



**AL- II Series Slave Controller**

**2C-771v1**

**Instructions Manual**  
**(For designers' use)**

**USER'S MANUAL**

Please ensure to read and understand this  
Instructions Manual before using the Product.  
Please keep this Instructions Manual at hand  
so that it is always available for reference.

MN0195-1

## Introduction

This instructions manual explains the handling of "AL- Series Slave Controller 2C-771v1", emphasizing the specifications to enable proper and safe use.

The manual is thus intended for designers of control systems using stepping motors or servo motors. Before using the product, read this manual carefully for better understanding.

Keep the manual handy so that you can read it whenever you want.

The 2C-771v1 allows axes to be controlled independently and therefore referred to each axis as follows:

1st axis	2nd axis	3rd axis	4th axis
X-axis	Y-axis	Z-axis	A-axis

This manual basically explains only the X-axis.

## Description of safety

This product must be handled correctly.

Handling the product incorrectly may cause unexpected accidents resulting in personal injuries or damage to your properties.

Many of those accidents can be avoided if you have advance information on dangerous situations.

This manual provides precautions where dangerous situations are predicted. The manual provides the following alert marking and messages for this purpose:

### **WARNING**

This indicates a hazardous situation that could result in death or serious personal injury if you do not perform the procedure correctly.

### **CAUTION**

This indicates a potentially hazardous situation that could result in personal injury or physical damage if you do not perform the procedure correctly.

## Before use

This product is not designed for use in the equipment related to nuclear power, aerospace equipment, vehicles, marine vessels, medical equipment directly in touch with human body, equipment anticipated to give a serious impact to properties, and other equipment required to provide high reliability.

Take failsafe measures so that the whole system operates safely even if the input power causes an error, a signal line is disconnected, or the main unit fails.

This product is equipped with a LIMIT (overtravel) signal and an FSSTOP signal to prevent mechanical damage.

The default values of these signals are set to ACTIVE OFF (B contact). Accordingly, even in a system configuration in which the FSSTOP and LIMIT signals are not used, pulses are not output unless NORMAL ON (GND connection) is enabled.

Be sure to use this product within the scope of the specifications described in this instruction manual in accordance with the specification method described therein.

Set up the product before operating it.  
Please refer to Section 3, "Setting."

Please refer to separate manual "AL- series device driver manual for Windows" also when you handle this product.

Introduction  
Description of safety  
Before use

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The main parts which revised by this manual

# 1 . Overview

## 1-1. Features

The AL- series is a high speed serial communication system of original controlling the flexible stepping motor, servo motor which can cope easily as well and I/O in the decentralization of the device and supporting axial addition.

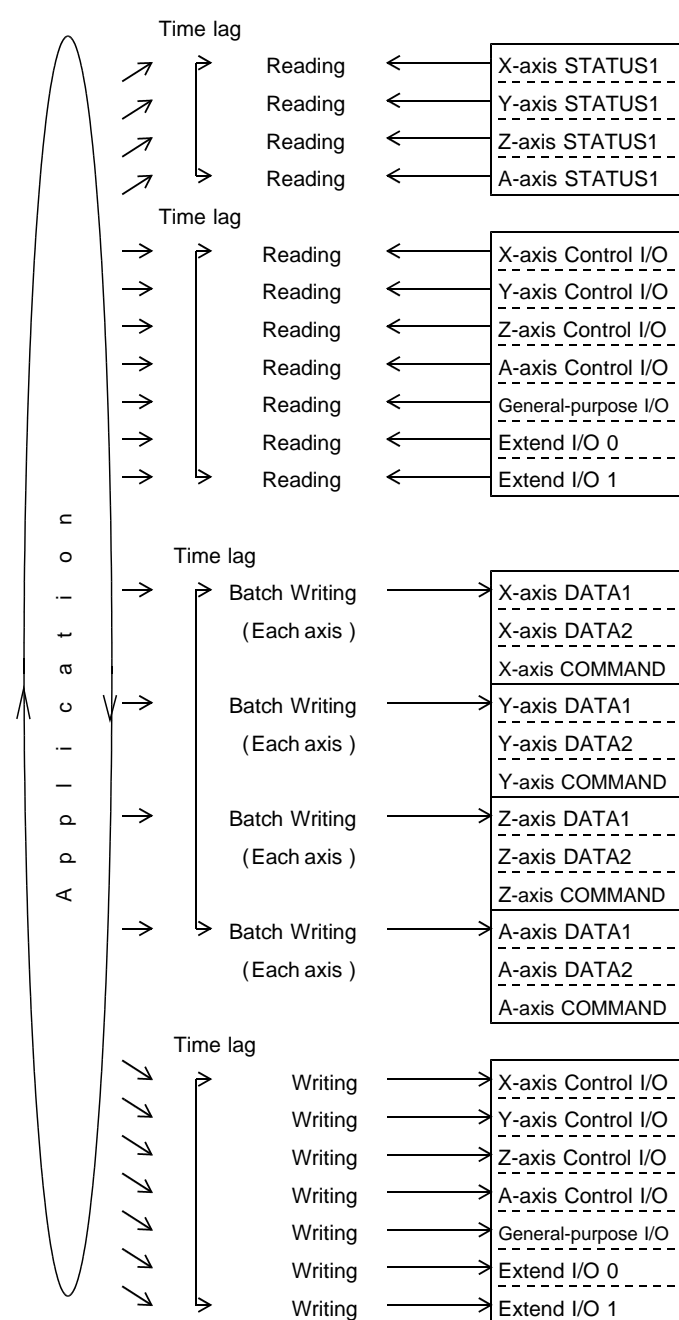
- The AL- series is an insulation type high-speed serial communications of 20 Mbps/50 m or 10 Mbps/100 m. As a result, the saving wiring for the personal computer system can be attempted by the performance (ratio of our company) that equals a board controller so far.
- The shift of board controller C-VX870 series (Device-function) for PCI made of our company and the USB series (Device-function and Unit-function) is easy depending on the device driver function for Windows.

The status of four axis batch reading and the command of four axis batch execution by the Unit-function is possible. This Unit-function can perform a unit and AL- interface by one function execution from an application.

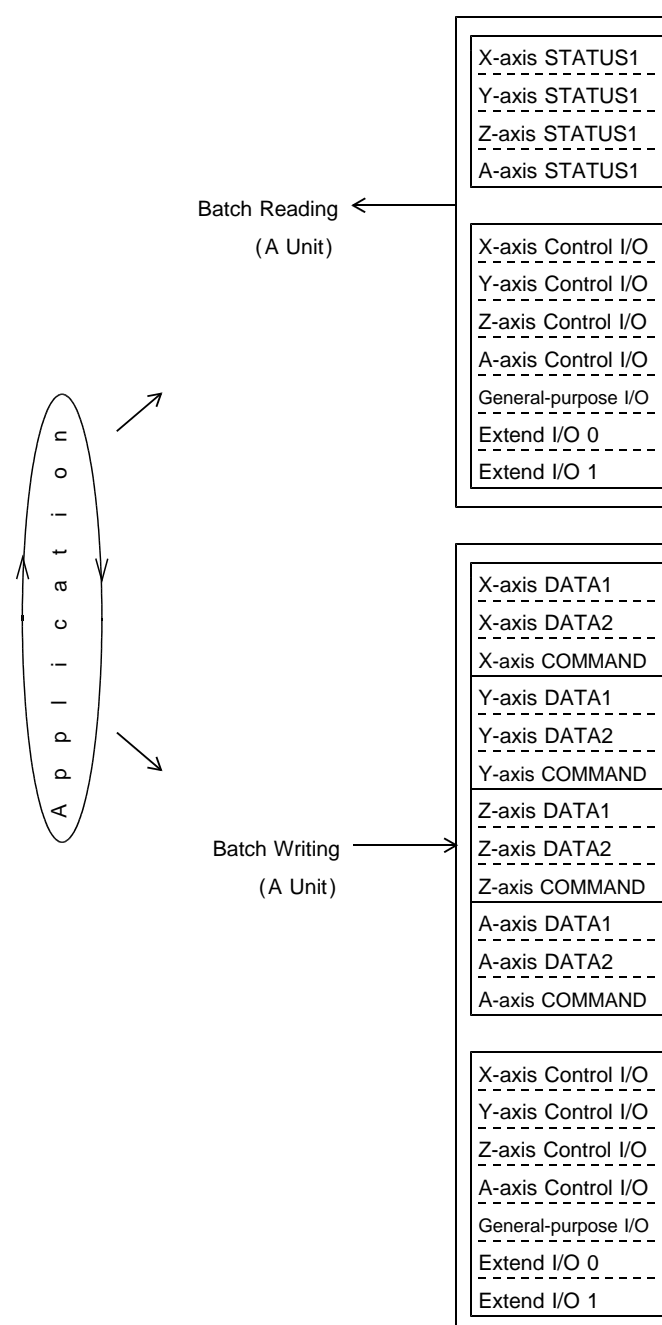
By this,

- The time crunch can be done compared with accessed Device-function of each axis and I/O-function of each I/O port.
- The Unit-function (writing) suppresses the difference at time until it instructs time each axis and each I/O output signal.
- The Unit-function can reduce the load of the application.
- It supports the Device-function, and can use the Device-function.
- The Unit-function can be used together with the Device-function and the I/O-function.

Access example in Device-function and I/O-function



Access example in Unit-function



2C-771v1 is equipped with our chip controller MCC to enable motor control using simple commands.

- It enables four independent drive or two axes linear interpolation drive (fixed interpolation-axes) or two axes circular interpolation drive (fixed interpolation-axes) by an easy commands.  
Moreover, it enable to optional axes liner interpolation drive. (Applied function)
- After the command being executed is finished, the commands stored in the reservation register are executed sequentially. Then this function can be allowed continuous drive. (Applied function)
- The 32-bit width address counter and the maximum output frequency of 6.5 MHz of the MCC enables high-precision, high-speed positioning.

As for 2C-771v1, a basic interface with the simple servo motor driver besides the stepping motor driver is possible. Moreover, it has the following I/O signal.

- It is equipped with the general-purpose I/O signal by two points for each.
- In addition, connect an Extend I/O unit (16/16 points or 32/32 points) by the serial communication without minding address setting and add a general-purpose I/O and can control it.

2C-771v1 is a small and easy controller.

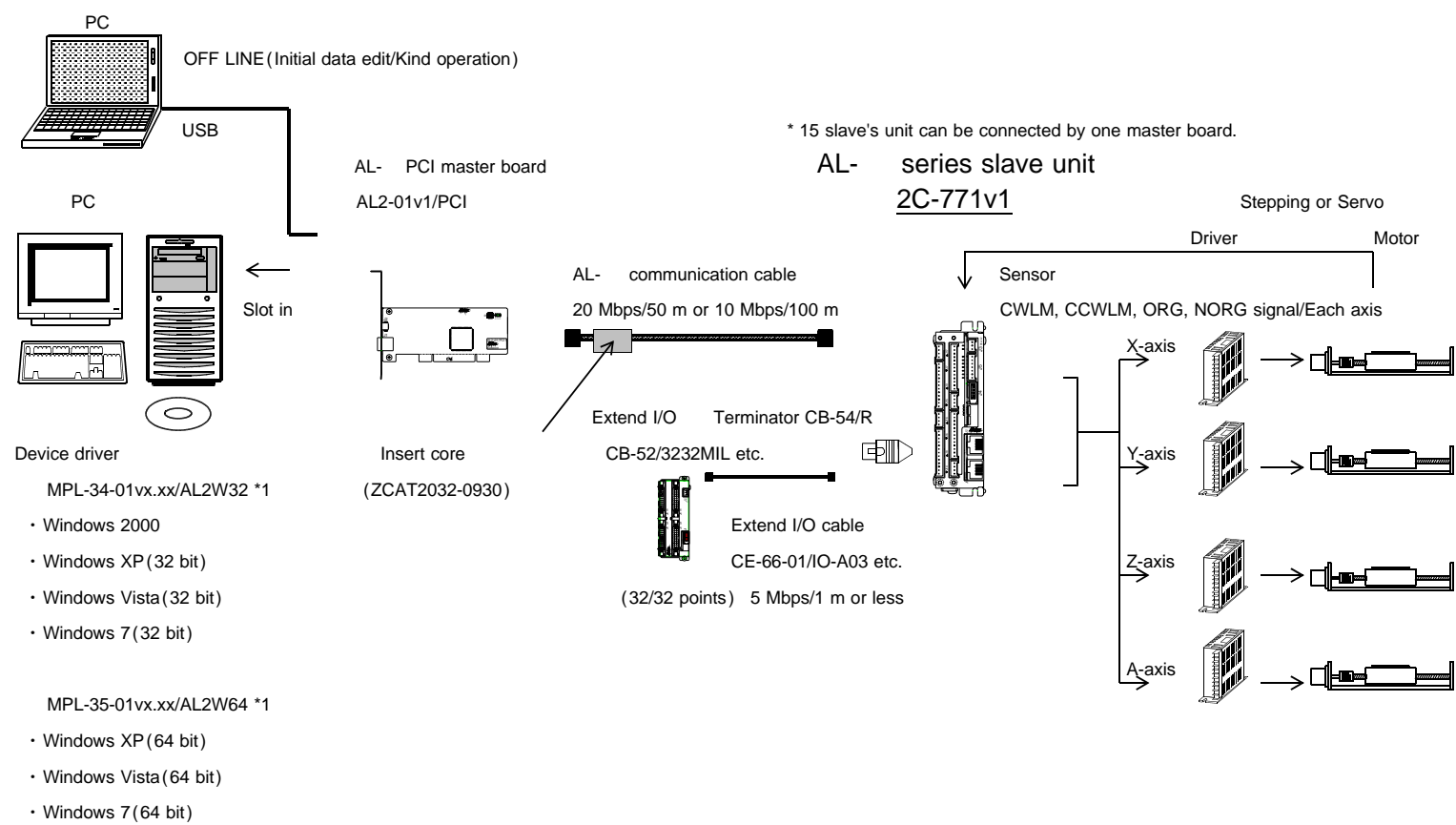
- The DIN rail installation and the base installations can be done.

## 1-2. Product configuration

Product name	Rating	Maker	Quantity	Remarks
Controller	2C-771v1	Melec Inc.	1	(Main Unit)
Connector	51103-0300	Molex	1	For power supply connector (Accessory)
Connector	51103-0600	Molex	4	For sensor connector (Accessory)
Connector	51103-0700	Molex	1	For general-purpose I/O connector (Accessory)
Contact	50351-8100	Molex	36	(Accessory)
Screw	M2.6 × 4	-	4	For sensor shield cable fixation (Accessory)
Screw	M3 × 4	-	4	For driver shield cable fixation (Accessory)

- Neither connected connector for the driver nor the contact are accessories.  
Please refer to the "connection / others" instruction manual for details of connection of the AL- series.

1-3. Example of system configuration



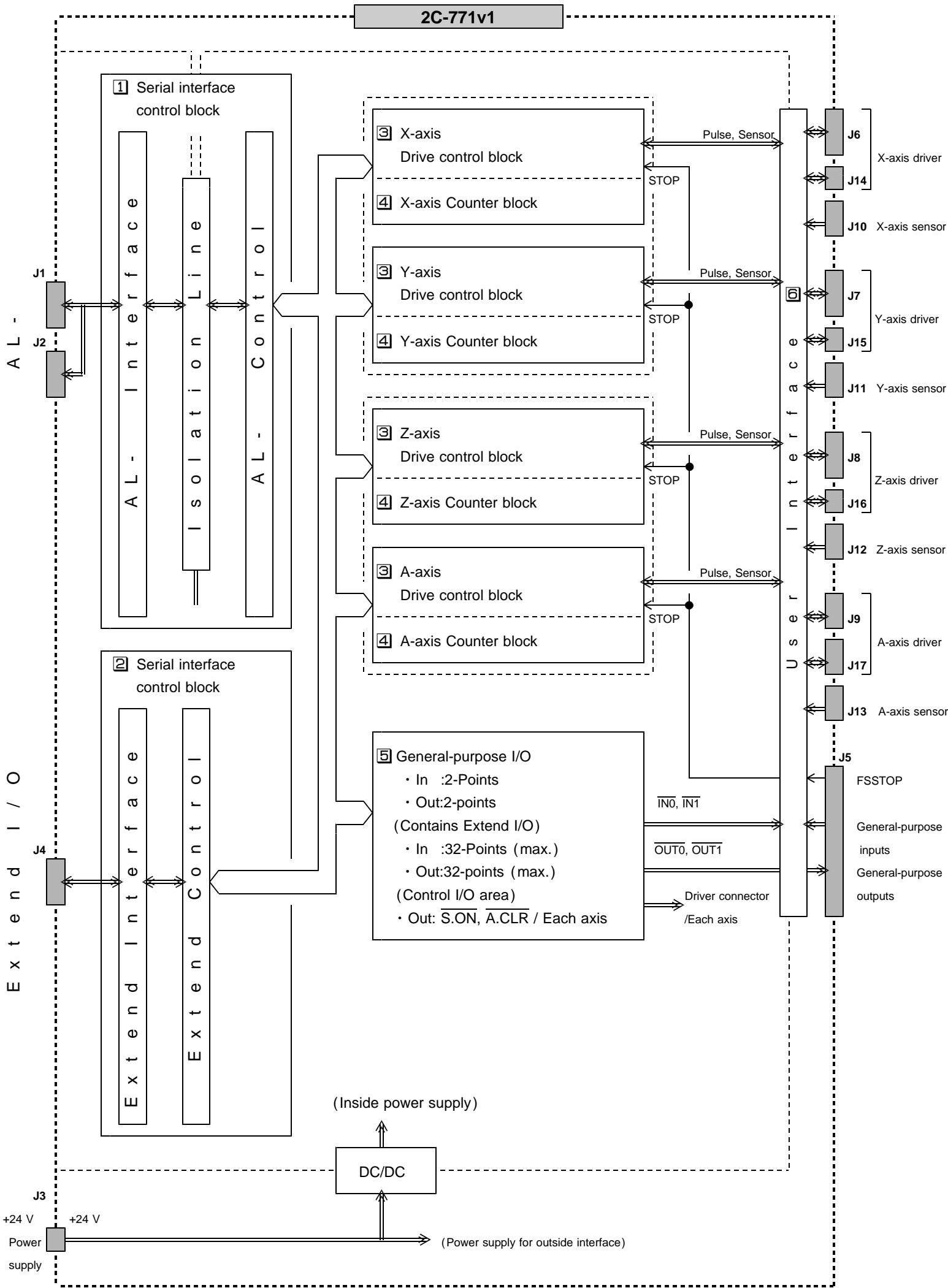
\*1 Version No. ... Please confirm the latest version of vx.xx at the manual of the device driver.

• AL- series prepared connectable cables easily.  
Please refer to the "connection / others" instruction manual for details of connection of the AL- series.

Example of other AL- series

Controller for servo or stepping motor		Controller with built-in driver		General-purpose I/O (Extend type)	General-purpose I/O (Slave type)	
Power supply relay board						
<div>CB-55-01/PS-T35</div> <div></div> <div><ul style="list-style-type: none"><li>• 4-distribution output of DC 24 V</li><li>• 1 A/terminal (3.5 A in total)</li></ul></div>	<div>2C-776Av1</div> <div></div> <div><ul style="list-style-type: none"><li>• 4-axes</li><li>• For encoder input</li></ul></div>	<div>2CD-7710v1/ADB5F30</div> <div></div> <div><ul style="list-style-type: none"><li>• 2-axes for 5-phase stepping motor</li><li>• 0.75 A/phase</li></ul></div>	<div>2CD-7713v1/GDB5F40</div> <div></div> <div><ul style="list-style-type: none"><li>• 2-axes for 5-phase stepping motor</li><li>• 1.4 A/phase</li></ul></div>	<div>CB-53/1616-MIL</div> <div></div> <div><ul style="list-style-type: none"><li>• Extend type</li><li>• In:16-points</li><li>• Out:16-points</li></ul></div>	<div>2CB-01v1/3232-MIL</div> <div></div> <div><ul style="list-style-type: none"><li>• Slave type</li><li>• In:32-points</li><li>• Out:32-points</li></ul></div>	<div>2CB-02v1/1616-MIL</div> <div></div> <div><ul style="list-style-type: none"><li>• Slave type</li><li>• In:16-points</li><li>• Out:16-points</li></ul></div>

1-4. Function block diagram



① Serial interface control block

This department is control block for AL- serial communication.

The AL- serial communications interface department is insulated with +24 V power supply and the internal logics.

② Serial interface control block

This department is control block for serial communication of Extend unit.

This block performs an Extend I/O unit and serial communication and can extend the I/O of 32 points /32 points input output (at the maximum).

The serial communication interface part is insulated from power supply +24 V.

③ Drive control block

The drive control block outputs serial pulses to the motor driver from pulse generator MCC.

(MCC is made by MELEC Inc.)

- This department detects origin sensor and a limit sensor signal and motor is controlled.
- Enables four axes independent drive, or two axes (X-axis and Y-axis, Z-axis and A-axis) linear interpolation drive, and circular interpolation drive.
- Enables stop four axes at immediate stop by FSSTOP signal from the outside.

To distinguish four axes, it is named X-axis, Y-axis, Z-axis, and A-axis.

④ Counter block

The counter block has two types of counters: ADDRESS COUNTER, PULSE COUNTER.

ADDRESS COUNTER, and PULSE COUNTER has 32-bit counter.

These counters count pulses output by the controller.

Each counter equipped with three compare registers. These registers count optional count.

\* The counter function of 2C-771v1 is specifications to count pulse of the pulse output.

When the application of the counter which used an outside pulse is necessary, please examine a controller product corresponding to the outside pulse input.

⑤ General-purpose I/O block

This block is controlling the following input/output.

These input/output ports can control easily by I/O-function.

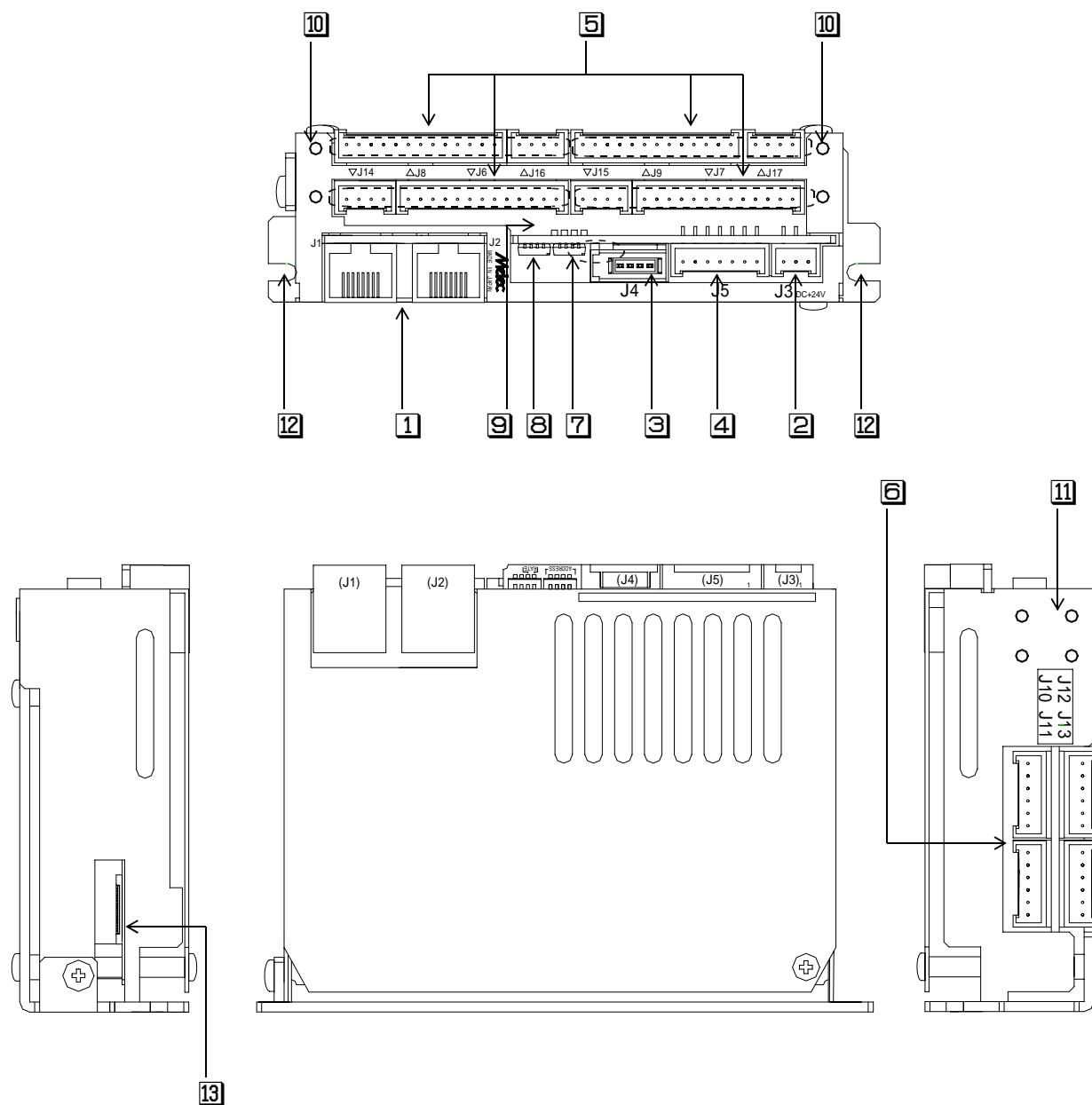
- General-purpose I/O area
  - ... The reading of the general-purpose Input  $\overline{\text{IN0}}$  signal and  $\overline{\text{IN1}}$  signal, the operation of the general-purpose output  $\overline{\text{OUT0}}$  signal and  $\overline{\text{OUT1}}$  signal are possible.
  - Moreover, enables operation as Latch signal and Clear signal of X-axis SS0 signal by the  $\overline{\text{IN0}}$  signal input.
  - And, enables operation as Latch signal and Clear signal of Y-axis SS1 signal by the  $\overline{\text{IN1}}$  signal input.
- Extend I/O area
  - ... When the area secure an extension input/output area for 32 points /32 points input/output and access it from an application in this input/output area, the area can control input/output by an Extend I/O unit and cyclic communication.
- Control I/O area
  - ... The interface of SERVO ON and ALARM CLEAR signal is possible as the servo driver's control I/O.
  - This Control I/O signal is reflected in each servo interface signal of the driver connector.

⑥ User Interface block

This department is interface block for the motor drivers, sensor signals, and general-purpose input and output equipment.



## 1-5. Externals of product



- ❶ J1, J2 ----- These are shield connector of the RJ-45 type that connects the AL- communication. J1 and J2 are connected with each unit and the communications cable can be connected in the multidrop.
- ❷ J3 ----- This is a connector to connect +24 V power supply.
- ❸ J4 ----- This is a connector to connect an Extend I/O unit (Option).
- ❹ J5 ----- This is a connector that connects immediate stop (FSSTOP signals) and general-purpose I/O ( $\overline{\text{IN0}}$ ,  $\overline{\text{IN1}}$ ,  $\overline{\text{OUT0}}$ , and  $\overline{\text{OUT1}}$  signals).
- ❺ J6, J7, J8, J9 ----- These are connector for the interface to the driver.  
J14, J15, J16, J17 J6, J14 is the one for the X-axis, J7, J15 is one for the Y-axis, J8, J16 is one for the Z-axis, and J9, J17 is the one for the A-axis.
- ❻ J10, J11, J12, J13 - These are connector to connect the sensor signals such as the LIMIT signal or the ORG signal. J10 is the one for the X-axis, J11 is one for the Y-axis, J12 is one for the Z-axis, and J13 is the one for the A-axis.

- ⑦ S1 ----- This is a setting switch of the slave address of the AL- communication.
- ⑧ S2 ----- This is a setting switch of the baud rate of the AL- communication.
- ⑨ LED (RDY) --- RDY LED (Green color) turns on at the time of RDY state of each axis.
- ⑩ Terminal ----- The terminal connect to the shield when the driver cable of shield.  
Use the screw of attached M3 × 4.
- ⑪ Terminal ----- The terminal connect to the shield when the sensor cable of shield.  
Use the screw of attached M2 .6 × 4.
- ⑫ Base installation part -- These are part that fixes the main unit to the installation base. (two places)  
Use the M3 screw.  
Moreover, it is possible to install it in the DIN rail with a exclusive use DIN attachment lug.  
Please refer to the connection/other manual for details.
- ⑬ Connector for adjustment --- This is a connector for adjustment of the main unit.  
Do not connect anything.

## 2 . Specifications

### 2-1. General specifications

No.	Item	Specifications
1	Supply voltage	DC +24 V (less than $\pm 10\%$ of the power supply voltage)
2	Power consumption	<p>800 mA or less *1</p> <p>*1 The value when the main unit supplies the power supply for the sensor is indicated. The main unit current consumption is 200 mA. Example: at the sensor of the current consumption 25 mA, and the servo driver connection.</p> <ul style="list-style-type: none"> <li>• 4 pieces <math>\times</math> 25 mA <math>\times</math> 4 axes = 400 mA</li> <li>• Three signal (by S.ON, A.CLR, and DRST are on) <math>\times</math> 8 mA <math>\times</math> 4 axes = 96 mA</li> <li>• The total current = 200 mA + 400 mA + 96 mA = 696 mA</li> </ul> <p>The totaled current consumption must not exceed 800 mA.</p>
3	Operating ambient temperature and humidity	<ul style="list-style-type: none"> <li>• 0 ~ + 40</li> <li>• 80 % RH or less (without dew condensation)</li> </ul>
4	Storage temperature and humidity	<ul style="list-style-type: none"> <li>• 0 ~ + 55</li> <li>• 80 % RH or less (without dew condensation)</li> </ul>
5	Installation environment	<ul style="list-style-type: none"> <li>• Inside a well-ventilated cabinet installed indoor, free from direct sunlight.</li> <li>• Not exposed to corrosive and flammable gasses, and not affected by oil mist, dust, salt, iron powder, water, and chemicals.</li> <li>• Not subject to constant vibration or excessive shock.</li> <li>• Not affected by electromagnetic noise caused by power equipment.</li> <li>• Free of radioactive materials and magnetic fields, and not in vacuum.</li> </ul>
6	Dimensions	W 37.2 $\times$ H 89.9 $\times$ D 124 (mm)
7	Weight	Approx. 0.25 kg

### 2-2. Communication specifications

No.	Item	Specifications
1	AL- interface	<ul style="list-style-type: none"> <li>• Conformity standard :RS485 (insulation type)</li> <li>• Transmission protocol :Protocol for AL- communication</li> <li>• Slave connection number :1 ~ 15 slave (slave address setting range: H' 1 ~ H' F)</li> <li>• Wiring distance/ baud rate :100 m(10 Mbps) / 50 m(20 Mbps)</li> </ul>
2	Extend interface	<ul style="list-style-type: none"> <li>• Conformity standard :RS485 (non-insulation: but there is insulation with +24 V. )</li> <li>• Connection number :Up to one unit</li> <li>• Wiring distance/ baud rate :1 m/5 Mbps</li> </ul>

## 2-3. Basic specifications

No.	Item	Specifications	
1	Number of control axes	Four axes	
2	Pulse output function	Output type	<ul style="list-style-type: none"> <li>• Independent direction output/ Specified direction output/ Phase-differential signal output</li> <li>• Line driver output</li> </ul>
		Output frequency	<ul style="list-style-type: none"> <li>• Independent drive : 0.1 Hz to 6.5 MHz</li> <li>• Interpolation drive : 0.1 Hz to 5 MHz</li> </ul>
		Acceleration/deceleration time constant	5000 ms/kHz to 0.0025 ms/kHz (Trapezoid/S-curve)
		Acceleration/deceleration shape	<ul style="list-style-type: none"> <li>• Trapezoid</li> <li>• S-curve (This feature enables to set asymmetrical shape.)</li> </ul>
		Triangular drive prevention function	During S-shaped acceleration/deceleration drive, INDEX drive may end before the maximum speed is reached. In this event, triangular drive can be automatically avoided.
		Number of output pulses	<ul style="list-style-type: none"> <li>• JOG drive : -65,535 to +65,535 pulse</li> <li>• SCAN drive : Up to infinite pulses</li> <li>• INDEX drive : -2,147,483,647 to + 2,147,483,647 pulses</li> </ul>
3	Encoder function	-	
4	Drive function	JOG drive	Pulses are constantly output until the specified pulses.
		SCAN drive	Pulses are continuously output until a stop command is detected.
		INDEX drive	Pulses are output until the specified relative or absolute address is reached.
		ORIGIN drive	The specified drive processes are performed. This drive is finished when the ORG signal specified edge is detected.
		2-axis linear interpolation drive	<ul style="list-style-type: none"> <li>• Linear interpolation is performed toward the specified coordinates from the current coordinates.</li> <li>• Driving type is selected from INDEX drive or SCAN drive.</li> <li>• Positional errors for the specified straight line are <math>\pm 0.5</math> LSB.</li> <li>• The absolute and relative addresses that can be specified for coordinates range from -2,147,483,647 to +2,147,483,647 (32 bits).</li> </ul>
		2-axis circular interpolation drive	<ul style="list-style-type: none"> <li>• Circular interpolation is performed toward the specified coordinates from the current coordinates on the circular curve specified by the center-point or passing-point coordinates.</li> <li>• Driving type is selected from INDEX drive or SCAN drive.</li> <li>• Max speed is 5 MHz.</li> <li>• Positional errors for the specified circuit curve are <math>\pm 1</math> LSB.</li> <li>• The relative addresses range from -8,388,607 to +8,388,607 (24 bits).</li> <li>• Short axis pulses range from -2,147,483,648 to +2,147,483,647 (32 bits).</li> </ul>
		Linear speed constant control	Control is performed to keep the synthesized speed of the two axes working for interpolation drive constant.

No.	Item	Specifications	
5	Stop function	Slow stop function	<ul style="list-style-type: none"> <li>• SLOW STOP command</li> <li>• Detection of a match of the comparator of each counter.</li> <li>• Deceleration stop by DALM signal.</li> </ul>
		Immediate stop function	<ul style="list-style-type: none"> <li>• FAST STOP command</li> <li>• FSSTOP signal (four axes stop)</li> <li>• Detection of a match of the comparator of each counter.</li> <li>• Immediate stop by DALM signal.</li> </ul>
		LIMIT signal	<ul style="list-style-type: none"> <li>+ direction stop</li> <li>• Immediate stop by CWLM signal and slow stop can be selected.</li> <li>• Slow stop or immediate stop can be performed for each axis upon detection of a match of the comparator (COMP2) of each counter.</li> <li>- direction stop</li> <li>• Immediate stop by CCWLM signal and slow stop can be selected.</li> <li>• Slow stop or immediate stop can be performed for each axis upon detection of a match of the comparator (COMP3) of each counter.</li> </ul>
6	Counter function	ADDRESS COUNTER	32-bit counter that manages absolute addresses by counting drive output pulses.
		PULSE COUNTER	32-bit counter that counts the drive pulse output or an encoder feedback pulses.
		Comparator function	Detection of a match of the three comparators of each counter. <ul style="list-style-type: none"> <li>• Upon detection of a match by the comparator, pulse output can be decelerated and then stopped, or stopped immediately.</li> <li>• Upon detection of a match by the comparator, status can be read.</li> <li>• The detection signal can be external status signal output.</li> </ul>
		AUTO CLEAR function	The counter can automatically be cleared upon detection of a match of COMP1 of each counter.
		AUTO ADD function	If the counter value reaches the COMP1, a value that is set by the data add to COMPARE REGISTER1 of each counter.
7	Other functions	For servo driver signal	The following signals are prepared as a signal for the servo. <ul style="list-style-type: none"> <li>• In-position signal input/ Phase signal input (<math>\overline{\text{DEND/PO}}</math>)</li> <li>• Driver alarm signal input (<math>\overline{\text{DALM}}</math>)</li> <li>• Servo reset signal output (<math>\overline{\text{DRST}}</math>)</li> <li>• Servo on signal output (<math>\overline{\text{S.ON}}</math>)</li> <li>• Alarm clear signal output (<math>\overline{\text{A.CLR}}</math>)</li> </ul>
		General-purpose I/O	Two points of input/output are prepared as general purpose I/O.
		Data reading function	Current status information can be read in real time. Current status information includes status data, count data of a counter etc.

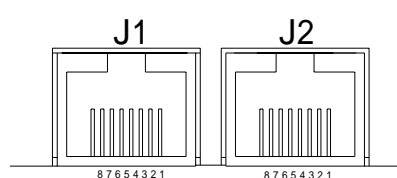
**2-4. Applied functions**

No.	Item	Specifications	
1	Drive function	UP/DOWN/CONST drive CHANGE function	<ul style="list-style-type: none"> <li>• Drive change for acceleration, deceleration, or constant speed can be performed upon detection of signal at an arbitrary change operation point.</li> </ul>
		SPEED CHANGE function	<ul style="list-style-type: none"> <li>• The drive pulse speed is changed upon detection of signal at an arbitrary change operation point.</li> </ul>
		RATE CHANGE function	<ul style="list-style-type: none"> <li>• The rate is changed upon detection of signal at an arbitrary change to the specified rate.</li> </ul>
		INDEX CHANGE function	<ul style="list-style-type: none"> <li>• Upon detection of signal at an arbitrary change operation point, the stop position at which drive is to be finished is changed.</li> <li>• Upon detection of the INC INDEX CHANGE command, the system performs INC INDEX drive by setting the specified data at the stop position of the relative address for which the start position is the origin.</li> <li>• Upon detection of the ABS INDEX CHANGE command, the system performs ABS INDEX drive by setting the specified data at the stop position of the absolute address managed with the address counter.</li> </ul>
		Optional axes liner interpolation drive	Linear interpolation is performed toward the specified coordinates from the current coordinates. Then long axis outputs pulses.
		INDEX drive control the start point at auto deceleration	This function is allowed to set OFFSET of the start point at auto deceleration. This function can be used when INDEX drive, liner interpolation and INDEX drive.
2	Count function	Ring counter function	The address counter, pulse counter each are a ring counter in which any maximum count can be set.
		Count data latch/clearance function	<p>This function latches count data of a counter at a specific latch timing and holds it till the next latch timing.</p> <p>Each counter can latch counter value at arbitrary timing.</p> <p>It is possible to clear a counter value at the latch timing.</p> <p>IN0 signal: for X-axis IN1 signal: for Y-axis</p>
		Data reading	Current status information includes setting data of X-axis or Y-axis, latch data of a counter etc.
3	Other functions	Command reservation function	<p>Each axis has a reservation register that can store data commands for ten instructions.</p> <ul style="list-style-type: none"> <li>• General-purpose commands of drive commands can be reserved in the reservation register.</li> <li>• After the command being executed is finished, the commands stored in the reservation register are executed sequentially.</li> </ul> <p>Then this function can be allowed continuous drive.</p>
		Input signal logical switch function	<p>The logic of the following input signals can be changed:</p> <ul style="list-style-type: none"> <li>• CWLM signal</li> <li>• CCWLM signal</li> <li>• DALM signal</li> <li>• FSSTOP signal</li> </ul>

Please refer to the chapter of the AL- series device driver manual application function for details of applied specification.

## 2-5. Input and output signal table

### (1) Serial communication connector (J1, J2)



Connector :RJ-45(shield type)  
Recommendation cable :KB-STP- L : length ( ~ 30 m or less)  
(Made by Sanwa Supply: It is not an accessory.)

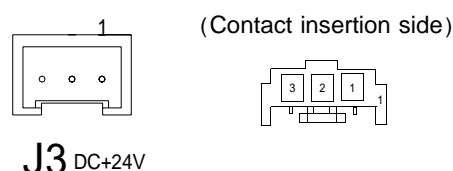
#### Reference

For more information about a cable preparing in the AL- series and a recommended cable, refer to the instruction manual of "connection / others" .

No.	Direction	Signal name	Description
1	-	N.C	Connection is prohibited.
2	-	N.C	Connection is prohibited.
3	I/O	+AL	+ side input/output signal of the serial data (line driver positive logic)
4	I	+V	Power supply for AL- communication (+6 V)
5	I	-V	GND for AL- communication (0 V)
6	I/O	-AL	- side input/output signal of the serial data (line driver negative logic)
7	-	N.C	Connection is prohibited.
8	-	N.C	Connection is prohibited.

- J1 and J2 are the same terminal arrays. It is possible to connect with either.
- When the multidrop is connected, the divergence connection is done to other slave equipment through J1 or the J2 connector.

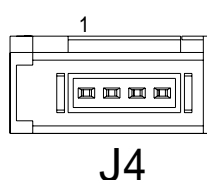
### (2) Power supply connector (J3)



Connector : 53426-0310 (Molex)  
Conformity connector : 51103-0300 (Molex: accessories)  
Conformity contact : 50351-8100 (Molex: accessories)  
Conformity crimp tool : 57295-5000 (Molex)  
Acceptable wire : AWG28 ~ AWG22  
(Coating 1.15 ~ 1.8)  
Conformity cable : CE-76/003C10-51103  
(1 m: It is not an accessories.)

No.	Direction	Signal name	Description
1	I	+24 V	DC +24 V power supply
2	-	GND	GND of +24 V power supply
3	-	F.G	Frame GND is connected with case.

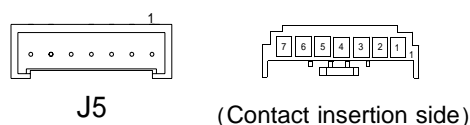
### (3) Extend I/O communication connector (J4)



Connector : 1565994-4 (e-CON: Tyco Electronics)  
Conformity cable : CE-66-01/IO-A03(0.3 m, It is not an accessories.)  
: CE-66-02/IO-A10(1 m, It is not an accessories.)

No.	Direction	Signal name	Description
1	I/O	+ RS485(EXT)	+ side signal of the Extend I/O serial data (line driver positive logic)
2	I/O	- RS485(EXT)	- side signal of the Extend I/O serial data (line driver negative logic)
3	-	S.G	Signal GND for Extend I/O
4	-	F.G	Frame GND is connected with case.

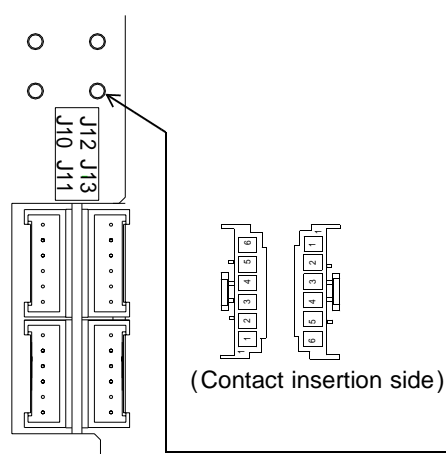
- Number of Extend I/O that can be connected from J4 is one unit.

**(4) General-purpose I/O connector (J5)**

Connector : 53426-0710 (Molex)  
 Conformity connector : 51103-0700 (Molex: accessories)  
 Conformity contact : 50351-8100 (Molex: accessories)  
 Conformity crimp tool : 57295-5000 (Molex)  
 Acceptable wire : AWG28 ~ AWG22  
 (Coating 1.15 ~ 1.8)

No.	Direction	Signal name	Description
1	-	R.GND	Return GND of each signal (for +24 V interface)
2	I	FSSTOP	Immediate stop signal of all axes (B contact)
3	I	$\overline{\text{IN0}}$	General-purpose input 0
4	I	$\overline{\text{IN1}}$	General-purpose input 1
5	O	$\overline{\text{OUT0}}$	General-purpose output 0
6	O	$\overline{\text{OUT1}}$	General-purpose output 1
7	-	N.C	Connection is prohibited.

- The default values of the FSSTOP signal is ACTIVE OFF input (B contact).  
 The pulse is not output if it doesn't connect into the status of NORMAL ON (GND connection) when signal unused.

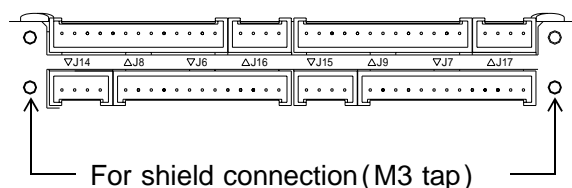
**(5) Sensor connector (J10: X-axis, J11: Y-axis, J12: Z-axis, J13: A-axis)**

Connector : 53426-0610 (Molex)  
 Conformity connector : 51103-0600 (Molex: accessories)  
 Conformity contact : 50351-8100 (Molex: accessories)  
 Conformity crimp tool : 57295-5000 (Molex)  
 Acceptable wire : AWG28 ~ AWG22  
 (Coating 1.15 ~ 1.8)

No.	Direction	Signal name	Description
1	I	CWLM	+(CW) direction LIMIT signal (B contact)
2	I	CCWLM	-(CCW) direction LIMIT signal (B contact)
3	I	$\overline{\text{NORG}}$	Machine origin proximity signal
4	I	$\overline{\text{ORG}}$	Machine origin signal
5	-	GND	Power supply (GND) for sensor
6	O	EXTVCOM+	Power supply (+24 V) for sensor

- The sensor connector is the same terminal array for all axes.
- The default values of the LIMIT signal of each axis are ACTIVE OFF input (B contact).  
 The pulse is not output if it doesn't connect into the status of NORMAL ON (GND connection) when signal unused.
- +24 V power supply GND and internal can be connected, and can use as power supply GND for return GND of sensor.
- GND and +24 V power supply GND is mutually connected internally.  
 These can be used as power supply GND for return GND and sensor.
- It can supply EXTVCOM+ as a power supply for sensor to the +24 V Max 150 mA/axis.  
 (There is an overcurrent protection circuit.)
- When user drops the shield of a cable for sensor, user uses a terminal in the sensor connector side, and please connect it.



**(6) DRIVER connector(J6, J14: X-axis, J7, J15: Y-axis, J8, J16: Z-axis, J9, J17: A-axis)**

Connector : 53426-1310 (Molex)

Connector : 53426-0410 (Molex)

\* Other party's connector and contact are not an accessory.

Conformity cable : The driver connection cable is prepared.

Please refer to the instruction manual of "connection / others". (It is not an accessory.)

**J6(X-axis), J7(Y-axis), J8(Z-axis), J9(A-axis)**

No.	Direction	Signal name	Description
1	O	CWP	+(CW) direction positive logic pulse
2	O	$\overline{\text{CWP}}$	+(CW) direction negative logic pulse
3	O	CCWP	-(CCW) direction positive logic pulse
4	O	$\overline{\text{CCWP}}$	-(CCW) direction negative logic pulse
5	O	DRSTCOM	For current output (+24 V) of DRST
6	O	$\overline{\text{DRST/M.F}}$	Servo reset signal when the servo driver. Motor current free signal when the stepping driver. (It is possible by general-purpose output. )
7	I	$\overline{\text{DEND/PO}}$	Position completion signal when the servo motor driver. Phase out signal when the stepping motor driver.
8	-	R.GND	Return GND
9	I	DALM	Driver alarm signal (It is possible by general-purpose input. )
10	-	R.GND	Return GND
11	O	EXTVCOM+	For the power supply (+24 V) of driver interface
12	O	$\overline{\text{S.ON}}$	Servo on signal (It is possible by general-purpose output.)
13	O	+COM	For photocoupler power source(+5 V) of $\overline{\text{CW/CCWP}}$ signal

**J14(X-axis), J15(Y-axis), J16(Z-axis), J17(A-axis)**

No.	Direction	Signal name	Description
1	O	$\overline{\text{A.CLR}}$	Alarm clear signal (It is possible by general-purpose output.)
2	I	+ZORG	+Z-phase signal of encoder
3	I	-ZORG	-Z-phase signal of encoder
4	-	D.GND	Digital GND(Return GND of line driver/line receiver)

- The driver connector is the same terminal array for all axes.
- The default values of the DALM signal of each axis are general-purpose input of ACTIVE OFF (B contact). The setting and B contact input of the halt function by the DALM signal detection can be switched to A contact input.
- It can supply EXTVCOM+ as a power supply for driver interface to the +24 V Max 30 mA/axis. (There is an overcurrent protection circuit.)
- S.ON and A.CLR output of Control I/O can be controlled with general-purpose I/O and Extend I/O according to the I/O-function or the Unit-function.

## 2-6. Input and output specifications

R1

## (1) Output specifications

## ● Output specification 1

Circuit	Description
<p>Same for all axes.</p>	<b>Signal name</b> CWP, $\overline{\text{CWP}}$ , CCWP, $\overline{\text{CCWP}}$ • + COM can be supplied for the photo coupler drive. (+4 V or more, Max. 30 mA)
	<b>Output method</b> Line driver (differential) output (Equivalent to 26C31: Compliant with RS422A)
	<b>Output current</b> $\pm 20 \text{ mA}$
	<b>Output frequency</b> Maximum 6.5 MHz (Independent drive)
	<b>Insulation</b> Non-insulated

## ● Output specification 2

Circuit	Description
<p>Same for all axes.</p>	<b>Signal name</b> $\overline{\text{DRST}}$
	<b>Interface voltage</b> +24 V
	<b>Output method</b> Nch transistor Open collector output
	<b>Output current</b> ON : 30 mA ( $V_{ce} = 1 \text{ V}$ or less) 50 mA ( $V_{ce} = 2 \text{ V}$ or less) OFF: 0.1 mA or less
	<b>Output response time</b> 1 ms or less (ON → OFF, OFF → ON)
	<b>Insulation</b> Photocoupler isolation (Between internal circuits and external circuits.)

## ● Output specification 3

Circuit	Description
<p>Same for all axes.</p> <p>Two points for the unit.</p>	<b>Signal name</b> ● Servo faction S.ON, A.CLR (EXTVCOM+ can be supplied by 24V for the driver: Up to 35 mA) ● General-purpose faction OUT0, OUT1
	<b>Interface voltage</b> +24 V
	<b>Output method</b> Nch transistor Open collector output
	<b>Output current</b> ON : 30 mA ( $V_{ce} = 1 \text{ V}$ or less) 50 mA ( $V_{ce} = 2 \text{ V}$ or less) OFF : 0.1 mA or less
	<b>Output response time</b> 1 ms or less (ON → OFF, OFF → ON)
	<b>Insulation</b> Photocoupler isolation (Between internal circuits and external circuits.)

\*1 An output electrical overload and short circuit should be careful.  
 An internal protection circuit (fuse) is blown.

## (2) Input specifications

### ● Input specification 1

Circuit	Description
<p>The sensor faction is each axis and a same specification. (The general purpose system and additionally (FSSTOP) is excluded.)</p>	<p><b>Signal name</b></p> <ul style="list-style-type: none"> <li>● Sensor faction ORG, NORG, CWLM, CCWLM *1 (EXTVCOM+ can be supplied by 24V for the sensor: Up to 100 mA)</li> <li>● Servo faction DEND/PO, DALM *1</li> <li>● General-purpose faction IN0, IN1</li> <li>● Other faction FSSTOP *1</li> </ul>
	<p><b>Interface voltage</b></p> <p>+24 V</p>
	<p><b>Input impedance</b></p> <p>6.8 K <math>\Omega</math></p>
	<p><b>ON/OFF level</b></p> <p>ON :2.5 mA or more OFF :0.8 mA or less</p>
	<p><b>Input response time</b></p> <p>1 ms or less (ON <math>\rightarrow</math> OFF、OFF <math>\rightarrow</math> ON)</p>
	<p><b>Insulation</b></p> <p>Photocoupler isolation (Between internal circuits and external circuits.)</p>

\* 1 The default value of each axis LIMIT signal, FSSTOP signal, and DALM signal is the ACTIVE OFF input.  
(B contact)

The pulse is not output if it doesn't connect it in the state of NORMAL ON (GND connection)  
when LIMIT signal and FSSTOP signal are unused.

- The logic of B contact input can be switched to A contact input. (Applied function)

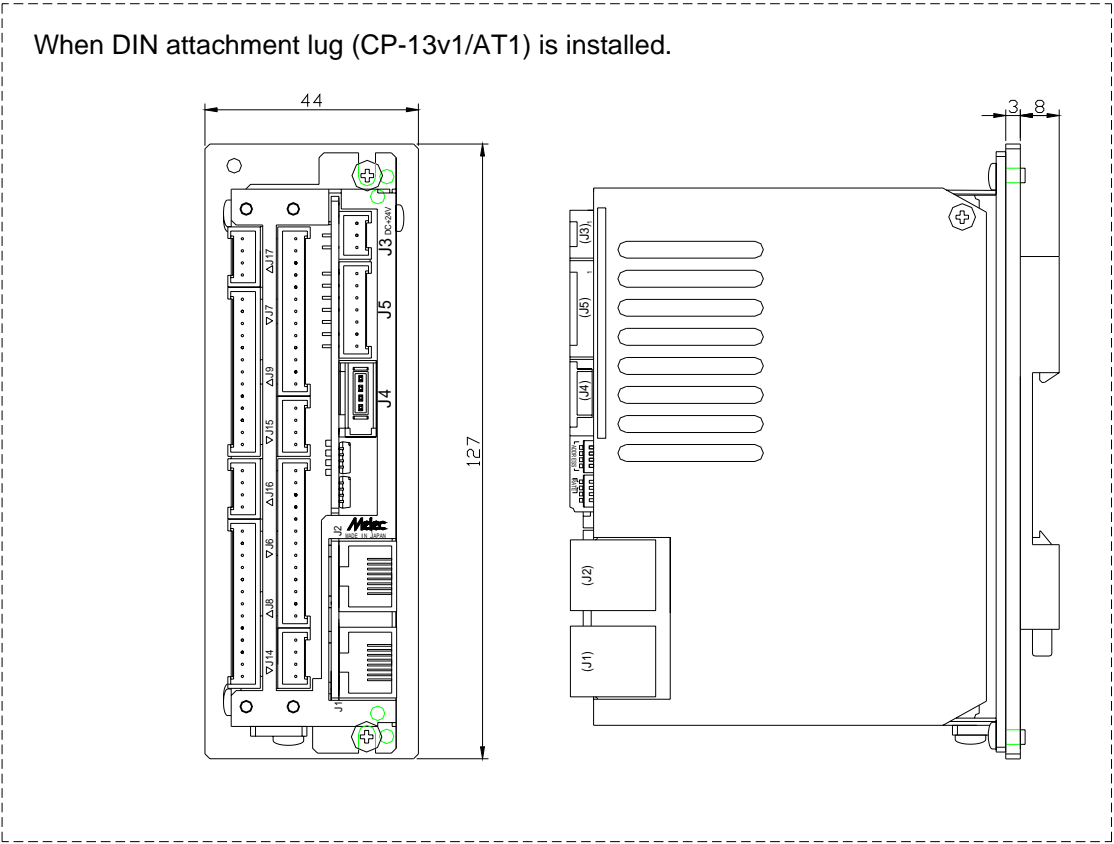
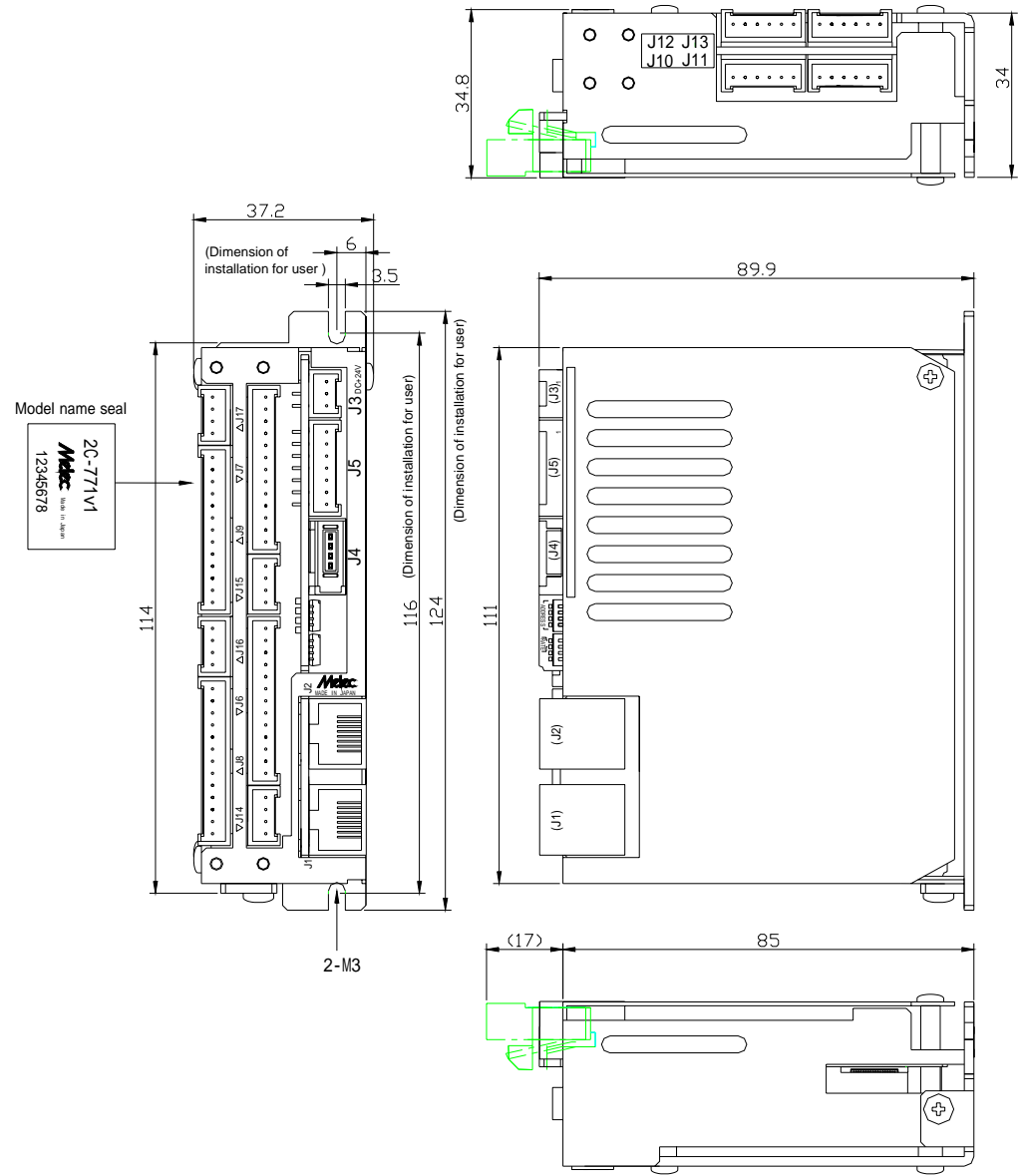
\* 2 An output electrical overload and short circuit should be careful.  
An internal protection circuit (fuse) is blown.

### ● Input specification 2

Circuit	Description
<p>Same for all axes.</p>	<p><b>Signal name</b></p> <p><math>\pm</math> ZORG</p>
	<p><b>Output method</b></p> <p>Line receiver input (Connect line driver with compliant RS422A.)</p>
	<p><b>Terminator</b></p> <p>220 <math>\Omega</math></p>
	<p><b>Input frequency</b></p> <p>100 KHz</p>
	<p><b>Insulation</b></p> <p>Non-insulated</p>

2-7. Outside dimensions

General tolerance ± 0.5 mm or less  
Externals tolerance ± 1 mm or less



## 3 . Setting

### 3-1. Installation of device driver for Windows

Device driver for Windows is necessary to operate this product.

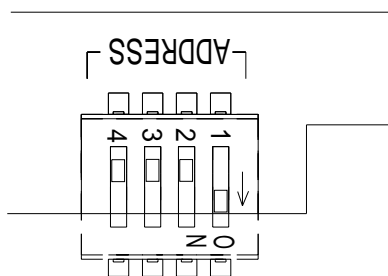
- Please refer to the installation manual attachment to a exclusive use device driver 「 MPL-34-01vx.xx/AL2W32 or MPL-35-01vx.xx/AL2W64 」 for details of the installation method.
- Please refer to the PCI master manual of the AL- series when it sets and operating by using application MAP-19-01vx.xx.

\* Version No. ... Please confirm the latest version of vx.xx at the manual of the device driver, and MAP-19 application.

### 3-2. Address setting of the AL- series (S1)

The slave address of the AL- communication is set with dip switch S1.

The master address is H' 0 fixation. And, please set not to overlap the address of each slave unit.



ADDRESS SWITCH No.	4	3	2	1
Setting is prohibited.	OFF	OFF	OFF	OFF
H' 1	OFF	OFF	OFF	ON
H' 2	OFF	OFF	ON	OFF
H' 3	OFF	OFF	ON	ON
H' C	ON	ON	OFF	OFF
H' D	ON	ON	OFF	ON
H' E	ON	ON	ON	OFF
H' F	ON	ON	ON	ON

Factory-set

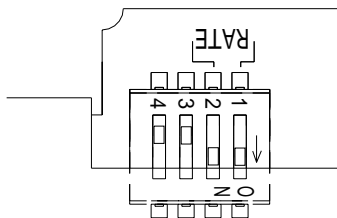
- When turning on power, the setting of S1 becomes effective.  
Set switch while turning off the power supply.  
And, turn on the power supply after the setting change.

### 3-3. Baud rate setting of the AL- series (S2)

The baud rate of the slave units of AL- communication is set with dip switch S2.

Set to masters the baud rate by an Environment-function.

And, set the same transmission rate as master to all slave units connected with the AL- series by the dip switch S2.



RATE SWITCH No.	4	3	2	1
Setting is prohibited.	OFF	OFF	OFF	OFF
Setting is prohibited.	OFF	OFF	OFF	ON
10 Mbps	OFF	OFF	ON	OFF
20 Mbps	OFF	OFF	ON	ON

Factory-set

- Turn off the 3rd and 4th bit of S2. These are the set prohibition.
- When turning on power, the setting of S2 becomes effective.  
Set switch while turning off the power supply.  
And, turn on the power supply after the setting change.

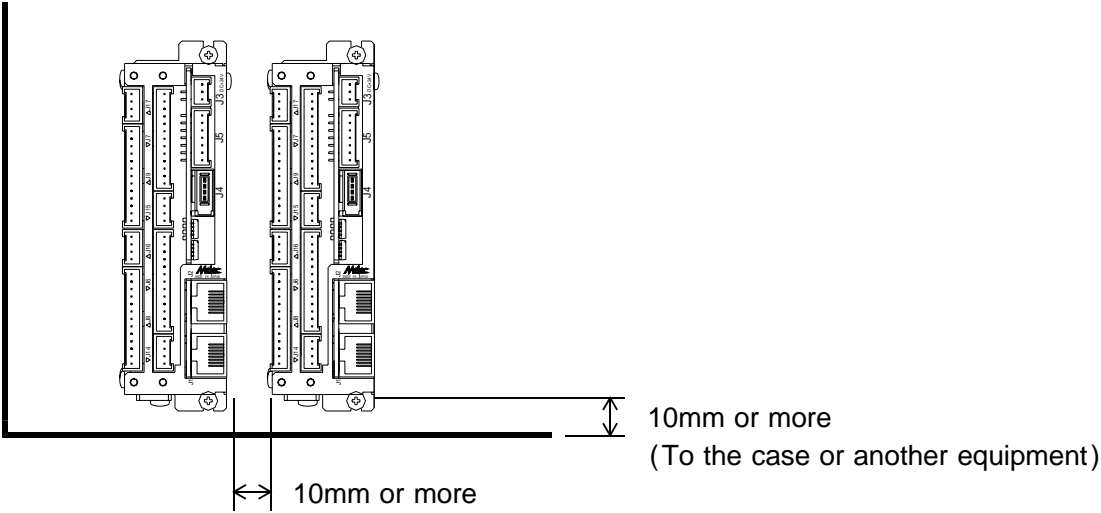
**4 . Installation and connection**

**4-1. Installation**

**(1) Installation distance**

Secure the flow of the wind for the upper and lower right and left 10 mm or more apart and set up 2C-771v1 as follows.

- Distance when two or more is arranged.
- Distance with panel of case.
- Distance with another equipment.

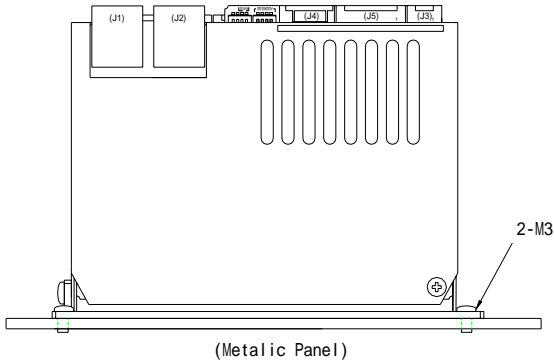


**(2) Installation method**

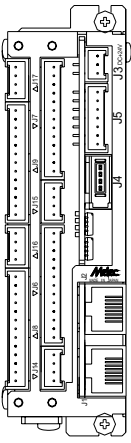
Horizontal installation

Install in a metallic panel by M3 screw.

The length of the screw must use appropriate length corresponding to the thickness of a metallic panel.

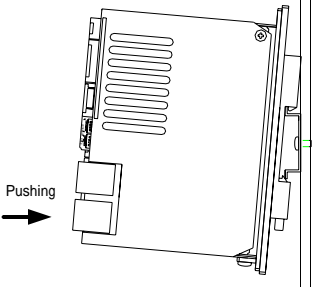


Vertical installation

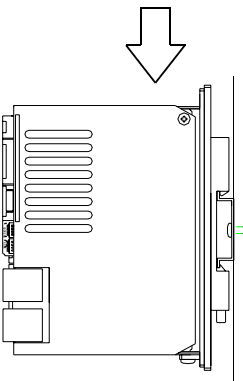


← Make the J3 connector upward, and install it with the M3 screw. The length of the screw must use appropriate length corresponding to the thickness of a metallic panel.

DIN rail installation



Exclusive use DIN attachment lug (CP-13v1/AT1) is installed on the main unit. Make J3 to the upward and install in the DIN rail.



\* Please refer to the "Connection /other" manual about the specification of DIN attachment lug.

## 4-2. Connection of AL- communication system

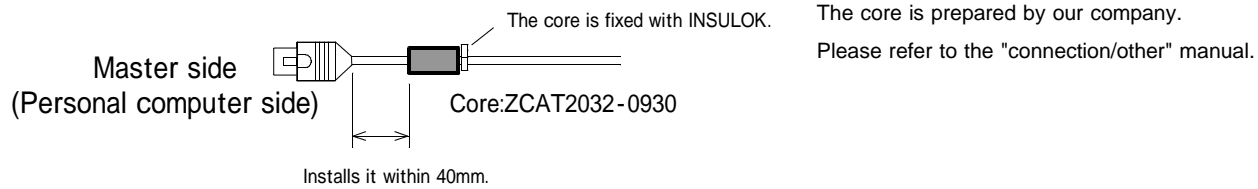
**CAUTION**

Operation not anticipated may cause damage of the machine and the product.

To prevent the malfunction by the noise, the AL- communications cable recommends recommended cable.

### (1) Core connection of AL- communications cable

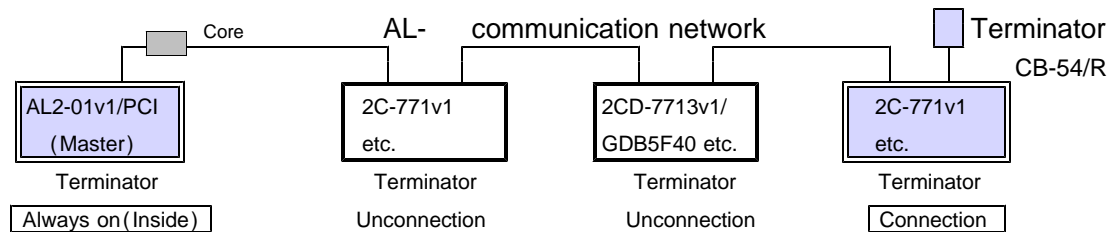
Please install the core in the master side. And, the personal computer system including the AL- communication is made to operated with stability.



### (2) Connection of terminator

Please connect terminator (CB-54/R) with the slave unit arranged on the AL- communication network edge. Please do not connect the terminator with other equipment.

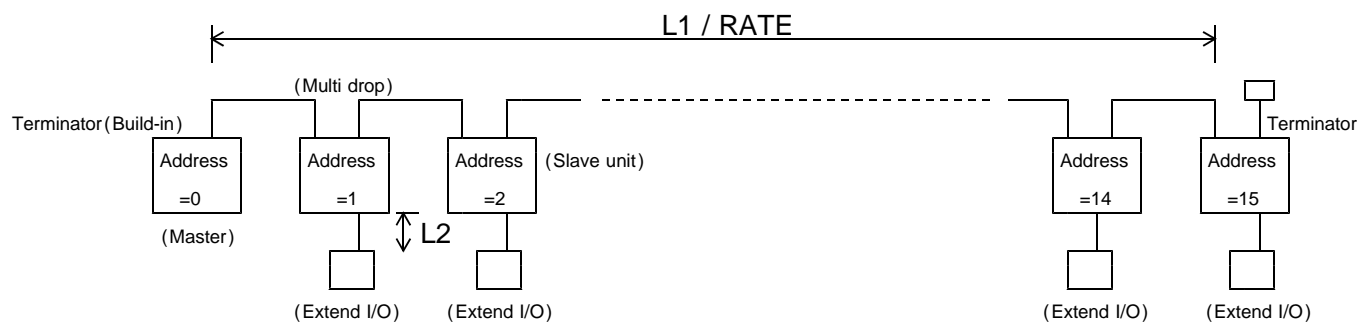
There is no problem even if AL- communications or the terminator are connected with either of J1, J2.



### (3) Wiring distance of AL- communication

The total wiring distance of the AL- communications cable is the following range including the multidrop wiring.

- The wiring distance of Extend I/O doesn't relate to AL- communication baud rate (RATE).
- The wiring distance of Extend I/O from each slave is within 1 m.



AL- communication baud rate and wiring distance

Wiring distance	RATE	
	10 Mbps	20 Mbps
L1 (AL- communication)	100 m or less	50 m or less
L2 (Extend I/O communication)	1m or less	

The number of slaves that can be connected directly with the AL- communication are 15 units or less. Extend I/O that can be extended directly from the slave unit is not included in the number of slaves.

### (4) Power supply and slave power supply for communication

The AL- communication power supply of each slave unit is supplied from the AL- master through the communications cable so that the entire AL- communication network should not become unstable when the power supply on each slave unit side is intercepted.

The reconnection of communications can be done by executing Environment-function to the master when the power supply of the main unit on the slave side is obstructed.

### 4-3. Connection example

#### (1) Examples of connection to power supply

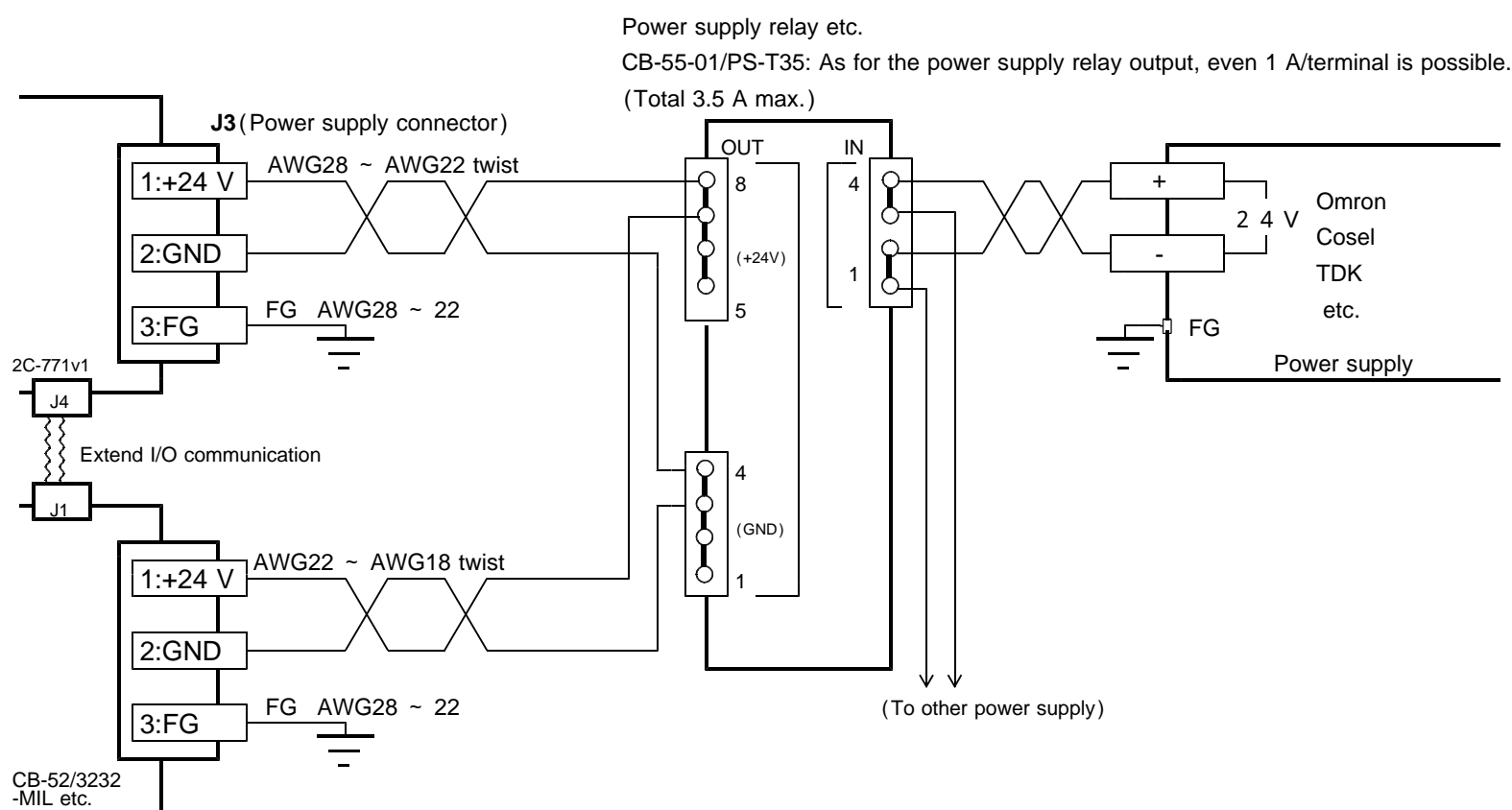


#### CAUTION

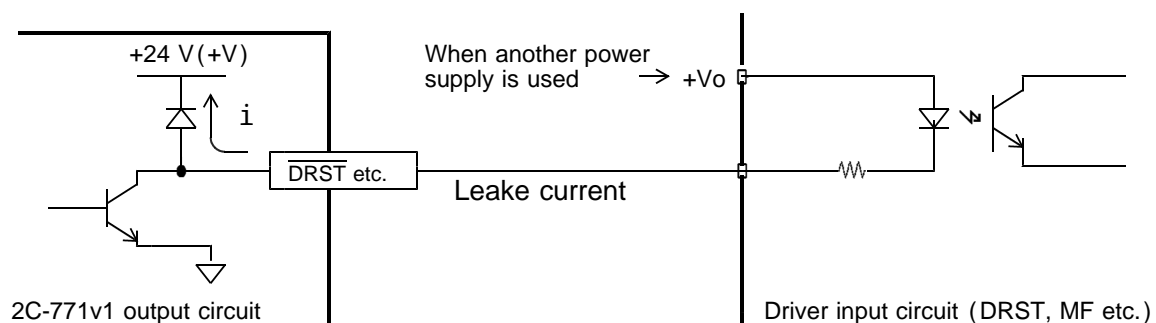
Operation not anticipated may cause damage of the machine and the product.

Separate the wiring for the power supply line by the following signal and 50 mm or more to prevent the malfunction by the noise.

- Principal circuit of another equipment.
- Power line of another equipment.
- AL- communications cable.



- Consider to confirm the current consumption of the wiring distance (resistance of the wire rod) and the AL- series product, and for the voltage drop of wiring to fill the input power supply specification of the product the thickness of the wire rod of the power supply.
- Take the power supply used for the driver interface from the power supply such as EXTVCOM+, and DRSTCOM prepared with 2C-771v1.  
Please refer to the example of connecting chapter 4-3(2) driver in detail.
- The Leake current flows through the protection diode of the output circuit when becoming power supply (+V) of power supply > 2C-771v1 of DRST or M.F signal output when supplying it in the power supply besides 2C-771v1, and the input circuit of the connection destination enters the state of turning on.





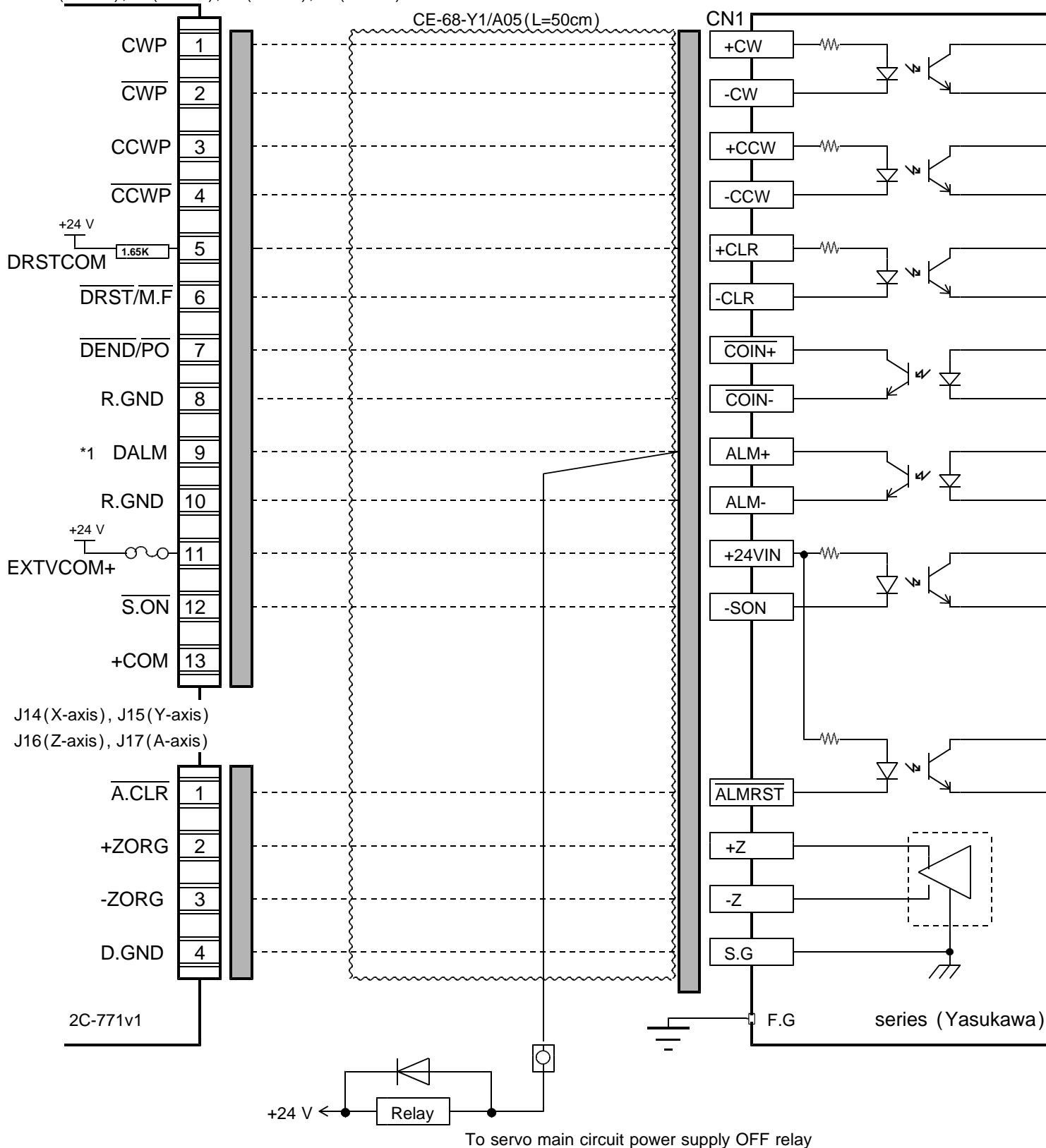
## (2) Examples of connection to driver

**⚠ CAUTION**

Operation not anticipated may cause damage of the machine and the product.  
Separate the signal wire of each motor driver by the power line and 50 mm or more to prevent the malfunction by the noise.  
Wire each signal within 1 m.

### Examples of connection to servo motor driver ( • series: Yasukawa)

J6(X-axis), J7(Y-axis), J8(Z-axis), J9(A-axis)



\*1 The DALM signal is ACTIVE OFF (B contact) input at default value.

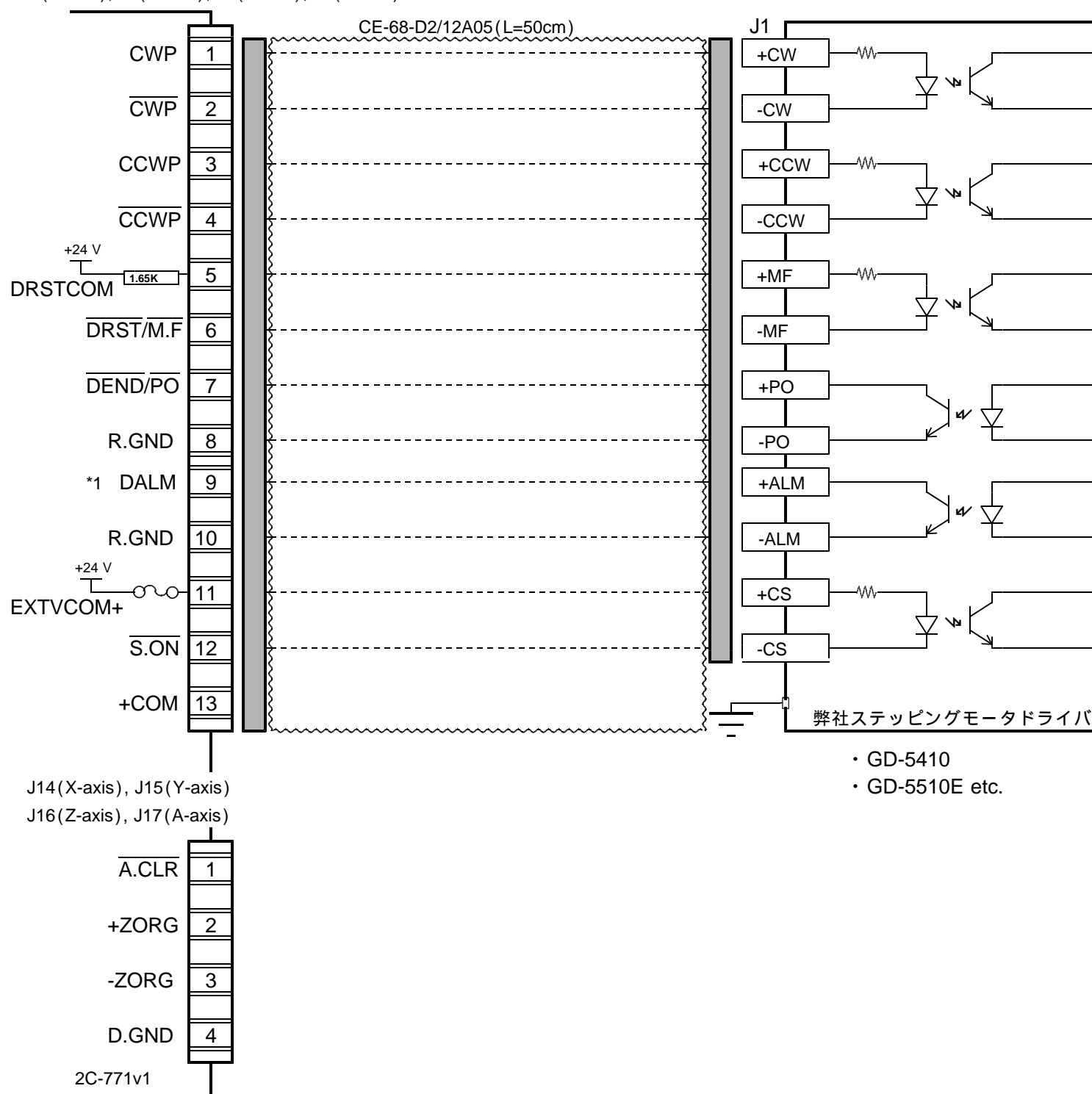
**Examples of connection to stepping motor driver (GD series: Made by our company)**

Please use the product of the DC driver all-in-one design when you use the stepping motor.

The special cable that can be easily connected with the stepping motor driver of the input made of our company AC type is prepared when a high-speed torque is necessary.

Each axis is the same.


J6 (X-axis), J7 (Y-axis), J8 (Z-axis), J9 (A-axis)



\*1 The DALM signal is ACTIVE OFF (B contact) input at default value.

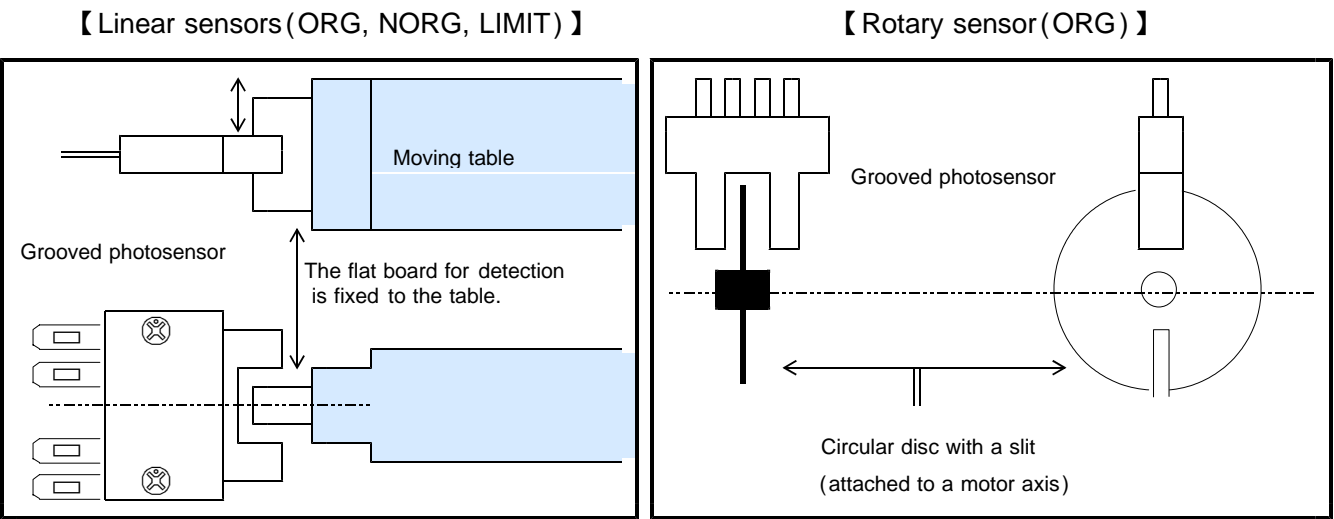
To do stepping motor driver's ALM signal (ACTIVE LOW) and the interface, active logic of the DALM signal input can be switched.

(3) Examples of connection to sensor (at photosensor)

 CAUTION

Operation not anticipated may cause damage of the machine and the product.  
Separate the signal wire of each sensor by the power line and 50 mm or more to prevent the malfunction by the noise.  
Wire each signal within 10 m.

Example of sensor attachment(photosensor)



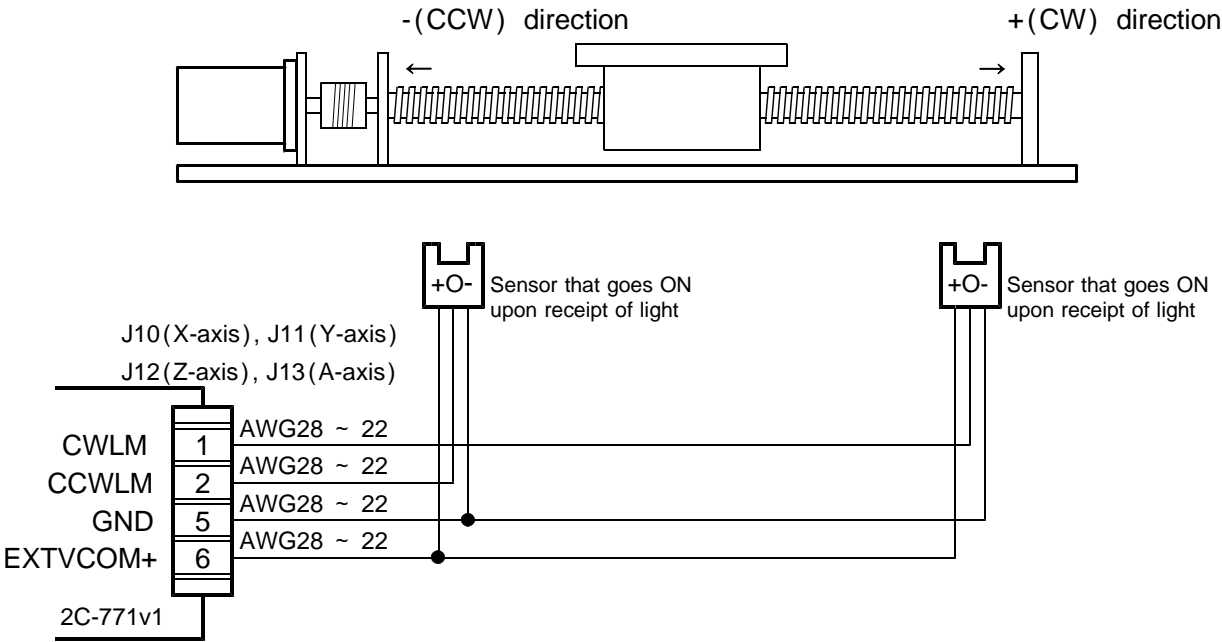
Example of recommended sensors

Sensor that goes OFF upon receipt of light		Sensor that goes ON upon receipt of light		Remarks Reference: Consumptioncurrent and type
Maker	Rating	Maker	Rating	
SUNX	PM- 24	SUNX	PM- 24	15 mA or less • NPN Type
	PM- 44		PM- 44	15 mA or less • NPN Type
	PM- 54		PM- 54	15 mA or less • NPN Type
	PM- 64		PM- 64	15 mA or less • NPN Type
OMRON	EE-SX910R	OMRON	EE-SX910R	15 mA or less • NPN Type

- Contact us, when you use sensors other than the above.  
(Example: large 35 mA article of consumption current etc.)

Example of connection to a LIMIT sensor

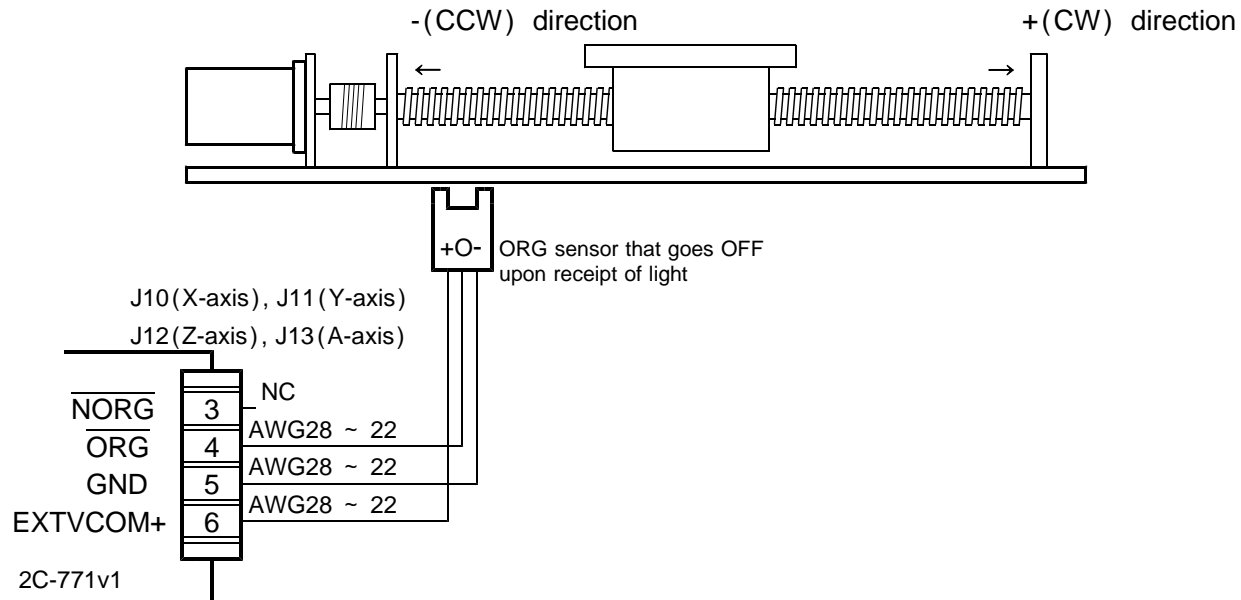
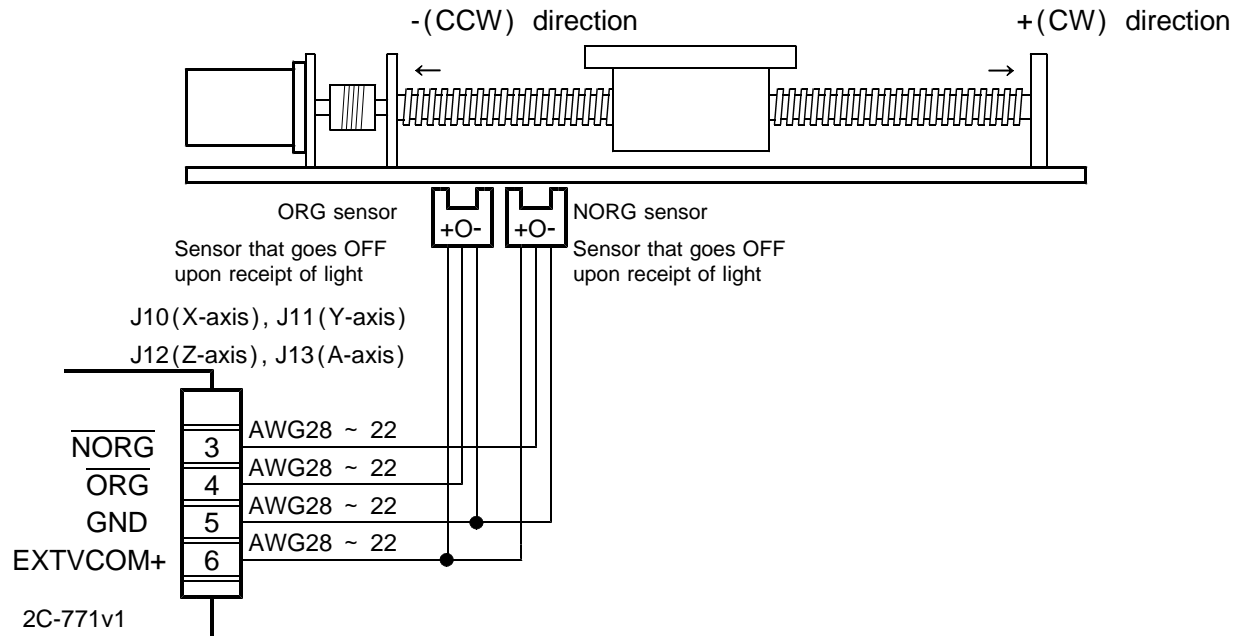
The pin numbering of each axis is the same.

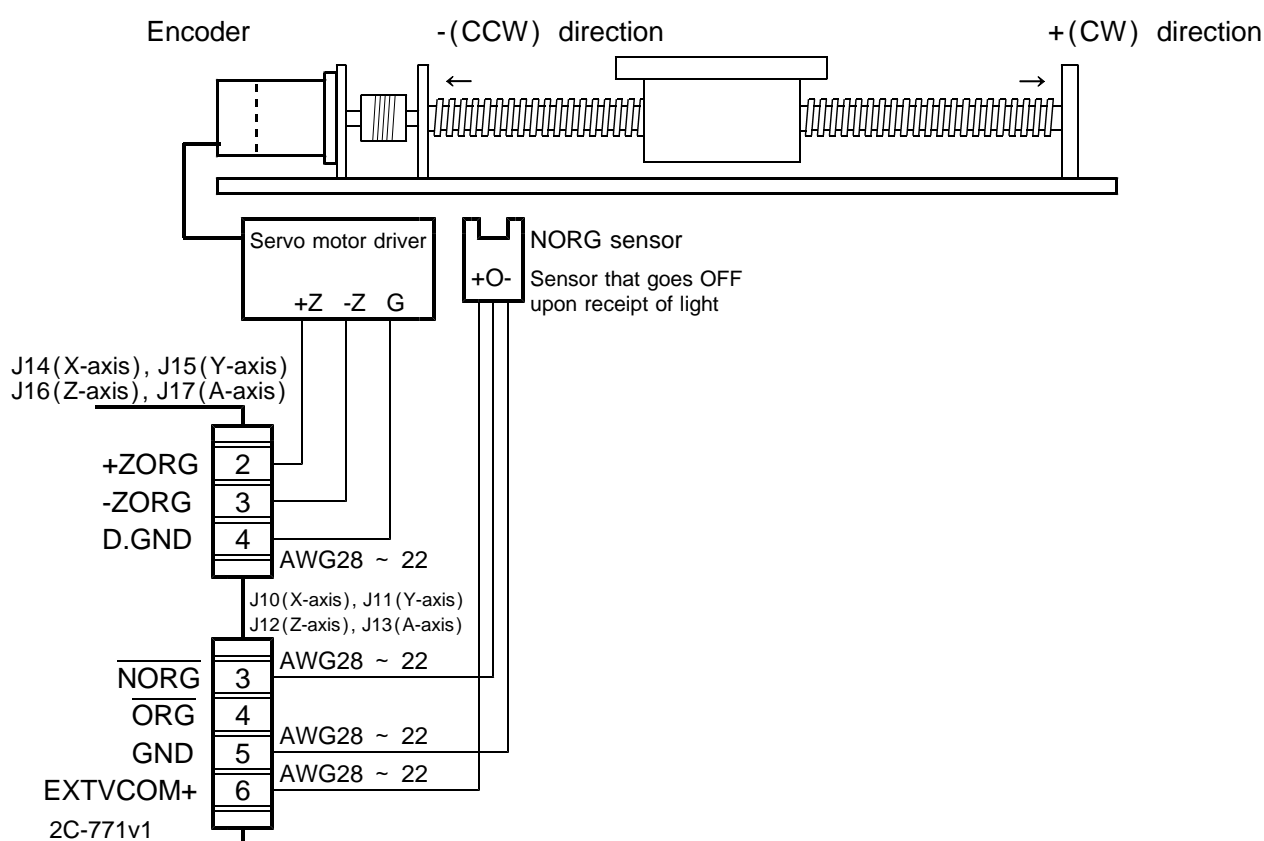


- The default value of the LIMIT signal is ACTIVE OFF (B contact) input.  
Even when the LIMIT signal is not used, the LIMIT signal input must be connected to GND in order to output pulses.

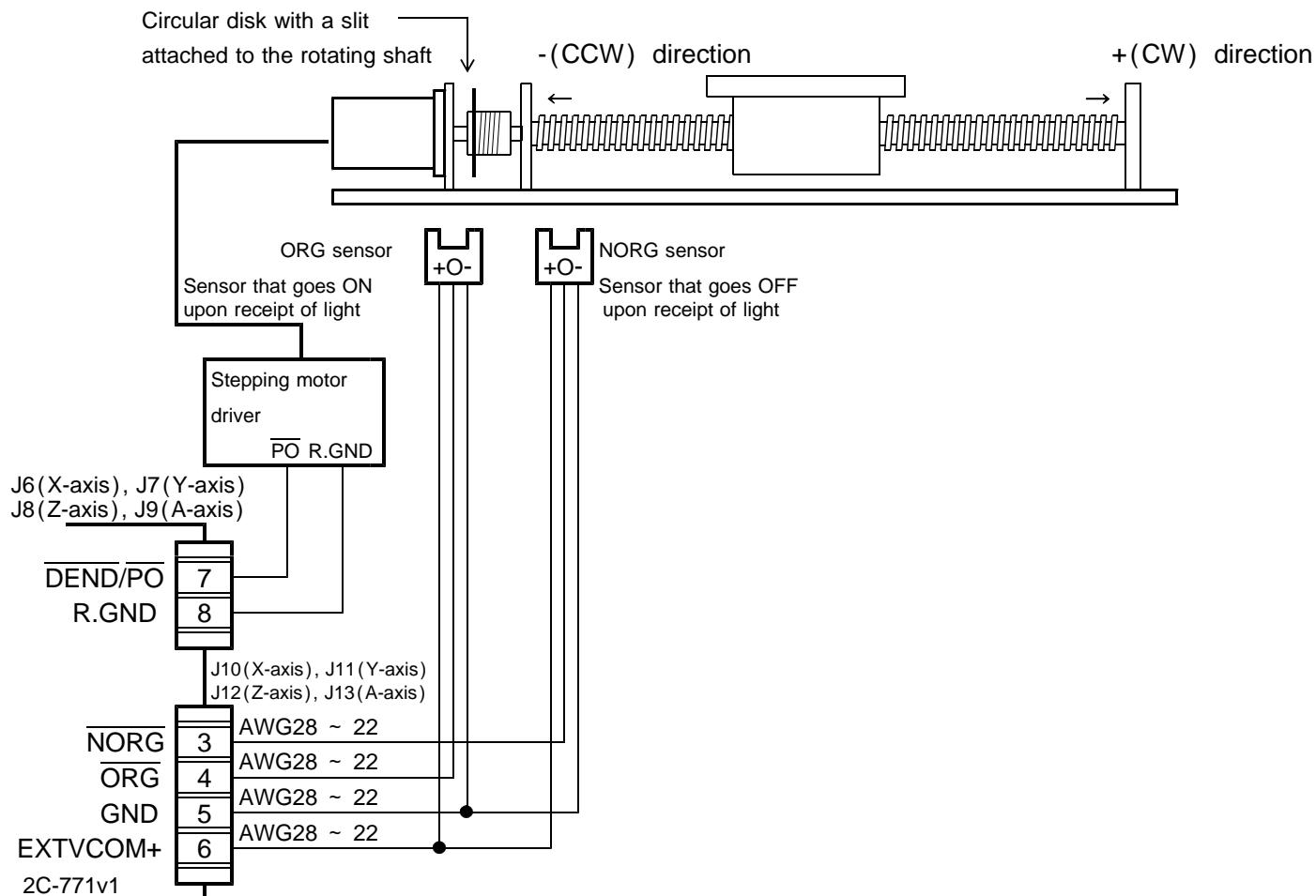
**Example of connection to an ORIGIN sensor**

The pin numbering of each axis is the same.

**【 When using the ORIGIN sensor only 】****【 When using the ORIGIN sensor + origin proximity signal 】**

**【 When using the Z-phase of encoder signal 】**

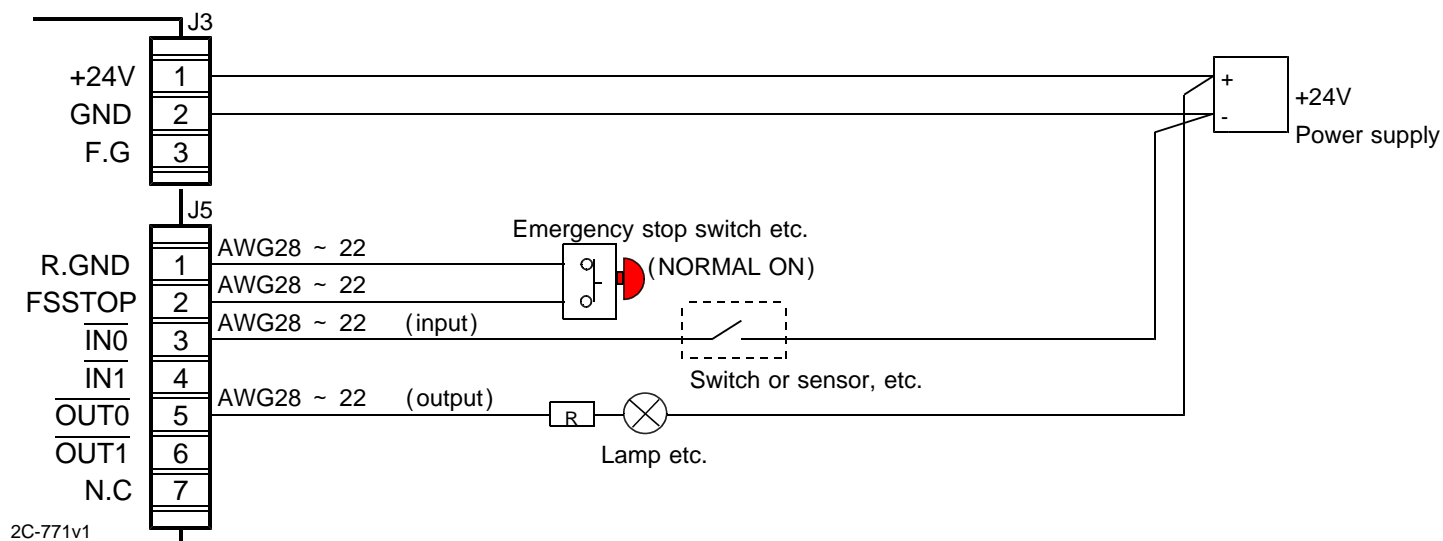
- The ORG signal is unconnection when the servo motor driver.  
And, please connect Z-phase (C ) signal with  $\pm$  ZORG signal.

**【 When using the P.O signal of stepping motor driver 】**

- The ORG signal can be detected by phase output (P.O) signal of stepping motor driver.  
In this case, change to the setting that detects the machine origin point by the P.O signal according to the ORIGIN SPEC SET function.

**(4) Examples of connection to general-purpose I/O****CAUTION**

Operation not anticipated may cause damage of the machine and the product.  
 Separate the signal wire by the power line and 50 mm or more to prevent the malfunction by the noise.  
 Wire each signal within 5 m.



- The default value of the FSSTOP signal is ACTIVE OFF (B contact) input.  
 Even when the FSSTOP signal is not used, the FSSTOP signal input must be connected to GND in order to output pulses.
- When general-purpose I/O point is insufficient, Extend I/O unit can be connected from 2C-771v1.

**(5) Examples of connection to Extend I/O unit**

One Extend I/O unit can be connected from the J4 connector of 2C-771v1.

- Please refer to the manual for details about an Extend I/O unit.

## 5 . Maintenance

### CAUTION

Incorrect handling may lead to an electric shock.

Inspection and maintenance need to be conducted by an expert engineer only.

Before inspecting and maintaining this product, turn off the power.

### CAUTION

An electric shock, injuries, and fire may be caused.

Do not make repair and modification such as product disassembly and parts replacement.

### 5-1. Maintenance and inspection

#### (1) Cleaning method

To use the product in a favorable condition, conduct cyclic cleaning as follows.

- During the cleaning of the connector terminal plating part, wipe it with a dry, soft cloth.
- If stain is not removed by the dry wiping, soak a cloth in a solution in which neutral detergent is diluted, wring it out, and wipe off the stain with it.
- Do not use a high-volatile solvent such as benzene and thinner, and a wipe.  
This may deteriorate gold plating by transformation and oxidation.

#### (2) Inspection method

To use the product in a favorable condition, conduct periodic inspection.

Usually conduct the inspection every six months or every year.

To use the product in an extremely hot and humid or dusty environment, shorten the inspection interval.

Inspection item	Inspection details	Criteria	Inspection method
Environment state	Check whether ambient and intra-device temperatures are appropriate.	0 ~ + 40	Thermometer
	Check whether ambient and intra-device humidities are appropriate.	10 % ~ 80 % RH (without dew condensation)	Hygrometer
	Check whether dust is deposited.	No dust	Visual check
Installation state	Check whether the product is firmly secured.	Not loose (6 kg·cm)	Torque wrench
	Check whether connectors are completely inserted.	Not loose and removed	Visual check
	Check whether cables are to be removed.	Not loose and removed	Visual check
	Check whether connecting cables are to be broken.	Appearance is normal.	Visual check

#### (3) Replacement method

If the product becomes faulty, repair it immediately because the entire device system may be affected.

To make the repair smoothly, a spare product should be prepared.

- To prevent an accident such as an electric shock during replacement, stop the device and turn off the power.
- If poor contacting is assumed, wipe contacts with a clean cotton cloth that is wet with industrial alcohol.
- Take a record of switch settings during replacement and return them to their state before the replacement.
- After the replacement, confirm that the new product is normal.
- For the faulty product replaced, have it repaired by returning it to the company with a report indicating as much details on the failure as possible.

### 5-2. Saving and disposal

#### (1) Saving method

Save the product in the following environment.

- Indoor (Place in which the product is not in the path of direct sunlight.)
- Place at ambient temperature and humidity within the specifications.
- Place free of corrosive and inflammable gases.
- Place free of dust, dirt, salt, and iron powder.
- Place free of direct vibration and shock to the product body.
- Place free of water, oil, and chemicals droplets.
- Place where a person cannot ride or put objects on the product.

#### (2) Disposal method

Handle the product as industrial waste.

**The main parts which revised by this manual**

Parts	Content
P18,19	<b>【R1】</b> ・ The Polyswitch of a protection circuit is revised at a fuse.



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This Operating Manual is subject to change without prior notice  
for the purpose of product improvement.

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