**Instruction Manual**

LINEARSERV

# Direct Drive Motor <LINEARSERV> Intelligent Drive <DrvPIII> Instruction Manual

IM 71M02D04-01E

YOKOGAWA ◆
Yokogawa Electric Corporation

IM 71M02D04-01E
10th Edition:2012.12.01

# _ Introduction

## Overview of This Manual

This manual provides information about LINEARSERV, a direct drive servo motor. Make sure to refer to this manual when you use the motor.

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## Strategic Goods Advisory

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# _ Conventions

**Symbols used in this manual**

Throughout this manual, the following symbol marks are used to distinguish explained information.


DANGER : Describes cautions for avoiding danger in potentially hazardous situations that may put operators' lives and bodies in danger such as electric shock accident.

WARNING : Describes points to be noted in situations that may cause damages to software and/or hardware or system troubles.

CAUTION : Describes important points when understanding operations and functions.

TIP : Describes supplementary information about descriptions.

SEE ALSO : Describes items and pages that should be referenced.

# _ Precautions

### ▯ Precautions Regarding this Manual

- Please make sure this manual is made available to all end users.
- Do not operate the product before reading this manual and thoroughly understanding its contents.
- This manual was created to provide detailed explanations of the functions offered by the product. It is not guaranteed that it will suit any particular purpose a customer might have.
- The reproduction or copying of any portion of this manual is strictly prohibited without prior permission from Yokogawa Electric.
- The information provided in this manual is subject to change without notice.
- If you have any questions or find any errors and/or omissions in the information provided in this manual, please contact our Sales Department or the dealer from whom the product was purchased.

### ▯ Precautions Regarding Protection, Safety and Product Modification

- To ensure your protection and that of the product, as well as the systems that use the product, please observe all safety instructions and other precautions listed in this manual.
- If you operate the product in a manner contrary to the instructions provided in this manual, the safety protection may be lost. In such an event, we make no warranties for the quality, performance, functions and safety of the product.
- If you install protection/safety circuits for the product or systems that use this product, make sure to install them on the product separately and externally. Do not install them inside the product, nor should any internal parts of the product be modified in order to do so.
- Be sure to replace any parts and consumables of the product with parts specified by us.
- This product is neither designed nor manufactured to be used under conditions that may directly affect the safety of humans including in nuclear or radiation-related devices, railway facilities, aircraft instruments, marine instruments, air-navigation facilities or medical devices. If it is necessary to apply the product in systems that directly affect the safety of humans, it is the user's own responsibility to construct a system for securing the safety of humans with devices and equipment other than the applicable product.
- Modification of the product is strictly prohibited.

### ▯ Product Disclaimer

- We make no warranty for the product except as prescribed by the guarantees.
- We assume no responsibility for damages any user or third party may incur through use of the product, nor for any direct or indirect damages that the user or a third party may incur due to product defects that cannot be predicted by us, etc.

**Software**

- We make no warranties for the software except as prescribed by the guarantees.
- Copying and use of the software for any purpose other than as intended by us, such as for use as a backup, is strictly prohibited.
- Keep the original storage media of this software in a safe place. If you do not have the original media, we may decline to offer our prescribed quality warranty and maintenance services.
- Reverse engineering of the software, including reverse compilation and reverse assembly, is strictly prohibited.
- The transfer, exchange or subleasing of any part of the software for unwarranted use by a third party is prohibited without prior permission from Yokogawa Electric.

WARNING

This is a Class A product, and it is designed for use in the industrial environment. Please use this in the industrial environment only.

**General Precautions Regarding LINEARSERV**

- Never install the motor in reverse, such as by fixing the slider of the motor and making the mounting plate move.
- When removing the drive's side panel to set jumpers or other items, be sure to turn the power supply OFF before doing so. It is dangerous to touch the high-voltage parts inside the unit.
- Be sure to ground the ground terminal to the earth.
- The clearance between the slider and the mounting plate is approximately 0.1 mm. Dirt or foreign substances adhering to the mounting surface may cause failures.
- Prepare a fixture on the load side for the cables that connect to the connectors of the slider, or fix them on the slider side using the cable attachment screws of the slider, etc., so that external force is not applied to the connectors. Failure to do so may lead to disconnection or breakdown.
- The optional cables provided by Yokogawa are consumables and have a limited life.
- Be sure that the mounting screws of a load never reach or exceed the effective screw depth of the slider.
- The motor's surface is magnetized. Keep objects that are affected by magnetism away from the motor.
- The motor structure is not resistant to dust, splashing or water (oil). When mounting the motor, please refer to the section "Specification/Installation, Precautions for Transportation and Storage" in this manual. Foreign substances and grease entering the encoder unit may cause malfunction and failure.
- The motor unit contains glass materials. Avoid subjecting it to vibration and impact.

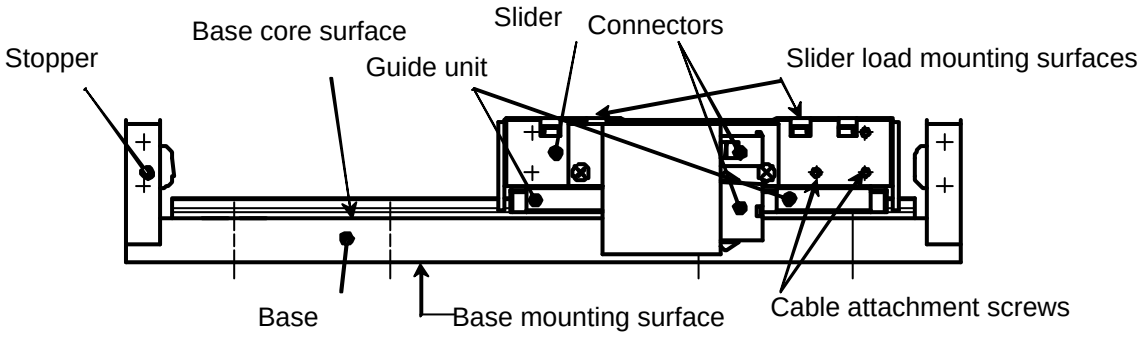



**Figure viewed from the connector side**

- The motor mounting plate of a product whose surface treatment suffix code is "N" is coated to prevent rust. Prior to mounting, wipe the coating of the base mounting surface completely with petroleum or chlorine solvent. If any coating remains, mechanical precision and function may be impaired. Please see the section "Installation" in this manual.

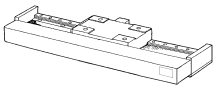
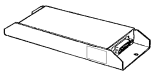
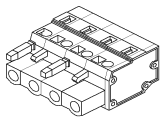
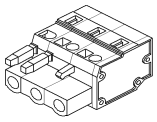
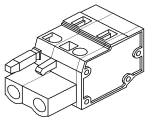
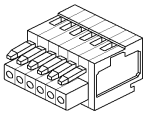
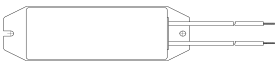
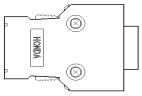
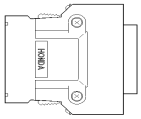
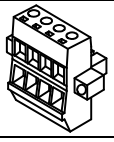
- The stopper in the motor is not intended to absorb impact during operation. Please prepare separate equipment for protection/safety procedures, such as a stopper and shock absorber. Refer to the section "Specification/Installation, Precautions for Transportation and Storage" in this manual.
- Be sure not to interfere with the movable area, including the load part, while the motor is operating. You may be injured if a hand is placed between the slider and the stopper, or if the movable part is touched.
- The guide unit requires grease for lubrication. Driving the motor under insufficiently lubricated conditions may lead to damage and failure. Please see the section "Maintenance/Inspection" in this manual.
- If you use the screw holes located above and below the box of the DrvPIII drive, be certain the tips of the screws penetrate no more than 8mm for the 500W and 2kW classes, or 6mm for the 4kW class, below the drive's surface. If this precaution is not observed, it may cause an electric shock, short circuit and/or damage to the motor.
- The drive should be installed on an appropriate metal cabinet, observing the safety measures prescribed by the Low Voltage Directive and EMC Directives.
- Interchangeability between motors and drives is possible only if the drive and the motor are compatible. In other words, the LINEARSERV motor's three-digit model code (LM□□□) must match that of the drive (UM1LP3-□□□) if you wish to change the combination and use the motor with a different drive unit.
- In the LINEARSERV series, each motor has been tuned to operate with a specific head amplifier. If the combination is different, the motor may not operate normally, or one or more devices may be damaged. Please combine and use a motor and head amplifier having the same model code, serial number and slider number.
- If the product is installed in such a way that cables are bent in the machine, etc., be sure the minimum bend radius of the cable is 50mm or more. Moreover, do not install cables such that they are bent repeatedly. It may cause disconnection and failure.
- Do not conduct over-voltage tests. Circuitry in the drive or motor may become damaged as a result of these types of destructive tests.
- Never attempt to disassemble or modify the motor or drive. We assume no responsibility if you disassemble or modify them.
- Disconnect all power and wait 7 minutes before servicing. May cause electric shock. The high voltage is applied to the regenerative resistor terminal. In general, it is necessary to wait 7 minutes for 2kW and 4kW classes or 4 minutes for 500W class until the voltage lowers to the safe level after powering off.
- Do not remove the separator attached in the regenerative resistor terminal of a drive. The separator is attached to the model with which the regenerative resistor is not supplied so that regenerative resistor may not be connected accidentally, and so that it cannot touch carelessly.
- If the motor moves in repeated reciprocating motion less than 20mm stroke, carry shakedown cruise for 50mm or longer over 10 times by every 10,000 reciprocating motions.
- Prepare a fixture in the control panel or on the machine, fix the cables to the fixture near the connectors, so that external force is not applied to the connectors.

- A part of machine parameters overwrites the related parameters when the power is recycled, if those parameters are changed. “10.0x (Data Sum Error)” may rarely occur in case that the control power supply is terminated before LED for RDY signal is lighted when the power is recycled. If this error occurs, restore user data, which was backed up beforehand, after initialization of user parameters (Backed up parameter values are set).
- Make sure not to terminate control power supply while All-Reset function is in execution. All-Reset needs more 5 (five) seconds for the completion. “10.0x (Data Sum Error)” may occur in case that the control power supply is terminated in this while. Execute All-Reset again if the error occurs.
- Utility software includes several functions, which recycle AC main power automatically. “10.0x (Data Sum Error)” may rarely occur in case that the control power supply is terminated before LED for RDY signal is lighted when the power is recycled. If this error occurs, restore user data, which was backed up beforehand, after initialization of user parameters (Backed up parameter values are set).
- If you turn off the power after the occurrence of overload error, please turn on the power after more than 10min.
  If this error occurs again, please review the operating conditions.

# Table of Contents

# 1. Checking the Product

Please check the product as soon as you receive it. Please examine the label and check that the types and quantities of the parts and products received, as well as accessories you have ordered, are correct. Perform a visual inspection to ensure that there are no abnormalities in their appearance.
If you received a different product than you ordered or the product does not conform to your expectations, please contact us or the dealer from whom you purchased the product immediately.

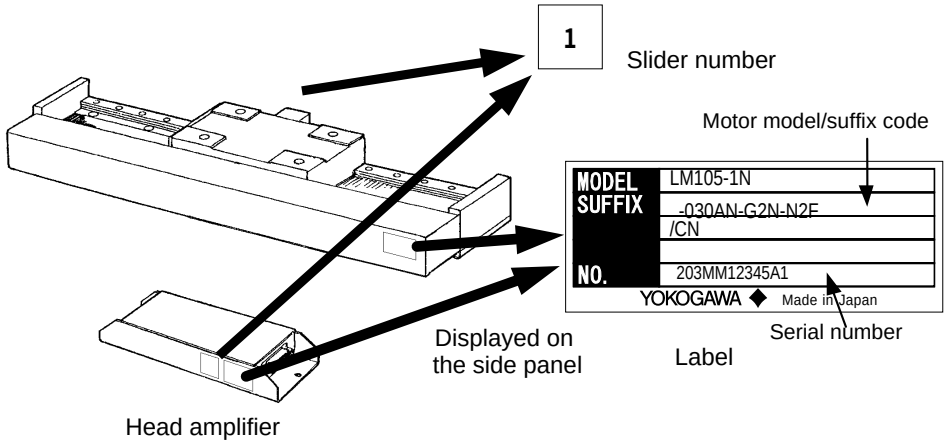
| Name of product/accessory | | Shape | Remarks |
|---|---|---|---|
| Motor unit | Motor unit |  | |
| | Head amplifier |  | Paired with a motor and tuned |
| Drive unit | Drive | The shape varies depending on the model. | Standard accessories (one piece per drive) |
| | TB1 power supply terminal connector (231-204/026-000 WAGO) |  | |
| | TB2 motor terminal connector (231-203/026-000 WAGO) |  | |
| | TB3 regeneration terminal connector (231-202/026-000 WAGO) |  | Models provided regenerative resistors (one piece per drive) See the table on the next page |
| | Screw-less terminal lever (231-131 WAGO) |  | Standard accessories (one piece per drive) |
| | TB4 sensor terminal connector (733-106 WAGO) |  | |
| | Regenerative resistor |  | Models provided regenerative resistors (one piece per drive) See the table on the next page |
| | CN2 encoder/resolver connector (PCR-S20FS, PCR-LS20LA1 Honda Tsushin Kogyo) |  | Supplied when order includes the additional suffix code "/CN." |
| | CN4 controller interface connector (PCR-S36FS, PCR-LS36LA Honda Tsushin Kogyo) |  | Supplied when the order includes contact I/O "XA" and additional suffix code "/CN." |
| | CN4 controller interface connector (TMSTBP 2, 5/4-ST-5, 08 Phoenix Contact) |  | Supplied when the order includes CC-Link "C1" and additional suffix code "/CN." |
| Option cables | | | Optional |

### List of Models Provided with Regenerative resistors

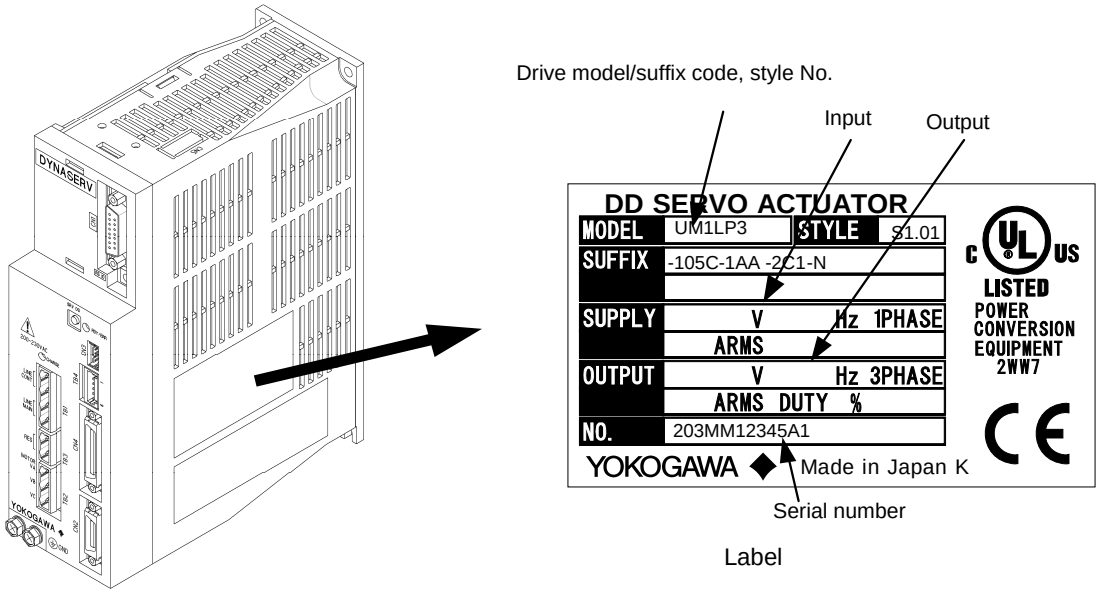
A regenerative resistor is provided for the models listed in the table below.

| Model | Suffix code | Regenerative resistor | |
|---|---|---|---|
| UM1LP3 | -240□-□□A-1□□-N | 80W | 60 Ω |
| | -330□-□□A-1□□-N | | |
| | -530□-□□A-1□□-N | | |
| | -240□-□□A-2□□-N | 80W | 200 Ω |
| | -330□-□□A-2□□-N | | |
| | -530□-□□A-2□□-N | | |

### Faceplate of the Motor




### Faceplate of the Drive



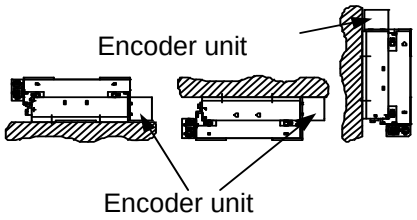
# 2. Precautions at Installation, Moving and Storage

## 2.1 Installation of the Motor

Mounting the motor the wrong way or at an inappropriate position may cause the deterioration of accuracy, shortening of the product's lifetime and a failure of the motor. Please be sure to observe the following precautions.

**Mounting Direction**

Mount the motor in one of the directions shown in the figures at right. If the motor is to be mounted vertically, mount it so that the encoder unit faces upward. If foreign substances or grease enter the encoder unit, the motor may malfunction or break down.




**Installation Location**

The motor is intended to be used in normal indoor conditions.

- Well ventilated places with little dust and debris
- Avoid installing the motor in an atmosphere with high temperature/high humidity or which contains dust, dirt, metal powder, corrosive gasses, etc.

| | | Motor | Remarks |
|---|---|---|---|
| Application | Temp. | 0 ~ 45°C: Standard<br>0 ~ 40°C: CE continuous operation rating | |
| | Humidity | 20 ~ 85% RH | There must be no condensation. |
| Average | Temp. | -20 ~ 85°C | |
| | Humidity | 20 ~ 85% RH | There must be no condensation. |
| Atmosphere | | There must be no corrosive gasses, dirt or dust<br>Must be used at an maximum altitude of 1000 meters above sea level (CE mounting condition) | |

**Mechanical Connection**

- The levelness of the load surface with respect to the slider's load mounting surface must be 0.01 mm or less.
- The clearance between the slider and mounting plate is approximately 0.1 mm. Dirt or foreign substances adhering to the base surface may cause failures.
- The motor mounting plate of products whose surface treatment suffix code is "N" is coated to prevent rust. Before mounting, wipe the coating of the base mounting surface completely with organic solvent (e.g. thinner, hydrocarbon solvent). If any coating remains, the mechanical precision and functions may be impaired. Prevent areas other than the base mounting surface, such as the core surface and guide unit, from being subjected to the solvent and any remaining coating. Failure to do so may cause deformation and breakdown. However, do not wipe off the grease in the guide unit.
- The tightening torque of screws for mounting the mounting plate and load on the slider must be 4 Nm for M4 screws, 13 Nm for M6 screws, 35 Nm for M8 screws, and 70 Nm for M10 screws. Prevent screws from loosening by applying Loctite 601 or an equivalent product.

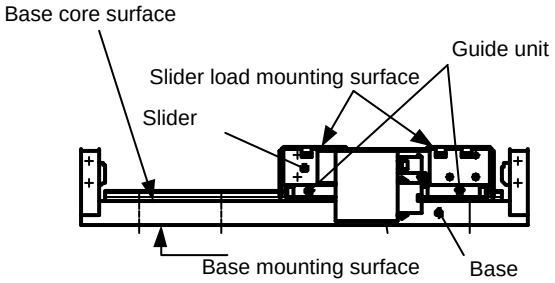



**Figure shown from the connector side**

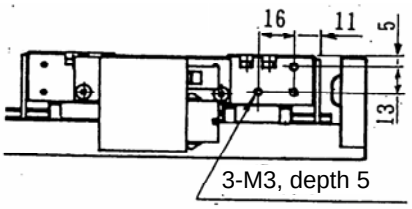
- Be sure the mounting screws of a load to the slider never reach or exceed the effective screw depth of the slider.
- The motor accuracy depends on the accuracy of the surface to which the mounting plate is attached. The surface accuracy affects the accuracy, lifetime, etc., of LINEARSERV. Therefore, the mounting plate should be mounted on a surface as accurate as possible. As a general guideline, use a reference value of 0.01 mm or less per 1000 mm of the motor's stroke length for the levelness of the mounting surface.
- Remove any burrs, dents, dirt and so forth from the surface on which the motor unit is mounted, and then place the motor unit on it carefully. Tighten the motor unit mounting bolts in the order from the center to both sides following the mounting surface. If the order of tightening the bolts is inappropriate or the bolts are tightened excessively, the motor unit may become deformed and accuracy may be impaired.

 Stopper and Shock Absorption

The stopper in the motor is not intended to absorb impact during operation. If the stopper is subjected to shock when mounting a load, the LINEARSERV and connected devices may be damaged or broken. Carefully mount an external safety stopper, impact-absorbing mechanism or similar device in order to avoid impact while the motor is operating, stopped or in transit. Please prepare separate equipment for protection/safety procedures, such as a stopper and shock absorber.

 Fixing Cables on the Slider

There are power and encoder cables exiting the connector parts at two places on the slider. During installation, fix the cables on the slider's side surface. Screw holes for that purpose are located on the slider's side surface. (See the figure below in the case of <LM105>, where cables are taken out to the right, or see the external appearance diagram for other models.) The connectors in the slider are for connecting the power cable and encoder cable. Prepare a fixture on the load side for the cables connected to the connectors of the slider, or fix them on the slider side using the cable attachment screws of the slider, etc., so that external force is not applied to the connectors. Failure to do so may lead to disconnection or breakdown.




<In the case of the LM105 model, where cables are taken out to the right>

## 2.2 Installation of the Drive

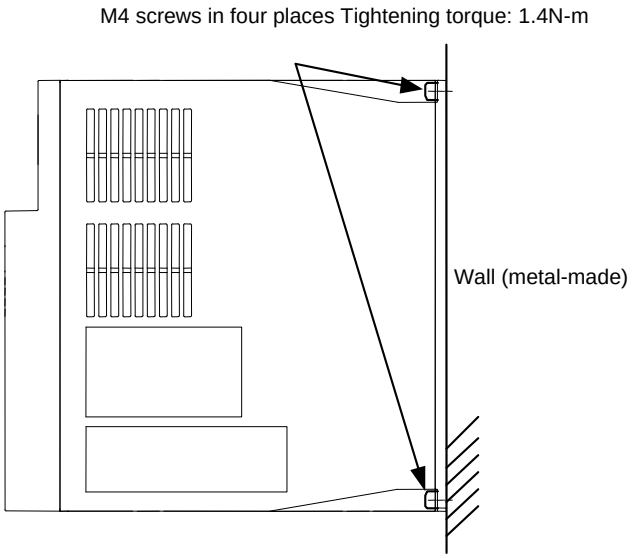
### ■ Installation Location

- Be sure to install the drive correctly in the control panel or on the machine.
- If there are other heating elements near the drive, make sure to prevent the temperature from becoming too high by installing a shield cover or similar protective device. Ensure that the temperature around the drive does not exceed 50°C.
- If there are vibration sources near the drive, install the drive using a vibration-proof material.
- Avoid installing the drive in an atmosphere with high temperature/high humidity or which contains dust, dirt, metal powder, corrosive gasses, etc.

| | | Drive environment specification | Remarks |
|---|---|---|---|
| At operation | Ambient temperature | 0 ~ 50°C | |
| | Ambient humidity | 20 ~ 90% RH | There must be no condensation. |
| At storage | Ambient temperature | -20 ~ 85°C | |
| | Ambient humidity | 20 ~ 90% RH | There must be no condensation. |
| Atmosphere | | There must be no corrosive gasses, dirt or dust. Must be used at an maximum altitude of 1000 meters above sea level (CE mounting condition) | |

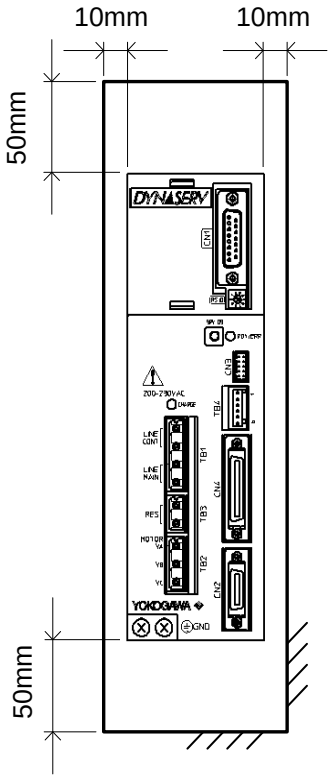
### ■ Installation Procedure

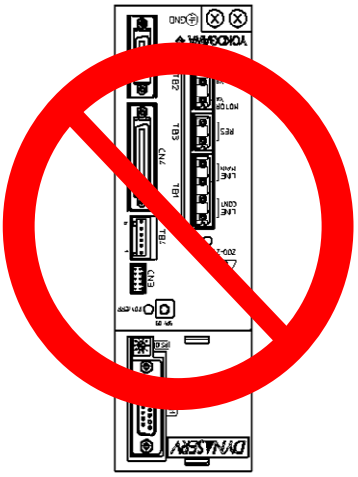
The drive is intended to be mounted on a vertical surface. Use the four mounting holes in the die cast section, and mount the drive securely to a metal plate.
If you use flat washers, use washers whose external diameter is 8mm (ISO).



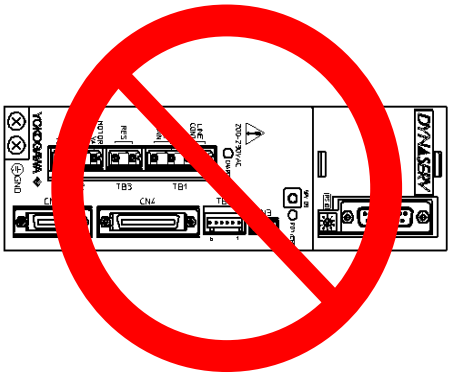
 500W Class Drives

- This drive utilizes convection (fanless) air cooling.
- Install the drive with the front panel facing forward. Do not install it with the panel surface facing upward or downward, up side down or sideways (see the figures below).
- Allow a clearance of 50mm or more above and below the drive and 10mm or more on the left and right sides for ventilation.
- The power consumption used by the drive itself is 30W.



Do not install up side down



Do not install sideways

## 2.3 Conformed Standards

In order to conform to the EMC directive, it is necessary to obtain certification for the entire equipment, including Yokogawa Electric's motor and drive, and control devices and electric components used in the customers' equipment.
The conformity of equipment to the EMC directive varies depending on the structure of control devices and components used in equipment, and wiring. It is the customers' responsibility to check and certify equipment's conformity.

**□ Motor**

- Low Voltage Directive (declaration) IEC34-1
- EMC directive (declaration) EN55011 class A group 1, EN61800-3

**□ Drive**

- Low Voltage Directive (declaration) EN50178
- EMC directive (declaration) EN55011 class A group 1, EN61800-3
- UL508C

**[Conformation to UL standard]**

The drive is certified to conform to the following UL standard:
Conformance with standard UL508C (File No. E238911)

**[UL Standard Certification Conditions and Safety Precautions]**

(i) Use 60/75 degrees Celsius CU wire only.
(ii) Open Type Equipment. Be sure to install the drive in the control panel before using it. It cannot be used if hung on a wall.
(iii) Suitable for use on a circuit capable of delivering not more than 5000 Arms symmetrical amperes, 240V maximum.
(iv) Distribution fuse size marking is included in the manual to indicate that the unit shall be connected with a Listed Class RK1 Fuse with the current ratings as shown in the table below:

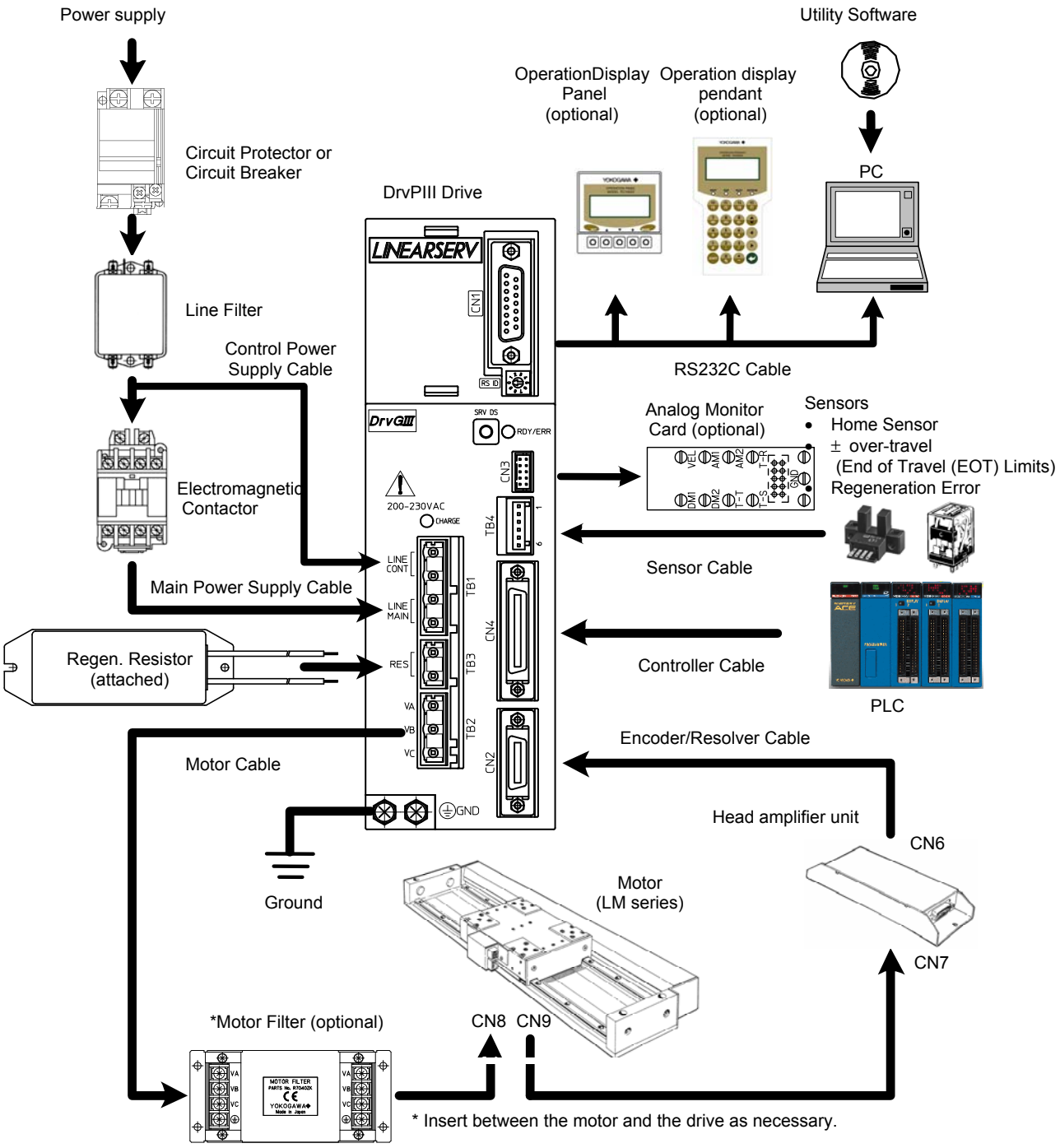
| Model No. | Class RK1 Fuse |
|---|---|
| All 500 W models | 5 [A] |
| All 2kW models | 15 [A] |

(v) Maximum surrounding air temperature 50 degrees Celsius.
(vi) CAUTION - Risk of Electric Shock - Capacitor discharge time is at least 7min.
(vii) CAUTION - Risk of Electric Shock - More than one disconnect switch may be required to deenergize the equipment before servicing.
(viii) Solid state motor overload protection is provided in each model.
(ix) Install device in pollution degree 2 environment.
(x) WARNING - Hot Surface – Risk of Burn.
(xi) Drive has no provision for motor over temperature protection.
Motor over temperature protection is required at end application.

# 3. Wiring

## 3.1 Overall Connection

### 3.1.1 Connection Diagram



### 3.1.2 Circuit Protector

| Drive | Circuit protector | | Fuse(Note 1) |
|---|---|---|---|
| | Model | Specification | |
| 500W class | CP32FM/5W (Fuji Electric) | 250VAC, 5A | LISTED CLASS RK1 5A |
| | CP30-BA2P1M5A (Mitsubishi Electric) | 250VAC, 5A | |
| 2kW class | CP32FM/15W (Fuji Electric) | 250VAC, 15A | LISTED CLASS RK1 15A |
| | CP30-BA2P1M15A (Mitsubishi Electric) | 250VAC, 15A | |

Notes: 1. If you acquire UL standard with this device, please use the above-mentioned fuse.

**!** DANGER

The drive does not have a built-in ground protection circuit. Install a ground-fault interrupt circuit with short-circuit protection or a ground-fault interrupt circuit for ground protection together with a circuit breaker if safety is of high priority in the system.

### 3.1.3 List of Recommended Parts

| Drive | Electromagnetic contactor | Line filter | | Motor filter |
|---|---|---|---|---|
| | | Model | Specification | |
| 500W class | SC11AA-M10 (Fuji Electric) | FN2070-6/06 (SCHAFFNER) | Single-phase AC 250V, 6A | R7040ZK (Yokogawa Electric) |
| | S-N11 (Mitsubishi Electric) | | | |
| 2kW class | SC18AA-M10 (Fuji Electric) | FN2070-10/06 (SCHAFFNER) | Single-phase AC 250V, 10A | |
| | S-N18 (Mitsubishi Electric) | | | |

| Drive | Sensors (EOT Limits and Home) | Relay |
|---|---|---|
| Common for 500W and 2kW classes | EE-SX670 (Omron) | MY2-D DC24V (Omron) |

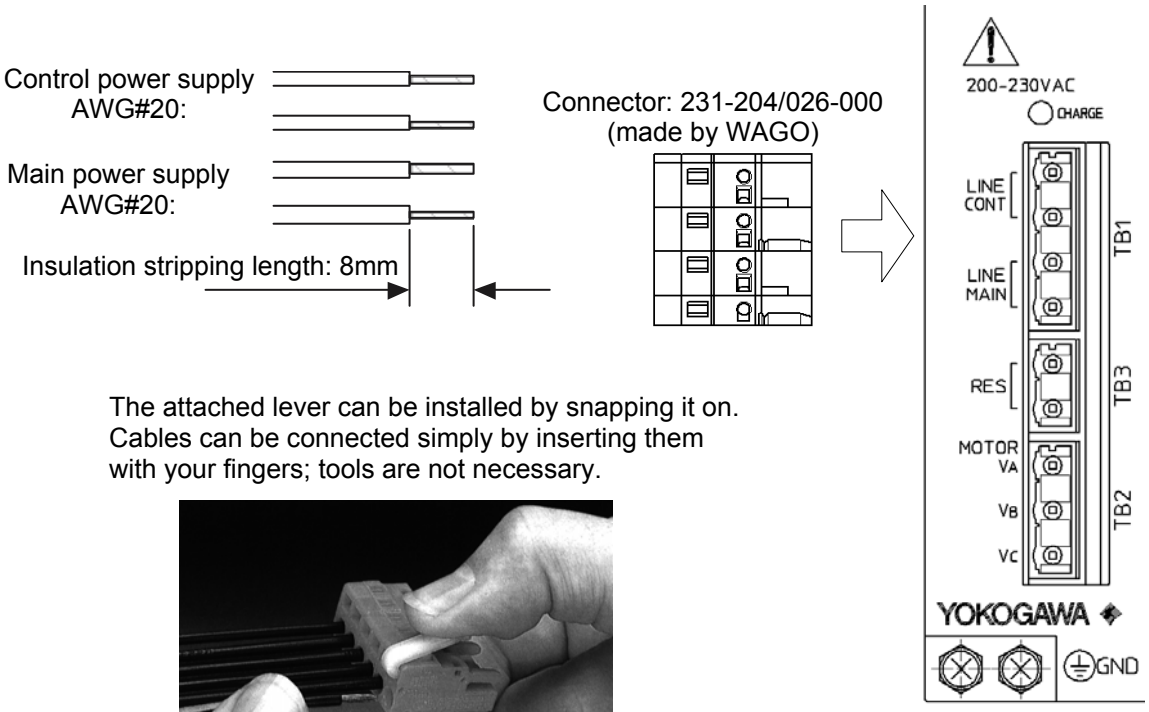
Notes: 1. Make sure to select parts that accommodate the total capacity of the system if two or more drives are used in the system.
2. Insert a motor filter as necessary.

### 3.1.4 List of Cable Specifications

**□ 500 W Class Drive Connection Cables**

| Cable | Specification | Current |
|---|---|---|
| Main power supply | AWG#20 (2.0mm$^2$) or more, length 30m or less | 6A |
| Control power supply | AWG#20 (0.5mm$^2$) or more, length 10m or less | 1A |
| Motor | AWG#20 (0.5mm$^2$) or more, length 15m or less | 6A |
| Ground | AWG#14 (2.0mm$^2$) or more<br>(Use as thick a cable as possible.)<br>Class 3 ground (ground resistance 100 Ω or less) | |
| Sensors (Limits and Home) | AWG#28 ~ 20 (0.08 ~ 0.5mm$^2$) | |
| Encoder/resolver | AWG#24 (0.2mm$^2$) twisted pair cable with a common shield, external diameter ∅9mm or less, length 10m or less | 0.1A |
| Head amplifier | AWG#22 (0.3mm$^2$) twisted pair cable with a common shield, external diameter ∅9mm or less, length 5m or less | |
| Controller | AWG#28 ~ 20 (0.08 ~ 0.5mm$^2$) cable with a common shield, external diameter ∅14mm or less, length 3m or less | 0.5 A |
| RS232C | Dedicated cable: C1P-ENN-2276-020 (2.0m) | |

## 3.2 Main Power Supply/Control Power Supply Terminal <TB1>

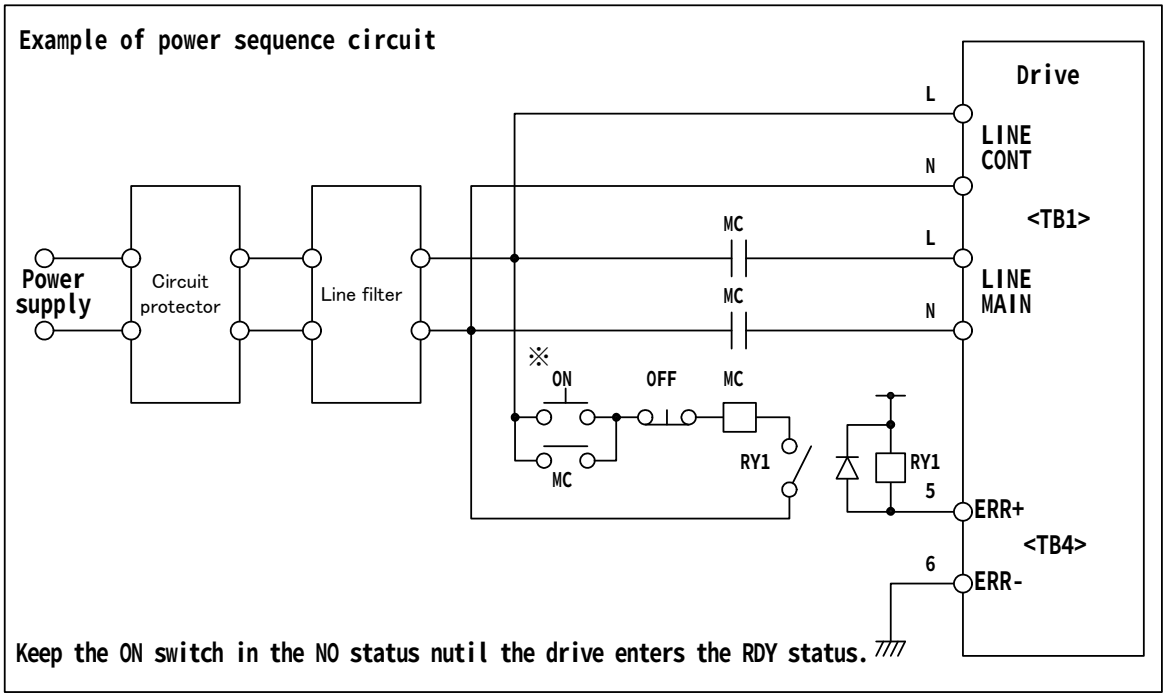



The attached lever can be installed by snapping it on.
Cables can be connected simply by inserting them with your fingers; tools are not necessary.



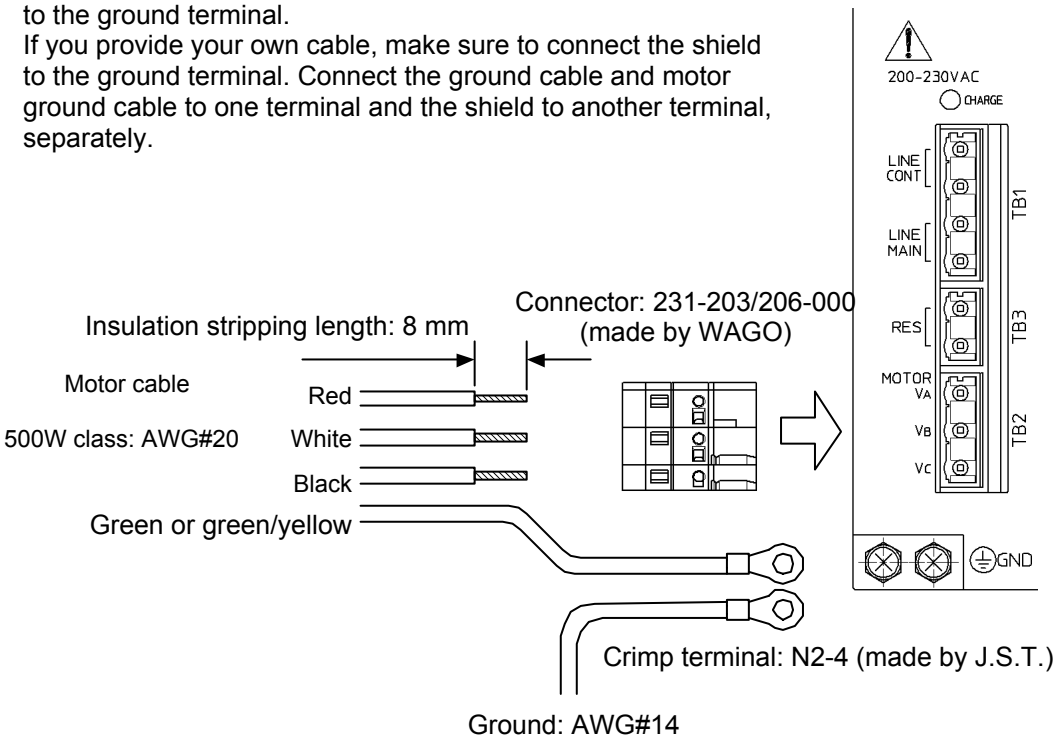
CAUTION

Set up a sequence circuit similar to the one shown below in order to avoid accidents where the drive burns out in case of over-voltage errors and regeneration errors.



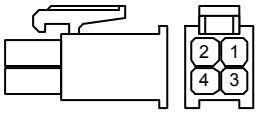
## 3.3 Motor Terminal/Ground <TB2>

Yokogawa's motor cables are twisted pair cables with a common shield with the motor ground cable. The shield is connected to the ground by connecting the motor ground cable to the ground terminal.
If you provide your own cable, make sure to connect the shield to the ground terminal. Connect the ground cable and motor ground cable to one terminal and the shield to another terminal, separately.



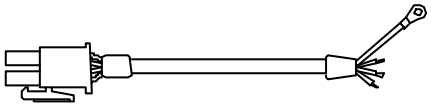

Terminal on Motor Side <CN8>

Housing: 172167-1 or 172338-1 (made by AMP)
Terminal: 170366-3 (made by AMP)
Manual tool : 755331-1 (made by AMP)




| Pin # | Signal name |
|---|---|
| 1 | $V_A$ |
| 2 | $V_B$ |
| 3 | $V_C$ |
| 4 | GND |

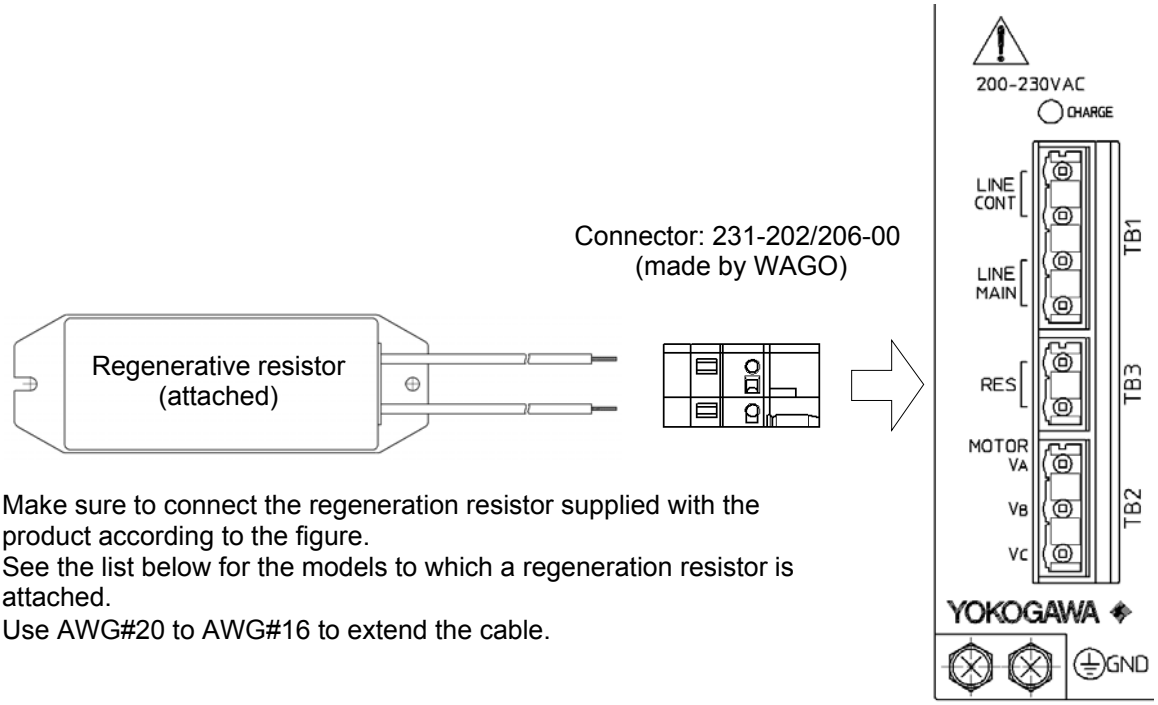
**Cable Specifications**

| Cable | Specification |
|---|---|
| Motor | AWG#20 (0.5mm$^2$) or more, length 10 m or less |
| | Optional cable: C1M-NA1-2061-□□□  |
| Ground | AWG#14 (2.0mm$^2$) or more<br>(Use as thick a cable as possible.)<br>Class 3 ground (ground resistance 100Ω or less)<br>Tightening torque of the terminal screws:<br>1.2N-m (12kgf-cm) (terminal screws: M4 x 0.7) |

DANGER

Make sure to perform ground in order to avoid electric shock accidents. Moreover, make sure to connect the GND terminals of the motor and the drive.

## 3.4 Regenerative resistor Terminal <TB3>




- Make sure to connect the regeneration resistor supplied with the product according to the figure.
  See the list below for the models to which a regeneration resistor is attached.
- Use AWG#20 to AWG#16 to extend the cable.

**□ List of Models Provided with Regenerative resistors**

| Model | Suffix code | Regenerative resistor | |
|---|---|---|---|
| UM1LG3 | -330□-□□A-1□□-N | 80W | 60 Ω |
| | -530□-□□A-1□□-N | | |
| | -240□-□□A-1□□-N | | |
| | -330□-□□A-2□□-N | 80W | 200 Ω |
| | -530□-□□A-2□□-N | | |
| | -240□-□□A-2□□-N | | |

CAUTION

If the motor is moved by external force, etc., additional large regenerative resistors will be required, regardless of whether or not a regenerative resistor is supplied with the model. When you replace attached regenerative resistors by the thing of other capacity, or when you connect regenerative resistors to the drive to which regenerative resistor is not appended, inquire at our sales department for more information.

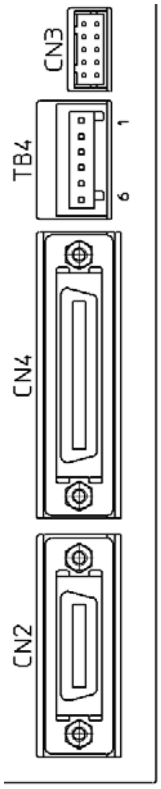
DANGER

Disconnect all power and wait 7 minutes, before servicing. Do not remove the separator attached in the regenerative resistor terminal of a drive. May cause electric shock. The high voltage is applied to the regenerative resistor terminal.

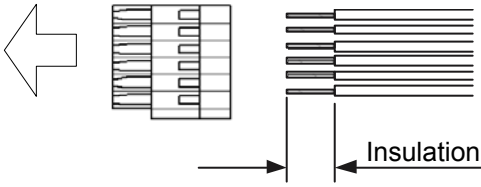
DANGER

A regenerative resistor generates high temperatures. Do not touch the regenerative resistor while operating the motor and the drive until the temperature has cooled down sufficiently.

## 3.5 Sensor Terminal <TB4>



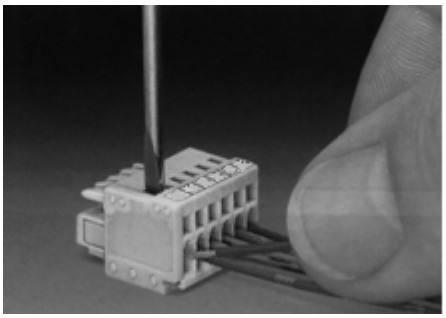

Connector: 733-106 (made by WAGO)



Wire size: AWG#28 to AWG#20

Insulation stripping length: 5mm

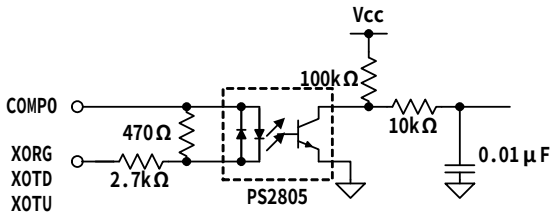
The connector can be attached through one-touch operation
by pulling down the spring in the slot in the upper part of the connector
using a drive. (The size of the tip of a drive is 2.0 x 0.4mm.)

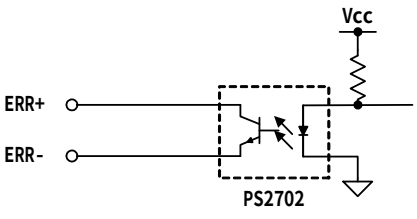


| Pin No. | Signal name | Definition |
|---|---|---|
| 1 | COMP0 | Sensor power |
| 2 | XORG | Home input B-contact |
| 3 | XOTD | - EOT input B-contact |
| 4 | XOTU | + EOT input B-contact |
| 5 | ERR+ | Regen. Resistor error output + |
| 6 | ERR- | Regen. Resistor error output - |

| Sensor input specification | |
|---|---|
| Rated voltage | 12 to 24VDC (±10%) |
| Rated input current | 4.1 mA/point (at 12VDC)<br>8.5 mA/point (at 24VDC) |
| Input impedance | 3.0 kΩ |
| Operating voltage (relative to COMP0) | Off: Less than 3.0VDC<br>On: 9.0VDC or more |
| Allowable leak current | Guarantee OFF at 1.0 mA or less |

| Regeneration error output | |
|---|---|
| Maximum service voltage | 30VDC |
| Maximum output current | 50 mA |



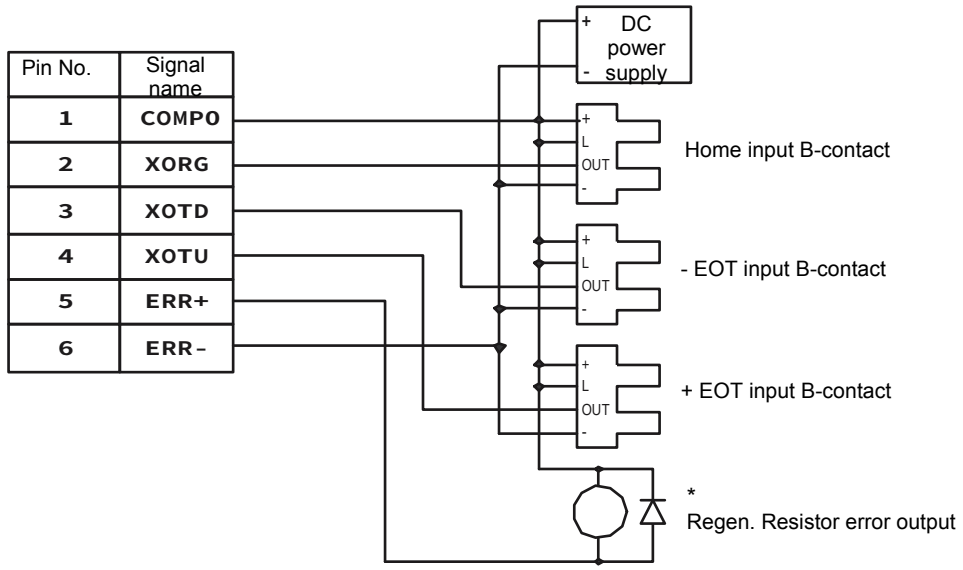

CAUTION

Make sure to set up a sequence circuit as shown in Section 3.2, "Main Power Supply/Control Power Supply Terminal <TB1>" in order to avoid accidents where the drive fails due to over-voltage errors and/or regeneration errors.

Example of sensor connection (Sensor: EE-SX670 made by Omron)

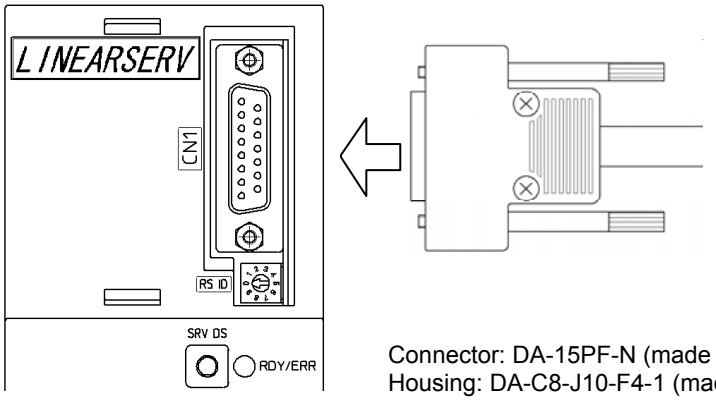
The sensor logic is connected to B-contact.
The sensor output must be set to switch OFF when the light is blocked.
The sensor of the type described above is turned off when the light is blocked by connecting cables as shown below.

| Pin No. | Signal name |
|---|---|
| 1 | COMPO |
| 2 | XORG |
| 3 | XOTD |
| 4 | XOTU |
| 5 | ERR+ |
| 6 | ERR– |




* See Section 3.2, "Main Power Supply/Control Power Supply Terminal " for more information about wiring the regeneration alarm outputs.

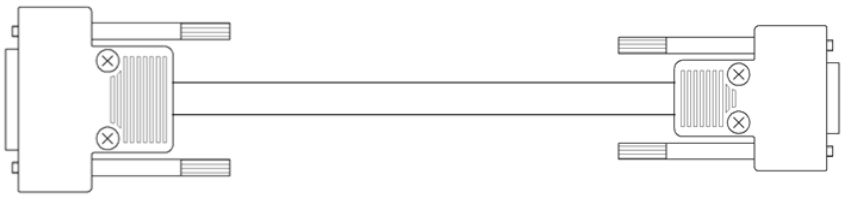
## 3.6 Serial Interface Connector <CN1>




Connector: DA-15PF-N (made by JAE)
Housing: DA-C8-J10-F4-1 (made by JAE)

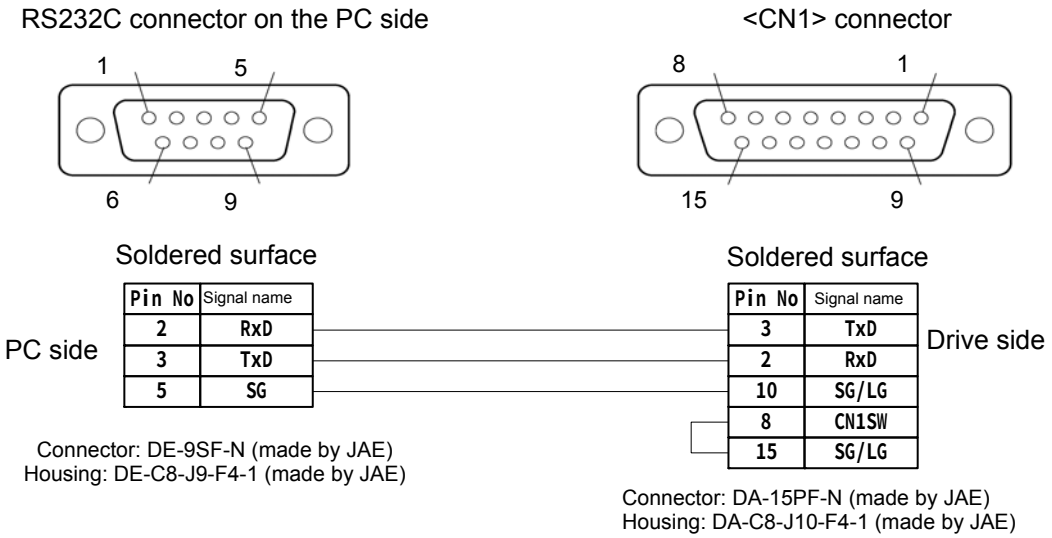
| Pin No. | Signal name | Definition |
|---|---|---|
| 1 | FG | Frame GND terminal (Shield) |
| 2 | RxD | RxD terminal RS232C single channel communication |
| 3 | TxD | TxD terminal RS232C single channel communication |
| 4 | A | Rx (+) side terminal RS485 multi-channel communication |
| 5 | Y | Tx (+) side terminal RS485 multi-channel communication |
| 6 | 485SW | Busy condition bit RS485 multi-channel |
| 7 | TRMP | Terminator terminal RS485 multi-channel communication (short circuited to #14 TRMN) |
| 8 | CN1SW | Busy condition bit CN1 |
| 9 | +5V | +5V power (operation display panel and pendant) |
| 10 | SG/LG | Signal GND terminal |
| 11 | B | Rx (-) side terminal RS485 multi-channel communication |
| 12 | Z | Tx (-) side terminal RS485 multi-channel communication |
| 13 | SG/LG | Signal GND terminal |
| 14 | TRHN | Terminator - terminal RS485 multi-channel communication (short circuited to #7 TRMP) |
| 15 | SG/LG | Signal GND terminal |

**RS232C Cable (Optional)**



C1P-ENN-2276-020 (2.0 m)

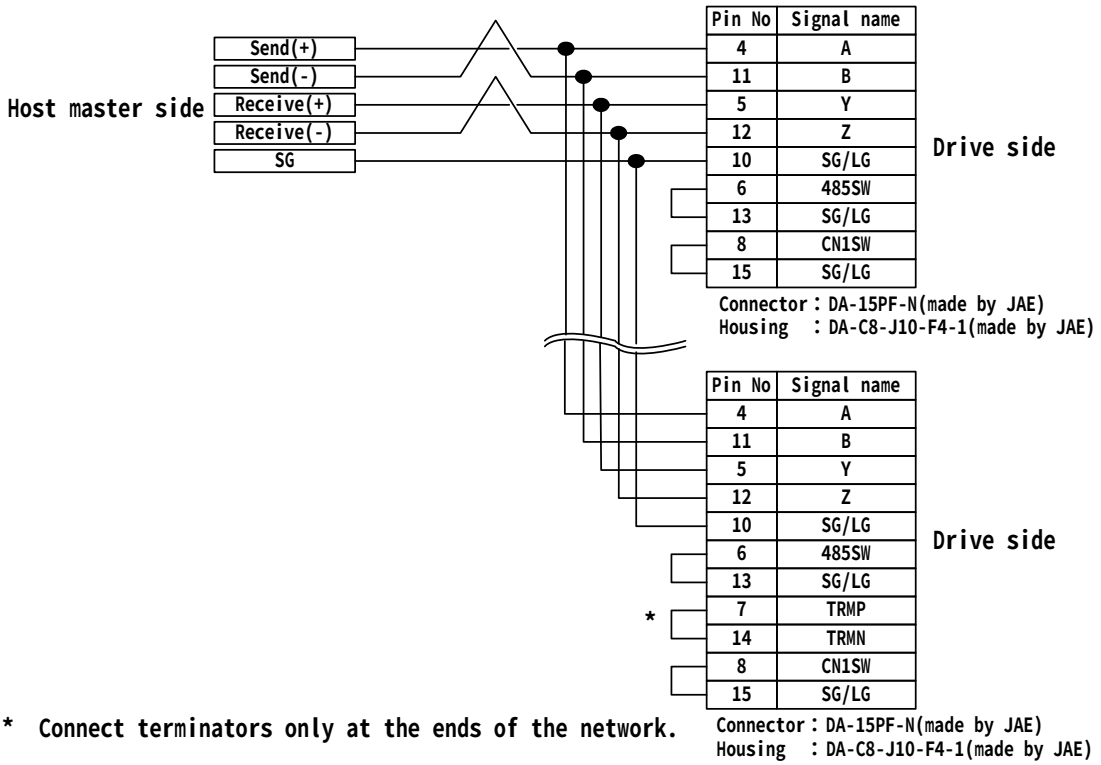
### RS232C Cable Wiring




WARNING

Do not connect any line to pins that are not specified.
Wrong connections may cause the drive and/or PC to breakdown.

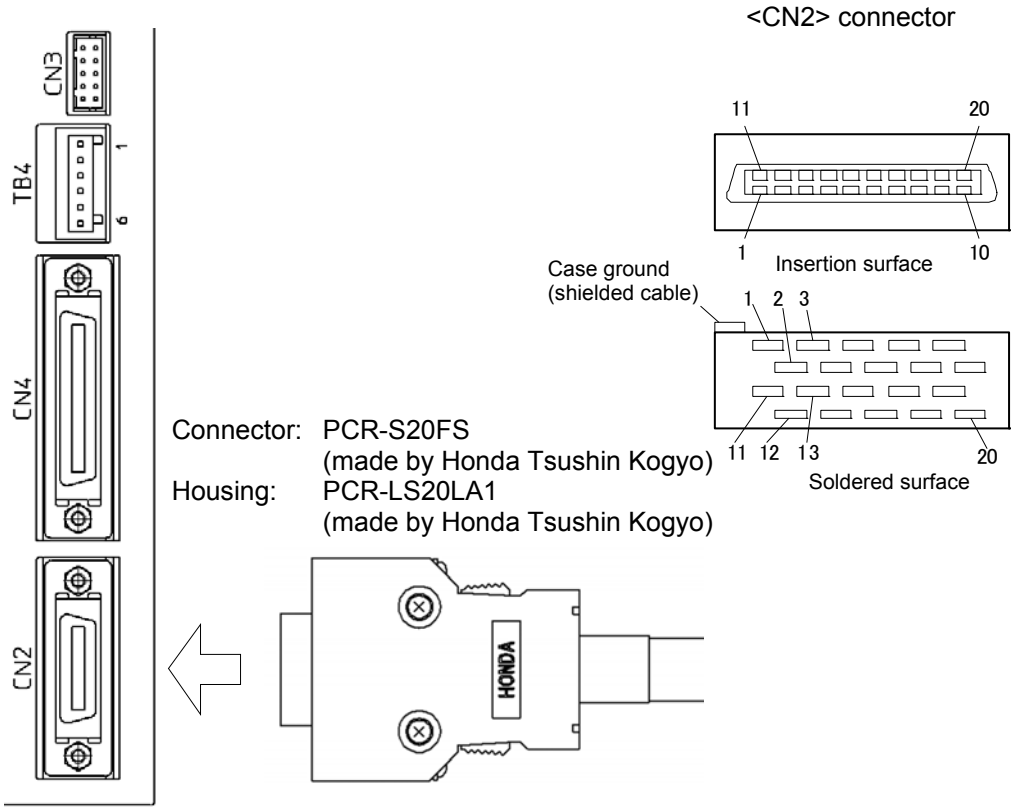
### RS485 Cable Wiring

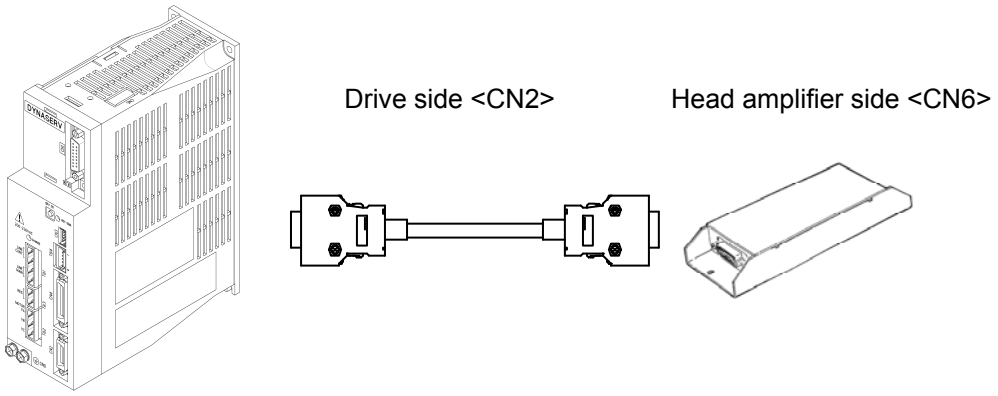



WARNING

Do not connect any line to pins that are not specified.
Wrong connections may cause the drive and/or PC to breakdown.

## 3.7 Encoder/Resolver Connector <CN2>



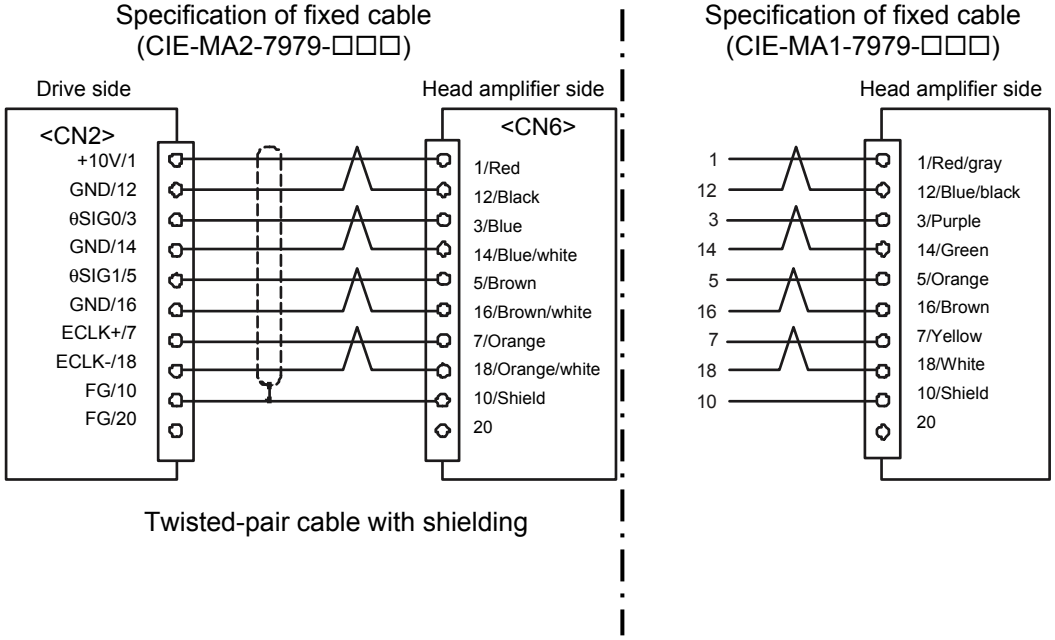

**Cable Specifications**

| Cable | Specification |
|---|---|
| | AWG#24 (0.2mm$^2$), twisted pair cable with a common shield, external diameter ∅9mm or less, length 10m or less |
| | Optional cableC1E-MA□-7979-□□□ |

### Table of Connector Signal Names and Wire Colors

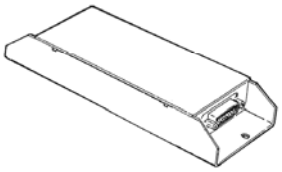
| Pin No. | Signal name | Fixed cable | Robot cable |
|---|---|---|---|
| 1 | +10V | Red | Red/gray |
| 2 | | | |
| 3 | SIG 0 | Blue | Purple |
| 4 | | | |
| 5 | SIG 1 | Brown | Orange |
| 6 | | | |
| 7 | ECLK+(3V) | Orange | Yellow |
| 8 | | | |
| 9 | | | |
| 10 | FG | Shielded cable | |
| 11 | | | |
| 12 | GND | Black | Blue/black |
| 13 | | | |
| 14 | GND | Blue/white | Green |
| 15 | | | |
| 16 | GND | Brown/white | Brown |
| 17 | | | |
| 18 | ECLK-(3V) | Orange/white | White |
| 19 | | | |
| 20 | FG | | |
| Case | | | |

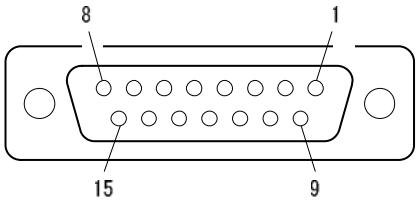
### Wiring between Head Amplifier and Drive



## 3.8 Head Amplifier Connectors <CN7, CN9>

Head amplifier side <CN7>

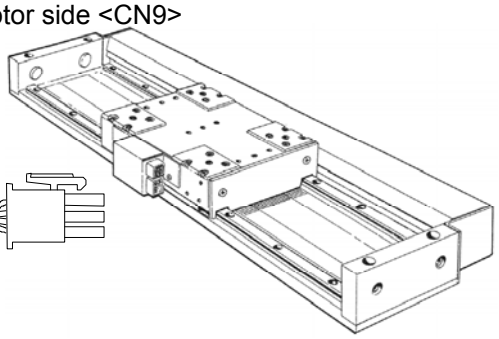


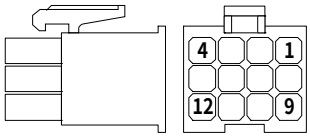



Soldered surface

Connector: DA-15PF-N (made by JAE)
Housing: DA-C8-J10-F4-1 (made by JAE)

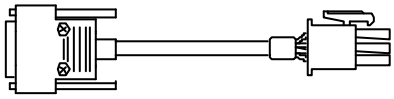
Motor side <CN9>



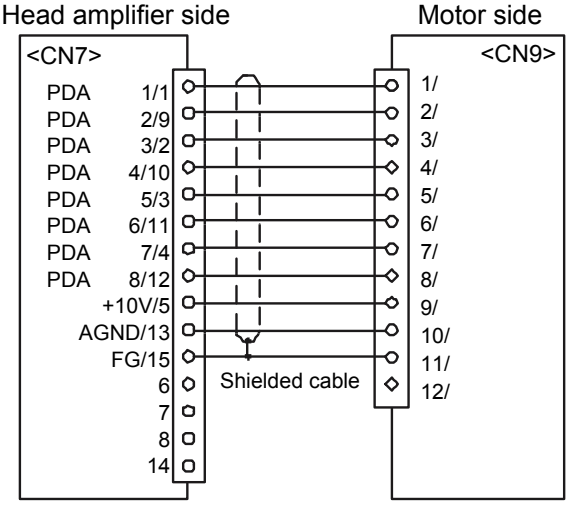



Terminal: 170365-3 (made by AMP)
Housing: 172170-1 or 172341-1(made by AMP)
Manual tool: 755330-1 (made by AMP)

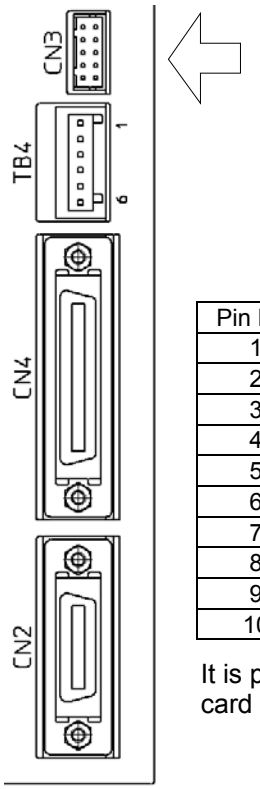
 Cable Specifications

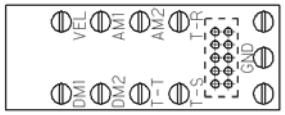
| Cable | Specification |
|---|---|
| Head amplifier | AWG#22 (0.3mm$^2$), Multi-conductor cable with a common shield, length 5 m or less<br>Use a highly flexible robot cable, as it is attached to a moving part. |
| | Optional cableC1E-MA1-2262-□□□  |

**Wiring between Head Amplifier and Motor**



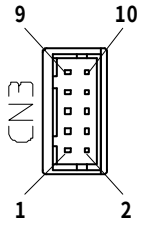
## 3.9 Analog Monitor Connector <CN3>




Analog monitor card (optional, R7041WC)

<CN3> connector




| Pin No. | Signal name | Definition |
|---|---|---|
| 1 | VEL | Velocity monitor terminal |
| 2 | AM1 | Analog monitor terminal 1 (general purpose monitor 1) |
| 3 | AM2 | Analog monitor terminal 2 (general purpose monitor 2) |
| 4 | DM1 | Digital monitor terminal 1 (general purpose monitor 1) |
| 5 | DM2 | Digital monitor terminal 2 (general purpose monitor 2) |
| 6 | T-R | Current command |
| 7 | T-T | Reserved |
| 8 | T-S | Reserved |
| 9 | <Prohibited> | Reserved Do not connect any line. |
| 10 | GND | GND terminal for monitor |

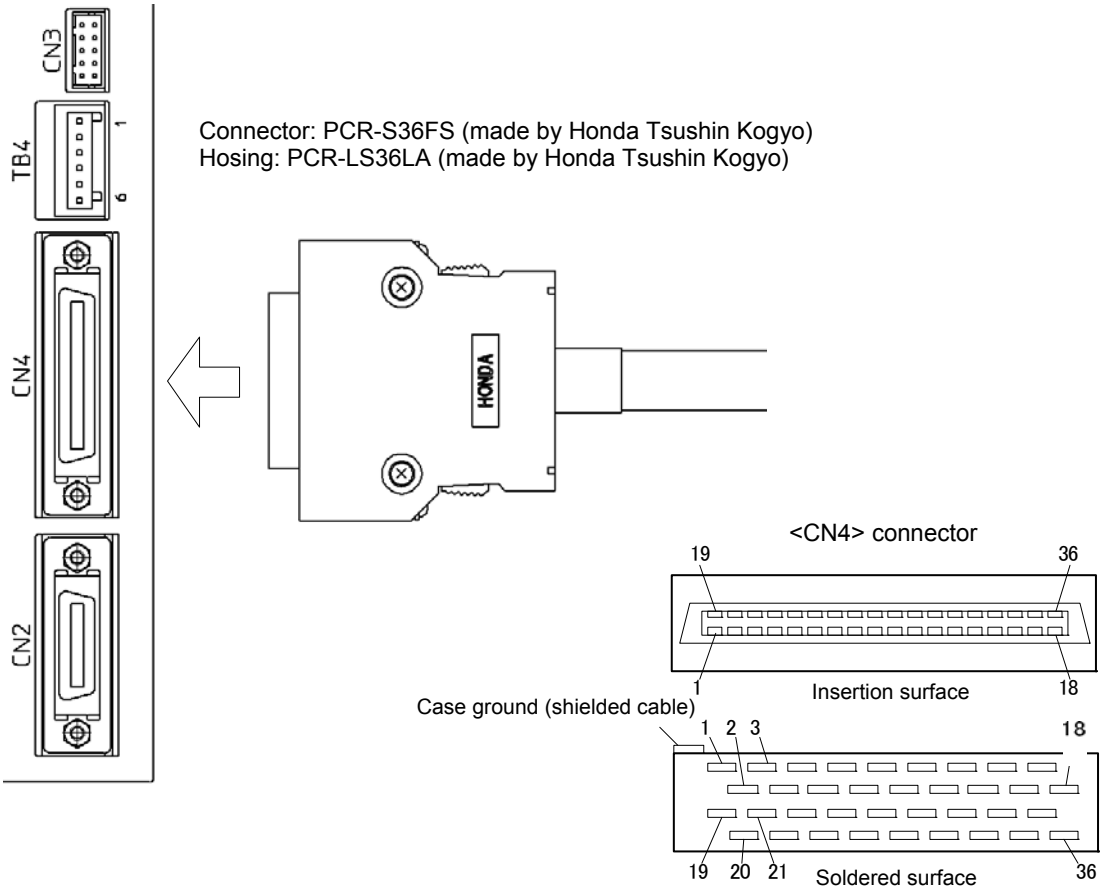
It is possible to monitor various states of the drive using the analog monitor card (optional).

CAUTION

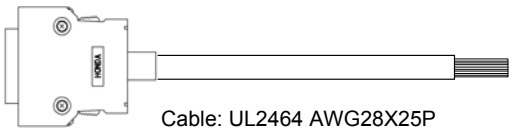
These signals are used for observation and troubleshooting only! Do not use them as feedback data to controllers. Make sure to use the analog monitor card (optional) to observe these signals.

## 3.10 Controller Interface Connector <CN4>

### 3.10.1 Contact I/O Interface




**Cable Specifications**

| | |
|---|---|
| Interface | AWG#28 to AWG#20 (0.08 ~ 0.5mm$^2$), cable with a common shield, external diameter ∅14mm or less, length 3m or less |
| | Option cable: C1P-ENN-4202-□□□  Cable: UL2464 AWG28X25P |

## ■ Table of Connector Signal Names and Wire Colors

| Pin No. | Signal name | Wire color | | Definition | Comment |
|---|---|---|---|---|---|
| | | Color | Mark | | |
| 1 | COMP1 | White | Blue or black 3 | Interface power supply + | Input appropriate power according to the interface spec. |
| 2 | COMN1 | Orange | Blue or black 1 | Interface power supply - | |
| 3 | DO_0 | Orange | Red 1 | I/O output 0 | The definition is assigned by the hard I/O assignment function. |
| 4 | DO_1 | Gray | | I/O output 1 | |
| 5 | DO_2 | White | | I/O output 2 | |
| 6 | DO_3 | Yellow | | I/O output 3 | |
| 7 | DO_4 | Pink | | I/O output 4 | |
| 8 | DO_5 | Orange | Red 2 | I/O output 5 | |
| 9 ~ 12 | (reserve) | | | | Do not connect any line. |
| 13 | Z_OUT+ | Yellow | Red 2 | Z-pulse + | Outputs the Z-pulse of the motor. |
| 14 | Z_OUT- | | Blue or black 2 | Z-pulse - | |
| 15 ~ 18 | (reserve) | | | | Do not connect any line. |
| 19 | DI_0 | Gray | Red 3 | I/O input 0 | The definition is assigned by the hard I/O assignment function. |
| 20 | DI_1 | White | | I/O input 1 | |
| 21 | DI_2 | Yellow | | I/O input 2 | |
| 22 | DI_3 | Pink | | I/O input 3 | |
| 23 | DI_4 | Orange | Red 4 | I/O input 4 | |
| 24 | DI_5 | Gray | | I/O input 5 | |
| 25 | DI_6 | White | | I/O input 6 | |
| 26 | DI_7 | Yellow | | I/O input 7 | |
| 27 | DI_8 | Pink | | I/O input 8 | |
| 28 | DI_9 | Orange | Continuous red line | I/O input 9 | |
| 29 | DI_10 | Gray | | I/O input 10 | |
| 30 | DI_11 | White | | I/O input 11 | |
| 31 ~ 36 | (reserve) | | | | Do not connect any line. |
| Shield | | | | Shield treatment terminal | Make sure to connect this. |

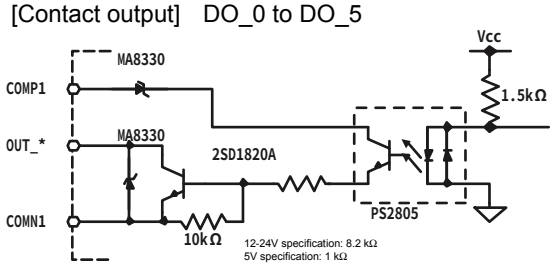
## DI/DO Initial Setting

| DO_0 to DO_5 initial setting | | | | |
|---|---|---|---|---|
| Pin No. | Signal name | Logic I/O signal abbreviation | Logic I/O signal name | Logic |
| 3 | DO_0 | OUT_SRDY | Servo ready | Positive |
| 4 | DO_1 | OUT_ERR | Error | Positive |
| 5 | DO_2 | OUT_MODE_EXE | Executing | Positive |
| 6 | DO_3 | OUT_POS | Positioning signal | Positive |
| 7 | DO_4 | OUT_AREA_0 | Area signal 0 | Positive |
| 8 | DO_5 | OUT_AREA_1 | Area signal 1 | Positive |

| DI_0 to DI_11 initial setting | | | | |
|---|---|---|---|---|
| Pin No. | Signal name | Logic I/O signal abbreviation | Logic I/O signal name | Logic |
| 19 | DI_0 | IN_EMG | Immediate stop | Positive |
| 20 | DI_1 | IN_SERVO | Servo | Positive |
| 21 | DI_2 | IN_START | Start table operation | Positive |
| 22 | DI_3 | IN_STOP | Stop table operation | Positive |
| 23 | DI_4 | IN_ABORT | Stop motion & table operation | Positive |
| 24 | DI_5 | IN_ERR_RESET | Error reset | Positive |
| 25 | DI_6 | IN_JOG_UP | Jog up | Positive |
| 26 | DI_7 | IN_JOG_DN | Jog down | Positive |
| 27 | DI_8 | IN_1_CODE. 0 | Code input 0 | Positive |
| 28 | DI_9 | IN_1_CODE. 0 | Code input 1 | Positive |
| 29 | DI_10 | IN_1_CODE. 0 | Code input 2 | Positive |
| 30 | DI_11 | IN_1_CODE. 0 | Code input 3 | Positive |

## DI/DO Contact Specifications

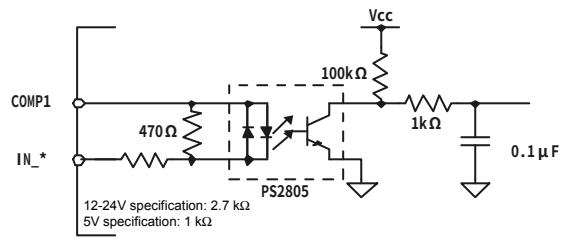
[Contact output] DO_0 to DO_5




| Interface suffix code | A | B |
|---|---|---|
| Rated voltage | 12 ~ 24VDC (±10%) | 5VDC (±10%) |
| Maximum load current | 0.1A/point, 0.5A/common | |
| Turn-On voltage | 0.5VDC or less | |
| Leakage current at off | 0.1mA or less | |

Positive logic: The output transistor switches on when the conditions for the signal are satisfied.
[Example] OUT_SRDY: The output transistor switches on when the servo is ready.

[Contact input] DI_0 to DI_11



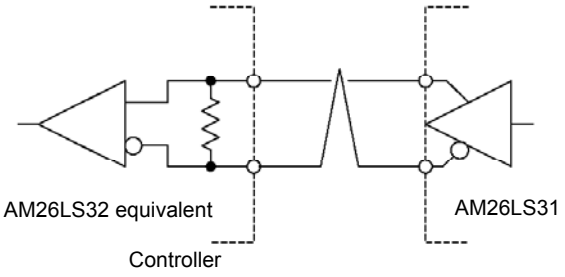

| Interface suffix code | A | B |
|---|---|---|
| Rated voltage | 12 ~ 24VDC (±10%) | 5VDC (±10%) |
| Rated input current | 4.1mA (at 12VDC) 8.5mA (at 24VDC) | 4.0mA (at 5VDC) |
| Impedance | 3.0kΩ | 1.0kΩ |
| Operating voltage (relative to COMP*) | ON: 9.0VDC or more OFF: 3.0VDC or less | ON: 4.0VDC or more OFF: 1.0VDC or less |
| Allowable leakage current | Guarantee off at 1.0mA or less | |

Positive logic: Current is conducted into the input photo-coupler when the conditions for the signal are satisfied.
[Example] IN_SERVO: Current is conducted into the photo-coupler when the servo is turned on.

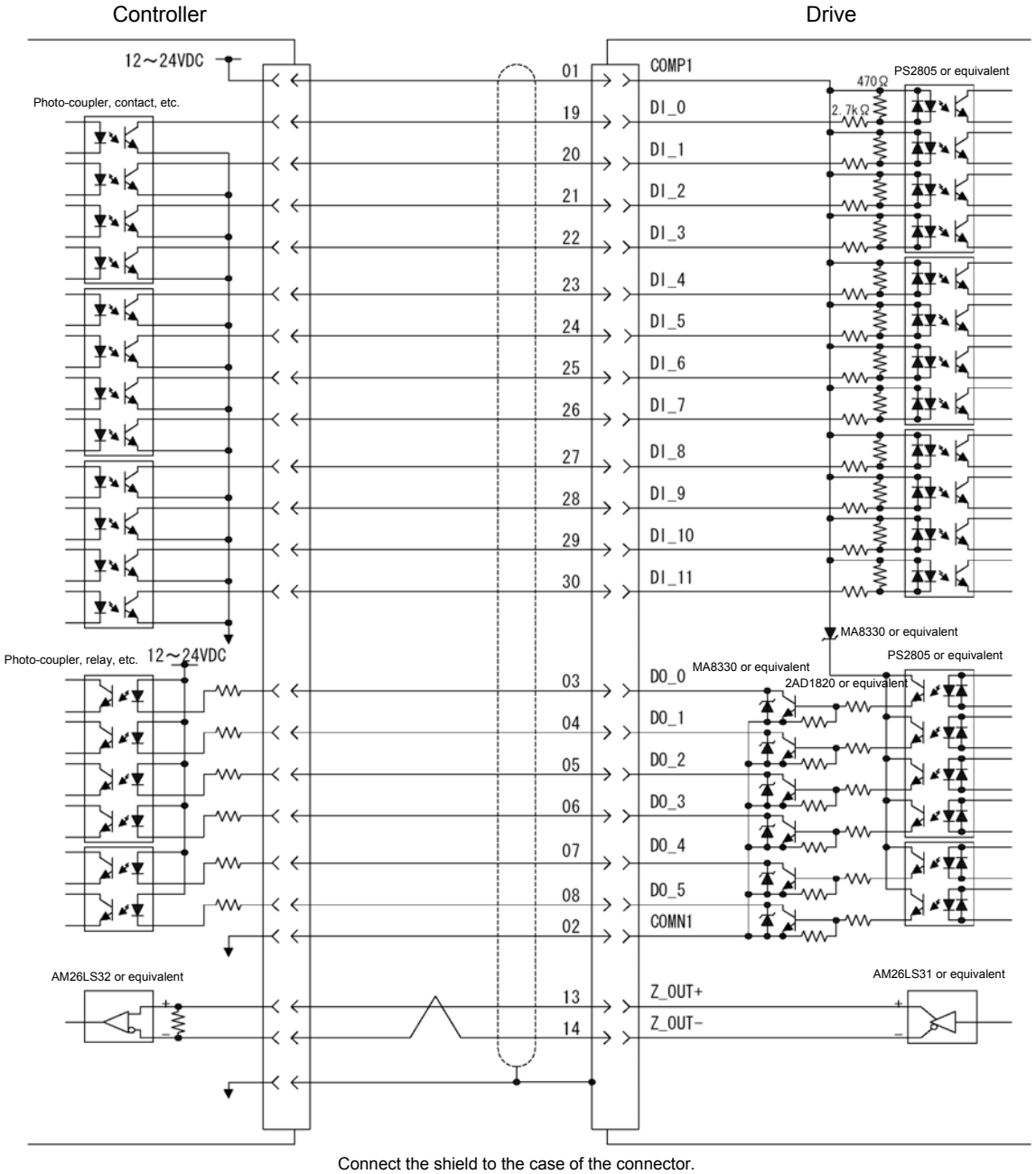
### ZERO Pulse Output Specification Z_OUT±

Connect a differential line receiver equivalent to the AM26LS32 that conforms to the RS422A standard.

**Output is on when the positive terminal has a higher voltage than the negative terminal**.

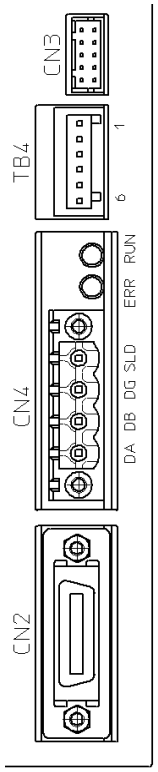



### Connection Example

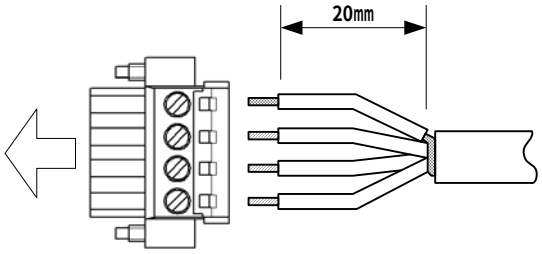



Connect the shield to the case of the connector.

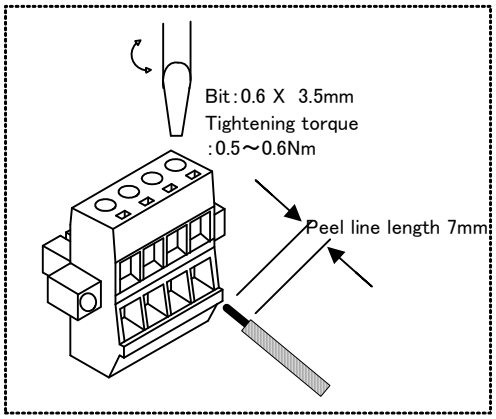
### 3.10.2 CC-Link Interface




**Connector: TMSTBP 2, 5/4-ST-5, 08 (made by Phoenix Contact)**

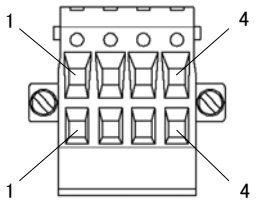



| Pin No. | Signal name | Wire color |
|---|---|---|
| 4 | SLD | - |
| 3 | DG | Yellow |
| 2 | DB | White |
| 1 | DA | Blue |




**Wiring of Communication Cable**

**<CN4> CC-Link connector**

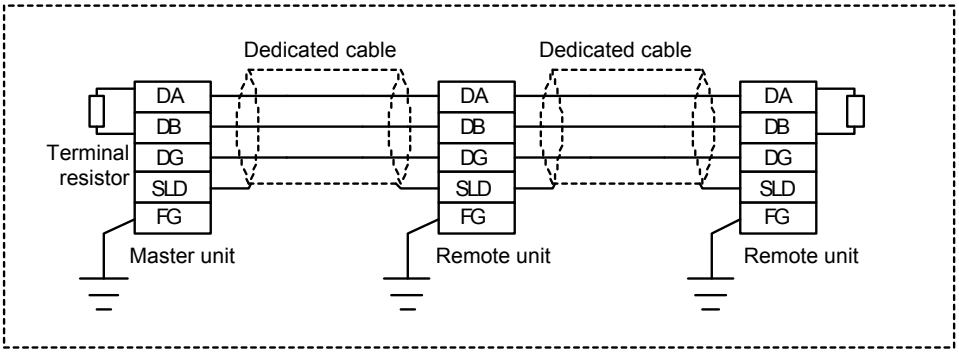



CAUTION

Please make the shield shorting (20mm or less) for the communication line malfunction so that prevent from the external noise.

**Unit Connection Method**

The following shows an example of typical configuration when connecting via CC-Link. The transmission path method employed is the bus method (EIA RS-485 compliant). The system configuration varies with customers. For more information, refer to user's manuals or other documents for the CC-Link master station main unit and CC-Link interface.



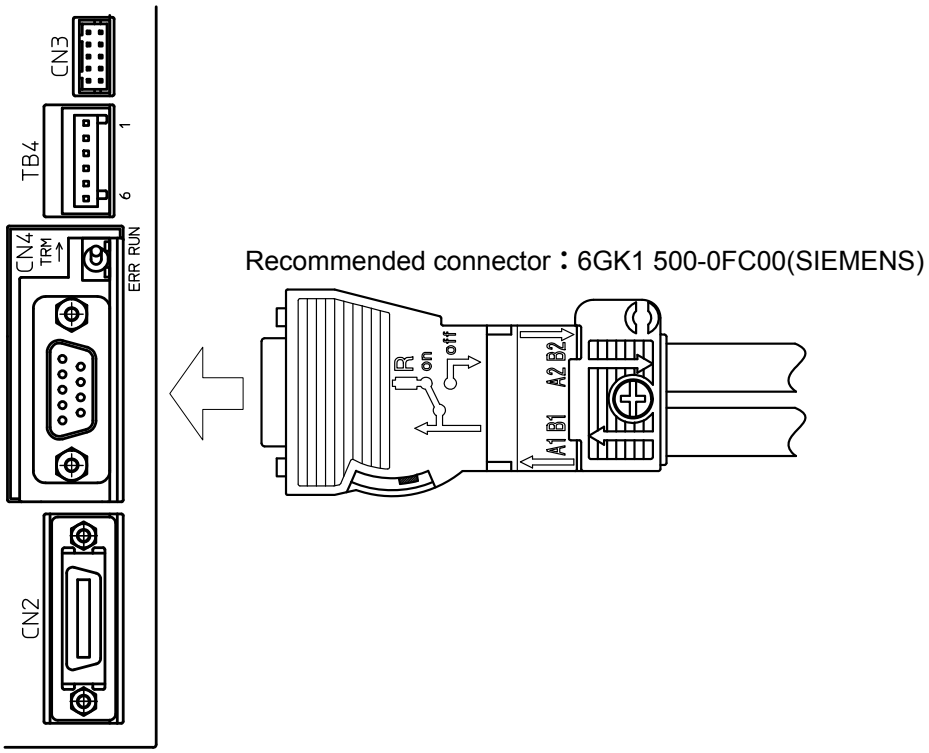
### Cable Specifications

FANC-SBH and FANC-SB can be used as dedicated CC-Link cables in a CC-Link system. The terminator that can be used depends on which type of the dedicated CC-Link cables is used.
Please be aware that performance cannot be guaranteed if you use any cables other than these dedicated CC-Link cables.
For more information about the dedicated CC-Link cables, refer to the CC-Link Interface User's Manual.
FANC-SBH and FANC-SB are manufactured by KURAMO ELECTRIC CO., LTD.

| Cable | FANC-SBH | FANC-SB |
|---|---|---|
| Terminator | 130 Ω, 1/2 W | 110 Ω, 1/2 W |

**Use the cable terminators attached to the master station.**

### 3.10.3 PROFIBUS DP Interface

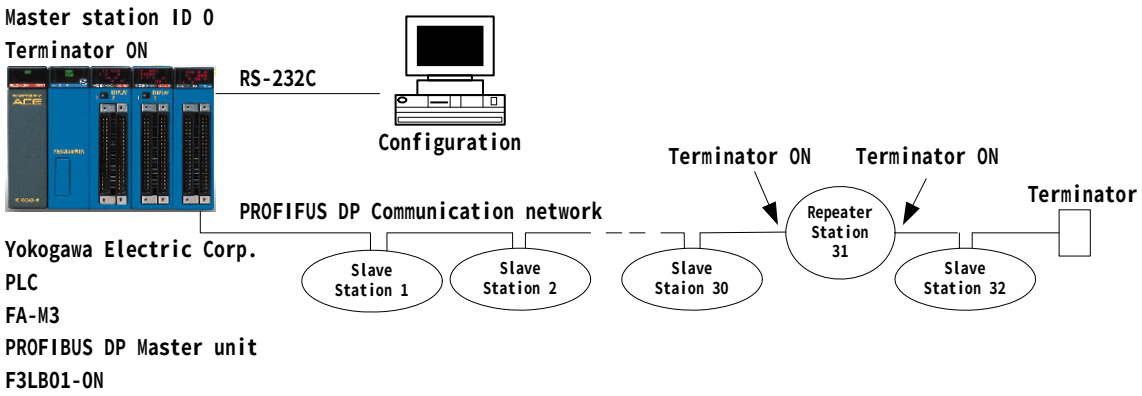



CAUTION

It interferes with the connector of 90° and 35° cable drawing out type with TB4. Please use the connector of 180° cable drawing out type.

**Network connection**

The bewlow figure shows the example of connecting the network of typical PROFIBUS DP. In the equipment arranged on the network edge, the terminator is needed. Please use the connector with built-in the terminator. The DrvP3 driver builds the terminator into.



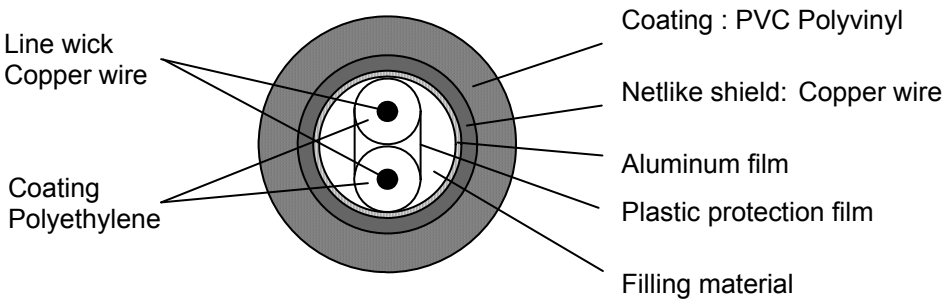
### Cable specification

PROFIBUS conforms to the RS485 standard. In the EN 50170 standard, the specification of the cable used for PROFIBUS is provided.

It is necessary to meet the cable of PROFIBUS the following specifications.

| | PROFIBUS DP type A cable |
|---|---|
| Impedance | 135 to 165 Ohm / 3 to 20 MHz |
| Capacity | < 30 pF / m |
| Resistance | < 110 Ohm / km |
| Conductor diameter | > 0.64 mm |
| Area of conductor | > 0.34 $mm^2$ |

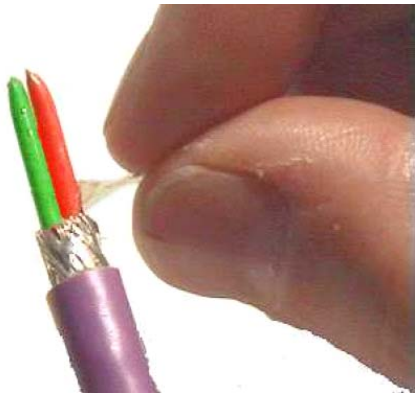
### Cable structure




### Cable processing

The above-mentioned recommended connector corresponds to the FastConnect stripping method. It is possible to flake off easily a cable coating and a netlike shield when the FastConnect striping tool is used.


FastConnect Stripping Tool(SIEMENS)

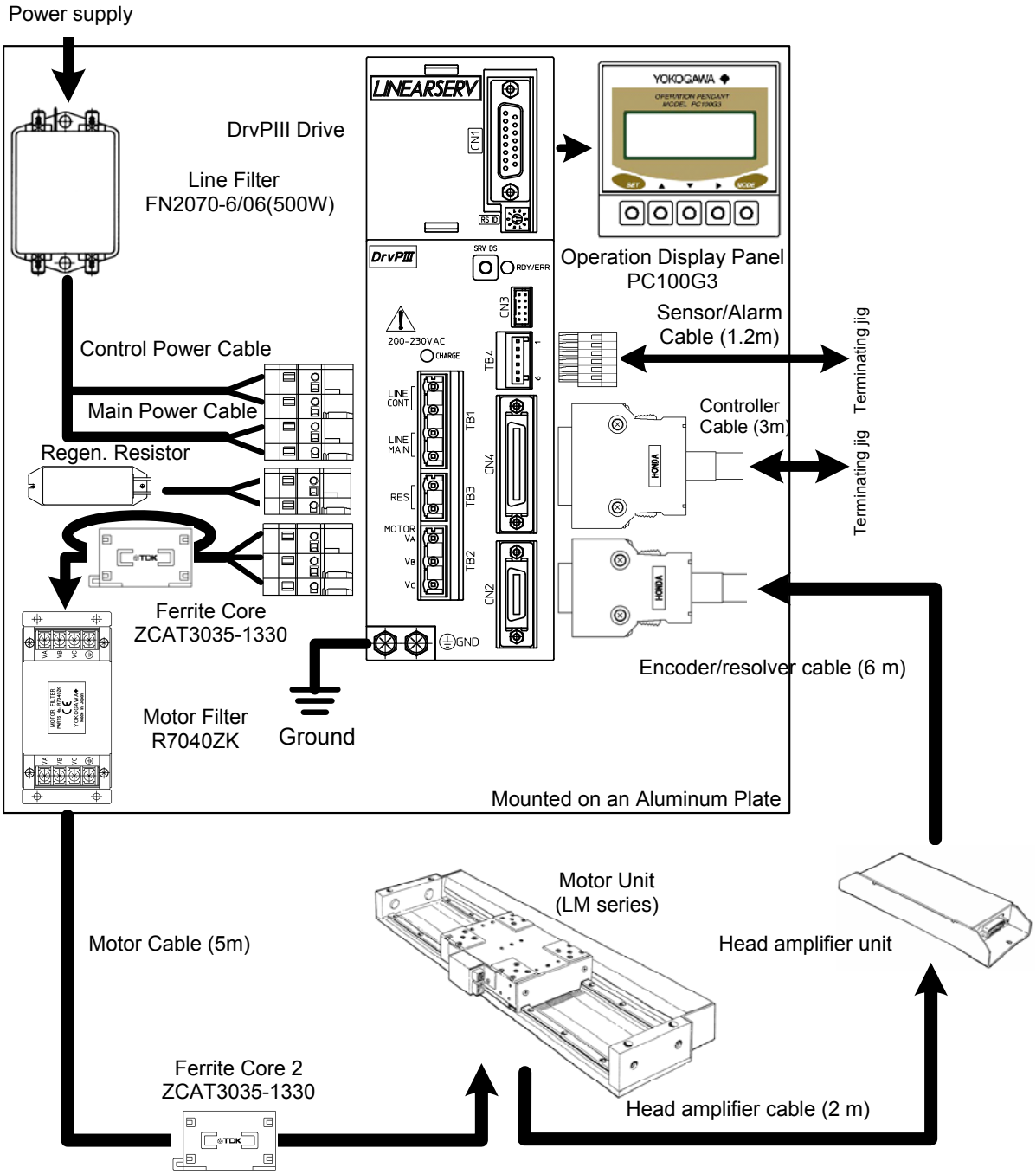


Cable terminal processing

## 3.11 Noise Prevention and Installation Conditions

A CE Declaration of Conformity (declaration) regarding EMC has been made for the DrvPIII drive under the following installation conditions.

**□ For Contact I/O Interface**

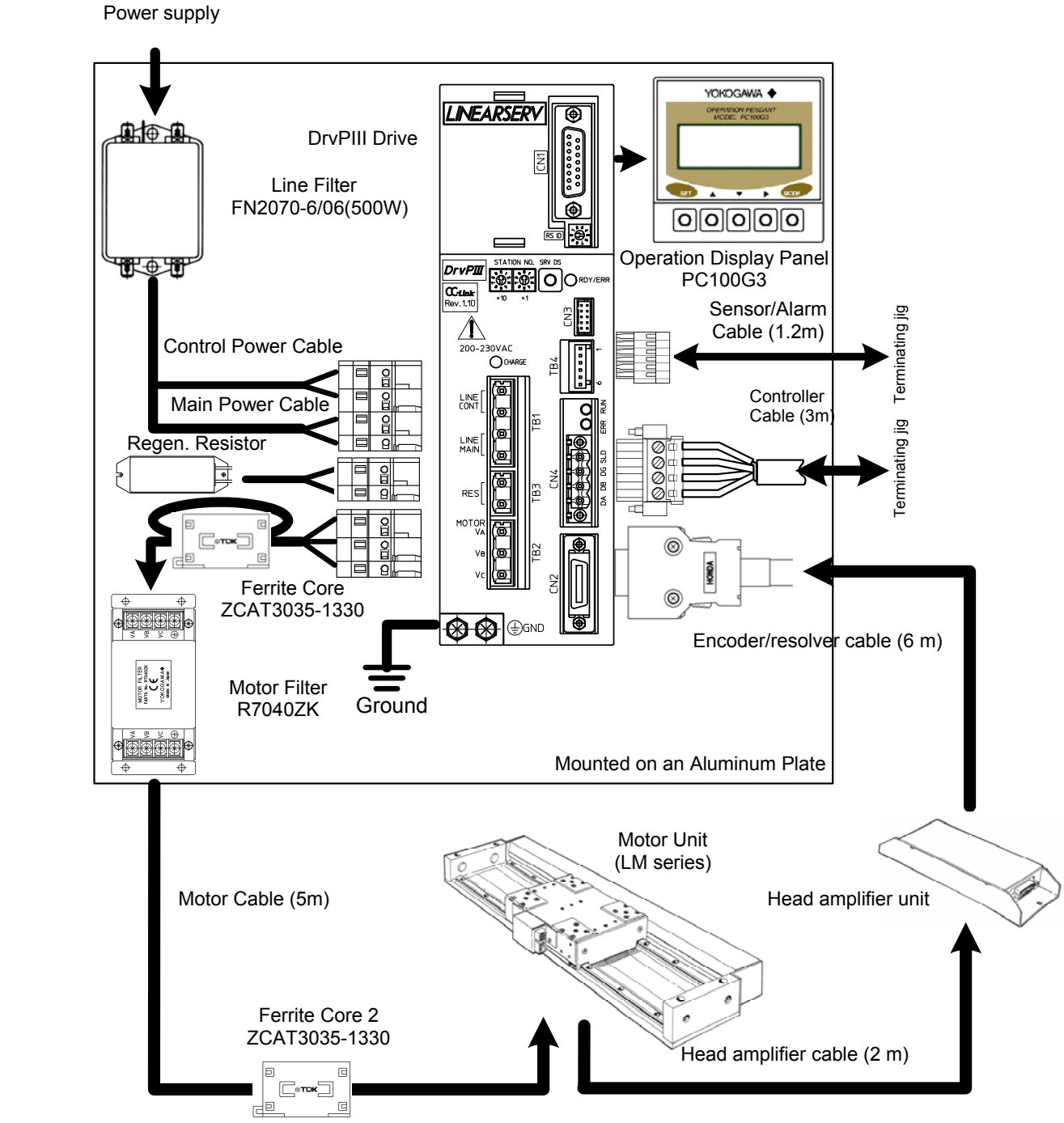



* 500W series should be connected to regenerative resistance for all series so that suitable EN61800-3 low frequency immunity agreement.

CAUTION

This installation guideline does not guarantee the performance. The installation conditions vary depending on the device used.

**For CC-Link Interface**

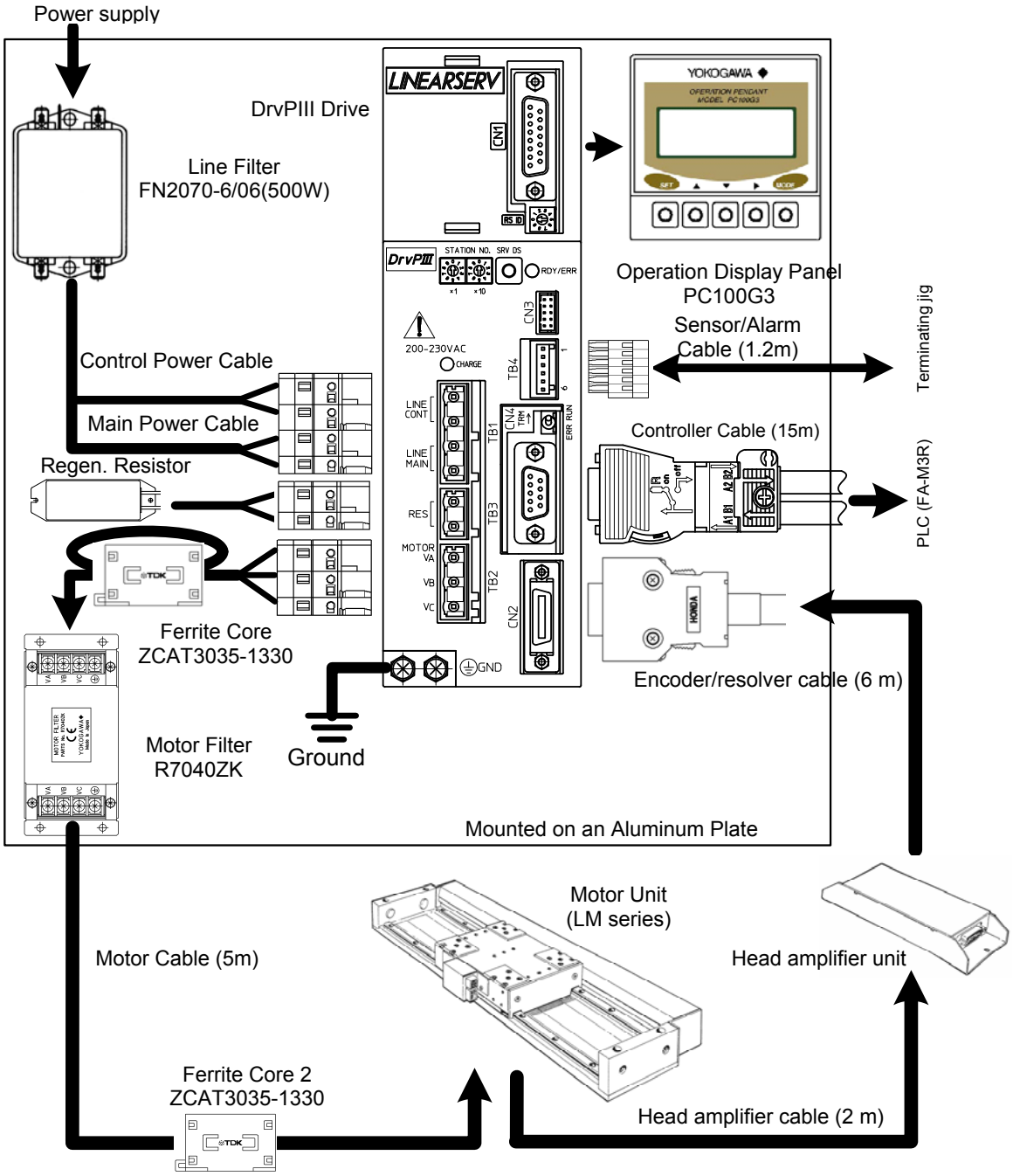



* 500W series should be connected to regenerative resistance for all series so that suitable EN61800-3 low frequency immunity agreement.

CAUTION

This installation guideline does not guarantee the performance. The installation conditions vary depending on the device used.

## For PROFIBUS DP Interface




* 500W series should be connected to regenerative resistance for all series so that suitable EN61800-3 low frequency immunity agreement.

CAUTION

This installation guideline does not guarantee the performance. The installation conditions vary depending on the device used.

# 4. Maintenance and Inspection

Do not disassemble the motor and the drive.
Make sure to conduct an overall inspection at least every 20,000 hours of operation or every 5 years. Depending on the operating environment and operating conditions, it is appropriate to carry out inspections at shorter intervals.
Depending on the result of inspection, the motor or the drive may require servicing or replacing.
If there are any problems with the external wiring or usage environment/operating conditions, solve such problems first and then repair or replace the motor or the drive.
Accumulated dust and dirt may cause failure; clean the motor and drive regularly to maintain good usage conditions.

## 4.1 Daily Inspection

Inspect the motor and the drive before the start of operation to check that there are no problems.
If you find any abnormalities, remove the causes and solve the problems before the start of operation. The daily inspection check list covers the minimum items that should be checked to ensure that there are no problems at the start of operation. Make sure the motor and the drive are in good conditions when using them, so that the operation will be stable and problem free.

| Check item | Inspection | Judgment criteria |
|---|---|---|
| Power supply | Is the input voltage within the standard range? | 200 ~ 230V + 10 to15% (200VAC system)<br>100 ~ 115V + 10 to15% (100VAC system) |
| Interface power supply | Is the input voltage within the standard range? | Depends on the interface specification |
| Peripheral environment | Is the ambient temperature appropriate? | 0 ~ 40°C (motor)<br>0 ~ 50°C (drive) |
| | Is the humidity appropriate? | 20 ~ 85% RH (motor)<br>20 ~ 90% RH (drive) |
| | Is there dust? | There must be no dust. |
| | Is there any condensation? | There must be no condensation. |
| Wiring condition | Are all connectors fixed securely? | The connectors must not be loosened. |
| | Are all screws of external wiring fixed? | The screws must not be loosened. |
| | Are there any cables that are close to getting cut? | There must be no abnormality in appearance and current conduction. |
| | Is there any interference between a cable and moving part? | There must be no contacts. |
| Installation condition | Is the main body fixed securely? | The main body must not be loosened. |
| | Is the load fixed securely? | The load must not be loosened. |
| | Are the driving sound and vibration normal? | There must not be any worse sounds or vibrations than during usual operation. |
| Conditions of internal mechanical parts | Are all bearings normal? | Bearings must rotate smoothly without play. |
| | Are the driving sound and vibration normal? | There must not be any worse sounds than usual operation. |
| Appearance | Are there any scratches, damages, dirt, deformation or discoloration? | There must be no scratches, damages, dirt, deformation and discoloration. |

## 4.2 Backup and Restore Operations of User Data

It is recommended to back up user data to avoid data loss in case of accidents.
Backed up data is useful when startup new devices. For example, it is possible to restore particular backed up data on several drives to use the same settings for each of them.
Backup and restore operations can be performed using the following methods.

**□ Backup and Restore Operations Using the Utility Software**

By backing up user data using the utility software, the data can be saved as electronic files. See Section 8.7.4, "Backup" for more information.

**□ Backup and Restore Operations Using the Operation Display Pendant (Optional)**

By backing up user data using the operation display pendant, the data can be saved in the embedded EEPROM of the operation display pendant. User data for multiple drives can be stored without using other external devices. See the technical document of the operation display pendant for more information.

## 4.3 Initialization of User Data (Reset All)

[Reset All] refers to returning all user data to the settings at the time of shipment from the factory. Perform [Reset All] when you want to redo the drive settings from the scratch.

ℓOperating Procedure

The reset all operation can be performed only by entering the designated command in [Terminal Function] of the utility software or [Terminal Function] of the operation display panel in order to prevent an erroneous operation. Erroneous operation can also be prevented by requiring a password with command. The command format is as follows.

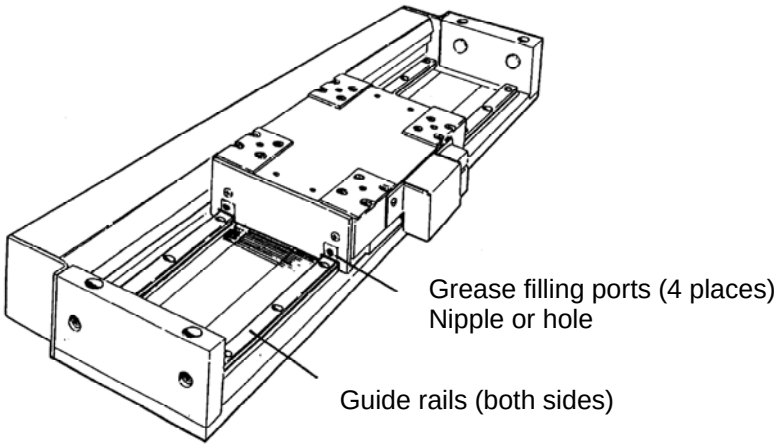
@90 : 2003
└── Password


A part of machine parameters overwrites the related parameters when the power is recycled, if those parameters are changed. • 0.0x (Data Sum Error) • may rarely occur in case that the control power supply is terminated before LED for RDY signal is lighted when the power is recycled.
If this error occurs, restore user data, which was backed up beforehand, after initialization of user parameters (Backed up parameter values are set).

## 4.4 Lubrication of the Motor Unit

To protect the linear guide unit of the motor unit against wear and damage, and assure a sufficiently long product life, it is important to keep the guide unit constantly lubricated.
For the linear guide unit of the motor unit, apply sufficient grease for lubrication from the grease filling ports shown in the figure below using a grease gun whenever the motor has operated for 100 km of driving distance or three months, whichever is sooner. After application, wipe away the excess grease from the linear guide unit using lint-free cloth or similar material. The rails of the linear guide unit require lubrication. Do not wipe the motor with organic solvent or similar substance. Using such solvent may damage the guide and motor units.
Different types of grease should be used depending on the model used. Be sure to refill with the appropriate grease. If in doubt, consult Yokogawa regarding the type of grease and grease gun to be used.

| Model | Grease to be used |
|---|---|
| LM105/LM110/<br>LM505/LM510 | Multemp PS No. 2 (made by Kyodo Yushi) |
| LM130/<br>LM205/LM210/LM230/LM240<br>LM305/LM310/LM330<br>LM530 | AFB grease (THK) for THK guide<br>Albania EP2 (Showa Shell) for IKO guide |



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