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## REFERENCE SPECIFICATIONS

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Product Name : AC servo driver  
Model Number: MINAS-A5NL Series M Size

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Issued on  
April 17<sup>th</sup>, 2014  
Revised on  
June 2<sup>nd</sup>, 2014

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**Contents**

1. Scope	1
2. Model Number	2
3. Applicable Motor and Applicable Feedback Scale	2
4. Basic Specifications	3
5. Dimensions	4
6. Appearance and Part Names	5
7. Connectors	6
7-1 Power Supply Connectors <b>CN102</b> , <b>CN103</b>	6
7-2 Moter Connector <b>CN101</b>	6
7-3 Feedback Scale Connector for Serial Communication Type <b>CN104</b>	6
7-4 Feedback Scale Connector for A / B / Z Type <b>CN3</b>	7
7-5 CS signals Connector <b>CN2</b>	8
7-6 USB Connector <b>CN7</b>	9
7-7 RTEX Connectors <b>CN10</b> , <b>CN11</b>	10
7-8 I/O Connector <b>CN1</b>	11
8. Wiring	12
8-1 Cables and Maximum Lengths	12
8-2 Cable Side Connectors	12
8-3 Precautions for Wiring	13
9. Safety Precautions	21
10. Life and Warranty	25
10-1 Life Expectancy of the Driver	25
10-2 Warranty Period	25
11. Others	26
Specification for Each Model	

## 1. Scope

This document is a specification for M size model of servo driver MINAS-A5NL series.

### <Software version>

This document applies to the servo drivers of the following software version:

Ver.8.02

For the software version, confirm it by the setup support software PANATERM or other function.

### <Related documents>

SX-DSV02309: Technical Reference - Functional specification -

SX-DSV02310: Technical Reference - Realtime Express (RTEX) communication specification –

\*This servo driver includes different specifications in part from technical reference - Functional specification -.

For details, refer to the page 3 or later of appendix.

\*If the description of related documents is different from this document, make this document a priority.

### <IMPORTANT>

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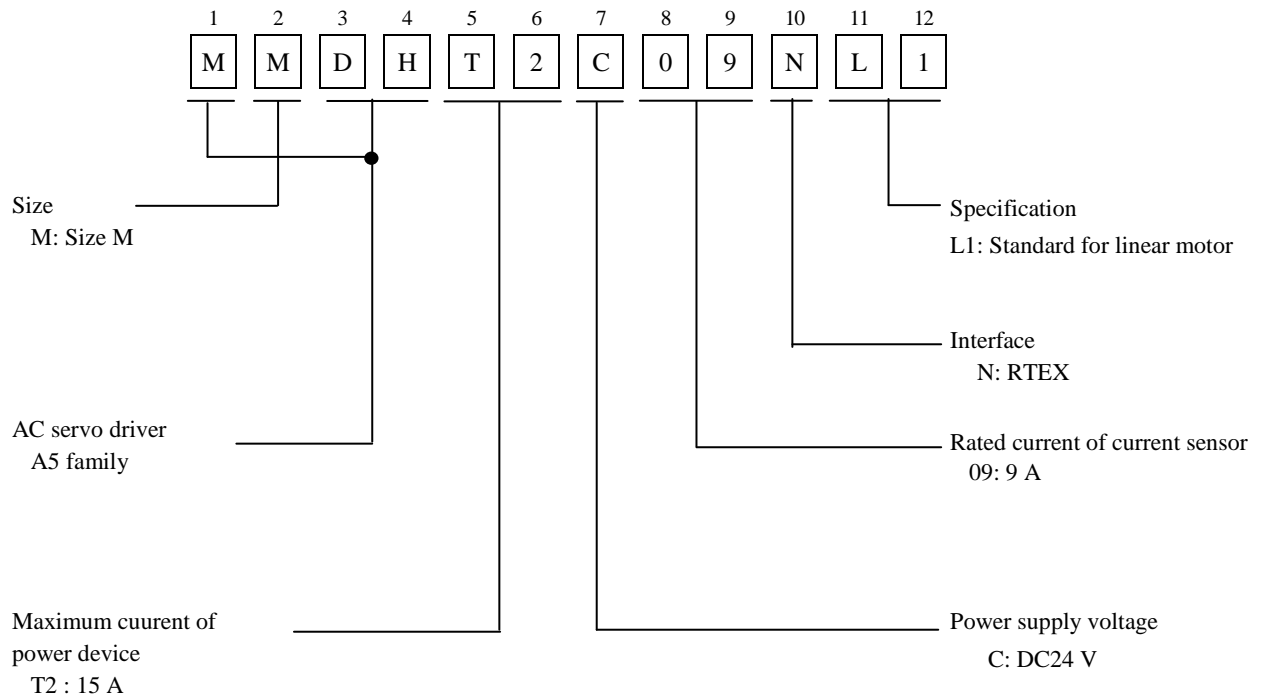
### **Operating Precautions**

Pay a special attention to following items in order to prevent failure and degradation of the product.

- Implement the measure against static electricity and handle it with great caution.
- Do not touch a electronic components except the heat sink of the product when installing and carrying it.
- Install in a metal control box in order to prevent malfunction by noises, such as an electromagnetic interference (EMI).
- Prevent foreign matter from getting into the product.
- Do not give an impact shock to the product.
- Do not add stress, such as a twist and bending, to the printed-circuit board of the product. Fix the cable so that stress is not added to the printed-circuit board and the connector of the product.

## 2. Model Number

The following shows how to interpret a Model number.



## 3. Applicable Motor and Applicable Feedback Scale

Driver				Applicable motor (Note 1)		Applicable feedback scale (Note 1)
Model No.	Size	Power Supply	PWM carrier frequency (Note 3)	Rated current [Ams]	Max. current [Ams]	
MMDHT2C09NL1	M	DC24 V	12k Hz	2.8	7.5	<ul style="list-style-type: none"> <li>•A / B / Z phase type</li> <li>• Serial communication type (Note 2)</li> </ul>

(Note 1) For the applicable motor and feedback scale, also refer to the technical document SX-DSV02309.

(Note 2) For the serial communication type of the rotary type, contact us.

(Note 3) Shows the default value. Usually, leave it as it is.

When you change the carrier frequency, confirm the temperature of the servo driver and the motor.

#### 4. Basic Specifications

Item		Description
Input power supply (Note 1)	Voltage	DC24 V +/- 10 %
	Voltage permission ripple	Rated output voltage +/- 5% of DC power supply (Note 2)
Conditions	Temperature	Operation temperature: 0-55 degrees C Storage temperature: -20-65 degrees C Guarantee the maximum temperature: 80 degrees C 72hours
	Humidity	Operation and storage humidity 90%RH or less (no condensation)
	Height above the sea	1,000 meters or less
	Vibration	5.88 m/s <sup>2</sup> or less, 10-60 Hz Continuous operation at resonance point is not allowed (Note 3)
Protection rating		IP00 (Note 4)

\* Easier condensation occurs when the temperature is reduced.

(Note 1) DC power using stabilized power supply (SELV) are provided with reinforced insulation.

(Note 2) Do not exceed the voltage including ripple of DC power supply voltage range of the servo driver.

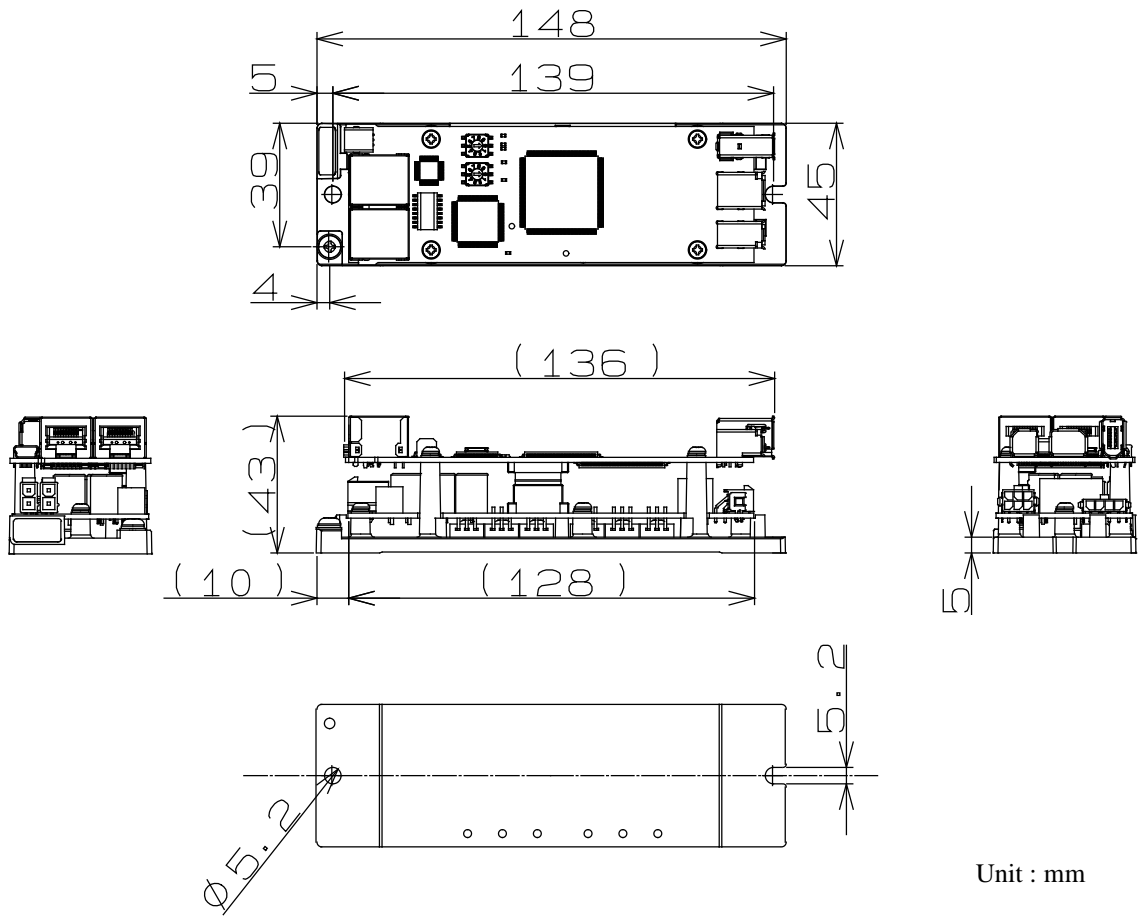
(Note 3) Do not install in a flexible region.

(Note 4) Protection rating of this servo driver is IP00 (No protection).

Make sure not to put the electric static discharge or the foreign matters such as dust when installing or handling the driver

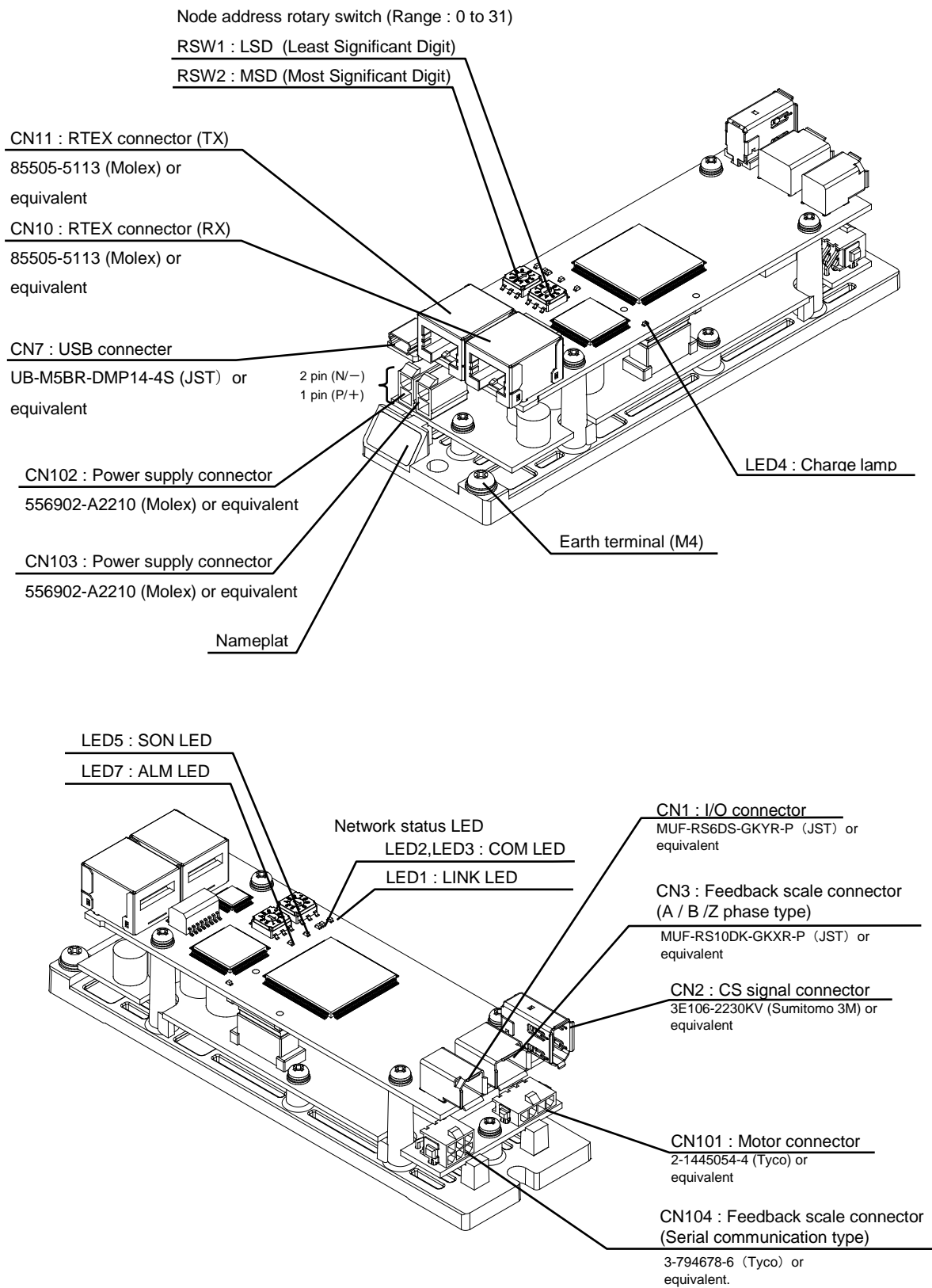
5. Dimensions

Size M



Unit : mm

## 6. Appearance and Part Names





## 7. Connectors

### 7-1 Power Supply Connectors CN102, CN103

Servo driver side : Molex 556902-A2210 equivalent, Plating : TIN

Pin no.	Symbol	Description
1	P (+ Line)	<ul style="list-style-type: none"> <li>• Input DC24 V.</li> <li>• DC power source using a stabilized power supply are provided with reinforced insulation.</li> </ul>
2	N (- Line)	

\* This servo driver has two power connectors, in order to install two or more daisy chain connection. In that case, be sure not to exceed the maximum current (9 A) of these connectors.

### 7-2 Motor Connector CN101

Servo driver side : Tyco Electronics 2-1445054-4 equivalent, Plating : TIN

Pin no.	Symbol	Description
1	U	Connect U phase of the motor winding
2	V	Connect V phase of the motor winding
3	W	Connect W phase of the motor winding
4	FG	Connect ground wire of the motor

### 7-3 Feedback Scale Connector for Serial Communication Type CN104

Servo driver side : Tyco Electronics 3-794678-6 equivalent, Plating : GOLD

Pin no.	Symbol	Description
1	-	NC (No connection)
2	EXPS	Feedback scale signal input / output (serial signal) (Note 1) (Note 2) (Note 3)
3	$\overline{\text{EXPS}}$	
4	E5V	Power supply output
5	E0V	
6	FG	Frame ground

Note 1: E0V is connected with the N (- Line) of the CN102 connector.

Note 2: E5V is rated at  $5\text{ V} \pm 5\%$  and 300 mA at maximum. To use an feedback scale and CS signal with a current consumption higher than that, a preparation of an external power supply is required. Some feedback scales may take longer time in initialization after turning on the power.

Note 3: In case an external power supply is used for the feedback scale, make sure that the E5V pin is open and no external power is supplied to the E5V pin.

7-4 Feedback Scale Connector for A / B / Z Type **CN3**

Servo driver side : J. S. T. Mfg MUF-RS10DK-GKXR-P equivalent, Plating : GOLD

Pin no.	Symbol	Description
1	E5V	Power supply output (Note 1) (Note 2) (Note 3)
2	E0V	
3	-	NC (No connection)
4	-	NC (No connection)
5	EXA	Feedback scale signal input / output (A / B / Z phase signal)
6	$\overline{\text{EXA}}$	
7	EXB	
8	$\overline{\text{EXB}}$	
9	EXZ	
10	$\overline{\text{EXZ}}$	
shell	FG	Frame ground

Note 1: E0V is connected with the N (- Line) of the CN102 connector.

Note 2: E5V is rated at  $5\text{ V} \pm 5\%$  and 300 mA at maximum. To use an feedback scale and CS signal with a current consumption higher than that, a preparation of an external power supply is required. Some feedback scales may take longer time in initialization after turning on the power.

Note 3: In case an external power supply is used for the feedback scale, make sure that the E5V pin is open and no external power is supplied to the E5V pin.

7-5 CS signals Connector **CN2**

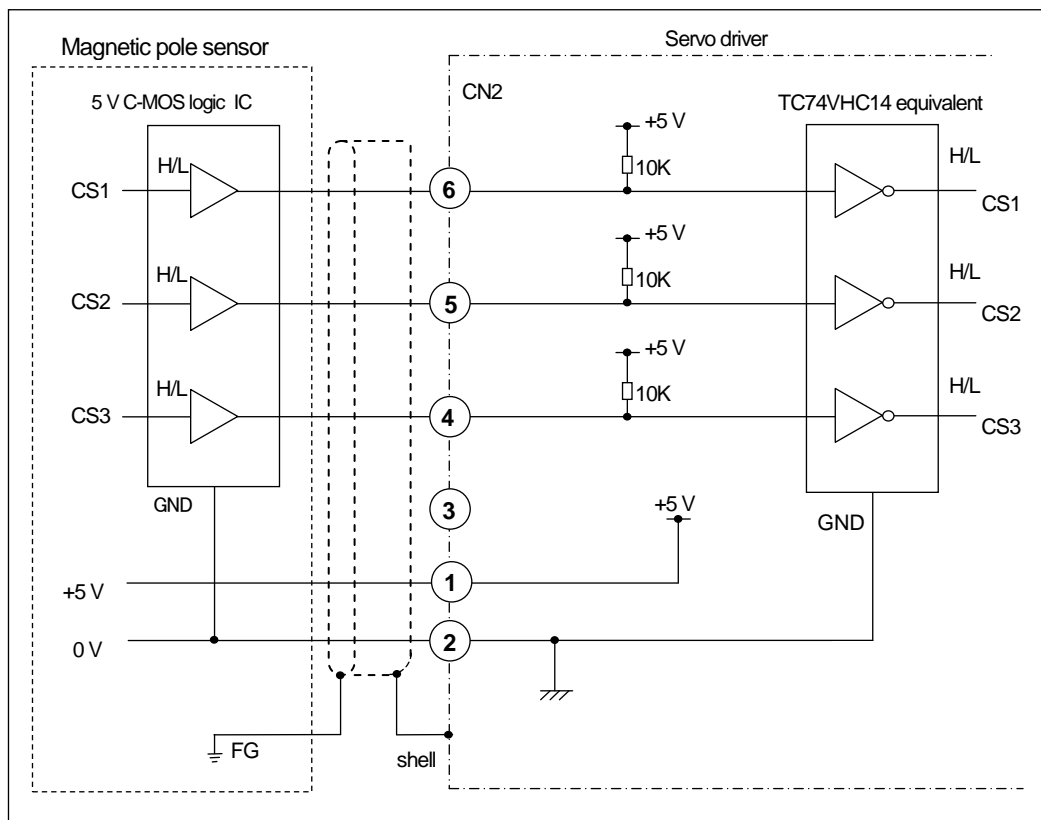
Servo driver side : Sumitomo 3M 3E106-2230KV equivalent, Plating : GOLD

Pin no.	Symbol	Description
1	E5V	Power supply output (Note 1) (Note 2)
2	E0V	
3	-	NC (No connection)
4	CS3	CS3 signal input
5	CS2	CS2 signal input
6	CS1	CS1 signal input
shell	FG	Frame ground

Note 1: E0V is connected with the N (- Line) of the CN102 connector.

Connet the ground of CS signal to E0V.

Note 2: E5V is rated at  $5\text{ V} \pm 5\%$  and 300 mA at maximum. To use an feedback scale and CS signal with a current consumption higher than that, a preparation of an external power supply is required.

**CS signal interface**

(Note) Refer to technical document SX-DSV02309 for the relation of the move direction of CS signal and the linear motor.

7-6 USB Connector CN7

Servo driver side : J. S. T. Mfg UB-M5BR-DMP14-4S equivalent, Plating : GOLD

By connecting to the PC through USB interface, various operations such as setting / changing of parameters, monitoring of control state, referencing of error/history, and saving/loading of parameters can be performed.

Pin no.	Symbol	Description
1	VBUS	USB communication signal
2	D-	
3	D+	
4	-	NC (No connection)
5	GND	Signal ground

## &lt;About the USB cable&gt;

Use a commercial-release USB cable with a ferrite core.

Connector of the servo driver side is a mini-B.

For the connector of a computer side, use it united with the specification of the computer to be used.

## 7-7 RTEX Connectors [CN10], [CN11]

Servo driver side : Molex 85505-5113 equivalent, Plating : GOLD

## [CN10] RX connector

Pin no.	Symbol	Description
1	-	Connect to pin 1 on TX connector of sending side node.
2	-	Connect to pin 2 on TX connector of sending side node.
3	RX+	Connect to pin 3 on TX connector of sending side node.
4	-	Connect to pin 4 on TX connector of sending side node.
5	-	Connect to pin 5 on TX connector of sending side node.
6	RX-	Connect to pin 6 on TX connector of sending side node.
7	-	Connect to pin 7 on TX connector of sending side node.
8	-	Connect to pin 8 on TX connector of sending side node.
Shell	FG	Connect to shield of cable

## [CN11] TX connector

Pin no.	Symbol	Description
1	-	Connect to pin 1 on RX connector of receiving side node.
2	-	Connect to pin 2 on RX connector of receiving side node.
3	TX+	Connect to pin 3 on RX connector of receiving side node.
4	-	Connect to pin 4 on RX connector of receiving side node.
5	-	Connect to pin 5 on RX connector of receiving side node.
6	TX-	Connect to pin 6 on RX connector of receiving side node.
7	-	Connect to pin 7 on RX connector of receiving side node.
8	-	Connect to pin 8 on RX connector of receiving side node.
Shell	FG	Connect to shield of cable.

Be sure to use shielded twisted pair (STP) in compliance with CAT5e or higher of TIA/EIA-568B.

7-8 I/O Connector **CN1**

Servo driver side : J. S. T. Mfg MUF-RS6DS-GKYR-P equivalent, Plating : GOLD

**Input**

Pin no.	Symbol	Description	I/O type
3	I-COM	<ul style="list-style-type: none"> <li>Connect to positive/negative polarity of the external power supply.</li> <li>Use power supply: 12 V +/-5 % to 24 V +/-5 %</li> </ul>	-
4	SI5	<ul style="list-style-type: none"> <li>Assign functions using parameters.</li> <li>For details, refer to the technical data - Basic function specification - SX-DSV02309.</li> <li>For factory default function assignment, refer to appendix "Specification for Each Model".</li> </ul>	i-1
5	SI6		i-1
6	SI7		i-1

(Note) SI1-SI4 and SI8 cannot be used with this servo driver.

**Output**

Pin no.	Symbol	Description	I/O type
1 2	SO1+ SO1-	<ul style="list-style-type: none"> <li>Assign functions using parameters.</li> <li>For details, refer to the technical data—Basic function specification—SX-DSV02309.</li> <li>For factory default function assignment, refer to appendix "Specification for Each Model".</li> </ul>	o-1

(Note) SI1-SI4 and SI8 cannot be used with this servo driver.

**Other**

Pin no.	Symbol	Description	I/O type
Shell	FG	<ul style="list-style-type: none"> <li>Connected to the Frame ground inside the servo driver.</li> </ul>	-

**I/O type**

<p><b>i-1</b></p> <p style="text-align: center;">or</p>	<p><b>o-1</b></p> <p>Note: To directly run the relay, attach a diode in parallel with the relay and in the direction shown in the figure above. VCE sat = 1.2 V</p>
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## 8. Wiring

### 8-1 Cables and Maximum Lengths

Name	Symbol	Maximum cable length	Cable
Power connection	CN102 CN103	-	AWG 18
Motor connection	CN101	3 m	AWG 20
Feedback Scale connection (A / B / Z, Serial)	CN3 CN104	3 m	Overall twisted shielded pair Core wire: 0.18 mm <sup>2</sup> or larger
CS signal connection	CN2	3 m	
I/O connection	CN1	1 m	
RTEX connection	CN10 CN11	100 m (Note 1)	Shielded twisted pair (STP) cable of category 5e or better

(Note 1) Refer to 8-3 (7) Connection to connectors CN10 , CN11 .

### 8-2 Cable Side Connectors

Symbol	Part name	Part number	Manufacturer
CN102 CN103	Connector	5557-02R	Molex
	Pin	5556TL	
CN101	Connector	1445022-4	Tyco Electronics
	Pin	794610-1	
	Connector	43645-0400	Molex
	Pin	43030-0001	
CN104	Connector	794617-6	Tyco Electronics
	Pin	794611-3	
	Connector	43025-0600	Molex
	Pin	43030-0002	
CN1	Connector	MUF-PK6W-Y	J. S. T. Mfg
CN2	Connector	3E206-0100KV	Sumitomo 3M
	Pin	3E306-3200-008	
CN3	Connector	MUF-PK10K-X	J. S. T. Mfg

Use connectors listed above or equivalents.

### 8-3 Precautions for Wiring

#### (1) Wiring to power connector

- [1] Power connector of the servo driver is tin plated. In order to avoid a bad contact caused by dissimilar metals, connector pins for the connection, please use the tin plating.
- [2] The DC power supply might have a trip to protect its components from over-voltage that is caused by the regenerated energy from motor. In that case, it is necessary to install the diode for protecting from the feedback current and also to install the DC bus capacitor for storing the regenerated energy between the DC power supply and drivers.
- [3] So that the specified voltage at the input servo driver, consider the transient voltage drop due to the impedance wiring, select both the diameter of the power line and the length.
- [4] This servo driver does not mount the inrush current limit circuit. Inrush current is dependent on the characteristics and wiring impedance of the connection power, please check the actual machine.
- [5] Because this servo driver to assume a connection with a stabilized power supply is provided with reinforced insulation, protective ground terminal is not available. M4 screw on the heat-sink is functional earth (FG).

#### (2) Wiring to motor connector

- [1] Motor connector of the servo driver is tin plated. In order to avoid a bad contact caused by dissimilar metals, connector pins for the connection, please use the tin plating.
- [2] For a noise countermeasure, attach the ferrite core U, V, W as necessary.

#### (3) Wiring to CS connector and feedback scale connector.

- [1] CS connector and feedback scale connector of the servo driver is gold plated. In order to avoid a bad contact caused by dissimilar metals, connector pins for the connection, please use the gold plating.
- [2] For the each cable is a stranded wire of core wire, please use Collective shield twisted pair cable.
- [3] Maximum cable length is 3 m. In order to meet the mitigation of the voltage drop of 5 V power supply to the encoder to long wiring, select the appropriate wire diameter.
- [4] Cable should be located well away from power cable and motor cable with large current.

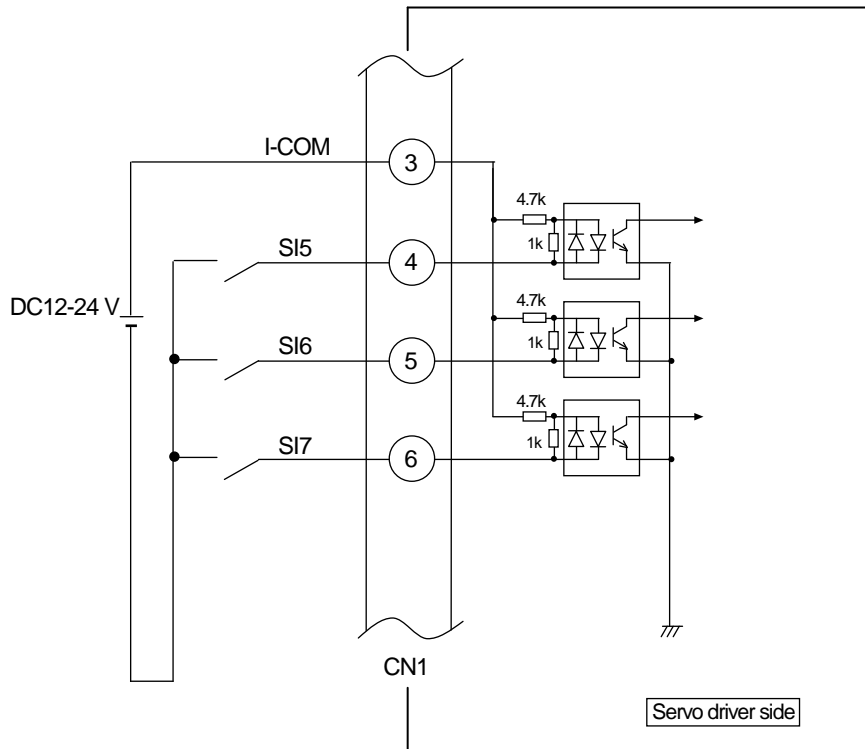
#### (4) Wiring to I/O connector

- [1] I/O connector of the servo driver is gold plated. In order to avoid a bad contact caused by dissimilar metals, connector pins for the connection, please use the gold plating.
- [2] Do not exceed the maximum voltage and current specification of the input and output.



(5) Wiring to connector **CN1**

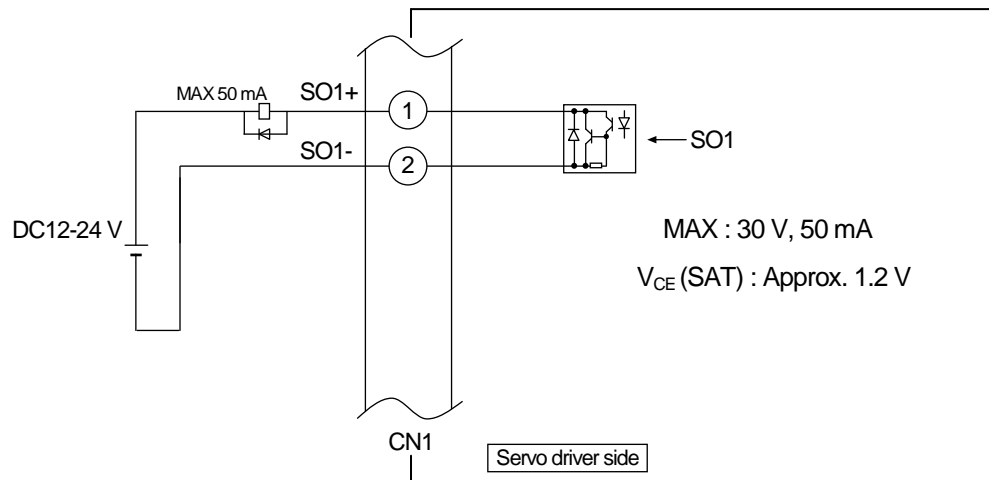
- [1] The 12–24 VDC power supply for the external control signal connected to the I-COM should be prepared by the customer.
- [2] Place the servo driver and its peripheral device as nearly as possible (up to 3 m) so as to shorten the wiring.
- [3] Wire the wiring as far away as possible (30 cm or more) from the power lines (P, N, U, V, W).  
Do not put them in the same duct or bind them together.

**Input**

The functions of the pins SI5-SI7 are assigned by parameters. For factory default settings, refer to Appendix “Specification for Each Model”.

### Output

- [4] Be aware of the polarity of the power supply for control signals. The servo driver is damaged by reverse connection of the polarity shown in the following figure.
- [5] To directly drive the relay with each output signal, make sure to attach a diode in parallel to the relay and in the direction as shown in the figure below. The servo driver can be damaged if the diode is not attached or the diode is attached in the reverse direction.
- [6] Apply 50 mA or less of current to output.

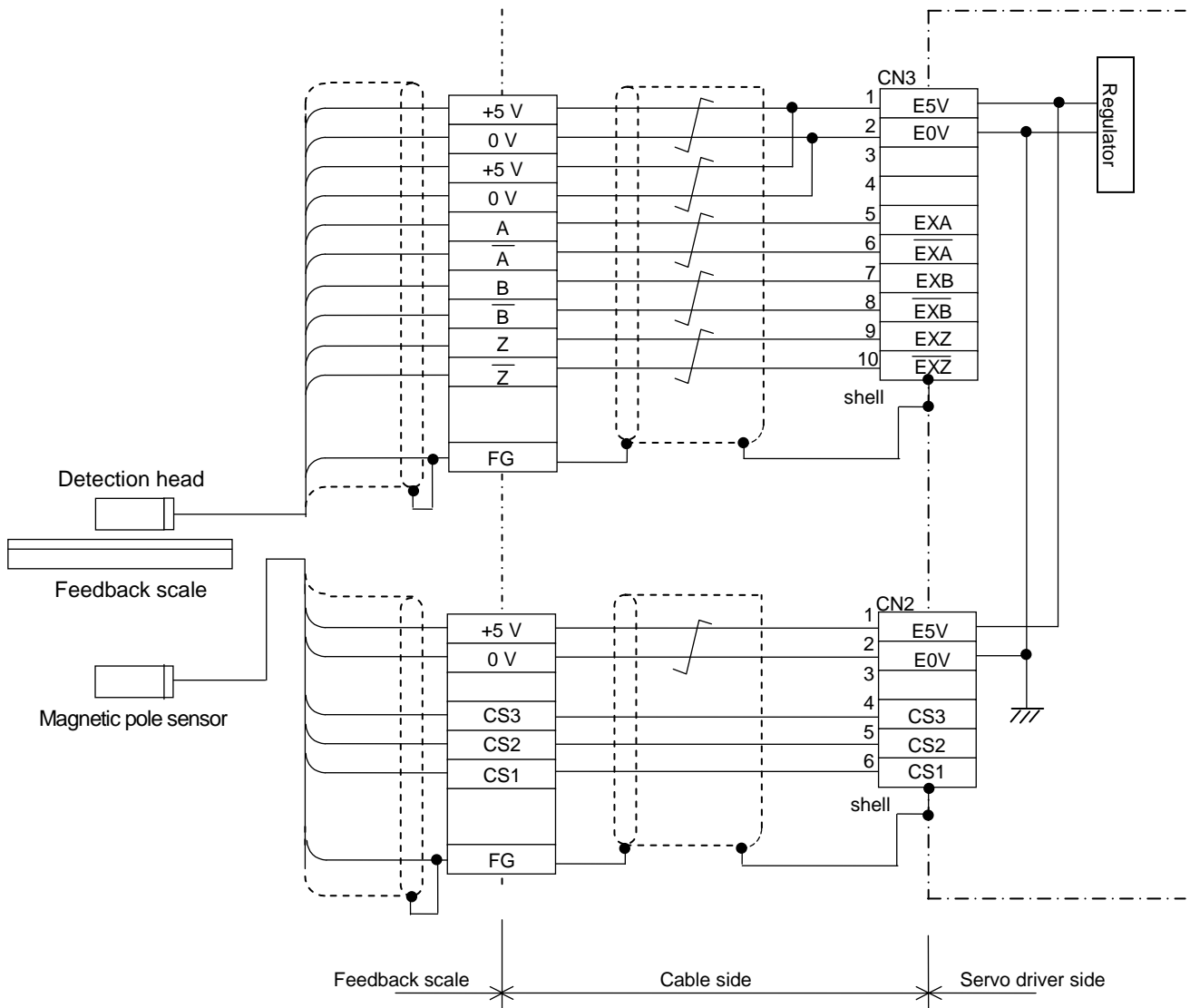


The functions of the pins SO1 are assigned by parameters. For factory default settings, refer to Appendix “Specification for Each Model”.

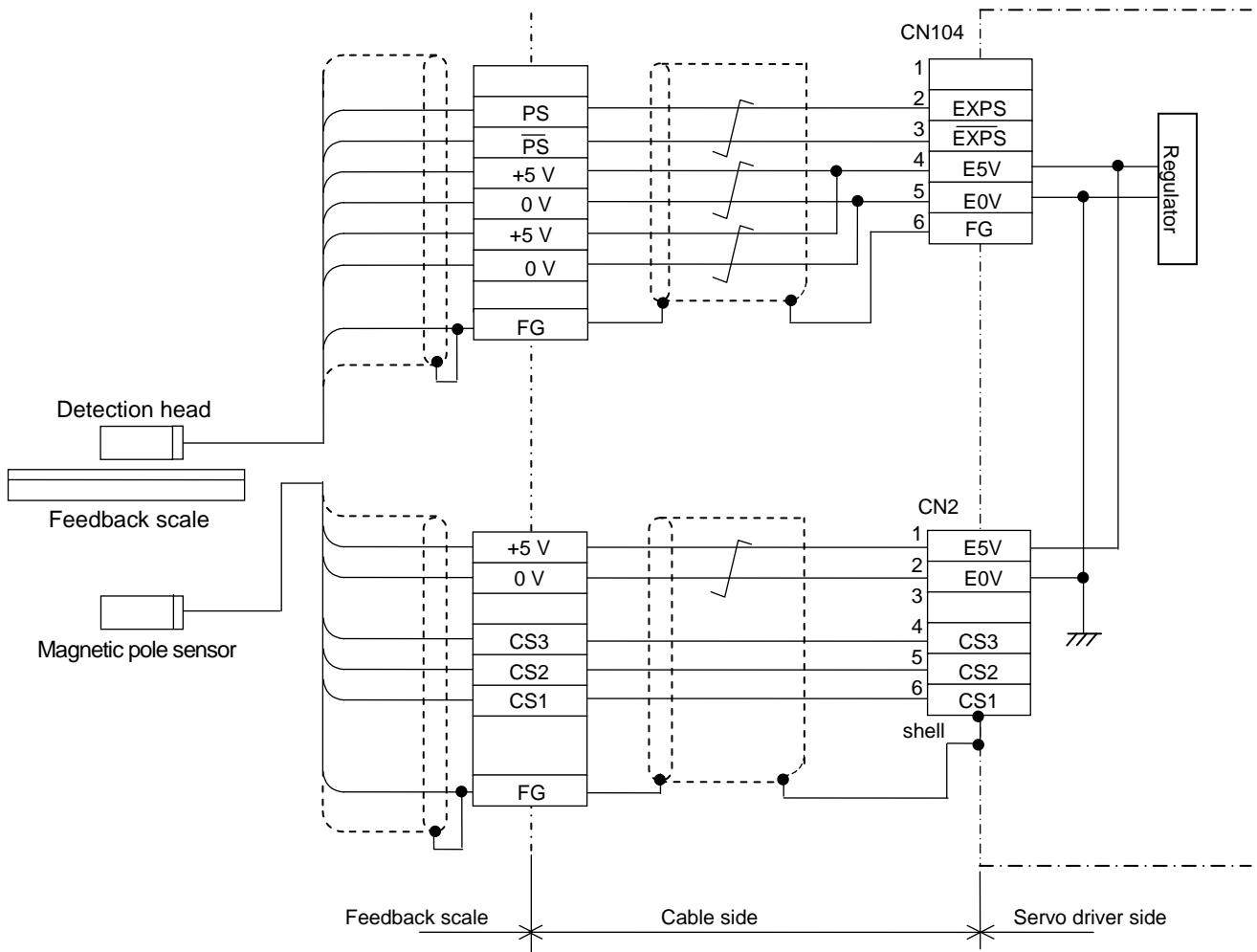
(6) Wiring to connector **CN104** **CN2** **CN3**

- [1] As for the feedback scale and CS signal cable, use the batch shielded twisted wire pairs whose core is 0.18 mm<sup>2</sup> or more.
- [2] The cable length should be up to 3 m. When the wiring is long, we recommend you to use the double wiring for the 5 V power supply in order to reduce the impact of voltage drop.
- [3] For the interface of CS signal connection, refer to chapter 7.
- [4] Make sure to connect the shield to 6 pin of **CN104**.
- [5] Wire the wiring as far away as possible (30 cm or more) from the power lines (P, N, U, V, W).  
Do not put them in the same duct or bind them together.
- [6] Do not connect anything to the empty pins of **CN104** and **CN2** and **CN3**.
- [7] **CN104** and **CN2** and **CN3** are capable to supply up to 5 V ± 5 % 300 mA power supply. When using a feedback scale and CS signal at more consumption current than this, customer is responsible for the power supply. Some external scales may take longer time in initialization after turning on the power. Design the power supply so as to meet the running timing after power-on which is described in “Basic function specifications.”
- [8] When using a magnet pole position estimation function without CS signal, wiring of **CN2** is unnecessary.

## An example of A / B / Z phase type wiring



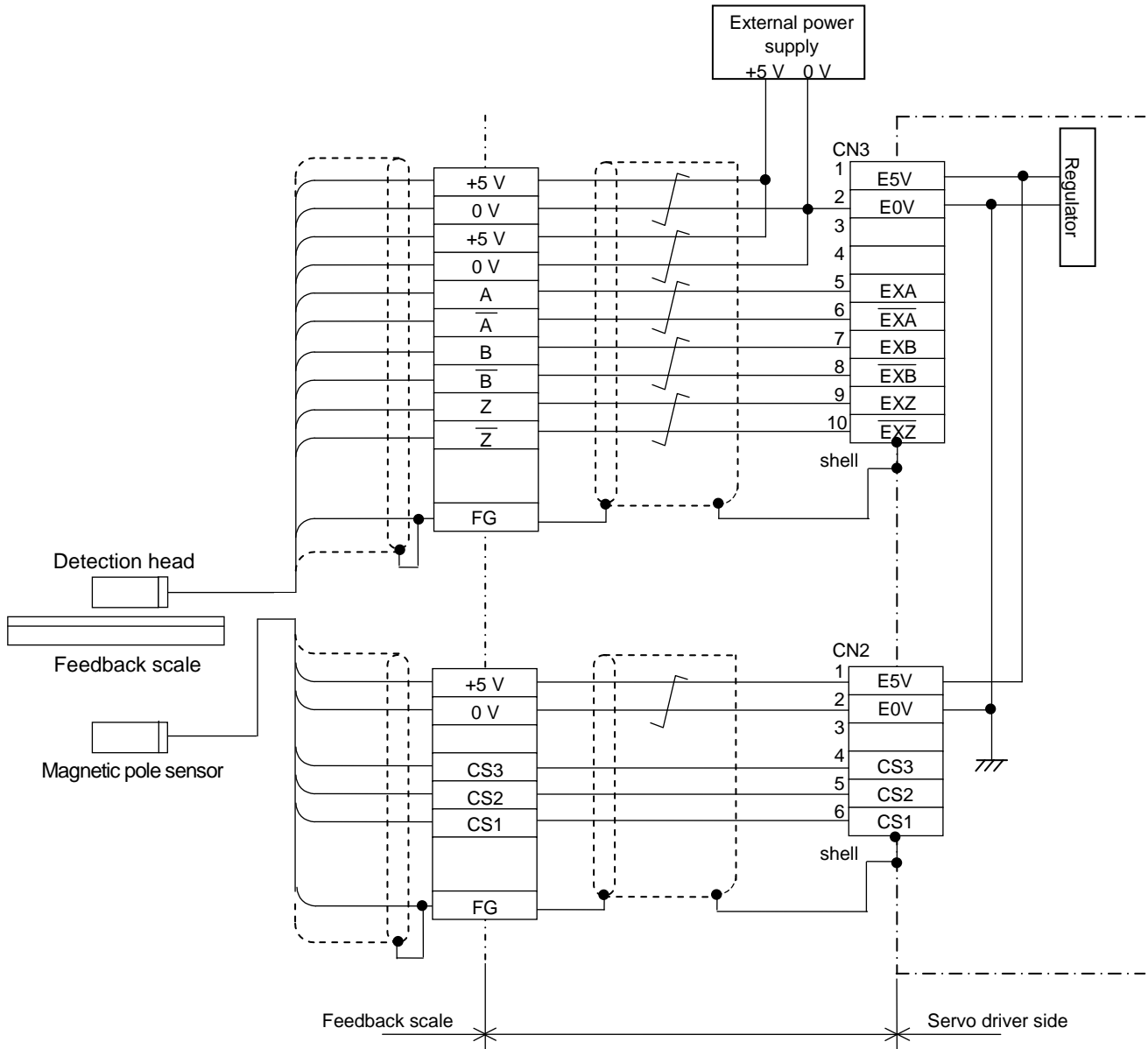
An example of serial communication type wiring



An example of A / B / Z phase type wiring with the external power supply

(Note 1) Connect the ground of the external power supply and scale to E0V pin.

(Note 2) Do not connect with E5V pin. And do not supply E5V pin with power supply from the exterior.



(7) Wiring to connector **CN10**, **CN11**

[1] Use shielded twisted pair (STP) in compliance with category 5e or higher of TIA/E1A-568B.

If both ends of the shield are not grounded, EMC performance will degrade.

When installing connector plug on both ends of shielded cable, positively connect the shield to the metallic plug shell.

For colors of wire and matching connector pins, be compliant with TIA/E1A568B (see figure below).

Pins 3 and 6 are for signal wire.

Also, connect wire to 3 unused pairs on the connector: 1-2, 4-5 and 7-8.

When using 2-pair wire instead of 4-pair wire, connect pins 1-2 and 3-6, and leave pins 4-5 and 7-8 on connector unconnected.

Use plugs compliant with IEC 60603-7 standard.

[2] Length of communication cable

- a. Inter-nodes: max. 100 m
- b. Total length of cables in the communication loop: max. 200 m

Both requirements should be met.

If the requirement b above cannot be met, consult with us.

Because specifications such as flexural characteristic, temperature range and insulation material differ from manufacturer to manufacturer, select the cable best suitable for your application.

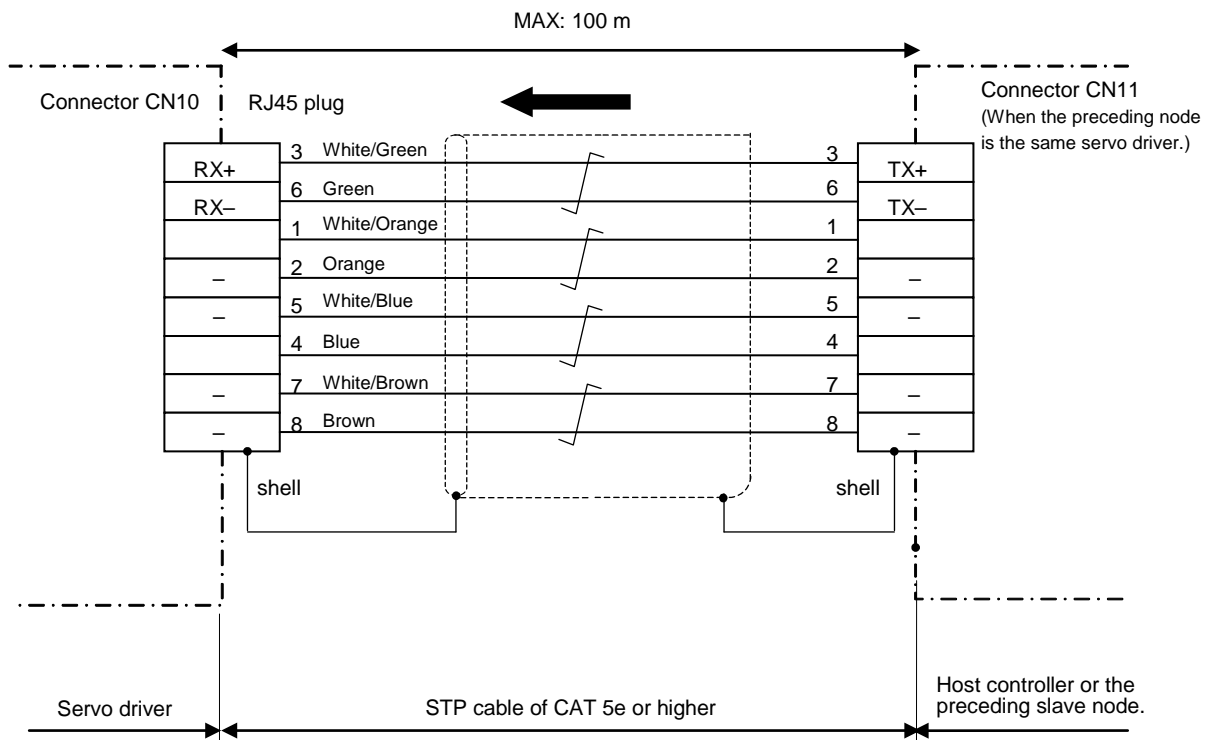
Select the cable for movable application according to your operating condition.

<Communication cable used in our evaluation>

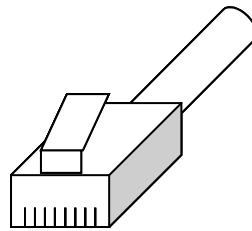
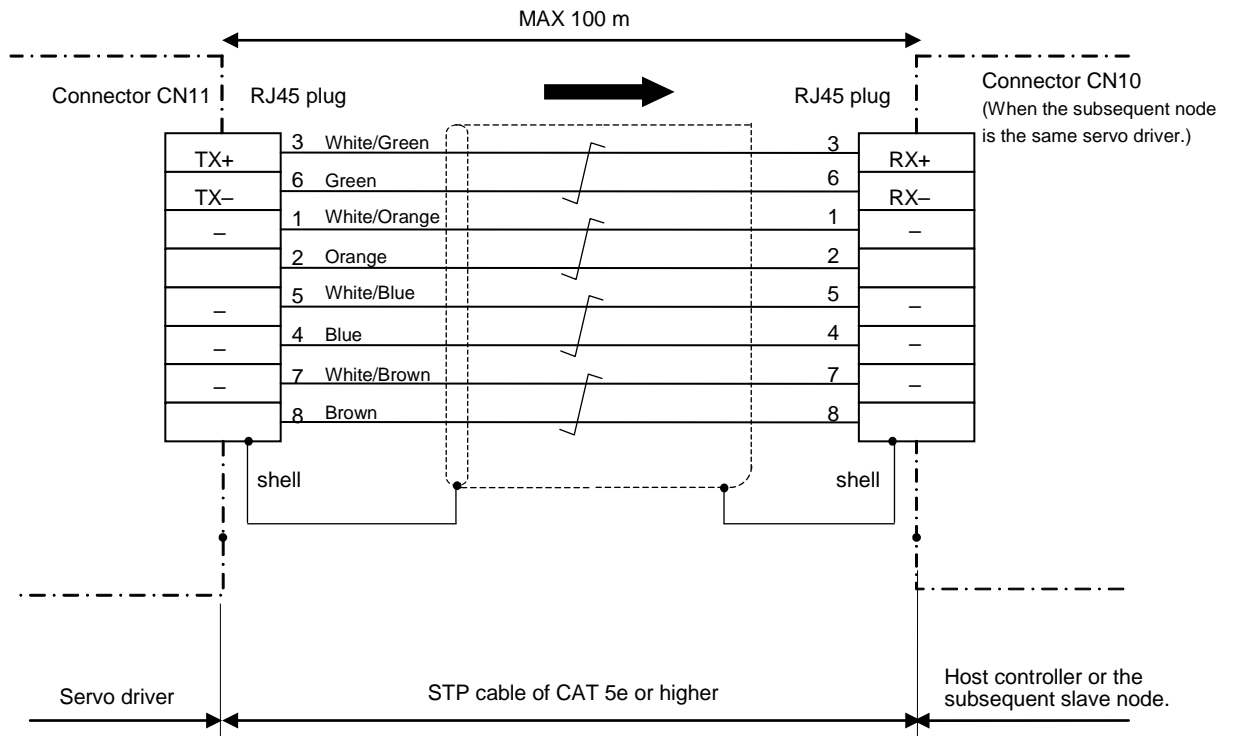
Manufacturer: Sanwa Supply Inc.

Part No.: KB-STP-\*K, Category: 5e, STP

Connection to CN10



Wiring to connector CN11



1 → 8



Pins on RJ45 plug





# SAFETY PRECAUTIONS

## 9. Safety Precautions

- Danger and damage caused when the safety precautions are ignored are described in the following categories and signs:

 <b>DANGER</b>	Description of this sign indicates “urgent danger that may cause death or serious injury.”
 <b>CAUTION</b>	Description of this sign indicates “danger that may cause injury or property damage.”

- Rules to keep are categorized and described with the following graphics.

	This graphic indicates “Prohibited” acts that are not permitted.
	This graphic indicates “Mandatory” acts that must be performed forcibly.



## DANGER



- (1) Be sure not to store or use the equipment under conditions subjected to vibrations (5.88 m/s<sup>2</sup> or heavier) or an impact shock, foreign matters such as dust, metal particles oil mist, liquids such as water, oil and polishing liquid, near flammable objects, in an atmosphere of corrosive gas (such as H<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub>, Cl<sub>2</sub>), or in an atmosphere of flammable gas.
- (2) Do not place any flammable objects near a liner motor, a servo driver.
- (3) Do not drive the motor with an external force.
- (4) Do not damage or strain the cable, or do not apply excessive stress. Do not place a heavy item on the cable or do not pinch the cable.
- (5) Do not use the equipment with the cable soaked in oil or water.
- (6) Do not install the equipment near a heating object such as a heater or a large wire-wound resistor. (Install a thermal shield, etc. to avoid the influences of heating object.)
- (7) Do not connect the motor directly with a commercial power.
- (8) Do not use the equipment under conditions subject to strong vibrations or an impact shock.
- (9) Be sure not to touch a rotating part of a motor during operation.
- (10) Be sure not to touch inside a servo driver.
- (11) Motor servo driver heat sink and peripheral device become very hot. Do not touch them.
- (12) Do not carry out wiring or do not operate the equipment with wet hands.
- (13) Wiring work is strictly allowed only for an engineer specializing electrical work.





## SAFETY PRECAUTIONS



- (14) A liner motor other than specified is not provided with a protection device. Protect a motor with an overcurrent protection device, a ground-fault interrupter, overheating protection device, and emergency stop device, etc.
- (15) When operating the servo driver after an earthquake, inspect installation conditions of the servo driver and the motor and safety of the equipment to make sure that no fault exists.
- (16) After turning off the power, the inside circuit remains charged at a high voltage for a while. When moving, wiring or inspection the equipment, completely shut off the power supply input outside the servo driver and leave for 15 minutes or longer before working.
- (17) Install and mount the equipment securely to prevent personal injury caused by poor installation or mounting on an earthquake.
- (18) Install an external emergency shutoff circuit to stop operation and interrupt power immediately upon emergency.  
Emission of smoke or dust may occur due to a fault of a motor or a servo driver used in combination.
- (19) Mount the motor, the servo driver and the peripheral devices on a noncombustible material such as metal.
- (20) Provide correct and secure wiring. Insecure wiring or incorrect wiring may cause runaway or burning of a motor. During wiring work, avoid entry of conductive dust such as wire chippings in a servo driver.
- (21) Connect cables securely and provide secure insulation on current-carrying parts using insulation material.
- (22) FG screw (M4) should be tighten to a torque of 1.0 ~ 1.2 N • m.



## CAUTION



- (23) Do not hold cables or liner motor shaft when carrying the equipment.
- (24) Do not adjust or change servo driver gains extremely, and do not make operations of the machine instable.
- (25) The equipment may suddenly restart after recovery from shutdown upon a power failure. Keep away from the equipment.  
Specify settings of the equipment to secure safety for human against such restart operations.
- (26) When the equipment is energized, keep away from the motor and mechanism driven by the motor in case of malfunction.
- (27) Avoid a strong shock to the product.
- (28) Be sure not to use the electromagnetic contactor installed on the power supply to start or stop the motor.
- (29) Avoid frequent switching on and off the main power supply of the servo driver.
- (30) Do not fall or topple over the equipment when carrying or installing.



# SAFETY PRECAUTIONS



## CAUTION



- (31) Do not climb the motor or do not place a heavy item on the motor.
- (32) Do not put a foreign matter into the servo driver.
- (33) Do not use the equipment under direct sunlight. When storing the equipment, avoid direct sunlight and store under conditions of operating temperatures and humidity.
- (34) Be sure not to disassemble or modify the equipment.  
Disassembling and repair is allowed only for the manufacturer or sales agency authorized by the manufacturer.
- (35) Please use power are provided with reinforced insulation the stabilized power supply (SELV). Do not connect the positive side and the negative side and ground (FG) of the input power of servo driver.
- (36) This servo driver is Built-in type (degree of protection IP00). Please note that during the installation so without applying static electricity. Static electricity is applied to runaway or burning, destruction, and cause of failure.
- (37) This servo driver does not have a built-in fuse. Please set up the disconnect device in the connection side.

- (38) Use a liner motor and a servo driver in combination specified by the manufacturer. A customer shall be responsible for verifying performances and safety of combination with other servo driver.
- (39) A failure of a liner motor or a combined servo driver may cause burning of motor, or emission of smoke and dust. Take this into consideration when the application of the machine is clean room related.
- (40) Install the equipment adequately in consideration of output and main unit weight.
- (41) Keep the ambient conditions of an installed motor within a range of allowable ambient temperatures and of allowable humidity.
- (42) Install the equipment by specified procedures and in specified orientation.
- (43) Install the devices by keeping specified distances between a servo driver and inside control panel or other devices.
- (44) For a test run, hold down a motor and disconnect from a mechanical system to verify operations before installing on the equipmen
- (45) Verify that an input power supply voltage satisfies the servo driver specifications before turning on the power and start operation. An input voltage higher than rated may cause ignition and smoking in the servo driver, which may cause runaway or burning of a motor in some cases.
- (46) When an alarm status occurs, remove a cause of the problem before restarting.  
Careless restarting without removing a cause of problem may cause malfunction or burning of a motor.
- (47) The linear motor may not be able to hold due to expiring useful life or a mechanical structure. Install a braking device on the equipment to secure safety.
- (48) Pay attention to heat radiation. The servo driver generates heat by operating a motor. A servo driver used in a sealed control box may cause an extreme rise of temperature.  
Consider cooling so that an ambient temperature around the servo driver satisfies an operating range.
- (49) Maintenance and inspection is allowed only for a specializing person.
- (50) Turn off the power when the equipment is not used for a long term.
- (51) When the dynamic brake operates at the high speed driving, stop the motor during about 10 minutes. When operating the motor on the conditions beyond it, dynamic brake may be disconnected and the brake function may stop operating.

- Capacitance of the capacitors of power supply rectifier circuit drops over time. To avoid a secondary problem due to a failure, replacement of capacitors is recommended at an interval of approximately 5 years. Commission the manufacturer or sales agency authorized by the manufacturer to replace the parts.
- Be sure to read the operating manual (safety book) before use.



## SAFETY PRECAUTIONS

### Servo driver's ambient temperature

The driver's service life significantly depends on the ambient temperature.

Do measures cooling such as fan installation.

**Operating temperature range: 0 to 55 degrees C**

We have made the best efforts to ensure quality of this product. However, application of external noise (include radiation) or static electricity, or a defect of the input power supply, wiring or components may cause the servo driver to operate beyond the preset conditions. Therefore, you should exercise thorough caution to ensure safety against an unexpected operation.

## 10. Life and Warranty

### 10-1 Life Expectancy of the Driver

The Servo driver has 28,000 hours of life expectancy when used continuously under the following conditions.

Definition of the life Life end shall be defined as the capacitance of the electrolytic capacitor is reduced by 20 % from the ex-factory status.

Condition	{ Input power source: DC 24 V Ambient temperature: 55 degree C Output torque: Rated constant value No. of revolutions: Rated constant No. of revolutions

Note that the life varies due to the working conditions.

### 10-2 Warranty Period

#### (1) Warranty period

For a period of 12 months from the date of delivery or 18 months from the manufacturing month, whichever is shorter.

This warranty shall be exempted in the following cases,

- [1] defects resulting from misuse and/or repair or modification by the customer
- [2] defects resulting from drop of the product or damage during transportation
- [3] defects resulting from improper usage of the product beyond the specifications
- [4] defects resulting from fire, earthquake, lightning, flood, damage from salt, abnormal voltage or other act of God, or other disaster.
- [5] defects resulting from the intrusion of foreign material to the product, such as water, oil or metallic particles.

This warranty shall be exempted when the life of component exceeds its rated standard life.

#### (2) Warranty scope

Panasonic warrants the replacement of the defected parts of the product or repair of them when the defects of the product occur during the warranty period, and when the defects are under Panasonic responsibility. This warranty only covers the product itself and does not cover any damage incurred by such defects.

## 11. Others

- Precautions for export of this product and the equipment incorporating this product If the end user or end purpose of this product relates to military affairs, armament and so on, this product may be subject to the export regulations prescribed in “Foreign Exchange and Foreign Trade Control Law”. To export this product, take thorough examination, and follow the required export procedure.
- We cannot warrant this product, if it is used beyond the specified operating conditions.
- Compliance with the relevant standards should be considered by the user.
- The final decision on the compatibility with the installations and components at the user’s site, in terms of structure, dimensions, characteristics and other conditions, should be made by the user.
- When using this product in your equipment, be careful about the compatibility with the servo motor and the servo driver to be used together.
- For performance improvement or other reasons, some components of this product may be modified in a range that satisfies the specifications given in this document.
- Any specification change shall be based on our authorized specifications or the documents presented by the user. If a specification change may affect the functions and characteristics of this product, we will produce a trial product, and conduct examination in advance. Note that the produce price may be changed with a change in its specifications.
- We have made the best efforts to ensure the product quality. However, complete equipment at customer’s site may malfunction due to a failure of this product. Therefore, take precautions by providing fail-safe design at customer’s site, and ensure safety within the operating range of the work place.
- Failure of this product depending on its content, may generate smoke of about one cigarette. Take this into consideration when the application of the machine is clean room related.
- When the equipment runs without connecting the servomotor’s shaft electrically to ground, electrolytic corrosion may occur on the motor bearing and the bearing noise may get louder depending on the equipment and installing environment. So, customer is responsible to check and verify it.
- A customer must verify and inspect the equipment. Please be careful when using in an environment with high concentrations of sulphur or sulphuric gases, as sulphuration can lead to disconnection from the chip resistor or a poor contact connection.
- Take care to avoid inputting a supply voltage which significantly exceeds the rated range to the power supply of this product. Failure to heed this caution may result in damage to the internal parts, causing smoking and/or a fire and other trouble.
- When discard batteries, provide insulation using a tape etc. and discard the batteries abiding by a municipal law.
- When discarding the equipment, process the item as an industrial waste.
- Confirmation of safety and matching of the servo amplifier and linear motor, execute the responsibility of your company.
- This production is designed for general industry applications, and is not designed for applications of nuclear plant, aerospace, transportation, medical, various safety equipments, highly clean equipments that involve human lives, or for usage under special environment.

**【Exemption clause regarding with distribution of drive specified on this spec.】**

- Product responsibility will be owned by the publisher of this specification regarding with the drive on this specification, when product had been supplied to the party which agreed to this specification.
- Product responsibility will not be owned by the publisher of this specification when product had gone through the channel or end user which had not conducted the specification agreement.
- Publisher recommends that the drive is to be supplied with the motor manufacture with its motor, based on this specification being agreed with the motor manufacture.
- Specification is to be agreed with the machine manufacture, when the machine manufacture intends to procure the drive and motor separately.
- When in case the agreement of this specification becomes difficult, then we will supply the drive based on the responsibility of the distributor who has agreed to this specification.
- This specification does not assure the operation of the motor matched to the drive specified by this specification. Publisher does not confirm the matching of the motor to drive, and therefore please take extra care in confirming the matching to the motor by equipment manufacture, distributor, or motor manufacture.
- When an unexpected trouble occurs at the matching of motor, distributor, motor manufacture, and machine manufacture is to correspond the trouble in good faith. in good faith

Specification for Each Model
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● MINAS-A5NL Series Size M

Model	MMDHT2C09NL1
Power supply input	DC24 V
Maximum instantaneous output current	15 A
Maximum continuous output current	9 A
Regenerative processing function	Unprovided
Auto gain tuning function	Provided
Dynamic brake function	Provided
Ambient temperature	0–55 degrees C
Main power supply cable	HVSF 0.75–2.0 mm <sup>2</sup> AWG 14–18
Ground cable	HVSF 2.0 mm <sup>2</sup> AWG 14
Motor cable	HVSF 0.50 mm <sup>2</sup> AWG 20 (5 A rated)
Inrush Current	No limit by driver
Weight	Approx. 0.2 kg
Dimensions	Size M

## I/O connector (CN1) default function allocation

CN1 connector		Default function			
Name	Pin number	Signal name	Parameter setting ( ): decimal notation	Symbol	Logic
SI5	4	Home	00222222h (2236962)	HOME	Normally open
SI6	5	Positive overtravel	00010101h (65793)	POT	Normally open
SI7	6	Negative overtravel	00020202h (131586)	NOT	Normally open
SO1	1,2	Motor brake release	00030303h (197379)	BRK-OFF	Normally open



### Differences of Specification

This servo driver differs in the following specification to technical documents (- Functional specification -).

#### ■ Basic Specification

Item		Description
Control signal	Input	3-input can be assigned any function with the parameter.
	Output	1-output can be assigned any function with the parameter.
Pulse signal	Output	Not supported.
Safety terminal		Not supported.
Front panel		Equipped with the followings on the PCB instead of the front panel. 1. Network status LED (See the below). 2. SON LED (See the below). 3. ALM LED (See the below). 4. Rotary switches for node address setting.
Regeneration		Not supported.
Dynamic brake		Built-in

#### ■ LED Display

This servo driver does not have 7 segment LED and it has LED shown below as an alternative to this.

##### Network status LED (LINK, COM)

###### LINK LED

Display status		Description
LED1	Not lit	Not connected (Transmission node is not powered on, or cable is broken etc.)
	Lit green	Connected normally (TX of transmission node and RX of local node are correctly connected electrically.)

###### COM LED

Display status		Description				
		RTEX communication status	Pr7.23 bit4 = 0		Pr7.23 bit4 = 1	
			MNM1221 status *1)	State of synchronization between communication and servo	MNM1221 status *1)	State of synchronization between communication and servo
LED2	Not lit	Not established	• INITIAL	Independent	• INITIAL	Not established
LED3					• RING_CONFIG • READY	• RING_CONFIG • READY • RUNNING
	Lit green	Established	• RUNNING		• RUNNING	Established
LED2	Blinking red	RTEX communication-related clearable alarm occurs.				
	Lit red	RTEX communication-related unclearable alarm occurs.				

\*1) MNM1221 is an ASIC for RTEX communication control.

##### SON LED

Display status		Description
LED5	Lit green	Servo ON
	Not lit	Servo OFF

##### ALM LED

Display status		Description
LED7	Not lit	Normally
	Lit red	Alarm occurs

This servo driver does not support the following protective and warning functions.

■ Protective functions

Error No.		Description
Main	Sub	
13	1	Main power supply undervoltage protection
14	1	IPM error protection
18	0	Over-regeneration load protection
	1	Over-regeneration Tr error protection
28	0	Limit of pulse replay error protection
30	0	Safety detection
33	0	Overlaps allocation error 1 protection
	2	Input function number error 1 protection
	4	Output function number error 1 protection

■ Warning functions

	Warning No. (Hex.)	Description
General warning	A1	Over-regeneration warning
	A2	Battery warning
	A3	Fan warning
Extended warning	C3	Main power off warning

PARAMETER

MODEL MMDHT2C09NL1

Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value								
0	0	Operational direction setup	1	1	13	Thrust feed forward filter	0.00	2	16	2nd damping frequency	0.0	3	23	Feedback scale selection	0	4	24	For manufacturer's use	0								
	1	Not used	-		14	2nd gain setup	1		17	2nd damping filter setup	0.0		24	Not used	-		25	Not used	-	25	Not used	-					
	2	Real-time auto tuning setup	1		15	Mode of position control switching	0		18	3rd damping frequency	0.0		25	Not used	-		26	Reversal of feedback scale direction	0	26	Not used	-	26	Not used	-		
	3	Machine stiffness at real-time auto tuning	13		16	Delay time of position control switching	5.0		19	3rd damping filter setup	0.0		26	Reversal of feedback scale direction	0		27	Feedback scale Z-phase disconnection detection disable	0	27	Not used	-	27	Not used	-		
	4	Mass ratio	250		17	Level of position control switching	50		20	4th damping frequency	0.0		27	Feedback scale Z-phase disconnection detection disable	0		28	Not used	-	28	Not used	-	28	Not used	-		
	5	Not used	-		18	Hysteresis at position control switching	33		21	4th damping filter setup	0.0		28	Not used	-		29	For manufacturer's use	0	29	Not used	-	29	Not used	-		
	6	Not used	-		19	Position gain switching time	3.3		22	Position command smoothing filter	0.0		29	For manufacturer's use	0		30	Not used	-	30	Not used	-	30	Not used	-		
	7	Not used	-		20	Mode of velocity control switching	0		23	Position command FIR filter	0.0		31	For manufacturer's use	0		31	In-position range	10	31	In-position range	10	31	In-position range	10		
	8	Not used	-		21	Delay time of velocity control switching	0.0		3	0	Not used		-	32	For manufacturer's use		0	32	In-position output setup	0	32	In-position output setup	0	32	In-position output setup	0	
	9	Numerator of electronic gear	1		22	Level of velocity control switching	0			1	Not used		-	33	For manufacturer's use		0	33	INP hold time	0	33	INP hold time	0	33	INP hold time	0	
	10	Denominator of electronic gear	1		23	Hysteresis at velocity control switching	0			2	Not used		-	34	For manufacturer's use		0	34	Zero-speed	50	34	Zero-speed	50	34	Zero-speed	50	
	11	For manufacturer's use	2500		24	Mode of thrust control switching	0			3	Not used		-	35	SI5 input selection		2236962	35	Speed coincidence range	50	35	Speed coincidence range	50	35	Speed coincidence range	50	
	12	For manufacturer's use	0		25	Delay time of thrust control switching	0.0			4	For manufacturer's use		0	36	SI6 input selection		65793	36	At-speed	1000	36	At-speed	1000	36	At-speed	1000	
	13	1st thrust limit	500		26	Level of thrust control switching	0			5	For manufacturer's use		0	37	SI7 input selection		131586	37	Mechanical brake action in stop	0	37	Mechanical brake action in stop	0	37	Mechanical brake action in stop	0	
	14	Position deviation excess setup	100000		27	Hysteresis at thrust control switching	0			6	Not used		-	38	For manufacturer's use		0	38	Mechanical brake action in motion	0	38	Mechanical brake action in motion	0	38	Mechanical brake action in motion	0	
	15	Not used	-		2	0	Adaptive filter mode setup			0	7		Not used	-	39		Not used	-	39	Brake release speed setup	30	39	Brake release speed setup	30	39	Brake release speed setup	30
	16	For manufacturer's use	3			1	1st notch frequency			5000	8		Not used	-	40		Not used	-	40	Warning output 1 selection	0	40	Warning output 1 selection	0	40	Warning output 1 selection	0
17	For manufacturer's use	0	2	1st notch width selection		2	9	Not used		-	41	SO1 output selection	197379	41	Warning output 2 selection	0	41	Warning output 2 selection	0	41	Warning output 2 selection	0					
1	0	1st gain of position loop	48.0	3		1st notch depth selection	0	10		Not used	-	42	For manufacturer's use	592137	42	2nd in-position range	10	42	2nd in-position range	10	42	2nd in-position range	10				
	1	1st gain of velocity loop	27.0	4		2nd notch frequency	5000	11		Not used	-	5	0	Not used	-	0	Not used	-	0	Not used	-	0	Not used	-			
	2	1st time constant of velocity loop integration	21.0	5		2nd notch width selection	2	12		Acceleration time setup	0		1	Not used	-	1	Not used	-	1	Not used	-	1	Not used	-			
	3	1st filter of speed detection	0	6		2nd notch depth selection	0	13		Deceleration time setup	0		2	Not used	-	2	Not used	-	2	Not used	-	2	Not used	-			
	4	1st time constant of thrust filter	0.84	7		3rd notch frequency	5000	14		S-curve acceleration/deceleration time setup	0		3	For manufacturer's use	0	3	For manufacturer's use	0	3	For manufacturer's use	0	3	For manufacturer's use	0			
	5	2nd gain of position loop	57.0	8		3rd notch width selection	2	15		Not used	-		4	For manufacturer's use	0	4	Over-travel inhibit input setup	1	4	Over-travel inhibit input setup	1	4	Over-travel inhibit input setup	1			
	6	2nd gain of velocity loop	21.0	9		3rd notch depth selection	0	16		Not used	-		5	For manufacturer's use	0	5	Sequence at over-travel inhibit	0	5	Sequence at over-travel inhibit	0	5	Sequence at over-travel inhibit	0			
	7	2nd time constant of velocity loop integration	1000.0	10		4th notch frequency	5000	17	Speed limit selection	0	6		For manufacturer's use	4	6	Sequence at servo-off	0	6	Sequence at servo-off	0	6	Sequence at servo-off	0				
	8	2nd filter of speed detection	0	11		4th notch width selection	2	18	Not used	-	7		For manufacturer's use	0	7	For manufacturer's use	0	7	For manufacturer's use	0	7	For manufacturer's use	0				
	9	2nd time constant of thrust filter	0.84	12		4th notch depth selection	0	19	Not used	-	8		Not used	-	8	For manufacturer's use	1	8	For manufacturer's use	1	8	For manufacturer's use	1				
	10	Velocity feed forward gain	30.0	13		Selection of damping filter switching	0	20	Not used	-	9		For manufacturer's use	0	9	For manufacturer's use	70	9	For manufacturer's use	70	9	For manufacturer's use	70				
	11	Velocity feed forward filter	0.50	14		1st damping frequency	0.0	21	Speed limit value 1	0	10		For manufacturer's use	0	10	Sequence at alarm	0	10	Sequence at alarm	0	10	Sequence at alarm	0				
12	thrust feed forward gain	0.0	15	1st damping filter setup		0.0	22	Speed limit value 2	0	11	For manufacturer's use		0.00	11	thrust setup for quick stop	0	11	thrust setup for quick stop	0	11	thrust setup for quick stop	0					

PARAMETER

MODEL MMDHT2C09NL1

Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value	Cate - gory	Pr.	Parameter	Default value				
5	12	Over-load level setup	0	6	8	Positive direction thrust compensation	0	6	39	For manufacturer's use	0	7	19	Not used	-				
	13	Over-speed level setup	0		9	Negative direction thrust compensation	0		40	Disturbance thrust compensating phase setup	0		20	RTEX communication period	3	7	50	Not used	-
	14	Motor working range setup	1.0		10	Function expansion setup	0		41	1st damping filter depth	0		21	RTEX command update period	2	8	51	Not used	-
	15	Control input reading setup	0		11	Not used	-		42	2 stage thrust filter	0		22	RTEX function expansion 1	0	8	52	For manufacturer's use	0
	16	Not used	-		12	Not used	-		43	2 stage thrust filter damping	1000		23	RTEX function expansion 2	18	8	0	For manufacturer's use	0
	17	Not used	-		13	Not used	-		44	Not used	-		24	RTEX function expansion 3	0	8	1	Profile linear acceleration	100
	18	Not used	-		14	Quick stop time at alarm	200		45	Not used	-		25	RTEX velocity unit	0	8	2	For manufacturer's use	0
	19	Not used	-		15	2nd over-speed level setup	0		46	Not used	-		26	RTEX warning setup of continuous com. error	0	8	3	For manufacturer's use	0
	20	Position unit selection	0		16	Not used	-		47	Function expansion setup 2	0		27	RTEX warning setup of cumulative com. error	0	8	4	Profile linear deceleration	100
	21	Thrust limit selection	1		17	Not used	-		48	Tuning filter	0		28	RTEX update counter warning setup	0	8	5	For manufacturer's use	0
	22	2nd thrust limit	500		18	Power-up wait time	0.0	49	Command / tuning filter damping	0	29	RTEX monitor selection 1	0	8	6	Not used	-		
	23	Not used	-		19	Not used	-	50	Viscous friction compensating gain	0	30	RTEX monitor selection 2	0	8	7	Not used	-		
	24	Not used	-		20	For manufacturer's use	0	7	0	For manufacturer's use	0	31	RTEX monitor selection 3	0	8	8	Not used	-	
	25	Positive direction thrust limit	500		21	For manufacturer's use	0		1	For manufacturer's use	0	32	RTEX monitor selection 4	0	8	9	Not used	-	
	26	Negative direction thrust limit	500		22	For manufacturer's use	0		2	Not used	-	33	RTEX monitor selection 5	0	8	10	Profile distance after position latched	0	
	27	Not used	-		23	Disturbance thrust compensating gain	0		3	Thrust limited output setup	0	34	RTEX monitor selection 6	0	8	11	Not used	-	
	28	Not used	-		24	Disturbance observer filter	0.53		4	For manufacturer's use	0	35	RTEX command setup 1	0	8	12	Profile homing mode	0	
	29	For manufacturer's use	2		25	Not used	-		5	For manufacturer's use	0	36	RTEX command setup 2	0	8	13	Profile homing speed 1	50	
	30	Not used	-		26	Not used	-		6	For manufacturer's use	0	37	RTEX command setup 3	0	8	14	Profile homing speed 2	5	
	31	USB axis address	1		27	Warning latch setup	0		7	For manufacturer's use	0	38	RTEX update counter warning protection setup	0	8	15	For manufacturer's use	0	
	32	Not used	-		28	Not used	-		8	For manufacturer's use	0	39	For manufacturer's use	0	8	16	Not used	-	
	33	For manufacturer's use	0		29	Not used	-		9	For manufacturer's use	360	40	RTEX function expansion 4	1	8	17	Not used	-	
	34	For manufacturer's use	4		30	Not used	-		10	Software-limit function	0	41	RTEX function expansion 5	0	8	18	Not used	-	
	6	0	Not used		-	31	Real-time auto tuning estimation speed		1	11	Positive software-limit value	500000	42	Not used	-	8	19	For manufacturer's use	0
		1	Not used		-	32	Real-time auto tuning custom setup		0	12	Negative software-limit value	-500000	43	output setup for completion of estimating magnetic poles position	0	8	0	Motor type selection	1
		2	Velocity deviation excess setup		0	33	Not used		-	13	home offset for absolute encoder	0	44	Not used	-	8	1	Feedback scale resolution / Number of scale pulses per rotation	0.000
		3	Not used		-	34	Not used		-	14	For manufacturer's use	0	45	Not used	-	8	2	Magnetic pole pitch	0.00
		4	Not used		-	35	Not used		-	15	NEAR range	10	46	Not used	-	8	3	Number of pole pairs per rotation	0
		5	Position 3rd gain valid time		0.0	36	Not used		-	16	Not used	-	47	Not used	-	8	4	Weight of motor's movable section / Motor inertia	0.00
		6	Position 3rd gain scaling factor		100	37	Oscillation detecting level		0.0	17	Not used	-	48	Not used	-	8	5	Rated motor thrust / Rated motor torque	0.0
	7	thrust command additional value	0		38	Warning mask setup	4	18	Not used	-	49	Not used	-	8	6	Rated motor effective current	0.0		
														9	7	Maximum instantaneous motor current	0.0		

