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## Operating Instructions (Overall)

### AC Servo Motor & Driver MINAS A5II/A5 series



\* This product image is 200 W type of A5 series.

- Thank you for purchasing this Panasonic product.
- Before operating this product, please read the instructions carefully, and save this manual for future use.
- This product is for industrial equipment. Don't use this product at general household.

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Thank you for purchasing Digital AC Servo Motor & Driver, MINAS A5 series. This instruction manual contains information necessary to correctly and safely use the MINAS A5II/A5 series motor and driver. By reading this instruction manual, you will learn how to identify the model of the motor and driver that will be best suitable your application, how to wire and set up them, how to set parameters, and how to locate possible cause of symptom and to take corrective action.

This is the original instruction.

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**Caution** 

- 1) Any part or whole of this document shall not be reproduced without written permission from us.
- 2) Contents of this document are subject to change without notice.

## 1. Before Using the Products

### Check of the Driver Model ... Installation

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Describes how to identify and select the desired product and components, how to read the specifications, and how to install the equipment.

## 2. Preparation

### Operating requirements and procedure

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Shows the timing chart and the list of parameters, and describes how to make wiring and to use the front panel.

## 3. Connection

### Wiring ... I/O settings

---

Shows block diagrams for each control mode and connection diagrams to the host controller, I/O settings.

## 4. Setup

### Describes parameters ... JOG running

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Shows describes parameters and procedure of test operation.

## 5. Adjustment

### Gain adjustment ... Auto tuning

---

Describes various adjusting method including auto tuning and manual gain tuning.

## 6. When in Trouble

Read this section when you encounter trouble or error.

## 7. Supplement

Contains S-T characteristic diagram, dimensional outline drawing, supplemental description on communications and operation.

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# Safety Precautions



Please observe safety precautions fully.

The following explanations are for things that must be observed in order to prevent harm to people and damage to property.


- Misuses that could result in harm or damage are shown as follows, classified according to the degree of potential harm or damage.



	<b>Danger</b>	Indicates great possibility of death or serious injury.
	<b>Caution</b>	Indicates the possibility of injury or property damage.

- The following indications show things that must be observed.

	Indicates something that must not be done.
	Indicates something that must be done.

## **Danger**

	<b>Do not subject the Product to water, corrosive or flammable gases, and combustibles.</b>	Failure to observe this instruction could result in fire, electrical shocks, damages and breakdowns.
	<b>Do not place combustibles near by the motor, driverd regenerative resistor and dynamic brake resistor..</b>	Failure to observe this instruction could result in electrical shock, injury or fire.
	<b>Don't use the motor in a place subject to excessive vibration or shock.</b>	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	<b>Don't use cables soaked in water or oil.</b>	Failure to observe this instruction could result in fire and breakdowns.
	<b>The installation area should be away from heat generating objects such as a heater and a large wire wound resistor.</b>	Failure to observe this instruction could result in electrical shock, injury or fire.
	<b>Never connect the motor directly to the commercial power supply.</b>	Failure to observe this instruction could result in burn and electrical shocks.
	<b>Don't attempt to carry out wiring or manual operation with wet hand.</b>	
	<b>Do not put your hands in the servo driver.</b>	

	<b>In the case of the motor with shaft end keyway, do not touch the keyway with bare hands.</b>	Failure to observe this instruction could result in personal injury.
	<b>Do not touch the rotating portion of the motor while it is running. Failure to observe this instruction could result in damages and breakdowns.</b>	
	<b>Do not touch the motor, servo driver, heat sink, regenerative resistor and dynamic brake resistor, since they become very hot.</b>	Failure to observe this instruction could result in burns.
	<b>Do not drive the motor with external power.</b>	Failure to observe this instruction could result in fire.
	<b>Do not subject the cables to excessive force, heavy object, or pinching force, nor damage the cables.</b>	Failure to observe this instruction could result in electrical shocks, damages and breakdowns.
	<b>Installation area should be free from excessive dust, and from splashing water and oil.</b>	Failure to heed this precaution will result in electric shock, personal injury, fire, malfunction or damage.
	<b>Mount the motor, driver and peripheral equipments on incombustible material such as metal.</b>	Installation on a flammable material may cause fire.
	<b>Wiring has to be carried out by the qualified and authorized specialist.</b>	Allowing a person with no expertise to carry out wiring will result in electrical shocks.
	<b>Correctly run and arrange wiring.</b>	Incorrect wiring will result in short circuit, electric shock, personal injury, etc.
	<b>After correctly connecting cables, insulate the live parts with insulator.</b>	Incorrect wiring will result short circuit, electric shock, fire or malfunction.
	<b>Ground the earth terminal of the motor and driver without fail.</b>	Floating ground circuit will cause electric shock.
	<b>Install and mount the Product and machinery securely to prevent any possible fire or accidents incurred by earthquake.</b>	Failure to heed this requirement will result in electric shock, personal injury, fire, malfunction or damage.
	<b>Install an emergency stop circuit externally so that you can stop the operation and shut off the power immediately.</b>	
	<b>Install an overcurrent protection, earth leakage breaker, over-temperature protection and emergency stop apparatus without fail.</b>	Failure to heed these requirements will result in electric shock, personal injury or fire.
	<b>Check and confirm the safety of the operation after the earthquake.</b>	
<b>Before transporting, wiring and inspecting the driver, turn off power and wait for a time longer than that specified on the name plate on the side panel of the product; and make sure that there is no risk of electrical shock.</b>	Energized circuit will cause electric shock.	



# Safety Precautions

Please observe safety precautions fully.



## Caution

	<p><b>Do not hold the motor cable or motor shaft during the transportation.</b></p>	<p>Failure to observe this instruction could result in injuries.</p>
	<p><b>Don't drop or cause topple over of something during transportation or installation.</b></p>	<p>Failure to observe this instruction could result in injuries and breakdowns.</p>
	<p><b>Do not step on the Product nor place the heavy object on them.</b></p>	<p>Failure to observe this instruction could result in electrical shocks, injuries, breakdowns and damages.</p>
	<p><b>Don't use the equipment under direct sunshine.</b></p>	<p>Failure to heed these instructions will cause personal injury or fire.</p>
	<p><b>Do not block the heat dissipating holes or put the foreign particles into them.</b></p>	<p>Failure to observe this instruction could result in electrical shocks and fire.</p>
	<p><b>Do not give strong impact shock to the Product.</b></p>	<p>Failure to observe this instruction could result in breakdowns.</p>
	<p><b>Do not give strong impact shock to the motor shaft.</b></p>	<p>Failure to observe this instruction could result in a failure of the detector etc.</p>
	<p><b>Do not turn on and off the main power of the driver repeatedly.</b></p>	<p>Failure to observe this instruction could result in breakdowns.</p>
	<p><b>Never run or stop the motor with the electro-magnetic contactor installed in the main power side.</b></p>	<p>Failure to observe this instruction could result in breakdowns.</p>
	<p><b>Do not make an extreme gain adjustment or change of the drive. Do not keep the machine running/operating unstably.</b></p>	<p>Failure to observe this instruction could result in injuries.</p>
	<p><b>Do not use the built-in brake as a "Braking" to stop the moving load.</b></p>	<p>Failure to observe this instruction could result in injuries and breakdowns.</p>
	<p><b>Do not approach to the machine since it may suddenly restart after the power resumption. Design the machine to secure the safety for the operator even at a sudden restart.</b></p>	<p>Failure to observe this instruction could result in injuries.</p>
	<p><b>Never attempt to perform modification, dismantle or repair.</b></p>	<p>Failure to heed this instruction will result in fire, electric shock, personal injury or malfunction.</p>



	<b>Make an appropriate mounting of the Product matching to its wight and output rating.</b>	Failure to heed these requirements will result in personal injury or malfunction.
	<b>Observe the specified mounting method and direction.</b>	
	<b>Use the eye bolt of the motor for transportation of the motor only, and never use this for transportation of the machine.</b>	Using it for transportation of the machine will cause personal injury or malfunction.
	<b>Don't place any obstacle object around the motor and peripheral, which blocks air passage.</b>	Temperature rise will cause burn injury or fire.
	<b>Adjust the motor and driver ambient environmental condition to match the motor operating temperature and humidity.</b>	Failure to heed these requirements will result in personal injury or malfunction.
	<b>Create the specified clearance between the driver and the control panel inner surface or other devices.</b>	
	<b>Observe the specified voltage.</b>	Operation from a voltage outside the rated voltage will cause electric shock, personal injury or fire.
	<b>Connect the brake control relay to the relay which is to shut off at emergency stop in series.</b>	Missing of one of these devices will result in personal injury or malfunction.
	<b>Provide protection device against idling of electromagnetic brake or gear head, or grease leakage from gear head.</b>	No protection will cause personal injury, damage, pollution or fire.
	<b>Use the motor and the driver in the specified combination.</b>	Not using the motor and the driver in the specified combination will result in fire.
	<b>Test-run the securely fixed motor without loading to verify normal operation, and then connect it to the mechanical system.</b>	Operation using a wrong model or wrong wiring connection will result in personal injury.
	<b>When any error occurs, remove the cause and release the error after securing the safety, then restart.</b>	Not removing the cause of the error will result in personal injury.
	<b>If the driver fails, shut off the power on the power supply side of the driver.</b>	Allowing a large current to continue to pass will result in fire.
	<b>Maintenance must be performed by an experienced personnel.</b>	Wrong wiring will cause personal injury or electric shock.
<b>Always keep power disconnected when the power is not necessary for a long time.</b>	Improper operation will cause personal injury.	
<b>When you dispose the batteries, observe any applicable regulations or laws after insulating them with tape.</b>		
<b>This Product shall be treated as Industrial Waste when you dispose.</b>		

# Conformance to international standards



(A5II, A5 series)



(A5IE, A5E series)



## Conformed Standards

		Driver	Motor
EC Directives	EMC Directives	EN55011 EN61000-6-2 EN61800-3	—
	Low-Voltage Directives	EN61800-5-1	EN60034-1 EN60034-5
	Machinery Directives Functional safety *1	ISO13849-1 (PL d) (Cat. 3) EN61508 (SIL 2) EN62061 (SIL 2) EN61800-5-2 (STO) IEC61326-3-1	—
UL Standards		UL508C (E164620)	UL1004-1, UL1004-6 (E327868)
CSA Standards		C22.2 No.14	C22.2 No.100
Radio Waves Act (South Korea) (KC) *2		KN11 KN61000-4-2, 3, 4, 5, 6, 8, 11	—

IEC : International Electrotechnical Commission  
 EN : Europaischen Normen  
 EMC : Electromagnetic Compatibility  
 UL : Underwriters Laboratories  
 CSA : Canadian Standards Association

Pursuant to the directive 2004/108/EC, article 9(2)  
 Panasonic Testing Centre  
 Panasonic Service Europe, a division of  
 Panasonic Marketing Europe GmbH  
 Winsbergring 15, 22525 Hamburg, F.R. Germany

• When export this product, follow statutory provisions of the destination country.

\*1 A5IE and A5E series doesn't correspond to the functional safety standards.

\*2 Information related to the Radio Waves Act (South Korea)

This servo driver is a Class A commercial electromagnetic radio wave generator not designed for home use. The user and distributor should be aware of this fact.

A 급 기기 (업무용 방송통신기자재)

이 기기는 업무용(A 급) 전자파적합기기로서 판매자

또는 사용자는 이 점을 주의하시기 바라며, 가정외의

지역에서 사용하는 것을 목적으로 합니다.

(대상기종 : Servo Driver)

This product is not an object of China Compulsory Certification (CCC).

### Note

For details on compatibility with international standard, refer to P.2-2 Conformance to international standards.

Routine maintenance and inspection of the driver and motor are essential for the proper and safe operation.

## Notes on Maintenance and Inspection

- 1) Turn on and turn off should be done by operators or inspectors themselves. When establishing a system using safety functions, completely understand the applicable safety standards and the operating instruction manual or technical documents for the product.
- 2) Internal circuit of the driver is kept charged with high voltage for a while even after power-off. Turn off the power and allow 15 minutes or longer after LED display of the front panel has gone off, before performing maintenance and inspection.
- 3) Disconnect all of the connection to the driver when performing megger test (Insulation resistance measurement) to the driver, otherwise it could result in breakdown of the driver.
- 4) Do not use benzene, thinner, alcohol, acidic cleaner and alkaline cleaner because they can discolor or damage the exterior case.
- 5) The upper fan on H-frame driver is kept deactivated while servo is off, for the purpose of energy saving. This is normal.

## Inspection Items and Cycles

General and normal running condition

**Ambient conditions : 30 °C (annual average), load factor of 80 % or lower, operating hours of 20 hours or less per day.**

Perform the daily and periodical inspection as per the items below.

Type	Cycles	Items to be inspected
Daily inspection	Daily	<ul style="list-style-type: none"> <li>• Ambient temperature, humidity, speck, dust or foreign object</li> <li>• Abnormal vibration and noise</li> <li>• Main circuit voltage</li> <li>• Odor</li> <li>• Lint or other particles at air holes</li> <li>• Cleanliness at front portion of the driver and connector</li> <li>• Damage of the cables</li> <li>• Loose connection or misalignment between the motor and machine or equipment</li> <li>• Pinching of foreign object at the load</li> </ul>
Motor with Gear Reducer	Annual	<ul style="list-style-type: none"> <li>• Loose tightening</li> <li>• Trace of overheat</li> <li>• Damage to the terminal block</li> <li>• Loose fasteners on terminal block</li> </ul>


**Note**

Inspection cycle may change when the running conditions of the above change.

# Maintenance and Inspections

## Guideline for Parts Replacement

Use the table below for a reference. Parts replacement cycle varies depending on the actual operating conditions. Defective parts should be replaced or repaired when any error have occurred.

 <b>Prohibited</b>	<b>Disassembling for inspection and repair should be carried out only by authorized dealers or service company.</b>
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Product	Component	Standard replacement cycles (hour)	Note
Driver	Smoothing condenser	Approx. 5 years	These hours or cycles are reference. When you experience any error, replacement is required even before this standard replacement cycle.
	Cooling fan	2 to 3 years (10000 to 30000 hours)	
	Aluminum electrolytic capacitor (on PCB)	Approx. 5 years	
	Rush current preventive relay	Approx. 100000 times (depending on working condition)	
	Rush current preventive resistor	Approx. 20000 times (depending on working condition)	
Motor	Bearing	3 to 5 years (20000 to 30000 hours)	
	Oil seal	5000 hours	
	Encoder	3 to 5 years (20000 to 30000 hours)	
	Battery for absolute encoder	Life time varies depending on working conditions. Refer to the Operating Instructions attached to the battery for absolute encoder.	

# 1. Before Using the Products

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The AC Servo Motor & Driver, MINAS A5 series is the latest servo system that meets all demands from a variety of machines which require high speed, high precision and high performance or which require simplified settings.

Compared with the preceding A4 series, product of A5 series offers superior performance while requiring simple setup and adjustment by the user.

Newly designed motors have wide range of outputs from 50 W to 15.0 kW, associated with 20-bit incremental encoder and reduced cogging torque.

(Only for position control type have range of outputs from 50 W to 5.0 kW.)

They are compatible with 2 closed controls (serial communication type and A-/B-phase output type) and provided with various automatic adjusting functions such as real time auto tuning with many automatic setting parameters to make complex tuning easy.

(Only for position control type do not conform to full-closed control.)

In addition to the functions of MINAS A5 series, MINAS A5II series adopted two-degree-of-freedom control system which enables faster and more precise adjustment.

It also supports the new feature “fit gain” function of PANATERM, which provides an automatic gain adjustment in a simple and short time.

These motors assure higher stability with low stiffness machine and high-speed, high accurate operation with high stiffness machine. They can be used in combination with a wide variety of machines.

This manual is written as a complete guide for you so that you can fully and correctly make use of all functions available from MINAS A5.

When describing A5II series specific functions and features, this manual distinguishes them by using **A5II** symbols and notes.

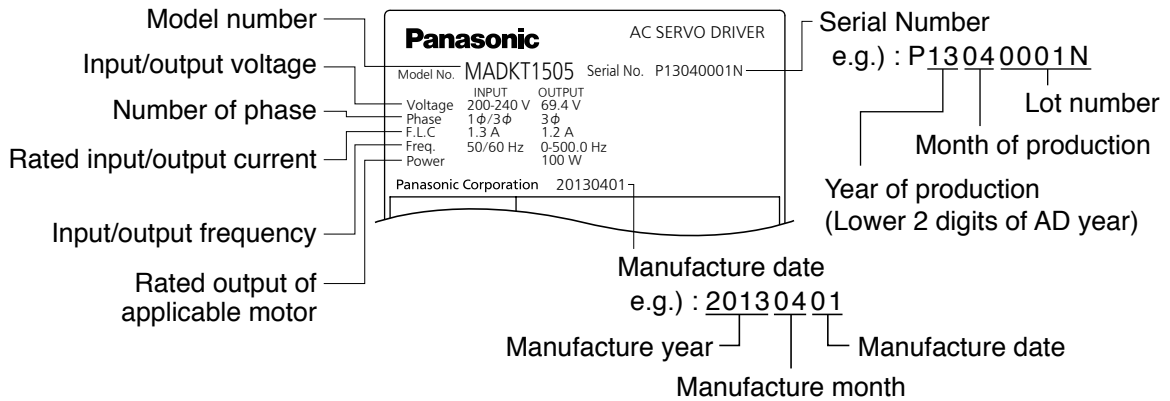
- Make sure that the model is what you have ordered.
- Check if the product is damaged or not during transportation.
- Check if the Operating Instructions (safety) are included or not.
- Check if the power connector, motor connectors, connector for external regenerative resistor connection (D-frame (400 V) and E-frame) and safety by-pass plug are included or not.

(Neither the power connector nor motor connector are included to F-frame to H-frame.)

(Safety bypass plug is not supplied with only for position control type because it does not use this plug.)

**Contact to a dealer if you find any failures.**

### Contents of Name Plate



### Model Designation

Velocity, position, torque and full-closed control type

**M A D K T 1 5 0 5 \* \* \***

1 to 4      4      5 to 6      7      8 to 9      10 to 12

Special specifications (letters and numbers)

Only for position control type

**M A D K T 1 5 0 5 E \* \***

1 to 3      4      5 to 6      7      8 to 9      10      11 to 12

Special specifications (letters and numbers)

Only for position control type

Frame-size symbol

Symbol	Frame
MAD	A-frame
MBD	B-frame
MCD	C-frame
MDD	D-frame
MED	E-frame
MFD	F-frame
MGD	G-frame
MHD	H-frame

NOTE)

Only for position control type is provided A-Frame to F-frame.

Max. current rating of power device

Symbol	Current rating
T1	10 A
T2	15 A
T3	30 A
T4	35 A
T5	50 A
T7	75 A
TA	100 A
TB	150 A
TC	300 A

Current detector rating

Symbol	Current rating
05	5 A
07	7.5 A
10	10 A
12	12 A
20	20 A
30	30 A
40	40 A
64	64 A
90	90 A
A2	120 A
B4	240 A

Power supply

Symbol	Specifications
1	Single phase, 100 V
3	3-phase, 200 V
4	3-phase, 400 V
5	Single/3-phase, 200 V

Series

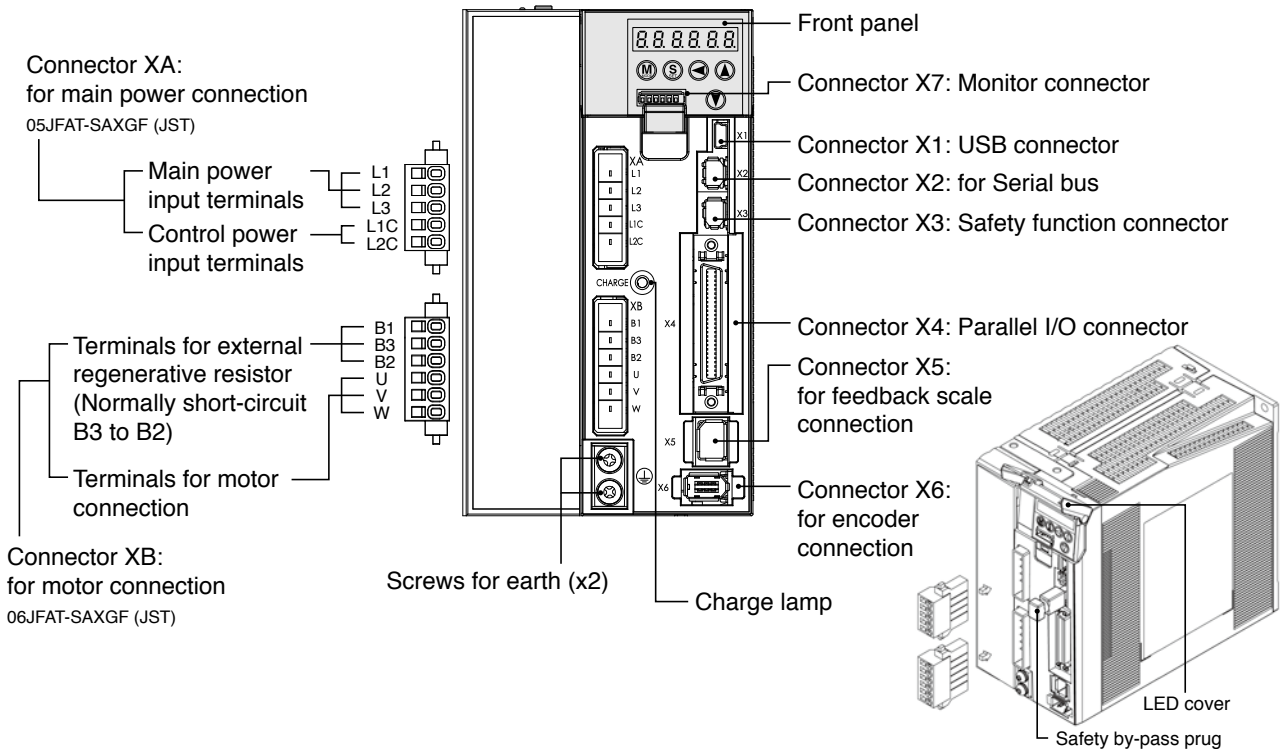
Symbol	Velocity, Position, Torque, Full-Closed type	Position control type
K	A5II series	A5IE series
H	A5 series	A5E series



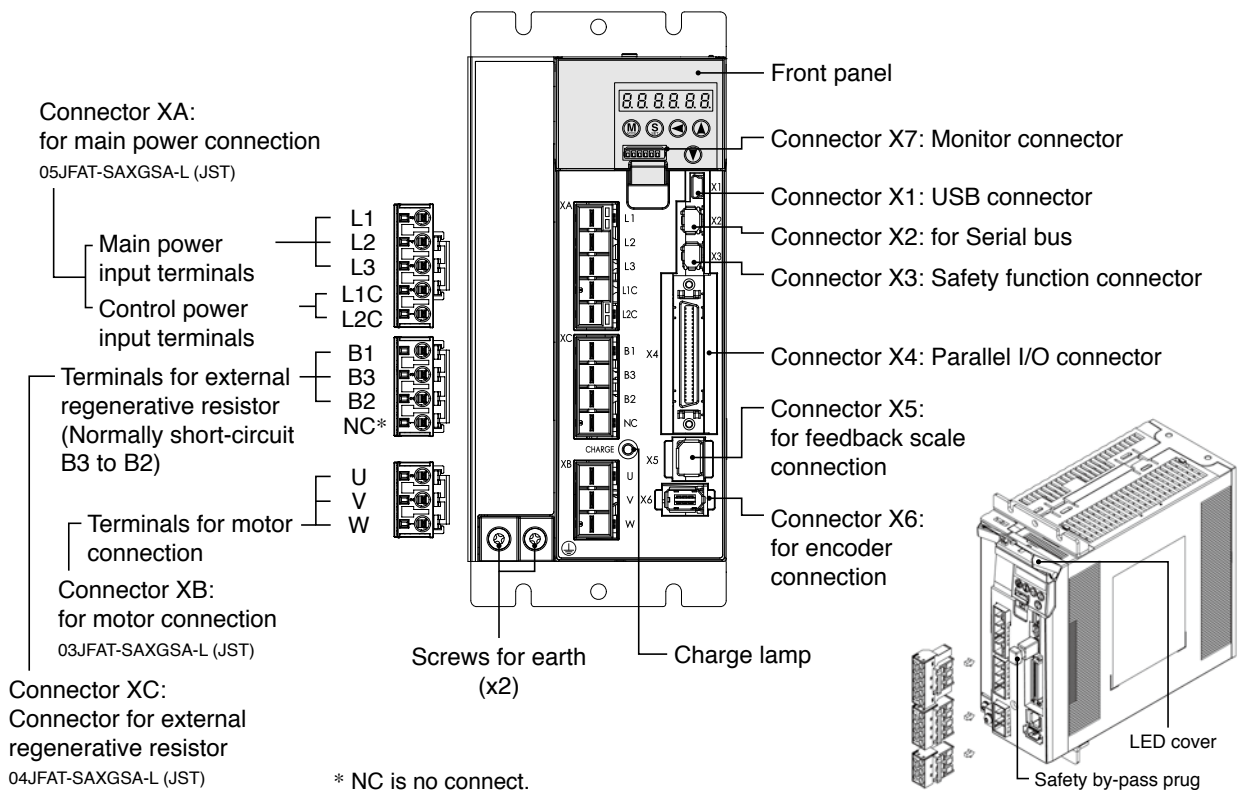
# 1 Before Using the Products

# 2. Driver Parts Description

## A to D-frame



## E-frame



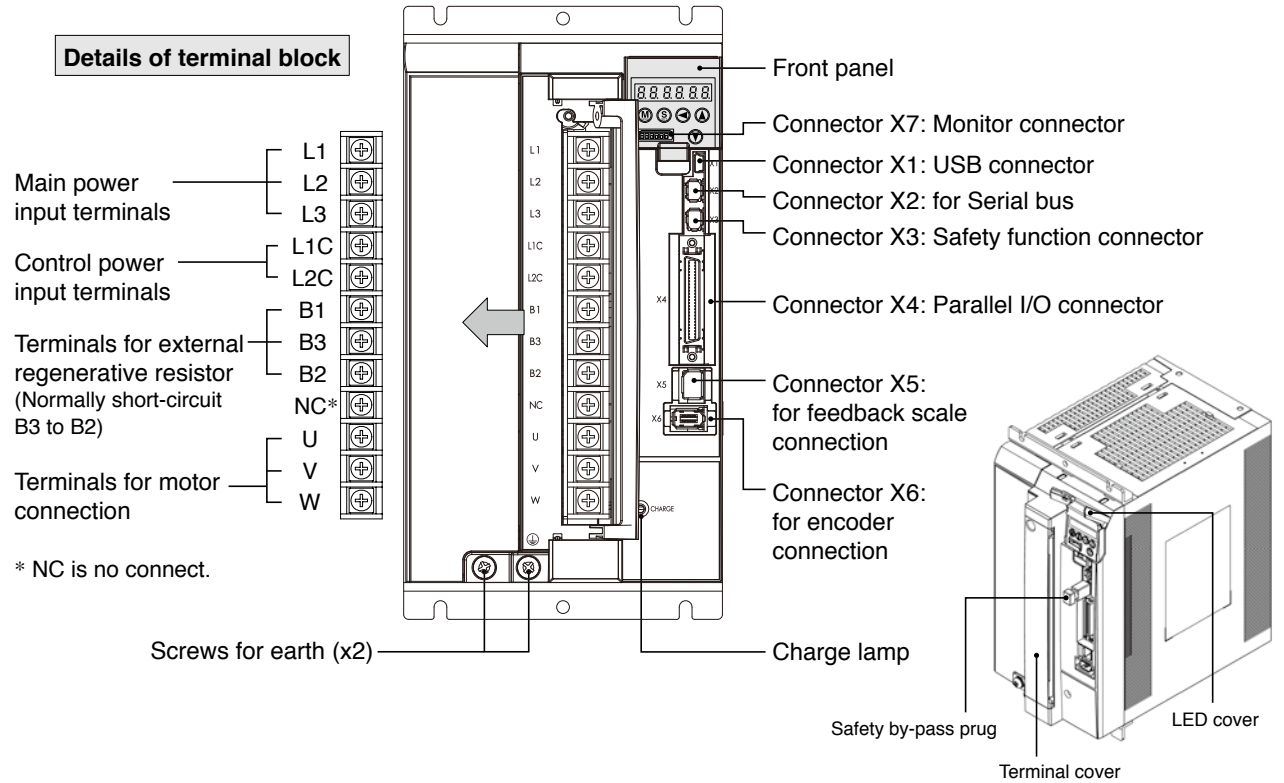
### Note

- Connector XA and XB are attached in A to D-frame driver.
- Connector XA, XB and XC are attached in E-frame driver.
- The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

## 2. Driver

### Parts Description

## F-frame



#### Note

The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

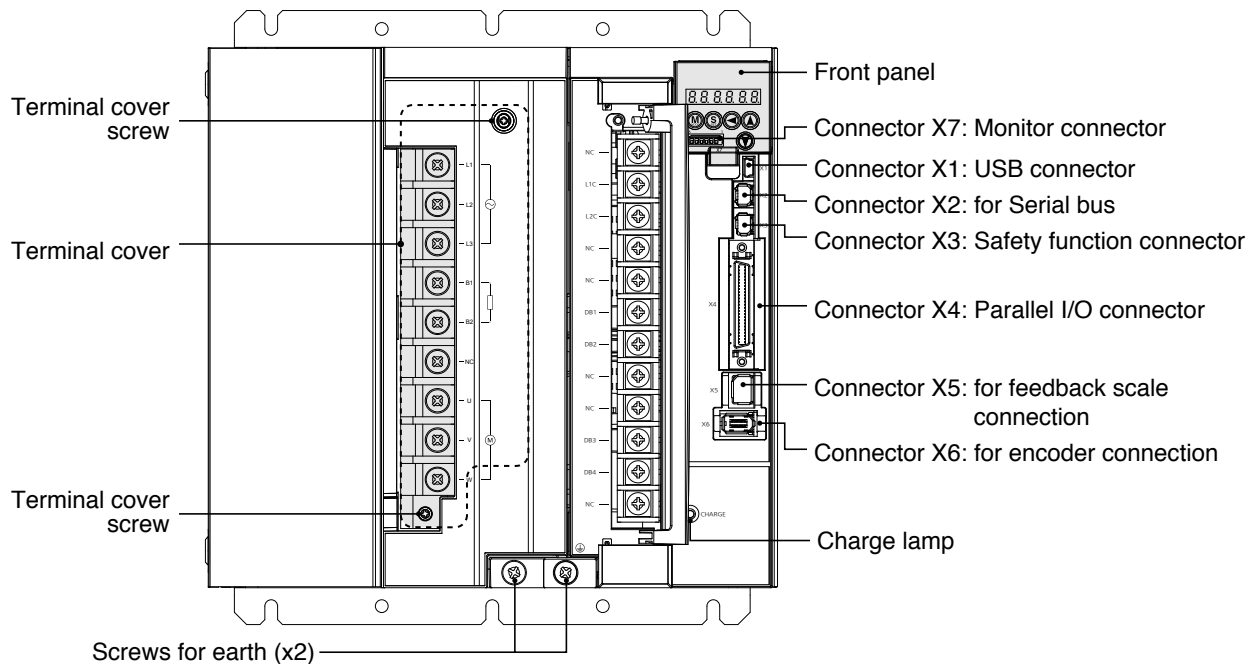
#### Related page

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• P.2-10 “Driver and List of Applicable Peripheral Equipments” • P.7-73 to 7-78 “Dimensions”

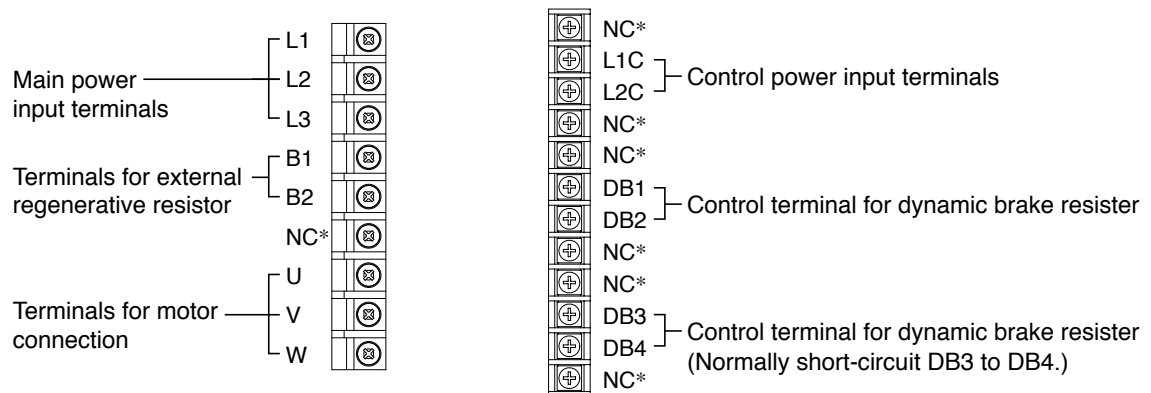
## 2. Driver

### Parts Description

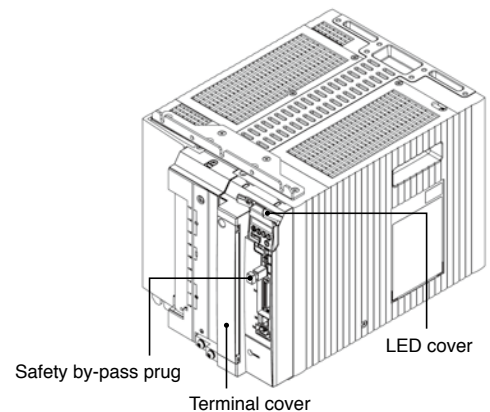
#### G-frame



#### Details of terminal block



\* NC is no connect.



#### Note

• The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

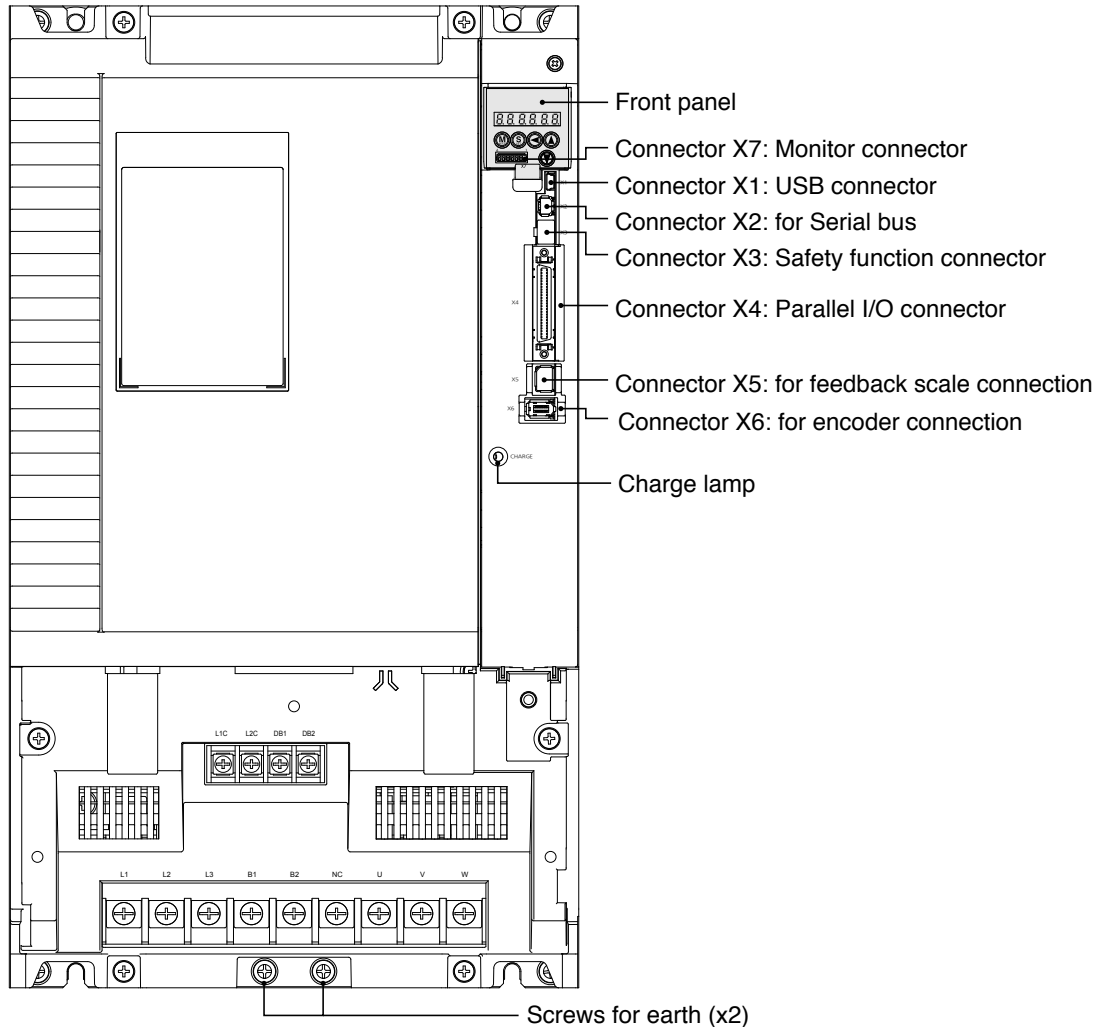
#### Related page

• P.1-23 "Check of the Combination of the Driver and the Motor" • P.1-30 "Installation"  
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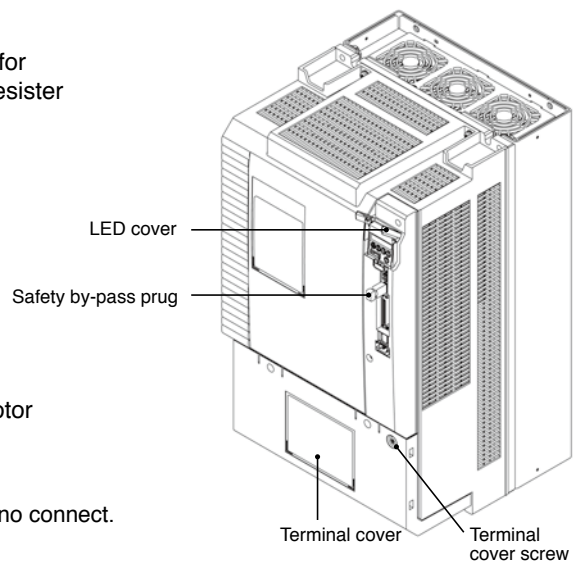
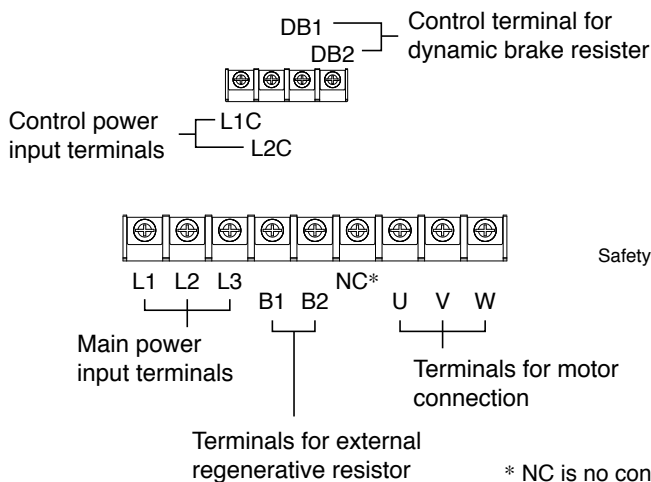
## 2. Driver

### Parts Description

### H-frame



#### Details of terminal block



#### Note

- The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

#### Related page

- P.1-23 "Check of the Combination of the Driver and the Motor" • P.1-30 "Installation"
- P.2-10 "Driver and List of Applicable Peripheral Equipments" • P.7-73 to 7-78 "Dimensions"

## 2. Driver

### Parts Description

#### D, E-frame (400 V)

Connector XA:

for main power connection

03JFAT-SAYGSA-L (JST)

Connector XD:

Control power input terminals

02MJFAT-SAGF (JST)

Control power

input terminals

24V

0V

Main power

input terminals

L1

L2

L3

Terminals for external

regenerative resistor

(Normally short-circuit

B3 to B2)

B1

B3

B2

NC\*

Terminals for

motor connection

U

V

W

Connector XB:

for motor connection

03JFAT-SAXGSA-L (JST)

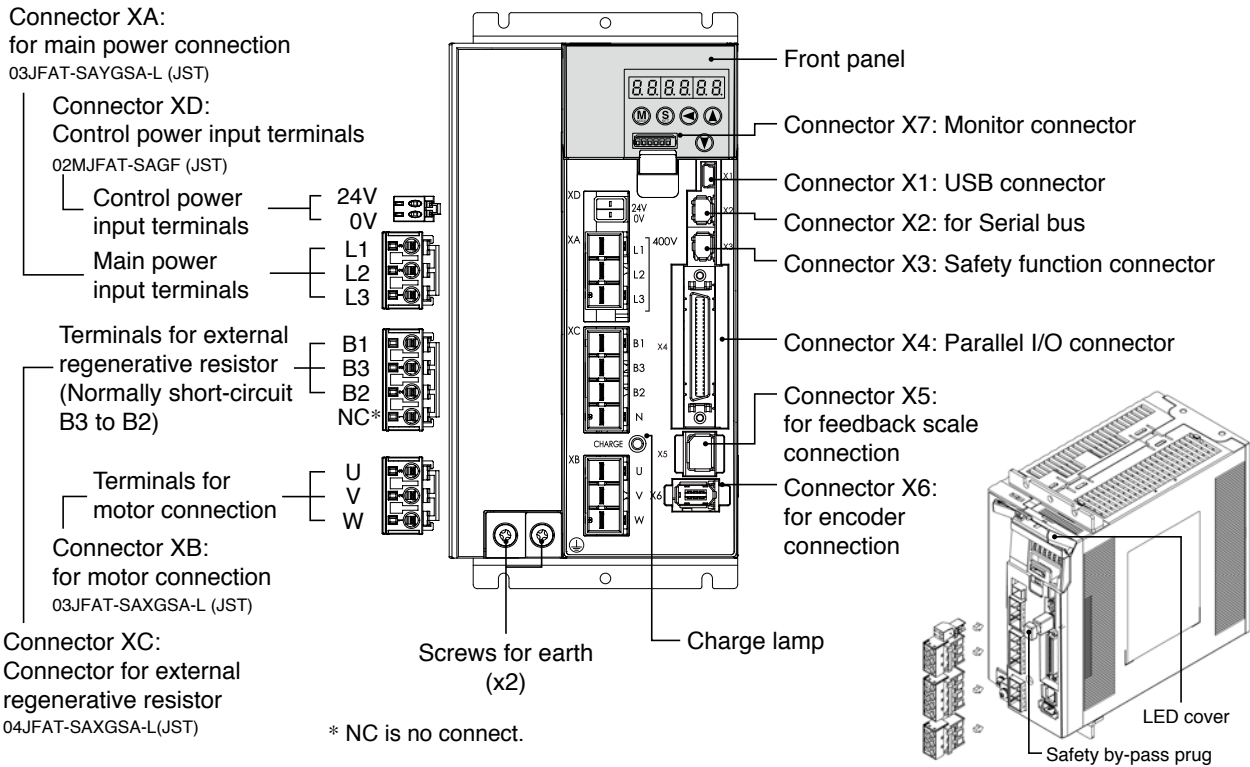
Connector XC:

Connector for external

regenerative resistor

04JFAT-SAXGSA-L(JST)

\* NC is no connect.



#### F-frame (400 V)

##### Details of terminal block

Control power

input terminals

24V

0V

Main power

input terminals

L1

L2

L3

Terminals for external

regenerative resistor

(Normally short-circuit

B3 to B2)

B1

B3

B2

NC\*

Terminals for motor

connection

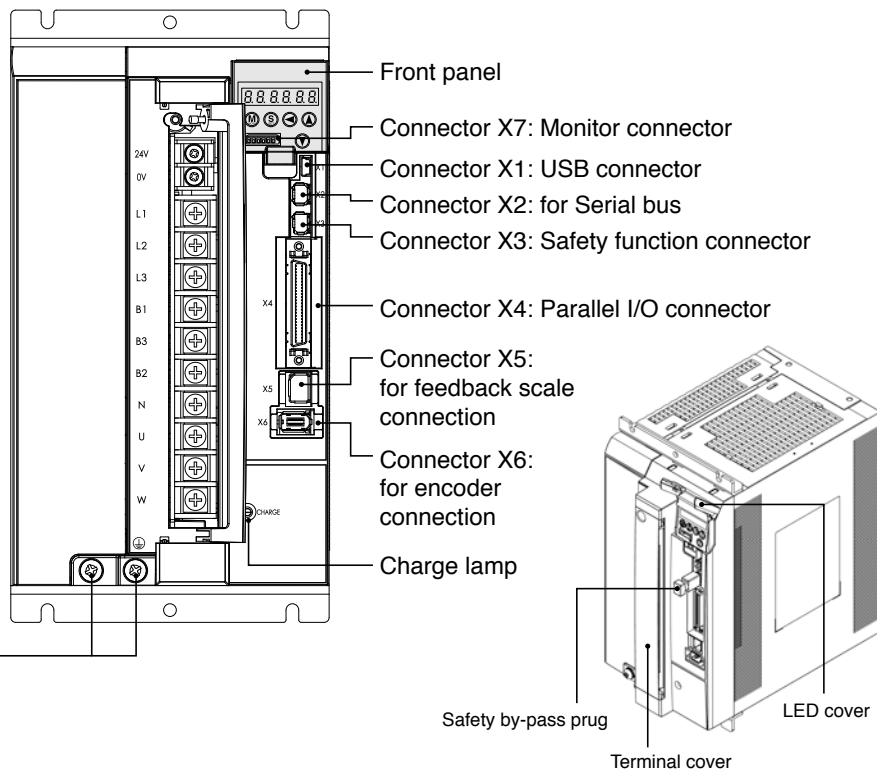
U

V

W

\* NC is no connect.

Screws for earth (x2)



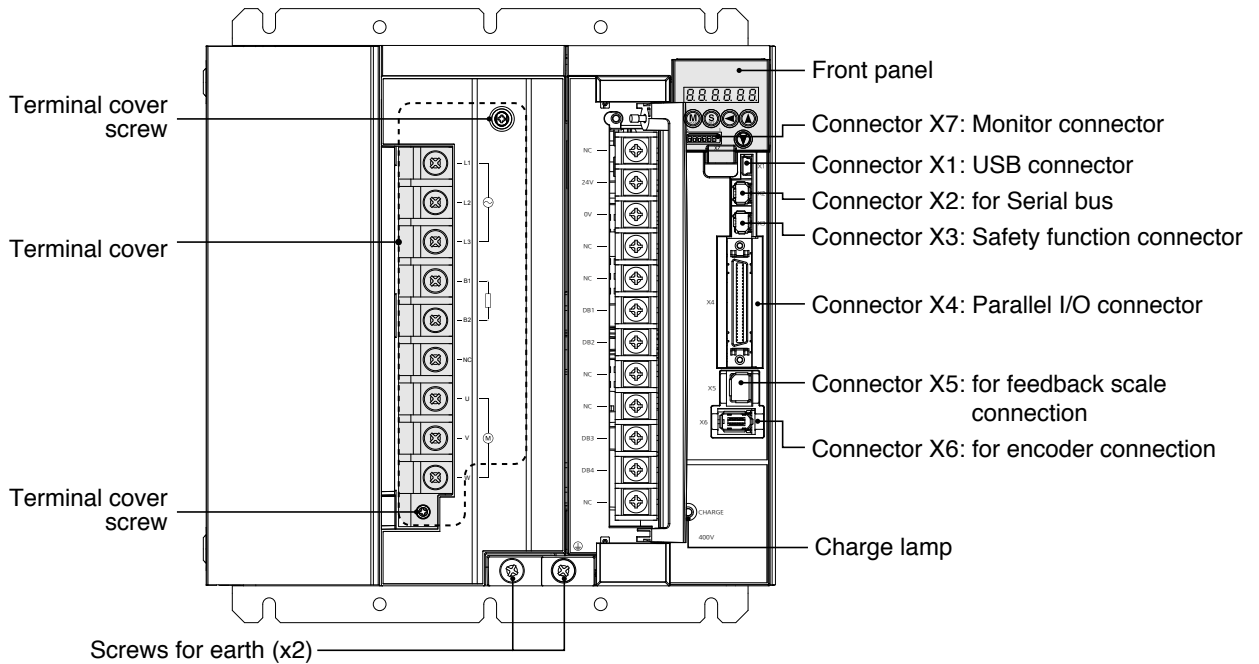
##### Note

- Connector X1 and X2 are attached in A to D-frame driver.
- Connector XA, XB, XC and XD are attached in D and E-frame (400 V) driver.
- The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

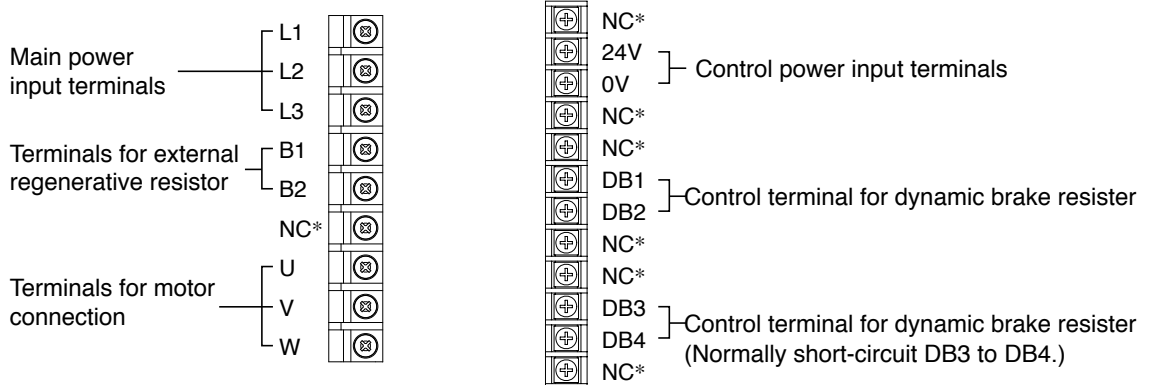
## 2. Driver

### Parts Description

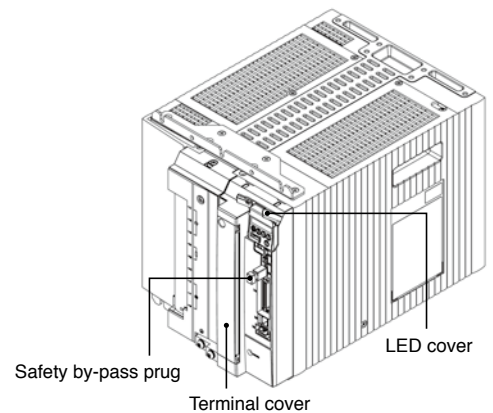
#### G-frame (400 V)



#### Details of terminal block



\* NC is no connect.



#### Note

• The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

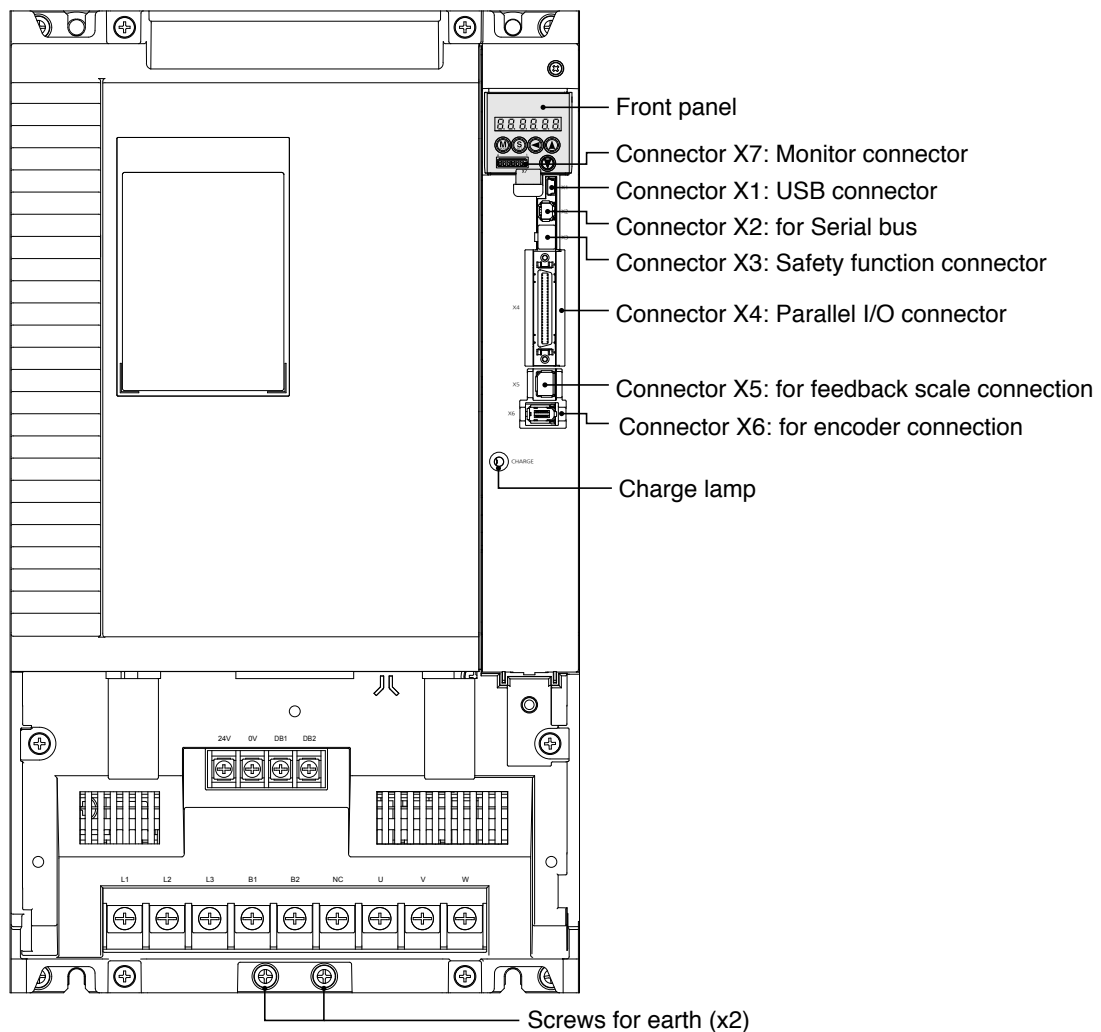
#### Related page

• P.1-23 "Check of the Combination of the Driver and the Motor" • P.1-30 "Installation"  
• P.2-10 "Driver and List of Applicable Peripheral Equipments" • P.7-73 to 7-78 "Dimensions"

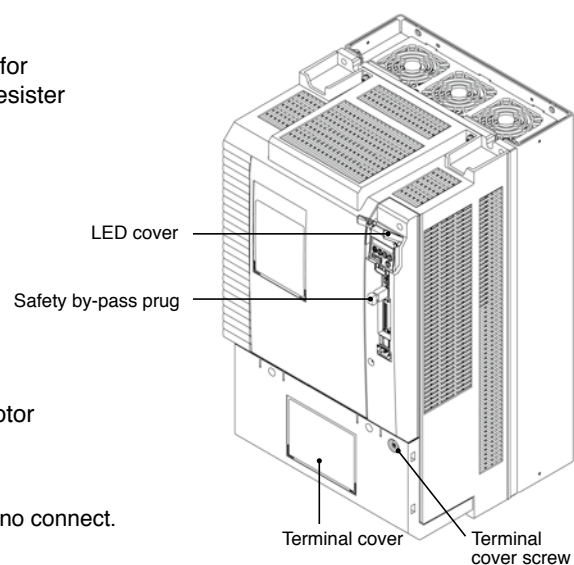
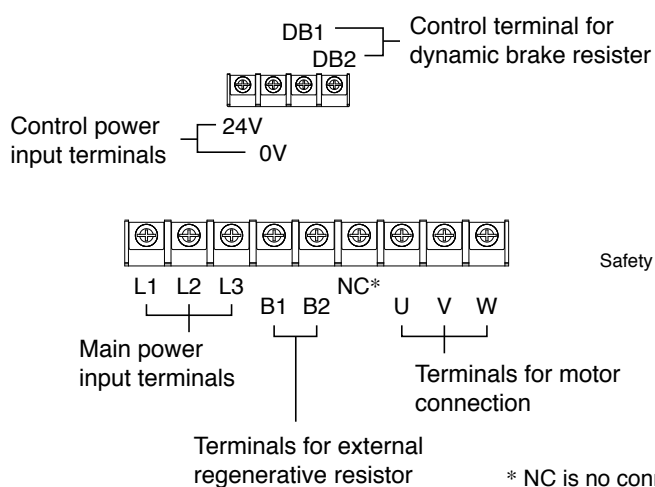
## 2. Driver

### Parts Description

### H-frame (400 V)



#### Details of terminal block



#### Note

- The figure above shows connections on velocity, position, torque and full-closed mode driver. Only for position control type is not provided with X2, X3 and X5.

#### Related page

- P.1-23 "Check of the Combination of the Driver and the Motor" • P.1-30 "Installation"
- P.2-10 "Driver and List of Applicable Peripheral Equipments" • P.7-73 to 7-78 "Dimensions"

# 1 Before Using the Products

# 2. Driver

## Specifications (Velocity, position, torque, full-closed control type)

Basic Specifications	Input power	100 V	Main circuit	Single phase, 100 V to 120 V	+10 % -15 %	50 Hz/60 Hz	
			Control circuit	Single phase, 100 V to 120 V	+10 % -15 %	50 Hz/60 Hz	
		200 V	Main circuit	A to D-frame	Single/3-phase, 200 V to 240 V	+10 % -15 %	50 Hz/60 Hz
				E to H-frame	3-phase, 200 V to 230 V	+10 % -15 %	50 Hz/60 Hz
			Control circuit	A to D-frame	Single phase, 200 V to 240 V	+10 % -15 %	50 Hz/60 Hz
				E to H-frame	Single phase, 200 V to 230 V	+10 % -15 %	50 Hz/60 Hz
		400 V *1	Main circuit	3-phase, 380 V to 480 V	+10 % -15 %	50 Hz/60 Hz	
			Control circuit	DC24 V ± 15 %			
		Withstand voltage			Primary to earth: withstand 1500 VAC, 1 min, (sensed current: 20 mA) [100 V/200 V] withstand 1960 VAC, 1 min, (sensed current: 20 mA) [400 V] * 400 V control circuit is excluded.		
	Environment	temperature	Ambient temperature: 0°C to 55°C (free from freezing) Storage temperature: -20°C to 65°C (Max. temperature guarantee: 80 °C for 72 hours free from condensation*2)				
		humidity	Both operating and storage : 20 % to 85 %RH or less (free from condensation*2)				
		Altitude	Lower than 1000 m				
		Vibration	5.88 m/s <sup>2</sup> or less, 10 Hz to 60 Hz (No continuous use at resonance frequency)				
	Control method			IGBT PWM Sinusoidal wave drive			
	Encoder feedback			17-bit (131072 resolution) absolute encoder, 7-wire serial 20-bit (1048576 resolution) incremental encoder, 5-wire serial			
	Feedback scale feedback			A/B phase, initialization signal differential input. Manufacturers that support serial communication scale: Mitsutoyo Corp. Magsescale Co., Ltd. (old Sony Manufacturing Systems Corp.)			
	Parallel I/O connector	Control signal	Input	General purpose 10 inputs The function of general-purpose input is selected by parameters.			
			Output	General purpose 6 outputs The function of general-purpose input is selected by parameters.			
		Analog signal	Input	3 inputs (16-bit A/D : 1 input, 12-bit A/D : 2 inputs)			
			Output	2 outputs (Analog monitor: 2 output)			
		Pulse signal	Input	2 inputs (Photocoupler input, Line receiver input) Photocoupler input is compatible with both line driver I/F and open collector I/F. Line receiver input is compatible with line driver I/F.			
			Output	4 outputs ( Line driver: 3 output, open collector: 1 output) Feed out the encoder feedback pulse (A, B and Z-phase) or feedback scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector.			
	Communication function	USB	Connection with PC etc.				
		RS232	1 : 1 communication to a host.				
RS485		1 : n communication to a host.					
Safety function			Used for functional safety.				
Front panel			(1) 5 keys (MODE, SET, UP, DOWN, SHIFT) (2) LED (6-digit) (3) Monitor connector (Analog monitor output (2 ch), Digital monitor output (1 ch))				
Regeneration			A, B, G and H-frame: no built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)				
Dynamic brake			A to G-frame: Built-in (external resistor is also available to G-frame) H-frame: External only				
Control mode			Switching among the following 7 mode is enabled, (1) Position control (2) Velocity control (3) Toque control (4) Position/Velocity control (5) Position/Torque control (6) Velocity/Torque control (7) Full-closed control				

### Caution

\*1 The specification out of Japan.

\*2 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.

### Related page

• P.1-30 "Installation of Driver" • P.1-34 "Installation of Motor"



## 2. Driver

### Specifications (Velocity, position, torque, full-closed control type)

Function	Control input		(1) Servo-ON input (2) Alarm clear input (3) Gain switching input (4) Positive direction over-travel inhibition input (5) Negative direction over-travel inhibition input (6) Forced alarm input (7) Inertia ratio switching input	
	Control output		(1) Servo-Alarm output (2) Servo-Ready output (3) External brake release signal (4) Speed arrival output (5) Torque in-limit signal output (6) Zero-speed detection output signal (7) Alarm output (8) Alarm attribute output (9) Servo on status output*	
	Position control	Control input		(1) Deviation counter clear (2) Command pulse inhibition (3) Command dividing gradual increase switching (4) Damping control switching (5) Torque limit switching (6) Control mode switching
		Control output		(1) Positioning complete (In-position) (2) Positional command ON/OFF output
		Pulse input	Max. command pulse frequency	Exclusive interface for Photocoupler: 500 kpps Exclusive interface for line driver : 4 Mpps
			Input pulse signal format	Differential input. Selectable with parameter. ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)
			Electronic gear (Division/Multiplication of command pulse)	Process command pulse frequency × electronic gear ratio $\left(\frac{1 \text{ to } 2^{30}}{1 \text{ to } 2^{30}}\right)$ as positional command input. Use electronic gear ratio in the range 1/1000 times to 1000 times.
			Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input
		Analog input	Torque limit command input	Individual torque limit for both positive and negative direction is enabled.
			Torque feed forward input	Analog voltage can be used as torque feed forward input.
		Instantaneous Speed Observer		Available
		Damping Control		Available
	Two-degree-of-freedom control system		Only available at A5II Series	
	Velocity control	Control input		(1) Selection of internal velocity setup (2) Speed zero clamp (3) Speed command sign input (4) Control mode switching
		Control output		(1) Speed coincidence output (2) Speed command ON/OFF output
		Analog input	Velocity command input	Speed command input can be provided by means of analog voltage. Parameters are used for scale setting and command polarity. (6 V/Rated rotational speed Default)
			Torque limit command input	Individual torque limit for both positive and negative direction is enabled.
			Torque feed forward input	Analog voltage can be used as torque feed forward input.
		Internal velocity command		Switching the internal 8speed is enabled by command input.
		Soft-start/down function		Individual setup of acceleration and deceleration is enabled, with 0 s/1000 r/min to 10 s/1000 r/min. Sigmoid acceleration/deceleration is also enabled.
		Zero-speed clamp		0-clamp of internal velocity command with speed zero clamp input is enabled.
		Instantaneous Speed Observer		Available
		Two-degree-of-freedom control system		Only available at A5II Series
	Torque control	Control input		(1) Speed zero clamp (2) Torque command sign input (3) Control mode switching
		Control output		(1) Speed coincidence output (2) Speed in-limit output
		Analog input	Torque command input	Torque command input can be provided by means of analog voltage. Parameters are used for scale setting and command polarity. (3 V/rated torque Default)
		Speed limit function		Speed limit value with parameter t is enabled.
Full-closed control	Control input		(1) Deviation counter clear (2) Command pulse inhibition (3) Command dividing gradual increase switching (4) Damping control switching (5) Torque limit switching	
	Control output		(1) Full-closed positioning complete (2) Positional command ON/OFF output	
	Pulse input	Max. command pulse frequency	Exclusive interface for Photocoupler: 500 kpps Exclusive interface for line driver : 4 Mpps	
		Input pulse signal format	Differential input. Selectable with parameter. ((1) Positive and Negative direction, (2) A and B-phase, (3) Command and direction)	
		Electronic gear (Division/Multiplication of command pulse)	Process command pulse frequency × electronic gear ratio $\left(\frac{1 \text{ to } 2^{30}}{1 \text{ to } 2^{30}}\right)$ as positional command input. Use electronic gear ratio in the range 1/1000 times to 1000 times.	
		Smoothing filter	Primary delay filter or FIR type filter is adaptable to the command input	
	Analog input	Torque limit command input	Individual torque limit for both positive and negative direction is enabled.	
		Torque feed forward input	Analog voltage can be used as torque feed forward input.	
	Setup range of division/multiplication of feedback scale		1/40 times to 160 times The ratio of encoder pulse (numerator) to external scale pulse (denominator) can be set to 1 to 2 <sup>20</sup> (numerator) to 1 to 2 <sup>20</sup> (denominator), but should be set to a ratio within the range shown above.	
	Damping Control		Available	
Common	Auto tuning		The load inertia is identified in real time by the driving state of the motor operating according to the command given by the controlling device and set up support software "PANATERM". The gain is set automatically in accordance with the rigidity setting.	
	Division of encoder feedback pulse		Set up of any value is enabled (encoder feedback pulses count is the max.).	
	Protective function	Hard error	Over-voltage, under-voltage, over-speed, over-load, over-heat, over-current and encoder error etc.	
		Soft error	Excess position deviation, command pulse division error, EEPROM error etc.	
Traceability of alarm data		The alarm data history can be referred to.		

\* **A5II** : Only available on A5II series.

# 1 Before Using the Products

## 2. Driver

### Specifications (Only for position control type)

Basic Specifications	Input power	100 V	Main circuit		Single phase, 100 V to 120 V	+10 % -15 %	50 Hz/60 Hz		
			Control circuit		Single phase, 100 V to 120 V	+10 % -15 %	50 Hz/60 Hz		
		200 V	Main circuit	A to D-frame	Single/3-phase, 200 V to 240 V	+10 % -15 %	50 Hz/60 Hz		
				E to F-frame	3-phase, 200 V to 230 V	+10 % -15 %	50 Hz/60 Hz		
			Control circuit	A to D-frame	Single phase, 200 V to 240 V	+10 % -15 %	50 Hz/60 Hz		
				E to F-frame	Single phase, 200 V to 230 V	+10 % -15 %	50 Hz/60 Hz		
		400 V	Main circuit	D to F-frame	3-phase, 380 V to 480 V	+10 % -15 %	50 Hz/60 Hz		
			Control circuit	D to F-frame	DC24 V ± 15 %				
		Withstand voltage					Primary to earth: withstand 1500 VAC, 1 min, (sensed current: 20 mA) [100 V/200 V] withstand 1960 VAC, 1 min, (sensed current: 20 mA) [400 V] * 400 V control circuit is excluded.		
		Environment		temperature	Ambient temperature: 0°C to 55°C (free from freezing) Storage temperature: -20°C to 65°C (Max. temperature guarantee: 80 °C for 72 hours free from condensation <sup>*2</sup> )				
	humidity			Both operating and storage : 20 % to 85 %RH or less (free from condensation)					
	Altitude			Lower than 1000 m					
	Vibration			5.88 m/s <sup>2</sup> or less, 10 Hz to 60 Hz (No continuous use at resonance frequency)					
	Control method			IGBT PWM Sinusoidal wave drive					
	Encoder feedback			20-bit (1048576 resolution) incremental encoder, 5-wire serial					
	Parallel I/O connector		Control signal	Input	General purpose 10 inputs The function of general-purpose input is selected by parameters.				
				Output	General purpose 6 outputs The function of general-purpose input is selected by parameters.				
			Analog signal	Output	2 outputs (Analog monitor: 2 output)				
			Pulse signal	Input	2 inputs (Photocoupler input, Line receiver input) Photocoupler input is compatible with both line driver I/F and open collector I/F. Line receiver input is compatible with line driver I/F.				
	Output	4 outputs ( Line driver: 3 output, open collector: 1 output) Feed out the encoder feedback pulse (A, B and Z-phase) or feedback scale pulse (EXA, EXB and EXZ-phase) in line driver. Z-phase and EXZ-phase pulse is also fed out in open collector.							
Communication function		USB	Connection with PC etc.						
Front panel			(1) 5 keys (2) LED (6-digit) (3) Analog monitor output (2 ch)						
Regeneration			A, B-frame: no built-in regenerative resistor (external resistor only) C to F-frame: Built-in regenerative resistor (external resistor is also enabled.)						
Dynamic brake			A to F-frame: Built-in						
Control mode			(1) Position control (2) Internal velocity control (3) Position/ Internal velocity control						

#### Caution

\*1 The specification out of Japan.

\*2 Air containing water vapor will become saturated with water vapor as the temperature falls, causing dew.

#### Related page

• P.1-30 "Installation of Driver" • P.1-34 "Installation of Motor"

#### Caution

Only for position control type is provided A-Frame to F-frame.