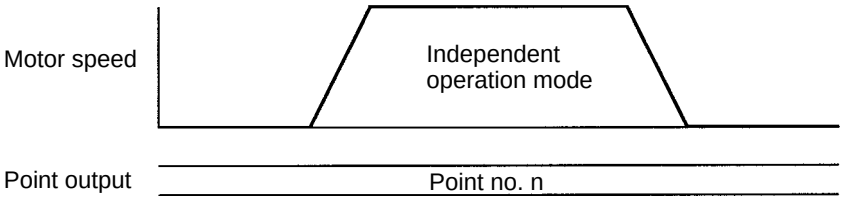
This data specifies the method for moving to the next positioning after a positioning operation has been executed.

Set value	Description
0	Independent operation mode
1	Automatic incremental mode
2	Continuous operation mode

Note Only the independent operation mode can be set in Pd64r for point number 64.

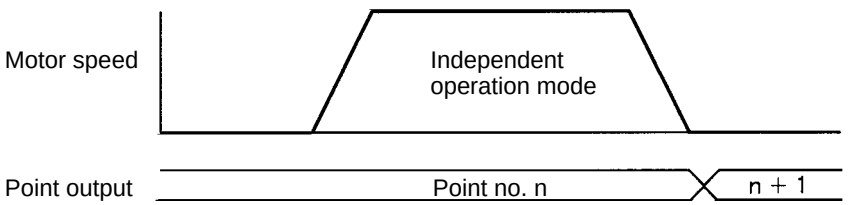
Independent Operation Mode

- Operation is stopped in servo-lock upon completion of positioning at the selected point number.
- The selected point number is output to point outputs 0 to 6 (P.OUT0 to P.OUT6).
- To execute the next positioning, turn ON the start signal after the point number is input.



Automatic Incremental Mode

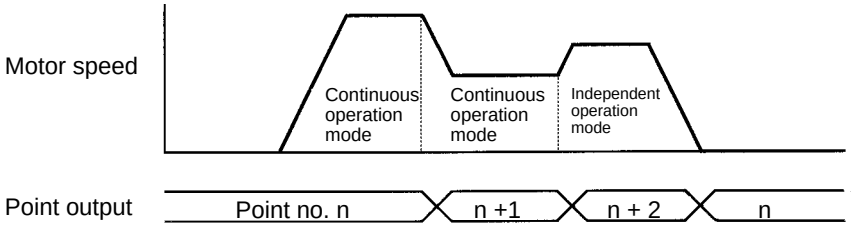
- Operation is stopped in servo-lock upon completion of positioning for the selected point number.
- After operation is stopped, the next point number is output to point outputs 0 to 6 ((P.OUT0 to P.OUT6).
- When the start signal is input (i.e., turns ON), positioning is executed for the next point number. (When positioning is executed in order of point numbers, there is no need to set the point number every time.)



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Continuous Operation Mode

- In this mode, the Position Driver stays in continuous operation without being stopped in servo-lock.
- Until the continuous operation mode specification is canceled (i.e., until the mode changes into independent operation mode or automatic incremental mode), the Position Driver continues operating and refreshing the present point number.
- P.OUT0 to P.OUT6 are refreshed whenever the present point number changes.



Precautions when Using Continuous Operation Mode with Feeder Control

- With feeder control (UP-01: 12), positioning is executed with the present value at the time the start signal turns ON taken as the reference (origin).
- If the Position Driver is in continuous operation mode, the present value will be set to 0 at the moment the start signal is turned ON after the point number is input. The present value cannot be cleared, however, if the next positioning is performed because the start signal is not input in that case. Therefore, for example, make the following settings for a high-speed feed distance of 900 mm followed by a low-speed feed distance of 100 mm.

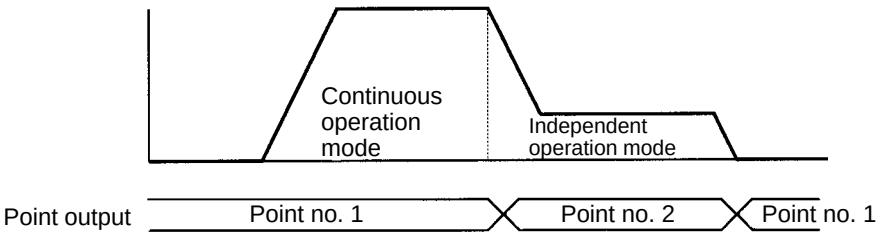
Setting Example 1

Point number 1 = “I + 900.000,” continuous operation mode
Point number 2 = “I + 100.000,” independent operation mode

Setting Example 2

Point number 1 = “I + 900.000,” continuous operation mode
Point number 2 = “A + 1,000.000,” independent operation mode

Note In these examples, PP-01 is set to 0.001 for the minimum setting unit.



Note 1. There is no difference in operation between the data attributes “I” and “A” at point number 1.

Note 2. The operation at point number 2 varies according to the data attribute (I/A) setting.

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3-7 Operational Sequence

3-7-1 Origin Search

Function

- When a motor with an incremental encoder/resolver is used, an operation to establish the mechanical origin after the power has been turned ON is required. This operation is called “origin search.”
- The origin search operation establishes the mechanical origin by actually operating the motor and utilizing the limit input signals (CCWL/CWL), the origin proximity signal (ORG), and the motor sensor’s Z-phase signal.
- When an absolute encoder is used, origin search is not required because the absolute-value data is retained by the battery even when the Driver’s power supply is turned OFF. (Origin compensation and origin teaching are enabled.)
- There are three origin search patterns, according to the position from which the origin search is begun.

  Pattern 1: When the origin search is executed between the limit input signal input in the reverse of the origin search direction and the origin proximity signal input.

  Pattern 2: When the origin search is executed while the origin proximity signal is ON.

  Pattern 3: When the origin search is executed between the origin proximity signal input and the limit input signal input in the origin search direction.

Note If the OFF position of the origin proximity signal (ORG) is close to the motor sensor’s Z-phase position, the origin position may deviate due to inconsistency in the origin proximity OFF position (one revolution for U/H-series motors, and 1/2 revolution for M-series motors). If that occurs, remove the motor from the mechanical system and adjust the Z-phase position. Then reinstall the motor.

U Series:	Z-phase output is 1 pulse per revolution, so rotate motor shaft for 1/2 revolution.
H Series:	Z-phase output is 1 pulse per revolution, so rotate motor shaft for 1/2 revolution.
M Series:	Z-phase output is 2 pulses per revolution, so rotate motor shaft for 1/4 revolution.

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PTP Parameters

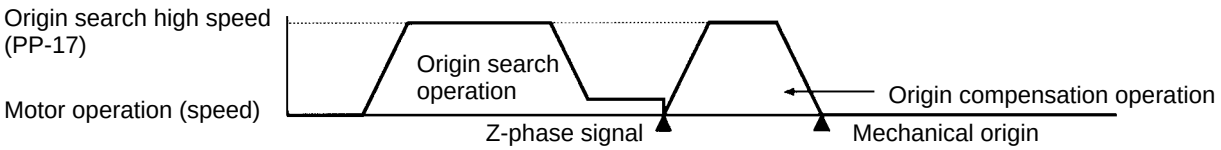
The following PTP parameter settings are related to origin search. Make the settings according to the mechanical system.

No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation
14	Reference speed (leftmost digits)	1/s	0 to 9,999	0	Specifies machine axis reference speed per second.
15	Reference speed (rightmost digits)		0 to 9,999	500	
17	Origin search high speed	1%	1 to 199	10	Specifies origin proximity search speed in origin search operation as override value based on reference speed. (This value is used as axis speed for origin compensation as well.) Set an appropriate value so that the origin proximity signal can be detected accurately.
18	Origin search low speed	1%	1 to 199	1	Specifies phase-Z search speed in origin search operation as override value based on reference speed. Set an appropriate value so that the speed will be 500 r/min maximum.
19	Origin search direction		0, 1	0	Specifies origin search direction. 0: Begin in positive (+) direction 1: Begin in negative (–) direction
06	Origin compensation (leftmost digits)	1 pulse	–9,999 to 9,999	0	Specifies number of motor sensor pulses for movement between origin search completion position and mechanical origin. The value can be obtained by origin teaching.
07	Origin compensation (rightmost digits)		0 to 9,999	0	

Note 1. The acceleration and deceleration times for origin search will be acceleration time 0 (PP-20) and deceleration time 0 (PP-22).

Note 2. The direction of movement for origin search is determined by the origin search direction (PP-19) and motor rotation direction (UP-26) settings. (The factory settings are for origin search to be executed with the motor rotating in the forward direction (CCW) with a positive (+) direction setting (i.e., present position incremented).

Note 3. When origin compensation (PP-06, PP-07) is set, positioning moves for just the set amount after the motor's sensor Z-phase signal is detected.



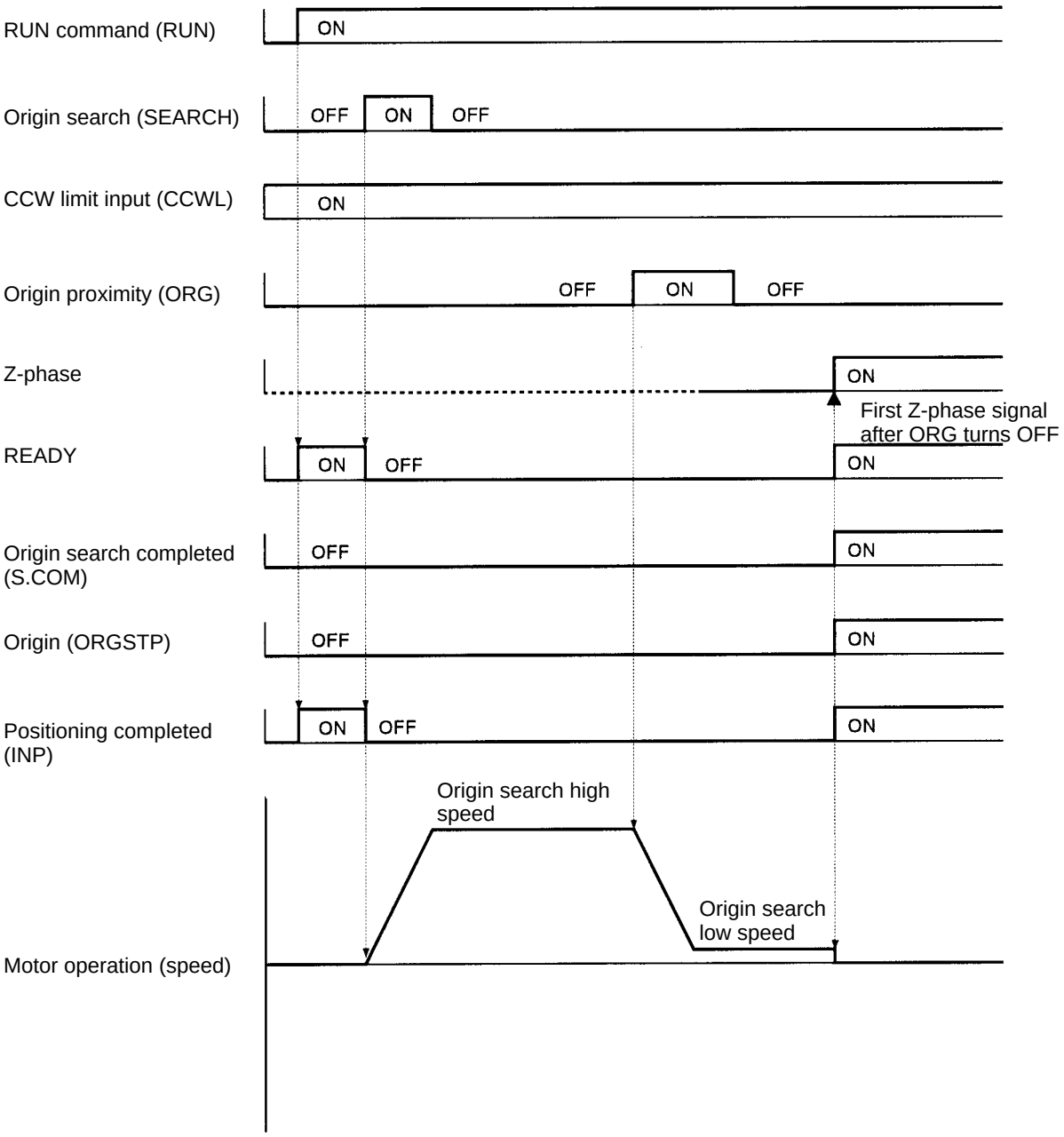
Operation

- The operation sequences for the three origin search patterns are shown below.
- For these examples it is assumed that the factory settings are used for the origin search direction (PP-19) and the motor rotation direction (UP-26), and that origin compensation (PP-06, PP-07) is set to "0."
- Origin search operation will start when the origin search (SEARCH) signal is turned ON, with the READY signal ON.

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Origin Search Pattern 1: Starting Between CWL Signal and Origin Proximity Signal

1. Positioning begins in the origin search direction at the origin search high speed.
2. Positioning changes to the origin search low speed when the origin proximity signal turns ON (rising edge).
3. The origin is established by the first Z-phase signal that is received after the origin proximity signal turns OFF (falling edge).

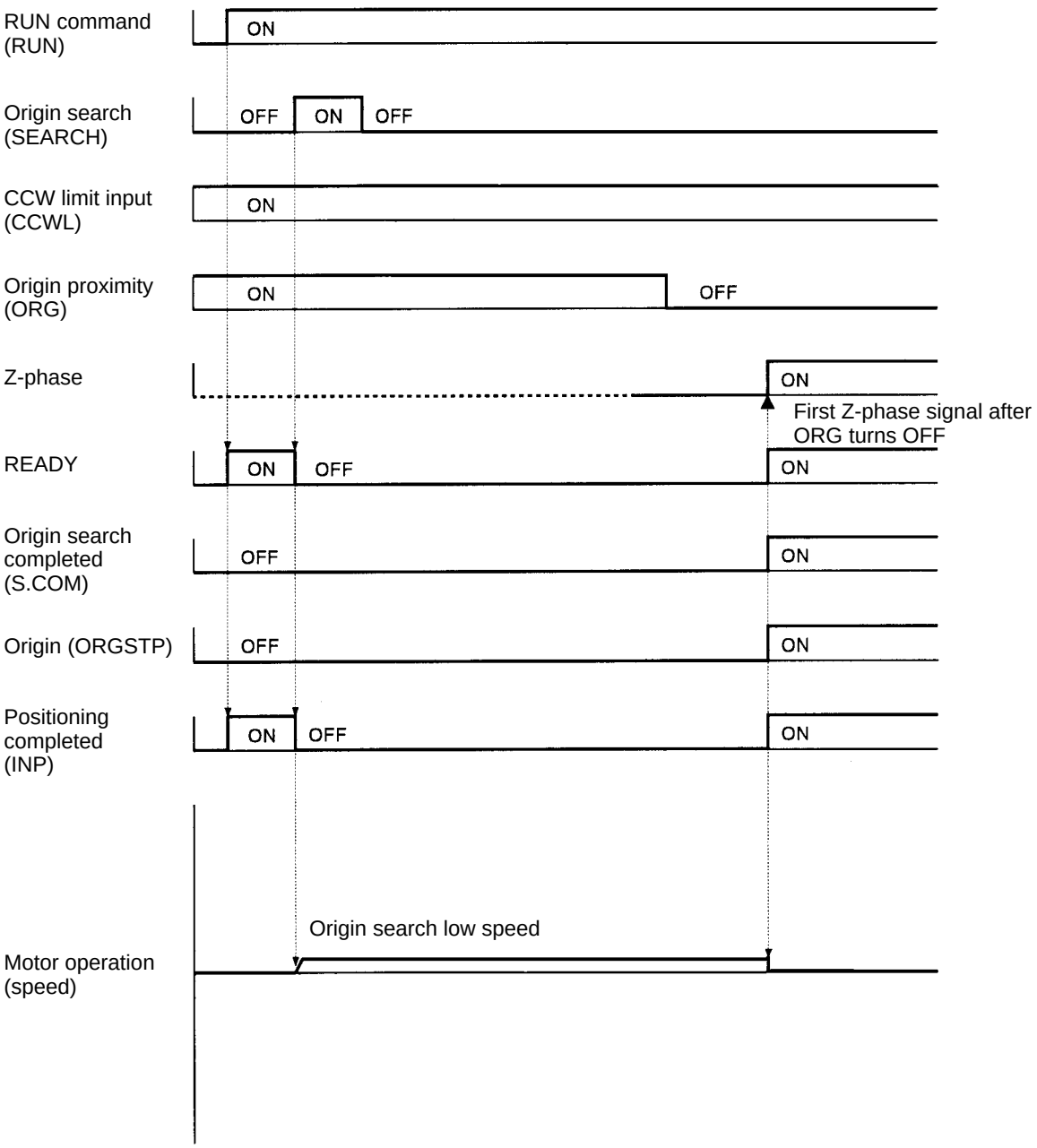


Note After the RUN command (RUN) signal turns ON, there will be an interval of 110 ms max. before the READY signal and the positioning completed (INP) signal turn ON.

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Origin Search Pattern 2: Starting With Origin Proximity Input Signal ON

1. Positioning begins in the origin search direction at the origin search low speed.
2. The origin is established by the first Z-phase signal that is received after the origin proximity signal turns OFF (falling edge).

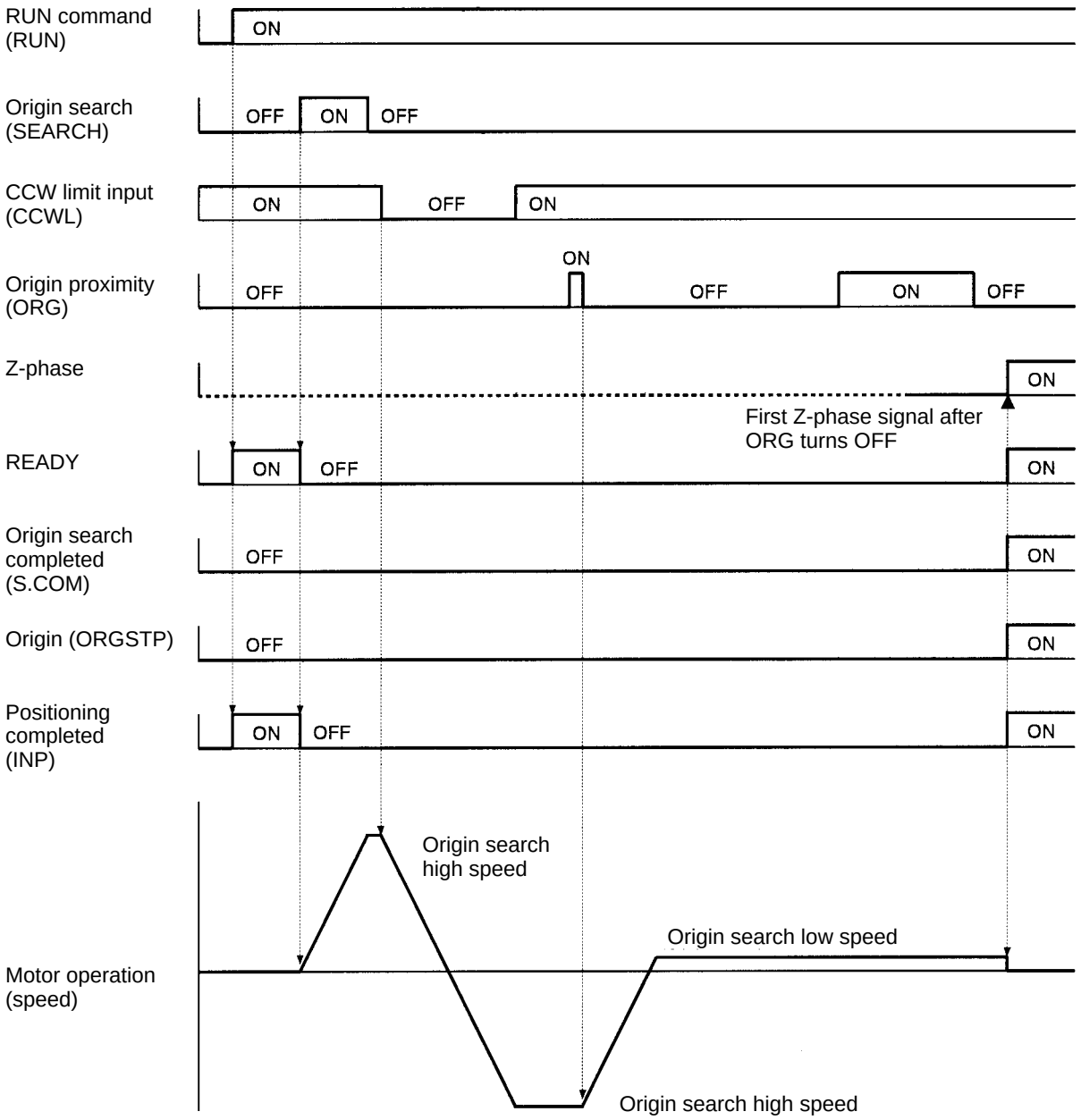


Note After the RUN command (RUN) signal turns ON, there will be an interval of 110 ms max. before the READY signal and the positioning completed (INP) signal turn ON.

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Origin Search Pattern 3: Starting Between Origin Proximity Signal and CCWL Signal

1. Positioning begins in the origin search direction at the origin search high speed.
2. The direction of movement is reversed when the CCWL signal turns OFF.
3. When the origin proximity signal turns from ON to OFF, the direction of movement is reversed again and the speed is changed to the origin search low speed.
4. The origin is established by the first Z-phase signal that is received after the origin proximity signal turns OFF.

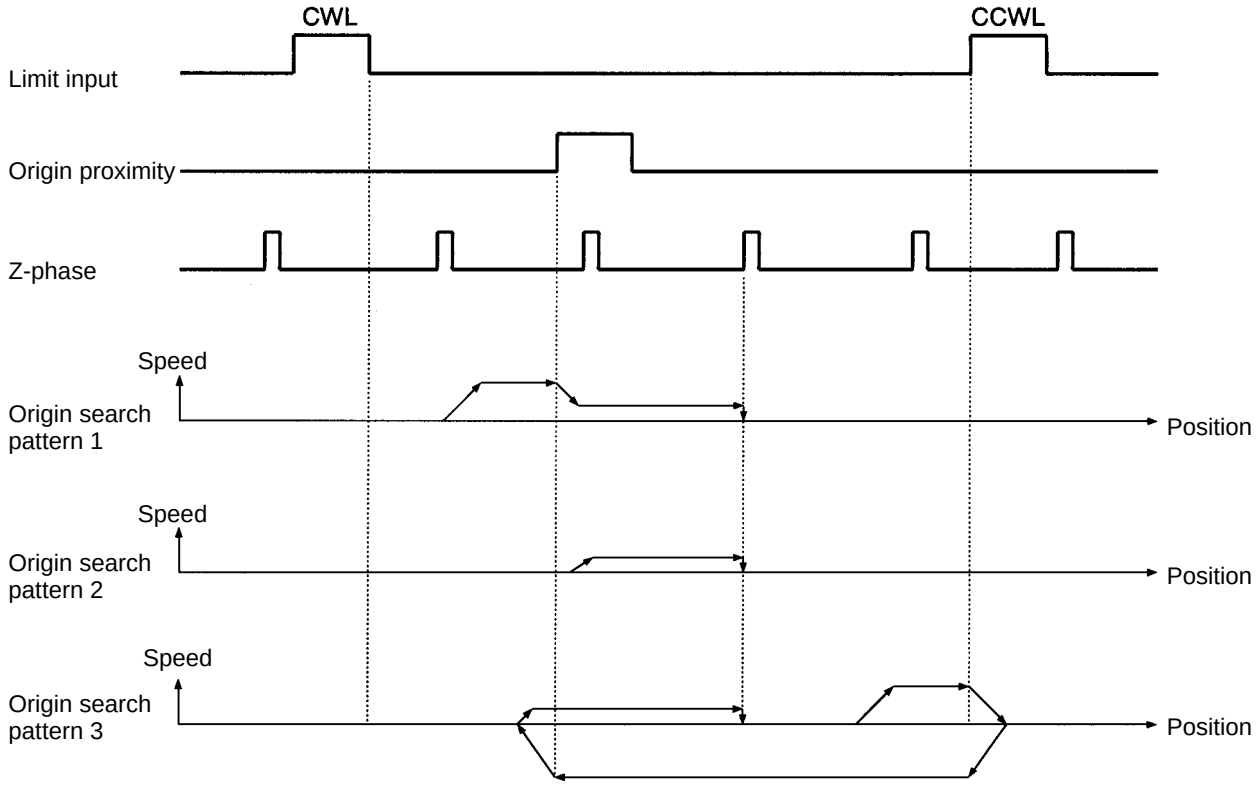


Note After the RUN command (RUN) signal turns ON, there will be an interval of 110 ms max. before the READY signal and the positioning completed (INP) signal turn ON.

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Summary of Origin Search Operation

Origin search direction: + direction



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Origin Search Example Program (SYSMAC C200H-HX/HG/HE)

The following ladder program example (for SYSMAC C200H-HX/HG/HE) is provided for reference

□Word Allocation

In this program example, the I/O signals are allocated to the input and output words as follows:

Output Unit: Word 0

Bit number	Position Driver signal name	
0	RUN	RUN command
1	START	Start
2	RESET	Alarm reset
3	SEARCH	Origin search
4	+JOG	+JOG operation
5	–JOG	–JOG operation
6	TEACH	Teach
7	STOP	Deceleration stop
8	P.IN0	Point selection 0 / Position 0
9	P.IN1	Point selection 1 / Position 1
10	P.IN2	Point selection 2 / Position 2
11	P.IN3	Point selection 3 / Position 3
12	P.IN4	Point selection 4 / Position 4
13	P.IN5	Point selection 5 / Position 5
14	P.IN6	Point selection 6 / Position 6
15	P.IN7	Position 7

Input Unit: Word 8

Bit number	Position Driver signal name	
0	BO	Brake output
1	READY	Ready
2	S.COM	Origin search completed
3	ORGSTP	Origin stop
4	T.COM	Teaching completed
5	RUNON	Motor running
6	INP	Positioning completed
7	$\overline{\text{ALM}}$	Alarm
8	P.OUT0	Point output 0 / Position selection 1
9	P.OUT1	Point output 1/ Position selection 2
10	P.OUT2	Point output 2 / Position selection 3
11	P.OUT3	Point output 3/ Position selection 4
12	P.OUT4	Point output 4/ Speed selection
13	P.OUT5	Point output 5
14	P.OUT6	Point output 6
15		(Not used.)

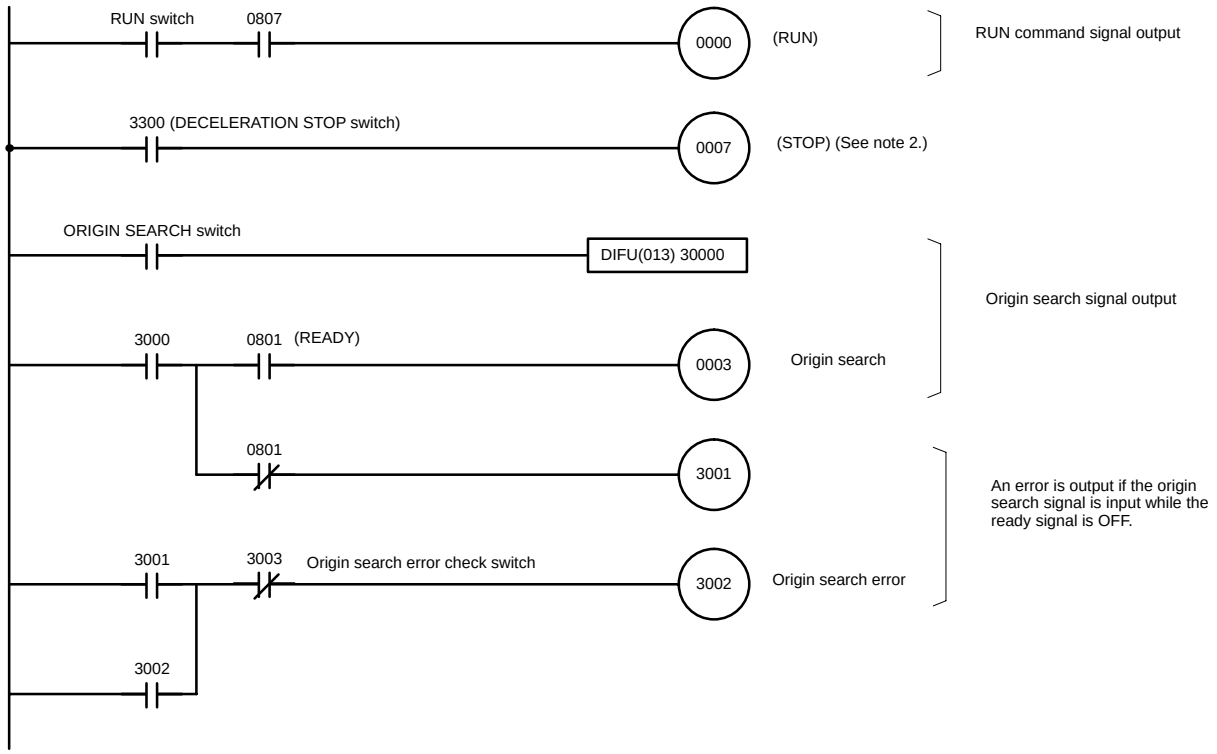
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IR Area

Word 30 in the IR area is used.

□Ladder Program

- For this example program it is assumed that limit input signals (CCWL and CWL) and origin proximity signals used for origin search operations are directly input from the sensors.
- There are three types of origin search, depending on the beginning position for the search, but for the purposes of this ladder program example they are all the same. (So there is no need to change the origin search pattern.)
- The program uses bits in IR 30.



Note 1. A CompoBus/S-type Position Driver can also be used by changing the word allocation. For details regarding word allocations, refer to the Master Unit operation manual.

Note 2. Bit allocation will be made for the deceleration stop (STOP) signal when using a CompoBus/S-type Position Driver. In this case, the deceleration stop (STOP) signal must be turned ON in the ladder program. (If the deceleration stop signal for external control input (CN 4-4), or ladder program input (OUT 7) is OFF, the motor will not run.)

3-7-2 Origin Teaching

Function

- The origin teaching operation sets any given position as the mechanical origin.
- If the motor sensor's Z-phase position (the origin search completion position) is not at the desired mechanical origin after an origin search operation, it will be possible to move to any given position and use the origin teaching operation to make that position the mechanical origin (present value 0).

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- The amount of movement at this time is taken by the PTP parameters (PP-06, PP-07) as the origin compensation, and in subsequent origin search operations this value is used to move to the origin teaching position (the mechanical origin) to complete the origin search.

Note Origin teaching cannot be executed if the origin is not established.

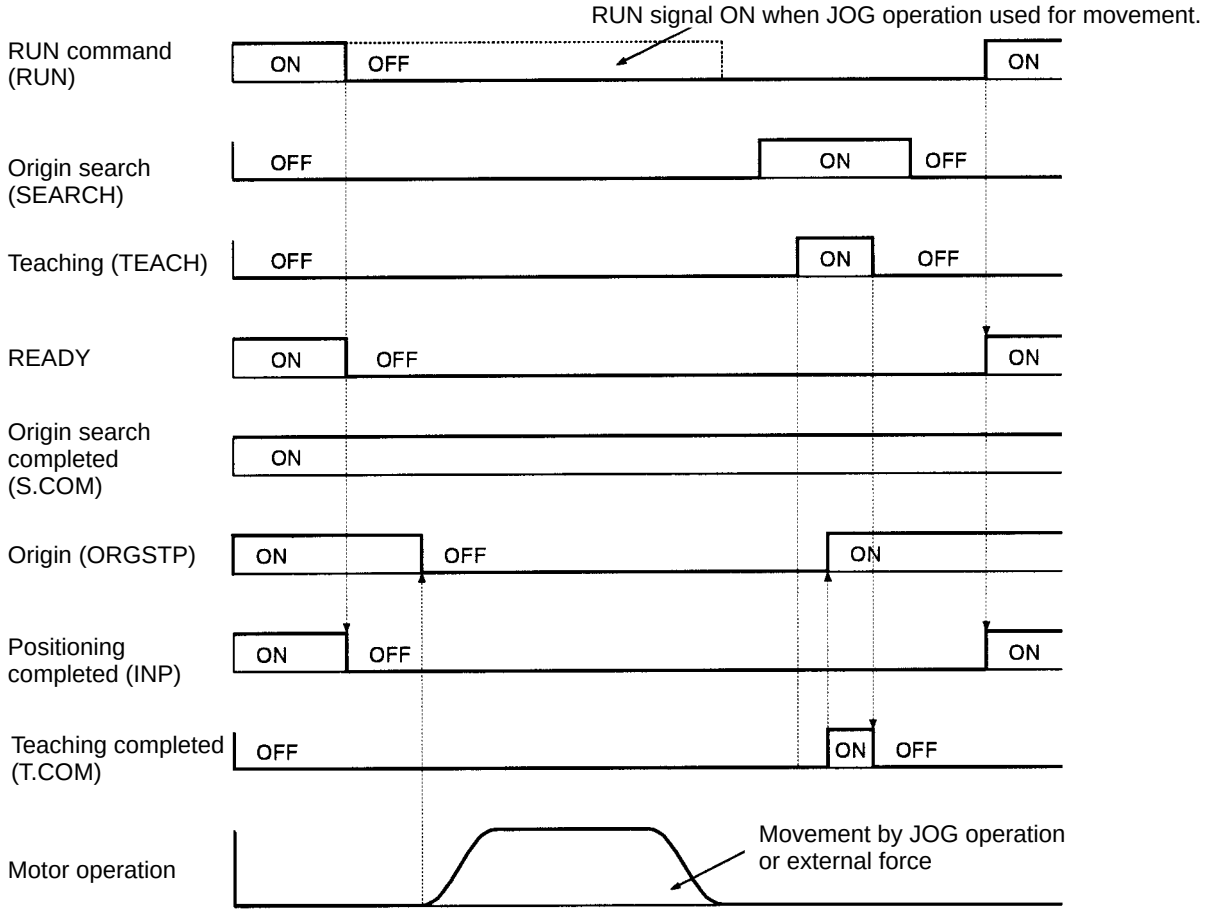
PTP Parameters

The following PTP parameters are set by the origin teaching operation.

No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation
06	Origin compensation (leftmost digits)	1 pulse	–9,999 to 9,999	0	Specifies number of motor sensor pulses for movement between origin search completion position and mechanical origin. The value can be obtained by origin teaching.
07	Origin compensation (rightmost digits)		0 to 9,999	0	

Operation

1. Complete the origin search operation.
2. Use the JOG operation or external force (with servo OFF) to move to the mechanical origin.
3. Turn OFF the RUN command (if the JOG operation has been used).
4. Turn ON the origin search (SEARCH) command, and then turn ON the teaching (TEACH) command. (When the origin teaching operation has been completed, the teaching completed signal (T.COM) turns ON.



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3-7-3 Teaching

Function

- The teaching operation takes the motor's present value as the position data in the specified PTP data.
- Teaching is only enabled when the control mode is set for point positioning (UP-01: 11 or 12).
- The position data that is taken by the teaching operation is all absolute-value (A) data. Also, the speed data, acceleration/deceleration selection, and operation mode selection do not change. (Make the settings after teaching is completed.)
- Teaching can be executed with the RUN command either ON or OFF, so it can be executed while the mechanical system is being moved by either the JOG operation or external force.

Note Teaching cannot be executed if the origin is not established.

PTP Parameters

The following PTP parameters are set by the teaching operation.

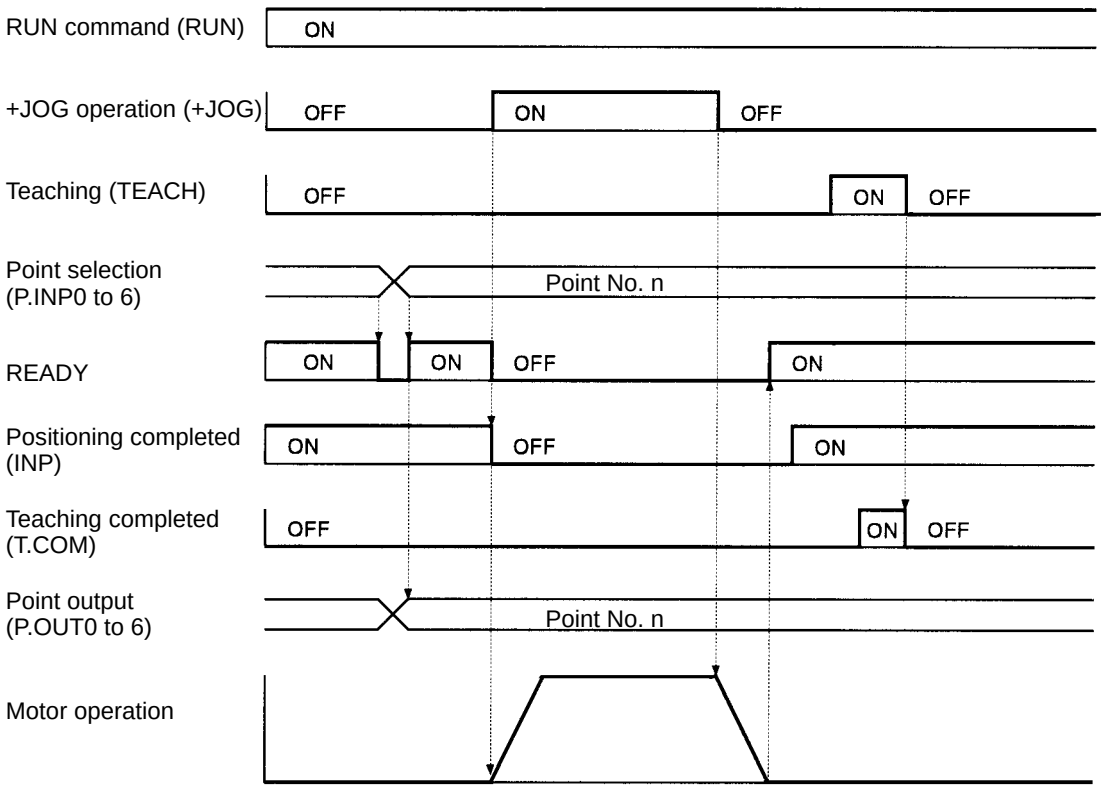
No. Pd-	Name	Min. unit	Setting range	Factory setting	Explanation
H	Point No. position data (leftmost digits)	(PP-01)	(I/A) –3,999 to 3,999	(I) 0	Specifies point no. position data. A value between –39,999,999 and 39,999,999 can be set. Leftmost digit is used to specify "A" (absolute) or "I" (incremental) value. **Note 1.** represents a number from 01 to 64. **Note 2.** With teaching, the position data is A (absolute value)
L	Point No. position data (rightmost digits)	(PP-01)	0 to 9,999	0	

Operation (Example: Teaching With JOG)

1. Input to points 0 to 6 (P.IN0 to 6) the point numbers to be taught. (Make sure that they match the numbers for point outputs 0 to 6 (P.OUT0 to 6).
2. Use the JOG operation (+JOG or –JOG) to rotate the motor.
3. Move to the position that is to be taught, and then turn ON the teaching (TEACH) input.

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4. When the teaching completed signal (T.COM) turns ON, turn OFF the teaching (TEACH) input.



3-7-4 Point Positioning (UP-01: 11 or 12)

Function

- Positioning is executed according to the PTP data of point numbers input to P.IN0 to P.IN6.
- Positioning is started when the start signal is turned ON while the ready signal is ON.
- The ready signal is turned OFF at the moment positioning begins and turned ON again upon completion of the positioning operation.

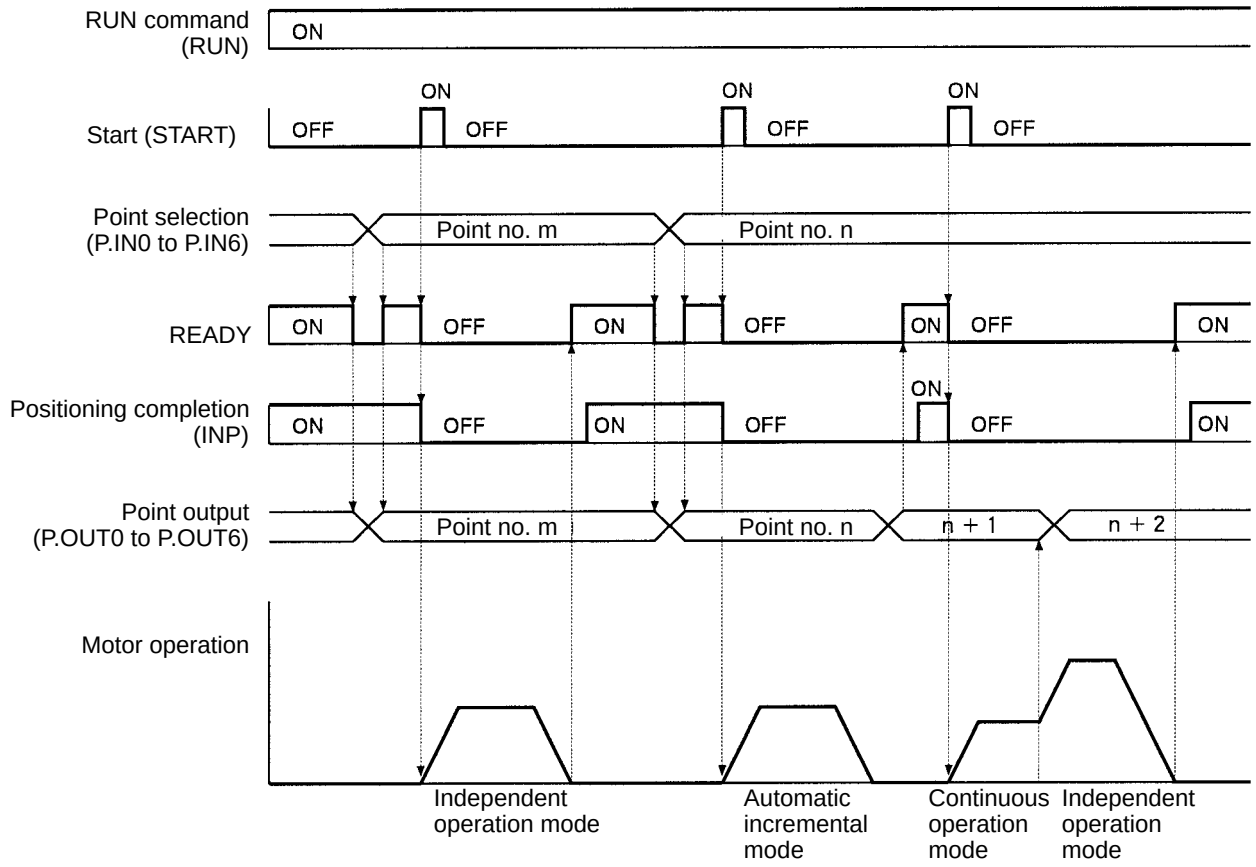
Note With feeder control (UP-01: 12), the present value is cleared when the start signal is turned ON.

Operation

1. Input the point numbers to P.IN0 to P.IN6. (Make sure that the P.OUT0 to P.OUT6 signals match the point numbers input to P.IN0 to P.IN6.)
2. Make sure that the ready signal is ON. Then turn ON the start signal.
3. Positioning will begin and the ready signal will be turned OFF.

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4. The ready signal will be turned ON again upon completion of the positioning.



Point Positioning Program Example (C200H-HX/HG/HE)

The following point positioning ladder program example (for SYSMAC C200H-HX/HG/HE) is provided for reference

□Word Allocation

In this program example, the I/O signals are allocated to the input and output words as follows:

Output Unit: Word 0

Bit number	Position Driver signal name	
0	RUN	RUN command
1	START	Start
2	RESET	Alarm reset
3	SEARCH	Origin search
4	+JOG	+JOG operation
5	–JOG	–JOG operation
6	TEACH	Teach
7	STOP	Deceleration stop (See note 2.)
8	P.IN0	Point selection 0 / Position 0
9	P.IN1	Point selection 1 / Position 1
10	P.IN2	Point selection 2 / Position 2

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Bit number	Position Driver signal name	
11	P.IN3	Point selection 3 / Position 3
12	P.IN4	Point selection 4 / Position 4
13	P.IN5	Point selection 5 / Position 5
14	P.IN6	Point selection 6 / Position 6
15	P.IN7	Position 7

Input Unit: Word 8

Bit number	Position Driver signal name	
0	BO	Brake output
1	READY	Ready
2	S.COM	Origin search completed
3	ORGSTP	Origin stop
4	T.COM	Teaching completed
5	RUNON	Motor running
6	INP	Positioning completed
7	$\overline{\text{ALM}}$	Alarm
8	P.OUT0	Point output 0 / Position selection 1
9	P.OUT1	Point output 1/ Position selection 2
10	P.OUT2	Point output 2 / Position selection 3
11	P.OUT3	Point output 3/ Position selection 4
12	P.OUT4	Point output 4/ Speed selection
13	P.OUT5	Point output 5
14	P.OUT6	Point output 6
15		(Not used.)

DM Area

DM No.	Data contents
00	Point number
01	Input signal
02	Output signal

IR Area

Word 30 in the IR area is used.

Note 1. A CompoBus/S-type Position Driver can also be used by changing the word allocation. For details regarding word allocations, refer to the Master Unit operation manual.

Note 2. Bit allocation will be made for the deceleration stop (STOP) signal when using a CompoBus/S-type Position Driver.

Note 3. Point numbers 0 to 64 (BCD) are input to P.IN0 to P.IN6 and output from P.OUT0 to P.OUT6.

Input to the Position Driver

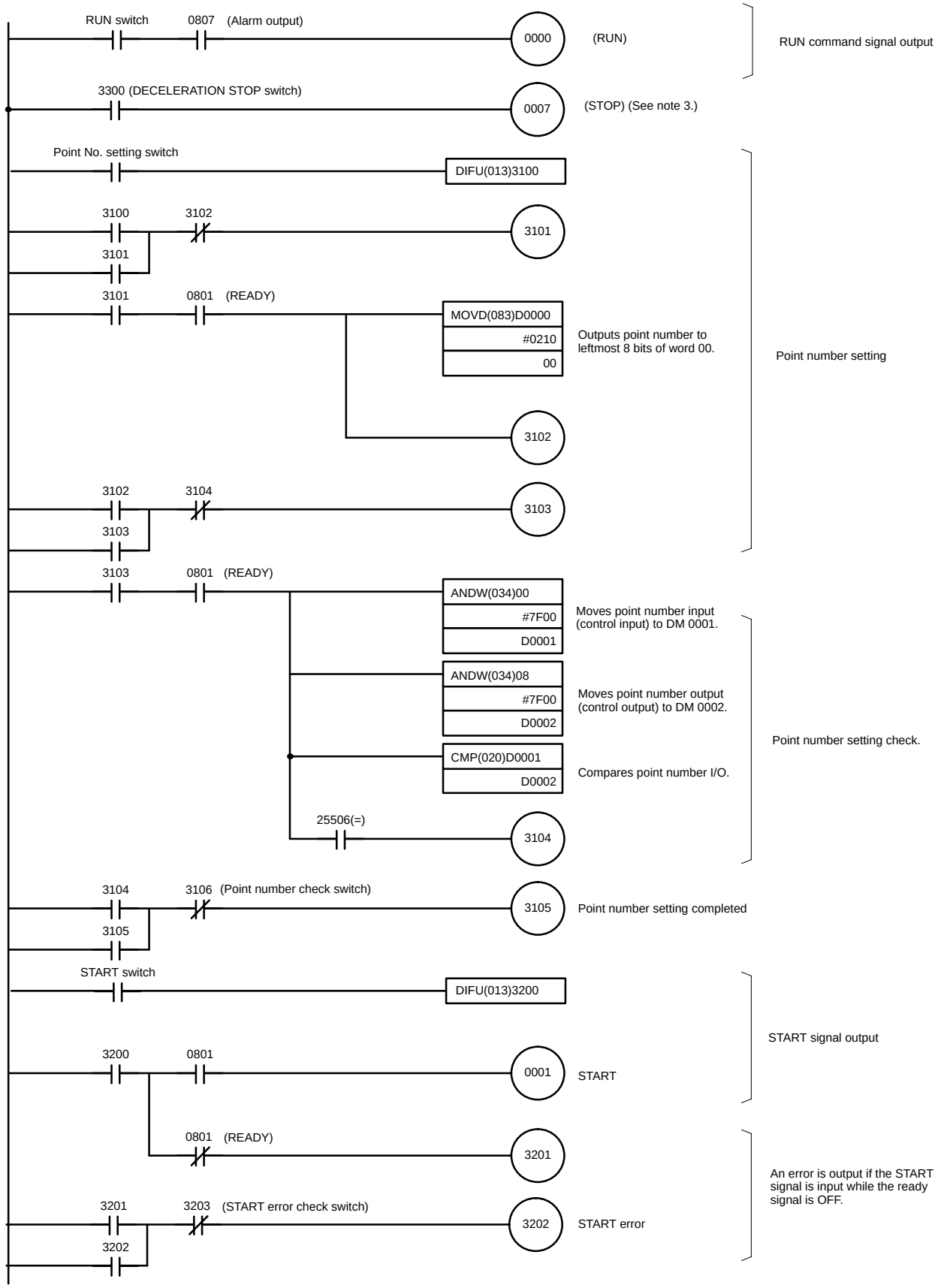
P.IN6	P.IN5	P.IN4	P.IN3	P.IN2	P.IN1	P.IN0
4×10^1	2×10^1	1×10^1	8×10^0	4×10^0	2×10^0	1×10^0

Output from the Position Driver

P.OUT6	P.OUT5	P.OUT4	P.OUT3	P.OUT2	P.OUT1	P.OUT0
4×10^1	2×10^1	1×10^1	8×10^0	4×10^0	2×10^0	1×10^0

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□Ladder Program



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Note 1. The point number setting switch is a contact for taking the point number (DM 00) into the Position Driver.

Note 2. Turn ON the point number check switch (3106) and the START switch when “point number setting completed” (3105) is output.

Note 3. When using a CompoBus/S-type Position Driver, the deceleration stop (STOP) signal must be turned ON in the ladder program. (If the deceleration stop signal for external control input (CN 4-4), or ladder program input (OUT 7) is OFF, the motor will not run.)

3-7-5 Direct Positioning (UP-01: 13 or 14)

Function

- Positioning is executed by taking in sequence the position and speed data entered for positions 0 to 7 (P.IN0 to 7), according to the timing output signals for position data selections 1 to 4 (P.OUT0 to 3) and the speed data selection (P.OUT4).
- When the teach signal is turned ON, the Position Driver starts reading the data. Both the teaching completed (T.COM) and ready signals are turned ON when the Position Driver has finished reading the data.
- Positioning is started when the start signal is turned ON while the ready signal is ON.
- The ready signal is turned OFF during positioning and turned ON again upon completion of the positioning operation.

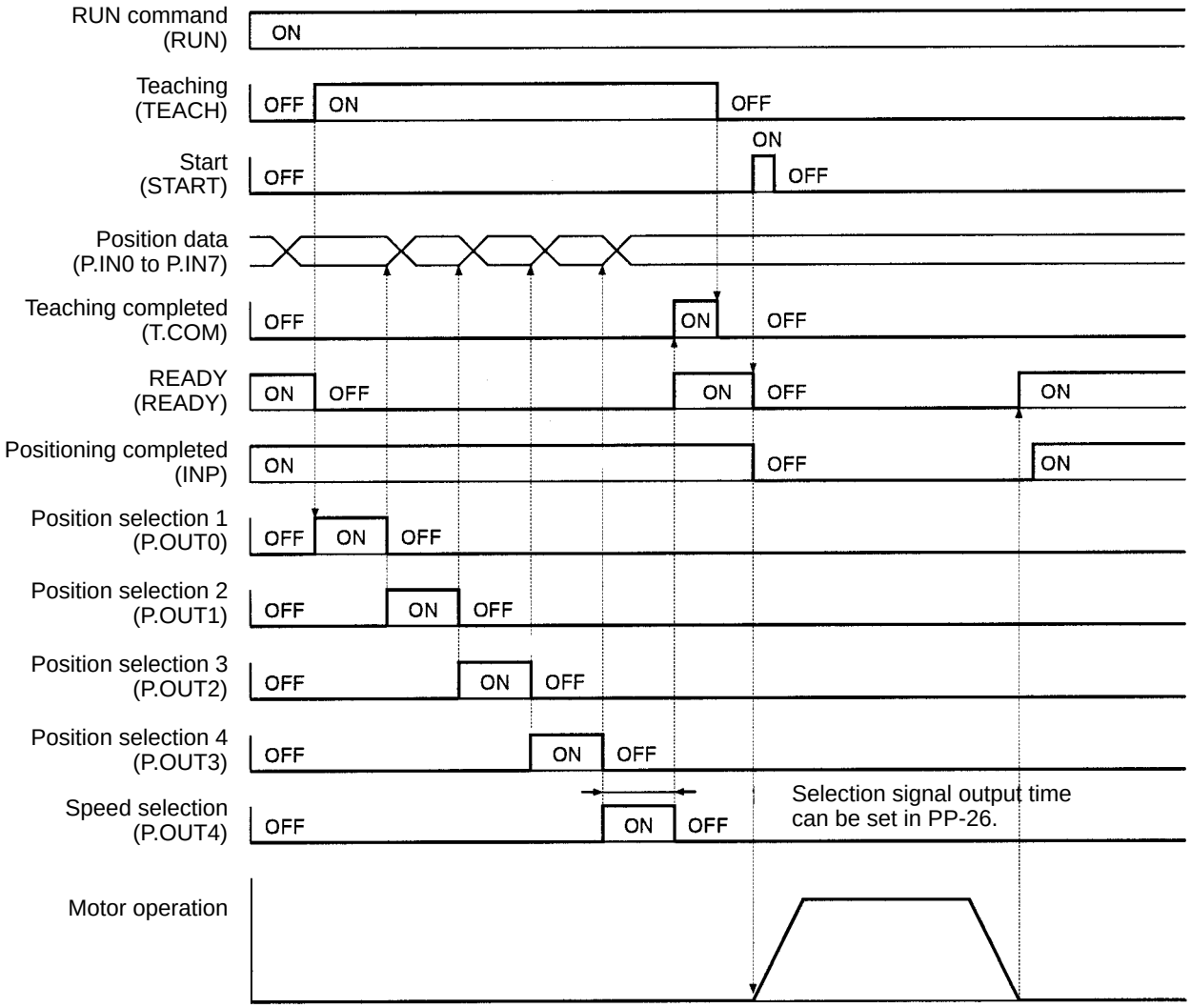
Note With feeder control (UP-01: 12), the present value is cleared when the start signal is turned ON.

Operation

1. The two rightmost digits of the position data are input to P.IN0 to P.IN7.
2. The teach signal is turned ON. Position selection 1 (P.OUT0) are turned ON and OFF and the position data is taken at the falling edge.
3. Next position selection 2 (P.OUT1 is turned ON. While P.OUT1 is ON, positions 0 to 7 are taken into the third and fourth digits.
4. The remaining position data (i.e., the rest of the digits, sign bit, and I/A bit) and speed data are taken in the same way.
5. After all the data has been taken, both the teaching completed (T.COM) and ready signals are turned ON. After it is confirmed that they have turned ON, the teach signal is turned OFF.
6. When the start signal is turned ON, positioning begins and the ready signal is turned OFF.

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7. The ready signal is turned ON again upon completion of the positioning operation.



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Direct Positioning Program Example (C200H-HX/HG/HE)

The following direct positioning ladder program example (for SYSMAC C200H-HX/HG/HE) is provided for reference.

□Word Allocation

In this program example, the I/O signals are allocated to the input and output words as follows:

Output Unit: Word 0

Bit number	Position Driver signal name	
0	RUN	RUN command
1	START	Start
2	RESET	Alarm reset
3	SEARCH	Origin search
4	+JOG	+JOG operation
5	–JOG	–JOG operation
6	TEACH	Teach
7	STOP	Deceleration stop (See note 2.)
8	P.IN0	Point selection 0 / Position 0
9	P.IN1	Point selection 1 / Position 1
10	P.IN2	Point selection 2 / Position 2
11	P.IN3	Point selection 3 / Position 3
12	P.IN4	Point selection 4 / Position 4
13	P.IN5	Point selection 5 / Position 5
14	P.IN6	Point selection 6 / Position 6
15	P.IN7	Position 7

Input Unit: Word 8

Bit number	Position Driver signal name	
0	BO	Brake output
1	READY	Ready
2	S.COM	Origin search completed
3	ORGSTP	Origin stop
4	T.COM	Teaching completed
5	RUNON	Motor running
6	INP	Positioning completed
7	$\overline{\text{ALM}}$	Alarm
8	P.OUT0	Point output 0 / Position selection 1
9	P.OUT1	Point output 1/ Position selection 2
10	P.OUT2	Point output 2 / Position selection 3
11	P.OUT3	Point output 3/ Position selection 4
12	P.OUT4	Point output 4/ Speed selection
13	P.OUT5	Point output 5
14	P.OUT6	Point output 6
15		(Not used.)

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DM Area

DM number	Data contents
01	Input signal
02	Output signal
10	Positioning data (rightmost digits)
11	Positioning data (leftmost digits)
12	Speed data
20	Indirect table for positioning data
21	Digit transfer control data table

IR Area

Word 30 in the IR area is used.

Note 1. A CompoBus/S-type Position Driver can also be used by changing the word allocation. For details regarding word allocations, refer to the Master Unit operation manual.

Note 2. Bit allocation will be made for the deceleration stop (STOP) signal when using a CompoBus/S-type Position Driver.

Note 3. Input position data (BCD) and speed data (BCD) into P.IN 0 to 7 with P.OUT0 to 4.

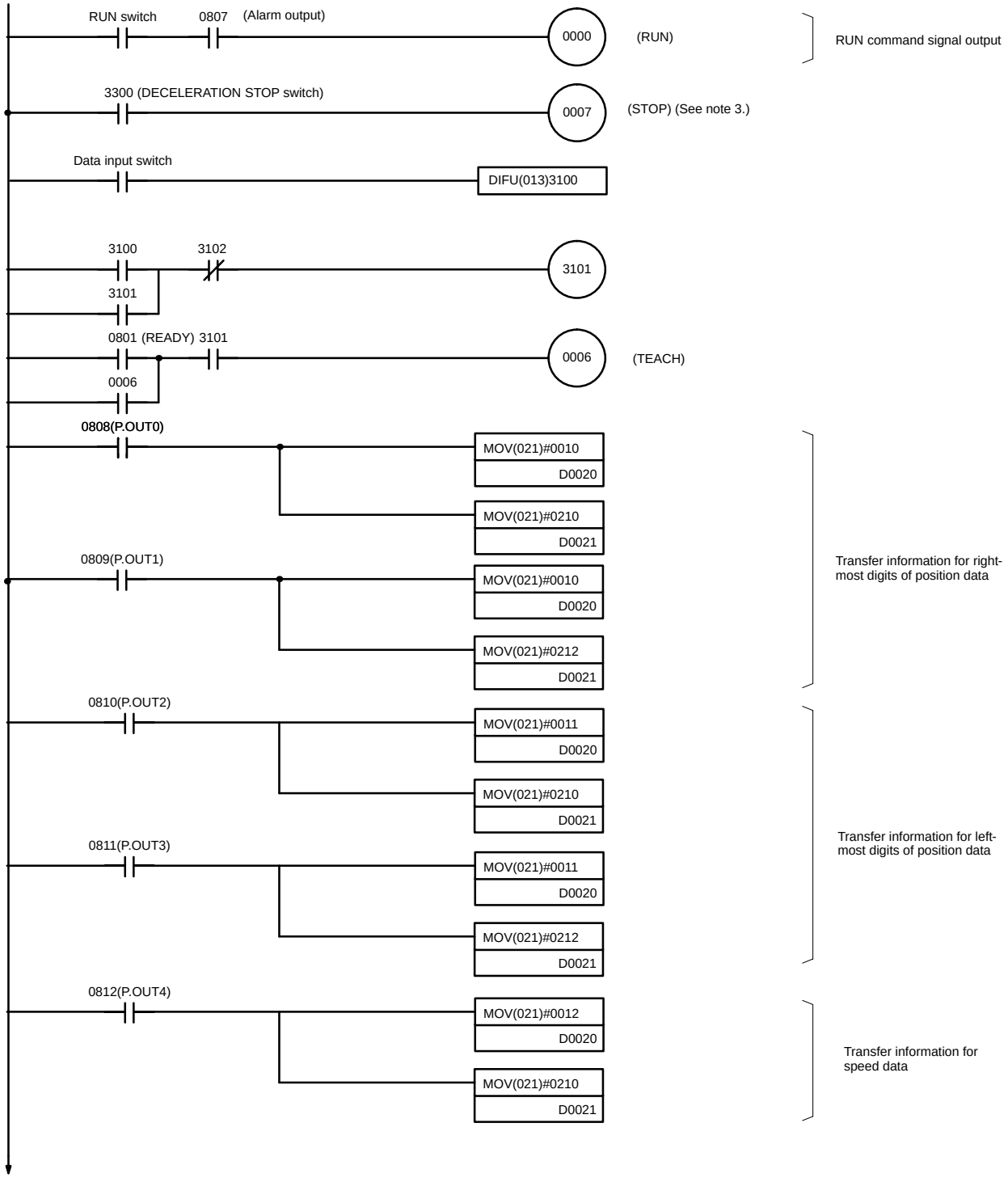
P.IN7	P.IN6	P.IN5	P.IN4	P.IN3	P.IN2	P.IN1	P.IN0
$8 \times 10^{n+1}$	$4 \times 10^{n+1}$	$2 \times 10^{n+1}$	$1 \times 10^{n+1}$	8×10^{n}	4×10^{n}	2×10^{nn}	1×10^{n}

Position data: P.OUT0 ON; n=0, P.OUT1 ON; n=2, P.OUT2 ON; n=4, P.OUT3 ON; n=6
P.IN6; ±data 0: +, 1: –
P.IN7; INC/ABS data 0: INC, 1: ABS

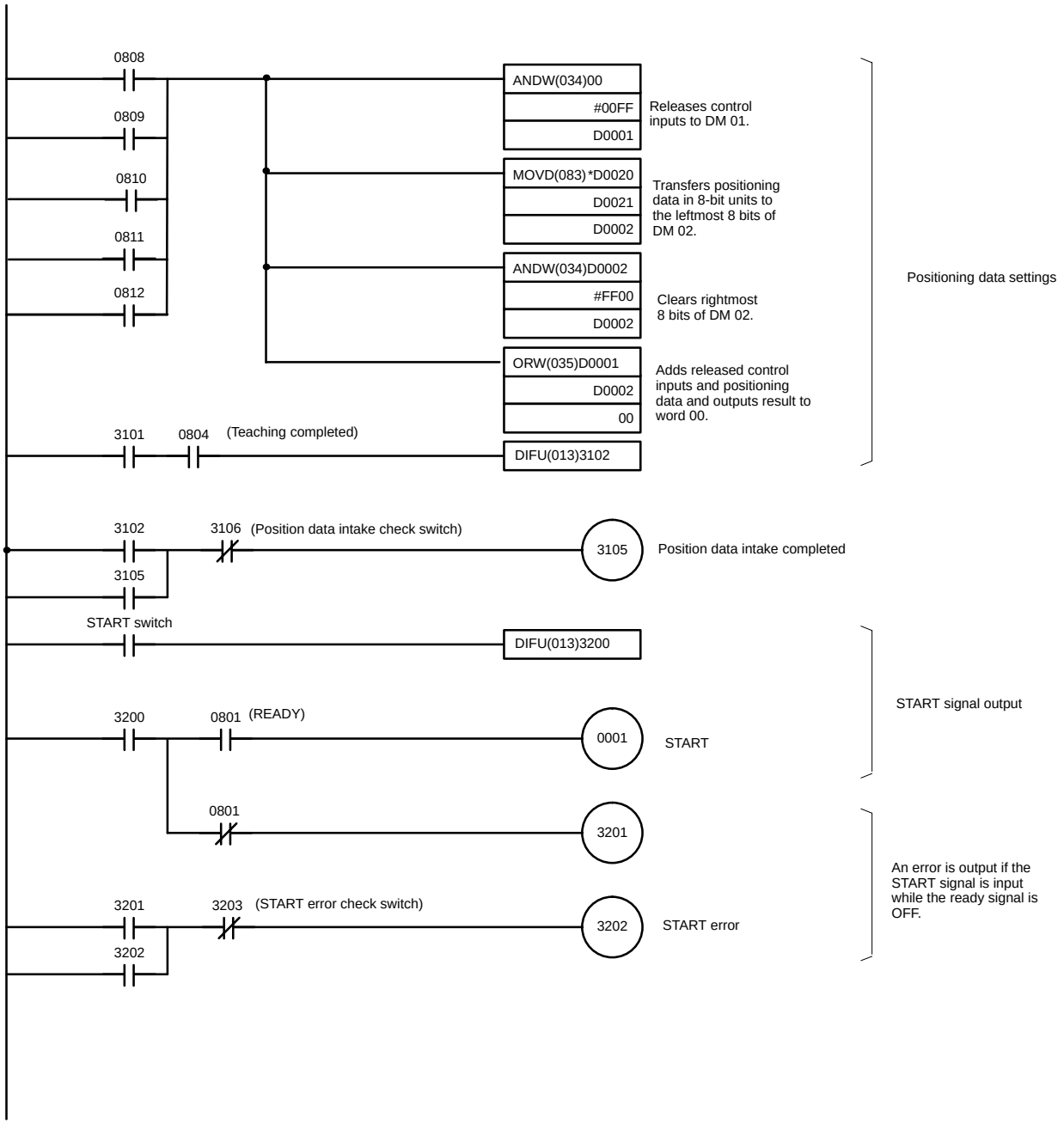
Speed data: P.OUT4 ON; n=0

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□Ladder Program



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Note 1. The data input switch is a contact for taking the set position data into the Position Driver.

Note 2. Turn ON the position data intake switch (3106) and the START switch when “position data intake completed” (3105) is output.

Note 3. When using a CompoBus/S-type Position Driver, the deceleration stop (STOP) signal must be turned ON in the ladder program. (If the deceleration stop signal for external control input (CN 4-4), or ladder program input (OUT 7) is OFF, the motor will not run.)

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3-8 Trial Operation

After the wiring is complete and the parameter settings have been made, conduct a trial operation. First, in system check mode, check the motor's rotation direction without connecting a load (i.e., without connecting the mechanical system), and check to be sure that the I/O signals are correctly wired. Then, connect the mechanical system, auto-tune the system, and confirm that the correct operation pattern is performed. If an error occurs during trial operation, refer to *Chapter 4 Application* and apply the appropriate measures.

3-8-1 Trial Operation Procedure

Preparations

□Turning OFF the Power Supply

The power supply must be turned OFF and back ON in order for some of the parameter settings to go into effect, so always turn OFF the power supply before starting.

□Leaving the Motor With No Load Connected

Do not connect a load to the motor shaft during trial operation in case the motor runs out of control.

□Preparing to Stop the Motor

Make sure that the power switch can be turned OFF or the RUN command can be used to stop the motor immediately in case of trouble.

Actual Trial Operation

(1) Powering Up

- With the RUN command OFF, apply an AC voltage.
- After internal initialization, the mode will be the Monitor Mode.

Monitor display example:



- Set the speed loop proportional gain (AJ2.) to approximately 1.0. (Match the gain with no load.)

1. Confirm the initial display (Monitor Mode) shown above.
2. Press the Mode Key twice to enter the Adjustment Parameters Edit Mode.
3. Press the Increment Key to display the contents of AJ2. (speed loop proportional gain).
4. Press the Shift Key and Data Key to enable the data to be changed. (The digit that can be changed will flash.)
5. Press the Shift Key, Increment Key, or Decrement Key as required to change the setting to 1.0.
6. Press the Data Key to end the data change operation.

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Note 1. The factory setting for the speed loop proportional gain (AJ2.) is 1.0 (multiple).

Note 2. In the Adjustment Parameters Edit Mode, the set value is re-written at the point where the number is changed by pressing the Increment Key and Decrement Key.

(2) Testing the Motor (Refer to *3-8-2 System Check Mode*.)

- Execute the motor test operation in System Check Mode and perform the following checks.

  Is the motor's rotation direction correct?

  Are there any abnormal sounds or vibration?

  Is anything abnormal occurring?

(3) Checking the I/O Signal Wiring

- Execute the output signal test in System Check Mode and perform the following check. (Refer to *3-8-2 System Check Mode*.)

  Are signals from the Position Driver being correctly read by the host controller?

- Check the following item with the Check Mode's I/O signal display. (Refer to *4-2 Check Mode*.)

  Are signals and limit inputs from the host controller, origin proximity signals, deceleration stop input signals, and so on, being correctly read by the Position Driver?

(4) Auto-tuning With a Load Connected (Refer to *3-9 Making Adjustments*.)

- Connect the motor shaft to the load (mechanical system) securely, being sure to tighten screws so that they will not become loose.
- Execute auto-tuning in System Check Mode.

(5) Turning ON the RUN Command Input

- Turn ON the run command input.
- Check to be sure that the motor goes into servo-lock status.

(6) Operating at Low Speed

- Operate the motor at low speed.
  The meaning of "low speed" can vary with the mechanical system. Here, "low speed" means approximately 10% to 20% of the actual operating speed.
- Check the following items.

  Is the emergency stop operating correctly?
  Are the limit switches operating correctly?
  Is the operating direction of the machinery correct?
  Are the operating sequences correct?
  Are there any abnormal sounds or vibration?
  Is anything abnormal occurring?

(7) Operating Under Normal Load Conditions

- Operate the motor in a regular pattern and check the following items.

  Is the speed correct? (Use the Monitor Mode's motor speed display and the mechanical speed display.)
  Is the load torque roughly equivalent to the measured value? (Use the Monitor Mode's motor current display and the effective load factor display.)
  Are the positioning points correct?
  When an operation is repeated, is there any discrepancy in positioning?
  Are there any abnormal sounds or vibration?
  Is either the motor or the Driver abnormally overheating?
  Is anything abnormal occurring?

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(8) Readjusting the Gain

- If the gain could not be adjusted completely using auto-tuning, perform the procedure in *3-9 Making Adjustments* to adjust the gain manually.

3-8-2 System Check Mode

The System Check Mode is used to conduct the motor test, output signal test, and auto-tuning. To enter this mode, use the following procedure:

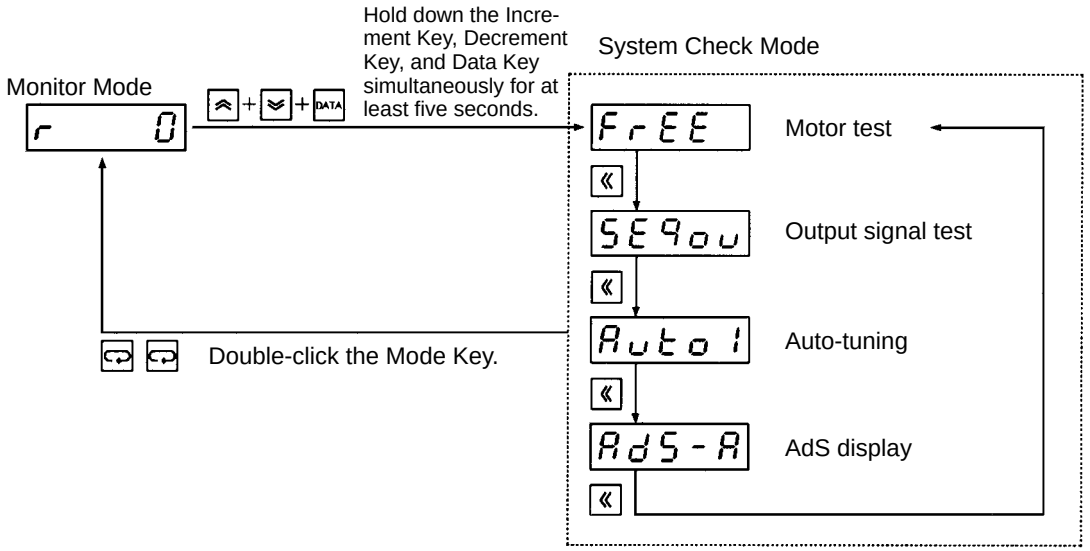
1. Press the Mode Key to go into the Monitor Mode.
2. Hold down the Increment Key, Decrement Key, and Data Key simultaneously for at least five seconds to go into the System Check Mode.

To exit the System Check Mode, double-click the Mode Key.

Note The motor test operation is a function for operating the motor with only the Position Driver and the motor. The limit inputs and deceleration stop input are disabled, so before conducting this test check to make sure that there will be no adverse effect on the equipment.

Entering the System Check Mode

The System Check Mode can be entered from the Monitor Mode.



Functions in System Check Mode

□Motor Test Operation

- With the motor test operation, the motor is operated in forward and reverse by means of key operations with just the motor and Position Driver connected. (Connection to a host controller is not required.)
- The motor speed can be set by UP-29 (motor test r/min). The factory setting is 50 r/min.

□Output Signal Test

- With the output signal test, Position Driver output signals are turned ON and OFF.
- This test is used to check the connections with the host controller.

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□Auto-tuning

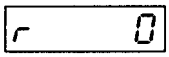
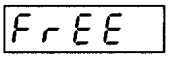
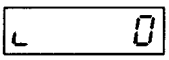
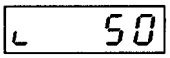
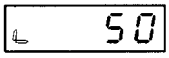
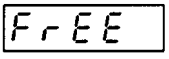
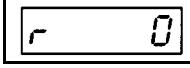
- With auto-tuning, the size and characteristics of the load (the mechanical system) can be checked, and the gain can be automatically adjusted and set accordingly.
- There are three kinds of gain to be set: position loop gain (AJ.4), speed loop proportional gain (AJ.2), and speed loop integral gain (AJ.3).
- There are three parameters for auto-tuning: reciprocating rotation range (Auto1), target response frequency (Auto2), and maximum rotation speed (Auto3).

Note For details regarding auto-tuning, refer to *3-9 Making Adjustments*.

□AdS Display

This is a parameter for manufacturer adjustments. Do not change the setting.

Motor Test Operation Procedure

Display example	Key operation
	Press the Mode Key to enter Monitor Mode.
	Hold down the Increment Key, Decrement Key, and Data Key simultaneously for at least five seconds to enter System Check Mode.
	Press the Data Key to go to servo-ON status.
	Press the Increment Key to test forward operation. (The motor should rotate in the forward direction while the Increment Key is being held down.)
	Press the Decrement Key to test reverse operation. (The motor should rotate in the reverse direction while the Decrement Key is being held down.)
	Press the Data Key to go to servo-OFF status.
	Double-click the Mode Key to return to Monitor Mode.

□User Parameter Settings

The motor speed can be set by UP-29 (motor test r/min).

No. UP-	Name	Min. unit	Setting range	Factory setting	Explanation
29	Motor test r/min	1 r/min	1 to 8,000	50	Specifies the motor speed during the motor test operation.

Note Be sure to set this parameter to no more than the motor's rated speed.

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Output Signal Test Operating Procedure

Display example	Key operation
r 0	Press the Mode Key to enter Monitor Mode.
FrEE	Hold down the Increment Key, Decrement Key, and Data Key simultaneously for at least five seconds to enter System Check Mode.
SEqou	Press the Shift Key to bring up the output signal test display.
S00-0	Press the Data Key and Shift Key to enable the output signal test. (The output signals will all be turned OFF.)
S02-0	Use the Increment Key and the Decrement Key to select the signal. In this example the origin signal (ORGSTP) is selected.
S02-1	Press the Data Key to turn ON the output signal. (“1” indicates “ON.”)
S02-0	Press the Data Key again to turn OFF the output signal. (“1” indicates “OFF.”)
SEqou	Press the Mode Key to return to the output signal test display.
r 0	Double-click the Mode Key to return to Monitor Mode.

□Output Signal Numbers, Symbols, and Names

Number	Symbol	Name
S00	READY	READY
S01	S.COM	Origin search completed
S02	ORGSTP	Origin stop
S03	T.COM	Teaching completed
S04	RUNON	Motor running
S05	INP	Positioning completed
S06	$\overline{\text{ALM}}$	Alarm
S07	P.OUT0	Point output 0 / Position selection 1
S08	P.OUT1	Point output 1 / Position selection 2
S09	P.OUT2	Point output 2 / Position selection 3
S10	P.OUT3	Point output 3 / Position selection 4
S11	P.OUT4	Point output 4 / Speed selection
S12	P.OUT5	Point output 5
S13	P.OUT6	Point output 6
S14	BO	Brake output

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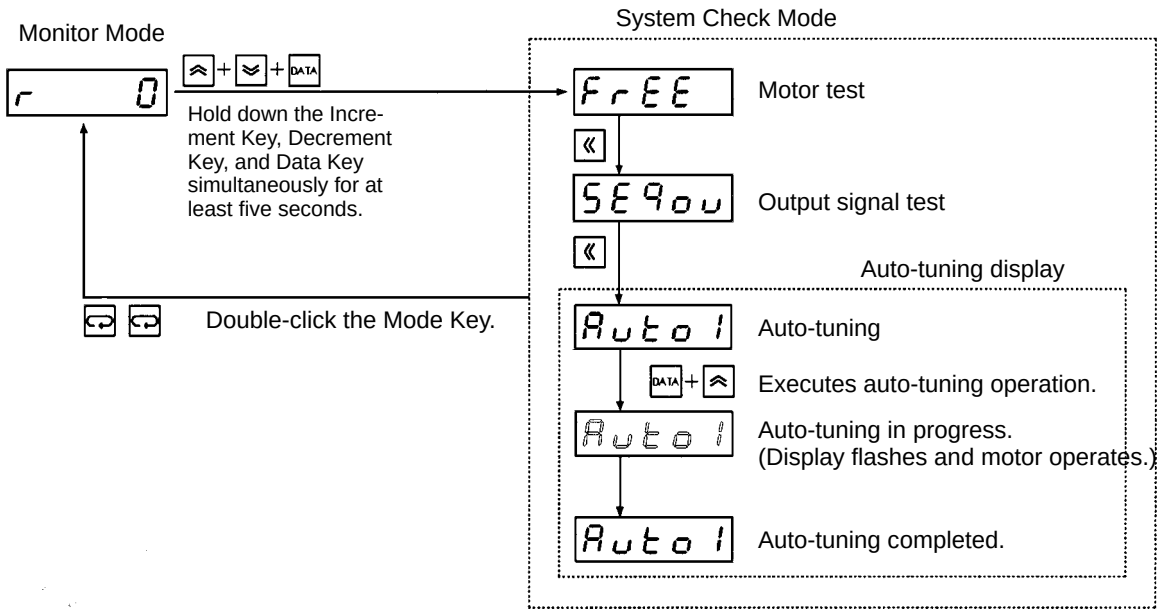
3-9 Making Adjustments

3-9-1 Auto-tuning

Auto-tuning is a function for automatically operating the motor to adjust the position loop gain, speed loop proportional gain, and speed loop integral gain.
If adjustments cannot be made by auto-tuning, refer to *3-9-2 Manually Adjusting Gain*.
When using auto-tuning, the limit inputs and deceleration stop input must be connected.

Basic Auto-tuning Procedure

- To go into auto-tuning, first enter the System Check Mode from the Monitor Mode, and then press the Shift Key to bring up the auto-tuning display.
- After setting the auto-tuning parameters, press the Data Key and Increment Key simultaneously to begin the auto-tuning operation.
- When the auto-tuning operation has been completed, double-click the Mode Key to return to the Monitor Mode.



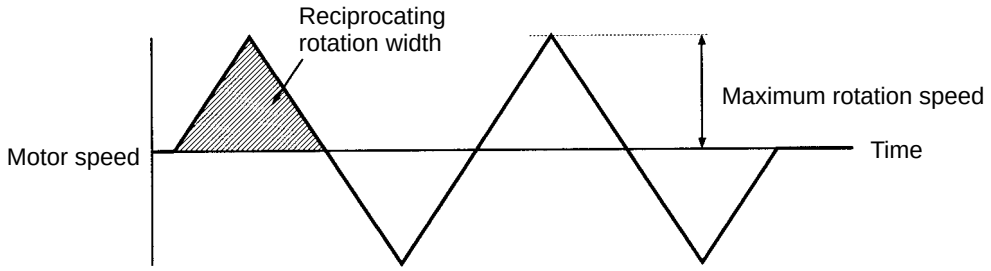
Auto-tuning Parameter Settings

Display	Name	Min. unit	Setting range	Factory setting	Explanation
Auto 1	Reciprocating rotation width	1 rev.	1 to 300	1	Specifies the amount to move to one side in reciprocating operation during auto-tuning execution.
Auto 2	Destination cutoff frequency	1 Hz	1 to 100	40	Specifies the position loop responsiveness. (Normally set from 20 Hz to 80 Hz.)
Auto 3	Maximum rotation speed	1 r/min	1 to 4,000	1,000	Specifies the maximum motor speed during auto-tuning execution.

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Note 1. The reciprocating operation is performed twice during auto-tuning. Check the mechanical operating range and set the reciprocating rotation range accordingly.

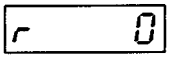
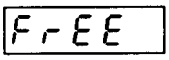
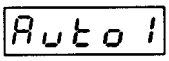
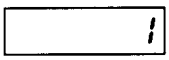
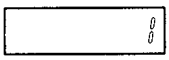
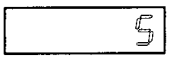
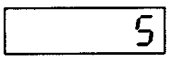
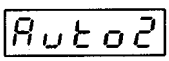
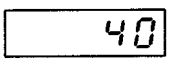
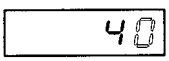
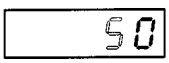
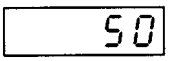
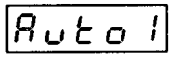
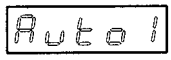
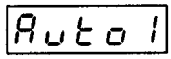
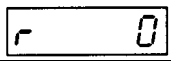
Note 2. Set the maximum rotation speed to the maximum speed for actual operation.



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Operating Procedure Example

In this auto-tuning example, it is assumed that the reciprocating rotation range is set to 5 (revolutions), the target response frequency is set to 50 (Hz), and the maximum rotation speed is set to 2,000 (r/min).

Display example	Key operation
	Press the Mode Key to enter Monitor Mode.
	Hold down the Increment Key, Decrement Key, and Data Key simultaneously for at least five seconds to enter System Check Mode.
	Press the Shift Key twice to bring up the auto-tuning display (reciprocating rotation range).
	Press the Increment Key to display the reciprocating rotation range data.
	Press the Data Key and Shift Key to enable the data to be changed. (The digit that can be changed will flash.)
	Use the Increment Key, the Decrement Key, and the Shift Key to change the setting to “5.”
	Press the Data Key to save the new setting.
	Press the Increment Key to bring up the target response frequency display.
	Press the Increment Key to display the target response frequency data.
	Press the Data Key and Shift Key to enable the data to be changed. (The digit that can be changed will flash.)
	Use the Increment Key, the Decrement Key, and the Shift Key to change the setting to “50.”
	Press the Data Key to save the new setting.
	Press the Increment Key to bring up the maximum rotation speed display.
	Press the Increment Key to display the maximum rotation speed data.
	Press the Data Key and Shift Key to enable the data to be changed. (The digit that can be changed will flash.)
	Use the Increment Key, the Decrement Key, and the Shift Key to change the setting to “2000.”
	Press the Data Key to save the new setting.
	Press the Increment Key to bring up the auto-tuning display (reciprocating rotation range).
	Press the Data Key and the Increment Key to execute auto-tuning. (The display will flash while the motor is operating.)
	When the display stops flashing it indicates that the auto-tuning operation is completed.
	Double-click the Mode Key to return to Monitor Mode.

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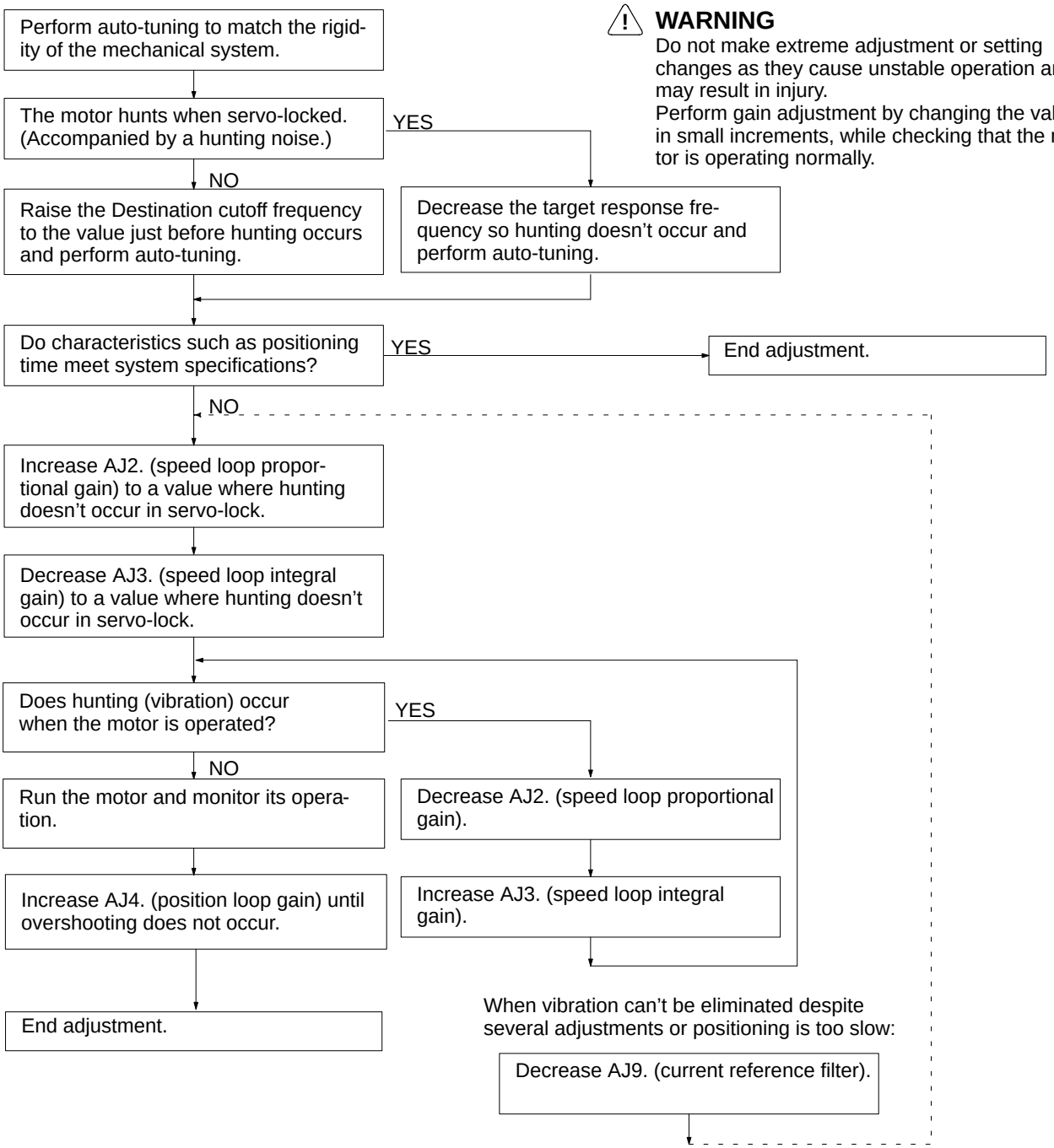
Notes on Auto-tuning Settings

- The reciprocating operation is performed twice during auto-tuning, so pay careful attention to the mechanical operating range.
- The amount of movement to one side in reciprocating operation during auto-tuning is the value set in the “Auto1” auto-tuning parameter (reciprocating operation width).
- The motor speed during auto-tuning is the value set in the “Auto3” auto-tuning parameter (maximum rotation speed).
- When auto-tuning is completed, the adjustment parameter settings for position loop gain (AJ4.), speed loop proportional gain (AJ2.), and speed loop integral gain (AJ3.) will be changed automatically. (They will not be changed until the operation has been completed.)
- If the response is not sufficient for the gain after the auto-tuning adjustments, then refer to *3-9-2 Manually Adjusting Gain* and adjust the gain manually.

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3-9-2 Manually Adjusting Gain

Gain Adjustment Flowchart



WARNING
Do not make extreme adjustment or setting changes as they cause unstable operation and may result in injury.
Perform gain adjustment by changing the value in small increments, while checking that the motor is operating normally.

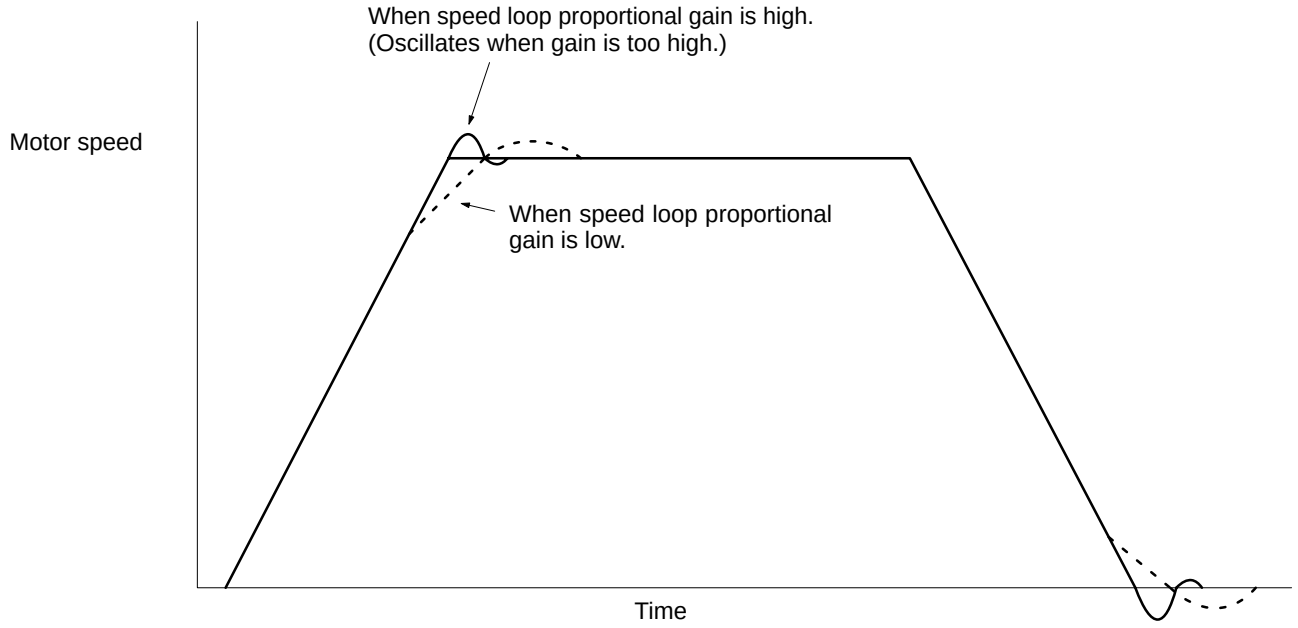
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3-9-3 Adjustment Parameter Details

PRM No.	Parameter name	Setting range	Unit	Factory setting
AJ2.	**Speed loop proportional gain**	**0.0 to 100.0**	**Multiple**	**1.0**

- This parameter adjusts the speed loop response.
- As the gain is increased, the servo rigidity is strengthened. The greater the inertia rate, the higher this is set. If the gain is set too high, oscillation will occur.
- Adjustment can be performed more quickly by first setting the load inertia ratio.

Response When Speed Loop Proportional Gain is Adjusted

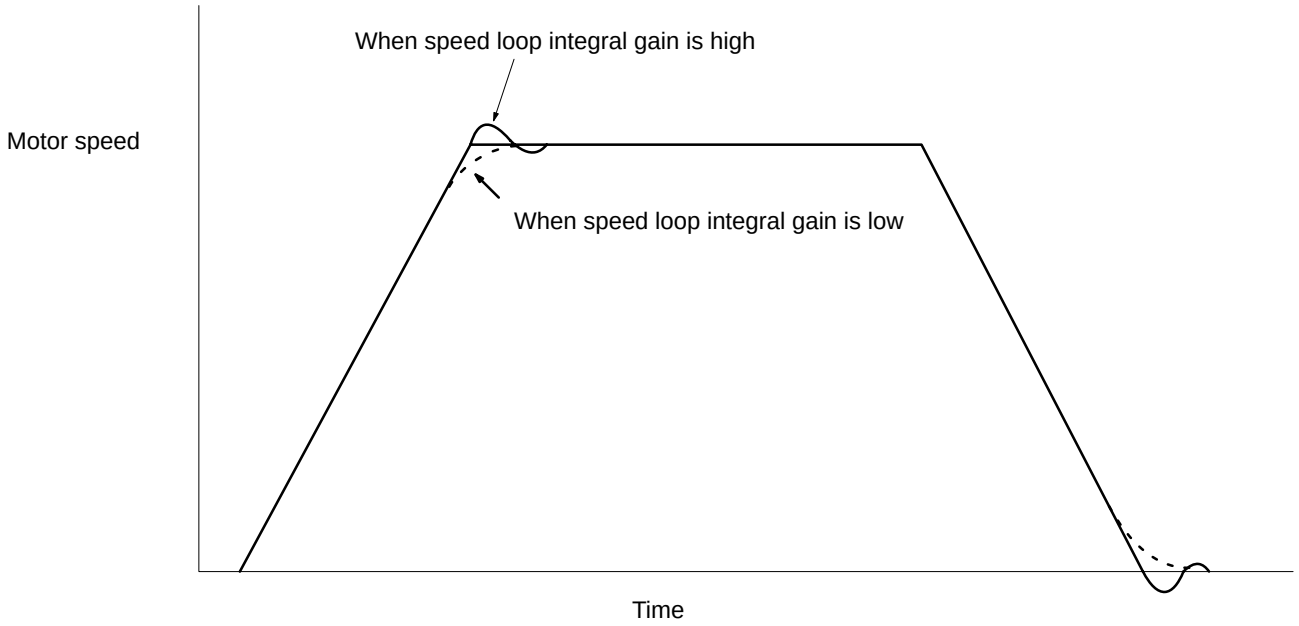


PRM No.	Parameter name	Setting range	Unit	Factory setting
AJ3.	**Speed loop integral gain**	**0.1 to 20.0**	**Multiple**	**1.0**

- This parameter sets the speed loop integral gain.
- As the gain is decreased, the responsiveness is lowered and the resistance to external force is weakened. If the gain is set too high, oscillation will occur.

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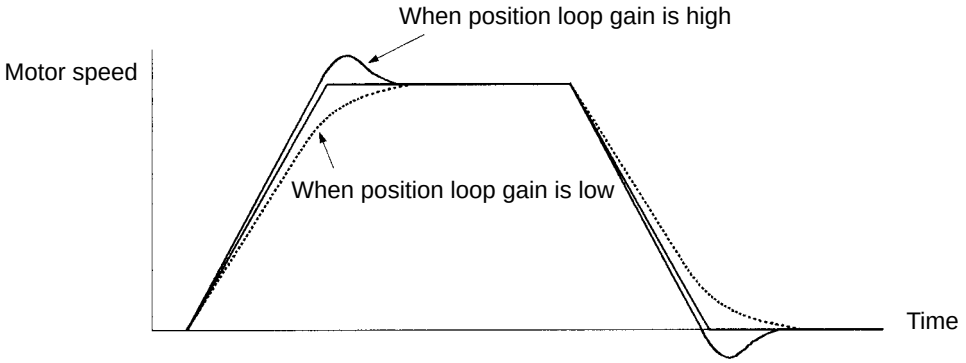
Response When Speed Loop Integral Gain is Adjusted



PRM No.	Parameter name	Setting range	Unit	Factory setting
AJ4.	Position loop gain	1 to 200	rad/s	30

- Adjust the position loop response to match the mechanical rigidity.
- The servo system's responsiveness is determined by the position loop gain. When the position loop gain is high, the servo system's responsiveness will be high and positioning can be executed quickly. In order to increase the position loop gain, it is necessary to raise the mechanical rigidity and increase the characteristic frequency. For normal construction machinery, set the gain to 50 to 70 (rad/s); for general purpose machinery and assembly machinery, 30 to 50 (rad/s); for industrial robots, 10 to 30 (rad/s).
- If the system has low mechanical rigidity or low characteristic frequency, increasing the position loop gain will cause mechanical resonance and will generate an overload alarm.
- If the position loop gain is low, the positioning time can be shortened by using feed forward.

Response When Position Loop Gain is Adjusted



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PRM No.	Parameter name	Setting range	Unit	Factory setting
AJ7.	**Interrupt gain suppression**	**0 to 10,000**	**---**	**0**

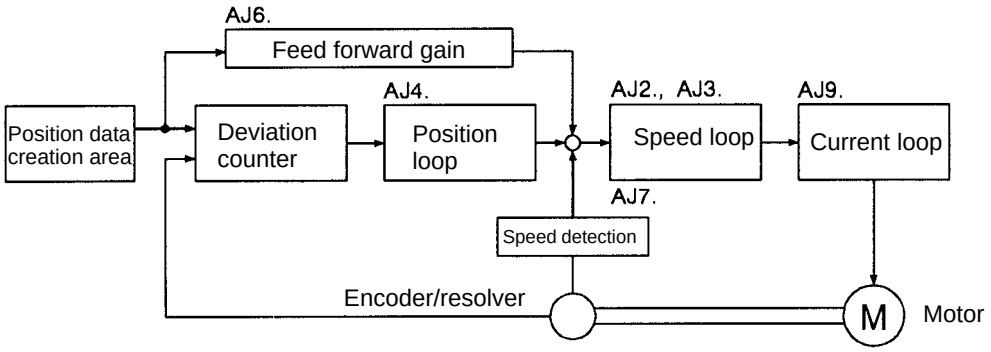
- If any value other than “0” is set for this parameter, the speed loop integral gain will be disabled when stopped, and the speed loop proportional gain will be suppressed.
- As the set value is increased, the amount of suppression is increased and the speed loop proportion gain is lowered.
- Adjust this parameter if the motor makes abnormal noises when stopping.

PRM No.	Parameter name	Setting range	Unit	Factory setting
AJ8.	**Feed-forward gain**	**0.0 to 2.0**	**Multiple**	**0.0**

- This parameter is effective when the position loop gain is low (25 rad/s). It is not effective when the position loop gain is high.
- Feed forward adds to the speed loop directly without going through the error counter, so responsiveness is increased without the error counter’s integral term being entered (when the load system operates without reference delays).
- Before the feed-forward gain can be adjusted, the position loop must be fully adjusted and the speed loop must be operating with stability. Check to make sure that these conditions are met before attempting to adjust the feed-forward gain.
- When the feed-forward amount is set too high, the speed reference becomes like a sawtooth wave and the motor makes abnormal noises. Raise the value gradually, beginning with 0.0 (multiple).
- Make the adjustment so that the positioning completion output does not repeatedly turn ON and OFF, and so that there is no speed overshooting.

PRM No.	Parameter name	Setting range	Unit	Factory setting
AJ9.	**Current reference filter**	**400 to 20,000**	**rad/s**	**6,000**

- This parameter specifies the current reference cut-off frequency.
- Gradually lower this value if vibration occurs due to a mechanical resonance frequency.



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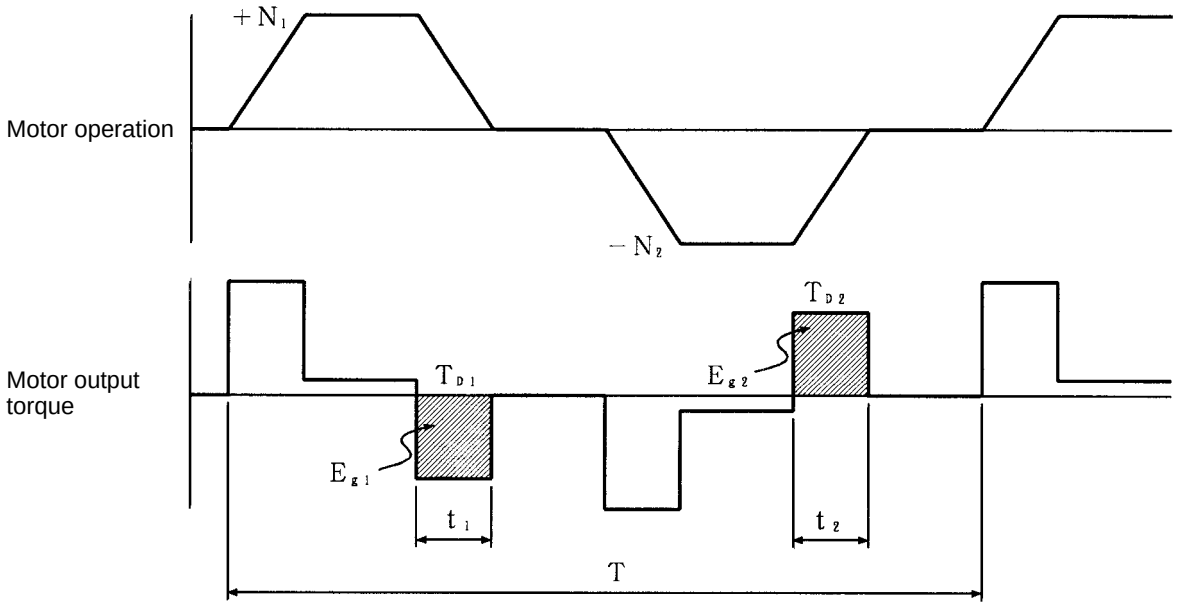
3-10 Regenerative Energy Absorption

Regenerative energy produced at times such as Servomotor deceleration is absorbed by the Position Driver's internal capacitors, thereby preventing an increase in DC voltage. If the regenerative energy from the Servomotor becomes too large, however, an overvoltage error will occur. In such cases, it is necessary to connect a Regeneration Resistor to increase the regeneration processing capacity.

3-10-1 Calculating Regenerative Energy

Regenerative energy is produced when the direction of Servomotor rotation or output torque is reversed. The methods for calculating regenerative energy for the horizontal and vertical axes are explained below.

Horizontal Axis



Note In the output torque graph, acceleration in the positive direction is shown as positive, and acceleration in the negative direction is shown as negative.
The regenerative energy for each section can be found by means of the following formulas:

$E_{g1} = 1/2 \quad N_1 \quad T_{D1} \quad t_1 \quad 1.027 \times 10^{-2}$ [J]
$E_{g2} = 1/2 \quad N_2 \quad T_{D2} \quad t_2 \quad 1.027 \times 10^{-2}$ [J]

N_1, N_2: Rotation speed at beginning of deceleration [r/min]
T_{D1}, T_{D2}: Deceleration torque [kgf cm]
t_1, t_2: Deceleration time [s]

Note There is some loss due to winding resistance, so the actual regenerative energy will be approximately 90% of the figure derived by the formula.

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The maximum regenerative energy (E_g) occurring in any operational section can be found by means of the following formula:

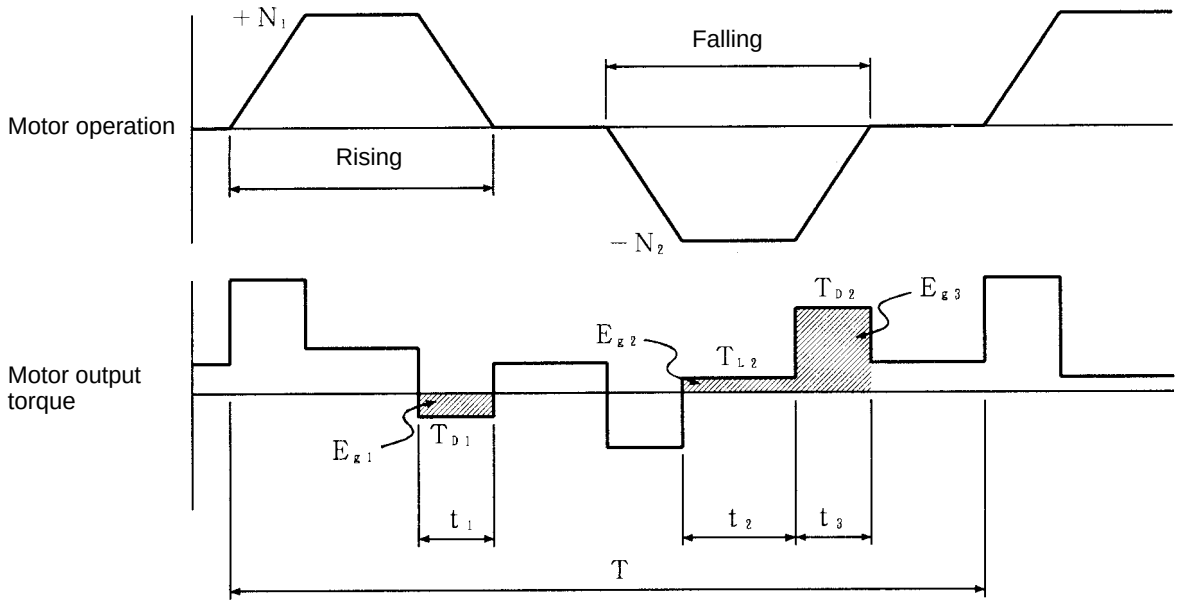
[Unit: J]
E_g is the larger of E_{g1} and E_{g2}.

The average regenerative power per cycle of operation can be found by means of the following formula:

[Unit: W]
$P_r = (E_{g1} + E_{g2})/T$ [W]
T: Operation cycle [s]

The maximum regenerative energy (E_g) and the average regenerative power (P_r) must not exceed the regeneration absorption capacity of the Driver. If the regeneration absorption capacity is insufficient, connect a Regeneration Resistor.

Vertical Axis



Note In the output torque graph, acceleration in the positive direction (rising) is shown as positive, and acceleration in the negative direction (falling) is shown as negative.
The regenerative energy for each section can be found by means of the following formulas:

$E_{g1} = 1/2 \quad N_1 \quad T_{D1} \quad t_1 \quad 1.027 \times 10^{-2}$ [J]
$E_{g2} = N_2 \quad T_{L2} \quad t_2 \quad 1.027 \times 10^{-2}$ [J]
$E_{g3} = 1/2 \quad N_2 \quad T_{D2} \quad t_3 \quad 1.027 \times 10^{-2}$ [J]

N_1, N_2: Rotation speed at beginning of deceleration [r/min]
T_{D1}, T_{D2}: Deceleration torque [kgf cm]
T_{L2}: Torque when falling [kgf cm]
t_1, t_3: Deceleration time [s]
t_2: Travel time equivalent to torque when falling [s]

Note There is some loss due to winding resistance, so the actual regenerative energy will be approximately 90% of the figure derived by the formula.

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The maximum regenerative energy (E_g) occurring in any operational section can be found by means of the following formula:

[Unit: J]
E_g is the largest of E_{g1}, E_{g2}, E_{g3}.

The average regenerative power per cycle of operation can be found by means of the following formula:

[Unit: W]
$P_r = (E_{g1} + E_{g2} + E_{g3})/T$ [W]
T: Operation cycle [s]

The maximum regenerative energy (E_g) and the average regenerative power (P_r) must not exceed the regeneration absorption capacity of the Driver. If the regeneration absorption capacity is insufficient, connect a Regeneration Resistor.

3-10-2 Position Driver Absorbable Regenerative Energy

The Position Driver absorbs regenerative energy by means of an internal capacitor. If there is more regenerative energy than can be absorbed by the capacitor, an overvoltage error will be generated and operation cannot continue. The amounts of regenerative energy that can be absorbed by the various Position Drivers alone are shown in the tables below. If regenerative energy exceeding these values is produced, take the following measures.

- Connect a Regeneration Resistor.
- Lower the operating rotation speed. (The regenerative energy is proportional to the square of the rotation speed.)
- Lengthen the deceleration time. (Reduce the amount of regenerative energy per unit time.)

200-VAC Input Type

Model	Regeneration processing capacity	
	Average regenerative power (W)	Regenerative energy (J)
FND-X06H-	13	17
FND-X12H-	24	17
FND-X25H-	37	22
FND-X50H-	160	38

Note The input voltage is the value at 200 VAC. As the input voltage is increased, the amount of regenerative energy that can be absorbed is decreased.

100-VAC Input Type

Model	Regeneration processing capacity	
	Average regenerative power (W)	Regenerative energy (J)
FND-X06L-	13	17
FND-X12L-	17	17

Note The input voltage is the value at 100 VAC. As the input voltage is increased, the amount of regenerative energy that can be absorbed is decreased.

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3-10-3 Regenerative Energy Absorption by Regeneration Resistor

If the Position Driver alone cannot absorb the regenerative energy, connect a Regeneration Resistor. The Regeneration Resistor connects between the P and J terminals at the Position Driver's terminal block.

⚠ **Caution** Be careful when connecting the Regeneration Resistor. If done incorrectly it will damage the Position Driver.

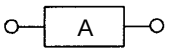
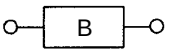
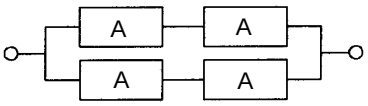
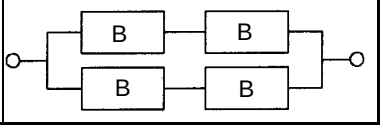
⚠ **Caution** The Regeneration Resistor heats up to 120°C, so be careful not to place it near equipment or wiring that may be affected by heat. Also be sure to install a radiation shield that satisfies the heat radiation conditions.

Selecting a Regeneration Resistor

□Types of Regeneration Resistors

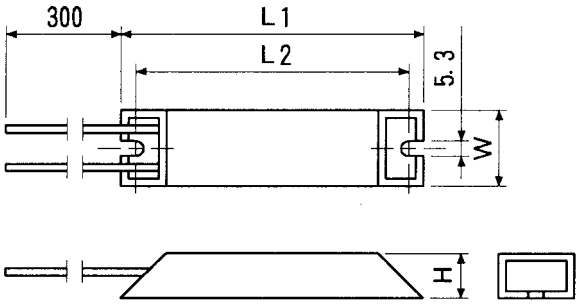
Type	Model	Resistance	Nominal capacity	Regeneration absorption at 120 C	Heat radiation conditions
A	R88A-RR20030	30Ω	200 W	100 W	t3 × 350 (aluminum)
B	R88A-RR40030	30Ω	400 W	200 W	t3 × 350 (aluminum)

□Regeneration Resistor Combinations

	Regeneration absorption capacity			
	100 W	200 W	400 W	800 W
Combination method				

Note Select a combination with a capacity greater than the average regenerative power (P_r).

□Dimensions (Unit: mm)

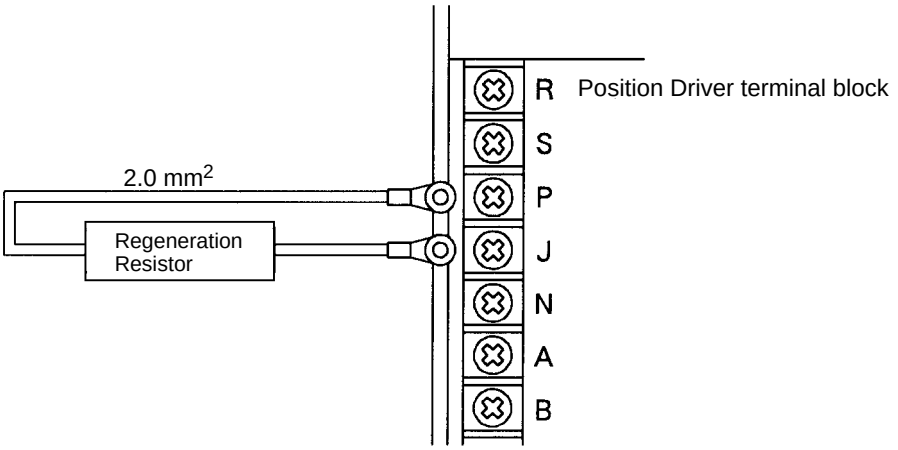


Model	L1	L2	W	H
R88A-RR20030	215	200	50	25
R88A-RR40030	265	250	60	30

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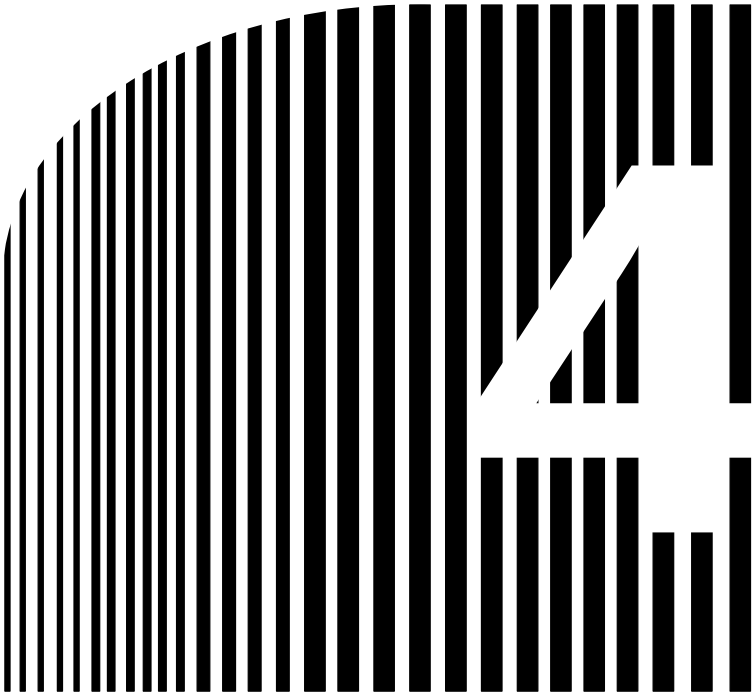
Wiring the Regeneration Resistor

As shown in the following diagram, connect the Regeneration Resistor between the P and J terminals at the Position Driver's terminal block.



Note With the FND-X50H- , connect a Regeneration Resistor between P and JP1. In this case, remove the short bar between JP1 and JP2.

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Chapter 4

• Application •

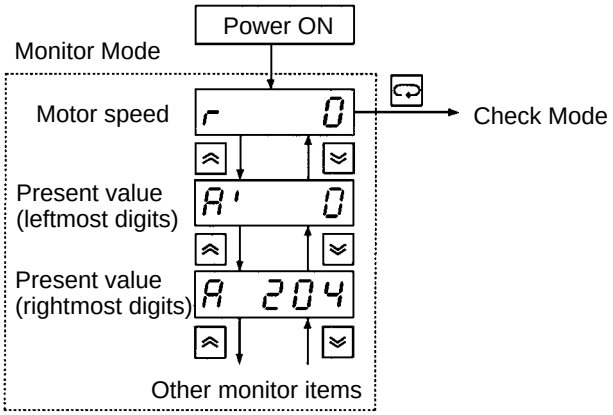
4-1 Monitor Mode
4-2 Check Mode
4-3 Monitor Output
4-4 Protection and Diagnosis
4-5 Troubleshooting
4-6 Periodic Maintenance

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4-1 Monitor Mode

The following ten items can be monitored in Monitor Mode: motor speed, present value, reference value, position deviation, mechanical speed, motor current, effective load factor, electrothermal value, electrical angle, and regenerative absorption rate.
The Monitor Mode is entered when the Position Driver's power supply is turned ON. The various items to be monitored can be displayed one at a time by pressing the Increment Key and Decrement Key.

□ Operation in Monitor Mode



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□Monitor Details

Display	Monitored item	Unit	Explanation
r	Motor speed	r/min	Displays the actual rotation speed of the motor shaft.
A’	Present value (leftmost digits)	Mechanical axis movement	Calculates and displays the present value of the mechanical axis based on feedback from the motor sensor.
A	Present value (rightmost digits)		
C’	Reference value (leftmost digits)	Mechanical axis movement	Displays the mechanical axis position referenced by the Position Driver.
C	Reference value (rightmost digits)		
E’	Position deviation (leftmost digits)	Pulse	Displays the deviation of the present value from the reference value with encoder/resolver resolution.
E	Position deviation (rightmost digits)		
P’	(Not used.)	---	---
P	(Not used.)		
F’	Mechanical speed (leftmost digits)	Mechanical axis movement per second	Calculates and displays the movement speed of the mechanical axis based on feedback from the motor sensor.
F	Mechanical speed (rightmost digits)		
cF	(Not used.)	---	---
cc	(Not used.)	---	---
L	Motor current	A_{0-P}	Displays the output current to the motor.
bL	Effective load factor	%	Displays the effective load factor with respect to the motor’s rated current value. Effective load factor = (output current effective value) / (motor’s rated current) Effective values are calculated at the time interval set for HP-33 (load factor time constant).
oL	Electrothermal value	%	Calculates the motor’s heat generation from the output current and displays it as a percentage of the heat generation in rated operation. (When the power is turned ON, 90 [%] is displayed.) If this value exceeds 110 [%], an A.L17 (motor overload) alarm will be detected.
d	Electrical angle	deg	Displays the motor’s electrical angle (0.0 to 360.0).
rL	Regenerative absorption rate	%	When a Regeneration Resistor is connected, this monitor item displays the regenerative absorption current as a percentage of the motor’s rated current.

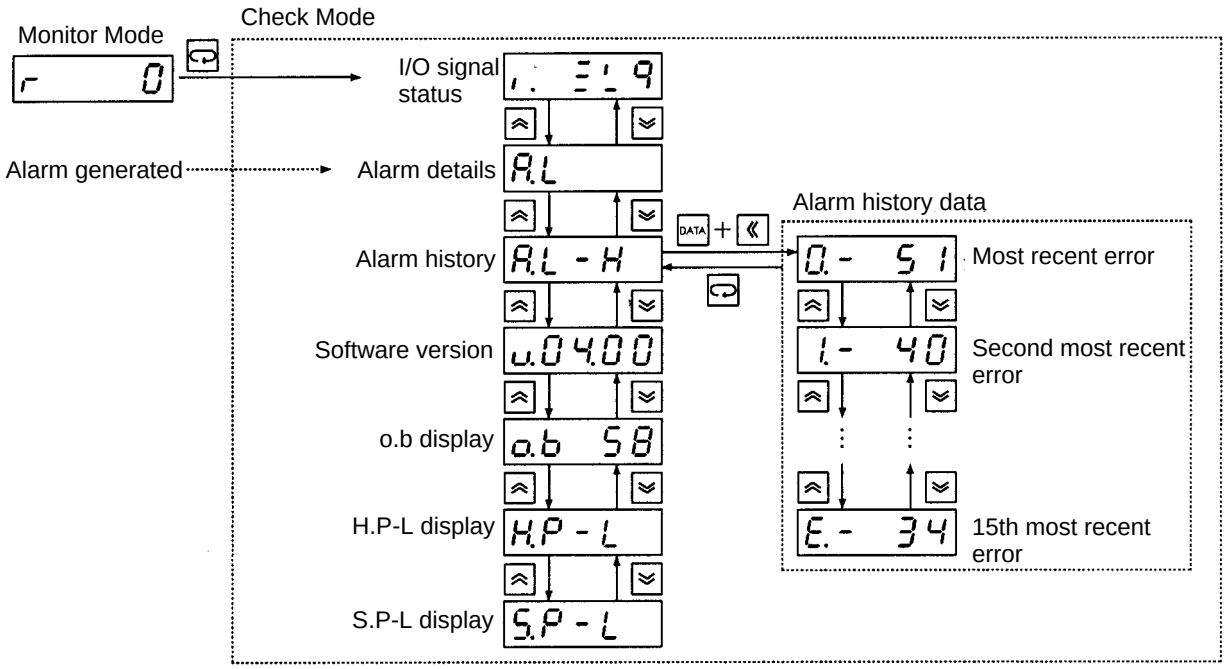
Note In the motor speed, present value, position deviation, mechanical speed, and motor current monitoring displays, the respective display will flash if the value is negative. (The numeric portion will not flash.)

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4-2 Check Mode

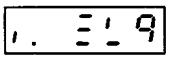
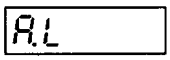
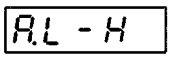
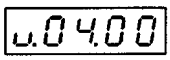
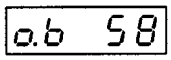
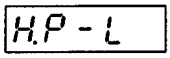
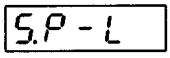
The following four items can be displayed in Check Mode: I/O signal status, alarm details, alarm history, and software version
To enter the Check Mode, press the Mode Key while in Monitor Mode. Also, the Check Mode's alarm display is brought up automatically when an alarm is generated. The Check Mode's items can be displayed one at a time by pressing the Increment Key and Decrement Key.

□Operation in Check Mode



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☐Check Mode Display Details

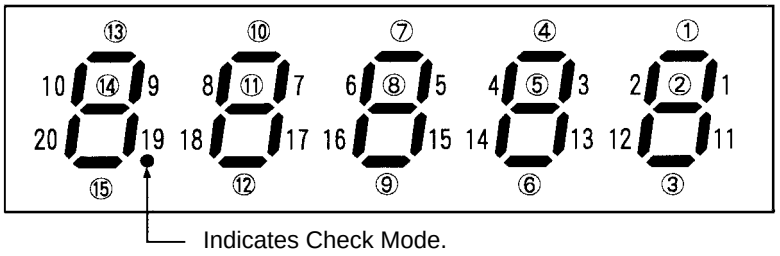
Display	Contents	Explanation
	I/O signal status	Displays the ON/OFF status of control I/O signals.
	Alarm details	Displays details regarding alarms that are generated. (The example display at the left indicates that no alarm has been generated. When an alarm occurs, the alarm code is displayed here.) This display is brought up automatically whenever an alarm occurs during operation. The alarm can be cleared by pressing the Data Key at that time. If multiple errors occur simultaneously, however, it will be necessary to press the Data Key for each error. For details regarding alarms, refer to *4-4 Protection and Diagnosis*.
	Alarm history	Displays the errors that have occurred in the past. (Up to 15 errors are retained in memory.)
	Software version	Displays the software version.
	o.b display	(Not used.)
	H.P-L display	(Not used.)
	S.P-L display	(Not used.)

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4-2-1 I/O Signal Status

With the I/O signal status display, the ON/OFF status of control I/O signals is indicated by the turning ON and OFF of 7-segment display LED bits.

□I/O Signal Bit Allocation



The vertical LEDs show the ON/OFF status of inputs (1 to 20) and the horizontal LEDs show the ON (lit)/OFF (not lit) status of outputs ((1) to (15)).

□Input Signal Allocation

Bit No.	Symbol	Name	DIO type	CompoBus/S type
1	CCWL	CCW limit input	CN1-1	CN4-1
2	CWL	CW limit input	CN1-2	CN4-2
3	ORG	Origin proximity	CN1-3	CN4-3
4	RUN	RUN command	CN1-4	OUT0
5	START	START	CN1-5	OUT1
6	RESET	Alarm reset	CN1-6	OUT2
7	SEARCH	Origin search	CN1-7	OUT3
8	+JOG	+JOG operation	CN1-8	OUT4
9	–JOG	–JOG operation	CN1-9	OUT5
10	TEACH	TEACH	CN1-10	OUT6
11	P.IN0	Point selection 0/ Position 0	CN1-11	OUT8
12	P.IN1	Point selection 1/ Position 1	CN1-12	OUT9
13	P.IN2	Point selection 2/ Position 2	CN1-13	OUT10
14	P.IN3	Point selection 3/ Position 3	CN1-14	OUT11
15	P.IN4	Point selection 4/ Position 4	CN1-15	OUT12
16	P.IN5	Point selection 5/ Position 5	CN1-16	OUT13
17	P.IN6	Point selection 6/ Position 6	CN1-17	OUT14
18	P.IN7	Position 7	CN1-18	OUT15
19	---	(Not used.)	---	---
20	STOP	Deceleration stop	CN1-20	OUT7, CN4-4 (see note)

Note When the deceleration stop signal for both OUT7 and CN4-4 is ON, bit No. 20 will be lit.

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□Output Signal Allocation

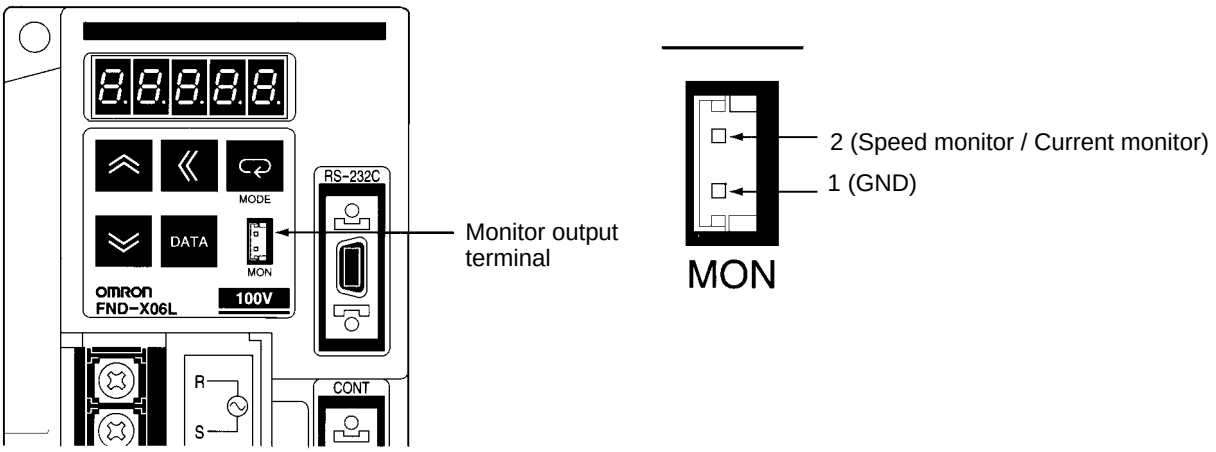
Bit No.	Symbol	Name	DIO type	CompoBus/S type
(1)	BO	Brake output	CN1-21	IN0, CN4-8
(2)	READY	Ready	CN1-22	IN1
(3)	S.COM	Origin search completed	CN1-23	IN2
(4)	ORGSTP	Origin stop	CN1-24	IN3
(5)	T.COM	Teaching completed	CN1-25	IN4
(6)	RUNON	Motor running	CN1-26	IN5
(7)	INP	Positioning completed	CN1-27	IN6
(8)	$\overline{\text{ALM}}$	Alarm	CN1-28	IN7
(9)	P.OUT0	Point output 0/ Position selection 1	CN1-29	IN8
(10)	P.OUT1	Point output 1/ Position selection 2	CN1-30	IN9
(11)	P.OUT2	Point output 2/ Position selection 3	CN1-31	IN10
(12)	P.OUT3	Point output 3/ Position selection 4	CN1-32	IN11
(13)	P.OUT4	Point output 4/ Speed selection	CN1-33	IN12
(14)	P.OUT5	Point output 5	CN1-32	IN13
(15)	P.OUT6	Point output 6	CN1-35	IN14

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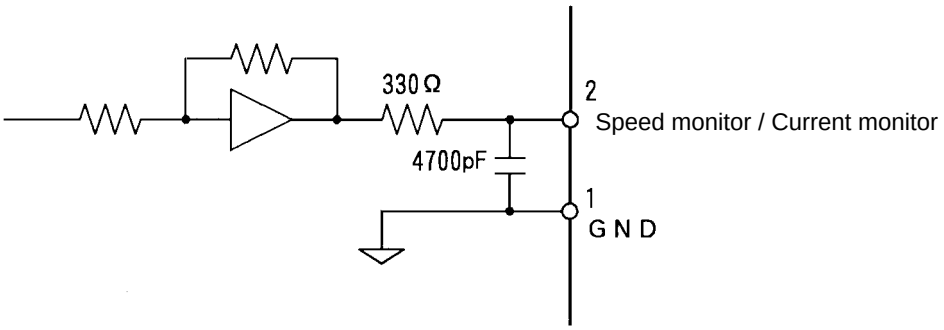
4-3 Monitor Output

The Position Driver outputs (analog) a voltage proportional to the motor's rotation speed and current. The monitor voltage is output from the monitor output terminal on the front panel of the Position Driver. This analog output can be used to install a meter in the control panel or to provide more precise gain adjustments.

□Monitor Output Terminal on Driver's Front Panel



□Monitor Output Circuitry



□Monitor Output Specifications

Speed monitor	With 0 V as center, voltage output at rate of 3 V/(motor's rated speed). Forward rotation: (+) voltage; reverse rotation: (–) voltage output Output accuracy: approx. ±10%
Current monitor	With 0 V as center, voltage output at rate of 3 V/(motor's maximum current). Forward acceleration: (+) voltage; reverse acceleration: (–) voltage Output accuracy: approx. ±10%

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□User Parameter Setting

No. UP-	Name	Min. unit	Setting range	Factory setting	Explanation
25	Monitor output selection	---	000 to 011	010	Specifies the output terminal function. 0 └ Voltage polarity 0: Not reversed 1: Reversed └ Speed/Current selection 0: Current 1: Speed

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4-4 Protection and Diagnosis

4-4-1 Alarms

The Position Driver has the error detection functions shown below. When an error is detected the output signal ALM (CN1-28) turns OFF and the alarm is displayed.

The following table shows the alarm codes that are displayed on the Position Driver's front panel, and it provides explanations of each of their meanings.

Display	Error detection function	Meaning of code and probable cause	Motor current
A.L01	Overcurrent	Overcurrent or overheating detected.	Servo OFF
A.L02	Overvoltage	Main circuit's DC voltage exceeded 410 VDC.	Servo OFF
A.L03	Voltage drop	Main circuit's DC voltage fell below 200 VDC.	Servo OFF
A.L06	Resolver disconnection	The resolver is disconnected.	Servo OFF
A.L07	Power status error	The main circuit connections are different from the settings.	Servo OFF
A.L09	Regeneration Resistor overheat	The internal Regeneration Resistor has overheated (only for FND-X50).	Servo OFF
A.L10	Regeneration operation error	The regeneration transistor has been ON for more than 50 ms (only for FND-X50).	Servo OFF
A.L12	Clock stopped	The Position Driver's clock is stopped.	Servo OFF
A.L15	Overcurrent (soft)	The current exceeded the motor's rated current (120%).	Servo OFF
A.L16	Speed amp saturation	The speed amp was saturated for more than 3 seconds.	Servo OFF
A.L17	Motor overload	The electrothermal value exceeded 110%.	Servo OFF
A.L18	Short time overload	The current exceeded the motor's rated current (120%) for a sustained period of time.	Servo OFF
A.L19	Resolver error	There was an error in the resolver feedback.	Servo OFF
A.L20	Speed over	The motor speed exceeded 120% of the maximum speed.	Servo OFF
A.L21	Deviation counter over	The deviation counter's accumulated pulses exceeded $\pm 2^{21}$.	Servo OFF
A.L26	Parameter setting error	The user parameter settings (UP-01, UP-02) are not appropriate.	Servo OFF
A.L32	Resolver error	The resolver feedback was in error.	Servo OFF
A.L34	+ Software limit over	The reference value exceeded the software limit in the positive direction (PP-10, PP-11).	Servo-lock
A.L35	– Software limit over	The reference value exceeded the software limit in the negative direction (PP-12, PP-13).	Servo-lock
A.L37	Coordinate counter over	The present value exceeded $\pm 2^{31}$. Teaching or origin teaching was executed with the parameter setting exceeded.	Servo-lock

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Display	Error detection function	Meaning of code and probable cause	Motor current
A.L38	Overrun	The limit input signal in the direction of movement turned OFF.	Servo OFF
A.L40	Encoder disconnection	An encoder disconnection or short-circuit was detected.	Servo OFF
A.L41	Encoder communications error	There was an error in the encoder's S-phase data (or A-phase when an absolute encoder is connected).	Servo OFF
A.L42	Absolute encoder backup error	The absolute encoder's backup voltage dropped.	Servo OFF
A.L43	Absolute encoder checksum error	There was an error in the absolute encoder's memory data check.	Servo OFF
A.L44	Absolute encoder battery error	The absolute encoder's backup battery voltage dropped.	Servo OFF
A.L45	Absolute encoder absolute value error	There was an error in the absolute encoder's sensor check.	Servo OFF
A.L46	Absolute encoder over speed	The speed exceeded 400 r/min when multiple rotation data was transmitted.	Servo OFF
A.L47	Encoder data not transmitted	The encoder's S-phase data was not transmitted within the prescribed time.	Servo OFF
A.L48	Encoder initialization error	The encoders reception circuitry malfunctioned.	Servo OFF
A.L50	BCD data error	The input data for P.IN0 to 7 is not BCD.	Servo-lock
A.L51	Present position unknown	START, TEACH, or ORIGIN TEACH was executed when the origin was not established.	Servo-lock
A.L52	PTP data not set	A point number was selected for which the PTP data was not set.	Servo-lock

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4-4-2 Countermeasures to Alarms

Alarm display	Error content	Condition when error occurred	Probable cause	Countermeasures
A.L01	Overcurrent	Occurred when power was turned ON.	Control board defective.	Replace Driver.
		Occurred when Servo was turned ON.	Current feedback circuit error	Replace Driver.
			Main circuit transistor module error	
			Servomotor power line is short-circuited or grounded.	• Correct the power line short-circuiting or grounding. • Measure the insulation resistance at the Servomotor itself. If there is short-circuiting, replace the Servomotor.
	Overheating	Occurred during operation even though power was ON. If reset is executed after waiting for a time, operation resumes.	The ambient temperature for the Driver is higher than 55°C.	Bring the ambient temperature for the Driver down to 55°C or lower.
			The load torque is too high.	• Lighten the load. • Lengthen the acceleration time. • Select another Servomotor.
A.L02	Overvoltage	Occurred when power was turned ON.	The power supply voltage is outside of the allowable range.	• The supply voltage must be 170 to 264 VAC when 200 VAC is specified • The supply voltage must be 85 to 127 VAC when 100 VAC is specified.
		Occurred during motor deceleration.	The load inertia is too large.	• Lengthen the deceleration time. • Calculate the regeneration and select a Regeneration Resistor.
			The power supply voltage is outside of the allowable range.	• The supply voltage must be 170 to 264 VAC when 200 VAC is specified • The supply voltage must be 85 to 127 VAC when 100 VAC is specified.
			The external Regeneration Resistor is damaged.	Calculate the amount of regeneration and replace the Regeneration Resistor with one of the appropriate capacity.
		Occurred while lowering (vertical shaft).	Gravity torque is too large.	• Add a counterbalance to the machine, and reduce the gravity torque. • Reduce the lowering speed. • Connect an external Regeneration Resistor.

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Alarm display	Error content	Condition when error occurred	Probable cause	Countermeasures
A.L03	Voltage drop	Occurred during operation.	The power supply voltage fell below the prescribed value.	• For 200-VAC input specifications, use a 170 to 264-VAC power supply. • For 100-VAC input specifications, use an 85 to 127-VAC power supply.
		Occurred during motor acceleration	The power supply capacity is insufficient.	Increase the power supply capacity.
A.L06	Resolver disconnection	Occurred when power was turned ON.	The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.
			The resolver's wiring is disconnected or faulty.	• Connect any places that are disconnected. • Correct the wiring.
		Occurred after slight movement at the beginning.	There is poor contact at the connectors.	Make sure the connectors are inserted firmly and locked into place.
A.L07	Power status error	---	An error occurred in the main circuit.	Replace the Driver.
A.L09	Regeneration Resistor overheat	Occurred during operation.	The regenerative absorption exceeded the internal absorption.	Connect an external Regeneration Resistor.
			The power supply voltage is outside the allowable range.	Use a 170 to 264-VAC power supply.
A.L10	Regeneration operation error	Occurred during operation.	The Regeneration Resistor is damaged.	• Replace the external Regeneration Resistor. • If an external Regeneration Resistor is not being used, replace the Driver.
			An external Regeneration Resistor is not being used and the short bar has been removed from between JP1 and JP2 on the terminal block.	Mount a short bar between JP1 and JP2.
			The regeneration circuit is damaged.	Replace the Driver.
A.L12	Clock stop	---	The Position Driver's internal clock has stopped.	Replace the Driver.
A.L15	Overcurrent (soft) [The current exceeded the motor's rated current (120%).]	Occurred during operation.	The mechanical system is locked.	Correct the places that are locked.
			The power lines are wired incorrectly.	Correct the wiring.
			The power lines are shorted-circuited or grounded.	Correct the short-circuiting or grounding.
			The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.
A.L16	Speed amp saturation [The speed amp was saturated for more than 3 seconds.]	Occurred during operation.	The mechanical system is locked.	Correct the places that are locked.
			The power lines are wired incorrectly.	Correct the wiring.
			The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.

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Alarm display	Error content	Condition when error occurred	Probable cause	Countermeasures
A.L17	Motor overload [The electrothermal value exceeded 110%.]	Occurred during operation.	The mechanical system is locked.	Correct the places that are locked.
			The power lines are wired incorrectly.	Correct the wiring.
			The load is too large.	• Lighten the load. • Lengthen the deceleration time.
			The gain adjustment is incorrect.	Re-adjust the gain.
A.L18	Short time overload [The current exceeded the motor's rated current (120%) for a sustained period of time.]	Occurred during operation.	The mechanical system is locked.	Correct the places that are locked.
			The power lines are wired incorrectly.	Correct the wiring.
			The load is too large.	• Lighten the load. • Lengthen the deceleration time.
			The gain adjustment is incorrect.	Re-adjust the gain.
A.L19	Resolver error [There was an error in the resolver feedback.]	Occurred during operation.	The resolver cable is disconnected.	• Connect any disconnected places. • Correct any faulty contacts.
			Malfunctioning was caused by noise.	Wire the resolver cables separately from the power lines.
A.L20	Speed over [The motor speed exceeded 120% of the maximum speed.]	The motor operated at high speed upon startup.	There was a resolver feedback error.	Wire the resolver cables separately from the power lines.
			The encoder is wired incorrectly.	Correct the wiring.
		Occurred during operation.	The gain adjustment is incorrect.	Re-adjust the gain.
A.L21	Deviation counter over [The error counter's accumulated pulses exceeded $\pm 2^{21}$.]	Motor did not operate even though the START signal was turned ON.	The motor power lines or the encoder lines are wired incorrectly.	Correct the wiring.
			The mechanical system is locked.	Correct the places that are locked.
		Occurred at high-speed rotation.	The motor power lines or the encoder lines are wired incorrectly.	Correct the wiring.
		Occurred when positioning with a large amount of movement or during a JOG operation.	The gain adjustment is incorrect.	Re-adjust the gain.
			Acceleration was too sudden.	Lengthen the acceleration time.
			The load is too large.	• Lighten the load. • Select another motor.
		Occurred when operating at the maximum rotation speed.	The reference speed is too high.	Correct the speed settings.
			The slip compensation is too large.	Correct the slip compensation.
A.L26	Parameter setting error	Occurred when power was turned ON.	No data is set for UP-01 and UP-02, or else the setting is incorrect.	Correctly set the data for UP-01 and UP-02. (After setting the data, turn the power off and back ON.)

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Alarm display	Error content	Condition when error occurred	Probable cause	Countermeasures
A.L32	Resolver error	Occurred when power was turned ON.	The resolver cable is disconnected.	Connect any disconnected places.
			The resolver cable wiring is incorrect.	Correct the wiring.
			The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.
A.L34	+ Software limit over	Occurred during operation.	The reference value set in PP-10 and PP-11 was exceeded.	• Reset the alarm and use JOG or manual operation to release from the software limit. • Correct the reference value. • Correct the PP-10 and PP-11 values.
A.L35	– Software limit over	Occurred during operation.	The reference value set in PP-12 and PP-13 was exceeded.	• Reset the alarm and use JOG or manual operation to release from the software limit. • Correct the reference value. • Correct the PP-12 and PP-13 values.
A.L37	Coordinate counter over [The present value exceeded $\pm 2^{31}$.]	Occurred during shaft movement.	The reference value is too large.	Correct the reference value.
			Feedback control is being employed in PTC control mode.	Correctly set the control mode (UP-01). (After setting the data, turn the power OFF and back ON.)
A.L38	Overrun [The limit input signal in the direction of movement turned OFF during an operation other than origin search.]	Occurred during shaft movement.	The reference value is too large.	Correct the reference value.
			The limit sensor's position is incorrect.	Correct the limit sensor's position.
		Occurred when beginning.	The limit sensor's polarity is incorrect.	Wire the sensor so that it turns ON during normal operation.
			The limit sensor is broken.	Replace the limit sensor.
A.L40	Encoder disconnection	Occurred after moving just a little at the beginning.	The encoder's lines are disconnected.	Connect any disconnected places.
			There is poor contact at the connectors.	Make sure the connectors are inserted firmly and locked into place.
			The encoder's wiring is incorrect.	Correct the wiring.
			The encoder is damaged.	Replace the motor.
			The Driver is damaged.	Replace the Driver.
		Occurred when power was turned ON.	The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.
			The encoder cable is loose.	Make sure the connectors are inserted firmly and locked into place.
A.L41	Encoder communications error (see note 1)	Occurred when power was turned ON.	The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.
			The encoder S-phase wiring is incorrect.	Correct the wiring.

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Alarm display	Error content	Condition when error occurred	Probable cause	Countermeasures
A.L42	Absolute encoder backup error	Occurred when power was turned ON.	The absolute encoder's backup voltage dropped (even if the encoder was being used for the first time).	Perform the absolute encoder setup.
A.L43	Absolute encoder checksum error	Occurred when power was turned ON.	There was an error in the absolute encoder's memory data check.	Perform the absolute encoder setup.
A.L44	Absolute encoder battery error	Occurred when power was turned ON.	The absolute encoder's backup battery voltage dropped (to 2.6 to 2.8 V max.).	Replace the battery and then perform the absolute encoder setup.
A.L45	Absolute encoder absolute value error	Occurred when power was turned ON.	There was an error in the absolute encoder's sensor check. (Internal encoder error)	• Turn the power OFF and then back ON. • If the error persists, then replace the motor.
A.L46	Absolute encoder over speed	Occurred when power was turned ON.	The speed exceeded 400 r/min when the power was turned ON.	Turn ON the power while the motor is stopped
A.L47	Encoder data not transmitted	Occurred when power was turned ON.	The UP-02 (applicable motor) setting is wrong.	Set the motor model code correctly.
			The encoder S-phase wiring is disconnected.	Connect any disconnected places.
A.L48	Encoder initialization error	Occurred when power was turned ON.	The Driver malfunctioned.	• Turn the power OFF and then back ON. • If the error persists, then replace the motor.
A.L50	BCD data error	Occurred when power was turned ON.	The data input for direct positioning was not BCD.	Re-input the data and make sure it is correct.
			The point number input for point positioning was not BCD.	
A.L51	Present position unknown	Occurred at startup or when teaching.	START, TEACH, or ORIGIN TEACH was executed when the origin was not established.	Execute an origin search to establish the origin.
A.L52	PTP data not set	Occurred when power was turned ON.	A point number was selected for which the PTP data was not set.	• Set the correct PTP data. • Select a point number for which PTP data has been set.

Note 1. If the motor has been incorrectly connected, or if the applicable motor (UP-02) has been incorrectly set, the motor may perform some revolutions before an A.L41 error is generated. Check the settings for the connected motor and the applicable motor before recommencing operation.

Note 2. For details on replaceable batteries, refer to *2-2-7 Battery Wiring and Encoder Setup for Absolute Encoder.*

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4-4-3 CompoBus/S-type Position Driver Protective and Diagnostic Functions

With the CompoBus/S Master Unit (C200HW-SRM21 is used here as an example) and the CompoBus/S-type Position Driver (FND-X -SRT), the communications status can be checked using the LED indicators.

□FND-X -SRT

Diagnosis Using LED Indicator Status

Indicator status			Probable cause of error	Countermeasure
PWR	COMM	ERR		
Not lit	Not lit	Not lit	The Position Driver's power is not turned on.	Turn on the power for the Position Driver.
Lit	Not lit	Not lit	The Slave's node address is set in the 8 to 15 range when the maximum number of Slaves connectible to the Master is 16.	Set the node address from 0 to 7, or set the maximum number of connectible Slaves to 32.
Lit	Not lit	Lit	A communications error occurred during communications.	Establish the cause of the error by checking the LED indicator on the Master and take appropriate countermeasures.
			The Master is a CQM1, and the number of occupied points per node is set to 4.	Change the setting to 8-point mode.
Lit	Not lit	---	The Master's power is not turned on.	Turn on the power for the Master.

□CompoBus/S Master Unit (Example: C200HW-SRM21)

Diagnosis Using LED Indicator Status

Indicator	Status	Meaning
RUN (green)	Lit	The Position Driver is operating normally.
	Not lit	Indicates one of the following conditions: The power is OFF, there is an I/O setting error, the CPU Unit is in standby status, or there is a unit number setting error.
SD (yellow)	Lit	Data is being transmitted.
	Not lit	Data is not being transmitted.
RD (yellow)	Lit	Data is being received.
	Not lit	Data is not being received.
ERC (red)	Lit	A Slave has been withdrawn from communications. (Communications error)
	Not lit	The Slaves are communicating normally.
IN/OUT (red)	Lit	An error has occurred with an Output Slave.
	Not lit	An error has occurred with an Input Slave or all Slaves are operating normally.
8 4 2 1 (red)	Lit/Not lit	These indicators represent the four-digit binary slave number of the Slave in which the error occurred.

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4-4-4 Overload Characteristics

An overload protection function (electrothermal) is built into the Position Driver to protect against Position Driver or Servomotor overload. If a motor overload (A.L17) or temporary overload (A.L18) does occur, first clear the cause of the error and then wait at least one minute for the Servomotor temperature to drop before turning ON the power again. If the power is turned ON again too soon, the Servomotor coil may be damaged.

□Motor Overload (A.L17) Detection

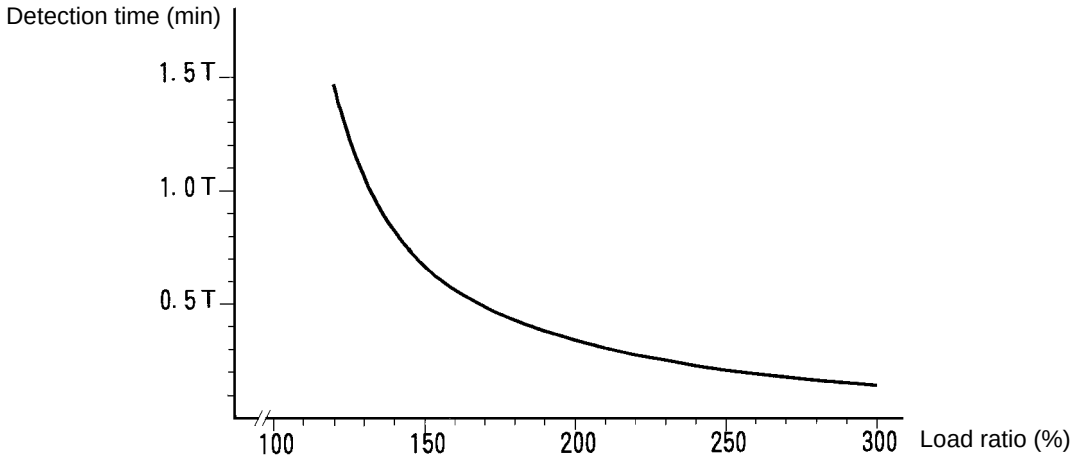
Detection Method

- A motor overload is detected by first calculating the motor's heat generation (the electrothermal value) from the current flowing to the motor.
- If 110% of the electrothermal value is exceeded, a motor overload will be detected.
- The electrothermal value is displayed by the Monitor Mode's electrothermal value display (oL).

Detection Time

When a uniform load is added beginning with an electrothermal value of 0, the time until the Driver detects a motor overload is as shown in the following diagram. (Reference value)

Note The initial value for the electrothermal value when the Driver is powered up is set at 90%. This is because of the need to rapidly detect an overload in order to prevent motor burnout. Therefore a thermal value of about 90% will be displayed even when there is no overload to the motor when the power is turned ON. As long as there is no overload, however, the electrothermal value will be gradually decreased, so there is no problem for operation.



Note 1. The load ratio is calculated in relation to the motor's rated current.

$$\text{Load ratio (\%)} = \frac{\text{Motor current}}{\text{Motor rated current}} \times 100$$

Note 2. The value for "T" is determined individually for each Servomotor model, and indicates the motor's burn time constant.

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- **U-series (30 to 750 W) Servomotors**

Motor model	Wattage	T (min)
R88M-U03030	30 W	4
R88M-U05030	50 W	4
R88M-U10030	100 W	8
R88M-U20030	200 W	8
R88M-U40030	400 W	10
R88M-U75030	750 W	18

- **U-UE-series Servomotors**

Motor model	Wattage	T (min)
R88M-UE10030	100 W	8
R88M-UE20030	200 W	8
R88M-UE40030	400 W	10
R88M-UE75030	750 W	18

- **U-series (1 to 2 kW) Servomotors**

Motor model	Wattage	T (min)
R88M-U1K030	1 kW	30
R88M-U1K530	1.5 kW	39
R88M-U2K030	2 kW	45

- **H-series Servomotors**

Motor model	Wattage	T (min)
R88M-H05030	50 W	6
R88M-H10030	100 W	7
R88M-H20030	200 W	12
R88M-H30030	300 W	15
R88M-H50030	500 W	18
R88M-H75030	750 W	20
R88M-H1K130	1,100 W	22

- **M-series Servomotors (1,200 r/min)**

Motor model	Wattage	T (min)
R88M-M20012	200 W	19
R88M-M40012	400 W	24
R88M-M70012	700 W	41
R88M-M1K112	1,100 W	37
R88M-M1K412	1,400 W	58
R88M-M1K812	1,800 W	64

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• M-series Servomotors (2,000 r/min)

Motor model	Wattage	T (min)
R88M-M20020	200 W	14
R88M-M40020	400 W	15
R88M-M70020	700 W	31
R88M-M1K120	1,100 W	38
R88M-M1K820	1,800 W	53
R88M-M2K220	2,200 W	54

• M-series Servomotors (4,000 r/min)

Motor model	Wattage	T (min)
R88M-M06040	60 W	7
R88M-M12040	120 W	11
R88M-M20040	200 W	7
R88M-M40040	400 W	17
R88M-M70040	700 W	34
R88M-M1K140	1,100 W	21
R88M-M1K040	2,000 W	36

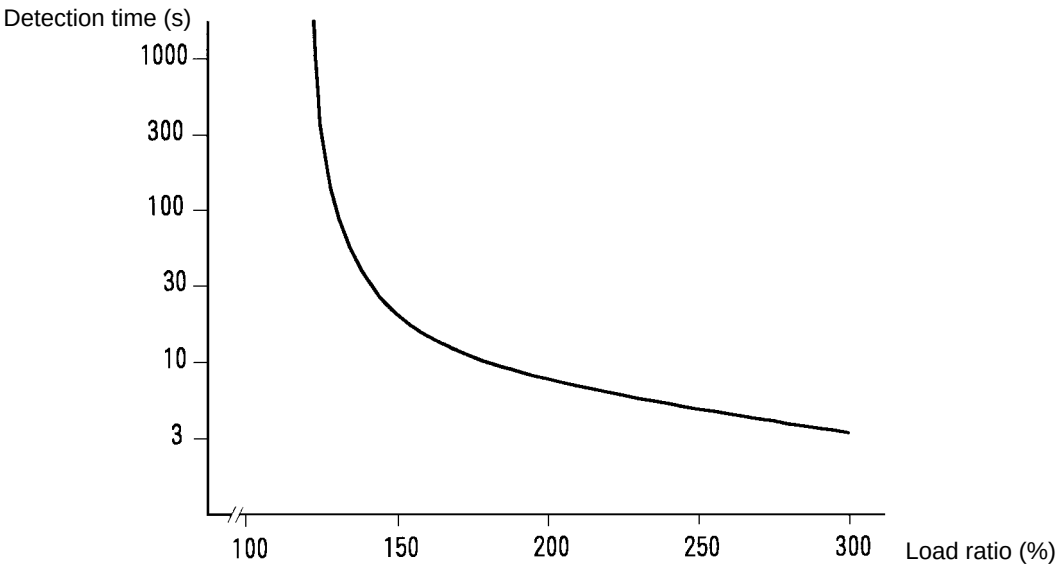
□Short Time Overload (A.L18) Detection

Detection Method

A temporary overload is detected when the motor's current continually exceeds 120% of the motor's rated current for at least a fixed period of time.

Detection Time

The detection time is as shown in the following diagram. It is the same for all Servomotor models. (Reference value)

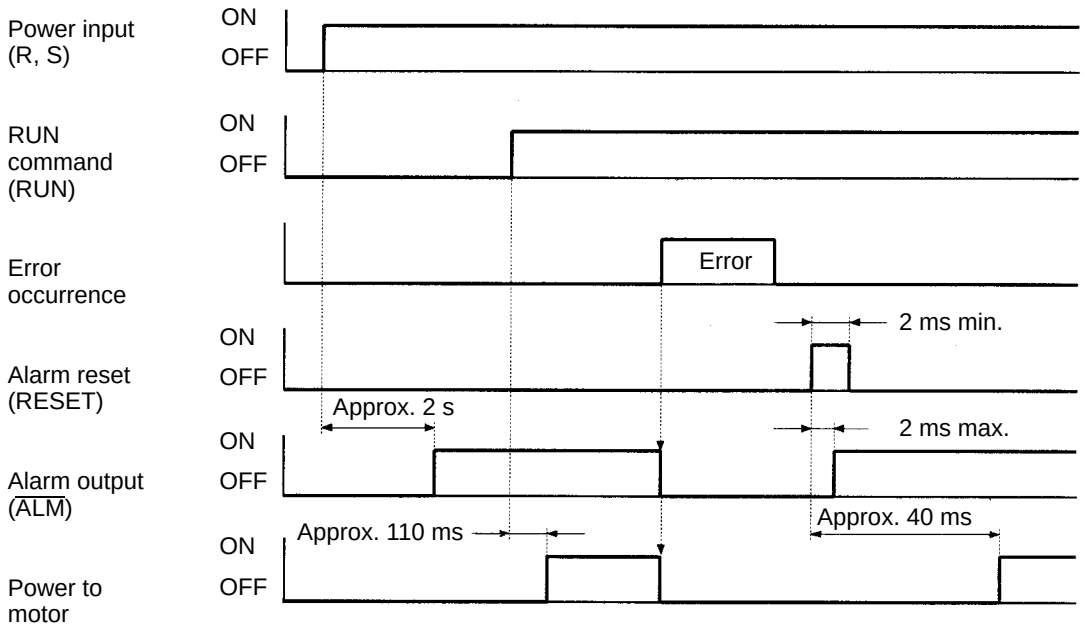


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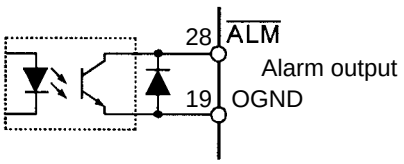
4-4-5 Alarm Output

This chapter describes the timing of alarm outputs when power is turned ON and when alarms occur. The method used to clear alarms is also described.

□Timing Chart



□Alarm Output Circuitry (DIO Type)



Output specifications: 24 VDC, 40 mA max.
Normal: Output transistor ON
Error (alarm): Output transistor OFF

□Clearing Alarms

- Any of the following methods can be used to clear alarms:
  Turn ON the alarm reset signal (RESET).
  Turn the power supply OFF and then back ON.
  Press the Data Key while the alarm is displayed.

  Power status alarms (A.L07), however, cannot be cleared by turning the power OFF and then back ON.
- Operation will start as soon as the alarm is cleared if the alarm is cleared while the RUN command (RUN) is ON, possibly creating a dangerous situation. Turn OFF the RUN command before clearing alarms.

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4-5 Troubleshooting

4-5-1 Preliminary Inspection

This section describes the preliminary inspections and monitoring devices that are required to locate and clear the cause of an error.

□ Power Supply Voltage Check

- Check that the voltage at the AC power supply terminals is within the following range:
  100-VAC-input type 85 to 127 VAC
  200-VAC-input type 170 to 264 VAC

  If the voltage is outside this range, faulty operation may occur. Provide the correct power supply.
- Check that the power supply voltages for external device interfaces are within the following range:
  23 to 25 VDC

  If the voltage is outside this range, faulty operation may occur. Provide the correct power supply.

□ Monitoring Device Selection

Alarm Check

If an alarm has been generated, check the alarm code and take countermeasures in accordance with the meaning of that code.

If an alarm has not been generated, take countermeasures in accordance with the nature of the error. (Refer to *4-5-4 Troubleshooting*.)

Monitoring Device Type

The following types of monitoring device are available.

Position Driver Display Panel

Investigate the error using the 7-segment LED display panel on the front side of the Position Driver along with the operating keys. (When an alarm has been generated, it will automatically be displayed.) The investigation procedure for this device type is explained in this manual.

Teaching Box

Use the following three items together. (When an alarm has been generated, it will automatically be displayed.)

CVM1-PRO01	Programming Console without ROM.
CVM1-MP702 CVM1-MP703	Memory Cassette compatible with FND-X and MC/NC Units, or FND-X-dedicated Memory Cassette.
CV500-CN 2A	Connecting Cable to connect the Position Driver and the Teaching Box. (The in the model name represents the length of the cable. Any of the lengths 2, 4, or 6 m can be used.)

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For details on the operating procedures for this device type, refer to the *Teaching Box (For Position Drivers) Operating Manual (W354)*.

4-5-2 Precautions

When performing checks of the inputs and outputs following error generation, there is a possibility that the Position Driver will operate unexpectedly or suddenly stop. Be sure to take the following precautions. Do not perform any operations or procedures not described in this manual.

□ Precautions

- When checking for breaks in cables be sure to disconnect the wiring first. With the wiring is connected, there is still a possibility of continuity caused by a return circuit, even if a continuity check is performed.
- If the encoder signal goes out, the Motor will run out of control, and an error will be generated. When investigating the encoder signal, remove the Motor from the mechanical system first.
- When measuring output from the encoder, take the measurement at E0V (0-V encoder power supply) as a basis. By measuring the differential between CH1 and CH2 with an oscilloscope, the effects of noise can be offset.
- Before performing checks, ensure that nobody is inside the mechanical equipment, and that if the Motor runs out of control, no damage will be caused. Also, in preparation for the unlikely event of the Motor running out of control, before performing checks for errors, first check that an emergency stop can be performed for the machinery.

4-5-3 Replacing the Position Driver and the Motor

Use the following procedure to replace the Position Driver or Motor.

□ Replacing the FND-X Position Driver

1. Make a copy of the Position Driver parameters.

   Using the Position Driver operation keys, display all of the parameters and create a written record of them. (Refer to *7-2 Parameter Settings Tables*.)

2. Replace the Position Driver.

   With the CompoBus/S-type, set the communications unit number switch to the original FND-X setting.

3. Set the Position Driver parameters.

   With Personal Computer Monitoring Software:
   Using the Personal Computer Monitoring Software, transfer all the parameters saved at the personal computer to the Position Driver.

   Without Personal Computer Monitoring Software:
   Using the Position Driver operation keys, recreate all the parameter settings recorded in step 1.

4. Perform origin teaching.

   If there is no origin compensation because, for example, the backup copy of the parameters was made at the design stage, it will be necessary to perform origin teaching.
   Use the following procedure to perform origin teaching.

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Procedure for Origin Teaching

a) After replacement, perform origin search with the new Position Driver.

b) Move to the original position of the origin by moving the mechanical system by hand in a servo-free state, or by moving the mechanical system using JOG operations.

c) Turn OFF the Position Driver run command (RUN), and after turning the origin search input (SEARCH) ON, turn ON the teaching input (TEACH).

d) Check that the teaching completed output (T.COM) turns ON. An origin compensation that makes the present position of the system into the position of the origin, will be registered in the Position Driver.

□Replacing the Motor

1. Replace the Motor.
2. Perform origin teaching.

   When the Motor is replaced, the Motor's own origin position (Z phase) will shift, making it necessary to perform origin teaching.

Procedure for Origin Teaching

a) After replacement, perform origin search.

b) Move to the original position of the origin by moving the mechanical system by hand in a servo-free state, or by moving the mechanical system using JOG operations.

c) Turn OFF the Position Driver run command (RUN), and after turning the origin search input (SEARCH) ON, turn ON the teaching input (TEACH).

d) Check that the teaching completed output (T.COM) turns ON. An origin compensation that makes the present position of the system into the position of the origin, will be registered in the Position Driver.

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4-5-4 Troubleshooting

When an error occurs, check the error contents by means of the operating status and alarm display, investigate the cause and apply the appropriate countermeasures.

□Error Diagnosis by Means of Operating Status (DIO, CompoBus/S)

Symptom	Probable cause	Items to check	Countermeasures
The LED indicator does not light even when the power supply is turned ON.	Power supply lines are improperly connected.	Check the power supply voltage.	Correct the power supply.
		Check the power supply lines.	Correct the wiring.

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Symptom	Probable cause	Items to check	Countermeasures
The motor does not operate even when the START command is input.	The RUN signal is OFF.	Use the Check Mode to check the RUN signal's ON/OFF status.	• Input the RUN signal. • Correct the wiring.
	The correspondence between the Driver and the Servomotor is incorrect.	Check the models.	Combine models that correspond correctly.
	The CWL/CCWL inputs are OFF.	Use the Check Mode to check the inputs.	Correct the wiring.
	The software limit is being detected.	Use the Monitor Mode to check the present value.	Correctly set the software limits.
		Check the software limits (PP-10, 11, 12, 13).	
	Deceleration stop is OFF.	Use the Check Mode to check the input.	DIO type: • Correct the wiring. CompoBus/S type: • Turn both the external control input (CN4-4) and the CompoBus/S input (OUT7) ON. • Correct the wiring.
	The point number input is 0.	Use the Check Mode to check the input.	Correctly set the point number input.
	One of the following signals is being input: origin search, teaching, JOG, or alarm reset.	Use the Check Mode to check the inputs.	Correct the wiring.
	During direct positioning, the position data is set for "I (incremental) 0."	Check the position data setting.	Correctly set the position data.
	The position data (Pd) to be executed does not match the present value.	Check the position data (Pd).	Correctly set the position data (Pd).
	The motor's power lines are disconnected.	Check the power lines.	Correct the wiring.
	The control mode is incorrect.	Check the control mode (UP-01).	Correctly set the control mode.
	The START signal is not being input.	Use the Check Mode to check the input.	Correct the wiring.
	During direct positioning, the positioning data is not being properly received.	Check the wiring for the position and speed data selections.	Correct the wiring.
		Check the setting of the signal output time (PP-26).	Check the signal reception timing and correctly set the pulse width.
	Reference speed (PP-14, 15) is "0."	Check the reference speed (PP-14, 15) setting.	Correctly set the reference speed (PP-14, 15).
The rotation direction is wrong.	The motor rotation direction (UP-26) setting is incorrect.	Check the motor rotation direction (UP-26) setting.	Correctly set the motor rotation direction (UP-26)
	The position data (Pd) setting is incorrect.	Check the position data (Pd) setting.	Correctly set the position data (Pd).
	During direct positioning, the position data's polarity input is incorrect.	Check the position data setting.	Correctly set the position data.
	The encoder/resolver wiring is incorrect.	Check the encoder/resolver wiring.	Correct the wiring.

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Symptom	Probable cause	Items to check	Countermeasures
The position is slipping.	The point number input is incorrect.	Use the Check Mode to check the point number input.	Correctly set the point number input.
	The position data (Pd) setting is incorrect.	Check the position data (Pd) setting.	Correctly set the position data (Pd).
	The minimum setting unit (PP-01) or pulse rate (PP-02, 03) setting is incorrect.	Check the minimum setting unit (PP-01) and pulse rate (PP-02, 03) settings.	Correctly set the minimum setting unit and pulse rate settings.
	The compensation (PP-08, 09) setting is incorrect.	Check the compensation (PP-08, 09) setting.	Correctly set the compensation (PP-08, 09).
	Dedicated lines are not being used for the encoder/resolver.	Check the encoder/resolver lines.	Replace the encoder/resolver lines with dedicated lines.
	The operation mode for the point number being executed is incorrect.	Check the operation mode (Pd r) setting.	Correctly set the operation mode (Pd r).
	The coupling connecting the motor shaft to the mechanical system is loose.	Check the mechanical system.	Check and adjust the machinery.
	The belt is loose.		
	During an origin search, the motor sensor's Z-phase position and the origin proximity OFF position are too close.	Repeat the origin search and check whether the search completion position is different.	Disconnect the motor from the mechanical system and shift the Z-phase position by the amount shown below. Then reinstall the motor. U Series: 1/2 revolution H Series: 1/2 revolution M Series: 1/4 revolution
The motor stops during operation.	The deceleration stop (STOP) input turned OFF.	Use the Check Mode to check the input.	Correct the wiring.
	The alarm reset (RESET) input turned ON.	Use the Check Mode to check the input.	Correct the wiring.
	The CWL/CCWL input turned OFF (when the alarm selection (PP-25) is 0).	Use the Check Mode to check the input.	• Correctly set the position data. • Correct the wiring.
	The software limit is being detected (when the alarm selection (PP-25) is 0).	Use the Monitor Mode to check the present position.	Correctly set the position data.
		Check the software limits (PP-10, 11, 12, 13).	Correctly set the software limits.
The motor operates momentarily, but then it stops operating.	The applicable motor (UP-02) setting is incorrect.	Check the applicable motor (UP-02) setting.	Correctly set the applicable motor (UP-02).
	The motor's power lines and the encoder/resolver lines are wired incorrectly.	Check the wiring of the motor's power lines and the encoder/resolver lines.	Correct the wiring.
Motor operation is unstable.	The motor's power lines and the encoder/resolver lines are wired incorrectly.	Check the wiring of the motor's power lines and the encoder/resolver lines.	Correct the wiring.
	The coupling connecting the motor shaft to the mechanical system is eccentric, and screws may be loose.	Check the mechanical system. Rotate the motor with no load (disconnected from the mechanical system).	Check and adjust the machinery.
	Gain is wrong.	---	• Use auto-tuning. • Adjust the gain manually.

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Symptom	Probable cause	Items to check	Countermeasures
Motor is overheating.	The ambient temperature is too high.	Check to be sure that the ambient temperature around the motor is no higher than 40°C.	Lower the ambient temperature to 40°C or lower. (Use a cooler or fan.)
	The ventilation is obstructed.	Check to see whether anything is blocking ventilation.	Ensure adequate ventilation.
	There is an overload.	Use the Monitor Mode to check the electrothermal value.	• Lighten the load. • Change to a larger capacity motor.
There are unusual noises.	The machinery is vibrating.	Inspect the machinery to see whether there are any foreign objects in the movable parts, or whether there is any damage, deformation, or looseness.	Fix any problems causing vibration.
	The speed loop gain adjustment is insufficient.	---	• Use auto-tuning. • Adjust the gain manually.
The parameters cannot be changed.	The parameters are write-protected.	Check the computer's monitoring software.	Using the computer's monitoring software, release the write protection.
Output torque is insufficient	The motor has only made small movements (approx. ±6 pulses of encoder resolution) from the power supply position.	---	After making the motor perform rotations of over ±6 pulses, re-attempt normal operation.

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□Error Diagnosis by Means of Operating Status (CompoBus/S Only)

Symptom	Probable cause	Items to check	Countermeasures
There is an error in the communications data.	The node address is overlapping another node address.	Check the node address settings of all the Slaves.	Correctly set the node addresses.
	The Programmable Controller's load shutdown bit has turned ON.	Check the status of the Programmable Controller's load shutdown bit.	Turn OFF the load shutdown bit.
	The communications cable connection or the communications cable itself is faulty.	Check the connections. (If a flat cable is being used, check the connector area.)	Connect the cable properly.
		Check the connectors.	Replace the connectors if necessary.
		Check the conductivity of the communications cable.	Replace the cable if necessary.
	There is no terminating resistance connected, or it is connected at some position other than the farthest Unit.	Check the location of the terminating resistance.	Connect the terminating resistance at the last Unit.
	The Master Unit is not connected at the end of the main line.	Check the location of the Master Unit.	Connect the Master Unit at the end of the main line.
	The length of the main line, a branch line, or the total length is greater than the prescribed limit.	Check the lengths of the main and branch lines, and the total combined length.	Correct the wiring so that the lengths of the main and branch lines, and the total combined length, are within the prescribed limits.
	VCTF cable is combined with special flat cable.	Check the cables that are being used.	Use either VCTF or flat cable, but not both together.
Communications will not start.	The Master is for a CQM1 System, and the Programmable Controller occupies either two or four words, and a node address is set which is not permitted for nodes 0 to 7. (An "address over" error is generated.)	Check the number of words occupied by the Master Unit's Programmable Controller, and the number of points occupied per node address.	Change the number of words occupied by the Programmable Controller and the number of points occupied per node address.

Note If a communications error occurs, refer to the operation manual for the Master Unit.

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4-6 Periodic Maintenance

⚠ **WARNING** Do not attempt to take the Unit apart or repair. Doing either of these may result in electrical shock or injury.

⚠ **Caution** Resume operation only after transferring to the new Unit the contents of the data required for operation. Not doing so may result in equipment damage.

Servomotors and Position Drivers contain many components and will operate properly only when each of the individual components is operating properly. Some of the electrical and mechanical components require maintenance depending on application conditions. In order to ensure proper long-term operation of Servomotors and Position Drivers, periodic inspection and part replacement is required according to the service life of the components.

The periodic maintenance cycle depends on the installation environment and application conditions of the Servomotor or Position Driver. Recommended maintenance times are listed below for Servomotors and Position Drivers. Use these as references in determining actual maintenance schedules.

□ Servomotors

- Recommended Periodic Maintenance

  Oil Seal: 2,000 hours

  Bearings: 20,000 hours (U Series); 30,000 hours (H Series, M Series)

  Application Conditions: Ambient motor operating temperature of 40 C, within allowable shaft load, rated operation (rated torque and r/m), installed as described in operation manual.

- The radial loads during operation (rotation) on timing pulleys and other components contacting belts is twice the still load. Consult with the belt and pulley manufacturers and adjust designs and system settings so that the allowable shaft load is not exceeded even during operation. If a motor is used under a shaft load exceeding the allowable limit, the motor shaft can break, the bearings can burn out, and other problems can occur.

□ Position Drivers

- Recommended Periodic Maintenance

  Aluminum analytical capacitors: 50,000 hours at ambient temperature of 35 C

  Fans: 55,000 hours at ambient temperature of 20 C (FND-X50H- only)

  Application Conditions: Rated operation (rated torque) and installation as described in the User's Manual.

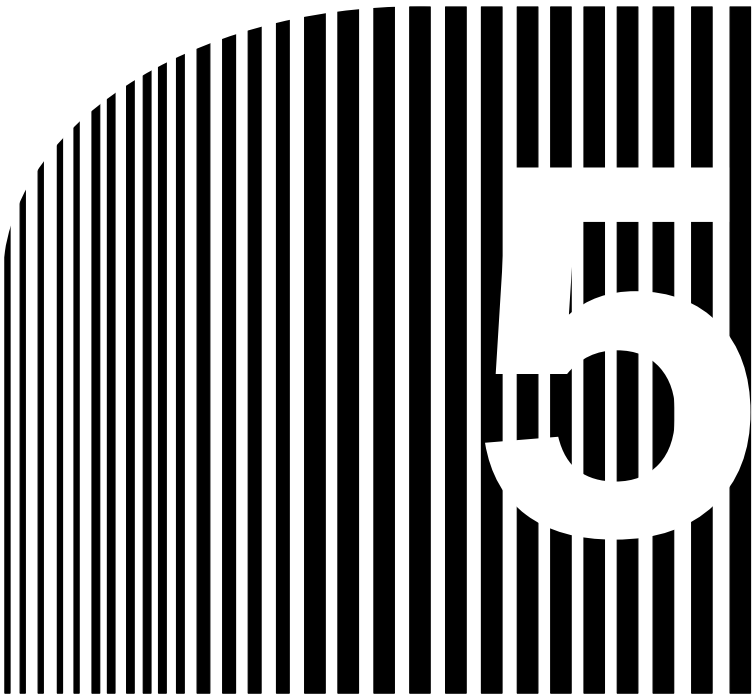
- The life of aluminum analytical capacitors is greatly affected by the ambient operating temperature. Generally speaking, an increase of 10 C in the ambient operating temperature will reduce capacitor life by 50%. We recommend that ambient operating temperature be lowered and the power supply time be reduced as much as possible to lengthen the maintenance times for Position Drivers.
- It is recommended that the Position Driver be inspected at five-year intervals if they are used under conditions worse than the above or not used over a long time of time. Contact your OMRON representative for inspection and the necessity of any component replacement.

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□Lithium Battery

- When using a U-series Servomotor with absolute encoder, periodic maintenance will be required for the lithium battery. For details about battery lifetimes and replacement methods, refer to *2-2-7 Battery Wiring and Encoder Setup for Absolute Encoder*.

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Chapter 5

• Specifications •

5-1 Position Driver Specifications
5-2 Servomotor Specifications
5-3 Cable Specifications

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5-1 Position Driver Specifications

5-1-1 General Specifications (Common to DIO, CompoBus/S)

Item	Specifications
Power supply voltage	Single-phase 200-VAC (FND-X06H/-X12H/-X25H-): Single-phase 200/240 VAC, –15% to +10%, at 50/60 Hz Three-phase 200-VAC (FND-X50H-): Three-phase 200/240 VAC, –15% to +10%, at 50/60 Hz Single-phase 100-VAC (FND-X06L/-X12L-): Single-phase 100/115 VAC, –15% to +10%, at 50/60 Hz
Ambient operating temperature	0 to 55°C
Ambient operating humidity	35% to 90% RH (with no condensation)
Ambient storage temperature	–10 to 70°C
Ambient storage humidity	35% to 90% RH (with no condensation)
Storage and operating atmosphere	No corrosive gasses.
Dielectric strength	1,500 VAC_{RMS} for 1 min at 50/60 Hz
Insulation resistance	Between supply input terminals and case: 5 MΩ min. (at 500 VDC)
Vibration resistance	10 to 150 Hz in X, Y, and Z directions with 0.10-mm double amplitude; acceleration: 9.8 m/s^2 {1 G} max.; time coefficient: 8 min; 4 sweeps
Impact resistance	Acceleration 98 m/s^2 {10 G} max., in X, Y, and Z directions, three times each.
Protective structure	Built into panel (IP00).
Low-voltage Directives applicable class	Overvoltage category II Pollution degree II

Note 1. The above items reflect individual evaluation testing. The results may differ under compounded conditions.

Note 2. Absolutely do not conduct a withstand voltage test or a megger test on the Position Driver. If such tests are conducted, internal elements may be damaged.

Note 3. Depending on the operating conditions, some Position Driver parts will require maintenance. Refer to *4-6 Periodic Maintenance* for details.

Note 4. The service life of the Position Driver is 50,000 hours at an average ambient temperature of 35°C (at the rated torque and the rated rotation speed).

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5-1-2 Performance Specifications

□DIO Position Drivers

Item		FND-X06L	FND-X12L	FND-X06H	FND-X12H	FND-X25H	FND-X50H
Continuous output current (0-P)		2.0 A	3.0 A	2.0 A	4.8 A	8.0 A	20 A
Momentary maximum output current (0-P)		6.0 A	12 A	6.0 A	12 A	25 A	50 A
Input power supply	Main circuit	Single-phase 100/115 VAC (85 to 127 V) 50/60 Hz (The main circuit and control circuits use the same terminals.)		Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz (The main circuit and control circuits use the same terminals.)			Three-phase 200/240 VAC (170 to 264 V) 50/60 Hz
	Control circuits						Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz
Position/ speed feedback	U Series (INC)	30 to 750 W: Optical Incremental encoder, 2,048 pulses/revolution 1 to 2 kW: Optical Incremental encoder, 4,096 pulses/revolution					
	U Series (ABS)	30 to 750 W: Optical Absolute encoder, 1,024 pulses/revolution 1 to 2 kW: Optical Absolute encoder, 8,192 pulses/revolution					
	U-UE Series	Optical Incremental encoder, 1,024 pulses/revolution					
	H Series	Magnetic Incremental encoder, 2,000 pulses/revolution					
	M Series	Resolver, absolute accuracy 0.18° max.; ambient temperature 25°					
Applicable load inertia (See note 1.)	U Series (INC)	Maximum of 30 times motor's rotor inertia		Maximum of 30 times motor's rotor inertia		Maximum of 20 times motor's rotor inertia (10 times for 1-kW model)	Maximum of 10 times motor's rotor inertia
	U Series (ABS)	Maximum of 20 times motor's rotor inertia		Maximum of 20 times motor's rotor inertia		Maximum of 18 times motor's rotor inertia (10 times for 1-kW model)	Maximum of 10 times motor's rotor inertia
	U-UE Series	Maximum of 30 times motor's rotor inertia		Maximum of 30 times motor's rotor inertia		Maximum of 20 times motor's rotor inertia	---
	H Series	Maximum of 10 times motor's rotor inertia					
	M Series	Maximum of 10 times motor's rotor inertia					
Inverter method		PWM method based on IGBT					
PWM frequency		10 kHz					
Weight		Approx. 1.5 kg		Approx. 1.5 kg		Approx. 2.5 kg	Approx. 4.5 kg
Frequency response (speed control)		100 Hz (at a load inertia equivalent to motor's rotor inertia)					
Position loop gain		1 to 200 (rad/s)					
Feed forward		0% to 200% of speed reference					
Pulse rate		1/32,767 ≤ (pulse rate 1 / pulse rate 2) ≤ 32,767/1					

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Item		FND-X06L	FND-X12L	FND-X06H	FND-X12H	FND-X25H	FND-X50H
Positioning completion width		1 to 32,767 (pulses) U Series (INC): 8,192 pulses/revolution; U Series (ABS): 4,096 pulses/revolution; U-UE Series: 4,096 pulses/revolution; H Series: 8,000 pulses/revolution M Series 24,000 pulses/revolution					
Acceleration/Deceleration time		0 to 9,999 (ms); acceleration and deceleration times set separately. Two times can be set for each. S-curve acceleration/deceleration function available (filter time constant: 0.00 to 32.76 s).					
Sequence input		19 pts. (limit inputs, origin proximity, RUN command, START, alarm reset, origin search, JOG operation, teaching, point selection, position data, deceleration stop) Photocoupler input: 24 VDC, 8 mA External power supply: 24 VDC ±1 V, 150 mA min.					
Sequence output		15 pts. (brake output, READY, origin search completion, origin, teaching, motor running, positioning completion, alarm, point output, position selection, speed selection) Open collector output: 24 VDC, 40 mA					
Monitor output (See note 2.)	Speed monitor	3 V/motor's rated speed (output accuracy: approx. ±10%)					
	Current monitor	3 V/motor's maximum current (output accuracy: approx. ±10%)					
Heating value	Main circuit	17 W	20 W	17 W	27 W	47 W	110 W
	Control circuit	23 W	23 W	23 W	23 W	23 W	26 W
Regenerative absorption capacity		13 W + 17 J	17 W + 17 J	13 W + 17 J	24 W + 17 J	37 W + 22 J	160 W + 38 J
Protective functions		Overcurrent, overvoltage, resolver disconnection, power status error, clock stopped, overcurrent (soft), speed amp saturation, motor overload, temporary overload, resolver error, speed over, error counter over, parameter setting error, software limit over, coordinate counter over, overrun, encoder disconnection, encoder communications error, absolute encoder backup error, absolute encoder checksum error, absolute encoder absolute error, absolute encoder over speed, encoder data not transmitted, BCD data error, present value undetermined, PTP data not set, Regeneration Resistor overheat, regeneration operation error					

Note 1. The applicable load inertia is expressed as a factor of the motor's rotary inertia.

Note 2. For the monitor output, the monitor items and voltage polarity can be set by parameter UP-25 (monitor output selection).

□CompoBus/S Position Drivers

Item		FND-X06L -SRT	FND-X12L -SRT	FND-X06H -SRT	FND-X12H -SRT	FND-X25H -SRT	FND-X50H -SRT
Continuous output current (0-P)		2.0 A	3.0 A	2.0 A	4.8 A	8.0 A	20 A
Momentary maximum output current (0-P)		6.0 A	12 A	6.0 A	12 A	25 A	50 A
Input power supply	Main circuit	Single-phase 100/115 VAC (85 to 127 V) 50/60 Hz (The main circuit and control circuits use the same terminals.)		Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz (The main circuit and control circuits use the same terminals.)			Three-phase 200/240 VAC (170 to 264 V) 50/60 Hz
	Control circuits						Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz

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Item		FND-X06L -SRT	FND-X12L -SRT	FND-X06H -SRT	FND-X12H -SRT	FND-X25H -SRT	FND-X50H -SRT
Position/ speed feed-back	U Series (INC)	30 to 750 W: Optical Incremental encoder, 2,048 pulses/revolution 1 to 2 kW: Optical Incremental encoder, 4,096 pulses/revolution					
	U Series (ABS)	30 to 750 W: Optical Absolute encoder, 1,024 pulses/revolution 1 to 2 kW: Optical Absolute encoder, 8,192 pulses/revolution					
	U-UE Series	Optical Incremental encoder, 1,024 pulses/revolution					
	H Series	Magnetic incremental encoder, 2,000 pulses/revolution					
	M Series	Resolver, absolute accuracy 0.18° max.; ambient temperature 25°					
Applicable load inertia (See note 1.)	U Series (INC)	Maximum of 30 times motor's rotor inertia		Maximum of 30 times motor's rotor inertia		Maximum of 20 times motor's rotor inertia (10 times for 1-kW model)	Maximum of 10 times motor's rotor inertia
	U Series (ABS)	Maximum of 20 times motor's rotor inertia		Maximum of 20 times motor's rotor inertia		Maximum of 18 times motor's rotor inertia (10 times for 1-kW model)	Maximum of 10 times motor's rotor inertia
	U-UE Series	Maximum of 30 times motor's rotor inertia		Maximum of 30 times motor's rotor inertia		Maximum of 20 times motor's rotor inertia	---
	H Series	Maximum of 10 times motor's rotor inertia					
	M Series	Maximum of 10 times motor's rotor inertia					
Inverter method		PWM method based on IGBT					
PWM frequency		10 kHz					
Weight		Approx. 1.5 kg		Approx. 1.5 kg		Approx. 2.5 kg	Approx. 4.5 kg
Frequency response (speed control)		100 Hz (at a load inertia equivalent to motor's rotor inertia)					
Position loop gain		1 to 200 (rad/s)					
Feed forward		0% to 200% of speed reference					
Pulse rate		1/32,767 ≤ (pulse rate 1 / pulse rate 2) ≤ 32,767/1					
Positioning completion width		1 to 32,767 (pulses) U Series (INC): 8,192 pulses/revolution; U Series (ABS): 4,096 pulses/revolution; UE Series: 4,096 pulses/revolution; H Series: 8,000 pulses/revolution M Series 24,000 pulses/revolution					
Acceleration/Deceleration time		0 to 9,999 (ms); acceleration and deceleration times set separately. Two times can be set for each. S-curve acceleration/deceleration function available (filter time constant: 0.00 to 32.76 s).					
CompoBus/S		16 input points (RUN command, start, alarm reset, origin search, JOG operation, inching, point selection, position data, deceleration stop) 16 output points (brake output, ready, origin search completed, origin, teaching completed, motor running, positioning completed, alarm, point output, position/speed data selection)					
Sequence input		4 pts. (limit inputs, origin proximity, deceleration stop) Photocoupler input: 24 VDC, 8 mA External power supply: 24 VDC ±1 V, 40 mA min.					
Sequence output		1 pt. (brake output) Open collector output: 24 VDC, 40 mA					
Monitor output (See note 2.)	Speed monitor	3 V/motor's rated speed (output accuracy: approx. ±10%)					
	Current monitor	3 V/motor's maximum current (output accuracy: approx. ±10%)					

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Item		FND-X06L -SRT	FND-X12L -SRT	FND-X06H -SRT	FND-X12H -SRT	FND-X25H -SRT	FND-X50H -SRT
Heating value	Main circuit	17 W	20 W	17 W	27 W	47 W	110 W
	Control circuit	23 W	23 W	23 W	23 W	23 W	26 W
Regenerative absorption capacity		13 W + 17 J	17 W + 17 J	13 W + 17 J	24 W + 17 J	37 W + 22 J	160 W + 38 J
Protective functions		Overcurrent, overvoltage, resolver disconnection, power status error, clock stopped, overcurrent (soft), speed amp saturation, motor overload, temporary overload, resolver error, speed over, error counter over, parameter setting error, software limit over, coordinate counter over, overrun, encoder disconnection, encoder communications error, absolute encoder backup error, absolute encoder checksum error, absolute encoder absolute error, absolute encoder over speed, encoder data not transmitted, BCD data error, present value undetermined, PTP data not set, CompoBus/S communications error, Regeneration Resistor overheat, regeneration operation error					

Note 1. The applicable load inertia is expressed as a factor of the motor's rotary inertia.

Note 2. For the monitor output, the monitor items and voltage polarity can be set by parameter UP-25 (monitor output selection).

5-1-3 I/O Specifications

□Terminal Blocks (FND-X06/-X12/-X25)

Signal	Function	Condition	
R S	Power supply input	These are the application power supply input terminals for the main circuit and control circuit. Pay attention to the power supply voltage, because it varies according to the model. FND-X H- : Single-phase 200/240 VAC (170 to 264 VAC) 50/60 Hz FND-X L- : Single-phase 100/115 VAC (85 to 127 VAC) 50/60 Hz	
P J	Main circuit DC output Regeneration Resistor connection terminal	These are the connection terminals for the Regeneration Resistor (R88A-RR20030/-RR40030). Connect them when the regeneration energy is high.	
N	Main circuit DC output	This is the main circuit DC output terminal.	
A	Servomotor's A-phase and U-phase output	Red	These are the terminals for outputs to the Servomotor. Be careful to wire them correctly. OMNUC Servomotors can be connected to these terminals with R88A-CAU Cable (for U/U-UE-series Servomotors) or R88A-CAH Cable (for H-series Servomotors). OMRON does not provide a dedicated cable to connect these terminals to OMNUC M-series Servomotors, so the user must provide an appropriate cable if an M-series Servomotor is used.
B	Servomotor's B-phase and V-phase output	White	
C	Servomotor's C-phase and W-phase output	Blue or black	
⏚	Frame ground	Green	This is the connection terminal. Use at lease a class-3 ground (100 Ω or less). This ground is used in common for Servomotor output and power supply input.

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□Terminal Blocks (FND-X50H-)

Signal	Function	Condition	
R0 S0	Control power supply input	These are the power supply input terminals for the control circuit. Single-phase 200/240 VAC (170 to 264 VAC) 50/60 Hz	
R S T	Main circuit power supply input	These are the power supply input terminals for the main circuit. Three-phase 200/240 VAC (170 to 264 VAC) 50/60 Hz	
P JP1 JP2	Main circuit DC output Regeneration Resistor connection terminal	These are the connection terminals for the Regeneration Resistor (R88A-RR20030/-RR40030). Connect them when the regeneration energy is high. When connecting a Regeneration Resistor, remove the short bar from between JP1 and JP2.	
N	Main circuit DC output	This is the main circuit DC output terminal.	
MC COM BO BI1 BI2	Not used	(Do not connect anything to these terminals. Do not remove the short bar from between BI1 and BI2.)	
A	Servomotor's A-phase and U-phase output	Red	These are the terminals for outputs to the Servomotor. Be careful to wire them correctly. OMNUC Servomotors can be connected to these terminals with R88A-CAUB Cable (for U-series Servomotors). OMRON does not provide a dedicated cable to connect these terminals to OMNUC M-series Servomotors, so the user must provide an appropriate cable if an M-series Servomotor is used.
B	Servomotor's B-phase and V-phase output	White	
C	Servomotor's C-phase and W-phase output	Blue or black	
⏚	Frame ground	Green	This is the connection terminal. Use at a ground of 100 Ω or less. This ground is used in common for Servomotor output and power supply input.

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□CN2 (M.SEN) Motor Sensor Connectors (DIO, CompoBus/S)

Pin No.	Signal name	Name	I/O interface
1	E0V	Encoder power supply ground	Power supply output for encoder: 5 V, 120 mA
2	S1	SIN excitation winding	Resolver excitation signal output
3	S3	SIN excitation winding	Resolver excitation signal output
4	E5V	Encoder power supply, +5 V	Power supply outlet for encoder: 5 V, 120 mA
5	NC	---	---
6	S2	COS excitation winding	Resolver excitation signal output
7	S4	COS excitation winding	Resolver excitation signal output
8	+ABS	Absolute encoder signal + input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
	R1	Resolver signal input	Resolver detection signal input
9	–ABS	Absolute encoder signal – input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
	R2	Resolver signal input	Resolver detection signal input
10	NC	---	---
11	SG	Resolver cable shield ground	Resolver cable shield ground
12	+BAT	Battery +	Absolute encoder backup power supply output: 3.6 V, 16 μA (for backup, rotation stopped) 2μA (when +5-V voltage is applied)
13	–BAT	Battery –	
14	S+/Z+	Encoder + S/+ Z-phase input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
15	S–/Z–	Encoder – S/– Z-phase input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
16	A+	Encoder + A-phase input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
17	A–	Encoder – A-phase input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
18	B+	Encoder + B-phase input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
19	B–	Encoder – B-phase input	Line driver input (conforming to EIA-RS422A) (Input impedance: 220 Ω)
20	FG	Encoder cable shield ground	Encoder cable shield ground

Connectors Used

Receptacle at Position Driver	10220-52A2JL	(Sumitomo 3M)
Soldered plug at cable side	10120-3000VE	(Sumitomo 3M)
Case at cable side	10320-52A0-008	(Sumitomo 3M)

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□CN2 (Motor Sensor Connector) Pin Arrangement

2	S1	SIN excitation winding
4	E5V	Encoder power supply, +5V
6	S2	COS excitation winding
8	+ABS	Absolute encoder signal +
	R1	Resolver signal input
10	NC	

1	E0V	Encoder power supply ground
3	S3	SIN excitation winding
5	NC	
7	S4	COS excitation winding
9	–ABS	Absolute encoder signal –
	R2	Resolver signal input

12	+BAT	Battery +
14	S+/Z+	Encoder+S/+Z-phase input
16	A+	Encoder +A-phase input
18	B+	Encoder +B-phase input
20	FG	Encoder cable shield ground

11	SG	Resolver cable shield ground
13	–BAT	Battery –
15	S–/Z–	Encoder–S/–Z-phase input
17	A–	Encoder – A-phase input
19	B–	Encoder – B-phase input

□CN5 (RS-232C) Communications Connectors (DIO, CompoBus/S)

Pin No.	Signal	Name	Interface
1	TXD	Transmission data	Transmission data (conforming to EIA RS-232C)
2	DTR	Transmission/reception-capable output	Transmission/reception-capable output (conforming to EIA RS-232C)
3	NC	---	---
4	RTS	Reception-capable output	Reception-capable output (conforming to EIA RS-232C)
5	RXD+	Reception data +	Reception data (conforming to EIA RS-422) Input impedance: 330 Ω
6	RXD–	Reception data –	
7	TXD+	Transmission data +	Transmission data (conforming to EIA RS-422)
8	TXD–	Transmission data –	
9	RXD	Reception data	Reception data (conforming to EIA RS-232C)
10	CTS	Reception-capable input	Reception-capable input (conforming to EIA RS-232C)
11	+5V	+5-V output	External terminal power supply, 5 V, 300 mA
12	FG	Shield ground	Shield ground
13	FG		
14	GND	0 V	Power supply ground for external terminal

Connectors Used

Receptacle at Position Driver	10214-52A2JL	(Sumitomo 3M)
Soldered plug at cable side	10114-3000VE	(Sumitomo 3M)
Case at cable side	10314-52A0-008	(Sumitomo 3M)

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□CN5 (Communications Connector) Pin Arrangement

2	DTR	Transmission/ reception-capable output	1	TXD	Transmission data	9	RXD	Reception data	8	TXD–	Transmission data –
4	RTS	Reception-capable output	3	NC		11	+5V	+5 output	10	CTS	Reception-capable input
6	RXD–	Reception data –	5	RXD+	Reception data +	13	FG	Shield ground	12	FG	Shield ground
			7	TXD+	Transmission data +				14	GND	0 V

□Monitor Output Terminal (MON)

Pin No.	Signal name	Name	I/O interface
1	GND	Output ground	Monitor ground
2	MON	Monitor output	Speed monitor: 3 V/motor's rated speed, 1 mA Current monitor: 3 V/motor's maximum current, 1 mA

Connectors Used

Connectors at Position Driver	B2B-EH-A	(J.S.T. Mfg. Co., Ltd.)
Cable housing	EHR-2	(J.S.T. Mfg. Co., Ltd.)
Cable contacts	BEH-001T-P0.6	(J.S.T. Mfg. Co., Ltd.)

□CN6 BAT Connectors

Pin No.	Signal name	Name	I/O interface
1	FG	Shield ground	Shield ground
2	BAT	Backup battery + input	Absolute encoder backup battery connection terminal, 2.8 to 4.5 V
3	BATGND	Backup battery – input	

Connectors Used

Connectors at Position Driver	B3PS-VH	(J.S.T. Mfg. Co., Ltd.)
Cable housing	VHR-3N	(J.S.T. Mfg. Co., Ltd.)
Cable contacts	BVH-21T-P1.1	(J.S.T. Mfg. Co., Ltd.)

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□CN1 (CONT) Control Signal Connectors (DIO Position Drivers Only)

Control Inputs

Pin No.	Symbol	Name
1	CCWL	CCW limit input
2	CWL	CW limit input
3	ORG	Origin proximity
4	RUN	RUN command
5	START	START
6	RESET	Alarm reset
7	SEARCH	Origin search
8	+JOG	+JOG operation
9	–JOG	–JOG operation
10	TEACH	TEACH
11	P.IN0	Point selection 0 / Position 0
12	P.IN1	Point selection 1 / Position 1
13	P.IN2	Point selection 2 / Position 2
14	P.IN3	Point selection 3 / Position 3
15	P.IN4	Point selection 4 / Position 4
16	P.IN5	Point selection 5 / Position 5
17	P.IN6	Point selection 6 / Position 6
18	P.IN7	Position 7
20	STOP	Deceleration stop
36	+24V	+24-V power supply input for control

Control Outputs

Pin No.	Symbol	Name
19	OGND	Output ground
21	BO	Brake output
22	READY	Ready
23	S.COM	Origin search completed
24	ORGSTP	Origin stop
25	T.COM	Teaching completed
26	RUNON	Motor running
27	INP	Positioning completed
28	$\overline{\text{ALM}}$	Alarm
29	P.OUT0	Point output 0 / Position selection 1
30	P.OUT1	Point output 1 / Position selection 2
31	P.OUT2	Point output 2 / Position selection 3
32	P.OUT3	Point output 3 / Position selection 4
33	P.OUT4	Point output 4 / Speed selection
34	P.OUT5	Point output 5
35	P.OUT6	Point output 6

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Connectors Used

Receptacle at Position Driver	10236-6202JL	(Sumitomo 3M)
Soldered plug at cable side	10136-3000VE	(Sumitomo 3M)
Case at cable side	10336-52A0-008	(Sumitomo 3M)

Note 1. The control input interface is a photocoupler input of 24 VDC at 8 mA.

Note 2. For the external power supply, use 24 VDC ±1 V at 150 mA minimum.

Note 3. The control output interface is a photocoupler output of 24 VDC at 40 mA.

□CN1 (Control Signal Connector) Pin Arrangement

			1	CCWL	CCW limit input				19	OGND	Output ground
2	CWL	CW limit input				20	STOP	Deceleration stop			
			3	ORG	Origin proximity				21	BO	Brake output
4	RUN	RUN command				22	READY	READY			
			5	START	START				23	S.COM	Origin search completed
6	RESET	Alarm reset				24	ORGSTP	Origin stop			
			7	SEARCH	Origin search				25	T.COM	Teaching completed
8	+JOG	+JOG operation				26	RUNON	Motor running			
			9	–JOG	–JOG operation				27	INP	Positioning completed
10	TEACH	Teach				28	$\overline{\text{ALM}}$	Alarm			
			11	P.IN0	Point selection 0/ Position 0				29	P.OUT0	Point output 0/ Position selection 1
12	P.IN1	Point selection 1/ Position 1				30	P.OUT1	Point output 1/ Position selection 2			
			13	P.IN2	Point selection 2/ Position 2				31	P.OUT2	Point output 2/ Position selection 3
14	P.IN3	Point selection 3/ Position 3				32	P.OUT3	Point output 3/ Position selection 4			
			15	P.IN4	Point selection 4/ Position 4				33	P.OUT4	Point output 4/ Speed selection
16	P.IN5	Point selection 5/ Position 5				34	P.OUT5	Point output 5			
			17	P.IN6	Point selection 6/ Position 6				35	P.OUT6	Point output 6
18	P.IN7	Position 7				36	+24V	+24-V power supply input for control			

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□CN1 (CONT) CompoBus/S Communications Terminals

Symbol	Name	Function
BD H	CompoBus/S serial line (+)	These are the terminals for connecting CompoBus/S communications cable. When wiring them, be careful with the polarity.
BD L	CompoBus/S serial line (–)	

IN (16 Input Points)

I/O allocation	Symbol	Name
OUT0	RUN	RUN command
OUT1	START	Start
OUT2	RESET	Alarm reset
OUT3	SEARCH	Origin search
OUT4	+JOG	+JOG operation
OUT5	–JOG	–JOG operation
OUT6	TEACH	Teach
OUT7	STOP	Deceleration stop
OUT8	P.IN0	Point selection 0 / Position 0
OUT9	P.IN1	Point selection 1 / Position 1
OUT10	P.IN2	Point selection 2 / Position 2
OUT11	P.IN3	Point selection 3 / Position 3
OUT12	P.IN4	Point selection 4 / Position 4
OUT13	P.IN5	Point selection 5 / Position 5
OUT14	P.IN6	Point selection 6 / Position 6
OUT15	P.IN7	Position 7

OUT (16 Output Points)

I/O allocation	Symbol	Name
IN0	BO	Brake output
IN1	READY	Ready
IN2	S.COM	Origin search completed
IN3	ORGSTP	Origin stop
IN4	T.COM	Teaching completed
IN5	RUNON	Motor running
IN6	INP	Positioning completed
IN7	$\overline{\text{ALM}}$	Alarm
IN8	P.OUT0	Point output 0 / Position selection 1
IN9	P.OUT1	Point output 1 / Position selection 2
IN10	P.OUT2	Point output 2 / Position selection 3
IN11	P.OUT3	Point output 3 / Position selection 4
IN12	P.OUT4	Point output 4 / Speed selection
IN13	P.OUT5	Point output 5
IN14	P.OUT6	Point output 6
IN15	---	Not used

Note For I/O allocation, refer to the operation manual for the Master Unit.

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□CN4 (LIMIT) External Control Signal Connectors (CompoBus/S Only)

Pin No.	Symbol	Name
1	CCWL	CCW limit input
2	CWL	CW limit input
3	ORG	Origin proximity
4	STOP	Deceleration stop
5	NC	
6	NC	
7	+24V	+24-V power supply input for control
8	BO	Brake output
9	NC	
10	NC	
11	NC	
12	NC	
13	NC	
14	0GND	Ground

Connectors Used

Receptacle at Position Driver	10214-6202JL	(Sumitomo 3M)
Soldered plug at cable side	10114-3000VE	(Sumitomo 3M)
Case at cable side	10314-52A0-008	(Sumitomo 3M)

Note 1. The control input interface is a photocoupler input of 24 VDC at 8 mA.

Note 2. For the external power supply, use 24 VDC ±1 V at 40 mA minimum.

Note 3. The control output interface is a photocoupler output of 24 VDC at 40 mA.

□CN4 Pin Arrangement

2	CWL	CW limit input	1	CCWL	CCW limit input	9			8	BO	Brake output
4	STOP	Deceleration stop	3	ORG	Origin proximity	11			10		
6			5			13			12		
			7	+24V	+24-V power supply input for control				14	OGND	Output ground

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5-2 Servomotor Specifications

5-2-1 U-series 30-W to 750-W Servomotors (INC/ABS)

☐General Specifications

Item	Specifications
Ambient operating temperature	0 to 40°C
Ambient operating humidity	20% to 80% RH (with no condensation)
Ambient storage temperature	–10 to 75°C
Ambient storage humidity	20% to 85% RH (with no condensation)
Storage and operating atmosphere	No corrosive gasses.
Vibration resistance	10 to 150 Hz in X, Y, and Z directions with 0.2-mm double amplitude; acceleration: 24.5 m/s^2 {2.5 G} max.; time coefficient: 8 min; 4 sweeps
Impact resistance	Acceleration 98 m/s^2 {10 G} max., in X, Y, and Z directions, three times
Insulation resistance	Between power line terminals and case: 10 MΩ min. (500-VDC megger)
Dielectric strength	Between power line terminals and case: 1,500 VAC for 1 min (10 mA max.) at 50/60 Hz (JEC 2121)
Run position	All directions
Insulation grade	Type B (JIS C4004) (Type A according to UL standards)
Structure	Totally-enclosed self-cooling
Protective structure	Models conforming to UL/cUL standards: IP-42 (JEM1030) Models conforming to EC Directives: IP-44 (IEC 34-5) (not including the shaft opening) Cannot be used in environment with water-soluble cutting fluids.
Vibration grade	V-15 (JEC2121)
Mounting method	Flange-mounting

Note 1. Vibration may be amplified due to sympathetic resonance of machinery, so do not exceed 19.6 m/s^2 (2 G) over a long period of time.

Note 2. The above items reflect individual evaluation testing. The results may differ under compounded conditions.

Note 3. The Servomotor cannot be used in a misty atmosphere.

Note 4. The drip-proof specifications for models conforming to UL/cUL standards are covered by IP-44. (Models with drip-proof specifications provide drip-proofing on Servomotors with oil seals.)

☐Performance Specifications with an Incremental Encoder

Item	Unit	R88M -U03030HA/ -U03030VA	R88M -U05030HA/ -U05030VA	R88M -U10030HA/ -U10030VA	R88M -U20030HA/ -U20030VA	R88M -U40030HA/ -U40030VA	R88M -U75030HA/ -U75030VA
Rated output (See note.)	W	30	50	100	200	400	750
Rated torque (See note.)	N m	0.095	0.159	0.318	0.637	1.27	2.39
	kgf cm	0.974	1.62	3.25	6.49	13.0	24.3

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Item		Unit	R88M -U03030HA/ -U03030VA	R88M -U05030HA/ -U05030VA	R88M -U10030HA/ -U10030VA	R88M -U20030HA/ -U20030VA	R88M -U40030HA/ -U40030VA	R88M -U75030HA/ -U75030VA
Rated rotation speed		r/min	3,000					
Momentary maximum rotation speed		r/min	4,500					
Momentary maximum torque (See note.)		N m	0.29	0.48	0.96	1.91	3.82	7.10
		kgf cm	2.92	4.87	9.75	19.5	39.0	72.9
Rated current (See note.)		A (rms)	0.42	0.60	0.87	2.0	2.6	4.4
Momentary maximum current (See note.)		A (rms)	1.3	1.9	2.8	6.0	8.0	13.9
Rotor inertia		kg m^2 ($GD^2/4$)	0.21×10^{-5}	0.26×10^{-5}	0.40×10^{-5}	1.23×10^{-5}	1.91×10^{-5}	6.71×10^{-5}
		kgf cm s^2	0.21×10^{-4}	0.27×10^{-4}	0.41×10^{-4}	1.26×10^{-4}	1.95×10^{-4}	6.85×10^{-4}
Torque constant (See note.)		N m/A	0.255	0.286	0.408	0.355	0.533	0.590
		kgf cm/A	2.60	2.92	4.16	3.62	5.44	6.01
Induced voltage constant (See note.)		mV/ (r/min)	8.89	9.98	14.0	12.4	18.6	20.6
Power rate (See note.)		kW/s	4.36	9.63	25.4	32.8	84.6	85.1
Mechanical time constant		ms	1.5	0.9	0.5	0.4	0.3	0.3
Winding resistance		Ω	15.8	9.64	6.99	1.34	1.23	0.45
Winding impedance		mH	23.1	16.9	13.2	7.2	7.9	5.7
Electrical time constant		ms	1.5	1.8	1.9	5.4	6.4	13
Momentary allowable radial load		N	186			490		735
		kgf	19			50		75
Momentary allowable thrust load		N	127			176		392
		kgf	13			18		40
Allowable radial load		N	68		78	245		392
		kgf	7		8	25		40
Allowable thrust load		N	54		54	74		147
		kgf	5.5		5.5	7.5		15
Weight	Without brake	kg	Approx. 0.3	Approx. 0.4	Approx. 0.5	Approx. 1.1	Approx. 1.7	Approx. 3.4
	With brake	kg	Approx. 0.6	Approx. 0.7	Approx. 0.8	Approx. 1.6	Approx. 2.2	Approx. 4.3
Radiation shield dimensions		Material: A1	t6 x 250					
Applicable Position Driver (FND-)		200-V input	X06H-			X12H-		X25H-
		100-V input	X06L-			X12L-	---	---

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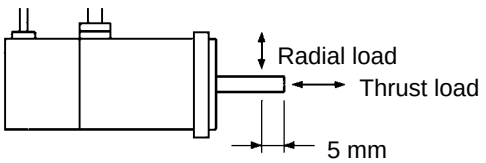
Item		Unit	R88M -U03030HA/ -U03030VA	R88M -U05030HA/ -U05030VA	R88M -U10030HA/ -U10030VA	R88M -U20030HA/ -U20030VA	R88M -U40030HA/ -U40030VA	R88M -U75030HA/ -U75030VA
Brake specifications	Brake inertia	kg m^2 ($GD^2/4$)	0.09×10^{-5}			0.58×10^{-5}		1.40×10^{-5}
		kgf cm s^2	0.09×10^{-4}			0.59×10^{-4}		1.43×10^{-4}
	Excitation voltage	V	24 VDC ±10% (No polarity)					
	Power consumption	W (at 20°C)	6.0			6.5		6.0
	Current consumption	A (at 20°C)	0.25			0.27		0.25
	Static friction torque	N m	0.2 min.		0.34 min.	1.5 min.		2.5 min.
		kgf cm	2.0 min.		3.5 min.	15.0 min.		25.0 min.
	Absorption time (See note 3.)	ms	40 max.		60 max.	100 max.		200 max.
	Release time (See note 3.)	ms	20 max.		30 max.	40 max.		50 max.
	Backlash	(Reference value)	±1°					
	Rating	---	Continuous					
	Insulation grade	---	Type F					

Note 1. The values for torque and rotation speed characteristics, are the values at an armature winding temperature of 100°C, combined with the Position Driver. Other values are at normal conditions (20°C, 65%). The maximum momentary torque is a reference value.

Note 2. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 3. The operation time measurement is the measured value with a surge killer (CR50500, by Okaya Electric Industrial Co.) installed.

Note 4. The allowable radial load indicates the value at a location 5 mm from the end of the shaft. (See the diagram below.)



Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 20,000 hours at normal usage as the standard.

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□Performance Specifications with an Absolute Encoder

Item		Unit	R88M -U03030TA/ -U03030XA	R88M -U05030TA/ -05030XA	R88M -U10030TA/ -U10030XA	R88M -U20030TA/ -U20030XA	R88M -U40030TA/ -U40030XA	R88M -U75030TA/ -U75030XA
Rated output (See note.)		W	30	50	100	200	400	750
Rated torque (See note.)		N m	0.095	0.159	0.318	0.637	1.27	2.39
		kgf cm	0.974	1.62	3.25	6.49	13.0	24.3
Rated rotation speed		r/min	3,000					
Momentary maximum rotation speed		r/min	4,500					
Momentary maximum torque (See note.)		N m	0.29	0.48	0.96	1.91	3.82	7.10
		kgf cm	2.92	4.87	9.75	19.5	39.0	72.9
Rated current (See note.)		A (rms)	0.42	0.60	0.87	2.0	2.6	4.4
Momentary maximum current (See note.)		A (rms)	1.3	1.9	2.8	6.0	8.0	13.9
Rotor inertia		kg m^2 (GD^2/4)	0.46×10^{-5}	0.51×10^{-5}	0.65×10^{-5}	1.48×10^{-5}	2.16×10^{-5}	6.96×10^{-5}
		kgf cm s^2	0.47×10^{-4}	0.53×10^{-4}	0.67×10^{-4}	1.52×10^{-4}	2.21×10^{-4}	7.11×10^{-4}
Torque constant (See note.)		N m/A	0.255	0.286	0.408	0.355	0.533	0.590
		kgf cm/A	2.60	2.92	4.16	3.62	5.44	6.01
Induced voltage constant (See note.)		mV/ (r/min)	8.89	9.98	14.0	12.4	18.6	20.6
Power rate (See note.)		kW/s	4.36	9.63	25.4	32.8	84.6	85.1
Mechanical time constant		ms	1.5	0.9	0.5	0.4	0.3	0.3
Winding resistance		Ω	15.8	9.64	6.99	1.34	1.23	0.45
Winding impedance		mH	23.1	16.9	13.2	7.2	7.9	5.7
Electrical time constant		ms	1.5	1.8	1.9	5.4	6.4	13
Momentary allowable radial load		N	186			490		735
		kgf	19			50		75
Momentary allowable thrust load		N	127			176		392
		kgf	13			18		40
Allowable radial load		N	68		78	245		392
		kgf	7		8	25		40
Allowable thrust load		N	54		49	68		147
		kgf	5.5		5	7		15
Weight	Without brake	kg	Approx. 0.45	Approx. 0.55	Approx. 0.65	Approx. 1.2	Approx. 1.8	Approx. 3.5
	With brake	kg	Approx. 0.75	Approx. 0.85	Approx. 0.95	Approx. 1.7	Approx. 2.3	Approx. 4.5

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Item		Unit	R88M -U03030TA/ -U03030XA	R88M -U05030TA/ -05030XA	R88M -U10030TA/ -U10030XA	R88M -U20030TA/ -U20030XA	R88M -U40030TA/ -U40030XA	R88M -U75030TA/ -U75030XA
Radiation shield dimensions		Material: A1	t6 x 250					
Applicable Position Driver (FND-)		200-V input	X06H-			X12H-		X25H-
		100-V input	X06L-			X12L-	---	---
Brake specifications	Brake inertia	kg m^2 ($GD^2/4$)	0.09×10^{-5}			0.58×10^{-5}		1.40×10^{-5}
		kgf cm s^2	0.09×10^{-4}			0.59×10^{-4}		1.43×10^{-4}
	Excitation voltage	V	24 VDC ±10% (No polarity)					
	Power consumption	W (at 20°C)	6.0			6.5		6.0
	Current consumption	A (at 20°C)	0.25			0.27		0.25
	Static friction torque	N m	0.2 min.		0.34 min.	1.5 min.		2.5 min.
		kgf cm	2.0 min.		3.5 min.	15.0 min.		25.0 min.
	Absorption time (See note 3.)	ms	40 max.		60 max.	100 max.		200 max.
	Release time (See note 3.)	ms	20 max.		30 max.	40 max.		50 max.
	Backlash	(Reference value)	±1°					
	Rating	---	Continuous					
	Insulation grade	---	Type F					

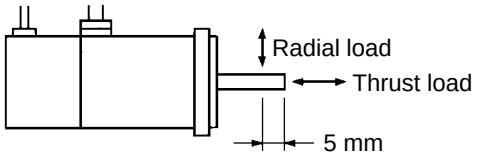
Note 1. The values for torque and rotation speed characteristics, are the values at an armature winding temperature of 100°C, combined with the Position Driver. Other values are at normal conditions (20°C, 65%). The maximum momentary torque is a reference value.

Note 2. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 3. The operation time measurement is the measured value with a surge killer (CR50500, by Okaya Electric Industrial Co.) installed.

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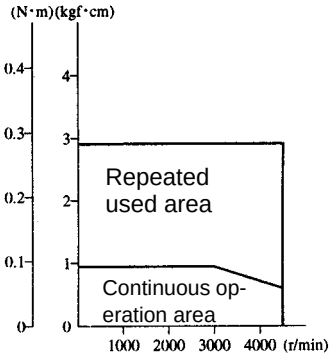
Note 4. The allowable radial load indicates the value at a location 5 mm from the end of the shaft. (See the diagram below.)



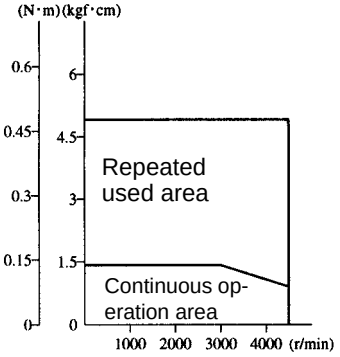
Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 20,000 hours at normal usage as the standard.

☐Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)

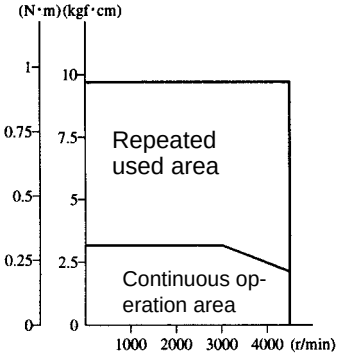
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R88M-U03030VA/XA



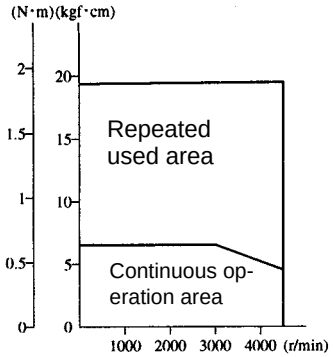
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R88M-U05030VA/XA



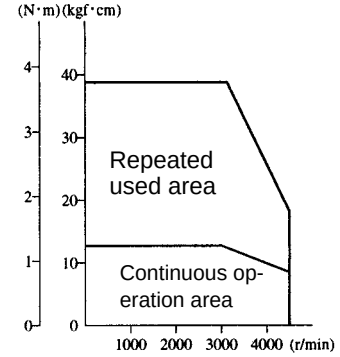
R88M-U10030HA/TA
R88M-U10030VA/XA



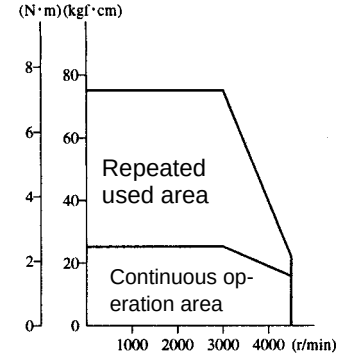
R88M-U20030HA/TA
R88M-U20030VA/XA



R88M-U40030HA/TA
R88M-U40030VA/XA



R88M-U75030HA/TA
R88M-U75030VA/XA



☐Servomotor and Mechanical System Temperature Characteristics

- U-series AC Servomotors use rare earth magnets (neodymium–iron magnets). The temperature coefficient for these magnets is approximately -0.13%/°C. As the temperature drops, the Servomotor's momentary maximum torque increases, and as the temperature rises the Servomotor's momentary maximum torque decreases. When the normal temperature of 20°C and -10°C are compared, the momentary maximum torque increases by approximately 4%. Conversely, when the magnet warms up to 80°C from the normal temperature of 20°C, the momentary maximum torque decreases by approximately 8%.

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- Generally, in a mechanical system, when the temperature drops the friction torque increases and the load torque becomes larger. For that reason, overloading may occur at low temperatures. In particular, in systems which use deceleration devices, the load torque at low temperatures may be nearly twice the load torque at normal temperatures. Check with a current monitor to see whether overloading is occurring at low temperatures, and how much the load torque is. Likewise, check to see whether there abnormal Servomotor overheating or alarms are occurring at high temperatures.
- An increase in load friction torque visibly increases load inertia. Therefore, even if the Position Driver parameters are adjusted at a normal temperature, there may not be optimal operation at low temperatures. Check to see whether there is optimal operation at low temperatures too.

□ Incremental Encoder Specifications

Item	Standards
Encoder method	Optical incremental encoder
Number of output pulses	A, B phase: 2,048 pulses/revolution, Z phase: 1 pulse/revolution
Power supply voltage	5 VDC±5%
Power supply current	DC, 350 mA (for load resistance of 220 Ω)
Pulse duty characteristics	50% ±10%
Phase characteristics	90° ±43.2°
Phase relationship	For rotation in the CW direction, A phase is advanced by 90° compared to B phase.
Maximum rotation speed	4,500 r/min
Maximum response frequency	153.6 kHz
Output signals	+A, –A, +B, –B, +S, –S
Output interface	Conforming to EIA RS-422A. Output based on AM26LS31CN or equivalent.
Serial communications data	Z phase, poll sensor, U, V, W phase
Serial communications method	Combination communications method based on A, B, and S phases.

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□Absolute Encoder Specifications

Item	Standards
Encoder method	Optical absolute encoder
Number of output pulses	A, B phase: 1,024 pulses/revolution, Z phase: 1 pulse/revolution
Maximum rotational amount	±99,999 revolution
Power supply voltage	5 VDC±5%
Power supply current	DC, 170 mA (for load resistance of 220 Ω)
Applicable battery voltage	3.6 VDC
Battery consumption current	16 μA during backup or when operation is stopped, 2 μA when 5 V is supplied
Pulse duty characteristics	50% ±10%
Phase characteristics	90° ±36°
Phase relationship	For rotation in the CW direction, A phase is advanced by 90° compared to B phase.
Maximum rotation speed	4,500 r/min
Maximum response frequency	76.8 kHz
Output signals	+A, –A, +B, –B, +Z, –Z, +ABS, –ABS
Output interface	Conforming to EIA RS-422A. Output based on MC3487 or equivalent.
Absolute-value communications data	Rotation amount Absolute position within rotation

5-2-2 U-UE-series Servomotors

□General Specifications

Item	Specifications
Ambient operating temperature	0°C to 40°C
Ambient operating humidity	20% to 80% RH (with no condensation)
Ambient storage temperature	–10°C to 75°C
Ambient storage humidity	20% to 85% RH (with no condensation)
Storage and operating atmosphere	No corrosive gasses.
Vibration resistance	10 to 150 Hz in X, Y, and Z directions with 0.2-mm double amplitude; acceleration: 24.5 m/s^2 {2.5 G} max.; time coefficient: 8 min; 4 sweeps
Impact resistance	Acceleration 98 m/s^2 {10 G} max., in X, Y, and Z directions, three times
Insulation resistance	Between power line terminals and case: 10 MΩ min. (500-VDC megger)
Dielectric strength	Between power line terminals and case: 1,500 VAC for 1 min (10 mA max.) at 50/60 Hz (JEC 2121)
Run position	All directions
Insulation grade	Type B (JIS C4004)
Structure	Totally-enclosed self-cooling
Protective structure	Models not conforming to any standards: IP-42 (JEM1030) Models conforming to EC Directives: IP-44 (IEC 34-5) (not including the shaft opening) Cannot be used in environment with water-soluble cutting fluids.
Vibration grade	V-15 (JEC2121)
Mounting method	Flange-mounting

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Note 1. Vibration may be amplified due to sympathetic resonance of machinery, so do not exceed 19.6 m/s^2 (2 G) over a long period of time.

Note 2. The above items reflect individual evaluation testing. The results may differ under compounded conditions.

Note 3. The Servomotor cannot be used in a misty atmosphere.

□Performance Specifications

Item		Unit	R88M -UE10030H-S1/ -UE10030V-S1	R88M -UE20030H-S1/ -UE20030V-S1	R88M -UE40030H-S1/ -UE40030V-S1	R88M -UE75030H-S1/ -UE75030V-S1
Rated output (See note.)		W	100	200	400	750
Rated torque (See note.)		N m	0.318	0.637	1.27	2.39
		kgf cm	3.25	6.49	13.0	24.3
Rated rotation speed		r/min	3,000			
Momentary maximum rotation speed		r/min	4,500			
Momentary maximum torque (See note.)		N m	0.96	1.91	3.82	7.10
		kgf cm	9.75	19.5	39.0	72.9
Rated current (See note.)		A (rms)	0.87	2.0	2.6	4.4
Momentary maximum current (See note.)		A (rms)	2.8	6.0	8.0	13.9
Rotor inertia		kg m^2 (GD^2/4)	0.40×10^{-5}	1.23×10^{-5}	1.91×10^{-5}	6.71×10^{-5}
		kgf cm s^2	0.41×10^{-4}	1.26×10^{-4}	1.95×10^{-4}	6.85×10^{-4}
Torque constant (See note.)		N m/A	0.408	0.355	0.533	0.590
		kgf cm/A	4.16	3.62	5.44	6.01
Induced voltage constant (See note.)		mV/ (r/min)	14.0	12.4	18.6	20.6
Power rate (See note.)		kW/s	25.4	32.8	84.6	85.1
Mechanical time constant		ms	0.5	0.4	0.3	0.3
Winding resistance		Ω	6.99	1.34	1.23	0.45
Winding impedance		mH	13.2	7.2	7.9	5.7
Electrical time constant		ms	1.9	5.4	6.4	13
Momentary allowable radial load		N	186	490		735
		kgf	19	50		75
Momentary allowable thrust load		N	127	176		392
		kgf	13	18		40
Allowable radial load		N	78	245		392
		kgf	8	25		40
Allowable thrust load		N	54	74		147
		kgf	5.5	7.5		15
Weight	Without brake	kg	Approx. 0.5	Approx. 1.1	Approx. 1.7	Approx. 3.4
	With brake	kg	Approx. 0.8	Approx. 1.6	Approx. 2.2	Approx. 4.3
Radiation shield dimensions		Material: A1	t6 x 250			
Applicable Position Driver (FND-)		200-V input	X06H-	X12H-		X25H-
		100-V input	X06L-	X12L-	---	---

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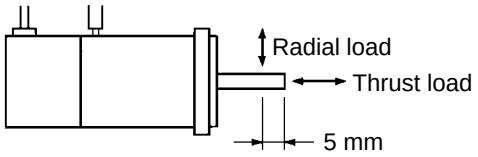
Item		Unit	R88M -UE10030H-S1/ -UE10030V-S1	R88M -UE20030H-S1/ -UE20030V-S1	R88M -UE40030H-S1/ -UE40030V-S1	R88M -UE75030H-S1/ -UE75030V-S1
Brake specifications	Brake inertia	kg m^2 ($GD^2/4$)	0.09 x 10^{-5}	0.58 x 10^{-5}		1.40 x 10^{-5}
		kgf cm s^2	0.09 x 10^{-4}	0.59 x 10^{-4}		1.43 x 10^{-4}
	Excitation voltage	V	24 VDC ±10% (No polarity)			
	Power consumption	W (at 20°C)	6.0	6.5		6.0
	Current consumption	A (at 20°C)	0.25	0.27		0.25
	Static friction torque	N m	0.34 min.	1.5 min.		2.5 min.
		kgf cm	3.5 min.	15.0 min.		25.0 min.
	Absorption time (See note 3.)	ms	60 max.	100 max.		200 max.
	Release time (See note 3.)	ms	30 max.	40 max.		50 max.
	Backlash	(Reference value)	±1°			
	Rating	---	Continuous			
	Insulation grade	---	Type F			

Note 1. The values for torque and rotation speed characteristics, are the values at an armature winding temperature of 100°C, combined with the Position Driver. Other values are at normal conditions (20°C, 65%). The maximum momentary torque is a reference value.

Note 2. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 3. The operation time measurement is the measured value with a surge killer (CR50500, by Okaya Electric Industrial Co.) installed.

Note 4. The allowable radial load indicates the value at a location 5 mm from the end of the shaft. (See the diagram below.)



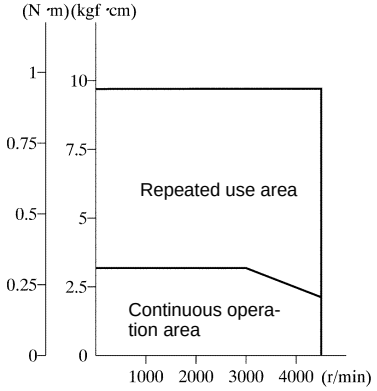
Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 20,000 hours at normal usage as the standard.

Note 6. U-series UE Servomotors can be used only with Position Driver software version 4.01 (September 1997) or later.

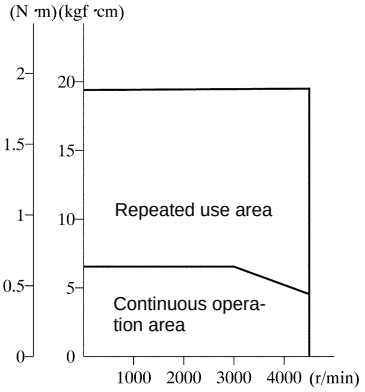
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☐Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)

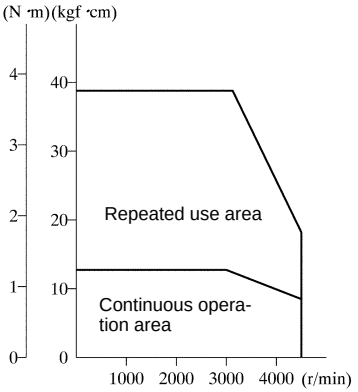
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R88M-UE10030V-S1



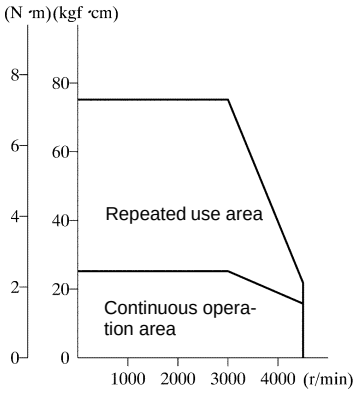
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R88M-UE20030V-S1



R88M-UE40030H-S1
R88M-UE40030V-S1



R88M-UE75030H-S1
R88M-UE75030V-S1



☐Servomotor and Mechanical System Temperature Characteristics

- U-UE-series AC Servomotors use rare earth magnets (neodymium–iron magnets). The temperature coefficient for these magnets is approximately -0.13%/°C. As the temperature drops, the Servomotor's momentary maximum torque increases, and as the temperature rises the Servomotor's momentary maximum torque decreases. When the normal temperature of 20°C and -10°C are compared, the momentary maximum torque increases by approximately 4%. Conversely, when the magnet warms up to 80°C from the normal temperature of 20°C, the momentary maximum torque decreases by approximately 8%.
- Generally, in a mechanical system, when the temperature drops the friction torque increases and the load torque becomes larger. For that reason, overloading may occur at low temperatures. In particular, in systems which use deceleration devices, the load torque at low temperatures may be nearly twice the load torque at normal temperatures. Check with a current monitor to see whether overloading is occurring at low temperatures, and how much the load torque is. Likewise, check to see whether there abnormal Servomotor overheating or alarms are occurring at high temperatures.
- An increase in load friction torque visibly increases load inertia. Therefore, even if the Position Driver parameters are adjusted at a normal temperature, there may not be optimal operation at low temperatures. Check to see whether there is optimal operation at low temperatures too.

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□Encoder Specifications

Item	Standards
Encoder method	Optical incremental encoder
Number of output pulses	A, B phase: 1,024 pulses/revolution, Z phase: 1 pulse/revolution
Power supply voltage	5 VDC±5%
Power supply current	DC, 350 mA (for load resistance of 220 Ω)
Pulse duty characteristics	50% ±10%
Phase characteristics	90° ±43.2°
Phase relationship	For rotation in the CW direction, A phase is advanced by 90° compared to B phase.
Maximum rotation speed	4,500 r/min
Maximum response frequency	76.8 kHz
Output signals	+A, –A, +B, –B, +S, –S
Output interface	Conforming to EIA RS-422A. Output based on AM26LS31CN or equivalent.
Serial communications data	Z phase, poll sensor, U, V, W phase
Serial communications method	Combination communications method based on A, B, and S phases.

5-2-3 U-series 1-kW to 2-kW Servomotors (INC/ABS)

□General Specifications

Item	Specifications
Ambient operating temperature	0 to 40°C
Ambient operating humidity	20% to 80% RH (with no condensation)
Ambient storage temperature	–20 to 60°C
Ambient storage humidity	20% to 80% RH (with no condensation)
Storage and operating atmosphere	No corrosive gasses.
Vibration resistance	10 to 150 Hz in X, Y, and Z directions with 0.2-mm double amplitude; acceleration: 24.5 m/s^2 {2.5 G} max.; time coefficient: 8 min; 4 sweeps
Impact resistance	Acceleration 98 m/s^2 {10 G} max., in X, Y, and Z directions, three times
Insulation resistance	Between power line terminals and case: 10 MΩ min. (500-VDC megger)
Dielectric strength	Between power line terminals and case: 1,500 VAC for 1 min (10 mA max.) at 50/60 Hz (JEC 2121)
Run position	All directions
Insulation grade	Type F (JIS C4004)
Structure	Totally-enclosed self-cooling
Protective structure	Models not conforming to any standards: IP-65 (IEC 34-5) (This standard does not apply to the shaft opening. The connector used for the standard cable conforms to IP-30.) Models conforming to EC Directives: IP-55 (IEC 34-5) (This standard does not apply to the shaft opening. The connector used for the standard cable conforms to IP-30.) Cannot be used in environment with water-soluble cutting fluids.
Vibration grade	V-15 (JEC2121)
Mounting method	Flange-mounting

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Note 1. Vibration may be amplified due to sympathetic resonance of machinery, so do not exceed 19.6 m/s^2 (2 G) over a long period of time.

Note 2. Use water-resistance cables for the power cables and encoder cables in locations subject to contact with water.

Note 3. The above items reflect individual evaluation testing. The results may differ under compounded conditions.

Note 4. The Servomotor cannot be used in a misty atmosphere.

□Performance Specifications with an Incremental Encoder

Item		Unit	R88M -U1K030H/ -U1K030V	R88M -U1K530H/ -U1K530V	R88M -U2K030H/ -U2K030V
Rated output (See note.)		W	1,000	1,500	2,000
Rated torque (See note.)		N m	3.18	4.77	6.36
		kgf cm	32.4	48.7	65.0
Rated rotation speed		r/min	3,000		
Momentary maximum rotation speed		r/min	4,500		
Momentary maximum torque (See note.)		N m	9.54	14.3	16.1 (See note 7.)
		kgf cm	97.2	146	164 (See note 7.)
Rated current (See note.)		A (rms)	6.1	9.9	12.0
Momentary maximum current (See note.)		A (rms)	17	28	35.4
Rotor inertia		kg m^2 ($GD^2/4$)	1.74×10^{-4}	2.47×10^{-4}	3.19×10^{-4}
		kgf cm s^2	1.78×10^{-3}	2.52×10^{-3}	3.26×10^{-3}
Torque constant (See note.)		N m/A	0.59	0.54	0.52
		kgf cm/A	6.1	5.5	5.3
Induced voltage constant (See note.)		mV/ (r/min)	22.2	20.0	19.5
Power rate (See note.)		kW/s	57.9	92.2	103
Mechanical time constant		ms	0.9	0.7	0.6
Winding resistance		Ω	0.67	0.31	0.19
Winding impedance		mH	4.75	2.40	1.57
Electrical time constant		ms	7.1	7.7	8.3
Momentary allowable radial load		N	1,570		
		kgf	160		
Momentary allowable thrust load		N	590		
		kgf	60		
Allowable radial load		N	680		
		kgf	70		
Allowable thrust load		N	190		
		kgf	20		
Weight	Without brake	kg	Approx. 4.6	Approx. 5.8	Approx. 7.0
	With brake	kg	Approx. 6.0	Approx. 7.5	Approx. 8.5
Radiation shield dimensions		Material: A1	t20 x 400		
Applicable Position Driver (FND-)		200-V input	X25H-	X50H-	
		100-V input	---		

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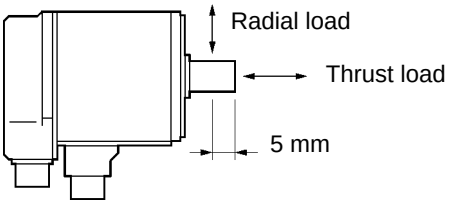
Item		Unit	R88M -U1K030H/ -U1K030V	R88M -U1K530H/ -U1K530V	R88M -U2K030H/ -U2K030V
Brake specifications	Brake inertia	kg m^2 (GD^2/4)	0.33 x 10^{-4}		
		kgf cm s^2	0.34 x 10^{-3}		
	Excitation voltage	V	24 VDC ±10% (No polarity)		
	Power consumption	W (at 20°C)	7		
	Current consumption	A (at 20°C)	0.29		
	Static friction torque	N m	80 min.		
		kgf cm	7.8 min.		
	Absorption time (See note 3.)	ms	180 max.		
	Release time (See note 3.)	ms	100 max.		
	Backlash	(Reference value)	±0.5°		
	Rating	---	Continuous		
	Insulation grade	---	Type F		

Note 1. The values for torque and rotation speed characteristics, are the values at an armature winding temperature of 100°C, combined with the Position Driver. Other values are at normal conditions (20°C, 65%). The maximum momentary torque is a reference value.

Note 2. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 3. The operation time measurement is the measured value with a surge killer (CR50500, by Okaya Electric Industrial Co.) installed.

Note 4. The allowable radial load indicates the value at a location 5 mm from the end of the shaft. (See the diagram below.)



Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 20,000 hours at normal usage as the standard.

Note 6. U-series 1-kW to 2-kW Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

Note 7. The momentary maximum torque for 2-kW Servomotors is approx. 16% less than when used with a standard U-series Servodriver.

□Performance Specifications with an Absolute Encoder

Item	Unit	R88M -U1K030T/ -U1K030X	R88M -U1K530T/ -U1K530X	R88M -U2K030T/ -U2K030X
Rated output (See note.)	W	1,000	1,500	2,000
Rated torque (See note.)	N m	3.18	4.77	6.36
	kgf cm	32.4	48.7	65.0

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Item		Unit	R88M -U1K030T/ -U1K030X	R88M -U1K530T/ -U1K530X	R88M -U2K030T/ -U2K030X
Rated rotation speed		r/min	3,000		
Momentary maximum rotation speed		r/min	4,500		
Momentary maximum torque (See note.)		N m	9.54	14.3	16.1 (See note 7.)
		kgf cm	97.2	146	164 (See note 7.)
Rated current (See note.)		A (rms)	6.1	9.9	12.0
Momentary maximum current (See note.)		A (rms)	17	28	35.4
Rotor inertia		kg m^2 ($GD^2/4$)	1.74×10^{-4}	2.47×10^{-4}	3.19×10^{-4}
		kgf cm s^2	1.78×10^{-3}	2.52×10^{-3}	3.26×10^{-3}
Torque constant (See note.)		N m/A	0.59	0.54	0.52
		kgf cm/A	6.1	5.5	5.3
Induced voltage constant (See note.)		mV/ (r/min)	22.2	20.0	19.5
Power rate (See note.)		kW/s	57.9	92.2	103
Mechanical time constant		ms	0.9	0.7	0.6
Winding resistance		Ω	0.67	0.31	0.19
Winding impedance		mH	4.75	2.40	1.57
Electrical time constant		ms	7.1	7.7	8.3
Momentary allowable radial load		N	1,570		
		kgf	160		
Momentary allowable thrust load		N	590		
		kgf	60		
Allowable radial load		N	680		
		kgf	70		
Allowable thrust load		N	190		
		kgf	20		
Weight	Without brake	kg	Approx. 5.0	Approx. 6.2	Approx. 7.4
	With brake	kg	Approx. 6.5	Approx. 8.0	Approx. 9.0
Radiation shield dimensions		Material: A1	t20 x 400		
Applicable Position Driver (FND-)		200-V input	X25H-	X50H-	
		100-V input	---		

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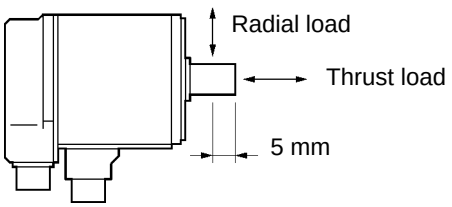
Item		Unit	R88M -U1K030T/ -U1K030X	R88M -U1K530T/ -U1K530X	R88M -U2K030T/ -U2K030X
Brake specifications	Brake inertia	kg m^2 ($GD^2/4$)	0.33×10^{-4}		
		kgf cm s^2	0.34×10^{-3}		
	Excitation voltage	V	24 VDC ±10% (No polarity)		
	Power consumption	W (at 20°C)	7		
	Current consumption	A (at 20°C)	0.29		
	Static friction torque	N m	80 min.		
		kgf cm	7.8 min.		
	Absorption time (See note 3.)	ms	180 max.		
	Release time (See note 3.)	ms	100 max.		
	Backlash	(Reference value)	±0.5°		
	Rating	---	Continuous		
	Insulation grade	---	Type F		

Note 1. The values for torque and rotation speed characteristics, are the values at an armature winding temperature of 100°C, combined with the Position Driver. Other values are at normal conditions (20°C, 65%). The maximum momentary torque is a reference value.

Note 2. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 3. The operation time measurement is the measured value with a surge killer (CR50500, by Okaya Electric Industrial Co.) installed.

Note 4. The allowable radial load indicates the value at a location 5 mm from the end of the shaft. (See the diagram below.)



Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 20,000 hours at normal usage as the standard.

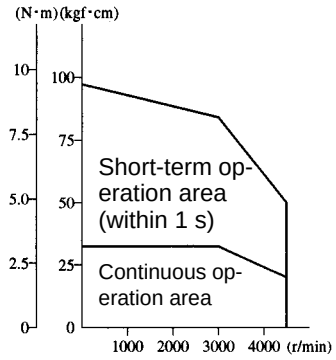
Note 6. U-series 1-kW to 2-kW Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

Note 7. The momentary maximum torque for 2-kW Servomotors is approx. 16% less than when used with a standard U-series Servodriver.

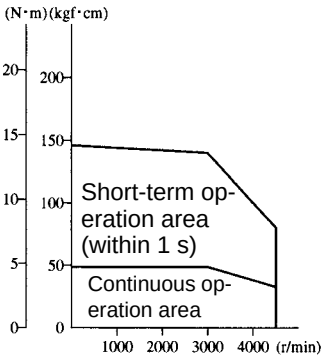
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☐Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200-VAC Input)

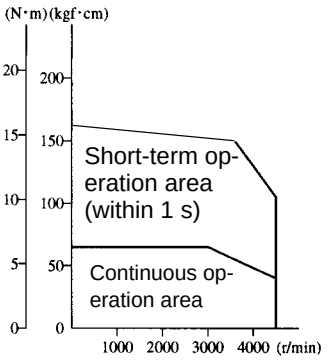
R88M-U1K030H/T
R88M-U1K030V/X



R88M-U1K530H/T
R88M-U1K530V/X



R88M-U2K030H/T
R88M-U2K030V/X

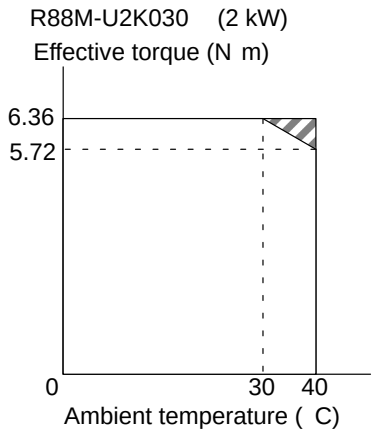


☐Servomotor and Mechanical System Temperature Characteristics

- U-series AC Servomotors use rare earth magnets (neodymium–iron magnets). The temperature coefficient for these magnets is approximately -0.13%/°C. As the temperature drops, the Servomotor's momentary maximum torque increases, and as the temperature rises the Servomotor's momentary maximum torque decreases. When the normal temperature of 20°C and -10°C are compared, the momentary maximum torque increases by approximately 4%. Conversely, when the magnet warms up to 80°C from the normal temperature of 20°C, the momentary maximum torque decreases by approximately 8%.
- Generally, in a mechanical system, when the temperature drops the friction torque increases and the load torque becomes larger. For that reason, overloading may occur at low temperatures. In particular, in systems which use deceleration devices, the load torque at low temperatures may be nearly twice the load torque at normal temperatures. Check with a current monitor to see whether overloading is occurring at low temperatures, and how much the load torque is. Likewise, check to see whether there abnormal Servomotor overheating or alarms are occurring at high temperatures.
- An increase in load friction torque visibly increases load inertia. Therefore, even if the Position Driver parameters are adjusted at a normal temperature, there may not be optimal operation at low temperatures. Check to see whether there is optimal operation at low temperatures too.

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⚠Caution Do not use a 2-kW Servomotor in the shaded range in the following graph. Heat generated by the Motor may cause the Encoder to malfunction.



□Incremental Encoder Specifications

Item	Standards
Encoder method	Optical incremental encoder
Number of output pulses	A, B phase: 4,096 pulses/revolution, Z phase: 1 pulse/revolution
Power supply voltage	5 VDC±5%
Power supply current	DC, 350 mA (for load resistance of 220 Ω)
Pulse duty characteristics	50% ±10%
Phase characteristics	90° ±36°
Phase relationship	For rotation in the CW direction, A phase is advanced by 90° compared to B phase.
Maximum rotation speed	4,500 r/min
Maximum response frequency	307.2 kHz
Output signals	+A, –A, +B, –B, +S, –S
Output interface	Conforming to EIA RS-422A. Output based on MC3487 or equivalent.
Serial communications data	Z phase, poll sensor, U, V, W phase
Serial communications method	Combination communications method based on A, B, and S phases.

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☐ Absolute Encoder Specifications

Item	Standards
Encoder method	Optical absolute encoder
Number of output pulses	A, B phase: 8,192 pulses/revolution, Z phase: 1 pulse/revolution
Maximum rotational amount	±99,999 revolution
Power supply voltage	5 VDC±5%
Power supply current	DC, 400 mA (for load resistance of 220 Ω)
Applicable battery voltage	3.6 VDC
Battery consumption current	10 μA (At backup or rotation stop.)
Pulse duty characteristics	50% ±10%
Phase characteristics	90° ±36°
Phase relationship	For rotation in the CW direction, A phase is advanced by 90° compared to B phase.
Maximum rotation speed	4,500 r/min
Maximum response frequency	614.4 kHz
Output signals	+A, –A, +B, –B, +Z, –Z,
Output interface	Conforming to EIA RS-422A. Output based on SN75158 or equivalent.
Absolute-value communications data	Rotation amount Absolute position within rotation (output only when power is supplied)

5-2-4 H-series Servomotors

☐ General Specifications

Item	Specifications
Ambient operating temperature	0 to 40°C
Ambient operating humidity	35% to 85% RH (with no condensation)
Ambient storage temperature	–10 to 75°C
Ambient storage humidity	35% to 85% RH (with no condensation)
Storage and operating atmosphere	No corrosive gasses.
Run position	All directions
Insulation grade	Type B
Structure	Totally-enclosed self-cooling
Protective structure	IP-52 Cannot be used in environment with water-soluble cutting fluids.
Vibration grade	V-15 (JEC2121)
Mounting method	Flange-mounting

Note 1. The above items reflect individual evaluation testing. The results may differ under compounded conditions.

Note 2. The Servomotor cannot be used in a misty atmosphere.

Note 3. The drip-proofing specifications are covered by IP-54. (Models with drip-proof specifications provide drip-proofing on Servomotors with oil seals.)

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□Performance Characteristics

Item		Unit	R88M -H05030	R88M -H10030	R88M -H20030	R88M -H30030	R88M -H50030	R88M -H75030	R88M -H1K130
Rated output (See note.)		W	50	100	200	300	500	750	1100
Rated torque (See note.)		N m	0.16	0.32	0.64	0.95	1.59	2.39	3.50
		kgf cm	1.62	3.25	6.50	9.74	16.2	24.4	35.7
Rated rotation speed		r/min	3,000						
Momentary maximum rotation speed		r/min	4,000						
Momentary maximum torque (See note.)		N m	0.48	0.95	1.91	2.86	4.76	7.17	8.62
		kgf cm	4.86	9.74	19.5	29.2	48.6	73.2	88
Rotor inertia		kg m^2 ($GD^2/4$)	0.14×10^{-4}	0.22×10^{-4}	0.44×10^{-4}	0.65×10^{-4}	2.5×10^{-4}	4.1×10^{-4}	5.7×10^{-4}
		kgf cm s^2	1.4×10^{-4}	2.2×10^{-4}	4.5×10^{-4}	6.6×10^{-4}	26×10^{-4}	42×10^{-4}	58×10^{-4}
Torque constant (See note.)		N m/A	0.22	0.35	0.43	0.49	0.43	0.47	0.59
		kgf cm/A	2.2	3.6	4.4	5.0	4.4	4.8	6.0
Induced voltage constant (See note.)		mV/(r/min)	23	37	45	52	45	50	62
Power rate (See note.)		kW/s	1.8	4.7	9.1	14	9.7	14	21
Mechanical time constant		ms	6.9	2.7	2.3	1.7	2.2	1.4	1.3
Winding resistance		Ω	24	16	10	6.1	1.6	0.74	0.80
Winding impedance		mH	51	43	38	28	10	6.6	6.9
Electrical time constant		ms	2.1	2.7	3.8	4.5	6.5	9.0	8.6
Momentary allowable radial load		N	147		343		637		834
		kgf	15		35		65		85
Momentary allowable thrust load		N	196		275		490		490
		kgf	20		28		50		50
Allowable radial load		N	103	113	186	196	353	373	441
		kgf	10.5	11.5	19.0	20.0	36.0	38.0	45.0
Allowable thrust load	A	N	29		78		118		147
		kgf	3.0		8.0		12.0		15.0
	B	N	29		78		118		147
		kgf	3.0		7.5		11.0		13.0
Weight	Without brake	kg	Approx. 0.9	Approx. 1.1	Approx. 1.8	Approx. 2.2	Approx. 4.3	Approx. 5.6	Approx. 6.8
	With brake	kg	Approx. 1.4	Approx. 1.6	Approx. 2.6	Approx. 3.0	Approx. 6.5	Approx. 7.8	Approx. 9.0

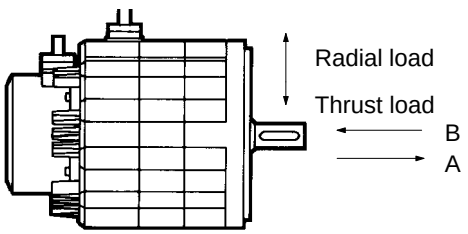
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Item		Unit	R88M -H05030	R88M -H10030	R88M -H20030	R88M -H30030	R88M -H50030	R88M -H75030	R88M -H1K130
Radiation shield dimensions		Material: A1	t6 x 150		t6 x 250		t12 x 250		
Applicable Position Driver (FND-)		200-V input	X06H-		X12H-		X25H-		
		100-V input	X06L-		X12L-	---	---	---	---
Brake specifications	Brake inertia	kg m^2 ($GD^2/4$)	0.02×10^{-4}		0.05×10^{-4}		0.5×10^{-4}		
		kgf cm s^2	0.2×10^{-4}		0.5×10^{-4}		5×10^{-4}		
	Excitation voltage	V	24 VDC ±10% (No polarity)						
	Power consumption	W (at 20°C)	10		11		22		
	Static friction torque	N m	0.5 min.		1.5 min.		5.4 min.		
		kgf cm	5 min.		15 min.		55 min.		
	Absorption time	ms	50 max. (reference value)						
	Release time	ms	30 max. (reference value)		50 max. (reference value)				
	Backlash	(Reference value)	±1.2°		±0.9°		±0.7°		
	Rating	---	Continuous						
	Insulation grade	---	Type F						

Note **1.** The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note **2.** For motors with brakes, increase the size of the radiation shield by 100 mm (example: t6 x 250 → t6 x 350).

Note **3.** The allowable radial load indicates the value at the center of the shaft (i.e., 1/2 of the output shaft length). (See the diagram below.)



Note **4.** The allowable thrust load varies depending on the shaft direction.

Note **5.** The allowable radial load and the allowable thrust load are the values determined by taking a service life of 30,000 hours at normal usage as the standard.

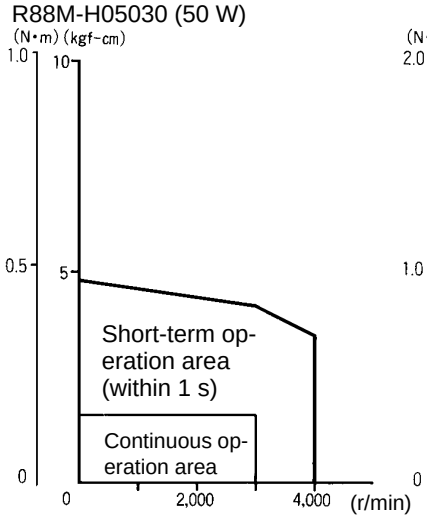
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Note **6.** H-series Servomotors can be used only with Position Driver software version 4.01 (September 1997) or later.

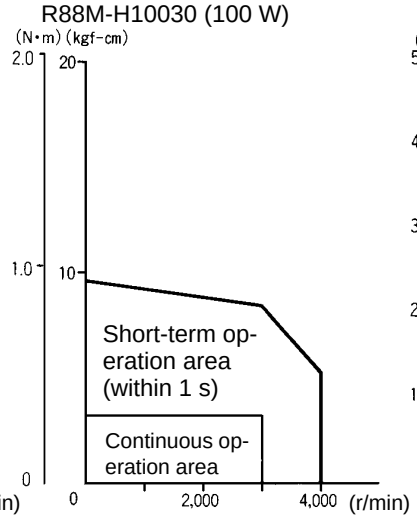
☐ Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)

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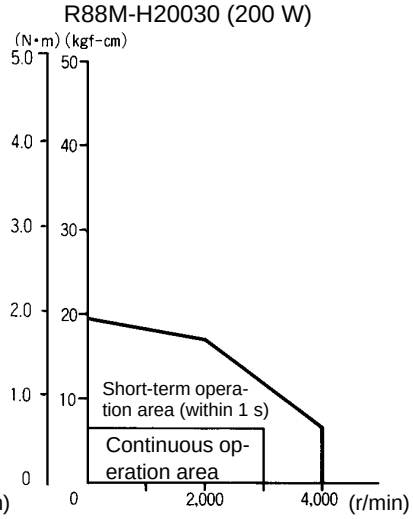
R88M-H05030 (50 W)



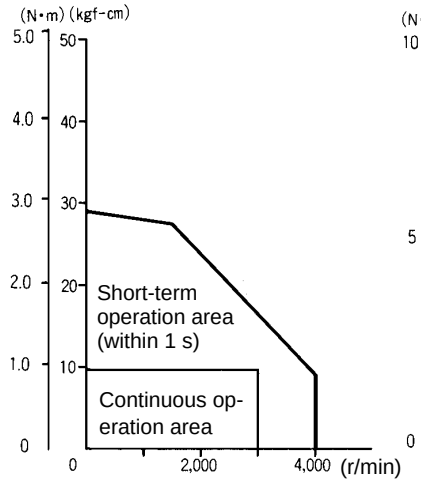
R88M-H10030 (100 W)



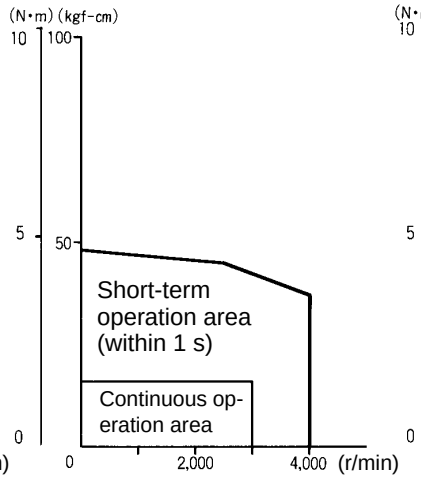
R88M-H20030 (200 W)



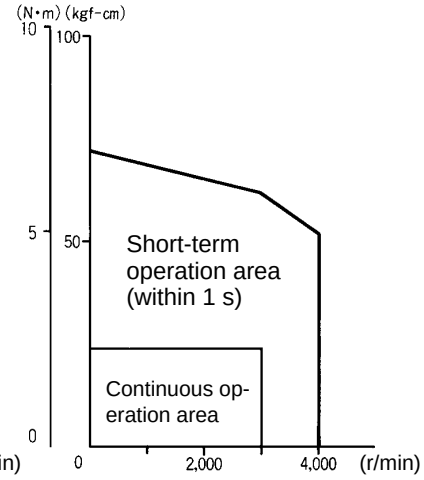
R88M-H30030 (300 W)



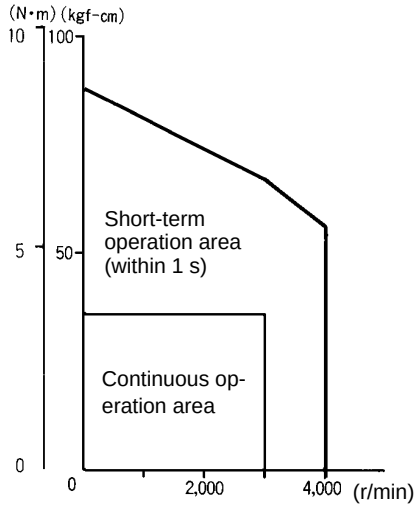
R88M-H50030 (500 W)



R88M-H75030 (750 W)



R88M-H1K130 (1100 W)



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□Encoder Specifications

Item	Standards
Encoder method	A, B, Z phase: Magnetic incremental encoder with MR elements
Number of output pulses	A, B phase: 2,000 pulses/revolution, Z phase: 1 pulse/revolution
Power supply voltage	5 VDC±5%
Pulse duty characteristics	50% ±10%
Phase characteristics	90° ±40°
Phase relationship	For rotation in the CW direction, A phase is advanced by 90° compared to B phase.
Maximum rotation speed	4,000 r/min
Maximum response frequency	133.3 kHz
Output signals	+A, –A, +B, –B, +S, –S
Output interface	Conforming to EIA RS-422A. Output based on AM26LS31CN or equivalent.
Serial communications data	Z phase, poll sensor, U, V, W phase
Serial communications method	Manchester code

5-2-5 M-series Servomotors

□General Specifications

Item	Specifications
Ambient operating temperature	0 to 40°C
Ambient operating humidity	35% to 85% RH (with no condensation)
Ambient storage temperature	–10 to 75°C
Ambient storage humidity	35% to 85% RH (with no condensation)
Storage and operating atmosphere	No corrosive gasses.
Run position	All directions
Insulation grade	Type F (JIS C4004)
Structure	Totally-enclosed self-cooling
Protective structure	IP-42 (JEM1030) Cannot be used in environment with water-soluble cutting fluids.
Vibration grade	V-15 (JEC2121)
Mounting method	Flange-mounting

Note 1. The above items reflect individual evaluation testing. The results may differ under compounded conditions.

Note 2. The Servomotor cannot be used in a misty atmosphere.

Note 3. The drip-proofing specifications are covered by IP-44. (Models with drip-proof specifications provide drip-proofing on Servomotors with oil seals.)

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□Performance Characteristics

1,200 r/min

Item		Unit	R88M -M20012	R88M -M40012	R88M -M70012	R88M -M1K112	R88M -M1K412	R88M -M1K812
Rated output (See note.)		W	200	400	700	1,100	1,400	1,800
Rated torque (See note.)		N m	1.59	3.18	5.57	8.75	11.1	14.3
		kgf cm	16.2	32.5	56.8	89.3	114	146
Rated rotation speed		r/min	1,200					
Momentary maximum rotation speed		r/min	1,300					
Momentary maximum torque (See note.)		N m	4.3	7.4	17.6	16.7	30.4	44.1
		kgf cm	44.0	75.0	180	170	310	450
Rated current (See note.)		A (rms)	2.1	2.9	4.0	6.6	8.4	9.3
Momentary maximum current (See note.)		A (rms)	7.1	7.1	14.2	14.2	28.3	35.4
Rotor inertia		kg m^2 ($GD^2/4$)	6.3×10^{-4}	9.8×10^{-4}	1.6×10^{-3}	4.2×10^{-3}	4.9×10^{-3}	6.5×10^{-3}
		kgf cm s^2	6.4×10^{-3}	1.0×10^{-2}	1.6×10^{-2}	4.3×10^{-2}	5.0×10^{-2}	6.6×10^{-2}
Torque constant (See note.)		N m/A	0.74	1.10	1.40	1.32	1.32	1.53
		kgf cm/A	7.6	11.2	14.3	13.5	13.5	15.6
Induced voltage constant (See note.)		mV/ (r/min)	53	72	88	82	83	92
Power rate (See note.)		kW/s	4.0	10	20	18	25	32
Mechanical time constant		ms	7.3	3.5	2.3	3.1	2.8	1.9
Winding resistance		Ω	9.8	6.4	4.2	1.9	1.5	1.0
Winding impedance		mH	70	65	50	20	40	27
Electrical time constant		ms	7.1	10.1	11.8	10	26	26
Momentary allowable radial load		N	880	940	1,000	2,040	2,100	2,190
		kgf	90	96	102	208	214	223
Momentary allowable thrust load		N	2,380	2,380	2,380	5,390	5,390	5,390
		kgf	243	243	243	550	550	550
Allowable radial load		N	480 (560)	519 (600)	548 (640)	1,029 (1,190)	1,058 (1,230)	1,107 (1,270)
		kgf	49 (57)	53 (61)	56 (65)	105 (121)	108 (125)	113 (130)
Allowable thrust load		N	68 (88)	58 (78)	58 (69)	156 (190)	147 (180)	127 (160)
		kgf	7 (9)	6 (8)	6 (7)	16 (19)	15 (18)	13 (16)
Weight	Without brake	kg	Approx. 6.5	Approx. 9.0	Approx. 14	Approx. 22	Approx. 26	Approx. 34
	With brake	kg	Approx. 7.1	Approx. 10	Approx. 15	Approx. 24	Approx. 28	Approx. 38

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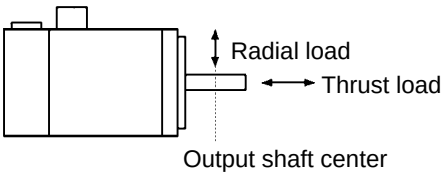
Item		Unit	R88M -M20012	R88M -M40012	R88M -M70012	R88M -M1K112	R88M -M1K412	R88M -M1K812
Radiation shield dimensions		Material: FE (See note 4.)	t15 x 250		t20 x 300	t20 x 400		
Applicable Position Driver (FND-)		200-V input	X12H-		X25H-	X50H-		
		100-V input	X12L-	---				
Brake specifications	Brake inertia	kg m^2 (GD^2/4)	1.9 x 10^{-5}	3.2 x 10^{-5}	6.8 x 10^{-5}	2.9 x 10^{-4}		3.0 x 10^{-4}
		kgf cm s^2	1.9 x 10^{-4}	3.3 x 10^{-4}	6.9 x 10^{-4}	2.9 x 10^{-3}		3.1 x 10^{-3}
	Excitation voltage	V	24 VDC ±10% (No polarity)					
	Power consumption	W (at 20°C)	9.8	15		18		22
	Current consumption	A (at 20°C)	0.41	0.63		0.76		0.92
	Static friction torque	N m	2.0 min.	3.9 min.	7.8 min.	16 min.		29 min.
		kgf cm	20 min.	40 min.	80 min.	160 min.		300 min.
	Absorption time (See note 3.)	ms	25 max.	35 max.	40 max.	60 max.		90 max.
	Release time (See note 3.)	ms	15 max.	15 max.	20 max.	40 max.		35 max.
	Backlash	(Reference value)	±0.36°	±0.32°	±0.27°	±0.24°		±0.21°
	Rating	---	Continuous					
	Insulation grade	---	Type B					

Note 1. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 2. The operation time measurement is the measured value with a surge killer installed.

Note 3. For Servomotors with brakes, increase the dimensions of the radiation shield by 50 mm each. (For example: t15 x 250 becomes t15 x 300.)

Note 4. The allowable radial load indicates the value at the center of the shaft (i.e., 1/2 of the output shaft length). (See the diagram below.)



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Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 30,000 hours at normal usage as the standard (or 20,000 hours for the items in parentheses).

Note 6. M-series 1,200-r/min, 1,100 to 1,800-W Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

2,000 r/min

Item	Unit	R88M -M20020	R88M -M40020	R88M -M70020	R88M -M1K120	R88M -M1K820	R88M -M2K220
Rated output (See note.)	W	200	400	700	1,100	1,800	2,200
Rated torque (See note.)	N m	0.955	1.91	3.34	5.25	8.58	10.5
	kgf cm	9.74	19.5	34.1	53.6	87.6	107
Rated rotation speed	r/min	2,000					
Momentary maximum rotation speed	r/min	2,200					
Momentary maximum torque (See note.)	N m	3.3	3.9	9.6	12.9	21.6	26.5
	kgf cm	34.0	40.0	98.0	132	220	270
Rated current (See note.)	A (rms)	2.0	3.3	4.1	5.5	8.6	12.3
Momentary maximum current (See note.)	A (rms)	7.1	7.1	14.2	14.2	35.4	35.4
Rotor inertia	kg m^2 ($GD^2/4$)	1.6×10^{-4}	6.3×10^{-4}	9.8×10^{-4}	1.6×10^{-3}	4.2×10^{-3}	4.9×10^{-3}
	kgf cm s^2	1.6×10^{-3}	6.4×10^{-2}	1.0×10^{-2}	1.6×10^{-2}	4.3×10^{-2}	5.0×10^{-2}
Torque constant (See note.)	N m/A	0.56	0.57	0.81	0.95	0.98	0.85
	kgf cm/A	5.7	5.8	8.3	9.7	10	8.7
Induced voltage constant (See note.)	mV/ (r/min)	35	40	50	62	50	53
Power rate (See note.)	kW/s	6.0	5.8	11	18	17	22
Mechanical time constant	ms	3.4	7.9	3.1	2.6	2.1	2.6
Winding resistance	Ω	10	6.1	3.1	2.2	0.70	0.58
Winding impedance	mH	46	32	25	21	17	14
Electrical time constant	ms	4.5	5.3	8.1	9.6	24	24
Momentary allowable radial load	N	420	880	940	1,000	2,,040	2,100
	kgf	43	90	96	102	208	214
Momentary allowable thrust load	N	1,180	2,380	2,380	2,380	5,390	5,390
	kgf	120	243	243	243	550	550
Allowable radial load	N	205 (250)	401 (470)	431 (500)	460 (540)	862 (1,000)	891 (1,030)
	kgf	21 (25)	41 (48)	44 (51)	47 (55)	88 (102)	91 (105)
Allowable thrust	N	19 (29)	68 (88)	58 (78)	58 (69)	156 (190)	147 (180)

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Item		Unit	R88M -M20020	R88M -M40020	R88M -M70020	R88M -M1K120	R88M -M1K820	R88M -M2K220
load		kgf	2 (3)	7 (9)	6 (8)	6 (7)	16 (19)	15 (18)
Weight	Without brake	kg	Approx. 3.2	Approx. 6.5	Approx. 9.0	Approx. 14	Approx. 22	Approx. 26
	With brake	kg	Approx. 3.6	Approx. 7.1	Approx. 10	Approx. 15	Approx. 24	Approx. 28
Radiation shield dimensions		Material: FE (See note 4.)	t15 x 250	t20 x 300			t20 x 400	
Applicable Position Driver (FND-)		200-V input	X12H-		X25H-		X50H-	
		100-V input	X12L-	---				
Brake specifications	Brake inertia	kg m^2 ($GD^2/4$)	6.7×10^{-4}	1.9×10^{-5}	3.2×10^{-5}	6.8×10^{-5}	2.8×10^{-4}	
		kgf cm s^2	6.8×10^{-5}	1.9×10^{-4}	3.3×10^{-4}	6.9×10^{-3}	2.9×10^{-3}	
	Excitation voltage	V	24 VDC ±10% (No polarity)					
	Power consumption	W (at 20°C)	6.0	9.8	15		18	
	Current consumption	A (at 20°C)	0.25	0.41	0.63		0.76	
	Static friction torque	N m	0.98 min.	2.0 min.	3.9 min.	7.8 min.	16 min.	
		kgf cm	10 min.	20 min.	40 min.	80 min.	160 min.	
	Absorption time (See note 3.)	ms	30 max.	25 max.	35 max.	40 max.	60 max.	90 max.
	Release time (See note 3.)	ms	10 max.	15 max.	15 max.	20 max.	40 max.	35 max.
	Backlash	(Reference value)	±0.85°	±0.36°	±0.32°	±0.27°	±0.24°	±0.21°
	Rating	---	Continuous					
	Insulation grade	---	Type B					

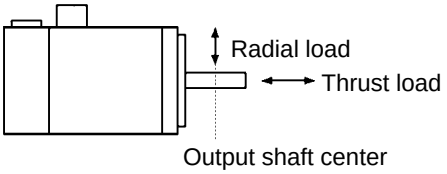
Note 1. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 2. The operation time measurement is the measured value with a surge killer installed.

Note 3. For Servomotors with brakes, increase the dimensions of the radiation shield by 50 mm each. (For example: t15 x 250 becomes t15 x 300.)

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Note 4. The allowable radial load indicates the value at the center of the shaft (i.e., 1/2 of the output shaft length). (See the diagram below.)



Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 30,000 hours at normal usage as the standard (or 20,000 hours for the items in parentheses).

Note 6. M-series 2,000-r/min 1,100 to 2,200-W Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

4,000 r/min

Item	Unit	R88M -M06040	R88M -M12040	R88M -M20040	R88M -M40040	R88M -M70040	R88M -M1K140	R88M -M2K040
Rated output (See note.)	W	60	120	200	400	700	1,100	2,000
Rated torque (See note.)	N m	0.143	0.286	0.477	0.955	1.67	2.62	4.77
	kgf cm	1.46	2.92	4.87	9.74	17.0	26.8	48.7
Rated rotation speed	r/min	4,000						
Momentary maximum rotation speed	r/min	4,400						
Momentary maximum torque (See note.)	N m	0.490	1.03	1.52	3.72	4.61	6.86	15.7
	kgf cm	5.00	10.5	15.5	38.0	47.0	70.0	160
Rated current (See note.)	A (rms)	1.5	1.8	2.1	3.4	4.6	5.0	10.5
Momentary maximum current (See note.)	A (rms)	4.9	7.1	7.1	14.2	14.2	14.2	35.4
Rotor inertia	kg m^2 ($GD^2/4$)	2.9×10^{-5}	4.1×10^{-5}	8.9×10^{-5}	1.6×10^{-4}	6.3×10^{-4}	9.8×10^{-4}	1.6×10^{-3}
	kgf cm s^2	3.0×10^{-4}	4.2×10^{-4}	9.1×10^{-4}	1.6×10^{-3}	6.4×10^{-3}	1.0×10^{-2}	1.6×10^{-2}
Torque constant (See note.)	N m/A	0.15	0.19	0.23	0.28	0.35	0.52	0.46
	kgf cm/A	1.5	1.9	2.3	2.9	3.6	5.3	4.7
Induced voltage constant (See note.)	mV/ (r/min)	8.0	11.3	16.3	20	23.3	31.7	30
Power rate (See note.)	kW/s	0.70	2.0	2.6	5.8	4.4	7.0	15
Mechanical time constant	ms	6.6	3.8	7.6	4.5	7.4	3.2	2.8
Winding resistance	Ω	7.35	4.7	6.52	3.55	2.2	1.33	0.57
Winding impedance	mH	13	12	25	15	12	11	5.5
Electrical time constant	ms	1.8	2.6	3.8	4.2	5.5	8.3	9.6

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Item		Unit	R88M -M06040	R88M -M12040	R88M -M20040	R88M -M40040	R88M -M70040	R88M -M1K140	R88M -M2K040
Momentary allowable radial load		N	140	160	370	420	880	940	1,000
		kgf	14	16	38	43	90	96	102
Momentary allowable thrust load		N	440	440	1,180	1,180	2,380	2,380	2,380
		kgf	45	45	120	120	243	243	243
Allowable radial load		N	58 (69)	58 (78)	147 (180)	166 (200)	323 (370)	343 (400)	362 (420)
		kgf	6 (7)	6 (8)	15 (18)	17 (20)	33 (38)	35 (41)	37 (43)
Allowable thrust load		N	5 (6.9)	4 (5.9)	19 (29)	19 (29)	58 (69)	49 (59)	39 (49)
		kgf	0.6 (0.7)	0.5 (0.6)	2 (3)	2 (3)	6 (7)	5 (6)	4 (5)
Weight	Without brake	kg	Approx. 1.2	Approx. 1.6	Approx. 2.3	Approx. 3.2	Approx. 6.5	Approx. 9.0	Approx. 14
	With brake	kg	Approx. 1.4	Approx. 1.8	Approx. 2.7	Approx. 3.6	Approx. 7.1	Approx. 10	Approx. 15
Radiation shield dimensions		Material: FE (See note 4.)	t15 x 250		t20 x 300				
Applicable Position Driver (FND-)		200-V input	X12H-				X25H-		X50H-
		100-V input	X12L-			---			
Brake specifications	Brake inertia	kg m^2 (GD^2/4)	1.5 x 10^{-6}		6.7 x 10^{-6}		1.9 x 10^{-5}	3.2 x 10^{-5}	6.8 x 10^{-5}
		kgf cm s^2	1.5 x 10^{-5}		6.8 x 10^{-5}		1.9 x 10^{-4}	3.3 x 10^{-5}	6.9 x 10^{-5}
	Excitation voltage	V	24 VDC ±10% (No polarity)						
	Power consumption	W (at 20°C)	5.0		6.0		9.8	15	
	Current consumption	A (at 20°C)	0.21		0.25		0.41	0.63	
	Static friction torque	N m	0.59 min.		0.98 min.		2.0 min.	3.9 min.	7.8 min.
		kgf cm	6 min.		10 min.		20 min.	40 min.	80 min.
	Absorption time (See note 3.)	ms	25 max.		30 max.		25 max.	35 max.	40 max.
	Release time (See note 3.)	ms	10 max.		10 max.		15 max.	15 max.	20 max.
	Backlash	(Reference value)	±1.2°		±0.85°		±0.36°	±0.32°	±0.27°
	Rating	---	Continuous						
	Insulation grade	---	Type B						

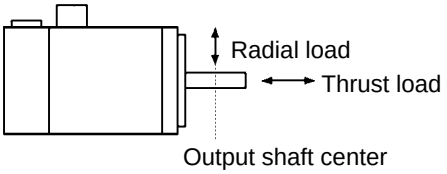
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Note 1. The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)

Note 2. The operation time measurement is the measured value with a surge killer installed.

Note 3. For Servomotors with brakes, increase the dimensions of the radiation shield by 50 mm each. (For example: t15 x 250 becomes t15 x 300.)

Note 4. The allowable radial load indicates the value at the center of the shaft (i.e., 1/2 of the output shaft length). (See the diagram below.)



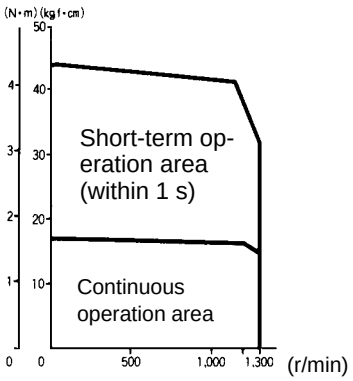
Note 5. The allowable radial load and the allowable thrust load are the values determined by taking a service life of 30,000 hours at normal usage as the standard (or 20,000 hours for the items in parentheses).

Note 6. M-series 4,000 r/min 1,100 to 2,000 W Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

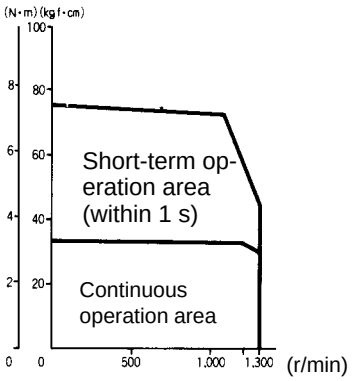
□Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)

1,200 r/min

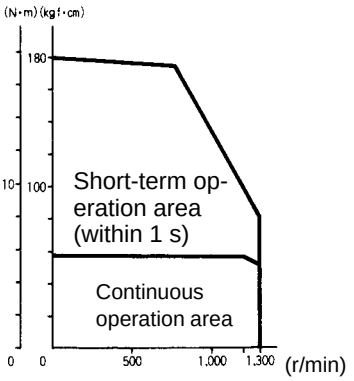
R88M-M20012



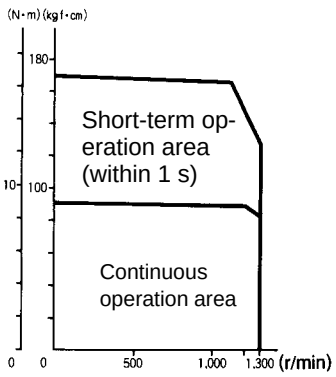
R88M-M40012



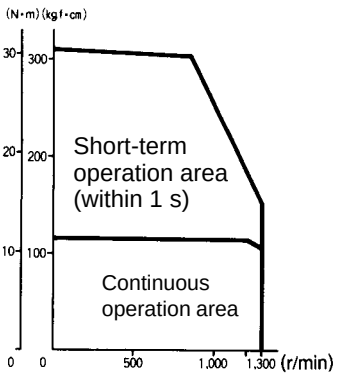
R88M-M70012



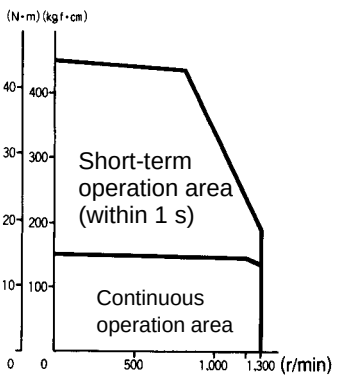
R88M-M1K112



R88M-M1K412



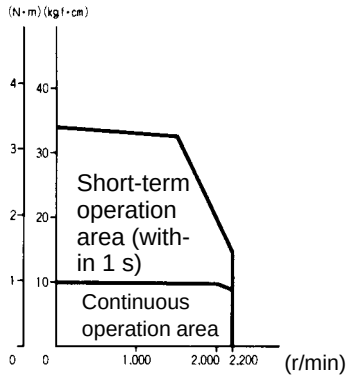
R88M-M1K812



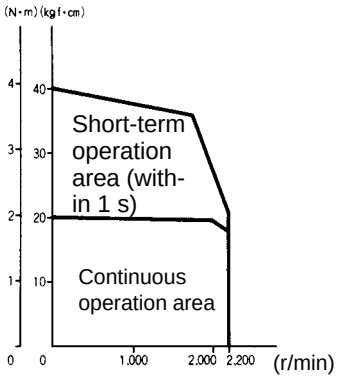
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2,000 r/min

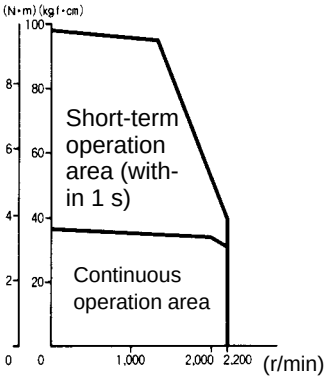
R88M-M20020



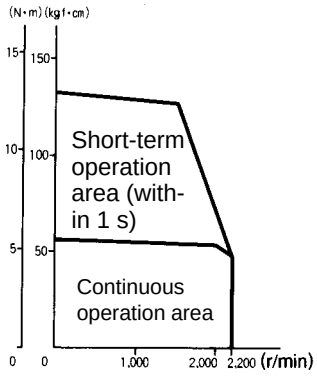
R88M-M40020



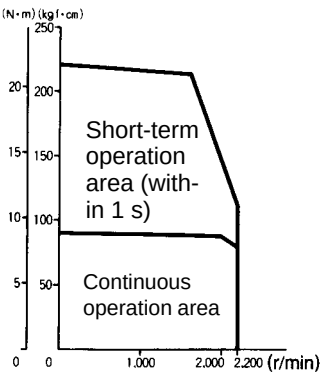
R88M-M70020



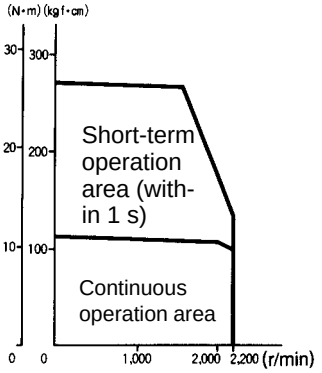
R88M-M1K120



R88M-M1K820



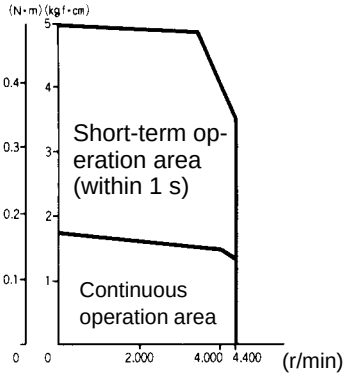
R88M-M2K220



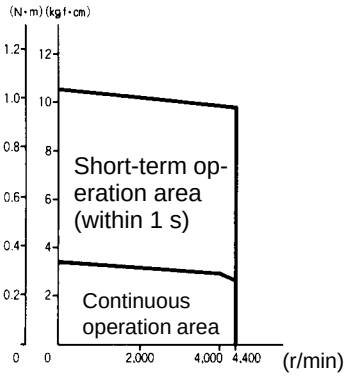
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4,000 r/min

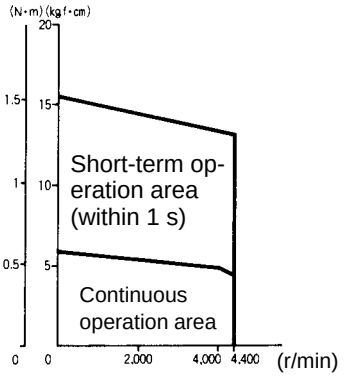
R88M-M06040



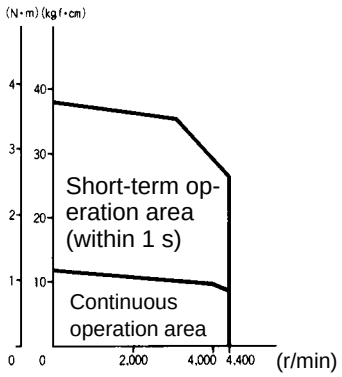
R88M-M12040



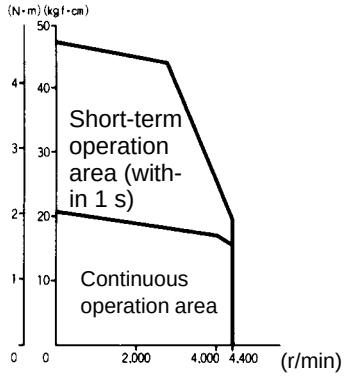
R88M-M20040



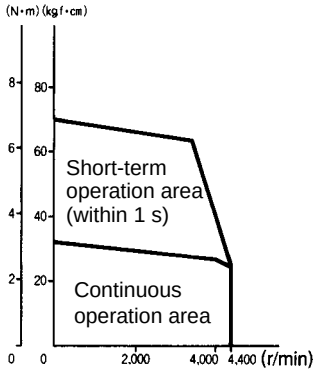
R88M-M40040



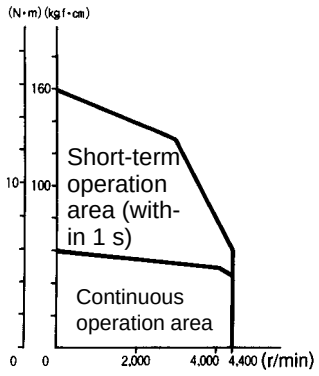
R88M-M70040



R88M-M1K140



R88M-M2K040



☐Resolver Specifications

Item	Standards
Accuracy	Absolute accuracy: 0.18° max. (Ambient temperature: 25°C)
Origin signal	2 pulses/revolution

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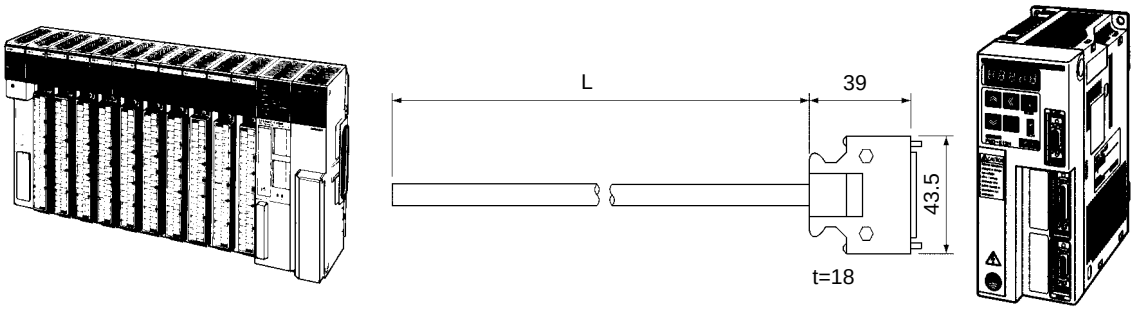
5-3 Cable Specifications

5-3-1 General Control Cables (DIO Position Drivers Only)

Cable Models

Model	Length (L)	Outer diameter of sheath
FND-CCX001S	1 m	11.8 dia.
FND-CCS002S	2 m	

Connection Configuration



SYSMAC C-series Programmable Controller

FND-X-series Position Driver

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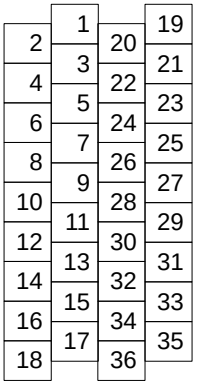
Wiring

Pin No.	Insulation color	Dot mark	Dot mark color	Signal name
1	Light brown	–	Black	CCWL
2	Light brown	–	Red	CWL
3	Yellow	–	Black	ORG
4	Yellow	–	Red	RUN
5	Light green	–	Black	START
6	Light green	–	Red	RESET
7	Gray	–	Black	SEARCH
8	Gray	–	Red	+JOG
9	White	–	Black	–JOG
10	White	–	Red	TEACH
11	Light brown	– –	Black	P.IN0
12	Light brown	– –	Red	P.IN1
13	Yellow	– –	Black	P.IN2
14	Yellow	– –	Red	P.IN3
15	Light green	– –	Black	P.IN4
16	Light green	– –	Red	P.IN5
17	Gray	– –	Black	P.IN6
18	Gray	– –	Red	P.IN7
19	White	– –	Black	OGND
20	White	– –	Red	STOP
21	Light brown	– – –	Black	BO
22	Light brown	– – –	Red	READY
23	Yellow	– – –	Black	S.COM
24	Yellow	– – –	Red	ORGSTP
25	Light green	– – –	Black	T.COM
26	Light green	– – –	Red	RUNON
27	Gray	– – –	Black	INP
28	Gray	– – –	Red	$\overline{\text{ALM}}$
29	White	– – –	Black	P.OUT0
30	White	– – –	Red	P.OUT1
31	Light brown	– – – –	Black	P.OUT2
32	Light brown	– – – –	Red	P.OUT3
33	Yellow	– – – –	Black	P.OUT4
34	Yellow	– – – –	Red	P.OUT5
35	Light green	– – – –	Black	P.OUT6
36	Light green	– – – –	Red	+24V

Cable: UL2464, AWG24X18P

Note Connect the shield to the shield plate under the connector cover.

Connector Pin Arrangement



Connector plug model: 10136-3000VE (Sumitomo 3M)
Connector case model: 10336-52A0-008 (Sumitomo 3M)

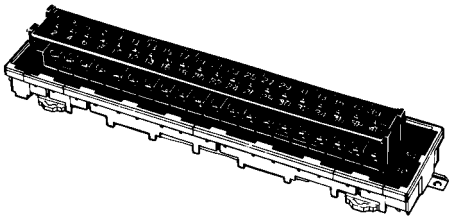
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5-3-2 Connector Terminal Board Conversion Unit Cables (DIO Position Drivers Only)

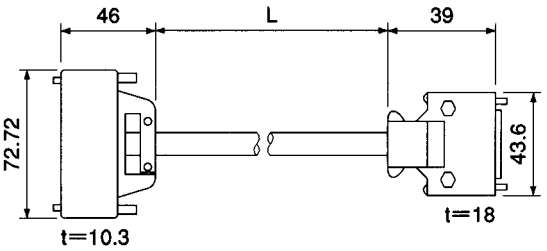
Cable Models

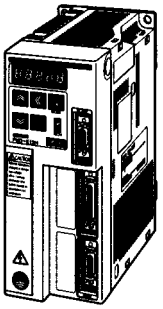
Model	Length (L)	Outer diameter of sheath
R88A-CTU001N	1 m	9.9 dia.
R88A-CTU002N	2 m	

Connection Configuration



XW2B-40F5-P Connector Terminal Board

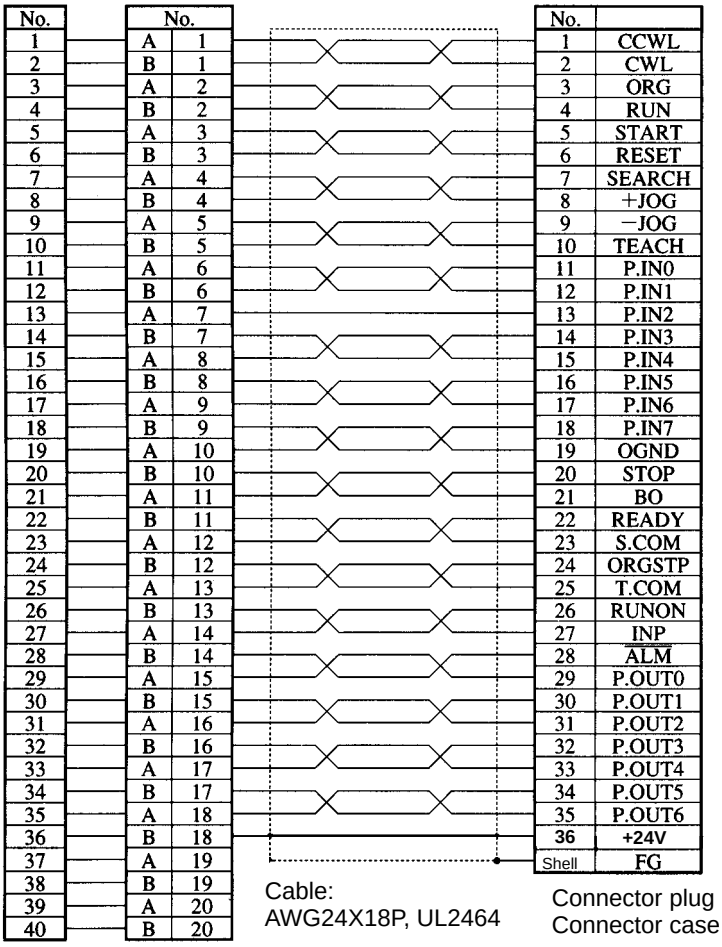




FND-X-series Position Driver

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Wiring



No.	No.		No.	
1	A	1	1	CCWL
2	B	1	2	CWL
3	A	2	3	ORG
4	B	2	4	RUN
5	A	3	5	START
6	B	3	6	RESET
7	A	4	7	SEARCH
8	B	4	8	+JOG
9	A	5	9	−JOG
10	B	5	10	TEACH
11	A	6	11	P.IN0
12	B	6	12	P.IN1
13	A	7	13	P.IN2
14	B	7	14	P.IN3
15	A	8	15	P.IN4
16	B	8	16	P.IN5
17	A	9	17	P.IN6
18	B	9	18	P.IN7
19	A	10	19	OGND
20	B	10	20	STOP
21	A	11	21	BO
22	B	11	22	READY
23	A	12	23	S.COM
24	B	12	24	ORGSTP
25	A	13	25	T.COM
26	B	13	26	RUNON
27	A	14	27	INP
28	B	14	28	$\overline{\text{ALM}}$
29	A	15	29	P.OUT0
30	B	15	30	P.OUT1
31	A	16	31	P.OUT2
32	B	16	32	P.OUT3
33	A	17	33	P.OUT4
34	B	17	34	P.OUT5
35	A	18	35	P.OUT6
36	B	18	36	+24V
37	A	19	Shell	FG
38	B	19		
39	A	20		
40	B	20		

Cable:
AWG24X18P, UL2464

Connector plug model: 10114-3000VE (Sumitomo 3M)
Connector case model: 10314-52A0-008 (Sumitomo 3M)

Connector plug model: FCN-361J040-AU (Fujitsu)
Connector case model: FCN-36C040-B (Fujitsu)

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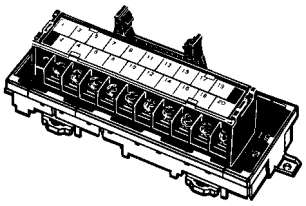
5-3-3 External Control Signal Connecting Cables (CompoBus/S Position Drivers Only)

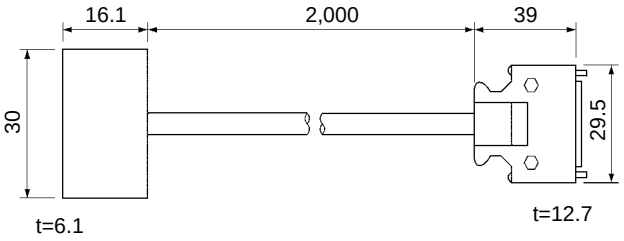
□Connector-Terminal Block Conversion Unit Cable

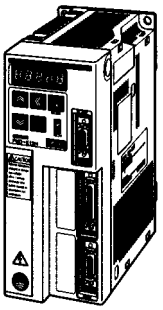
Cable

Model	Length (L)	Outer diameter of sheath
FND-CTX002N	2 m	7.4 dia.

Connection Configuration



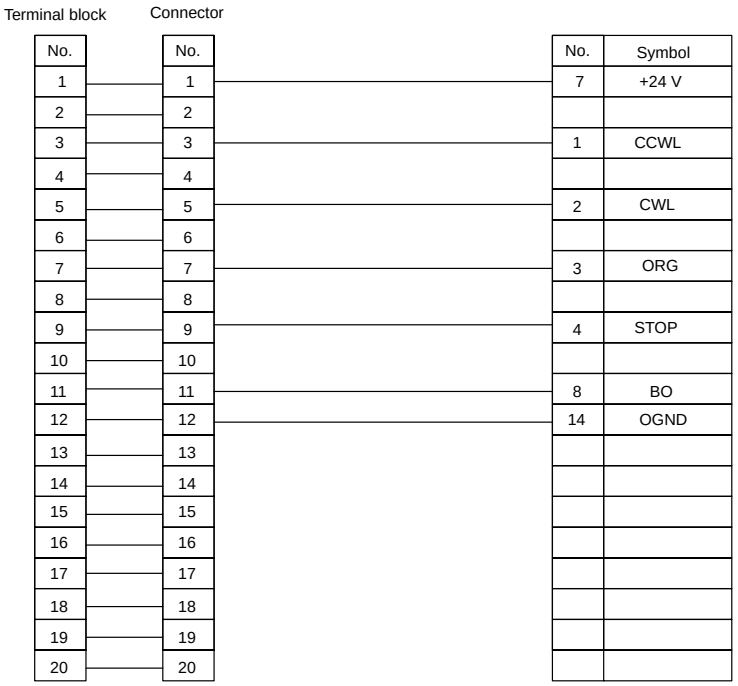




XW2B-20G4 or XW2B-20G5 Connector–Terminal Block

FND-X-series Position Driver

Wiring



Connector model: XG4M-2030-T (OMRON)

Contact plug model: 10114-3000VE (Sumitomo 3M)
Contact case model: 10314-52A0-008 (Sumitomo 3M)

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5-3-4 Encoder Cables

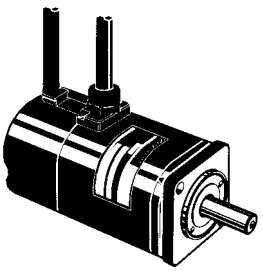
□Encoder Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards and U-UE-series Servomotors not Conforming to Any Standards With Incremental Encoder

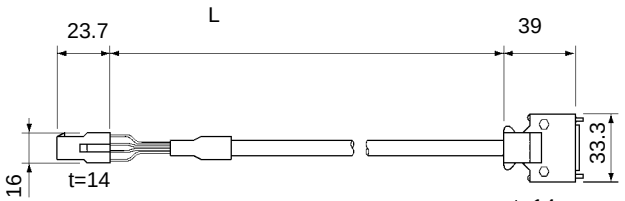
Cable Models

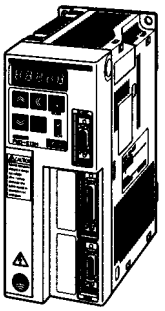
Model	Length (L)	Outer diameter of sheath
R88A-CRU003C	3 m	8 dia.
R88A-CRU005C	5 m	
R88A-CRU010C	10 m	
R88A-CRU015C	15 m	
R88A-CRU020C	20 m	

Note Up to a maximum of 20 meters between the Servomotor and the Position Driver is 20 m.

Connection Configuration





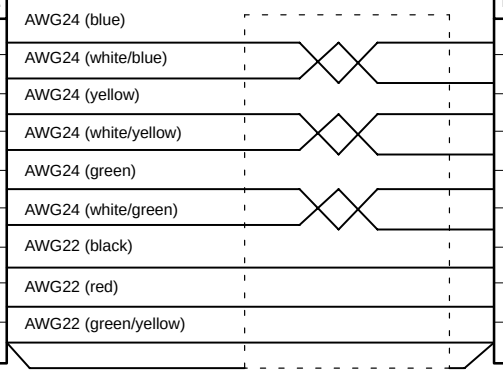


U-series 30-W to 750-W AC Servomotor
conforming to UL/cUL standards
U-UE-series AC Servomotor not conforming
to any standards with incremental encoder

FND-X-series Position Driver

Wiring

Symbol	No.
A+	1
A–	2
B+	3
B–	4
S+	5
S–	6
E0V	7
E5V	8
FG	9



No.	Symbol
1	A+
2	A–
3	B+
4	B–
5	S+
6	S–
7	E0V
8	E5V
9	FG

Cable: AWG22 × 3C + AWG24 × 3P
UL2589

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For Cable

Connector housing model:	172161-1 (Nippon Amp)	Contact plug model:	10120-3000VE (Sumitomo 3M)
Connector socket contact model:	170365-1 (Nippon Amp)	Contact case model:	10320-52A0-008 (Sumitomo 3M)
Crimping tool:	724649-1		
Pulling tool:	724668-2		

For Motor

Contact plug model:	172169-1 (Nippon Amp)
Connector pin contact model:	170359-1 (Nippon Amp)

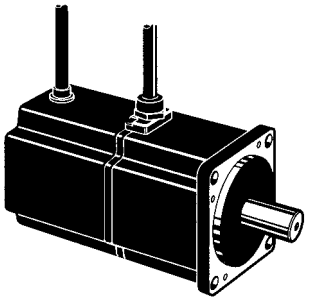
□Encoder Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards with Absolute Encoder

Cable Models

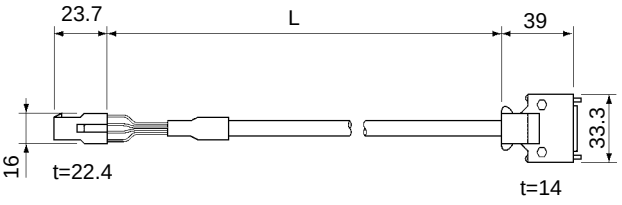
Model	Length (L)	Outer diameter of sheath
R88A-CSU003C	3 m	10.3 dia.
R88A-CSU005C	5 m	
R88A-CSU010C	10 m	
R88A-CSU015C	15 m	
R88A-CSU020C	20 m	

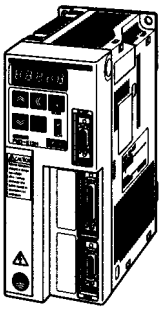
Note The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



U-series 30-W to 750-W AC Servomotor conforming to UL/cUL standards with absolute encoder

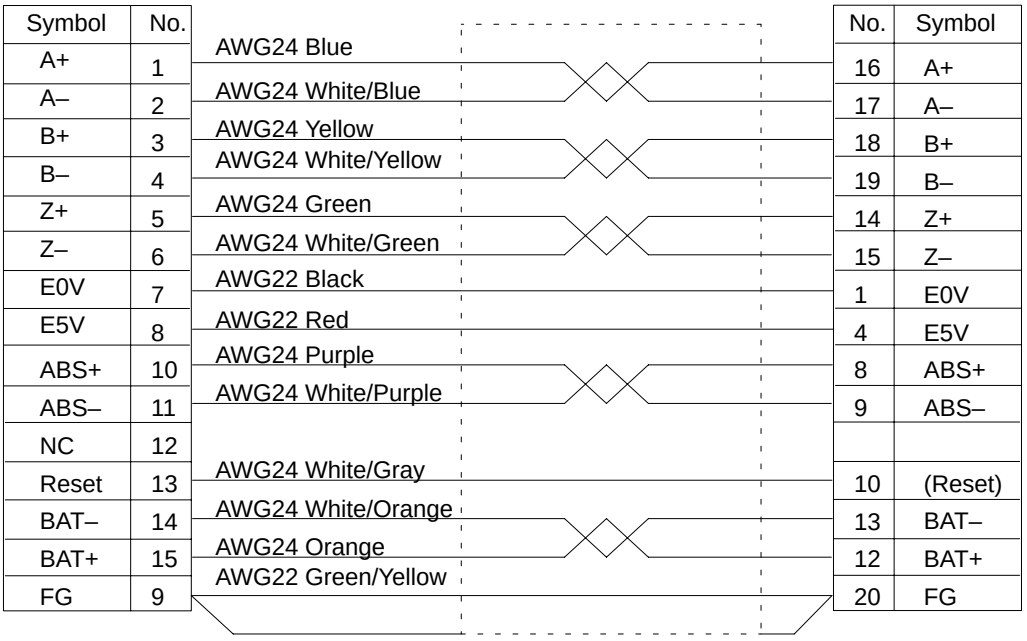




FND-X-series Position Driver

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Wiring



Cable: AWG22 × 3C + AWG24 × 6P
UL2589

For Cable

Connector housing model:	172163-1 (Nippon Amp)	Contact plug model:	10120-3000VE (Sumitomo 3M)
Connector socket contact model:	170365-1 (Nippon Amp)	Contact case model:	10320-52A0-008 (Sumitomo 3M)
Crimping tool:	724649-1		
Pulling tool:	724668-2		

For Motor

Contact plug model:	172171-1 (Nippon Amp)
Connector pin contact model:	170359-1 (Nippon Amp)

□Encoder Cables for U-series 30-W to 750-W Servomotors and U-UE-series Servomotors Conforming to EC Directives with Incremental Encoders

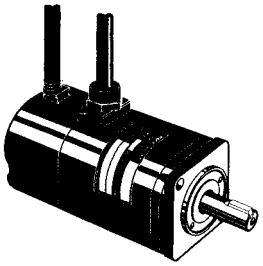
Cable Models

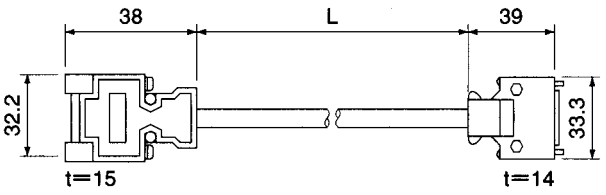
Model	Length (L)	Outer diameter of sheath
R88A-CRUD003C	3 m	8.0 dia.
R88A-CRUD005C	5 m	
R88A-CRUD010C	10 m	
R88A-CRUD015C	15 m	
R88A-CRUD020C	20 m	

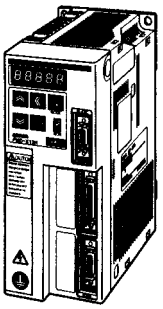
Note The maximum distance between the Servomotor and the Position Driver is 20 m.

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Connection Configuration







U-series 30-W to 750-W AC Servomotor conforming to EC Directives
U-UE-series AC Servomotor conforming to EC Directives with incremental encoder

FND-X-series Position Driver

Wiring

Symbol	No.
A+	1
A–	2
B+	3
B–	4
S+	5
S–	6
E0V	7
E5V	8
FG	9

AWG24 Blue
AWG24 White/Blue
AWG24 Yellow
AWG24 White/Yellow
AWG24 Green
AWG24 White/Green
AWG22 Black
AWG22 Red
AWG22 Green Yellow

No.	Symbol
16	A+
17	A–
18	B+
19	B–
14	S+
15	S–
1	E0V
4	E5V
20	
Shell	FG

Cable: AWG22 × 3C + AWG24 × 3P
UL2589

For Cable

Connector model: 17JE13090-02D8A (Daiichi Electronic Industries)
Contact plug model: 10120-3000VE (Sumitomo 3M)
Stand model: 17L-002A1 (Daiichi Electronic Industries)
Contact case model: 10320-52A0-008 (Sumitomo 3M)

For Motor

Connector model: 17JE23090-02D8A (Daiichi Electronic Industries)

□Encoder Cables for U-series 30-W to 750-W Servomotors Conforming to EC Directives with Absolute Encoders

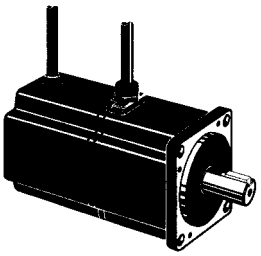
Cable Models

Model	Length (L)	Outer diameter of sheath
R88A-CSUD003C	3 m	10.3 dia.
R88A-CSUD005C	5 m	
R88A-CSUD010C	10 m	
R88A-CSUD015C	15 m	
R88A-CSUD020C	20 m	

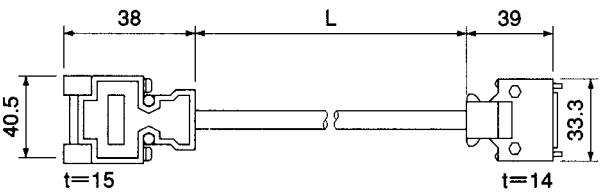
Note The maximum distance between the Servomotor and the Position Driver is 20 m.

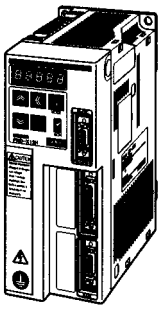
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Connection Configuration



U-series 30-W to 750-W AC Servomotor conforming to EC Directives with absolute encoder





FND-X-series Position Driver

Wiring

Symbol	No.		No.	Symbol
A+	1	AWG24 Blue	16	A+
A–	2	AWG24 White/Blue	17	A–
B+	3	AWG24 Yellow	18	B+
B–	4	AWG24 White/Yellow	19	B–
Z+	5	AWG24 Green	14	Z+
Z–	6	AWG24 White/Green	15	Z–
E0V	7	AWG22 Black	1	E0V
E5V	8	AWG22 Red	4	E5V
ABS+	10	AWG24 Purple	8	ABS+
ABS–	11	AWG24 White/Purple	9	ABS–
NC	12			
Reset	13	AWG24 White/Gray	10	(Reset)
BAT–	14	AWG24 White/Orange	13	BAT–
BAT+	15	AWG24 Orange	12	BAT+
FG	9	AWG22 Green/Yellow	20	
			Shell	FG

Cable: AWG22 × 3C + AWG24 × 6P

For Cable

Connector model: 17JE13150-02D8A (Daiichi Electronic Industries)
Contact plug model: 10120-3000VE (Sumitomo 3M)
Stand model: 17L-002A1 (Daiichi Electronic Industries)
Contact case model: 10320-52A0-008 (Sumitomo 3M)

For Motor

Connector model: 17JE23150-02D8A (Daiichi Electronic Industries)

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□Encoder Cables for U-series 1-kW to 2-kW Servomotors with Incremental or Absolute Encoders

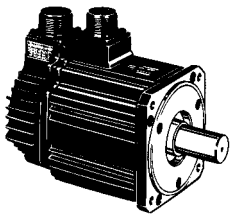
Note To conform to EC Directives, use the recommended connectors (refer to *2-1-2 Installation Conditions*).

Cable Models

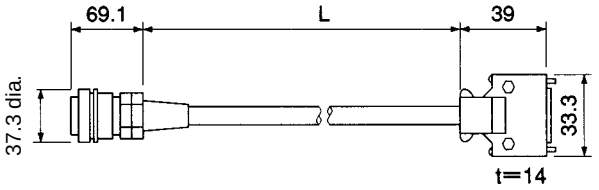
Model	Length (L)	Outer diameter of sheath
R88A-CRUB003C	3 m	10.3 dia.
R88A-CRUB005C	5 m	
R88A-CRUB010C	10 m	
R88A-CRUB015C	15 m	
R88A-CRUB020C	20 m	

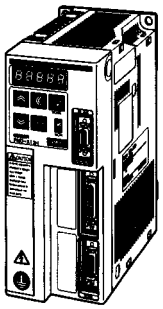
Note The maximum between the Servomotor and the Position Driver is 20 m.

Connection Configuration



U-series 1-kW to 2-kW AC Servomotor

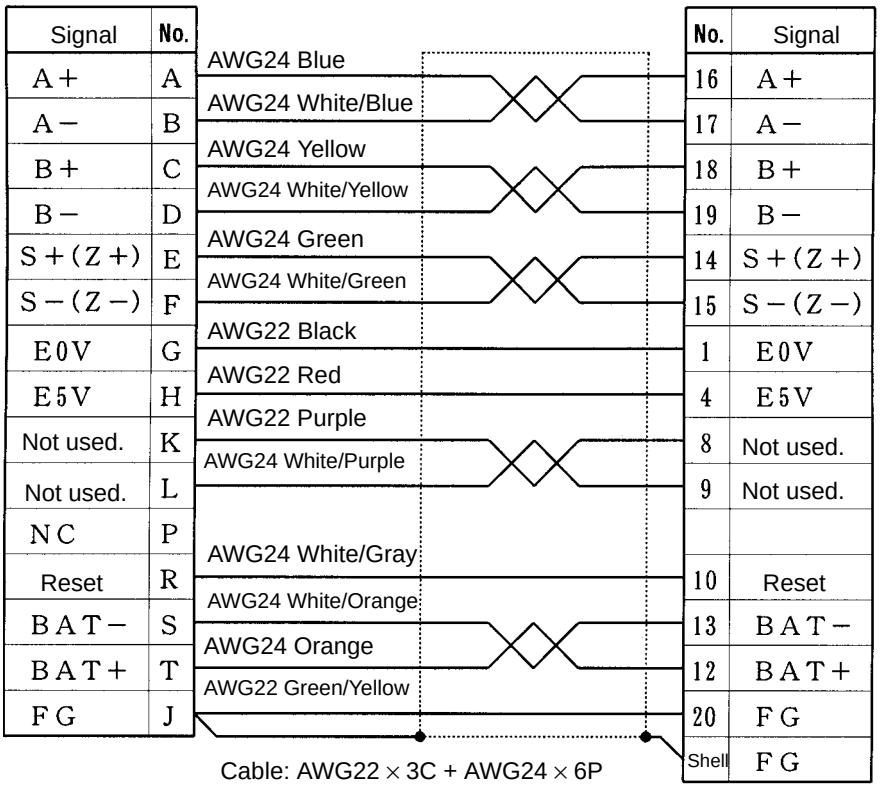




FND-X-series Position Driver

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Wiring



Cable: AWG22 × 3C + AWG24 × 6P

For Cable

Connector plug model: MS3106B20-29S
Cable clamp model: MS3057-12A
Connector plug model: 10120-3000VE (Sumitomo 3M)
Contact case model: 10320-52A0-008 (Sumitomo 3M)

For Motor

Receptacle model: MS3102A20-29P

□Encoder and Conversion Cables for H-series Servomotors

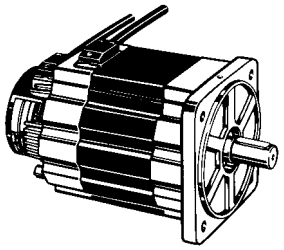
Encoder Cable Models

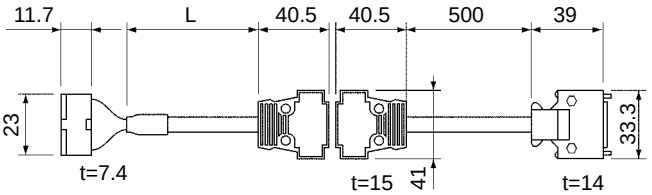
Model	Length (L)	Outer diameter of sheath
R88A-CRH001C	1 m	8.0 dia.
R88A-CRH003C	3 m	
R88A-CRH005C	5 m	
R88A-CRH010C	10 m	
R88A-CRH015C	15 m	
R88A-CRH020C	20 m	
R88A-CRH030C	30 m	

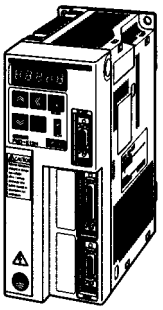
Note Up to a maximum of 30 m between the Servomotor and the Position Driver is 20 m.

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Connection Configuration







OMNUC H-series AC Servomotor | Encoder Cable | Conversion Cable | FND-X-series Position Driver

Wiring

Symbol	No.		No.	Symbol
E5V	1	Red	9	E5V
E0V	2	Black	13	E0V
RG	3	Gray	14	RG
A+	5	Blue	8	A+
A−	6	Orange	7	A−
B+	7	Pink	6	B+
B−	8	Light blue	5	B−
S+	9	Yellow	4	S+
S−	10	Brown	3	S−
SG	4	Green	15	SG

Cable: AWG22 × 3P + 3C
UL2589

For Cable

Plug housing model: SMP-10V-NC (J.S.T. Mfg. Co., Ltd.)
Contact socket model: BHF-001GI-0.8BS (J.S.T. Mfg. Co., Ltd.)
Crimping tool: YC-12
Pulling tool: SMJ-06

Contact plug model: XM2A-1501 (OMRON)
Contact case model: XM2S-1511 (OMRON)

For Motor

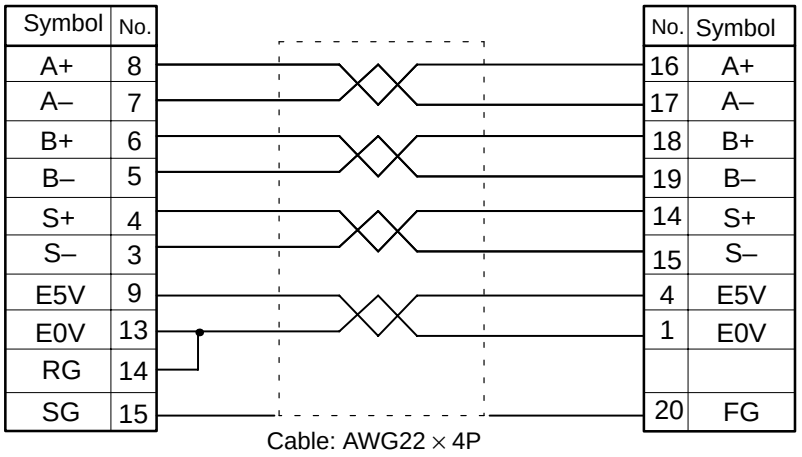
Receptacle housing model: SMR-10V-N (J.S.T. Mfg. Co., Ltd.)
Contact pin model: SYM-001G-0.6A (J.S.T. Mfg. Co., Ltd.)

Conversion Cable for H-series Servomotors

Model	Length (L)	Outer diameter of sheath
R88A-CRH0R5T	0.5 m	7.5 dia.

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Wiring



Cable: AWG22 × 4P

Contact cover model: XM2S-1511 (OMRON)
Contact socket model: XM2D-1501 (OMRON)
Fixture model: XM2Z-0001 (OMRON)

Contact plug model: 10120-3000VE (Sumitomo 3M)
Contact case model: 10320-52A0-008 (Sumitomo 3M)

5-3-5 Resolver Cables

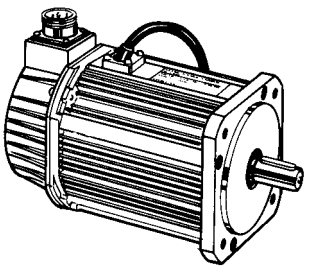
□Resolver and Conversion Cables for M-series Servomotors

Cable Models

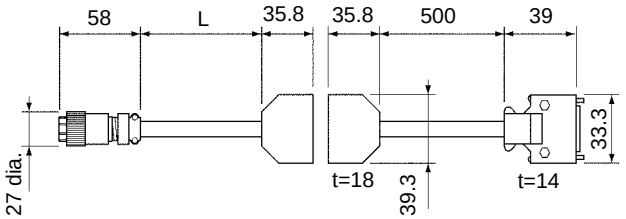
Model	Length (L)	Outer diameter of sheath
R88M-CRM003N	3 m	8.2 dia.
R88M-CRM005N	5 m	
R88M-CRM010N	10 m	
R88M-CRM015N	15 m	
R88M-CRM020N	20 m	
R88M-CRM030N	30 m	
R88M-CRM040N	40 m	
R88M-CRM050N	50 m	

Note The maximum distance between the Servomotor and the Position Driver is 50 m.

Connection Configuration

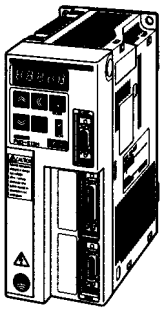


OMNUC M-series AC Servomotor



Resolver Cable

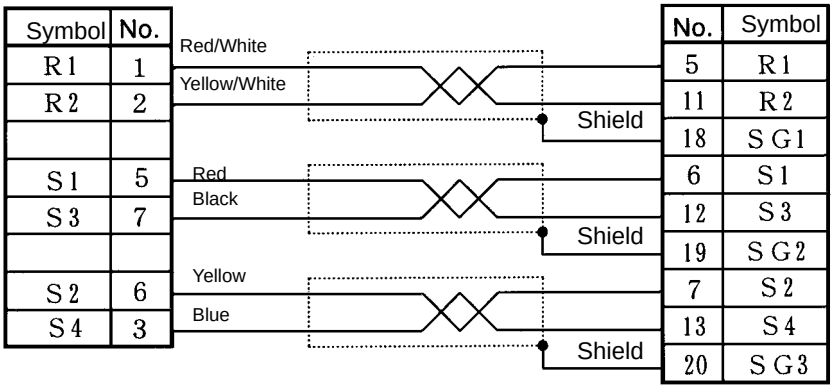
Conversion Cable



FND-X-series Position Driver

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Wiring



Cable: AWG24 x 3P

Connector Model

For Cable

Socket: JRC-16WPQ-7S (Hirose Electric)
Plug: JRC-16WPQ-CP10 (Hirose Electric)

Connector plug model: MR-20F (Honda Tsushin Kogyo Co., Ltd.)
Connector case model: MR-20L (Honda Tsushin Kogyo Co., Ltd.)

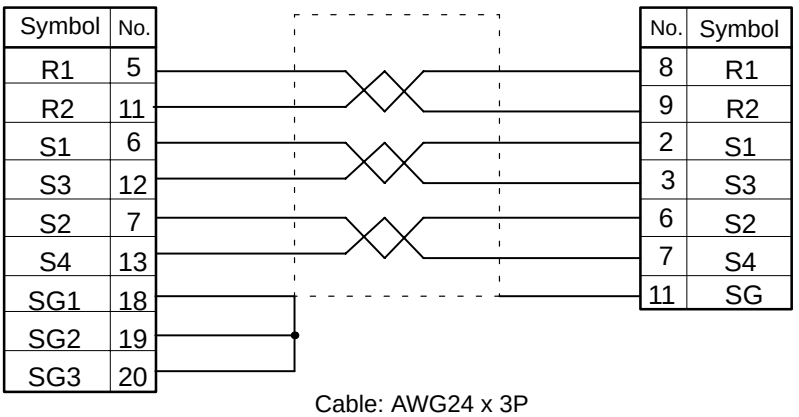
For Motor

Receptacle: JRC-16WRQ-7P (Hirose Electric)

Conversion Cable for M-series Servomotors

Model	Length (L)	Outer diameter of sheath
R88A-CRM0R5T	0.5 m	6.1 dia.

Wiring



Cable: AWG24 x 3P

Relay case model: MR-20LK2G (Honda Tsushin Kogyo Co., Ltd.)
Connector model: MR-20RM (Honda Tsushin Kogyo Co., Ltd.)

Connector plug model: 10120-3000VE (Sumitomo 3M)
Connector case model: 10320-52A0-008 (Sumitomo 3M)

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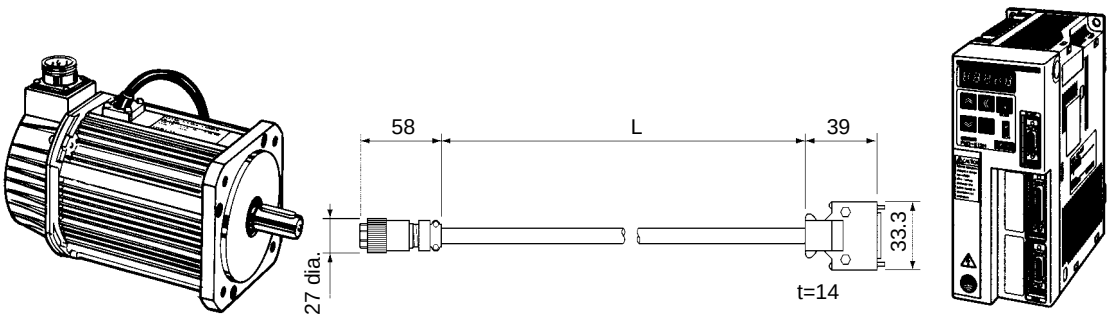
□Resolver Cables for M-series Servomotors

Cable Models

Model	Length (L)	Outer diameter of sheath
R88M-CRMA003N	3 m	8.2 dia.
R88M-CRMA005N	5 m	
R88M-CRMA010N	10 m	
R88M-CRMA015N	15 m	
R88M-CRMA020N	20 m	
R88M-CRMA030N	30 m	
R88M-CRMA040N	40 m	
R88M-CRMA050N	50 m	

Note The maximum distance between the Servomotor and the Position Driver is 20 m.

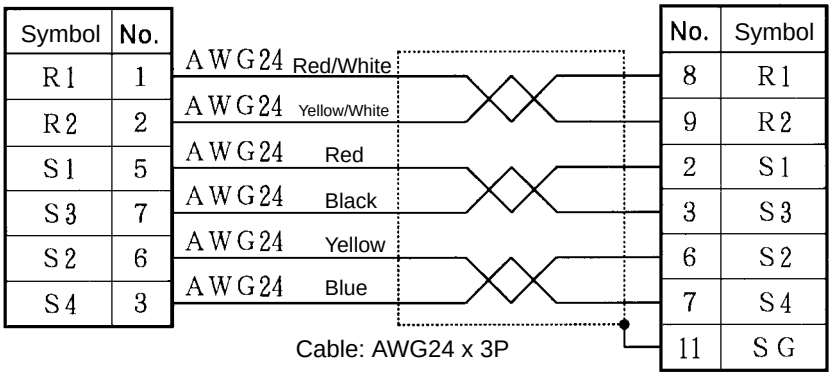
Connection Configuration



OMNUC M-series AC Servomotor

FND-X-series Position Driver

Wiring



For Cable

Socket: JRC-16WPQ-7S (Hirose Electric)
Plug: JRC-16WPQ-CP10 (Hirose Electric)

Connector plug model: 10120-3000VE (Sumitomo 3M)
Connector case model: 10320-52A0-008 (Sumitomo 3M)

For Motor

Receptacle: JRC-16WRQ-7P (Hirose Electric)

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5-3-6 Power Cables

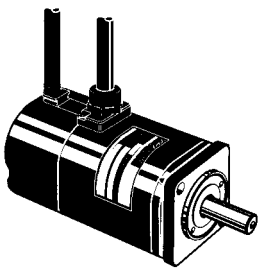
□Power Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards and U-UE-series Servomotors not Conforming to Any Standards without Brake

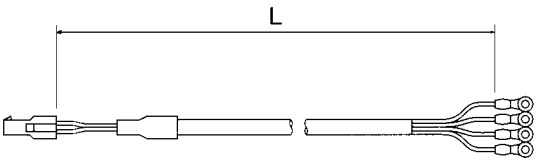
Cable Models

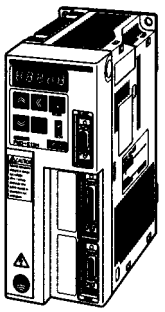
Model	Length (L)	Outer diameter of sheath
R88A-CAU003S	3 m	5.8 dia.
R88A-CAU005S	5 m	
R88A-CAU010S	10 m	
R88A-CAU015S	15 m	
R88A-CAU020S	20 m	

Note The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration





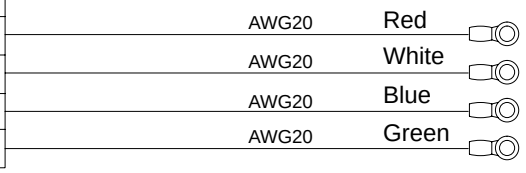


U-series 30-W to 750-W AC Servomotor
conforming to UL/cUL standards
UE-series AC Servomotor not conforming
to any standards without brake

FND-X-series Position Driver

Wiring

Symbol	No.
U-phase	1
V-phase	2
W-phase	3
GR	4



Cable: AWG20 × 4C
UL2517

M4 Crimp terminals

For Cable

Connector housing model:	172159-1 (Nippon Amp)
Connector socket contact model:	170366-1 (Nippon Amp)
Crimping tool:	724651-1
Pulling tool:	724668-2

For Motor

Contact plug model:	172167-1 (Nippon Amp)
Connector pin contact model:	170359-1 (Nippon Amp) 30 to 100 W 170360-1 (Nippon Amp) 200 to 750 W

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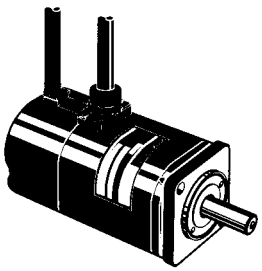
□Power Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards and U-UE-series Servomotors not Conforming to Any Standards With Brake

Cable Models

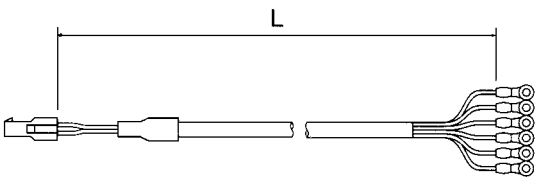
Model	Length (L)	Outer diameter of sheath
R88A-CAU003B	3 m	6.8 dia.
R88A-CAU005B	5 m	
R88A-CAU010B	10 m	
R88A-CAU015B	15 m	
R88A-CAU020B	20 m	

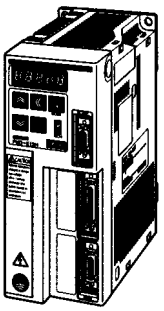
Note The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



U-series 30-W to 750-W AC Servomotor conforming to UL/cUL standards
U-UE-series AC Servomotor not conforming to any standards with brake

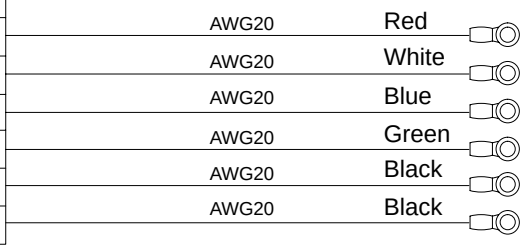




FND-X-series Position Driver

Wiring

Symbol	No.
U-phase	1
V-phase	2
W-phase	3
GR	4
Brake	5
Brake	6



Cable: AWG20 × 6C
UL2517

M4 Crimp terminals

For Cable

Connector housing model:	172160-1 (Nippon Amp)
Connector socket contact model:	170366-1 (Nippon Amp)
Crimping tool:	724651-1
Pulling tool:	724668-2

For Motor

Contact plug model:	172168-1 (Nippon Amp)
Connector pin contact model:	170359-1 (Nippon Amp) 30 to 100 W 170360-1 (Nippon Amp) 200 to 750 W

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□Power Cables for U-series 30-W to 750-W and U-UE-series Servomotors

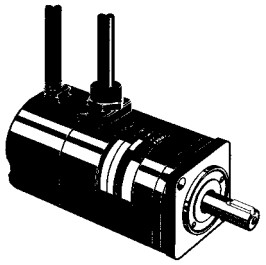
Cable Models

Model	Length (L)	Outer diameter of sheath	Remarks
R88A-CAU001	1 m	5.8 dia.	For models without brake
R88A-CAU01B	1 m	6.8 dia.	For models with brake

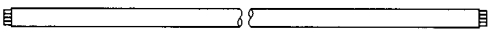
Note 1. The power cable comes in units of 1 m. Cut the cable as required to make the specified length.

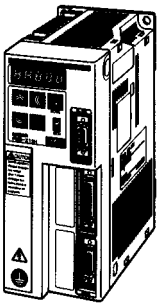
Note 2. The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



U-series 30-W to 750-W AC Servomotor
U-UE-series AC Servomotor

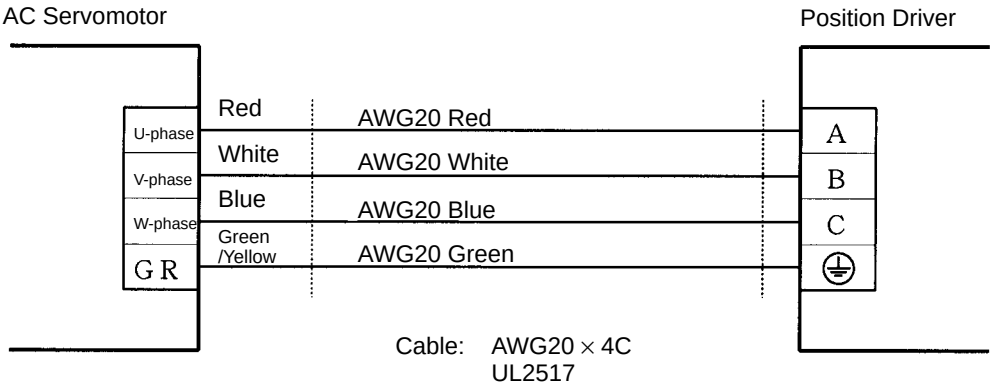




FND-X-series Position Driver

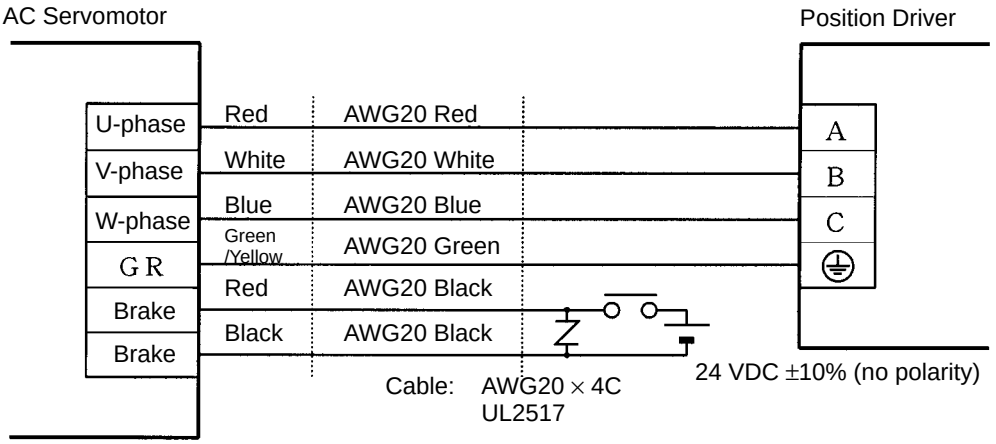
Wiring

R88A-CAU001



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R88A-CAU01B



□Power Cables for U-series 1-kW to 2-kW Servomotors Without Brake

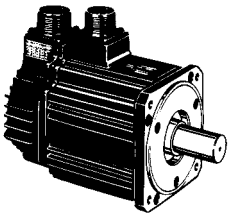
Note To conform to EC Directives, use the recommended connectors (refer to *2-1-2 Installation Conditions*).

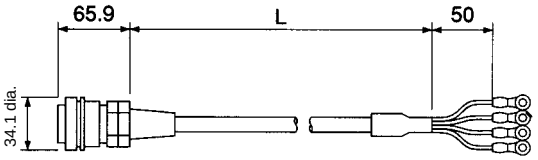
Cable Models

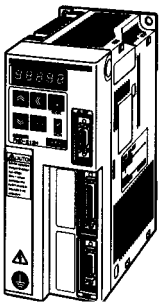
Model	Length (L)	Outer diameter of sheath
R88A-CAUB003S	3 m	14 dia.
R88A-CAUB005S	5 m	
R88A-CAUB010S	10 m	
R88A-CAUB015S	15 m	
R88A-CAUB020S	20 m	

Note The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration





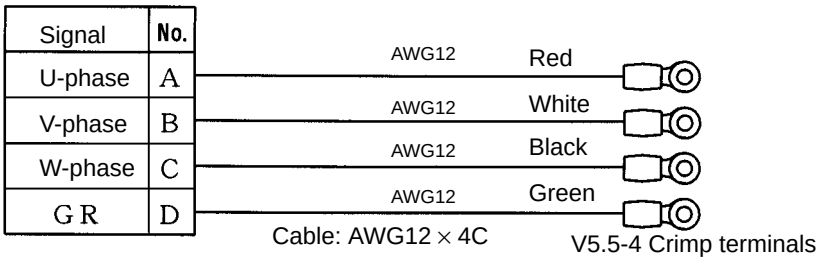


U-series 1-kW to 2-kW AC Servomotor without brake

FND-X-series Position Driver

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Wiring



For Cable
Connector plug model: MS3106B18-10S
Cable clamp model: MS3057-10A

For Motor
Receptacle MS3102A18-10P

□Power Cables for U-series 1-kW to 2-kW Servomotors With Brake

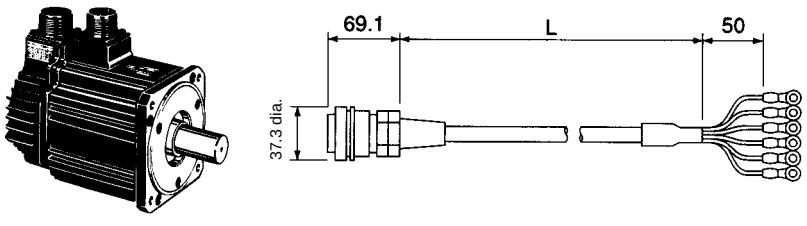
Note To conform to EC Directives, use the recommended connectors (refer to *2-1-2 Installation Conditions*).

Cable Models

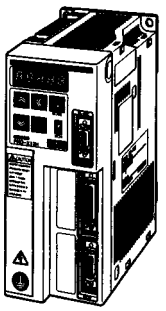
Model	Length (L)	Outer diameter of sheath
R88A-CAUB003S	3 m	16.5 dia.
R88A-CAUB005S	5 m	
R88A-CAUB010S	10 m	
R88A-CAUB015S	15 m	
R88A-CAUB020S	20 m	

Note The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



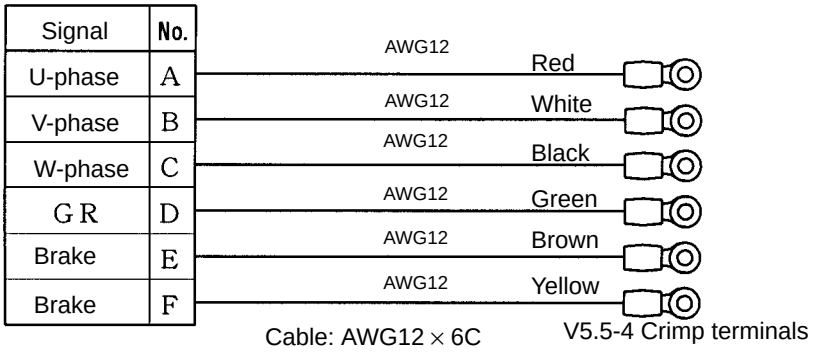
U-series 1-kW to 2-kW AC Servomotor with brake



FND-X-series Position Driver

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Wiring



For Cable
Connector plug model: MS3106B20-15S
Cable clamp model: MS3057-12A

For Motor
Receptacle model: MS3102A20-15P

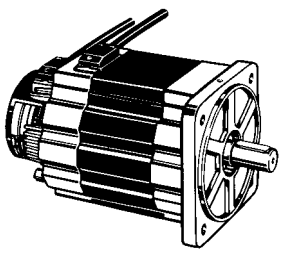
□Power Cables for H-series Servomotors Without Brake

Cable Models

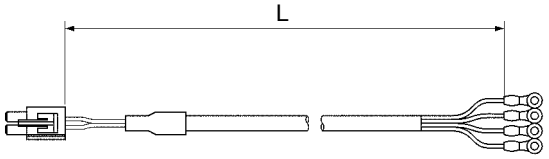
Model	Length (L)	Wire size	Outer diameter of sheath
R88A-CAH001S	1 m	AWG18	5.8 dia.
R88A-CAH003S	3 m		
R88A-CAH005S	5 m		
R88A-CAH010S	10 m		
R88A-CAH015S	15 m	AWG16	11.3 dia.
R88A-CAH020S	20 m		
R88A-CAH030S	30 m		

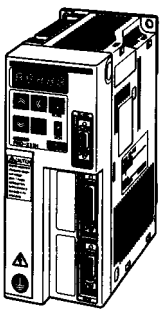
Note The maximum distance between the Servomotor and the Position Driver is 30 m.

Connection Configuration



OMNUC H-series AC Servomotor
(without brake)



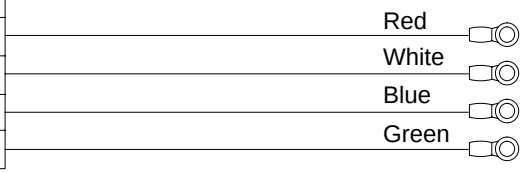


FND-X-series Position Driver

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Wiring

Symbol	No.
A-phase	1
B-phase	2
C-phase	3
GR	4



Cable: AWG18 × 4
AWG16 x 4
UL2517

M4 Crimp terminals

For Cable

Plug housing model: LP-04-1 (J.S.T. Mfg. Co., Ltd.)
Contact socket model: LLF-61T-2.0 (J.S.T. Mfg. Co., Ltd.)
Crimping tool: YC-9
Pulling tool: LEJ-20
Insertion tool LIT-2013

For Motor

Receptacle housing model: LR-04-1 (J.S.T. Mfg. Co., Ltd.)
Contact pin model: SLM-61T-2.0 (J.S.T. Mfg. Co., Ltd.)

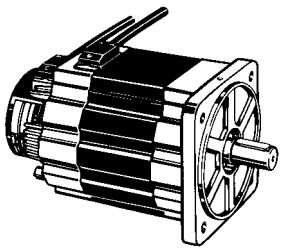
□Power Cables for H-series Servomotors With Brake

Cable Models

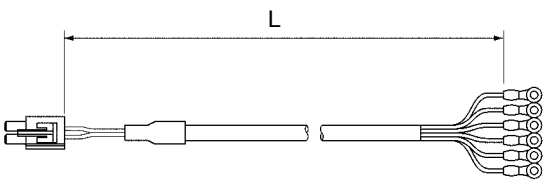
Model	Length (L)	Wire size	Outer diameter of sheath
R88A-CAH001B	1 m	AWG18	8.3 dia.
R88A-CAH003B	3 m		
R88A-CAH005B	5 m		
R88A-CAH010B	10 m		
R88A-CAH015B	15 m	AWG16	11.3 dia.
R88A-CAH020B	20 m		
R88A-CAH030B	30 m		

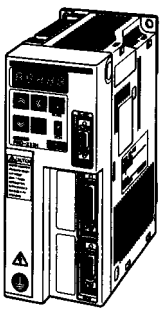
Note The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



OMNUC H-series AC Servomotor
(without brake)





FND-X-series Position Driver

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Wiring

Symbol	No.
A-phase	1
B-phase	2
C-phase	3
GR	4
Brake	5
Brake	6



Cable: AWG18 × 6 M4 Crimp terminals
AWG16 x 4 + AWG20 x 2
UL2517

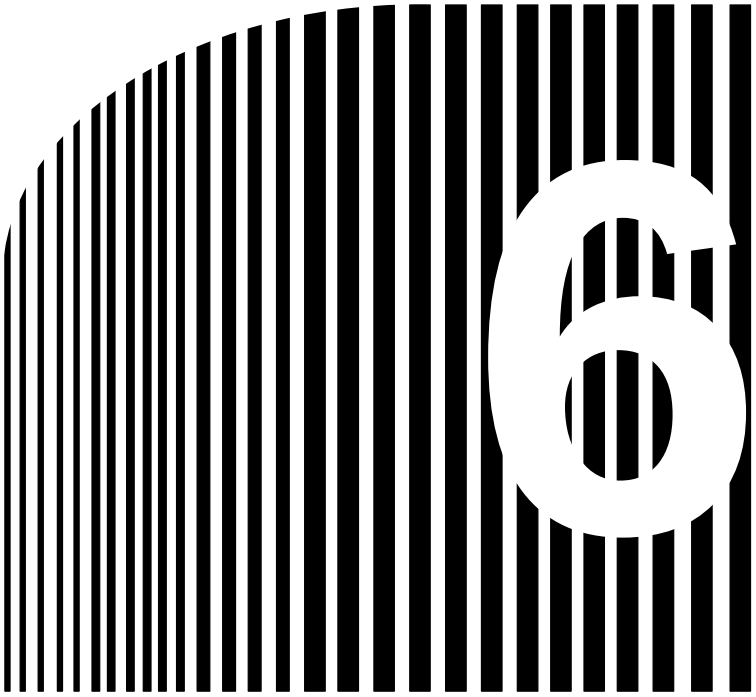
For Cable

Plug housing model: LP-06-1 (J.S.T. Mfg. Co., Ltd.)
Contact socket model: LLF-61T-2.0 (J.S.T. Mfg. Co., Ltd.)
Crimping tool: YC-9
Pulling tool: LEJ-20
Insertion tool: LIT-2013

For Motor

Receptacle housing model: LR-06-1 (J.S.T. Mfg. Co., Ltd.)
Contact pin model: SLM-61T-2.0 (J.S.T. Mfg. Co., Ltd.) A, B, C, GR
SLM-01T-2.0 (J.S.T. Mfg. Co., Ltd.) Brake

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Chapter 6

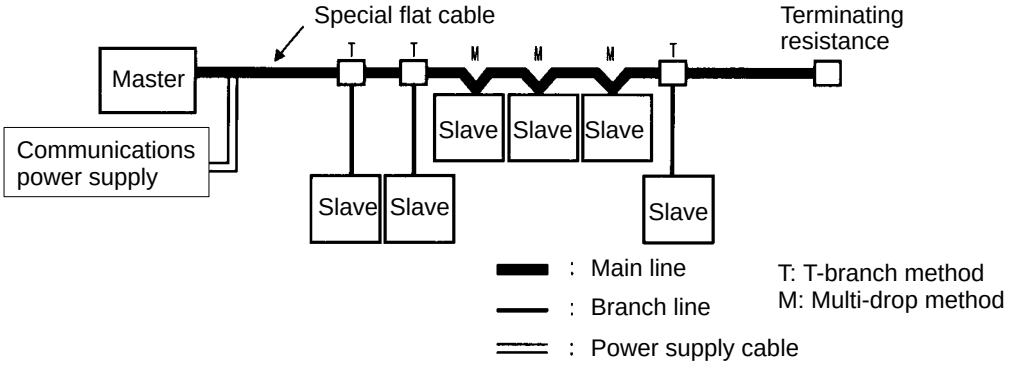
• CompoBus/S Specifications •

6-1 CompoBus/S Configuration Requirements
6-2 CompoBus/S Communications Specifications
6-3 Connecting a CompoBus/S System

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6-1 CompoBus/S Configuration Requirements

The CompoBus/S is configured as shown in the following diagram.



Masters

The Master controls the CompoBus/S and manages the external I/O for each of the Slaves. There is only one Master per CompoBus/S System. The Master must be connected at the end of the main line as shown in the above diagram.

Slaves

Slaves process external I/O by communicating with the CompoBus/S and Master.

Main and Branch Lines

The main line is the cable that connects the furthest separated terminals. Branch lines are the cables that branch out from the main line.

Cable

With the CompoBus/S, either special flat cable or VCTF cable can be used for communications. When flat cable is used, the communications power supply can be provided from the CompoBus/S cable. The configuration example in the above diagram uses flat cable. When VCTF cable is used, the power supply must be provided to the Slaves through a separate cable. (A communications power supply is not required for the FND-X.)

Connection Method

The CompoBus/S has two methods for connecting Slaves: the T-branch method and the multi-drop method. With the T-branch method, Slaves are connected to branch lines that branch off from the main line. With the multi-drop method, Slaves are connected directly to the main line.

Termination Resistance

In order to stabilize communications, it is necessary to install terminating resistance at the opposite end of the main line from the Master. There are two types of terminating resistance: the connector type with special flat cable, and the terminal block type.

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□Types of Connection-related Devices

Aside from Masters and Slaves, the following devices are used with a CompoBus/S System.

Cable Types

The following table shows the two cable types and their specifications.

Type	Specifications
VCTF (commercially available)	Vinyl cord, VCTF, JIS C 3306 Two-core nominal cross-sectional area: 0.75 mm^2 (signal line x 2) Conductor resistance (20°C): 25.1 Ω/km
SCA1-4F10 Special Flat Cable (length: 100 m)	Nominal cross-sectional area: 0.75 mm^2 x 4 (signal line x 2, power line x 2) Ambient operating temperature: 60°C max.

Note Do not use any VCTF cable other than two-core cable.

Connector and Terminal Block Types

The following table shows the types of connectors and terminal blocks that can be used.

Type	Model	Remarks
Pressure connector for branching	SCN1-TH4	This connector is used for branching from the main line to branch lines. It can only be used with special flat cable.
Pressure connector for extension	SCN1-TH4E	This connector is used for extending special flat cable.
Pressure connector with terminating resistance	SCN1-TH4T	This is a connector with terminating resistance. It can only be used with special flat cable.
Terminal block with terminating resistance	SRS1-T	This is a terminal block with terminating resistance. It can be used with either VCTF or special flat cable.

Note 1. Connect the terminating resistance (i.e., pressure connectors or terminal blocks with terminating resistance) at the end of the main line farthest from the Master.

Note 2. Use commercially available terminal blocks for branching or extending VCTF cable.

Note 3. For details regarding connectors and terminal blocks, refer to the *CompoBus/S Operation Manual (W266)*.

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6-2 CompoBus/S Communications Specifications

This section provides details for CompoBus/S communications.

□ Communications Specifications

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Communications method</td><td>Special CompoBus/S protocol</td></tr>
<tr><td>Communications baud rate</td><td>750,000 baud</td></tr>
<tr><td>Modulation method</td><td>Baseband method</td></tr>
<tr><td>Coding method</td><td>Manchester coding method</td></tr>
<tr><td>Error control checks</td><td>Manchester code check, frame length check, parity check</td></tr>
<tr><td>Cable used</td><td>Vinyl cord, VCTF, JIS C 3306:
Two-core nominal cross-sectional area: 0.75 mm^2 (signal line x 2) (VCTF cable)
Special flat cable: 0.75 mm^2 x 4 (signal line x 2, power line x 2)</td></tr>
<tr><td>Communications distance</td><td>VCTF Cable
<table>
<tr><td>Main line length</td><td>Branch line length</td><td>Total branch length</td></tr>
<tr><td>100 meters max.</td><td>3 meters max.</td><td>50 meters max.</td></tr>
</table>
Special Flat Cable
<table>
<tr><td>Main line length</td><td>Branch line length</td><td>Total branch length</td></tr>
<tr><td>30 meters max.</td><td>3 meters max.</td><td>30 meters max.</td></tr>
</table>
Even when special flat cable is used, if no more than 16 Slaves are connected the main line length can be extended to a maximum of 100 meters, and the total branch line length extended to a maximum of 50 meters.</td></tr>
</table>

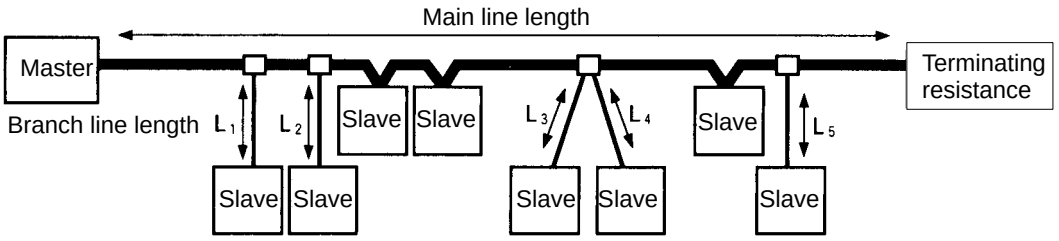
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<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Maximum number of I/O Points, maximum number of connected Slaves, communications cycle time</td><td>
When a C200HW-SRM21 or SRM1-C01/02 Master Unit is Used (for C200HX/HG/HE, C200HS)
<table>
<tr><th>Max. number of I/O points</th><th>Maximum number of Slaves</th><th>Communications cycle time</th></tr>
<tr><td>IN: 64; OUT: 64</td><td>IN:8; OUT: 8</td><td>0.5 ms</td></tr>
<tr><td>IN: 128; OUT: 128</td><td>IN: 16; OUT: 16</td><td>0.8 ms</td></tr>
</table>
When a CQM1 Master Unit is Used (For CQM1)
<table>
<tr><th>Max. I/O points</th><th>Maximum number of Slaves</th><th>Communications cycle time</th></tr>
<tr><td rowspan="2">IN: 64; OUT: 64</td><td>IN:8; OUT: 8 (in 8-pt. mode)</td><td>0.5 ms</td></tr>
<tr><td>IN: 16; OUT: 16 (in 4-pt. mode)</td><td>Cannot be used.*</td></tr>
<tr><td rowspan="2">IN: 32; OUT: 32</td><td>IN:4; OUT: 4 (in 8-pt. mode)</td><td>0.5 ms</td></tr>
<tr><td>IN:8; OUT: 8 (in 4-pt. mode)</td><td>Cannot be used.*</td></tr>
<tr><td rowspan="2">IN: 16; OUT: 16</td><td>IN:2; OUT: 2 (in 8-pt. mode)</td><td>0.5 ms</td></tr>
<tr><td>IN:4; OUT: 4 (in 4-pt. mode)</td><td>Cannot be used.*</td></tr>
</table>
*The 4-point mode cannot be used when an FND-X Position Driver is connected.
</td></tr>
</table>

Note Only the high-speed communications mode is available with the FND-X.

□Maximum Cable Length

The “main line length” indicates the sum of the cable lengths between the Master Unit and the terminating resistance connected to the farthest terminal from the main line. The “branch line length” indicates the length of any cable that branches off from the main line. The “total branch line length” indicates the sum of all the branch lines connected to the main line.



Total branch line length = $L_1 + L_2 + L_3 + L_4 + L_5$

The main line length, branch line length, and total branch line length depend on the type of cable used and the number of Slaves connected, as shown in the following table.

Cable type	Main line length	Branch line length	Total branch length
VCTF cable	100 m max.	3 m max.	50 m max.
Special flat cable	30 m max. (See note 1.)	3 m max.	30 m max. (See note 1.)

Note 1. If no more than 16 Slaves are connected, the main line can be extended to a maximum of 100 meters and the total branch line length to a maximum of 50 meters, just as with VCTF cable.

Note 2. Use either VCTF cable or special flat cable, and do not mix them.

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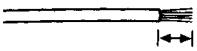
6-3 Connecting a CompoBus/S System

This manual only explains the CompoBus/S wiring related to FND-X-series Position Drivers. For more information on connecting communications cables, wiring, Slaves, and so on, refer to the *CompoBus/S Operation Manual (W266)*.

□Preparing Communications Cables

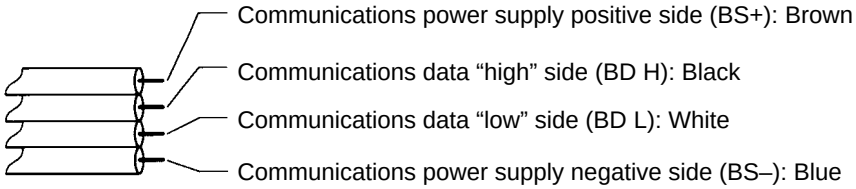
When connecting CompoBus/S cable to the Position Driver, follow the procedure shown below to prepare the cable.

1. Remove 5 to 7 mm of the insulation from the end of the communications cable (two wires), and securely twist the loose strands together for each of them.



When using commercially-available VCTF cable, determine in advance which signal wire is to be used for BD H (high) and which for BD L (low).

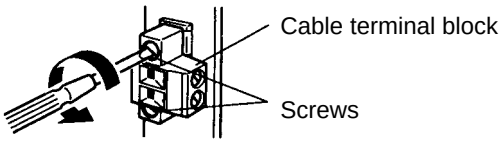
For special flat cable, the signal wires are as shown below.



2. When using special flat cable, the two power supply signal wires must be insulated.

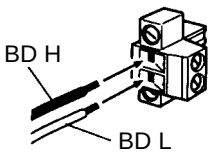
□Connecting Communications Cable

1. Use a flat-head screwdriver to loosen the Position Driver’s two CompoBus/S communications terminal screws, and remove the cable terminal block.



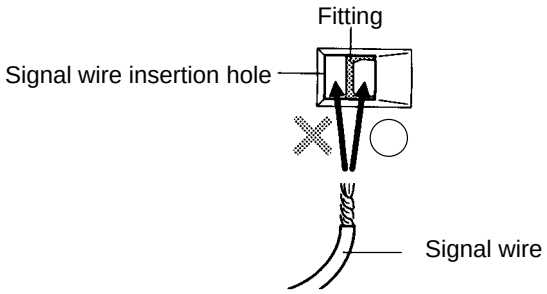
Note If the communications cable can be connected by simply tightening the screws, the cable terminal block need not be removed.

2. Loosen the screws that fasten the signal wires to the cable terminal block, and carefully insert the two signal wires into their respective holes in the terminal block.

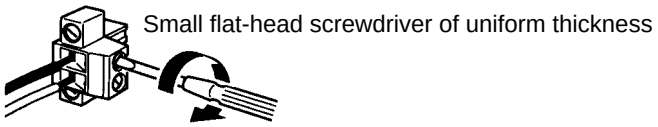


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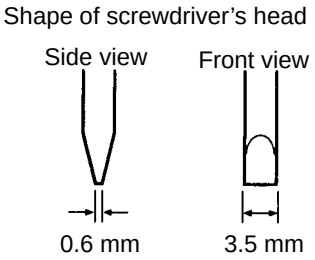
Note Before inserting the signal wires, make sure that the screws have been loosened sufficiently. If a screw is too tight when a wire is inserted, the wire may go into the gap in the rear of the fitting instead of going into the proper place. If this happens, the wire cannot be securely fastened.



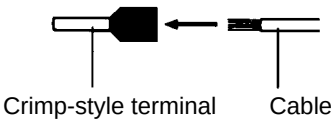
3. Tighten the cable terminal block screws to the proper torque of 0.5 N m for each signal wire. Use a small flat-head screwdriver with of uniform thickness. A normal screwdriver which is thin only at the end will not fit all the way in.



Note The XW4Z-00C Screwdriver is available from OMRON especially for this task.

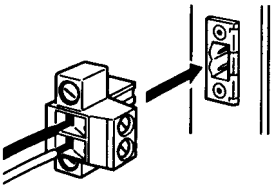


The A1 Series by Phoenix Contact is recommended as a crimp-stye terminal for the cable. Phoenix Contact also supplies the ZA3 as a special-purpose tool.



Insert the cable and crimp it.

4. Be careful to match the directions of the cable terminal block and the Position Driver's terminal block, and insert the cable terminal block. Be sure to push it all the way in.

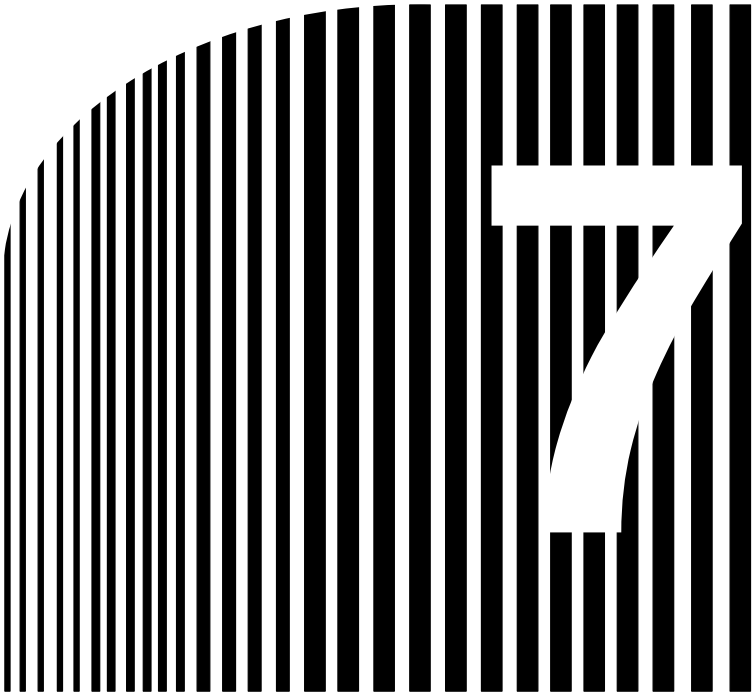


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Note Connect the cable with enough room so that it will not be pulled or bent. Also be sure not to place heavy objects on the cable cord, or it may cause short circuiting.

5. Use a flat-head screwdriver to fasten the two screws that were loosened in step 1 to a torque of 0.2 N m.

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Chapter 7

• Appendices •

7-1 Standard Models
7-2 Parameter Settings Tables

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7-1 Standard Models

☐Position Drivers

Specifications			Model
DIO Type	200-VAC input	6 A	FND-X06H
		12 A	FND-X12H
		25 A	FND-X25H
		50 A	FND-X50H
	100-VAC input	6 A	FND-X06L
		12 A	FND-X12L
CompoBus/S Type	200-VAC input	6 A	FND-X06H-SRT
		12 A	FND-X12H-SRT
		25 A	FND-X25H-SRT
		50 A	FND-X50H-SRT
	100-VAC input	6 A	FND-X06L-SRT
		12 A	FND-X12L-SRT

☐Teaching Box

Specifications			Model
Teaching Box			CVM1-PRO01
ROM Cassette	Common to FND-X, MC/NC Units		CVM1-MP702
	FND-X only		CVM1-MP703
Connecting Cable		2 m	CV500-CN22A
		4 m	CV500-CN42A
		6 m	CV500-CN62A

Note A ROM Cassette and Connecting Cable are required in order to use the Teaching Box.

☐External Regenerative Resistors

Specification	Model
Regeneration capacity: 100 W, 30Ω	R88A-RR20030
Regeneration capacity: 200 W, 30Ω	R88A-RR40030

☐General Control Cable (DIO Type)

Specifications		Model
Control Cable for FND-X	1 m	FND-CCX001S
(With connector on one end.)	2 m	FND-CCX002S

☐Connector-Terminal Board (DIO Type)

Specification		Model
Connector for Control Cable		R88A-CNU01C
Connector-Terminal Board		XW2B-40F5-P
Connecting Cable for Connector-Terminal Board	1 m	R88A-CTU001N
	2 m	R88A-CTU002N

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□Cable, Conversion Unit, Connector for External Control Signals

Specification		Model
Connector-Terminal Block Conversion Unit Cable	2 m	FND-CTX002N
Connector-Terminal Block Conversion Unit	M3 screws	XW2B-20G4
	M3.5 screws	XW2B-20G5
External Control Signal (CN4) Connector		R88A-CNX01C

Note When wiring the external control signal (C4) for the CompoBus/S type, either use the Unit in combination with a Connector-Terminal Block Conversion Unit and Cable, or prepare a cable yourself for the CN4 connector.

□U-series 30 to 750-W AC Servomotors Conforming to UL/cUL Standards with U-series Incremental Encoder

Specifications				Model
Straight shaft with no key	Standard (without brake)	3,000 r/min	30 W	R88M-U03030HA
			50 W	R88M-U05030HA
			100 W	R88M-U10030HA
			200 W	R88M-U20030HA
			400 W	R88M-U40030HA
			750 W	R88M-U75030HA
	With brake	3,000 r/min	30 W	R88M-U03030HA-B
			50 W	R88M-U05030HA-B
			100 W	R88M-U10030HA-B
			200 W	R88M-U20030HA-B
			400 W	R88M-U40030HA-B
			750 W	R88M-U75030HA-B
Straight shafts with keys	Standard (without brake)	3,000 r/min	30 W	R88M-U03030HA-S1
			50 W	R88M-U05030HA-S1
			100 W	R88M-U10030HA-S1
			200 W	R88M-U20030HA-S1
			400 W	R88M-U40030HA-S1
			750 W	R88M-U75030HA-S1
	With brake	3,000 r/min	30 W	R88M-U03030HA-BS1
			50 W	R88M-U05030HA-BS1
			100 W	R88M-U10030HA-BS1
			200 W	R88M-U20030HA-BS1
			400 W	R88M-U40030HA-BS1
			750 W	R88M-U75030HA-BS1

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□U-series 30 to 750-W AC Servomotors Conforming to UL/cUL Standards with U-series Absolute Encoder

Specifications				Model
Straight shafts with no keys	Standard (without brake)	3,000 r/min	30 W	R88M-U03030TA
			50 W	R88M-U05030TA
			100 W	R88M-U10030TA
			200 W	R88M-U20030TA
			400 W	R88M-U40030TA
			750 W	R88M-U75030TA
	With brake	3,000 r/min	30 W	R88M-U03030TA-B
			50 W	R88M-U05030TA-B
			100 W	R88M-U10030TA-B
			200 W	R88M-U20030TA-B
			400 W	R88M-U40030TA-B
			750 W	R88M-U75030TA-B
Straight shafts with keys	Standard (without brake)	3,000 r/min	30 W	R88M-U03030TA-S1
			50 W	R88M-U05030TA-S1
			100 W	R88M-U10030TA-S1
			200 W	R88M-U20030TA-S1
			400 W	R88M-U40030TA-S1
			750 W	R88M-U75030TA-S1
	With brake	3,000 r/min	30 W	R88M-U03030TA-BS1
			50 W	R88M-U05030TA-BS1
			100 W	R88M-U10030TA-BS1
			200 W	R88M-U20030TA-BS1
			400 W	R88M-U40030TA-BS1
			750 W	R88M-U75030TA-BS1

□U-series 30 to 750-W AC Servomotors Conforming to EC Directives with Incremental Encoder

Specifications				Model
Straight shafts with keys	Standard (without brake)	3,000 r/min	30 W	R88M-U03030VA-S1
			50 W	R88M-U05030VA-S1
			100 W	R88M-U10030VA-S1
			200 W	R88M-U20030VA-S1
			400 W	R88M-U40030VA-S1
			750 W	R88M-U75030VA-S1
	Standard (with brake)	3,000 r/min	30 W	R88M-U03030VA-BS1
			50 W	R88M-U05030VA-BS1
			100 W	R88M-U10030VA-BS1
			200 W	R88M-U20030VA-BS1
			400 W	R88M-U40030VA-BS1
			750 W	R88M-U75030VA-BS1

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□U-series 30 to 750-W AC Servomotors Conforming to EC Directives with Absolute Encoder

Specifications				Model
Straight shafts with no keys	Standard (without brake)	3,000 r/min	30 W	R88M-U03030XA-S1
			50 W	R88M-U05030XA-S1
			100 W	R88M-U10030XA-S1
			200 W	R88M-U20030XA-S1
			400 W	R88M-U40030XA-S1
			750 W	R88M-U75030XA-S1
	Standard (with brake)	3,000 r/min	30 W	R88M-U03030XA-BS1
			50 W	R88M-U05030XA-BS1
			100 W	R88M-U10030XA-BS1
			200 W	R88M-U20030XA-BS1
			400 W	R88M-U40030XA-BS1
			750 W	R88M-U75030XA-BS1

□U-UE-series AC Servomotors Not Conforming to Any Standards with Incremental Encoder

Specifications				Model
Straight shafts with keys	Standard (without brake)	3,000 r/min	100 W	R88M-UE10030H-S1
			200 W	R88M-UE20030H-S1
			400 W	R88M-UE40030H-S1
			750 W	R88M-UE75030H-S1
	With brake	3,000 r/min	100 W	R88M-UE10030H-BS1
			200 W	R88M-UE20030H-BS1
			400 W	R88M-UE40030H-BS1
			750 W	R88M-UE75030H-BS1

□U-UE-series AC Servomotors Conforming to EC Directives with Incremental Encoder

Specifications				Model
Straight shafts with keys	Standard (without brake)	3,000 r/min	100 W	R88M-UE10030V-S1
			200 W	R88M-UE20030V-S1
			400 W	R88M-UE40030V-S1
			750 W	R88M-UE75030V-S1
	With brake	3,000 r/min	100 W	R88M-UE10030V-BS1
			200 W	R88M-UE20030V-BS1
			400 W	R88M-UE40030V-BS1
			750 W	R88M-UE75030V-BS1

Note When selecting a U-series or U-UE-series Servomotor, the Servomotor must be a 200-VAC type (HA/TA/VA/XA or H/A) even when the U/U-UE Servomotor is combined with a 100-VAC-input Position Driver. A 100-VAC-type Servomotor cannot be connected.

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□U-series 1 to 2-kW AC Servomotors Not Conforming to Any Standards with Incremental Encoder

Specifications				Model
Straight shafts with no keys	Standard (without brake)	3,000 r/min	1 kW	R88M-U1K030H
			1.5 kW	R88M-U1K530H
			2 kW	R88M-U2K030H
	Standard (with brake)	3,000 r/min	1 kW	R88M-U1K030H-B
			1.5 kW	R88M-U1K530H-B
			2 kW	R88M-U2K030H-B
Straight shafts with keys	Standard (without brake)	3,000 r/min	1 kW	R88M-U1K030H-S1
			1.5 kW	R88M-U1K530H-S1
			2 kW	R88M-U2K030H-S1
	Standard (with brake)	3,000 r/min	1 kW	R88M-U1K030H-BS1
			1.5 kW	R88M-U1K530H-BS1
			2 kW	R88M-U2K030H-BS1

□U-series 1 to 2-kW AC Servomotors Not Conforming to Any Standards with Absolute Encoder

Specifications				Model
Straight shafts with no keys	Standard (without brake)	3,000 r/min	1 kW	R88M-U1K030T
			1.5 kW	R88M-U1K530T
			2 kW	R88M-U2K030T
	Standard (with brake)	3,000 r/min	1 kW	R88M-U1K030T-B
			1.5 kW	R88M-U1K530T-B
			2 kW	R88M-U2K030T-B

□U-series 1 to 2-kW AC Servomotors Conforming to EC Directives with Incremental Encoder

Specifications				Model
Straight shafts with keys	Standard (without brake)	3,000 r/min	1 kW	R88M-U1K030V-S1
			1.5 kW	R88M-U1K530V-S1
			2 kW	R88M-U2K030V-S1
	Standard (with brake)	3,000 r/min	1 kW	R88M-U1K030V-BS1
			1.5 kW	R88M-U1K530V-BS1
			2 kW	R88M-U2K030V-BS1

□U-series 1 to 2-kW AC Servomotors Conforming to EC Directives with Absolute Encoder

Specifications				Model
Straight shafts with keys	Standard (without brake)	3,000 r/min	1 kW	R88M-U1K030X-S1
			1.5 kW	R88M-U1K530X-S1
			2 kW	R88M-U2K030X-S1
	Standard (with brake)	3,000 r/min	1 kW	R88M-U1K030X-BS1
			1.5 kW	R88M-U1K530X-BS1
			2 kW	R88M-U2K030X-BS1

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□H-series AC Servomotors with Incremental Encoder

Specifications				Model
Straight shafts with keys	Standard (without brake)	3,000 r/min	50 W	R88M-H05030
			100 W	R88M-H10030
			200 W	R88M-H20030
			300 W	R88M-H30030
			500 W	R88M-H50030
			750 W	R88M-H75030
			1100 W	R88M-H1K130
	With brake	3,000 r/min	50 W	R88M-H05030-B
			100 W	R88M-H10030-B
			200 W	R88M-H20030-B
			300 W	R88M-H30030-B
			500 W	R88M-H50030-B
			750 W	R88M-H75030-B
			1100 W	R88M-H1K130-B

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□M-series AC Servomotors with Resolver

Specifications				Model
Straight shafts with keys	Standard (without brake)	1,200 r/min	200 W	R88M-M20012
			400 W	R88M-M40012
			700 W	R88M-M70012
			1100 W	R88M-M1K112
			1400 W	R88M-M1K412
			1800 W	R88M-M1K812
		2,000 r/min	200 W	R88M-M20020
			400 W	R88M-M40020
			700 W	R88M-M70020
			1100 W	R88M-M1K120
			1800 W	R88M-M1K820
			2200 W	R88M-M2K220
		4,000 r/min	60 W	R88M-M06040
			120 W	R88M-M12040
			200 W	R88M-M20040
			400 W	R88M-M40040
			700 W	R88M-M70040
			1100 W	R88M-M1K140
			2000 W	R88M-M2K040
	With brake	1,200 r/min	200 W	R88M-M20012-B
			400 W	R88M-M40012-B
			700 W	R88M-M70012-B
			1100 W	R88M-M1K112-B
			1400 W	R88M-M1K412-B
			1800 W	R88M-M1K812-B
		2,000 r/min	200 W	R88M-M20020-B
			400 W	R88M-M40020-B
			700 W	R88M-M70020-B
			1100 W	R88M-M1K120-B
			1800 W	R88M-M1K820-B
			2200 W	R88M-M2K220-B
		4,000 r/min	60 W	R88M-M06040-B
			120 W	R88M-M12040-B
			200 W	R88M-M20040-B
			400 W	R88M-M40040-B
			700 W	R88M-M70040-B
			1100 W	R88M-M1K140-B
			2000 W	R88M-M2K040-B

Note The 60-W and 120-W motor output shafts for the 4,000-r/min type are “A cut” (i.e., the cross-section of the shaft is shaped like an “A ”).

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☐Encoder Cable for U-series 30 to 750-W AC Servomotors Conforming to UL/cUL Standards

Specifications			Model
For Servomotors with incremental encoders. (With connectors on both sides.)		3 m	R88A-CRU003C
		5 m	R88A-CRU005C
		10 m	R88A-CRU010C
		15 m	R88A-CRU015C
		20 m	R88A-CRU020C
	Cable only	1-m units	R88A-CRU001
For Servomotors with absolute encoders. (With connectors on both sides.)		3 m	R88A-CSU003C
		5 m	R88A-CSU005C
		10 m	R88A-CSU010C
		15 m	R88A-CSU015C
		20 m	R88A-CSU020C

☐Encoder Cable for U-series 30 to 750-W AC Servomotors Conforming to EC Directives

Specifications			Model
For Servomotors with incremental encoders. (With connectors on both sides.)		3 m	R88A-CRUD003C
		5 m	R88A-CRUD005C
		10 m	R88A-CRUD010C
		15 m	R88A-CRUD015C
		20 m	R88A-CRUD020C
	Cable only	1-m units	R88A-CRU001
For Servomotors with absolute encoders. (With connectors on both sides.)		3 m	R88A-CSUD003C
		5 m	R88A-CSUD005C
		10 m	R88A-CSUD010C
		15 m	R88A-CSUD015C
		20 m	R88A-CSUD020C

☐Encoder Cable for U-UE-series AC Servomotors Not Conforming to Any Standards

Specifications			Model
For Servomotors with incremental encoders. (With connectors on both sides.)		3 m	R88A-CRU003C
		5 m	R88A-CRU005C
		10 m	R88A-CRU010C
		15 m	R88A-CRU015C
		20 m	R88A-CRU020C
	Cable only	1-m units	R88A-CRU001

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☐Encoder Cable for U-UE-series AC Servomotors Conforming to EC Directives

Specifications			Model
For Servomotors with incremental encoders. (With connectors on both sides.)		3 m	R88A-CRUD003C
		5 m	R88A-CRUD005C
		10 m	R88A-CRUD010C
		15 m	R88A-CRUD015C
		20 m	R88A-CRUD020C
	Cable only	1-m units	R88A-CRU001

☐Encoder Cable for U-series 1 to 2-kW AC Servomotors

Specifications		Model
For Servomotors with incremental encoders. (With connectors on both sides.)	3 m	R88A-CRUB003N
	5 m	R88A-CRUB005N
	10 m	R88A-CRUB010N
	15 m	R88A-CRUB015N
	20 m	R88A-CRUB020N

☐Encoder Cable for H-series AC Servomotors

Specifications		Model
With connectors on both sides	1 m	R88A-CRH001C
	3 m	R88A-CRH003C
	5 m	R88A-CRH005C
	10 m	R88A-CRH010C
	15 m	R88A-CRH015C
	20 m	R88A-CRH020C
	30 m	R88A-CRH030C
H-series Conversion Cable	50 cm	R88A-CRH0R5T

☐Resolver Cable for M-series AC Servomotors

Specifications		Model
With connectors on both sides	3 m	R88A-CRM003N
	5 m	R88A-CRM005N
	10 m	R88A-CRM010N
	15 m	R88A-CRM015N
	20 m	R88A-CRM020N
	30 m	R88A-CRM030N
	40 m	R88A-CRM040N
	50 m	R88A-CRM050N
M-series Conversion Cable	50 cm	R88A-CRM0R5T

Note Resolver Cables can be used in combination with M-series Conversion Cable.

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☐Power Cable for U-series 30 to 750-W AC Servomotors Conforming to UL/cUL Standards

Specifications			Model
Cable with connector on both sides for Servomotor without brake		3 m	R88A-CAU003S
		5 m	R88A-CAU005S
		10 m	R88A-CAU010S
		15 m	R88A-CAU015S
		20 m	R88A-CAU020S
	Cable only	1-m units	R88A-CAU001
Cable with connector on both sides for Servomotor with brake		3 m	R88A-CAU003B
		5 m	R88A-CAU005B
		10 m	R88A-CAU010B
		15 m	R88A-CAU015B
		20 m	R88A-CAU020B
	Cable only	1-m units	R88A-CAU01B

☐Power Cable for U-series 30 to 750-W AC Servomotors Conforming to EC Directives

Specifications		Model
For Servomotor without brake	1-m units	R88A-CAU001
For Servomotor with brake	1-m units	R88A-CAU01B

Note The above models are for the Cable only.

☐Power Cable for U-UE-series AC Servomotors Not Conforming to Any Standards

Specifications			Model
Cable with connector on both sides for Servomotor without brake		3 m	R88A-CAU003S
		5 m	R88A-CAU005S
		10 m	R88A-CAU010S
		15 m	R88A-CAU015S
		20 m	R88A-CAU020S
	Cable only	1-m units	R88A-CAU001
Cable with connector on both sides for Servomotor with brake		3 m	R88A-CAU003B
		5 m	R88A-CAU005B
		10 m	R88A-CAU010B
		15 m	R88A-CAU015B
		20 m	R88A-CAU020B
	Cable only	1-m units	R88A-CAU01B

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☐Power Cable for U-UE-series AC Servomotors Conforming to EC Directives

Specifications		Model
For Servomotor without brake	1-m units	R88A-CAU001
For Servomotor with brake	1-m units	R88A-CAU01B

Note The above models are for the Cable only.

☐Power Cable for U-series 1 to 2-kW AC Servomotors

Specifications		Model
Cable with connector on both sides for Servomotor without brake	3 m	R88A-CAUB003S
	5 m	R88A-CAUB005S
	10 m	R88A-CAUB010S
	15 m	R88A-CAUB015S
	20 m	R88A-CAUB020S
Cable with connector on both sides for Servomotor with brake	3 m	R88A-CAUB003B
	5 m	R88A-CAUB005B
	10 m	R88A-CAUB010B
	15 m	R88A-CAUB015B
	20 m	R88A-CAUB020B

☐Power Cable for H-series AC Servomotors

Specifications		Model
Cable with connector on one end for Servomotor without brake	1 m	R88A-CAH001S
	3 m	R88A-CAH003S
	5 m	R88A-CAH005S
	10 m	R88A-CAH010S
	15 m	R88A-CAH015S
	20 m	R88A-CAH020S
	30 m	R88A-CAH030S
Cable with connector on one end for Servomotor with brake	1 m	R88A-CAH001B
	3 m	R88A-CAH003B
	5 m	R88A-CAH005B
	10 m	R88A-CAH010B
	15 m	R88A-CAH015B
	20 m	R88A-CAH020B
	30 m	R88A-CAH030B

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7-2 Parameter Settings Tables

□User Parameters (UP-01 to UP-29)

No. UP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?	Set value
01	Control mode	---	00 to FF	11	Specifies position control mode: 11: Point positioning (PTP) 12: Point positioning (feeder) 13: Direct positioning (PTP) 14: Direct positioning (feeder)	Yes	
02	Motor code	---	0000 to FFFF	0000	Motor model code	Yes	
03	Resolver cable length	1 m	1 to 120	5	Sets the resolver cable length for when M-series motor is used. (Valid only for M-series motors.)	No	
07	In-position width	1 pulse	1 to 32,767	3	Outputs positioning completed signal (INP) according to number of motor sensor pulses set as positioning deviation. OMNUC U Series with incremental encoder: 8,192 pulses/rotation OMNUC U Series with absolute encoder: 4,096 pulses/rotation OMNUC U/U-UE Series with: 4,096 pulses/rotation OMNUC H Series with absolute encoder: 8,000 pulses/rotation OMNUC M Series: 24,000 pulses/rotation	No	
11	Current limit	0.1%	0.0 to 100.0	100.0	Specifies rate based on maximum motor current as 100%.	No	
14	S-curve acceleration/deceleration time	0.01 s	0.00 to 32.76	0.00	Sets the time until 90% of the target speed is obtained. “0.00“ sets trapezoidal acceleration and deceleration.	No	
16	Brake mode	---	0 to 3	0	0: Dynamic brake 1: On-hold brake (stops in deceleration time) 2: On-hold brake (stops after rotation according to error counter’s accumulated number of pulses) 3: On-hold brake (free-running stop)	Yes	

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No. UP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?	Set value
25	Monitor output	---	000 to 011	010	Specifies monitor output function. 0 └ Positive voltage 0: Not reversed 1: Reversed └ Speed/Current selection 0: Current 1: Speed	No	
26	Motor rotation direction	---	0, 1	0	Specifies motor rotation direction. 0: Forward rotation 1: Reverse direction	No	
28	Brake ON speed	0.1%	0.0 to 100.0	1.0	Specifies r/min to turn OFF break output in on-hold brake mode. Specifies rate based on rated motor r/min as 100%. * The brake may be damaged if the on-hold brake mode is selected for motors rotating at high speed.	No	
29	Motor test speed	1 r/min	1 to 8,000	50	Specifies r/min for motors for testing. * When testing a motor, make sure that the set value is less than the rated motor r/min.	No	
30	External regeneration resistance value	0.1 Ω	0.0 to 100.0	0.0	Specifies the regeneration absorption value (Ω). * Only valid for FND-X50H- . * When using an OMRON-made external Regeneration Resistor, set to 30.0 (Ω).	Yes	
31	External regeneration resistance capacity	0.01 kW	0.00 to 327.67	0.00	Specifies the regeneration absorption capacity (kW). Only valid for FND-X50H- .	Yes	

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□H Parameters (HP-33, HP-46)

No. HP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?	Set value
33	Load rate time	1 s	1 to 60	30	Specifies interval for effective load factor calculation to value obtained from machine cycle time multiplied by integer.	No	
46	In-position timer (See note.)	3.2 ms	3.2 to 320.0	3.2	Specifies minimum positioning completion ON time and minimum READY signal OFF time.	No	

Note If the positioning completed signal (READY) is input to the Programmable Controller (PC), make sure that the set value is large enough so that the PC can respond.
Set value ≧ PC cycle time × 2 + PC input delay time + 1 ms
For the CompoBus/S type, make the PC's input delay time two times that of the communications cycle.

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□PTP Parameters (PP-01 to PP-26)

No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?	Set value
01	Minimum setting unit	---	0.0001 to 1	0.0001	Specifies basic unit for movement and speed value setting and display.	Yes	
02	Pulse rate 1 (Rotation)	1 revolution	1 to 32,767	1	Specifies PP-02 to n and PP-03 to x (Note: "n" is the number of motor revolutions and "x" is machine axis movement.)	Yes	
03	Pulse rate 2 (Movement)	1	1 to 32,767	10		Yes	
04	Minimum resolution (leftmost digits)	---	---	0.0	Displays the movement of the mechanical axis per 1 motor sensor pulse. (Setting not possible.)	Yes	
05	Minimum resolution (rightmost digits)	---	---	0042		Yes	
06	Origin compensation (leftmost digits)	1 pulse	–9,999 to 9,999	0	Specifies number of motor sensor pulses for movement between origin search completion position and machine axis origin. * The value can be obtained by origin teaching.	No	
07	Origin compensation (rightmost digits)		0 to 9,999	0		No	
08	Compensation (leftmost digits)	(PP-01) (See note 1.)	0 to 9,999	0	Specifies backlash compensation if UP-01 is set to 11 or 13 in PTP control mode. Specifies slip compensation if UP-01 is set to 12 or 14 in feeder control mode.	No	
09	Compensation (rightmost digits)		0 to 9,999	0		No	
10	Forward software limit (leftmost digits)	(PP-01) (See note 1.)	–9,999 to 9,999	9,999	Specifies software limit position in forward direction. * The software limit overflow in the positive direction is not detected if the value is set to 9999,9999.	No	
11	Forward software limit (rightmost digits)		0 to 9,999	9,999		No	
12	Reverse software limit (leftmost digits)	(PP-01) (See note 1.)	–9,999 to 9,999	–9,999	Specifies software limit position in reverse direction. * The software limit overflow in the reverse direction is not detected if the value is set to –9999,9999.	No	
13	Reverse software limit (rightmost digits)		0 to 9,999	9,999		No	
14	Reference speed (leftmost digits)	1/s	0 to 9,999	0	Specifies machine axis reference speed per second.	No	
15	Reference speed (rightmost digits)		0 to 9,999	500		No	

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No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?	Set value
16	JOG speed	1%	1 to 199	10	Specifies motor r/min in JOG operation as override value based on reference speed.	No	
17	Origin search high speed	1%	1 to 199	10	Specifies origin proximity search speed in origin search operation as override value based on reference speed. This value is used as axis speed for origin compensation as well. * Set an appropriate value so that the origin proximity signal can be detected accurately.	No	
18	Origin search low speed	1%	1 to 199	1	Specifies phase-Z search speed in origin search operation as override value based on reference speed. * Set an appropriate value so that the speed will be 500 r/min maximum.	No	
19	Origin search direction	---	0, 1	0	Specifies origin search direction. 0: Forward direction 1: Reverse direction	No	
20	Acceleration time 0	1 ms	0 to 9,999	0	Specifies time spent in reaching reference speed after system is in operation. * This value is used as acceleration time for the Position Driver in origin search operation, JOG operation, point positioning operation, and direct positioning operation.	No	
21	Acceleration time 1	1 ms	0 to 9,999	100	Specifies time spent in reaching reference speed after system is in operation. * This value is valid if the Position Driver is in point positioning operation.	No	
22	Deceleration time 0	1 ms	0 to 9,999	0	Specifies time spent in decelerating reference speed to a stop. * This value is used as deceleration time for the Position Driver in origin search operation, JOG operation, point positioning operation, and direct positioning operation.	No	

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No. PP-	Name	Min. unit	Setting range	Factory setting	Explanation	Re-power required?	Set value
23	Deceleration time 1	1 ms	0 to 9,999	100	Specifies time spent in decelerating reference speed to a stop. * This value is valid if the Position Driver is in point positioning operation.	No	
24	Deceleration stop mode	---	0 to 2	1	Selects stop method with STOP signal OFF. 0: Free-running stop 1: Deceleration stop 2: Error counter reset stop	No	
25	Alarm selection	---	00 to 11	11	Selects alarm processing method with limit or soft limit detection. └ Overrun 0: Servo-lock stop 1: Servo-free alarm └ Soft limit 0: Servo-lock stop 1: Servo-lock alarm	No	
26	Selection signal output time (See note 2.)	0.8 ms	0.8 to 800.0	20.0	Specifies time during which P.OUT0 to P.OUT4 signals are turned ON for selecting position data and speed data for direct positioning.	No	

Note 1. The PP-01 parameter indicates the changes in the smallest value that can be used for setting. The unit is movement of the mechanical axis (herein referred to as the “mechanical axis movement unit”), and can be changed as required using the pulse rate setting.
Examples of mechanical axis movement units:
Linear units: mm, cm, m, inch, yard
Revolution units: degrees, radians, revolutions
Other units: pulses

Note 2. Be sure to set enough time for the Programmable Controller (PC) to respond when the position and speed data selections are received by the PC.
Set value $\geqq$ PC cycle time $\times$ 2 + PC input delay time + 1 ms
For the CompoBus/S type, make the PC’s input delay time two times that of the communications cycle.

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□PTP Data (Pd01 to Pd64)

Explanation of Settings

No. Pd	Name	Minimum setting unit	Setting range	Factory setting	Description
H	Point No. position data (leftmost digits)	(PP-01)	(I/A) –3,999 to 3,999	(I) 0	Specifies point No. position data. A value between –39,999,999 and 39,999,999 can be set. Leftmost digit is used to specify "A" (absolute) or "I" (incremental) value.
L	Point No. position data (rightmost digits)	(PP-01)	0 to 9,999	0	
F	Point No. speed data	1%	1 to 199	1	Specifies override value based on reference speed.
A	Point No. acceleration/deceleration selection	---	00 to 11	00	Selects acceleration/deceleration time for positioning. └ Acceleration 0: Acceleration time 0 1: Acceleration time 1 └ Deceleration 0 Deceleration time 0 1: Deceleration time 1
r	Point No. operation mode selection	---	0 to 2	0	0: Independent operation mode 1: Automatic incremental mode 2: Continuous operation mode

Note The position data (leftmost digits) display is as follows, according to whether the sign is plus or minus and whether the values are incremental or absolute.

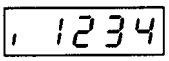
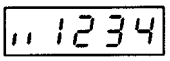
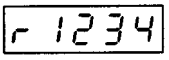
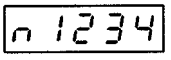
Sign	I (Incremental value designation)	A (Absolute value designation)
+	I + 1234 	A + 1234 
–	I – 1234 	A – 1234 

Table for Entering Settings

No. Pd-	Position data			Speed data (F)	Acceleration/ deceleration selection (A)	Operation mode (r)
	(I/A)	Leftmost (H)	Rightmost (L)			
01						
02						
03						
04						
05						
06						
07						
08						

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No. Pd-	Position data			Speed data (F)	Acceleration/ deceleration selection (A)	Operation mode (r)
	(I/A)	Leftmost (H)	Rightmost (L)			
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
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32						
33						
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36						
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39						
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41						
42						
43						
44						
45						
46						
47						
48						
49						
50						

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No. Pd-	Position data			Speed data (F)	Acceleration/ deceleration selection (A)	Operation mode (r)
	(I/A)	Leftmost (H)	Rightmost (L)			
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						

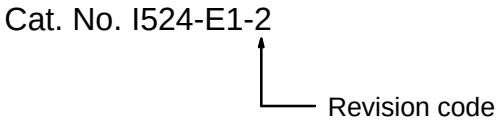
□ Adjustment Parameters (AJ2 to AJ9)

No.	Parameter name	Min. unit	Setting range	Factory setting	Explanation	Set value
AJ2	Speed loop proportional gain	0.1x	0.0 to 100.0	1.0	Gain for adjusting position loop response	
AJ3	Speed loop integral gain	0.1x	0.1 to 20.0	1.0	Speed loop integral gain	
AJ4	Position loop gain	1 rad/s	1 to 200	30	Position loop gain	
AJ7	Interrupt gain suppression	1	0 to 10,000	0	Speed loop proportional gain suppression when stopped	
AJ8	Feed forward gain	0.1x	0.0 to 2.0	0.0	Feed forward gain	
AJ9	Current reference filter	1 rad/s	400 to 20,000	6,000	Cutoff frequency for current reference	

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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	February 1998	Original production
2	April 1999	Major changes, including information on new Position Drivers, parameters, etc., have been made.

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OMRON Corporation
Systems Components Division
14F Nissei Bldg.
1-6-3, Osaki, Shinagawa-ku,
Tokyo 141-0032 Japan
Tel: (81)3-3779-9038/Fax: (81)3-3779-9041

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