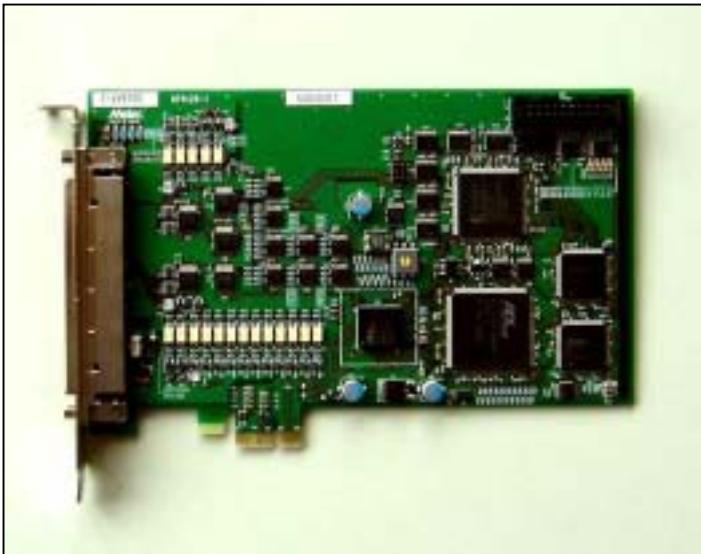# Melec

Stepping & Servo Motor Controller

C-VX870E
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.

C E

MN0149

Introduction

This instructions manual explains the handling of "Stepping Motor and Servo Motor Controller C-VX870E" 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 C-VX870E allows axes to be controlled independently and therefore referred to each axis as follows:

Product Name	Number of axes	1st axis	2nd axis	3rd axis	4th axis
C-VX870E	4 axes	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 initial 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.
Refer to Section 3, "Setting."

When board Contorller (C-VX870E) is used on Windows, refer to separate manual
"C-VX870 series Device Driver Manual (MNO105,MNO106)".

When board Contorller (C-VX870E) is used on any OS other than Windows, refer to separate manual
"Technical Data A. (MNO110)"

Introduction
Description of Safety
Before Use

The main parts which revised by this manual

OVERVIEW

1-1. Features

The C-VX870E is a controller equipped with four independently functioning axes.
This controller supports servo and stepping motors that can directly be inserted into slots of a PCI Express bus system(x1 Lane) conforming to PCI Express bus specifications R1.0a.

The board shape is the OEM(x1 Lane) short card size(107 x 170) of the PCI Express bus standard.

The C-VX870E is equipped with our chip controller MC007 to enable motor control using simple commands.

C-VX870E enables four independently linear interpolation driving, 2-axis linear interpolation (fixed interpolation-axes) or 2-axis circular interpolation (fixed interpolation-axes) driving.

The 32-bit width address counter and the maximum output frequency of 6.5 MHz of the MC007 enables high-precision, high-speed positioning.

Also equipped with a multi-functional 32-bit pulse counter, and 16-bit pulse differential counter, the C-VX870E has a variety of application such as counting feedback pulses from the servo driver, detecting step-out of the stepping motor with an encoder.   The applications also include interrupt output and external signal output using the comparator function of each counter.

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 C-VX870E is enable to optional axes liner interpolation drive or optional 2-axis circular interpolation drive. **(Applied function)**

1-2. Product Configuration

Product name	Rating	Maker	Quantity	Remarks
Controller	C-VX870E	Melec Inc.	1	(Main unit)

1-3. Example of System Configuration
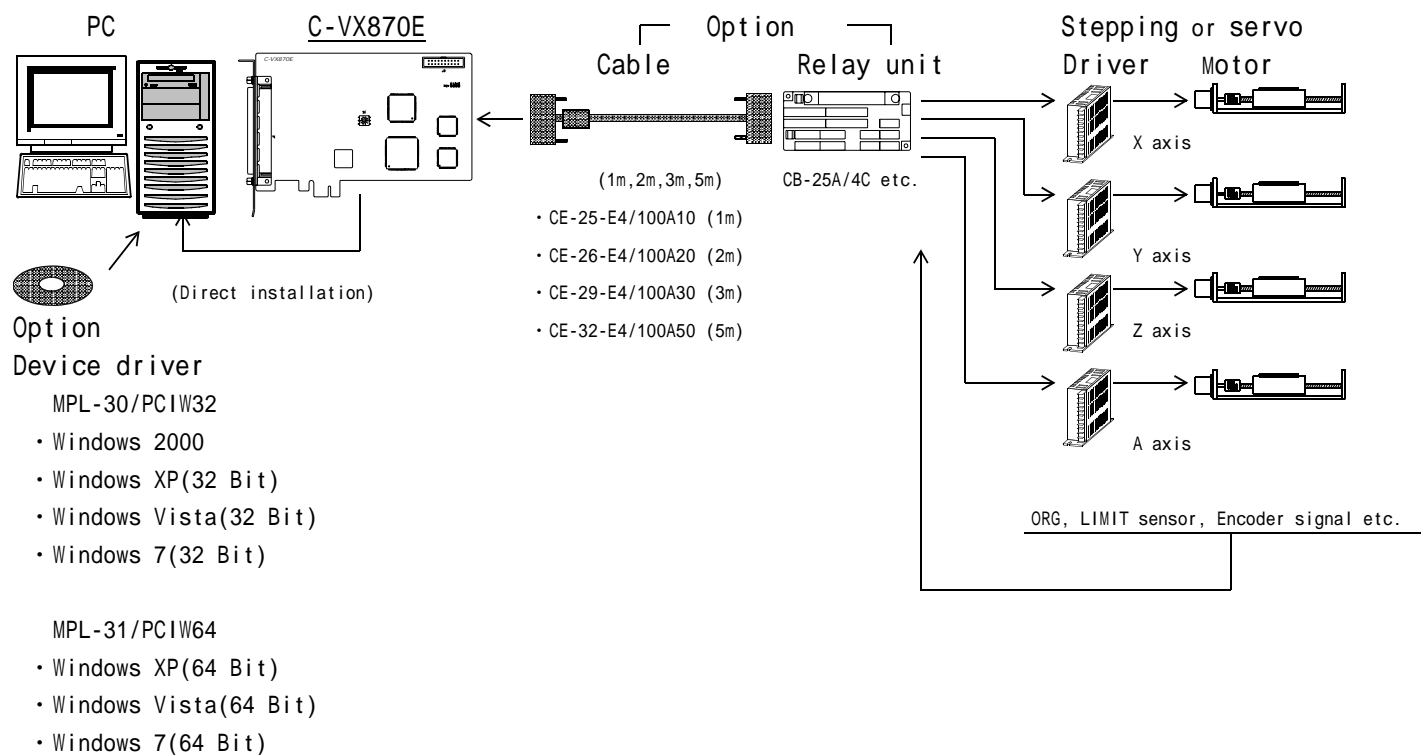
1-4. Function Block Diagram

1 Bus interface block
   Interface block with the PCI Express bus
   The PCI Express is x1 lane.

2 Drive control block
   The drive control block outputs serial pulses to the motor driver.

   The 2-axis indicated by ☐ is interrelation.

   It enables 2-axis linear interpolation driving or 2-axis circular interpolation driving.

3 Counter block
   The counter block has three types of counters: ADDRESS COUNTER, PULSE COUNTER, and DFL COUNTER.
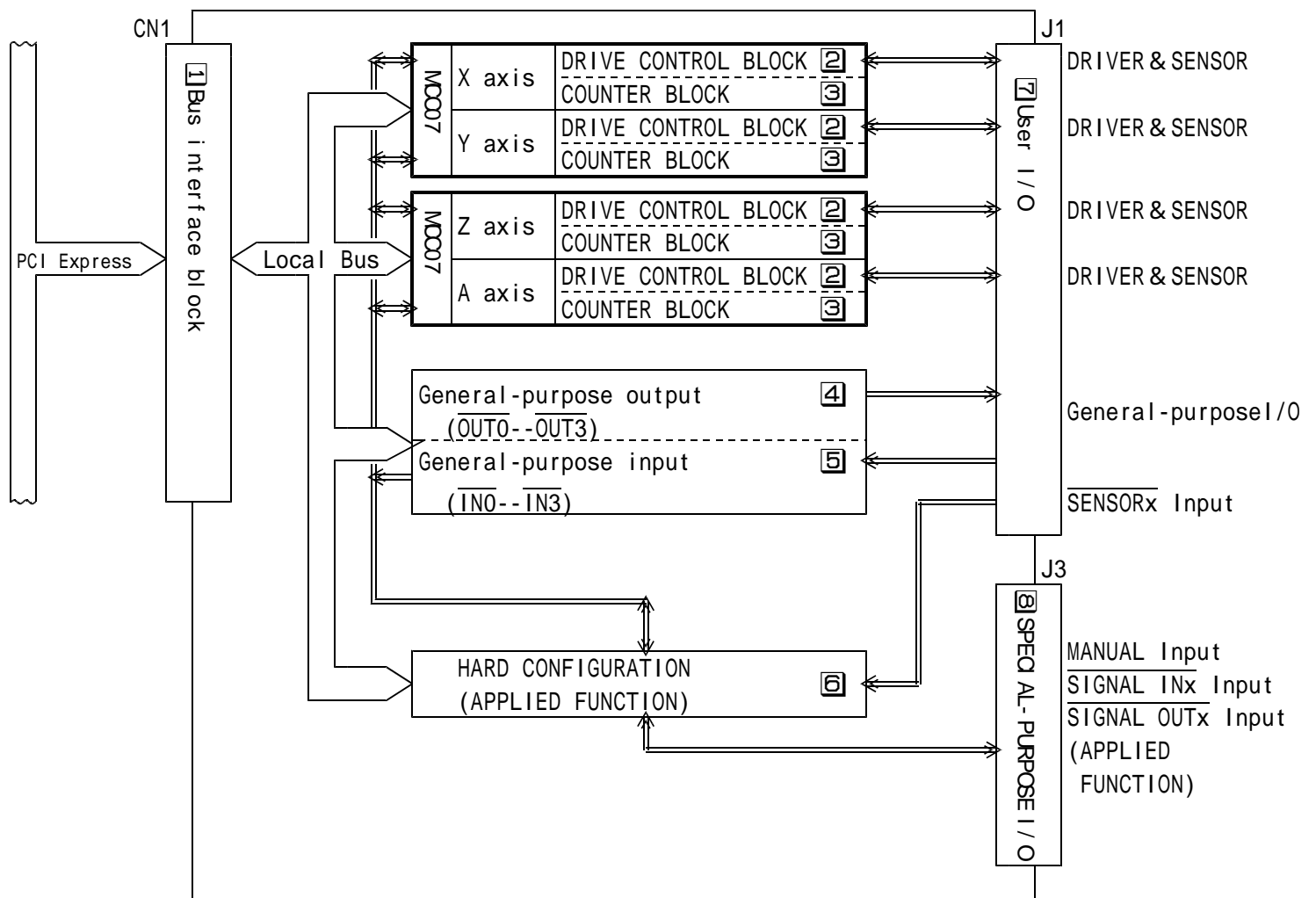   (Can use as hard timer.)
   ADDRESS COUNTER, PULSE COUNTER has 32-bit counter, DFL COUNTER has 16-bit counter.
   These counters count pulses output by the controller or signals such as feedback signals from the
   encoder.
   Each counter equipped with three compare registers. These registers count optional count.

4 General-purpose OUTPUT block
   The block can control $\overline{OUT0}$ $\overline{OUT3}$

5 General-purpose INPUT block
   The block can control $\overline{IN0}$ $\overline{IN3}$

6 HARD CONFIGURATION block (APPLIED FUNCTION)
   The HARD CONFIGURATION block is a control block that allows the user to connect User I/O and
   Special-purpose I/O to signals: Multipurpose sensor signal input to each axis, signal for
   synchronization control, status signal.
   The control block is used for multipurpose sensor function, Synchronous drive function, Status
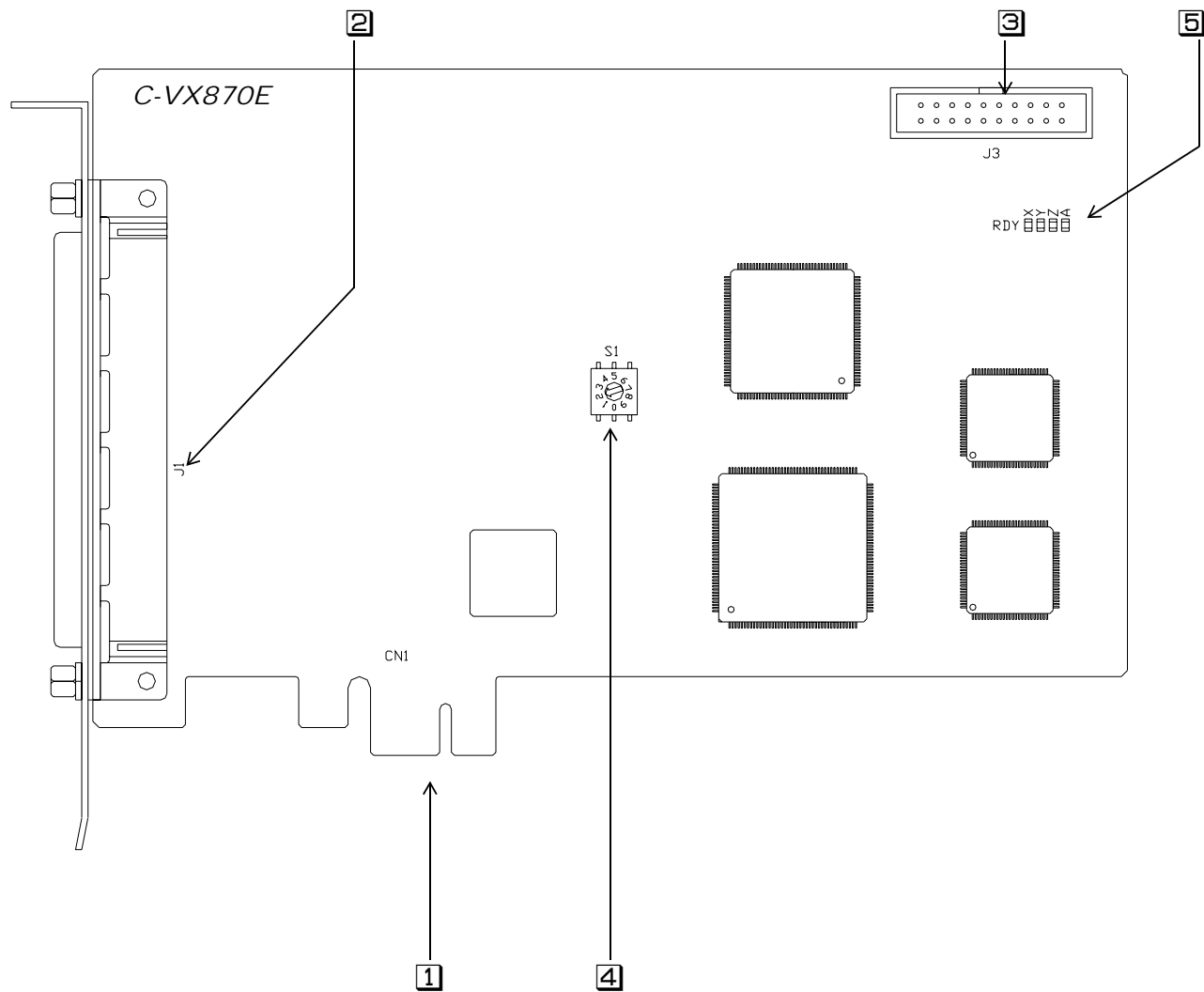   output function.

⑦ User I/O block
The user I/O block interfaces with motor drivers, sensors, and general-purpose I/O equipment signals.

⑧ Special-purpose I/O block (APPLIED FUNCTION)
The block interfaces with input signals what motors can be operated manually, and what can output status signals to the outside.

1-5. Externals of product

1 CN1 ------- x1 lane board edge connector inserted into a PCI Express bus slot.

2 J1 --------- 100-pin half pitch connector that interfaces the motor driver, sensor signals, and equipment having +24V interface I/O.
Dedicated interface cables (1m, 2m, 3m, and 5m) and relay units are available.

3 J3 --------- Connector that interfaces with external signals at TTL level.
(APPLIED FUNCTION) Motors can be operated by manual operation through this connector.
External input signals can be assigned as input signals to signals for the SENSOR and signal for synchronization control.
Signals can be output to the outside by status signal of each axis.
A general-purpose standard MIL connector is used.

4 S1 ---------- Rotary switch that is set so that PCI can recognize the board number.
If two or more boards are inserted into the PC simultaneously, set the switch properly so that every board number is unique.

5 RDY LED --LEDs that allows the user to simply monitor the X, Y, Z, and A axes to check whether the axes are operating normally. The RDY LED corresponding to each axis is on while the axis is waiting for a command and is off during command processing.

SPECIFICATIONS

2-1. PCI Specifications

No.	Item	Specifications
1	Applicable standard	PCI Express Base Specification Rev1.0a
2	Bus interface	PCI Express x1 lane
3	Interrupt	INTA#
4	system resouce	I/O : 4K-byte
5	Dimensions	PCI Express OEM x1 short card size(107mm× 170mm× 17mm)

2-2 General Specifications

No.	Item	Specifications		
1	Supply voltage, power consumption	+3.3V± 9 , 1.4A or less DC+24V± 2V, 200mA or less (for photocoupler interface)		
2	Operating ambient temperature and humidity	0 45 80 RH or less (without dew condensation)		
3	Storage temperature and humidity	0 55 80 RH or less (without dew condensation)		
4	Installation environment	Inside a well-ventilated cabinet installed indoor, free from direct sunlight Not exposed to corrosive and flammable gasses, and not affected by oil mist, dust,salt, iron powder, water, and chemicals Not subject to constant vibration or excessive shock Not affected by electromagnetic noise caused by power equipment Free of radioactive materials and magnetic fields, and not in vacuum		
5	Weight	About 0.2 kg		

2-3. Basic Specifications

No.	Item	Specifications	
1	Number of control axes	4 axes	
2	Pulse output function	Output type	Independent direction output/Specified direction output/ Phase-differential signal output Line driver output
		Output frequency	Independent drive 0.1 Hz to 6.5 MHz Interpolation drive 0.1 Hz to 5 MHz
		Acceleration/deceleration time constant	5000 ms/kHz to 0.0025 ms/kHz (Trapezoid/S-curve)
		Acceleration/deceleration shape	Trapezoid/S-curve(This feature enables to set asymmetrical shape)
		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	JOG drive : -65,535 to +65,535 pulse SCAN drive : Up to infinite pulses INDEX drive : -2,147,483,647 to + 2,147,483,647 pulses
3	Encoder function	Input type	Incremental Line receiver input
		Input range	5MHz
		External signal output	External signals such as hand pulser signals that are input to the EA and EB signals can be output as CWP and CCWP signals.
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	Linear interpolation is performed toward the specified coordinates from the current coordinates. Driving type is selected from INDEX drive or SCAN drive. Max speed is 5MHz. Positional errors for the specified straight line are ± 0.5 LSB. The absolute and relative addresses that can be specified for coordinates range from -2,147,483,647 to +2,147,483,647 (32 bits).
		2-axis circular interpolation drive	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. Driving type is selected from INDEX drive or SCAN drive. Max speed is 5MHz. Positional errors for the specified circuit curve are ± 1 LSB. The relative addresses range from -8,388,607 to +8,388,607 (24 bits). Short axis pulses range from -2,147,483,648 to +2,147,483,647 (32 bits).
		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	SLOW STOP command Detection of a match of the comparator of each counter. $\overline{IN0}$--$\overline{IN3}$ signal setting the DALM input function, the DALM signal can be used as the slow stop signal. Multipurpose sensor signal (SS0, SS1)
		Immediate stop function	FAST STOP command FSSTOP singal (User I/O) $\overline{FSSTOP}$ signal (Special-purpose I/O) Detection of a match of the comparator of each counter. $\overline{IN0}$--$\overline{IN3}$ signal setting the DALM input function, the DALM signal can be used as the immdiate stop signal. Multipurpose sensor signal (SS0, SS1)
		LIMIT signal	+ direction stop Immediate stop by CWLM signal and slow stop can be selected. Slow stop or immediate stop can be performed for each axis upon detection of a match of the comparator (COMP2) of each counter. - direction stop Immediate stop by CCWLM signal and slow stop can be selected. Slow stop or immediate stop can be performed for each axis upon detection of a match of the comparator (COMP3) of each counter.
6	Counter function	Address counter	32-bit counter that manages absolute addresses by counting drive output pulses
		Pulse counter	32-bit counter that countes external pulse signals or encoder feedback pulses.
		Pulse differential counter	16-bit counter that detects differences in the number of pulses by counting external pulse signals and encoder feedback pulses. It can also be used as a 16-bit timer.
		Comparator function	Detection of a match of the three comparators of each counter. Upon detection of a match by the comparator, pulse output can be decelerated and then stopped, or stopped immediately. Upon detection of a match by the comparator, output external status signal.
		AUTO CLEAR function	The comparator of each counter: The counter can automatically be cleared upon detection of a match of COMP1 of each counter.
		AUTO ADD function	The comparator of each counter: If the couter value reaches the COMP1, a value that is set by the data add to COMPARE REGISITER1.
7	Other functions	Servo driver support function	The signals are specially prepared as servo driver suport signals. Servo positioning completion input/phase ($\overline{DEND}/\overline{PO}$) signal input Servo reset output ($\overline{DRST}$) General-purpose input signal (DALM.etc) ($\overline{IN0}$--$\overline{IN3}$) General-purpose output signal (S.ON.etc) ($\overline{OUT0}$--$\overline{OUT3}$)
		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		Description of specifications
1	Drive function	UP/DOWN/CONST drive CHANGE function	Drive change for acceleration, deceleration, or constant speed can be performed upon detection of signal at an arbitrary change operation point.
		SPEED CHANGE function	The drive pulse speed is changed upon detection of signal at an arbitrary change operation point.
		RATE CHANGE function	The rate is changed upon detection of signal at an arbitrary change to the specified rate.
		INDEX CHANGE function	Upon detection of signal at an arbitrary change operation point, the stop position at which drive is to be finished is changed. 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. 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.
		Optional axes liner interpolation drive	Linear interpolation is performed toward the specified coordinates from the current coordinates. Then long axis outputs pulses.
		Optional 2-axis circular interpolation drive	Circular interpolation is performed toward the specified coordinates from the current coordinates on the circular curve.
		INDEX drive controll 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 INDEX drive, and circular interpolation INDEX drive.
		MANUAL SCAN drive	MANUAL SCAN/JOG drive in the + or - direction is performed by operation of SELA to D, $\overline{MAN}$, $\overline{CWMS}$, $\overline{CCWMS}$ signal input through the J3 connector.
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	This function latches count data of a counter at a specific latch timing and holds it till the next latch timing. Each counter can latch counter value at arbitrary timing. It is possible to clear a counter value at the latch timing.
3	Other functions	Interrupt function	Each axis can output interrupt signals to the CPU. Each interrupt signal is output when an interrupt is caused by drive end, state of a reservation register, and detection of a match by the counter.
		Command reservation function	Each axis has a reservation register that can store data commands for ten instructions. General-purpose commands of Drive commands can be reserved in the reservation register. 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.
		Input signal logical switch function	The input signal can be changed to logic as follows: CWLM CCWLM $\overline{DALM}$ ($\overline{INx}$ is used for DALM function)

| No.	Item		Description of specifications
3	Other functions	Input signal time constant function	The input signal can be set time constant as follows: CWLM CCWLM $\overline{DALM}$ ($\overline{INx}$ is used for DALM function) $\overline{DEND}/\overline{PO}$ $\overline{ORG}$ $\overline{NORG}$ ± ZORG ± EA, EB
		Multipurpose sensor signal input	Each axis has multipurpose sensor signal input used as stop signal, trigger signal of a counter latch data and drive CHANGE operating signal. The signal can be used as multipurpose sensor as follows: $\overline{SENSORx}$ input signal $\overline{SIGNAL\ INx}$ input signal A status in any axis
		Status external signal output function	The compare register value, STATUS, output signal of each counter can output as $\overline{SIGNAL\ OUTx}$ output signal.
		Synchronized start function	You can perform synchronized start with any axis. A condition of start can be set by the condition as follows: $\overline{SENSORx}$ input signal $\overline{SIGNAL\ INx}$ input signal A status in any axis PAUSE command
		Status read Data reading	Current status information can be read in real time. Current status information includes setting data any axis, latch data of a counter etc.

Applied function. Refer to the separate manual MPL-30/PCI W32 Applied Functions Part

2-5. Input and Output Signal Table

(1) User I/O connector

Pin assignments

Connector type name   DX10A -100S(50) (HIROSE Electric)
Adaptable socket   DX30A -100P(50) ,DX31A -100P etc.
                       (Hirose Electric, not included in attached accessories)
Adaptable cable   1 m, 2 m, 3 m, or 5 m shielded cable (option)

```
    50                                              1

    100                                             51
```
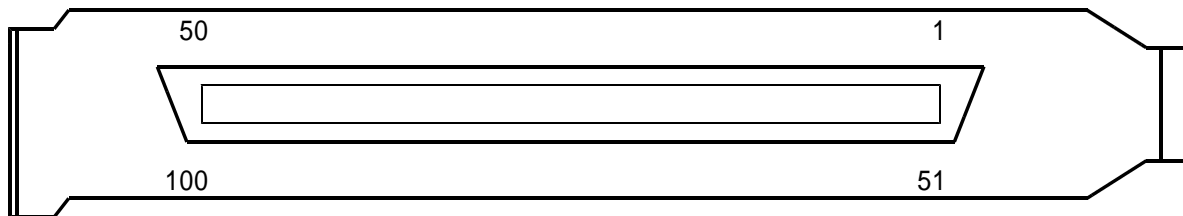
Signal table

⚠CAUTION	This product may be damaged. Do not connect +24V to any pin other than EXTV. After wiring, be sure to confirm the wiring before power-on.

A signal indicated by [   ] is photocoupler-insulated.
A signal is enable to set time constants marked with   . (Applied function)
Logic switching is enabled for an input signal marked with   . (Applied function)
  Logic switching is enabled for general-purpose input signal $\overline{INx}$,
  when this signal is used for DALM function

(Note 1)
An external power supply is required for a signal that is photocoupler-insulated.
The specified input voltage range is +24V ± 2V.
Current consumption at +24V is up to 200 mA.
The initial values of the CWLM and CCWLM signals of each axis and the FSSTOP signal are
ACTIVE OFF input (B contact).
An external power supply must be connected even if these signals are not used.
The default contact B is recommended for the CWLM and CCWLM signals.
However, A-contact signal input can also be used by switching logic.

(Note 2)
$\overline{SENSORx}$ input signals are used for multipurpose sensor function, synchronization control
function. These input signals is used by any functions setting. (Applied function)
The initial value after resetting is as follows:
$\overline{SENSOR0}$ signal is SSO of Z axis, $\overline{SENSOR1}$ signal is SSO of A axis.
When $\overline{SENSORx}$ input signal is used for multipurpose sensor function, this signal can not use in
MANUAL mode.
When MANUAL mode, the functions of multipurpose sensor assigned to the $\overline{SENSORx}$ input signal are
invalid.
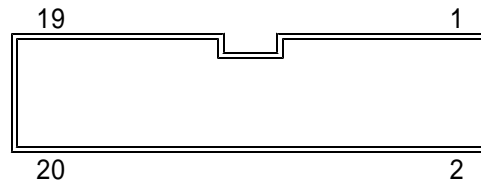When BUS mode, this function are valid.

Pin No.	Dir- ect- ion	Signal name	Description	Pin No.	Dir- ect- ion	Signal name	Description
1	In	XCWLM	X axis + (CW/Y direction limit signal	51	In	ZCWLM	Z axis + (CW/Y direction limit signal
2	In	XCCWLM	X axis - (CCW/Y direction limit signal	52	In	ZCCWLM	Z axis - (CCW/Y direction limit signal
3	In	XNORG	X axis machine origin proximity signal	53	In	ZNORG	Z axis machine origin proximity signal
4	In	XORG	X axis machine origin signal	54	In	ZORG	Z axis machine origin signal
5	In	YCWLM	Y axis + (CW/Y direction limit signal	55	In	ACWLM	A axis + (CW/Y direction limit signal
6	In	YCCWLM	Y axis - (CCW/Y direction limit signal	56	In	ACCWLM	A axis - (CCW/Y direction limit signal
7	In	YNORG	Y axis machine origin proximity signal	57	In	ANORG	A axis machine origin proximity signal
8	In	YORG	Y axis machine origin signal	58	In	AORG	A axis machine origin signal
9	In	SENSOR0	Multipurpose sensor, synchronous start signal (Note 2)	59	In	SENSOR1	Multipurpose sensor, synchronous start signal (Note 2)
10	In	IN0	General-purpose input 0 signal ( ) (This signal allows X axis driver error signal)	60	Out	OUT0	General-purpose output 0 signal
11	In	IN1	General-purpose input 1 signal ( ) (This signal allows Y axis driver error signal)	61	Out	OUT1	General-purpose output 1 signal
12	In	IN2	General-purpose input 2 signal ( ) (This signal allows Z axis driver error signal)	62	Out	OUT2	General-purpose output 2 signal
13	In	IN3	General-purpose input 3 signal ( ) (This signal allows A axis driver error signal)	63	Out	OUT3	General-purpose output 3 signal
14		EXTV	External power supply for coupler (Note 1)	64		EXTVGND	External power supply for coupler GND (Note 1)
15		EXTV		65		EXTVGND	
16	Out	+COM	XCWP, XCCWP +common (+5V)	66	Out	+COM	ZCWP, ZCCWP +common (+5V)
17	Out	XCWP	X axis + (CW/Y direction positive logic pulse output	67	Out	ZCWP	Z axis + (CW/Y direction positive logic pulse output
18	Out	XCWP	X axis + (CW/Y direction negative logic pulse output	68	Out	ZCWP	Z axis + (CW/Y direction negative logic pulse output
19	Out	XCCWP	X axis -(CCW/Y direction positive logic pulse output	69	Out	ZCCWP	Z axis -(CCW/Y direction positive logic pulse output
20	Out	XCCWP	X axis -(CCW/Y direction negative logic pulse output	70	Out	ZCCWP	Z axis -(CCW/Y direction negative logic pulse output
21	Out	XDRSTCOM	XDRST current output (+24V)	71	Out	ZDRSTCOM	ZDRST current output (+24V)
22	Out	XDRST	X axis servo reset signal (This signal is used for general purpose output)	72	Out	ZDRST	Z axis servo reset signal (This signal is used for general purpose output)
23	In	XDEND/XPO	X axis positioning completion signal /X axis PO signal	73	In	ZDEND/ZPO	Z axis positioning completion signal /Z axis PO signal
24		N C	Reserved	74		N C	Reserved
25	In	+XEA	X axis encoder +A phase signal	75	In	+ZEA	Z axis encoder +A phase signal
26	In	-XEA	X axis encoder -A phase signal	76	In	-ZEA	Z axis encoder -A phase signal
27	In	+XEB	X axis encoder +B phase signal	77	In	+ZEB	Z axis encoder +B phase signal
28	In	-XEB	X axis encoder -B phase signal	78	In	-ZEB	Z axis encoder -B phase signal
29	In	+XZORG	X axis encoder +Z phase signal	79	In	+ZZORG	Z axis encoder +Z phase signal
30	In	-XZORG	X axis encoder -Z phase signal	80	In	-ZZORG	Z axis encoder -Z phase signal
31	Out	N C	Reserved(No connecting)	81		N C	Reserved
32	Out	+COM	YCWP, YCCWP +common (+5V)	82	Out	+COM	ACWP, ACCWP +common (+5V)
33	Out	YCWP	Y axis + (CW/Y direction positive logic pulse output	83	Out	ACWP	A axis + (CW/Y direction positive logic pulse output
34	Out	YCWP	Y axis + (CW/Y direction negative logic pulse output	84	Out	ACWP	A axis + (CW/Y direction negative logic pulse output
35	Out	YCCWP	Y axis - (CCW/Y direction positive logic pulse output	85	Out	ACCWP	A axis - (CCW/Y direction positive logic pulse output
36	Out	YCCWP	Y axis - (CCW/Y direction negative logic pulse output	86	Out	ACCWP	A axis - (CCW/Y direction negative logic pulse output
37	Out	YDRSTCOM	YDRST current output (+24V)	87	Out	ADRSTCOM	ADRST current output (+24V)
38	Out	YDRST	Y axis servo reset signal (This signal is used for general purpose output)	88	Out	ADRST	A axis servo reset signal (This signal is used for general purpose output)
39	In	YDEND/YPO	Y axis positioning completion signal /Y axis PO signal	89	In	ADEND/APO	A axis positioning completion signal /A axis PO signal
40		N C	Reserved	90		N C	Reserved
41	In	+YEA	Y axis encoder +A phase signal	91	In	+AEA	A axis encoder +A phase signal
42	In	-YEA	Y axis encoder -A phase signal	92	In	-AEA	A axis encoder -A phase signal
43	In	+YEB	Y axis encoder +B phase signal	93	In	+AEB	A axis encoder +B phase signal
44	In	-YEB	Y axis encoder -B phase signal	94	In	-AEB	A axis encoder -B phase signal
45	In	+YZORG	Y axis encoder +Z phase signal	95	In	+AZORG	A axis encoder +Z phase signal
46	In	-YZORG	Y axis encoder -Z phase signal	96	In	-AZORG	A axis encoder -Z phase signal
47	Out	N C	Reserved(No connecting)	97		N C	Reserved
48	In	FSSTOP	All axes immediate stop signal	98	In	RESET	All-axis reset signal
49		N C	Reserved	99		N C	Reserved
50		D.GND	Internal +5V digital GND	100		D.GND	Internal +5V digital GND

(2) Special-purpose I/O connector

The conector of the applied function.

Pin assignment

Connector type name XG4C-2031 (OMRON)
Adaptable connector socket XG4M2030 (OMRON, not included in attached accessories)
Adaptable cable MIL 20P 1.5m flat cable (option)

```
19                              1
┌──────────┐  ┌────────────────┐
│          └──┘                │
│                              │
└──────────────────────────────┘
20                              2
```

Signal table

All input signal is not able to set time constants, to switch logic.

(Note 1) When the $\overline{MAN}$ signal goes low, this bord is MANUAL mode.
When the $\overline{MAN}$ signal goes high, this bord return to BUS mode.
The $\overline{MAN\ RDY}$ signal is enable to go high by MAN MASK command.
When the $\overline{MAN}$ signal is low level, this bord is not MANUAL mode by setting $\overline{MAN}$ signal low level.

(Note 2) $\overline{SIGNAL\ INx}$ input signal can be use general-purpose sensor function and synchronous start function.
If these signal is used, set the functions that need to be changed from their values.
The initial value after the relevant signal is reset is "No function".
If this bord is MANUAL mode, You can not use $\overline{SIGNAL\ INx}$ input signal.
When this bord is MANUAL mode, this signal(SEL A-D) enable to select an axis that perfoms MANUAL SCAN drive.
The functions assigned to the $\overline{SIGNAL\ INx}$ input signal are invalid. And when this bord returns to BUS mode, the functions assigned to this signal are valid.

(Note 3) $\overline{SIGNAL\ OUTx}$ output signal can be output status signals of any axes by setting status output function.
The initial values after the relevant signal is reset are as follows:
$\overline{SIGNAL\ OUT0}$ is CNTINT signal of X axis.
$\overline{SIGNAL\ OUT1}$ is CNTINT signal of Y axis.

(Note 4) When this bord is MANUAL mode, $\overline{SS0},\overline{SS1}$ input signal(SEL A-D) enables general-purpose sensor that MANUAL SCAN drive specified axis.
When general-purpose sensor function is set as "UP/DOWN/CONST command", this input signal enable acceleration/deceleration command signal of MANUAL SCAN drive.

Pin No.	Direction	Signal name	Description	
			BUS mode	MANUAL mode
1		D.GND	GND(internal +5V GND)	
2	In	MAN	MANUAL mode select signal (Note 1)	
3	In	FSSTOP	All axes immediate stop signal	
4	In	CWMS	Invalid	CW direction MANUAL SCAN drive command signal
5	In	CCWMS		CCW direction MANUAL SCAN drive command signal
6		D.GND	GND(internal +5V GND)	
7	In	SIGNAL IN0 / SEL A	General-purpose, synchronous start signal (Note 2)	The signals can be combined to select the axis used for manual operation.
8	In	SIGNAL IN1 / SEL B		
9	In	SEL C	Invalid	
10	In	SEL D		
11	Out	SIGNAL OUT0	Staus output signal	(The initial value after resetting XCNTINT) (Note 3)
12	Out	SIGNAL OUT1		(The initial value after resetting YCNTINT)
13	Out	NC	Reserved	
14	Out	NC		
15		D.GND	GND(internal +5V GND)	
16	Out	+5V	Internal +5V	
17	In	SS0	Invalid	MANUAL SCAN drive acceleration/ deceleration command signal (General-purpse sensor signal) (Note 4)
18	In	SS1		
19	Out	MAN RDY	Permission signal switching MANUAL mode (Note 1)	
20		D.GND	GND(internal +5V GND)	

2-6. Input and Output Specifications

(1) Output specifications

Output specifications 1

Circuit	Description	
	Signal name	CWP, $\overline{CWP}$, CCWP, $\overline{CCWP}$
	Output method	Line driver (differential) output (Equivalent to 26C31: Compliant with RS422A)
	Output current	± 20mA
	Output frequency	Maximum 6.5MHz (Indipendent drive)
	Insulation	Non-insulated

Output specifications 2

Circuit	Description	
	Signal name	$\overline{OUT0-3}$
	Interface voltage	+24V
	Output method	Nch transistor Open collector output
	Output current	ON : 30mA(Vce 1V or less) 50mA(Vce 2V or less) OFF : 0.1mA or less
	Output response time	1ms or less (ON→OFF, OFF→ON)
	Insulation	Photocoupler insulation (between internal circuits and external circuits)

Output specifications 3

Circuit	Description	
	Signal name	$\overline{DRST}$ (Can be connected from DRSTCOM to the +5V current limiting circuit: up to 15 mA)
	Interface voltage	+24V
	Output method	Nch transistor Open collector output
	Output current	ON : 30mA(Vce 1V or less) 50mA(Vce 2V or less) OFF : 0.1mA or less
	Output response time	1ms or less (ON→OFF, OFF→ON)
	Insulation	Photocoupler insulation (between internal circuits and external circuits)

Output specifications 4(Applied function)

Circuit	Description	
	Signal name	SIGNAL OUT0,1
	Interface voltage	+30V or less
	Output method	Open collector output
	Output current	ON : 10mA(Vce 0.6V or less) OFF : 0.3mA or less
	Output response time	1μs or less (A latch and output time width can be set for output.) (ON→OFF, OFF→ON)
	Insulation	Non-insulated

(2) Input specifications

Input specifications 1

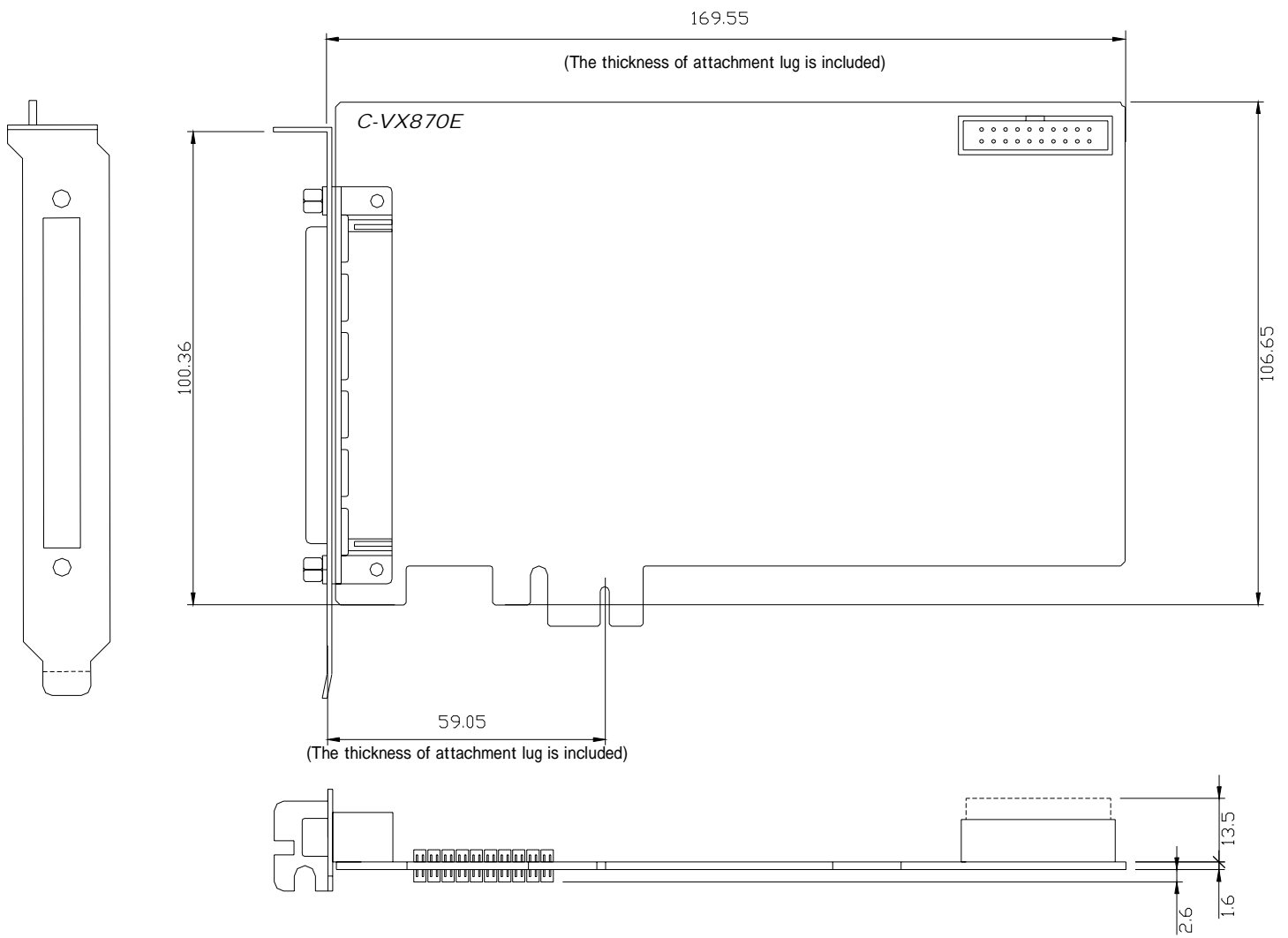| Circuit	Description	
+24V EXTV 24V± 2V or less Photocoupler 6.8K ORG, NORG DEND/PO INx, SENSORx RESET (A connect) Photocoupler 6.8K CWLM,CCWLM FSSTOP (B connect) Common for all axes (Excluding INx, SENSORx, FSSTOP, RESET)	Signal name	$\overline{ORG}$, $\overline{NORG}$, $\overline{DEND/PO}$, $\overline{INO\text{-}3}$ $\overline{SENSORO,1}$, $\overline{RESET}$ (A contact) FSSTOP, CWLM,CCWLM (B contact)
	Interface voltage	+24V
	Input impedance	6.8K
	ON/OFF level	ON : 2.5mA or more OFF : 0.8mA or less
	Input response time	1ms or less (a signal other than the $\overline{RESET}$) 5ms or less($\overline{RESET}$) (ON→OFF OFF→ON)
	Insulation	Photocoupler insulation (between internal circuits and external circuits)

Input specifications 2

Circuit	Description	
+5V Connected to a line driver output circuit (compliant with RS422) Equivalent to 26C32 220 Equivalent to 26C31 +5V D.GND Common for all axes	Signal name	± EA ± EB ± ZORG
	Interface specifications	Line receiver input (should be connected to an RS422-compliant line driver)
	Input terminating resistor	220
	Response frequency	± EA,EB : 5MHz ± ZORG : 100KHz
	Insulation	Non-insulated

Input specifications 3 (Applied function)

Circuit	Description	
+5V 1.0K $\overline{MAN}$, $\overline{CWMS}$, $\overline{CCWMS}$, $\overline{SSO,SS1}$, FSSTOP, $\overline{SIGNAL INx}$ /SEL x Equivalent to HC14 150K/10K LS06 switch etc. (Internal 5V GND) D.GND J3 connector signal	Signal name	$\overline{MAN}$, $\overline{CWMS}$, $\overline{CCWMS}$, $\overline{SSO,SS1}$, FSSTOP $\overline{SIGNAL INO,1}$ /SEL x
	Interface specifications	TTL level CMOS schmitt input
	Input level	High level open
		Low level 0.8V or less
	Input response time	5ms or less($\overline{MAN}$, $\overline{CWMS}$, $\overline{CCWMS}$) 1ms or less($\overline{SSO,SS1}$, FSSTOP) 10us or less($\overline{SIGNAL INO,1}$ /SEL x) (ON→OFF OFF→ON)
	Insulation	Non-insulated

2-7. Outside Dimensions

C-VX870E

169.55
(The thickness of attachment lug is included)

100.36

106.65

59.05
(The thickness of attachment lug is included)

13.5

2.6

1.6

SETTING
Before integrating the C-VX870E into the PC, set the switches on the board.

3-1. Setting the Board Number(S1)

Assign a board number to the C-VX870E using the rotary switch S1 on the board.
(By default (before shipment from the factory), the rotary switch is bord number 1)
When two or more C-VX870E boards are used, assign board numbers to the second and any
subsequent boards in such a way that no numbers are duplicated.
The following figure shows an example in which board number 2 is assigned.
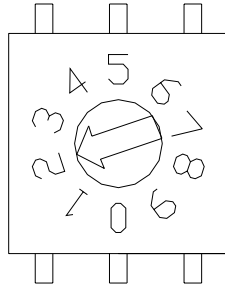
The S1 setting is validated after power-on.
Set the switch with power off, and turn it on after changing the setting.

CONNECTION
4-1. Example of user I/O Interface Power Supply Connection

For the user interface power supply (EXTV) of controller C-VX870E connect +24 Vdc from the common power supply so that it turns on and off in synchronization with externally connected equipment.
For easy connection, use the optional relay unit.

For the power supply used for the driver interface($\overline{OUTx}$ signal, $\overline{DRST}$ signal), use one prepared by the controller, such as DRSTCOM.
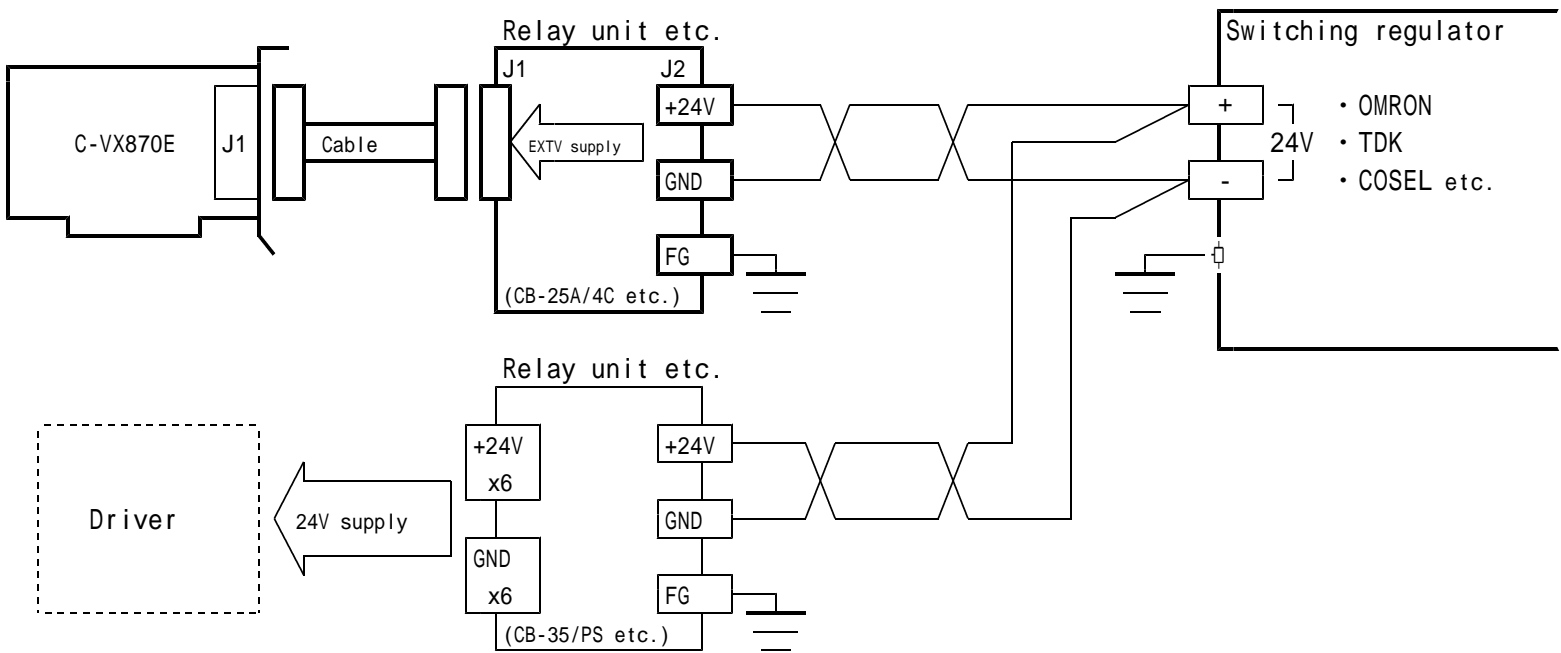For details, refer to Section 4-2, "Examples of Connection to Drivers."

Power may be supplied to the driver from a power supply different from the C-VX870E such as by connecting to the $\overline{OUTx}$ or $\overline{DRST}$ signal of the servo driver or motor free (MF) signal of the stepping driver. If so and power supply to the driver (+Vo) is greater than power supply to the C-VX870E (+V), leak current i flows through the protection diode of the output circuit and the input circuit of the connection destination may be put in the ON state.
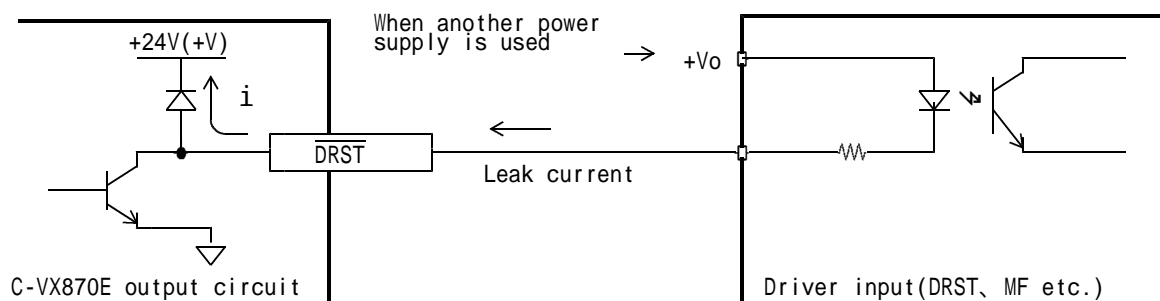
4-2 Examples of Connection to Drivers
(1) Example of connection to the stepping motor driver
(x axis pin numbers are used in this example.)
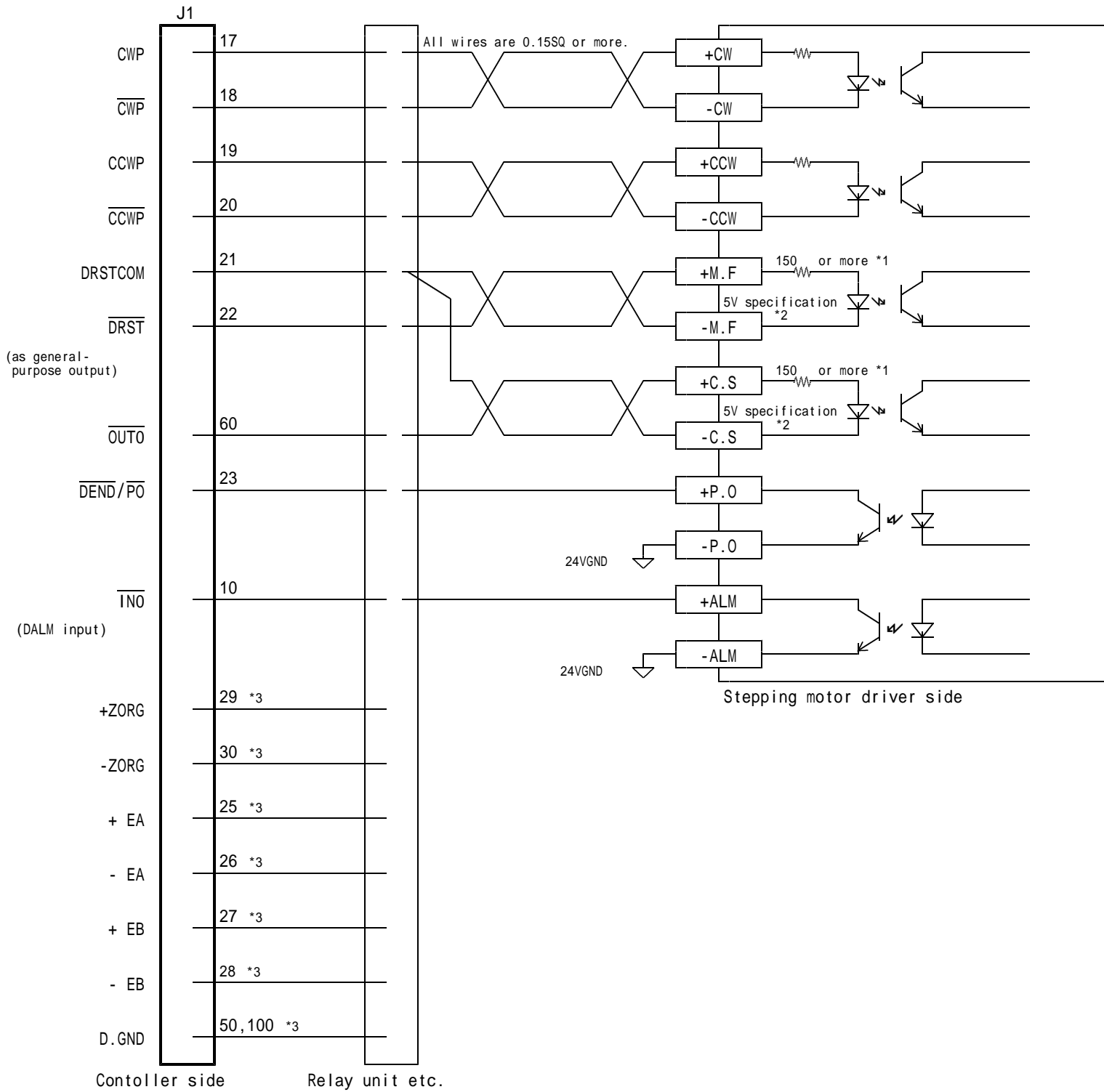
J1

Controller side label	Pin		Driver side
CWP	17		+CW
$\overline{CWP}$	18		-CW
CCWP	19		+CCW
$\overline{CCWP}$	20		-CCW
DRSTCOM	21		+MF
$\overline{DRST}$	22		-MF
$\overline{OUT0}$	60		+C.S / -C.S
$\overline{DEND/PO}$	23		+P.O / -P.O
$\overline{IN0}$	10		+ALM / -ALM

All wires are 0.15SQ or more.

150 or more *1
5V specification *2

150 or more *1
5V specification *2

24VGND

24VGND

Stepping motor driver side

(as general-purpose output)

(DALM input)

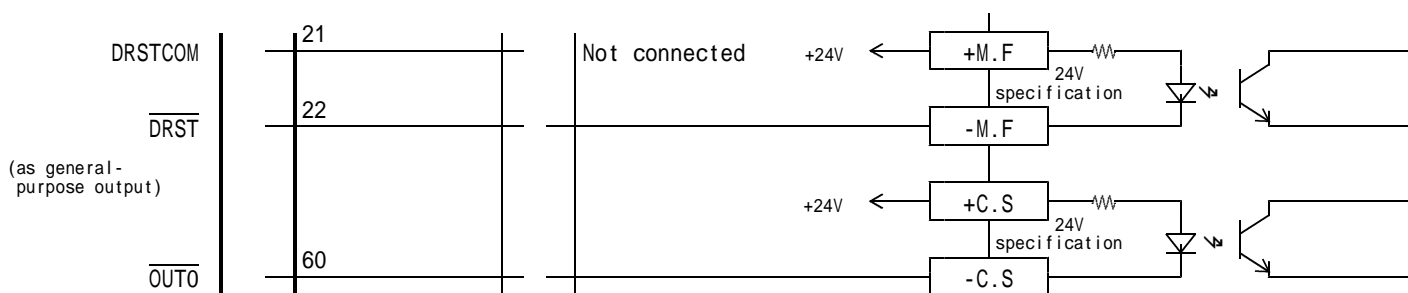|	Pin
+ZORG	29 *3
-ZORG	30 *3
+ EA	25 *3
- EA	26 *3
+ EB	27 *3
- EB	28 *3
D.GND	50,100 *3

Controller side   Relay unit etc.

*1 If the current limiting resistor on the driver side is less than 150 , externally add
resistor so that the total resistor value becomes 150 or more.
*2 When the input circuit uses a +24V interface, the connection is as follows:

	Pin		
DRSTCOM	21	Not connected	+24V ← +MF / -MF
$\overline{DRST}$	22		
$\overline{OUT0}$	60		+24V ← +C.S / -C.S

24V specification

24V specification

(as general-purpose output)

*3 The signal is connected when the encoder is used.
Example of connection refers to "Example of connection to the servo motor driver".

(2) Examples of Connection to the servo motor driver

(X axis pin numbers are used in this sample.)

All wires are 0.15SQ or more.

| Controller side | Relay unit etc. | Servo motor driver side |

*1 If the current limiting resistor on the driver side is less than 150 , externally add
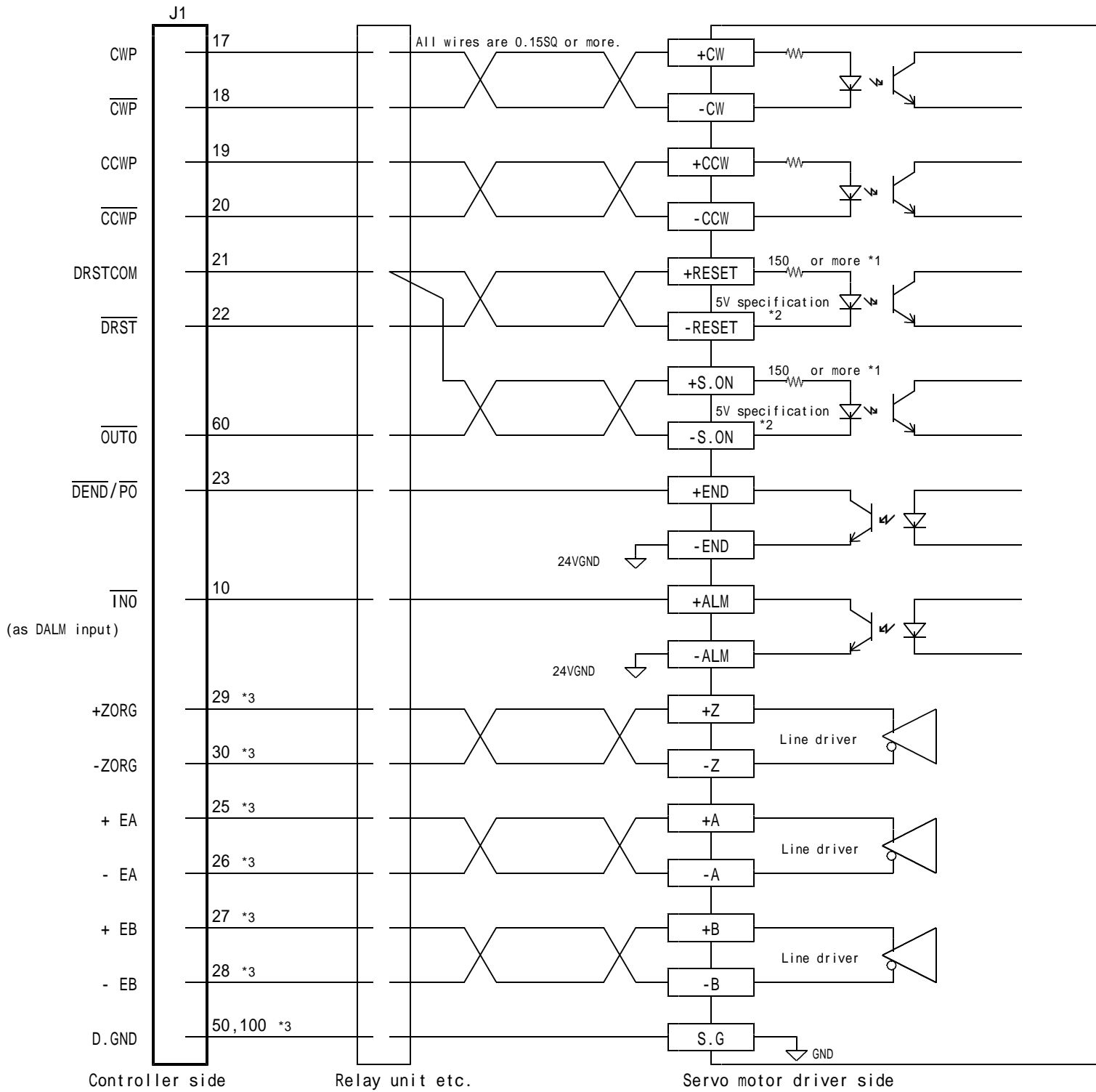   resistor so that the total resistor value becomes 150 or more.

*2 When input circuit of the servo driver uses a +24V interface, the connection is as follows:

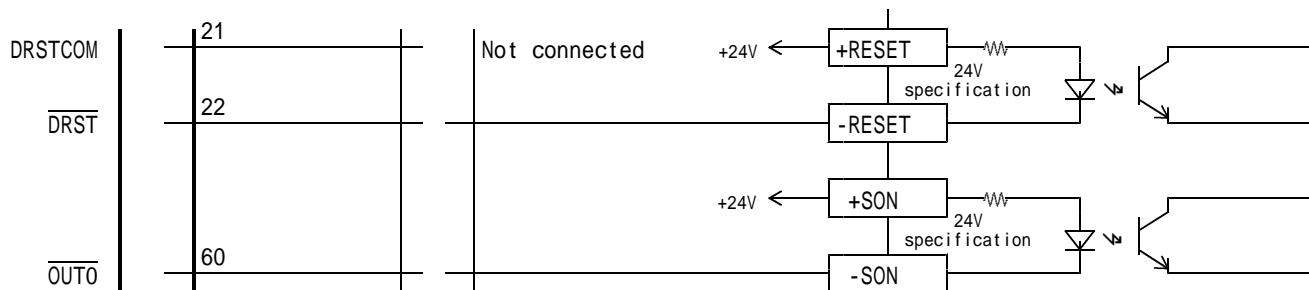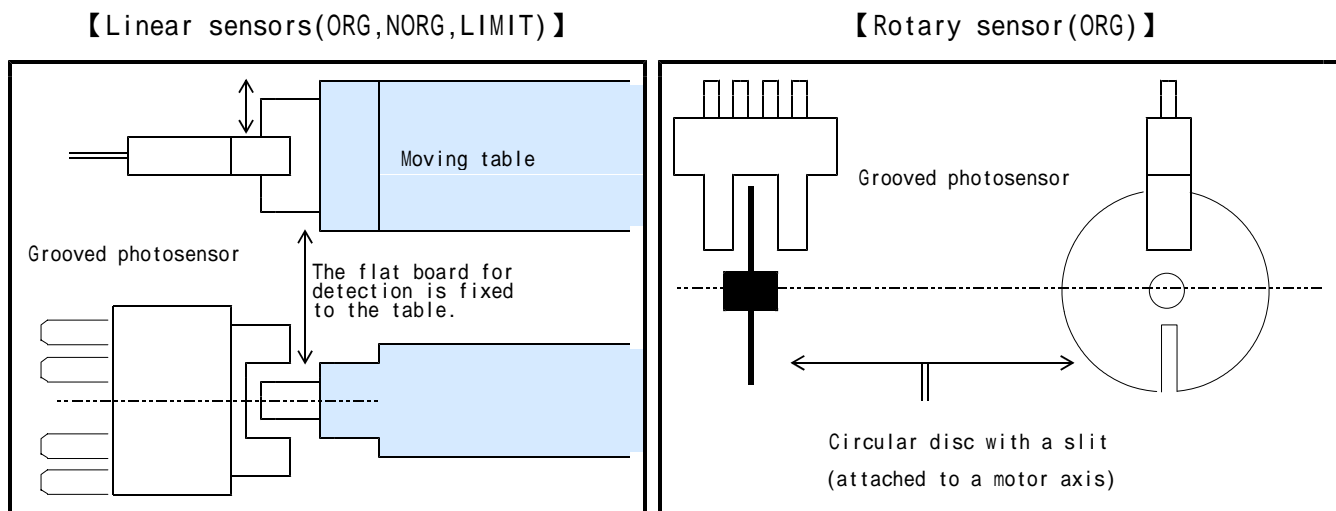
*3 The signal is connected when the encorder signal is used.
   Connect the encorder signal to the line driver output circuit.

4-3. Examples of Connection to Sensor
### (1) Example of sensor attachment(photosensor)

Linear sensors(ORG,NORG,LIMIT)   Rotary sensor(ORG)

Example of recommended sensors

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

Please contact us, when you use sensors other than the above.
(example: large 35mA article of consumption current etc.)

(2) Example of connection to a limit sensor
X axis pin number are used in this example.

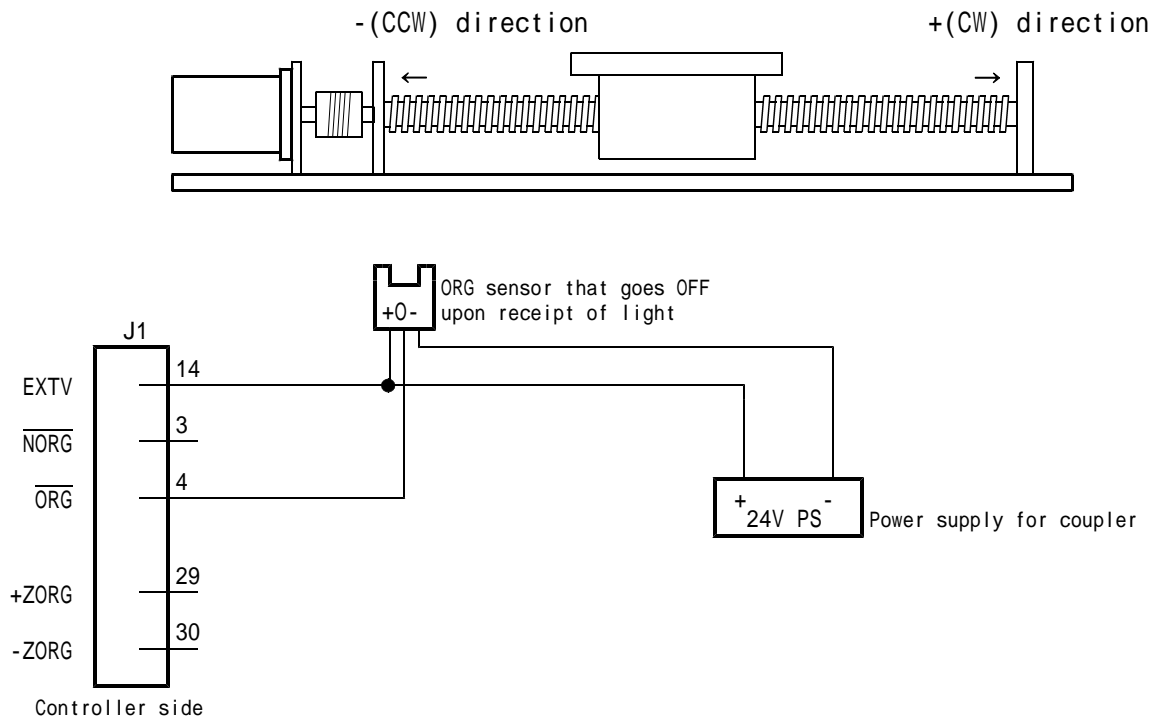-(CCW) direction   +(CW) direction
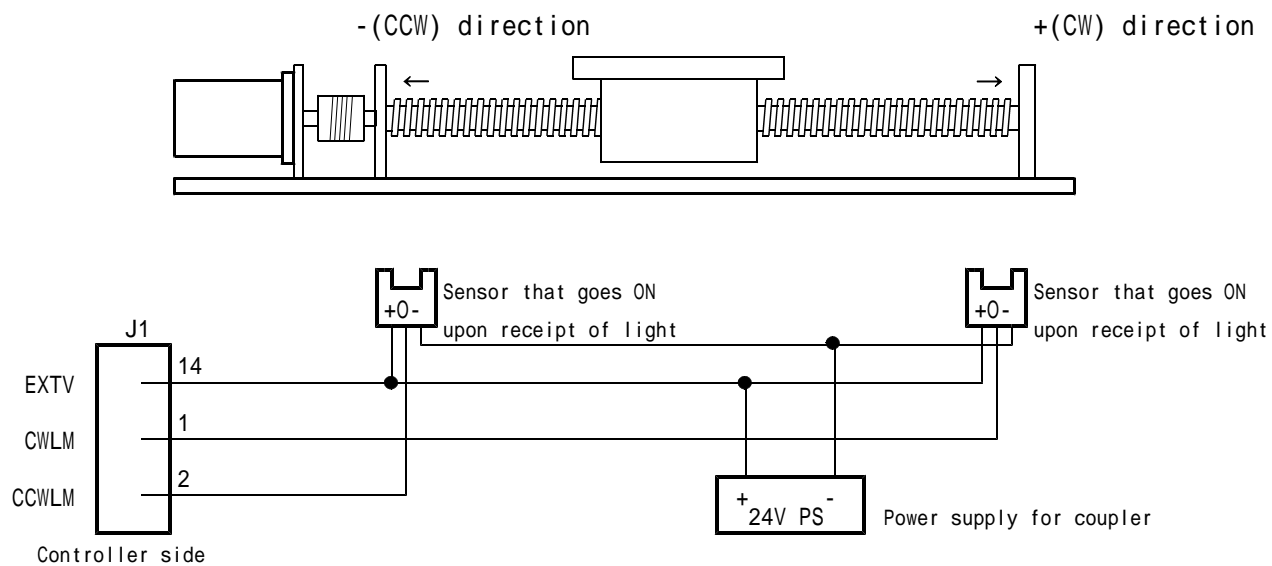
The initial value of the limit signal is active-off (B contact) input.
Even when the limit signal is not used, the limit signal input must be connected to GND in order to output pulses.
  * Input logic of the limit signal can be switched. (Applied function)

(3) Example of connection to an origin sensor

X axis pin numbers are used in this example.

When using the origin sensor only

-(CCW) direction   +(CW) direction

ORG sensor that goes OFF upon receipt of light

J1

EXTV — 14

$\overline{NORG}$ — 3

$\overline{ORG}$ — 4

+ZORG — 29

-ZORG — 30

Controller side

24V PS   Power supply for coupler

When using the origin sensor+origin proximity signal

-(CCW) direction   +(CW) direction

ORG sensor
Sensor that goes OFF upon receipt of light

NORG sensor
Sensor that goes OFF upon receipt of light

J1

EXTV — 14

$\overline{NORG}$ — 3

$\overline{ORG}$ — 4

+ZORG — 29

-ZORG — 30

Controller side

24V PS   Power supply for coupler
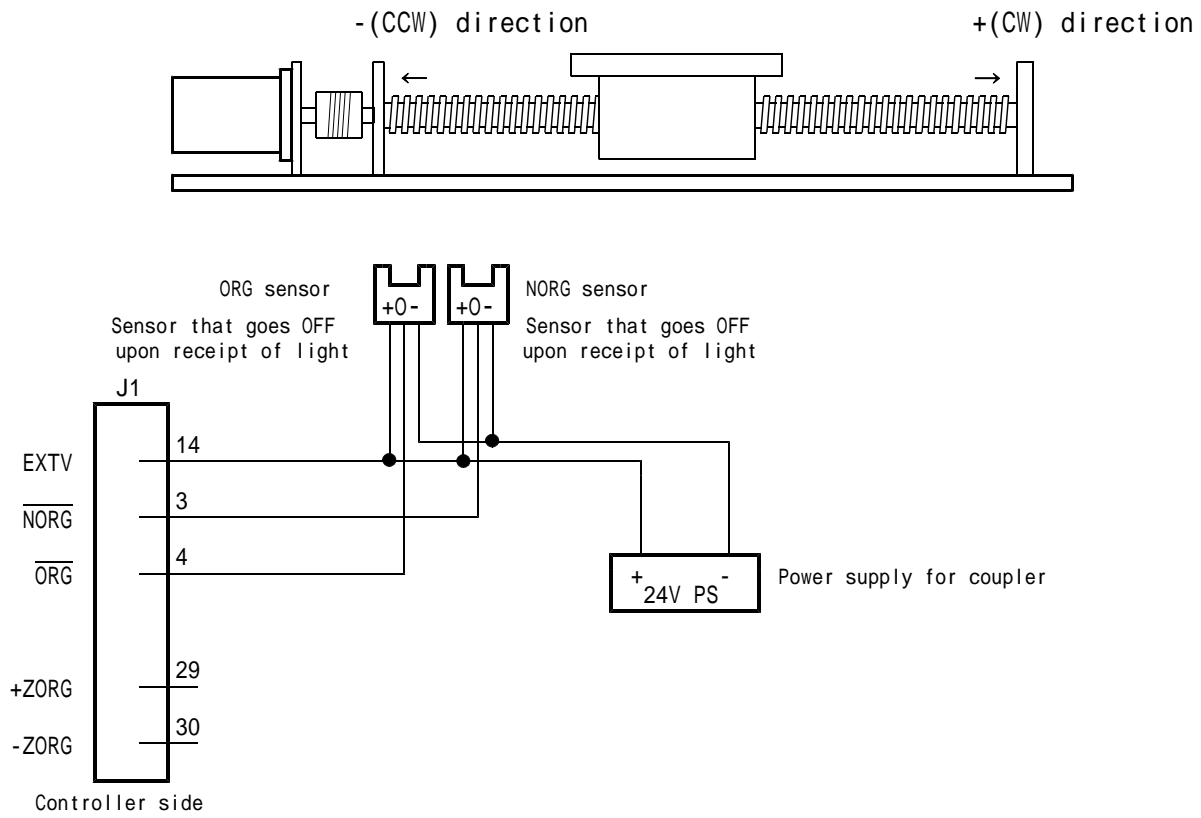
When using the Z-phase signal of an encoder

-(CCW) direction   +(CW) direction

Servo motor
driver   +Z -Z

NORG sensor
Sensor that goes OFF upon receipt of light

J1

EXTV   14

$\overline{NORG}$ 3

$\overline{ORG}$ 4

+ZORG   29

-ZORG   30

+ -
24V PS   Power supply for coupler

*Connect the Z phase to the line driver output circuit.

Controller side
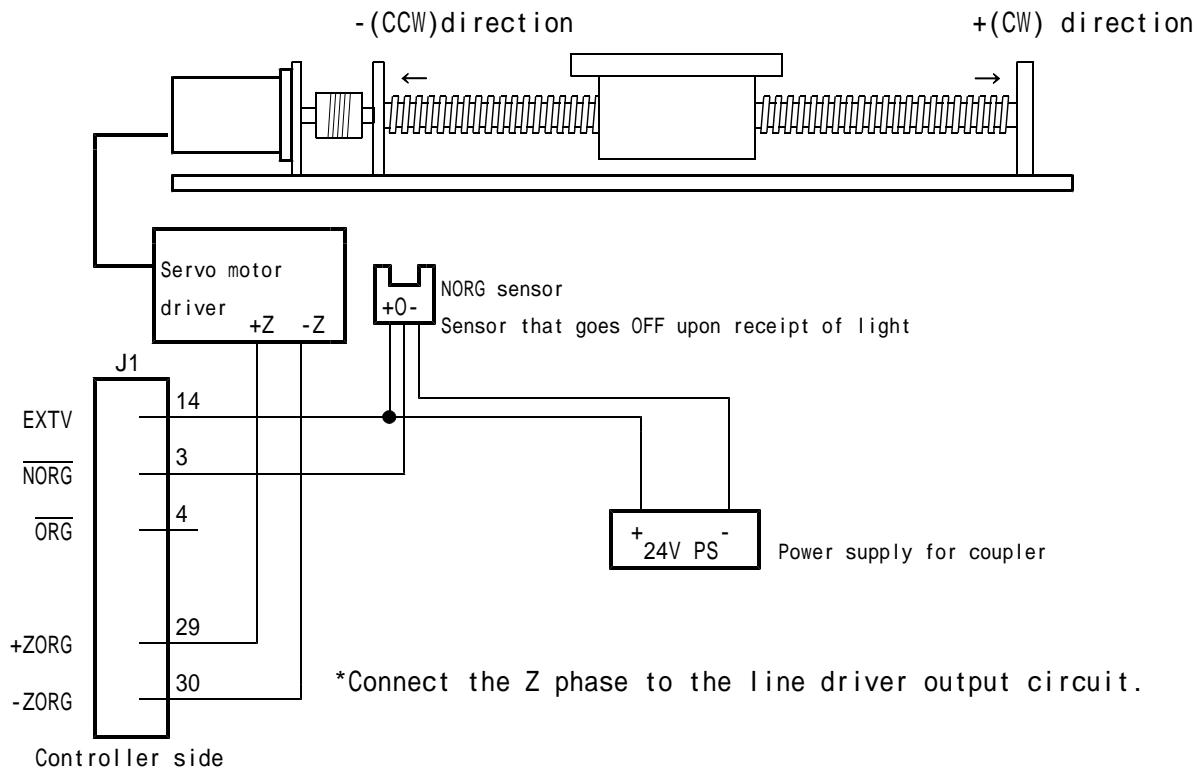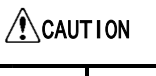
When using the PO signal of stepping motor driver

Circular disk with a slit
attached to the rotating shaft

-(CCW) direction   +(CW) direction

ORG sensor
Sensor that goes ON
upon receipt of light

NORG sensor
Sensor that goes OFF
upon receipt of light

Stepping
motor driver
$\overline{PO}$ R GND

J1

EXTV   14

$\overline{NORG}$ 3

$\overline{ORG}$ 4

$\overline{DEND}/\overline{PO}$ 23

+ZORG   29

-ZORG   30

+ -
24V PS   Power supply for coupler

Controller side
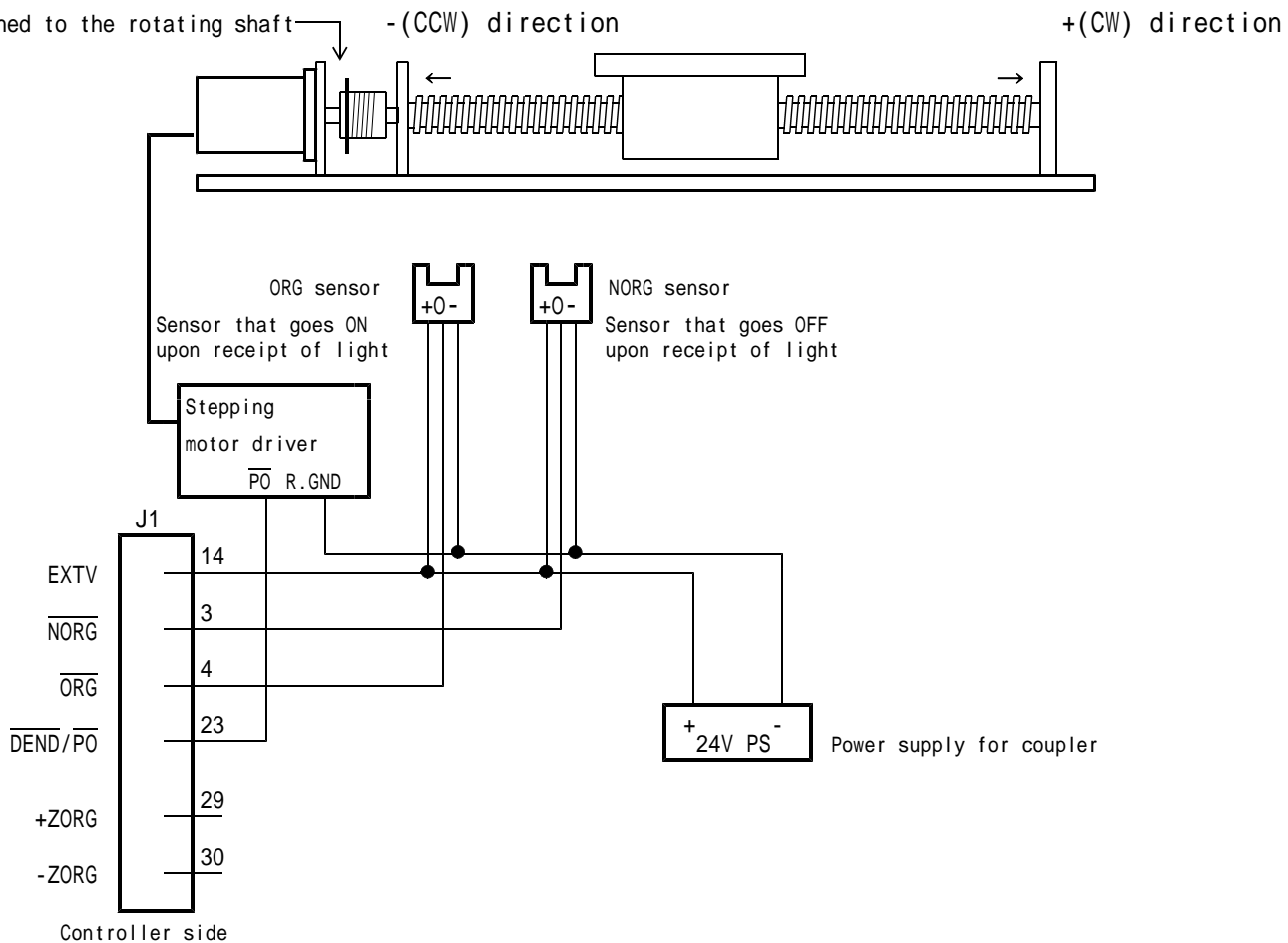
Maintenance

⚠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 cycleic cleaning as follows.

During the cleaning of the 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 + 45	Thermometer
	Check whether ambient and intra-device humidifies 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(6kg 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.

Conforming to Europe standards

6-1. Low Voltage Directive

The product does not cover low voltagae directive on the conditions as follows:

The product is placed in the PC(Enclosure) declared CE marking.
And the control power of PCI bus is fed by the PC.

The power of the interface +24V is fed by the direct current power which primary and secondary are reinforced insulation.

A signal should interface using the motor drivers with which strengthening insulation of a primary side and the secondary side was carried out. Or a signal should interface between the motor drivers with which a primary and secondary side is supplied by the power supply by which strengthening insulation was carried out.

6-2. EMC Directive

The product declare CE marking based on EMC(2004/108/EC) Directive.

Applicable standards
EN61000-6-4
EN61000-6-2
EN61000-3-2
EN61000-3-3

The product is tested for EMC mesurement by EMC mesurement facilities.
EMC is changed by the equipment configuration including controllers and motor drivers.
Be sure to test EMC mesurement in the condition installed in the final equipment.

Configuration

The metalic enclosure (Metal Enclosure) and a metaled shielded cable (with a ferrite core) work to shield noise.
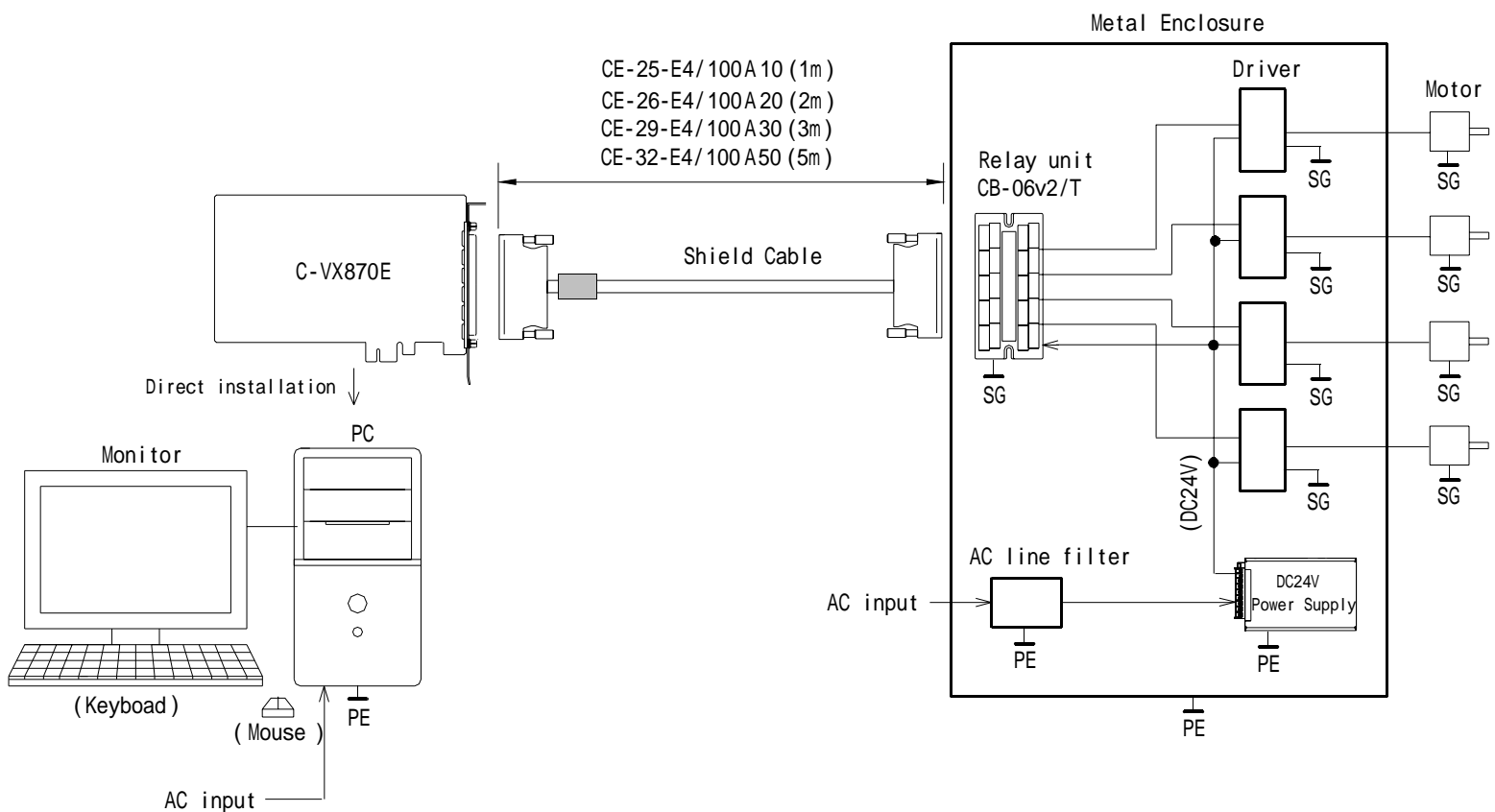
The main parts which revised by this manual

Parts	Content
None	