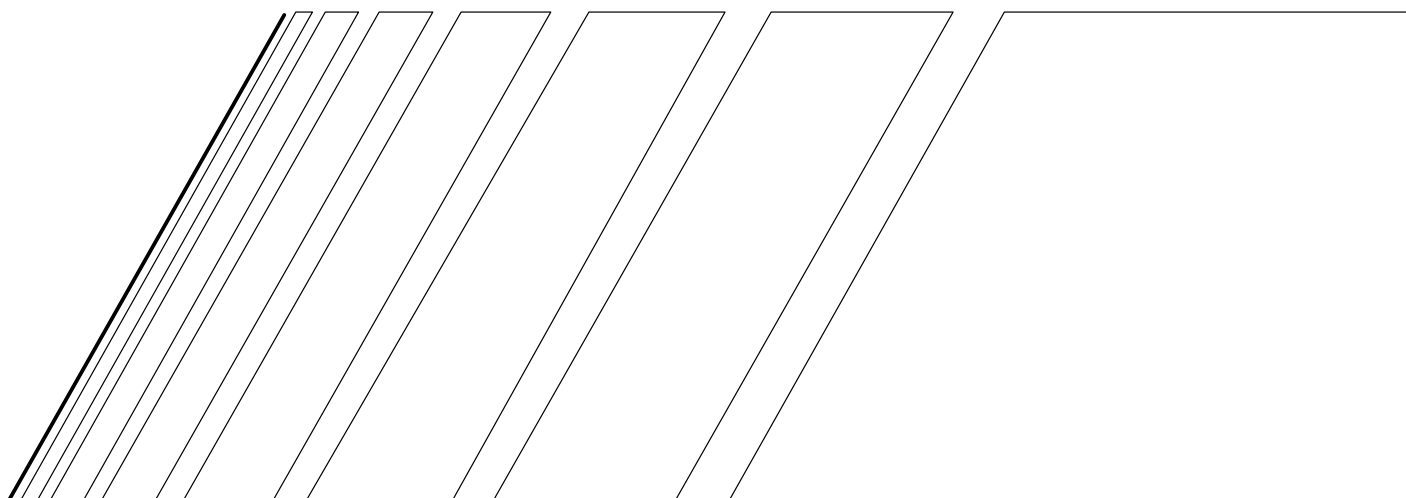




# USER'S MANUAL

## OMNUC FND-X<sub>SERIES</sub>

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

**POSITION DRIVERS**

---

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.

## ***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.

## 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  $\Omega$  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.

## ***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.

-  **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***

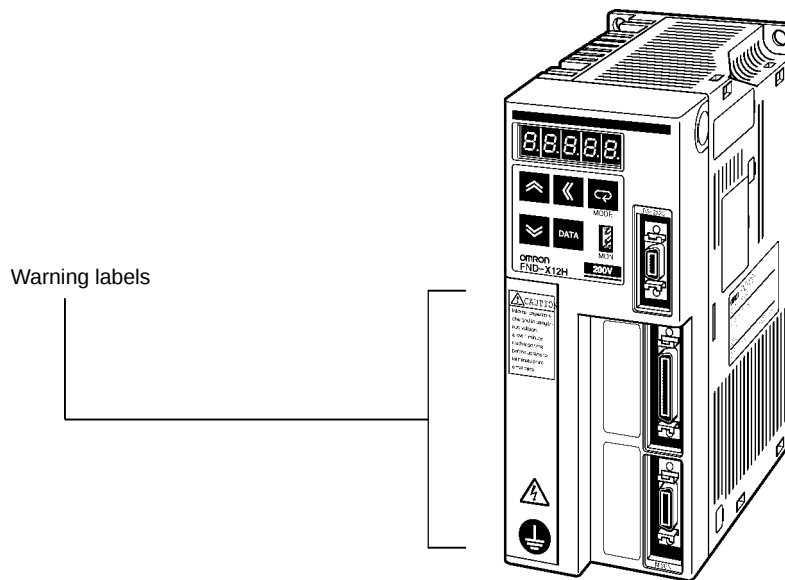
-  **Caution** Confirm that no adverse effect will occur in the system before performing the test operation. Not doing so may result in equipment damage.
-  **Caution** Check the newly set parameters for proper execution before actually running them. Not doing so may result in equipment damage.
-  **Caution** 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***

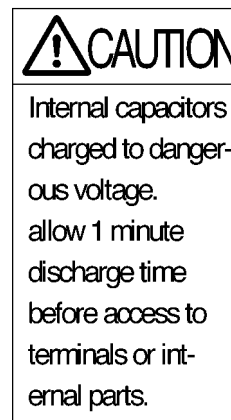
-  **WARNING** Do not attempt to take the Unit apart or repair. Doing either of these may result in electrical shock or injury.
-  **Caution** Resume operation only after transferring to the new Unit the contents of the data required for operation. Not doing so may result in equipment damage.

## 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  $\Omega$  or less.

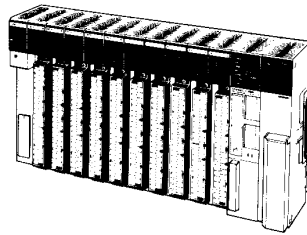
# VISUAL INDEX

## 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.

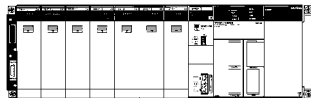
SYSMAC C/CV  
Programmable Controller



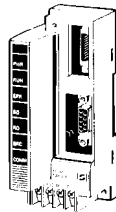
5-3-1 General Control  
Cable Specifications

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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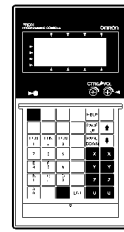
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- 4-4 Protection and Diagnosis
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# OMNUC FND-X Series

## Teaching Box

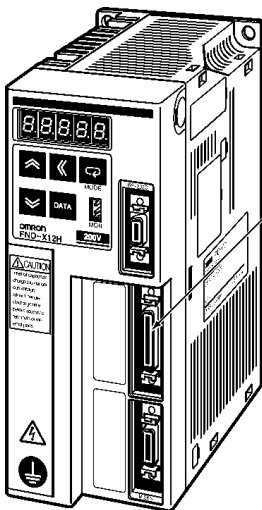


CVM1-PRO01 Teaching Box  
ROM Cassette:  
CVM1-MP702  
(Common for MC Units and  
Position Drivers)  
CVM1-MP703

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

RS-422 Teaching Box connections cable

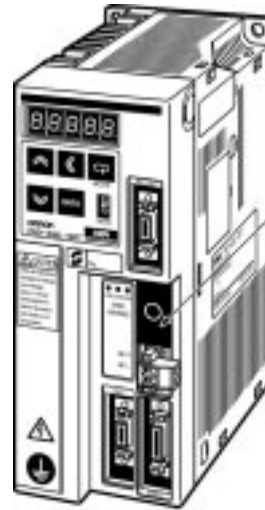
## OMNUC FND-X-series Position Drivers



2-2-2 Control Circuitry  
Terminal Wiring

### DIO Type

200 V: FND-X□□H  
100 V: FND-X□□L



5-1 Position Driver Specifications

2-2-3 Wiring Terminal Blocks

3-3-3 Mode Details

6-3 Connecting a CompoBus/S  
System

### CompoBus/S Type

200 V: FND-X□□H-SRT  
100 V: FND-X□□L-SRT

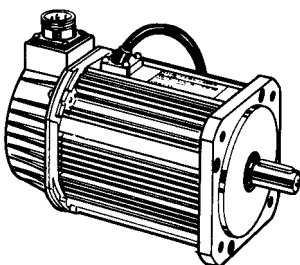
## 5-3 Cable Specifications

Power signals



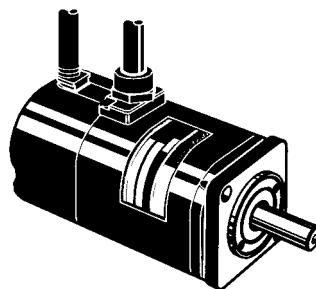
Encoder/Resolver signals

## OMNUC M-series AC Servomotors



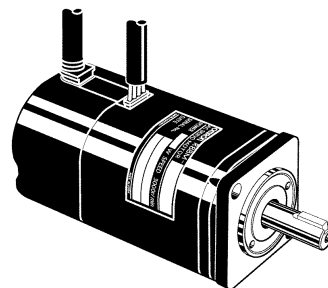
1200 r/min: 200 to 1.8 kW with Resolver  
2000 r/min: 200 to 2.2 kW with Resolver  
4000 r/min: 60 to 2 kW with Resolver

## OMNUC U-series AC Servomotors



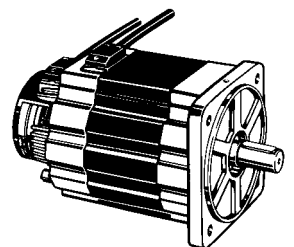
3000 r/min: 30 to 2 kW with  
Incremental Encoder  
3000 r/min: 30 to 2 kW with  
Absolute Encoder

## 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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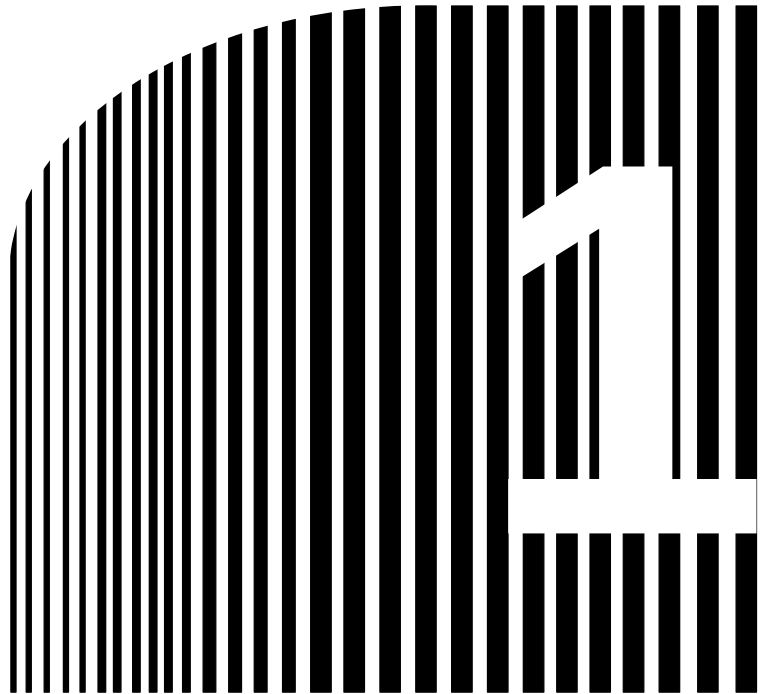
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|                                    |
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# Chapter 1

## • Introduction •

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

## 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-

- 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<br>200/240 (170 to 264) VAC at<br>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 |

| Position Driver                                     |           | Applicable AC Servomotor |                  |                 |             |
|-----------------------------------------------------|-----------|--------------------------|------------------|-----------------|-------------|
| Input power supply                                  | Model     | Series                   | Model            | Output capacity | Rated r/min |
| Three-phase<br>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          | 1200 r/min  |
|                                                     |           |                          | R88M-M1K112      | 1100 W          |             |
|                                                     |           |                          | R88M-M1K412      | 1400 W          |             |
|                                                     |           |                          | R88M-M1K812      | 1800 W          |             |
| Single-phase<br>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 a 100-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.

## ☐ 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.

### 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.

### **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.

## ☐ 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.

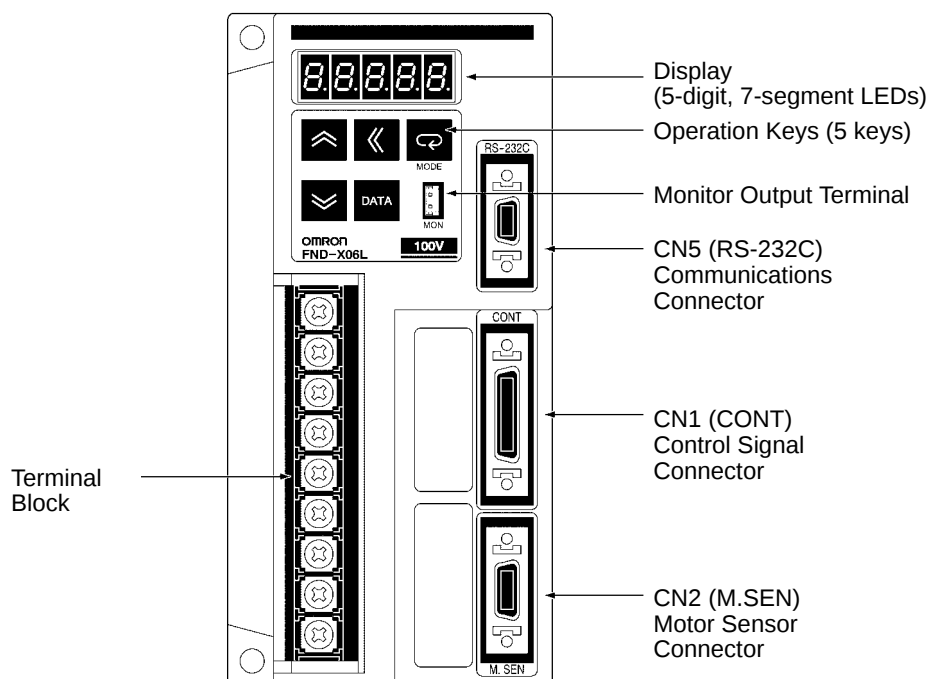
### **Sequential Output Test Function**

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.

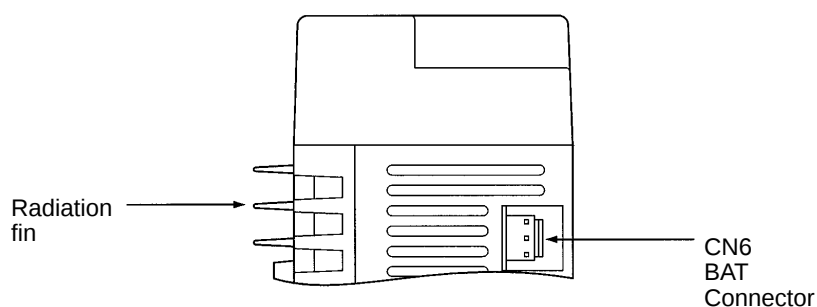
## 1-2 Nomenclature and Key Operations

### DIO Position Drivers

#### Front View



#### Bottom View

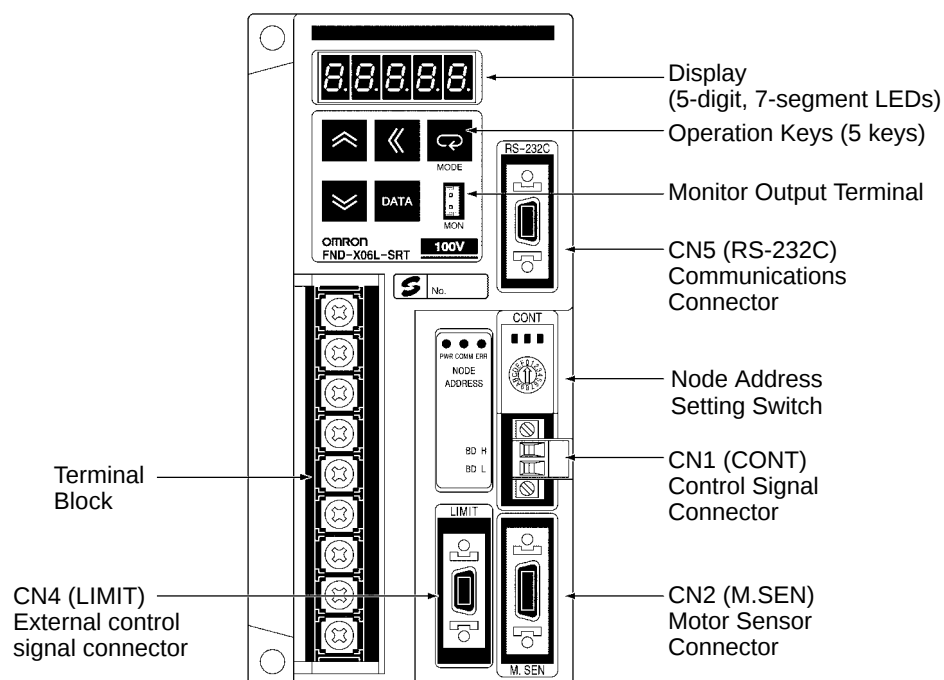


#### □ Key Operations

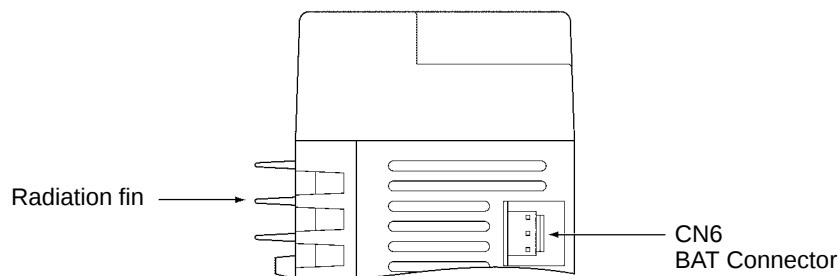
| Key | Name          | Main function                                   |
|-----|---------------|-------------------------------------------------|
|     | Mode Key      | Changes the Position Driver's mode.             |
|     | Shift Key     | Shifts the operation column to the left.        |
|   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

## 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 Key      | Saves the set data.                             |
|     | Increment Key | Increments the parameter address or data value. |
|     | Decrement Key | Decrements the parameter address or data value. |

## 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

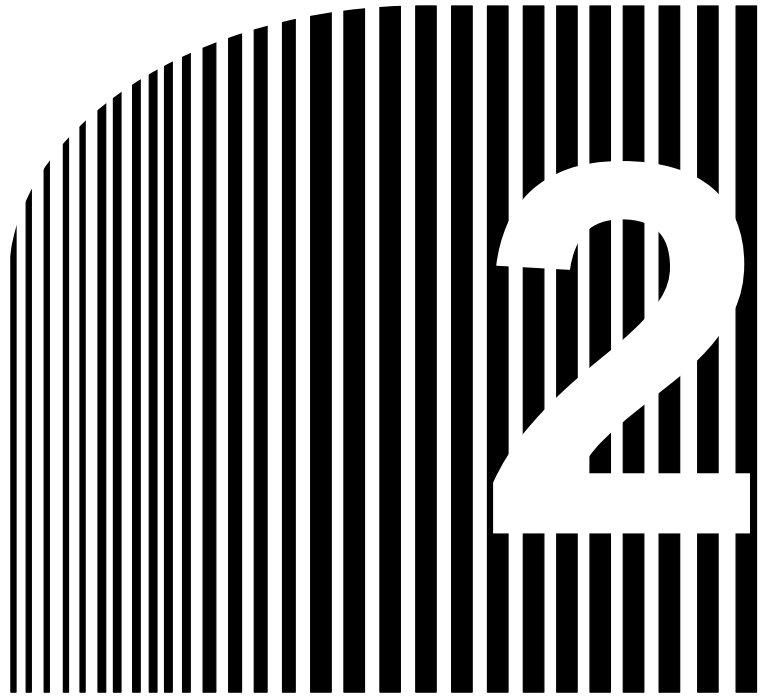
| Power supply | AC Servomotors |                     | Encoder             |
|--------------|----------------|---------------------|---------------------|
| 200 VAC      | R88M-U         | 30HA- (30 to 750 W) | Incremental encoder |
| 200 VAC      | R88M-U         | 30TA- (30 to 750 W) | Absolute encoder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

**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.



## Chapter 2

- **Design and Installation**

2-1 Installation

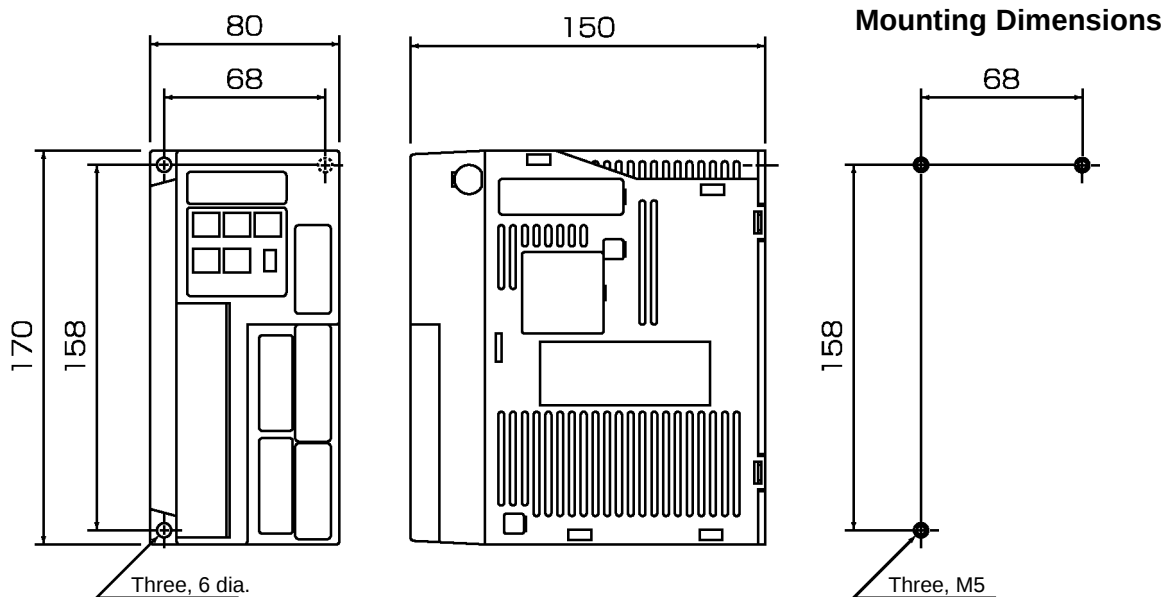
2-2 Wiring

## 2-1 Installation

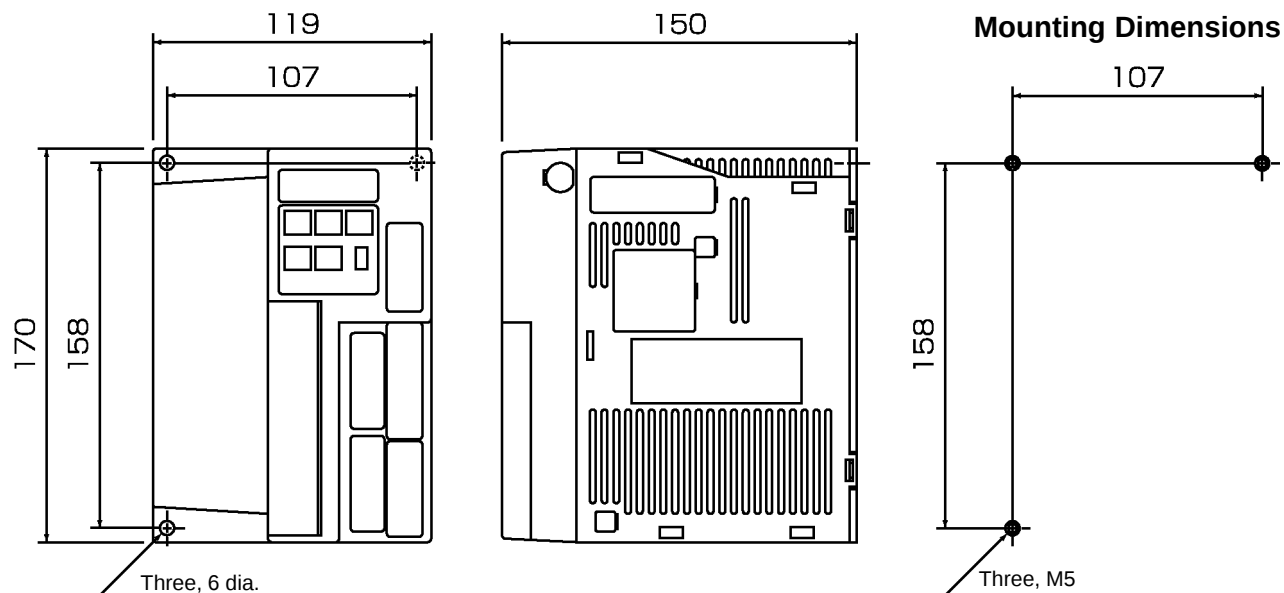
### 2-1-1 External Dimensions (Unit: mm)

#### DIO and CompoBus/S Position Drivers

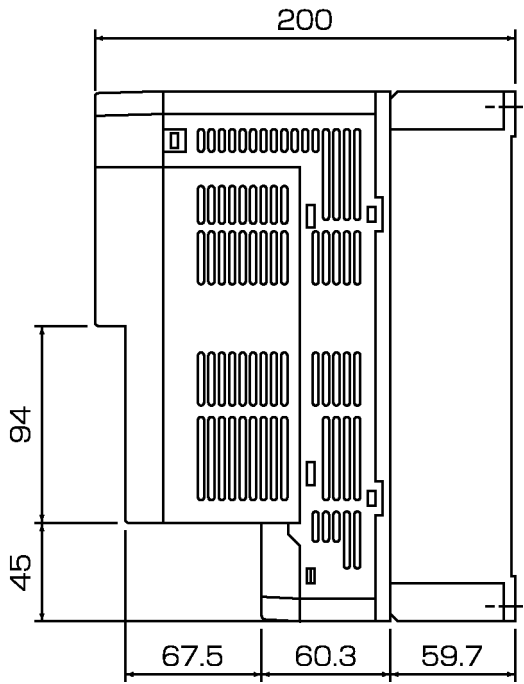
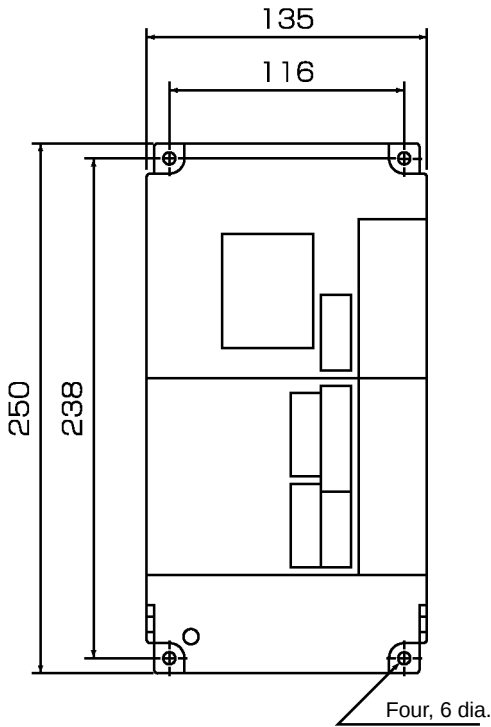
- 200-VAC FND-X06H- /-X12H-  
100-VAC FND-X06L- /-X12L-



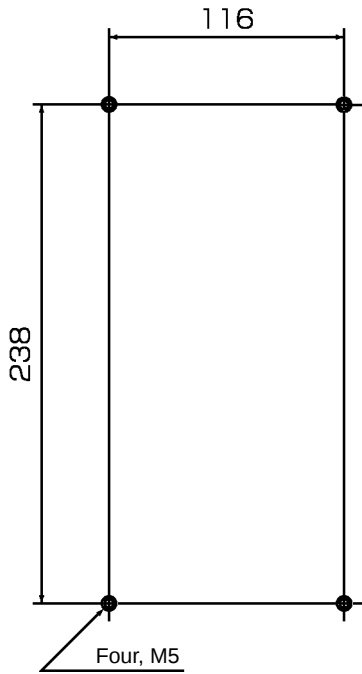
- 200-VAC FND-X25H-



200-VAC FND-X50H-

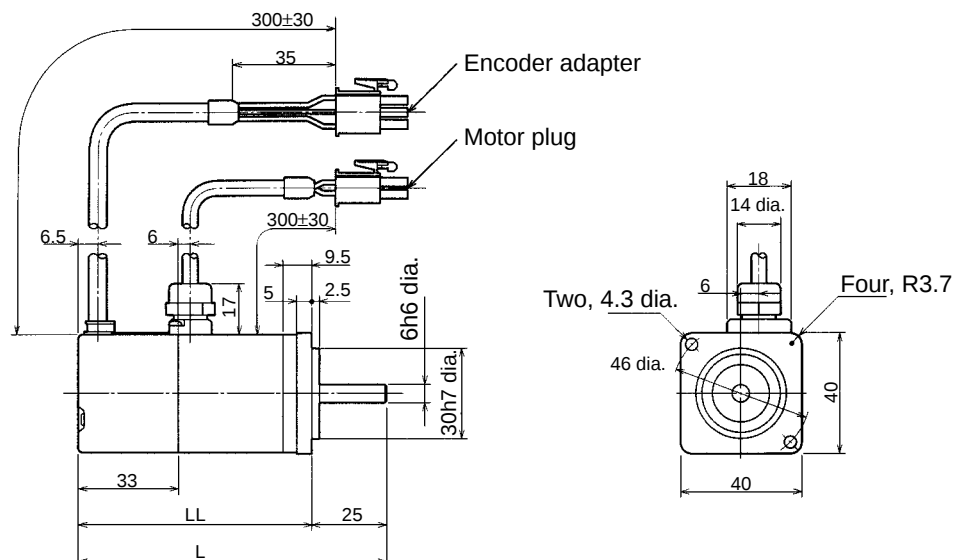


Mounting Dimensions

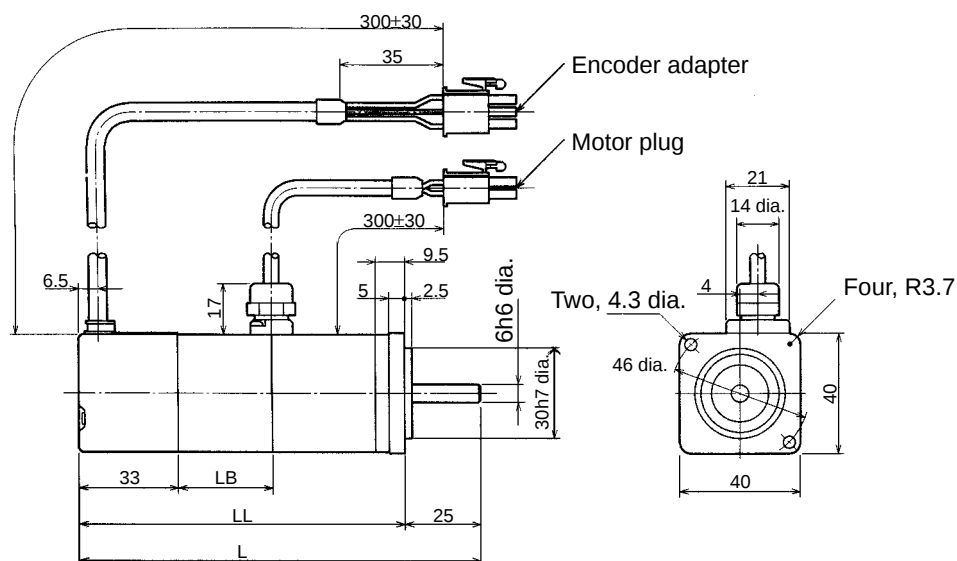


## OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to UL/cUL

- **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

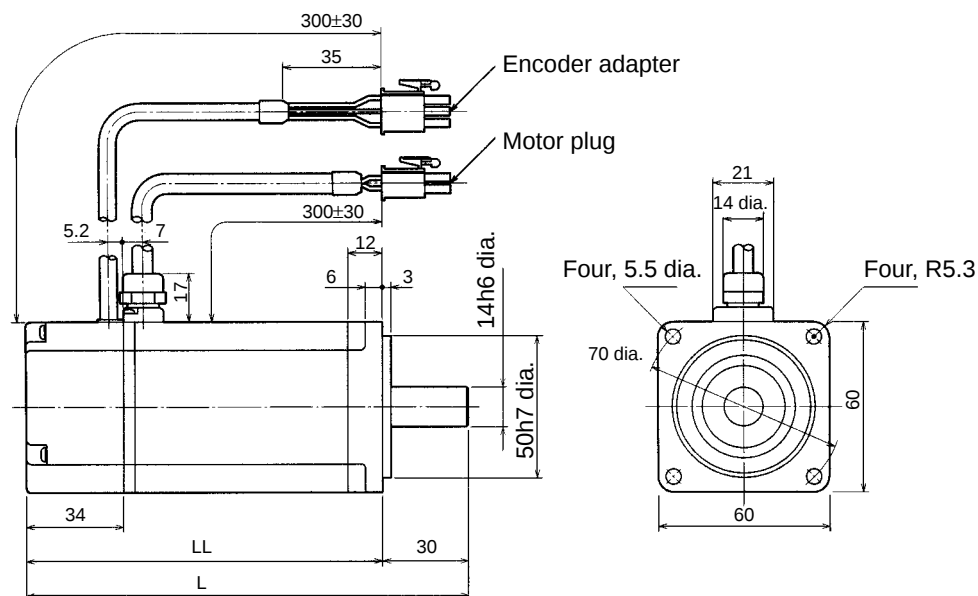


| Standard Models (Without Brakes) |       |      |   |
|----------------------------------|-------|------|---|
| Model                            | L     | LL   | S |
| R88M-U03030HA                    | 94.5  | 69.5 | 6 |
| R88M-U05030HA                    | 102.0 | 77.0 | 6 |
| R88M-U10030HA     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

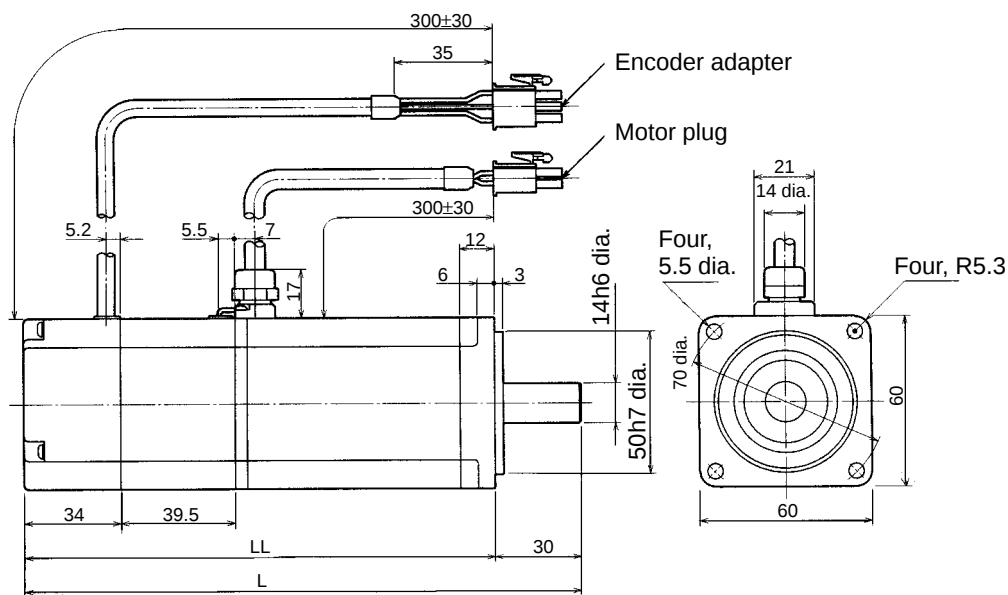
| Models with Brakes |       |       |      |   |
|--------------------|-------|-------|------|---|
| Model              | L     | LL    | LB   | S |
| R88M-U03030HA-B    | 126   | 101   | 31.5 | 6 |
| R88M-U05030HA-B    | 133.5 | 108.5 | 31.5 | 6 |
| R88M-U10030HA-B    | 160   | 135   | 40.5 | 8 |

## 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 |

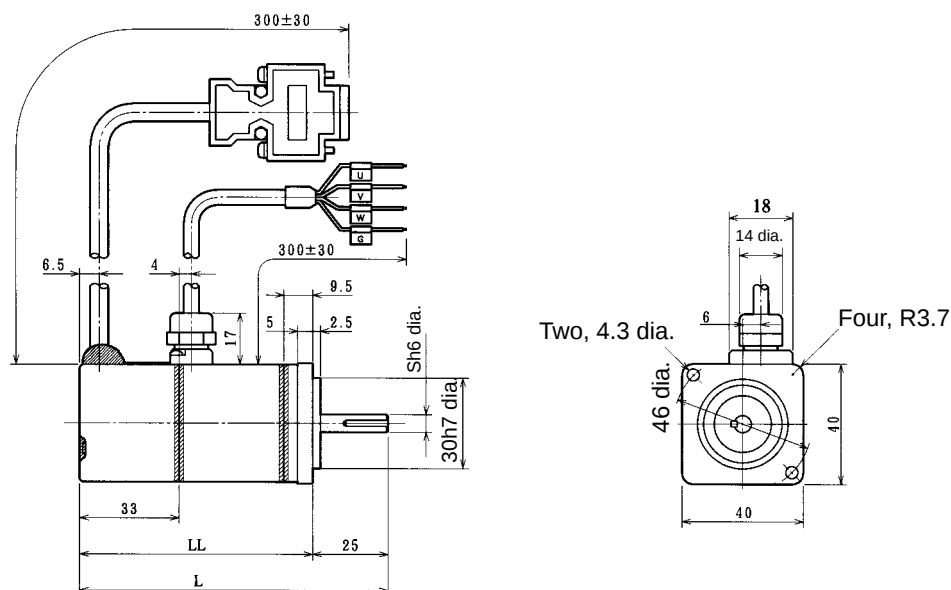
| Models with Brakes |     |     |
|--------------------|-----|-----|
| Model              | L   | LL  |
| R88M-U20030HA-B    | 166 | 136 |
| R88M-U40030HA-B    | 194 | 164 |

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

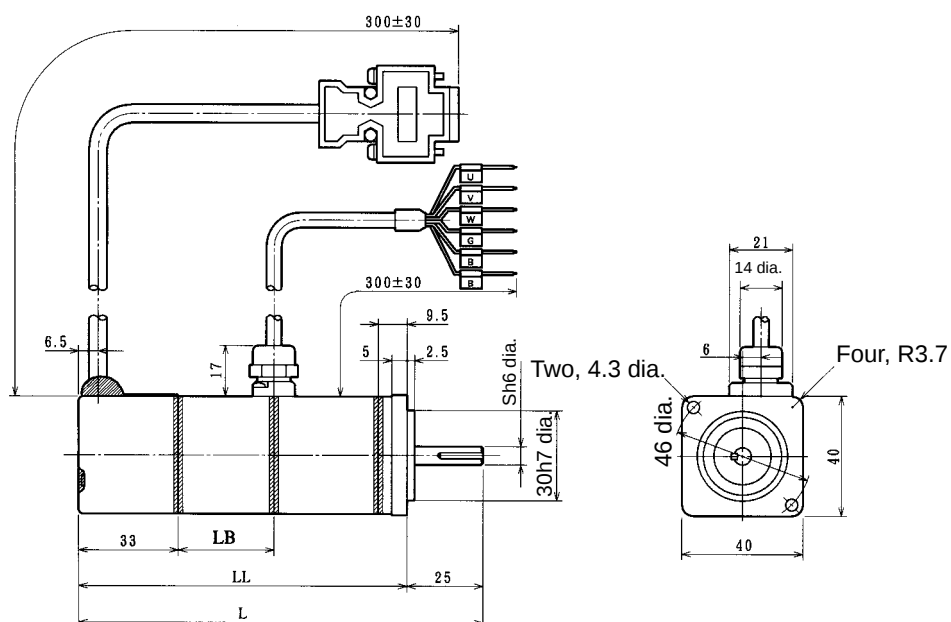


## OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 30 to 750 W) Conforming to EC Directives

- **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

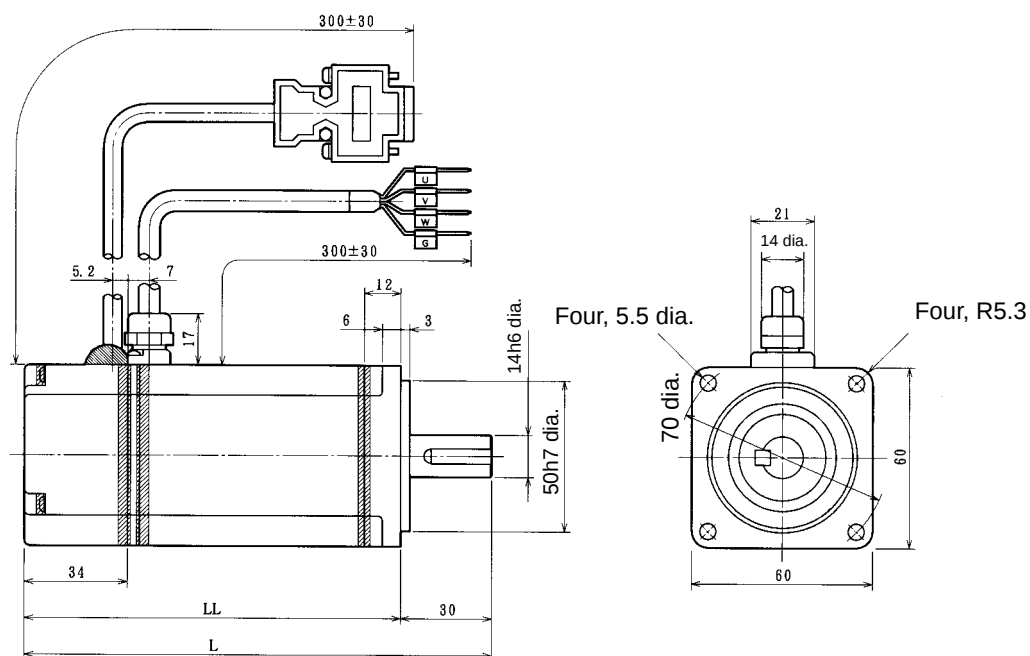


| Standard Models (Without Brakes) |       |      |   |
|----------------------------------|-------|------|---|
| Model                            | L     | LL   | S |
| R88M-U03030VA-S1                 | 94.5  | 69.5 | 6 |
| R88M-U05030VA-S1                 | 102.0 | 77.0 | 6 |
| R88M-U10030VA-S1  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

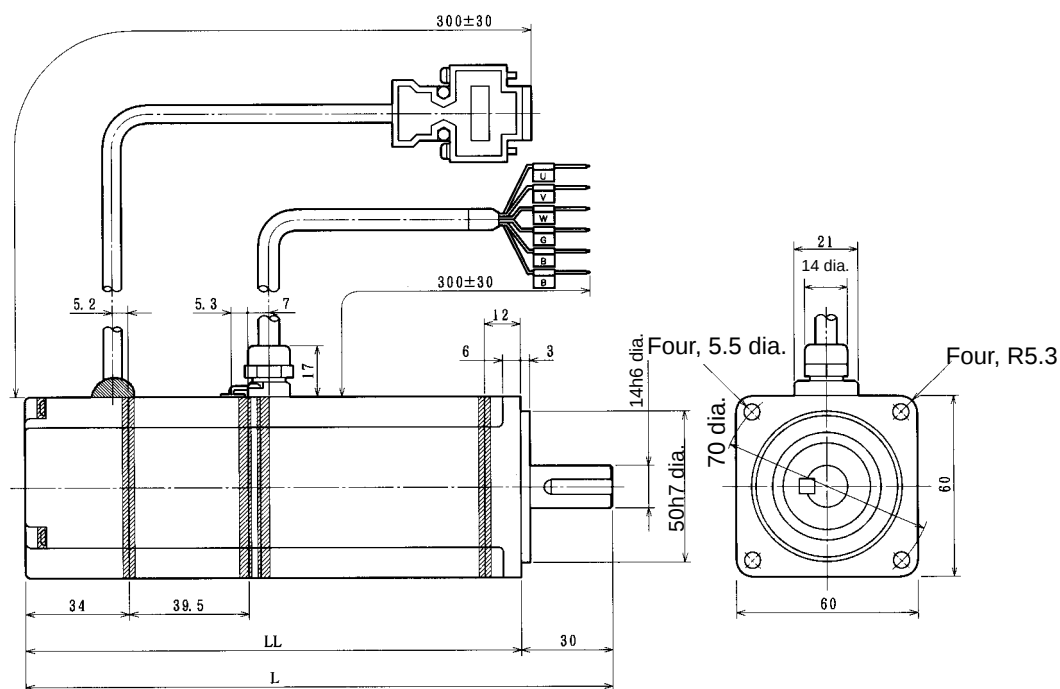
| Models with Brakes |       |       |      |   |
|--------------------|-------|-------|------|---|
| Model              | L     | LL    | LB   | S |
| R88M-U03030VA-BS1  | 126   | 101   | 31.5 | 6 |
| R88M-U05030VA-BS1  | 133.5 | 108.5 | 31.5 | 6 |
| R88M-U10030VA-BS1  | 160   | 135   | 40.5 | 8 |

## 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

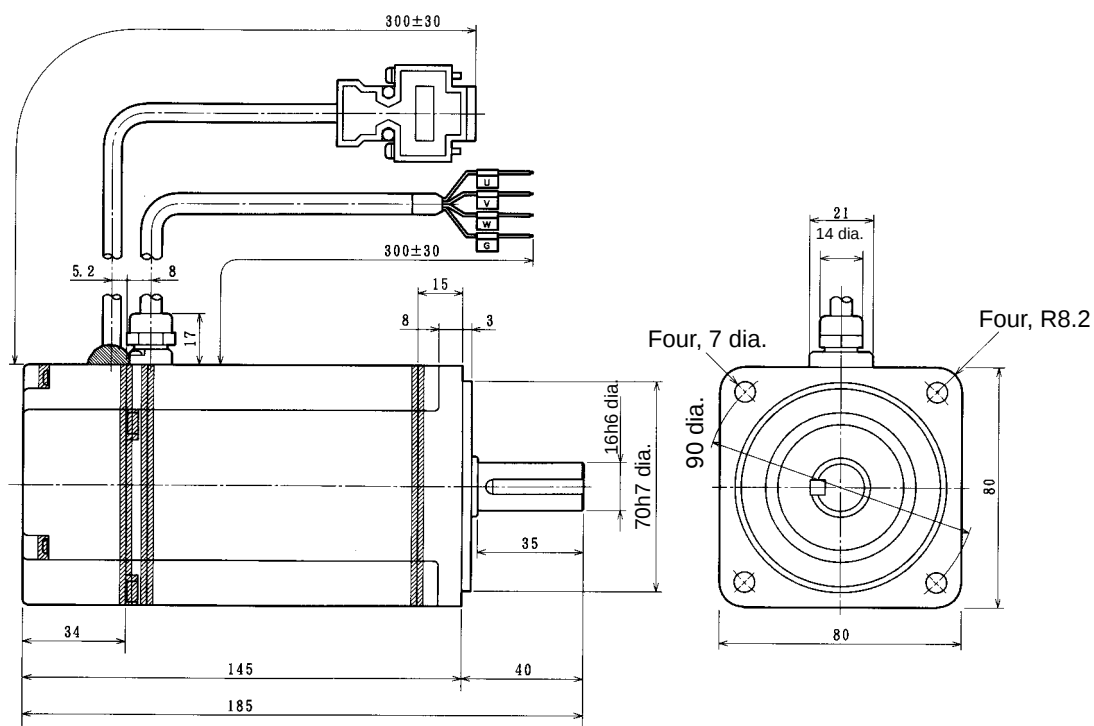


| Standard Models (Without Brakes) |       |       |
|----------------------------------|-------|-------|
| Model                            | L     | LL    |
| R88M-U20030VA-S1                 | 126.5 | 96.5  |
| R88M-U40030VA-S1                 | 154.5 | 124.5 |

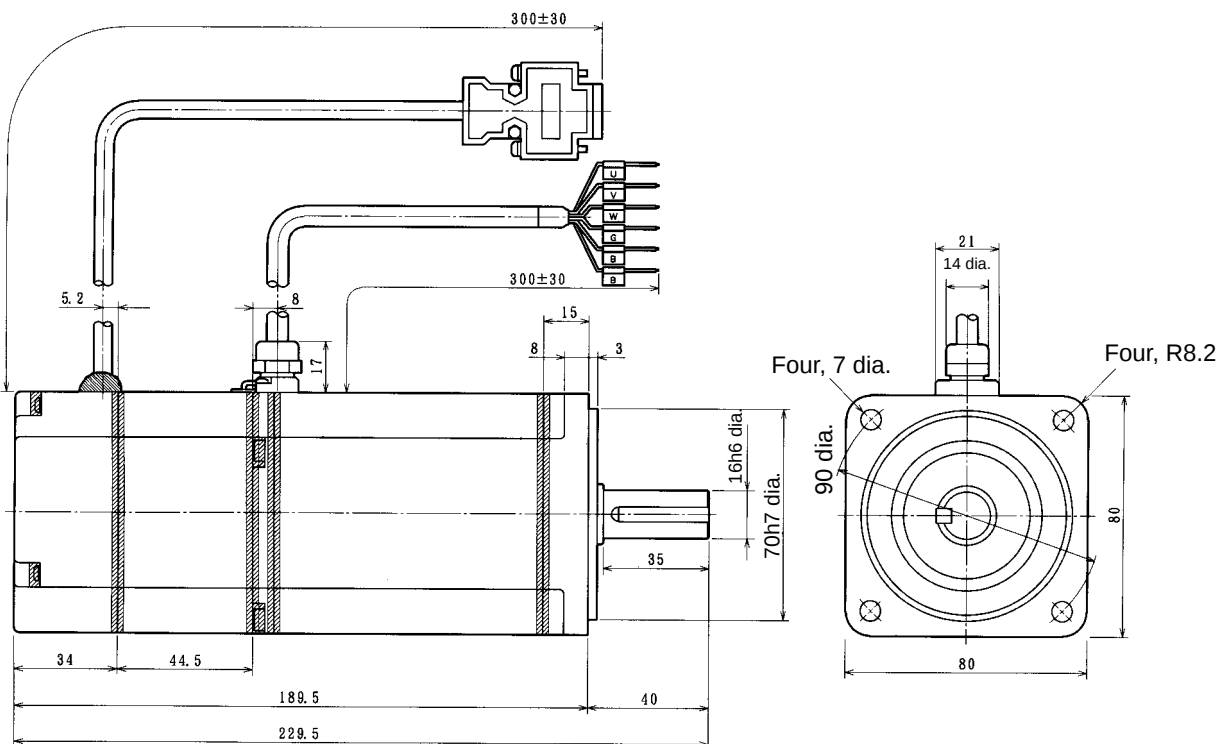
| Models with Brakes |     |     |
|--------------------|-----|-----|
| Model              | L   | LL  |
| R88M-U20030VA-BS1  | 166 | 136 |
| R88M-U40030VA-BS1  | 194 | 164 |

# 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

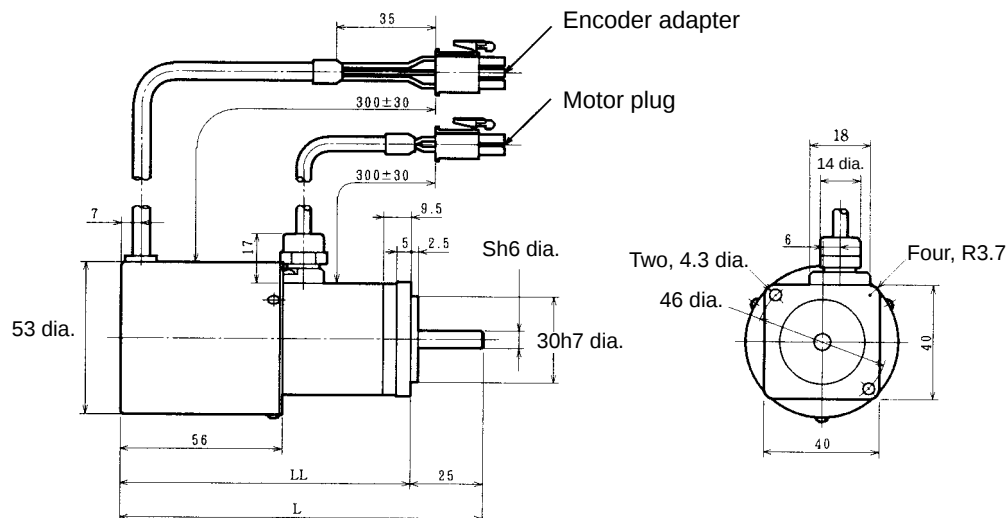


## 750-W Models with Brakes: R88M-U75030VA-BS1

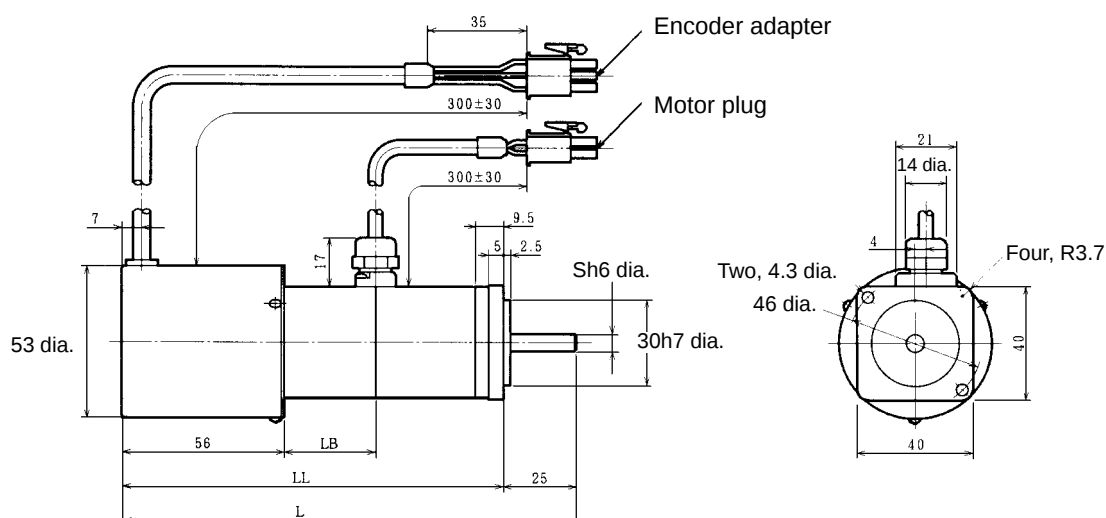


## OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to UL/cUL

- **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

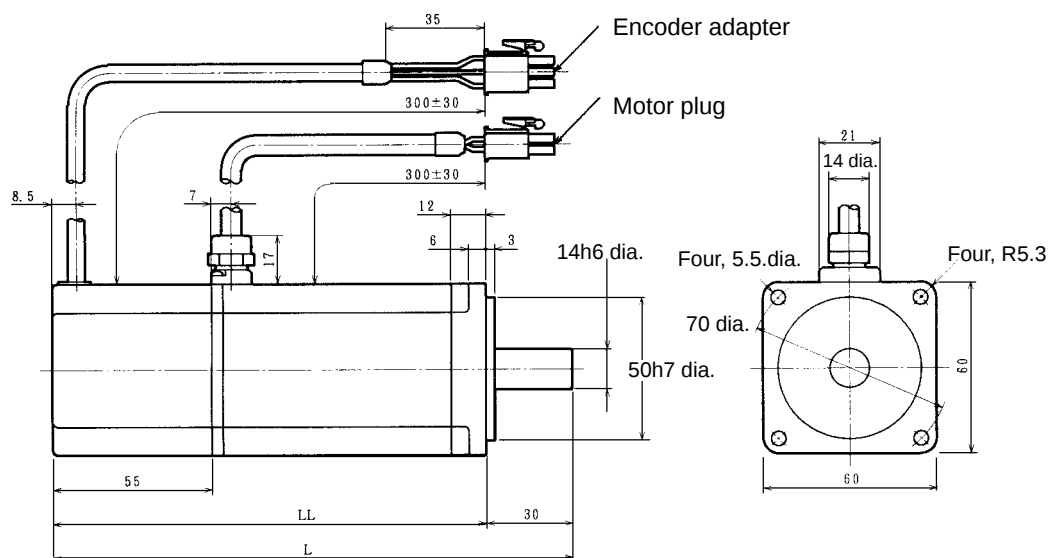


| Standard Models (Without Brakes) |       |       |   |
|----------------------------------|-------|-------|---|
| Model                            | L     | LL    | S |
| R88M-U03030TA                    | 117.5 | 92.5  | 6 |
| R88M-U05030TA                    | 125   | 100   | 6 |
| R88M-U10030TA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

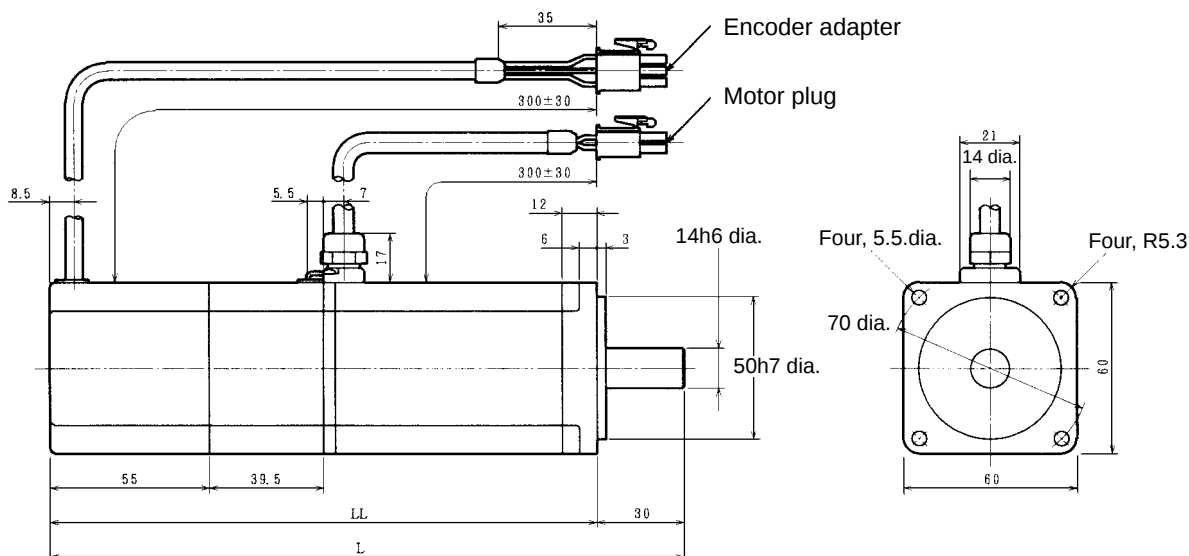
| Models with Brakes |       |       |      |   |
|--------------------|-------|-------|------|---|
| Model              | L     | LL    | LB   | S |
| R88M-U03030TA-B    | 149   | 124   | 31.5 | 6 |
| R88M-U05030TA-B    | 156.5 | 131.5 | 31.5 | 6 |
| R88M-U10030TA-B    | 183   | 158   | 40.5 | 8 |

## 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

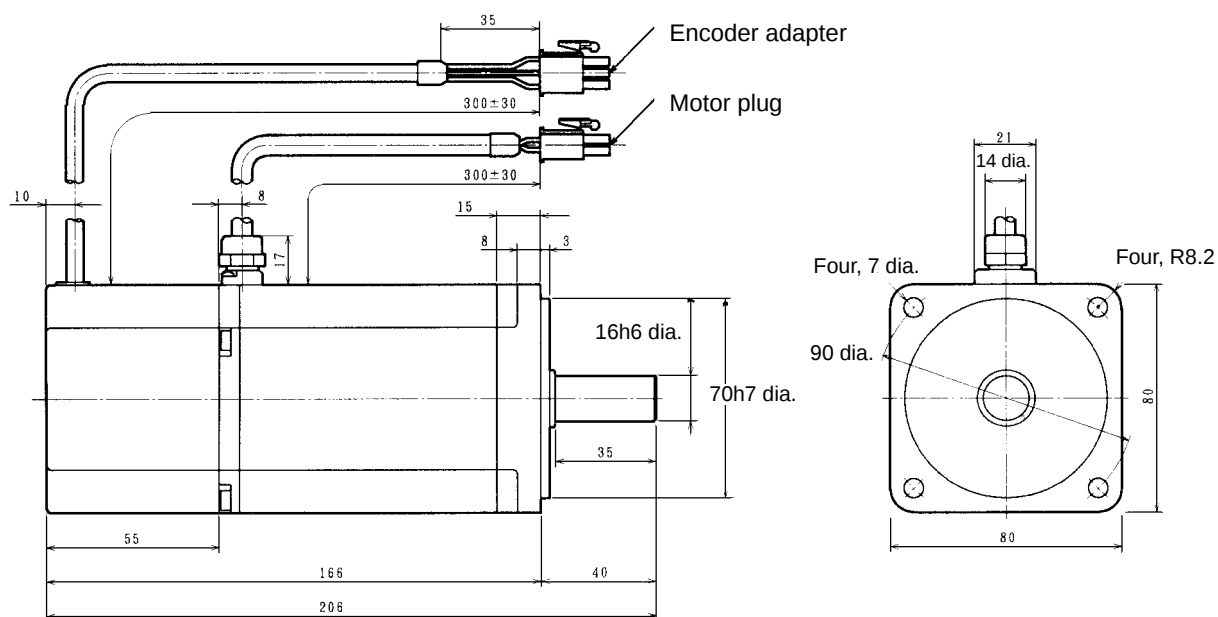


| Standard Models (Without Brakes) |       |       |
|----------------------------------|-------|-------|
| Model                            | L     | LL    |
| R88M-U20030TA                    | 147.5 | 117.5 |
| R88M-U40030TA                    | 175.5 | 145.5 |

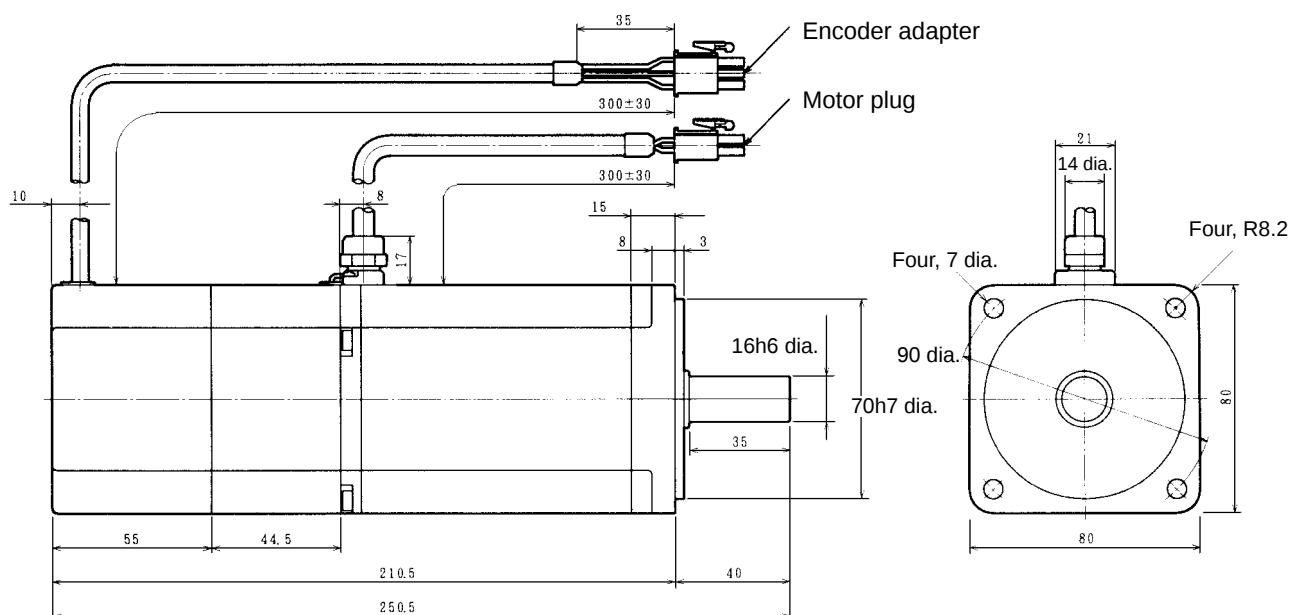
| Models with Brakes |     |     |
|--------------------|-----|-----|
| Model              | L   | LL  |
| R88M-U20030TA-B    | 187 | 157 |
| R88M-U40030TA-B    | 215 | 185 |

## 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

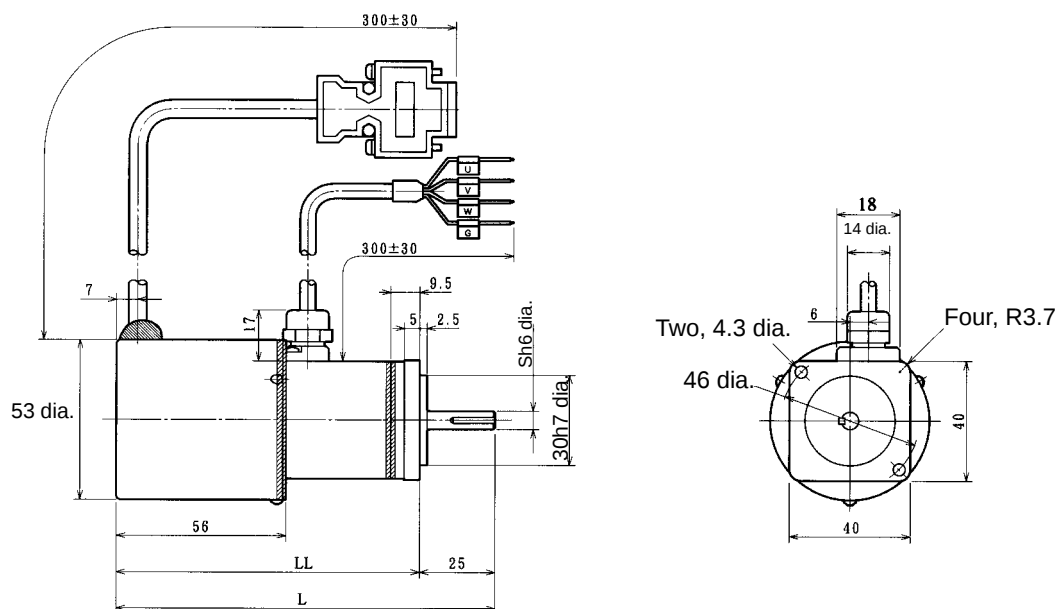


### 750-W Models with Brakes: R88M-U75030TA-B

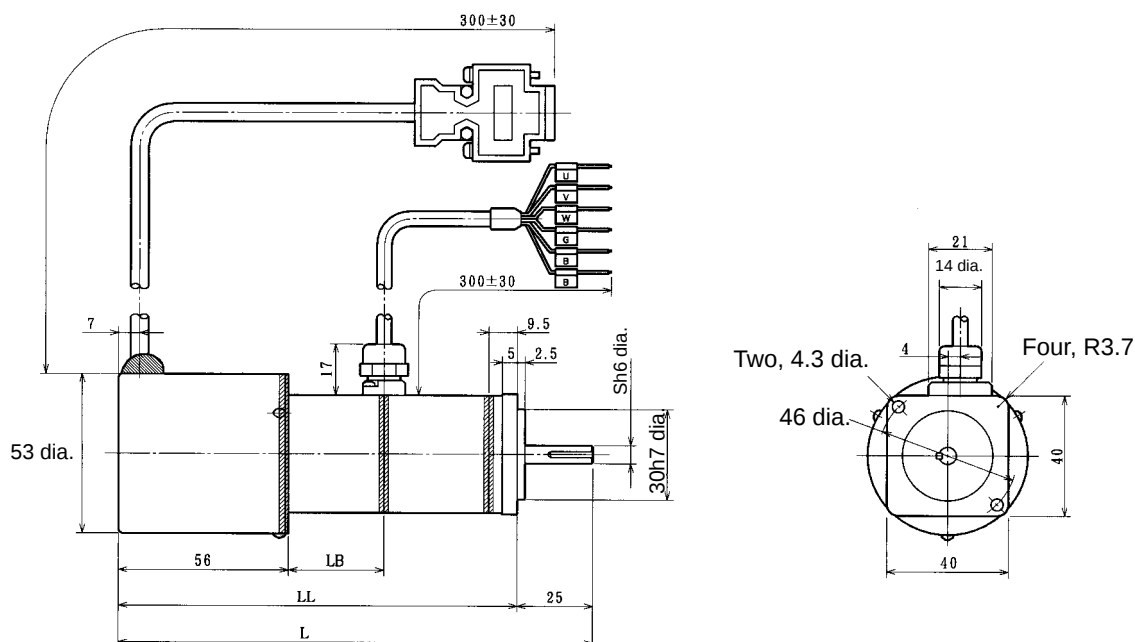


# OMNUC U-Series AC Servomotors with Absolute Encoders (U-ABS 30 to 750 W) Conforming to EC Directives

- 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

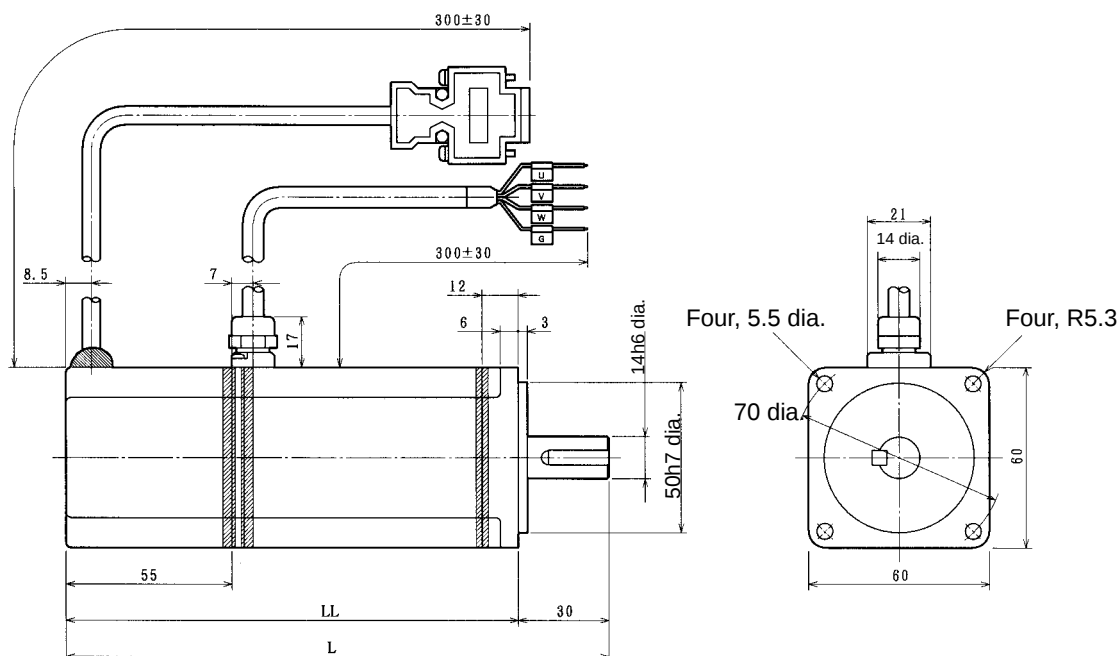


| Standard Models (Without Brakes) |       |       |   |
|----------------------------------|-------|-------|---|
| Model                            | L     | LL    | S |
| R88M-U03030XA-S1                 | 117.5 | 92.5  | 6 |
| R88M-U05030XA-S1                 | 125   | 100   | 6 |
| R88M-U10030XA-S1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

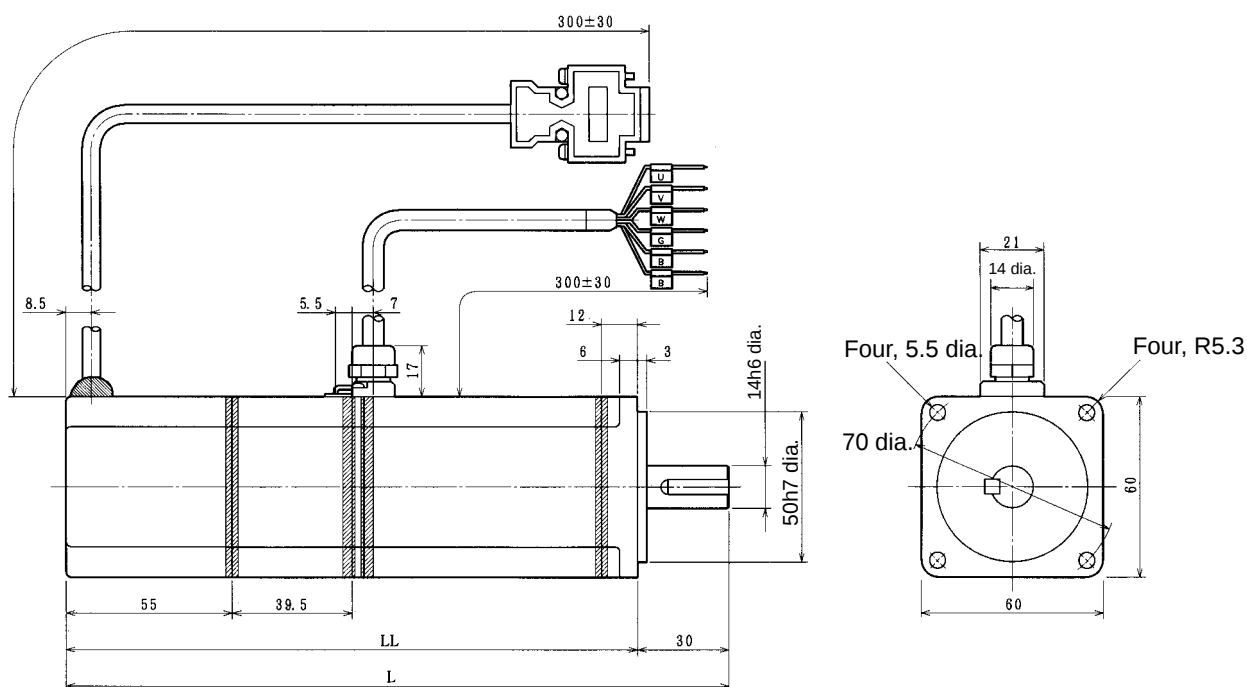
| Models with Brakes |       |       |      |   |
|--------------------|-------|-------|------|---|
| Model              | L     | LL    | LB   | S |
| R88M-U03030XA-BS1  | 149   | 124   | 31.5 | 6 |
| R88M-U05030XA-BS1  | 156.5 | 131.5 | 31.5 | 6 |
| R88M-U10030XA-BS1  | 183   | 158   | 40.5 | 8 |

## 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 |

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



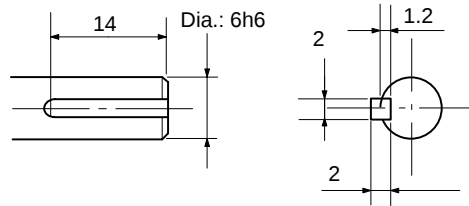
## U-Series AC Servomotor Shaft Dimensions with Keys (U-INC, U-ABS, 30 to 750 W)

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

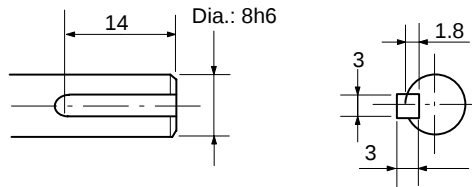
With Brakes: R88M-U03030 -BS1, R88M-U05030 -BS1



### □ 100-W Models

Standard: R88M-U10030 -S1

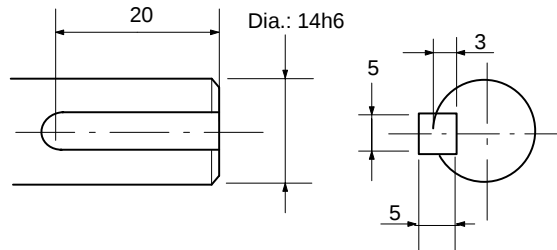
With Brakes: R88M-U10030 -BS1



### □ 200-W/400-W Models

Standard: R88M-U20030 -S1, R88M-U40030 -S1

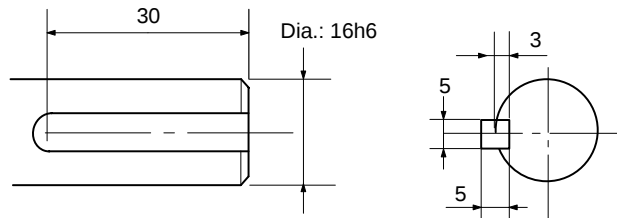
With Brakes: R88M-U20030 -BS1, R88M-U40030 -BS1



### □ 750-W Models

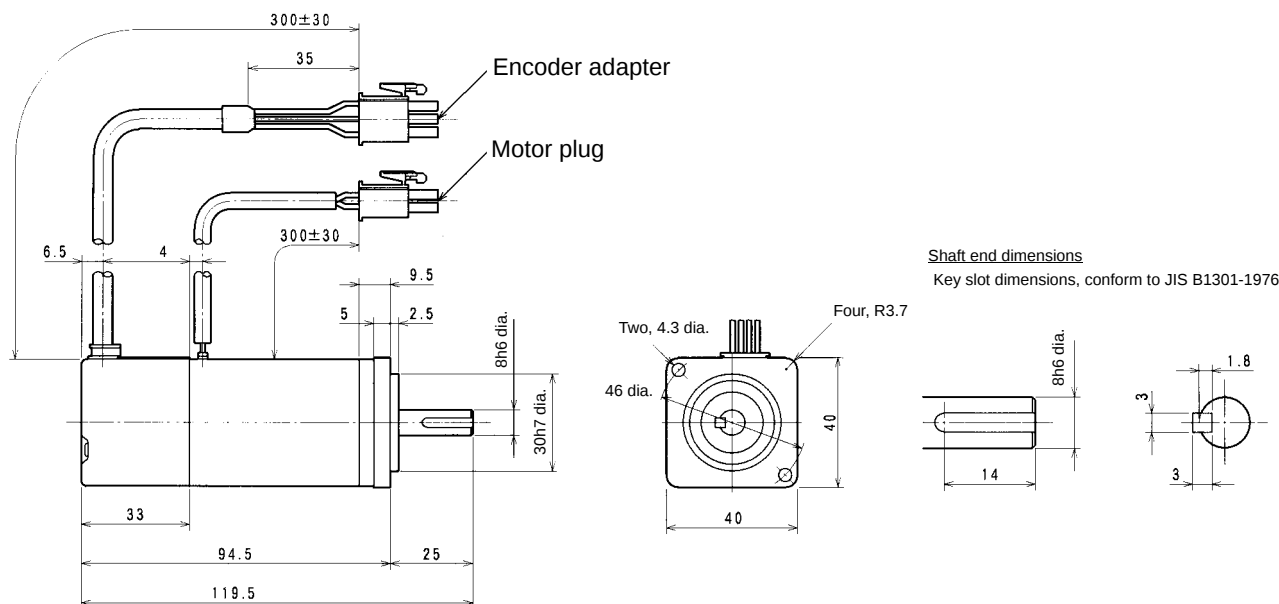
Standard: R88M-U75030 -S1

With Brakes: R88M-U75030 -BS1

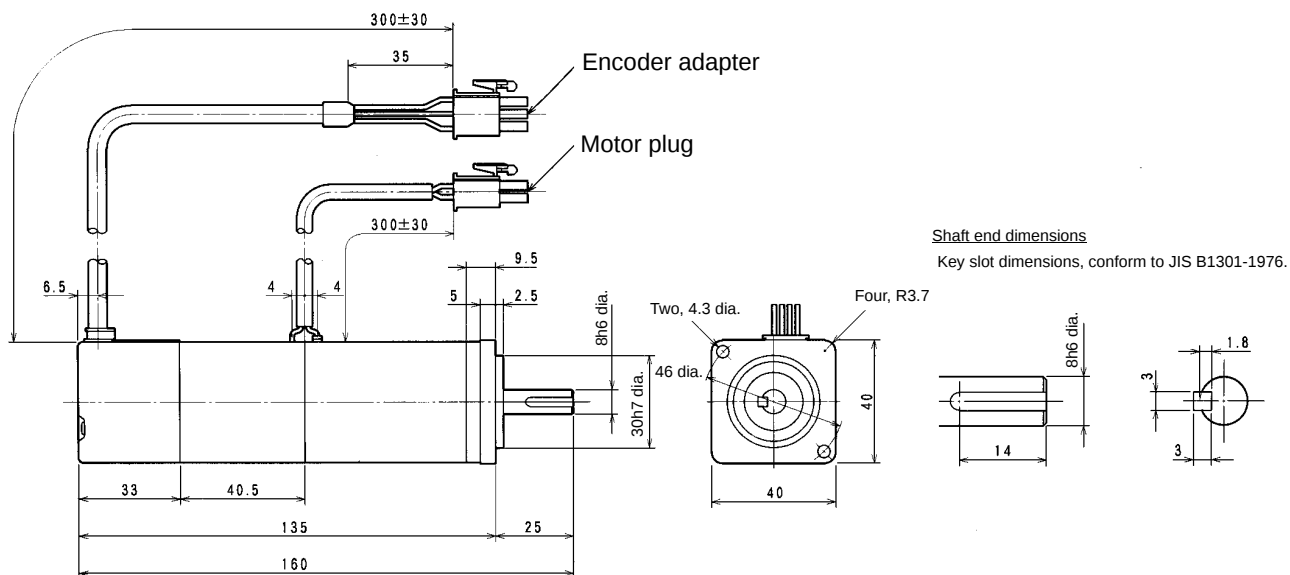


## OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Not Conforming to Any Standards

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

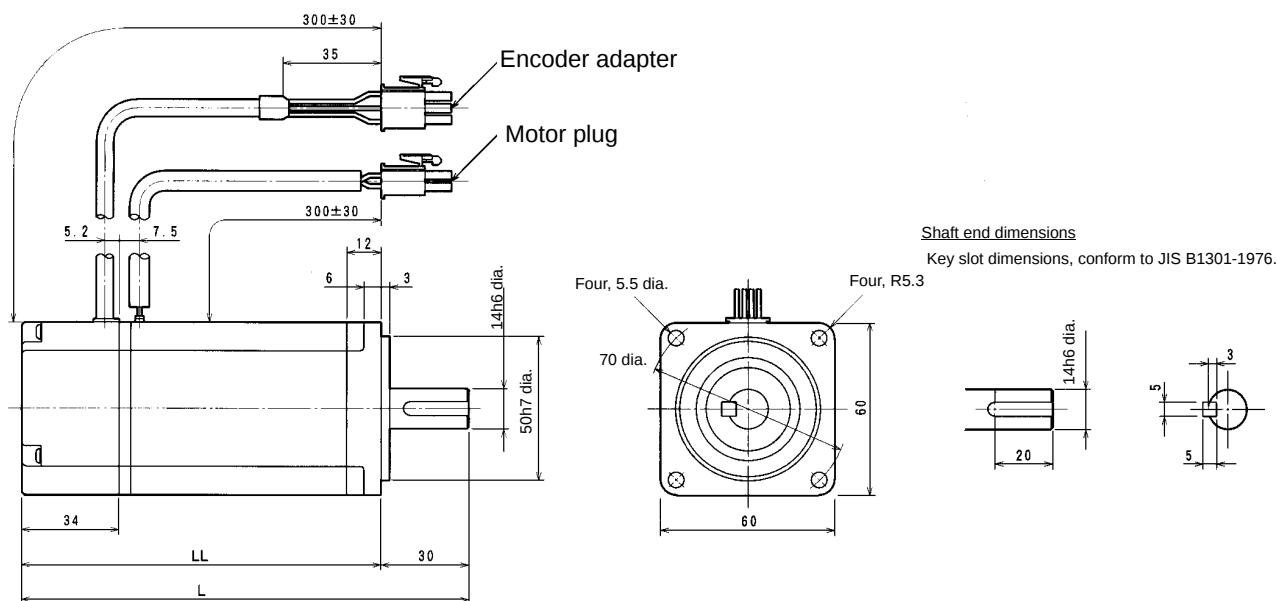


### □100-W Models with Brakes: R88M-UE10030H-BS1

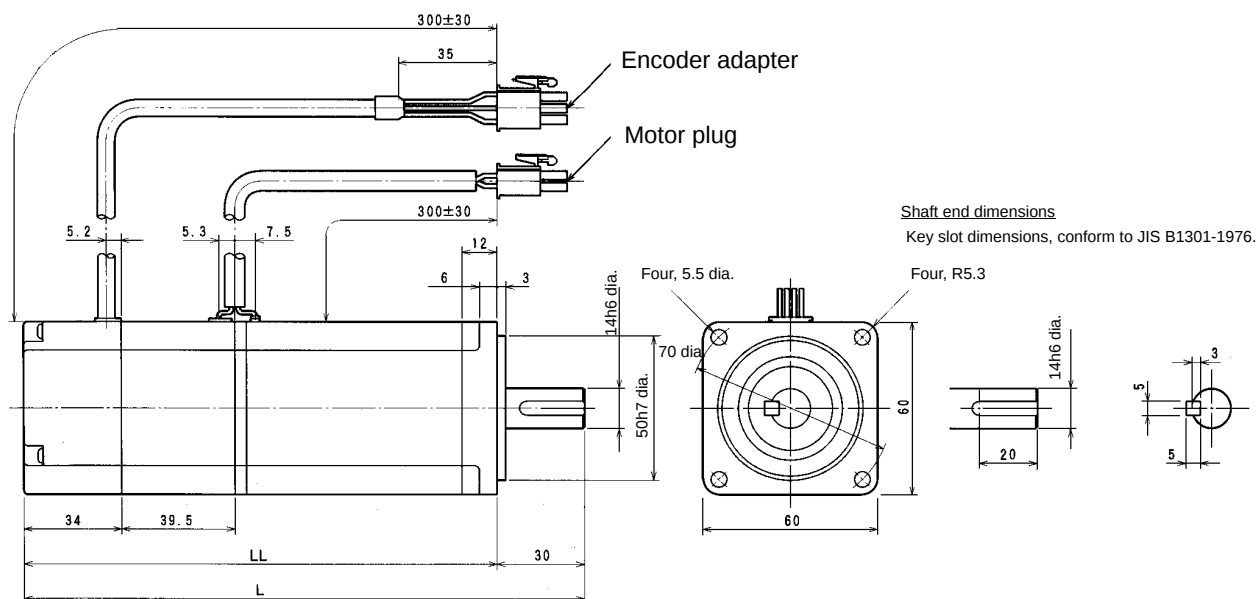


## OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE)

### 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

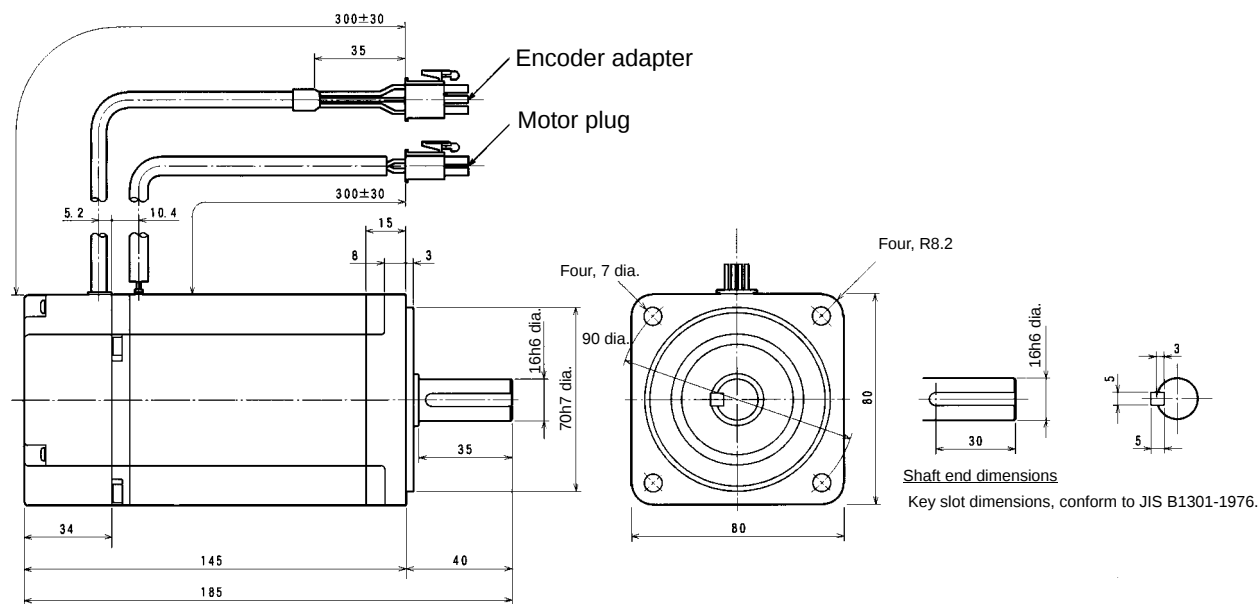


| Standard Models (Without Brakes) |       |       |
|----------------------------------|-------|-------|
| Model                            | L     | LL    |
| R88M-UE20030H-S1                 | 126.5 | 96.5  |
| R88M-UE40030H-S1                 | 154.5 | 124.5 |

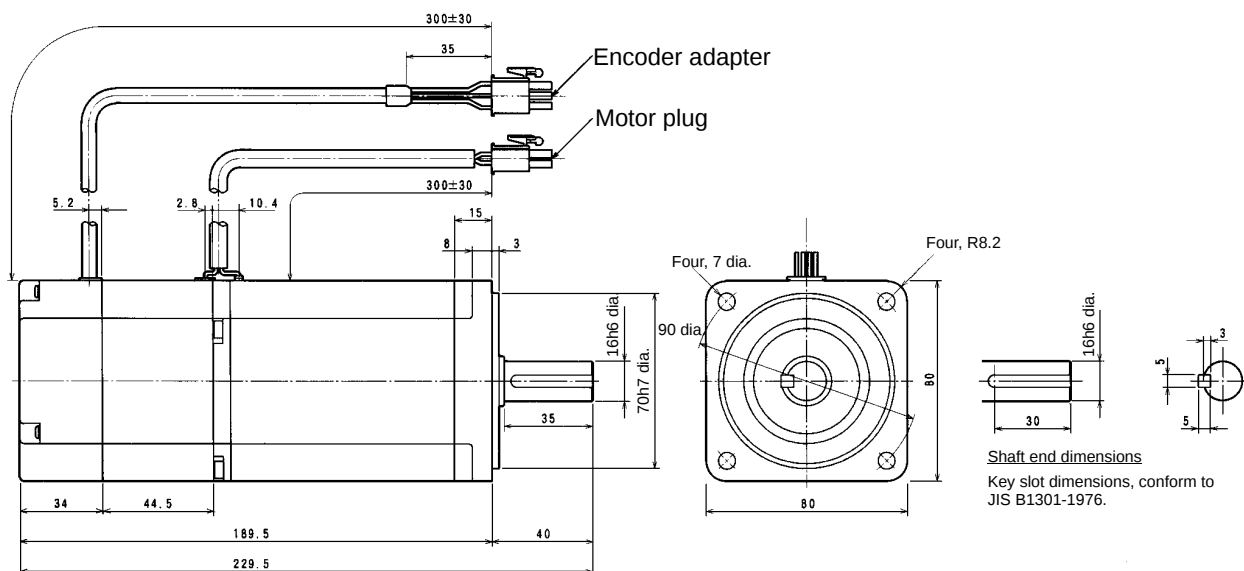
| Models with Brakes |     |     |
|--------------------|-----|-----|
| Model              | L   | LL  |
| R88M-UE20030H-BS1  | 166 | 136 |
| R88M-UE40030H-BS1  | 194 | 164 |

## 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

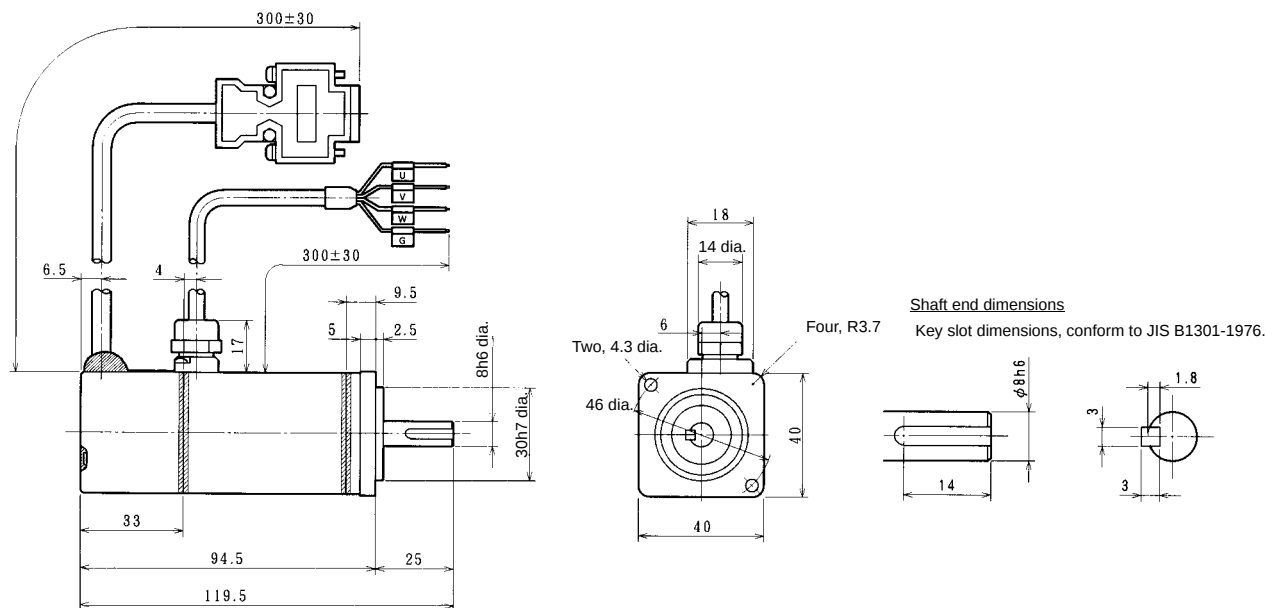


### □750-W Models with Brakes: R88M-UE75030H-BS1

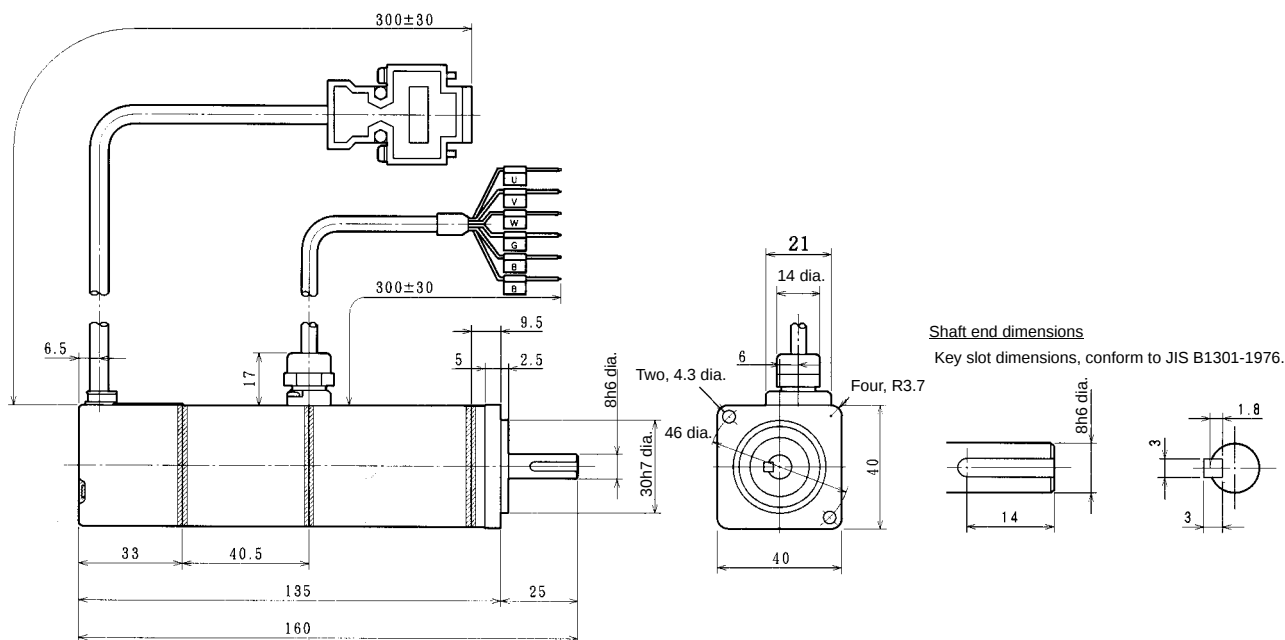


## OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Conforming to EC Directives

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

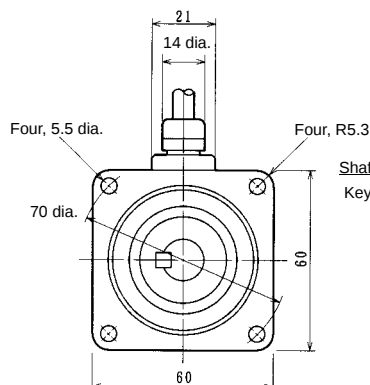
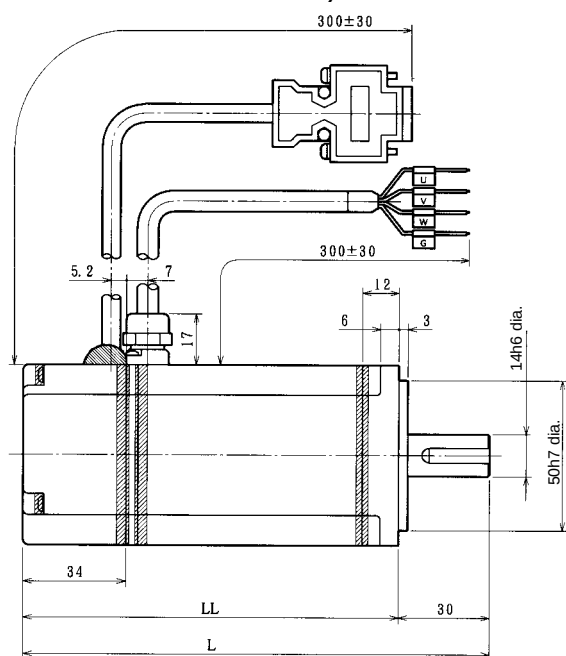


### □ 100-W Models with Brakes: R88M-UE10030V-BS1



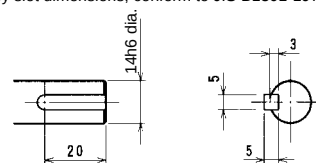
## OMNUC U-UE-Series AC Servomotors with Incremental Encoders (UE) Conforming to EC Directives (Contd.)

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

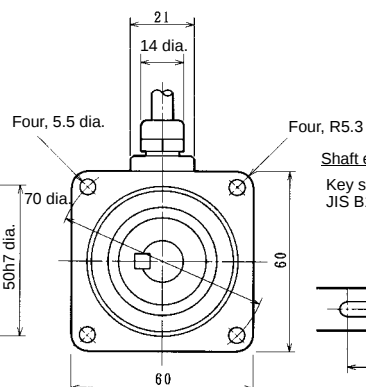
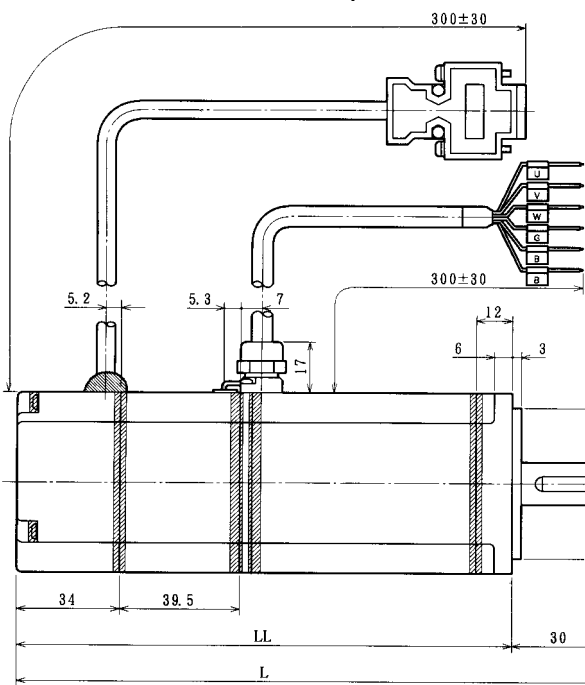


### Shaft end dimensions

Key slot dimensions, conform to JIS B1301-1976.

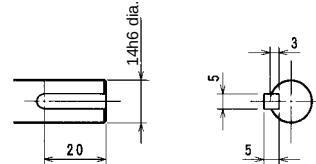


☐ **200-W/400-W Models with Brakes:**  
R88M-UE20030V-BS1, R88M-UE40030V-BS1



### Shaft end dimensions

Key slot dimensions, conform to JIS B1301-1976.



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

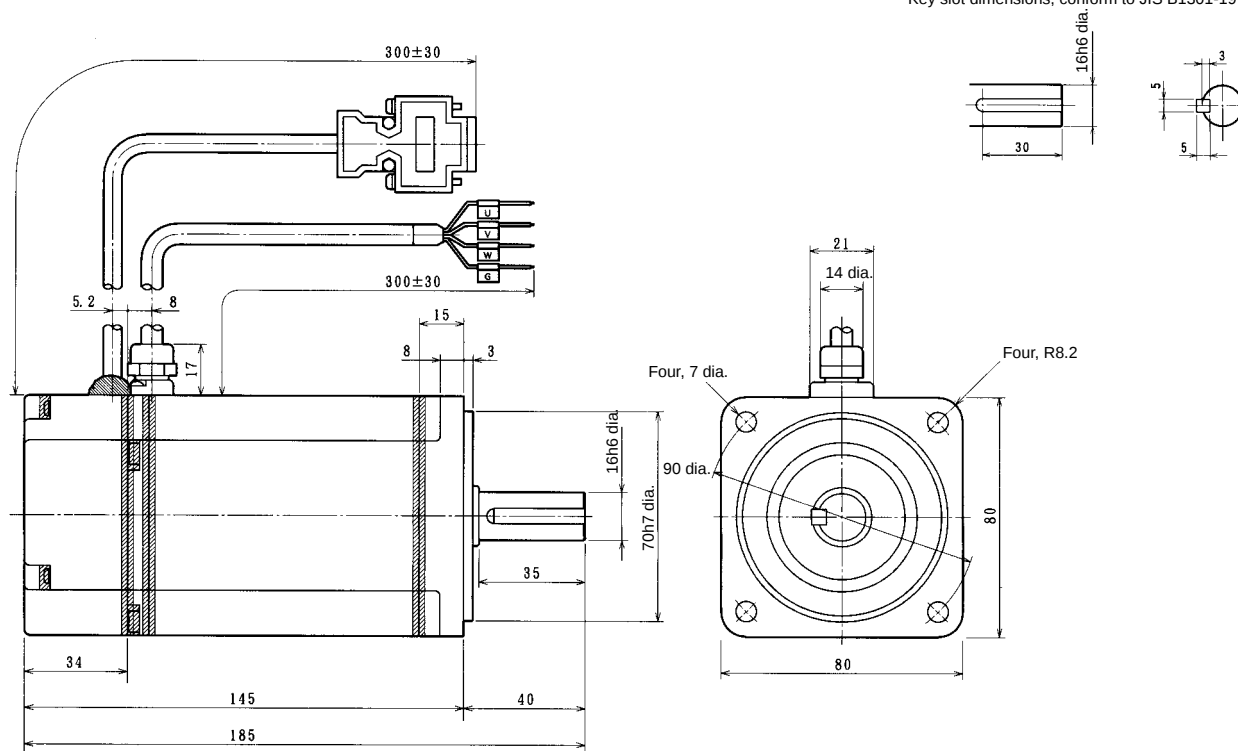
| Models with Brakes |     |     |
|--------------------|-----|-----|
| Model              | L   | LL  |
| R88M-UE20030V-BS1  | 166 | 136 |
| R88M-UE40030V-BS1  | 194 | 164 |

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

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

Shaft end dimensions

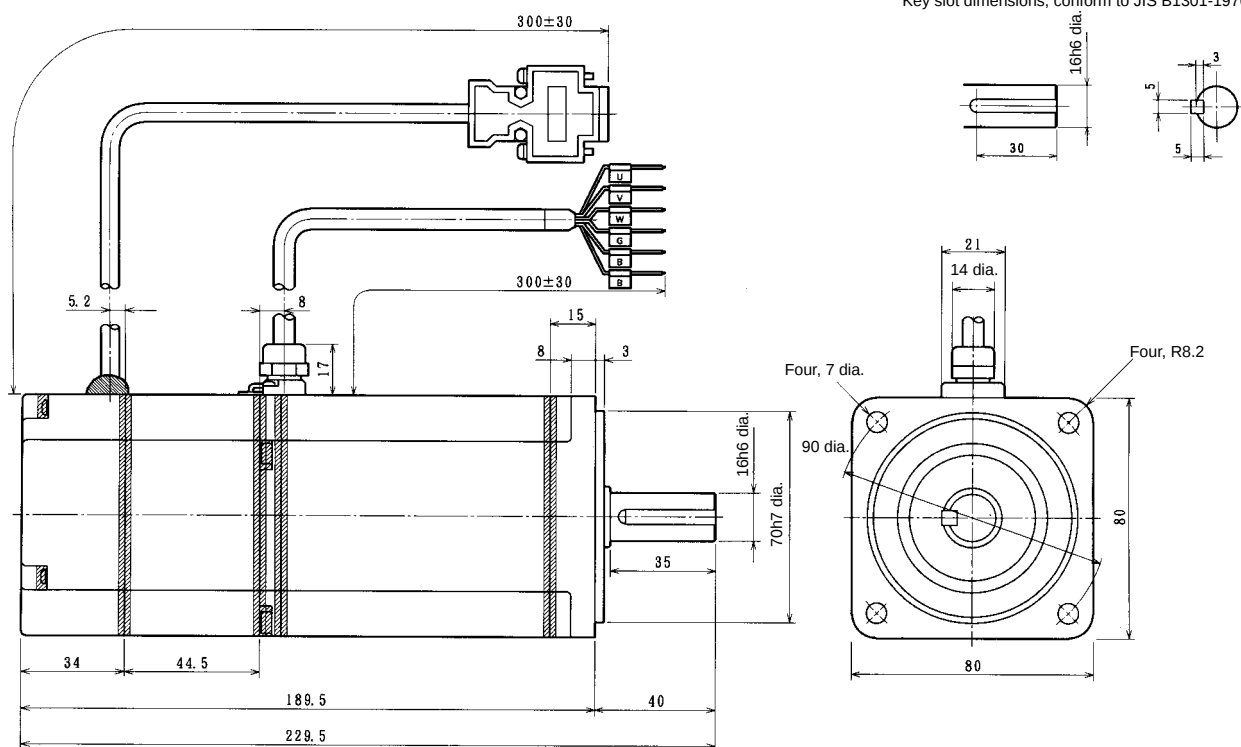
Key slot dimensions, conform to JIS B1301-1976.



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

Shaft end dimensions

Key slot dimensions, conform to JIS B1301-1976.

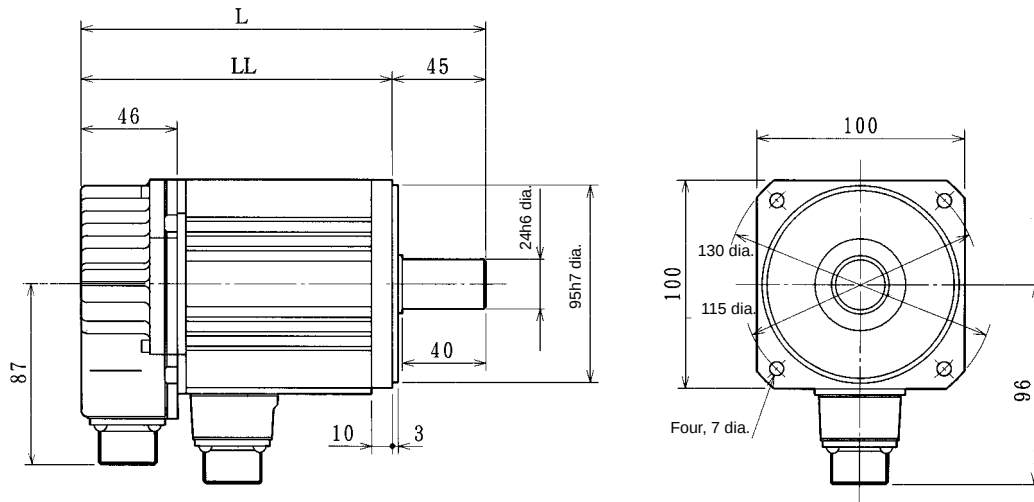


## OMNUC U-Series AC Servomotors with Incremental Encoders (U-INC 1 to 2 kW)

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

Not Conforming to Any Standards: R88M-U1K030H/-U1K530H/-U2K030H

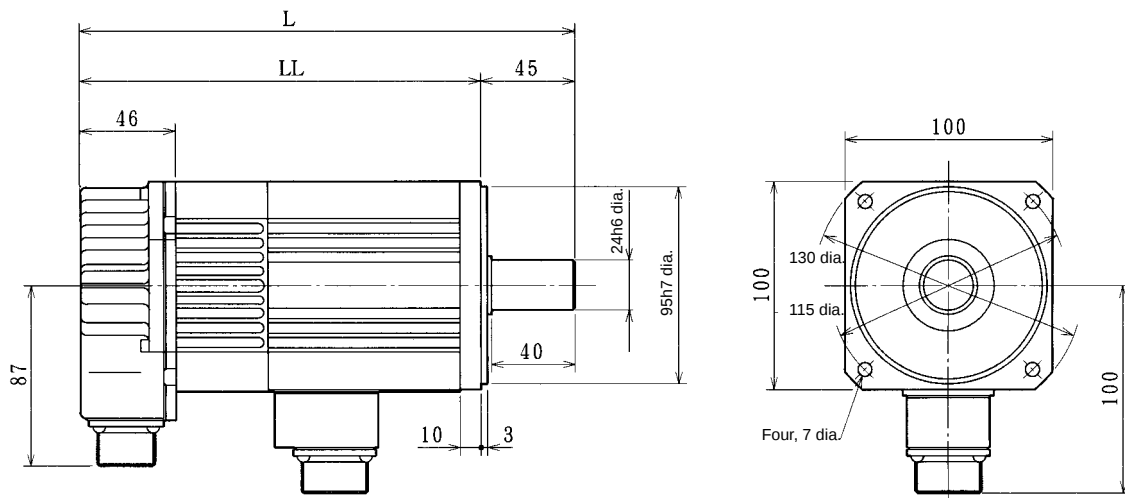
Conforming to EC Directives: R88M-U1K030V-S1/-U1K530V-S1/-U2K030V-S1



### 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 |

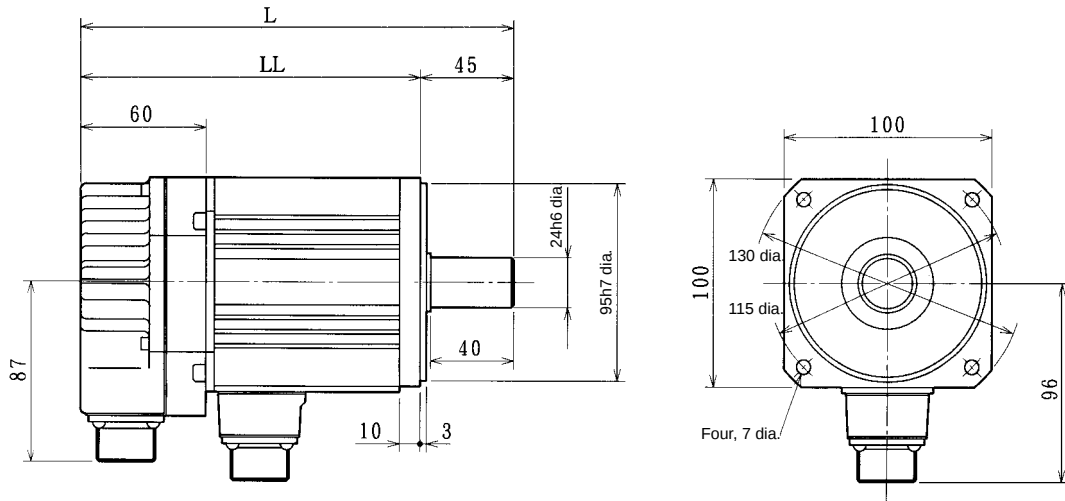
**Note** Servomotors with model numbers ending in “S1” have straight shafts with keys. Refer to *page 2-25 U-Series AC Servomotor Shaft Dimensions with Keys* for key dimensions.

## 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

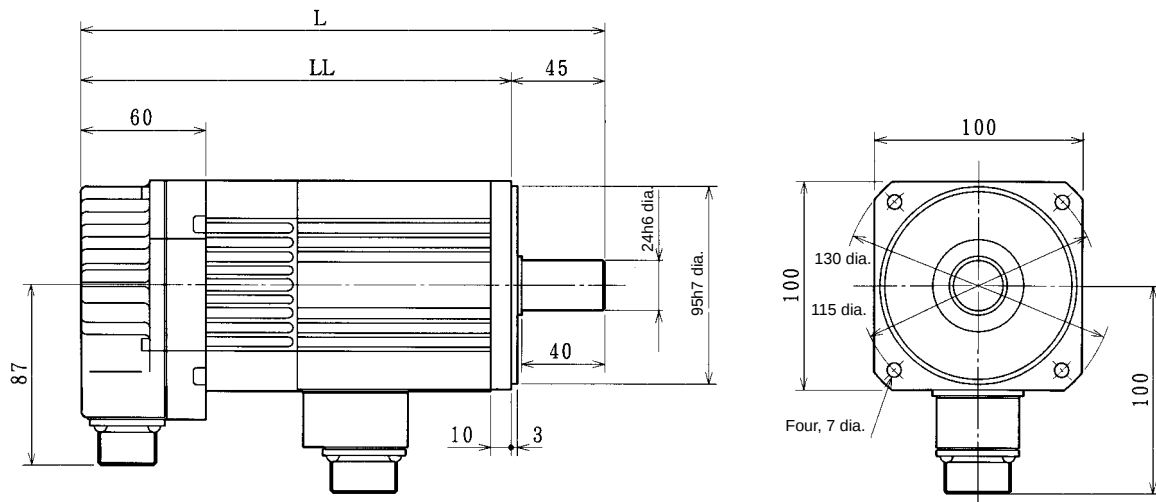
Conforming to EC Directives: R88M-U1K030X-S1/-U1K530X-S1/-U2K030X-S1



### 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.

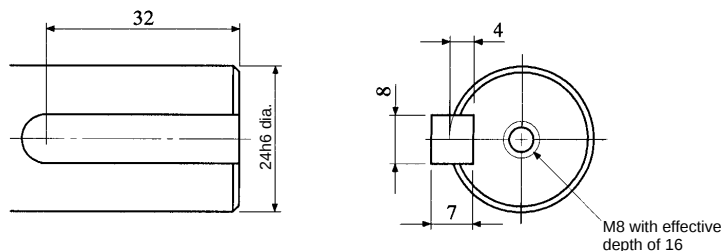
### U-Series AC Servomotor Shaft Dimensions with Keys (U-INC, U-ABS, 1 to 2 kW)

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

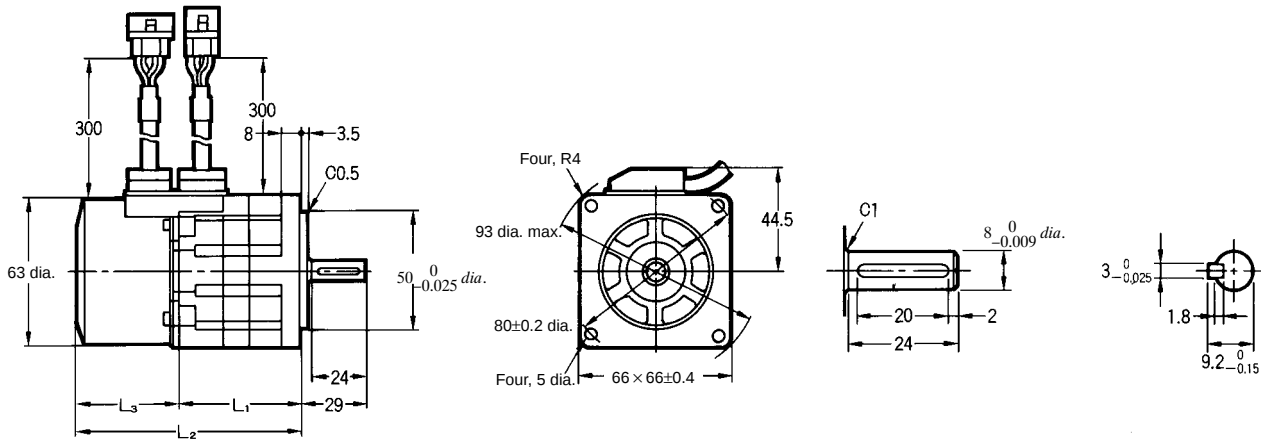
**With Brakes:** R88M-U1K030 -BS1, R88M-U1K530 -BS1, R88M-U2K030 -BS1



## 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

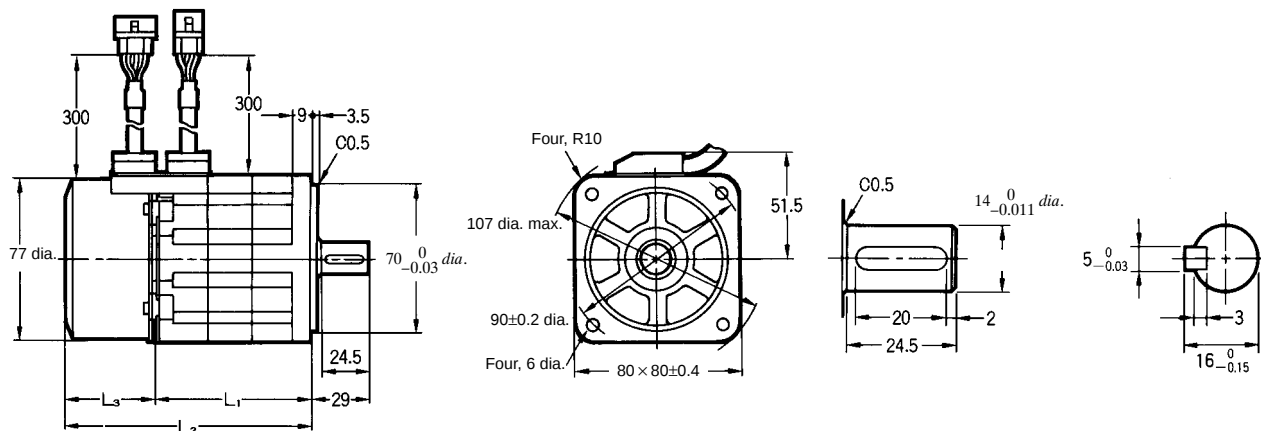


| Standard Models (Without Brakes) |      |     |      |
|----------------------------------|------|-----|------|
| Model                            | L1   | L2  | L3   |
| R88M-H05030 (50 W)               | 53.5 | 99  | 45.5 |
| R88M-H10030 (100 W)              | 63.5 | 109 | 45.5 |

| 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



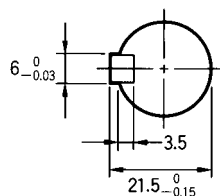
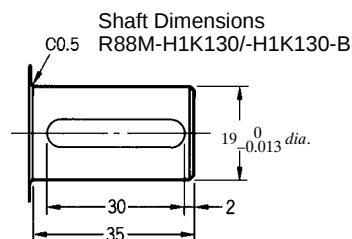
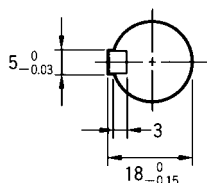
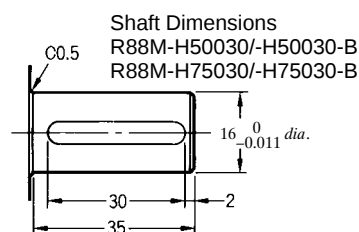
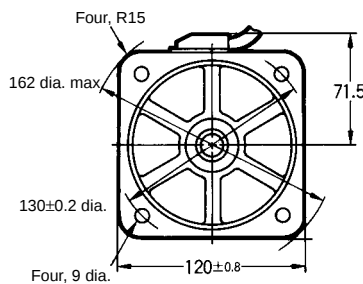
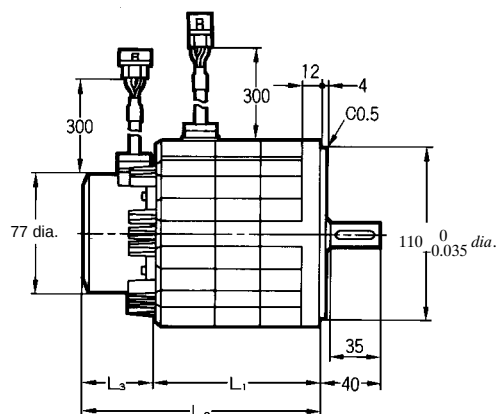
| Standard Models (Without Brakes) |    |       |      |
|----------------------------------|----|-------|------|
| Model                            | L1 | L2    | L3   |
| R88M-H20030 (200 W)              | 77 | 123.5 | 46.5 |
| R88M-H30030 (300 W)              | 89 | 135.5 | 46.5 |

| 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 |

## 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

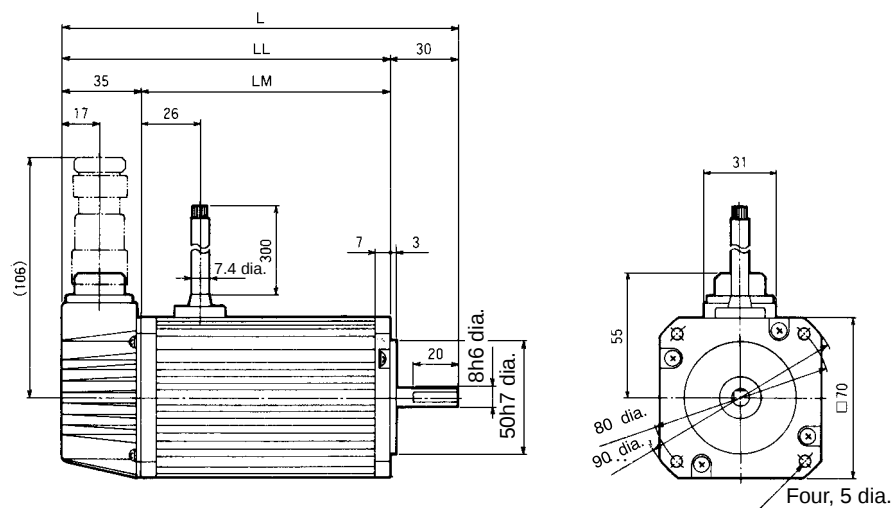


| Standard Models (Without Brakes) |       |       |      |
|----------------------------------|-------|-------|------|
| Model                            | L1    | L2    | L3   |
| R88M-H50030 (500 W)              | 107.5 | 154.0 | 46.5 |
| R88M-H75030 (750 W)              | 126.0 | 172.5 | 46.5 |
|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

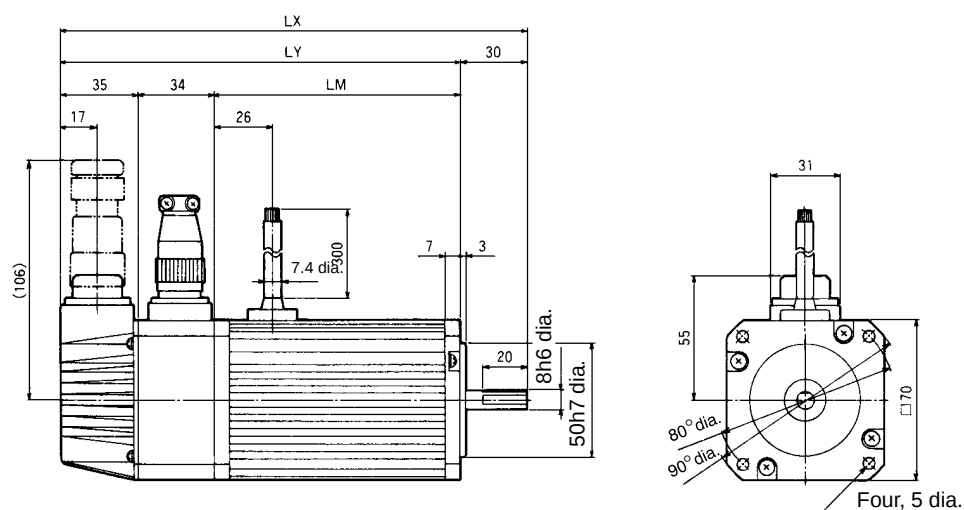
| Models With Brakes     |       |       |      |
|------------------------|-------|-------|------|
| Model                  | L1    | L2    | L3   |
| R88M-H50030-B (500 W)  | 148.5 | 195.0 | 46.5 |
| R88M-H75030-B (750 W)  | 167.0 | 213.5 | 46.5 |
| R88M-H1K130-B (1100 W) | 185.5 | 232.0 | 46.5 |

## OMNUC M-Series AC Servomotors with Resolvers (M)

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



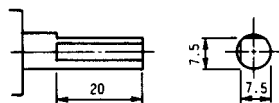
□ 60-W/120-W (4,000 r/min) Models with Brakes: R88M-M06040-B, R88M-M12040-B



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

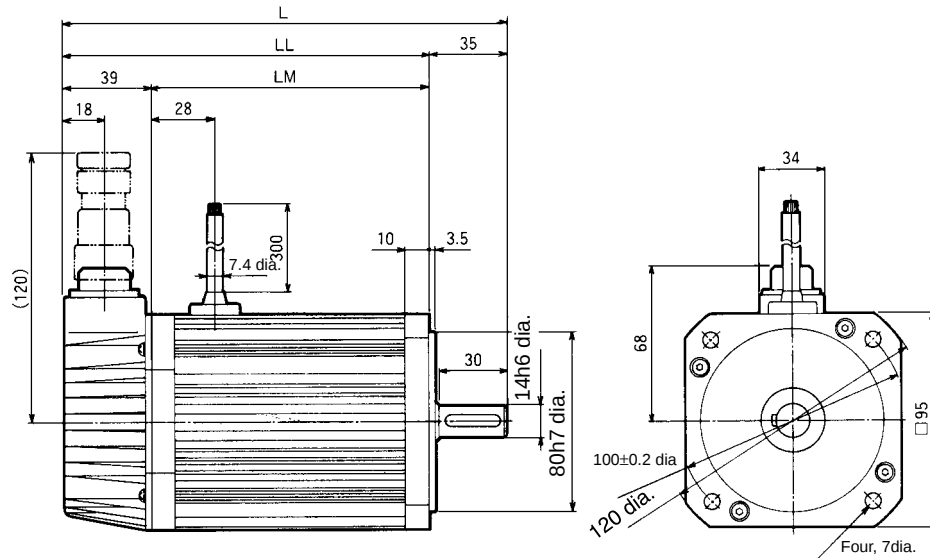
| Models with Brakes |     |     |     |
|--------------------|-----|-----|-----|
| Model              | LX  | LY  | LM  |
| R88M-M06040-B      | 184 | 154 | 85  |
| R88M-M12040-B      | 209 | 179 | 110 |

□ Shaft End Dimensions

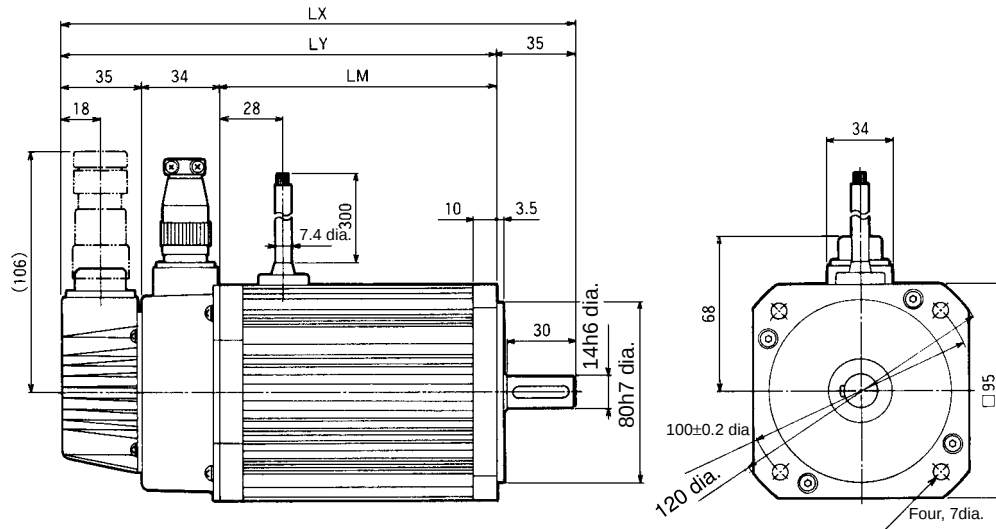


# OMNUC M-Series AC Servomotors with Resolvers (M) (Contd.)

- 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



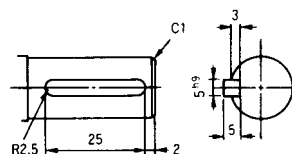
- 200-W (2,000 r/min) Models with Brakes: R88M-M20020-B
- 200-W/400-W (4,000 r/min) Models with Brakes: R88M-M20040-B, R88M-M40040-B



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

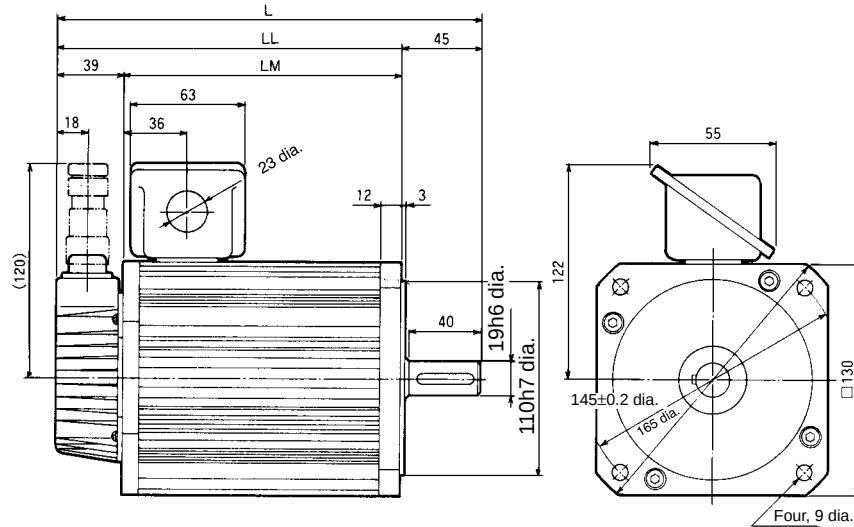
| Models with Brakes |     |     |     |
|--------------------|-----|-----|-----|
| Model              | LX  | LY  | LM  |
| R88M-M20040-B      | 196 | 161 | 92  |
| R88M-M20020-B      | 226 | 191 | 122 |
| R88M-M40040-B      |     |     |     |

## □ Shaft End Dimensions

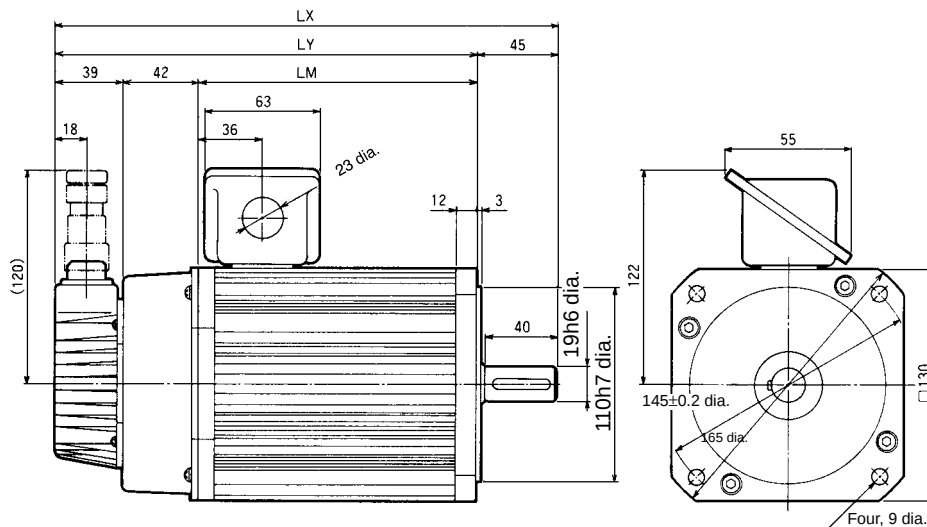


## OMNUC M-Series AC Servomotors with Resolvers (M) (Contd.)

- 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



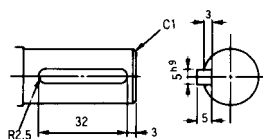
- 200-W/400-W/700-W (1,200 r/min)  
Models with Brakes: R88M-M20012-B, R88M-M40012-B, R88M-M70012-B
- 400-W/700-W/1,100-W (2,000 r/min) Models with Brakes: R88M-M40020-B, R88M-M70020-B, R88M-M1K120B
- 700-W/1,100-W/2,000-W (4,000 r/min) Models with Brakes: R88M-M70040-B, R88M-M1K140-B, R88M-M2K040-B



| 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      |     |     |     |

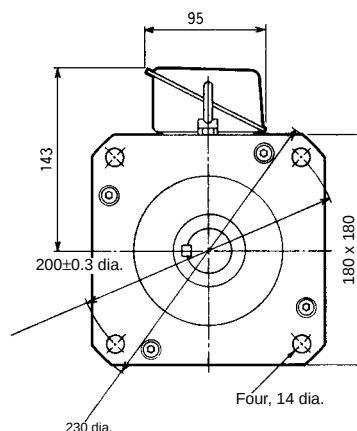
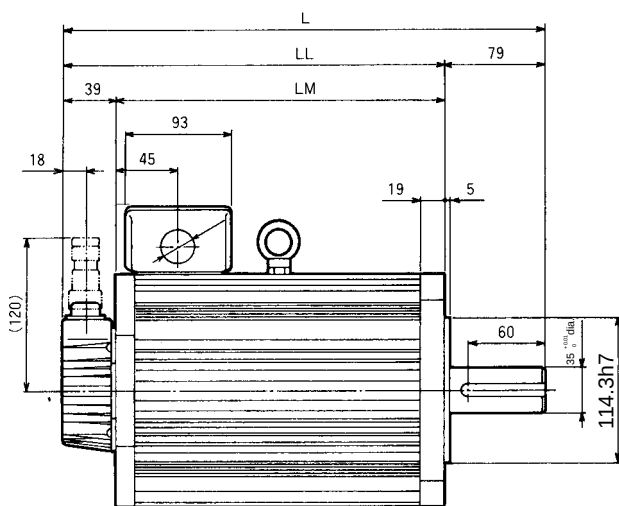
□ Shaft End Directions



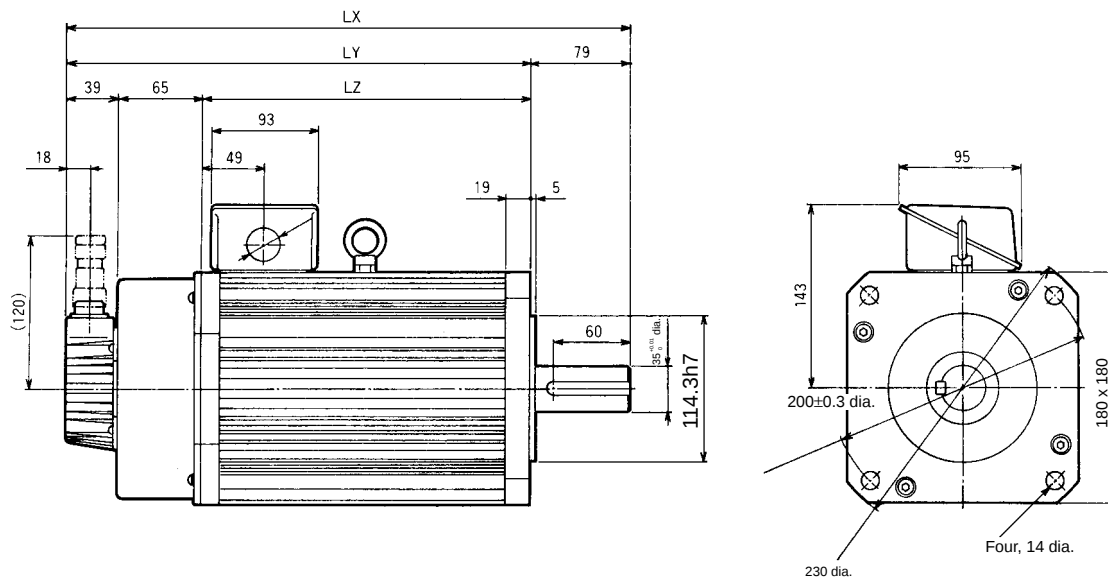
OMNUC M-Series AC Servomotors with Resolvers (Contd.)

□ 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



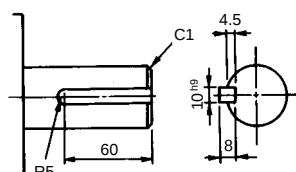
- 1,100-W/1,400-W/1,800-W (1,200 r/min) Models with Brakes:  
R88M-M1K112-B/-M1K412-B/-M1K812-B
- 1,800-W/2,200-W (2,000 r/min) Models with Brakes:  
R88M-M1K820-B/-M2K220-B



| 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

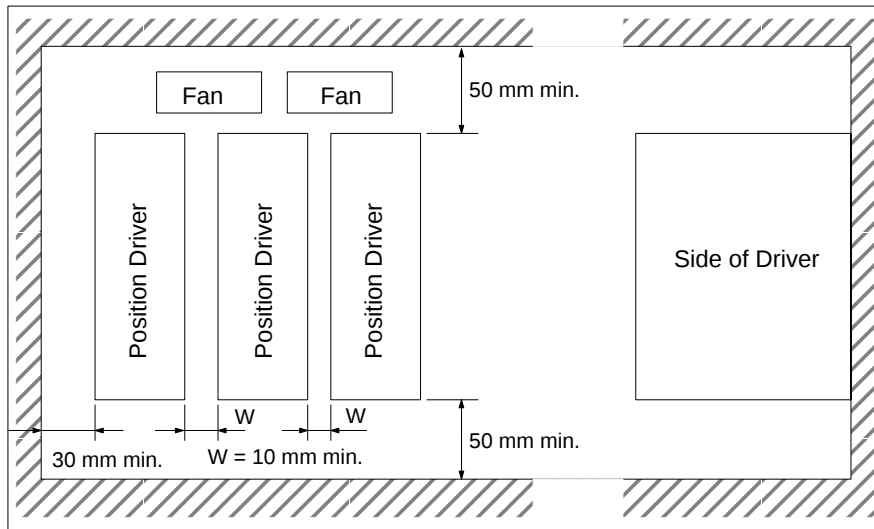


## 2-1-2 Installation Conditions

### 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.

### □ 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

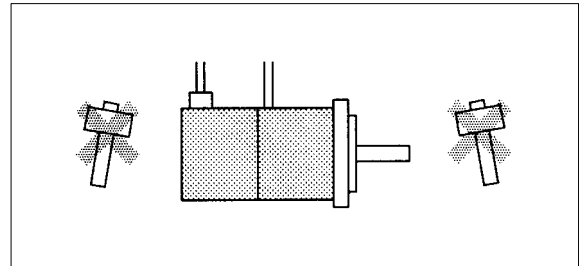
### □ Operating Environment

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<sup>2</sup> {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.



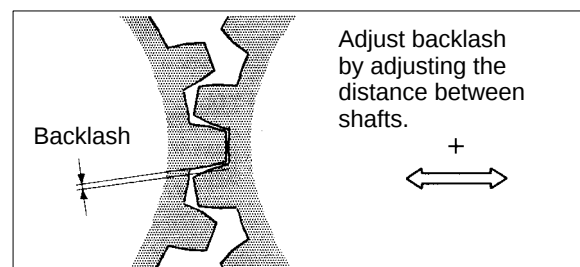
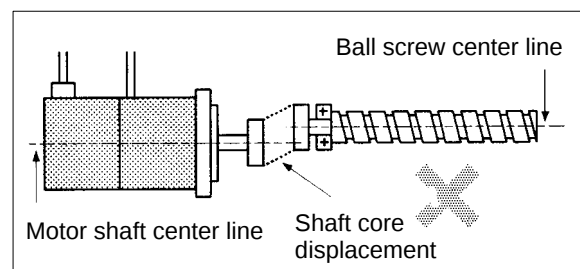
### □ Connecting to Mechanical Systems

- 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.

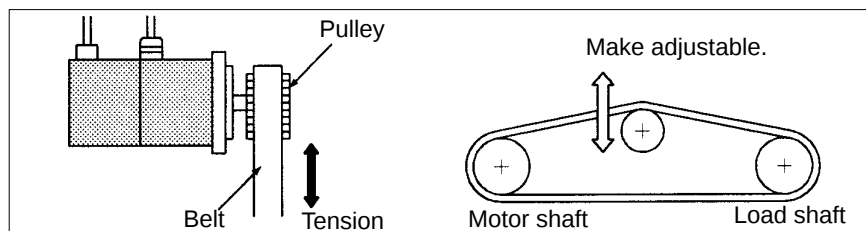
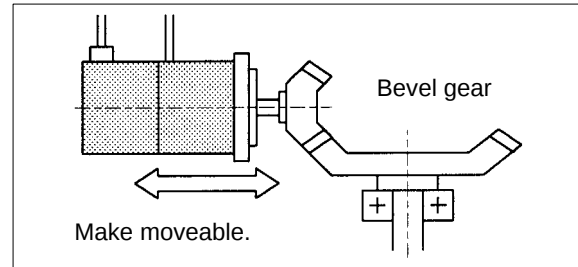
#### Recommended Coupling

| 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.



- 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.

**Power Cable Connectors**

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

**Encoder Cable Connectors**

| Servomotor | Connector model                                                                           | Cable clamp model                                                                                                                                                                                            | Manufacturer                              |
|------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| All models | Elbow connectors:<br>JA08A-20-29S-J1-EB<br><br>Straight connectors:<br>JA06A-20-29S-J1-EB | Sheath exterior diameter of 6.5 to 9.5 mm:<br>JL04-2022CKE (09)<br><br>Sheath exterior diameter of 9.5 to 13 mm:<br>JL04-2022CKE (12)<br><br>Sheath exterior diameter of 12.9 to 16 mm:<br>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.

- 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  $\pm 6$  pulses). If only a very small distance is to be moved, move the motor at least  $\pm 6$  pulses after turning ON the power before starting actual operation.

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## **2-2 Wiring**

---

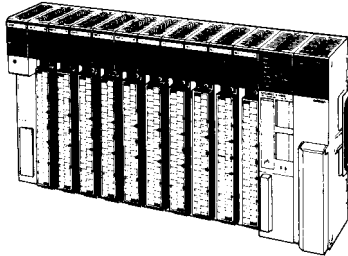
### **2-2-1 Overview**

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.)

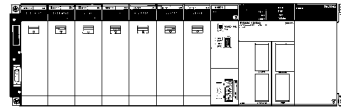
**Note** Refer to *Chapter 5 Specifications* for details on connectors and cables.

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

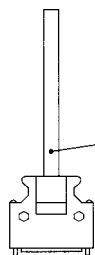
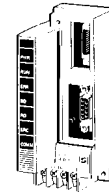
SYSMAC CV/C-series  
Programmable Controller



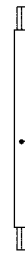
C200HX/HG/HE or CQM1  
Programmable Controller



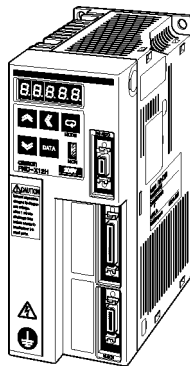
SRM1-C01/-C02  
Master Control Unit



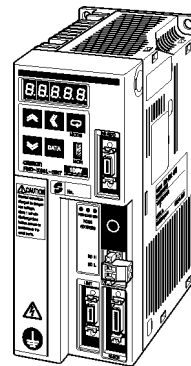
General-purpose  
Control Cable  
FND-CCX S



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

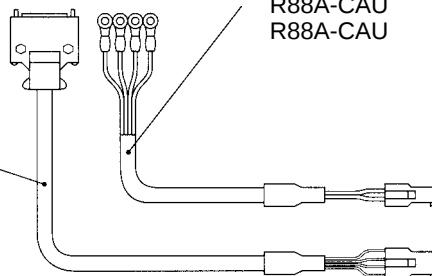


FND-X-series Position Driver  
(DIO Type)



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

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

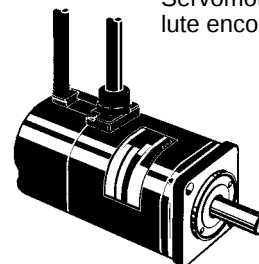


Power Cable  
R88A-CAU S  
R88A-CAU B

Backup Battery



Connect when using a  
Servomotor with an absolute  
encoder.

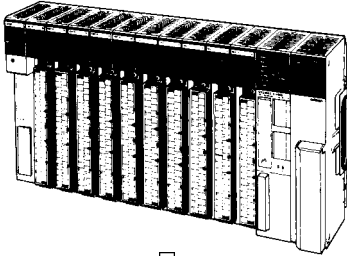


OMNUC U-Series AC Servomotor  
Conforming to UL/cUL or  
U-UE-Series AC Servomotor Not  
Conforming to Any Standards

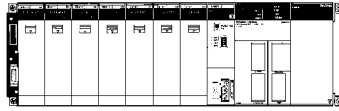
**Note** Refer to *Chapter 5 Specifications* for connector and cable specifications.

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

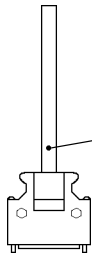
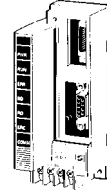
SYSMAC CV/C-series  
Programmable Controller



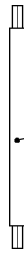
C200HX/HG/HE or CQM1  
Programmable Controller



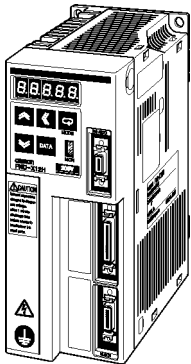
SRM1-C01/-C02  
Master Control Unit



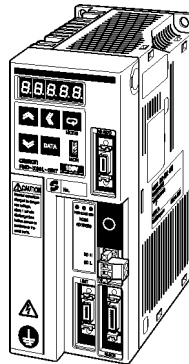
General-purpose  
Control Cable  
FND-CCX S



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



FND-X-series Position Driver  
(DIO Type)

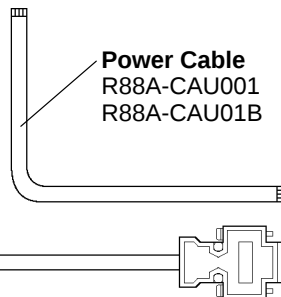


FND-X-series Position Driver  
(CompoBus/S Type)

Encoder Cable  
R88A-CRUD C  
(for incremental encoder)  
R88A-CSUD C  
(for absolute encoder)



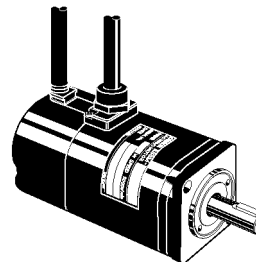
Power Cable  
R88A-CAU001  
R88A-CAU01B



Backup Battery



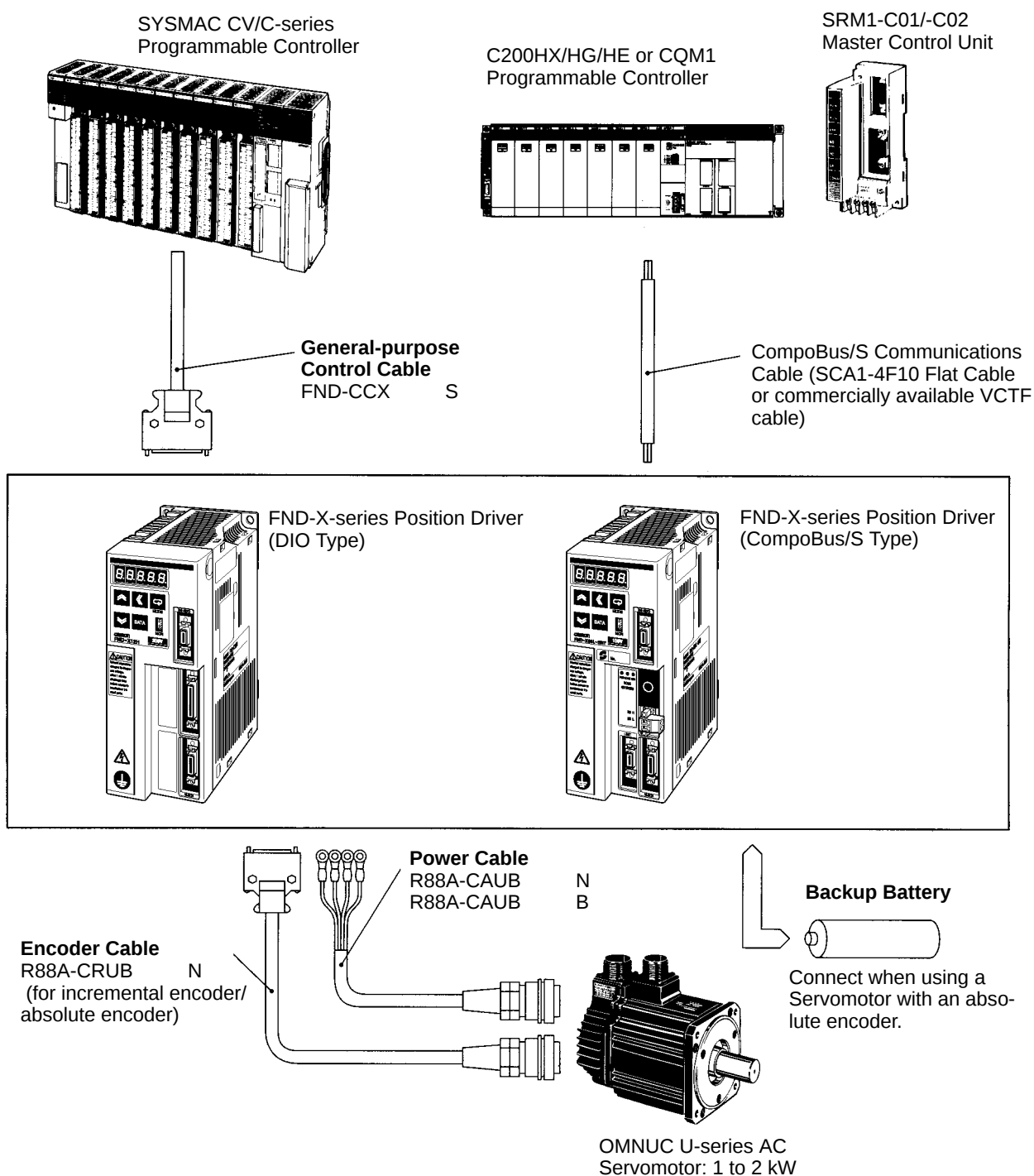
Connect when using a  
Servomotor with an absolute  
encoder.



OMNUC U-Series AC Servomotor  
Conforming to EC Directives or  
U-UE-Series AC Servomotor Con-  
forming to EC Directives

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

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

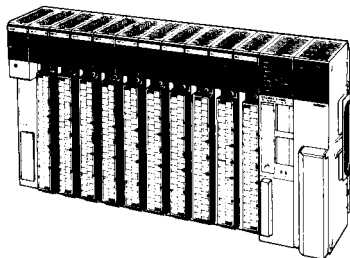


**Note 1.** Refer to *Chapter 5 Specifications* for connector and cable specifications.

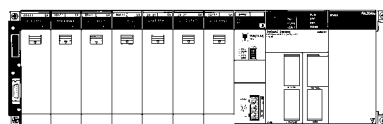
**Note 2.** To perform mounting in accordance with EC Directives, use a Servomotor that conforms to EC Directives. In addition, replace the connectors for the power cable and the encoder cable at the Servomotor with the recommended Connectors listed under *Water and Drip Resistance* in *2-1-2 Installation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

## Using an OMNUC H-series AC Servomotor

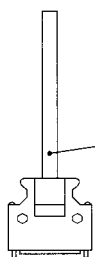
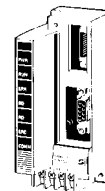
SYSMAC CV/C-series  
Programmable Controller



SYSMAC HX/HG/HE or CQM1  
Programmable Controller



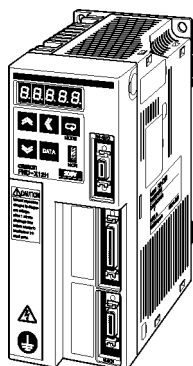
SRM1-C01/-C02  
Master Control Unit



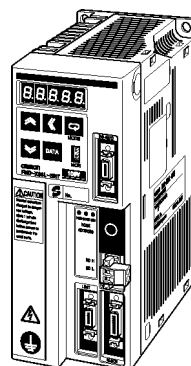
General-purpose  
Control Cable  
FND-CCX S



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

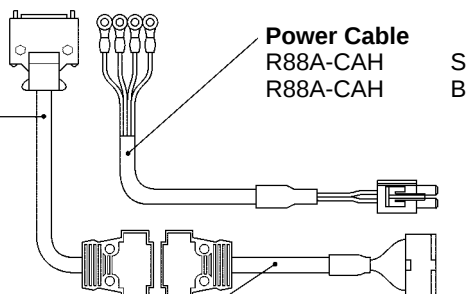


FND-X-series Position Driver  
(DIO Type)



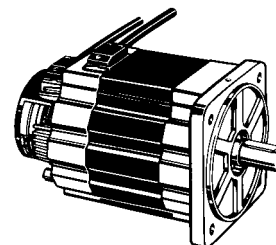
FND-X-series Position Driver  
(CompoBus/S Type)

Conversion Cable  
R88A-CRH0R5T



Power Cable  
R88A-CAH S  
R88A-CAH B

Encoder Cable  
R88A-CRH C

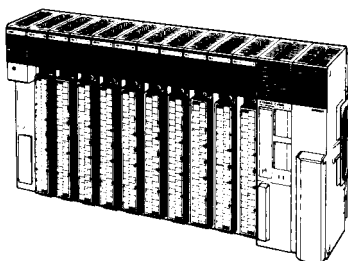


OMNUC H-series AC  
Servomotor

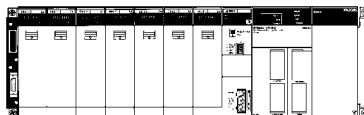
**Note** Refer to *Chapter 5 Specifications* for connector and cable specifications.

## Using an OMNUC M-series AC Servomotor

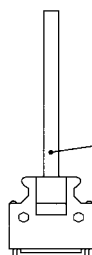
SYSMAC CV/C-series  
Programmable Controller



C200HX/HG/HE or CQM1  
Programmable Controller



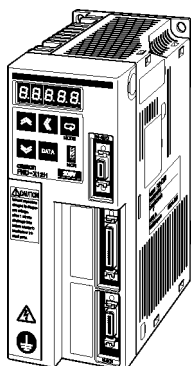
SRM1-C01/-C02  
Master Control Unit



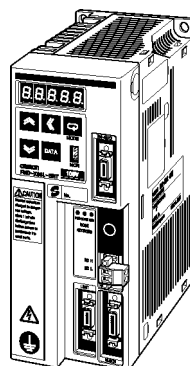
General-purpose  
Control Cable  
FND-CCX S



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)

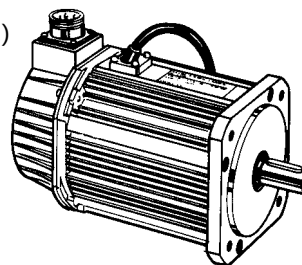
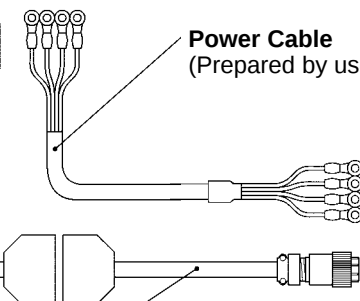
Conversion Cable  
R88A-CRM0R5T



Power Cable  
(Prepared by user.)

Resolver Cable  
R88A-CRM

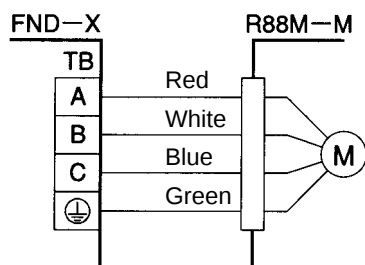
N



OMNUC M-series  
AC Servomotor

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

## □ Wiring Power Cables



## □ Power Cable Wire Sizes

| Model<br>R88M- | Wire size       |       |
|----------------|-----------------|-------|
|                | mm <sup>2</sup> | 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<br>R88M- | Wire size       |       |
|----------------|-----------------|-------|
|                | mm <sup>2</sup> | 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 |

## 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 | 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.

**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            | 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).

### External Control Signal Connectors (CN4: LIMIT) Pin Arrangement

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

#### □ 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 is OFF for the external control input (CN4-4) or the CompoBus/S input (OUT7).

### 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)<br>ON: Drive possible<br>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)<br>ON: Drive possible<br>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)<br>When OFF, error counter is cleared.<br>ON: Power ON to motor<br>OFF: Power OFF to motor                                                                                                                                                                                                                          | IN0                 |
| CN1-5  | OUT1        | START  | START            | Begins positioning operation (rising edge enabled)<br>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):<br>ON: Origin search begins<br>When RUN is OFF (status enabled):<br>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):<br>When UP-01 = 11 or 12, motor's present position is taken for PTP data when this bit turns ON.<br>When UP-01 = 13 or 14, P.IN0 to P.IN7 is taken as positioning data when this bit turns ON.<br>When RUN is OFF and ORIGIN SEARCH is ON (status enabled):<br>Motor's present position is taken for origin compensation amount. | IN6                 |

| DIO    | Compo Bus/S   | Signal | Name                                   | Function and interface                                                                                                                                                                                                                                                                       | Internal allocation |
|--------|---------------|--------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| CN1-11 | OUT8          | P.IN0  | Point selection 0/<br>Position 0       | Positioning data inputs (status enabled)<br>When UP-01 = 11 or 12, PTP data No. is input as positioning data. Range: 1 to 64, BCD input.<br>When UP-01 = 13 or 14, positioning data is input. Range: 1 to 99, BCD input.<br>Taken in order, two digits at a time, from the rightmost digits. | IN7                 |
| CN1-12 | OUT9          | P.IN1  | Point selection 1/<br>Position 1       |                                                                                                                                                                                                                                                                                              | IN8                 |
| CN1-13 | OUT10         | P.IN2  | Point selection 2/<br>Position 2       |                                                                                                                                                                                                                                                                                              | IN9                 |
| CN1-14 | OUT11         | P.IN3  | Point selection 3/<br>Position 3       |                                                                                                                                                                                                                                                                                              | IN10                |
| CN1-15 | OUT12         | P.IN4  | Point selection 4/<br>Position 4       |                                                                                                                                                                                                                                                                                              | IN11                |
| CN1-16 | OUT13         | P.IN5  | Point selection 5/<br>Position 5       |                                                                                                                                                                                                                                                                                              | IN12                |
| CN1-17 | OUT14         | P.IN6  | Point selection 6/<br>Position 6       |                                                                                                                                                                                                                                                                                              | IN13                |
| CN1-18 | OUT15         | P.IN7  | Position 7                             |                                                                                                                                                                                                                                                                                              | IN14                |
| CN1-20 | CN4-4<br>OUT7 | STOP   | Deceleration stop                      | Stops according to deceleration stop mode (falling edge enabled)<br>ON: Motor driven<br>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<br>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           | ALM    | Alarm                                  | Output indicates error occurrence at the driver or motor. Output OFF when an alarm occurs.                                                                                                                                                                                                   | OUT6                |

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

## 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.

| 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.

|            |                                 |            |                |
|------------|---------------------------------|------------|----------------|
| 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.

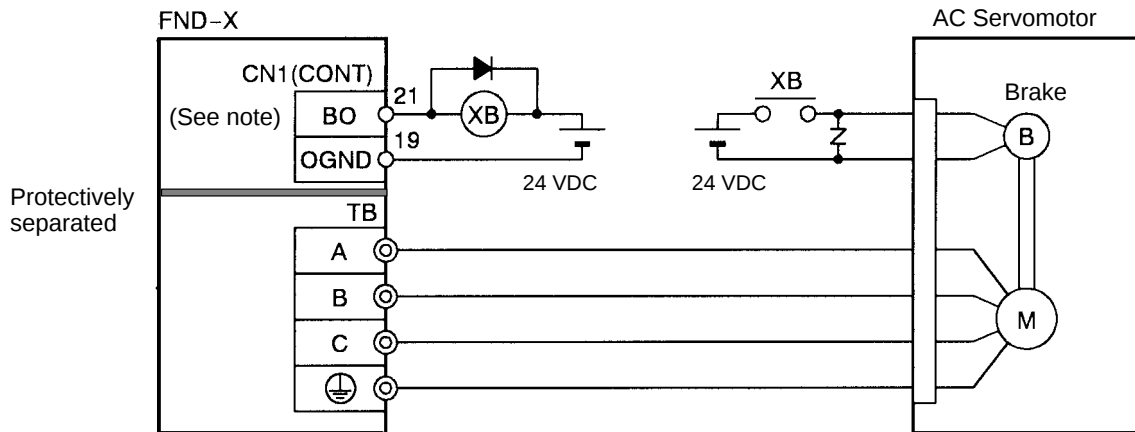
When the RUN signal has been turned OFF.

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).

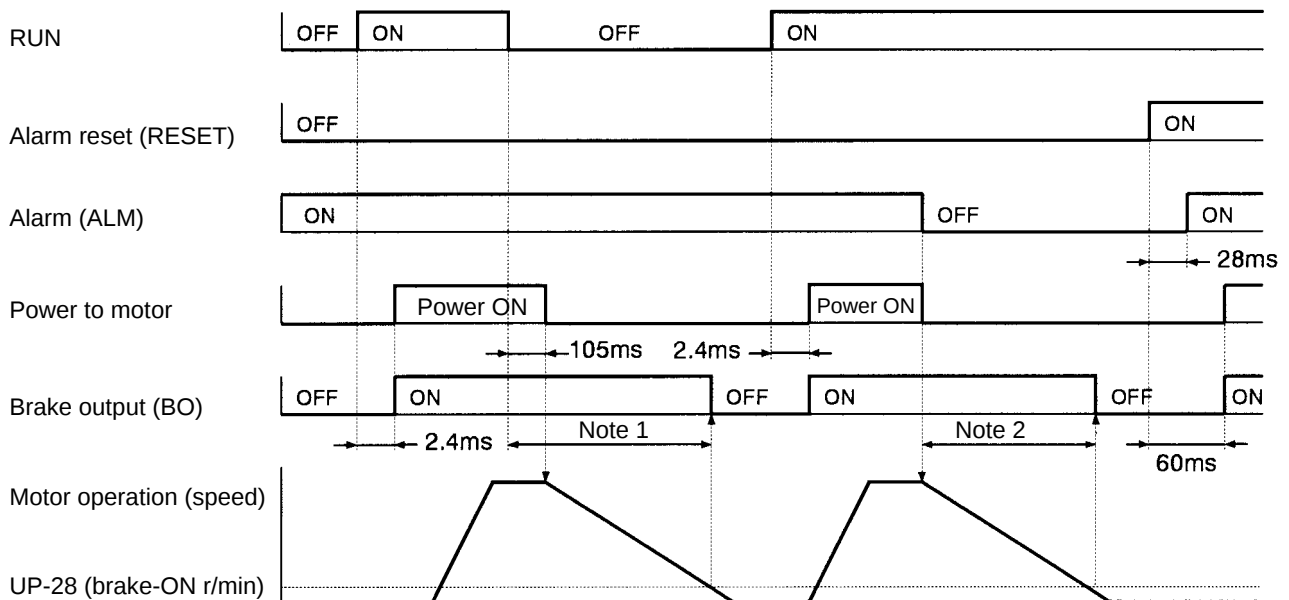
## Electromagnetic Brake Wiring and Operational Sequence

### • 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

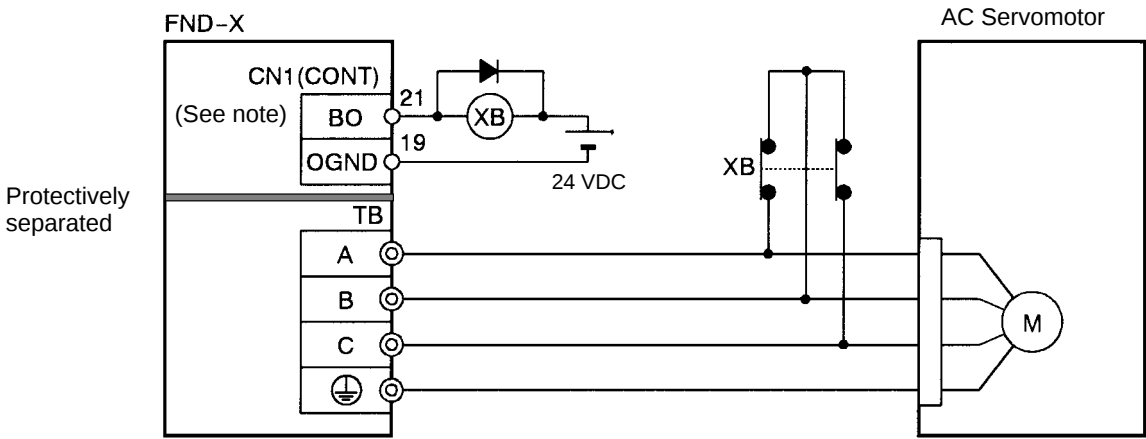


**Note 1.** When the motor is stopped, the brake output turns OFF in approximately 2.4 ms.

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

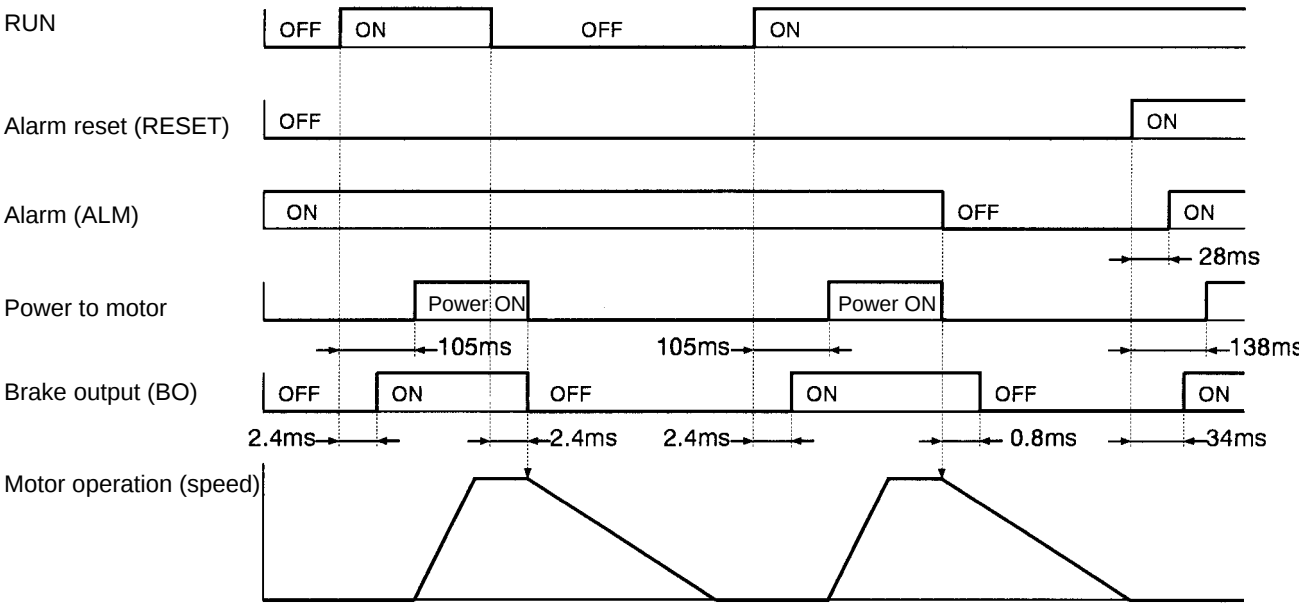
Dynamic Brake Wiring and Operational Sequence

• 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.

|       |                         |            |     |
|-------|-------------------------|------------|-----|
| 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 |
| 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 /<br>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.)

- 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  $10^1$ .

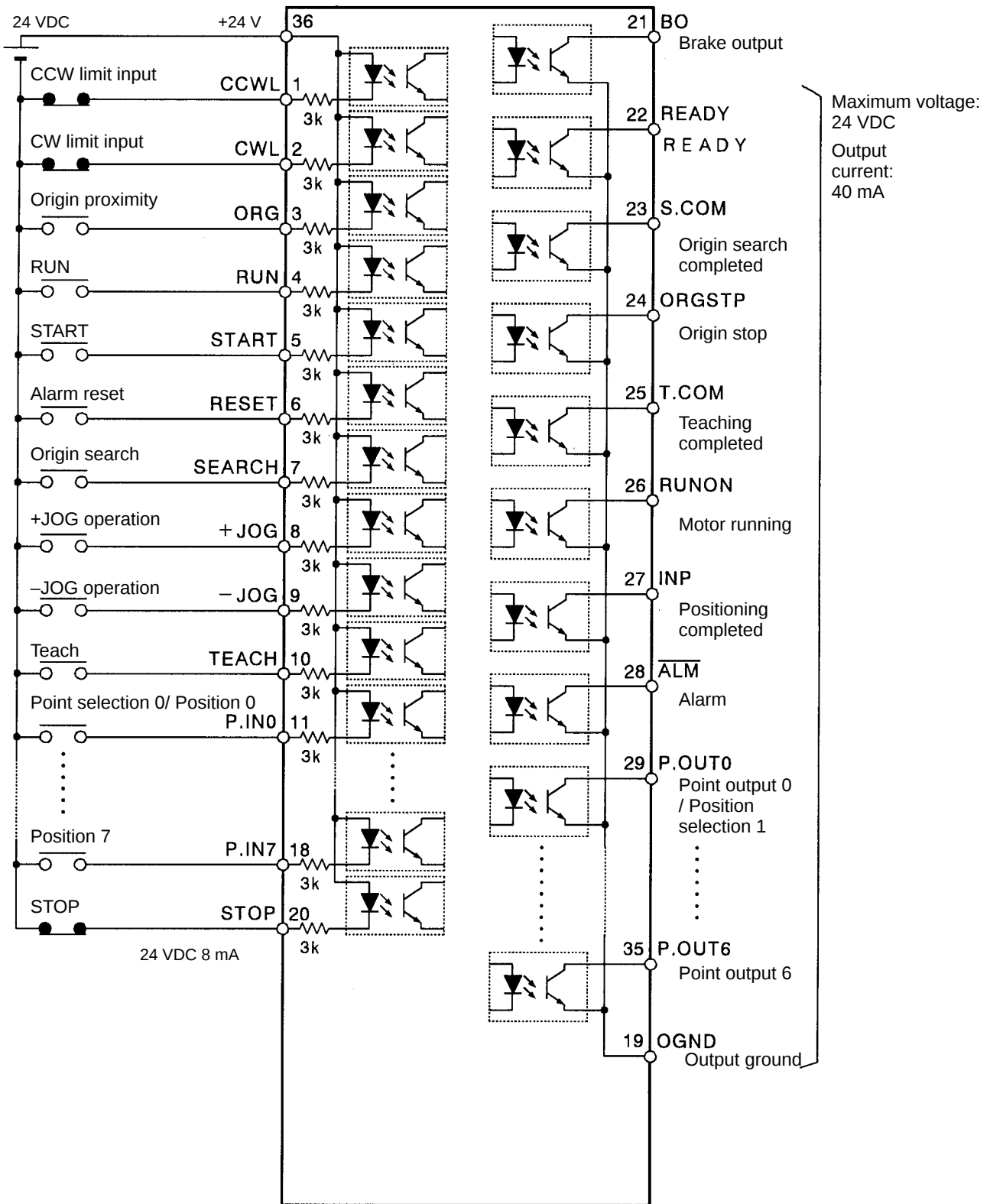
Example: When point No. 12 is selected.

|              |   |   |   |   |   |   |   |               |
|--------------|---|---|---|---|---|---|---|---------------|
| 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.

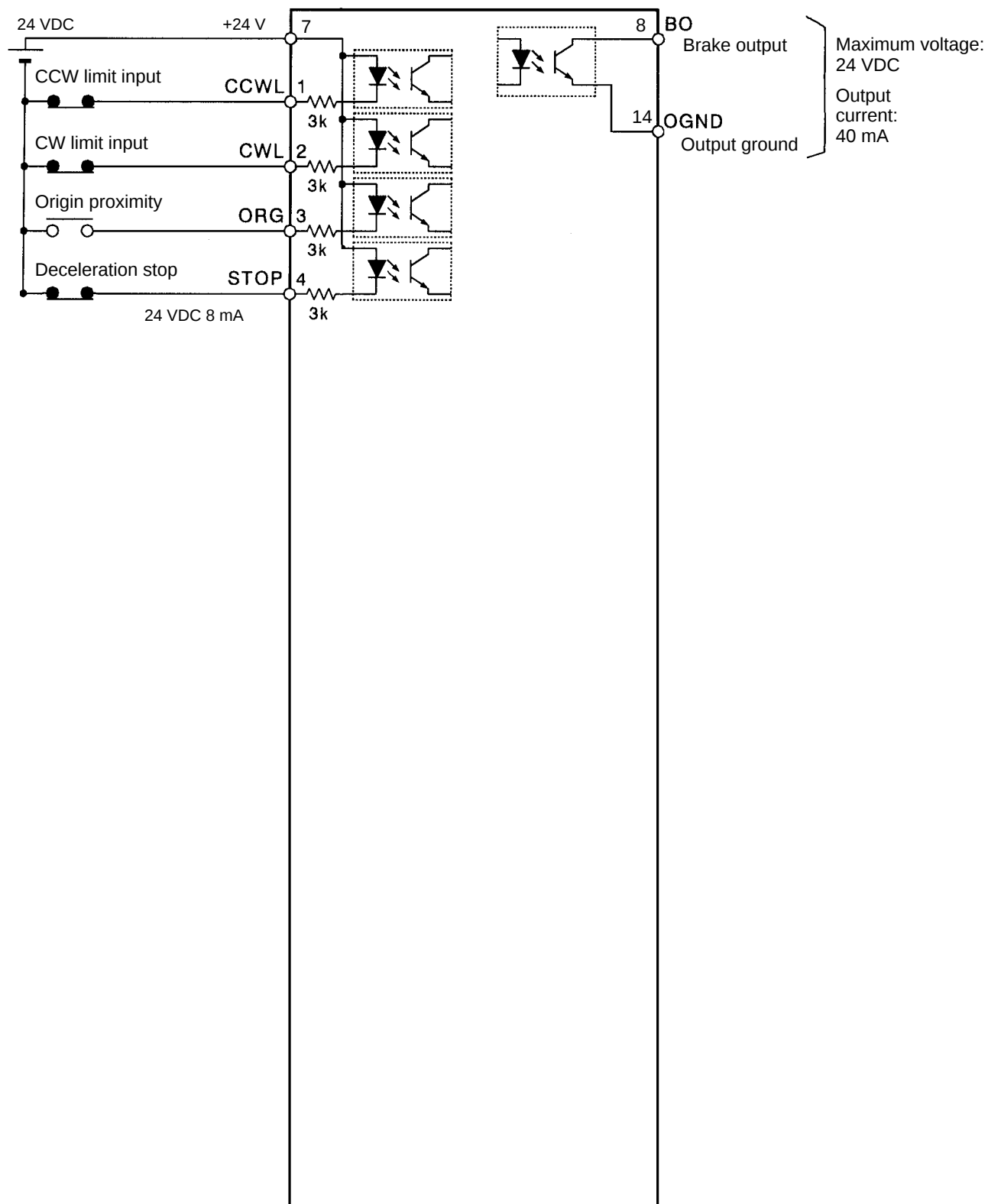
## Control I/O Connections and External Signal Processing (DIO Position Drivers)



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

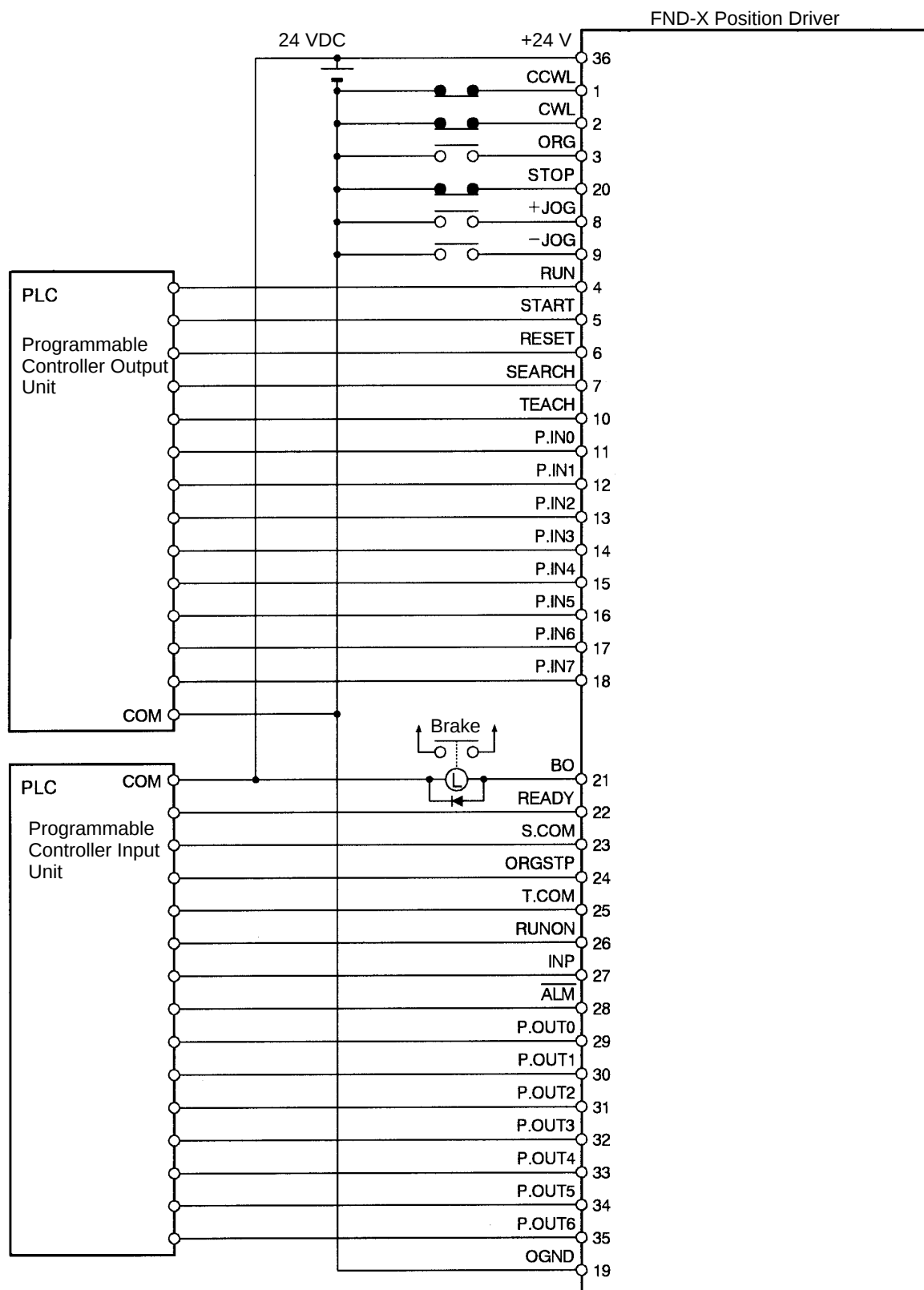
**Note 2.** The wiring for control inputs P.OUT 1 to 5 is omitted. The output circuitry is the same as for P.OUT 0.

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

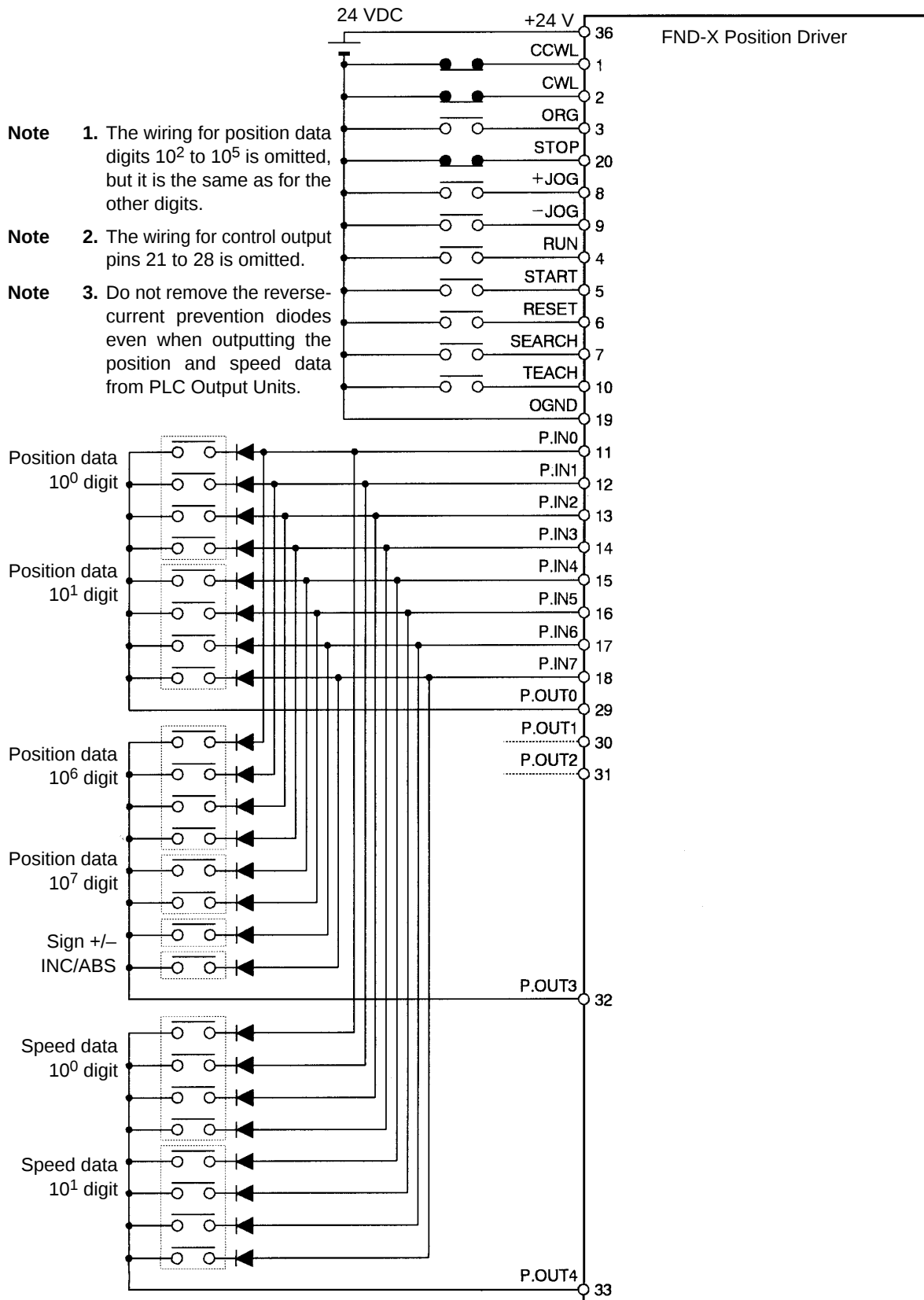


**Note** The Servomotor cannot be driven if the deceleration stop signal is OFF for the external control input (CN4-4) or the CompoBus/S input (OUT7).

## Example: Connecting DIO Position Drivers to a Programmable Controller



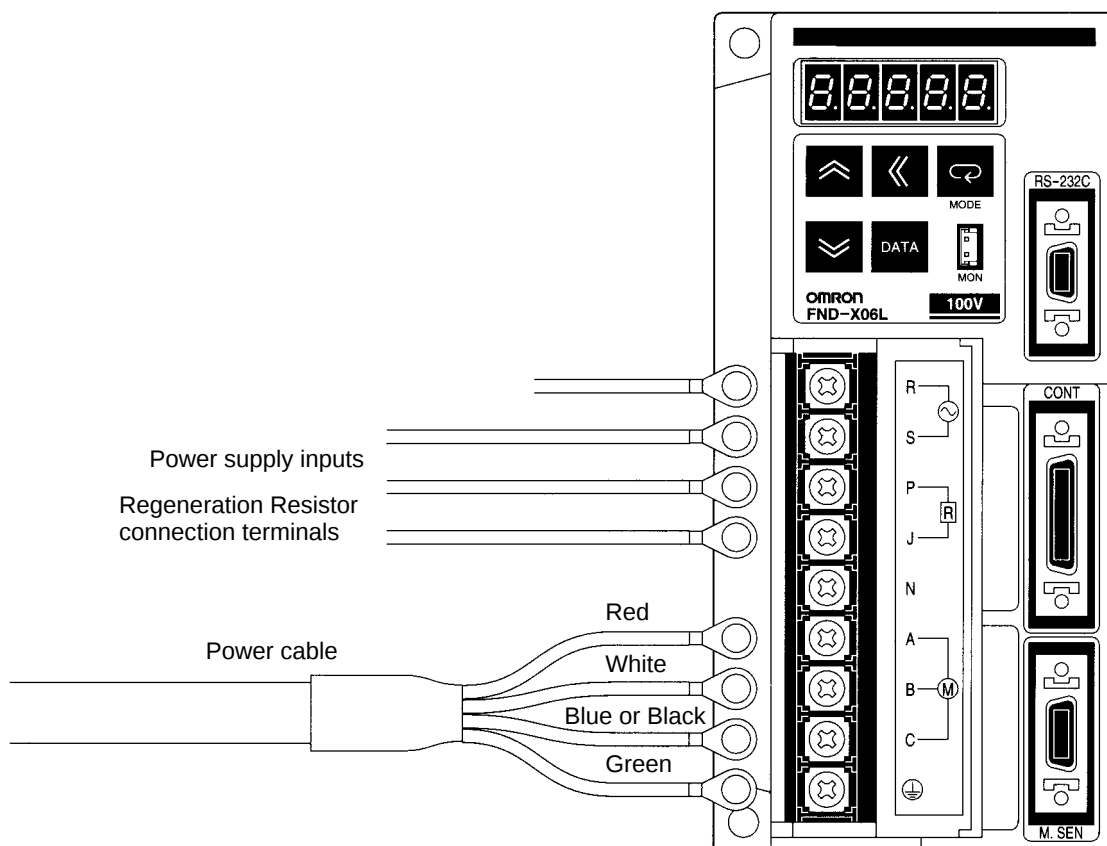
# Example: Connecting DIO Position Drivers to Thumbwheel Switch (Positioning Data Designation by Direct Input)



## 2-2-3 Wiring Terminal Blocks

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

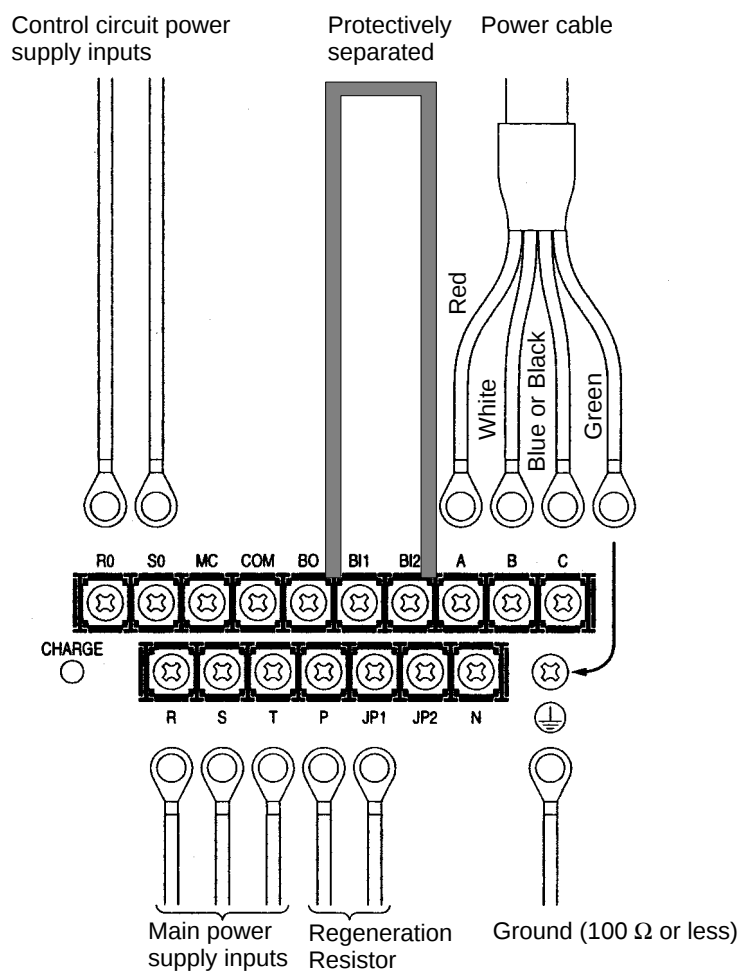
### Wiring FND-X06 to X25 Terminal Blocks



| Terminal label                                                                      | Name                                                                 | Function                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R                                                                                   | Power supply input                                                   | The commercial power supply input terminals for the main circuit and the control circuits.<br>FND-X H- : Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz<br>FND-X L- : Single-phase 100/115 VAC (85 to 127 V) 50/60 Hz |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| S                                                                                   |                                                                      |                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| P                                                                                   | Main circuit DC output<br>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)                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| J                                                                                   |                                                                      |                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 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).<br><br>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 $\Omega$ 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.

## Wiring FND-X50 Terminal Blocks



| 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                                                                                   |                                                                      | Three-phase 200/240 VAC (170 to 264 V) 50/60 Hz                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                     |
| T                                                                                   |                                                                      |                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                     |
| P                                                                                   | Main circuit DC output<br>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.<br><br>OMNUC Servomotors can be connected to these terminals with R88A-CAUB Cable (for U-series Servomotors).<br><br>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 $\Omega$ 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.

### 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 <sup>2</sup> |           | 1.25 mm <sup>2</sup> |                      |
|                                                       | Tightening torque | 1.3 N·m              |           |                      |                      |
| Control circuit power supply input terminals (R0, S0) | Effective current | ---                  |           |                      | 0.35 A               |
|                                                       | Wire size         | ---                  |           |                      | 0.75 mm <sup>2</sup> |
|                                                       | 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 <sup>2</sup> |           | 1.25 mm <sup>2</sup> | 2.0 mm <sup>2</sup>  |
|                                                       | Tightening torque | 1.3 N·m              |           |                      |                      |
| Frame ground terminal (PE)                            | Wire size         | 0.75 mm <sup>2</sup> |           | 1.25 mm <sup>2</sup> | 2.0 mm <sup>2</sup>  |
|                                                       | 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 <sup>2</sup> |           |
|                                          | 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 <sup>2</sup> |           |
|                                          | Tightening torque | 1.3 N·m              |           |
| Frame ground terminal (PE)               | Wire size         | 0.75 mm <sup>2</sup> |           |
|                                          | 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.

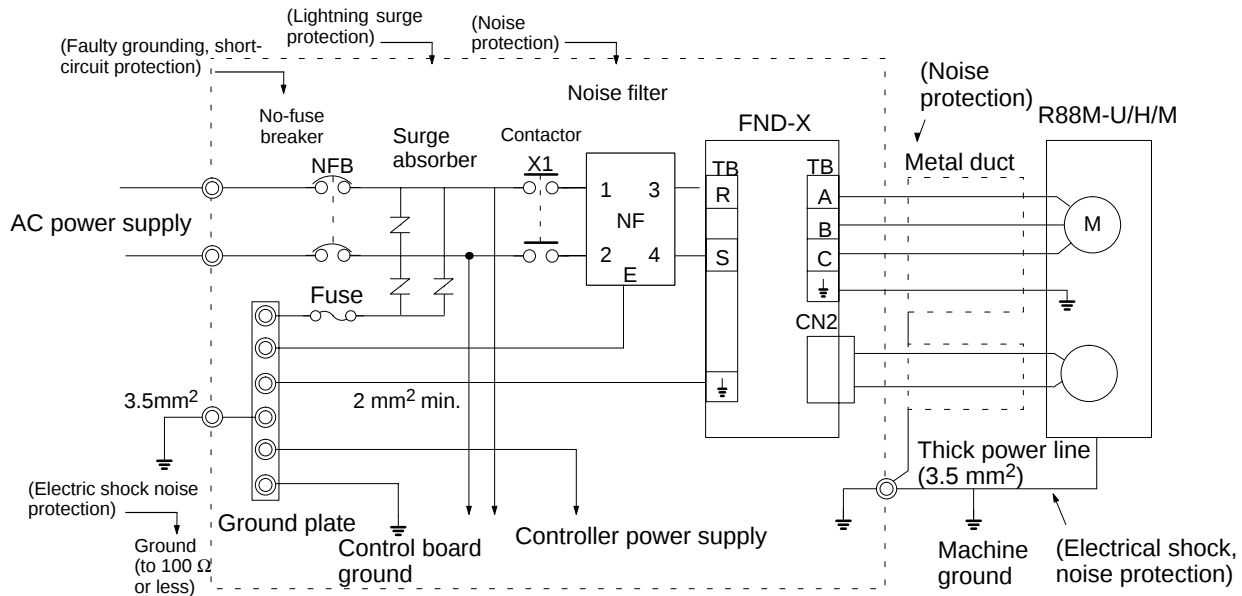
#### ☐ Heat-resistant Vinyl Wiring, UL1007, Rated Temperature 80°C (Reference Value)

| AWG size | Nominal cross-sectional area (mm <sup>2</sup> ) | Configuration (wires/mm <sup>2</sup> ) | 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   |

## 2-2-4 Wiring for Noise Resistance

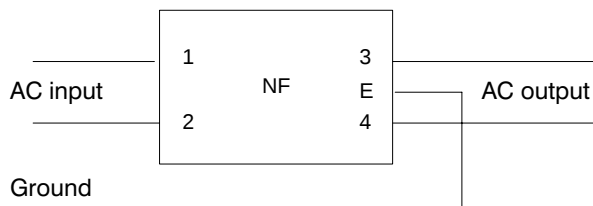
### □ Wiring Method for FND-X06 to -X25

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.

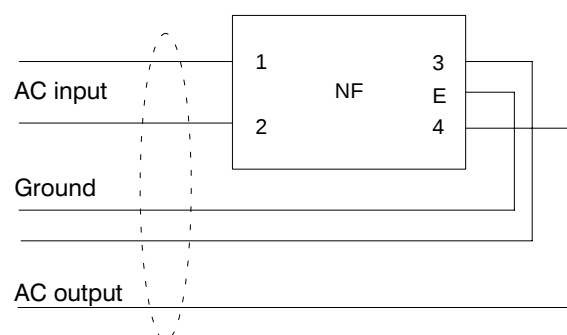


- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Use a grounding plate for the frame ground for each Unit, as shown in the illustration, and ground to a single point.
- Use ground lines with a minimum thickness of  $3.5 \text{ mm}^2$ , and arrange the wiring so 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.

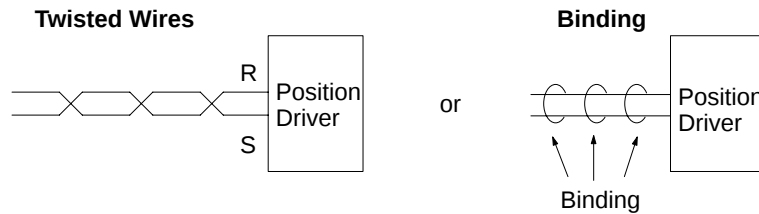
**Right:** Separate input and output



**Wrong:** Noise not filtered effectively



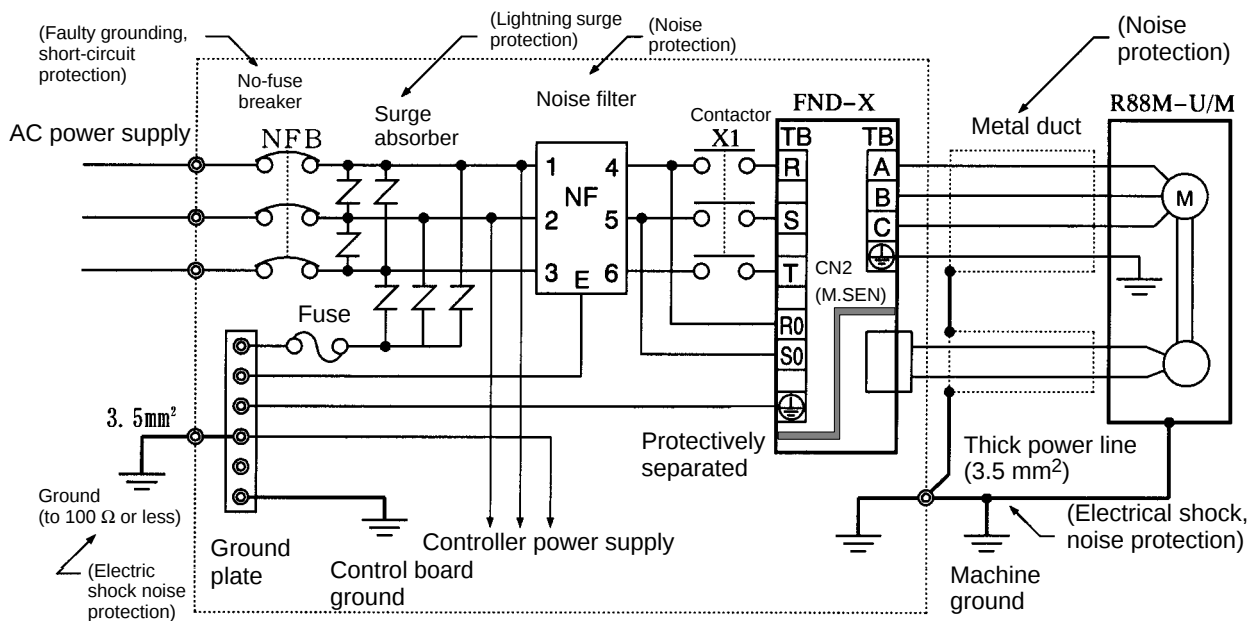
- Use twisted-pair cables for the power supply cables whenever possible, or bind the cables.



- Separate power supply cables and signal cables when wiring.

## □ Wiring Method for FND-X50H-

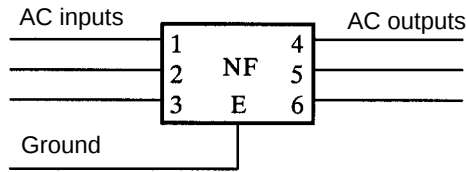
Noise resistance will vary greatly depending on the wiring method used. Resistance to noise can be increased by paying attention to the items described below.



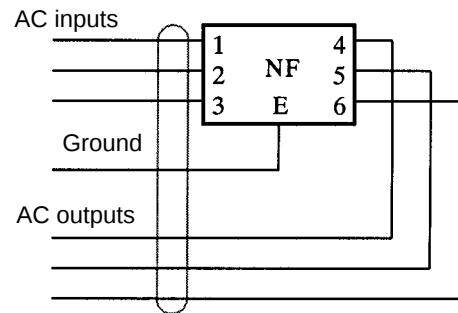
- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Use a grounding plate for the frame ground for each Unit, as shown in the illustration, and ground to a single point.
- Use ground lines with a minimum thickness of 3.5 mm<sup>2</sup>, and arrange the wiring so that 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

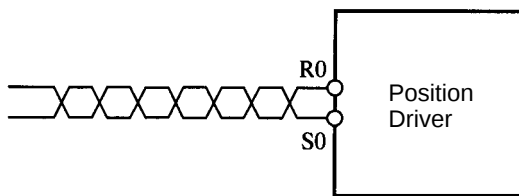


**Wrong:** Noise not filtered effectively

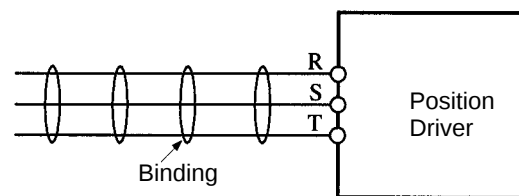


- Use twisted-pair cables for the power supply cables whenever possible, or bind the cables.

**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.

### 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  $\mu$ s. 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.

### 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 times 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.<br>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:<br>24-VDC system varistor: 39 V<br>100-VDC system varistor: 200 V<br>100-VAC system varistor: 270 V<br>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.<br>CR-50500 0.5 $\mu$ F-50 $\Omega$<br>CRE-50500 0.5 $\mu$ F-50 $\Omega$<br>S2-A-0 0.2 $\mu$ F-500 $\Omega$                                 |

**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.

### 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)<br>(including high-frequency current) | Leakage current (resistor-capacitor,<br>in commercial power supply frequency range) |
|--------------|----------------------------------------------------------------|-------------------------------------------------------------------------------------|
| FND-X06 /X12 | 35 mA <sub>0-P</sub>                                           | 2 mA <sub>rms</sub>                                                                 |
| FND-X25      | 40 mA <sub>0-P</sub>                                           | 2 mA <sub>rms</sub>                                                                 |
| FND-X50H     | 120 mA <sub>0-P</sub>                                          | 3 mA <sub>rms</sub>                                                                 |

**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.

- 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- $\mu$ F 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**

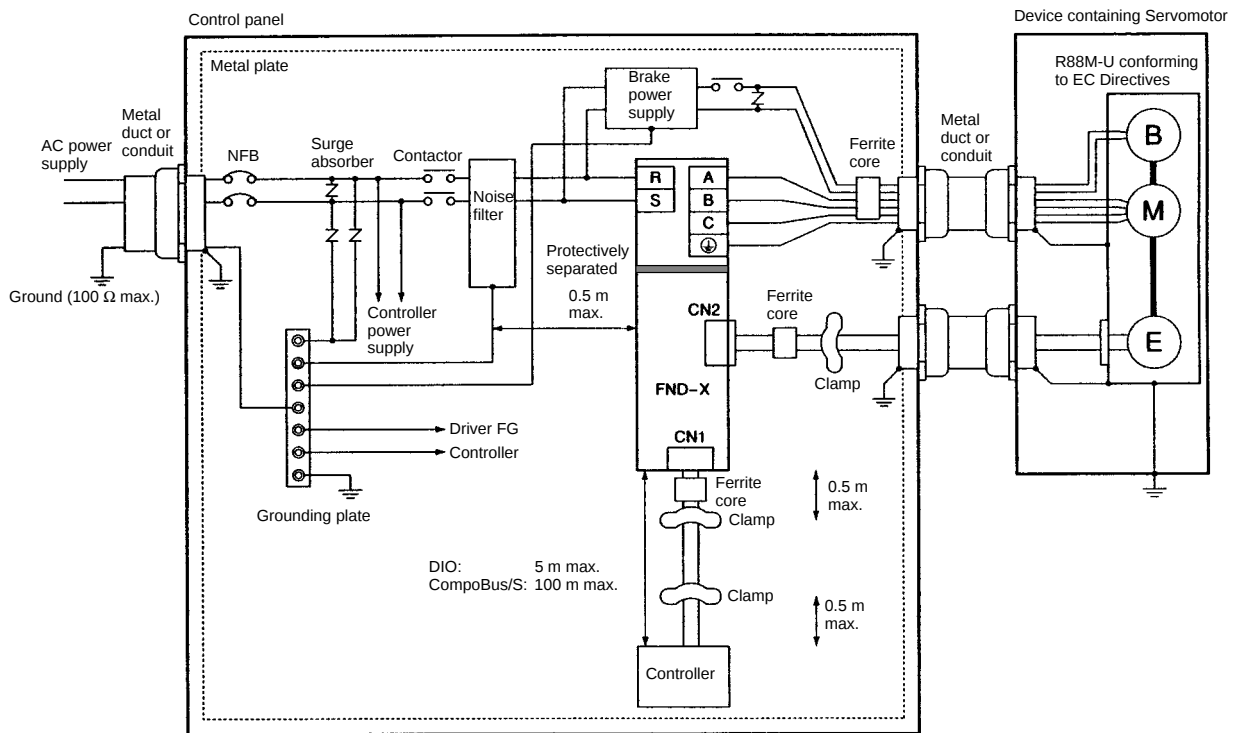
Position Drivers will meet the requirements of the EMC Directives if they are connected to a U-Series Servomotor that conforms to the EC directives and are wired under the conditions described in this section. If the connected devices, wiring, and other conditions cannot be made to fulfill the installation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

## □ Wiring Methods

### FND-X06 to X25 Position Drivers

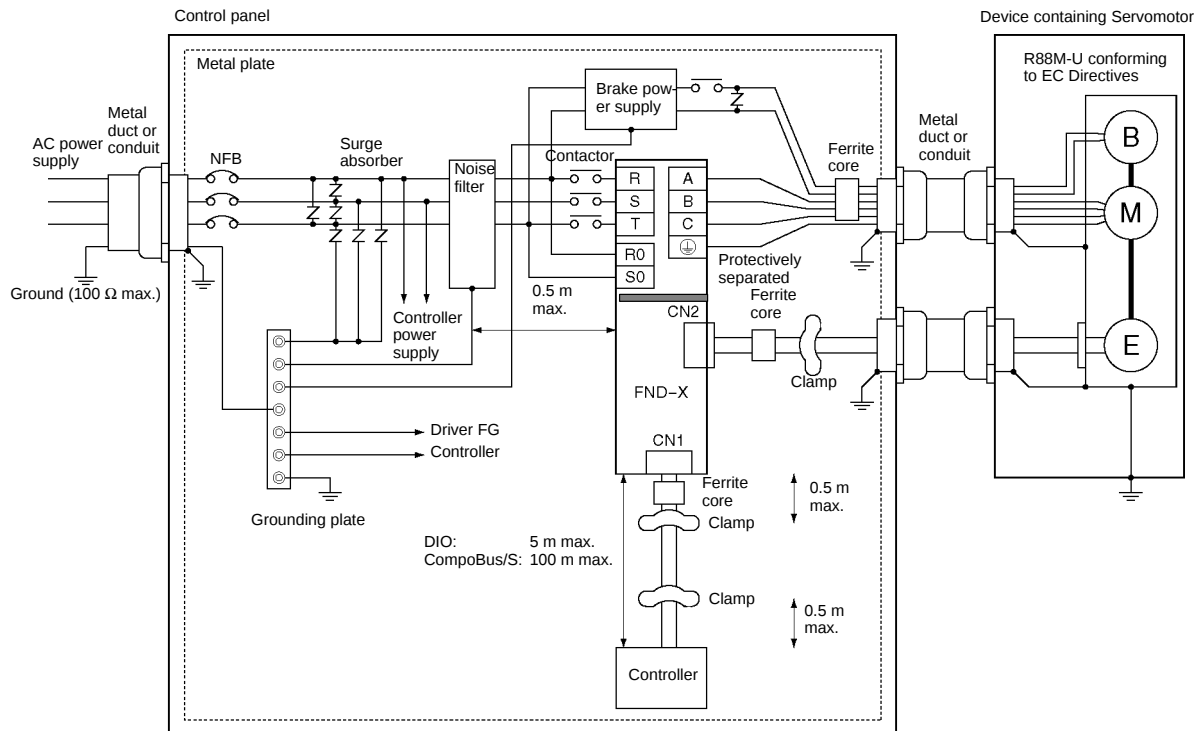


**Note 1.** The cable winding for the ferrite core must be 1 turn.

**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.

## 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.

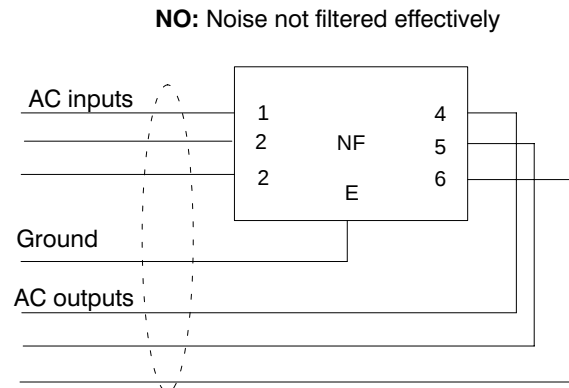
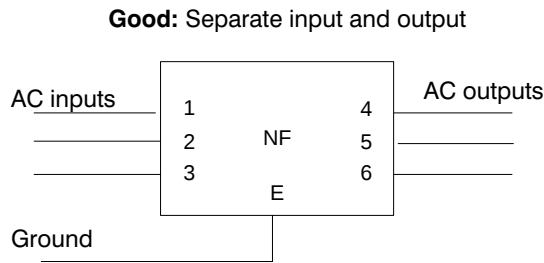
## All Position Drivers

- 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.

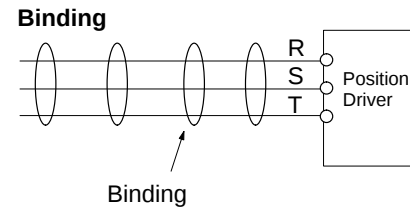
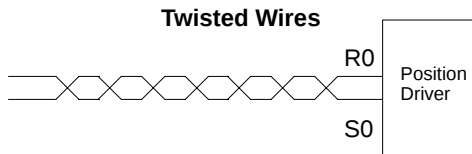
## □ Noise Filters

- 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.

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

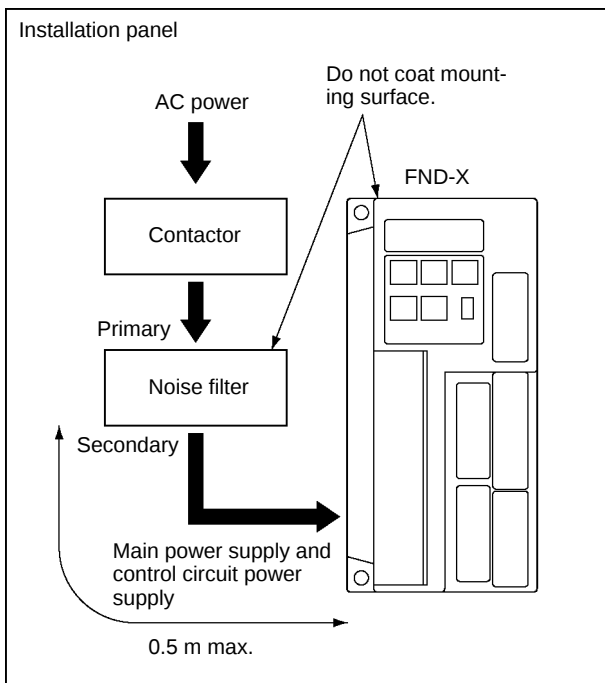


- Use twisted-pair cables for the power supply cables whenever possible, or bind the cables.

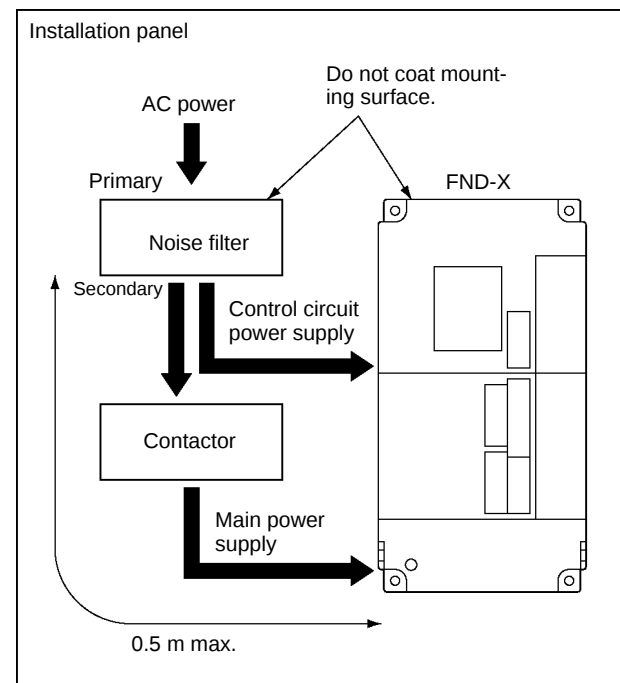


- Separate power supply cables and signal cables when wiring.

**FND-X06 to X25 Position Drivers**



**FND-X50H- Position Drivers**

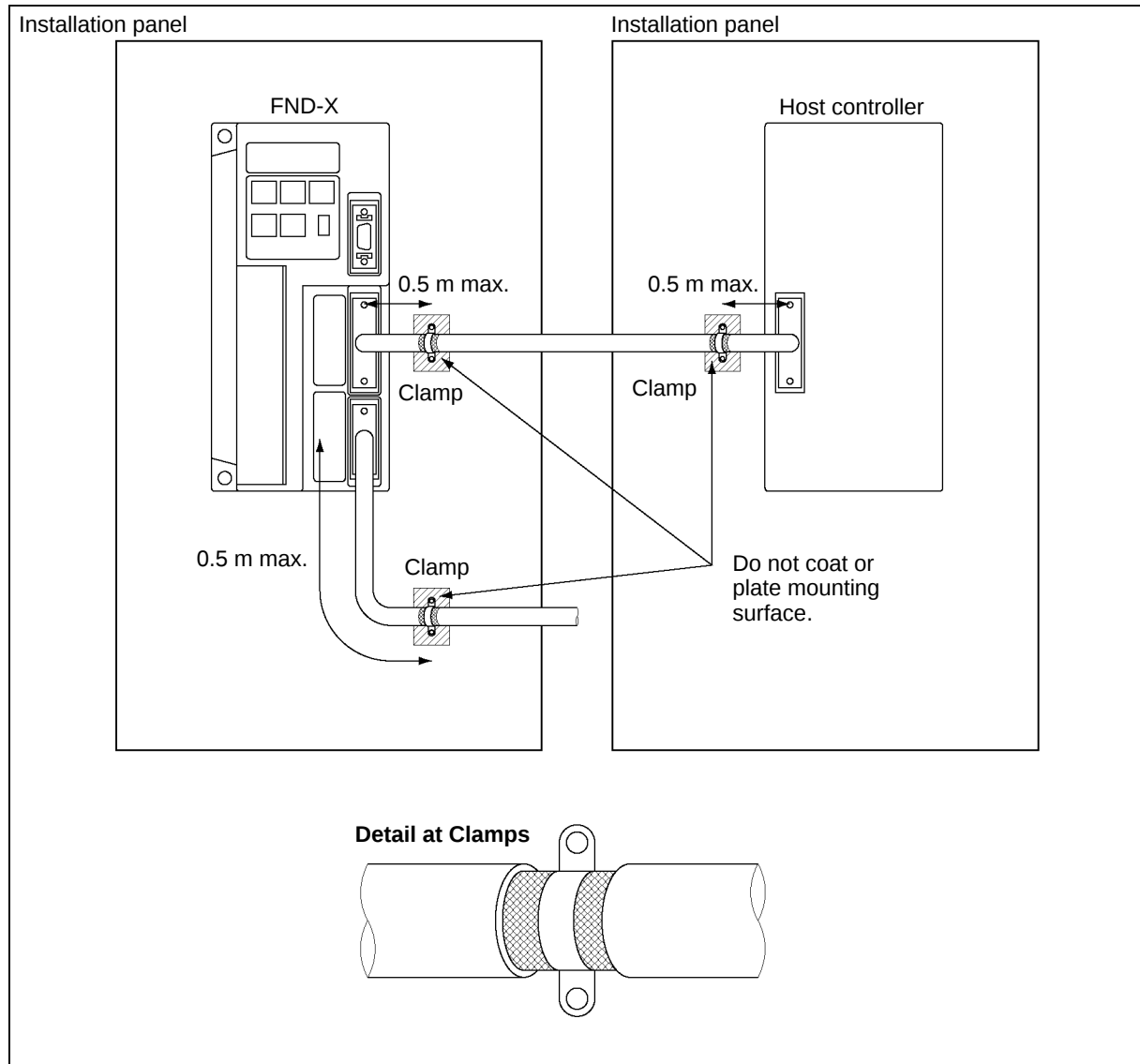


## Connecting Cables

- 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.

- 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



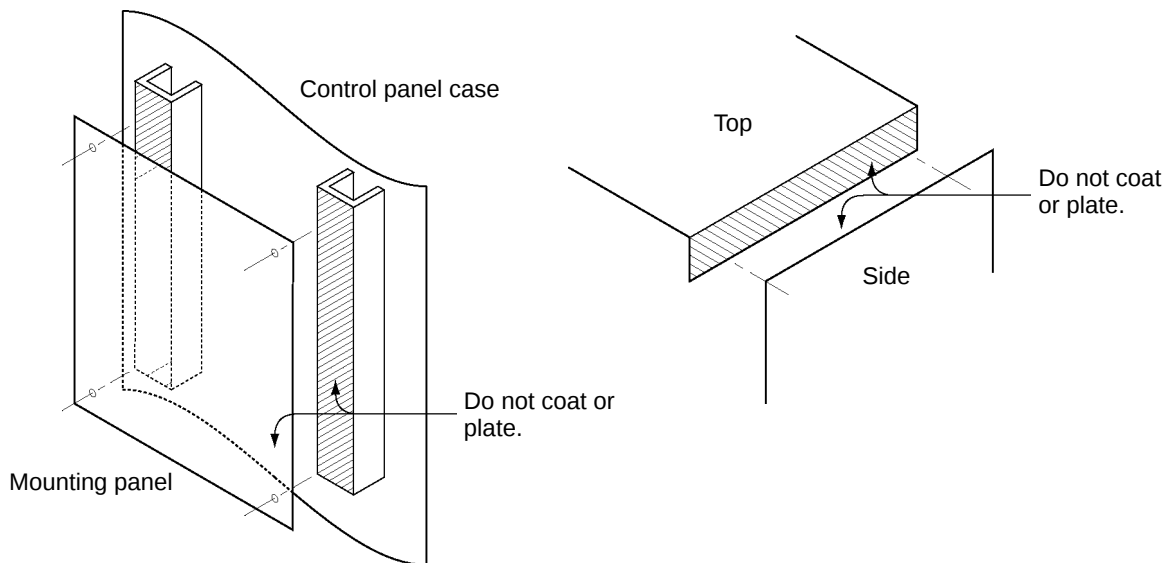
## □ Control Panel Structure

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

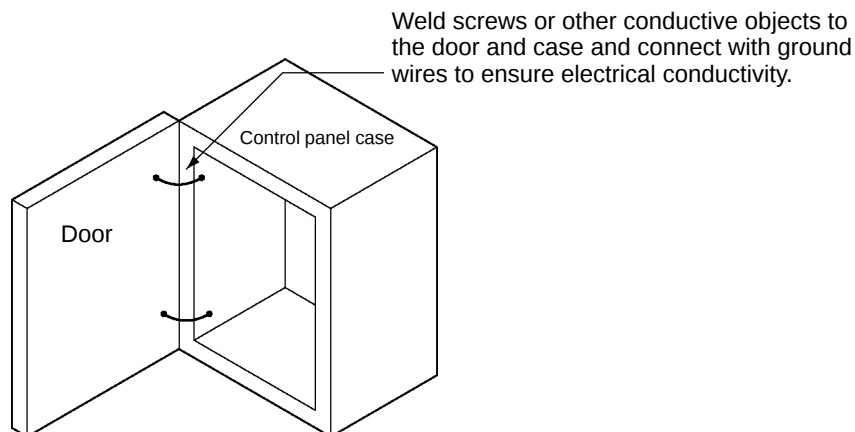
- Use a metal control panel with welded joints on the top, bottom, and all sides. The case must be electrically conductive.

- 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 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.



## □ 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  $\mu$ s. If pulses are wide, either decrease the current or change to a larger-capacity surge absorber.

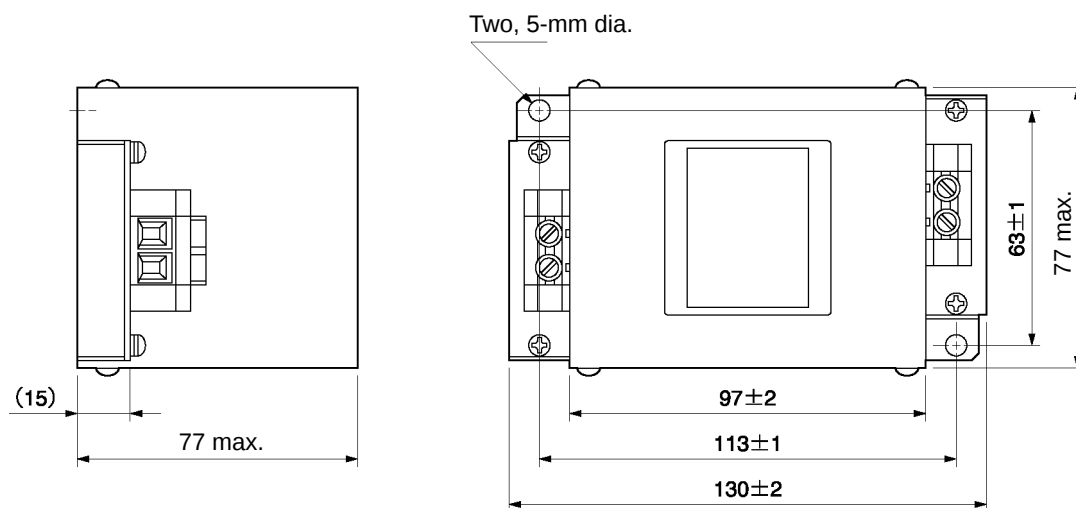
### Ferrite Cores

| Maker | Model        |
|-------|--------------|
| TDK   | ZCAT305-1330 |

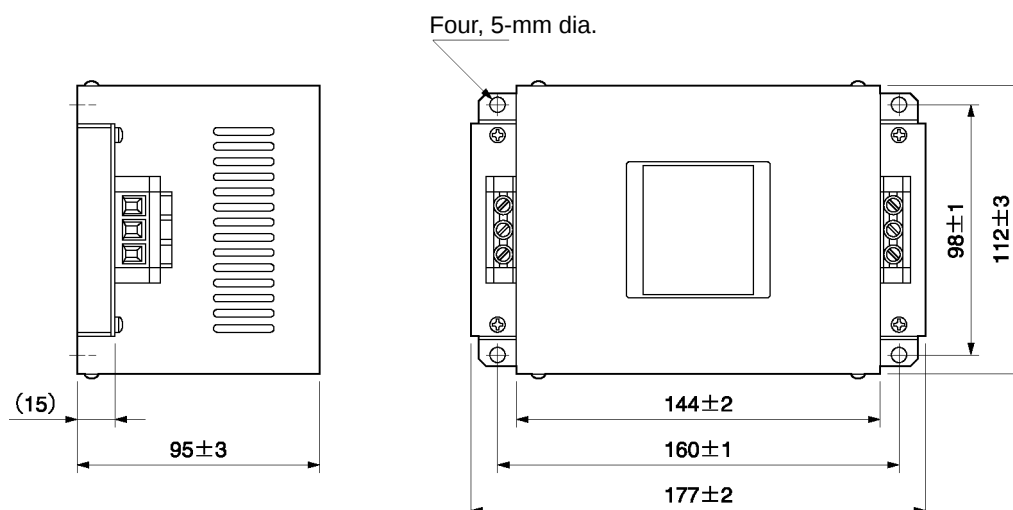
### Power Supply Input Noise Filters

| 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  |

### NF2010A-PI/NF2015A-PI Dimensions



### HF2030A-PI Dimensions



### 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.<br>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:<br>24-VDC system varistor: 39 V<br>100-VDC system varistor: 200 V<br>100-VAC system varistor: 270 V<br>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.<br>CR-50500 0.5 $\mu$ F-50 $\Omega$<br>CRE-50500 0.5 $\mu$ F-50 $\Omega$<br>S2-A-0 0.2 $\mu$ F-500 $\Omega$                                           |

**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.

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

| Driver       | Leakage current (resistor)<br>(including high-frequency current) | Leakage current (resistor-capacitor,<br>in commercial power supply frequency range) |
|--------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| FND-X06 /X12 | 35 mA <sub>0-P</sub>                                             | 2 mA <sub>rms</sub>                                                                 |
| FND-X25      | 40 mA <sub>0-P</sub>                                             | 2 mA <sub>rms</sub>                                                                 |
| FND-X50H     | 120 mA <sub>0-P</sub>                                            | 3 mA <sub>rms</sub>                                                                 |

**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

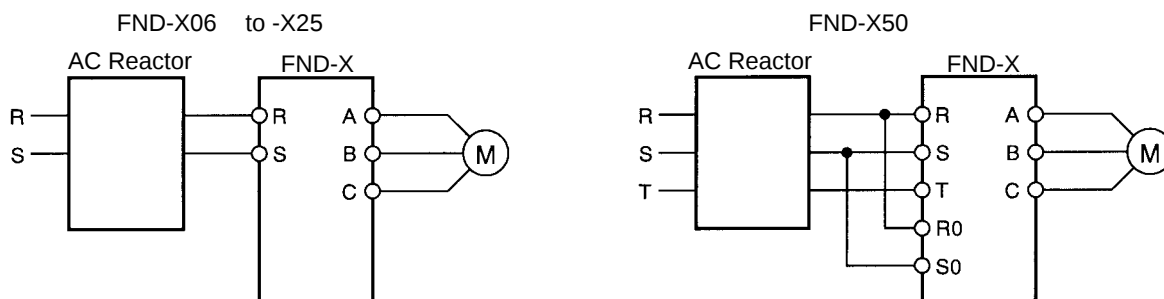
Position can be affected if control I/O signals are influenced by noise. Follow the methods outlined below for the power supply and wiring.

- 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.

## □ 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



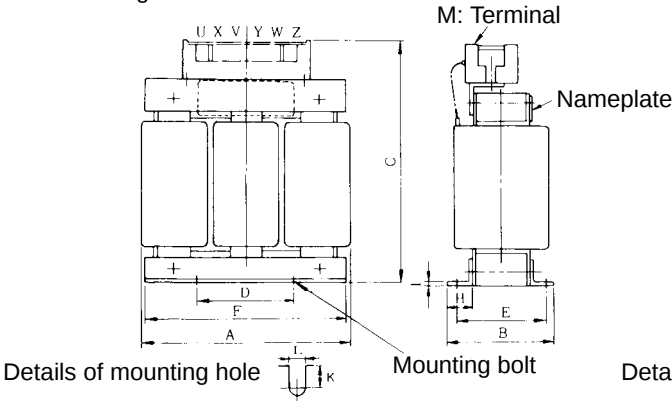
### Application Specifications

| Drivers                | AC Reactor            |               |            |      |        |
|------------------------|-----------------------|---------------|------------|------|--------|
|                        | Model                 | Rated current | Inductance | Loss | Weight |
| FND-X06L-<br>FND-X12L- | 3G3IV-PUZBAB5A2.1MH   | 5 A           | 2.1 mH     | 15 W | 2.5 kg |
| 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   |

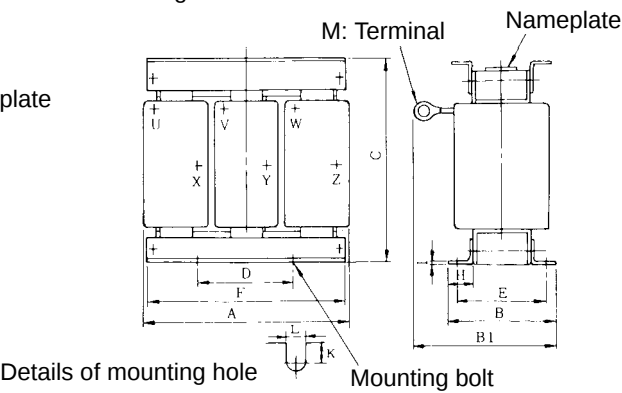
Dimensions

| Model<br>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

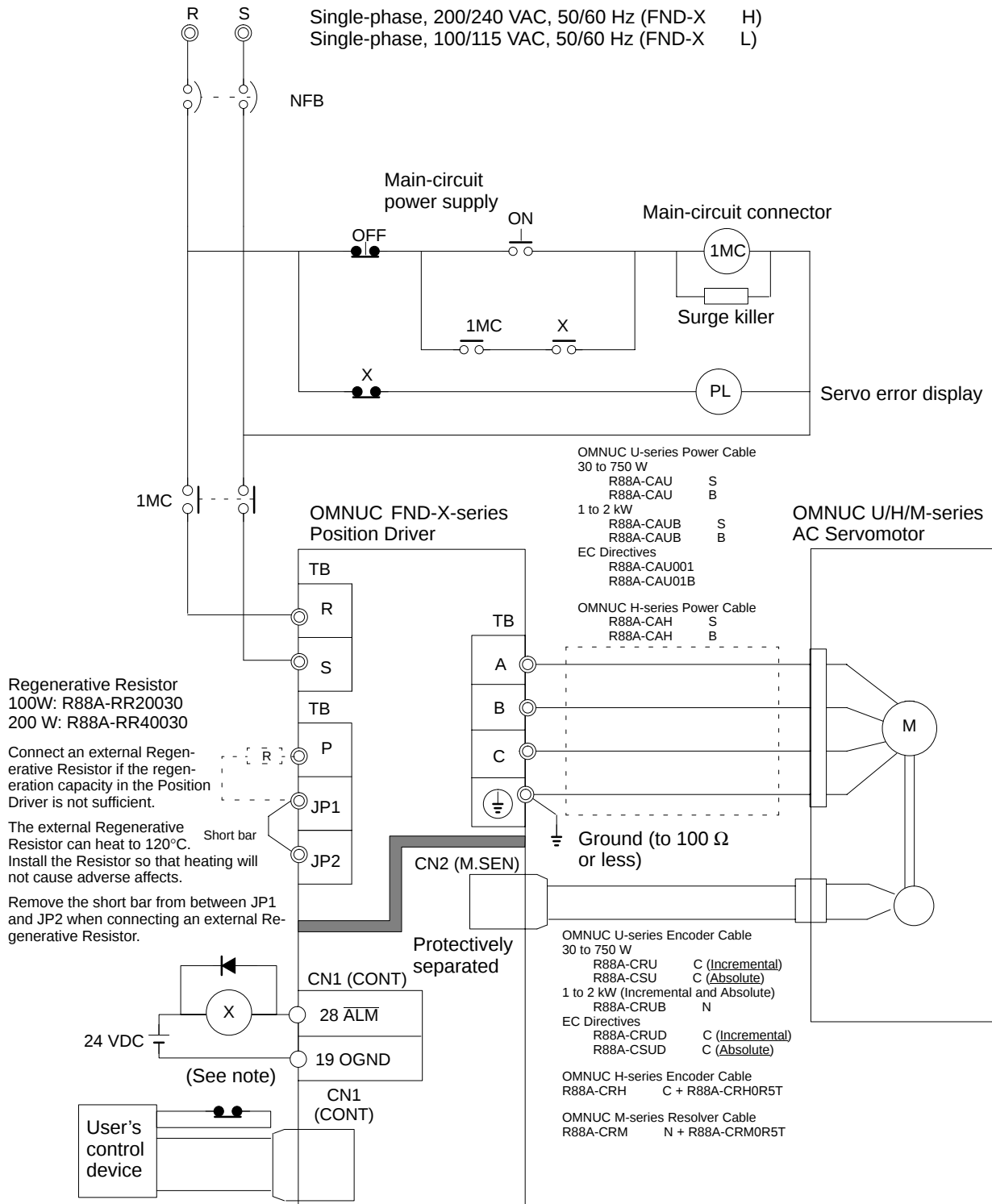


Drawing 2



## 2-2-6 Peripheral Device Connection Examples

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



**DIO Position Drivers:**FND-CCX S

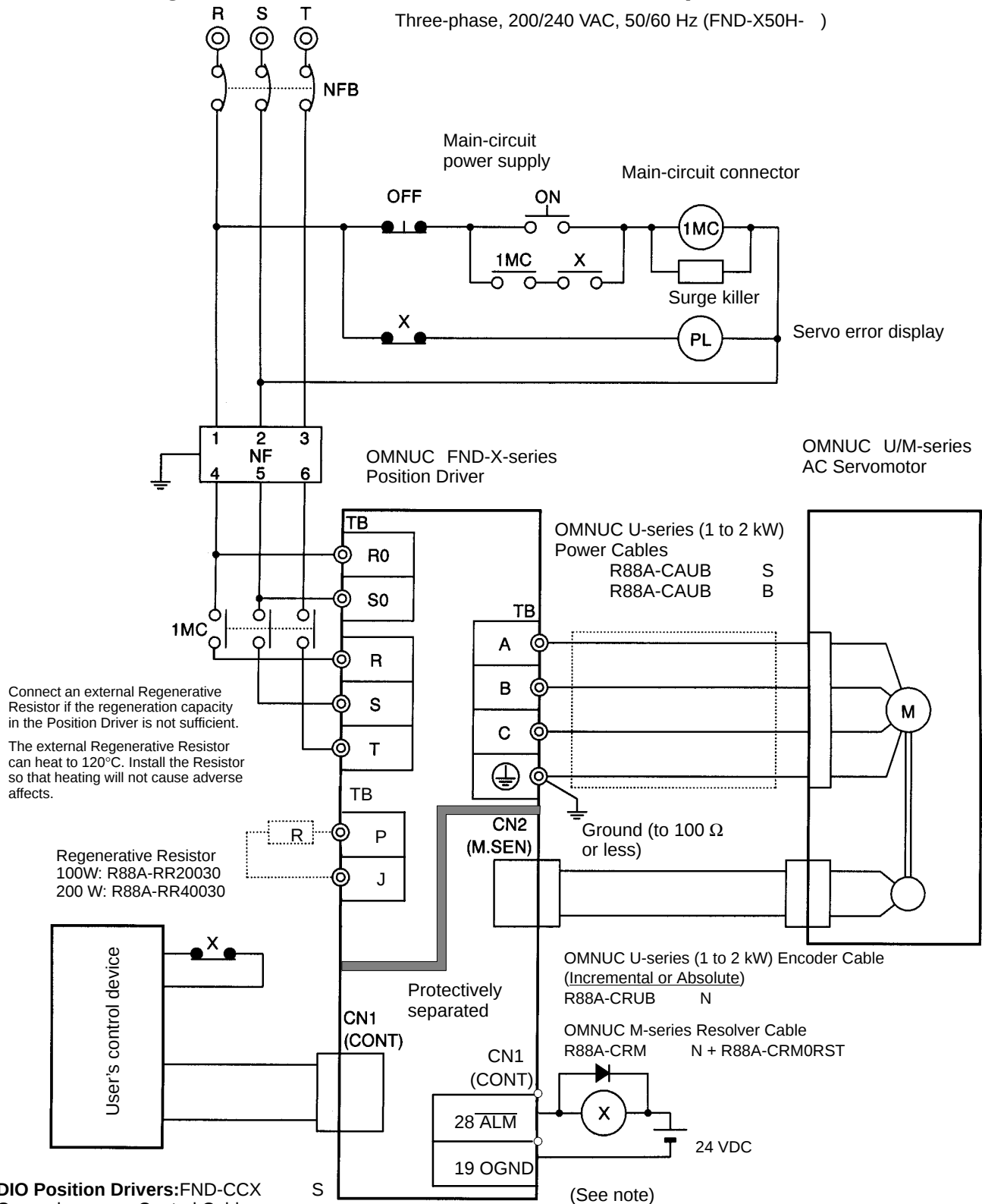
General-purpose Control Cable

**CompoBus/S Position Drivers:** Communications Cable  
(SCA1-4F10 Flat Cable or commercially available VCTF  
cable (VCTF JIS C3306 2-core 0.75mm<sup>2</sup>))

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

# □ Connecting FND-X50H- Position Drivers to Peripheral Devices

Three-phase, 200/240 VAC, 50/60 Hz (FND-X50H- )



**DIO Position Drivers:**FND-CCX  
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<sup>2</sup>))

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

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

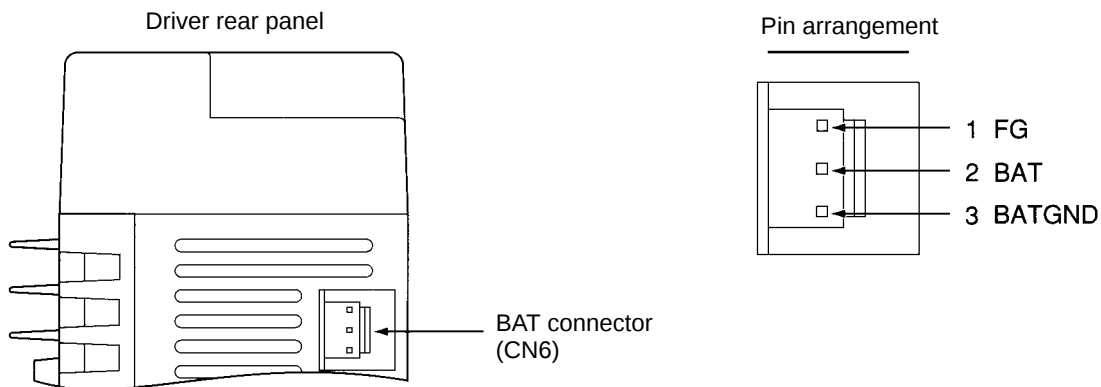
When using a U-series Servomotor with an absolute encoder, connect a lithium battery to the BAT connector (C6) so that the position data will be retained when the power supply is turned OFF. This section explains how to wire and replace the battery, and how to set up the absolute encoder.

Use one of the following methods.

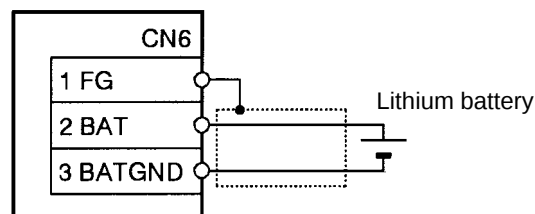
1. Obtain an OTS-BAT01 Battery with Connector and Cable.
2. Obtain a lithium battery and connector and prepare the battery so that it can be connected to CN6.  
(The C500-BAT08 Battery cannot be connected directly. The connector must be replaced with a recommend connector and the battery must be prepared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

### ☐ 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.)

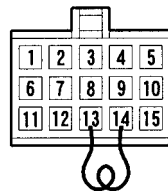
## □ Setup Method

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

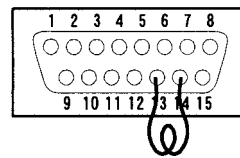
1. Wire the Position Driver, Servomotor, and encoder correctly if they are not already wired correctly.
2. Connect the battery.
3. Turn ON power to the Position Driver.
4. Leave the power ON for three minutes.

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

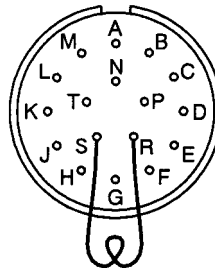
5. Perform the following steps for 30-W to 750-W models.
  - a) Turn OFF the power to the Position Driver.
  - b) Remove the encoder connector.
  - c) Reset the data by shorting between encoder connector terminals 13 and 14 (on the motor side) for one or two seconds. (See the following diagram.)



Models conforming to UL/cUL

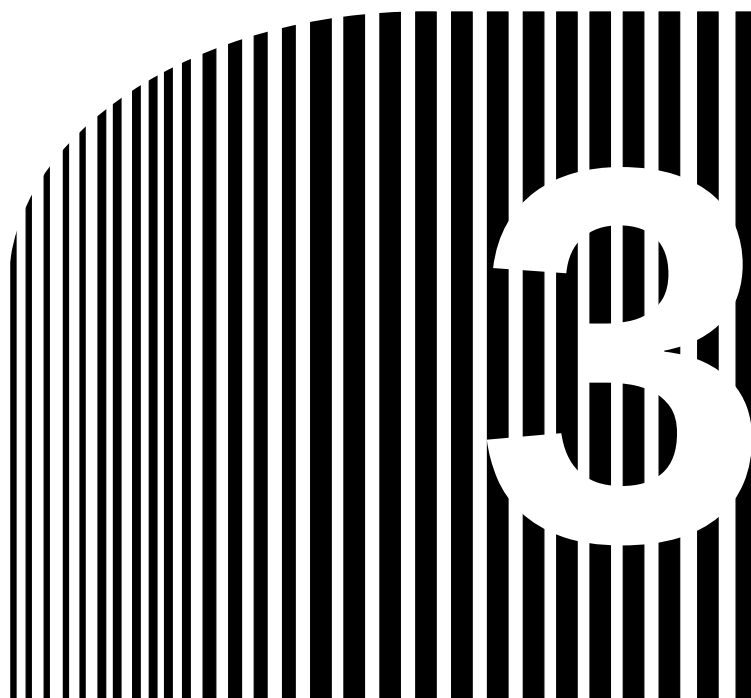


Models conforming to EC Directives



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.



## 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

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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*.

## ***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

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### 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 ( $\perp$ ) 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.

### 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<br>(parameter setting error)                                       |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |

**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.

**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)**

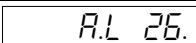
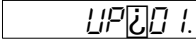
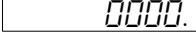
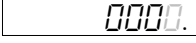
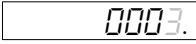
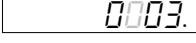
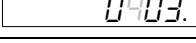
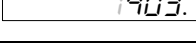
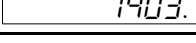
| Motor model | Capacity | Code |
|-------------|----------|------|
| R88M-M20020 | 200 W    | 0205 |
| R88M-M40020 | 400 W    | 0206 |
| R88M-M70020 | 700 W    | 0207 |
| R88M-M1K120 | 1100 W   | 0208 |
| R88M-M1K820 | 1800 W   | 0217 |
| R88M-M2K220 | 2200 W   | 0218 |

**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 |

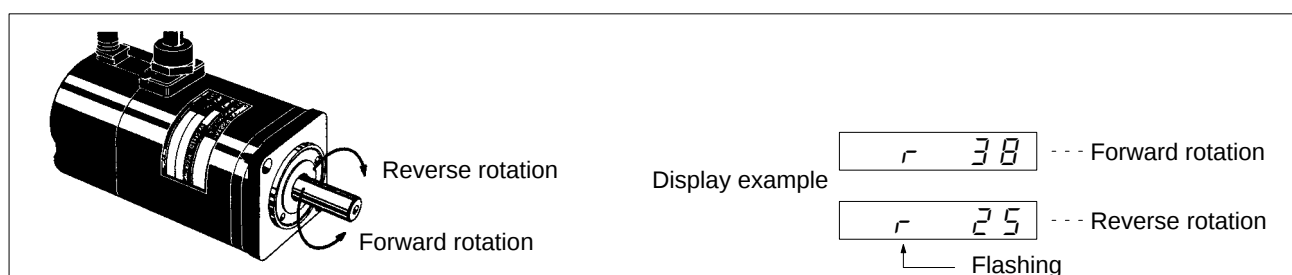
**Note** U-UE-series (U-series, UE-type) and H-series Servomotors can only be used with Position Driver software version 4.01 (September 1997) or later. U-series 1 to 2-kW and M-series 1.1 to 2.2-kW Servomotors can only be used with Position Driver software version 4.04 (April 1999) or later.

## Example: Procedure for Setting Code 1403

| Display                                                                           | Key operation                                                                                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Parameter setting error (A.L 26) displayed. (The "." in the rightmost digit flashes.)                                                                            |
|  | Press the Mode Key twice to display the user parameters.                                                                                                         |
|  | Press the Increment Key three times to display the contents of UP-02 (applicable motor).                                                                         |
|  | Press the Data Key and the Shift Key simultaneously to enable data to be changed.                                                                                |
|  | Press the Increment Key three times to enter "3" for the rightmost digit.                                                                                        |
|  | Press the Shift Key twice. The "100" digit (the third digit from the right) will flash.                                                                          |
|  | Press the Increment Key four times to enter "4" for the "100" digit.                                                                                             |
|  | 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. |
|  | 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.

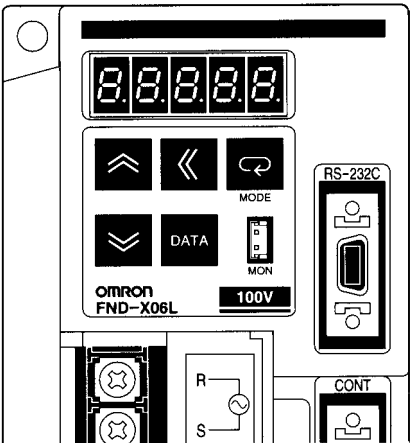


If an error message (A.L ) is displayed when the power is turned ON, refer to *Chapter 4 Application* and take the necessary countermeasures.

3-3 Using the Display Area

3-3-1 Key Operations

□ Display Area Layout



□ Key Functions

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

### 3-3-2 Modes and Mode Changes

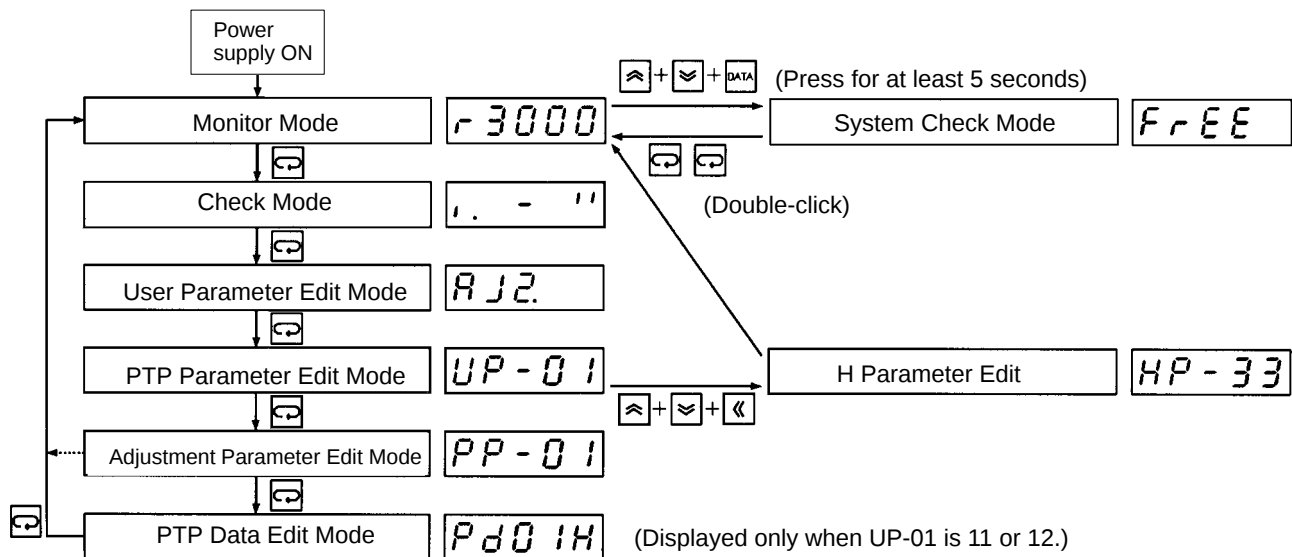
#### □ Modes

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.                                                                                                                                             |

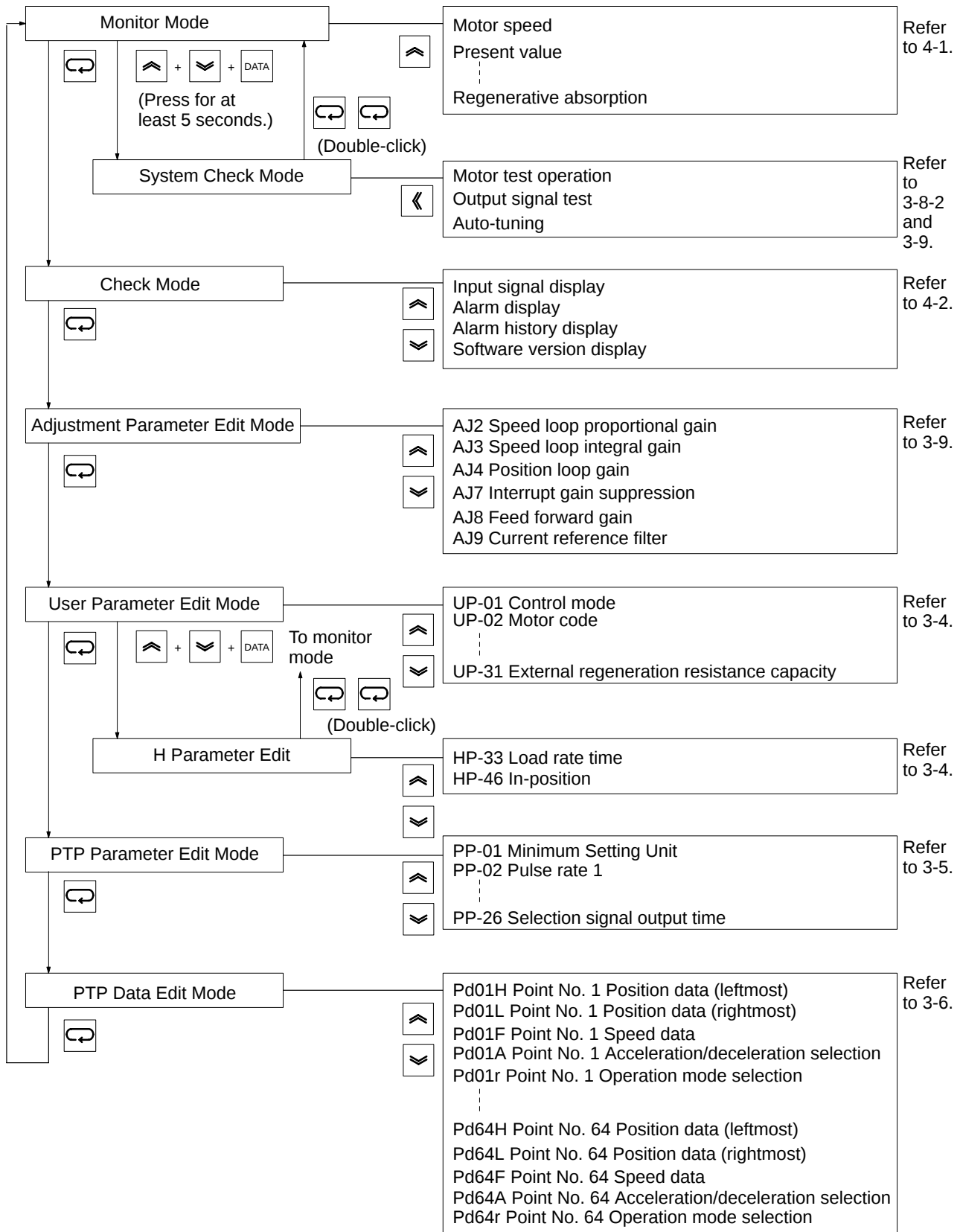
#### □ Changing Modes

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



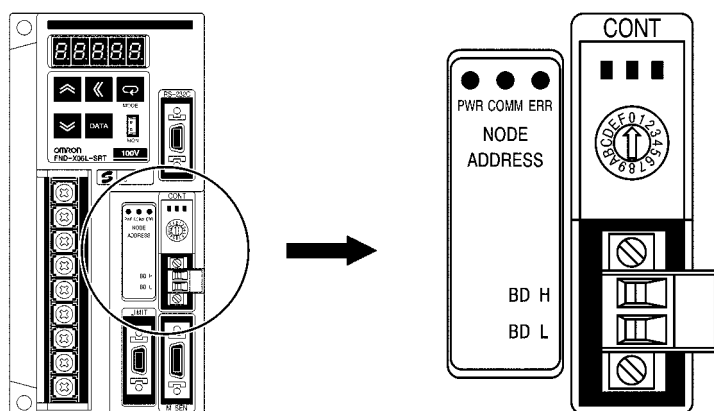
### 3-3-3 Mode Details

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



### 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.

**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   | 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*.

### 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,<br>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,<br>Shift Key                                          |
| Save the data in memory. . . . .                | Data Key                                                                            |

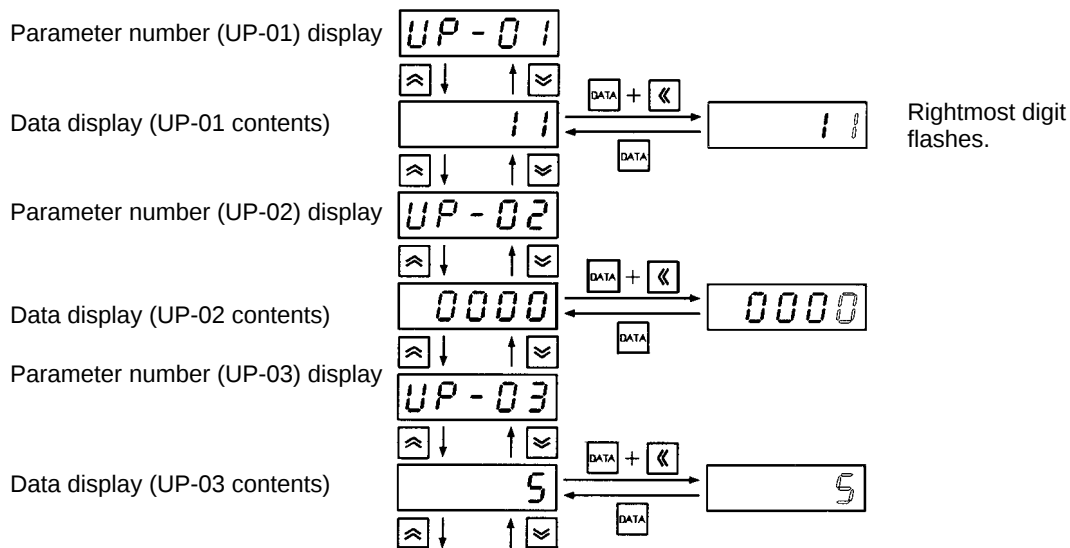
#### 3-4-1 Setting User Parameters and H Parameters

##### ☐ 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.

### User Parameters Display Example

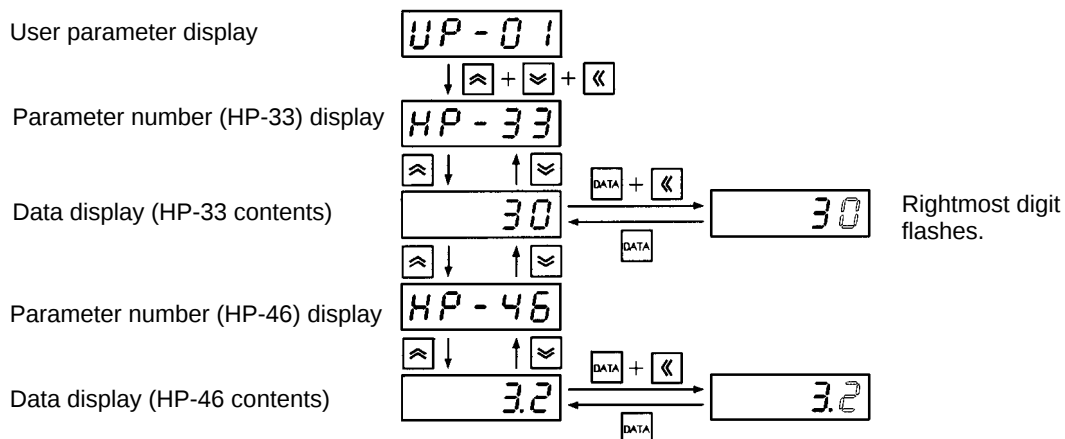


### □ Setting H Parameters

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



### 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:<br>11: Point positioning (PTP)<br>12: Point positioning (feeder)<br>13: Direct positioning (PTP)<br>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.<br><br>OMNUC U Series (30 to 750 W) with incremental encoder:<br>8,192 pulses/rotation<br>OMNUC U Series (30 to 650 W) with absolute encoder:<br>4,096 pulses/rotation<br>OMNUC U Series (1 to 2 kW) with incremental encoder:<br>16,384 pulses/rotation<br>OMNUC U Series (1 to 2 kW) with absolute encoder: 32,768 pulses/rotation<br>OMNUC U-UE Series:<br>4,096 pulses/rotation<br>OMNUC H Series: 8,000 pulses/rotation<br>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.<br>"0.00" sets trapezoidal acceleration and deceleration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No                 |
| 16      | Brake mode                              | ---       | 0 to 3        | 0               | 0: Dynamic brake<br>1: On-hold brake (stops in deceleration time)<br>2: On-hold brake (stops after rotation according to error counter's accumulated number of pulses)<br>3: On-hold brake (free-running stop)                                                                                                                                                                                                                                                                                                                                                                             | Yes                |

| No. UP- | Name                                      | Min. unit    | Setting range  | Factory setting | Explanation                                                                                                                                                                                                                      | Re-power required? |
|---------|-------------------------------------------|--------------|----------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 25      | Monitor output                            | ---          | 000 to 011     | 010             | Specifies monitor output function.<br>0<br>└ Positive voltage<br>0: Not reversed<br>1: Reversed<br>Speed/Current selection<br>0: Current<br>1: Speed                                                                             | No                 |
| 26      | Motor rotation direction                  | ---          | 0, 1           | 0               | Specifies motor rotation direction.<br>0: Forward rotation<br>1: Reverse direction                                                                                                                                               | No                 |
| 28      | Brake ON speed                            | 0.1%         | 0.0 to 100.0   | 1.0             | Specifies r/min to turn OFF brake output in on-hold brake mode.<br>Specifies rate based on rated motor r/min as 100%.<br><br>* 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.<br><br>* 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 $\Omega$ | 0.0 to 100.0   | 0.0             | Specifies the regeneration absorption resistance value ( $\Omega$ )<br>* Only valid for FND-X50H- .<br>* When using an OMRON External Regeneration Resistor, set to 30.0 ( $\Omega$ ).                                           | Yes                |
| 31      | External regeneration resistance capacity | 0.01 kW      | 0.00 to 327.67 | 0.00            | Specifies the regeneration absorption resistance capacity (kW).<br>* 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                 |

**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  $\geq$  PC cycle time  $\times$  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)  $\times$  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) <ul style="list-style-type: none"> <li>Executes position control according to positioning data set for internal point data (PTP data: Pd ).</li> <li>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).</li> <li>Used for positioning between points, such as pick-and-place.</li> </ul>                            |
| 12        | Point positioning (feeder) <ul style="list-style-type: none"> <li>Executes position control according to positioning data set for internal point data (PTP data: Pd ).</li> <li>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).</li> <li>Present position is cleared at startup. Used for feed control such as sheet feeding.</li> </ul> |
| 13        | Direct positioning (PTP) <ul style="list-style-type: none"> <li>Executes position control according to position and speed data entered for control inputs P.IN0 to 7 (position data 0 to 7).</li> <li>Used for positioning between points, such as pick-and-place.</li> </ul>                                                                                                                                                     |
| 14        | Direct positioning (feeder) <ul style="list-style-type: none"> <li>Executes position control according to position and speed data entered for control inputs P.IN0 to 7 (position data 0 to 7).</li> <li>Present position is cleared at startup. Used for feed control such as sheet feeding.</li> </ul>                                                                                                                          |

**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.

### 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 |

**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 |
|--------------|------------------------------|-----------------|----------|-----------------|
| <b>UP-03</b> | <b>Resolver cable length</b> | <b>1 to 120</b> | <b>m</b> | <b>5</b>        |

- 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.

| PRM No.      | Parameter name           | Setting range      | Unit         | Factory setting |
|--------------|--------------------------|--------------------|--------------|-----------------|
| <b>UP-07</b> | <b>In-position width</b> | <b>1 to 32,767</b> | <b>Pulse</b> | <b>3</b>        |

- 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 |
|--------------|----------------------------|---------------------|----------|-----------------|
| <b>UP-11</b> | <b>Current limit value</b> | <b>0.0 to 100.0</b> | <b>%</b> | <b>100.0</b>    |

- 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 |
|--------------|-----------------------------------------------|---------------------|----------|-----------------|
| <b>UP-14</b> | <b>S-curve acceleration/deceleration time</b> | <b>0.0 to 32.76</b> | <b>s</b> | <b>0.00</b>     |

- 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 |
|--------------|-------------------|---------------|------------|-----------------|
| <b>UP-16</b> | <b>Brake mode</b> | <b>0 to 3</b> | <b>---</b> | <b>0</b>        |

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.)

| PRM No.      | Parameter name        | Setting range     | Unit | Factory setting |
|--------------|-----------------------|-------------------|------|-----------------|
| <b>UP-25</b> | <b>Monitor output</b> | <b>000 to 011</b> | ---  | <b>010</b>      |

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 |
|--------------|---------------------------------|---------------|------|-----------------|
| <b>UP-26</b> | <b>Motor rotation direction</b> | <b>0, 1</b>   | ---  | <b>0</b>        |

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 |
|--------------|-----------------------|---------------------|----------|-----------------|
| <b>UP-28</b> | <b>Brake ON speed</b> | <b>0.0 to 100.0</b> | <b>%</b> | <b>1.0</b>      |

- 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 |
|--------------|-------------------------|-------------------|--------------|-----------------|
| <b>UP-29</b> | <b>Motor test speed</b> | <b>1 to 8,000</b> | <b>r/min</b> | <b>50</b>       |

- 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 |
|--------------|-----------------------------------------------|---------------------|----------|-----------------|
| <b>UP-30</b> | <b>External regeneration resistance value</b> | <b>0.0 to 100.0</b> | <b>Ω</b> | <b>0.0</b>      |

- 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.

| PRM No.      | Parameter name                                   | Setting range         | Unit      | Factory setting |
|--------------|--------------------------------------------------|-----------------------|-----------|-----------------|
| <b>UP-31</b> | <b>External regeneration resistance capacity</b> | <b>0.00 TO 327.67</b> | <b>kW</b> | <b>0.00</b>     |

- 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 |
|--------------|-----------------------|----------------|----------|-----------------|
| <b>HP-33</b> | <b>Load rate time</b> | <b>1 to 60</b> | <b>s</b> | <b>30</b>       |

- 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 |
|--------------|--------------------------|---------------------|-----------|-----------------|
| <b>HP-46</b> | <b>In-position timer</b> | <b>3.2 to 320.0</b> | <b>ms</b> | <b>3.2</b>      |

- 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  $\geq$  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.

### 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)*.

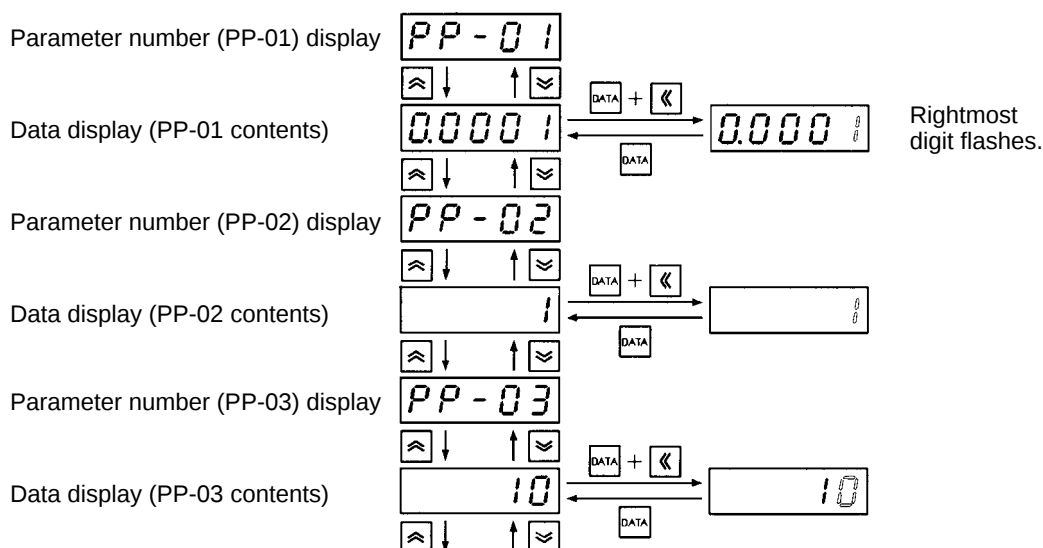
|                                                 |                                                                                     |
|-------------------------------------------------|-------------------------------------------------------------------------------------|
| Go to the User Parameter Edit Mode. . . . .     | Mode Key                                                                            |
| Display the pertinent parameter number. . . . . | Increment Key, Decrement Key,<br>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,<br>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.

## 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.<br>* 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.                                                                                              | No                 |
| 09      | Compensation (rightmost digits)           |                       | 0 to 9,999      | 0               | Specifies slip compensation if UP-01 is set to 12 or 14 in feeder control mode.                                                                                               | 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.<br>* 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                 |

| No. PP- | Name                                      | Min. unit                | Setting range   | Factory setting | Explanation                                                                                                                                                                                                                                                                        | Re-power required? |
|---------|-------------------------------------------|--------------------------|-----------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 12      | Reverse software limit (leftmost digits)  | (PP-01)<br>(See note 1.) | –9,999 to 9,999 | –9,999          | Specifies software limit position in the reverse direction.<br><br>* 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.<br><br>* 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.<br><br>* 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.<br>0: Forward direction<br>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.<br><br>* 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.<br><br>* This value will be valid if the Position Driver is in point positioning operation.                                                                                                         | No                 |

| 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.<br>* 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.<br>* 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.<br>0: Free-running stop<br>1: Deceleration stop<br>2: Error counter reset stop                                                                                                                       | No                 |
| 25      | Alarm selection                            | ---       | 00 to 11      | 11              | Selects alarm processing method with limit or soft limit detection.<br><br>└─ Overrun<br>0: Servo-lock stop<br>1: Servo-free alarm<br><br>└─ Soft limit<br>0: Servo-lock stop<br>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  $\geq$  PC cycle time  $\times$  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)  $\times$  2

### 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 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)

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 |
|--------------|-----------------------------------------------|------------------------|--------------|-----------------|
| <b>PP-06</b> | <b>Origin compensation (left-most digits)</b> | <b>–9,999 to 9,999</b> | <b>Pulse</b> | <b>0</b>        |

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

- 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 |
|--------------|---------------------------------------|-------------------|---------------------------------|-----------------|
| <b>PP-08</b> | <b>Compensation (leftmost digits)</b> | <b>0 to 9,999</b> | <b>Mechanical axis movement</b> | <b>0</b>        |

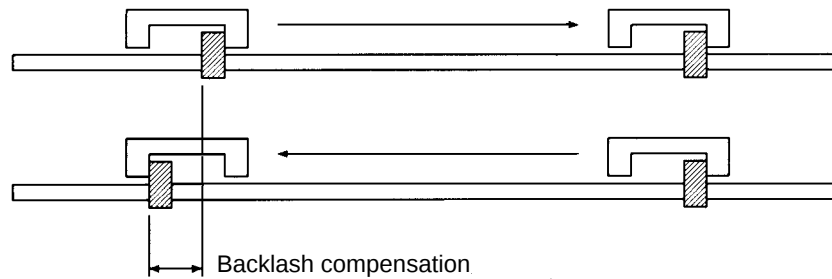
| PRM No.      | Parameter name                         | Setting range     | Unit                            | Factory setting |
|--------------|----------------------------------------|-------------------|---------------------------------|-----------------|
| <b>PP-09</b> | <b>Compensation (rightmost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

- 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

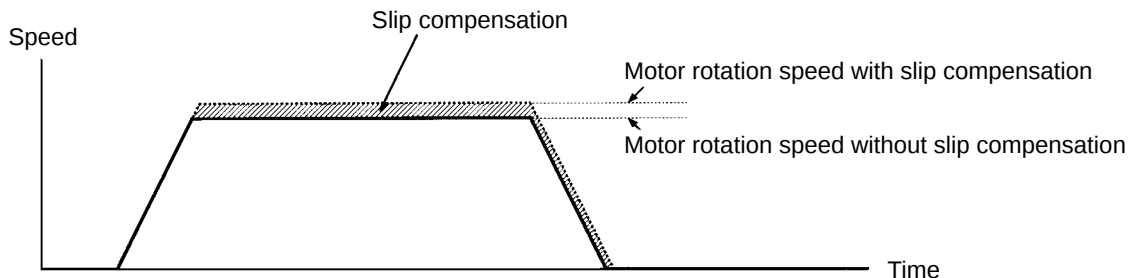
- Set the amount of play (backlash) for a mechanical system such as gears or chains.
- When movement is in the reverse direction from that of the previous operation, stopping precision can be improved by feeding an exact amount of compensation to absorb the backlash in the mechanical system.

- 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 movement | 9,999           |

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

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

- 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 |
|--------------|------------------------------------------|-------------------|---------------------------------|-----------------|
| <b>PP-14</b> | <b>Reference speed (leftmost digits)</b> | <b>0 to 9,999</b> | <b>Mechanical axis movement</b> | <b>0</b>        |

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

- 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 |
|--------------|------------------|-----------------|----------|-----------------|
| <b>PP-16</b> | <b>JOG speed</b> | <b>1 to 199</b> | <b>%</b> | <b>10</b>       |

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 |
|--------------|---------------------------------|-----------------|----------|-----------------|
| <b>PP-17</b> | <b>Origin search high speed</b> | <b>1 to 199</b> | <b>%</b> | <b>10</b>       |

- 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 |
|--------------|--------------------------------|-----------------|----------|-----------------|
| <b>PP-18</b> | <b>Origin search low speed</b> | <b>1 to 199</b> | <b>%</b> | <b>1</b>        |

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 |
|--------------|--------------------------------|---------------|------------|-----------------|
| <b>PP-19</b> | <b>Origin search direction</b> | <b>0, 1</b>   | <b>---</b> | <b>0</b>        |

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:  

$$[(\text{Target speed} - \text{present speed}) / \text{reference speed}] \times \text{acceleration time}$$

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).

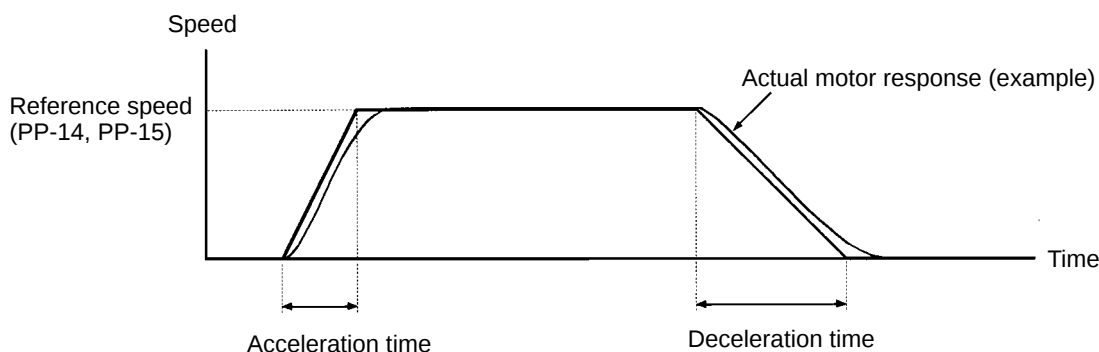
| PRM No. | Parameter name      | Setting range | Unit | Factory setting |
|---------|---------------------|---------------|------|-----------------|
| PP-22   | Deceleration time 0 | 0 to 9,999    | ms   | 0               |

| 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:  

$$[(\text{Present speed} - \text{target speed}) / \text{reference speed}] \times \text{deceleration time}$$
- 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



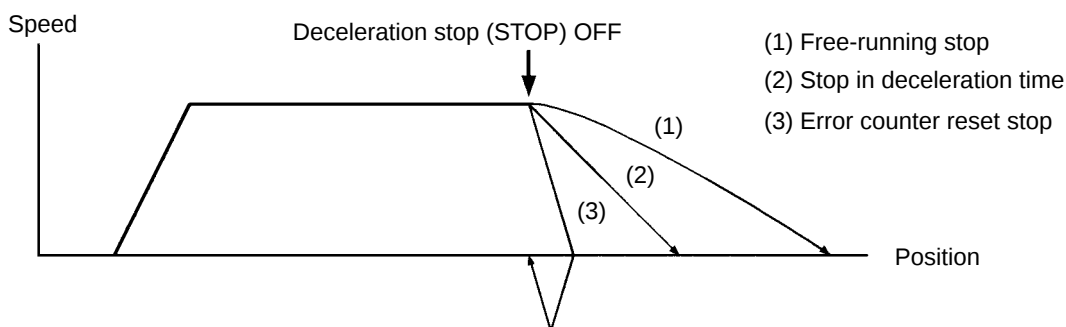
| PRM No. | Parameter name         | Setting range | Unit | Factory setting |
|---------|------------------------|---------------|------|-----------------|
| PP-24   | Deceleration stop mode | 0, 1, 2       | ---  | 1               |

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.

- 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  $\geq$  PC cycle time  $\times$  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)  $\times$  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.

## 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

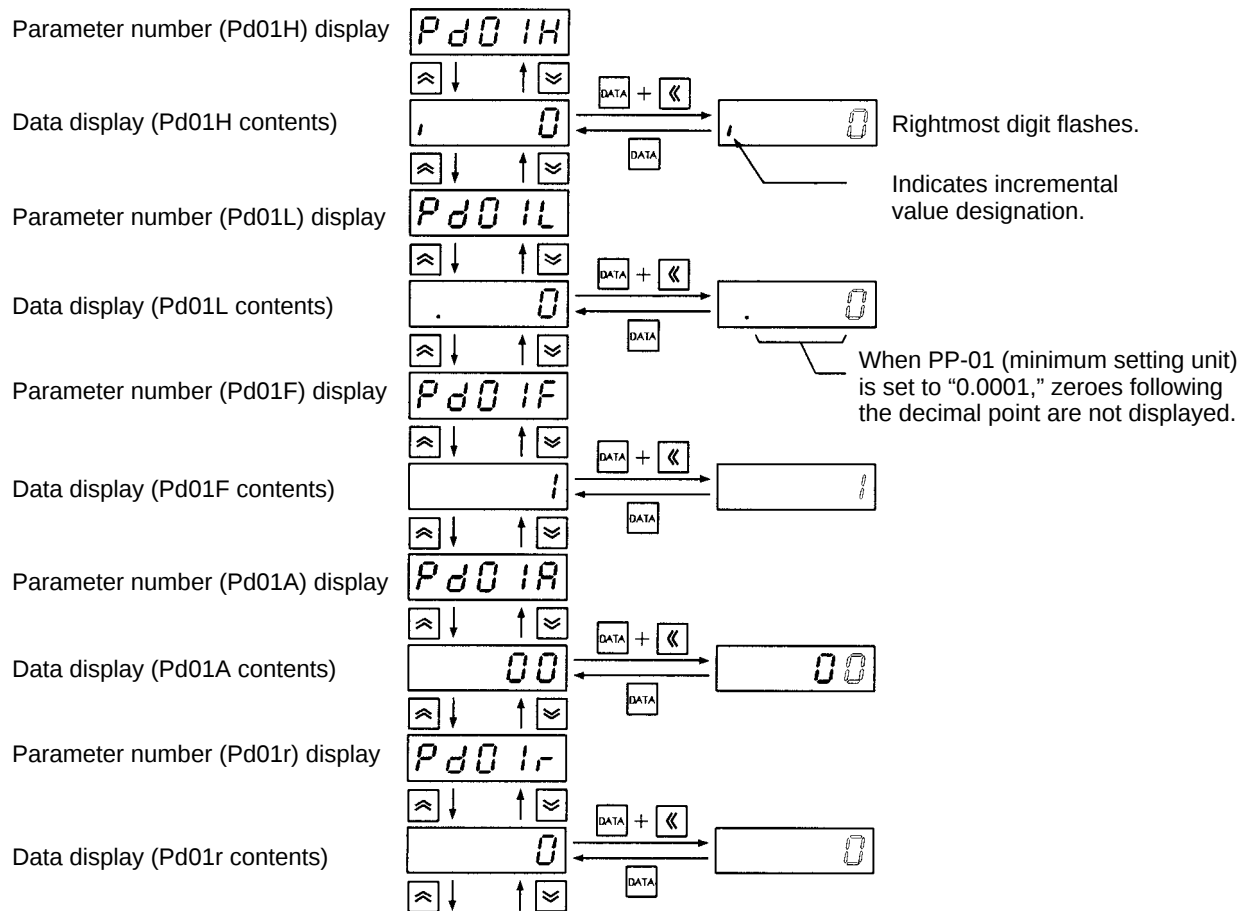
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### 3-6-1 Setting PTP Data (When UP-01 is 11 or 12)

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.

### 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).

**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<br>(Position) | Bit 3 | 4th digit<br>(Position) | Bit 3 | 6th digit<br>(Position) | Bit 3                   | Position I/A bit        |       | 2nd digit<br>(Speed) | Bit 3 |
| Position 6   |                         | Bit 2 |                         | Bit 2 |                         | Position sign bit       |                         | Bit 2 |                      |       |
| Position 5   |                         | Bit 1 |                         | Bit 1 |                         | 8th digit<br>(Position) | Bit 1                   | Bit 1 |                      |       |
| Position 4   |                         | Bit 0 |                         | Bit 0 |                         |                         | Bit 0                   | Bit 0 |                      |       |
| Position 3   | 1st digit<br>(Position) | Bit 3 | 3rd digit<br>(Position) | Bit 3 | 5th digit<br>(Position) | Bit 3                   | 7th digit<br>(Position) | Bit 3 | 1st digit<br>(Speed) | Bit 3 |
| Position 2   |                         | Bit 2 |                         | Bit 2 |                         | Bit 2                   |                         | Bit 2 |                      |       |
| Position 1   |                         | Bit 1 |                         | Bit 1 |                         | Bit 1                   |                         | Bit 1 |                      |       |
| Position 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.

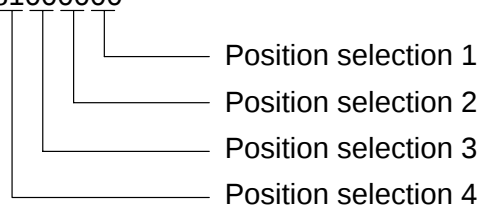
**Parameter Settings**

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)

### 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 | OFF             |   |
| Position 1   | OFF                  |   | OFF                  |   | OFF                  |   | OFF                  |   | OFF | OFF             |   |
| Position 0   | OFF                  |   | OFF                  |   | OFF                  |   | ON                   |   | OFF | OFF             |   |

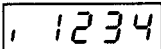
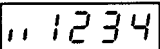
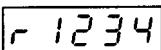
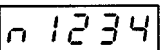
### 3-6-3 PTP Data (Pd01 to Pd64 )

| No. Pd | Name                                            | Minimum setting unit | Setting range            | Factory setting | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------|-------------------------------------------------|----------------------|--------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 01H    | Point No. 1 position data (leftmost digits)     | (PP-01)              | (I/A)<br>–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. <div>                         Acceleration                         <div>                             0: Acceleration time 0                             1: Acceleration time 1                         </div>                         Deceleration                         <div>                             0 Deceleration time 0                             1: Deceleration time 1                         </div> </div> |
| 01r    | Point No. 1 operation mode selection            | ---                  | 0 to 2                   | 0               | 0: Independent operation mode<br>1: Automatic incremental mode<br>2: Continuous operation mode                                                                                                                                                                                                                                                                                                                                                                                      |

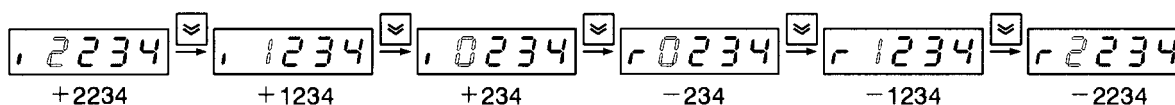
Pd02 to Pd63 are the same as Pd01 in data except for the point number.

|     |                                                  |         |                                |       |                                               |
|-----|--------------------------------------------------|---------|--------------------------------|-------|-----------------------------------------------|
| 64H | Point No. 64 position data (leftmost digits)     | (PP-01) | (I/A)<br>–3,999<br>to<br>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).

- 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  $\mu$ m, 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

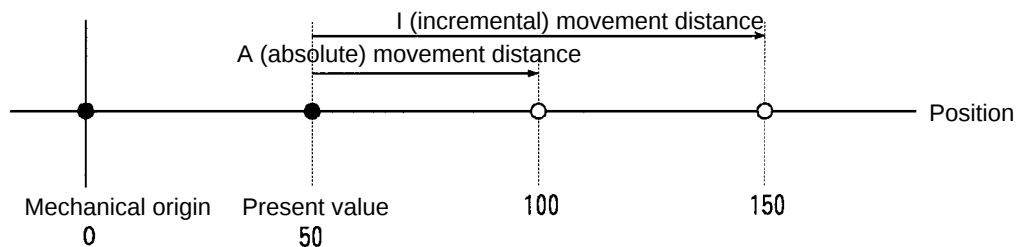
Leftmost digits Pd H = "I + 100" 1 100  
Rightmost digits Pd L = "0.000" 0.000

### • 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 (%)

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

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 |
|-------------|---------------------------------|---------------|------------|-----------------|
| <b>Pd r</b> | <b>Operation mode selection</b> | <b>0 to 2</b> | <b>---</b> | <b>0</b>        |

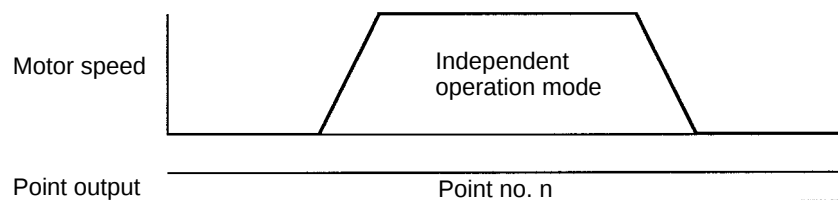
This data specifies the method for moving to the next positioning after a positioning operation has been executed.

| 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.

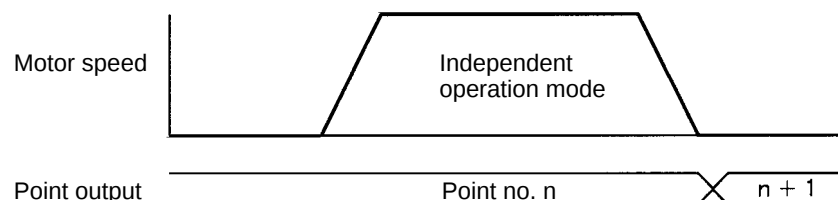
### Independent Operation Mode

- 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.



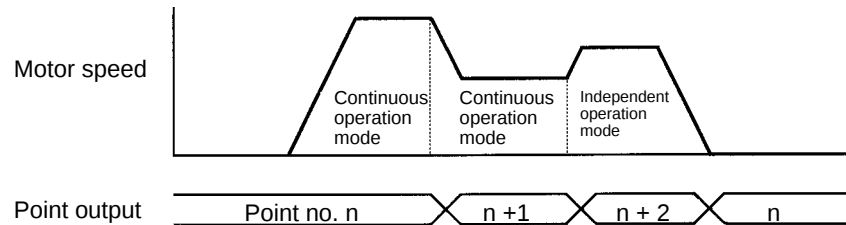
### Automatic Incremental Mode

- 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.)



### 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

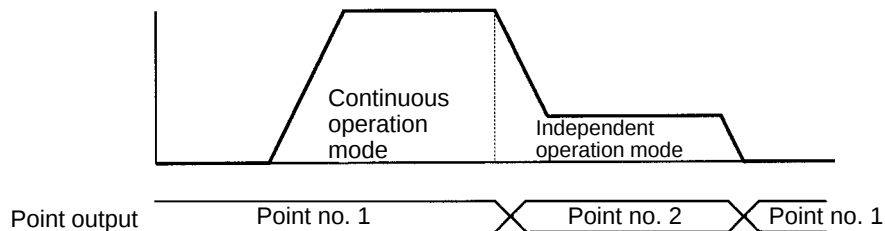
Point number 2 = "I + 100.000," independent operation mode

#### 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.

---

## 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. |

### PTP Parameters

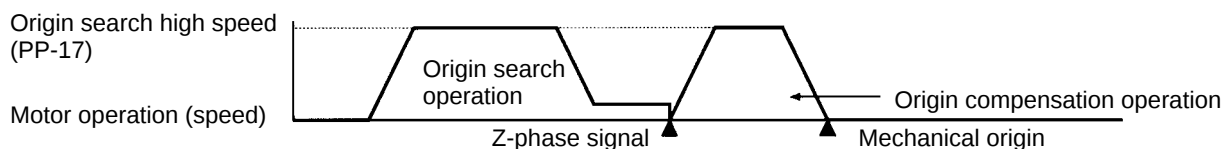
The following PTP parameter settings are related to origin search. Make the settings according to the mechanical system.

| 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.<br>0: Begin in positive (+) direction<br>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.

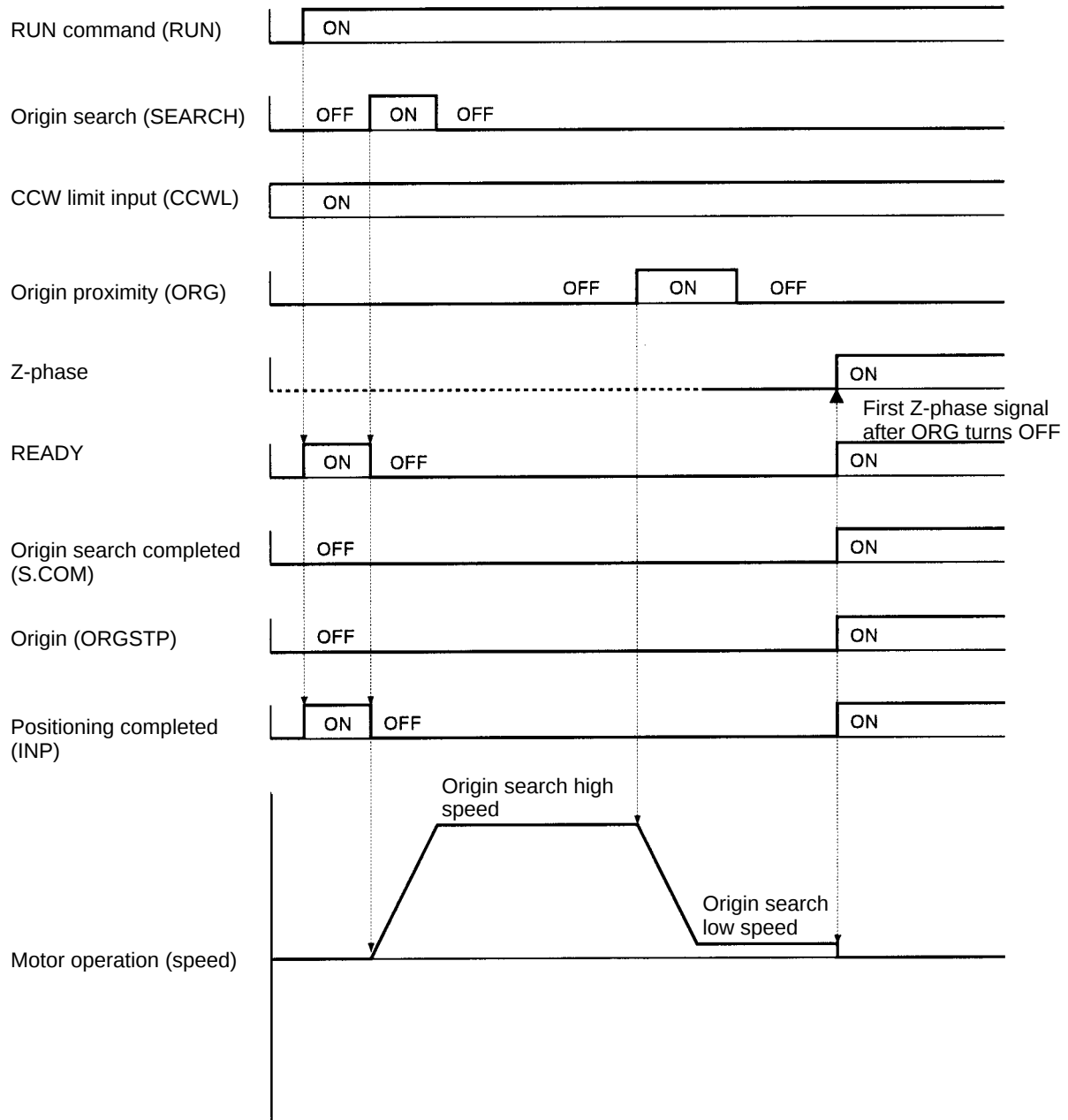


### Operation

- 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.

### Origin Search Pattern 1: Starting Between CWL Signal and Origin Proximity Signal

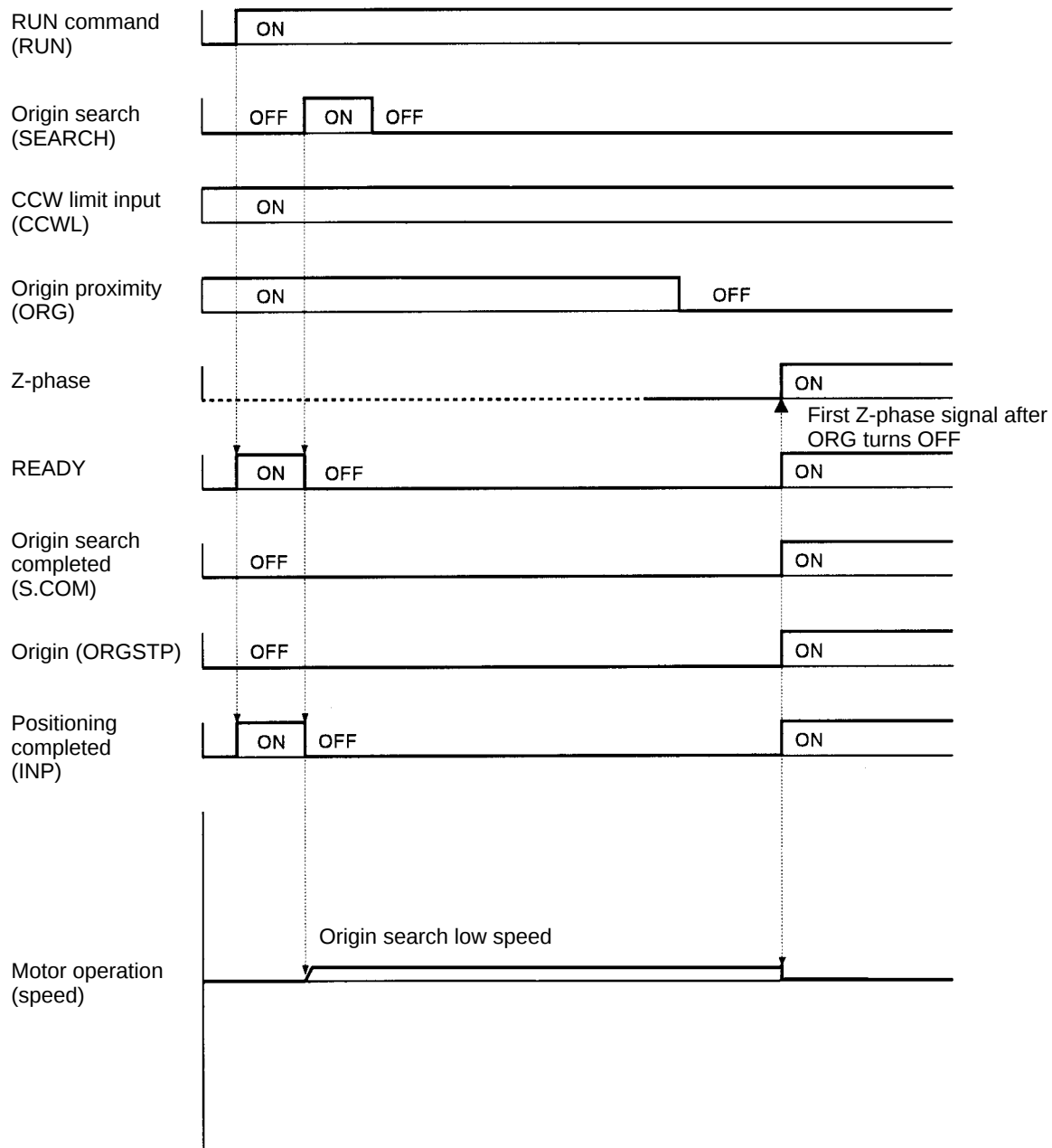
1. Positioning begins in the origin search direction at the origin search high speed.
2. Positioning changes to the origin search low speed when the origin proximity signal turns ON (rising edge).
3. The origin is established by the first Z-phase signal that is received after the origin proximity signal 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.

**Origin Search Pattern 2: Starting With Origin Proximity Input Signal ON**

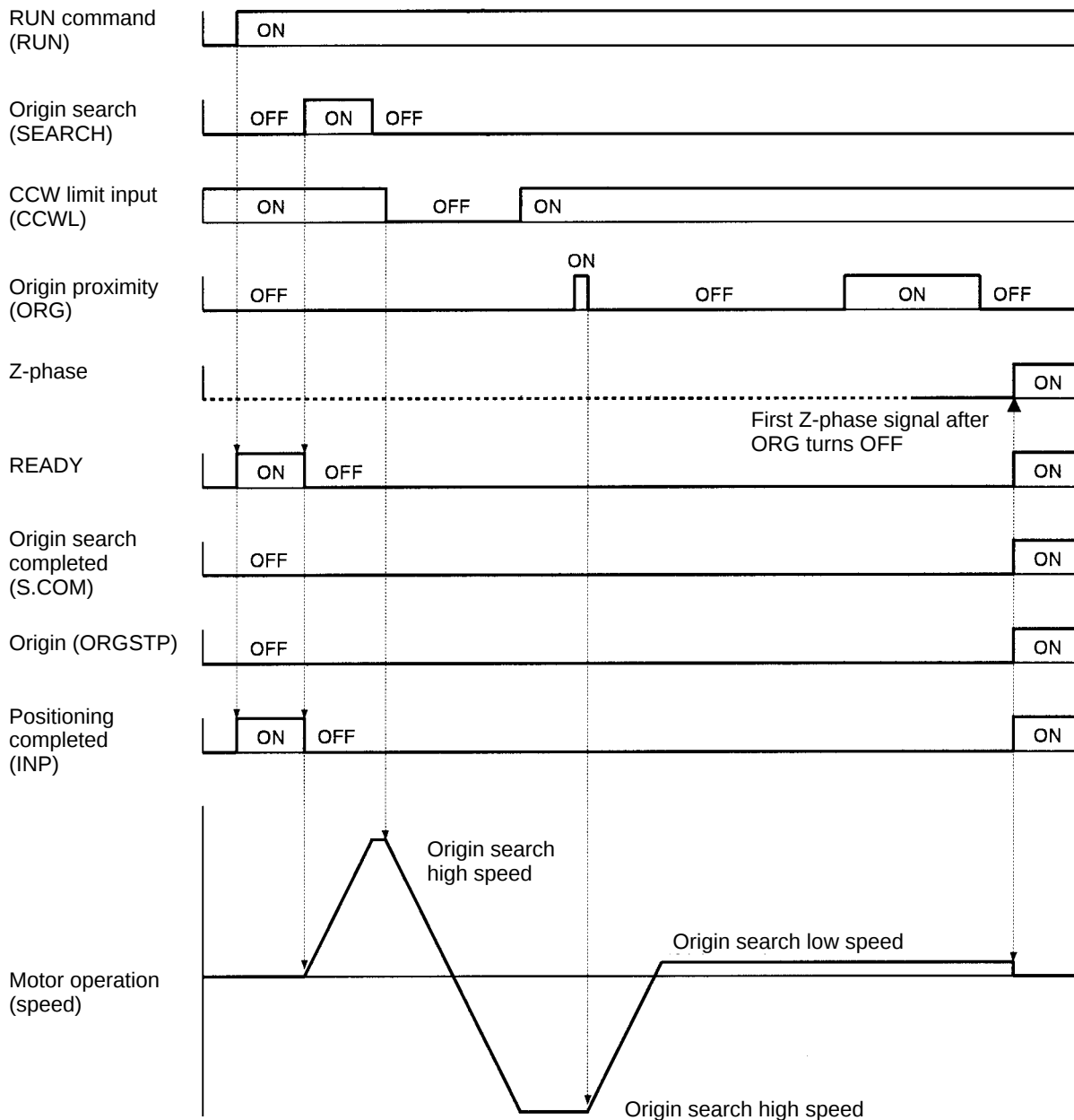
1. Positioning begins in the origin search direction at the origin search low speed.
2. The origin is established by the first Z-phase signal that is received after the origin proximity signal turns OFF (falling edge).



**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.

### Origin Search Pattern 3: Starting Between Origin Proximity Signal and CCWL Signal

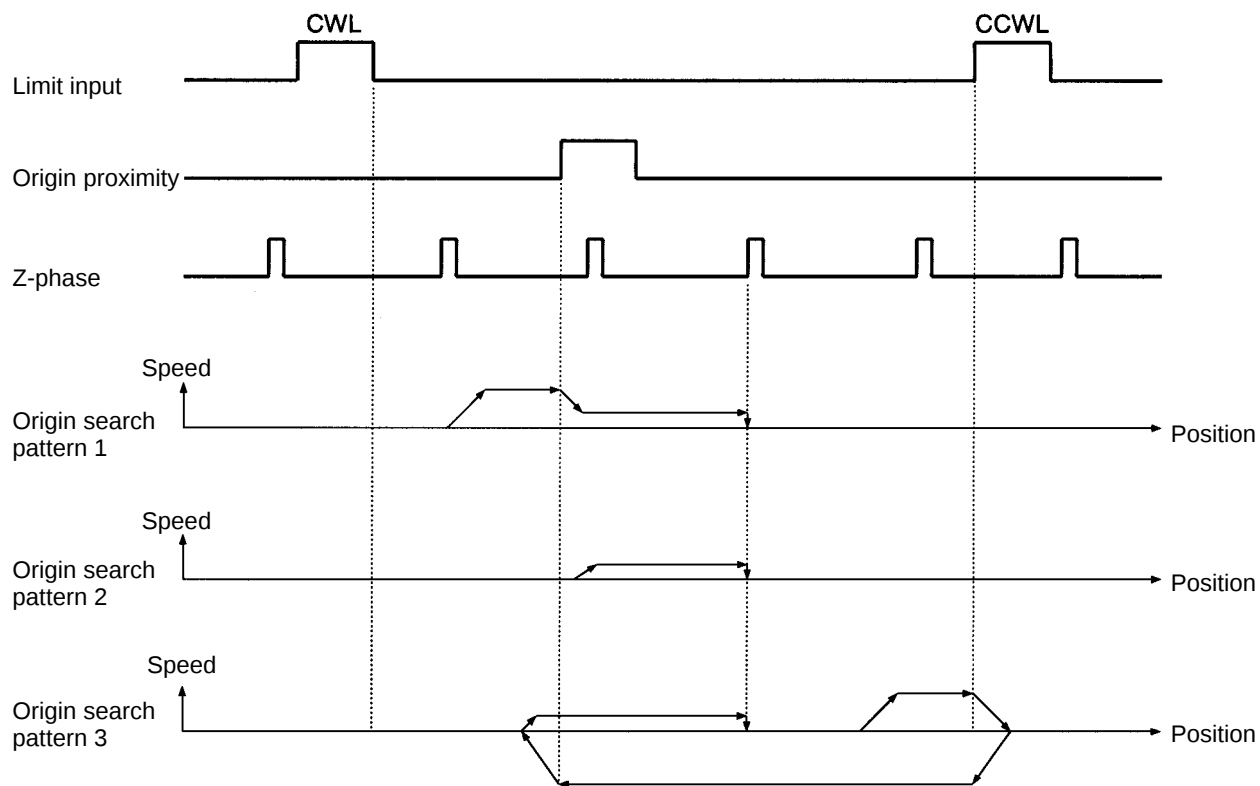
1. Positioning begins in the origin search direction at the origin search high speed.
2. The direction of movement is reversed when the CCWL signal turns OFF.
3. When the origin proximity signal turns from ON to OFF, the direction of movement is reversed again and the speed is changed to the origin search 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.

## Summary of Origin Search Operation

Origin search direction: + direction



## 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

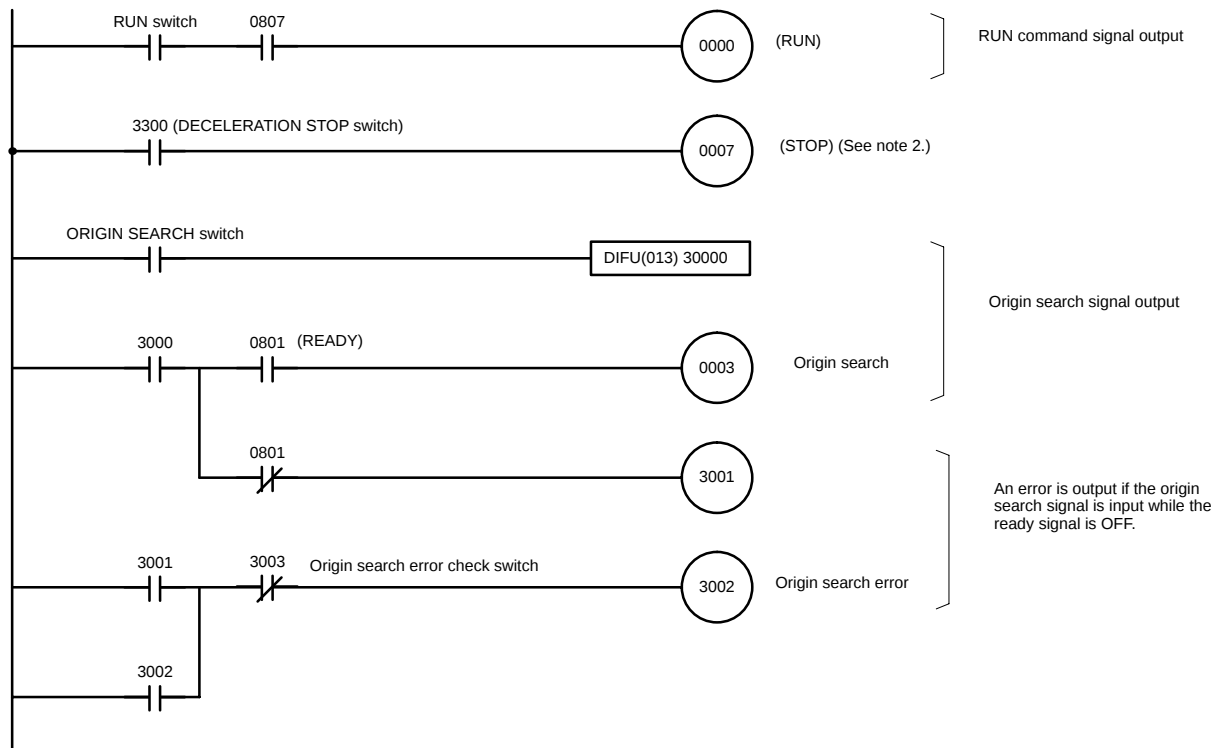
| Bit number | Position Driver signal name |                                       |
|------------|-----------------------------|---------------------------------------|
| 0          | BO                          | Brake output                          |
| 1          | READY                       | Ready                                 |
| 2          | S.COM                       | Origin search completed               |
| 3          | ORGSTP                      | Origin stop                           |
| 4          | T.COM                       | Teaching completed                    |
| 5          | RUNON                       | Motor running                         |
| 6          | INP                         | Positioning completed                 |
| 7          | 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.)                           |

**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).

- 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.

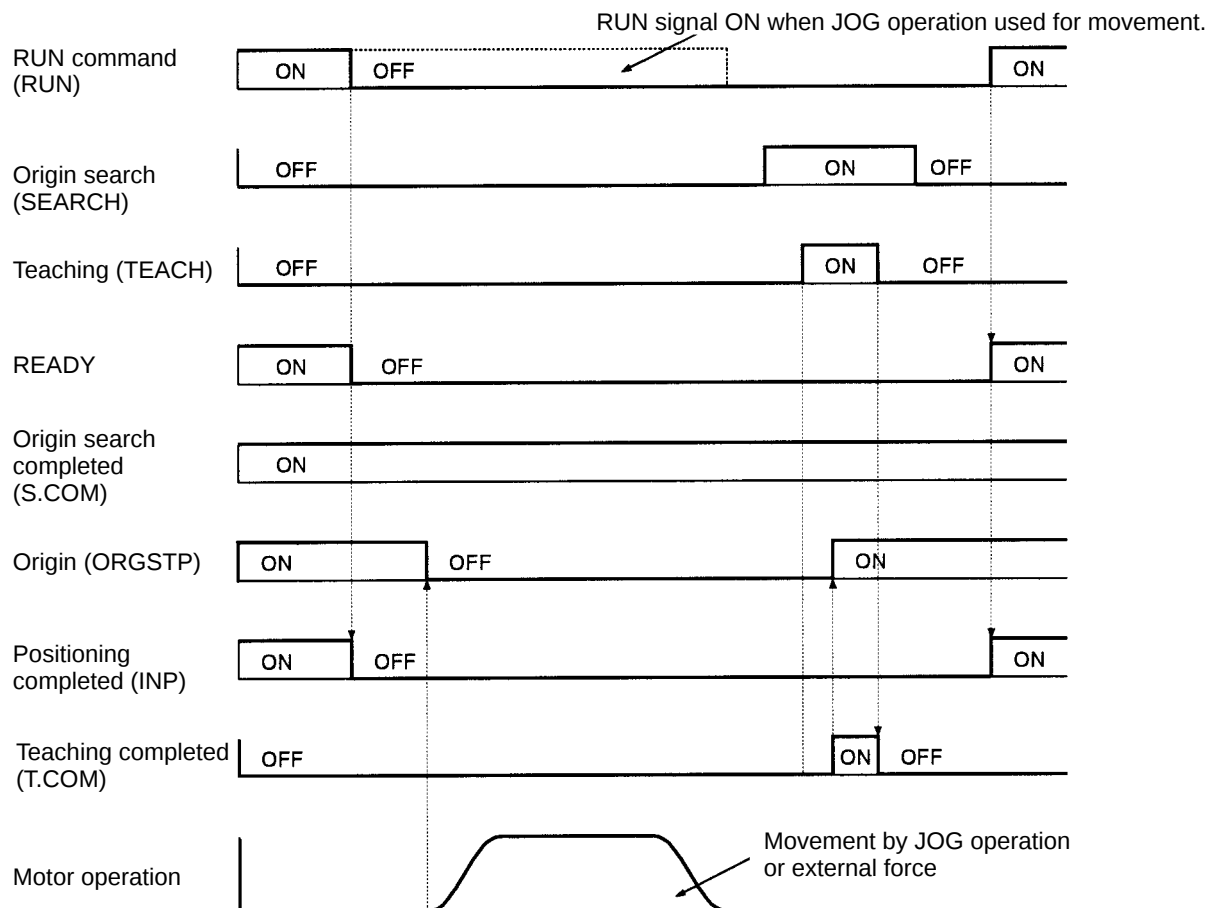
## PTP Parameters

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.



### 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

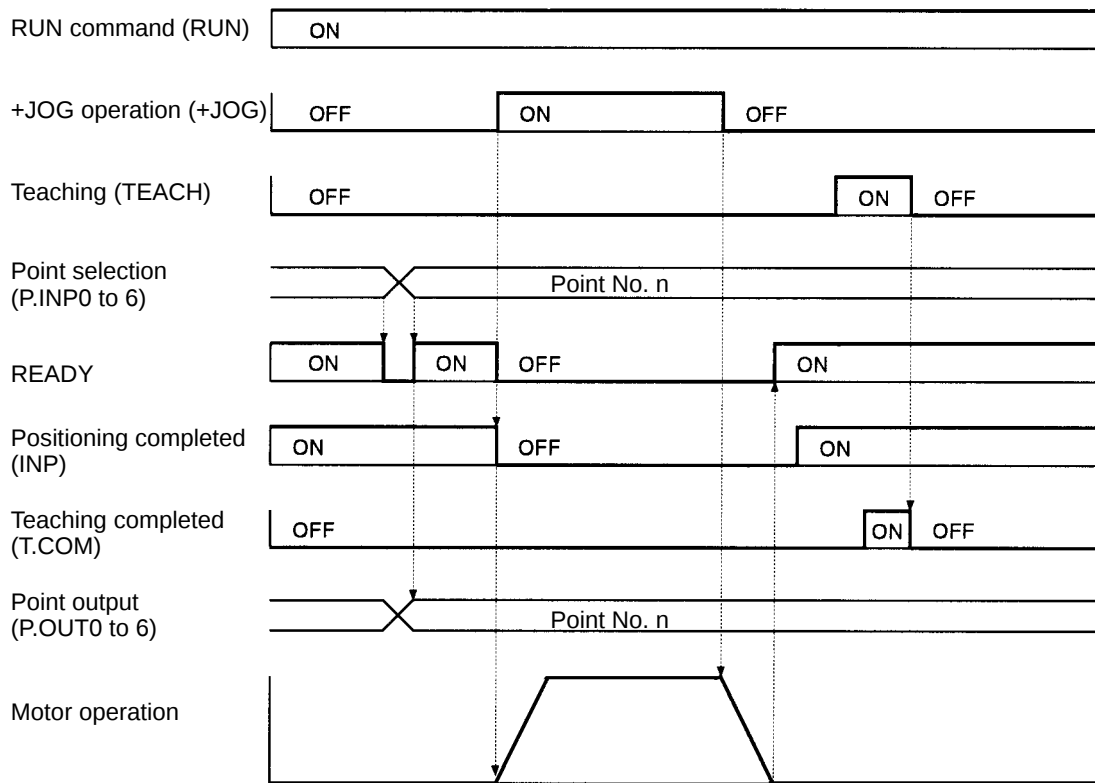
The following PTP parameters are set by the teaching operation.

| No. Pd- | Name                                       | Min. unit | Setting range            | Factory setting | Explanation                                                                                                                                                            |
|---------|--------------------------------------------|-----------|--------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H       | Point No. position data (leftmost digits)  | (PP-01)   | (I/A)<br>–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               | <p><b>Note 1.</b> represents a number from 01 to 64.</p> <p><b>Note 2.</b> With teaching, the position data is A (absolute value)</p>                                  |

#### 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.

- 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

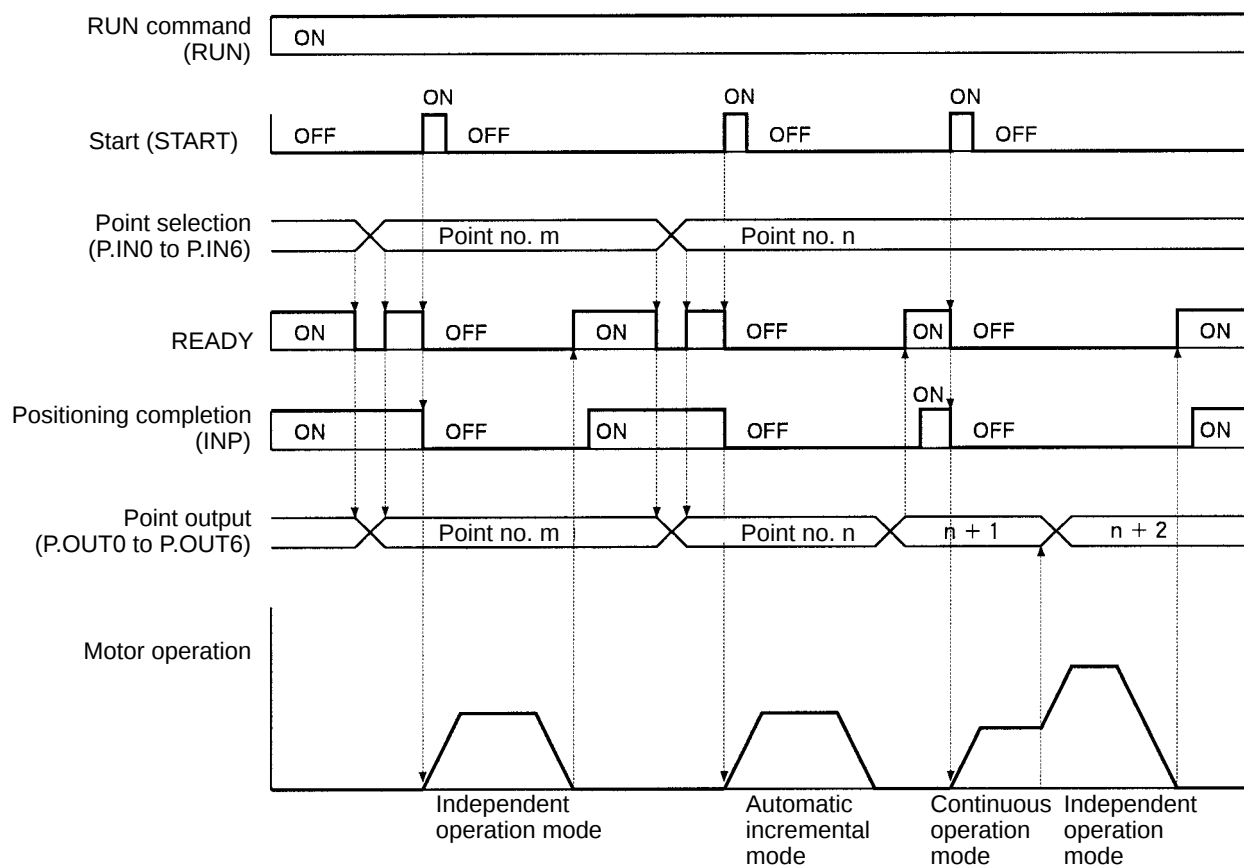
- Positioning is executed according to the PTP data of point numbers input to P.IN0 to P.IN6.
- Positioning is started when the start signal is turned ON while the ready signal is ON.
- The ready signal is turned OFF at the moment positioning begins and turned ON again upon completion of the positioning operation.

**Note** With feeder control (UP-01: 12), the present value is cleared when the start signal is turned ON.

#### Operation

- 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.)
- Make sure that the ready signal is ON. Then turn ON the start signal.
- Positioning will begin and the ready signal will be turned OFF.

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  |

| 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          | 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.

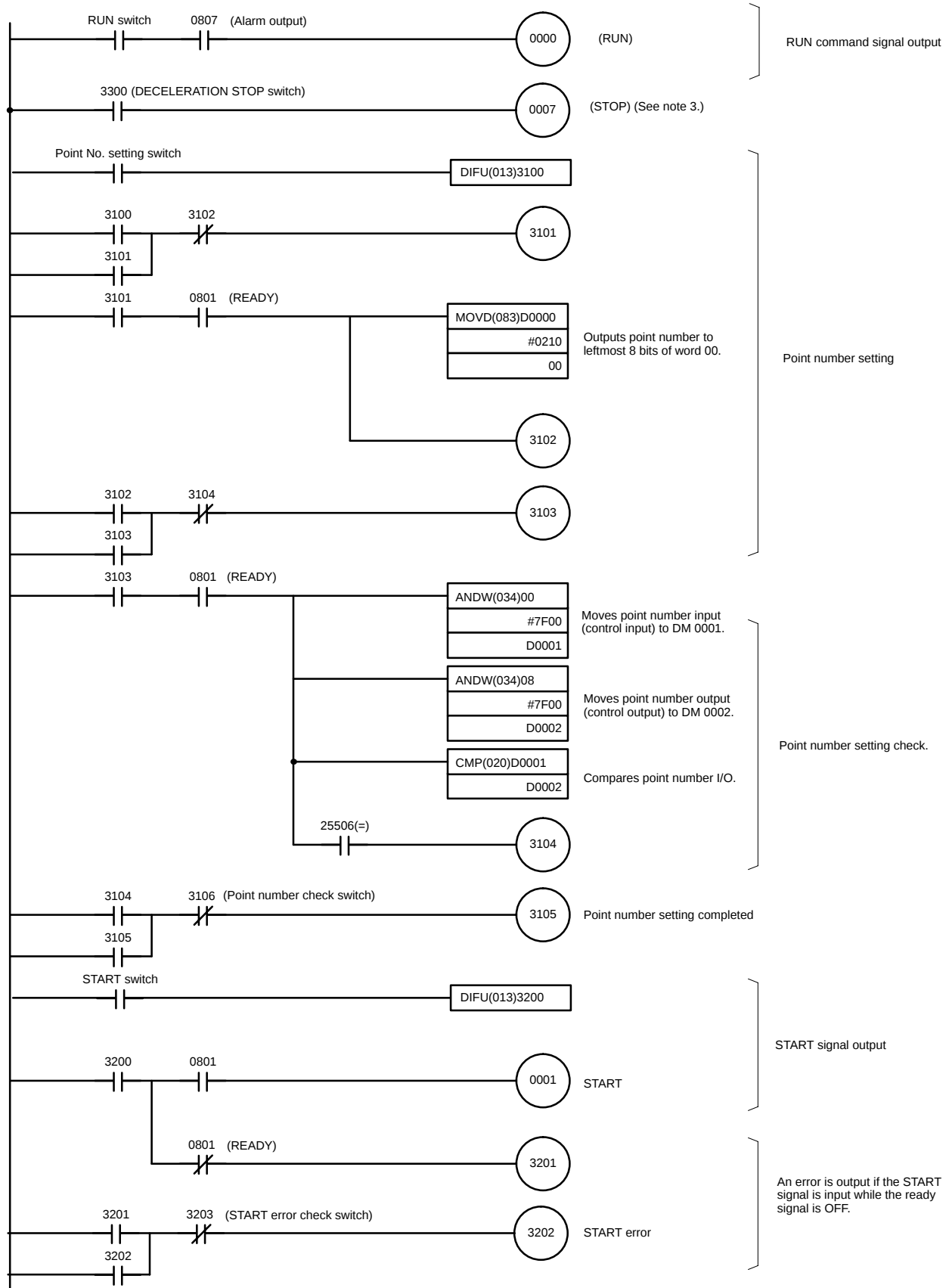
**Input to the Position Driver**

|                 |                 |                 |                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| P.IN6           | P.IN5           | P.IN4           | P.IN3           | P.IN2           | P.IN1           | P.IN0           |
| $4 \times 10^1$ | $2 \times 10^1$ | $1 \times 10^1$ | $8 \times 10^0$ | $4 \times 10^0$ | $2 \times 10^0$ | $1 \times 10^0$ |

**Output from the Position Driver**

|                 |                 |                 |                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| P.OUT6          | P.OUT5          | P.OUT4          | P.OUT3          | P.OUT2          | P.OUT1          | P.OUT0          |
| $4 \times 10^1$ | $2 \times 10^1$ | $1 \times 10^1$ | $8 \times 10^0$ | $4 \times 10^0$ | $2 \times 10^0$ | $1 \times 10^0$ |

# □ Ladder Program



- 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

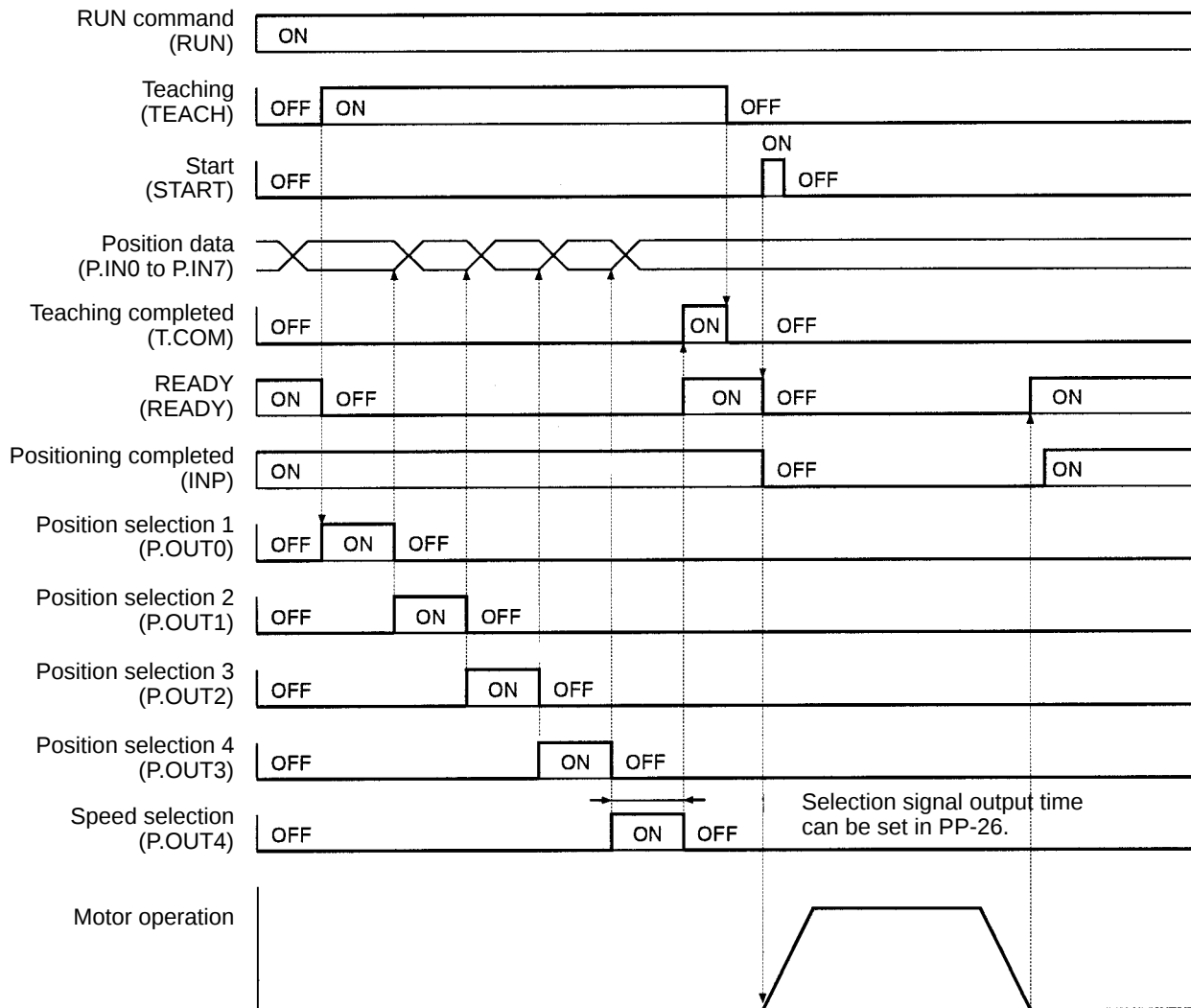
- Positioning is executed by taking in sequence the position and speed data entered for positions 0 to 7 (P.IN0 to 7), according to the timing output signals for position data selections 1 to 4 (P.OUT0 to 3) and the speed data selection (P.OUT4).
- When the teach signal is turned ON, the Position Driver 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.

7. The ready signal is turned ON again upon completion of the positioning operation.



## 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          | 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 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           |
| $8 \times 10^{n+1}$ | $4 \times 10^{n+1}$ | $2 \times 10^{n+1}$ | $1 \times 10^{n+1}$ | $8 \times 10^n$ | $4 \times 10^n$ | $2 \times 10^n$ | $1 \times 10^n$ |

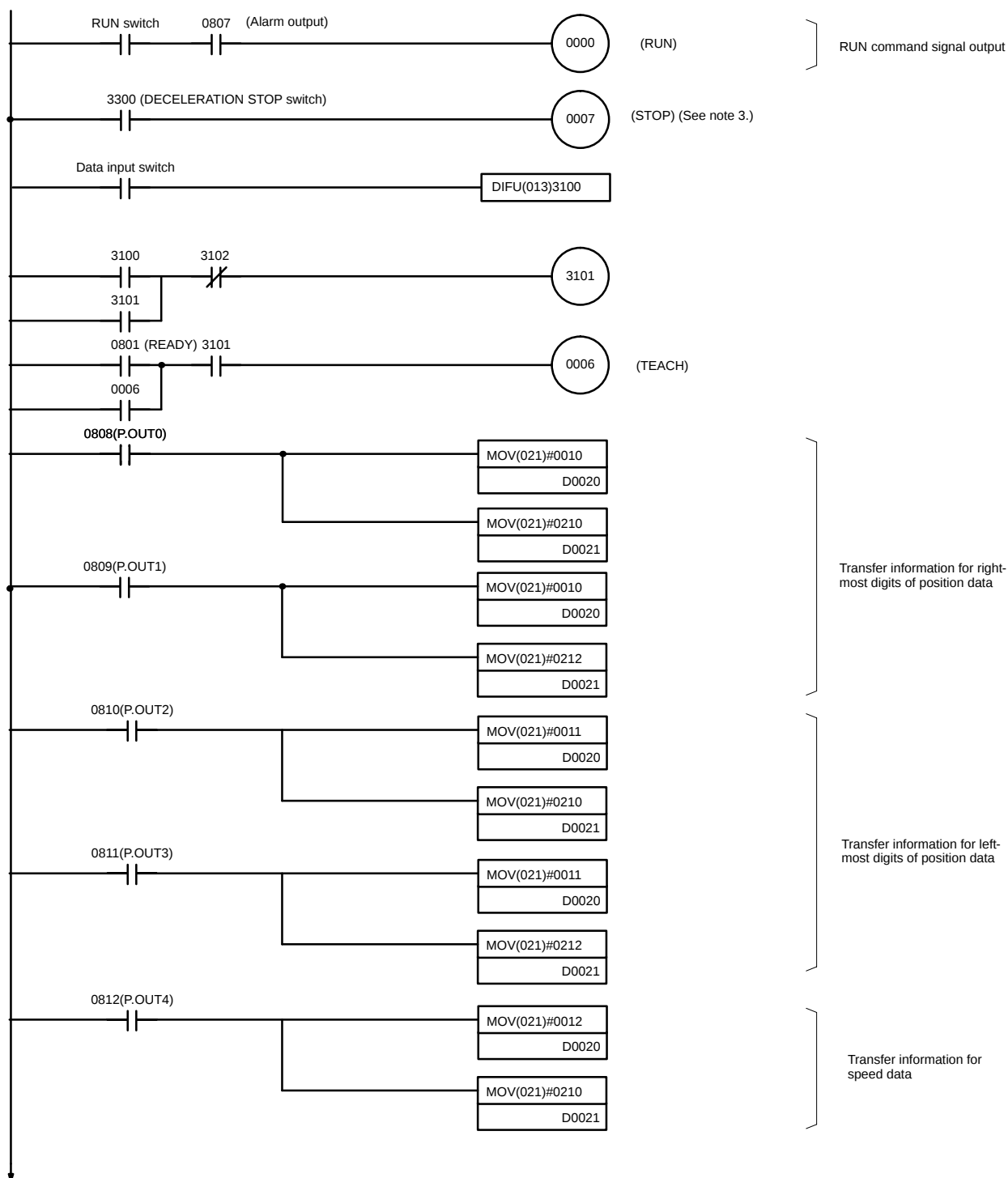
Position data: P.OUT0 ON; n=0, P.OUT1 ON; n=2, P.OUT2 ON; n=4, P.OUT3 ON; n=6

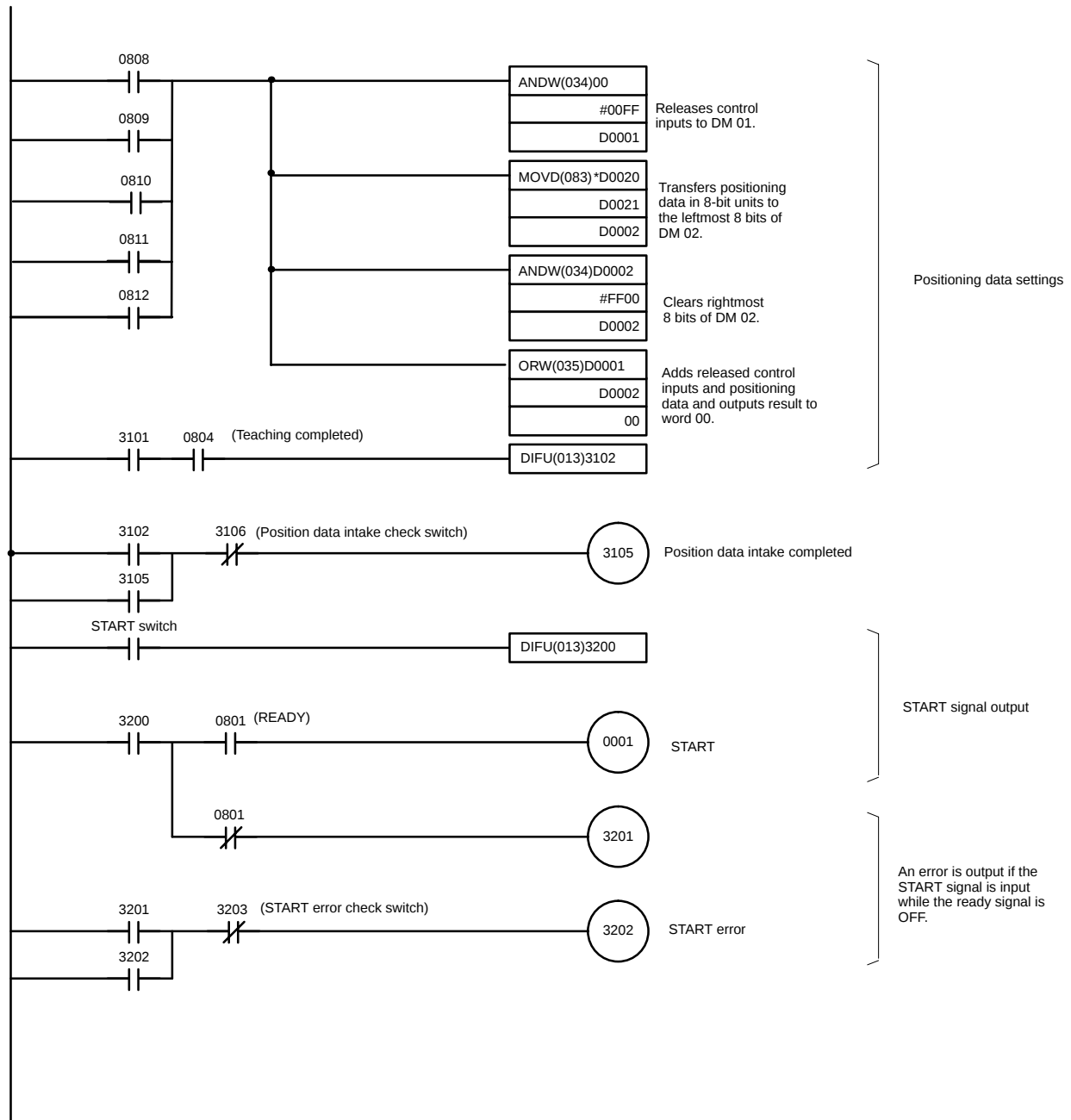
P.IN6;  $\pm$ data 0: +, 1: –

P.IN7; INC/ABS data 0: INC, 1: ABS

Speed data: P.OUT4 ON; n=0

# □ Ladder Program





- 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.)

## 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.

**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?

## (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:

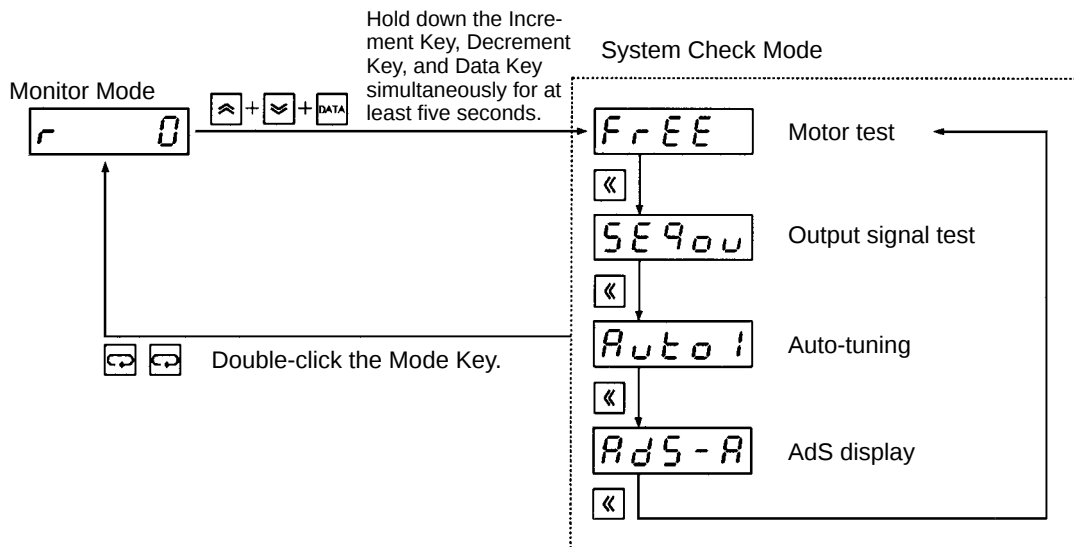
1. Press the Mode Key to go into the Monitor Mode.
2. Hold down the Increment Key, Decrement Key, and Data Key simultaneously for at least five seconds to go into the System Check Mode.

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.

☐ **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.                                                                                              |

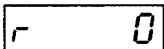
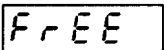
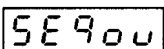
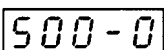
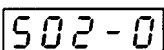
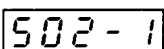
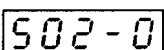
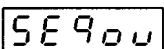
☐ **User Parameter Settings**

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.

## Output Signal Test Operating 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 Shift Key to bring up the output signal test display.                                                               |
|  | Press the Data Key and Shift Key to enable the output signal test. (The output signals will all be turned OFF.)               |
|  | Use the Increment Key and the Decrement Key to select the signal. In this example the origin signal (ORGSTP) is selected.     |
|  | Press the Data Key to turn ON the output signal. ("1" indicates "ON.")                                                        |
|  | Press the Data Key again to turn OFF the output signal. ("1" indicates "OFF.")                                                |
|  | Press the Mode Key to return to the output signal test display.                                                               |
|  | 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    | 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                          |

## 3-9 Making Adjustments

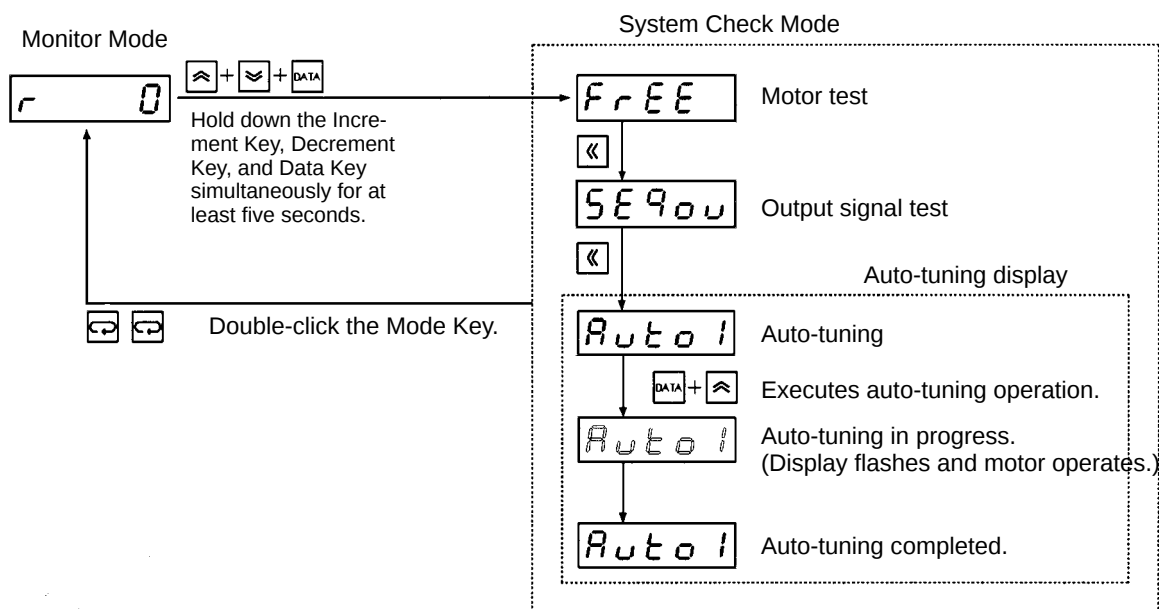
### 3-9-1 Auto-tuning

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.

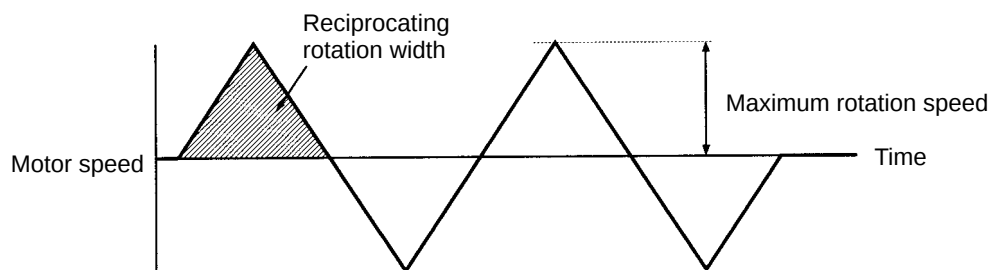


#### Auto-tuning Parameter Settings

| 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.                                   |

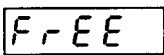
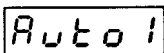
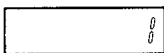
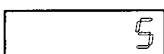
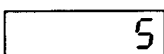
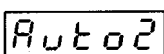
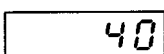
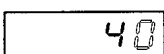
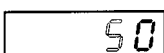
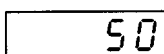
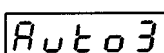
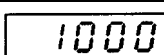
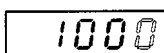
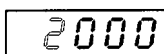
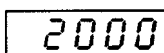
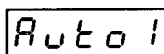
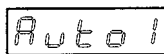
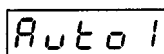
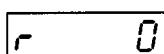
**Note 1.** The reciprocating operation is performed twice during auto-tuning. Check the mechanical operating range and set the reciprocating rotation range accordingly.

**Note 2.** Set the maximum rotation speed to the maximum speed for actual operation.



## 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).

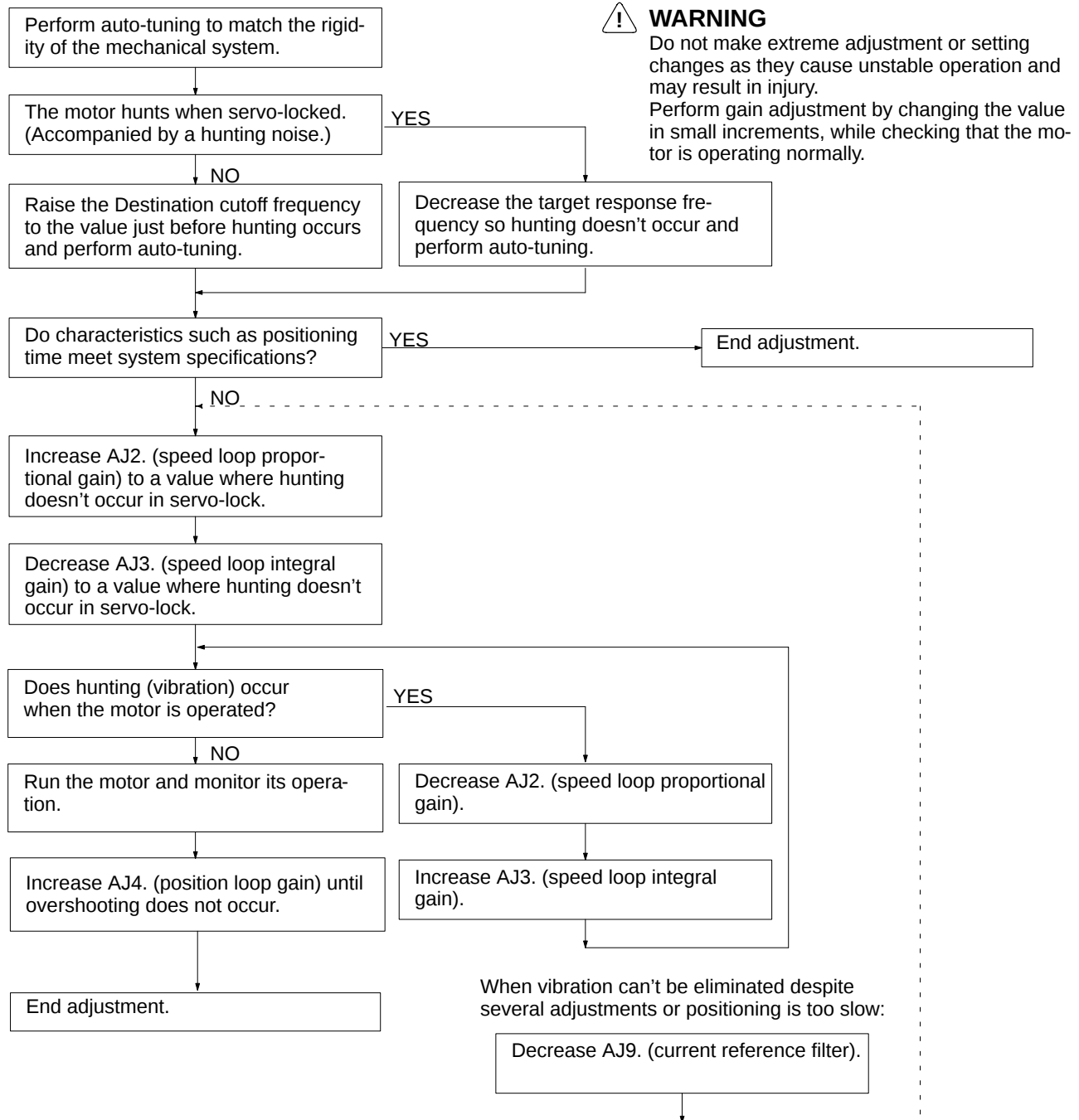
| Display example                                                                     | Key operation                                                                                                                 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
|    | 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.                                                                          |

### 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.

### 3-9-2 Manually Adjusting Gain

#### Gain Adjustment Flowchart

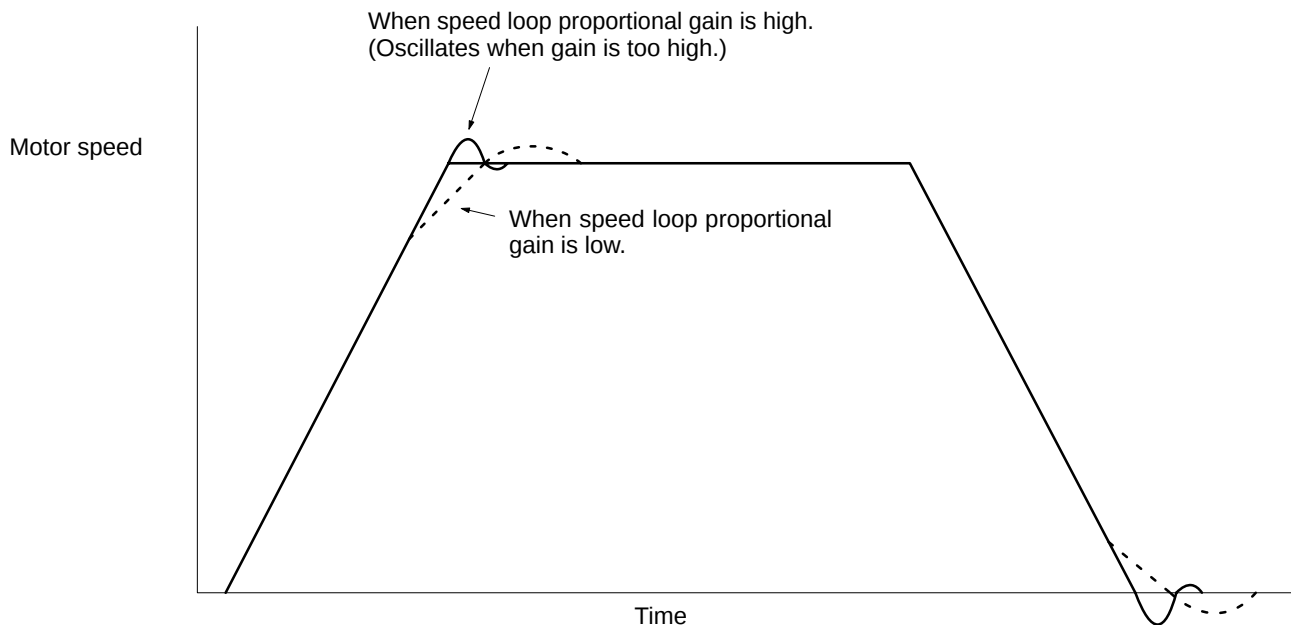


### 3-9-3 Adjustment Parameter Details

| PRM No.     | Parameter name                      | Setting range       | Unit            | Factory setting |
|-------------|-------------------------------------|---------------------|-----------------|-----------------|
| <b>AJ2.</b> | <b>Speed loop proportional gain</b> | <b>0.0 to 100.0</b> | <b>Multiple</b> | <b>1.0</b>      |

- 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.

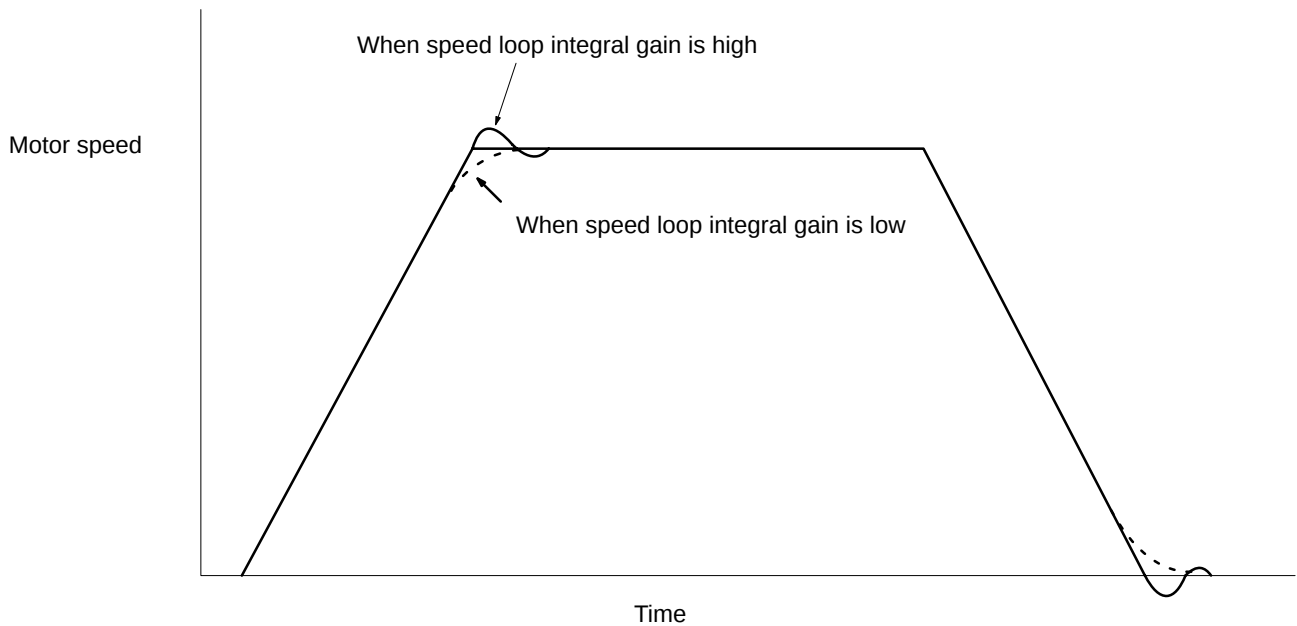
#### Response When Speed Loop Proportional Gain is Adjusted



| PRM No.     | Parameter name                  | Setting range      | Unit            | Factory setting |
|-------------|---------------------------------|--------------------|-----------------|-----------------|
| <b>AJ3.</b> | <b>Speed loop integral gain</b> | <b>0.1 to 20.0</b> | <b>Multiple</b> | <b>1.0</b>      |

- 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.

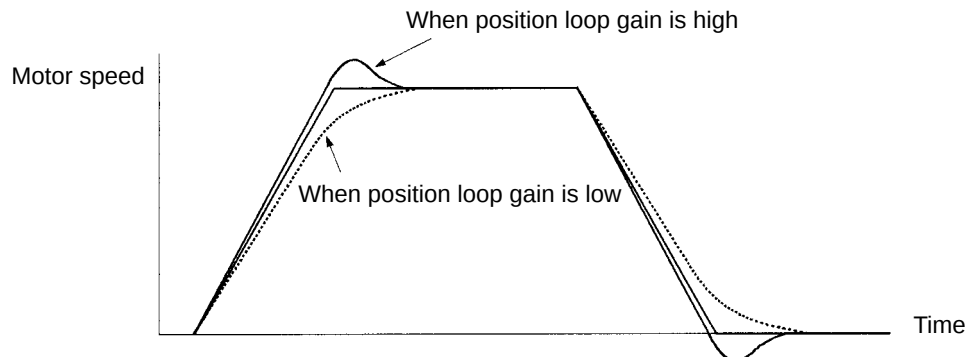
### Response When Speed Loop Integral Gain is Adjusted



| 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



| PRM No.     | Parameter name                    | Setting range      | Unit       | Factory setting |
|-------------|-----------------------------------|--------------------|------------|-----------------|
| <b>AJ7.</b> | <b>Interrupt gain suppression</b> | <b>0 to 10,000</b> | <b>---</b> | <b>0</b>        |

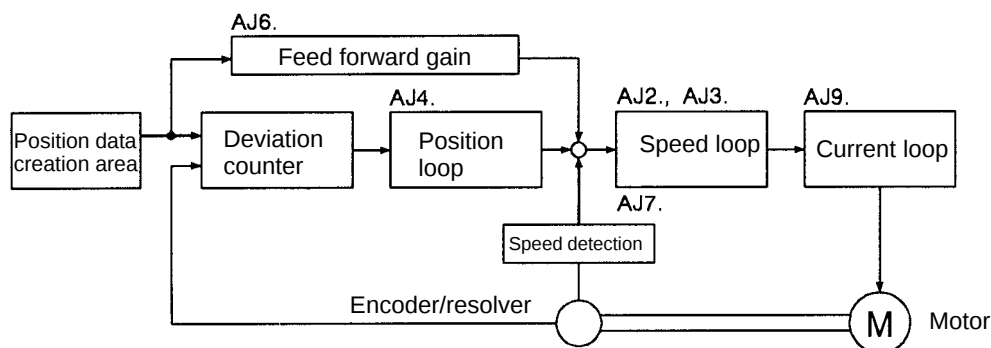
- If any value other than “0” is set for this parameter, the speed loop integral gain will be disabled when stopped, and the speed loop proportional gain will be suppressed.
- As the set value is increased, the amount of suppression is increased and the speed loop proportion gain is lowered.
- Adjust this parameter if the motor makes abnormal noises when stopping.

| PRM No.     | Parameter name           | Setting range     | Unit            | Factory setting |
|-------------|--------------------------|-------------------|-----------------|-----------------|
| <b>AJ8.</b> | <b>Feed-forward gain</b> | <b>0.0 to 2.0</b> | <b>Multiple</b> | <b>0.0</b>      |

- 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 |
|-------------|---------------------------------|----------------------|--------------|-----------------|
| <b>AJ9.</b> | <b>Current reference filter</b> | <b>400 to 20,000</b> | <b>rad/s</b> | <b>6,000</b>    |

- This parameter specifies the current reference cut-off frequency.
- Gradually lower this value if vibration occurs due to a mechanical resonance frequency.



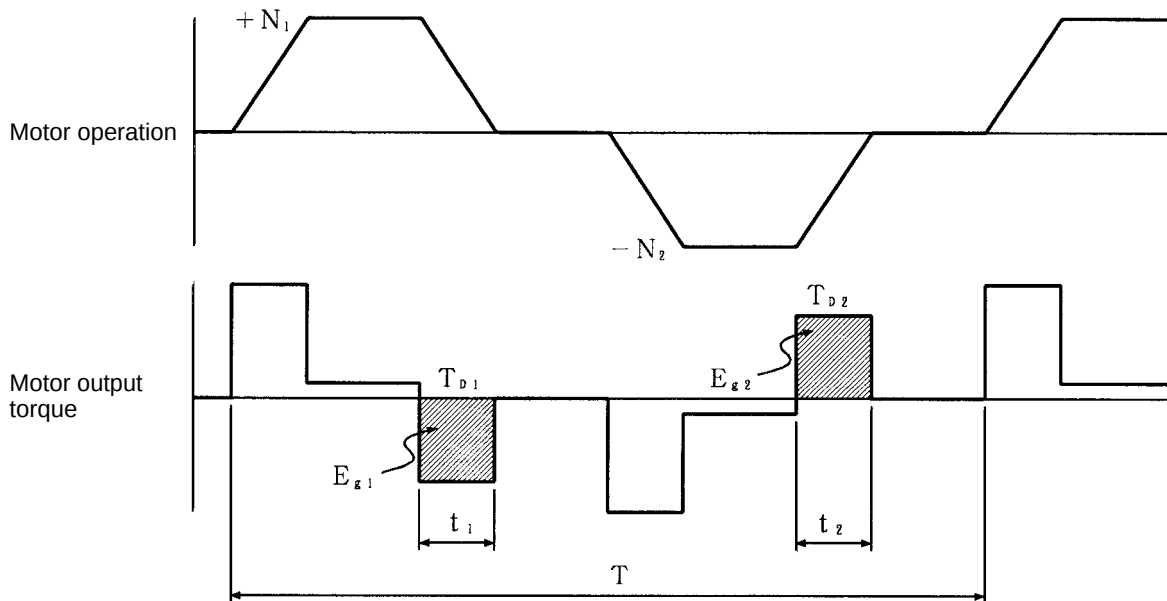
### 3-10 Regenerative Energy Absorption

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:

$$E_{g1} = 1/2 \quad N_1 \quad T_{D1} \quad t_1 \quad 1.027 \times 10^{-2} \text{ [J]}$$

$$E_{g2} = 1/2 \quad N_2 \quad T_{D2} \quad t_2 \quad 1.027 \times 10^{-2} \text{ [J]}$$

$N_1, N_2$ : 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.

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:

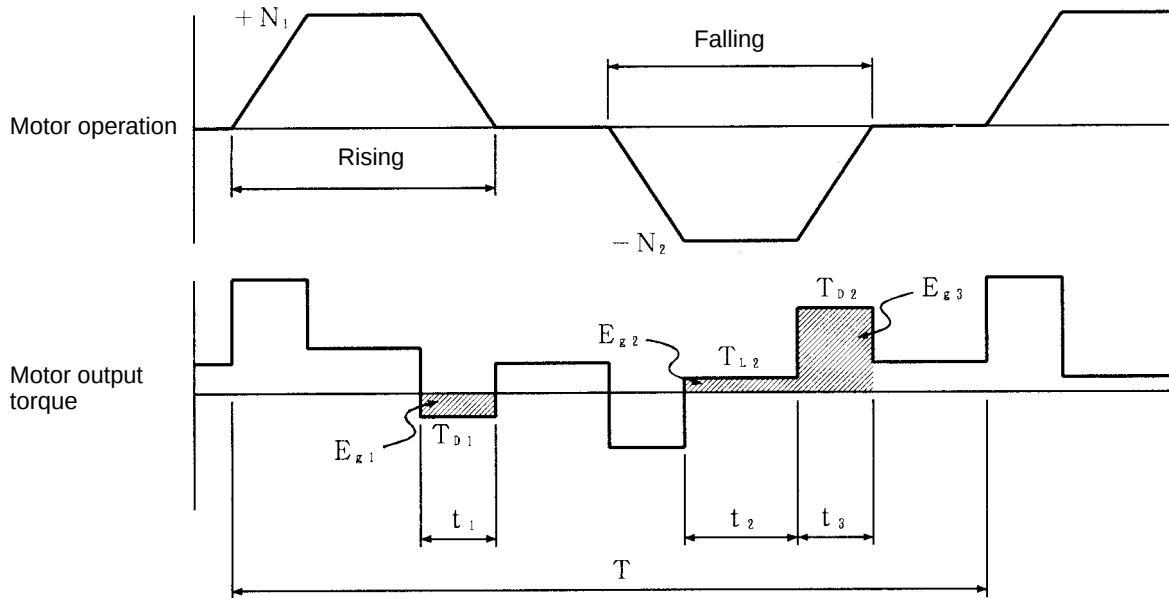
[Unit: W]

$P_r = (E_{g1} + E_{g2})/T$  [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:

$$E_{g1} = 1/2 N_1 T_{D1} t_1 \cdot 1.027 \times 10^{-2} \text{ [J]}$$

$$E_{g2} = N_2 T_{L2} t_2 \cdot 1.027 \times 10^{-2} \text{ [J]}$$

$$E_{g3} = 1/2 N_2 T_{D2} t_3 \cdot 1.027 \times 10^{-2} \text{ [J]}$$

$N_1, N_2$ : 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.

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.

### 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.

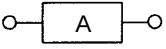
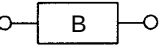
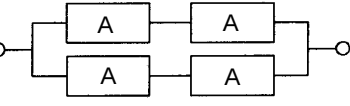
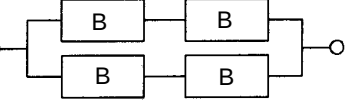
**Caution** The Regeneration Resistor heats up to 120°C, so be careful not to place it near equipment or wiring that may be affected by heat. Also be sure to install a radiation shield that satisfies the heat radiation conditions.

#### Selecting a Regeneration Resistor

##### Types of Regeneration Resistors

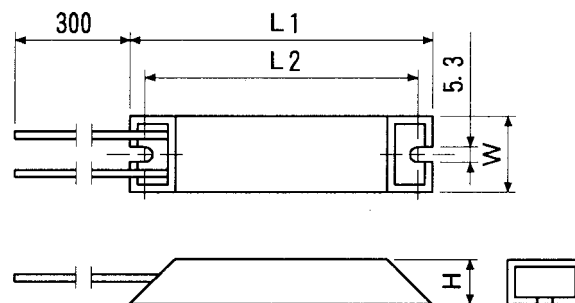
| Type | Model        | Resistance | Nominal capacity | Regeneration absorption at 120 C | Heat radiation conditions |
|------|--------------|------------|------------------|----------------------------------|---------------------------|
| A    | R88A-RR20030 | 30Ω        | 200 W            | 100 W                            | 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 ( $P_r$ ).

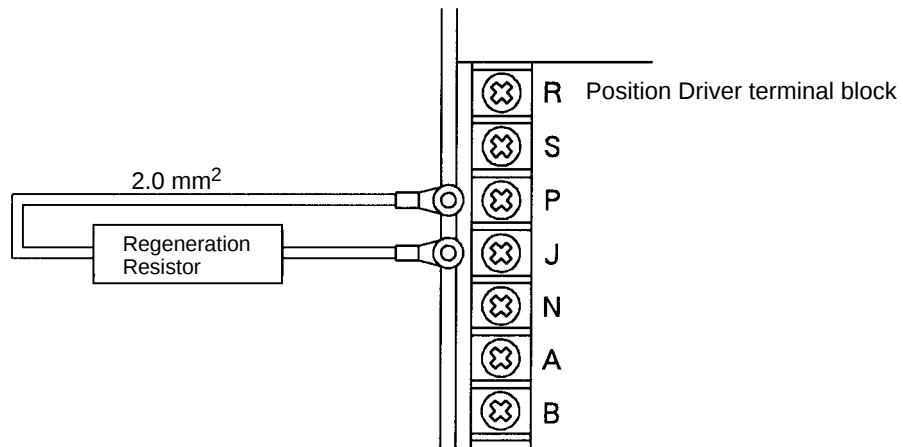
##### Dimensions (Unit: mm)



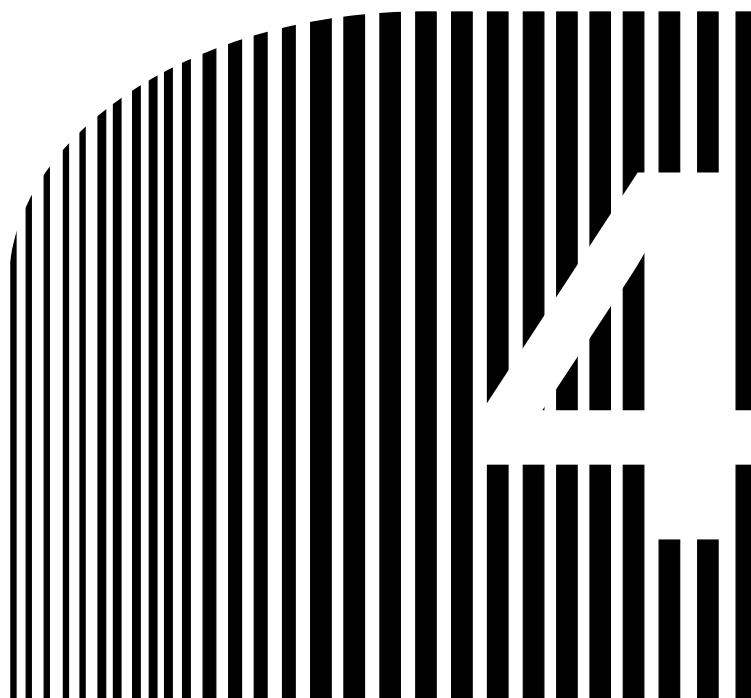
| Model        | L1  | L2  | W  | H  |
|--------------|-----|-----|----|----|
| R88A-RR20030 | 215 | 200 | 50 | 25 |
| R88A-RR40030 | 265 | 250 | 60 | 30 |

### 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.



## Chapter 4

### • Application •

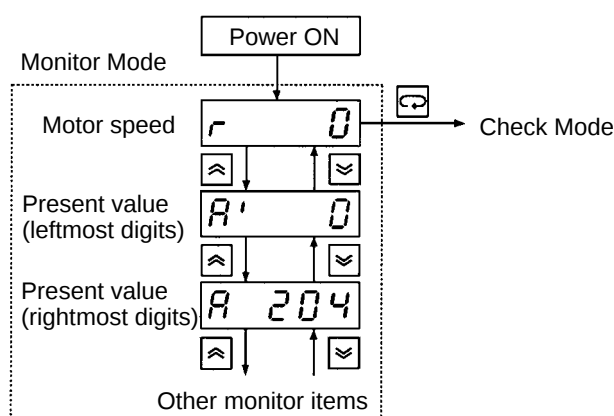
- 4-1 Monitor Mode
- 4-2 Check Mode
- 4-3 Monitor Output
- 4-4 Protection and Diagnosis
- 4-5 Troubleshooting
- 4-6 Periodic Maintenance

## 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



## □ 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 <sub>0-P</sub>                    | 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.<br>Effective load factor = (output current effective value) / (motor's rated current)<br>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.                                                                                                                        |

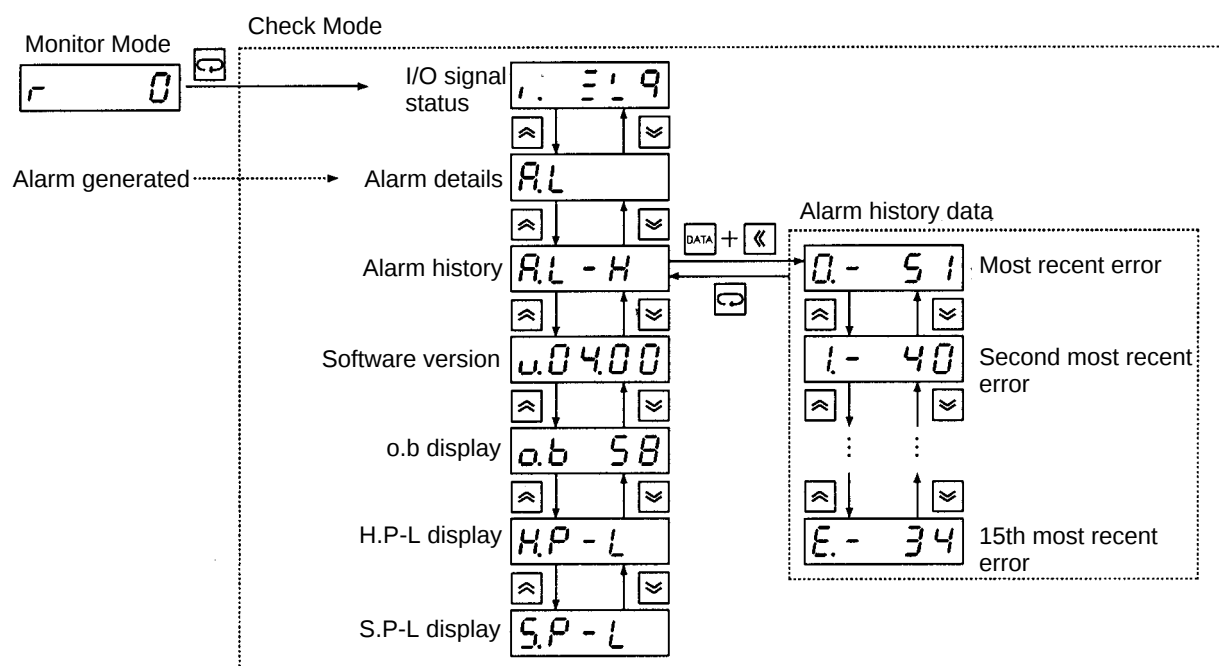
**Note** In the motor speed, present value, position deviation, mechanical speed, and motor current monitoring displays, the respective display will flash if the value is negative. (The numeric portion will not flash.)

## 4-2 Check Mode

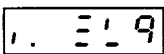
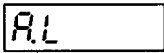
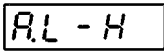
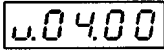
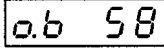
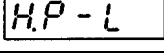
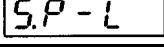
The following four items can be displayed in Check Mode: I/O signal status, alarm details, alarm history, and software version

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



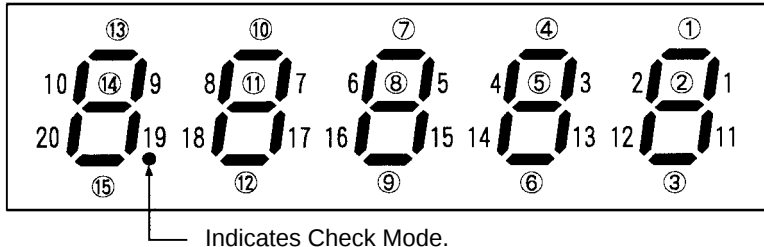
☐ Check Mode Display Details

| Display                                                                             | Contents          | Explanation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | I/O signal status | Displays the ON/OFF status of control I/O signals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|    | Alarm details     | <p>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.)</p> <p>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.</p> <p>For details regarding alarms, refer to <i>4-4 Protection and Diagnosis</i>.</p> |
|    | 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.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 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.

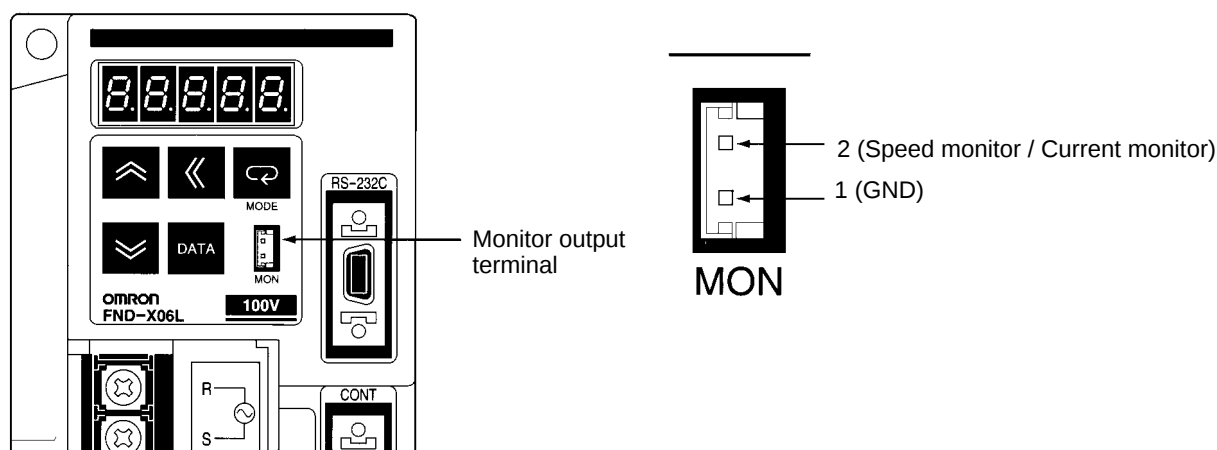
☐ Output Signal Allocation

| 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            |

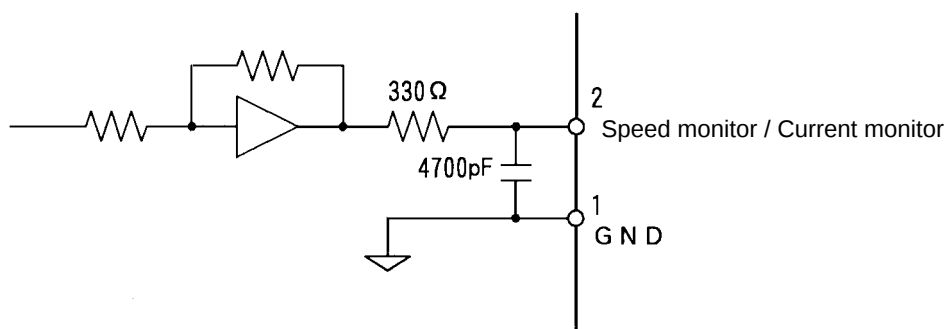
## 4-3 Monitor Output

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).<br>Forward rotation: (+) voltage; reverse rotation: (-) voltage output<br>Output accuracy: approx. $\pm 10\%$      |
| Current monitor | With 0 V as center, voltage output at rate of 3 V/(motor's maximum current).<br>Forward acceleration: (+) voltage; reverse acceleration: (-) voltage<br>Output accuracy: approx. $\pm 10\%$ |

☐ User Parameter Setting

| No.<br>UP- | Name                        | Min.<br>unit | Setting<br>range | Factory<br>setting | Explanation                                                                                                                                                      |
|------------|-----------------------------|--------------|------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 25         | Monitor output<br>selection | ---          | 000 to<br>011    | 010                | Specifies the output terminal function.<br>0<br>┌<br>└ Voltage polarity<br>0: Not reversed<br>1: Reversed<br>└ Speed/Current selection<br>0: Current<br>1: Speed |

## 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    |

| 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    |

## 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.       | <ul style="list-style-type: none"> <li>• Correct the power line short-circuiting or grounding.</li> <li>• Measure the insulation resistance at the Servomotor itself. If there is short-circuiting, replace the Servomotor.</li> </ul> |
|               | Overheating   | Occurred during operation even though power was ON.<br>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.                                | <ul style="list-style-type: none"> <li>• Lighten the load.</li> <li>• Lengthen the acceleration time.</li> <li>• Select another Servomotor.</li> </ul>                                                                                 |
| A.L02         | Overvoltage   | Occurred when power was turned ON.                                                                                       | The power supply voltage is outside of the allowable range. | <ul style="list-style-type: none"> <li>• The supply voltage must be 170 to 264 VAC when 200 VAC is specified</li> <li>• The supply voltage must be 85 to 127 VAC when 100 VAC is specified.</li> </ul>                                 |
|               |               | Occurred during motor deceleration.                                                                                      | The load inertia is too large.                              | <ul style="list-style-type: none"> <li>• Lengthen the deceleration time.</li> <li>• Calculate the regeneration and select a Regeneration Resistor.</li> </ul>                                                                          |
|               |               |                                                                                                                          | The power supply voltage is outside of the allowable range. | <ul style="list-style-type: none"> <li>• The supply voltage must be 170 to 264 VAC when 200 VAC is specified</li> <li>• The supply voltage must be 85 to 127 VAC when 100 VAC is specified.</li> </ul>                                 |
|               |               |                                                                                                                          | 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.                                | <ul style="list-style-type: none"> <li>• Add a counterbalance to the machine, and reduce the gravity torque.</li> <li>• Reduce the lowering speed.</li> <li>• Connect an external Regeneration Resistor.</li> </ul>                    |

| 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.                                                                              | <ul style="list-style-type: none"> <li>For 200-VAC input specifications, use a 170 to 264-VAC power supply.</li> <li>For 100-VAC input specifications, use an 85 to 127-VAC power supply.</li> </ul> |
|               |                                                                                | 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.                                                                                       | <ul style="list-style-type: none"> <li>Connect any places that are disconnected.</li> <li>Correct the wiring.</li> </ul>                                                                             |
|               |                                                                                | 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.                                                                                                  | <ul style="list-style-type: none"> <li>Replace the external Regeneration Resistor.</li> <li>If an external Regeneration Resistor is not being used, replace the Driver.</li> </ul>                   |
|               |                                                                                |                                                  | 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)<br>[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 short-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<br>[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.                                                                                                                                                                  |

| Alarm display | Error content                                                                                                  | Condition when error occurred                                                        | Probable cause                                                        | Countermeasures                                                                                                              |
|---------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| A.L17         | Motor overload<br>[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.                                                | <ul style="list-style-type: none"> <li>• Lighten the load.</li> <li>• Lengthen the deceleration time.</li> </ul>             |
|               |                                                                                                                |                                                                                      | The gain adjustment is incorrect.                                     | Re-adjust the gain.                                                                                                          |
| A.L18         | Short time overload<br>[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.                                                | <ul style="list-style-type: none"> <li>• Lighten the load.</li> <li>• Lengthen the deceleration time.</li> </ul>             |
|               |                                                                                                                |                                                                                      | The gain adjustment is incorrect.                                     | Re-adjust the gain.                                                                                                          |
| A.L19         | Resolver error<br>[There was an error in the resolver feedback.]                                               | Occurred during operation.                                                           | The resolver cable is disconnected.                                   | <ul style="list-style-type: none"> <li>• Connect any disconnected places.</li> <li>• Correct any faulty contacts.</li> </ul> |
|               |                                                                                                                |                                                                                      | Malfunctioning was caused by noise.                                   | Wire the resolver cables separately from the power lines.                                                                    |
| A.L20         | Speed over<br>[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<br>[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.                                                | <ul style="list-style-type: none"> <li>• Lighten the load.</li> <li>• Select another motor.</li> </ul>                       |
|               |                                                                                                                | 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.)                        |

| 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. | <ul style="list-style-type: none"> <li>Reset the alarm and use JOG or manual operation to release from the software limit.</li> <li>Correct the reference value.</li> <li>Correct the PP-10 and PP-11 values.</li> </ul> |
| A.L35         | – Software limit over                                                                                                     | Occurred during operation.                            | The reference value set in PP-12 and PP-13 was exceeded. | <ul style="list-style-type: none"> <li>Reset the alarm and use JOG or manual operation to release from the software limit.</li> <li>Correct the reference value.</li> <li>Correct the PP-12 and PP-13 values.</li> </ul> |
| A.L37         | Coordinate counter over<br>[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<br>[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.                                                                                                                                                                                                      |

| 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)                    | <ul style="list-style-type: none"> <li>• Turn the power OFF and then back ON.</li> <li>• If the error persists, then replace the motor.</li> </ul> |
| 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.                                                                              | <ul style="list-style-type: none"> <li>• Turn the power OFF and then back ON.</li> <li>• If the error persists, then replace the motor.</li> </ul> |
| 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.                                        | <ul style="list-style-type: none"> <li>• Set the correct PTP data.</li> <li>• Select a point number for which PTP data has been set.</li> </ul>    |

**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*.

### 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:<br>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.<br>(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.                                                                    |

### 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

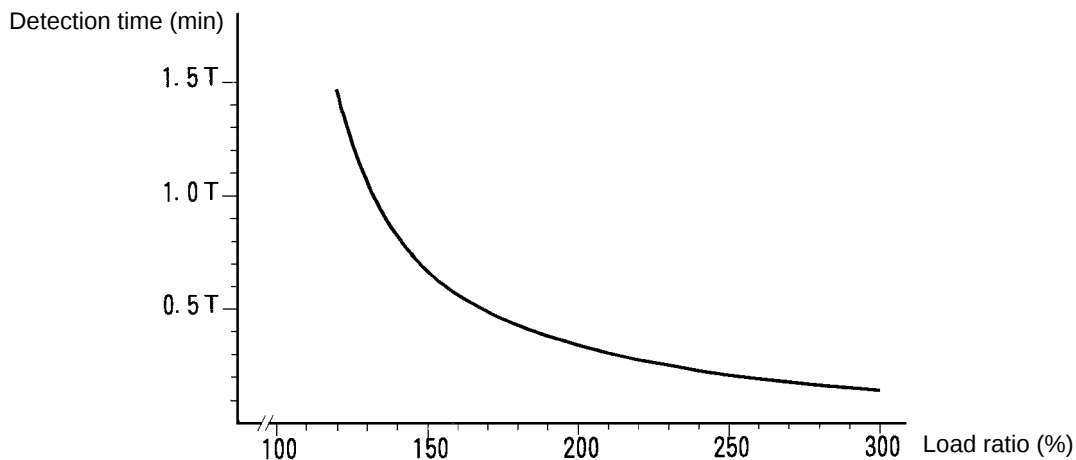
##### Detection Method

- 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.

• **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      |

• **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      |

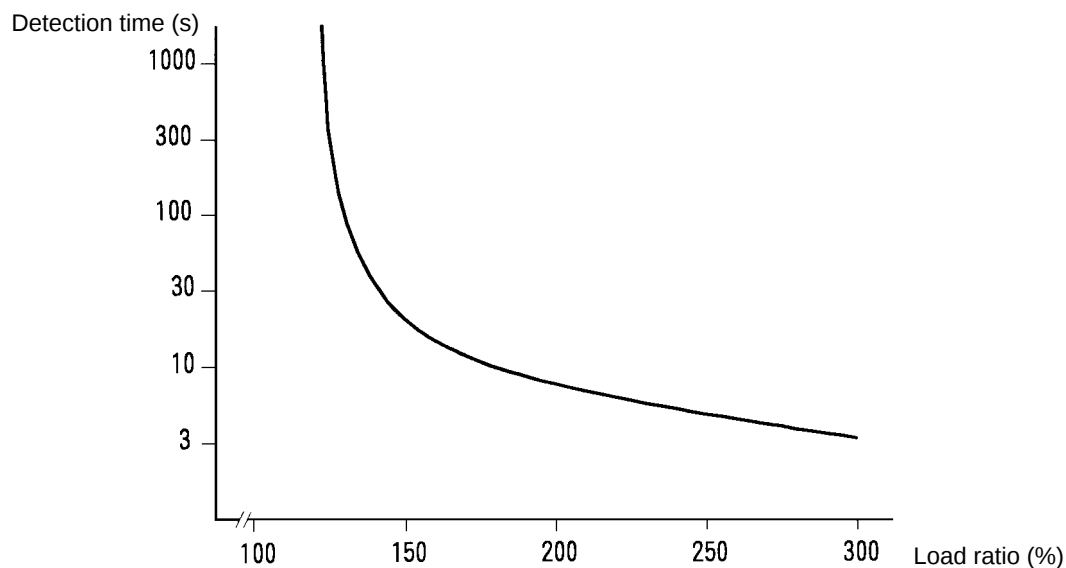
☐ **Short Time Overload (A.L18) Detection**

**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**

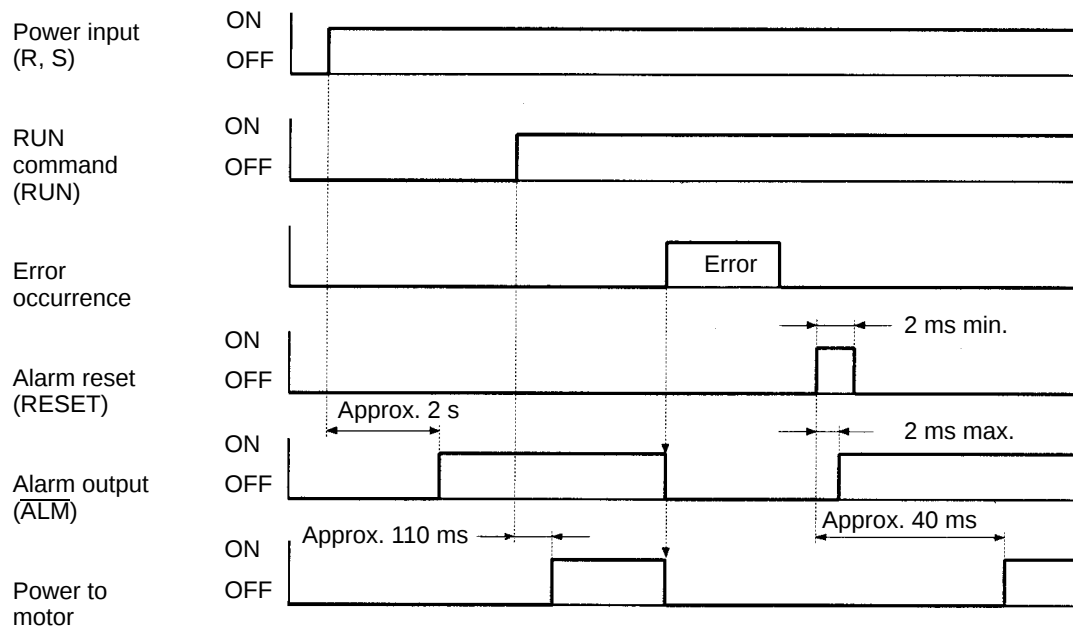
The detection time is as shown in the following diagram. It is the same for all Servomotor models. (Reference value)



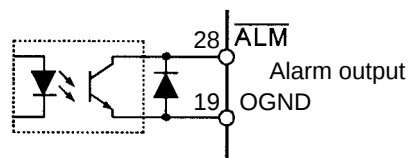
### 4-4-5 Alarm Output

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

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### 4-5-1 Preliminary Inspection

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This section describes the preliminary inspections and monitoring devices that are required to locate and clear the cause of an error.

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#### ☐ 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                                                                                                   | Memory Cassette compatible with FND-X and MC/NC Units, or             |
| CVM1-MP703                                                                                                   | 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.) |                                                                       |

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

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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

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Use the following procedure to replace the Position Driver or Motor.

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### ☐ 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.

**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.

## 4-5-4 Troubleshooting

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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.

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### ☐ 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.       |

| 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.  | <ul style="list-style-type: none"> <li>Input the RUN signal.</li> <li>Correct the wiring.</li> </ul>                                                                                                                                                             |
|                                                                  | 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: <ul style="list-style-type: none"> <li>Correct the wiring.</li> </ul> CompoBus/S type: <ul style="list-style-type: none"> <li>Turn both the external control input (CN4-4) and the CompoBus/S input (OUT7) ON.</li> <li>Correct the wiring.</li> </ul> |
|                                                                  | 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.                                                                                                                                                                                                                                              |

| 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.<br>U Series: 1/2 revolution<br>H Series: 1/2 revolution<br>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.                                                                | <ul style="list-style-type: none"> <li>Correctly set the position data.</li> <li>Correct the wiring.</li> </ul>                                                                                                         |
|                                                              | The software limit is being detected (when the alarm selection (PP-25) is 0 ).                                    | Use the Monitor Mode to check the present position.<br>Check the software limits (PP-10, 11, 12, 13). | Correctly set the position data.<br>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.                                                                                                    | ---                                                                                                   | <ul style="list-style-type: none"> <li>Use auto-tuning.</li> <li>Adjust the gain manually.</li> </ul>                                                                                                                   |

| Symptom                           | Probable cause                                                                                                         | Items to check                                                                                                                                      | Countermeasures                                                                                                     |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Motor is over-heating.            | 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.                                                                                             | <ul style="list-style-type: none"> <li>• Lighten the load.</li> <li>• Change to a larger capacity motor.</li> </ul> |
| 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.                                                                        | ---                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Use auto-tuning.</li> <li>• Adjust the gain manually.</li> </ul>           |
| 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. $\pm 6$ pulses of encoder resolution) from the power supply position. | ---                                                                                                                                                 | After making the motor perform rotations of over $\pm 6$ pulses, re-attempt normal operation.                       |

### □ 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. |
| Communications will not start.                | 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.                                                                                 |
|                                               | 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

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 **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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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.

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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 electrolytic capacitors: 50,000 hours at ambient temperature of 35 °C

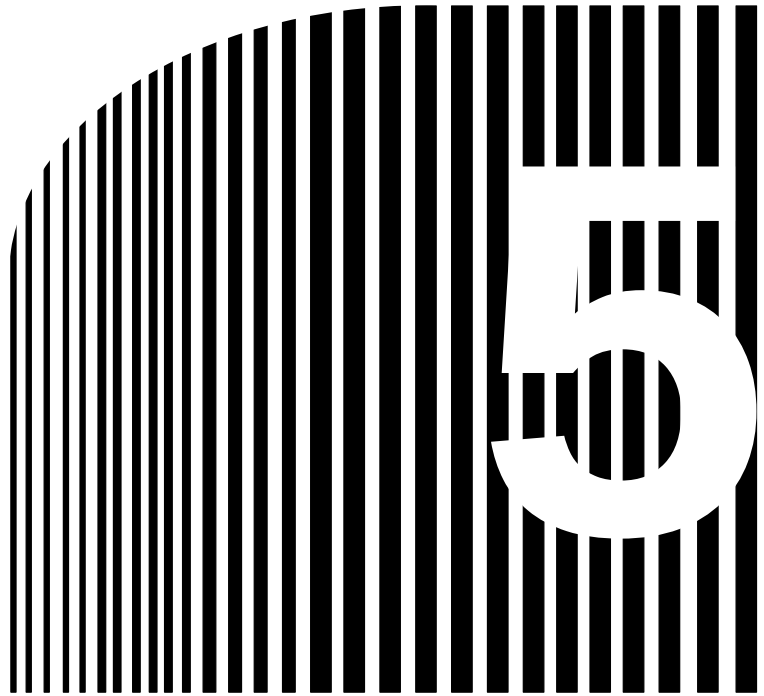
Fans: 55,000 hours at ambient temperature of 20 °C  
(FND-X50H- only)

Application Conditions: Rated operation (rated torque) and installation as described in the User's Manual.

- The life of aluminum electrolytic 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.

**☐ 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*.



## Chapter 5

### • Specifications •

- 5-1 Position Driver Specifications
- 5-2 Servomotor Specifications
- 5-3 Cable Specifications

## 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- ):<br>Single-phase 200/240 VAC, -15% to +10%, at 50/60 Hz<br>Three-phase 200-VAC (FND-X50H- ):<br>Three-phase 200/240 VAC, -15% to +10%, at 50/60 Hz<br>Single-phase 100-VAC (FND-X06L/-X12L- ):<br>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 <sub>RMS</sub> 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;<br>acceleration: 9.8 m/s <sup>2</sup> {1 G} max.; time coefficient: 8 min; 4 sweeps                                                                                                                                           |
| Impact resistance                       | Acceleration 98 m/s <sup>2</sup> {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<br>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).

## 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<br>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<br>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                                                                                  |          |                                                                                                                  |          |                                                                     |                                                  |

| Item                             |                 | FND-X06L                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | FND-X12L    | FND-X06H    | FND-X12H    | FND-X25H    | FND-X50H     |
|----------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|--------------|
| Positioning completion width     |                 | 1 to 32,767 (pulses)<br>U Series (INC): 8,192 pulses/revolution; U Series (ABS): 4,096 pulses/revolution;<br>U-UE Series: 4,096 pulses/revolution; H Series: 8,000 pulses/revolution<br>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)<br>Photocoupler input: 24 VDC, 8 mA<br>External power supply: 24 VDC $\pm$ 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)<br>Open collector output: 24 VDC, 40 mA                                                                                                                                                                                                                                                                                                                                                                                                                             |             |             |             |             |              |
| Monitor output (See note 2.)     | Speed monitor   | 3 V/motor's rated speed (output accuracy: approx. $\pm$ 10%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |             |             |             |              |
|                                  | Current monitor | 3 V/motor's maximum current (output accuracy: approx. $\pm$ 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<br>-SRT                                                                                                   | FND-X12L<br>-SRT | FND-X06H<br>-SRT                                                                                                    | FND-X12H<br>-SRT | FND-X25H<br>-SRT | FND-X50H<br>-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<br>(The main circuit and control circuits use the same terminals.) |                  | Single-phase 200/240 VAC (170 to 264 V) 50/60 Hz<br>(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 |

| Item                                        |                    | FND-X06L<br>-SRT                                                                                                                                                                                                                                                                                                                           | FND-X12L<br>-SRT | FND-X06H<br>-SRT                             | FND-X12H<br>-SRT | FND-X25H<br>-SRT                                                                   | FND-X50H<br>-SRT                                   |
|---------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------|------------------|------------------------------------------------------------------------------------|----------------------------------------------------|
| Position/<br>speed feed-<br>back            | U Series<br>(INC)  | 30 to 750 W: Optical Incremental encoder, 2,048 pulses/revolution<br>1 to 2 kW: Optical Incremental encoder, 4,096 pulses/revolution                                                                                                                                                                                                       |                  |                                              |                  |                                                                                    |                                                    |
|                                             | U Series<br>(ABS)  | 30 to 750 W: Optical Absolute encoder, 1,024 pulses/revolution<br>1 to 2 kW: Optical Absolute encoder, 8,192 pulses/revolution                                                                                                                                                                                                             |                  |                                              |                  |                                                                                    |                                                    |
|                                             | U-UE<br>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<br>load inertia<br>(See note 1.) | U Series<br>(INC)  | Maximum of 30 times<br>motor's rotor inertia                                                                                                                                                                                                                                                                                               |                  | Maximum of 30 times<br>motor's rotor inertia |                  | Maximum of<br>20 times<br>motor's rotor<br>inertia<br>(10 times for<br>1-kW model) | Maximum of<br>10 times<br>motor's rotor<br>inertia |
|                                             | U Series<br>(ABS)  | Maximum of 20 times<br>motor's rotor inertia                                                                                                                                                                                                                                                                                               |                  | Maximum of 20 times<br>motor's rotor inertia |                  | Maximum of<br>18 times<br>motor's rotor<br>inertia<br>(10 times for<br>1-kW model) | Maximum of<br>10 times<br>motor's rotor<br>inertia |
|                                             | U-UE<br>Series     | Maximum of 30 times<br>motor's rotor inertia                                                                                                                                                                                                                                                                                               |                  | Maximum of 30 times<br>motor's rotor inertia |                  | Maximum of<br>20 times<br>motor's rotor<br>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.<br>2.5 kg                                                                  | Approx.<br>4.5 kg                                  |
| Frequency response<br>(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                                  |                    | $1/32,767 \leq (\text{pulse rate 1} / \text{pulse rate 2}) \leq 32,767/1$                                                                                                                                                                                                                                                                  |                  |                                              |                  |                                                                                    |                                                    |
| Positioning completion<br>width             |                    | 1 to 32,767 (pulses)<br>U Series (INC): 8,192 pulses/revolution; U Series (ABS): 4,096 pulses/revolution; UE Series:<br>4,096 pulses/revolution; H Series: 8,000 pulses/revolution<br>M Series 24,000 pulses/revolution                                                                                                                    |                  |                                              |                  |                                                                                    |                                                    |
| Acceleration/Deceleratio<br>n time          |                    | 0 to 9,999 (ms); acceleration and deceleration times set separately. Two times can be set for<br>each. S-curve acceleration/deceleration function available (filter time constant: 0.00 to 32.76<br>s).                                                                                                                                    |                  |                                              |                  |                                                                                    |                                                    |
| CompoBus/S                                  |                    | 16 input points (RUN command, start, alarm reset, origin search, JOG operation, inching,<br>point selection, position data, deceleration stop)<br>16 output points (brake output, ready, origin search completed, origin, teaching completed,<br>motor running, positioning completed, alarm, point output, position/speed data selection) |                  |                                              |                  |                                                                                    |                                                    |
| Sequence input                              |                    | 4 pts. (limit inputs, origin proximity, deceleration stop)<br>Photocoupler input: 24 VDC, 8 mA<br>External power supply: 24 VDC ±1 V, 40 mA min.                                                                                                                                                                                           |                  |                                              |                  |                                                                                    |                                                    |
| Sequence output                             |                    | 1 pt. (brake output)<br>Open collector output: 24 VDC, 40 mA                                                                                                                                                                                                                                                                               |                  |                                              |                  |                                                                                    |                                                    |
| Monitor<br>output (See<br>note 2.)          | Speed<br>monitor   | 3 V/motor's rated speed (output accuracy: approx. ±10%)                                                                                                                                                                                                                                                                                    |                  |                                              |                  |                                                                                    |                                                    |
|                                             | Current<br>monitor | 3 V/motor's maximum current (output accuracy: approx. ±10%)                                                                                                                                                                                                                                                                                |                  |                                              |                  |                                                                                    |                                                    |

| Item                             |                 | FND-X06L<br>-SRT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | FND-X12L<br>-SRT | FND-X06H<br>-SRT | FND-X12H<br>-SRT | FND-X25H<br>-SRT | FND-X50H<br>-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<br>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.<br>FND-X H- : Single-phase 200/240 VAC (170 to 264 VAC) 50/60 Hz<br>FND-X L- : Single-phase 100/115 VAC (85 to 127 VAC) 50/60 Hz |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| P<br>J                                                                              | Main circuit DC output<br>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 least a class-3 ground (100 Ω or less). This ground is used in common for Servomotor output and power supply input.                                                                                                                                                                                                                                                                           |

□ Terminal Blocks (FND-X50H- )

| Signal                        | Function                                                            | Condition                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R0<br>S0                      | Control power supply input                                          | These are the power supply input terminals for the control circuit.<br>Single-phase 200/240 VAC (170 to 264 VAC) 50/60 Hz                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                      |
| R<br>S<br>T                   | Main circuit power supply input                                     | These are the power supply input terminals for the main circuit.<br>Three-phase 200/240 VAC (170 to 264 VAC) 50/60 Hz                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                      |
| P<br>JP1<br>JP2               | Main circuit DC output<br>Regeneration Resistor connection terminal | These are the connection terminals for the Regeneration Resistor (R88A-RR20030/-RR40030). Connect them when the regeneration energy is high.<br>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<br>COM<br>BO<br>BI1<br>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 $\Omega$ or less. This ground is used in common for Servomotor output and power supply input.                                                                                                                                                                                                                                |

### □ 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:<br>3.6 V, 16 μA (for backup, rotation stopped)<br>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) |

## □ CN2 (Motor Sensor Connector) Pin Arrangement

|    |      |                           |   |      |                             |    |       |                             |    |       |                              |
|----|------|---------------------------|---|------|-----------------------------|----|-------|-----------------------------|----|-------|------------------------------|
| 2  | S1   | SIN excitation winding    | 1 | E0V  | Encoder power supply ground | 12 | +BAT  | Battery +                   | 11 | SG    | Resolver cable shield ground |
| 4  | E5V  | Encoder power supply, +5V | 3 | S3   | SIN excitation winding      | 14 | S+/Z+ | Encoder+S/+Z-phase input    | 13 | –BAT  | Battery –                    |
| 6  | S2   | COS excitation winding    | 5 | NC   |                             | 16 | A+    | Encoder +A-phase input      | 15 | S–/Z– | Encoder–S/–Z-phase input     |
| 8  | +ABS | Absolute encoder signal + | 7 | S4   | COS excitation winding      | 18 | B+    | Encoder +B-phase input      | 17 | A–    | Encoder – A-phase input      |
|    | R1   | Resolver signal input     | 9 | –ABS | Absolute encoder signal –   | 20 | FG    | Encoder cable shield ground | 19 | B–    | Encoder – B-phase input      |
| 10 | NC   |                           |   | R2   | Resolver signal 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)                         |
| 6       | RXD–   | Reception data –                      | Input impedance: 330 Ω                                            |
| 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)

□ **CN5 (Communications Connector) Pin Arrangement**

|   |      |                                                |   |      |                        |    |     |                   |    |      |                                  |
|---|------|------------------------------------------------|---|------|------------------------|----|-----|-------------------|----|------|----------------------------------|
| 2 | DTR  | Transmission/<br>reception-ca-<br>pable output | 1 | TXD  | Transmission<br>data   | 9  | RXD | Reception<br>data | 8  | TXD– | Transmission<br>data –           |
| 4 | RTS  | Reception-<br>capable<br>output                | 3 | NC   |                        | 11 | +5V | +5 output         | 10 | CTS  | Reception-<br>capable in-<br>put |
| 6 | RXD– | Reception<br>data –                            | 5 | RXD+ | Reception<br>data +    | 13 | FG  | Shield<br>ground  | 12 | FG   | Shield<br>ground                 |
|   |      |                                                | 7 | TXD+ | Transmission<br>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<br>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<br>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.) |

## □ 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      | 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                        |

## 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  $\pm 1$  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

|    |       |                               |    |        |                               |    |        |                                      |    |        |                                      |
|----|-------|-------------------------------|----|--------|-------------------------------|----|--------|--------------------------------------|----|--------|--------------------------------------|
| 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 | 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-V power supply input for control | 35 | P.OUT6 | Point output 6                       |

### □ 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            | 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.

☐ **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  $\pm 1$  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  |
|   |      |                   | 3 | ORG  | Origin proximity                     |    |  |  | 10 |      |               |
|   |      |                   | 5 |      |                                      |    |  |  | 12 |      |               |
|   |      |                   | 7 | +24V | +24-V power supply input for control |    |  |  | 14 | OGND | Output ground |
| 4 | STOP | Deceleration stop |   |      |                                      | 11 |  |  |    |      |               |
| 6 |      |                   |   |      |                                      | 13 |  |  |    |      |               |

## 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 <sup>2</sup> {2.5 G} max.; time coefficient: 8 min; 4 sweeps                                                                   |
| Impact resistance                | Acceleration 98 m/s <sup>2</sup> {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)<br>(Type A according to UL standards)                                                                                                                                                                   |
| Structure                        | Totally-enclosed self-cooling                                                                                                                                                                                              |
| Protective structure             | Models conforming to UL/cUL standards:<br>IP-42 (JEM1030)<br>Models conforming to EC Directives:<br>IP-44 (IEC 34-5) (not including the shaft opening)<br>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<sup>2</sup> (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<br>-U03030HA/<br>-U03030VA | R88M<br>-U05030HA/<br>-U05030VA | R88M<br>-U10030HA/<br>-U10030VA | R88M<br>-U20030HA/<br>-U20030VA | R88M<br>-U40030HA/<br>-U40030VA | R88M<br>-U75030HA/<br>-U75030VA |
|-----------------------------|--------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Rated output<br>(See note.) | W      | 30                              | 50                              | 100                             | 200                             | 400                             | 750                             |
| Rated torque<br>(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                            |

| Item                                  |               | Unit                                      | R88M<br>-U03030HA/<br>-U03030VA | R88M<br>-U05030HA/<br>-U05030VA | R88M<br>-U10030HA/<br>-U10030VA | R88M<br>-U20030HA/<br>-U20030VA | R88M<br>-U40030HA/<br>-U40030VA | R88M<br>-U75030HA/<br>-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 <sup>2</sup><br>(GD <sup>2</sup> /4) | $0.21 \times 10^{-5}$           | $0.26 \times 10^{-5}$           | $0.40 \times 10^{-5}$           | $1.23 \times 10^{-5}$           | $1.91 \times 10^{-5}$           | $6.71 \times 10^{-5}$           |
|                                       |               | kgf cm s <sup>2</sup>                     | $0.21 \times 10^{-4}$           | $0.27 \times 10^{-4}$           | $0.41 \times 10^{-4}$           | $1.26 \times 10^{-4}$           | $1.95 \times 10^{-4}$           | $6.85 \times 10^{-4}$           |
| 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/<br>(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:<br>A1                           | t6 x 250                        |                                 |                                 |                                 |                                 |                                 |
| Applicable Position Driver (FND-)     |               | 200-V input                               | X06H-                           |                                 |                                 | X12H-                           |                                 | X25H-                           |
|                                       |               | 100-V input                               | X06L-                           |                                 |                                 | X12L-                           | ---                             | ---                             |

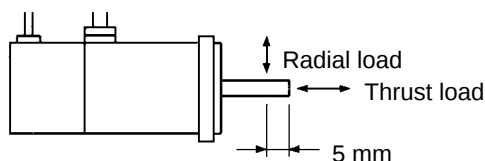
| Item                 |                                  | Unit                                      | R88M<br>-U03030HA/<br>-U03030VA | R88M<br>-U05030HA/<br>-U05030VA | R88M<br>-U10030HA/<br>-U10030VA | R88M<br>-U20030HA/<br>-U20030VA | R88M<br>-U40030HA/<br>-U40030VA | R88M<br>-U75030HA/<br>-U75030VA |
|----------------------|----------------------------------|-------------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Brake specifications | Brake inertia                    | kg m <sup>2</sup><br>(GD <sup>2</sup> /4) | 0.09 x 10 <sup>-5</sup>         |                                 |                                 | 0.58 x 10 <sup>-5</sup>         |                                 | 1.40 x 10 <sup>-5</sup>         |
|                      |                                  | kgf cm s <sup>2</sup>                     | 0.09 x 10 <sup>-4</sup>         |                                 |                                 | 0.59 x 10 <sup>-4</sup>         |                                 | 1.43 x 10 <sup>-4</sup>         |
|                      | 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<br>(See note 3.) | ms                                        | 40 max.                         |                                 | 60 max.                         | 100 max.                        |                                 | 200 max.                        |
|                      | Release time<br>(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.

□ Performance Specifications with an Absolute Encoder

| Item                                     |                                           | Unit           | R88M<br>-U03030TA/<br>-U03030XA | R88M<br>-U05030TA/<br>-05030XA | R88M<br>-U10030TA/<br>-U10030XA | R88M<br>-U20030TA/<br>-U20030XA | R88M<br>-U40030TA/<br>-U40030XA | R88M<br>-U75030TA/<br>-U75030XA |
|------------------------------------------|-------------------------------------------|----------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Rated output<br>(See note.)              |                                           | W              | 30                              | 50                             | 100                             | 200                             | 400                             | 750                             |
| Rated torque<br>(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<br>(See note.)             |                                           | A (rms)        | 0.42                            | 0.60                           | 0.87                            | 2.0                             | 2.6                             | 4.4                             |
| Momentary maximum current<br>(See note.) |                                           | A (rms)        | 1.3                             | 1.9                            | 2.8                             | 6.0                             | 8.0                             | 13.9                            |
| Rotor inertia                            | kg m <sup>2</sup><br>(GD <sup>2</sup> /4) |                | $0.46 \times 10^{-5}$           | $0.51 \times 10^{-5}$          | $0.65 \times 10^{-5}$           | $1.48 \times 10^{-5}$           | $2.16 \times 10^{-5}$           | $6.96 \times 10^{-5}$           |
|                                          | kgf cm s <sup>2</sup>                     |                | $0.47 \times 10^{-4}$           | $0.53 \times 10^{-4}$          | $0.67 \times 10^{-4}$           | $1.52 \times 10^{-4}$           | $2.21 \times 10^{-4}$           | $7.11 \times 10^{-4}$           |
| Torque constant<br>(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/<br>(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                     |

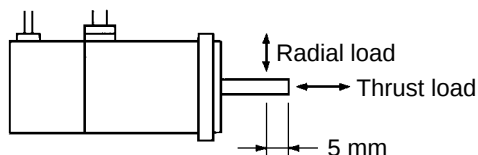
| Item                              |                               | Unit                                   | R88M<br>-U03030TA/<br>-U03030XA | R88M<br>-U05030TA/<br>-05030XA | R88M<br>-U10030TA/<br>-U10030XA | R88M<br>-U20030TA/<br>-U20030XA | R88M<br>-U40030TA/<br>-U40030XA | R88M<br>-U75030TA/<br>-U75030XA |
|-----------------------------------|-------------------------------|----------------------------------------|---------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| 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 <sup>2</sup> (GD <sup>2</sup> /4) | 0.09 x 10 <sup>-5</sup>         |                                |                                 | 0.58 x 10 <sup>-5</sup>         |                                 | 1.40 x 10 <sup>-5</sup>         |
|                                   |                               | kgf cm s <sup>2</sup>                  | 0.09 x 10 <sup>-4</sup>         |                                |                                 | 0.59 x 10 <sup>-4</sup>         |                                 | 1.43 x 10 <sup>-4</sup>         |
|                                   | 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.)

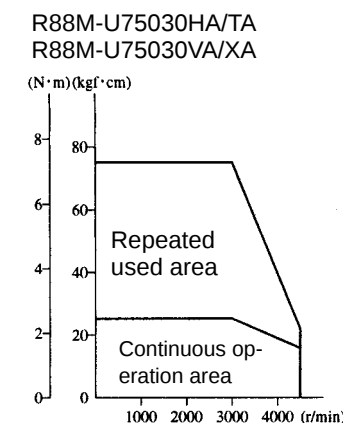
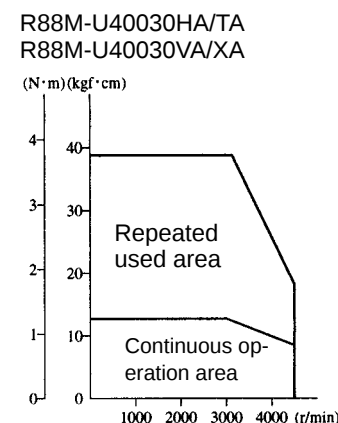
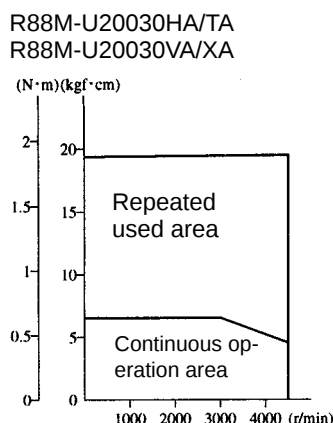
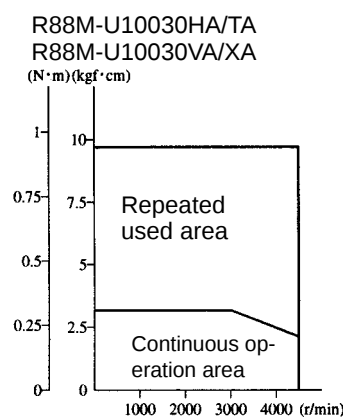
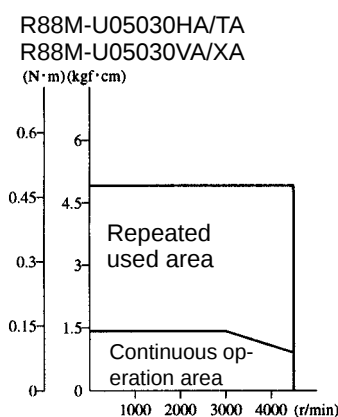
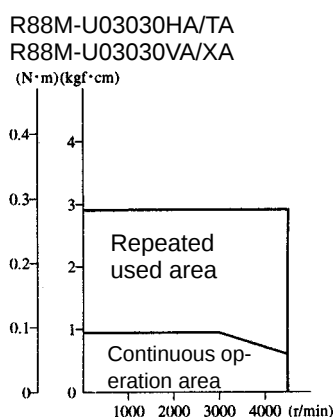
**Note 3.** The operation time measurement is the measured value with a surge killer (CR50500, by Okaya Electric Industrial Co.) installed.

**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.

### □ Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)



### □ 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  $-0.13\%/^{\circ}\text{C}$ . 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  $20^{\circ}\text{C}$  and  $-10^{\circ}\text{C}$  are compared, the momentary maximum torque increases by approximately 4%. Conversely, when the magnet warms up to  $80^{\circ}\text{C}$  from the normal temperature of  $20^{\circ}\text{C}$ , 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.

## ☐ 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 $\pm$ 5%                                                                    |
| Power supply current         | DC, 350 mA (for load resistance of 220 $\Omega$ )                                 |
| Pulse duty characteristics   | 50% $\pm$ 10%                                                                     |
| Phase characteristics        | 90° $\pm$ 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.<br>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.                    |

### ☐ 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          | $\pm 99,999$ revolution                                                               |
| Power supply voltage               | 5 VDC $\pm 5\%$                                                                       |
| Power supply current               | DC, 170 mA (for load resistance of 220 $\Omega$ )                                     |
| Applicable battery voltage         | 3.6 VDC                                                                               |
| Battery consumption current        | 16 $\mu$ A during backup or when operation is stopped, 2 $\mu$ A when 5 V is supplied |
| Pulse duty characteristics         | 50% $\pm 10\%$                                                                        |
| Phase characteristics              | 90° $\pm 36^\circ$                                                                    |
| 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.<br>Output based on MC3487 or equivalent.                   |
| Absolute-value communications data | Rotation amount<br>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 <sup>2</sup> {2.5 G} max.; time coefficient: 8 min; 4 sweeps                                                                    |
| Impact resistance                | Acceleration 98 m/s <sup>2</sup> {10 G} max., in X, Y, and Z directions, three times                                                                                                                                        |
| Insulation resistance            | Between power line terminals and case: 10 M $\Omega$ 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:<br>IP-42 (JEM1030)<br>Models conforming to EC Directives:<br>IP-44 (IEC 34-5) (not including the shaft opening)<br>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  $19.6 \text{ m/s}^2$  (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<br>-UE10030H-S1/<br>-UE10030V-S1 | R88M<br>-UE20030H-S1/<br>-UE20030V-S1 | R88M<br>-UE40030H-S1/<br>-UE40030V-S1 | R88M<br>-UE75030H-S1/<br>-UE75030V-S1 |
|---------------------------------------|----------------------------------------|--------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Rated output<br>(See note.)           |                                        | W            | 100                                   | 200                                   | 400                                   | 750                                   |
| Rated torque<br>(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<br>(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 <sup>2</sup> (GD <sup>2</sup> /4) |              | $0.40 \times 10^{-5}$                 | $1.23 \times 10^{-5}$                 | $1.91 \times 10^{-5}$                 | $6.71 \times 10^{-5}$                 |
|                                       | kgf cm s <sup>2</sup>                  |              | $0.41 \times 10^{-4}$                 | $1.26 \times 10^{-4}$                 | $1.95 \times 10^{-4}$                 | $6.85 \times 10^{-4}$                 |
| Torque constant<br>(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-                                 | ---                                   | ---                                   |

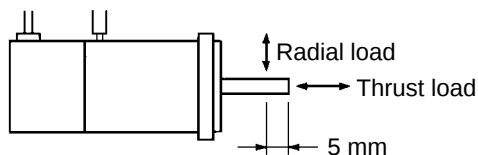
| Item                 |                               | Unit                                   | R88M<br>-UE10030H-S1/<br>-UE10030V-S1 | R88M<br>-UE20030H-S1/<br>-UE20030V-S1 | R88M<br>-UE40030H-S1/<br>-UE40030V-S1 | R88M<br>-UE75030H-S1/<br>-UE75030V-S1 |
|----------------------|-------------------------------|----------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Brake specifications | Brake inertia                 | kg m <sup>2</sup> (GD <sup>2</sup> /4) | 0.09 x 10 <sup>-5</sup>               | 0.58 x 10 <sup>-5</sup>               |                                       | 1.40 x 10 <sup>-5</sup>               |
|                      |                               | kgf cm s <sup>2</sup>                  | 0.09 x 10 <sup>-4</sup>               | 0.59 x 10 <sup>-4</sup>               |                                       | 1.43 x 10 <sup>-4</sup>               |
|                      | 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.

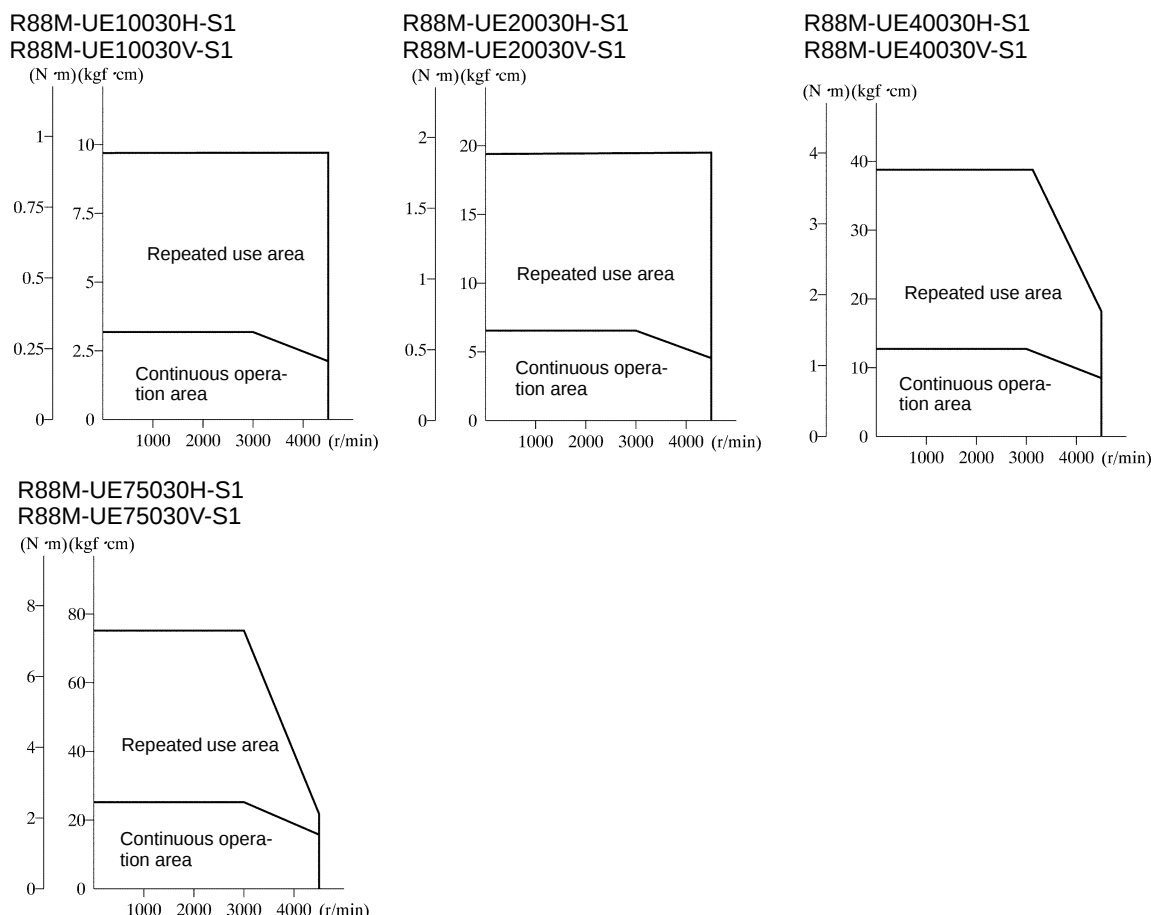
**Note 4.** The allowable radial load indicates the value at a location 5 mm from the end of the shaft. (See the diagram below.)



**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.

## □ Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)



## □ 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  $-0.13\%/^{\circ}\text{C}$ . 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  $20^{\circ}\text{C}$  and  $-10^{\circ}\text{C}$  are compared, the momentary maximum torque increases by approximately 4%. Conversely, when the magnet warms up to  $80^{\circ}\text{C}$  from the normal temperature of  $20^{\circ}\text{C}$ , 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.

☐ 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 $\pm$ 5%                                                                    |
| Power supply current         | DC, 350 mA (for load resistance of 220 $\Omega$ )                                 |
| Pulse duty characteristics   | 50% $\pm$ 10%                                                                     |
| Phase characteristics        | 90° $\pm$ 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.<br>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 <sup>2</sup> {2.5 G} max.; time coefficient: 8 min; 4 sweeps                                                                                                                                                                                                                                                                       |
| Impact resistance                | Acceleration 98 m/s <sup>2</sup> {10 G} max., in X, Y, and Z directions, three times                                                                                                                                                                                                                                                                                                                                           |
| Insulation resistance            | Between power line terminals and case: 10 M $\Omega$ 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:<br>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.)<br>Models conforming to EC Directives:<br>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.)<br>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  $19.6 \text{ m/s}^2$  (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<br>-U1K030H/<br>-U1K030V | R88M<br>-U1K530H/<br>-U1K530V | R88M<br>-U2K030H/<br>-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 <sup>2</sup> (GD <sup>2</sup> /4) | $1.74 \times 10^{-4}$         | $2.47 \times 10^{-4}$         | $3.19 \times 10^{-4}$         |
|                                       |               | kgf cm s <sup>2</sup>                  | $1.78 \times 10^{-3}$         | $2.52 \times 10^{-3}$         | $3.26 \times 10^{-3}$         |
| 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                            | ---                           |                               |                               |

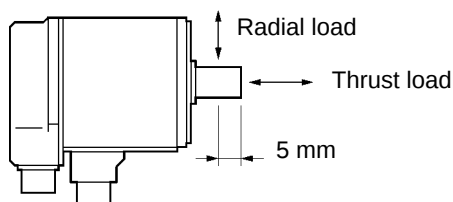
| Item                 |                               | Unit                                   | R88M<br>-U1K030H/<br>-U1K030V | R88M<br>-U1K530H/<br>-U1K530V | R88M<br>-U2K030H/<br>-U2K030V |
|----------------------|-------------------------------|----------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Brake specifications | Brake inertia                 | kg m <sup>2</sup> (GD <sup>2</sup> /4) | 0.33 x 10 <sup>-4</sup>       |                               |                               |
|                      |                               | kgf cm s <sup>2</sup>                  | 0.34 x 10 <sup>-3</sup>       |                               |                               |
|                      | 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<br>-U1K030T/<br>-U1K030X | R88M<br>-U1K530T/<br>-U1K530X | R88M<br>-U2K030T/<br>-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                          |

| Item                                    |               | Unit                                   | R88M<br>-U1K030T/<br>-U1K030X | R88M<br>-U1K530T/<br>-U1K530X | R88M<br>-U2K030T/<br>-U2K030X |
|-----------------------------------------|---------------|----------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Rated rotation speed                    |               | r/min                                  | 3,000                         |                               |                               |
| Momentary maximum rotation speed        |               | r/min                                  | 4,500                         |                               |                               |
| Momentary maximum torque<br>(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 <sup>2</sup> (GD <sup>2</sup> /4) | $1.74 \times 10^{-4}$         | $2.47 \times 10^{-4}$         | $3.19 \times 10^{-4}$         |
|                                         |               | kgf cm s <sup>2</sup>                  | $1.78 \times 10^{-3}$         | $2.52 \times 10^{-3}$         | $3.26 \times 10^{-3}$         |
| 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<br>(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<br>Position Driver (FND-)    |               | 200-V input                            | X25H-                         | X50H-                         |                               |
|                                         |               | 100-V input                            | ---                           |                               |                               |

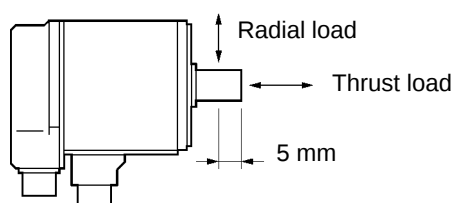
| Item                 |                               | Unit                                   | R88M<br>-U1K030T/<br>-U1K030X | R88M<br>-U1K530T/<br>-U1K530X | R88M<br>-U2K030T/<br>-U2K030X |
|----------------------|-------------------------------|----------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Brake specifications | Brake inertia                 | kg m <sup>2</sup> (GD <sup>2</sup> /4) | 0.33 x 10 <sup>-4</sup>       |                               |                               |
|                      |                               | kgf cm s <sup>2</sup>                  | 0.34 x 10 <sup>-3</sup>       |                               |                               |
|                      | 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.)



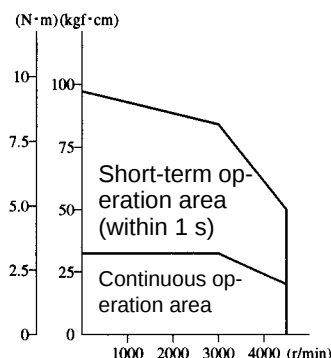
**Note 5.** The allowable radial load and the allowable thrust load are the values determined by taking a service life of 20,000 hours at normal usage as the standard.

**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.

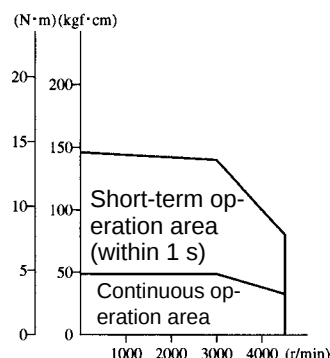
**Note 7.** The momentary maximum torque for 2-kW Servomotors is approx. 16% less than when used with a standard U-series Servodriver.

## □ Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200-VAC Input)

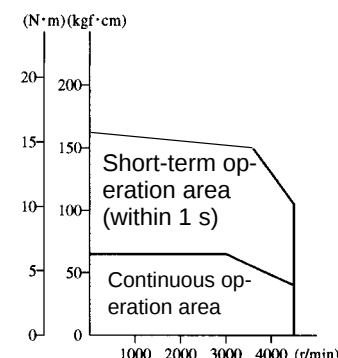
R88M-U1K030H/T  
R88M-U1K030V/X



R88M-U1K530H/T  
R88M-U1K530V/X



R88M-U2K030H/T  
R88M-U2K030V/X



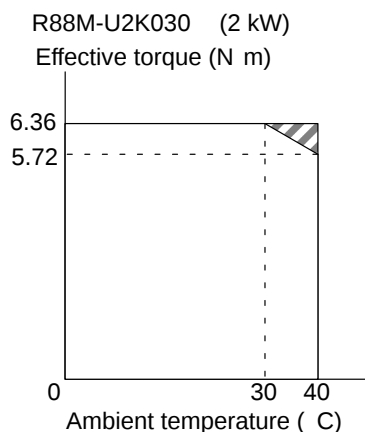
## □ Servomotor and Mechanical System Temperature Characteristics

- U-series AC Servomotors use rare earth magnets (neodymium-iron magnets). The temperature coefficient for these magnets is approximately  $-0.13\%/^{\circ}\text{C}$ . 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  $20^{\circ}\text{C}$  and  $-10^{\circ}\text{C}$  are compared, the momentary maximum torque increases by approximately 4%. Conversely, when the magnet warms up to  $80^{\circ}\text{C}$  from the normal temperature of  $20^{\circ}\text{C}$ , 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.



**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 $\pm$ 5%                                                                    |
| Power supply current         | DC, 350 mA (for load resistance of 220 $\Omega$ )                                 |
| Pulse duty characteristics   | 50% $\pm$ 10%                                                                     |
| Phase characteristics        | 90° $\pm$ 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.<br>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.                    |

### □ 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.<br>Output based on SN75158 or equivalent.                      |
| Absolute-value communications data | Rotation amount<br>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<br>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.)

□ Performance Characteristics

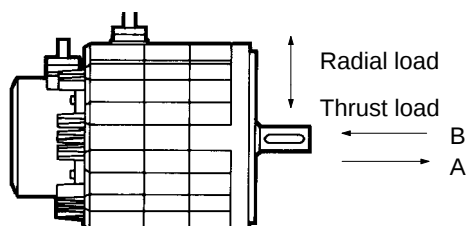
| Item                                 |               | Unit                                      | R88M<br>-H05030       | R88M<br>-H10030       | R88M<br>-H20030       | R88M<br>-H30030       | R88M<br>-H50030      | R88M<br>-H75030      | R88M<br>-H1K130      |
|--------------------------------------|---------------|-------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|
| Rated output<br>(See note.)          |               | W                                         | 50                    | 100                   | 200                   | 300                   | 500                  | 750                  | 1100                 |
| Rated torque<br>(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 <sup>2</sup><br>(GD <sup>2</sup> /4) | $0.14 \times 10^{-4}$ | $0.22 \times 10^{-4}$ | $0.44 \times 10^{-4}$ | $0.65 \times 10^{-4}$ | $2.5 \times 10^{-4}$ | $4.1 \times 10^{-4}$ | $5.7 \times 10^{-4}$ |
|                                      |               | kgf cm s <sup>2</sup>                     | $1.4 \times 10^{-4}$  | $2.2 \times 10^{-4}$  | $4.5 \times 10^{-4}$  | $6.6 \times 10^{-4}$  | $26 \times 10^{-4}$  | $42 \times 10^{-4}$  | $58 \times 10^{-4}$  |
| 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/<br>(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                  |                      |
|                                      |               | kgf                                       | 15                    |                       |                       | 35                    |                      | 65                   |                      |
| Momentary allowable thrust load      |               | N                                         | 196                   |                       |                       | 275                   |                      | 490                  |                      |
|                                      |               | kgf                                       | 20                    |                       |                       | 28                    |                      | 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                  |                      |
|                                      |               | kgf                                       | 3.0                   |                       |                       | 8.0                   |                      | 12.0                 |                      |
|                                      | B             | N                                         | 29                    |                       |                       | 78                    |                      | 118                  |                      |
|                                      |               | kgf                                       | 3.0                   |                       |                       | 7.5                   |                      | 11.0                 |                      |
| 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          |

| Item                              |                        | Unit                                   | R88M<br>-H05030           | R88M<br>-H10030 | R88M<br>-H20030           | R88M<br>-H30030 | R88M<br>-H50030        | R88M<br>-H75030 | R88M<br>-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 <sup>2</sup> (GD <sup>2</sup> /4) | 0.02 x 10 <sup>-4</sup>   |                 | 0.05 x 10 <sup>-4</sup>   |                 | 0.5 x 10 <sup>-4</sup> |                 |                 |
|                                   |                        | kgf cm s <sup>2</sup>                  | 0.2 x 10 <sup>-4</sup>    |                 | 0.5 x 10 <sup>-4</sup>    |                 | 5 x 10 <sup>-4</sup>   |                 |                 |
|                                   | 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.)



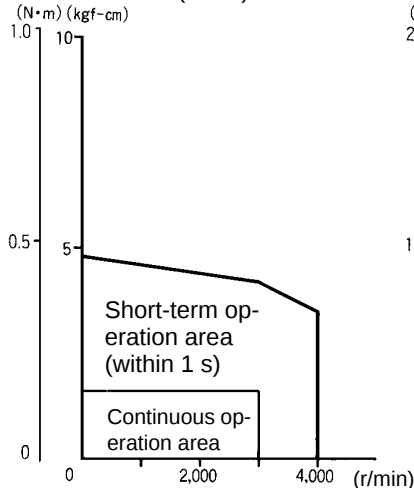
**Note 4.** The allowable thrust load varies depending on the shaft direction.

**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.

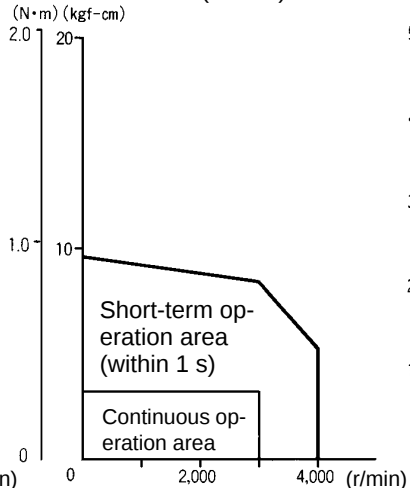
**Note 6.** H-series Servomotors can be used only with Position Driver software version 4.01 (September 1997) or later.

☐ **Torque and Rotation Speed Characteristics  
(Standard Cable: 3 m; 200/100-VAC Input)**

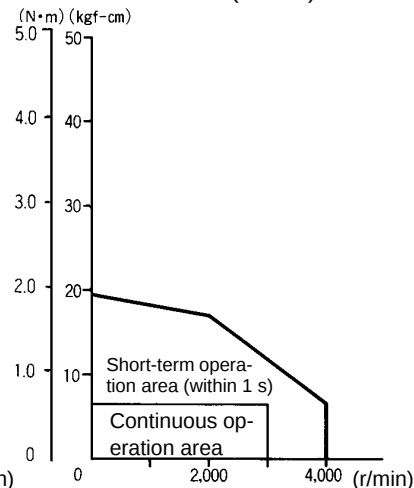
R88M-H05030 (50 W)



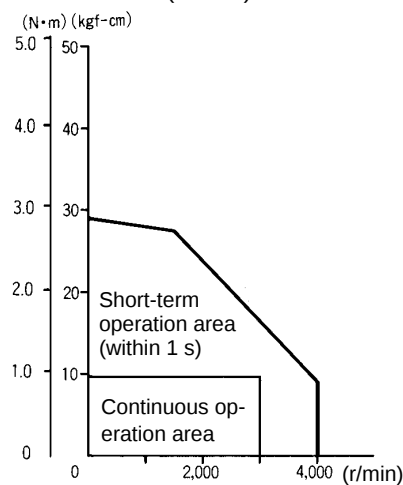
R88M-H10030 (100 W)



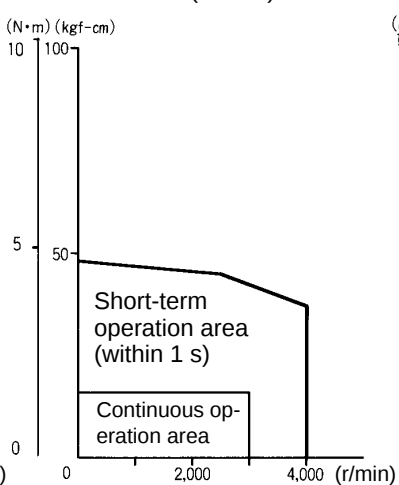
R88M-H20030 (200 W)



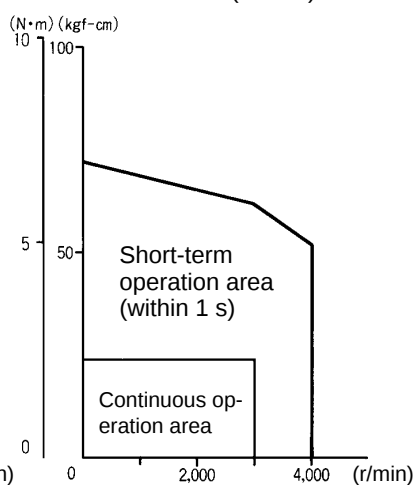
R88M-H30030 (300 W)



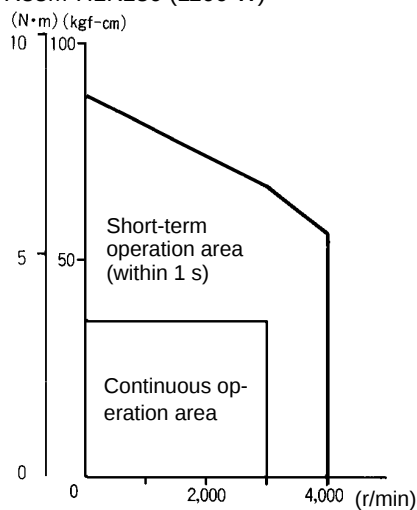
R88M-H50030 (500 W)



R88M-H75030 (750 W)



R88M-H1K130 (1100 W)



### □ 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 $\pm$ 5%                                                                    |
| Pulse duty characteristics   | 50% $\pm$ 10%                                                                     |
| Phase characteristics        | 90° $\pm$ 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.<br>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)<br>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.)

□ Performance Characteristics

1,200 r/min

| Item                                          |                                           | Unit           | R88M<br>-M20012      | R88M<br>-M40012      | R88M<br>-M70012      | R88M<br>-M1K112      | R88M<br>-M1K412      | R88M<br>-M1K812      |
|-----------------------------------------------|-------------------------------------------|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Rated output<br>(See note.)                   |                                           | W              | 200                  | 400                  | 700                  | 1,100                | 1,400                | 1,800                |
| Rated torque<br>(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<br>speed                       |                                           | r/min          | 1,200                |                      |                      |                      |                      |                      |
| Momentary maxi-<br>mum rotation<br>speed      |                                           | r/min          | 1,300                |                      |                      |                      |                      |                      |
| Momentary maxi-<br>mum torque (See<br>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<br>(See note.)                  |                                           | A (rms)        | 2.1                  | 2.9                  | 4.0                  | 6.6                  | 8.4                  | 9.3                  |
| Momentary maxi-<br>mum current<br>(See note.) |                                           | A (rms)        | 7.1                  | 7.1                  | 14.2                 | 14.2                 | 28.3                 | 35.4                 |
| Rotor inertia                                 | kg m <sup>2</sup><br>(GD <sup>2</sup> /4) |                | $6.3 \times 10^{-4}$ | $9.8 \times 10^{-4}$ | $1.6 \times 10^{-3}$ | $4.2 \times 10^{-3}$ | $4.9 \times 10^{-3}$ | $6.5 \times 10^{-3}$ |
|                                               | kgf cm s <sup>2</sup>                     |                | $6.4 \times 10^{-3}$ | $1.0 \times 10^{-2}$ | $1.6 \times 10^{-2}$ | $4.3 \times 10^{-2}$ | $5.0 \times 10^{-2}$ | $6.6 \times 10^{-2}$ |
| Torque constant<br>(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<br>constant (See<br>note.)    |                                           | mV/<br>(r/min) | 53                   | 72                   | 88                   | 82                   | 83                   | 92                   |
| Power rate (See<br>note.)                     |                                           | kW/s           | 4.0                  | 10                   | 20                   | 18                   | 25                   | 32                   |
| Mechanical time<br>constant                   |                                           | ms             | 7.3                  | 3.5                  | 2.3                  | 3.1                  | 2.8                  | 1.9                  |
| Winding resis-<br>tance                       |                                           | Ω              | 9.8                  | 6.4                  | 4.2                  | 1.9                  | 1.5                  | 1.0                  |
| Winding imped-<br>ance                        |                                           | mH             | 70                   | 65                   | 50                   | 20                   | 40                   | 27                   |
| Electrical time<br>constant                   |                                           | ms             | 7.1                  | 10.1                 | 11.8                 | 10                   | 26                   | 26                   |
| Momentary al-<br>lowable radial<br>load       | N                                         |                | 880                  | 940                  | 1,000                | 2,040                | 2,100                | 2,190                |
|                                               | kgf                                       |                | 90                   | 96                   | 102                  | 208                  | 214                  | 223                  |
| Momentary al-<br>lowable thrust<br>load       | N                                         |                | 2,380                | 2,380                | 2,380                | 5,390                | 5,390                | 5,390                |
|                                               | kgf                                       |                | 243                  | 243                  | 243                  | 550                  | 550                  | 550                  |
| Allowable radial<br>load                      | N                                         |                | 480 (560)            | 519 (600)            | 548 (640)            | 1,029<br>(1,190)     | 1,058<br>(1,230)     | 1,107<br>(1,270)     |
|                                               | kgf                                       |                | 49 (57)              | 53 (61)              | 56 (65)              | 105 (121)            | 108 (125)            | 113 (130)            |
| Allowable thrust<br>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<br>brake                          | kg             | Approx. 6.5          | Approx. 9.0          | Approx. 14           | Approx. 22           | Approx. 26           | Approx. 34           |
|                                               | With<br>brake                             | kg             | Approx. 7.1          | Approx. 10           | Approx. 15           | Approx. 24           | Approx. 28           | Approx. 38           |

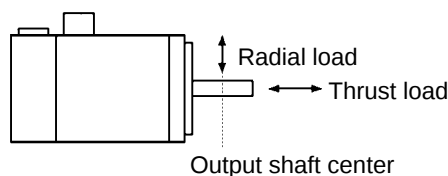
| Item                              |                               | Unit                                   | R88M<br>-M20012           | R88M<br>-M40012        | R88M<br>-M70012        | R88M<br>-M1K112        | R88M<br>-M1K412 | R88M<br>-M1K812        |  |
|-----------------------------------|-------------------------------|----------------------------------------|---------------------------|------------------------|------------------------|------------------------|-----------------|------------------------|--|
| 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 <sup>2</sup> (GD <sup>2</sup> /4) | 1.9 x 10 <sup>-5</sup>    | 3.2 x 10 <sup>-5</sup> | 6.8 x 10 <sup>-5</sup> | 2.9 x 10 <sup>-4</sup> |                 | 3.0 x 10 <sup>-4</sup> |  |
|                                   |                               | kgf cm s <sup>2</sup>                  | 1.9 x 10 <sup>-4</sup>    | 3.3 x 10 <sup>-4</sup> | 6.9 x 10 <sup>-4</sup> | 2.9 x 10 <sup>-3</sup> |                 | 3.1 x 10 <sup>-3</sup> |  |
|                                   | 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.)



**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<br>-M20020      | R88M<br>-M40020      | R88M<br>-M70020      | R88M<br>-M1K120      | R88M<br>-M1K820      | R88M<br>-M2K220      |
|------------------------------------------|-------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Rated output<br>(See note.)              | W                                         | 200                  | 400                  | 700                  | 1,100                | 1,800                | 2,200                |
| Rated torque<br>(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<br>(See note.)             | A (rms)                                   | 2.0                  | 3.3                  | 4.1                  | 5.5                  | 8.6                  | 12.3                 |
| Momentary maximum current<br>(See note.) | A (rms)                                   | 7.1                  | 7.1                  | 14.2                 | 14.2                 | 35.4                 | 35.4                 |
| Rotor inertia                            | kg m <sup>2</sup><br>(GD <sup>2</sup> /4) | $1.6 \times 10^{-4}$ | $6.3 \times 10^{-4}$ | $9.8 \times 10^{-4}$ | $1.6 \times 10^{-3}$ | $4.2 \times 10^{-3}$ | $4.9 \times 10^{-3}$ |
|                                          | kgf cm s <sup>2</sup>                     | $1.6 \times 10^{-3}$ | $6.4 \times 10^{-2}$ | $1.0 \times 10^{-2}$ | $1.6 \times 10^{-2}$ | $4.3 \times 10^{-2}$ | $5.0 \times 10^{-2}$ |
| Torque constant<br>(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/<br>(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)            |

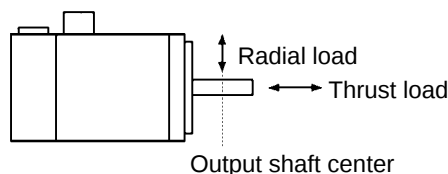
| Item                                      |                                             | Unit                                      | R88M<br>-M20020           | R88M<br>-M40020        | R88M<br>-M70020        | R88M<br>-M1K120        | R88M<br>-M1K820        | R88M<br>-M2K220 |  |
|-------------------------------------------|---------------------------------------------|-------------------------------------------|---------------------------|------------------------|------------------------|------------------------|------------------------|-----------------|--|
| load                                      |                                             | kgf                                       | 2 (3)                     | 7 (9)                  | 6 (8)                  | 6 (7)                  | 16 (19)                | 15 (18)         |  |
| Weight                                    | Without<br>brake                            | kg                                        | Approx. 3.2               | Approx. 6.5            | Approx. 9.0            | Approx. 14             | Approx. 22             | Approx. 26      |  |
|                                           | With<br>brake                               | kg                                        | Approx. 3.6               | Approx. 7.1            | Approx. 10             | Approx. 15             | Approx. 24             | Approx. 28      |  |
| Radiation shield<br>dimensions            |                                             | Material:<br>FE (See<br>note 4.)          | t15 x 250                 | t20 x 300              |                        |                        | t20 x 400              |                 |  |
| Applicable Posi-<br>tion Driver<br>(FND-) |                                             | 200-V in-<br>put                          | X12H-                     |                        |                        | X25H-                  |                        | X50H-           |  |
|                                           |                                             | 100-V in-<br>put                          | X12L-                     | ---                    |                        |                        |                        |                 |  |
| Brake speci-<br>fica-<br>tions            | Brake<br>inertia                            | kg m <sup>2</sup><br>(GD <sup>2</sup> /4) | 6.7 x 10 <sup>-4</sup>    | 1.9 x 10 <sup>-5</sup> | 3.2 x 10 <sup>-5</sup> | 6.8 x 10 <sup>-5</sup> | 2.8 x 10 <sup>-4</sup> |                 |  |
|                                           |                                             | kgf cm s <sup>2</sup>                     | 6.8 x 10 <sup>-5</sup>    | 1.9 x 10 <sup>-4</sup> | 3.3 x 10 <sup>-4</sup> | 6.9 x 10 <sup>-3</sup> | 2.9 x 10 <sup>-3</sup> |                 |  |
|                                           | Excita-<br>tion<br>voltage                  | V                                         | 24 VDC ±10% (No polarity) |                        |                        |                        |                        |                 |  |
|                                           | Power<br>con-<br>sump-<br>tion              | W (at<br>20°C)                            | 6.0                       | 9.8                    | 15                     |                        | 18                     |                 |  |
|                                           | Current<br>con-<br>sump-<br>tion            | A (at<br>20°C)                            | 0.25                      | 0.41                   | 0.63                   |                        | 0.76                   |                 |  |
|                                           | Static<br>friction<br>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.               |                 |  |
|                                           | Absorp-<br>tion<br>time<br>(See<br>note 3.) | ms                                        | 30 max.                   | 25 max.                | 35 max.                | 40 max.                | 60 max.                | 90 max.         |  |
|                                           | Release<br>time<br>(See<br>note 3.)         | ms                                        | 10 max.                   | 15 max.                | 15 max.                | 20 max.                | 40 max.                | 35 max.         |  |
|                                           | Back-<br>lash                               | (Reference<br>value)                      | ±0.85°                    | ±0.36°                 | ±0.32°                 | ±0.27°                 | ±0.24°                 | ±0.21°          |  |
|                                           | Rating                                      | ---                                       | Continuous                |                        |                        |                        |                        |                 |  |
|                                           | Insula-<br>tion<br>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.)



**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).

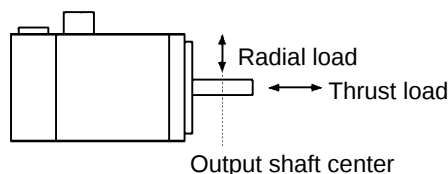
**Note 6.** M-series 2,000-r/min 1,100 to 2,200-W Servomotors can be used only with Position Driver software version 4.04 (April 1999) or later.

### 4,000 r/min

| Item                                          | Unit                                      | R88M<br>-M06040      | R88M<br>-M12040      | R88M<br>-M20040      | R88M<br>-M40040      | R88M<br>-M70040      | R88M<br>-M1K140      | R88M<br>-M2K040      |
|-----------------------------------------------|-------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Rated output<br>(See note.)                   | W                                         | 60                   | 120                  | 200                  | 400                  | 700                  | 1,100                | 2,000                |
| Rated torque<br>(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<br>speed                       | r/min                                     | 4,000                |                      |                      |                      |                      |                      |                      |
| Momentary<br>maximum rota-<br>tion speed      | r/min                                     | 4,400                |                      |                      |                      |                      |                      |                      |
| Momentary<br>maximum torque<br>(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<br>(See note.)                  | A (rms)                                   | 1.5                  | 1.8                  | 2.1                  | 3.4                  | 4.6                  | 5.0                  | 10.5                 |
| Momentary<br>maximum cur-<br>rent (See note.) | A (rms)                                   | 4.9                  | 7.1                  | 7.1                  | 14.2                 | 14.2                 | 14.2                 | 35.4                 |
| Rotor inertia                                 | kg m <sup>2</sup><br>(GD <sup>2</sup> /4) | $2.9 \times 10^{-5}$ | $4.1 \times 10^{-5}$ | $8.9 \times 10^{-5}$ | $1.6 \times 10^{-4}$ | $6.3 \times 10^{-4}$ | $9.8 \times 10^{-4}$ | $1.6 \times 10^{-3}$ |
|                                               | kgf cm s <sup>2</sup>                     | $3.0 \times 10^{-4}$ | $4.2 \times 10^{-4}$ | $9.1 \times 10^{-4}$ | $1.6 \times 10^{-3}$ | $6.4 \times 10^{-3}$ | $1.0 \times 10^{-2}$ | $1.6 \times 10^{-2}$ |
| Torque constant<br>(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<br>constant (See<br>note.)    | mV/<br>(r/min)                            | 8.0                  | 11.3                 | 16.3                 | 20                   | 23.3                 | 31.7                 | 30                   |
| Power rate (See<br>note.)                     | kW/s                                      | 0.70                 | 2.0                  | 2.6                  | 5.8                  | 4.4                  | 7.0                  | 15                   |
| Mechanical time<br>constant                   | ms                                        | 6.6                  | 3.8                  | 7.6                  | 4.5                  | 7.4                  | 3.2                  | 2.8                  |
| Winding resis-<br>tance                       | Ω                                         | 7.35                 | 4.7                  | 6.52                 | 3.55                 | 2.2                  | 1.33                 | 0.57                 |
| Winding imped-<br>ance                        | mH                                        | 13                   | 12                   | 25                   | 15                   | 12                   | 11                   | 5.5                  |
| Electrical time<br>constant                   | ms                                        | 1.8                  | 2.6                  | 3.8                  | 4.2                  | 5.5                  | 8.3                  | 9.6                  |

| Item                              |                               | Unit                                   | R88M<br>-M06040           | R88M<br>-M12040 | R88M<br>-M20040        | R88M<br>-M40040 | R88M<br>-M70040        | R88M<br>-M1K140        | R88M<br>-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 <sup>2</sup> (GD <sup>2</sup> /4) | 1.5 x 10 <sup>-6</sup>    |                 | 6.7 x 10 <sup>-6</sup> |                 | 1.9 x 10 <sup>-5</sup> | 3.2 x 10 <sup>-5</sup> | 6.8 x 10 <sup>-5</sup> |
|                                   |                               | kgf cm s <sup>2</sup>                  | 1.5 x 10 <sup>-5</sup>    |                 | 6.8 x 10 <sup>-5</sup> |                 | 1.9 x 10 <sup>-4</sup> | 3.3 x 10 <sup>-5</sup> | 6.9 x 10 <sup>-5</sup> |
|                                   | 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.                |
|                                   | Re-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                    |                 |                        |                 |                        |                        |                        |

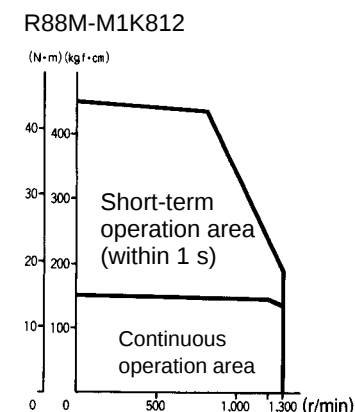
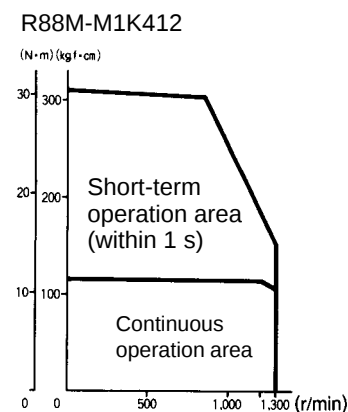
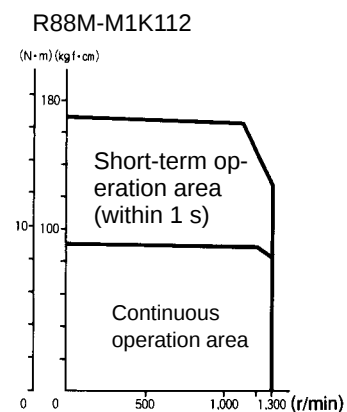
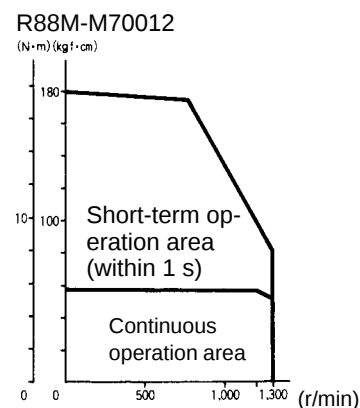
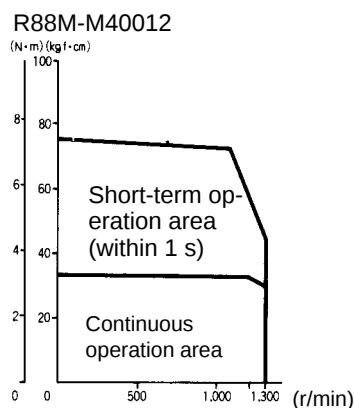
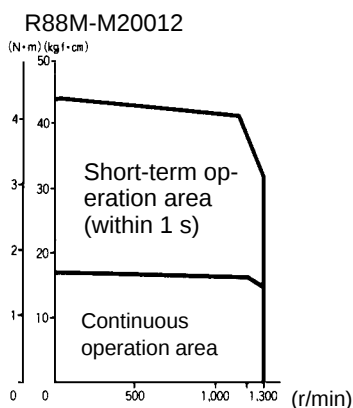
- Note 1.** The brakes are the non-excitation type. (When excitation voltage is added, it is cleared.)
- Note 2.** The operation time measurement is the measured value with a surge killer installed.
- Note 3.** For Servomotors with brakes, increase the dimensions of the radiation shield by 50 mm each. (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.

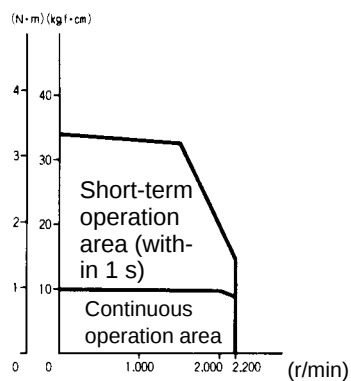
## ☐ Torque and Rotation Speed Characteristics (Standard Cable: 3 m; 200/100-VAC Input)

### 1,200 r/min

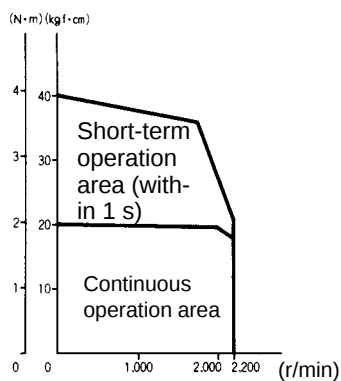


2,000 r/min

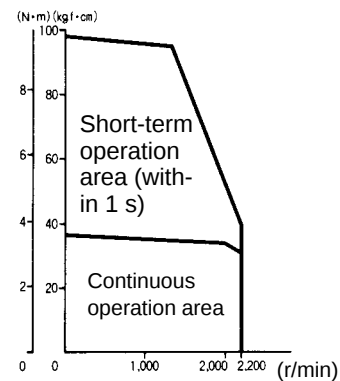
R88M-M20020



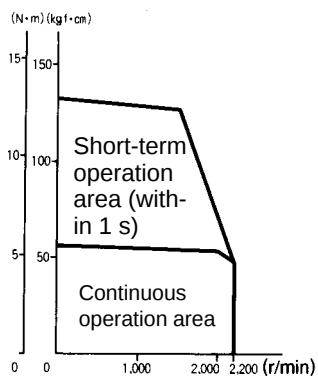
R88M-M40020



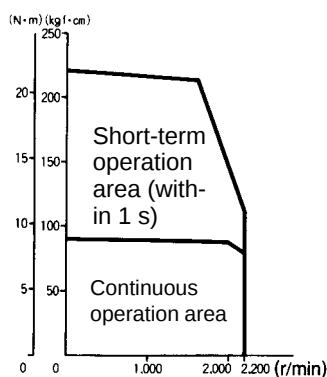
R88M-M70020



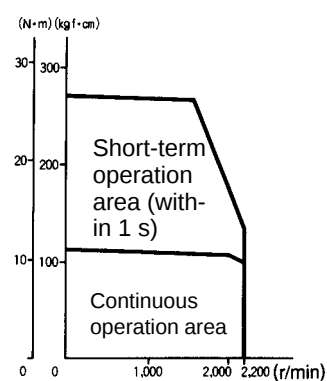
R88M-M1K120



R88M-M1K820

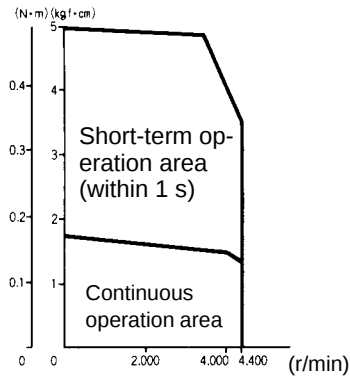


R88M-M2K220

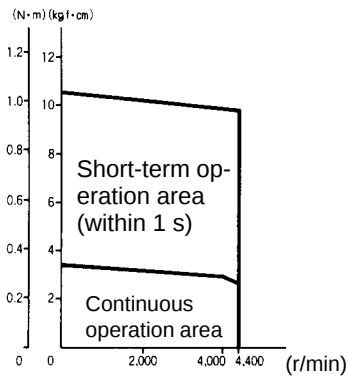


4,000 r/min

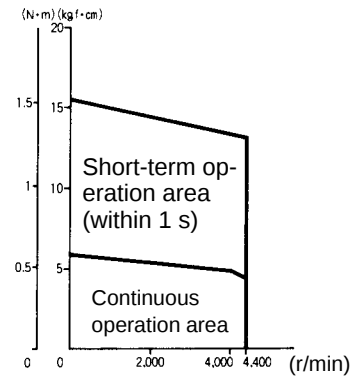
R88M-M06040



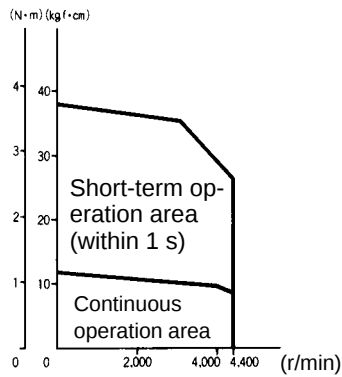
R88M-M12040



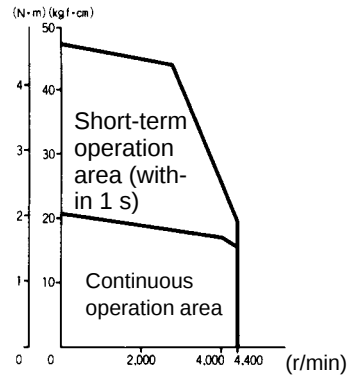
R88M-M20040



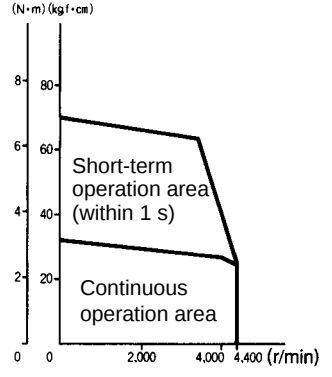
R88M-M40040



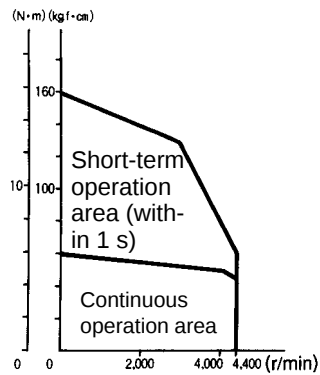
R88M-M70040



R88M-M1K140



R88M-M2K040



Resolver Specifications

| Item          | Standards                                                 |
|---------------|-----------------------------------------------------------|
| Accuracy      | Absolute accuracy: 0.18° max. (Ambient temperature: 25°C) |
| Origin signal | 2 pulses/revolution                                       |

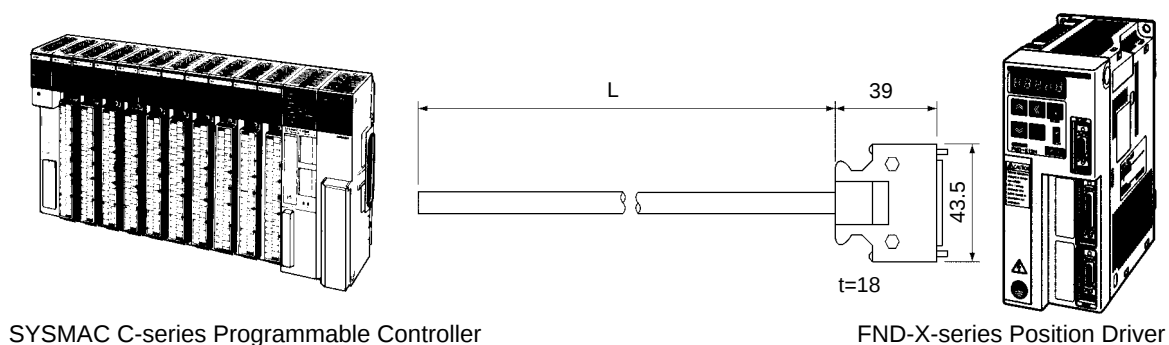
## 5-3 Cable Specifications

### 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



## 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            | 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        |

## Connector Pin Arrangement

|    |    |    |    |
|----|----|----|----|
|    | 1  |    | 19 |
| 2  | 3  | 20 | 21 |
| 4  | 5  | 22 | 23 |
| 6  | 7  | 24 | 25 |
| 8  | 9  | 26 | 27 |
| 10 | 11 | 28 | 29 |
| 12 | 13 | 30 | 31 |
| 14 | 15 | 32 | 33 |
| 16 | 17 | 34 | 35 |
| 18 |    | 36 |    |

Connector plug model:

10136-3000VE

(Sumitomo 3M)

Connector case model:

10336-52A0-008

(Sumitomo 3M)

Cable: UL2464, AWG24X18P

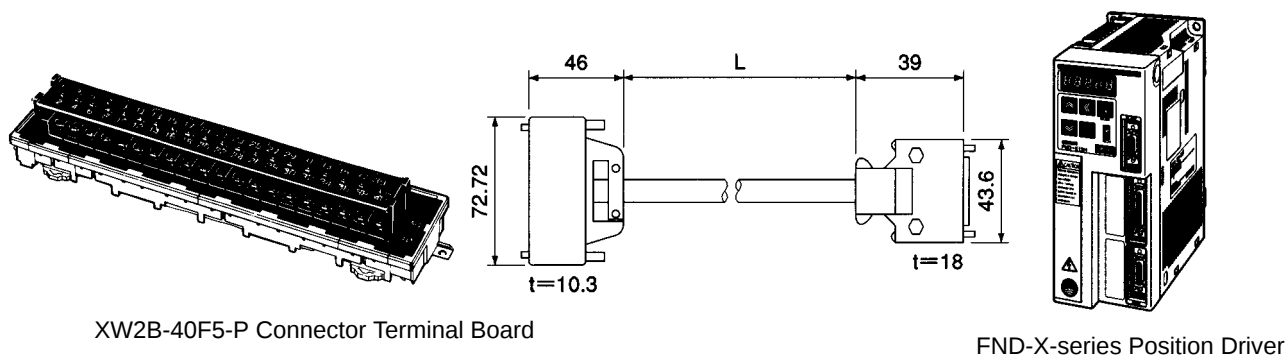
**Note** Connect the shield to the shield plate under the connector cover.

### 5-3-2 Connector Terminal Board Conversion Unit Cables (DIO Position Drivers Only)

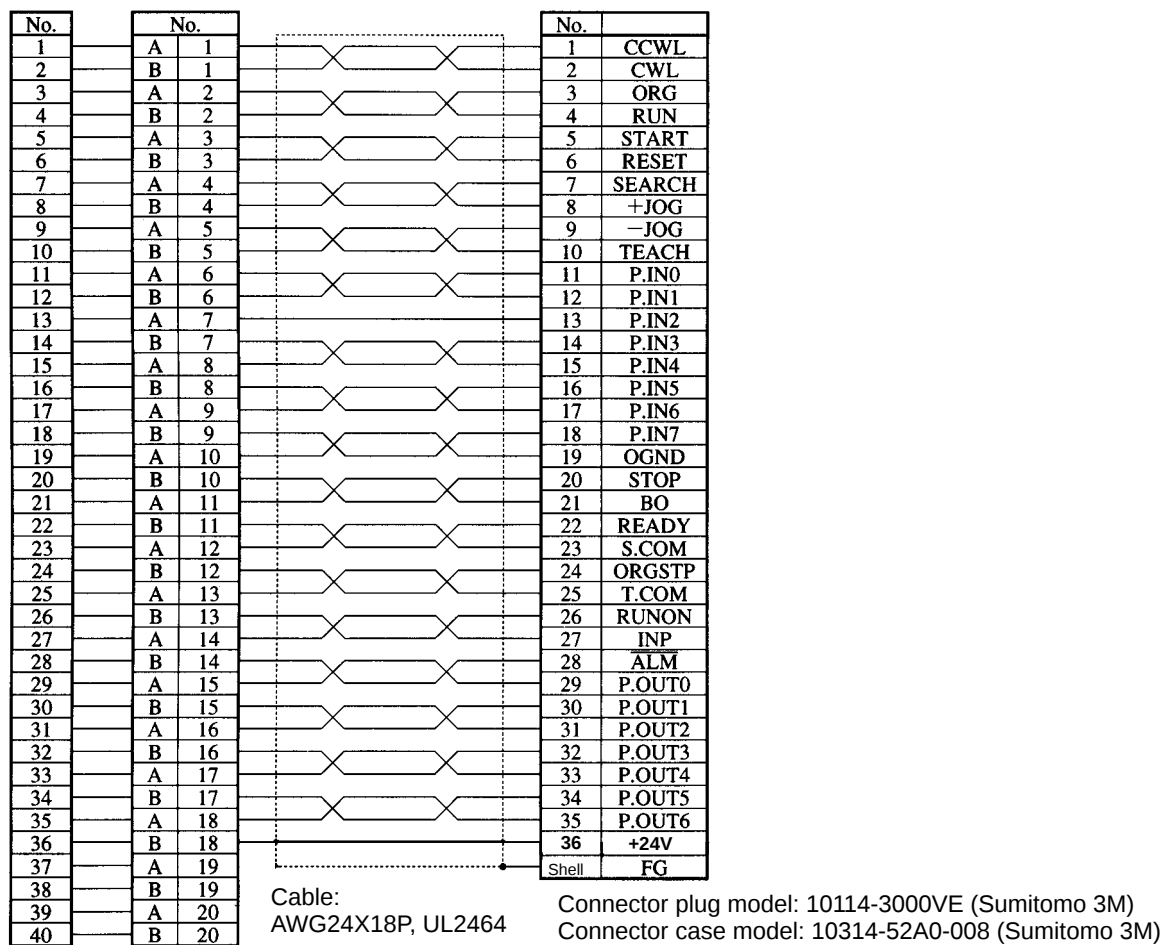
#### Cable Models

| Model        | Length (L) | Outer diameter of sheath |
|--------------|------------|--------------------------|
| R88A-CTU001N | 1 m        | 9.9 dia.                 |
| R88A-CTU002N | 2 m        |                          |

#### Connection Configuration



## Wiring



Connector plug model: FCN-361J040-AU (Fujitsu)  
Connector case model: FCN-36C040-B (Fujitsu)

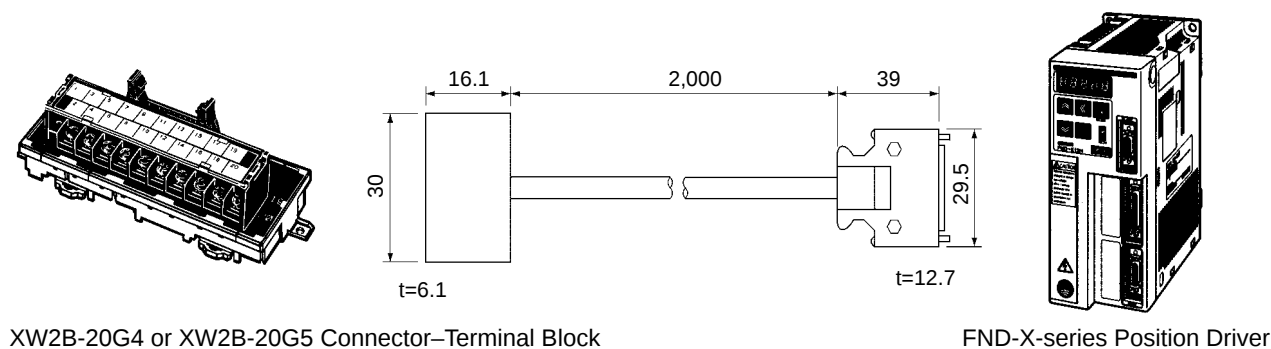
5-3-3 External Control Signal Connecting Cables  
(CompoBus/S Position Drivers Only)

Connector-Terminal Block Conversion Unit Cable

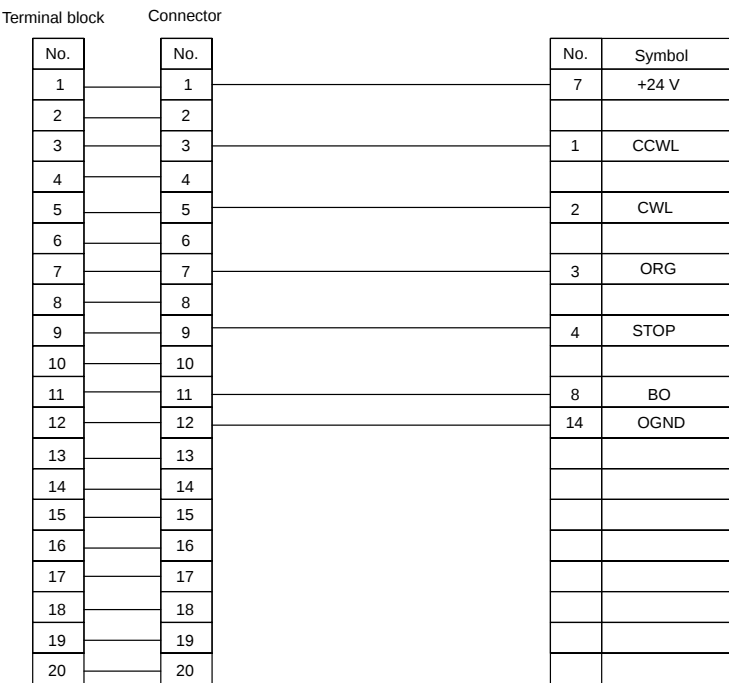
Cable

| Model       | Length (L) | Outer diameter of sheath |
|-------------|------------|--------------------------|
| FND-CTX002N | 2 m        | 7.4 dia.                 |

Connection Configuration



Wiring



Connector model: XG4M-2030-T (OMRON)      Contact plug model: 10114-3000VE (Sumitomo 3M)  
Contact case model: 10314-52A0-008 (Sumitomo 3M)

### 5-3-4 Encoder Cables

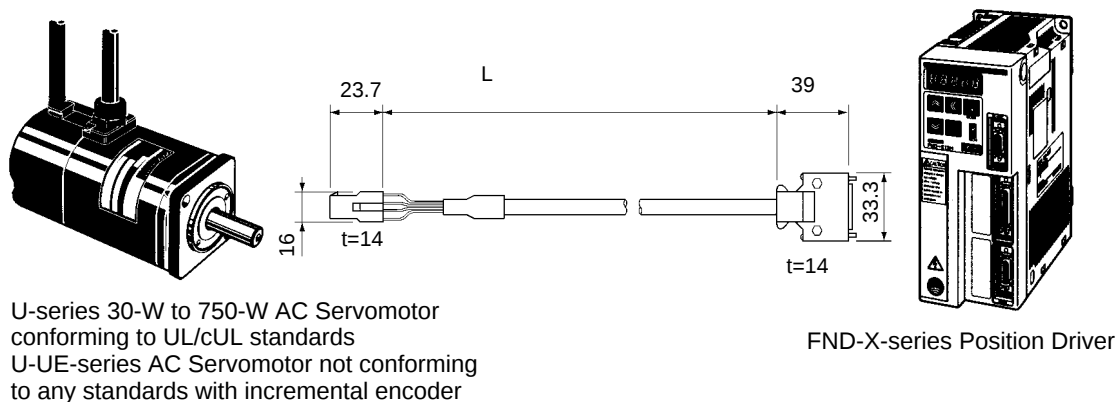
- Encoder Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards and U-UE-series Servomotors not Conforming to Any Standards With Incremental Encoder

#### 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



#### Wiring

| Symbol | No. |                      | No. | Symbol |
|--------|-----|----------------------|-----|--------|
| A+     | 1   | AWG24 (blue)         | 1   | A+     |
| A-     | 2   | AWG24 (white/blue)   | 2   | A-     |
| B+     | 3   | AWG24 (yellow)       | 3   | B+     |
| B-     | 4   | AWG24 (white/yellow) | 4   | B-     |
| S+     | 5   | AWG24 (green)        | 5   | S+     |
| S-     | 6   | AWG24 (white/green)  | 6   | S-     |
| E0V    | 7   | AWG22 (black)        | 7   | E0V    |
| E5V    | 8   | AWG22 (red)          | 8   | E5V    |
| FG     | 9   | AWG22 (green/yellow) | 9   | FG     |

Cable: AWG22 × 3C + AWG24 × 3P  
UL2589

## For Cable

Connector housing model: 172161-1 (Nippon Amp)  
 Connector socket contact model: 170365-1 (Nippon Amp)  
 Crimping tool: 724649-1  
 Pulling tool: 724668-2

Contact plug model: 10120-3000VE (Sumitomo 3M)  
 Contact case model: 10320-52A0-008 (Sumitomo 3M)

## For Motor

Contact plug model: 172169-1 (Nippon Amp)  
 Connector pin contact model: 170359-1 (Nippon Amp)

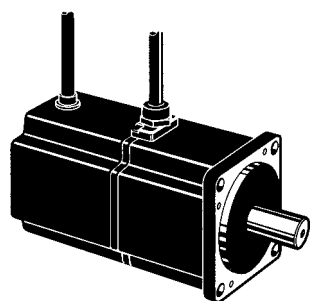
## ☐ Encoder Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards with Absolute Encoder

### Cable Models

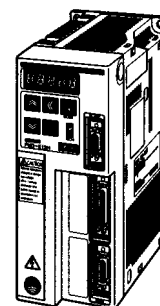
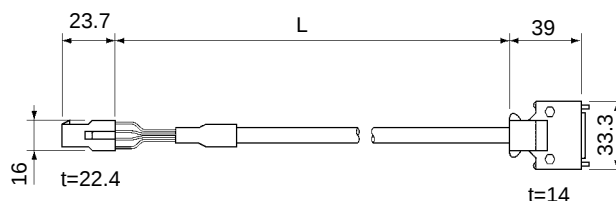
| Model        | Length (L) | Outer diameter of sheath |
|--------------|------------|--------------------------|
| R88A-CSU003C | 3 m        | 10.3 dia.                |
| R88A-CSU005C | 5 m        |                          |
| R88A-CSU010C | 10 m       |                          |
| R88A-CSU015C | 15 m       |                          |
| R88A-CSU020C | 20 m       |                          |

**Note** The maximum distance between the Servomotor and the Position Driver is 20 m.

### Connection Configuration

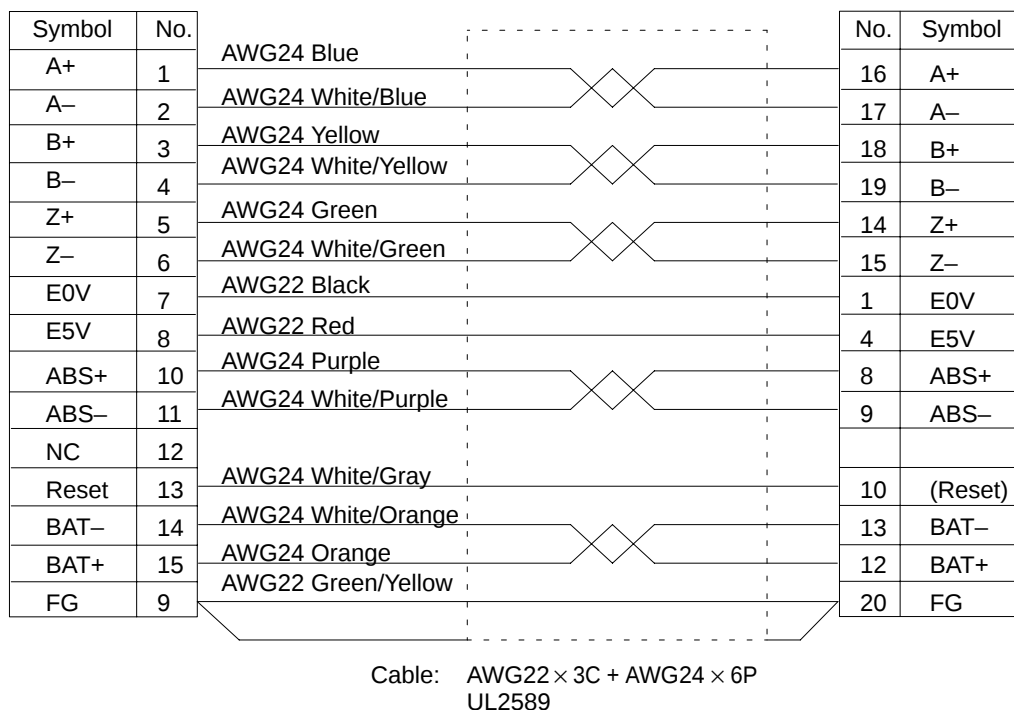


U-series 30-W to 750-W AC Servomotor conforming to UL/cUL standards with absolute encoder



FND-X-series Position Driver

## Wiring



### For Cable

Connector housing model: 172163-1 (Nippon Amp)  
 Connector socket contact model: 170365-1 (Nippon Amp)  
 Crimping tool: 724649-1  
 Pulling tool: 724668-2

Contact plug model: 10120-3000VE (Sumitomo 3M)  
 Contact case model: 10320-52A0-008 (Sumitomo 3M)

### For Motor

Contact plug model: 172171-1 (Nippon Amp)  
 Connector pin contact model: 170359-1 (Nippon Amp)

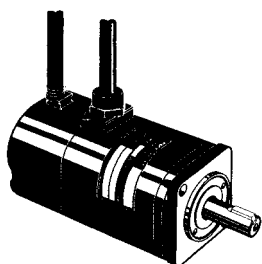
## ☐ Encoder Cables for U-series 30-W to 750-W Servomotors and U-UE-series Servomotors Conforming to EC Directives with Incremental Encoders

### Cable Models

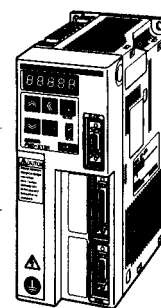
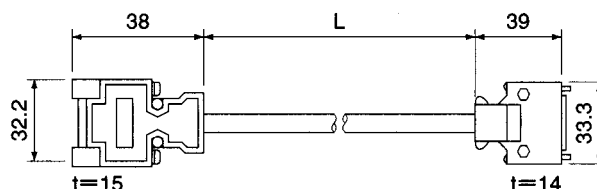
| Model         | Length (L) | Outer diameter of sheath |
|---------------|------------|--------------------------|
| R88A-CRUD003C | 3 m        | 8.0 dia.                 |
| R88A-CRUD005C | 5 m        |                          |
| R88A-CRUD010C | 10 m       |                          |
| R88A-CRUD015C | 15 m       |                          |
| R88A-CRUD020C | 20 m       |                          |

**Note** The maximum distance between the Servomotor and the Position Driver is 20 m.

## Connection Configuration

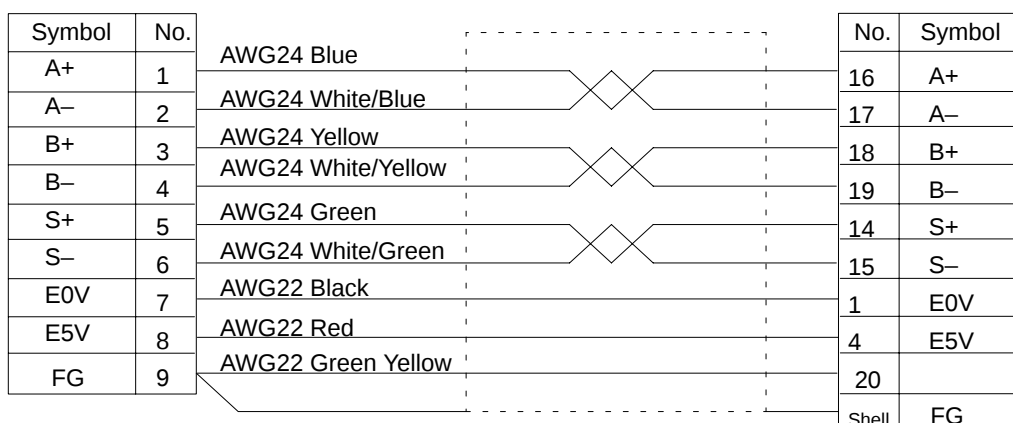


U-series 30-W to 750-W AC Servomotor conforming to EC Directives  
U-UE-series AC Servomotor conforming to EC Directives with incremental encoder



FND-X-series Position Driver

## Wiring



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)

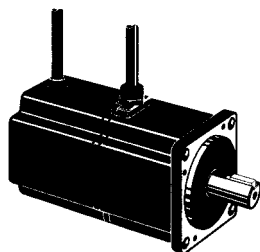
## ☐ Encoder Cables for U-series 30-W to 750-W Servomotors Conforming to EC Directives with Absolute Encoders

### Cable Models

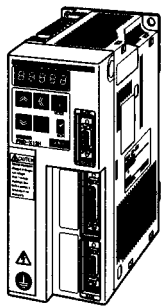
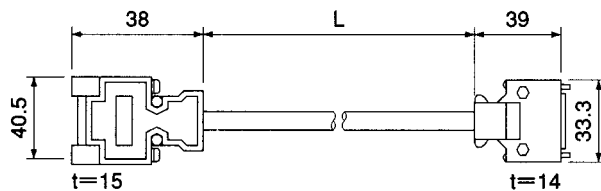
| Model         | Length (L) | Outer diameter of sheath |
|---------------|------------|--------------------------|
| R88A-CSUD003C | 3 m        | 10.3 dia.                |
| R88A-CSUD005C | 5 m        |                          |
| R88A-CSUD010C | 10 m       |                          |
| R88A-CSUD015C | 15 m       |                          |
| R88A-CSUD020C | 20 m       |                          |

**Note** The maximum distance between the Servomotor and the Position Driver is 20 m.

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)

## □ Encoder Cables for U-series 1-kW to 2-kW Servomotors with Incremental or Absolute Encoders

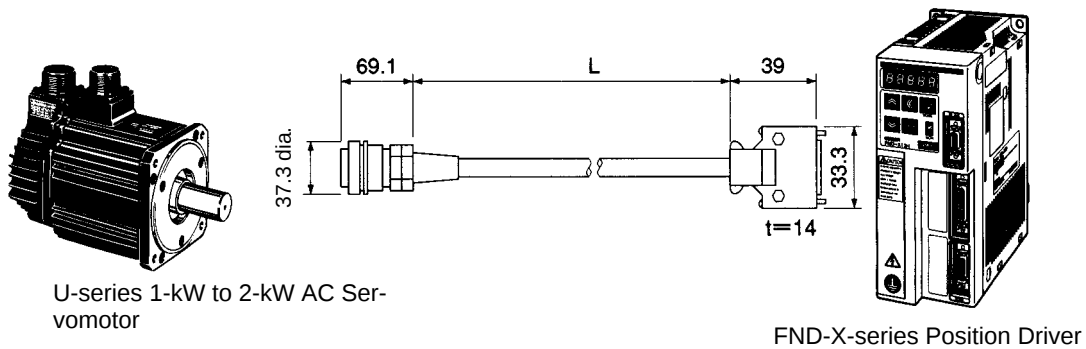
**Note** To conform to EC Directives, use the recommended connectors (refer to 2-1-2 *Installation Conditions*).

### Cable Models

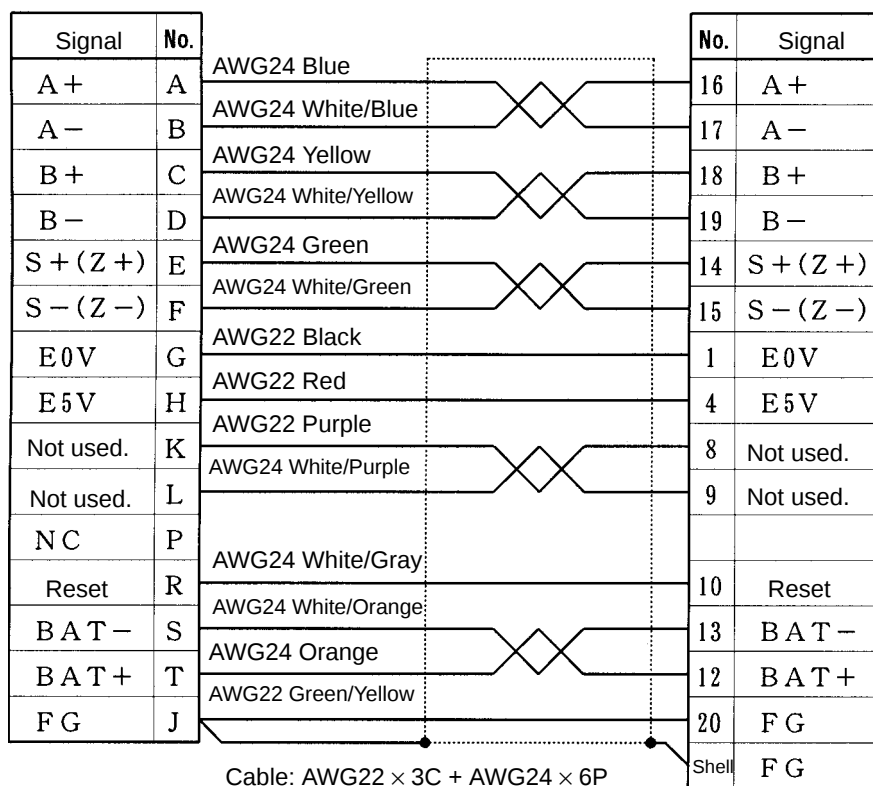
| Model         | Length (L) | Outer diameter of sheath |
|---------------|------------|--------------------------|
| R88A-CRUB003C | 3 m        | 10.3 dia.                |
| R88A-CRUB005C | 5 m        |                          |
| R88A-CRUB010C | 10 m       |                          |
| R88A-CRUB015C | 15 m       |                          |
| R88A-CRUB020C | 20 m       |                          |

**Note** The maximum between the Servomotor and the Position Driver is 20 m.

### Connection Configuration



## Wiring



### 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

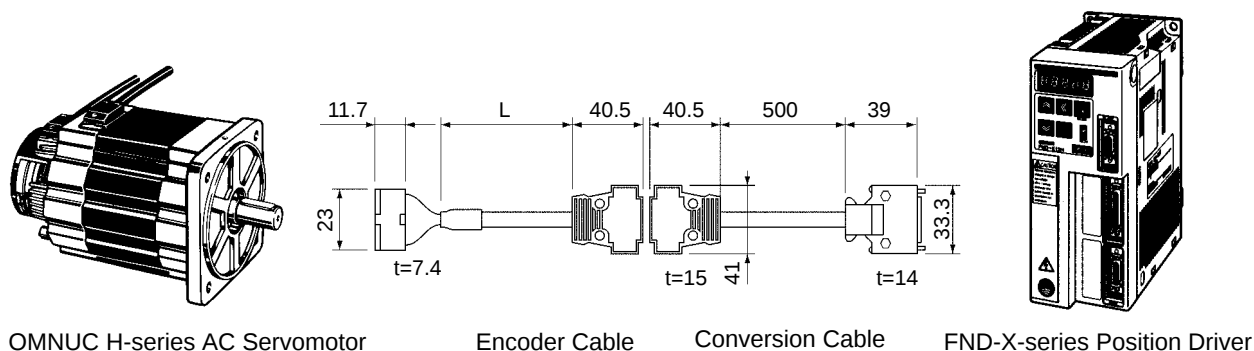
## Encoder and Conversion Cables for H-series Servomotors

### Encoder Cable Models

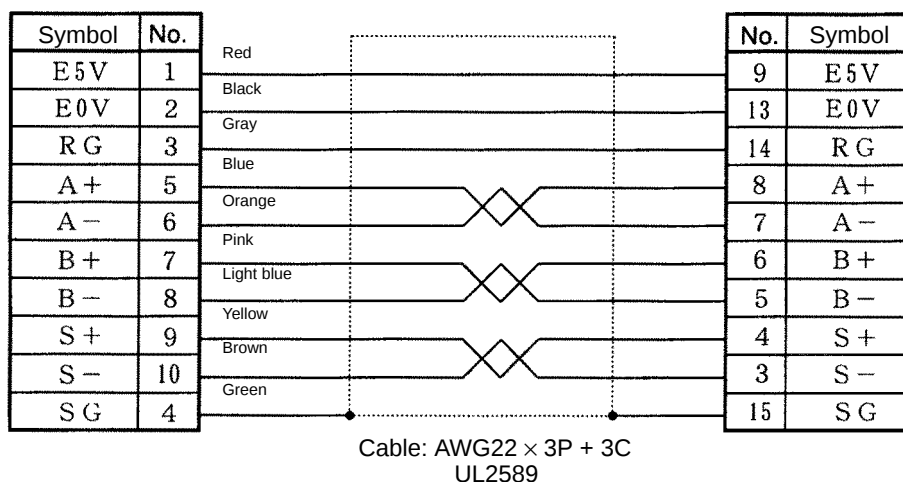
| Model        | Length (L) | Outer diameter of sheath |
|--------------|------------|--------------------------|
| R88A-CRH001C | 1 m        | 8.0 dia.                 |
| R88A-CRH003C | 3 m        |                          |
| R88A-CRH005C | 5 m        |                          |
| R88A-CRH010C | 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.

## Connection Configuration



## Wiring



### 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)

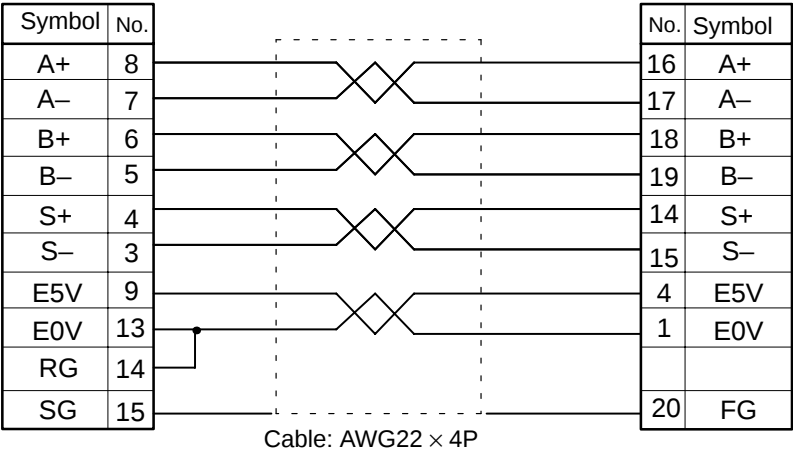
### For Motor

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.                 |

Wiring



Contact cover model: XM2S-1511 (OMRON)

Contact plug model: 10120-3000VE (Sumitomo 3M)

Contact socket model: XM2D-1501 (OMRON)

Contact case model: 10320-52A0-008 (Sumitomo 3M)

Fixture model: XM2Z-0001 (OMRON)

5-3-5 Resolver Cables

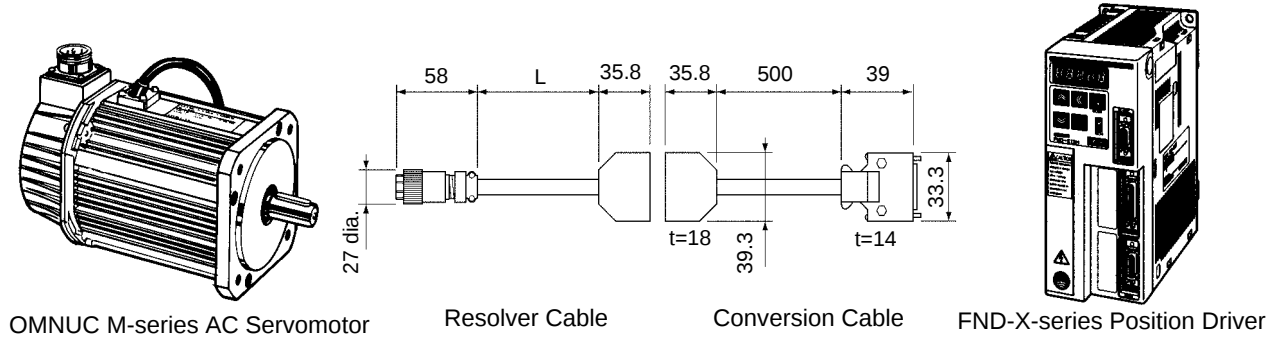
☐ Resolver and Conversion Cables for M-series Servomotors

Cable Models

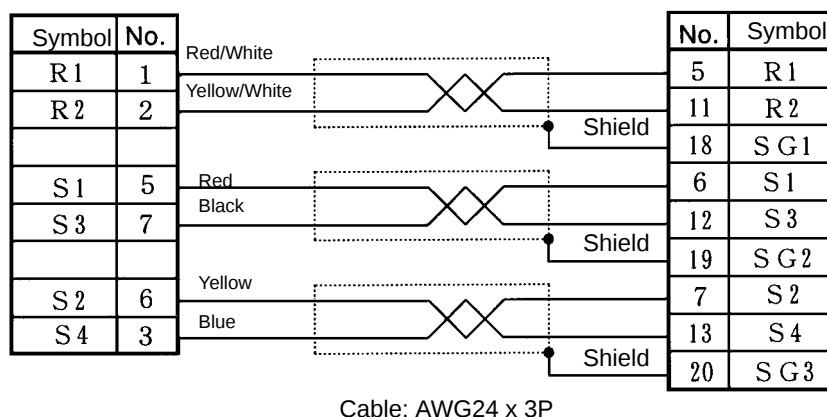
| Model        | Length (L) | Outer diameter of sheath |
|--------------|------------|--------------------------|
| R88M-CRM003N | 3 m        | 8.2 dia.                 |
| R88M-CRM005N | 5 m        |                          |
| R88M-CRM010N | 10 m       |                          |
| R88M-CRM015N | 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



## Wiring



## 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.)

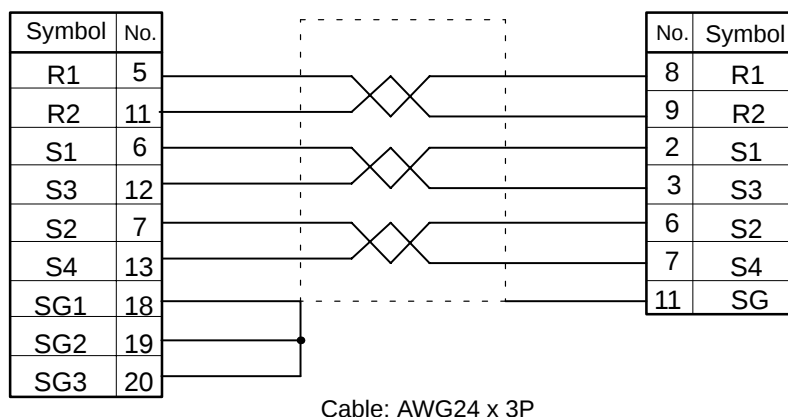
## For Motor

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



Relay case model: MR-20LK2G (Honda Tsushin Kogyo Co., Ltd.)

Connector plug model: 10120-3000VE (Sumitomo 3M)

Connector model: MR-20RM (Honda Tsushin Kogyo Co., Ltd.)

Connector case model: 10320-52A0-008 (Sumitomo 3M)

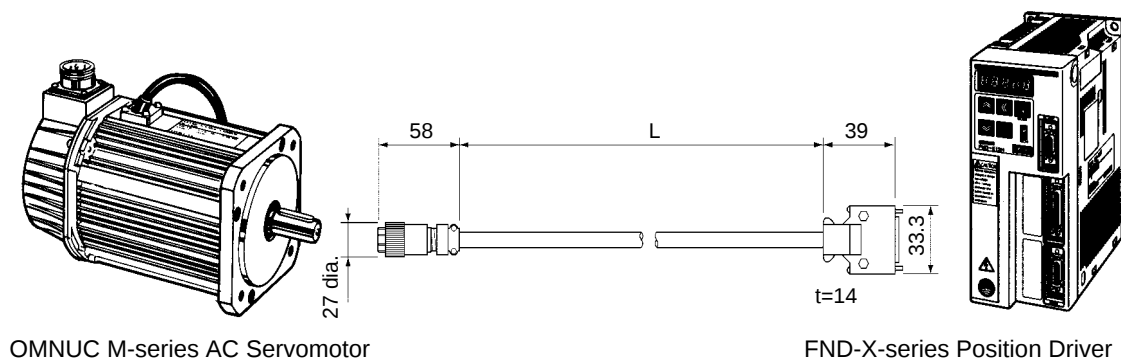
## Resolver Cables for M-series Servomotors

### Cable Models

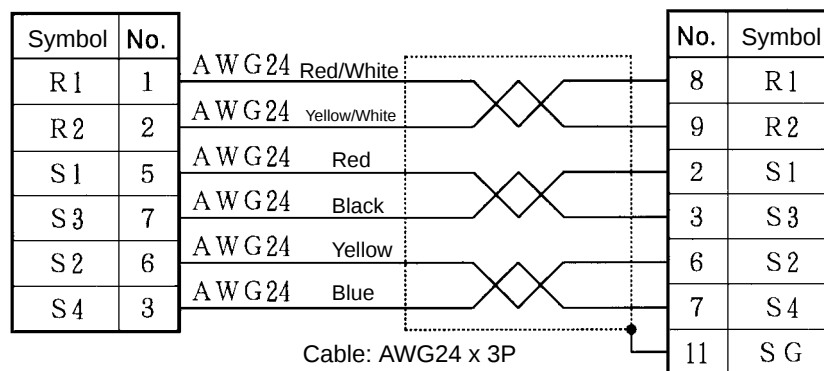
| Model         | Length (L) | Outer diameter of sheath |
|---------------|------------|--------------------------|
| R88M-CRMA003N | 3 m        | 8.2 dia.                 |
| R88M-CRMA005N | 5 m        |                          |
| R88M-CRMA010N | 10 m       |                          |
| R88M-CRMA015N | 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



### 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)

### 5-3-6 Power Cables

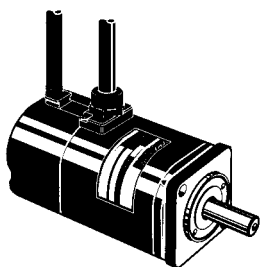
#### □ Power Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards and U-UE-series Servomotors not Conforming to Any Standards without Brake

##### Cable Models

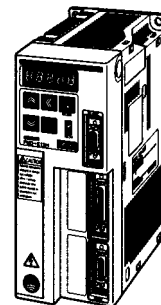
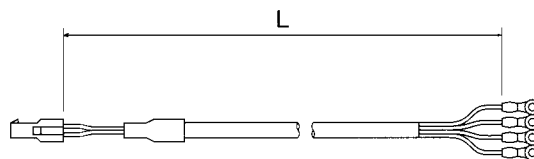
| Model        | Length (L) | Outer diameter of sheath |
|--------------|------------|--------------------------|
| R88A-CAU003S | 3 m        | 5.8 dia.                 |
| R88A-CAU005S | 5 m        |                          |
| R88A-CAU010S | 10 m       |                          |
| R88A-CAU015S | 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   | AWG20 | Red   |  |
| V-phase | 2   | AWG20 | White |  |
| W-phase | 3   | AWG20 | Blue  |  |
| GR      | 4   | AWG20 | Green |  |

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

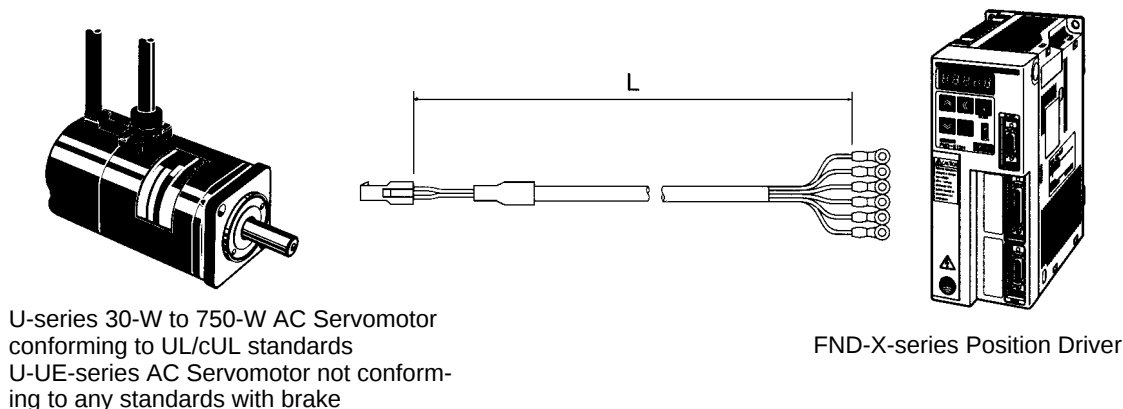
## □ Power Cables for U-series 30-W to 750-W Servomotors Conforming to UL/cUL Standards and U-UE-series Servomotors not Conforming to Any Standards With Brake

### 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



### Wiring

| Symbol  | No. |       |       |  |
|---------|-----|-------|-------|--|
| U-phase | 1   | AWG20 | Red   |  |
| V-phase | 2   | AWG20 | White |  |
| W-phase | 3   | AWG20 | Blue  |  |
| GR      | 4   | AWG20 | Green |  |
| Brake   | 5   | AWG20 | Black |  |
| Brake   | 6   | AWG20 | Black |  |

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 |

□ Power Cables for U-series 30-W to 750-W and U-UE-series Servomotors

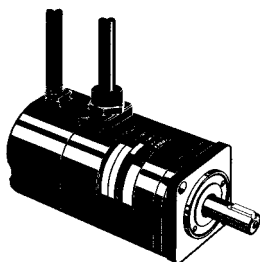
Cable Models

| 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    |

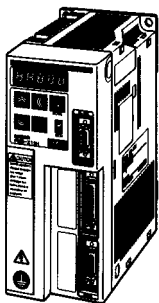
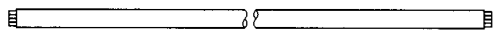
**Note 1.** The power cable comes in units of 1 m. Cut the cable as required to make the specified length.

**Note 2.** The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



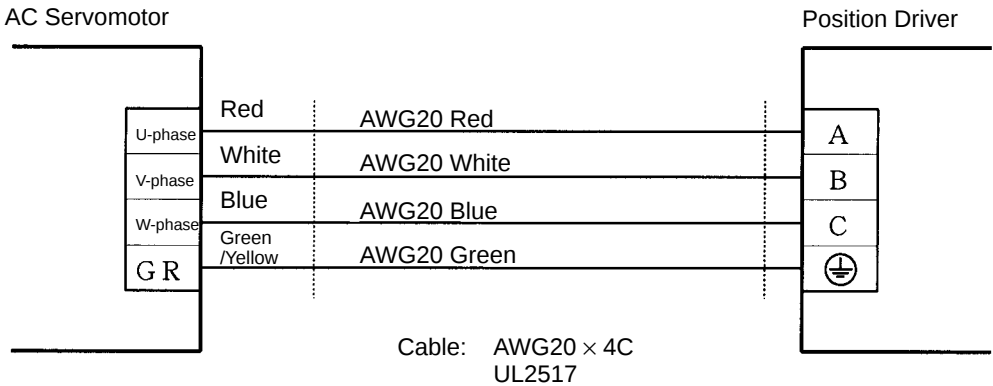
U-series 30-W to 750-W AC Servomotor  
U-UE-series AC Servomotor



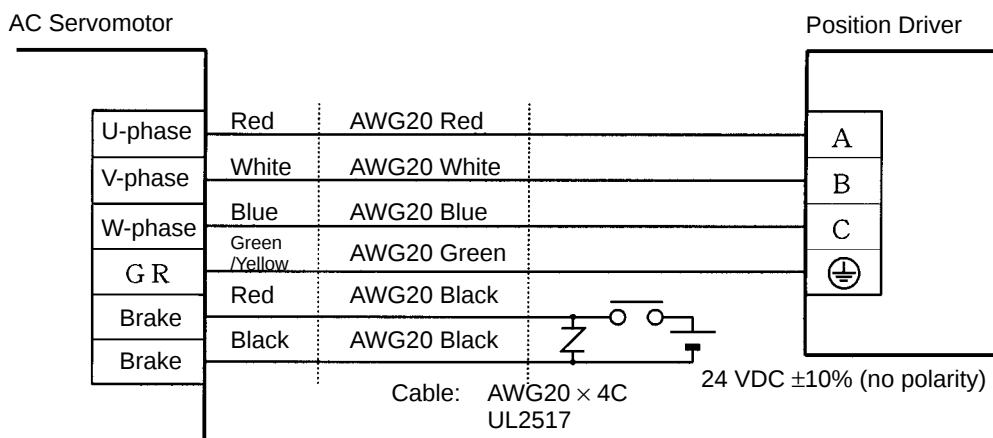
FND-X-series Position Driver

Wiring

R88A-CAU001



R88A-CAU01B



## □ Power Cables for U-series 1-kW to 2-kW Servomotors Without Brake

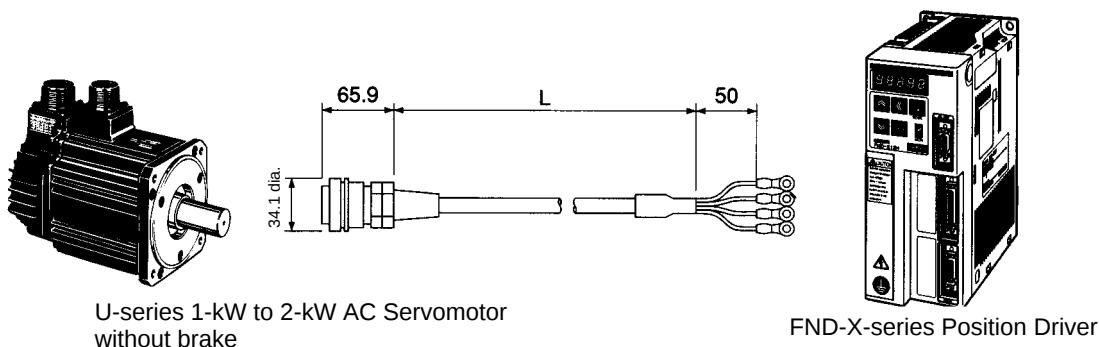
**Note** To conform to EC Directives, use the recommended connectors (refer to 2-1-2 *Installation Conditions*).

### Cable Models

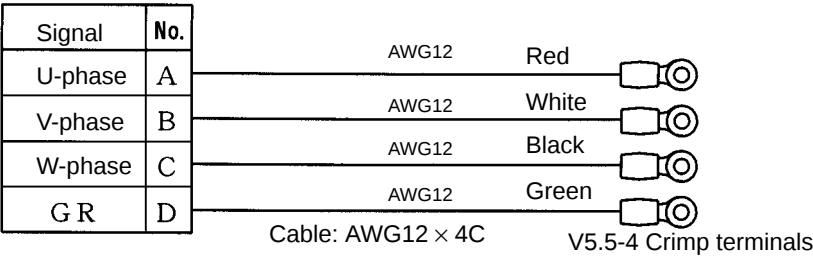
| Model         | Length (L) | Outer diameter of sheath |
|---------------|------------|--------------------------|
| R88A-CAUB003S | 3 m        | 14 dia.                  |
| R88A-CAUB005S | 5 m        |                          |
| R88A-CAUB010S | 10 m       |                          |
| R88A-CAUB015S | 15 m       |                          |
| R88A-CAUB020S | 20 m       |                          |

**Note** The maximum distance between the Servomotor and the Position Driver is 20 m.

### Connection Configuration



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

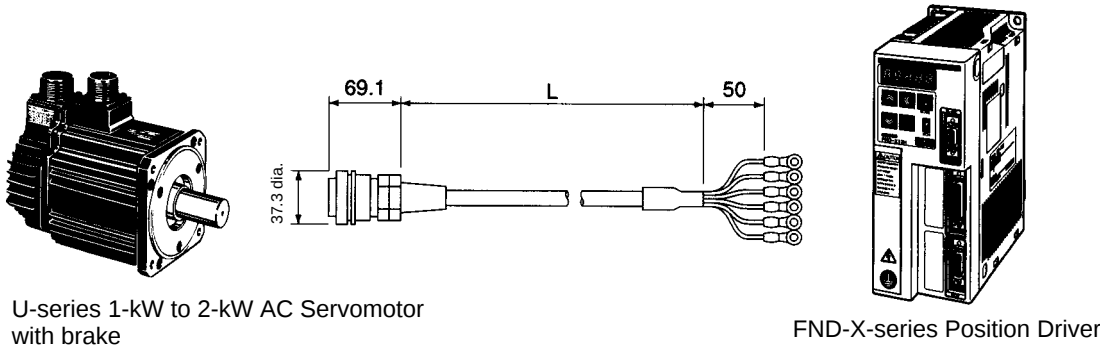
**Note** To conform to EC Directives, use the recommended connectors (refer to 2-1-2 *Installation Conditions*).

Cable Models

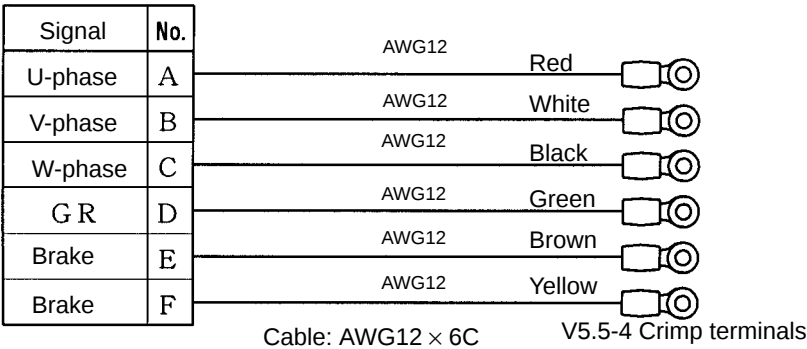
| Model         | Length (L) | Outer diameter of sheath |
|---------------|------------|--------------------------|
| R88A-CAUB003S | 3 m        | 16.5 dia.                |
| R88A-CAUB005S | 5 m        |                          |
| R88A-CAUB010S | 10 m       |                          |
| R88A-CAUB015S | 15 m       |                          |
| R88A-CAUB020S | 20 m       |                          |

**Note** The maximum distance between the Servomotor and the Position Driver is 20 m.

Connection Configuration



Wiring



**For Cable**  
Connector plug model: MS3106B20-15S  
Cable clamp model: MS3057-12A

**For Motor**  
Receptacle model: MS3102A20-15P

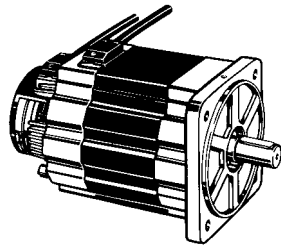
□ Power Cables for H-series Servomotors Without Brake

Cable Models

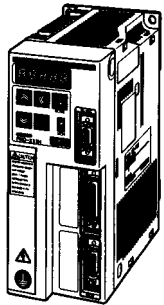
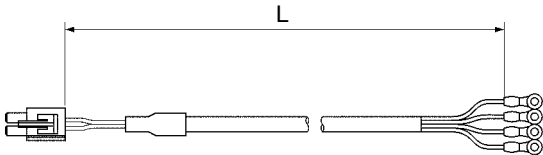
| Model        | Length (L) | Wire size | Outer diameter of sheath |
|--------------|------------|-----------|--------------------------|
| R88A-CAH001S | 1 m        | AWG18     | 5.8 dia.                 |
| R88A-CAH003S | 3 m        |           |                          |
| R88A-CAH005S | 5 m        |           |                          |
| 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

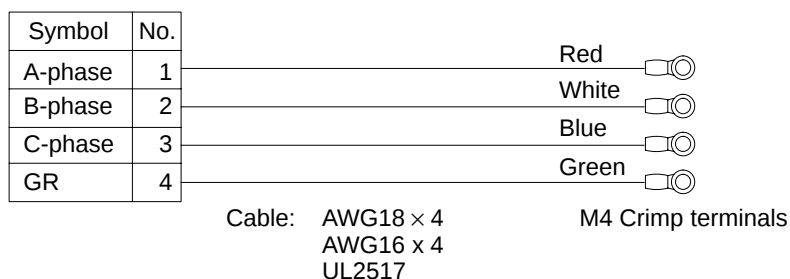


OMNUC H-series AC Servomotor  
(without brake)



FND-X-series Position Driver

## Wiring



### 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.)

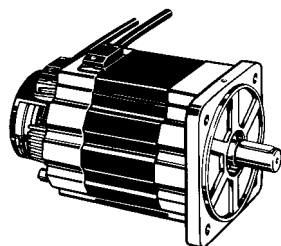
## Power Cables for H-series Servomotors With Brake

### Cable Models

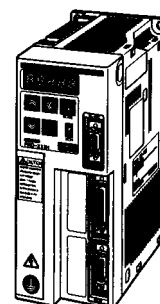
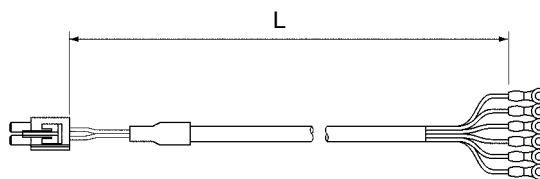
| Model        | Length (L) | Wire size | Outer diameter of sheath |
|--------------|------------|-----------|--------------------------|
| R88A-CAH001B | 1 m        | AWG18     | 8.3 dia.                 |
| R88A-CAH003B | 3 m        |           |                          |
| R88A-CAH005B | 5 m        |           |                          |
| 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

## Wiring

| Symbol  | No. |       |                                                                                    |
|---------|-----|-------|------------------------------------------------------------------------------------|
| A-phase | 1   | Red   |  |
| B-phase | 2   | White |  |
| C-phase | 3   | Blue  |  |
| GR      | 4   | Green |  |
| Brake   | 5   | Black |  |
| Brake   | 6   | Black |  |

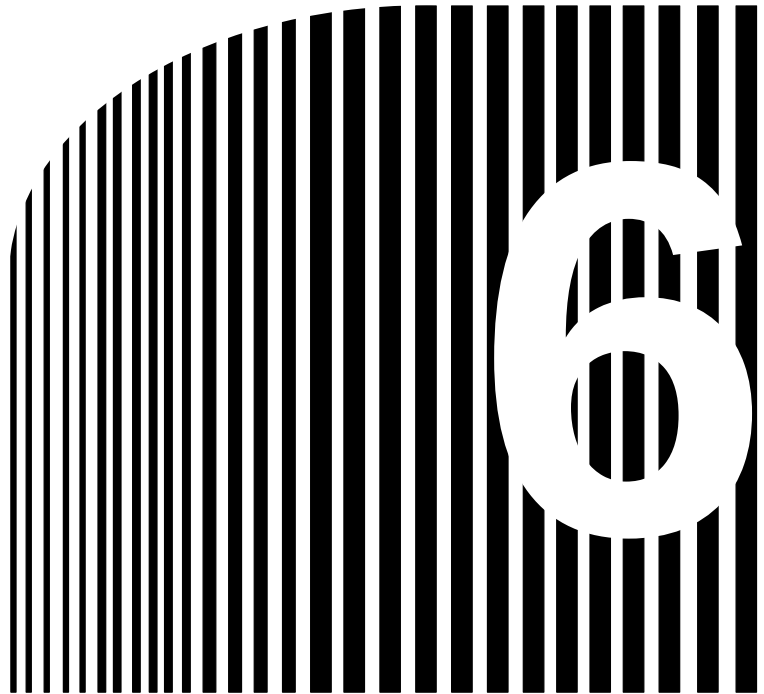
Cable: AWG18 x 6 M4 Crimp terminals  
AWG16 x 4 + AWG20 x 2  
UL2517

**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



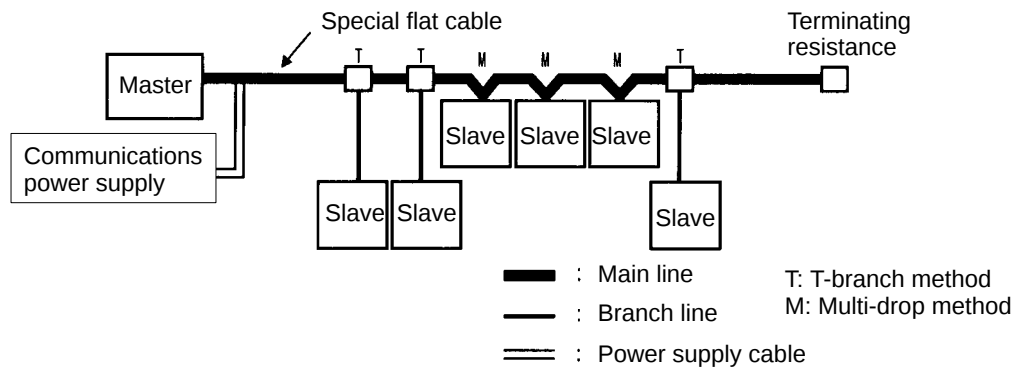
## Chapter 6

- **CompoBus/S Specifications** •

- 6-1 CompoBus/S Configuration Requirements
- 6-2 CompoBus/S Communications Specifications
- 6-3 Connecting a CompoBus/S System

## 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.

## □ 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<br>Two-core nominal cross-sectional area: 0.75 mm <sup>2</sup><br>(signal line x 2)<br>Conductor resistance (20°C): 25.1 Ω/km |
| SCA1-4F10 Special Flat Cable (length: 100 m) | Nominal cross-sectional area: 0.75 mm <sup>2</sup> x 4<br>(signal line x 2, power line x 2)<br>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)*.

## 6-2 CompoBus/S Communications Specifications

This section provides details for CompoBus/S communications.

### ☐ Communications Specifications

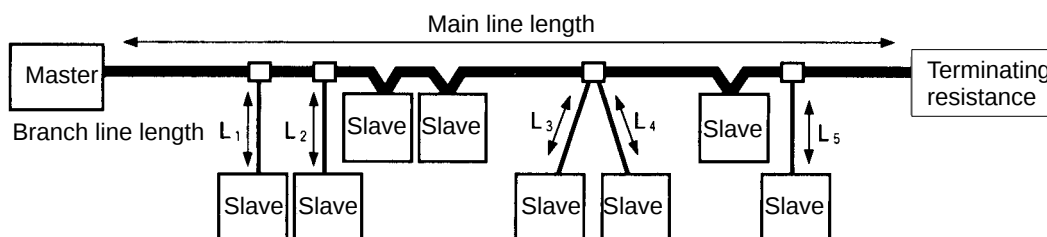
| Item                                                                                                                                                                                                                | Specifications                                                                                                                                                                                                |                    |                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|
| Communications method                                                                                                                                                                                               | Special CompoBus/S protocol                                                                                                                                                                                   |                    |                     |
| Communications baud rate                                                                                                                                                                                            | 750,000 baud                                                                                                                                                                                                  |                    |                     |
| Modulation method                                                                                                                                                                                                   | Baseband method                                                                                                                                                                                               |                    |                     |
| Coding method                                                                                                                                                                                                       | Manchester coding method                                                                                                                                                                                      |                    |                     |
| Error control checks                                                                                                                                                                                                | Manchester code check, frame length check, parity check                                                                                                                                                       |                    |                     |
| Cable used                                                                                                                                                                                                          | Vinyl cord, VCTF, JIS C 3306:<br>Two-core nominal cross-sectional area: 0.75 mm <sup>2</sup> (signal line x 2) (VCTF cable)<br>Special flat cable: 0.75 mm <sup>2</sup> x 4 (signal line x 2, power line x 2) |                    |                     |
| Communications distance                                                                                                                                                                                             | VCTF Cable                                                                                                                                                                                                    |                    |                     |
|                                                                                                                                                                                                                     | Main line length                                                                                                                                                                                              | Branch line length | Total branch length |
|                                                                                                                                                                                                                     | 100 meters max.                                                                                                                                                                                               | 3 meters max.      | 50 meters max.      |
|                                                                                                                                                                                                                     | Special Flat Cable                                                                                                                                                                                            |                    |                     |
|                                                                                                                                                                                                                     | Main line length                                                                                                                                                                                              | Branch line length | Total branch length |
|                                                                                                                                                                                                                     | 30 meters max.                                                                                                                                                                                                | 3 meters max.      | 30 meters max.      |
| 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. |                                                                                                                                                                                                               |                    |                     |

| Item                                                                                        | Specifications                                                                    |                                 |                           |
|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------|---------------------------|
| Maximum number of I/O Points, maximum number of connected Slaves, communications cycle time | When a C200HW-SRM21 or SRM1-C01/02 Master Unit is Used (for C200HX/HG/HE, C200HS) |                                 |                           |
|                                                                                             | Max. number of I/O points                                                         | Maximum number of Slaves        | Communications cycle time |
|                                                                                             | IN: 64; OUT: 64                                                                   | IN:8; OUT: 8                    | 0.5 ms                    |
|                                                                                             | IN: 128; OUT: 128                                                                 | IN: 16; OUT: 16                 | 0.8 ms                    |
|                                                                                             | When a CQM1 Master Unit is Used (For CQM1)                                        |                                 |                           |
|                                                                                             | Max. I/O points                                                                   | Maximum number of Slaves        | Communications cycle time |
|                                                                                             | IN: 64; OUT: 64                                                                   | IN:8; OUT: 8 (in 8-pt. mode)    | 0.5 ms                    |
|                                                                                             |                                                                                   | IN: 16; OUT: 16 (in 4-pt. mode) | Cannot be used.*          |
|                                                                                             | IN: 32; OUT: 32                                                                   | IN:4; OUT: 4 (in 8-pt. mode)    | 0.5 ms                    |
|                                                                                             |                                                                                   | IN:8; OUT: 8 (in 4-pt. mode)    | Cannot be used.*          |
| IN: 16; OUT: 16                                                                             | IN:2; OUT: 2 (in 8-pt. mode)                                                      | 0.5 ms                          |                           |
|                                                                                             | IN:4; OUT: 4 (in 4-pt. mode)                                                      | Cannot be used.*                |                           |
| *The 4-point mode cannot be used when an FND-X Position Driver is connected.                |                                                                                   |                                 |                           |

**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.



$$\text{Total branch line length} = L_1 + L_2 + L_3 + L_4 + L_5$$

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.

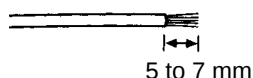
## 6-3 Connecting a CompoBus/S System

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

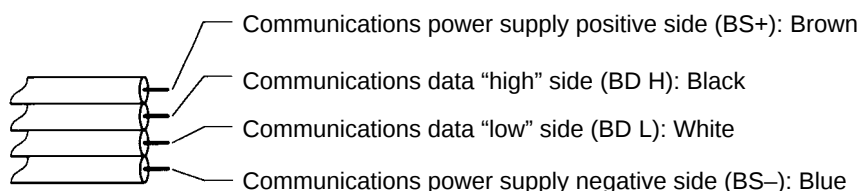
When connecting CompoBus/S cable to the Position Driver, follow the procedure shown below to prepare the cable.

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).

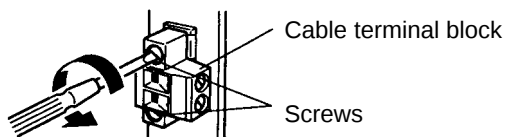
For special flat cable, the signal wires are as shown below.



2. When using special flat cable, the two power supply signal wires must be insulated.

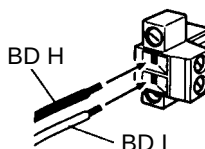
### □ Connecting Communications Cable

1. Use a flat-head screwdriver to loosen the Position Driver's two CompoBus/S communications terminal screws, and remove the cable terminal block.

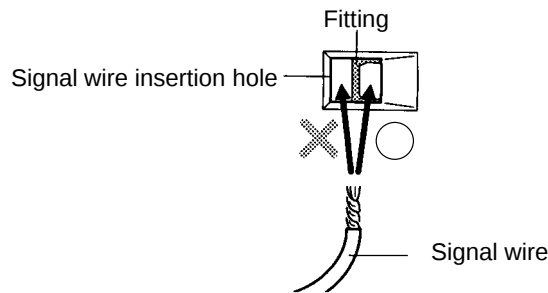


**Note** If the communications cable can be connected by simply tightening the screws, the cable terminal block need not be removed.

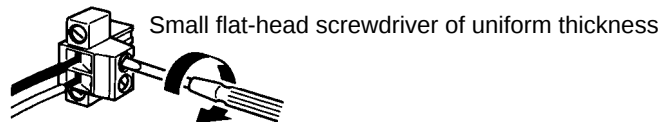
2. Loosen the screws that fasten the signal wires to the cable terminal block, and carefully insert the two signal wires into their respective holes in the terminal block.



**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.

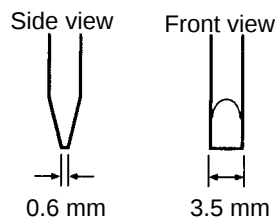


3. Tighten the cable terminal block screws to the proper torque of 0.5 N·m for each signal wire. Use a small flat-head screwdriver with of uniform thickness. A normal screwdriver which is thin only at the end will not fit all the way in.

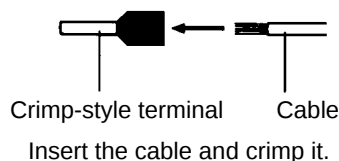


**Note** The XW4Z-00C Screwdriver is available from OMRON especially for this task.

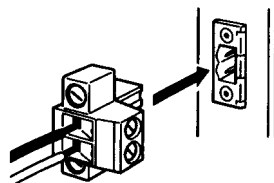
Shape of screwdriver's head



The A1 Series by Phoenix Contact is recommended as a crimp-style terminal for the cable. Phoenix Contact also supplies the ZA3 as a special-purpose tool.

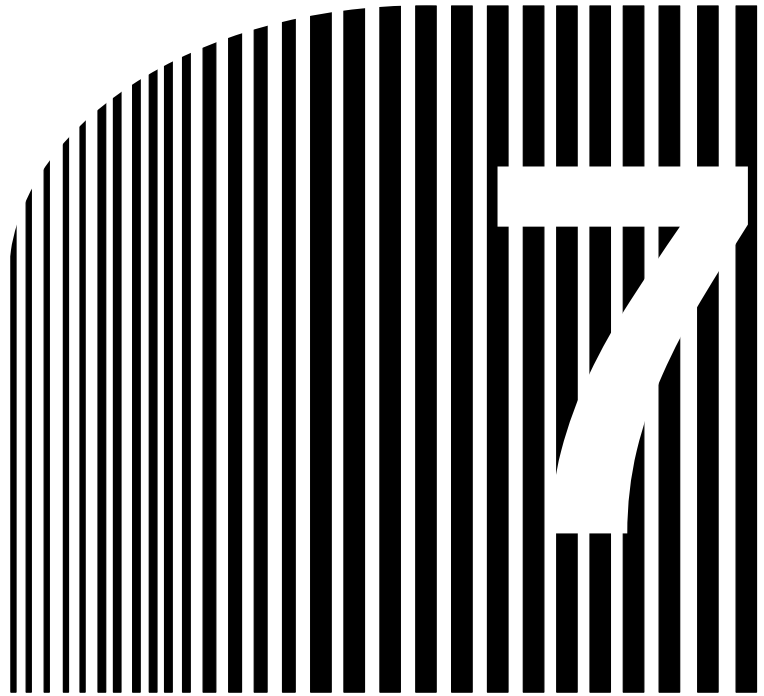


4. Be careful to match the directions of the cable terminal block and the Position Driver's terminal block, and insert the cable terminal block. Be sure to push it all the way in.



**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.



## Chapter 7

### • Appendices •

7-1 Standard Models

7-2 Parameter Settings Tables

## 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<br>(With connector on one end.) | 1 m | FND-CCX001S |
|                                                         | 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<br>Connector-Terminal Board | 1 m | R88A-CTU001N |
|                                                  | 2 m | R88A-CTU002N |

☐ **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-CN01C  |

**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 |

☐ **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 |

☐ **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.

☐ **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 |

☐ 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 |

□ 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”).

☐ **Encoder Cable for U-series 30 to 750-W AC Servomotors Conforming to UL/cUL Standards**

| Specifications                                                                 |            | Model        |
|--------------------------------------------------------------------------------|------------|--------------|
| For Servomotors with incremental encoders.<br>(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    |
| For Servomotors with absolute encoders.<br>(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.<br>(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     |
| For Servomotors with absolute encoders.<br>(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.<br>(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    |

☐ **Encoder Cable for U-UE-series AC Servomotors Conforming to EC Directives**

| Specifications                                                                 |           | Model         |
|--------------------------------------------------------------------------------|-----------|---------------|
| For Servomotors with incremental encoders.<br>(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.<br>(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.

☐ **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    |
| 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    |

☐ **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    |
| 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    |

☐ **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 |

## 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:<br>11: Point positioning (PTP)<br>12: Point positioning (feeder)<br>13: Direct positioning (PTP)<br>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.<br><br>OMNUC U Series with incremental encoder:<br>8,192 pulses/rotation<br>OMNUC U Series with absolute encoder: 4,096 pulses/rotation<br>OMNUC U/U-UE Series with:<br>4,096 pulses/rotation<br>OMNUC H Series with absolute encoder: 8,000 pulses/rotation<br>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.<br>"0.00" sets trapezoidal acceleration and deceleration.                                                                                                                                                                                                                                                                                                         | No                 |           |
| 16      | Brake mode                              | ---       | 0 to 3        | 0               | 0: Dynamic brake<br>1: On-hold brake (stops in deceleration time)<br>2: On-hold brake (stops after rotation according to error counter's accumulated number of pulses)<br>3: On-hold brake (free-running stop)                                                                                                                                                                                                             | Yes                |           |

| 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.<br>0<br>└ Positive voltage<br>0: Not reversed<br>1: Reversed<br>└ Speed/Current selection<br>0: Current<br>1: Speed                                                                       | No                 |           |
| 26      | Motor rotation direction                  | ---          | 0, 1           | 0               | Specifies motor rotation direction.<br>0: Forward rotation<br>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.<br>Specifies rate based on rated motor r/min as 100%.<br>* 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.<br>* 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 $\Omega$ | 0.0 to 100.0   | 0.0             | Specifies the regeneration absorption value ( $\Omega$ ).<br>* Only valid for FND-X50H- .<br>* When using an OMRON-made external Regeneration Resistor, set to 30.0 ( $\Omega$ ).                                            | Yes                |           |
| 31      | External regeneration resistance capacity | 0.01 kW      | 0.00 to 327.67 | 0.00            | Specifies the regeneration absorption capacity (kW).<br>Only valid for FND-X50H- .                                                                                                                                           | Yes                |           |

□ H Parameters (HP-33, HP-46)

| No.<br>HP- | Name                                | Min.<br>unit | Setting<br>range | Factory<br>setting | Explanation                                                                                                                        | Re-power<br>required? | Set<br>value |
|------------|-------------------------------------|--------------|------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------|
| 33         | Load rate<br>time                   | 1 s          | 1 to 60          | 30                 | Specifies interval for effective<br>load factor calculation to value<br>obtained from machine cycle<br>time multiplied by integer. | No                    |              |
| 46         | In-position<br>timer (See<br>note.) | 3.2 ms       | 3.2 to<br>320.0  | 3.2                | Specifies minimum positioning<br>completion ON time and<br>minimum READY signal OFF<br>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  $\geq$  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.

□ 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.<br>* 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.<br>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.<br>* 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.<br>* 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                 |           |

| 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.<br><br>* 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.<br><br>* 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.<br>0: Forward direction<br>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.<br><br>* 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.<br><br>* 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.<br><br>* 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                 |           |

| No.<br>PP- | Name                                             | Min.<br>unit | Setting<br>range | Factory<br>setting | Explanation                                                                                                                                                                                      | Re-power<br>required? | Set<br>value |
|------------|--------------------------------------------------|--------------|------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------|
| 23         | Deceleration<br>time 1                           | 1 ms         | 0 to<br>9,999    | 100                | Specifies time spent in decelerating reference speed to a stop.<br><br>* This value is valid if the Position Driver is in point positioning operation.                                           | No                    |              |
| 24         | Deceleration<br>stop mode                        | ---          | 0 to 2           | 1                  | Selects stop method with STOP signal OFF.<br>0: Free-running stop<br>1: Deceleration stop<br>2: Error counter reset stop                                                                         | No                    |              |
| 25         | Alarm selection                                  | ---          | 00 to 11         | 11                 | Selects alarm processing method with limit or soft limit detection.<br><br>└─ Overrun<br>0: Servo-lock stop<br>1: Servo-free alarm<br>└─ Soft limit<br>0: Servo-lock stop<br>1: Servo-lock alarm | No                    |              |
| 26         | Selection signal output<br>time (See<br>note 2.) | 0.8 ms       | 0.8 to<br>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  $\geq$  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.

□ 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)<br>–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              | <p>Selects acceleration/deceleration time for positioning.</p> <ul style="list-style-type: none"> <li>└ Acceleration <ul style="list-style-type: none"> <li>0: Acceleration time 0</li> <li>1: Acceleration time 1</li> </ul> </li> <li>└ Deceleration <ul style="list-style-type: none"> <li>0 Deceleration time 0</li> <li>1: Deceleration time 1</li> </ul> </li> </ul> |
| r      | Point No. operation mode selection            | ---                  | 0 to 2                   | 0               | <p>0: Independent operation mode<br/>1: Automatic incremental mode<br/>2: Continuous operation mode</p>                                                                                                                                                                                                                                                                    |

**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      |               |              |               |                |                                         |                    |

| No.<br>Pd- | Position data |              |               | Speed data<br>(F) | Acceleration/<br>deceleration<br>selection (A) | Operation<br>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         |               |              |               |                   |                                                |                       |
| 26         |               |              |               |                   |                                                |                       |
| 27         |               |              |               |                   |                                                |                       |
| 29         |               |              |               |                   |                                                |                       |
| 29         |               |              |               |                   |                                                |                       |
| 30         |               |              |               |                   |                                                |                       |
| 31         |               |              |               |                   |                                                |                       |
| 32         |               |              |               |                   |                                                |                       |
| 33         |               |              |               |                   |                                                |                       |
| 34         |               |              |               |                   |                                                |                       |
| 35         |               |              |               |                   |                                                |                       |
| 36         |               |              |               |                   |                                                |                       |
| 37         |               |              |               |                   |                                                |                       |
| 38         |               |              |               |                   |                                                |                       |
| 39         |               |              |               |                   |                                                |                       |
| 40         |               |              |               |                   |                                                |                       |
| 41         |               |              |               |                   |                                                |                       |
| 42         |               |              |               |                   |                                                |                       |
| 43         |               |              |               |                   |                                                |                       |
| 44         |               |              |               |                   |                                                |                       |
| 45         |               |              |               |                   |                                                |                       |
| 46         |               |              |               |                   |                                                |                       |
| 47         |               |              |               |                   |                                                |                       |
| 48         |               |              |               |                   |                                                |                       |
| 49         |               |              |               |                   |                                                |                       |
| 50         |               |              |               |                   |                                                |                       |

| No.<br>Pd- | Position data |              |               | Speed data<br>(F) | Acceleration/<br>deceleration<br>selection (A) | Operation<br>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                |           |

# Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. I524-E1-2



Revision code

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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